Notrees Wind Storage Project Description

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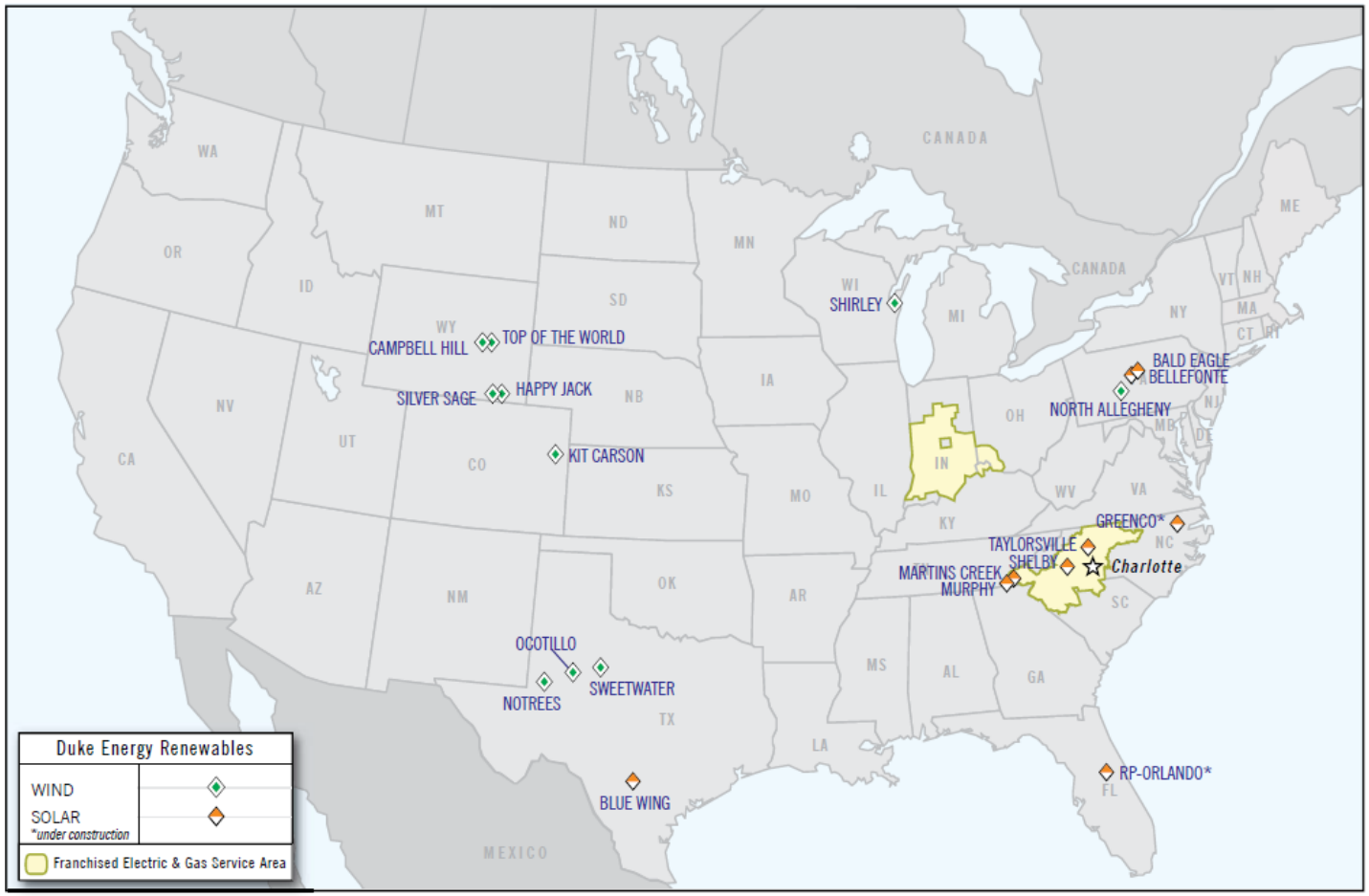
Project objective:

