Energy Storage Integration into the GLEAMM Project

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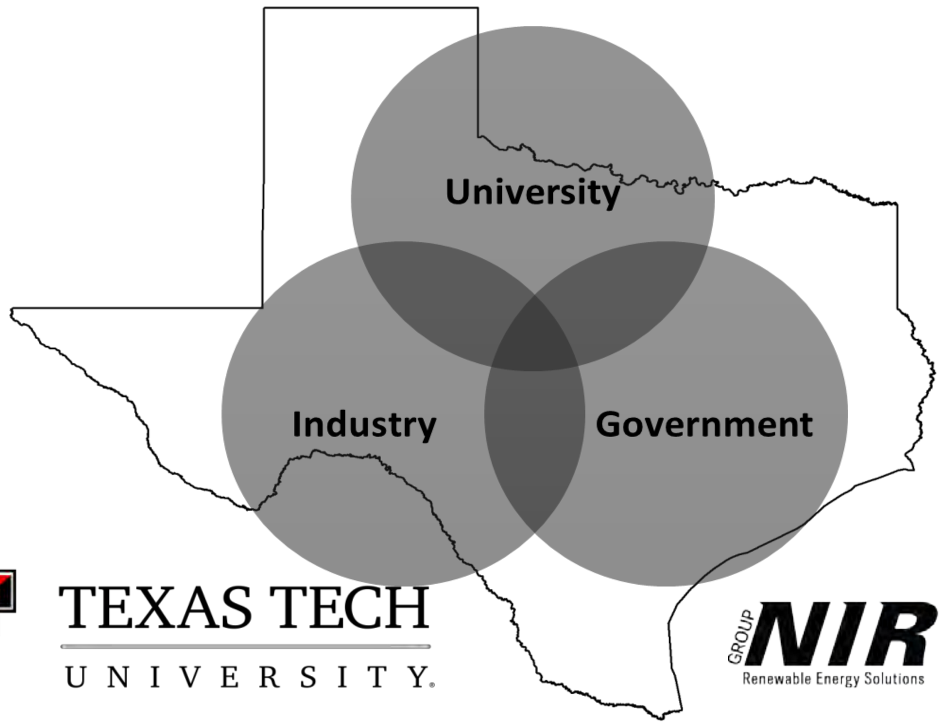
Texas Tech University

August 24, 2016

GLEAMM

GLOBAL LABORATORY FOR ENERGY ASSET MANAGEMENT AND MANUFACTURING



TEXAS TECH UNIVERSITY

GROUP NIR
Renewable Energy Solutions

2016 NM Regional Energy Storage & Grid Integration Workshop, Aug 24: 9:40 am

GLEAMM

GLOBAL LABORATORY FOR ENERGY ASSET MANAGEMENT AND MANUFACTURING

GLEAMM was established thanks to a $13 million dollar investment by the State of Texas and matching commitments from our corporate partners.

http://gleamm.org/

Increase Research

Accelerate Innovation

Grow Field Testing at Group NIRE

GLEAMM Collaborators

PanTEX

McAfee

University of Texas Arlington

intel

NEXTera ENERGY

NREL
National Renewable Energy Laboratory

LOCALGRID

Sandia National Laboratories

Gamesa

TOSHIBA
Leading Innovation

South Plains Electric Cooperative, Inc.

arpa·e
Advanced Research Projects Agency • ENERGY

PIONEER
NATURAL RESOURCES

NNSA
National Nuclear Security Administration

Lubbock Power & Light
The power is yours.

