



Schneider Electric
Microgrid Solutions

Economic Dispatch and Resilience of Distributed Energy Resources within a Campus Microgrid

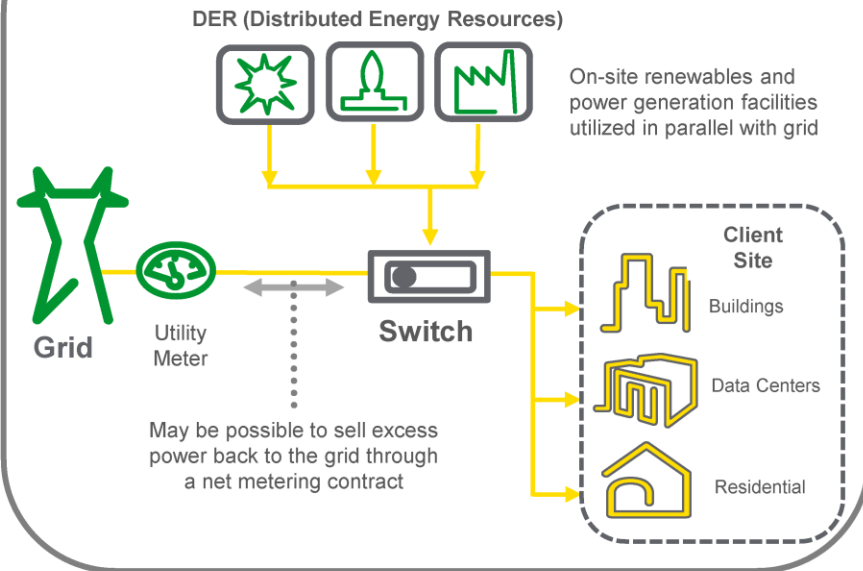
IDEA Campus Energy 2016

James Lee, P.E. – Staff Power Systems Engineer
February 11, 2016

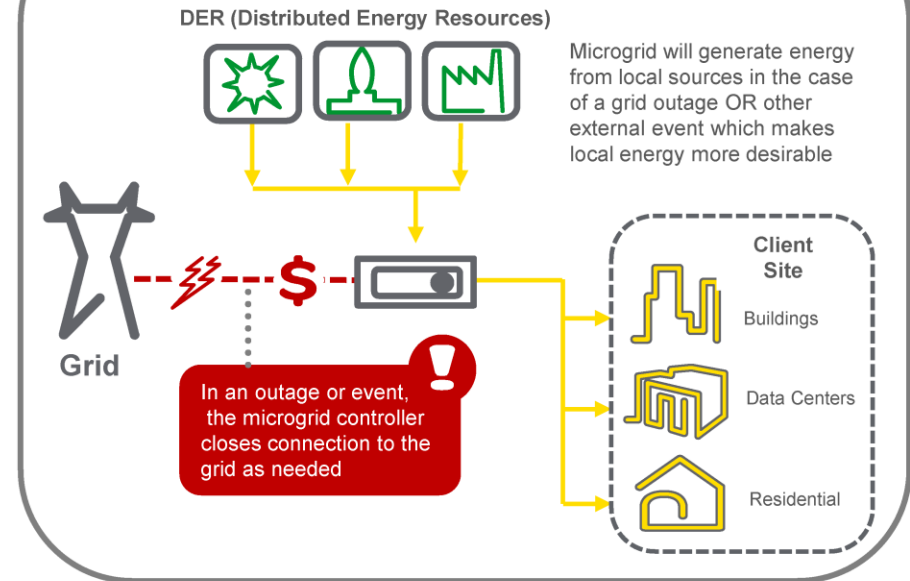
What is a Microgrid?

An integrated energy system consisting of interconnected loads and distributed energy resources...

In Normal Operations



In Island Mode



...which as an integrated system can operate *in parallel* with the grid or in an intentional *islanded* mode.