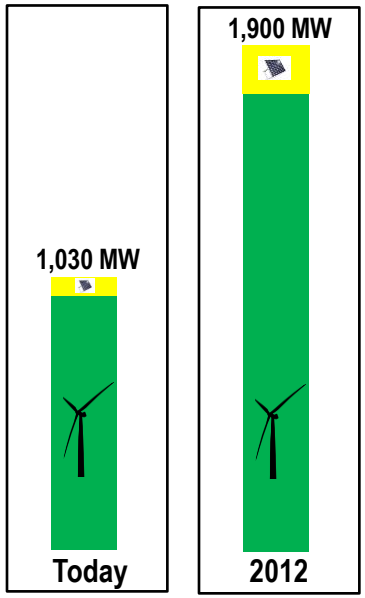
Provide validation that energy storage increases the value and practical application of wind generation, alleviates intermittency issues, and is commercially viable at utility scale

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

Duke Energy Renewables Overview





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

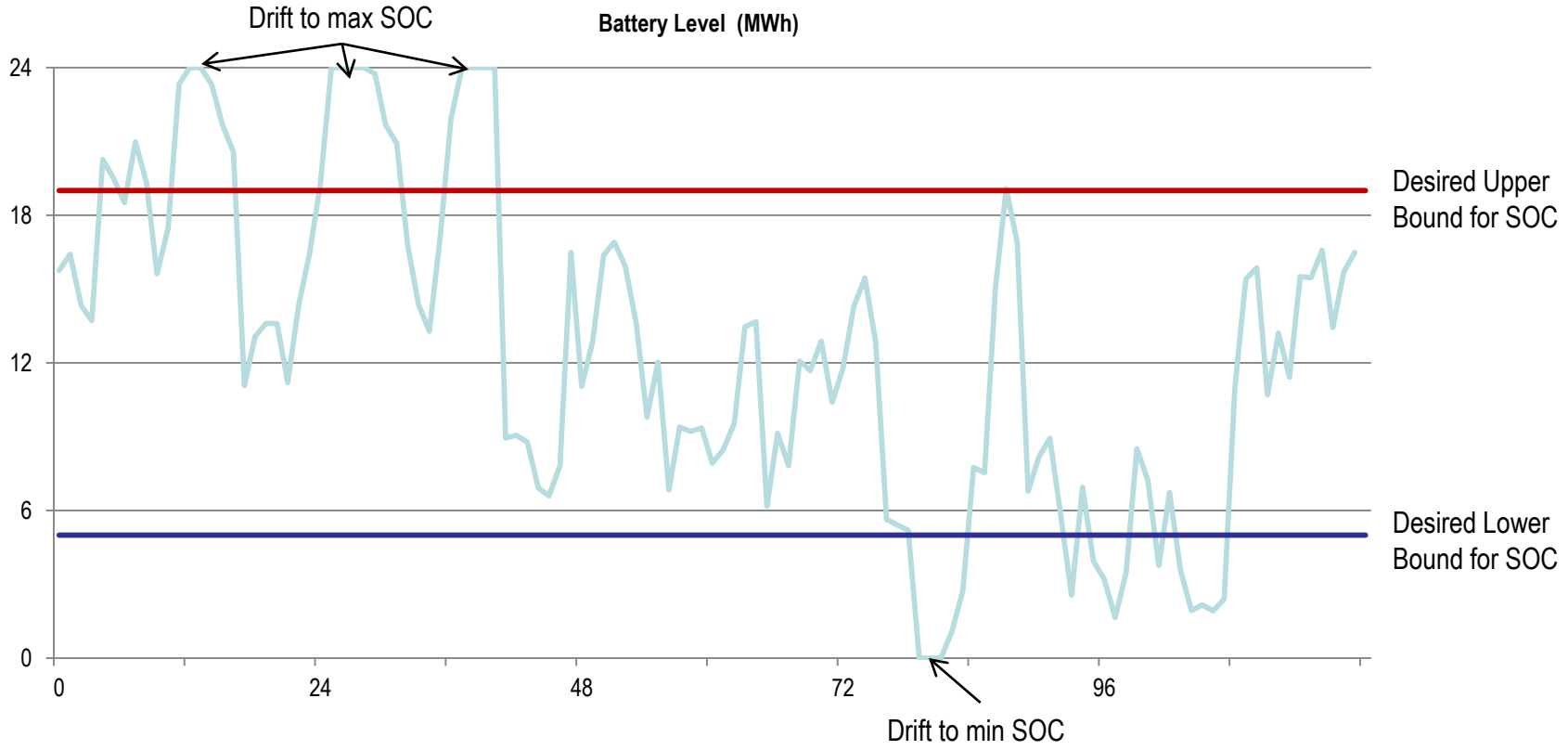
Location:	**Notrees, TX**
Application:	Notrees Wind Farm
ESS	Xtreme Power – DPR 36 MW / 24 MWh
COD	Q4 2012
Value:	▪ Frequency Regulation ▪ Energy Arbitrage ▪ Voltage Support ▪ Wind Firming ▪ Curtailment Mitigation ▪ Other Ancillary Services (Non-Spinning Reserve, Black Start)
Price:	$43.6 million