ONCOR
Electric Delivery

GE

DNV GL

Center for innovation

FREEDM
Systems Center

U.S. Department of ENERGY
Office of Science

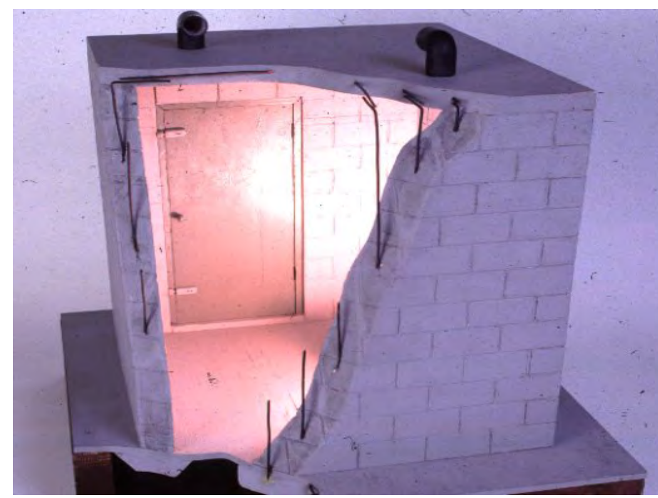
ERCOT

History of National Wind Institute (NWI) at Texas Tech University

May 11, 1970

Tornado Shelter in Impact Testing Lab

Drs. Swift, McDonald, Kiesling, & Mehta



Tornado Shelter, Dr. Kiesling

TTU National Wind Institute moving to Reese Center

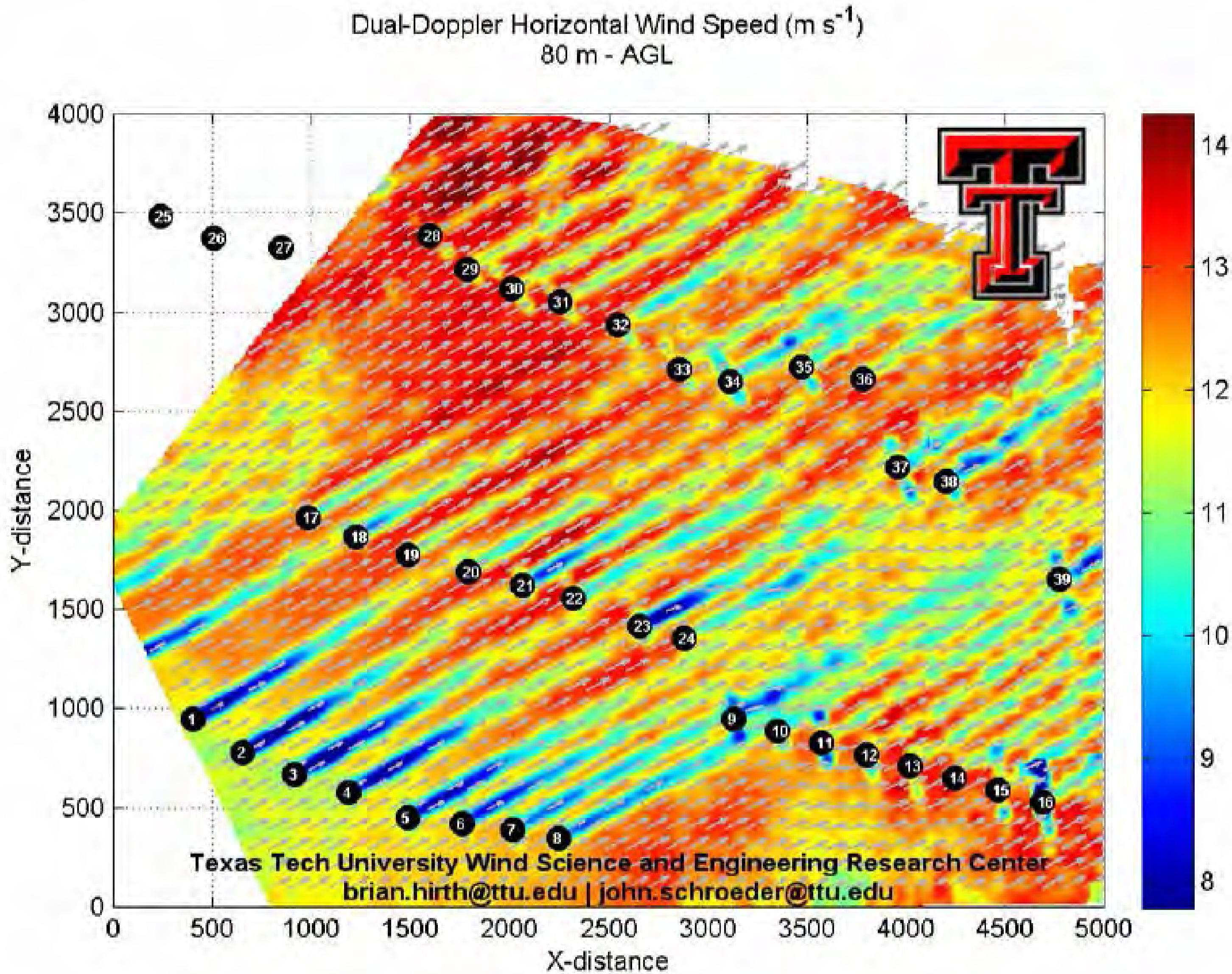
National Wind Institute (NWI) at Texas Tech University (TTU)

VORTECH Tornado Simulator

National Wind Institute (NWI) at Texas Tech University (TTU)

Dr. John Schroeder with KA-Band Mobile Radar

Flow Visualization



NWI Director Search

TEXAS TECH UNIVERSITY
National Wind Institute™

Director of Texas Tech University National Wind Institute

Job Description

The Texas Tech University (TTU) invites applications for the position of Director of Texas Tech National Wind Institute (NWI).

The primary focus of the Director will be to substantially expand the scope and international prominence of the NWI. The Director is expected to foster significant growth in research and fee-for-service revenues of the center. We seek applicants with a strong track record of extramural funding of research and publications in wind hazard, wind-energy production, storage and dissemination, or related fields. In addition, evidence of effective administrative activities or cross-disciplinary team leadership is preferred.

Discovery across Texas (DAT) Project

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CCET
Center for the Commercialization of Electric Technologies

Redefining the Next Generation of the Electric Grid Through Technology

About CCET | Participants | Projects | Discovery Across Texas | Texas Triangle | Advisory Groups | CCET/IEEE Student Contest | News | Events

Project Team

This diverse group of stakeholders arms this project with a deep understanding of all three phases of this Project.

