Integration of Renewable Generation

An Independent Power Producers' Perspective

Public Generating Pool EIM+ Workshop
Laura Beane
March 21, 2012

Rugby Wind Farm, Pierce County, North Dakota

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Iberdrola Renewables, Inc.

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A collection of exceptional assets…

- #2 developer of wind projects in the U.S. with over 4.8 GWs
- Represents 37% of Iberdrola S.A.'s global wind capacity
- 900 employees at the end of 2011
- 636 MW of CCGT & peaking capacity on the strategic CA-OR border
- Developing utility-scale photovoltaic projects, solar thermal projects, and biomass projects

US Renewables

Wind
4,800+ MW

Power
536 MW CCGT
100 MW peaking

Solar & Biomass
20 MW Solar
55 MW Biomass

Corporate Support

… with excellent growth prospects

Updated January 2012

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US Asset Portfolio

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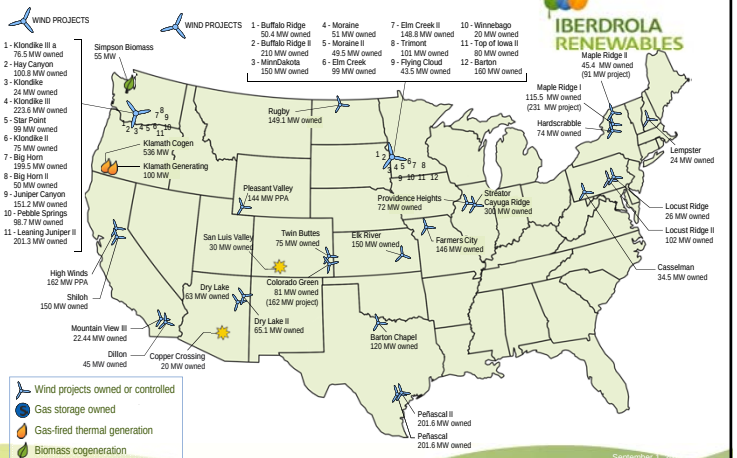

September 1, 20…

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Wind Energy's Impact to the Power System

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- Wind energy has four characteristics that affect how it is integrated into power systems:
  - Output variability
  - Near-zero variable cost
  - Difficulty of forecasting its output precisely
  - Remoteness
- These characteristics can be better accommodated in some markets structures than others
- The diversity of the US markets has made integration a difficult and fragmented effort

Optimal Wind Integration Conditions

- Large electric balancing area with access to neighboring markets
- Robust electric grid
- Short-term electricity generation markets
- Access to flexible generation and load
- Effective integration of wind forecasts into utility operations
- Flexible transmission services

IRI's Renewable Integration Goals

Increase Reliability & Operational Flexibility

- **Design generator to meet requirements in Interconnection Agreements**
  - *Voltage Support*
  - *Frequency Response*
- **Comply with current and future regional market and operational rules/ requirements**
  - *Bidding/Scheduling*
  - *Meter Data Submittals*
  - *Operational Requirements*
    - Dispatchability
    - Real Time Data Flow
    - Operator training and protocols

Minimize Costs

- **All resources should be treated equitably**
  - *Same access to market mechanisms as other generators to mitigate exposure to operational costs*
  - *Penalties should not be unfairly punitive based on unique operating characteristics*
- **Low cost integration solutions implemented prior to higher costs solutions**
- **Lead regional initiatives that result in optimal market structures**
  - *Large BA's with access to neighboring markets*
  - *Short-term electricity generation markets*
  - *Flexible transmission services*

Maximize Capability

- **Create new market opportunities**
  - *Ability to participate in ancillary services and capacity markets*
- **Advocate for rules that improve access to market:**
  - *Broad allocation of transmission costs for transmission that meets public policy objectives*
- **Long-term Certainty**
  - *Drive toward regulatory and market rules that create cost certainty.*

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Market-Type Comparison

Organized Markets (MISO, PJM, NYISO)	Hybrid Markets (SPP)	Bilateral Markets (West, South)
Large, single Balancing Area	Coordinate across multiple, smaller Balancing Areas	Small Balancing Areas, with limited coordination across the seams
Day-Ahead and Real-Time markets, with access to intra-hour flexibility (load and resources)	Bilateral markets, with access to intra-hour flexibility (load and resources)	Bilateral markets, with limited access to loads and owned resources within Balancing Area
Robust regional interconnections; flexible transmission services	Robust regional interconnections; physical transmission service with one fee for transactions across multiple SPP utilities	Physical transmission service, with "pancaked" rates across utilities
Robust regional transmission planning and cost allocation processes	Robust regional transmission planning and cost allocation processes	Regional planning done for "information only", limited regional cost allocation processes
Centralized forecast used to support system reliability; individual generators incented to submit forecasts (e.g. 4-hour, hourly, 5-minute granularity)	Centralized forecast used to support system reliability; no market-based incentives to use/improve generator forecasting.	No centralized forecasting; limited use of market-based incentives to use/improve generator forecasting.