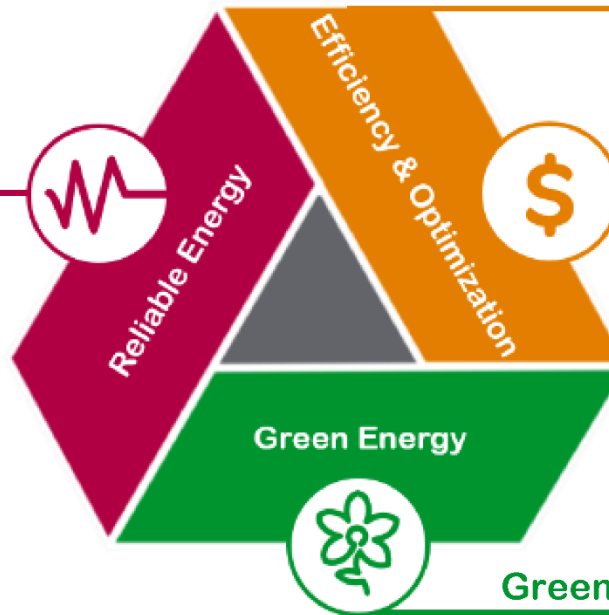
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Microgrid Advantages

Reliable Energy

- Ability to proactively “island” from utility
- Preserve critical loads 24/7/365
- Repurpose grid tied inverters for island mode operation
- Determine root cause of outages and restore power quickly



Efficiency & Optimization

- Minimize energy costs through fuel switching and energy savings
- Harness combined heat and power, maximize incentives
- Prioritize critical loads
- Monetize energy flexibility with the grid

Green Energy

- Incorporate low cost solar, low emission DER
- Implement net-zero projects
- Reduce green house gases

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Optimization Use Cases

- Tariff Management
 - Consume or produce energy at the most advantageous time
- Demand Control
 - Reduce demand charges
- Self consumption
 - Leverage on-site production capability
- Demand Response
 - Participate in grid balancing mechanisms



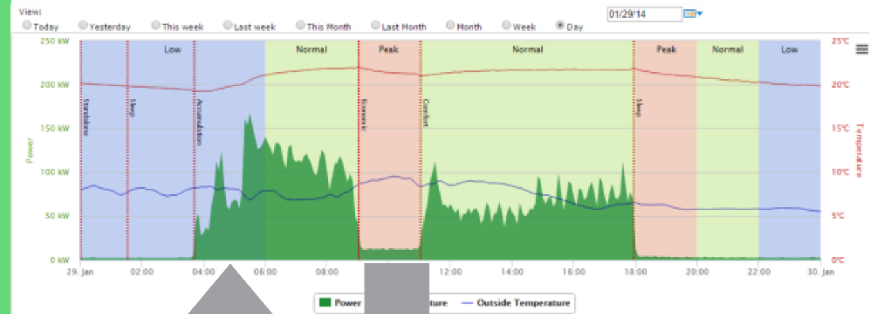
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Tariff Management Load Shifting

- Shift the electrical consumption from on peak hour to off peak hour, while ensuring the comfort of the occupant
- Example 1:* Charge an energy storage system during off peak period and discharge it during on peak period
- Example 2:* Consume electricity with a HVAC during off peak period (pre heating or pre cooling) and reduce its electrical consumption during peak period

Energy bill optimization



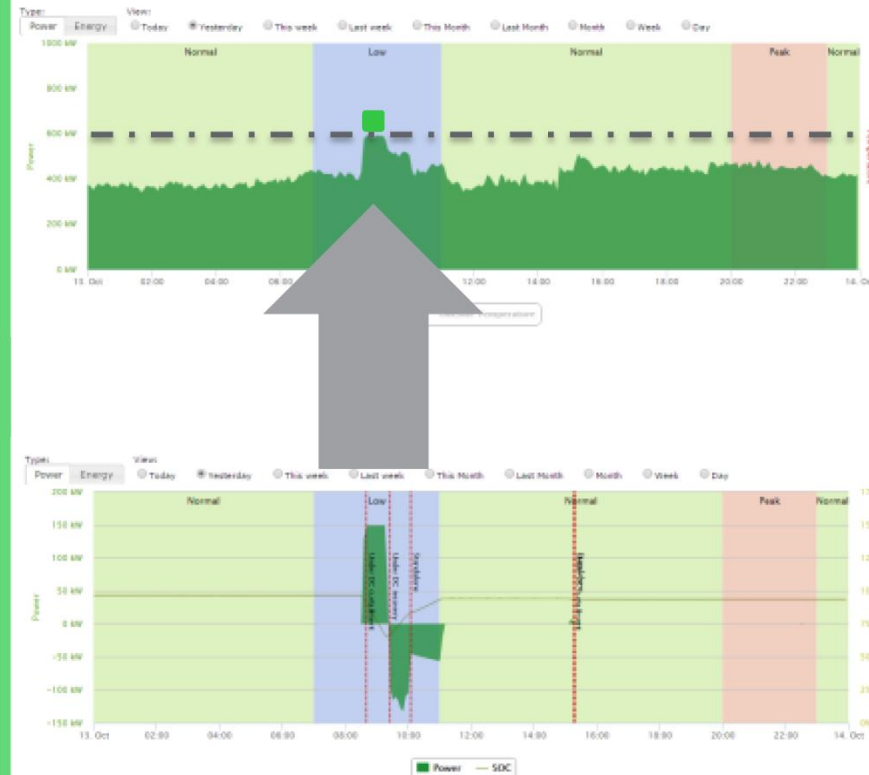
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Demand Charge Peak Shaving

