Xtreme Power

The Power to Control.

Dynamic Power Resource™

Energy Storage Drivers- Transmission

January, 24-25 2011

Perceptions

- Does not work
- Too expensive
- Not scalable

Xtreme Power, Inc.

Who we are…

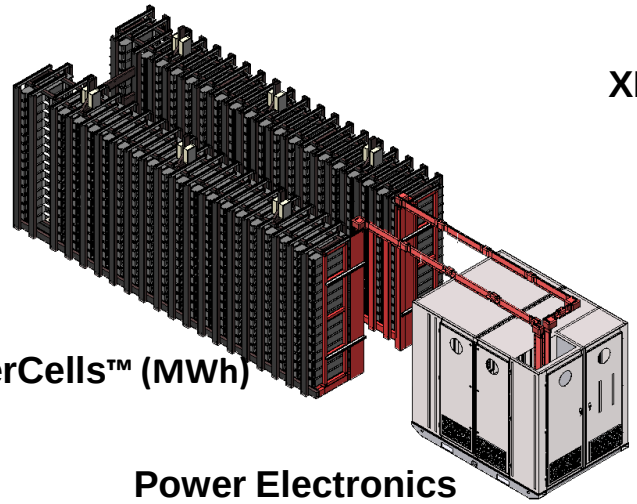
Manufacturer of Dynamic Power Resources™

- Founded in 2004 in Kyle, Texas
- 20+ years of R&D in our technology
- Contracts awarded and in final negotiations > 60 MWh
- US-based manufacturing
  - Oklahoma and Texas
  - 200 MWh of capacity
  - Expansion option: > 1 GWh
- Over $50 MM in funding: SAIL VP, Bessemer VP, Dow Chemical, Fluor, Dominion Power, BP, POSCO, Skylake Incuvest
- Utility industry leadership on our Board – Pat Wood, Foster Duncan

Xtreme Power Technology

Dynamic Power Resource™ (DPR™)

System Integration



PowerCells™ (MWh)

Power Electronics (MW)

XP Control System

Real Projects, Real Solutions

Project	Application	DPR™	COD	Services
SPT	Ancillary Services	0.5 MW / 0.1 MWh	Q4 2006	Peak-Shaving, Load-leveling
Maui	Wind	1.5 MW / 1.0 MWh	Q3 2009	Ramp Control, Curtailment Mitigation
Kahuku	Wind	15 MW / 10 MWh	Q1 2011	Ramp Control, Curtailment Mitigation
Xcel Energy SolarTAC	Solar	1.5 MW / 1.0 MWh	Q1 2011	Ramp Control, Curtailment Mitigation, Grid Services
Lanai	Solar	1.125 MW / 0.5 MWh	Q2 2011	Ramp Control, Grid Services
Ford	End-User	0.75 MW / 2.0 MWh	Q2 2011	Peak-Shaving, Load-leveling
Bronson*	Wind	10 MW / 20 MWh	Q4 2011	Ramp Control, Curtailment Mitigation, Grid Services
Bullseye	End-User + Solar	0.5 MW/ 1.0 MWh	Q4 2011	Ramp Control, Load-leveling
Tumbleweed*	Wind	36 MW / 24 MWh	Q4 2012	Ramp Control, Curtailment Mitigation, Grid Services
Tres Amigas	T&D	~ 100 MW / 200 MWh	Q2 2013	Grid Services

* Project not yet announced

Target Segments

Renewable Developers & Owners

$9.5 B

- Ramp Control
- Curtailment Mitigation
- Firming/Shaping
- Interconnection Compliance
- Grid Services

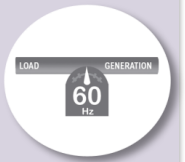
Transmission & Distribution Providers

$1.6 B

- T&D Deferral
- Voltage Support
- Power Quality
- Grid Reliability Enhancement

Ancillary Service Providers

$7.6 B



- Frequency Regulation
- Voltage Regulation
- Responsive Reserves

End Users

$16.5 B

- Peak Shaving
- Load Leveling
- Power Quality

Existing Ops Practices

- Operations rely on unused transmission to meet contingencies (N-1, etc.)
- Speed of breaker operations and oscillations require high speed responses
- Most Western transfer limits are not thermal capability of 500 kV lines, but voltage stability and overloads on the lower voltage system

Existing Planning Practices

- Extract maximum value from existing EHV assets
- "The **third** line in many paths adds cost-effective capacity"

Storage can fill these transmission needs

Presidio, TX

Electric Transmission Texas (jv of American Electric Power and MidAmerican Energy Holdings) power to town of Presidio, TX via 60 mile long 69 kV Transmission line

WPS- Rhinelander Loop

Transmission supplying growing load in northern Wisconsin with 115 kV loop of 200 miles limited by stability issues.

