A Sustained Coal Recovery?
“When You Get There, There’s No There There”

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A “Perfect Storm” of Market, Technological and Regulatory Developments are Undermining the Financial Viability of Many Coal-Fired Generators

• Continued low natural gas and energy market prices.
• Dramatically increased competition from wind & solar.
• Flat or nearly flat peak demands (MW) and energy loads (MWh) – More Competition for the same amount of pie.
• Electricity from coal-fired generators displaced by output from renewable and natural gas-fired units.
• An aging coal fleet.
• Volatile capacity market prices.
• EPA regulations
Declining U.S. Coal Consumption

Annual U.S. Coal Consumption by Power Plants

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2015</th>
<th>2016 (EEIA Estimate)</th>
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<tbody>
<tr>
<td></td>
<td>1040</td>
<td>741</td>
<td>690</td>
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Coal Consumption by Power Plants During First 6 Months of the Year

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
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<tbody>
<tr>
<td></td>
<td>428</td>
<td>371</td>
<td>360</td>
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Natural Gas Prices Have Declined Since 2008 and Are Expected to Remain Low

Low Gas Prices Lead to Lower Energy Prices in Competitive Wholesale Markets
More Gas-Fired Capacity is On the Way

• 16 GW of new gas-fired capacity under construction in PJM. Another 2.7 GW is in advanced development stage, according to SNL Financial. This means that it has met two of the following: necessary permits obtained, financing obtained, EPC contract signed, PPA signed, and turbines secured.

• 3.1 GW of gas-fired capacity under construction in ERCOT, with another 7.8 GW in advanced development.

• 1.7 GW of gas-fired capacity under construction in MISO.

Solar and Wind Pose Serious Threats to Financial Viability of Coal Plants

• Solar and wind installation costs and power purchase agreement (PPA) prices have been declining dramatically in recent years.

• With no fuel costs, utility-scale solar and wind facilities are dispatched ahead of coal plants – displaces energy from coal.

• Solar generation acts to keep energy market prices low during periods of peak demands. Wind generation puts pressure on market prices in both peak and off-peak hours.

• Distributed rooftop solar photovoltaic resources reduce loads on the electric grid and, therefore, reduce the need for generation from coal (and natural gas) plants.
Declining Wind PPA Prices in Recent Years


Dramatic Increases in Wind Capacity, Except in PJM
Wind Highlights

• Wind provided 32% of the energy in MISO’s North region in the 7 month period October 2015 through April 2016, with a high of over 42% of the energy in April 2016.

• 48.32% of the system load in SPP was served by wind at 2 am on April 5th.

• 48.28% of the load in ERCOT was served by wind on March 23rd, and 45.14% on February 18th.

• Wind capacity factors are improving. The average capacity factor for 15,029 MW of wind in MISO was 40.9% in February 2016.
Solar Coming in ERCOT
“As Far as the Eye Can See”

Coal’s Declining Market Share
Gas and Wind Displacing Coal in PJM

Gas and Wind Displacing Coal in SPP
Wind Replacing Coal-Fired Generation in ERCOT

Declines in Generation at Texas Coal-Fired Generators Between 2008 and 2015
Declining Generation at Southern Company’s Plant Hammond

Note – While Hammond’s generation was declining Georgia Power spent hundreds of millions of dollars adding a scrubber

Previously Base Load Coal Plants Have Become Peaking Units
Aging U.S. Coal Fleets (as % of total capacity)

Little-to-No Growth in Peak Demands
Why Are the Loads Flat or Relatively Flat?

- Impact of formal energy efficiency investments and increased interest from consumers in saving energy.
- Increased generation from distributed “rooftop” solar PV.
- GDP growth has outpaced increases in electricity consumption as a result of strategies by industrials and large utilities to better manage their power use and load + changing residential consumption habits.
- All of these likely to continue to dampen future growth.
- Recovery from Great Recession.
Result – Coal Plants Are Caught in Death Spiral (Or At Least Near-Death Experience)

- Many units generating much less power than before and/or not operating as base load generators.
- Plus, owners getting less for each MWh of power their plants generate.
- This means significantly lower revenues from power sales.
- But production costs at many plants are increasing. Capex, some expensive, also necessary.
- Generating at high cost and selling at low cost is never good!
- Coal is in serious trouble even without the EPA!

Example of a Failing Plant – IEEFA’s Estimated Average Annual Pre-Tax Losses for Big Brown (in TX) for the Years 2017-2024
Decline in Tax Values of Luminant’s Coal-Fired Generators in Texas

For More Information

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