Interstate Ozone Transport for the 2008 NAAQS

- EGU Emission Reduction Potential and Feasibility of Controls -

April 8, 2015

Preliminary Draft – Information Subject to Change

Emission Reduction Potential and Feasibility of Controls

- The goal of this presentation is to facilitate a dialogue with states about EGU NO_X reduction strategies that could help address interstate ozone transport for the 2008 NAAQS.
  - While this presentation shares projections using IPM, we will continue engaging with states on how other approaches (including the ERTAC tool) can inform SIP development.
- We are looking at EGU NO_X reduction strategies that can be in place by the 2017 ozone season.
- On January 22, 2015, EPA issued a memo and preliminary air quality modeling data, including projected ozone concentrations and contributions from upwind states to downwind locations.
  - We are updating our air quality modeling assessment related to ozone transport for the 2008 NAAQS and will share that as it is available.
- This presentation focuses on eastern states with contributions exceeding the CSAPR screening threshold, with respect to the 2008 ozone NAAQS, based on our preliminary data.

Presentation Outline

Near-term EGU NO_X reduction strategies

- Operating existing post-combustion controls
- State of the art combustion controls
- Shifting generation to lower-emitting EGUs

EGU NO_X reduction potential

- NO_X reduction potential assessment
- Near-term EGU NO_X reductions

Translating EGU NO_X reduction potential into EGU emission budgets

Post-2017 EGU NO_X reduction potential

Near-term EGU NO_X Reduction Strategies

Operating existing post-combustion controls

- Fully operating existing post-combustion controls utilizes investments that have already been made, can be done quickly, and can significantly reduce EGU NO_X emissions.
- Post-combustion NO_X controls include selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR).
  - SCRs can achieve up to 90% reduction in EGU NO_X (with sufficient installed catalyst).
  - SNCRs can achieve 20% to 30% reduction in EGU NO_X, beyond the reductions from combustion controls.
- These controls are in widespread use.
  - 64% of coal-fired EGU capacity in the east is equipped with post-combustion controls.
  - 75% of NGCC EGU capacity in the east is equipped with post-combustion controls.
- Recent power sector data reveals that some SCR and SNCR controls are being underutilized.
  - In some cases, controls are not fully operating.
  - In others, controls have been idled for months or years.

Near-term EGU NO_X Reduction Strategies

Cost analysis of operating existing post-combustion controls

- For SCRs and SNCRs that are not fully operating, the cost of full operation is linked to the cost of using additional ammonia or urea.
  - We estimate the cost of fully operating these controls to range from $400 per-ton to $500 per-ton.
- For SCRs and SNCRs that are idled, unit operators may need to restart payment of some fixed and variable costs associated with that control.
  - Fixed and variable costs include labor, maintenance and repair, reagent, parasitic load and ammonia or urea.
  - We estimate the cost per-ton of restarting idled controls to be $700 per-ton to $1,700 per-ton for SCRs and $1,900 per-ton and $3,300 per-ton for SNCRs.

Near-term EGU NO_X Reduction Strategies

State of the art combustion controls

- State of the art combustion controls such as low NO_X burners (LNB) and/or over-fire air (OFA) are cost-effective, can be installed quickly, and can significantly reduce EGU NO_X emissions.
  - 99% of coal-fired EGU capacity in the east is equipped with some control.
- Combustion controls alone can achieve NO_X rates of 0.15 to 0.50 lb/mmBtu.
  - Once installed, combustion controls reduce NO_X at all times of EGU operation.

Cost analysis for state of the art combustion controls

- The cost depends on combustion control type and unit type.
- We estimate the cost per-ton of state of the art combustion controls to be $500 per-ton to $1,200 per-ton.

