Cost and Economic Impacts of Pending EPA Regulations

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AEP - Background

AEP’s Generation Fleet
~39,000 MW Capacity
~80% of coal is in AEP-East

Coal/Lignite 66%
Gas/Oil 22%
Nuclear 6%
Pumped Storage/Hydro/Wind 6%

5.2 million customers in 11 states
Industry-leading size and scale of assets:

<table>
<thead>
<tr>
<th>Asset</th>
<th>Size</th>
<th>Industry Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Generation</td>
<td>~39,000 MW</td>
<td># 2</td>
</tr>
<tr>
<td>Transmission</td>
<td>~39,000 miles</td>
<td># 1</td>
</tr>
<tr>
<td>Distribution</td>
<td>~214,000 miles</td>
<td># 1</td>
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</tbody>
</table>
AEP Already Has Substantially Reduced SO\textsubscript{2} & NO\textsubscript{x} Emissions

- Since 1980 AEP’s TOTAL generating fleet has reduced:
  - SO\textsubscript{2} emissions by over 77%
  - NO\textsubscript{x} emissions by ~80%
EPA New Regulatory Challenges

- Climate Regulations (NSPS & NSR)
- Transport Rule (SO$_2$ & NOx)
- Mercury/Hazardous Air Pollutants (HAPs)
- Coal Combustion Residuals (CCR)
- Water Quality / Aquatic Impacts (316(b))
Possible Timeline for Environmental Regs for Electric Utilities

- **Ozone (O$_3$)**
  - Revised Ozone NAAQS
  - CAIR Vacated
  - CAIR Remanded
  - Begin CAIR Phase I Seasonal NOx Cap
  - Transport Rule proposal issued (CAIR Replacement)
  - CAIR Vacated
  - NO$_2$ Primary NAAQS
  - SO$_2$ Primary NAAQS
  - SO$_2$ NAAQS Revision
  - Final Transport Rule Expected (CAIR Replacement)
  - Ozone NAAQS Revision
  - Effluent Guidelines proposed rule expected
  - CO$_2$ Regulation (PSD/BACT)
  - 316(b) final rule expected

- **SOx/NOx**
  - SO$_2$ Primary NAAQS
  - 316(b) final rule expected
  - Effluent Guidelines Final rule expected
  - Effluent Guidelines Compliance 3-5 yrs after final rule

- **CAIR/Transport**
  - PM Transport Rule
  - 316(b) Compliance 3-4 yrs after final rule

- **Water**
  - Effluent Guidelines
  - Effluent Guidelines Compliance 3-5 yrs after final rule

- **PM/PM$_{2.5}$**
  - Begin CAIR Phase I Annual NOx Cap
  - Begin CAIR Phase I Annual SO$_2$ Cap
  - Next PM-2.5 NAAQS Revision
  - Final Rule for CCBs Mgmt
  - Ozone Transport Rule
  - Transport Rule Phase II Reductions
  - HAPS MACT Compliance 3 yrs after final rule

- **Ash**
  - Proposed Rule for CCBs Management
  - HAPs MACT proposed rule
  - Transport Rule Phase I Reductions

- **Hg/HAPS**
  - HAPs MACT final rule expected

- **CO$_2$**
  - CO$_2$ Regulation (PSD/BACT)
  - Transport Rule Phase I Reductions
  - Begin Compliance Requirements under Final CCB Rule (ground water monitoring, double liners, closure, dry ash conversion)

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Adapted from Wegman (EPA 2003) Updated 09.02.10
Typical AEP FGD Retrofit Timeline

- Timeline milestone lengths based on actual AEP construction experience
- Phases could be longer if the support system becomes strained from multiple companies facing similar compliance deadlines
- From 2003-10 AEP retrofitted 7,800 MWs (9 units), using over 35 million work hours at a cost of over $3.6 billion
Anticipated EPA Timeline for Retrofits or Replacement

Transport ➞ P,E&C ➞ Compliance
HAPs ➞ P,E&C ➞ Compliance
Coal Ash ➞ P,E&C ➞ Compliance
Water – 316(b) ➞ P,E&C ➞ Compliance

Rule Finalization ➞ P,E&C (Permitting, Engineering & Construction)

INFEASIBLE CONSTRUCTION TIMELINES

“The Nightmare on Utility Street?”

