REINHOLD ENVIRONMENTAL Ltd.

2012 NOx-Combustion Round Table & Expo Presentation

February 13-14, 2012, in Columbus, OH / Hosted by AEP

Clean Air Act Update
CSAPR and MATS

Brian Higgins

VP of Technology, Nalco Mobotec

13 February 2012

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EUEC Regulatory Comments

- Many EUEC presentation references in this talk
  - I'm happy to put you in contact with the authors if you want a copy of their talks
- One general theme from EUEC:
  - Timeline to implement
  - Without question, the practical implementation schedule was raised many times at EUEC.
  - From "there is no way we can do it" to "you should be well down the path"
  - Few comments suggesting taking a "wait and see" approach

Recent/Upcoming EPA Regulations

- Cross-State Air Pollution Rule (CSAPR)
  - was CAIR, then CATR
  - Final July 2011
  - Court “Stay” on December 30, 2011
- Power Plant Mercury and Air Toxics Standards (MATS)
  - “Utility MACT”
  - Final Rule in Federal Register on February 16th, 2012
- Industrial Boiler MACT
  - Final rule promulgated March 2011, but is currently “stayed”
- Ozone and PM NAAQS
  - Ozone review delayed until fall 2013
  - PM review delayed (2013?)

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Other Looming Environmental Drivers

- SO_2 NAAQS
  - Attainment Demonstration by 2017
  - Controls in place 3 years before attainment date?
- Title V Renewal
  - Must demonstrate compliance with all regulations
  - Entergy White Bluff – challenge to whether facility meets SO_2 1 hour NAAQS
- Consent Decrees

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Ash, Water, and GHG

- Coal Combustion Residuals (CCRs or ash)
  - Proposed rule is out – Final rule in 2012
  - EPA offered two potential regulatory approaches in its proposal; one under RCRA Subtitle C and another under Subtitle D.
- Cooling Water Intake Structures
  - Proposed rule is out – Final rule in July 2012
  - 8 or more years for compliance
  - Addresses impingement and entrainment
- GHG NSPS
  - In December 2010, EPA made the commitment
  - NSPS for new and modified sources is with OMB
    - Expected to be released February, 2012
  - No timeline standards for existing sources

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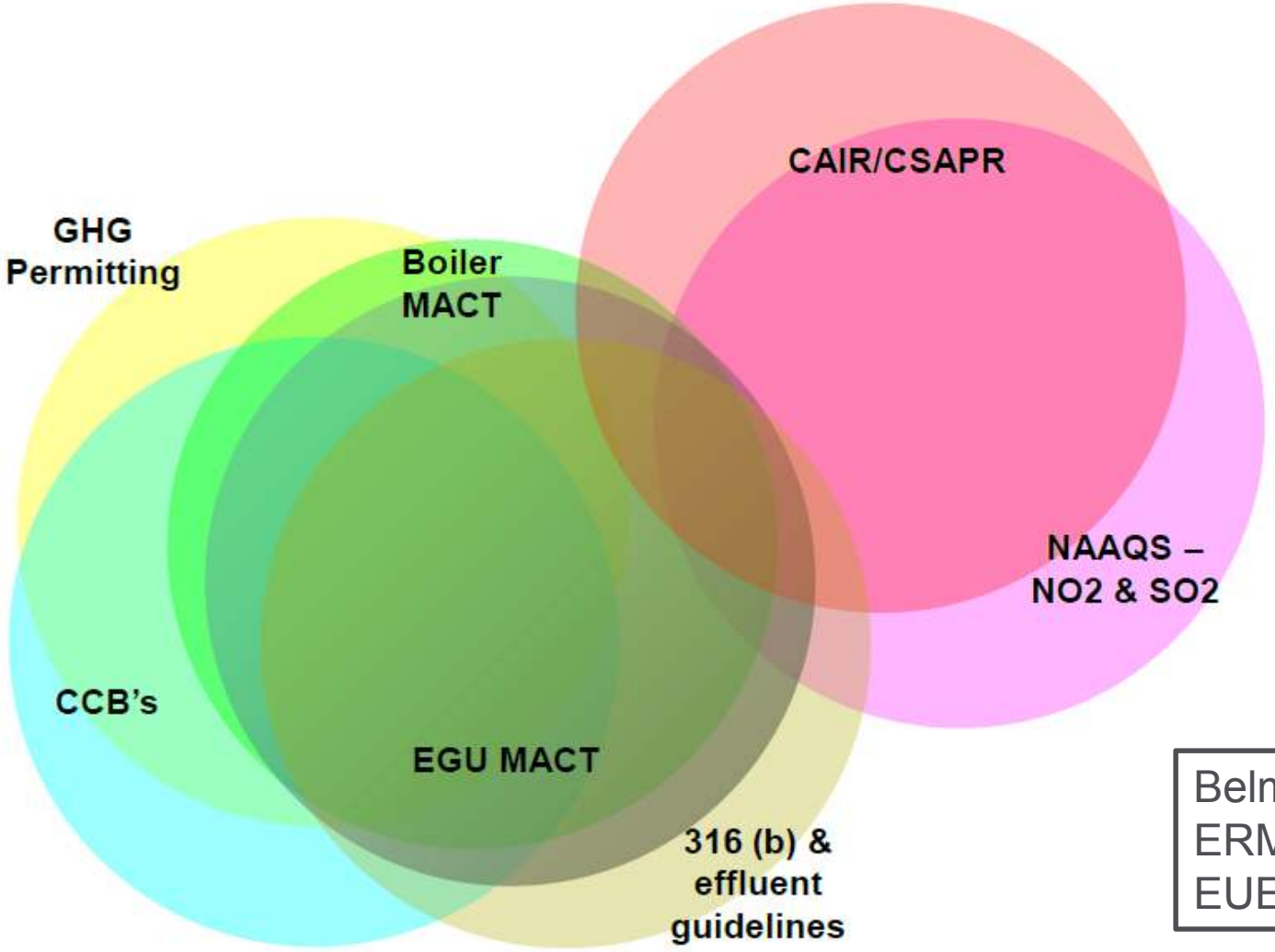
Holistic Approach to Regulations



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Clean Air Act (in one slide)

- Title I § 109-111
  - NAAQS (National Ambient Air Quality Standards)
    - CO, Pb, NO_2, PM_{10}, $PM_{2.5}$, O_3, SO_2
  - CAIR → CATR → CSAPR
    - NOx and SO_2 Limited-Cap-and-Trade to reduce $PM_{2.5}$ & O_3
- Title I § 112
  - Air Toxics (188 HAPs via surrogates: PM, HCl, Hg CO, and D/F)
  - MACT → MATS
- Title 1 § 160 - § 169
  - PSD, BACT, Regional Haze
- Title 1 § 171- § 193
  - Non-attainment (NAAQS) rules
- Operating Permits (Title V)
  - Major sources
  - Extra requirements for non-attainment areas
  - Permitting could create real delays

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CAA – § 109 - § 110
NAAQS
CAIR
CATR
CSAPR

CROSS-STATE AIR POLLUTION RULE

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Cross-State Air Pollution Rule

- *Final* CSAPR Signed:
  - Wednesday July 6, 2011
- Court Stay on December 30, 2011
  - Both sides claim victory
  - EPA:
    - "*The court's decision is not a decision on the merits of the rule.*"
  - Industry:
    - *Clearly there is a problem with the rule…*
- Currently reverted back to CAIR
- Reduce NOx and SO_2 with inter- and intra-state cap-and-trade
  - To reduce fine particles ($PM_{2.5}$) under 1997 fine particulate NAAQS
  - To reduce ozone under 2006 ozone NAAQS
    - Note that current $PM_{2.5}$ NAAQS is 2006 and Ozone NAAQS is 2008
- Specifically to address "cross-state transport"
  - Goal: eliminate non-attainment zones, […] affordably

CSAPR Stay

- Known:
  - Granted stay of the entire rule
  - Ordered CAIR to remain in effect during the stay
  - Designated the case as complex
  - Denied the motion to give advance notice of decision
  - Oral arguments on April 13, 2012
    - (Chartier, EEI, EUEC 2012)
- Unknown
  - *The court will do what the court will do*
  - Degree of the courts ruling (entire, partial, further delay)
- Other
  - CSAPR = BART for regional haze in affected states
    - (signed Dec 23, 2011 – comments until Feb 28)
  - Supplemental Rule stayed (CSAPR: IA, KS, MI, MO, OK, and WI)
  - EPA's data correction – two adjustments
    - Increased some state budgets (2%) – signed Feb 7, 2012

CAIR versus CSAPR

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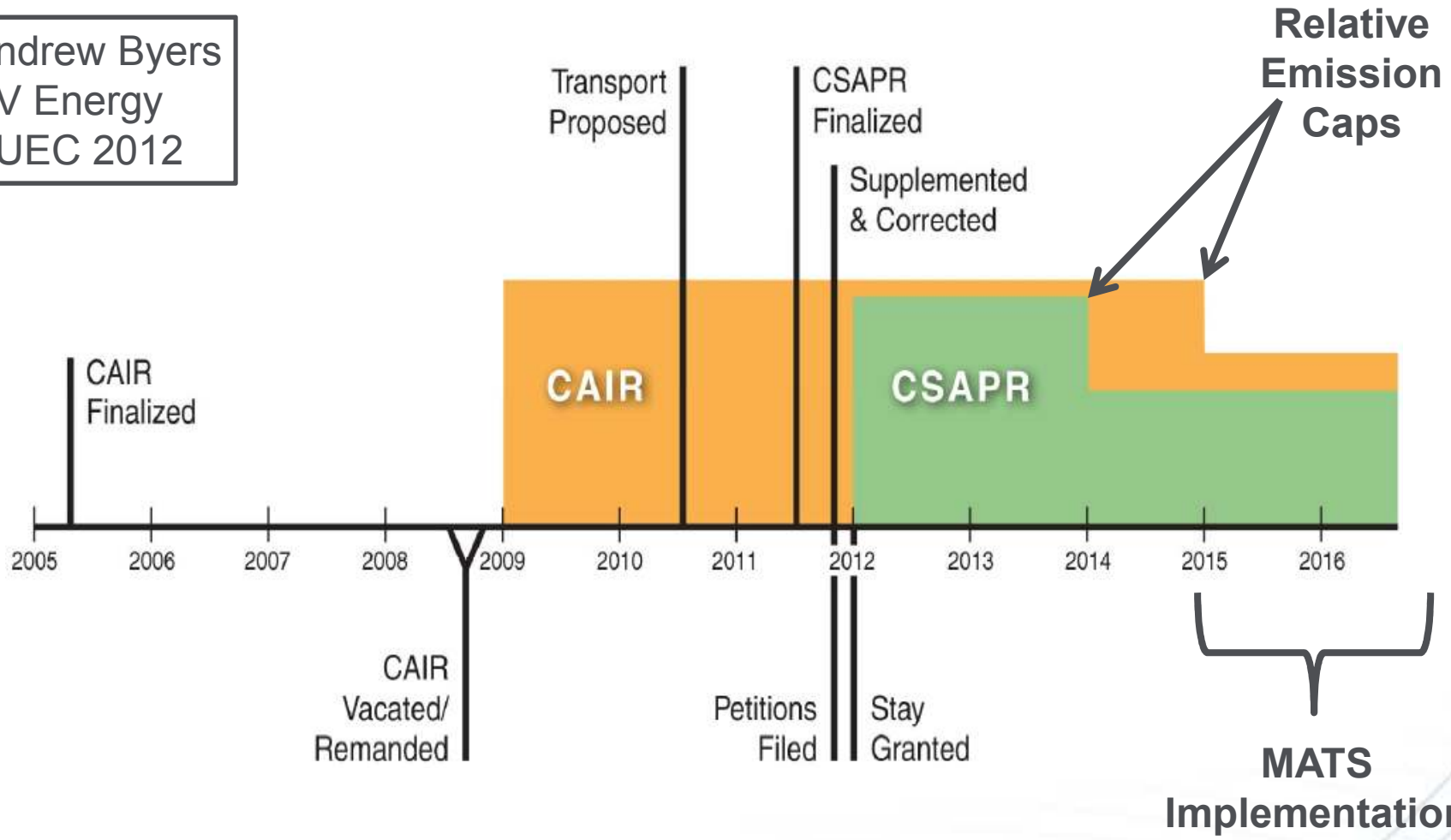