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Summary of Wind Integration Issues in BPA's Balancing Area

- Wind penetration is rapidly increasing in Balancing Area
  - Iberdrola Renewables is ~34% of the installed capacity in BPA's Balancing Area
- The hydro system is less flexible then in previous years
- Currently there are thousands of MW's of merchant flexible generation on BPA's system which cannot be accessed

Wind Integration Charge Background

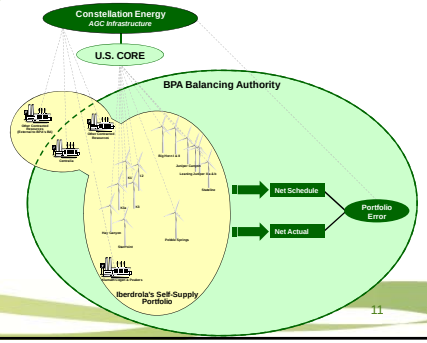
- In 2008 BPA implemented a Wind Integration Charge (WIC) of approximately $3.11/MWh
- In its 2009 rate case, BPA's initial Wind Integration Charge proposal was in excess of $11/MWh – a 350% increase over the initial charge
- Iberdrola Renewables began preparations to file with the WECC and the NERC to become certified as its own Balancing Authority (BA) and leave BPA's system entirely
- Through collaboration with industry stakeholders, BPA implemented changes resulting in a final WIC of approximately $5.89/MWh
- BPA allowed customers the option of self-supplying all or a portion of their required balancing reserves

Self-Supply Pilot Introduction

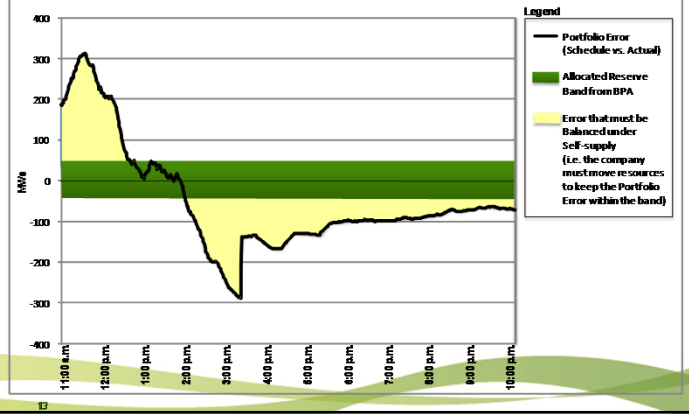
- Iberdrola Renewables elected to self-supply Generation Imbalance Reserves and continues to purchase Regulation Reserves and Following Reserves from BPA
- Iberdrola Renewables worked with BPA over a twelve month period to implement the first Customer Supplied Generation Imbalance (CSGI) pilot that went live September 1, 2010
  - Development and execution of the Participant Agreement
  - Installation of required communications and signaling equipment
  - Completion of comprehensive testing
  - Reconfiguration of settlement systems and processes
  - Execution of Balancing resource contracts
- The initial pilot continued through September 30, 2011 and Iberdrola Renewables elected to extend the pilot through September 30, 2013

Self-Supply Pilot Structure

- BPA has allocated a portion of Regulation and Following reserves to Iberdrola's generation portfolio and Iberdrola is responsible to self-supply Generation Imbalance reserves to resolve any remaining Station Control Error (SCE) – the difference between the net schedule and net output of Iberdrola Renewables northwest wind portfolio



Self-Supply Balancing Illustration



Self-Supply SCE Management

- Iberdrola Renewables' robust forecasting capabilities help to minimize the error of the northwest wind portfolio
- Iberdrola Renewables' Klamath Cogeneration facilities, including peaking units, are utilized to provide a portion of the needed generation to keep Iberdrola's portfolio balanced
- Iberdrola has also entered into contractual relationships with entities with dispatchable resources to provide additional generation capability
- All balancing generation is provided over dynamic schedules on an intra-hour basis or through the On Demand transmission product

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Constellation Energy Control & Dispatch

- Iberdrola has engaged Constellation Energy Control & Dispatch (CECD) to provide consulting services and Automatic Generation Control (AGC) infrastructure
- CECD provides balancing services for ~15 Balancing Authorities across the United States including the nation's first wind-only Balancing Authority
- Constellation's Responsibilities
  - Respond on a 4-second basis to the Portfolio Error
    - Execute dispatch of resources per resource stack
  - Monitor and respond to applicable compliance parameters
  - Report all aspects of self-supply portfolio

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Self-Supply Pilot Assessment & Lessons Learned

- Balancing wind is not for the faint of heart
- Despite challenges, Iberdrola has successfully balanced its nearly 1400 MW of wind and has exceeded performance requirements
- Success has been a team effort requiring cooperation and performance by all parties – Iberdrola, BPA, CECD & Versify
- New balancing agreements are optional with variable price (versus obligation at fixed price)
- Access to dynamic transfer capability is critical to success of CSGI and other initiatives designed to ease burden from BPA
- DSO 216 remains problematic despite Iberdrola's strong balancing performance

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What's Next?

- BPA's rate case process has already begun for the 2013-2015 rate period and Iberdrola Renewables has developed a proposal for wind balancing services which would replace BPA's existing Variable Energy Resource Balancing Service (VERBS)
  - Variable rate component designed to provide proper incentives for wind generators
  - Elimination of non-reliability based tag curtailments and other punitive penalties
- Iberdrola Renewables is partnering with other Northwest entities to explore implementation of an energy imbalance program at the Mid-C market hub that can ultimately be expanded to a west-wide footprint

Iberdrola Renewables continues to view the CSGI program as an interim solution until a fully functional balancing market evolves

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Questions?
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