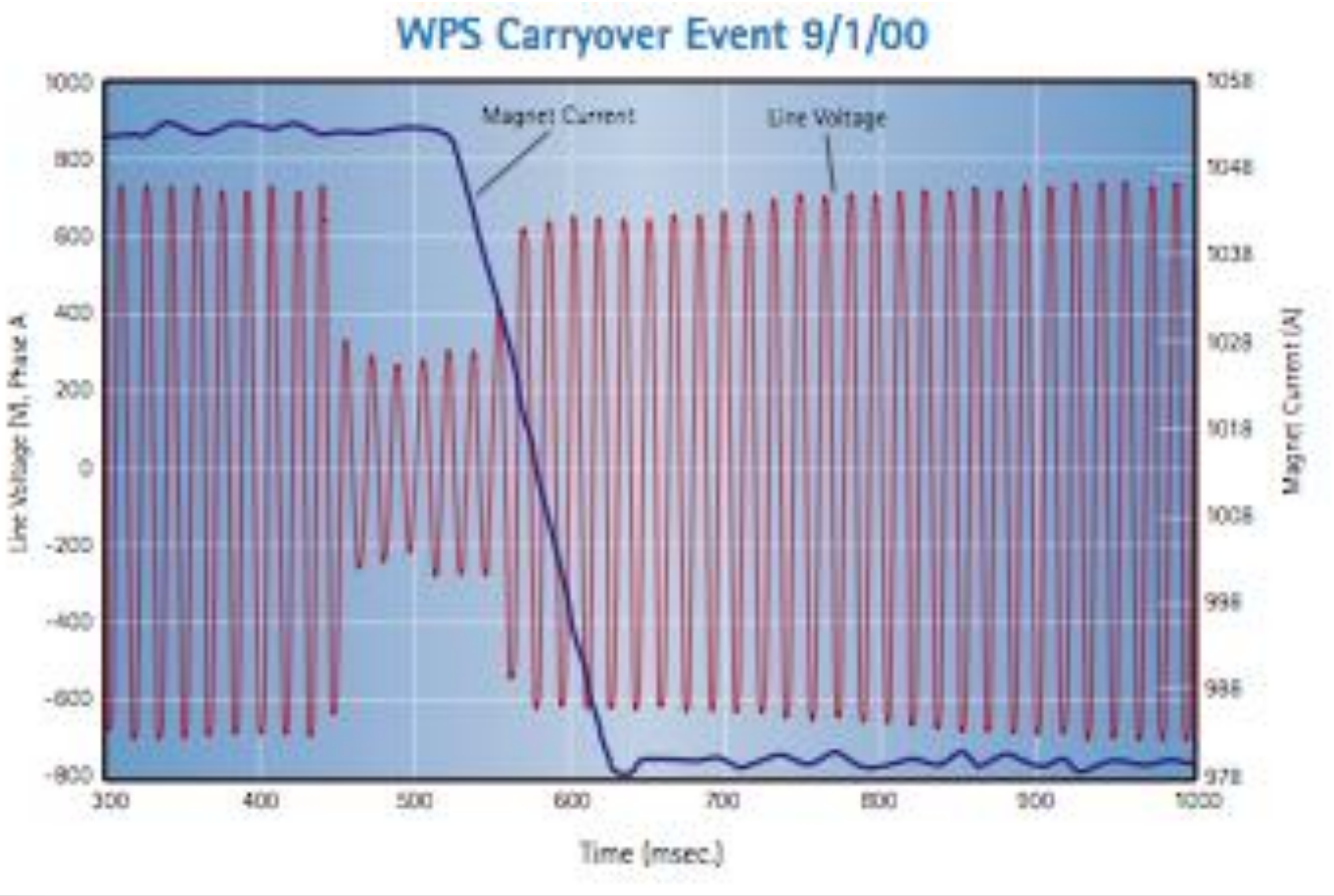
Alternatives est. cost $35 – $46 M required intrusion on bald eagle habitat, 10 years to complete. Mitigations included $3.2 M Storage installed in July 2000.

D-SMES™
Distributed-Superconducting Magnetic Energy Storage System

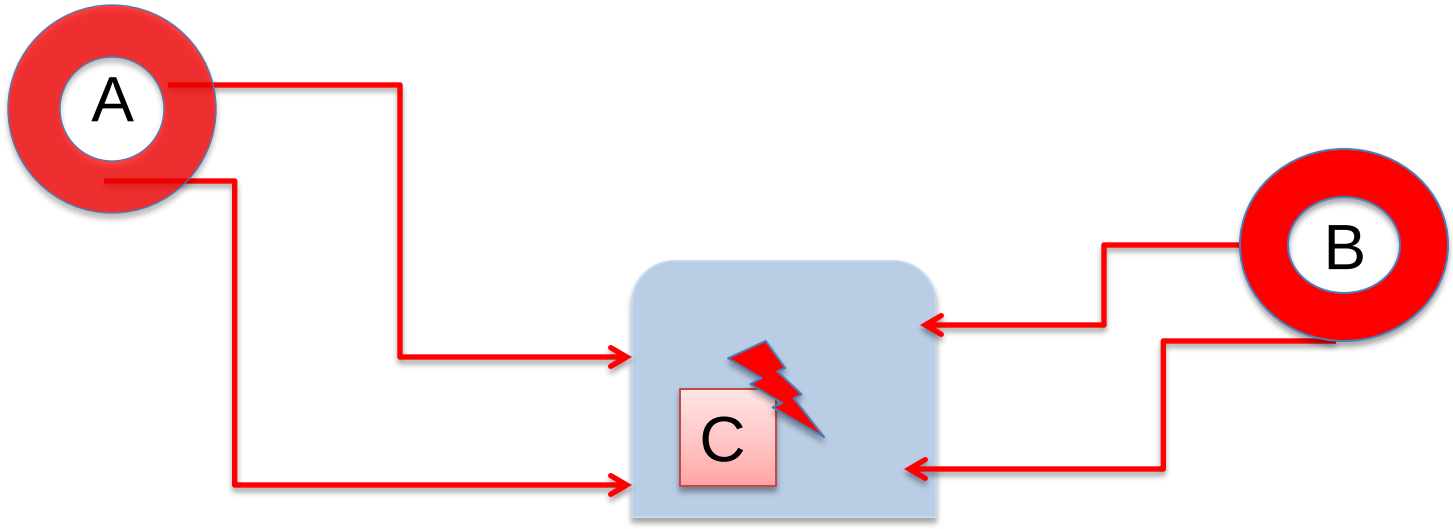
American Superconductor
REVOLUTIONIZING THE WAY THE WORLD USES ELECTRICITY™