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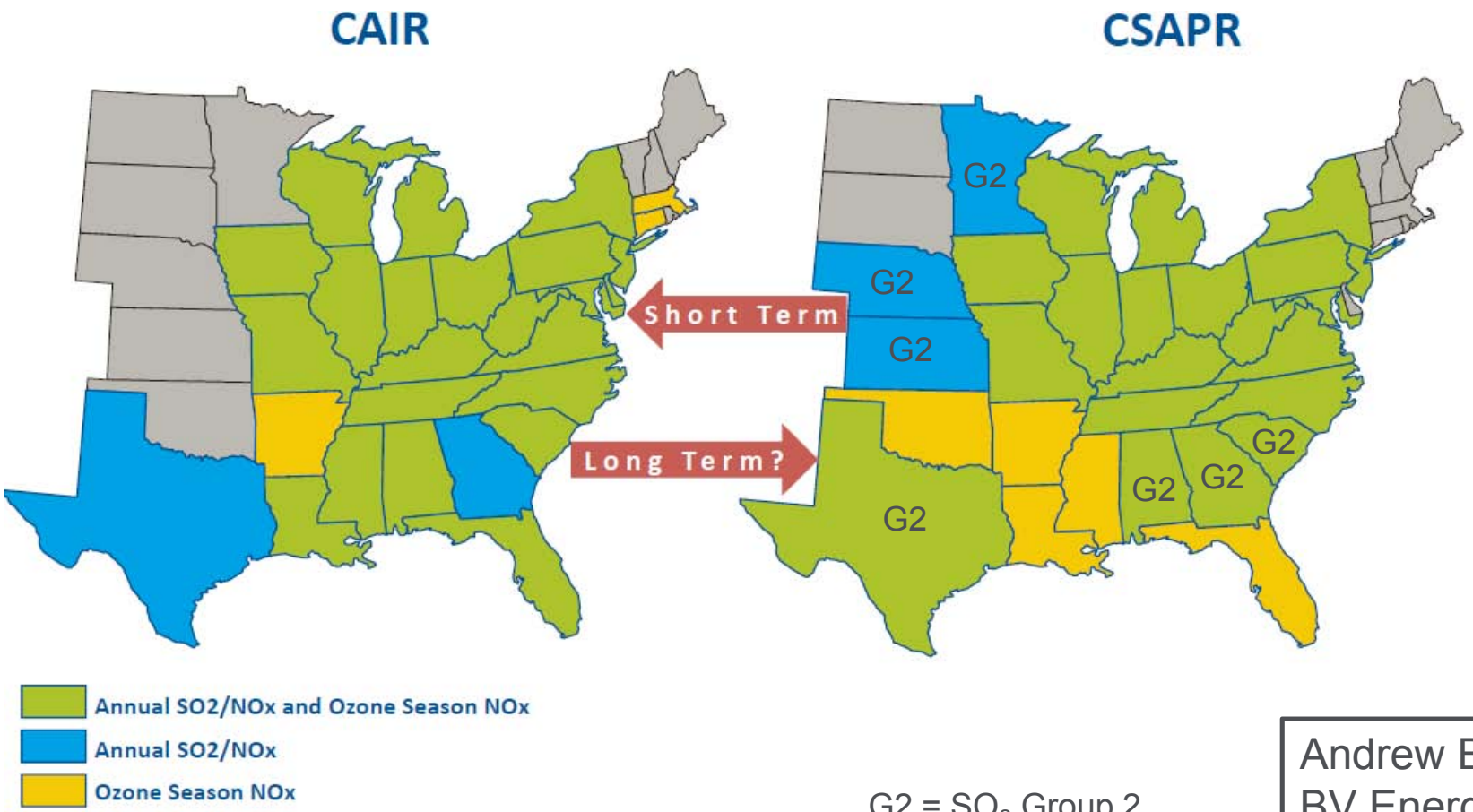
CAIR versus CSAPR



G2 = SO_2 Group 2

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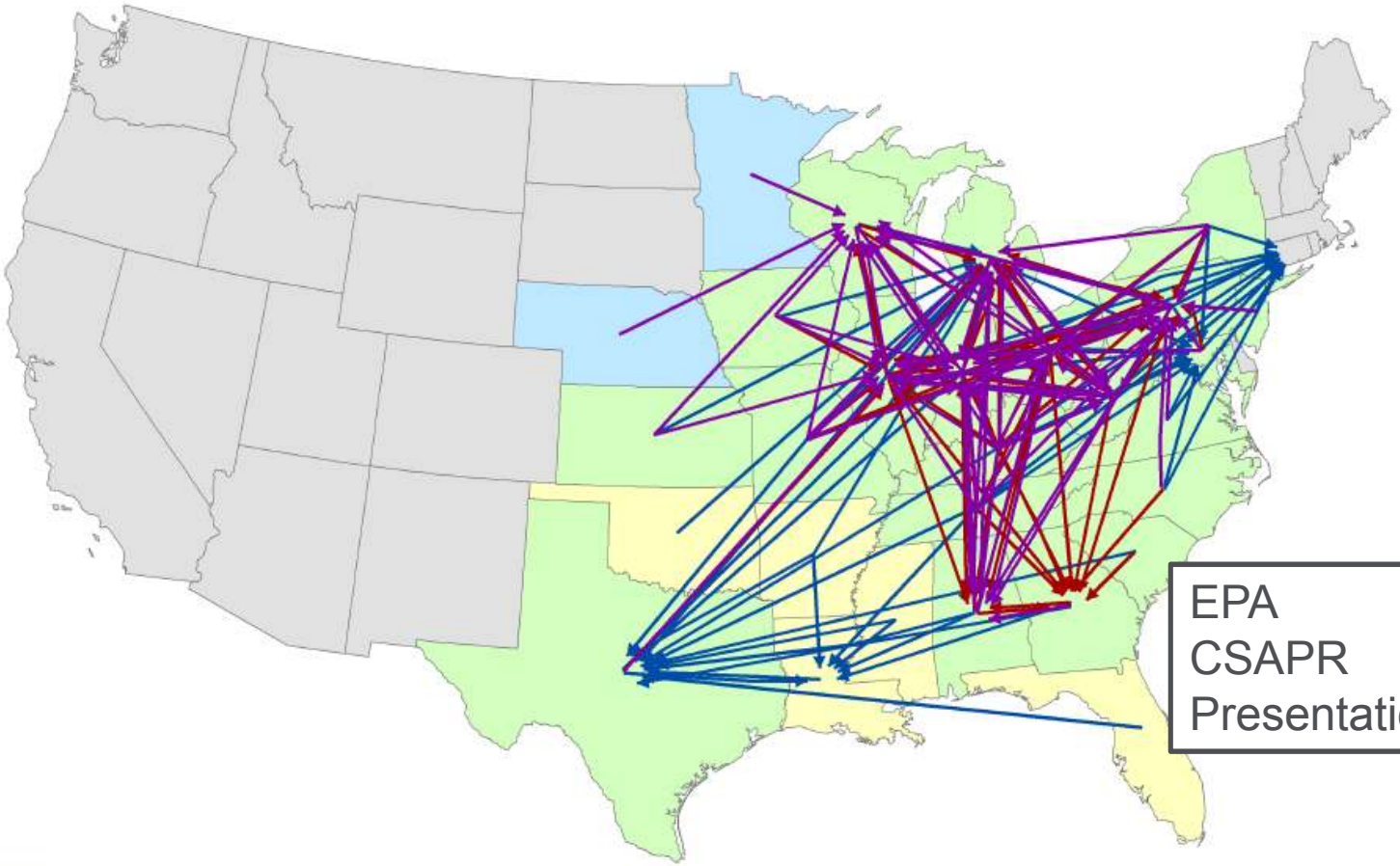
CSAPR Modeling



EPA
CSAPR
Presentation

States controlled for both fine particles (annual SO2 and NOx) and ozone (ozone season NOx) (21 States)
States controlled for fine particles only (annual SO2 and NOx) (2 States)
States controlled for ozone only (ozone season NOx) (5 States)
States not covered by the Cross-State Air Pollution Rule

Key to Arrows
Upwind-Downwind Linkage for Ozone
Upwind-Downwind Linkage for Annual $PM_{2.5}$
Upwind-Downwind Linkage for Daily $PM_{2.5}$

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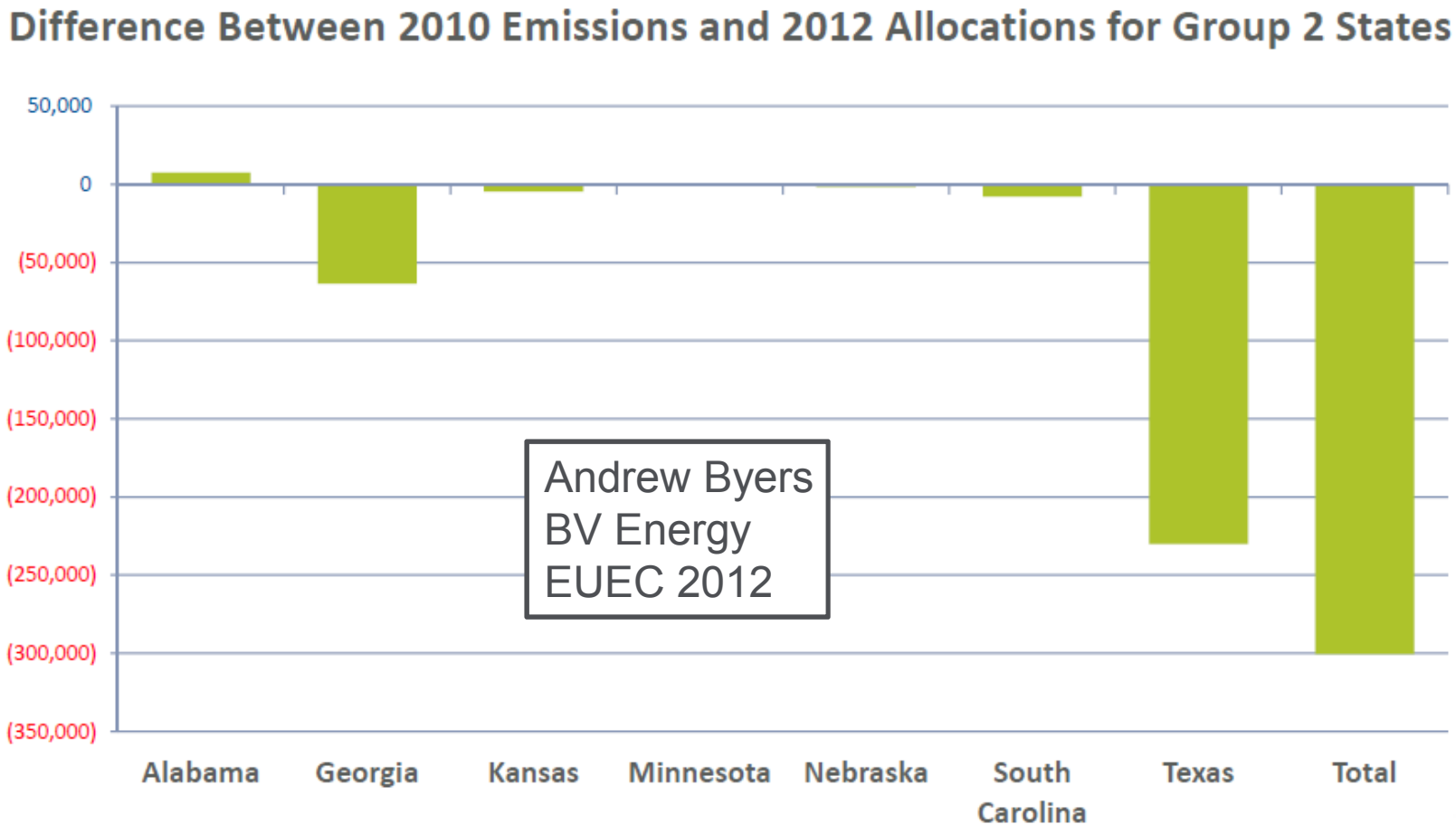
CSAPR 2012 Allocations



Limited trading area / opportunities for control

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CAIR NOx and SO_2 prices

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What's Next for CSAPR?