AEP TEXAS A unit of American Electric Power

FRONTIER ASSOCIATES

Electric Power Group

ERCOT

comverge

BLACK & VEATCH Building a world of difference.

CenterPoint. Energy

ONCOR

Sharyland Utilities

AUSTIN ENERGY

TXU energy

Xtreme Power The Power to Control.

IBM

Pecan Street Project

NIR GROUP Renewable Energy Solutions

ETT Electric Transmission Texas

TACC

South Plains Electric Cooperative Your Touchstone Energy® Cooperative

Discovery Across Texas

- Overview
- Project Team
- Synchrophasor Technology
- SMT Portal Planning
- Future Community

DEPARTMENT OF ENERGY UNITED STATES OF AMERICA

https://www.smartgrid.gov/files/CCET-SGDP-FTR_Feb_2015.pdf

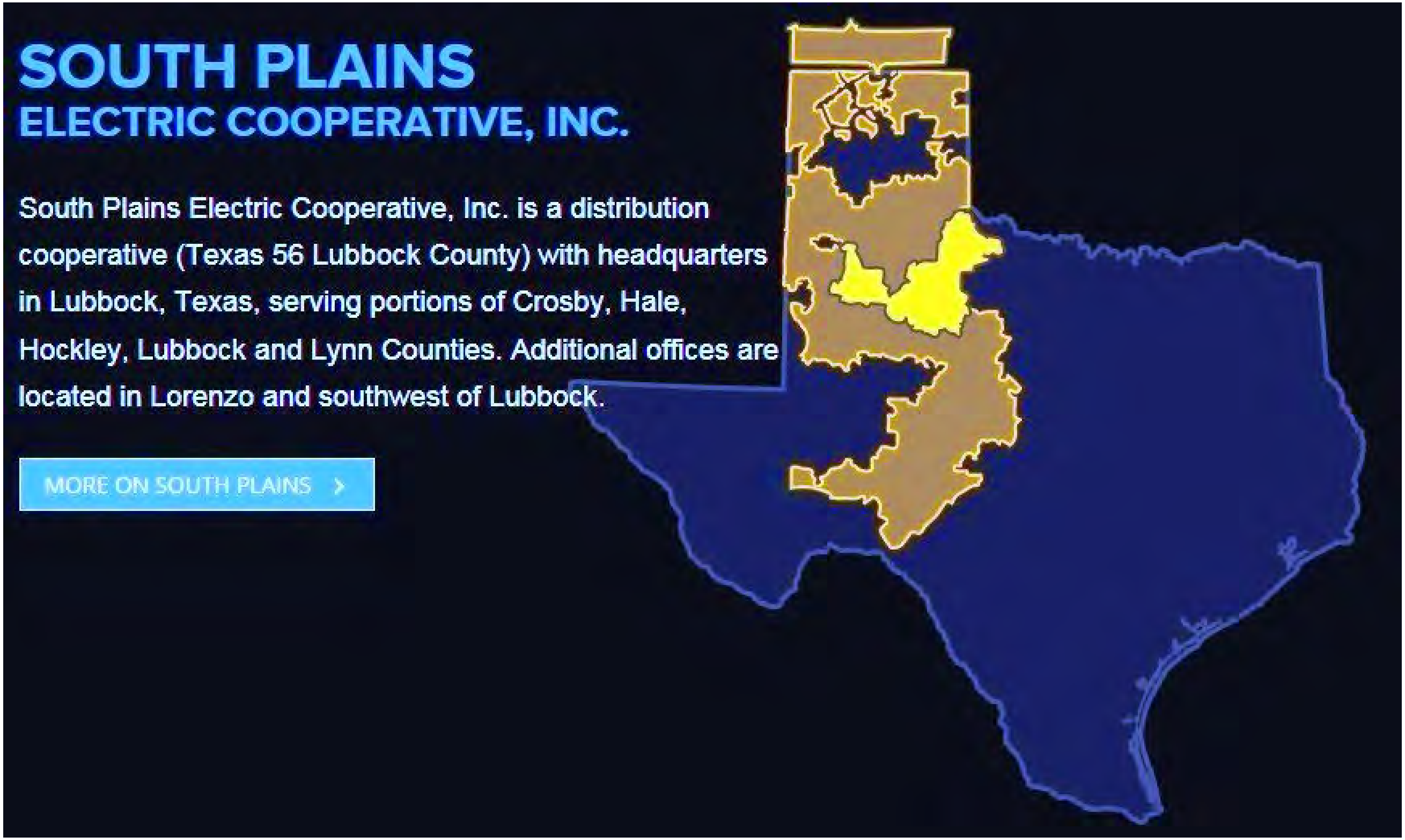
Battery Storage System (BSS) at Reese Technology Center from DAT Project