- 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

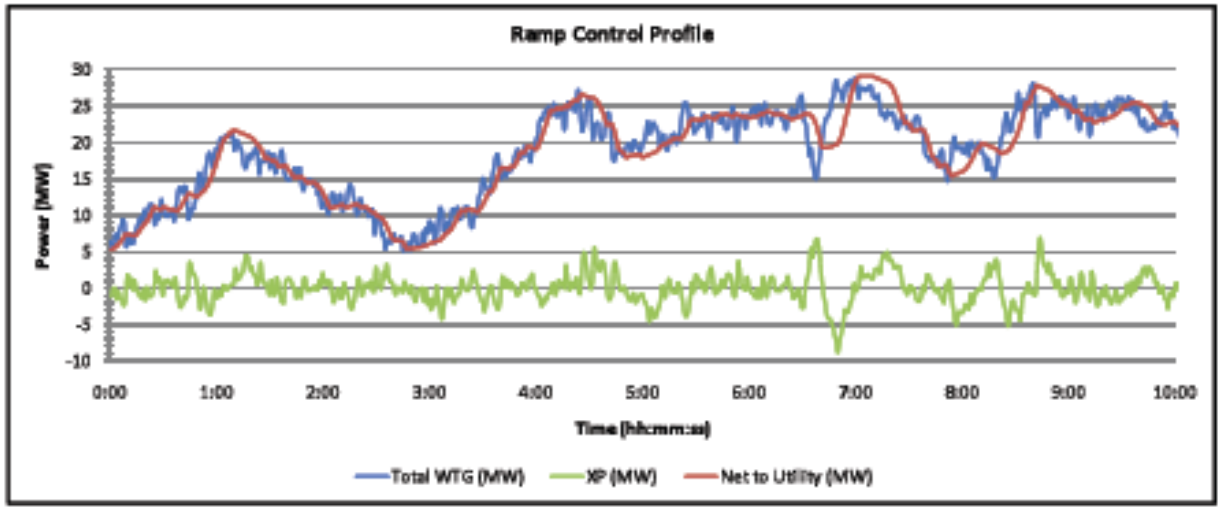
Primary battery usage will likely be providing regulation up/down services

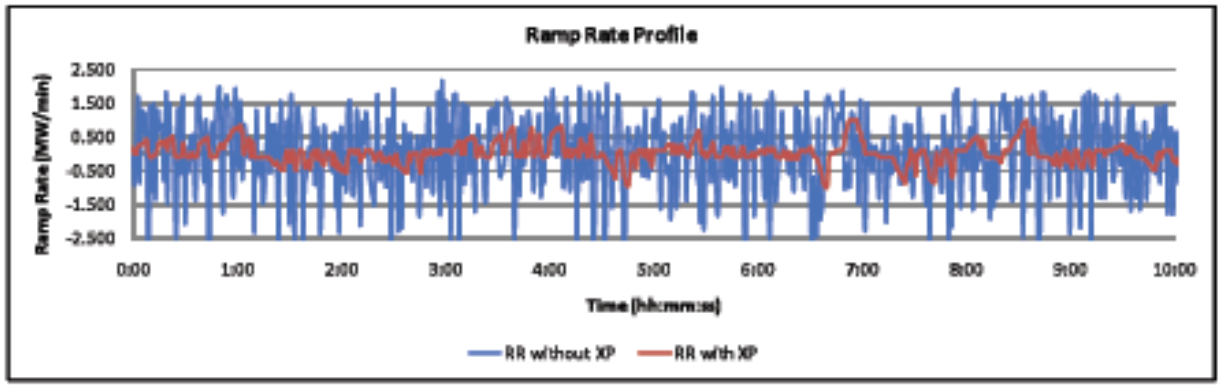
- Must learn how to optimize system within ERCOT market operations
- *Current regulation market signals suggest state-of-charge (SOC) drift will occur. Can we get an energy neutral signal for dispatch, or will bid strategies need to be adjusted to control for drift?*