- Shave the consumption peak in order to reduce demand charge or to avoid paying penalties
- *Example 1:* Shed an HVAC during a peak consumption period, while ensuring the comfort of the building occupant
- *Example 2:* Discharge an energy storage system or turn on a distributed generation asset during a peak consumption period

Energy bill optimization



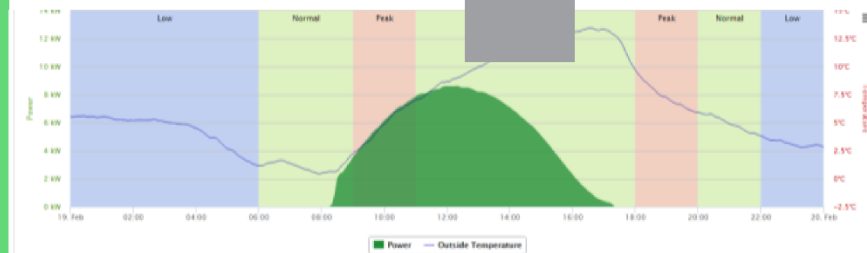
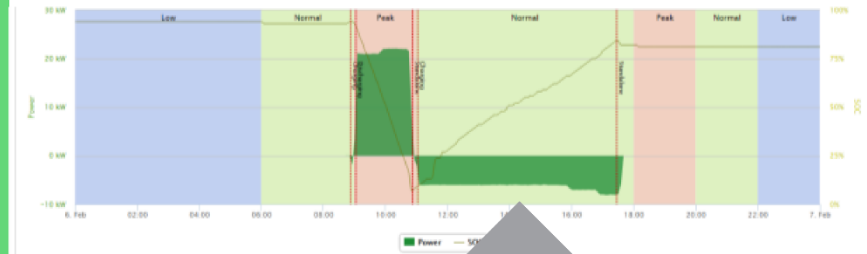
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Self Consumption

- Consume locally the energy which is produced locally
- *Example 1:* Charge an energy storage system with the excess electricity produced by a PV system and consume it later during the day

Being greener and energy bill optimization



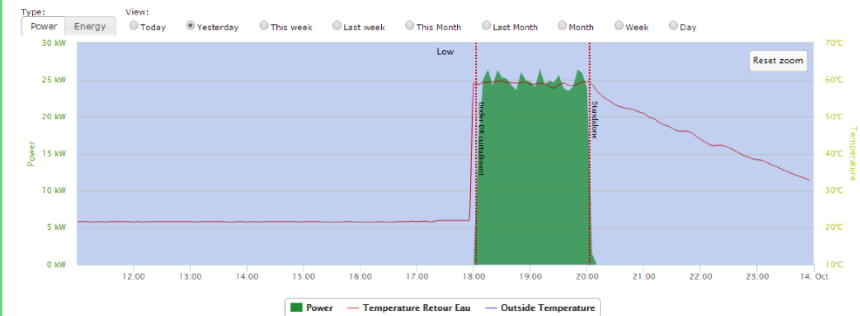
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Demand Response Load Curtailment

- Perform load curtailment following a Demand Response request
- Can be performed “manually” or via OpenADR with a utility / commercial aggregator who can bid on the energy market
- *Example 1:* Answer and perform automatic Demand Response requests sent by a commercial aggregator through OpenADR using an HVAC or energy storage system