WPS- Rhinelander Loop

American Superconductor
REVOLUTIONIZING THE WAY THE WORLD USES ELECTRICITY®

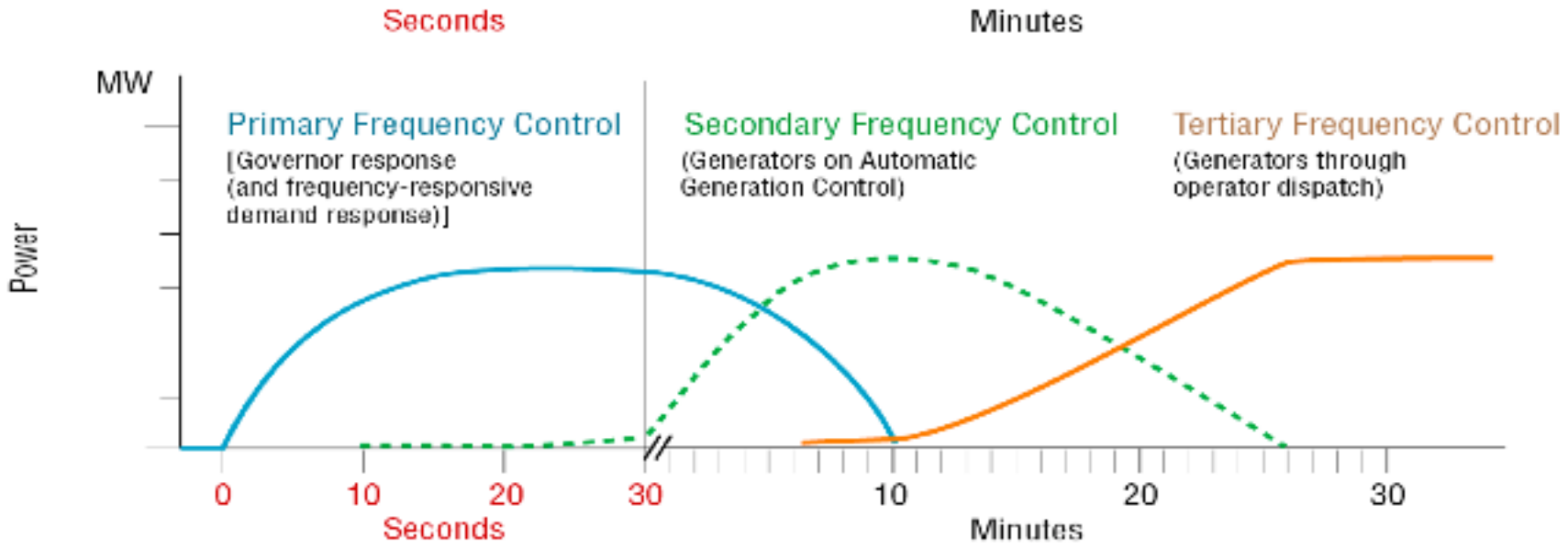


Storage as Transmission



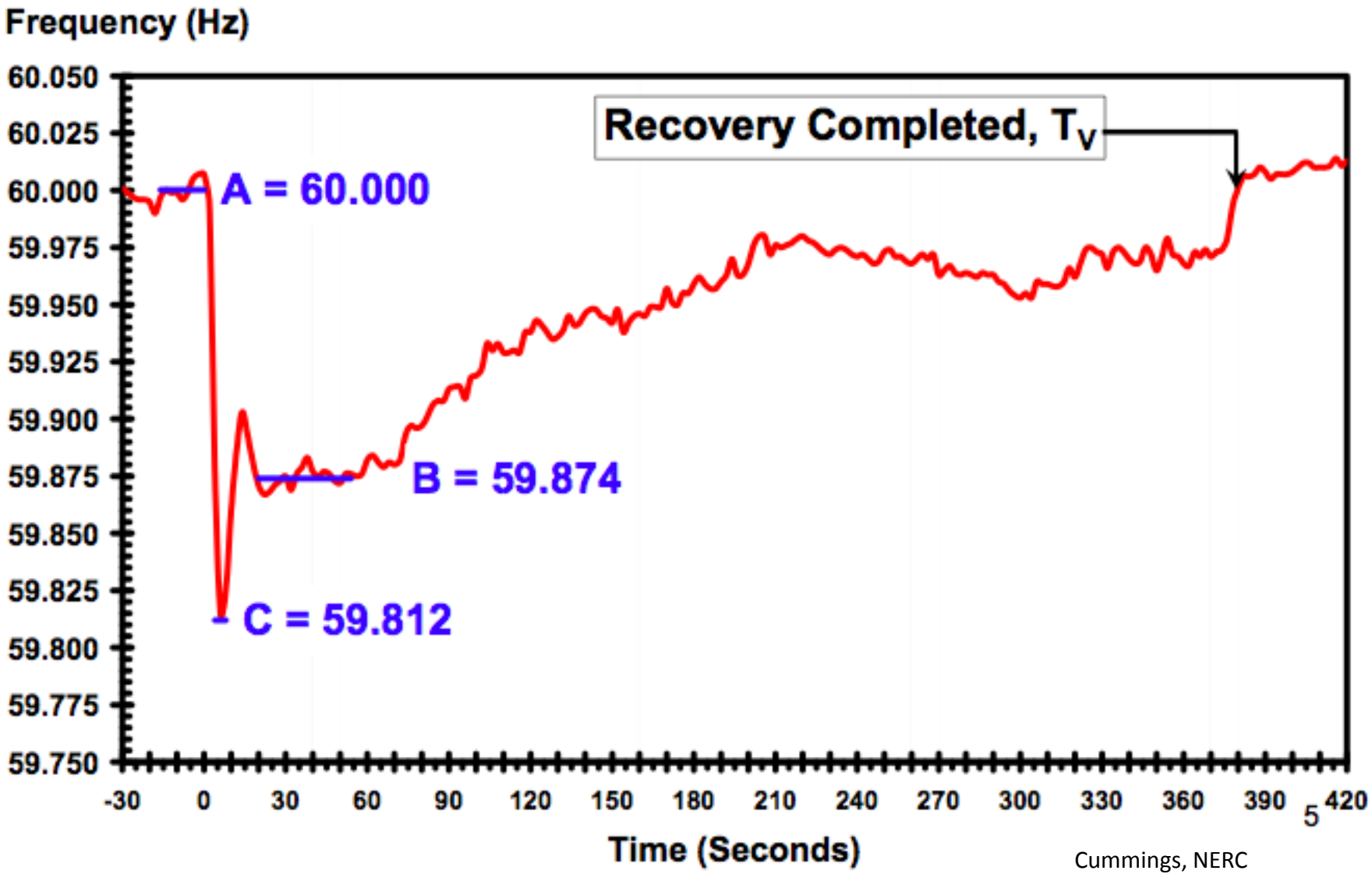
Load in Grey area supplied from points A & B. In the event of transmission line interruption, supply from storage at point C begins to discharge instantly.

