



Optimizing Renewable Projects Key Factors in Program Development

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UtiliWorks™

Utility Energy Transformation



Movement to Next Cycle Generation

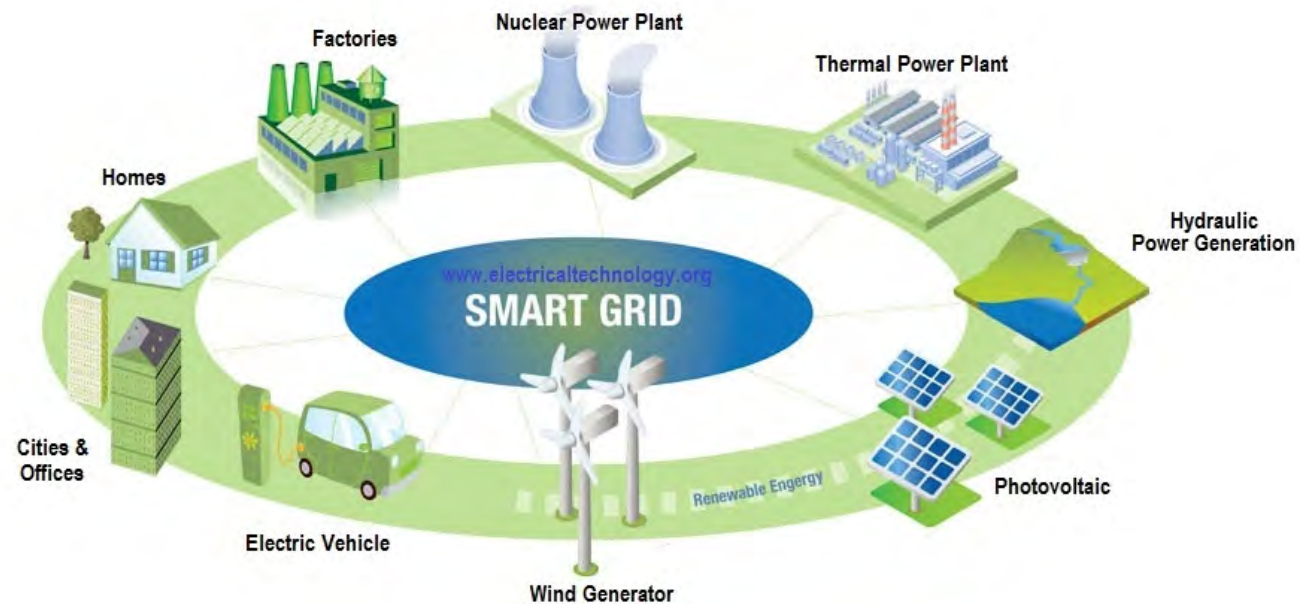
Industry Perspective

David Crane, former president and CEO of NRG Energy, said “as solar power, wind power and energy storage grow more efficient, and as more American homes also come to rely on cheap natural gas, energy customers will switch from buying power to generating their own through ‘microgrids’ - perhaps in as little as 30 years. Microgrids will soon phase out large centralized electrical grids.”

From US News Interview (2014)

The Smart Grid

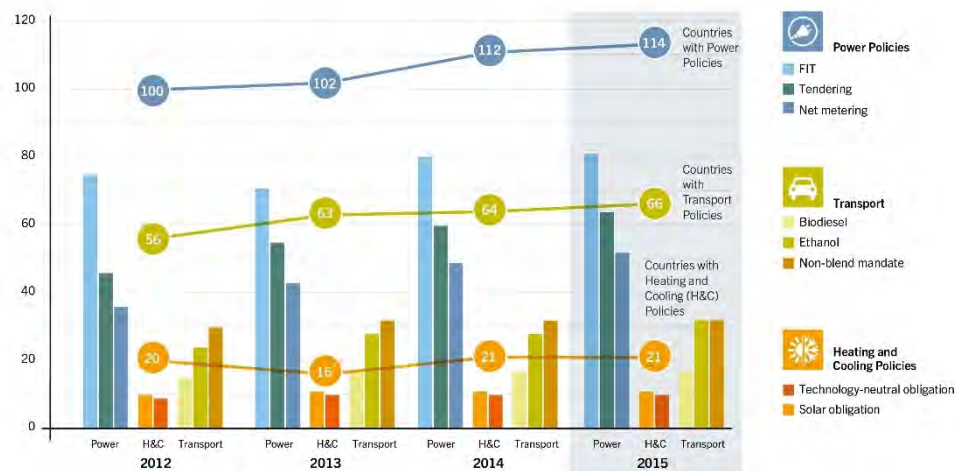
- The smart grid and renewable integration are intertwined
 - Advanced (“smart”) Meters
 - Energy Storage
 - Pricing Policies
 - Customer Engagement
 - Electric Vehicles
 - Predictive Analytics
 - Outage Management
 - Distribution Automation