- Stay Order does not address specific complaints
  - "Little clarity to an uncertain situation"
- **Three potential paths** forward for CSAPR
  1. Upheld = **move forward**, likely in 2013
  2. Side with one or more complaints = **revisions** (will take time)
  3. Vacate = **a new rule** to regulate transport of ozone and PM.
- Impacts:
  - 2 & 3 could restrict (or end) trading for SO_2 and NOx
  - A significant delay puts CSAPR on top of MATS in 2015
    - MATS controls will affect the SO_2 credit market

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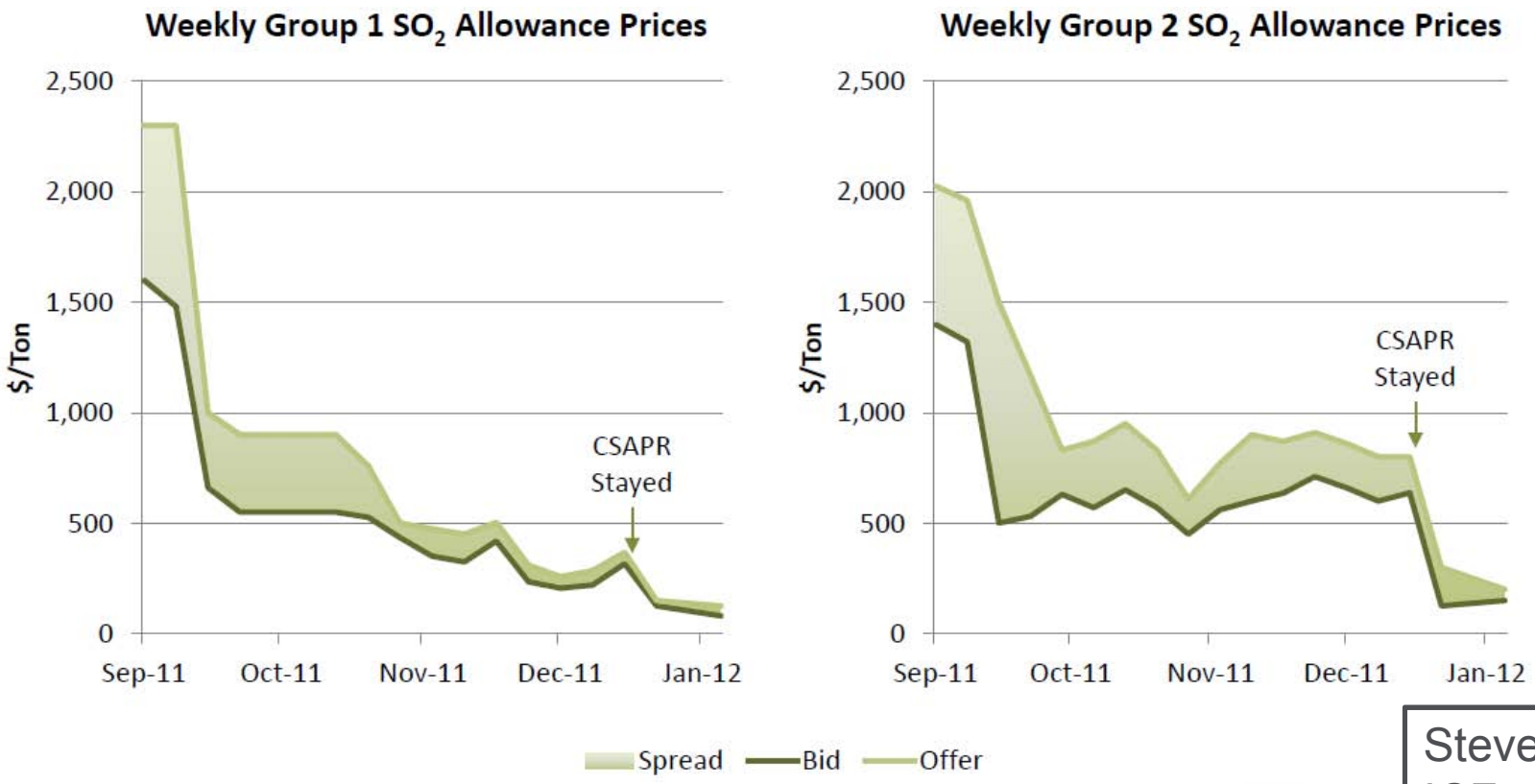
CSAPR SO_2 prices



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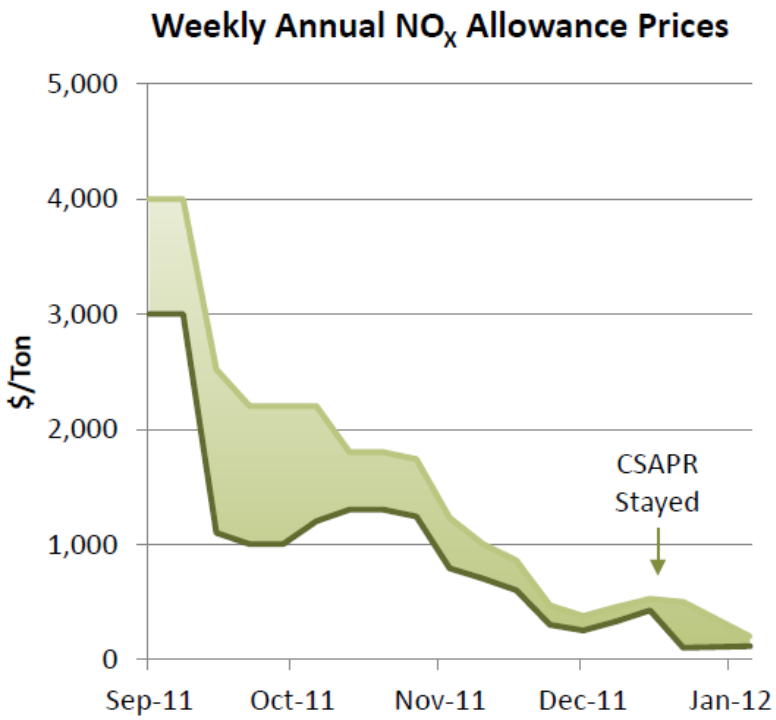
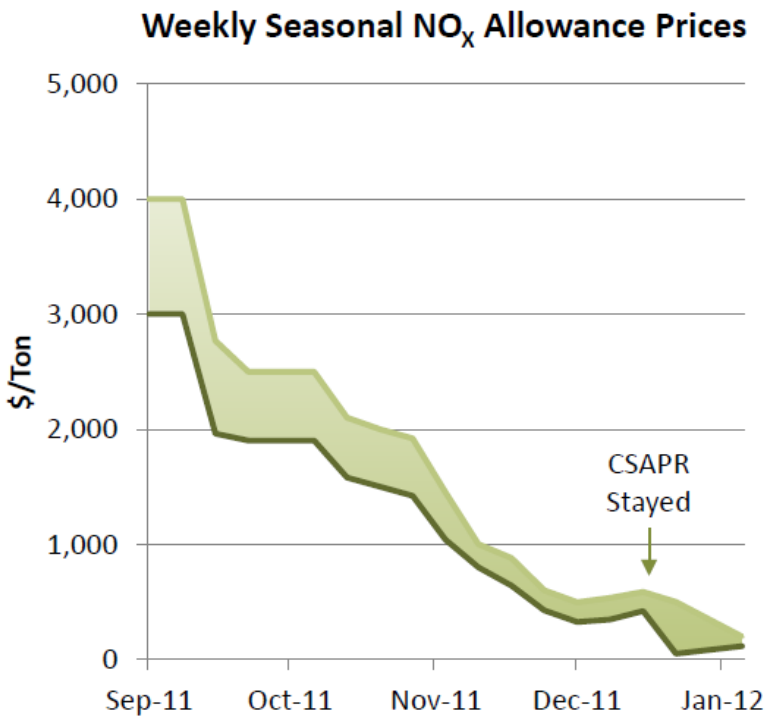
CSAPR NOx prices





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CSAPR Assurance Levels

- Discourages unlimited trading with the Assurance Provision
  - Now starting in 2014
- Assurance Level = State Budget + Variability Limit
  - Variability Limit =
    - 18 percent for annual NOx and SO_2 and 21 percent for the seasonal NOx
- If State Emissions are less than Assurance Level
  - The state is in compliance
  - No penalties, so long as every ton has a credit to cover it
  - This is true even if some affected sources in the state exceeded [illegible] allocations and prorated variability limits
- If State Emissions exceed Assurance Level
  - EPA determines which facilities/companies caused the state to exceed its limit and penalizes those facilities with two "additional" allowances

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CAA – § 112
HAPS – NESHAP
AIR TOXICS
MACT
MATS

POWER PLANT MERCURY AND AIR TOXICS STANDARDS

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Important Dates

- Utility MACT (MATS)
  - Final Rule is out
  - Final Rule in the Federal Register on February 16, 2012
  - Three-Year + 60 Day Compliance = April 17, 2015
    - One year EPA extensions on a case-by-case basis
    - One year administrative extension
      - Some people think that you need to violate to get this extension
- ICI (Boiler) MACT
  - Proposed (to reconsider final rule) = December 23, 2011
    - Public comments through February 21
  - Final-Final rule in April (?)
  - Compliance 3 years + one-year case-by-case delay (?)
  - Overlap with MATS creates a vender pileup, however industrial boiler solutions will necessarily be different

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Changes from the Proposed Rule

- Approach and methodology remained the same
- HCl, Hg, and PM limits mostly unchanged
- PM measurement method is now only “filterable”
  - Dropped condensable portion, citing selenium is controlled by acid gas limits
  - Also, the method has been modified
- More specific coal subcategory
  - Mine-mouth lignite
- Sub categories for oil units
  - Non-continental (better defined) and added limited use
- Work practice standards during start up and shut down
  - Controversial in that it might not match actual SS practices
  - Startup has to use natural gas or distillate oil
- Longer Hg averaging (90 days) with a lower limit (1 lb/TBtu)
- No fuel analysis required. Changes to performance testing needs and LEE definition
- NSPS Adjustments

Utility MACT Regulates EGUs

- Electric generating units (EGUs) are:
  - **Fossil** fuel fired
  - More than 25MWe
  - Selling power to the grid
- Cogeneration units can be defined as EGU
  - Combined heat and power
  - Slightly different definition, must sell:
    - > 25 MWe of “potential” power + > 1/3 of actual power

- Only considering retrofits rules
  - No review in this talk of new boilers or the new NSPS rules

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Fuel/Configuration Subcategories

- Coal-Fired and Solid Oil-Derived Fuel-Fired EGUs
  - Coal-fired EGUs:
    - Low-Rank Virgin Coal (mine-mouth lignite coal)
    - Not Low-Rank Virgin Coal (everything else)
  - Integrated Gasification Combined Cycle (IGCC)
    - Synthetic gas, derived from coal and/or solid oil-derived fuels
  - Solid “Oil-Derived” Fuel Fired
- Liquid Oil-Fired EGUs
  - Continental
  - Non-Continental
    - Higher limits due to poorer refined fuel options
  - Limited-Use
    - Work Practice Standards only

