

PENNSTATE



# GridSTAR

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Remote and Virtual Labs in  
Graduate Education

## Grid-Smart Technology Application & Resource Center

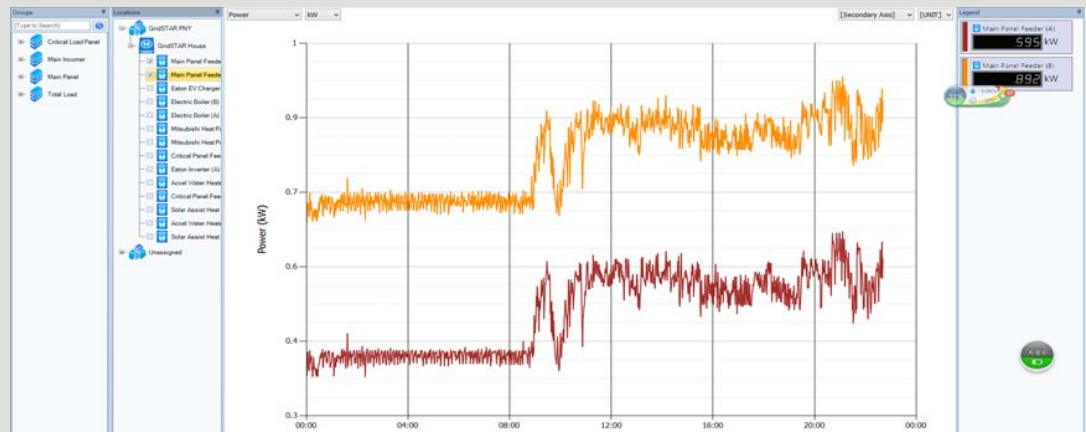


# Forecast Energy EnergiStream System

- ❖ The Forecast Energy “Energy Stream” System is a tool to monitor the Primary Panel Loads
  - ❖ Mini-split units, EV Chargers, Water Heater, Eaton Solar Inverter
  - ❖ Can easily see the power, and energy used of any load from the main panel in any time period.
- ❖ Serves as a data acquisition system, data logger, multi-protocol driver, data server, and demand controller.
- ❖ Includes a automated demand response client that communicates with utility and ISO servers

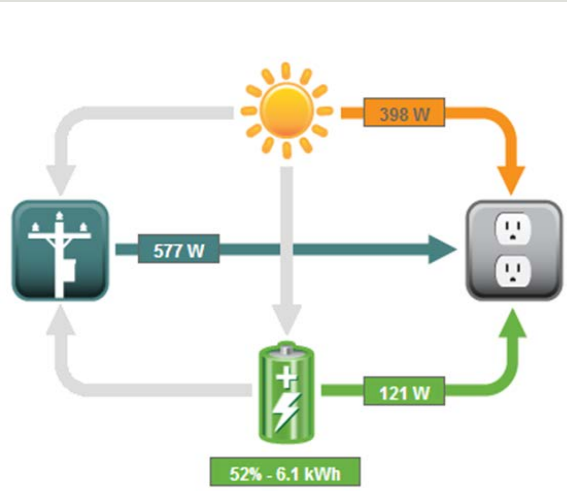


*EnergiStream interface*



# Sunverge System

- ❖ The Sunverge system that can monitor & control the photovoltaic array, storage batteries & critical loads.
  - ❖ Optimizes use of 10kWh battery storage, 4 kW solar array and grid energy as the loads in the Center require.
- ❖ Allows for intelligent and cost-effective distribution of solar, stored and grid energy orchestrating its delivery to loads.



	W	V	A	Hz	VA
PV	398.00	77.19	5.16		
Grid 1 In	266.00	119.99	4.83	59.97	580.00
Grid 2 In	311.00	120.53	5.40	59.97	648.00
Load 1 Out	525.00	121.09	7.65	59.98	921.00
Load 2 Out	571.00	121.09	8.14	59.98	980.00
Grid 1 Out	0.00	120.10	0.00	59.97	0.00
Grid 2 Out	0.00	120.62	0.00	59.97	0.00
Site Line 1	0.00	0.00	0.00		0.00
Site Line 2	0.00	0.00	0.00		0.00
Battery	-319.92	51.60	-6.20		