What are the policies driving renewable integration?

- European Union set a 20% renewables target by 2020
- Many of the U.S. states are looking towards a similar 20% renewable by 2020, and 25% by 2025
 - Governor Brown of California signed a 50% renewables by 2030 mandate

Number of Renewable Energy Policies and Number of Countries with Policies, by Type, 2012-15



Note: Figure does not show all policy types in use. Countries are considered to have policies when at least one national or state/provincial-level policy is in place. Some transport policies include both biodiesel and ethanol, in this case, the policy is counted once in each category (biodiesel and ethanol).

REN21 *Renewables 2016 Global Status Report*



Source: REN21 Policy Database

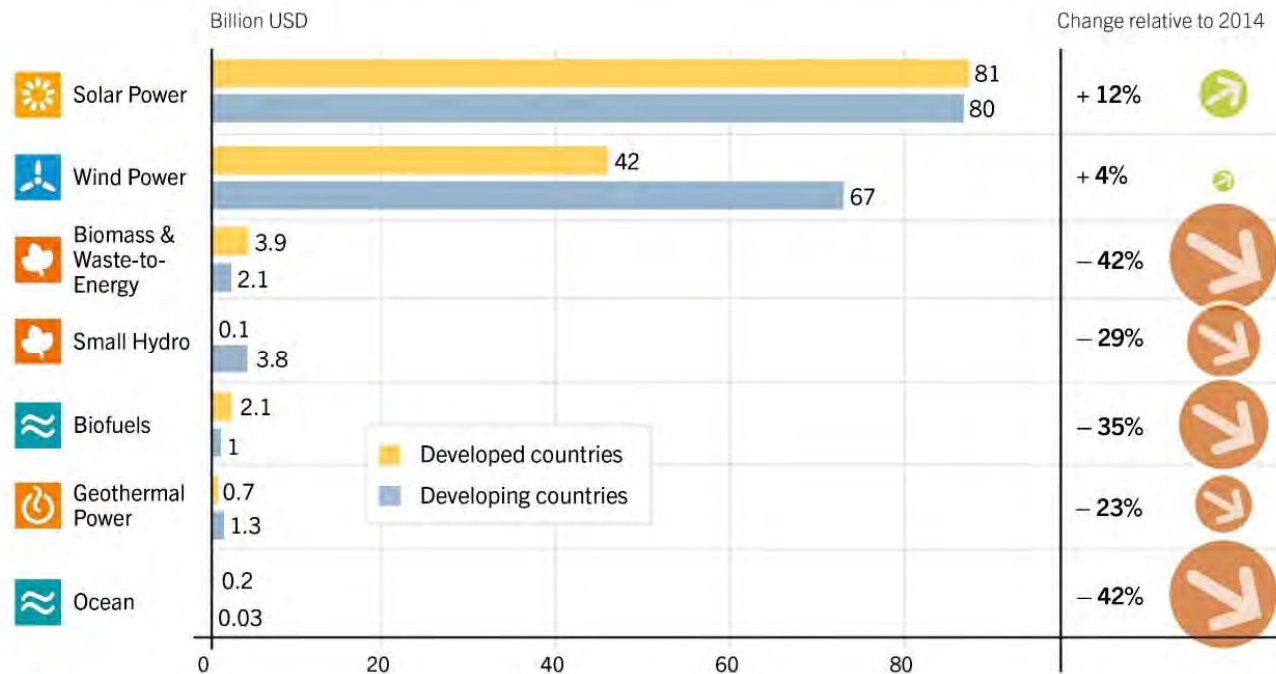
Sources: <https://ec.europa.eu/energy/en/topics/renewable-energy>
http://www.pv-magazine.com/news/details/beitrag/california-governor-brown-signs-50-renewable-portfolio-standard-into-law_100021447/#ixzz4He6NKmAP

What are the key contributors to successful renewable projects?