Energy bill optimization and contributing to the grid reliability



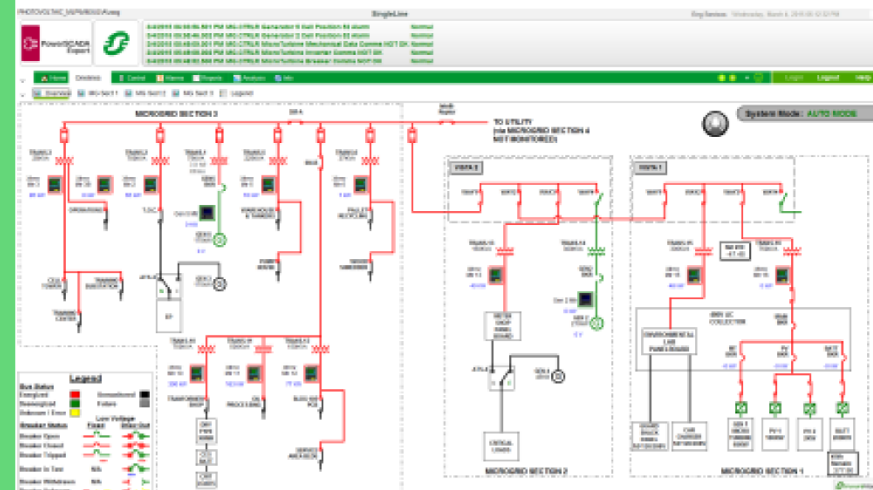
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Islanding management

- Off grid operation in case of utility loss
- Can be performed manually or automatically
 - *Example 1:* Automatically sense a utility loss, start on site generation and adapt energy consumption.
 - Ensure the right balance between production and consumption in real time
 - Reconnect to the grid

Energy reliability



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Microgrid Control System Components