http://www.younicos.com/en/home/

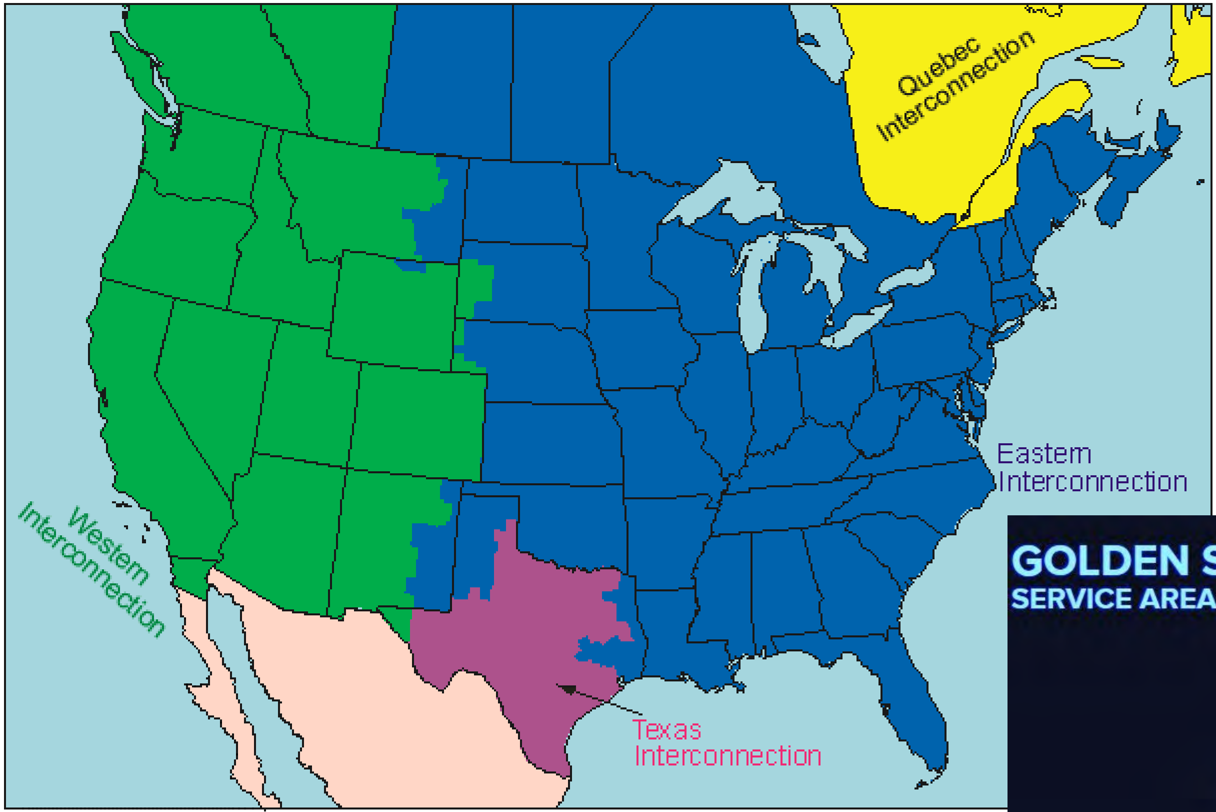
The Battery Storage System (BSS) uses 18 racks with 256 Li-Ion batteries totaling 4,608 battery cells with a combined energy storage capacity of 1 MW-hr.

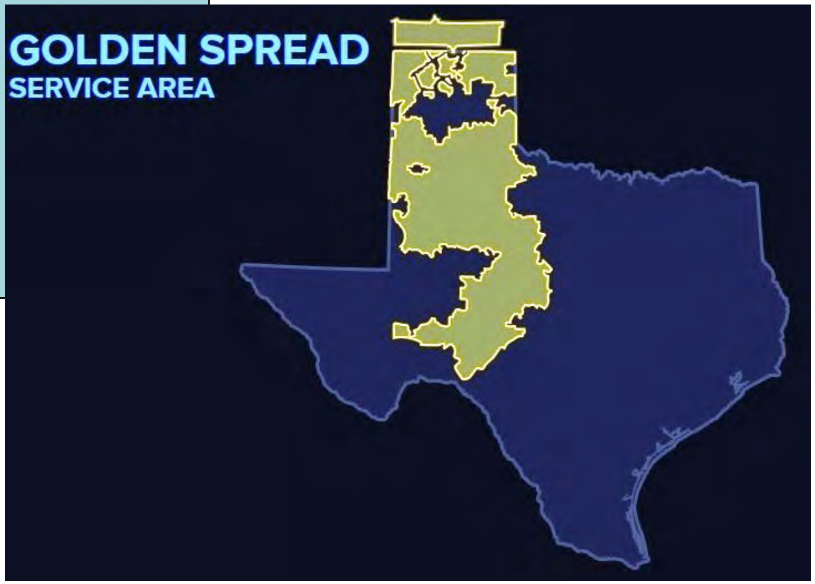
Site of Battery Storage System at Reese Technology Center

Battery System on South Plains Electric Coop, part of Golden Spread Coop



Golden Spread Cooperative part of SPP and Eastern Interconnect





Views of Battery Storage System (BSS)