- Physical location- Can we generate?
- Infrastructure- Can we supply it?
- Product demand- Do they need it?
- Profitability- Can we make money?
- Do we know what volume we will generate?
- Do we know when we will generate?

What are the world markets telling us about renewables?

Global New Investment in Renewable Energy by Technology, Developed and Developing Countries, 2015



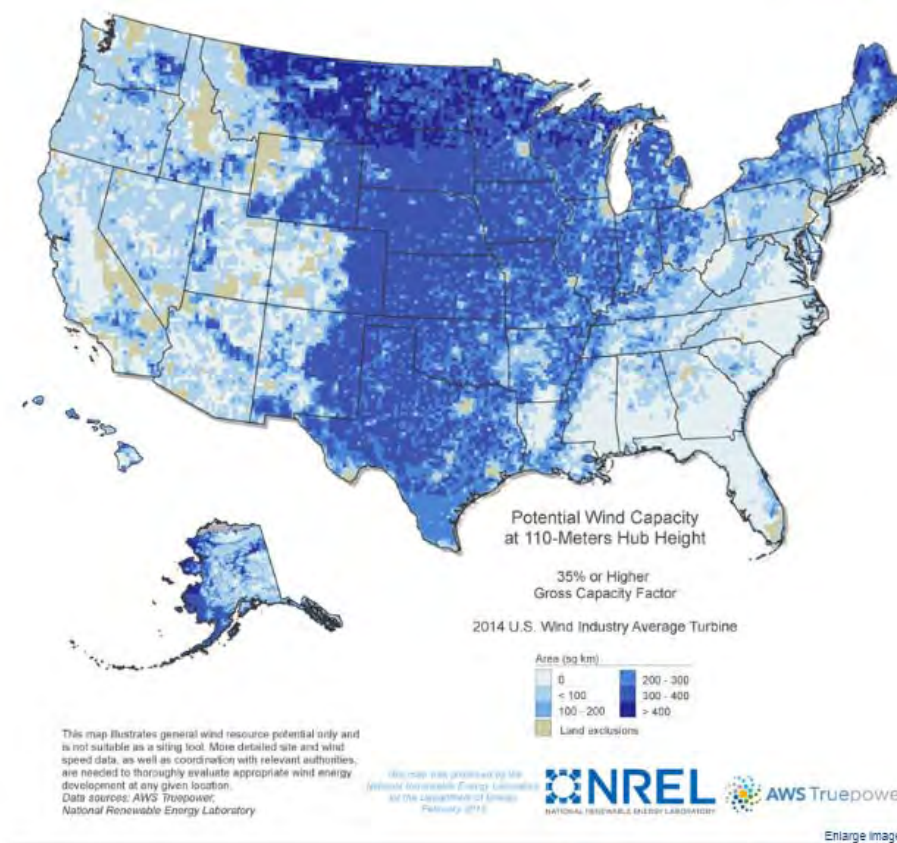
REN21 *Renewables 2016 Global Status Report*



Source: BNEF

Where does the opportunity for wind power exist today?

- Where does wind generate really make sense?
- 48,800 operating utility-scale wind turbines in the U.S.
 - Texas (17,711 MW)
 - Indiana (6,209 MW)
 - California (5,662 MW)