Needed Response to Outage



FERC 9/2010

Classic Frequency Excursion Recovery



Cummings, NERC

Kahuku, HI

First Wind 30 MW project, Clipper WTGs

- Weak 46 kV radial transmission,
- Inadequate communication link,
- Output ramp limits.

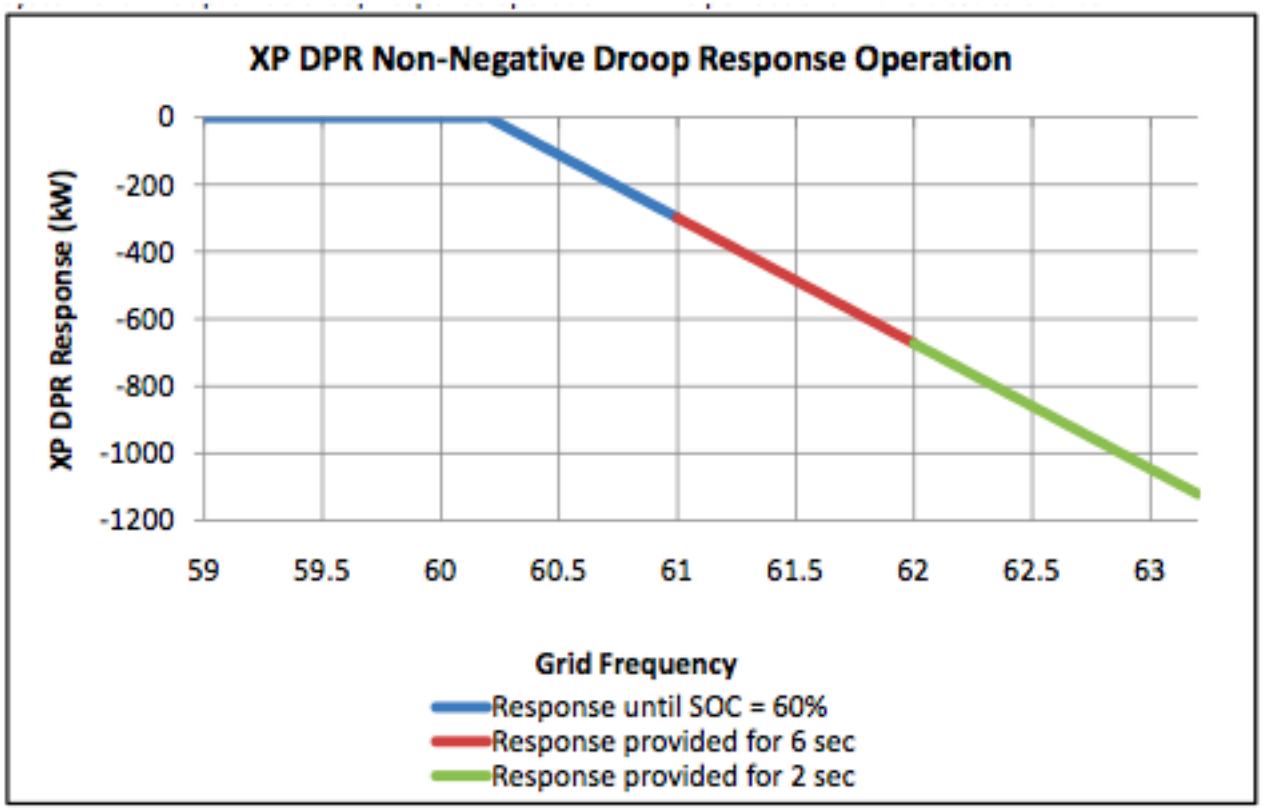
Grid Frequency Control Commercialization