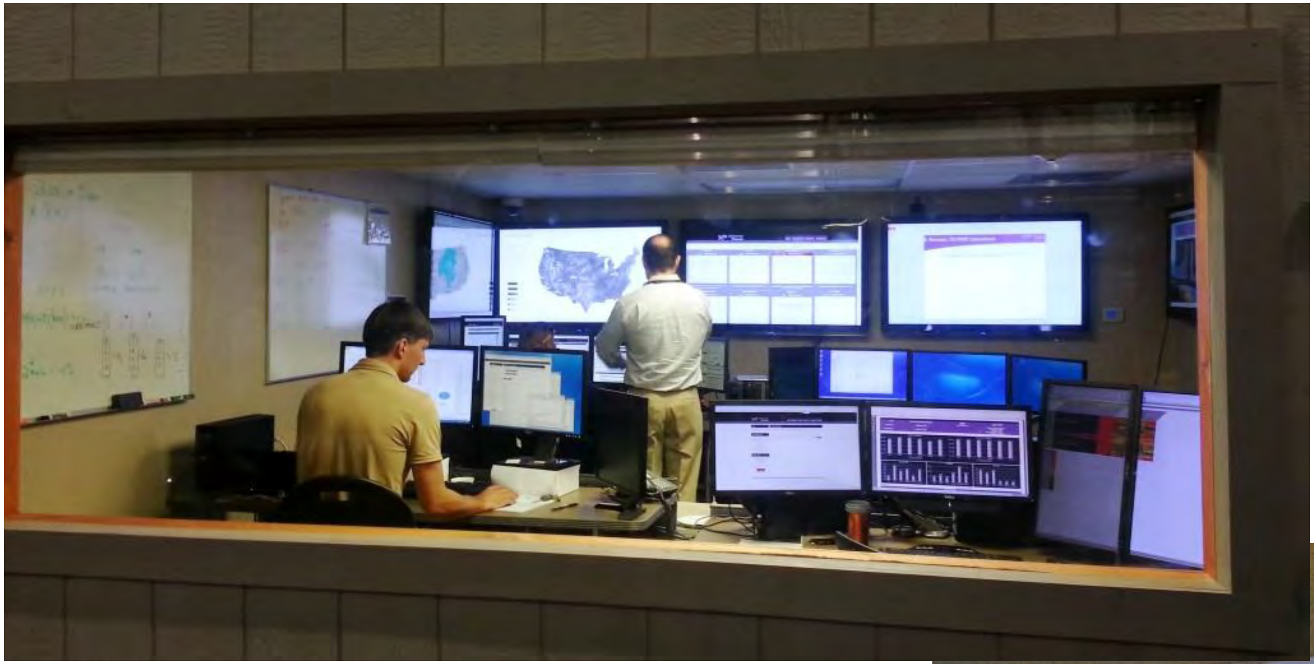
Views of Battery Storage System (BSS)

http://www.samsungsdi.com/ess/energy-storage-system-reference.html

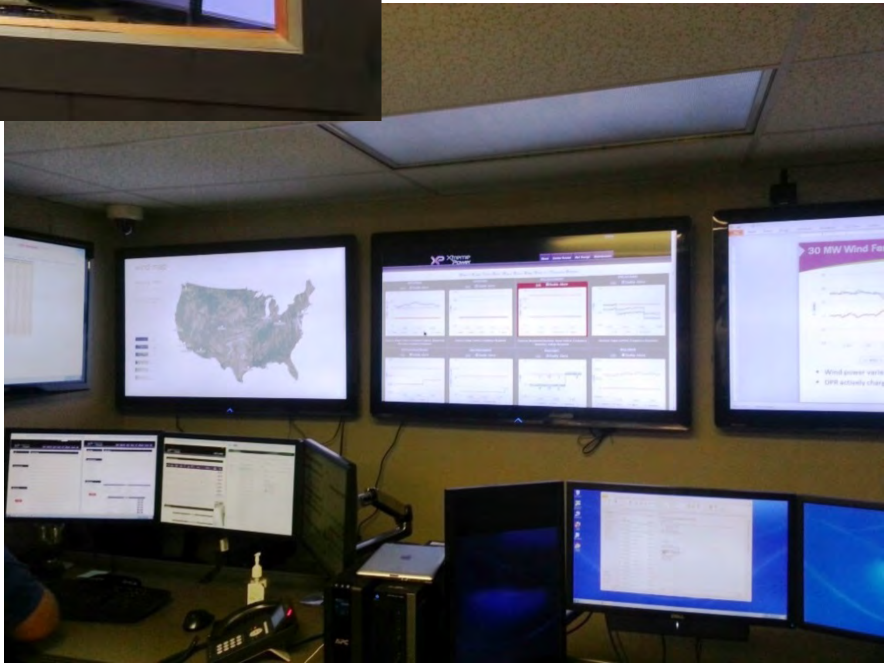
Views of Battery Storage System (BSS)