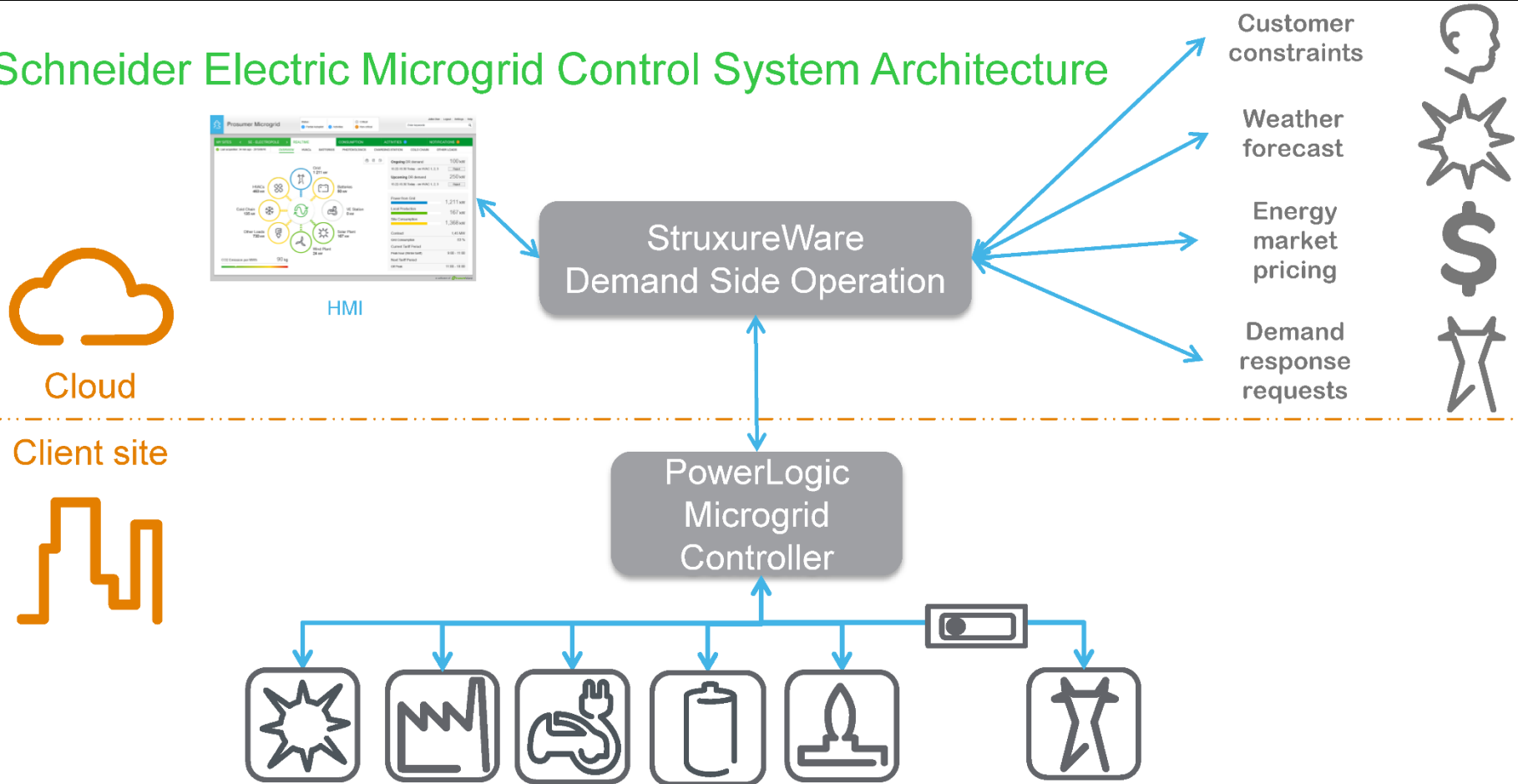
Optimization Engine

- Predictive management of DER (minute, hour, day forecast)
- Weather and Load Forecast information
- Interaction with third party actors (utilities, commercial aggregators etc)

Microgrid Controller

- Reactive management of DER (ms, s, minute)
- Data storage for improving reliability
- Management of Islanding Disconnection/Reconnection to the Grid
- Black start capability
- Load Control

Schneider Electric Microgrid Control System Architecture



StruxureWare Demand Side Operation

1 Collects...

- Microgrid energy data
- Weather forecasts information (Telvent DTN)
- Market based energy pricing
- Demand response information
- Customer constraints

2 Predicts...

- Advanced predictive algorithms create 24hour ahead DER schedules

3 And optimizes the DER operation

- Tariff Management
- Demand control
- Self consumption
- Demand-response programs



WE DELIVER.

Autonomous and Dynamic Microgrid built in less than 6 months

Project at a Glance

- 200 kW BESS
- 120 kW Solar PV
- 6 kW Solar PV
- 65 kW Microturbine
- 45 kW Gas recip
- 560 kW Diesels
- Wind - planned

Square D Switchboards

S&C Intellirupter

Schneider Electric PowerLogic Microgrid Controller

Schneider Electric SCADA Software



Efficiency & Optimization

- StruxureWare Demand Side Operation for economic optimization and dispatch
- Load preservation features for ensuring the most critical loads are served
- 4 separate Microgrids, **autonomous and dynamic**