Kahuku Wind Power

Location	Oahu, HI
Application	Wind
DPR™	15 MW / 10 MWh
COD	Q1 2011
Services	Ramp Control, Curtailment Mitigation

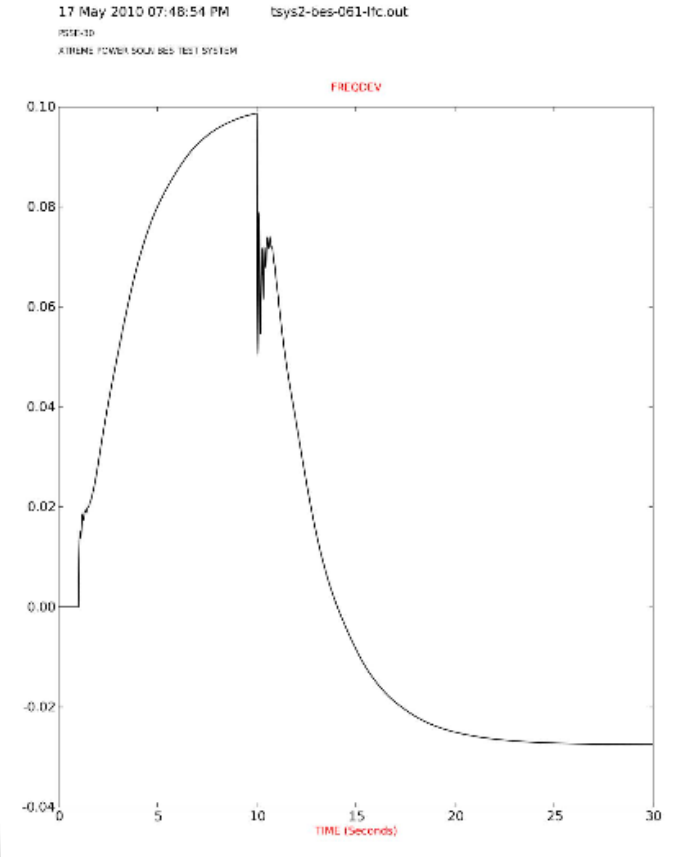
Under construction, this DPR™ will operate on a 30 MW wind farm on the island of Oahu to meet PPA ramp control requirements of ±1MW/min.