Detailed view of 60 Ah, 3.7V nom. Cells

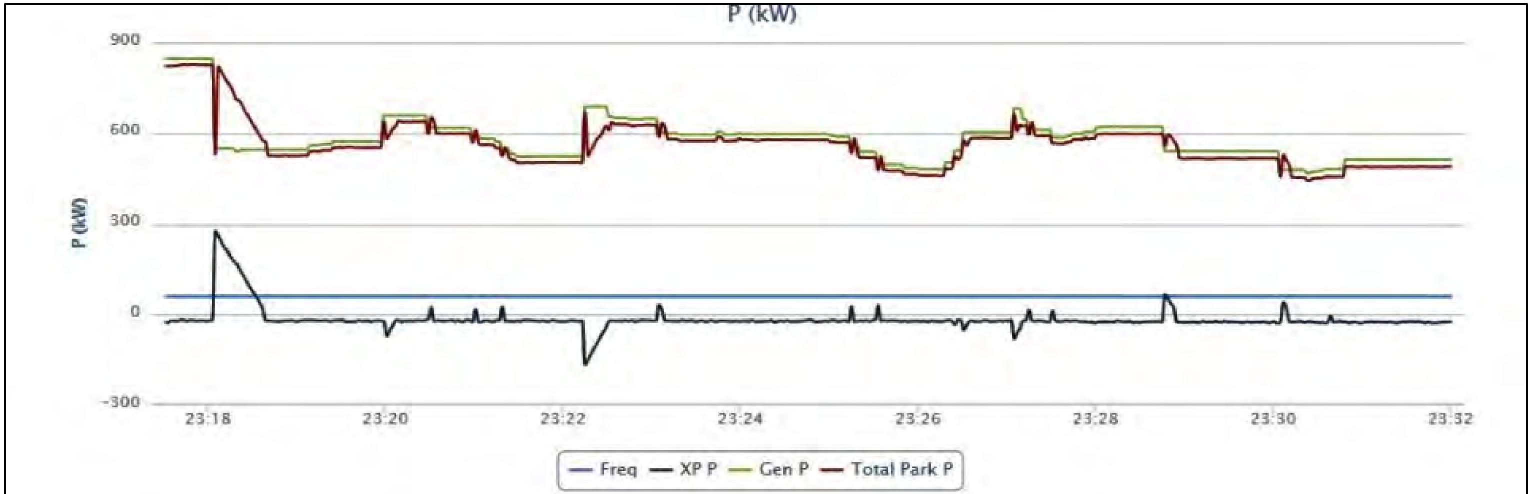
Remote Monitoring



Remote Monitoring from Manufacturer's Site



Battery in Ramp-Control Mode



System Information

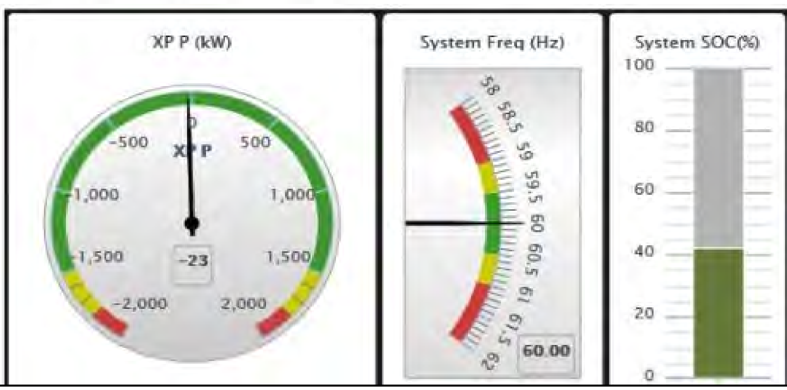
Rated Power = 1.5 MW.

Site Location = Lubbock, Texas.

Total Number of Online Dynamic Power Modules™ (DPM) = 1

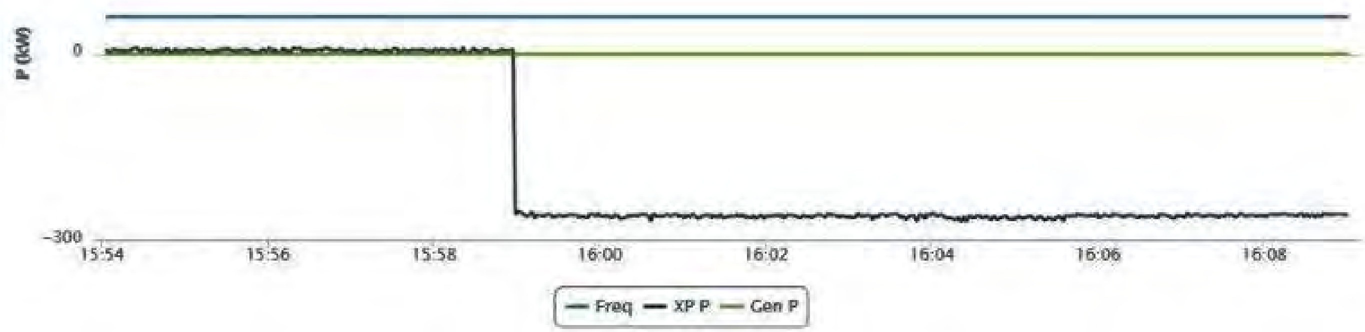
PCS	PCS Type	Pack Type	State
1	PK	Samsung	⏻

DPR Status	
TotalXP P	-26
TotalXP Q	22
Auto Manual	Auto
Gen P	513
Gen Q	-20



2016 NM Regional Energy Storage & Grid Integration Workshop, Aug 24: 9:40 am

Charging for Peak Shaving



System Information

Rated Power = 1.5 MW.