Near-term EGU NO_X Reduction Strategies

Shifting generation to lower-emitting EGUs

- Shifting generation to lower-emitting EGUs, similar to operating existing controls, utilizes investments that have already been made, can be done quickly, and can significantly reduce EGU NO_X emissions.
- The EGU fleet has trended toward lower-emitting generation due to market conditions and state and federal environmental policies.
  - New NGCC facilities emit 0.0095 lb/mmBtu of NO_X and represented 45% of new 2014 capacity.
  - Solar and wind generation have zero NO_X emissions and represented 20% and 28% of new 2014 capacity, respectively.
- Currently, low NO_X emitting fossil generation (NO_X rate less than 0.15 lb/mmBtu) account for 71% of electric generating capacity.
  - These units have an average capacity factor of 49%.
- Shifting generation occurs on a continuum in response to the limits on allowable emissions from the fleet (e.g., state budgets in trading programs).
  - EPA analyzed NO_X reduction potential from shifting generation using the Integrated Planning Model (IPM) version 5.14. Results for these assessments are available at www.epa.gov/powersectormodeling.

EGU NO_X Reduction Potential

NO_X reduction potential assessment

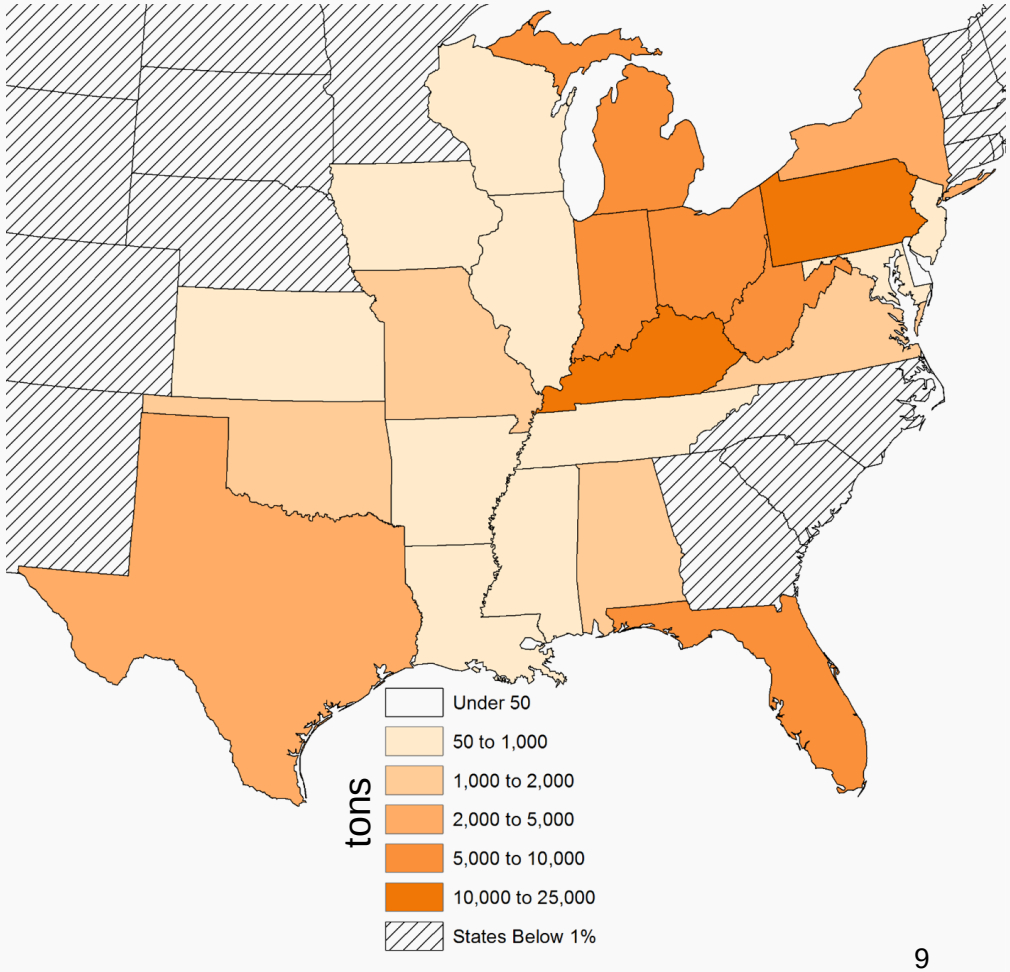
- EPA assessed the NO_X reduction potential from the EGU NO_X mitigation strategies discussed previously.
  - Operating existing post-combustion controls
    - Note: Different approaches could be used to illustrate the NO_X reduction potential of running existing SCR. EPA's assessment applies the lower of either (a) 2011 actual ozone season NO_X rates; or (b) a NO_X rate of 0.12 lb/mmBtu.
  - State of the art combustion controls
  - Shifting generation to lower-emitting EGUs
- Our assessment was informed by IPM analyses assessing a range of NO_X control costs.
  - Analyzed NO_X control costs at various representative levels, from $500 per-ton to $10,000 per-ton.
  - NO_X limits were applied during the ozone season (May through September).
- From the illustrative reductions across these scenarios, we have catalogued NO_X reductions by control strategy.

