Notrees Wind Storage Project Description

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Special thanks for support from DOE
Project objective:
Provide validation that energy storage increases the value and practical application of wind generation, alleviates intermittency issues, and is commercially viable at utility scale

The Energy Storage System will:
- Integrate with variable renewable energy production
- Improve use of power-producing assets by storing energy during non-peak generation periods
- Demonstrate benefits of using fast response energy storage to provide ancillary services for grid management
- Confirm that the solution can dispatch according to market price signals or pre-determined schedules utilizing ramp control
- Verify that energy storage solutions can operate within the ERCOT market protocols
In addition to these operating projects, DER has a number of projects under construction, and a development pipeline of approximately 5,000 MW.
Project site

- Notrees wind farm, owned and operated by Duke Energy Renewables
- Located in west Texas – Ector and Winkler Counties
- 152.6MW total wind generation capacity
- Energy Storage System (ESS) will be located at the substation and tied on the distribution side
### Notrees Battery Storage System

<table>
<thead>
<tr>
<th>Location:</th>
<th>Notrees, TX</th>
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<tbody>
<tr>
<td>Application:</td>
<td>Notrees Wind Farm</td>
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<tr>
<td>ESS</td>
<td>Xtreme Power – DPR</td>
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<td></td>
<td>36 MW / 24 MWh</td>
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<td>COD</td>
<td>Q4 2012</td>
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**Value:**
- Frequency Regulation
- Energy Arbitrage
- Voltage Support
- Wind Firming
- Curtailment Mitigation
- Other Ancillary Services (Non-Spinning Reserve, Black Start)

**Price:** $43.6 million

- 36MW/24MW battery storage integrated with an existing Duke wind farm in West Texas
- Storage system consists of 24 x 1.5 MVA/1 MWh modules
- Connected to the 34.5 kV wind farm collector system
- Separate storage control system to enable full visibility by TDSP & ERCOT of storage system
Anticipated Benefits: Regulation Up/Down

Primary battery usage will likely be providing regulation up/down services
- Must learn how to optimize system within ERCOT market operations
- Current regulation market signals suggest state-of-charge (SOC) drift will occur. Can we get an energy neutral signal for dispatch, or will bid strategies need to be adjusted to control for drift?
Anticipated Benefits

Ramp Control

No mechanism for monetizing this benefit in ERCOT at present

• Will there be defined market value for providing ramp control?

Source: Xtreme Power
Anticipated Benefits

Kahuku WTG Trip Event

- Four WTG’s tripped offline causing an ~8 MW drop in power
- DPR immediately discharges ~8 MW, ramps down park successfully

Source: Xtreme Power
Market Challenges

- Access to Markets
- Settlement
- Metering
- Registration Complexity
Current Project Timeline

2009 2010 2011 2012 2013

Phase I – Economic and Industry Evaluation

Phase II – Battery Engineering and Construction

Phase III – Battery Testing

Phase IV – Installation

Phase V – Commissioning & Operations

Accomplishments since last update:
- Completed project economic evaluation
- Awarded vendor contract to Xtreme Power
- Detailed system engineering started August 2011
- Site mobilization October 2011
Next Steps

- Final system design
- Build and install system
- System testing and commissioning
- Commercial Operations projected for October 1, 2012
- PUCT Storage Workshop – October 2011
- Establish rules for storage via ERCOT stakeholder process
- EPRI will work with Duke Energy to:
  - Finalize performance testing and analysis plan
  - Develop system benefits framework
  - Analyze and report system performance