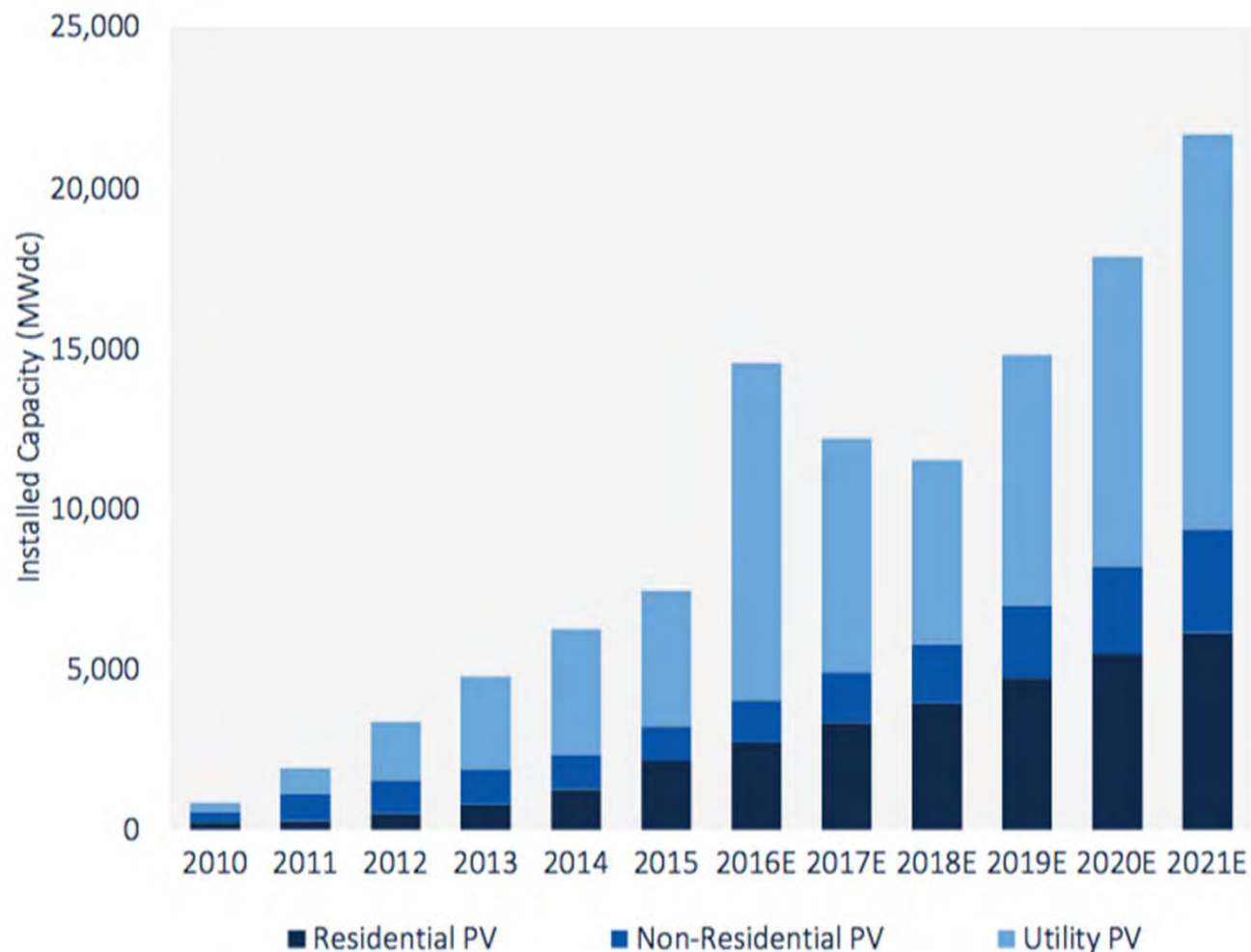
Where does the opportunity for wind power exist today?

- The additions of new wind turbines and infrastructure increased the power capacity for the year 2015 by 41%
- It created 88,000 jobs
- Turbine prices have fallen 20-40% lower than their highs in 2008
- Technology advancements including larger rotors increase capacity and efficiencies
- Wind energy prices are decreasing
 - For 2014 purchase power agreements, utilities were negotiating prices as low as 2.5 cents per kWh
 - The national average is ~11 cents per kWh

Sources: <http://www.awea.org/Resources/Content.aspx?ItemNumber=5059>
DOE "2014 Wind Technologies Market Report"

Where does the opportunity for solar exist today?

- Where does solar generation really make sense?



Source: U.S. Solar Market Insight: Q2 2016

Where does the opportunity for solar exist today?

