Substantial Changes Ahead for MISO North – Michigan Impacts

2018 MMEA Fall Conference

Mike Zenker, Managing Director of Market Analysis
NextEra Energy Resources
September 13, 2018
Investment totals more than $20 billion in clean, renewable technologies

**NextEra Energy Resources Portfolio**

- World leader in electricity generated from the wind and sun
- 20 GW\(^{1}\) of generation in operation
  - ~14 GW wind
  - ~2 GW solar
  - ~3 GW nuclear
  - ~1 GW natural gas/oil
- ~8 BCF of natural gas pipeline capacity operating or under development\(^{2}\)
- $4.9 B\(^{3}\) in operating revenues
- $45 B in total assets

**NextEra Energy Resources** is the world's largest operator of wind and solar energy, with a fleet of over 16,000 MW at 120 sites

\(^{1}\) Generation mix is based on MW capacity operated by Energy Resources including NextEra Energy Partners' assets

\(^{2}\) Includes 4 BCF Texas Pipelines operated by Energy Resources for NextEra Energy Partners

\(^{3}\) For the year ended December 31, 2016  Note: All other data as of September 30, 2017
The Following Information Was Carefully Selected From Over 30+ Years of “Work”
Natural gas price is the biggest driver of power prices in most power markets.

Gas and Power Prices in Michigan

- Michigan Hub (5 x 16)
- Michcon Gas
Natural gas price is the biggest driver of power prices in most power markets

Gas and Power Prices in Wisconsin

- **Wisconsin On-peak Power (5x16)**
- **Ventura Gas Price**
A Few Locations Dominate the Gas Supply Picture

Billions of Cubic Feet per Day

- Other
- Barnett
- Gulf Of Mexico
- Haynesville
- Utica & Marcellus
- Ohio & Penn
- N. LA
- Ft. Worth
Sources of Future Gas Supply Growth

60% of demand growth
The country has increasingly become bifurcated into premium and discounted markets.

**Michigan Enjoys a Growing Discount**
(discount to Henry Hub, $/MMBtu)

**While Massachusetts Remains a Premium Market**
(premium to Henry Hub, $/MMBtu)
Forward prices for natural gas (and power) already reflect the coming supply...if you need to buy gas or power, it is a good time buy

Forward Prices for Natural Gas

$ per MMBtu

- $2.00
- $2.50
- $3.00
- $3.50
- $4.00


- Today
- One Year Ago
- Two years Ago
With more new pipelines facing challenges, future gas prices could be driven by the *inability* of the industry to build pipe.

**Forecast Post-2020 Northeast Greenfield Takeaway Pipes**

WoodMac assumes the remaining 17 Bcf/d is built to the Midwest.

WoodMac assumes no more than 7 Bcf/d is built eastbound.
Mexico is increasingly dependent on U.S. supplies of natural gas

Mexico Gas Supply by Source

US Pipeline Imports
LNG
Domestic Production
Plenty of proposed new U.S. capacity: If every proposed U.S. project were built, the U.S. gas market would increase by 70% and the global LNG market by 135%
The power sector soaked up most of the supply growth over the past 10 years

Natural Gas Supply vs. Demand Growth\(^{(1)}\)
(cumulative growth 2007-2017)

\[ \text{Billion Cubic Feet/Day} \]

\[ \begin{align*}
\text{U.S. Supply Growth} & \quad \text{45\% Growth in 10 Years} \\
\text{U.S. Gas Demand Growth}\(^{(1)}\) & \quad \text{Surplus Gas Dumped into the Power Market} \\
\end{align*} \]

\[ \text{11\% Growth in 10 Years} \]

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\(^{(1)}\) Excluding power sector demand

Source: U.S. Energy Information Agency
Gas continues to challenge coal in MISO

Coal Dispatch Curve

If gas prices rise, more coal competes with gas

$/MMBtu

Gas @ $3.00

Gas @ $1.60
The cost to build and operate new gas, wind and solar power plants is challenging existing generation resources

Costs of Generation Resources

<table>
<thead>
<tr>
<th></th>
<th>Operating costs of existing plants (2020)</th>
<th>Costs to build and operate new plants (including incentives for wind/solar, 2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$/MWh</td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>$55</td>
<td>$56</td>
</tr>
<tr>
<td></td>
<td>$35</td>
<td>$30</td>
</tr>
<tr>
<td>Nuclear</td>
<td>$50</td>
<td>$45</td>
</tr>
<tr>
<td></td>
<td>$33</td>
<td>$12</td>
</tr>
<tr>
<td>Combined Cycle Gas-Fired</td>
<td>$28</td>
<td>$29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12</td>
</tr>
<tr>
<td></td>
<td>$21</td>
<td></td>
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</tbody>
</table>

The all-in cost of wind and solar will continue to compete with existing generation resources as tax credits phase down.

