ERTAC EGU Projection Tool: What Can You Do With it?

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Various Uses of the ERTAC EGU Tool

• Comparing Results to Other Estimations, like IPM
• Estimating the Effects of Regulations, like MATS
• Estimating the Effects of Growth Rate Assumptions
• Updating Results to Include Large, Unit-Specific Changes
• What-If Scenarios
• Improving Base Year (BY) Hourly Data
• Post Processor Development
Comparing ERTAC and IPM Results

- IPM-Integrated Planning Model
  - Used by EPA to estimate emissions from the power sector
    - [www.epa.gov/airmarkets/programs/ipm/](http://www.epa.gov/airmarkets/programs/ipm/)

- ERTAC team has developed comparison spreadsheet at the unit level

- [https://www.dropbox.com/sh/fcy982m38k4q40q/AADcl1ze4BnmAnx3Mtw_b8Nma?dl=0](https://www.dropbox.com/sh/fcy982m38k4q40q/AADcl1ze4BnmAnx3Mtw_b8Nma?dl=0)
ERTAC vs IPM: By Unit, Facility, State, or Pollutant

### Tons of SO2 Annually, 2018

<table>
<thead>
<tr>
<th></th>
<th>MD</th>
<th>NC</th>
<th>VA</th>
<th>WV</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERTACv2.2</td>
<td>34,317</td>
<td>36,002</td>
<td>9,230</td>
<td>53,616</td>
</tr>
<tr>
<td>ERTACv2.3</td>
<td>34,351</td>
<td>35,358</td>
<td>10,078</td>
<td>56,776</td>
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<tr>
<td>IPMv5.13</td>
<td>5,838</td>
<td>32,347</td>
<td>8,225</td>
<td>78,063</td>
</tr>
</tbody>
</table>

### Tons of NOx during the Ozone Season, 2018

<table>
<thead>
<tr>
<th></th>
<th>Chesterfield Power Station</th>
<th>Mount Storm Power Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERTACv2.2</td>
<td>1,128</td>
<td>1,748</td>
</tr>
<tr>
<td>ERTACv2.3</td>
<td>1,221</td>
<td>2,007</td>
</tr>
<tr>
<td>IPMv5.13</td>
<td>860</td>
<td>1,428</td>
</tr>
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</table>
# Tabular Formats

<table>
<thead>
<tr>
<th>Model</th>
<th>Data</th>
<th>ERTACv2.2</th>
<th>ERTACv2.3</th>
<th>IPMv5.13</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FY Gen (MW-hrs)</td>
<td>FY NOx, tpy</td>
<td>FY Gen (MW-hrs)</td>
</tr>
<tr>
<td>State</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL</td>
<td>50,737,405</td>
<td>34,703</td>
<td>51,950,354</td>
<td>36,433</td>
</tr>
<tr>
<td>AR</td>
<td>39,809,205</td>
<td>41,285</td>
<td>41,884,162</td>
<td>41,765</td>
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<tr>
<td>FL</td>
<td>54,670,129</td>
<td>35,234</td>
<td>50,691,474</td>
<td>33,032</td>
</tr>
<tr>
<td>GA</td>
<td>54,527,047</td>
<td>29,658</td>
<td>57,642,832</td>
<td>31,369</td>
</tr>
<tr>
<td>LA</td>
<td>24,702,843</td>
<td>15,243</td>
<td>21,699,664</td>
<td>14,314</td>
</tr>
<tr>
<td>MS</td>
<td>10,244,429</td>
<td>16,235</td>
<td>11,256,415</td>
<td>17,641</td>
</tr>
<tr>
<td>NC</td>
<td>53,314,717</td>
<td>33,989</td>
<td>58,552,139</td>
<td>41,564</td>
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<tr>
<td>SC</td>
<td>29,336,054</td>
<td>12,290</td>
<td>34,713,739</td>
<td>14,416</td>
</tr>
<tr>
<td>VA</td>
<td>18,079,343</td>
<td>15,578</td>
<td>20,476,660</td>
<td>17,467</td>
</tr>
<tr>
<td>WV</td>
<td>88,651,136</td>
<td>49,920</td>
<td>93,629,905</td>
<td>52,674</td>
</tr>
<tr>
<td>Grand Total</td>
<td>424,072,308</td>
<td>284,137</td>
<td>442,497,344</td>
<td>300,674</td>
</tr>
</tbody>
</table>
## Estimating Emissions Reductions from New Rules: 6 MATS Scenarios