Near-term EGU NO_X Reductions

Reductions from all near-term EGU NO_X reduction strategies

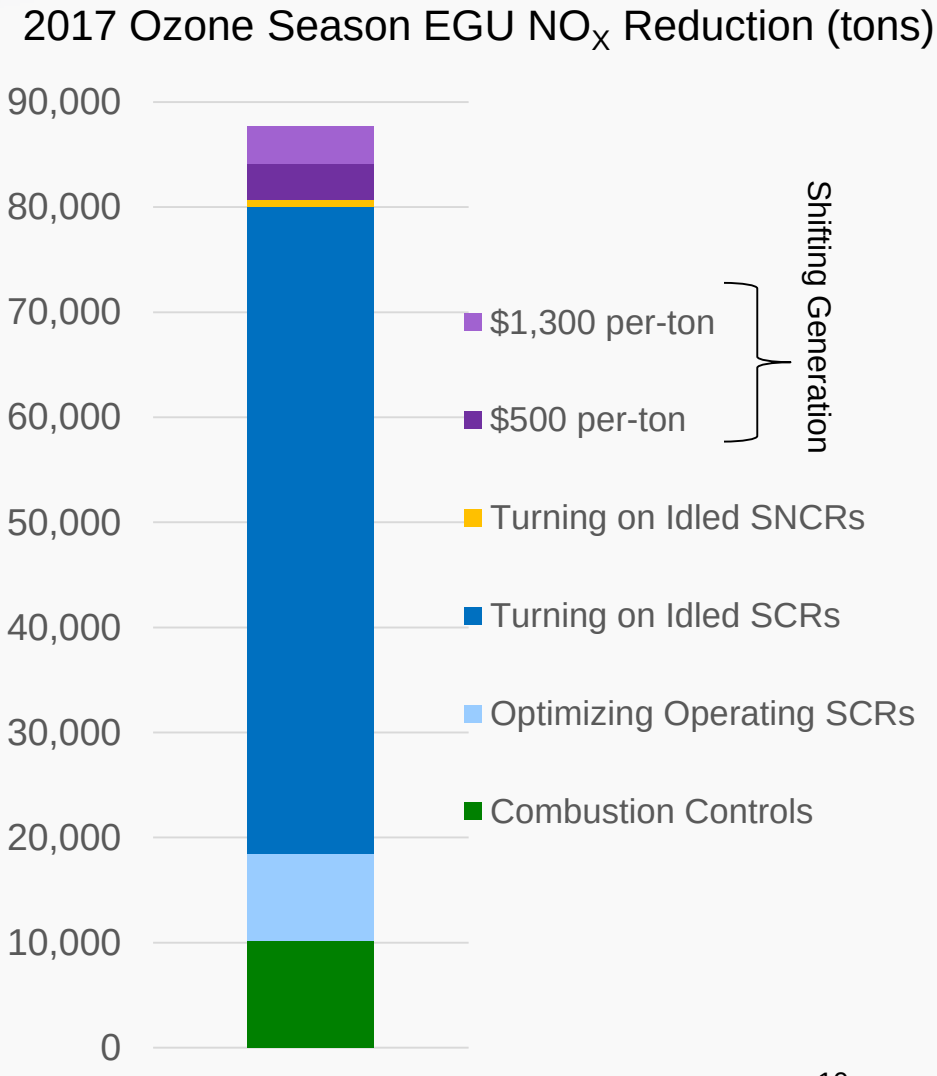
- The map illustrates the location of NO_X reductions achieved from all EGU NO_X strategies:
  - Operating existing post-combustion controls (SCR and SNCR)
  - State of the art combustion controls
  - Shifting generation to lower-emitting EGUs (illustrated using $1,300 per-ton assessment)
- Ozone season EGU NO_X reduction potential in the states examined adds up to over 80,000 tons.