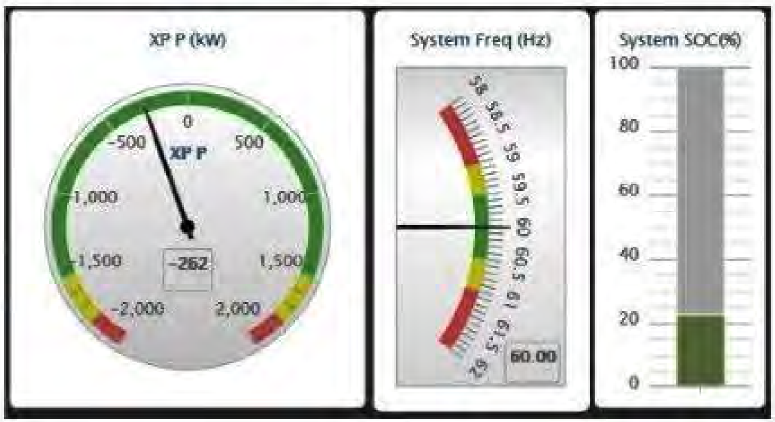
Server IP Address = 10.63.1.9.

Site Location = Lubbock, Texas.

Total Number of Online Dynamic Power Modules™ (DPM) = 1

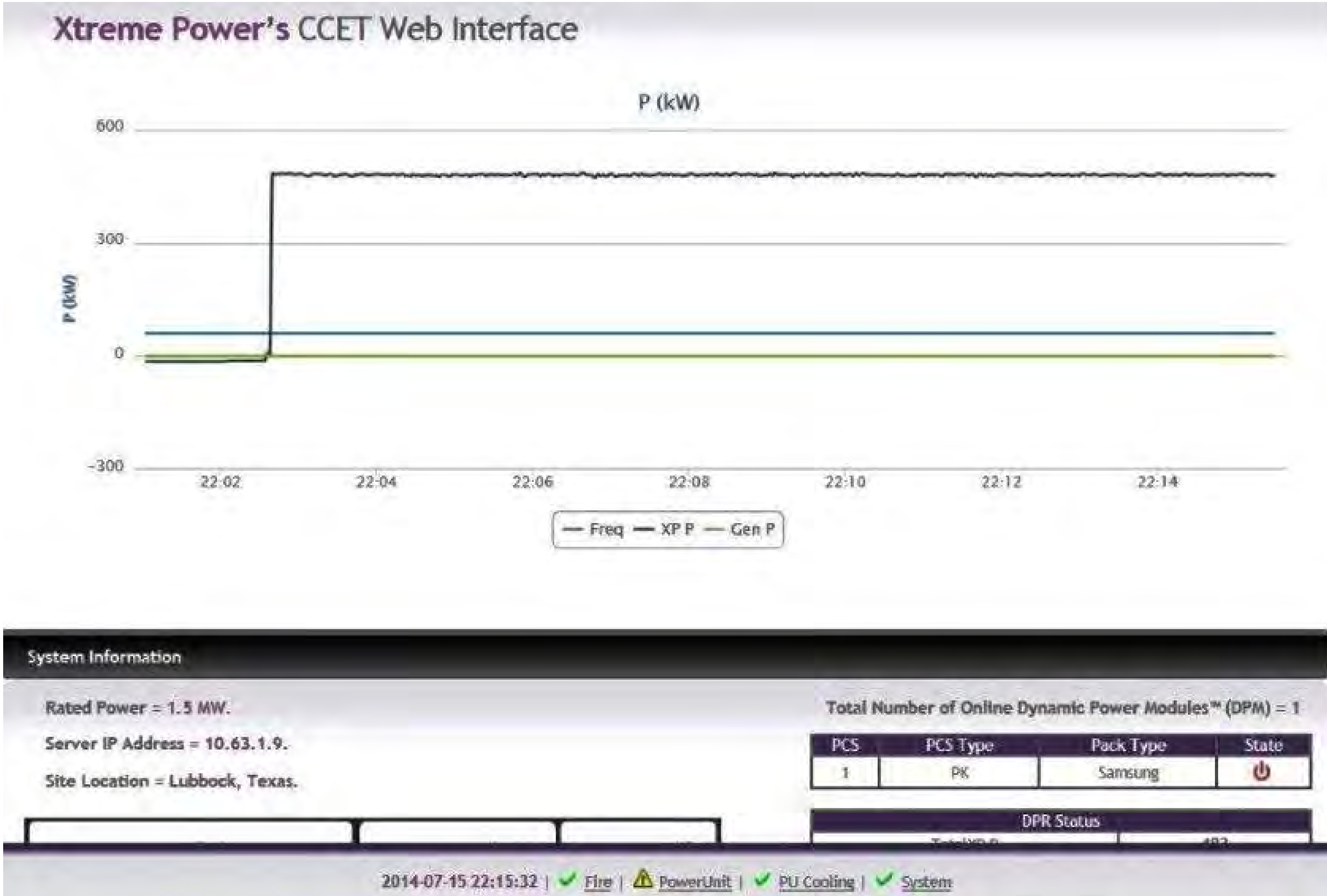
PCS	PCS Type	Pack Type	State
1	PK	Samsung	