CAA Process to Determine Limits

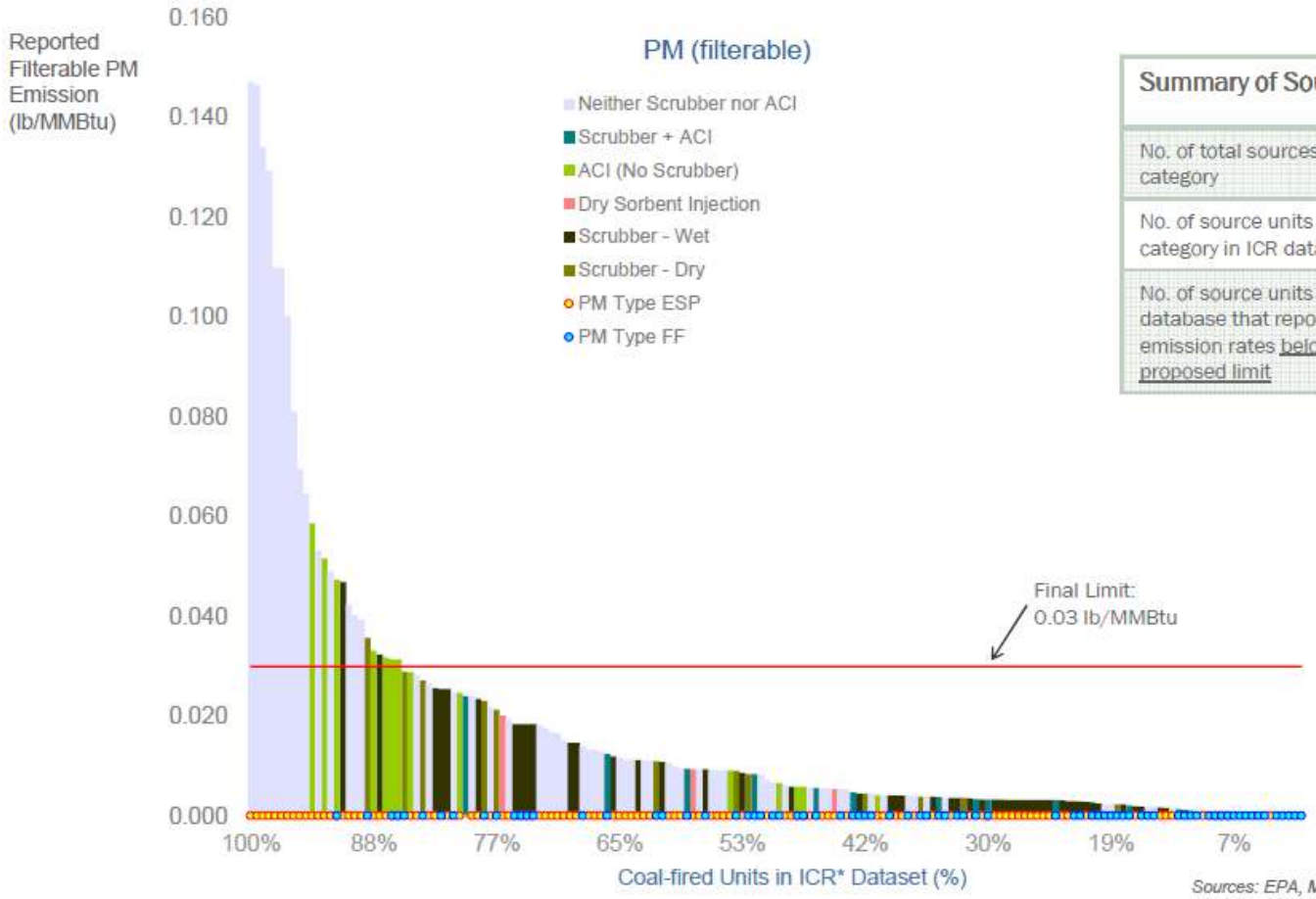
- Health Based Methods (for HCl) were rejected because ample margin of safety could not be established across all HAPs
  - Statement: this is the administrator's judgment
  - Original CAA was based on establishing health based standards.
  - Technology (MACT) based standards came in the 1990 amendments.
- Technology Based Methods
  - Emission limit = MACT Floor =
    - The average of the 12% best performing units
    - Separately determined for each fuel/configuration
- Since < 100% of the data is known, statistics are used:
  - Small data set = "Student's t-test" distribution
  - Normality tested by kurtosis, skewness, and goodness of fit
    - Based on results, either a normal or log-normal fit is used
  - MACT Floor = Upper Prediction Limit w/99% confidence
    - Typically well above average of the 12% best performing units

Existing Coal Limits

- PM 0.030 lb/MMBtu (total PM) – 0.30 lb/MWh
  - Includes only filterable pm
  - 1978 NSPS limit was 0.030 lb/MMBtu (!)
  - Will not be as hard for ESPs to get there
  - Doesn't preclude SO_3 injection for ash resistivity improvements
- HCl 0.002 lb/MMBtu – 0.02 lb/MWh
  - ~1.4 ppm @ 6% O_2 wet
  - DSI where there isn't already WFGD/DFGD
  - Some DFGD expected
- Hg 1.2 lb/TBtu – 0.013 lb/GWh
- Hg 4.0 lb/TBtu – 0.04 lb/GWh (low rank virgin coal)
  - Fuel and backend dependent (equipment & temperature)
- CO and D/F
  - Work Practice Standards every 3 to 4 years

PM ICR Data

(Amlan Saha, MJB&A, EUEC 2012)



Summary of Source Units	
No. of total sources in sub-category	1,091
No. of source units in sub-category in ICR database	172
No. of source units in ICR database that reported emission rates below the EPA proposed limit	147

85% of ICR are currently in compliance

Sources: EPA, MJB&A Analysis
**Information Collection Request*

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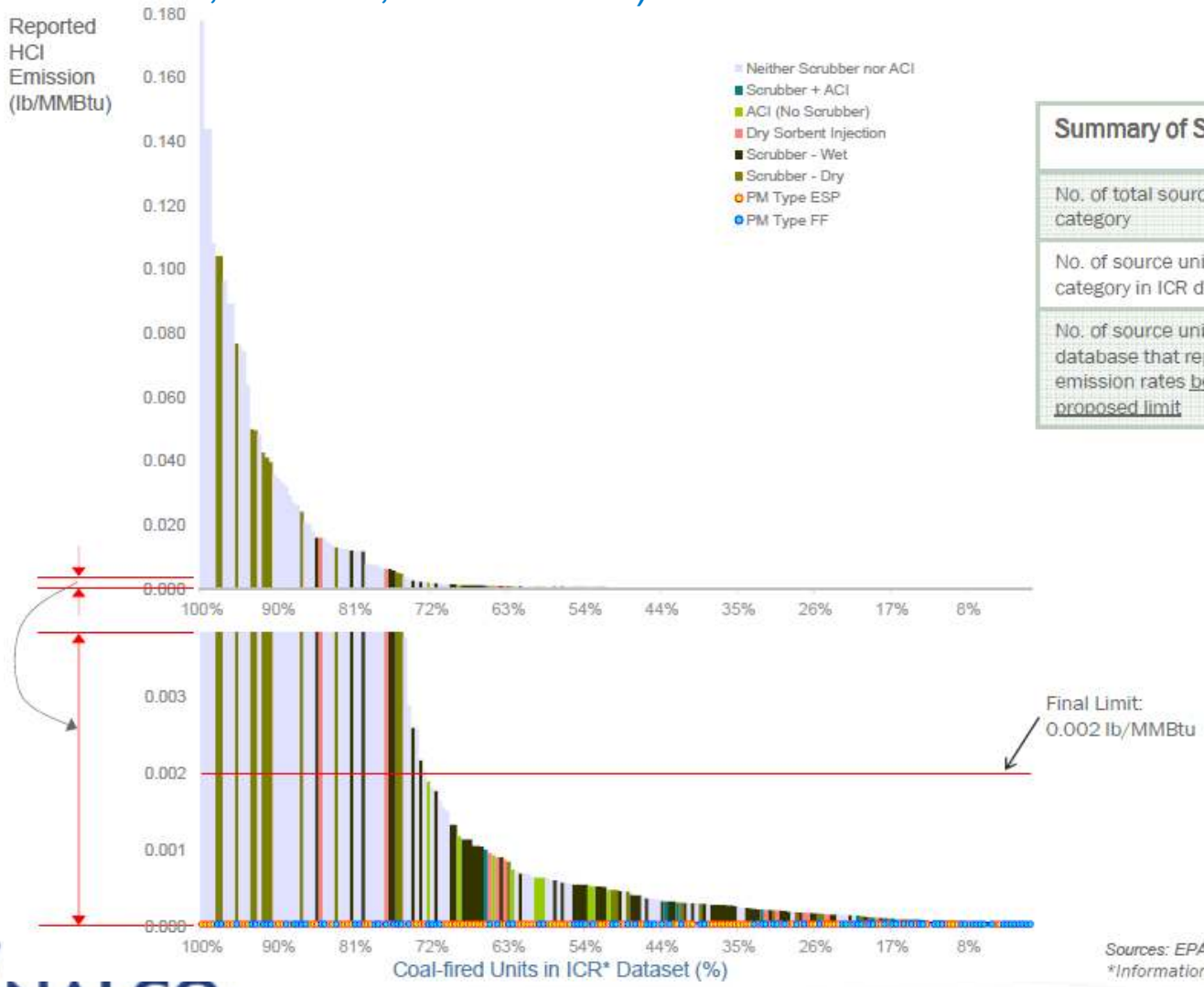
HCl ICR Data

(Amlan Saha, MJB&A, EUEC 2012)



Summary of Source Units	
No. of total sources in sub-category	1,091
No. of source units in sub-category in ICR database	217
No. of source units in ICR database that reported emission rates below the EPA proposed limit	158

73% of ICR are currently in compliance

Sources: EPA, MJB&A Analysis
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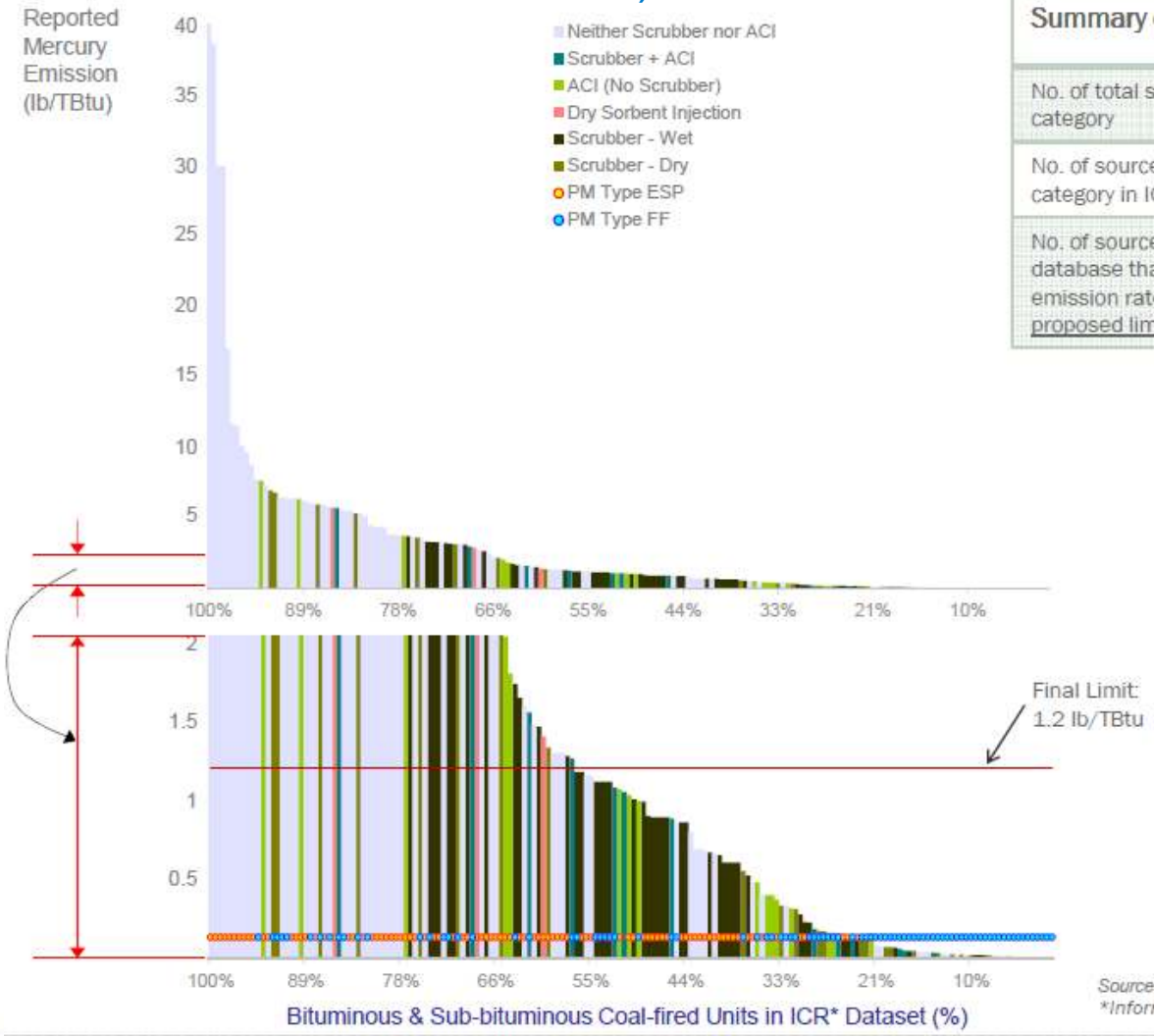
Mercury ICR Data

(Amlan Saha, MJB&A, EUEC 2012)



Summary of Source Units	
No. of total sources in sub-category	1,061
No. of source units in sub-category in ICR database	178
No. of source units in ICR database that reported emission rates below the EPA proposed limit	101

56% of ICR are currently in compliance

Sources: EPA, MJB&A Analysis
**Information Collection Request*

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Solid Oil-Derived Fuel (i.e., Pet Coke)