2017 Ozone Season EGU NO_X Reduction (tons)
- All Near-term EGU NO_X Reduction Strategies -



Near-term EGU NO_X Reductions

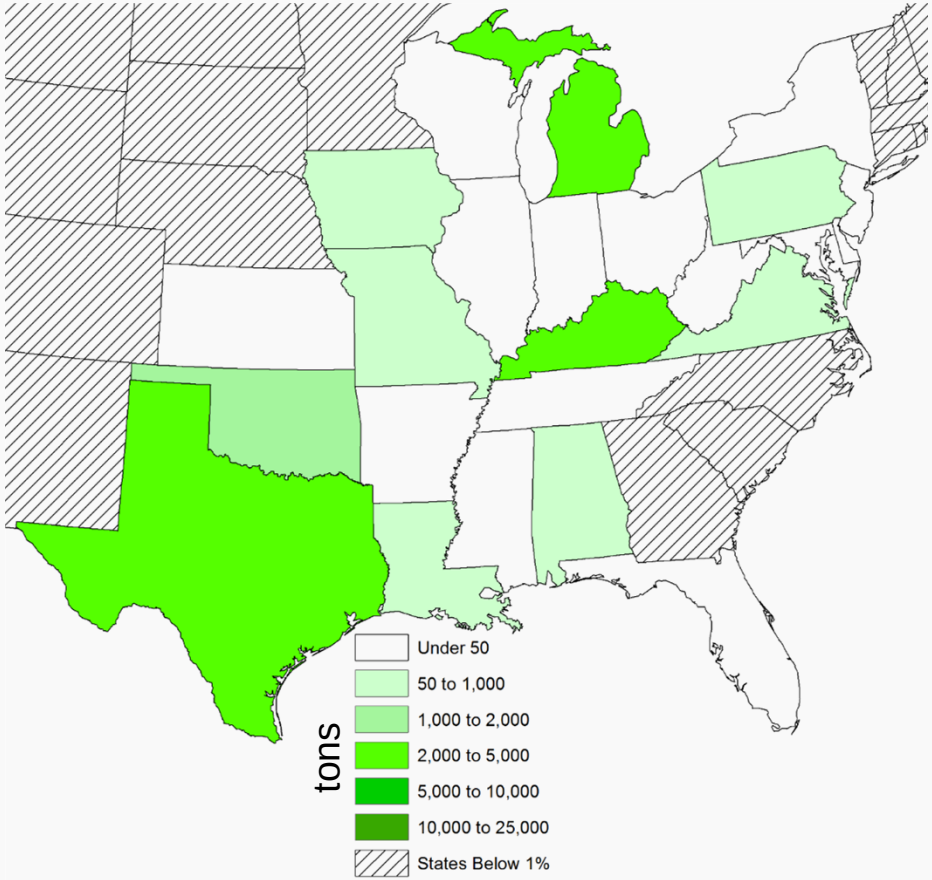
- State of the art combustion controls achieve approximately 10,000 tons of ozone season EGU NO_X reductions.
- Utilizing existing SCRs achieves approximately 70,000 tons of ozone season EGU NO_X reductions.
  - Optimizing SCRs achieves 8,300 tons.
  - Turning on idled SCRs achieves 62,000 additional tons.
- Turning on idled SNCRs achieves 700 tons of ozone season NO_X reductions.
- Shifting generation achieves approximately 3,400 tons at $500 per-ton and an additional 3,600 tons at $1,300 per-ton.
  - Additional scenarios are depicted on slide 12.