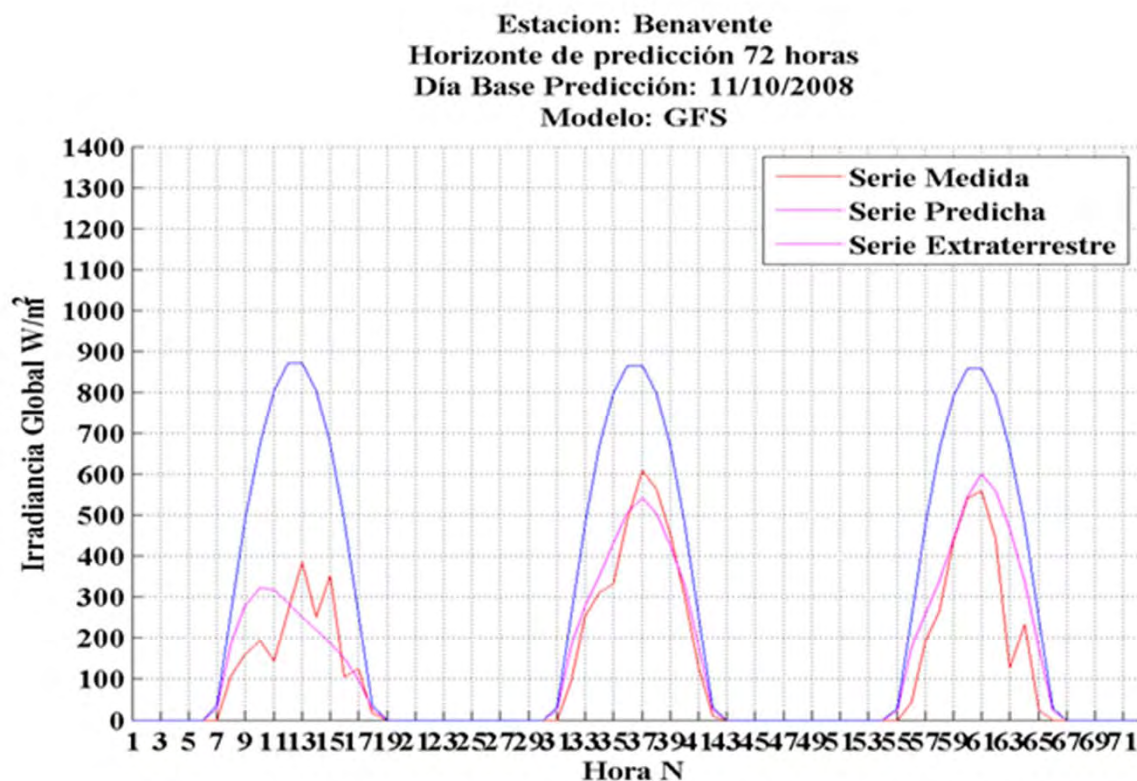
- Solar panels continue to decrease in cost at about an average of 10% each year since the 1980s
- Panels are becoming more efficient and more aesthetically pleasing
- Solar power installed in the U.S. has increased more than 23 times from 1.2 GW in 2008 to an estimated 27.4 GW at the end of 2015
- Solar workforce grew at a rate 12 times faster than the overall economy in 2015 - creating 208,859 jobs



Sources: <http://energy.gov/science-innovation/energy-sources/renewable-energy/solar>
Solar Foundation's National Solar Jobs Census 2015

How do we know when we will generate?

