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The Energy Generation Market – It's the End of the World as We Know It (And I Feel Fine)

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Agenda

- Energy Sector The View from Wall Street
- Stressing the System Baseload Retirements
- The New Normal Renewables and Gas
- Summary
- Questions



Energy Sector: The View from Wall Street

Companies seek to put capital to work with a focus on improving earnings in a challenging environment. Each sector is positioned differently, but there are common themes.

Sector Investment Themes



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Cross-cutting Themes

- Increasing capital spending and allocating capital between projects and sectors
- Making strategic moves and pursuing opportunities for growth
- Cutting costs and raising cash
- Preparing for rate cases and regulatory activity

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Stressing the System: Baseload Retirements Accelerate

Creative Destruction – A Sign Markets are Working or Road to Ruin?

- Who decides whether to add or subtract generation? How?
- Open to debate: What, if anything, needs to be done?

Energy Markets "Under Pressure"



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Stressing the System: Baseload Retirements Accelerate (Cont'd)



Average Size of Retired Generating Unit by Technology Type

Average Age of Retired Generating Unit by Technology Type (in Years)



Source: SNL; ScottMadden analysis

- The average size of retired plants has been increasing, with retired coal plants more than tripling since 2000, while the average size of retired gas steam turbine plants has doubled
- The average age of baseload units at retirement has increased gradually since 1990



ource: SNL; ScottMadden analysis

Stressing the System: Baseload Retirements Accelerate (Cont'd)

Current Operating Capacity (GW)



Age of Current Operating Baseload Capacity

Current operating baseload capacity is approximately 63% of total operating capacity
Close to a third of current operating baseload capacity is over the age of 40
Close to 10% of current operating baseload capacity is over the age of 50



Stressing the System: Baseload Retirements Accelerate (Cont'd)



The New Normal: Gas and Renewables

What does the future look like?

Coal replaced with natural gas, growth in renewables, and new technologies (storage, distributed generation, etc.)





The New Normal: Turbine Sales Return to Historical Levels



The New Normal: Turbine Sales Return to Historical Levels (Cont'd)



Aeroderivative 📕 Heavy Duty 🔲 Industrial 💻 Other

Source: SNL, Grid Connected Turbines in the US Only



Source: SNL, Grid Connected Turbines in the US Only

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- Heavy-duty turbine installations outpaced aeroderivative turbine installations in each of the past three years
- General Electric had the most total turbine installations over the past three years. However, Siemens had the most heavy-duty turbine installations
- Mitsubishi turbine installations had the largest average operating capacity in 2014 and 2016



Source: SNL, Grid Connected Turbines in the US Only

The New Normal: Renewables Are Continuing to Expand





- Operating capacity from utility scale renewables will increase approximately 60% by 2027 based on projects currently under development or construction
- An additional 71,000 MW of operating capacity from utility scale renewables has been announced, but development has not begun
- Distributed energy resources (e.g., rooftop solar) are not included in the above chart



The New Normal: Wind Power Generation

- Gangbusters growth 25,819 MW of wind capacity under construction or in advanced development as of the end of the second quarter of 2017, a 41% year-over-year increase
- 28% of the installed capacity for the year is contracted to corporate and other non-utility purchasers

Production tax credit boom bust – phase down from 2017-2019



U.S. Annual and Cumulative Wind Power Capacity Growth



The New Normal: Solar Power Generation

On December 18, 2015, the U.S. congress extended the 30% Investment Tax Credit (ITC) for solar through 2021

- +25 GW of extra solar capacity (2016-2020) and \$40 billion in incremental investment

Solar prices will likely continue to decline although at a slower rate



U.S. Annual PV Deployments – Historic and Forecasted



Summary

- Generation development "not dead yet"
 - Focus on gas, wind, and solar, "the new normal"...until it isn't
 - Gas continues to replace coal
 - Despite a political "all of the above" political strategy
- Gas prices continue to stay low even with exports
- Wholesale markets zero or near-zero marginal costs continue to hammer coal and nuclear
 - State and market issue in valuing capacity
 - States losing jobs, markets losing diversity
- Load growth approaching zero (aggregate)
 - Peakier peaks
 - How will it impact generation installation decisions?



Summary (Cont'd)

Think Global, Act Global



(Controlled centrally, one integrated system)

Think Global, Act Local



Think Local, Act Local



(Control is dispersed, many systems loosely tied)

Increasing change and complexity

Traditional Vertically Integrated Utility

- n Continued focus on central station generation, long-haul transmission
- n Technology initiatives focus on improving the existing integrated system
- n May see reduced loads due to energy efficiency and distributed resources, but customers do not secede
- n Utilities driving the "discussion"

Managed Network

- n High penetration of DG (combined heat & power and renewables)
- n Emergence and increased penetration of microgrids
- n Initiatives focus on integrating new grid components
- n Utilities orchestrating the "discussion"

Disaggregated Supply and Demand

- n High penetration of DG (combined heat & power and renewables)
- n Emergence and increased penetration of microgrids
- n Others driving the "discussion"

The traditional utility business model must evolve.





Summary (Cont'd)

Recommendations

- Plan Strategically
- Use Real Options
- Collaborate
- Don't Forget the Basics
- Advocate









Evolving Grid

Major Drivers

- New technologies, evolving resource mix, and market conditions changing energy delivery infrastructure
- Energy efficiency, demand response (DR), and demand-side management programs (DSM) encourage conservation
- Deployment and integration of distributed energy resources (DERs) is a game-changer facilitated by:
 - Regulatory policy and incentives
 - Technology advancements
 - Increased acceptance levels
- Technology forcing the need to manage both sides of the supply/demand equation



Evolving Grid (Cont'd)

Challenges

- Reliance on central station generation being called into question
- Regulatory models need to be reconsidered
 - Accommodate new market entrants
 - Address stranded investments
- Market operations are no longer one-way, centralized, and fully transparent





The Grid has become substantially greener in a short time...

Total emissions have fallen dramatically since 1990, even while total electricity generation has increased.





Source: EPA, https://www3.epa.gov/airmarkets/progress/datatrends/index.html

Can Wind and Solar Compete with Conventional Generation?



Green Challenges: Consumer choice

A little like peaceful atomic power and military atomic power, you really cannot have grid-scale green energy without distributed green energy.





Source: http://www.netanir.ir/upload/image/distributed-generation.jpg

Green Challenges: A darker side of green

If the greening of the grid means both utility-scale and distributed generation, then how much is our grid today like the telephone network in the late 1980s?

"Telephone networks, it was often said, had an intelligent core — the switches that ran everything and "dumb" edges, meaning the handsets in nearly every home and business in the nation.

The Internet, by contrast, would have a "dumb" core all the network did was carry data — with intelligent edges, meaning the individual computers controlled by users."