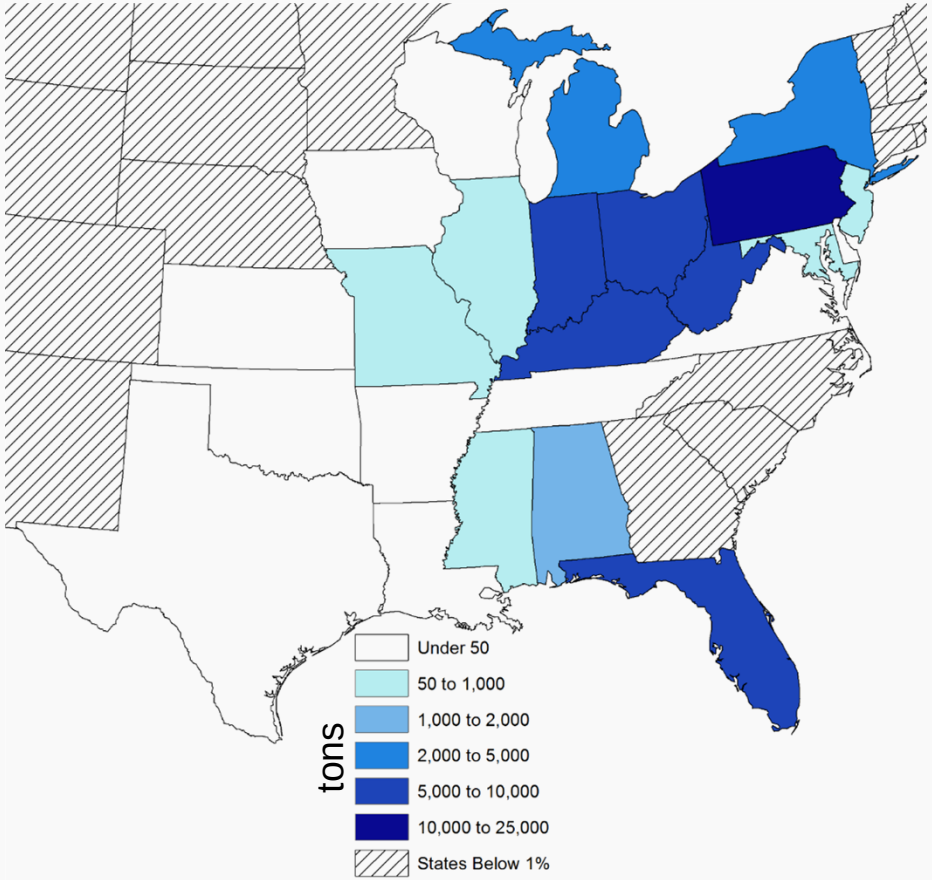
Near-term EGU NO_X Reductions

2017 Ozone Season EGU NO_X Reduction (tons)

State of the Art Combustion Controls
(10,000 tons total)