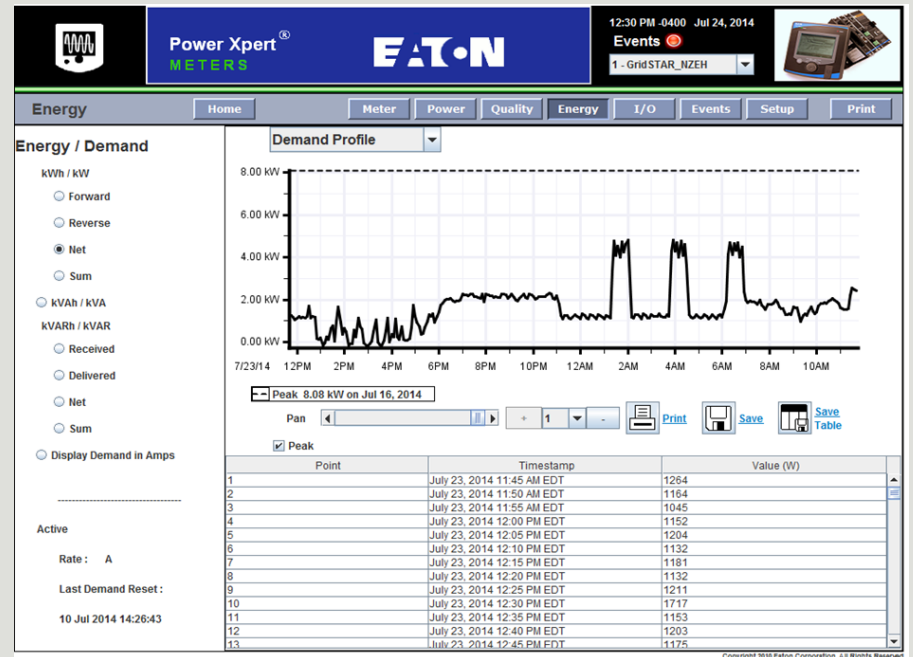
Sunverge Live Data Interface

# Eaton Power Xpert Meters

- ❖ The Eaton Power Xpert Meters provides detailed & real time power quality information.
- ❖ Meters monitor four components of GridSTAR Center:
  - ❖ Smart Grid Demonstration Residence
  - ❖ 125 kW Commercial Scale Battery Storage System
  - ❖ Solar Training Center
  - ❖ Electric Vehicle Charging Infrastructure



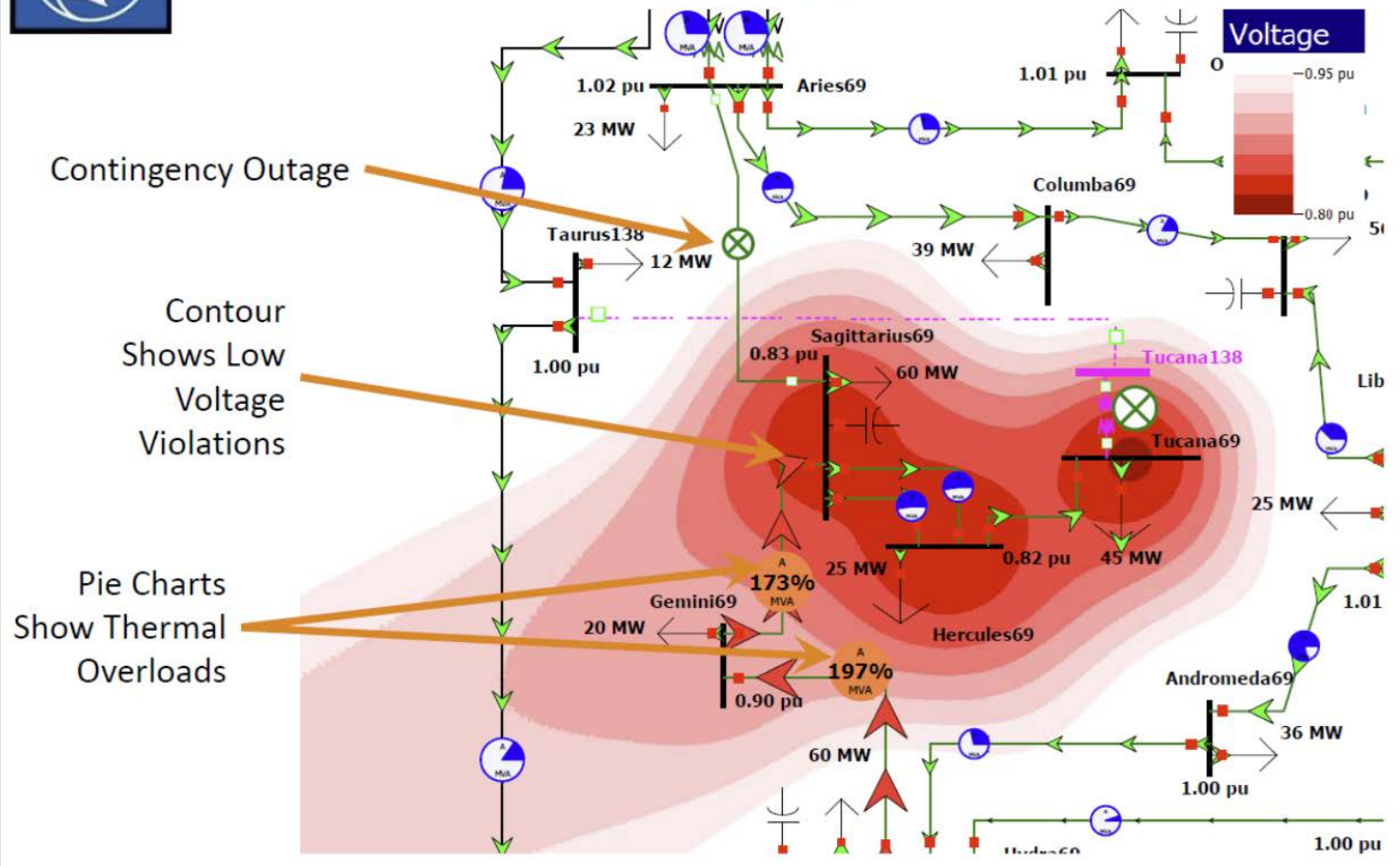
*Eaton Meter Interface for the Smart Grid Demonstration Residence*