<table>
<thead>
<tr>
<th>#</th>
<th>Scenario Name</th>
<th>Scenario Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flat rate option</td>
<td>All units with non-compliant FY emission rates reduced to 0.2 lbs/mmbtu SO₂</td>
</tr>
<tr>
<td>2</td>
<td>Capacity option</td>
<td>Units with capacity &gt;= 400 MW and FY rate &gt;0.2 lbs/mmbtu SO₂ have 90% or 98% applied. Smaller units with non-compliant FY emission rates have emission rates reduced to 0.2 lbs/mmbtu SO₂.</td>
</tr>
<tr>
<td>3</td>
<td>Emission rate option</td>
<td>Units with FY rate &gt; 1.0 lbs/mmbtu SO₂ have 90% or 98% control applied. Units with FY rate &lt;= 1.0 lbs/mmbtu SO₂ have 0.2 lbs/mmbtu SO₂ applied.</td>
</tr>
<tr>
<td>4</td>
<td>Retirement option</td>
<td>Unit with capacity &lt; 350 MW not meeting 0.2 lbs/mmbtu in the FY are retired. Coal units with a capacity &gt;= 350 MW and not meeting 0.2 lbs/mmbtu in the FY will have a 30% SO₂ reduction.</td>
</tr>
<tr>
<td>5</td>
<td>Fuel switch option</td>
<td>Units with a capacity &lt;350 MW and FY&gt;0.2 lbs/mmbtu switched to gas. Units with a capacity &gt;=350 MW and FY &gt;0.2 lbs/mmbtu have a 30% reduction applied.</td>
</tr>
<tr>
<td>6</td>
<td>Retirement/reduced control</td>
<td>Units with capacity &lt;350 MW and FY&gt;0.2 lbs/mmbtu retired. Units with a capacity &gt;=350 MW and not meeting 0.2 lbs/mmbtu in the FY will have a 15% SO₂ reduction</td>
</tr>
</tbody>
</table>
Case Study Results (CONUS)

Change in SO2 Emissions from assumptions on the 
≈ 39% of BY capacity not complying in 2.0 ref case

(FY=Future Year, O3S=Ozone Season)
Growth Rate Comparisons

• AEO an excellent source of growth rates
• Reference case information used to develop growth rates for use in CONUS ERTAC runs
• AEO offers other scenarios using different price assumptions for gas and coal
• ERTAC ran a Hi/Lo case study to look at different results for 2018 and 2020
• Data results at MARAMA-FTP://ERTACmembers/ERTAC EGU Code/Runs/CONUS-v2.1L1
Hi/Lo Growth Rate Analysis

Growth Rates
- For 2007 and 2011 base years
- Out years of 2017, 2018, 2020, and 2025

<table>
<thead>
<tr>
<th>Reference</th>
<th>Coal</th>
<th>CC &amp; SC Gas</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.426</td>
<td>1.057</td>
<td>0.277</td>
<td></td>
</tr>
<tr>
<td>Low Coal Prices</td>
<td>1.236</td>
<td>0.856</td>
<td>0.336</td>
</tr>
<tr>
<td>Low Gas Prices</td>
<td>0.297</td>
<td>1.294</td>
<td>0.293</td>
</tr>
</tbody>
</table>

Outputs
- Unit level activity estimates
- Unit level SO2 and NOx estimates
- May be compared by unit or region

2020 SO2 and NOx Emissions

2020 SO2 and NOx Emissions (tons)

- HiGas2020 - FY SO2
- HiGas2020 - FY NOx
- LoGas2020 - FY SO2
- LoGas2020 - FY NOx
Analyze Results of Unit Specific Changes

• ERTAC Team put together CONUS 2.1
• LADCO was informed shortly thereafter of significant changes to several midwestern coal fired units
• Lots of interest in possible activity and emissions ramifications
• LADCO ran CONUS2.1L1 to assess the results
• Took about a month to get the 2.1L1 answers
2.1 vs 2.1L1 - Results

Emissions Data
- Allows comparison of emissions based on midwest changes
- Unit, facility, state, and regional levels

Activity Data
- Changes in activity can also be compared
- Unit, facility, state, and regional levels
What-If Scenarios

• OTC Aggressive Retirements
  – Facilities will often announce retirements prior to states knowing about the impending unit changes
  – Press releases, web pages, industry journals, etc.
  – What happens to future year activity and emissions if all units noted as retiring by any media outlet actually do retire?

