Ripe for Retirement
The Case for Closing America’s Costliest Coal Plants

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Union of Concerned Scientists

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Coal Facing Growing Competition from Cleaner Alternatives

Share of total U.S. Electric Supply

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>51%</td>
<td>18%</td>
<td>1%</td>
</tr>
<tr>
<td>2009</td>
<td>47%</td>
<td>20%</td>
<td>2%</td>
</tr>
<tr>
<td>2010</td>
<td>47%</td>
<td>20%</td>
<td>2%</td>
</tr>
<tr>
<td>2011</td>
<td>44%</td>
<td>21%</td>
<td>3%</td>
</tr>
<tr>
<td>2012*</td>
<td>37%</td>
<td>30%</td>
<td>3%</td>
</tr>
</tbody>
</table>

*Thru August 2012. Source: EIA.

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An Aging U.S. Coal Fleet

![Bar chart showing installed capacity of coal fleet by age in years.]

- 5% of plants are 1-10 years old, accounting for 17 gigawatts.
- 2% of plants are 11-20 years old, accounting for 7 gigawatts.
- 17% of plants are 21-30 years old, accounting for 58 gigawatts.
- 36% of plants are 31-40 years old, accounting for 123 gigawatts.
- 24% of plants are 41-50 years old, accounting for 81 gigawatts.
- 17% of plants are 50+ years old, accounting for 58 gigawatts.

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Older Coal Generators Less Likely to Have SO₂ Controls
41.2 GW of Announced Coal Retirements Concentrated in Midwest & Southeast
41.2 GW of Announced Retirements: Older & Less Utilized than Remaining Fleet
86% of Announced Retirements Have Higher Operating Costs than Existing Natural Gas Plants

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What about the rest of the coal fleet?
Main Findings of Our Analysis

• 16.4 GW to 59 GW of coal generators are candidates for closure (above already announced retirements), based on economic criteria

• These economically vulnerable generators can be readily replaced with natural gas, renewables and efficiency

• Regulators, investors and utilities should rethink costly retrofits, if coal plants can be retired and replaced with cleaner, more affordable alternatives
Our Methodology

• **Step 1**: Identified base running costs of each operating coal generators

• **Step 2**: Added costs for any of the four most essential pollution controls (SO$_2$, NOx, Hg, PM) that were lacking

• **Step 3**: Compared costs of coal generators with pollution controls to average existing NGCC plant, new NGCC plant, and new wind projects

• **Sensitivity Analysis**: High/low natural gas prices, wind with/without PTC extension, $15/ton CO$_2$ price
Our Economic Test

<table>
<thead>
<tr>
<th></th>
<th>Dollars per Megawatt-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Generator</td>
<td></td>
</tr>
<tr>
<td>Existing NGCC</td>
<td></td>
</tr>
<tr>
<td>New NGCC</td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
</tr>
</tbody>
</table>

- Operating Costs*

*Includes 20-year levelized capital costs for new NGCC and wind.

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Our Economic Test

The diagram illustrates the costs per megawatt-hour for different energy sources, including Coal Generator, Existing NGCC, New NGCC (High and Low Estimate), and Wind. The costs are broken down into Carbon Price and Operating Costs.*

*Includes 20-year levelized capital costs for new NGCC and wind.
Our Economic Test

- **Coal Generator**
- **Existing NGCC**
- **New NGCC**
- **Wind**

Dollars per Megawatt-hour

- **Carbon Price**
- **Pollution Control Costs**
- **Operating Costs**

*Includes 20-year levelized capital costs for new NGCC and wind.

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Understanding the Focus of this Report

• Not an evaluation of compliance with federal clean air standards (new EPA rules)

• National analysis to identify coal generators that should be considered for closure; not a predictive tool

• Only considers costs associated with a subset of air pollution controls; excludes cooling water and coal ash-related costs as well as any other criteria

• Does not account for localized operating conditions, transmission constraints, reliability impacts, etc.
Operating Costs of Coal Generators vs. Existing and New Natural Gas Plants

High Estimate = 353 generators (59 GW) above red line
Low Estimate = 153 generators (16.4 GW) above blue line
Common Characteristics of Ripe for Retirement Generators

- **Old**: average age of 45 years
- **Underutilized**: 47% capacity factor
- **Dirty**: More than 70% lack adequate controls for at least 3 of 4 pollutants analyzed
59 GW of Ripe for Retirement Coal Generators
Concentrated in Midwest & Southeast
59 GW of Ripe-for-Retirement Generators
Concentrated in Midwest & Southeast
Top five states: GA, AL, MI, TN, FL

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100 GW of Total Capacity of Announced and Ripe-for-Retirement Coal Generation

Top five states (incl. announced retirements): OH, GA, AL, PA, NC
## Utilities with the Most Ripe-for-Retirement Capacity

<table>
<thead>
<tr>
<th>Power Company</th>
<th>Ripe for Retirement (MW)</th>
<th>Number of R4R Generators</th>
<th>Announced Retirements (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern Company</td>
<td>15,648</td>
<td>48</td>
<td>1,350</td>
</tr>
<tr>
<td>The Tennessee Valley Authority</td>
<td>5,385</td>
<td>28</td>
<td>969</td>
</tr>
<tr>
<td>Duke Energy</td>
<td>2,760</td>
<td>17</td>
<td>3,230</td>
</tr>
<tr>
<td>American Electric Power Company</td>
<td>2,355</td>
<td>4</td>
<td>5,846</td>
</tr>
<tr>
<td>First Energy</td>
<td>2,075</td>
<td>7</td>
<td>3,721</td>
</tr>
</tbody>
</table>

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Coal Capacity Deemed Ripe for Retirement Under Alternative Scenarios

[Bar chart showing capacity (GWh) with and without tax credits, under different scenarios: Core Analysis, High Natural Gas Prices, Low Natural Gas Prices, Carbon Price, Wind Power.]

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Coal Retirements & Maintaining Resource Adequacy
Excess Capacity Greater than Coal Retirements in Most Regions
Renewables, Efficiency & Natural Gas Can Replace Coal Retirements by 2020
Risks of Overreliance on Natural Gas

- Excess capacity
- Low natural gas prices
- Operational flexibility

BUT

- Price volatility (demand growth could drive-up prices)
- Environmental Concerns
- Still a fossil fuel
- Competing with RE

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Annual CO₂ Emissions Reductions from Coal Retirements

- Replace w/ Existing Natural Gas
- Replace w/ Zero-Emissions Sources

R4R - High Estimate
- 59 GW
- 157 Million Tons of CO₂

R4R - High Estimate + Announced Retirements
- 100 GW
- 245 Million Tons of CO₂
- 410 Million Tons of CO₂
Recommendations

• Regulators, investors and utilities should rethink costly retrofits and invest in cleaner, more affordable alternatives

• Improve Resource Planning by Regional Grid Operators & Utilities

• Enact Strong EPA Power Plant Pollution Standards, including for carbon dioxide emissions

• Adopt Strong State and Federal Clean Energy Policies
Questions?

To ask a question, please type it into the chat box on your screen.

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