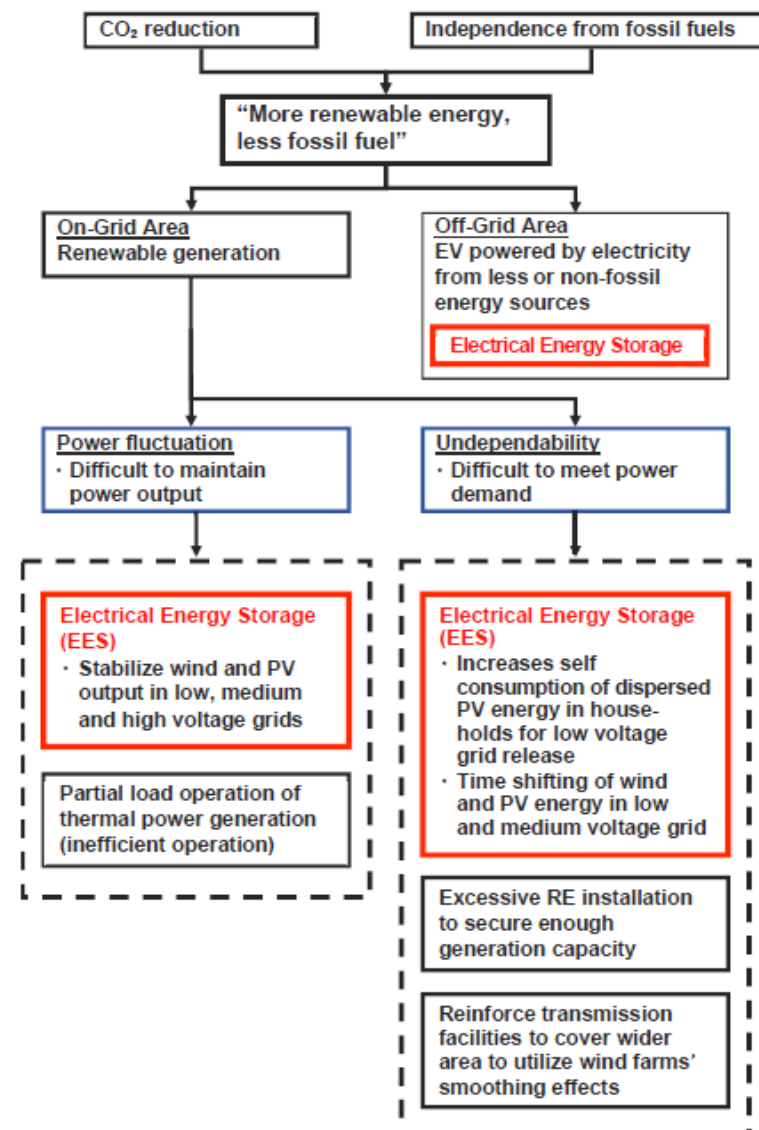
- Predictive analytics models are developed by various vendors, from the large players of IBM, Accenture to Locus Energy, Space-Time Insight, etc.



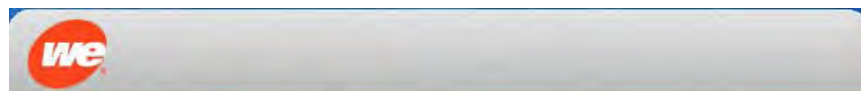
Source: Investigaciones y Recursos Solares Avanzados

How do we handle renewable generation when the demand is not there?

- Energy storage helps balance supply and demand by storing excess energy and distributing that energy when needed, creating a more flexible and reliable grid system.
- Use of batteries for energy storage are being researched aggressively.



Home Energy Storage



Wisconsin Time-of-Use

Residential (Rg2) and Commercial (Cg6)

Facilities charge (cents/day)	52.6020
Additional meter charge (cents/day)	5.9510

	Standard Flat rate	On peak	Off peak
Energy charge (cents/kWh) Residential (Rg2)	13.111 (Rg1)	19.680	8.964
Energy charge (cents/kWh) Commercial (Cg6)	13.282 (Cg1)	20.101	9.137

Rates are provided for comparison purposes only. Subject to change with PSCW approval. Other charges and/or credits may apply.

Residential: See [Wisconsin Tariff](#) for full details.

Commercial: See [Wisconsin Tariff](#) for full details.



- How does this affect my load curves?
- How does this affect my revenue generation?
- What are my pricing points going to be?
- Do I incentivizes energy storage?
- What benefits does the utility get from this?

Commercial Energy Storage



Who owns the Storage?

- The manufacturer
- Service Provider
- Utility

When do I pull power and why?

- % of my demand
- Cost of power
- Eliminate demand charge

Tesla's Energy Storage Park

- How will regulators handle this structure?
- Is Tesla a:
 - Utility?
 - Competitor?
 - Partner?



Energy as a Commodity

Los Angeles ←

→ Wisconsin



- How much can I “Ship” and when?
- How much profit can I make?
- Who buys it?
- When do I sell?

Wisconsin Time-of-Use

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In Summary

- Utility energy transformation
 - Policy drivers
- Wind and solar are a major focus
 - Costs are decreasing
 - Efficiencies in equipment are increasing
 - Creating jobs
- Predictive modeling and energy storage are vital elements
- Utilities need to understand how this will affect their relationship with customers:
 - Pricing structures
 - Rebates
 - Wholesale/ retail price for buying power
 - Customer engagements

Q&A

Thank You!

For questions and additional information, please contact:
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