The Future of U.S. Fossil Generation

Scott Weaver
IEA/EPRI Decarbonisation Workshop – October 17, 2016
AEP's Operational Capacity
~37,000+ MW

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

<table>
<thead>
<tr>
<th>Asset</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly-Owned Generation</td>
<td>32,000 MW</td>
</tr>
<tr>
<td>Transmission</td>
<td>40,000 miles</td>
</tr>
<tr>
<td>Distribution</td>
<td>224,000 miles</td>
</tr>
</tbody>
</table>
Generation Transformation

AEP’S GENERATING CAPACITY PORTFOLIO*

- 66% 70% 48% 22% 19% 30% 7% 6% 6% 4% 4% 11% 1% 1% 5%

Coal Natural Gas Nuclear Hydro, Wind, Solar & Pumped Storage Energy Efficiency/Demand Response**

1999 includes combined AEP and Central and South West generation assets

* Includes Purchase Power Agreements

** Does not represent a physical asset but avoided capacity. 1999 data is cumulative.
Corresponding CO$_2$ Reductions

TOTAL AEP SYSTEM – ANNUAL CO$_2$ EMISSIONS

in million metric tons

167.1 152.8 153.6 158.1 146.1 145.9 145.2 150.7 150.9 132.0 135.1 136.5 121.9 115.3 122.7 102.5

~39% Reduction in CO$_2$ (2000-2015)
New Capacity = Low Carbon

AEP SYSTEM PLANNED GENERATION RESOURCE ADDITIONS
regulated and AEP Ohio Purchase Power Agreement

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (MW)</th>
<th>Total (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>200, 700, 200, 700, 400, 450, 300, 150, 250, 250, 450, 450, 250, 400, 400, 400, 100</td>
<td>6,300</td>
</tr>
<tr>
<td>2017</td>
<td>825, 435</td>
<td>3,037</td>
</tr>
<tr>
<td>2018</td>
<td>907, 435</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>435</td>
<td></td>
</tr>
</tbody>
</table>

Source: Current Internal Integrated Resource Plans, which largely do not reflect ITC/PTC extension or Bonus Depreciation.
Wind and solar represents nameplate MW capacity.
Economic and Regulatory Factors Favor Low Carbon Generation

- Effective prohibition on new coal generation
- Other environmental regulations
- Low natural gas prices
- Cost declines in renewable energy
- Extension of tax subsidies
- Clean Power Plan and future carbon policy risk
Environmental/Regulatory Signposts

- Renewable Portfolio Standards (RPS)
- Production Tax Credit (PTC) for renewables
- Light Duty Vehicle CAFE Standards (54.5 mpg)
- New Taxes / Regulations on Drilling & Fracking
- Clean Power Plan
- CO₂ Performance Standards (New & Existing Plants)
- Revised SO₂, PM₂.5, and Ozone NAAQS Implementation
- Steam Electric Effluent Guidelines
- 316(b) Cooling Water Intake Requirements
- MATS
- CCR

Is the sun setting on coal?

2015 2020 2025
Existing Gas Capacity is Increasingly Being Utilized

![Natural Gas Trends Chart]

Source: U.S. Energy Information Administration
Generation Trends

Annual share of total U.S. electricity generation by source (1950-2016)

Source: U.S. Energy Information Administration
Clean Power Plan

• Federal GHG regulatory program for U.S. electric power sector beginning in 2022
• Targets a 32% reduction in CO₂ emissions as compared to 2005 levels
  • Reference point: US economy wide NDC is 26-28% by 2025
• Most studies indicate that Clean Power Plan (CPP) will further push coal out of generation mix in favor of natural gas and renewable generation
• Regulation currently subject to “stay” order while judicial system decides on legality
Under CPP U.S. Emissions will Continue to Trend Downward

Struggles for Coal Generation


U.S. Coal Fleet: 52 GW > 50 years old; 149 GW > 40 years old
Long Term Issues

• With a challenging economic environment and uncertainty over future public policy is there an appropriate incentive for continued investment in coal?
  • Coal represents ~3/4 of electric sector GHG emissions

• The U.S. is faced with losing a primary source of baseload power with onsite energy storage

• Other electric supply options have issues associated with maintaining reliability
  • Natural Gas - Firm Supply
  • Renewables - Intermittency
A Balance of Options is Needed

- A diverse generation portfolio that includes coal will enable a more reliable, flexible, affordable and efficient integrated grid for customers
- Reliable, dispatchable, low-cost fossil-fueled generation is the backbone to support intermittent renewable energy
- Work is need to ensure all resources can compete now AND in the future
- Particularly, should the electric sector be relied upon for emission abatement from other sectors
  - (i.e. electrification)
Coal Should be Part of Our Energy Future

• Coal consistently provides low-cost, reliable electricity in the U.S. and numerous state and local economies depend on its continued use

• Globally, China, India and developing countries continue to rely on coal

• Technology to reduce CO₂ from coal fueled power plants would offer significant global CO₂ reduction benefit toward long-term climate goals
  • Current CCS technology demonstrations have proven to be very expensive and fraught with risk (financial, technical, legal.)
  • We must do more to develop and deploy technologies that reduce carbon, increase efficiency and improve the flexibility of coal-fueled power generation

• Technology pathways exist to make this a reality
Conclusions

• A diverse energy supply (fossil, renewable, & nuclear) is essential to meeting our customers’ need for reliable, affordable, environmentally-responsible energy
• The grid is evolving and offers many new opportunities to meet customer demand, all requiring technology advancement
• Meeting the energy needs of the U.S. and the globe hinges upon maintaining and improving the fundamentals of our electric grid
  • Reliability
  • Affordability
  • Environmental responsibility
  • Sustainability