Perceptions and Realities

Challenges and Risks for Renewable Energy Integration

Sustainable Energy and Atmospheric Sciences Seminar

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Mark Ahlstrom, CEO
mark@windlogics.com

WindLogics Background

- Founded in 1989 by supercomputer architects
- Modeling & visualization systems for USAF, Israeli Air Force, NASA & others
- Fine-scale forecasting
- Acquired by FPL Energy in September 2006

60 people & 1000+ cores focused on wind energy's fuel supply:

- Wind Resource
- Wind Variability
- Wind Forecasting

NextEra Energy Resources (formerly FPL Energy)

- North American Wind Leader
  - 63 wind farms in 16 states and Canada
  - More than 6,300 MW in operation
- Largest generator of solar energy in North America
  - Seven solar plants
- Also owns & operates nuclear, hydro and gas plants
  - More than 16,000 MW of generation in operation
- Subsidiary of FPL Group, Inc. (NYSE: FPL)
  - FPL Group: annual revenues of ~$15 Billion and ‘A’ credit rating

Key Messages from this Talk

- Successfully integrating renewable energy is what matters
- Better forecasting is commonly viewed as the critical piece
- That view is wrong
- This real issues are not what you think
- By naively plunging in, there is a great risk of harm

Running a Power System (very simplified)

1. Estimate the load pattern for tomorrow

2. Create an economic plan for meeting that load with your available sources of electric power

3. Verify that you can maintain reliability, even if something fails or load varies from plan, by adding some additional resources to your plan

4. Execute the plan over the day, adjusting as necessary for what actually happens, and be sure you keep the lights on

Power System Operator View of Wind Forecasting

- Reliability is job #1
- Uncertainty of the load forecast is bad enough, and adding wind will increase my problem
- How can I view a wind plant as a “power plant” if I don’t dispatch its output?
- I need a perfect forecast… like I get from other generators
- Couldn’t I have nuclear or coal instead?

Wind Integration Costs

- Wind is a source of free fuel
- The fuel source is variable (not intermittent)
- In the context of traditional operating practices, both the variability of the power delivery and the uncertainty of the day-ahead forecast are perceived to add costs to the system
- This incremental cost from the variability and uncertainty, as compared with an ideal source of power, is typically called the "wind integration cost"

Realities on Wind Integration

- Energy versus capacity (power)
- Storage is a great system resource, but not a wind issue
- Integration challenges are often at low load (not peak load)
- Adding more conventional generation could make it worse
- It's easy to blame wind for system problems (examples)
- Demand management and plug-in hybrids with appropriate "Smart Grid" systems could do wonders

Realities on Wind Forecasts

- A good wind power forecast has some value if it is integrated and used appropriately
- Forecasts can (and must) be optimized to specific business problems
- Forecasts are often misused or misinterpreted
- Complex risks for conflict of interest, market rules or market manipulation in the use and distribution of system forecasting
- The “integration and use” is the big challenge

So how hard can it be?

- Get a really good weather/wind forecast
- Get clean data from the wind plants
- Know where turbines are located
- Know when they are available to run
- Know how the turbine will react to a wind condition
- Know when power is curtailed for transmission constraints
- Etc…

Obviously, if we can improve the wind forecast, the rest is just a data management problem and should be easy. Right?

The Real World

- Historical data
- SCADA data
  - Whose data is this, anyway?
- Locations and interconnections
- On-site met tower data
- Curtailment

Example: Xcel Minnesota Forecasting Project

The Xcel-NCAR Project

This is a very smart play for Xcel:

- Gets the PUC off their back
- Wonderful PR and a great local story
- Sounds like they are going “next generation”
- Gets a government lab to accept the problem
- If it doesn’t work, how can they be blamed?

How it will work out…

- Big promises and expectations
- Data and information realities
- Model resolution and assimilation will not help
- It won't be Xcel's problem
- And meanwhile, in the two years that have passed…

The Risk and Danger

- Unrealistic expectations, while well meaning and sincere, can harm the industry
- By emphasizing the wind forecast and failing to dramatically reduce power forecast error, critics could strengthen their argument that wind is “intermittent” and unreliable
- The real problem is much more complex and wind forecasting is just one aspect of it
- An extremely high level of involvement, integration and support will be needed to solve this problem in the utility control room

Too Big to Fail?

- Failure on a basic research project is often a useful result
- Failure on an end-user contract is very bad
- We can afford for private companies to fail or underperform on an end-user contract – the marketplace will cover for this
- It is better for the renewable industry to let private companies handle the failures, since the impact is very different if the "government" fails

Thoughts - Power System Tools

- Does a perfect forecast help?
- Recent study at Xcel Colorado found that a perfect forecast had higher integration costs than a smoothed forecast
- This is an interesting result…
  - Are accepted tools and practices adequate and appropriate?
  - Is this like Jack Nicholson in “A Few Good Men”?

Thoughts - Do they even need wind forecasting?

- Operating practices often make a larger difference
- When do you really need to commit your system?
- There are both technical and non-technical reasons for the current operating practices, but they could be changed
- The closer we can move commitment to real time, the more accurate the wind schedule and the more valuable the wind becomes to their system

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- That view is wrong
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- By naively plunging in, and implicitly accepting the problem, there is a great risk of harm

Recommendations

- Be very, very cautious and do not overpromise
- Know that the work will be much more difficult than you think
- Think about what is best for the bigger picture
- Don’t become the excuse

Questions & Discussion

Mark Ahlstrom, CEO
651.556.4262
mark@windlogics.com