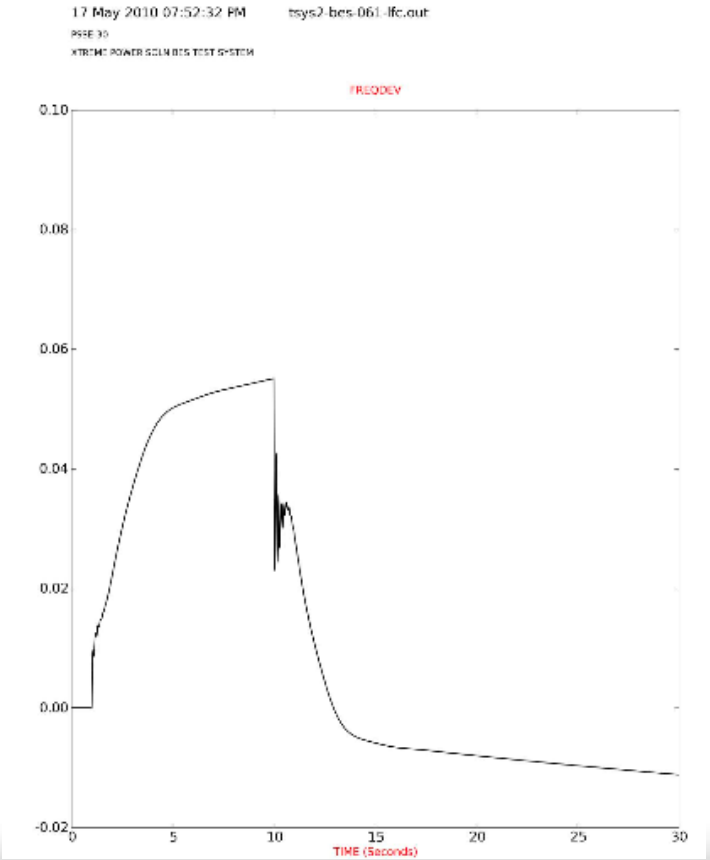
XP DPR Responds To Loss



Improved Frequency Response

Grid modeled with XP DPR responding in 0.050 seconds





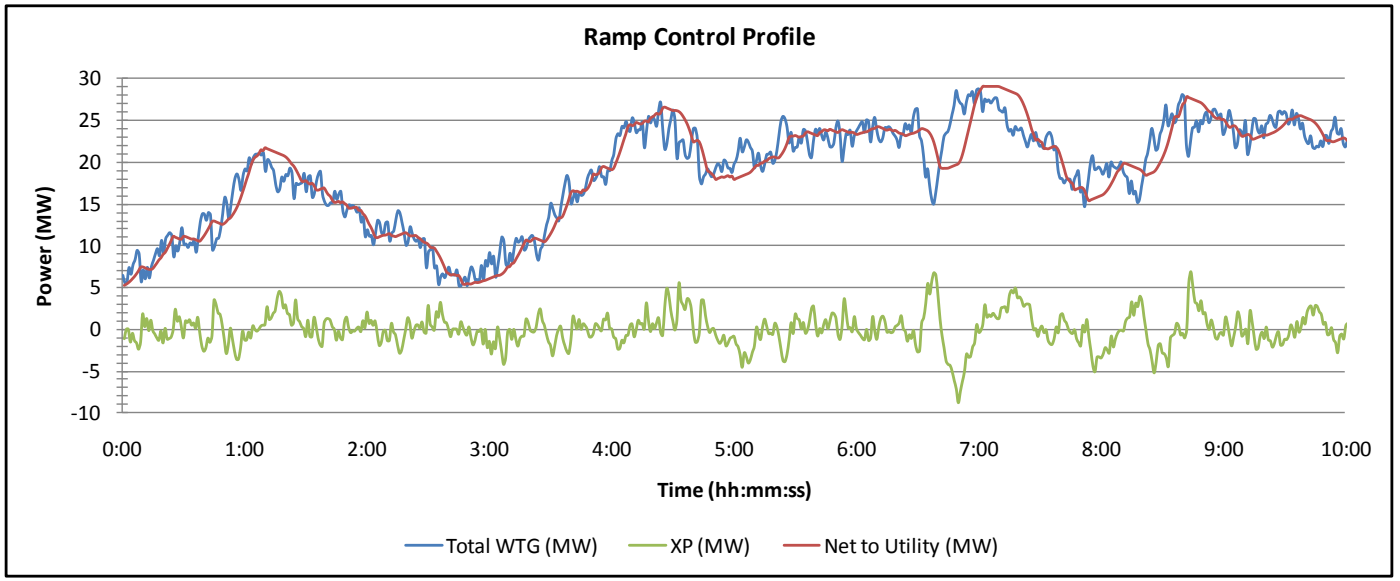
Ramp Control Demonstration

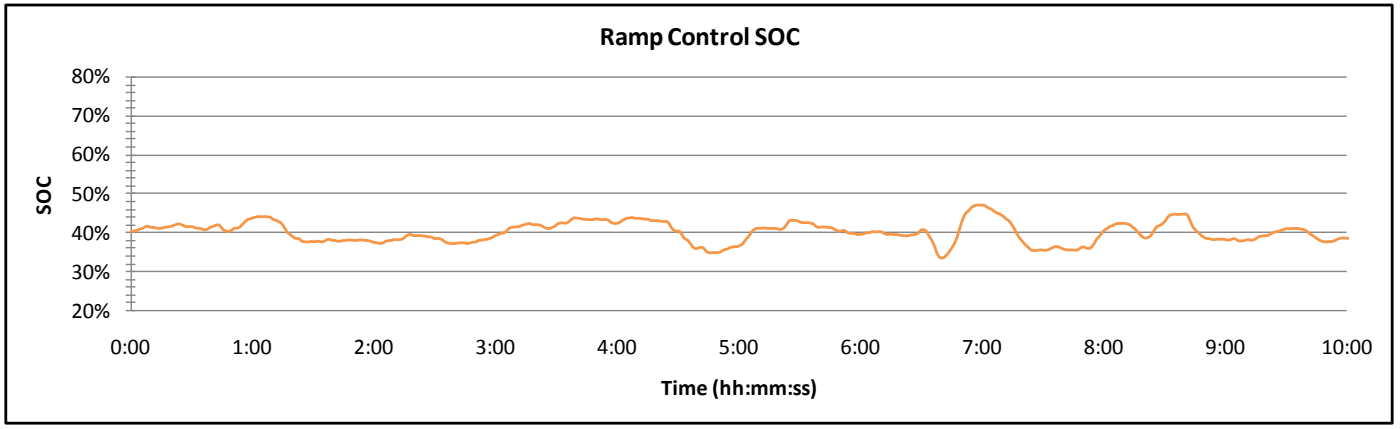
Kaheawa Wind Power

Location	Maui, Hi
Application	Wind
DPR™	1.5 MW / 1.0 MWh
COD	Q3 2009
Services	Ramp Control, Curtailment Mitigation

The first utility-scale Xtreme Power™ DPR™ operates on a 30 MW wind farm on a 80-200 MW grid. This DPR™ smoothes output to ±100kW/min and controls ramps to ±1MW/min.