• Control assumptions
  – What happens when control devices are assigned a minimum efficiency or rate?
  – What happens when control devices are assigned an optimal efficiency or rate?
2018 Regional Ozone Season NOx Emissions

Region #1

Region #2

Region #3

Region #4
Region #1 Average Afternoon NOx on OS Peak Days by Fuel/Unit Type

2018 Projected From 2011 NOx Emissions (Tons)

- 11/25 Shutdown List
- Lowest OS Rate
- Performance Standards
Mapping of Results

Unit Level NOX Emissions
- 0-75
- 75-240
- 240-435
- 435-645
- 645-910
- 910-1290
- 1290-1700
- 1700-2115
- 2115-2970
- 2970-3840
- 3840-7900
- 7900-11000
Impacts of CAMD Reporting Inconsistencies

- Two states examined impacts of combined cycles under-reporting gross load.

- Questions:
  - How does it affect NOx, particularly summertime NOx, emission estimates?
  - How does it affect CO2 emission estimates?

- ERTAC tool allows user to selectively adjust by hourly CAMD file using the nonCAMD hourly file.
RFCM BY Generation, Ref vs AdjGL

About a 22% increase in CC generation for the region

About a 3% increase in overall generation for the region
### Regional Data - lbs CO₂/MW-hr

<table>
<thead>
<tr>
<th></th>
<th>Boiler Gas</th>
<th>Coal</th>
<th>CC</th>
<th>Oil</th>
<th>SC</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run 1</td>
<td>989 lbs/MW-hr</td>
<td>2,116 lbs/MW-hr</td>
<td>872 lbs/MW-hr</td>
<td>1,461 lbs/MW-hr</td>
<td>952 lbs/MW-hr</td>
<td>1,260 lbs/MW-hr</td>
</tr>
<tr>
<td>Run 2</td>
<td>989 lbs/MW-hr</td>
<td>2,116 lbs/MW-hr</td>
<td>992 lbs/MW-hr</td>
<td>1,461 lbs/MW-hr</td>
<td>1,015 lbs/MW-hr</td>
<td>1,192 lbs/MW-hr</td>
</tr>
<tr>
<td>Run 3</td>
<td>989 lbs/MW-hr</td>
<td>2,116 lbs/MW-hr</td>
<td>878 lbs/MW-hr</td>
<td>1,461 lbs/MW-hr</td>
<td>950 lbs/MW-hr</td>
<td>1,080 lbs/MW-hr</td>
</tr>
<tr>
<td>Ref2.2</td>
<td>989 lbs/MW-hr</td>
<td>2,116 lbs/MW-hr</td>
<td>975 lbs/MW-hr</td>
<td>1,461 lbs/MW-hr</td>
<td>1,016 lbs/MW-hr</td>
<td>1,363 lbs/MW-hr</td>
</tr>
</tbody>
</table>
Region FY Data-NOx

The Growth Rates have a much larger impact on NOx emissions than the GL adjustments.

**Δ (1-Ref2.2) =** 425 tons (1.1% increase) GL adjustment

**Δ (2-Ref2.2) =** -10,070 tons (25.2% decrease) Higher NG GRs

**Δ (3-Ref2.2) =** -9,616 tons (24.0% decrease) GL adjustments & higher GRs

**Δ (1-Ref2.2) =** 220 tons (1.1% increase) GL adjustment

**Δ (2-Ref2.2) =** -5,052 tons (25.4% decrease) Higher NG GRs

**Δ (3-Ref2.2) =** -4,813 tons (24.2% decrease) GL adjustments & higher GRs
Post Processors

• Criteria Pollutant Post Processor – summarizes NOx, SO₂, activity at unit level
• CO₂ Post Processor – summarizes CO₂ and activity at unit level
• Graphical
  – provides nice unit level summary of information
  – Needs a lot of memory and time to run
• ERTAC_to_SMOKE – provides all necessary additional information (other pollutants, stack parameters, etc) to allow the ERTAC data to be fed into SMOKE for air quality modeling assessments
Graphical Post Processor

unit activities at SRVC-coal-3797-5 (page 1)

(a) Gload

(b) Gload

(c) Heat Input

(d) Heat Input

(a), (c) 2007 CAMD  ERTAC Projection

(b), (d) 2007 CAMD  ERTAC Projection
Graphical Post Processor

unit activities at SRVC-coal-3797-5 (page 2)
New Applications-Under Development or Being Considered

• Building Block #2: developing a post processor to reduce coal utilization and increase combined cycle utilization in each region such that each CC unit operates at least at 65% or 70% utilization

• Update the BY 2012 UAF with latest info
  – Run 2020, 2025 and 2030 FY projections
  – Analyze the result of improving all coal fired units’ heat rates by 6% (building block #1)
  – Analyze the result of updating the hourly gross load data for any combined cycle that under reports power generation

• SIP quality modeling effort-led by OTC for BY 2018
Any Questions?