# PowerWorld Simulation



## Loss of Aries-Sagittarius 69 kV



Contingency Outage

Contour Shows Low Voltage Violations

Pie Charts Show Thermal Overloads

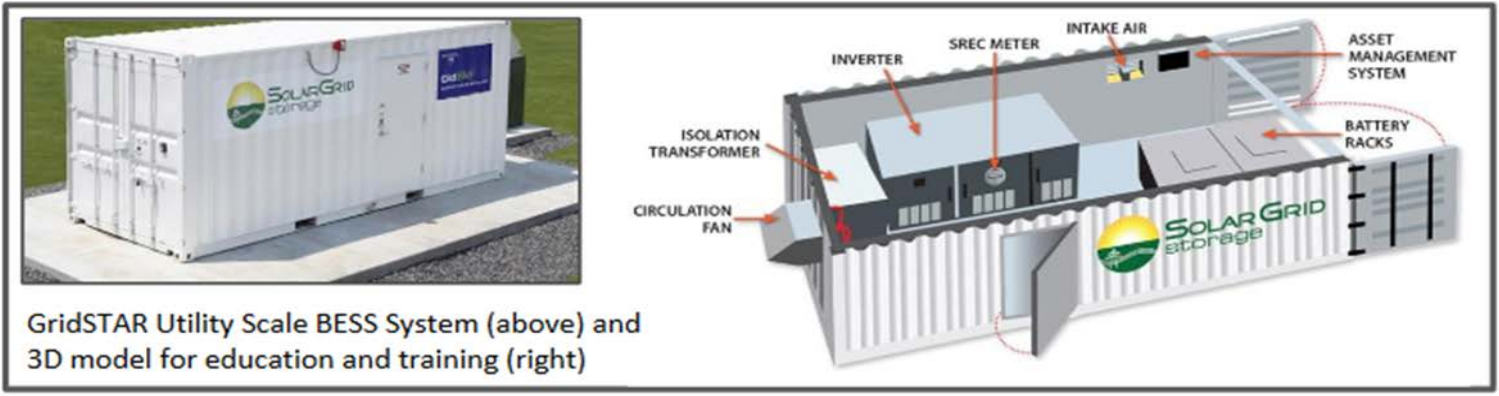
# NSF Project

Battery Energy Storage System

## BESS - ETI

Education and Training Initiative

## Immersive Experiential Learning



GridSTAR Utility Scale BESS System (above) and 3D model for education and training (right)



Graduate Course:

# Distributed Energy Planning and Management