Proof of Performance





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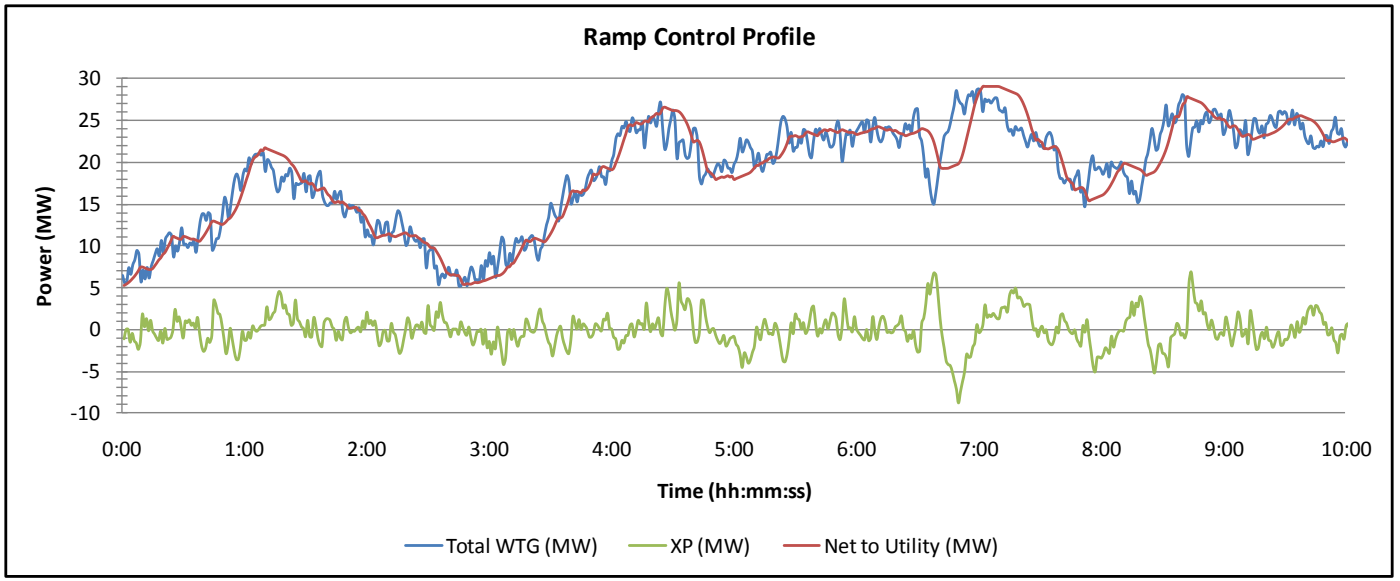
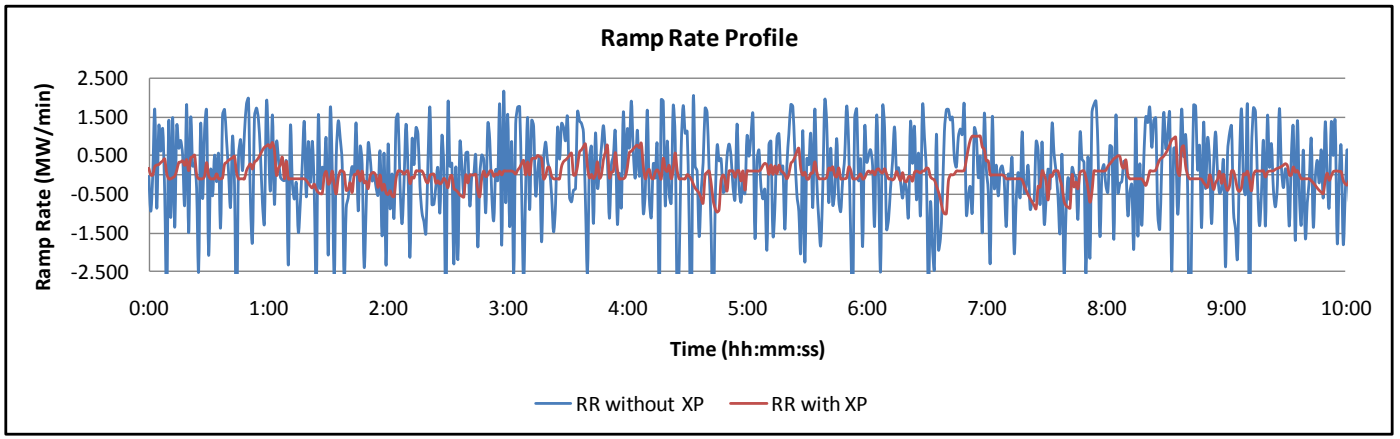




Ownership & Uses

- Transmission Owner
  - Alternative to traditional T&D (WPS, AEP)
  - Restricted from market activity, if in rate base
- IPP
  - Provide energy & ancillary services
  - Restricted from participation in reliability service, if in the energy services market
- Integrated Practice?
  - Services sold by Storage to customers in both Transmission and Generation?