- PM 0.008 lb/MMBtu (total PM) – 0.09 lb/MWh
  - Much stricter than coal
- HCl 0.005 lb/MMBtu – 0.05 lb/MWh
  - ~3.5 ppm @ 6% O_2 wet
  - Twice that of coal
- Hg 0.2 lb/TBtu – 0.002 lb/GWh
  - Much stricter than coal
- CO and D/F
  - Work Practice Standards every 3 to 4 years

Continental Liquid Oil Limits

- Metals Changed to PM
  - Can still do a direct metal measurement
- PM 0.030 lb/MMBtu – 0.30 lb/MWh
  - Filterable only
- HCl 0.002 lb/MMBtu – **0.01** lb/MWh
  - ~1.3 ppm @ 6% O_2 wet
  - Fuel moisture measurement requirement
- HF 0.0004 lb/MMBtu – 0.004 lb/MWh
- Organic HAP (CO and D/F)
  - Work Practice Standards every 3 to 4 years

- Will DSI be used for oil-fired units?
  - PM capture device issues…

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Output Based Emission Limit

- All emission limits are in either
  - lb/MMBtu or lb/MWh
- EPA assumes a heat rate of 10,000 Btu/kWh
  - Since 10,000 Btu/kWh = 10 MMBtu/MWh (= 0.01 TBtu/GWh)
- Therefore, the difference between the lb/MMBtu and lb/MWh emission limits is a factor of 10
- For example (existing coal > 8300 Btu/lb):
  - PM limit: 0.03 lb/MMBtu or 0.3 lb/MWh
  - HCl limit: 0.002 lb/MMBtu or 0.02 lb/MWh
  - Hg limit: 1.2 lb/TBtu or 0.013 lb/GWh
- Strategy for Utilities (typically)
  - If the actual heat rate is above 10,000 Btu/kWh then use lb/MMBtu
  - If the actual heat rate is below 10,000 Btu/kWh then use lb/MWh

Biomass is not in Utility MACT

- Coal fired if
  - > 10% coal per year heat input for 3 years, **or**
  - > 15% coal heat input for one year
- Utility MACT only covers “Fossil Fuel Fired”
  - Biomass is not regulated under Utility MACT
- Biomass EGUs fall under Boiler MACT
  - Boiler MACT is overall less stringent

Solid Waste Materials

- If an EGU burns ANY solid waste, it must comply to the CISWI MACT for the following six months
- Solid wastes are regulated under CAA section 129
  - CISWI MACT
  - http://www.epa.gov/ttn/atw/129/ciwi/ciwipg.html
- Solid waste is defined by RCRA
  - Resource Conservation and Recovery Act
  - http://www.epa.gov/epawaste/nonhaz/define/index.htm

Specific Compliance

- PM, HCl, HF, Hg
  - 30-day operating rolling averages
- Work Place Standards for CO and D/F
- The final rule provides two basic approaches for most situations:
  - Continuous monitoring
  - Periodic quarterly testing

PM Compliance

- PM is a surrogate for non-Hg HAP metals
- PM continuous parameter monitoring system (CPMS)
  - CPMS is a broader term than CEMs (which is limited to emissions)
  - In conjunction with an operating limit from stack testing
    - at or below highest previous 1-hr stack test (of nine – every time)
  - EPA thinks this will be most common
- Quarterly Stack Testing for Filterable PM testing
  - Method 5 (@320ºF)
  - PM CEMS
  - Method 29 (for individual species)
- SO_3 is (to some degree) included in Method 5 (as it was for ICR)
  - "Need 600ºF to completely vaporize SO_3 from filter testing"
- Fabric filters may still be needed for high SO_3 emitting sites

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Alternative PM Compliance

- Alternative to PM CEMs
  - Quarterly measurements (Method 5)
- Option 1: Total non-Hg HAP testing (Method 29)
  - Total non-Hg metals < 50.0 lb/TBtu (or 0.5 lb/MWh)
- Option 2: Individual non-Hg metals testing (Method 29)
  - Antimony, Sb < 0.8 lb/TBtu
  - Arsenic, As < 1.1 lb/TBtu
  - Beryllium, Be < 0.2 lb/TBtu
  - Cadmium, Cd < 0.3 lb/TBtu
  - Chromium, Cr < 2.8 lb/TBtu
  - Cobalt, Co < 0.8 lb/TBtu
  - Lead, Pb < 1.2 lb/TBtu
  - Manganese, Mn < 4.0 lb/TBtu
  - Nickel, Ni < 3.5 lb/TBtu
  - Selenium, Se < 5.0 lb/TBtu

PM Compliance Solutions

- Fabric Filters (Bag Houses) are the obvious 100% solution
- However, many cold side ESPs will meet the final requirements
- Wet ESPs are often discussed by the EPA as having a lot of HAP co-benefit (e.g., post-WFGD)
  - Expensive and have not seen broad installation
- Tuning marginal ESP units
  - Modification (new TR sets, larger plate separation, more fields)
  - Chemical additives to improve ash resistivity
  - Combustion modifications to reduce LOI and ash carry over
  - Fuel switch (e.g., lower ash fuel)
  - Derate (worse case)
- Beware that other “MACT Solutions” might help or hurt ESP
  - For example, trona injection for HCl capture
  - Expect to demonstrate before installing equipment (for now anyway)

Acid Gas Compliance

- HCl is a HAP and a surrogate for acid gases
- HCl CEMs is used for acid gas compliance
  - Appendix B of the rule
- Alternative: No HCl CEMS + no FGD
  - Quarterly EPA Method 26, 26A, or 320 testing
- SO_2 Alternative: FGD installed = use SO_2 CEMs
  - You must have, and always operate, a WFDG or DFGD
  - SO_2 CEMs used for acid gas compliance
  - SO_2 limit is 0.2 lb/MMBtu (80 ppm @ 6% O_2 wet)

HCl Compliance Solutions

- Desulphurization systems get HCl as co-benefit
- Duct (or Dry) Sorbent Injection (DSI)
  - Trona or Sodium Bicarbonate
  - Hydrated Lime (or other calcium-based sorbents)
  - Selective HCl sorbents in development
- Other chemical additives (duct or furnace)
  - Magnesium chemistries
  - Duct injection, furnace injection, or fuel additives
- Fuel switching or blending
- Wet ESPs too
- Big open question to CSAPR
  - Will there be HCl selective sorbents?
    - To some degree $Ca(OH)_2$ is selective
  - How much SO_2 reduction will MATS really deliver?

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Mercury Compliance

- Hg is a bioaccumulating HAP
- Options
  - Mercury CEMS
    - Continuous – 30 day average
  - Sorbent Traps
    - EPA Method 30B or 29, or sorbent trap monitoring system
  - 90 day average with smaller limits (1 lb/TBtu)
- Extensive detail in the rule's Appendix A

Mercury Compliance Solutions

- Halogen Oxidizers
  - MerControl® 7895 (bromine based oxidizer)
- Activated Carbon Injection
  - Can ruin ash sales and affect ESP
  - Beware high SO_3, which interferes
- Alkali injection
  - Usually as a co-benefit from other technologies
- Proprietary sorbents
  - Many in development
  - Goal is usually to preserve ash sales
- Co-benefit from acid gas reduction
  - Scrubbers (wet or dry) and DSI
  - Need oxidizers
  - Reemission chemistries (MerControl® 8034)
  - Watch out for water regulations

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CO and Dioxin/Furan Compliance

- Work Practice Standards
  - "Performance Tune-Ups"
  - Every planned major outage
    - No less than once every 3 yrs. (or 4 yrs. with Neural Network control system)

- Stepwise process detailed in the rule
  - Inspect burner and combustion controls (Fix if needed)
  - Inspect flame pattern (Fix if needed)
  - Inspect dampers (Fix if needed)
  - Inspect wind-box pressure (Fix if needed)
  - Inspect fuel-to-air control (Fix if needed)
  - Optimize for CO and NOx
  - Measure CO and NOx
  - Document, Record, Submit

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Startup and Shutdown

- Startup means either the first-ever firing of fuel in a boiler for the purpose of producing electricity, or the firing of fuel in a boiler after a shutdown event for any purpose. Startup ends when any of the steam from the boiler is used to generate electricity for sale over the grid or for any other purpose (including on site use).
- Shutdown means the cessation of operation of a boiler for any purpose. Shutdown begins either when none of the steam from the boiler is used to generate electricity for sale over the grid or for any other purpose (including on-site use) or at the point of no fuel being fired in the boiler, whichever is earlier. Shutdown ends when there is both no electricity being generated and no fuel being fired in the boiler.
- Clean fuels = Natural Gas, Distillate Oil, or blends
- I think the issue is the “generation of electricity” can happen before the boiler is stably “started up”.

Malfunction "Affirmative Defense"

- Defined as: "sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment or a process to operate in a normal or usual manner..."
- Emissions during malfunction are not regulated
  - Each Malfunction needs to be documented and reported to EPA
- The EPA will determine an appropriate response based on:
  - Good faith efforts to reduce the likelihood of malfunction
  - Root cause analyses to ascertain and rectify excess emissions
  - Was it, in fact, "sudden, infrequent, not reasonably preventable"?
  - OR was it "caused in part by poor maintenance or careless operation"?
- EPA is finalizing an affirmative defense to civil penalties for exceedances of emission limits that are caused by malfunctions
  - A set up for civil suits ("the defense")
- No change from proposed rule

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Malfunction “Affirmative Defense”

No penalty (which can be significant) if a timely notification to the EPA showing the following:

(1) The excess emissions:

(i) Were caused by a sudden, infrequent, and unavoidable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner; and

(ii) Could not have been prevented through careful planning, proper design or better operation and maintenance practices; and

(iii) Did not stem from any activity or event that could have been foreseen and avoided, or planned for; and

(iv) Were not part of a recurring pattern indicative of inadequate design, operation, or maintenance; and

(2) Repairs were made as expeditiously as possible when the applicable emission limitations were being exceeded. Off-shift and overtime labor were used, to the extent practicable to make these repairs; and

(3) The frequency, amount and duration of the excess emissions (including any bypass) were minimized to the maximum extent practicable during periods of such emissions; and

(4) If the excess emissions resulted from a bypass of control equipment or a process, then the bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and

(5) All possible steps were taken to minimize the impact of the excess emissions on ambient air quality, the environment and human health; and

(6) All emissions monitoring and control systems were kept in operation if at all possible, consistent with safety and good air pollution control practices; and

(7) All of the actions in response to the excess emissions were documented by properly signed, contemporaneous operating logs; and

(8) At all times, the facility was operated in a manner consistent with good practices for minimizing emissions; and

(9) A written root cause analysis has been prepared

Low Emitting EGU (LEE)

- Completely changed from the proposed rule…
- Some EGUs are currently in compliance
  - Hg, HCl, HF, filterable PM, total non-Hg HAP metals, **or** individual non-Hg HAP metals
- Must show compliance for three years
  - Must be below 50% of the MATS limit for 3 years (
    - Increased sample volume
    - Below 10% of the MATS limit for Hg for 3 years with the potential of less than 29 lb/yr of Hg
- No fuel testing is required

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Emission Averaging

- Common site emission averaging allowed for:
  - PM, HF, HCl, non-Hg HAP metals, or Hg
- Existing EGUs must:
  - Be in the same subcategory (fuel/configuration)
  - New sources are not included
  - Owned & controlled by one group, located on contiguous properties
- Appears that “can not exceed” test has been eliminated. There only appears to be a “does not exceed” test.
  - That is, Emission Averaging can be used at “one facility” for units in the “same subcategory”, so long as the averaged emissions are not more than what individual emissions would be under the rule.
- Stack Testing to be used for compliance (quarterly), or CEMS?
- Units sharing a common stack may be treated as one unit

What will be the impact of the MATS rule?