- **Transport Rule**
  - SO₂ and NOx caps in 2012, tighter SO₂ caps in 2014
  - FGD effectively “required” for most all AEP East units in 2014

- **Mercury and Other HAPs MACT Rules**
  - Compliance in 3 years = 1/2015 (or 1/2016 “case by case”)
  - FGD for acid gases likely required on most AEP-East units
  - Baghouses (BH) w/ activated carbon injection (ACI) COULD ALSO be required to meet Hg and heavy metal limits
  - Some AEP-West coal units may be able to comply with only BH and ACI; however other EPA requirements (CAVR) likely to force scrubbers at most units

- **CCR Rule (e.g. ash disposal)**
  - Compliance estimated by 2017
  - AEP capital + pond closure cost: $1.4-2.4 billion if “non-hazardous”
  - Costs DOUBLE with “hazardous” designation by EPA
Major AEP Impacts of Pending and New EPA Regulations

- Large Amount of AEP Coal Unit Retirements
  - 5 to 7 GW retired (~20-30% of AEP total capacity) by 2014-2015
  - Coal units potentially mothballed 2014-2016
- Capital Cost: $6 to 11 billion by 2020
  - As much as DOUBLE AEP Environmental Capital spend during last 20 years
- Ongoing additional O&M, fuel and purchased power expenses of $300 to 600 million per year
  - NPV cost of about $2 to $4 billion
- Large Electricity Rate Increases
  - Average of 20 to 30% across AEP system
Old/Small Units Very Likely to Retire by 2015 Under EPA Regulations

Assumptions
- Retrofit and New Build capital cost & O&M assumptions are from EPA estimates
- Coal Combustion Residuals (CCR) capital cost is from industry estimates
- Uncontrolled Coal Unit (300 MW) Requires FGD+SCR+CCR: Capital Cost ~$1,200/kW; Retrofit Life - 15 years; 11,000 Btu/kWh Heat Rate, $2.50/MMBtu Coal Price
- Gas Combined Cycle: Capital Cost - $1000/kW; Life - 30 years; 7,000 Btu/kWh Heat Rate, $5/MMBtu Gas Price
~75 GW BOTH unscrubbed AND >45 years old by 2015
~54 GW also "SMALL" - Almost ALL will retire by 2015 w/ EPA regs.
ICF-EEI Study Results: Large US & Regional Cost Impacts

ICF-EEI study first to assess impact of ALL new EPA rules

- Range of impacts from Run #3 (optimistic) to # 8 (pessimistic)
- ICF-EEI study “conservative” on retirements: (1) high gas prices (2) long 20 year life for retrofits (3) assumes retrofits can be done by 2015 (4) low end of range assume NO CO2 requirements
- Capital (most before 2015) more than DOUBLE U.S. electric industry environmental capital spend during 1991-2010

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<thead>
<tr>
<th></th>
<th>2010 Coal Capacity</th>
<th>&quot;Optimistic&quot; Case Retirements</th>
<th>&quot;Pessimistic&quot; Case Retirements</th>
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<tbody>
<tr>
<td>Total U.S. Coal (GW)</td>
<td>324</td>
<td>-46</td>
<td>-101</td>
</tr>
<tr>
<td>SERC Coal (GW)</td>
<td>100</td>
<td>-17</td>
<td>-41</td>
</tr>
<tr>
<td>RFC Coal (GW)</td>
<td>105</td>
<td>-16</td>
<td>-29</td>
</tr>
<tr>
<td>U.S. Incremental Capital (2012-2020) ($Billions)</td>
<td>141</td>
<td>247</td>
<td></td>
</tr>
</tbody>
</table>

“2010 Coal Capacity” Source: Ventyx Velocity Suite
Reliability Impacts of EPA Regulations on RFC / PJM

- RFC estimated to have between 16 and 29 GW of coal retirements, or about 15 to 25 percent of RFC coal, most occurring by 2015
- Also, substantial % of capacity will be retrofit in RFC over the exact same time period
- Retrofits often requires a plant to be taken offline at end of construction for 2-3 months
- AEP is likely to mothball some additional capacity during the 2014-16 in order to complete retrofits and continue to comply with MACT and Transport Rules
- PJM analysis will be required to determine if this poses any regional reliability problems
Local Reliability Impacts

- Almost all of AEP retirements will be subcritical coal units, which are located in the middle of the supply stack, and thus are “load following”
- These units often provide key ancillary services:
  - Voltage Support
  - Frequency Regulation
  - System Restoration
- Local transmission mitigation and local system restoration capability/capacity will need to be installed prior to unit retirements to ensure grid integrity
- Timing of EPA regulations NEEDS to be coordinated with time required to address these local issues
- Further PJM, SERC and other regional study is needed on this issue and potentially affected facilities
Other Economic Impacts of EPA Regulations

- Higher natural gas use and related price increases affects ALL consumers
- $0.50/MMBtu gas price change increases other consumer costs about $8-9 billion/year
- Net Job Impacts are Negative:
  - Near term increases in temporary (2-5 years) construction jobs
  - BUT, “NET” NEGATIVE for Total Jobs mostly due to large electricity price increases
    - CRA Testimony --- NET LOSS of 1 MM Jobs
    - ERRC Testimony --- NET LOSS of 2.5 MM Jobs
  - ‘Green jobs’ studies such as PERI study don’t consider big negatives of higher electricity & energy prices
There is a Better Way...

- More flexibility in regulations (e.g., HAPs emissions averaging, low capacity factor allowed during retrofit construction)
- Phase-in requirements over 2015-2020
- Allow off-ramp for units that commit to retire or repower through 2020
- Continues emission reduction progress starting today, but reduces capital cost, rate shock and other economic impacts
- All coal units “well controlled” by 2020