Allowed Uses

	End User Owned	TO Owned	IPP Owned
Reliability Services	Power Quality, UPS	Reliability T&D Rate-based. No Energy Markets.	No rate based. Support via energy market
Energy Services	Demand Reduction, Load Shift	Rate based for resource adequacy	Energy Markets only

Much More Than Ramp Control

Several valuable services Storage can provide

- Storage with fast response to AGC provides Regulation 2x – 20x better than conventional generation
- Storage can provide Frequency Response
- Storage can upgrade Transmission capacity

Lessons Learned

- Solid state/modern technology advances very quickly - power electronics, solar etc.
- Reliability enhanced by Storage
- Not all storage technology is created equal – different technology for different needs
- Scale, operating experience, and market certainty attracts investment, technology innovation, and growth

Recommendations

- Allow Storage owners to participate in the provision of multiple services
- Industry and Regulators need a better understanding of the Storage value proposition
- Consider Storage in addressing T&D issues, grid stability, VAR support
- Regulators “encourage” use of Storage

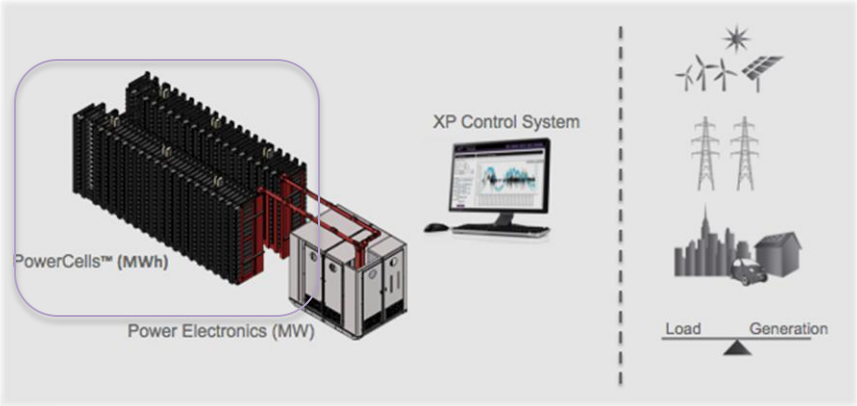
The Power to Control.

Xtreme Power Technology

Our Product

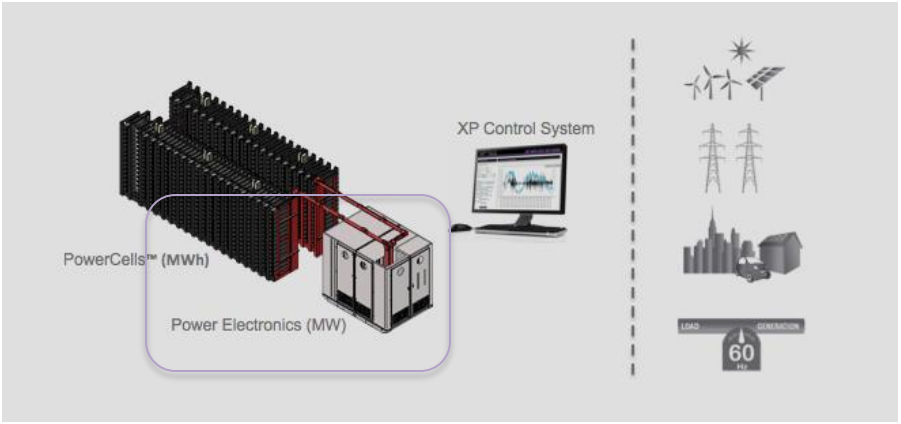
PowerCells™

- Solid-state, dry cell battery
- Uniform performance characteristics for scalability
- Low internal resistance
  - Operates at ambient temperature
  - Highly efficient
  - High instant power capacity
- 98% recyclable
- Safe, ease of siting



Xtreme Power Technology

Our Product

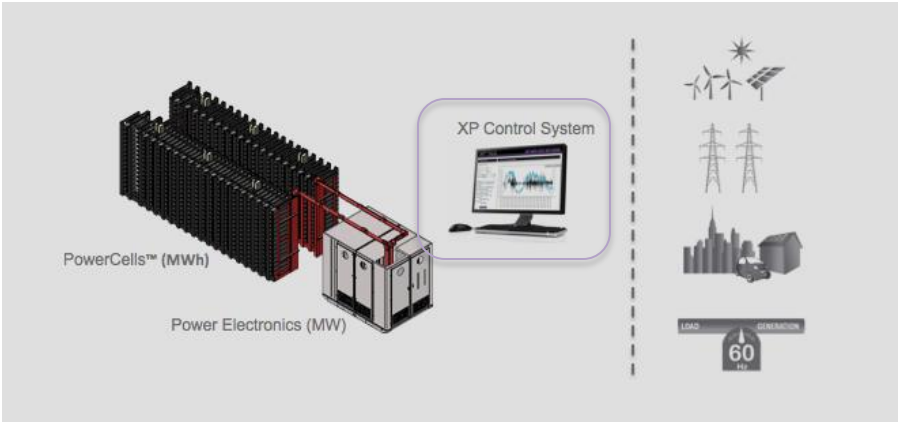


Power Electronics

- Bi-directional inverter/charger technology
- Full four quadrant performance, managing real & reactive power requirements
- Solid State
  - Microsecond response
  - Nominal O&M
- Close-Loop Water Cooled

Xtreme Power Technology

Our Product



XP Control System

- Custom algorithms for specific applications and services
- Fixed operating modes or dynamic response to changing market conditions
- Configurable program logic
- Redundant micro-safety controls
- Local or Remote control modes
- Automated or manual operation

Kahuku Construction Photos

Thank You

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