IMPACT ANALYSIS

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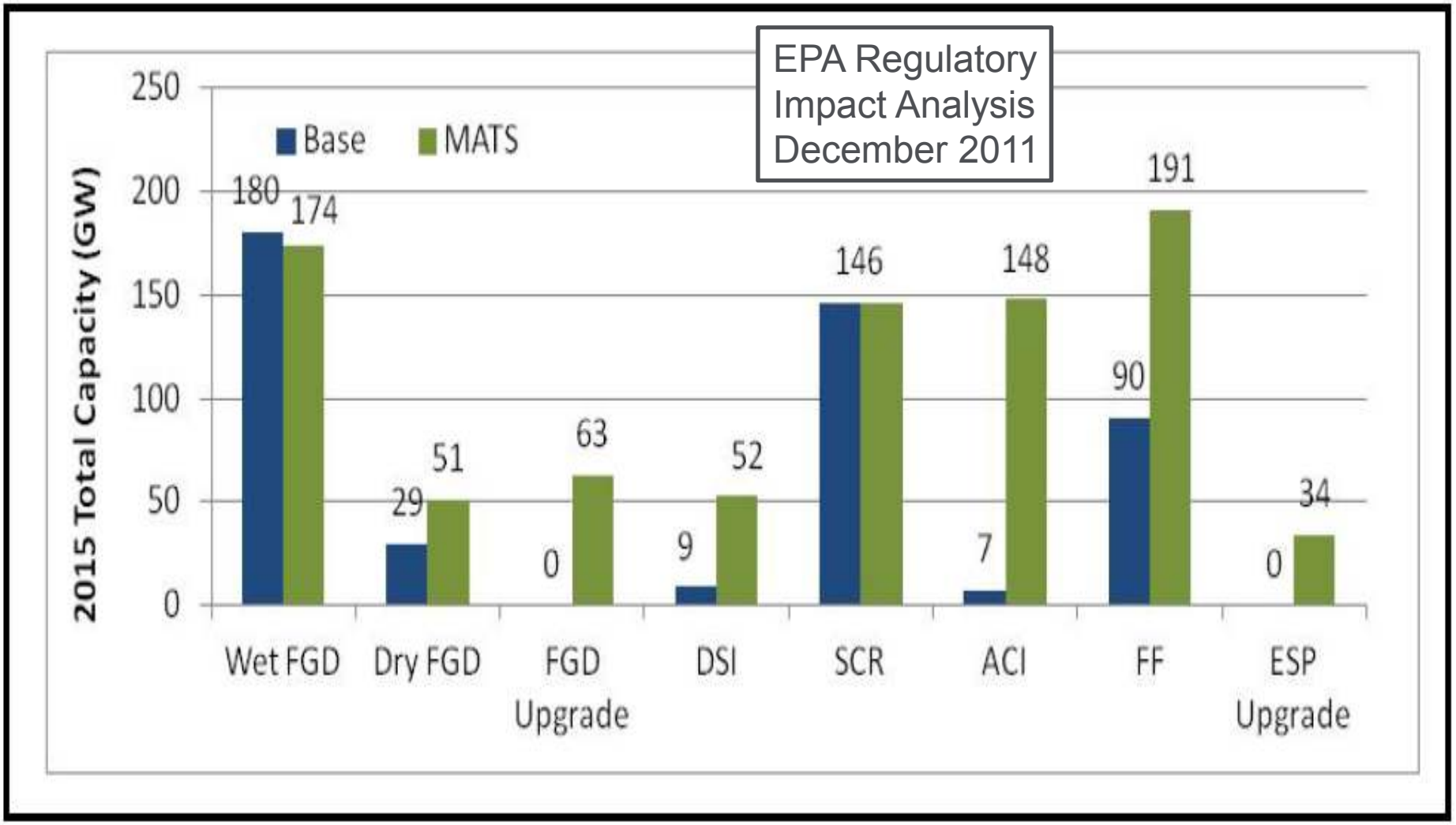
EPA's Expected MATS Impact



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EPA Projected MATS Mercury Reduction

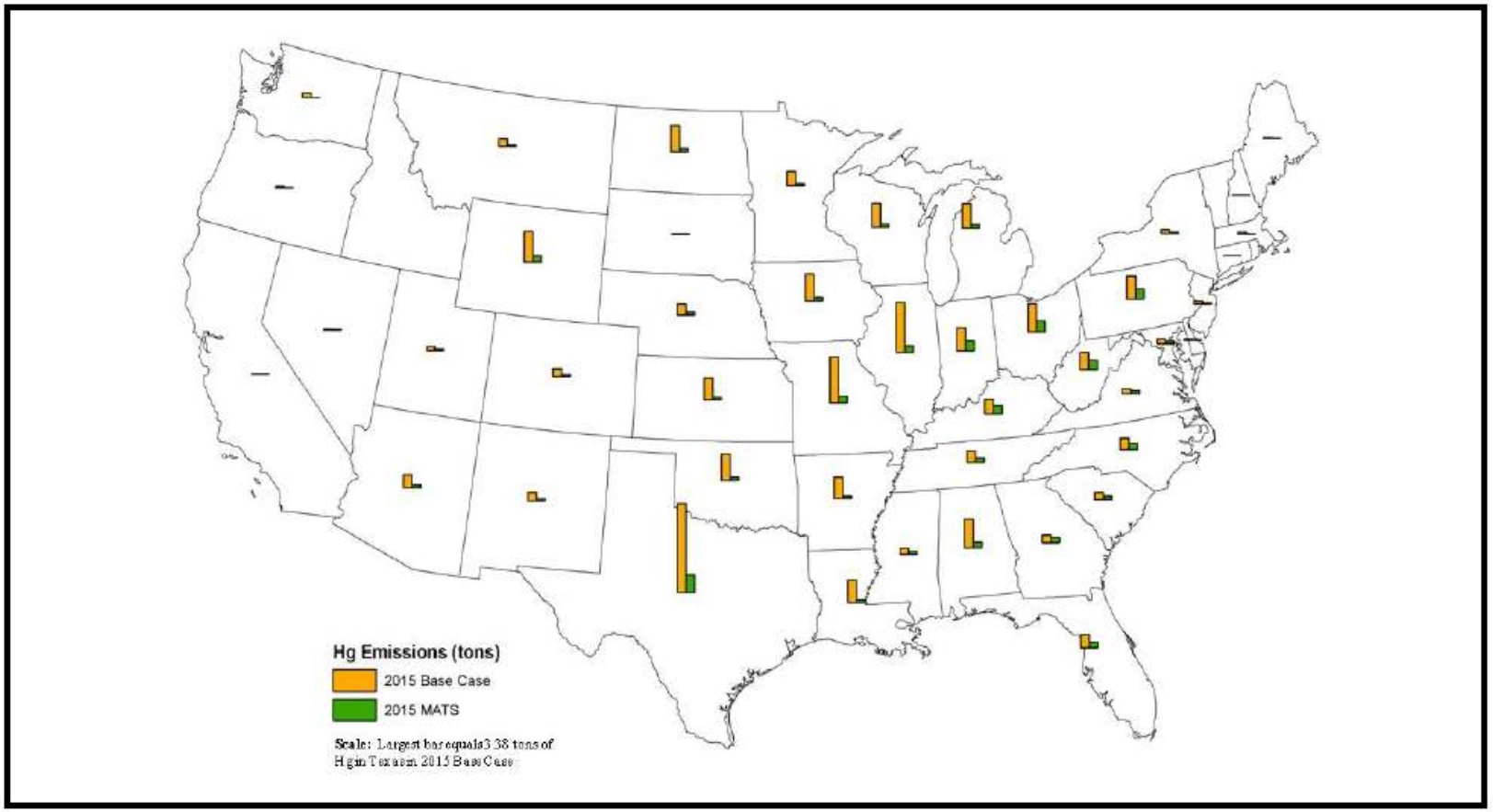

Figure 3-4. Mercury Emissions from the Power Sector in 2015 with and without MATS

EPA Regulatory Impact Analysis December 2011

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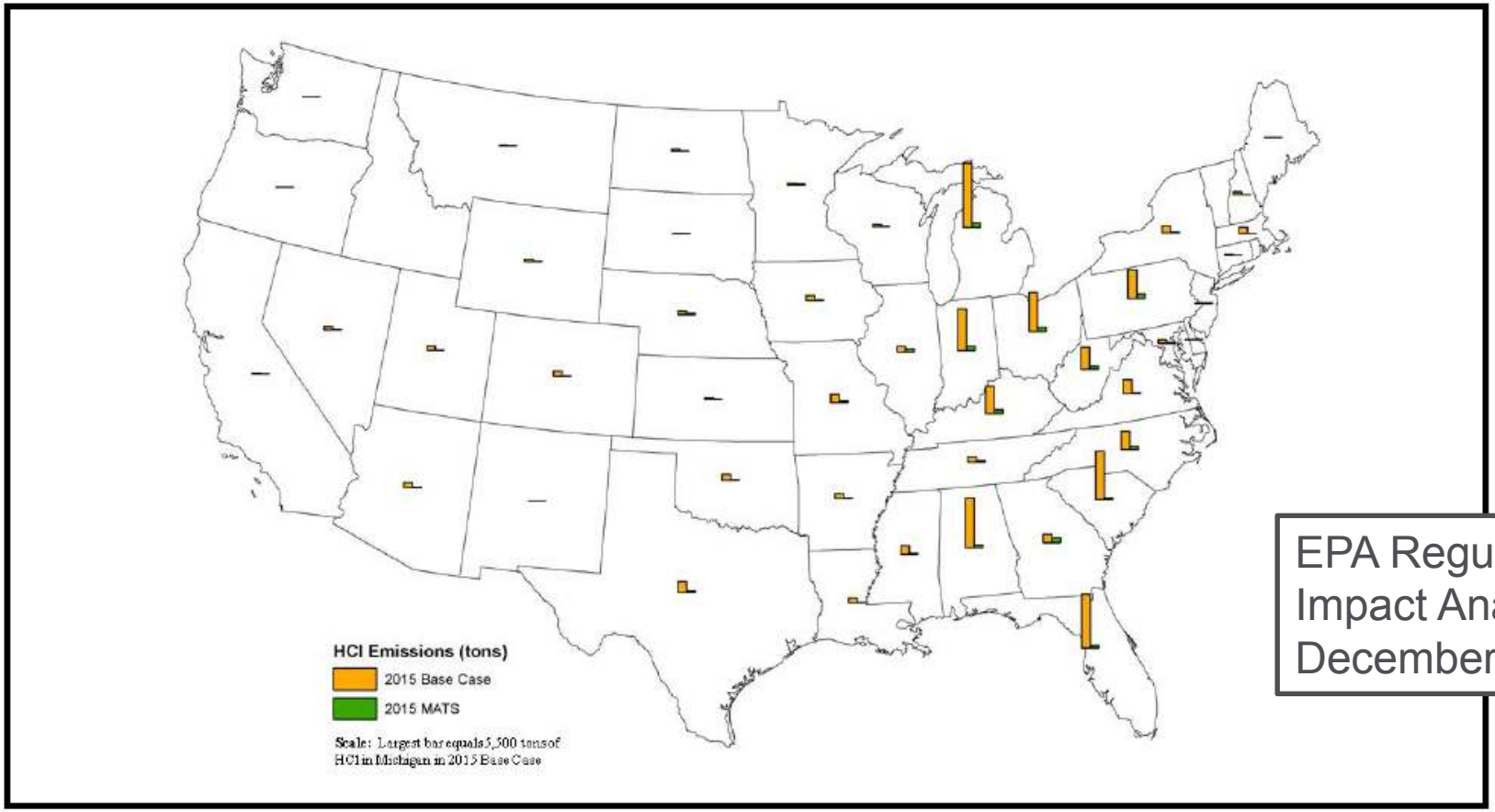
EPA Projected MATS HCl Reduction



EPA Regulatory Impact Analysis December 2011

Figure 3-5. Hydrogen Chloride Emissions from the Power Sector in 2015 with and without MATS