**Estimated Costs of Generation Resources Post Incentives**

(1) (cents/kWh)

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Estimated Cost (cents/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Wind</td>
<td>2 - 2.5¢</td>
</tr>
<tr>
<td>New Solar</td>
<td>3 - 4¢</td>
</tr>
<tr>
<td>New Combined Cycle Gas</td>
<td>3 - 4¢</td>
</tr>
<tr>
<td>Existing Coal (2)</td>
<td>3.5 - 5¢</td>
</tr>
<tr>
<td>Existing Nuclear (2)</td>
<td>4 - 5¢</td>
</tr>
</tbody>
</table>

Wind and solar combined with storage to firm and shape production is expected to compete economically with other generation in the next decade.

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1) Energy Resources' estimate
2) Represents operating cost per kWh including fuel
It has been cheaper to purchase power than to build a new gas-fired power plant.
With nearly 56% of the existing coal fleet out-of-the-money today, we see the potential for up to 47 GW of coal retirements between 2018 and 2025.

Coal retirements will be concentrated in PJM and MISO where 13 GW is announced or projected in the 2018 to 2025 period.

### Coal Plant Profitability

<table>
<thead>
<tr>
<th>Region</th>
<th>&lt;$10</th>
<th>$5-$10</th>
<th>$1-$5</th>
<th>$1-$10</th>
<th>&gt;$10</th>
</tr>
</thead>
<tbody>
<tr>
<td>MISO</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>PJM</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>SERC</td>
<td>10</td>
<td>20</td>
<td>30</td>
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<td>50</td>
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<td>SPP</td>
<td>10</td>
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<td>40</td>
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</tr>
<tr>
<td>WECC</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>ERCOT</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Northeast</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>

### Coal Fleet Evolution

- Total retirements: 50 GW
- Potential retirements: 47 GW

Coal retirements will be concentrated in PJM and MISO where 13 GW is announced or projected in the 2018 to 2025 period.

1) Profitability reflects annual estimated revenues less go-forward costs in 2020.
With nearly 45% of the existing nuclear fleet out-of-the-money today, we see the potential for up to 17 GW of retirements between 2018 and 2025.

**Nuclear Plant Profitability**

Profitability reflects annual estimated revenues less go-forward costs in 2020.

**Nuclear Capacity Evolution**

Includes addition of “under construction” Vogtle units (2.2 GW) in 2021 and 2022.

A further 14 GW of high cost nuclear is likely to retire in the 2026 to 2030 period as operating licenses and state subsidies expire.
Wind, solar and new CCGTs will compete to fill the hole left by retiring coal and nuclear power.

**Potential Replacement Power Market Share by 2025**

- **WECC**
  - Gas
  - Solar
  - Wind

- **MISO**
  - Gas
  - Solar

- **PJM**
  - Gas
  - Solar

- **SPP**
  - Gas
  - Solar

- **SERC**
  - Gas
  - Solar

- **ERCOT**
  - Gas
  - Solar

- **Northeast**

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1) Estimated market share on an energy (MWh) basis
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President Trump’s Environmental Policies and the U.S. Power Sector

Christopher Wilfong
Director, Energy Research

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Key Insights
- In an effort to end what they describe as the “war on coal,” the Trump administration has begun to roll back many of the environmental regulations put in place on the U.S. electric power sector under the Obama administration.
- Many analysts believe the impact to the overall economics of the coal fleet will be modest, as most of the damage in the so-called “war on coal” has been caused by competition from low-cost natural gas generation, rather than environmental regulations.
- Even in Texas, where the rollback of compliance with regional haze regulations means that some coal plants now do not need to install costly scrubbers, companies are still announcing new coal retirements.
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