Anticipated Benefits

Ramp Control



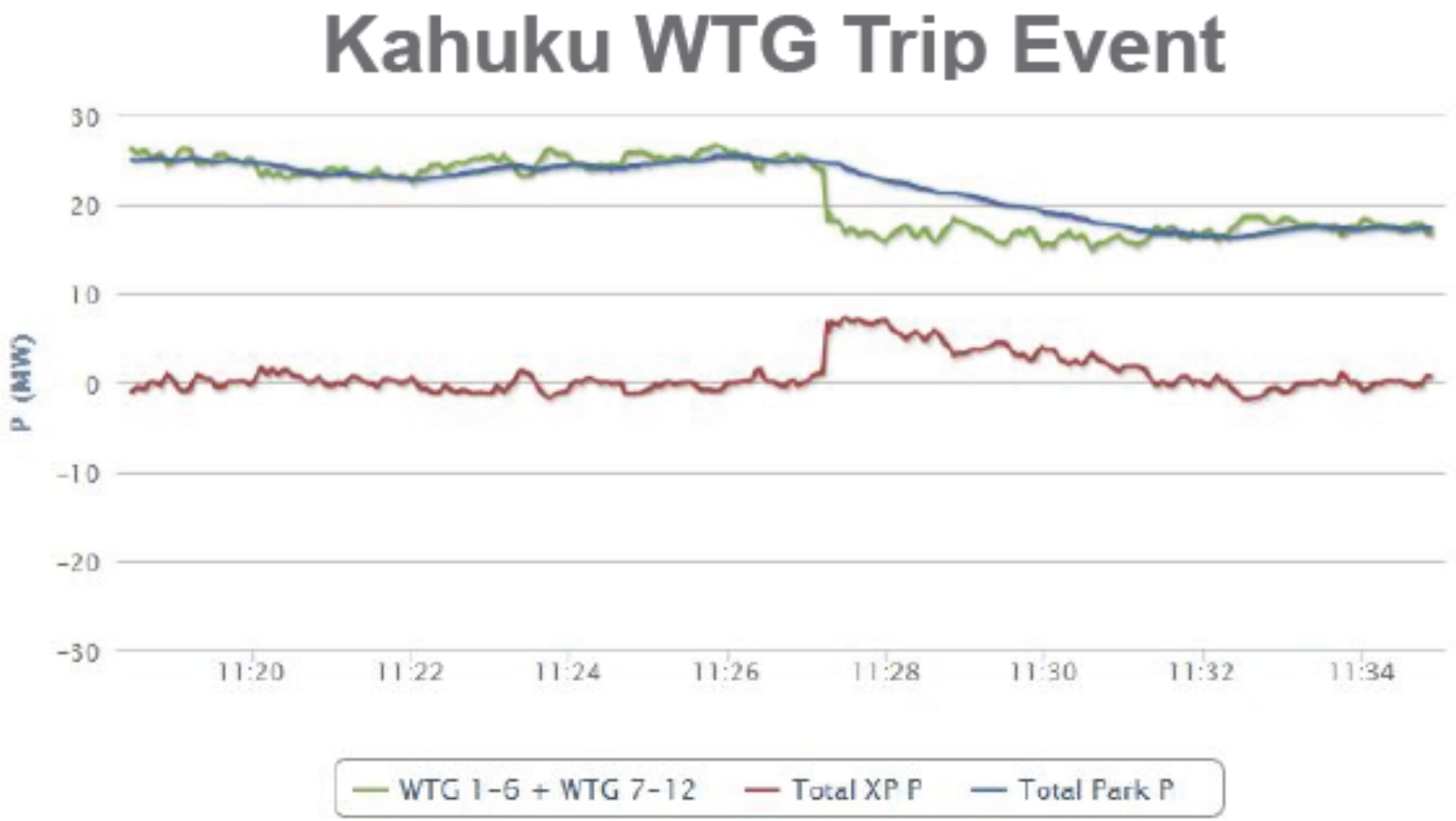


No mechanism for monetizing this benefit in ERCOT at present

- *Will there be defined market value for providing ramp control?*

Source: Xtreme Power

Anticipated Benefits



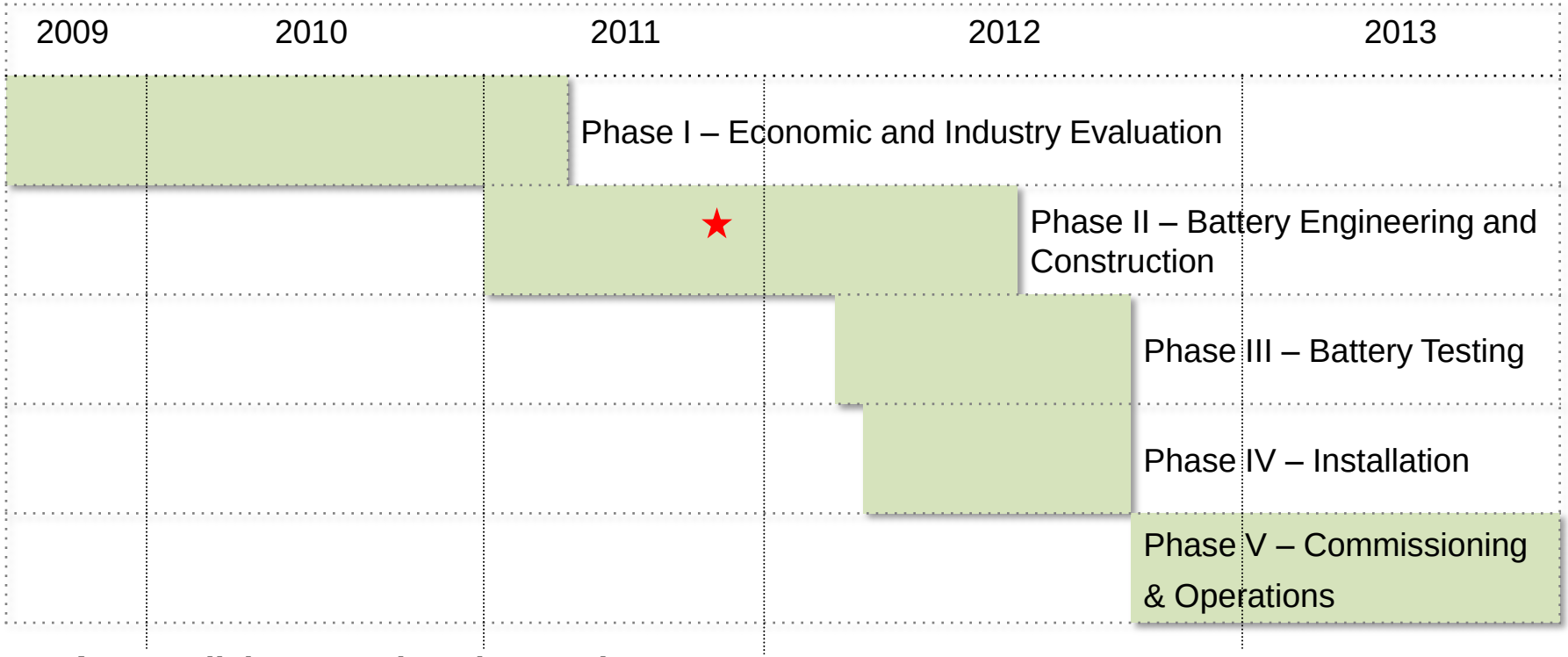
- Four WTG's tripped offline causing an ~8 MW drop in power
- DPR immediately discharges ~8 MW, ramps down park successfully

Source: Xtreme Power

Market Challenges

- Access to Markets
- Settlement
- Metering
- Registration Complexity

Current Project Timeline



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