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EPA Cited Benefits

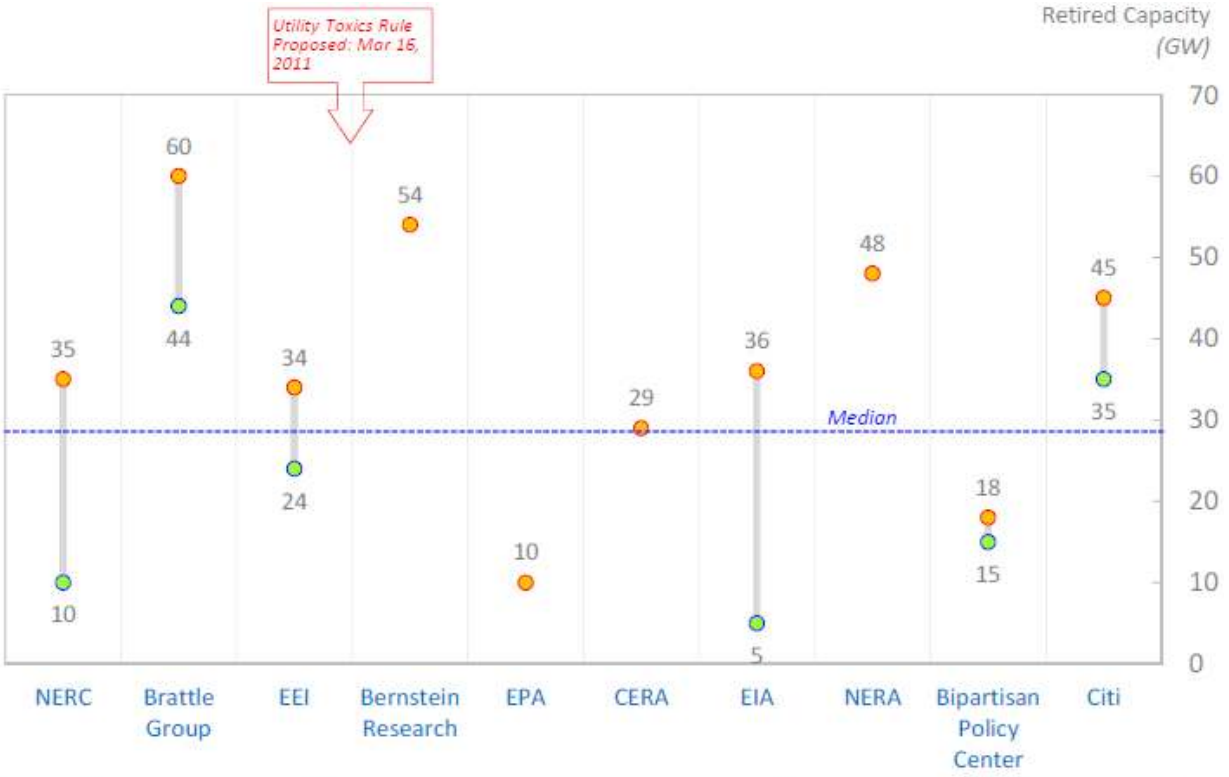
- The final rule will:
  - Prevent 90% of the mercury in coal from being emitted to the air
  - Reduce 88% of acid gas emissions from power plants
  - Cut 41% of SO_2 emissions beyond CSAPR
- Reduces human exposure to
  - mercury, arsenic, chromium, nickel, and particulate
- Reduces fish, mammal, and bird exposure to
  - mercury and acid rain pollution
- Provides employment for thousands of American workers
  - 46,000 short term and 8,000 long term
- Health improvement value from $37 billion to $90 billion each year by preventing
  - premature deaths, heart attacks, asthma attacks, and missed work
- Annual estimated costs of $9.6 billion

Retirements

- EPA's proposed rule cited 10 GW retired ***because of*** MATS
- Andrews – Burns & McDonnell
  - Mainly in Eastern US and Large Utilities
    - Units retiring: 190
    - Retiring Unit Total: 30 GW
    - Avg. 2010 Capacity Factor: 47%
    - Avg. Size: 147 MW
    - Avg. Heat Rate: 11,300 Btu/kW-hr
    - Age: 54 yrs.
- Michael Rossler – EEI
  - ~48 GW of coal-fired generation retirements have been announced already; ceiling may be ~60-80 GW
    - Take place between 2010 and 2022
    - Most will be 50-60 years old upon retirement
    - Due to fuel and/or compliance costs, consent decrees, age, etc.
    - Some will be replaced with natural gas
- Cheap Natural Gas is making the path forward complex

10 Retirement Predictions

Amlan Saha
MJB&A
EUEC 2012



	NERC	Brattle Group	EEI	Bernstein Research	EPA	CERA	EIA	NERA	Bipartisan Policy Center	Citi
Date Released	Oct 2010	Dec 2010	Jan 2011	Mar 2011	Mar 2011	Apr 2011	Apr 2011	May 2011	Jun 2011	Jul 2011
Regulations Considered	Air, Water, Ash	Air, Water	Air, Water, Ash	Air	Air *(Toxics Only)*	Air, Water	Air	Air	Air, Water, Ash	Air, Water, Ash
Baseline Exclusions	13 GW of announced retirements (may include non-coal units)	6 GW of retirements	22 GW of retirements	12 GW projected to retire due to "unit age"	13 GW of retirements	Figure indicated above is the assumed total	9 GW of retirements	5 GW of retirements	14-17 GW of retirements	Figure indicated above is the assumed total

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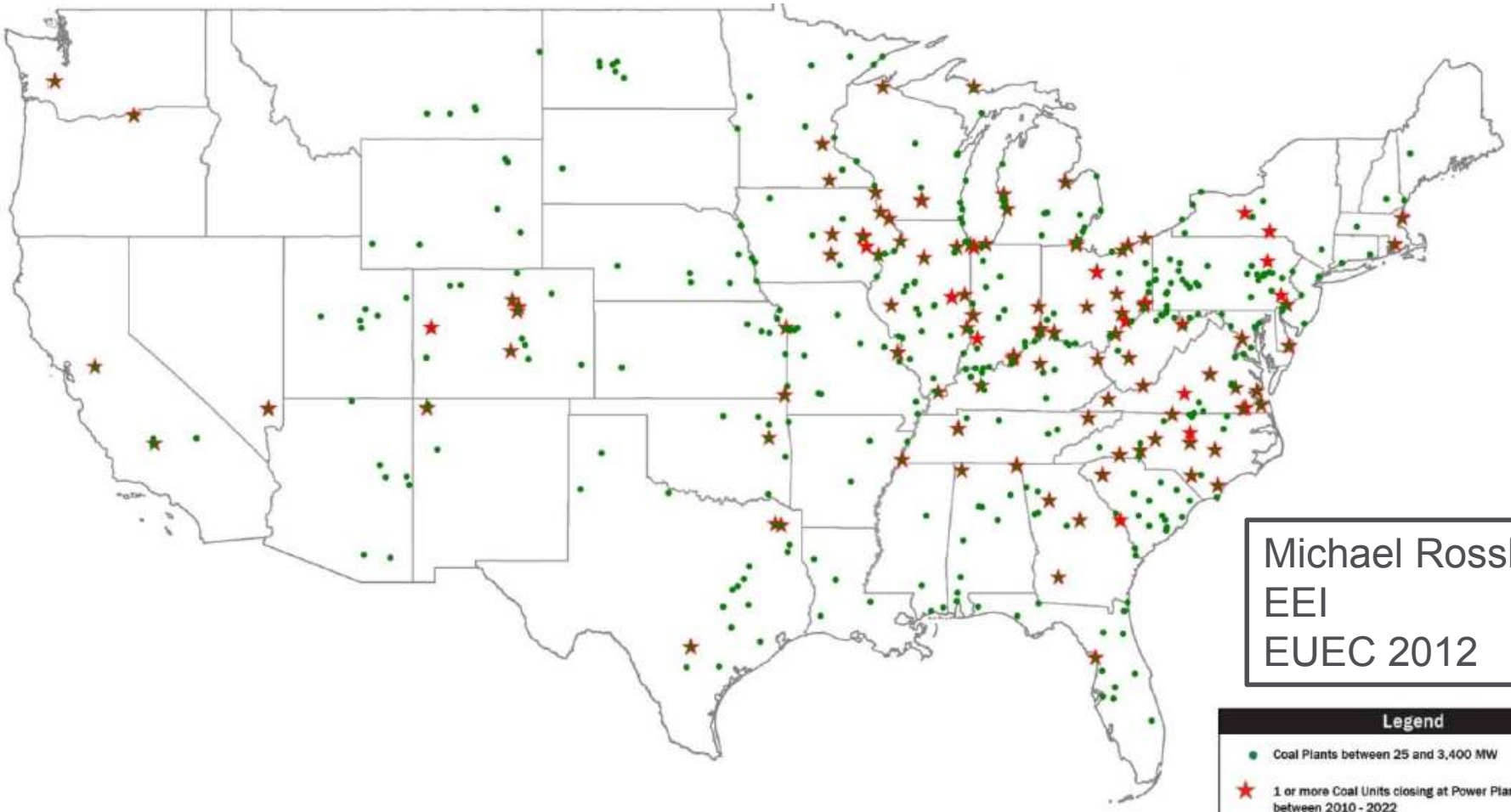
EEI Projected Plant Closures



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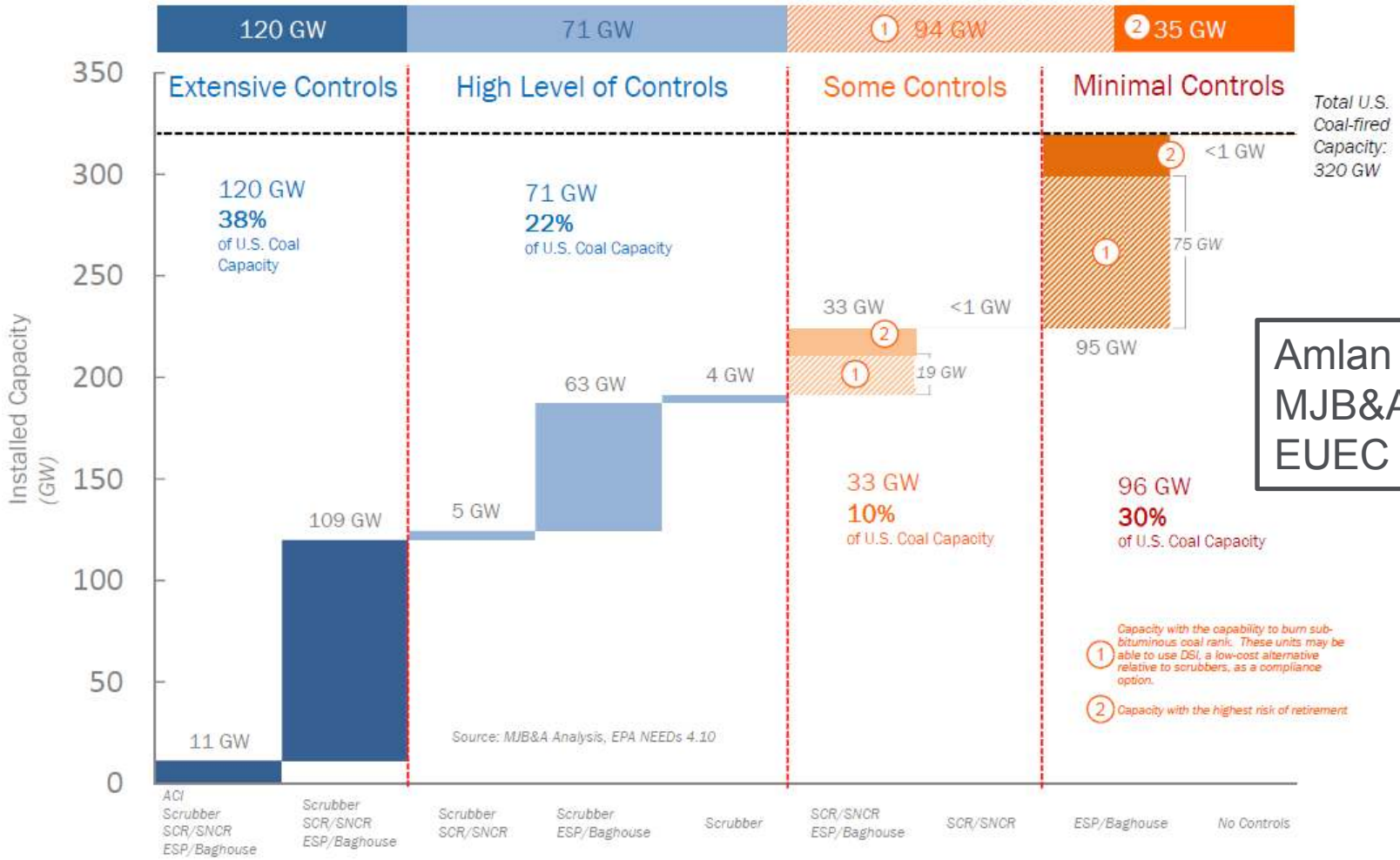
Existing Coal-Fired Fleet (320 GW)