DPR Status	
TotalXP P	-259
TotalXP Q	35
Auto Manual	Manual
Gen P	0
Gen Q	0



2014-07-15 16:09:01 | Fire | PowerUnit | PU Cooling | System

Discharging for Peak Shaving



Battery Operational Parameters and Use Cases

Table 1. Overall BESS Testing Approach

Number	Test Type	Time of Year	Time of Day	Duration
1	Ramping	All year	Night	Seconds
2	Demand Response	Summer (May to August)	Day	Minutes to hours depending on peak loads
3	Frequency Support	All year	Night	Seconds
4	Wind Speed Drop	All year	When drop occurs	Seconds to minutes
5	FRRS	All year	When needed	Until frequency recovers

Table 2. Parameters for Asset Characterization Module

Location of battery	Distribution
Market	Regulated
Owner	Utility (End User)
Type of Battery	Lithium-ion
Total name plate power output	1000 kW
Total name plate energy storage capacity	1000 kW hours (kWh)
Round trip efficiency	95%

Battery Operational Parameters and Use Cases

Response time of BESS	0.005 seconds
Cycle life	4000 cycles
Expected year over demand growth of electric system	2%
Expected life time	20 years
Average inflation rate	2%
Discount rate in net present value analysis	7%
Total Installed cost of deployment	$2,000,000
Fixed charge rate to annualize cost of deployment	11%
Non-energy operations and maintenance (O&M) cost	$50,000/year
Primary application	Demand charge management
Selected secondary application(s)	Renewables energy time-shift and electric service power quality

Economic Analysis

- $2,309,600 in reduced electricity costs (mostly from reduced demand charges)
- $594,900 in improved power quality savings (includes voltage and frequency support)
- $546,600 in emissions savings

This total gross benefit of $3,451,000 results in a return on investment of $491,200 (after the cost of the BESS, annual O&M expenses, etc.) for this option (benefits/cost = 1.16). Note that without the estimated environmental benefits, which are based on the future existence of a market for monetizing reduced emissions, the net return would be a negative $55,400. Even under the favorable conditions of being able to serve all of the identified functions, a utility likely would not make such an investment until the regulatory rules allowed cost recovery of storage investments or at least the environmental benefits.

Economic Analysis

	Cumulative Benefit and Cost Table					
	Benefits	Additional Benefits - Total Present Value over the Deployment Period	+	Primary and Secondary Benefits - Total Present Value over the Deployment Period	=	Total Benefit - Present Value over the Deployment Period
Market Revenue	Arbitrage Revenue	$ -		$ -		$ -
	Capacity Market Revenue	$ -		$ -		$ -
	Ancillary Services Revenue	$ -		$ -		$ -
Improved Asset Utilization	Optimized Generator Operation (Non-Utility	$ -		$ -		$ -
	Optimized Generator Operation (Utility/Ratepayer)	$ -		$ -		$ -
	Deferred Generation Capacity Investments	$ -		$ -		$ -
	Reduced Congestion Costs (Non-Utility Merchant)	$ -		$ -		$ -
	Reduced Congestion Costs (Utility/Ratepayer)	$ -		$ -		$ -
T&D Capital Savings	Deferred Transmission Investments	$ -		$ -		$ -
	Deferred Distribution Investments	$ -		$ -		$ -
Energy Efficiency	Reduced Electricity Losses	$ -		$ -		$ -
Electricity Cost Savings	Reduced Electricity Cost (Consumer)	$ -		$ 2,309,600		$ 2,309,600.00
	Reduced Electricity Cost (Utility/Ratepayer)	$ -		$ -		$ -
Power Interruptions	Reduced Outages (Consumer)	$ -		$ -		$ -
	Reduced Outages (Utility/Ratepayer)	$ -		$ -		$ -
Power Quality	Improved Power Quality	$ -		$ 594,900		$ 594,900.00
Air Emissions	Reduced CO2 Emissions	$ -		$ 127,500		$ 127,500.00
	Reduced SOx Emissions	$ -		$ 13,900		$ 13,900.00
	Reduced NOx Emissions	$ -		$ 36,200		$ 36,200.00
	Reduced PM Emissions	$ -		$ 369,000		$ 369,000.00
	Total Gross Benefit	**$ -**		**$ 3,451,100**		**$ 3,451,100.00**
	Costs					
	Capital Cost of Deployment (fixed charge rate)					$ 2,406,800.00
	Operating and maintenance costs not related to energy (labor for operation, plant maintenance, equipment wear leading to loss-					$ 546,900.00
	Decommissioning and Disposal Costs					$ 6,300.00
	Total Annual Cost of Deployment					**$ 2,959,900.00**
	Total Net Benefit					**$ 491,200.00**

Briefing of Congressman Michael McCaul
Chair of Homeland Security Committee on Cybersecurity