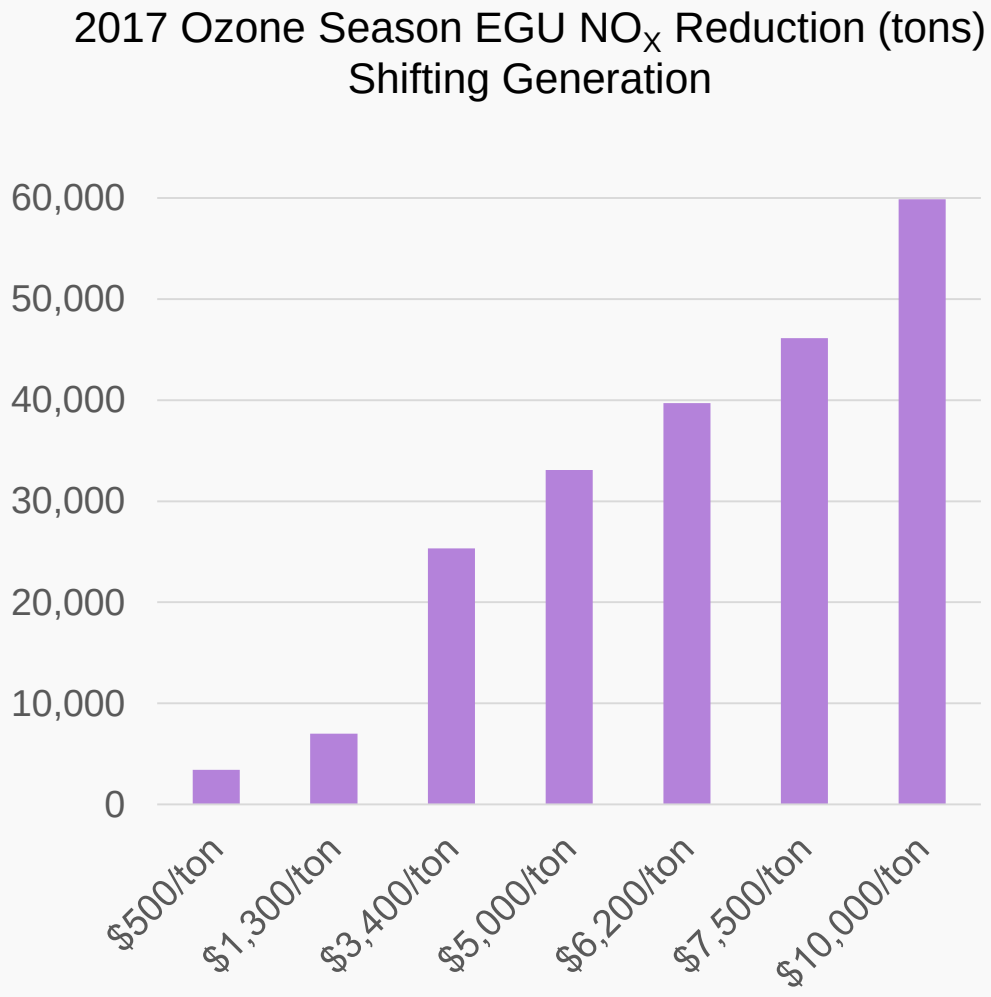


Optimizing SCRs and Turning on Idled SCRs
(70,000 tons total)



Near-term EGU NO_X Reductions

- The reduction potential from shifting generation varies in response to stringency of NO_X control.



Translating EGU NO_X Reduction Potential into EGU Emission Budgets

In addition to near-term reductions (for example, those presented in the previous slides), emission budgets could account for existing actions that are expected to influence EGU emissions by 2017, such as consent decrees, planned retirements, and new generation (i.e. base case conditions).

EPA would like to work with states to determine the best approach for establishing state-level NO_X budgets that are informed by the best available power sector data and emission projections (including information from the ERTAC tool).

Post-2017 EGU NO_X Reduction Potential

EPA's EGU NO_X reduction potential assessment provides additional information on NO_X reduction potential beyond 2017.

- We don't see a lot of additional reductions from the near-term EGU NO_X controls that are the focus of this discussion. These are primarily realized in 2017.
- We do see additional EGU NO_X reduction potential in 2020 with higher levels of NO_X control.
  - For example, nationally, up to 20 GW of additional SCR retrofit capacity could be economic in 2020 to 2025.
- We will continuing working with states to identify additional NO_X reductions in the post-2017 time-frame.

Appendix

EPA Base Case

- EPA developed a 2017 base case using the Integrated Planning Model (IPM).
- This base case reflects thousands of comments submitted on previous notices of data availability and other public comment opportunities.
  - EPA released NODAs on the ozone transport 2011 and 2018 base case emission inventories in November of 2013 and February of 2014, respectively.
- The 2017 base case represents the first increment of near-term NO_X reductions relative to 2014 emission levels, due to on-the-books policies and current market conditions.
- This base case was released publicly on March 25, 2015.
- More information on EPA's power sector modeling can be found at www.epa.gov/powersectormodeling.