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MJB&A
EUEC 2012

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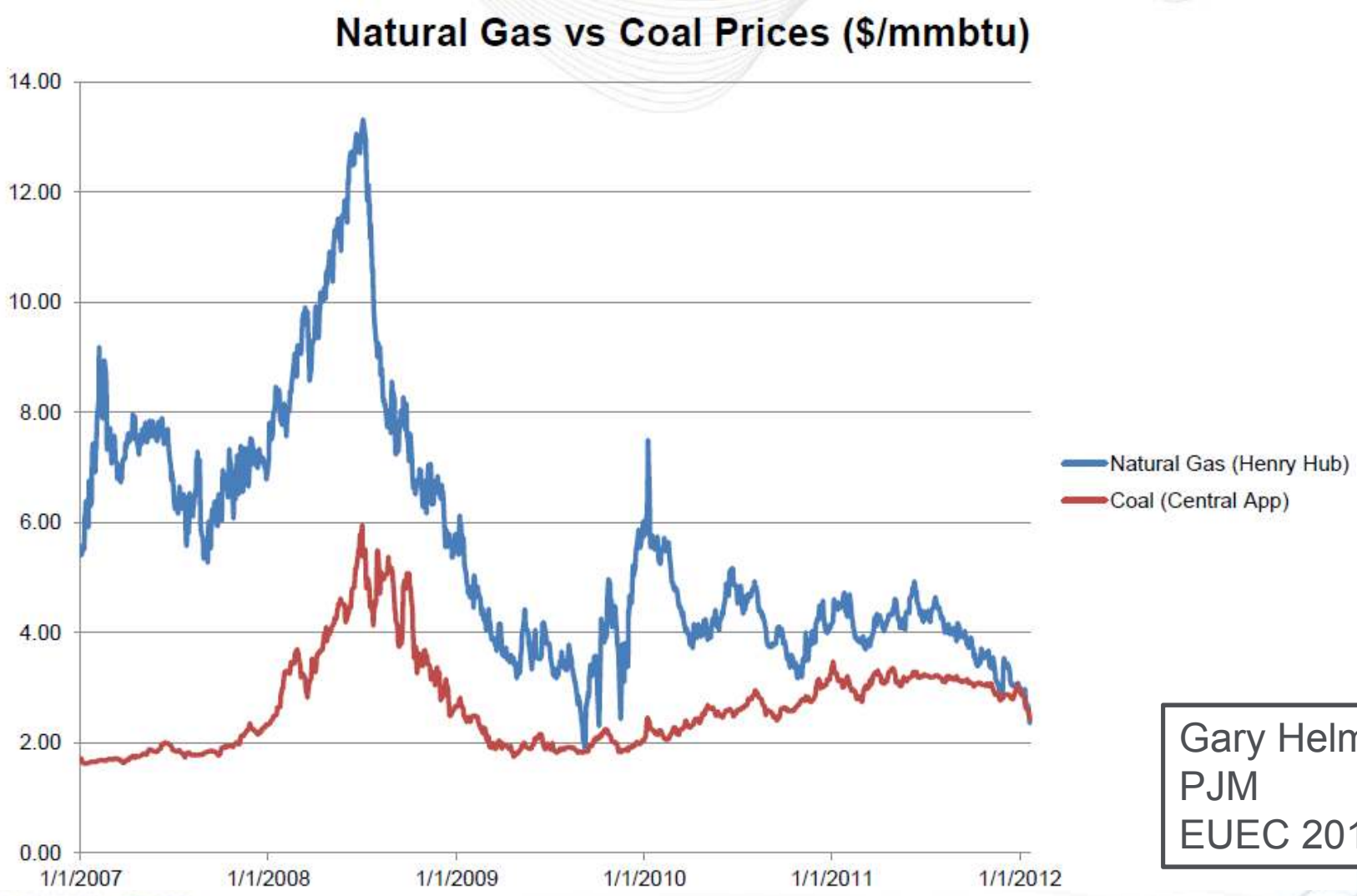
$2/MMBtu Natural Gas – Will it stay?



Gary Helm
PJM
EUEC 2012

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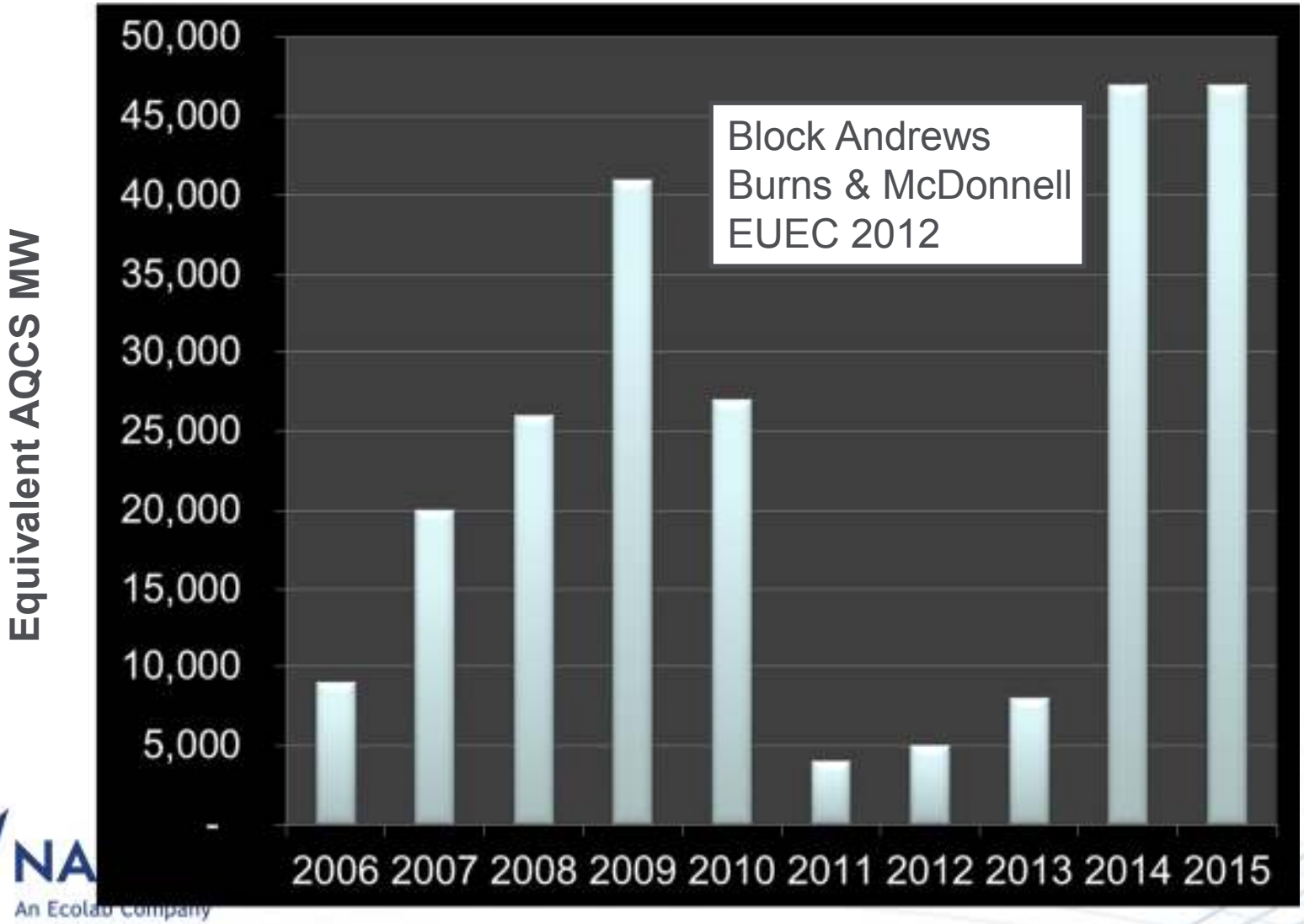
Projected Workload for Air Quality Control Systems (AQCS)



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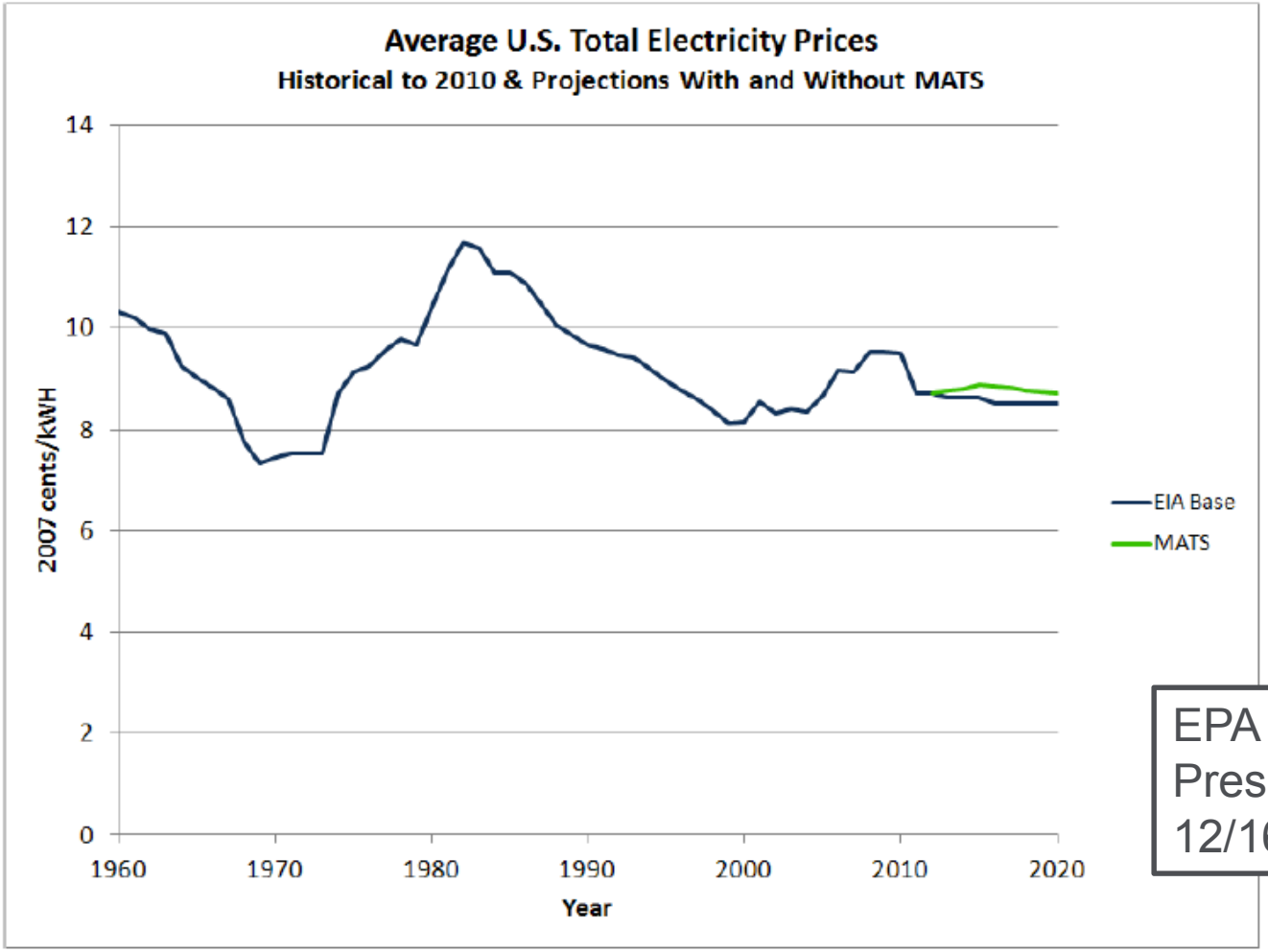
Retail Electrical Cost Increase



EPA MATS Presentation 12/16/11

Sources: EIA Historical (Annual Energy Review – October 2011); EIA Projected (Annual Energy Outlook 2011); EPA modeling of projected price increases using the Integrated Planning Model.

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Timing

- EPA expects most facilities will comply with this rule through a range of strategies, including the use of existing emission controls, upgrades to existing emission controls, installation of new pollution controls, and fuel switching.
- Existing sources generally will have up to 4 years if they need it to comply with MATS.
  - This includes the 3 years provided to all sources by the Clean Air Act. EPA's analysis continues to demonstrate that this will be sufficient time for most, if not all, sources to comply.
  - Under the Clean Air Act, state permitting authorities can also grant an additional year as needed for technology installation. EPA expects this option to be broadly available.
- EPA is also providing a clear pathway for reliability critical units to obtain a schedule with up to an additional year to achieve compliance. This pathway is described in a separate enforcement policy document. The EPA believes there will be few, if any situations, in which this pathway will be needed.
  - **Still in violation → Can NGOs sue?**
- AO for further delay is available for plants that can show Reliability is a problem if they shut down

Thank You

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