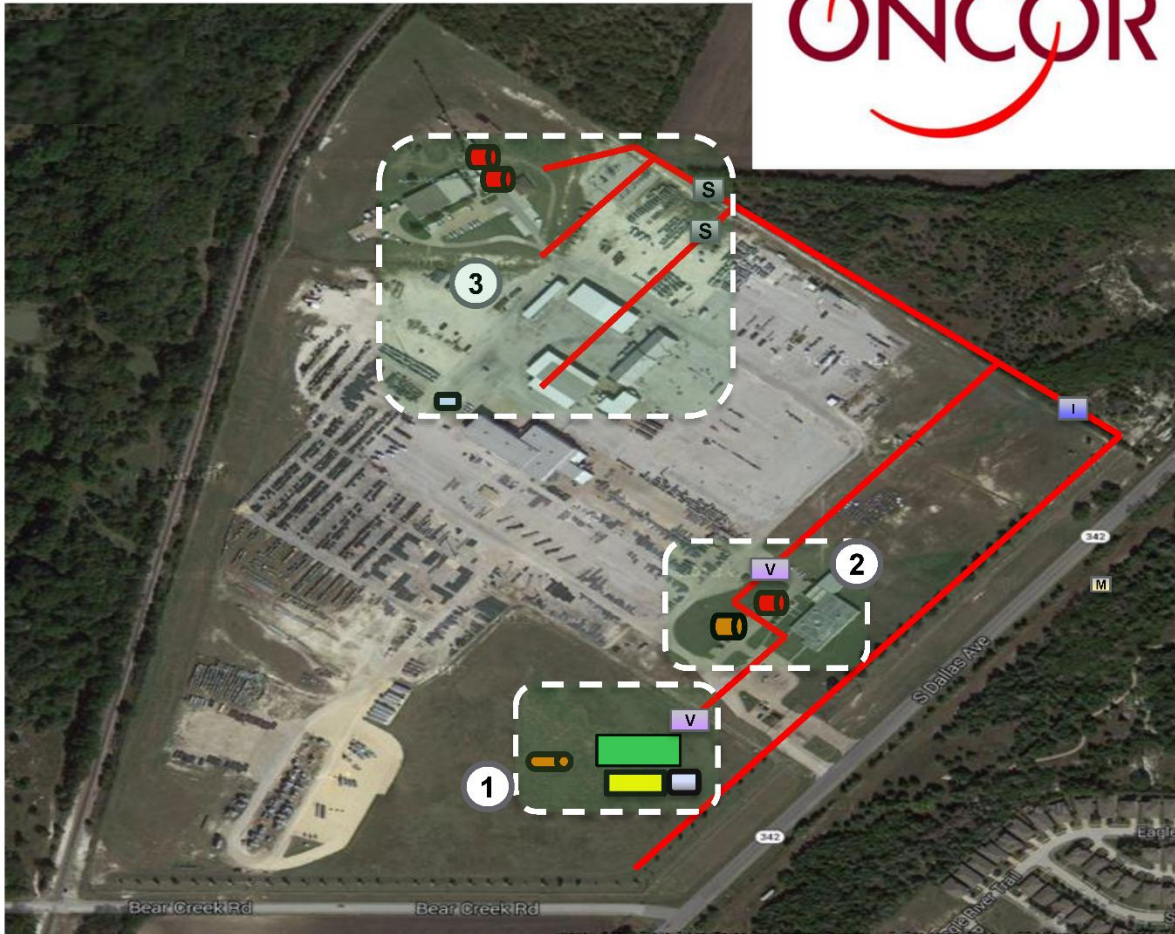


Green Energy

- Solar and cleaner gas (vs. just diesel)
- Low emission CHP (not utilizing thermal)
- Serves as a best practice for deploying an environmentally sustainable Microgrid, using solar in island mode

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Site:

-  Primary Meter Point
-  IntelliTeam on Grid Source
-  2 – Vista Switchgear
-  2 – Remote Switch

Area (3):

-  2 – 175 kW Diesel Backup Generators
-  1 – 25 kW/25kWh Battery

Area (2):

-  1 – 45 kW Propane Backup Generator
-  1 – 200 kW Diesel Backup Generator

Area (1):

-  Environmental Lab + Microgrid Demonstration/Education Center
-  Solar – 112 kW south-facing & 2kW west-facing
-  Battery – 200 kW / 400 kWh
-  Microturbine – 65 kW

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Energy storage system + Vista switch



Energy Storage System
200kW / 400kWh
(converted from current
source to voltage source
by project team)

S&C MV Vista switch

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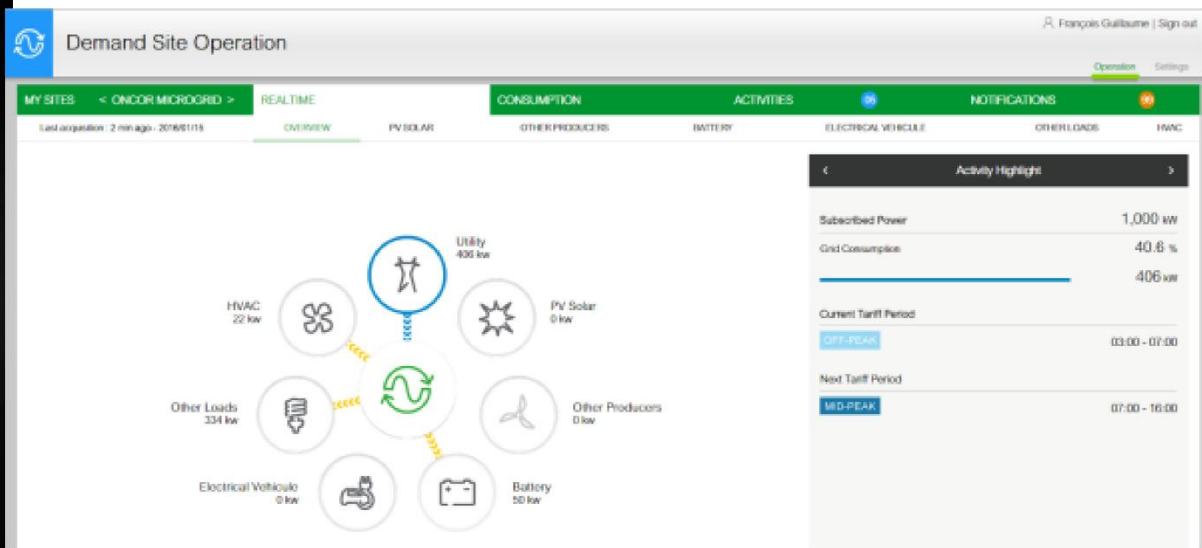
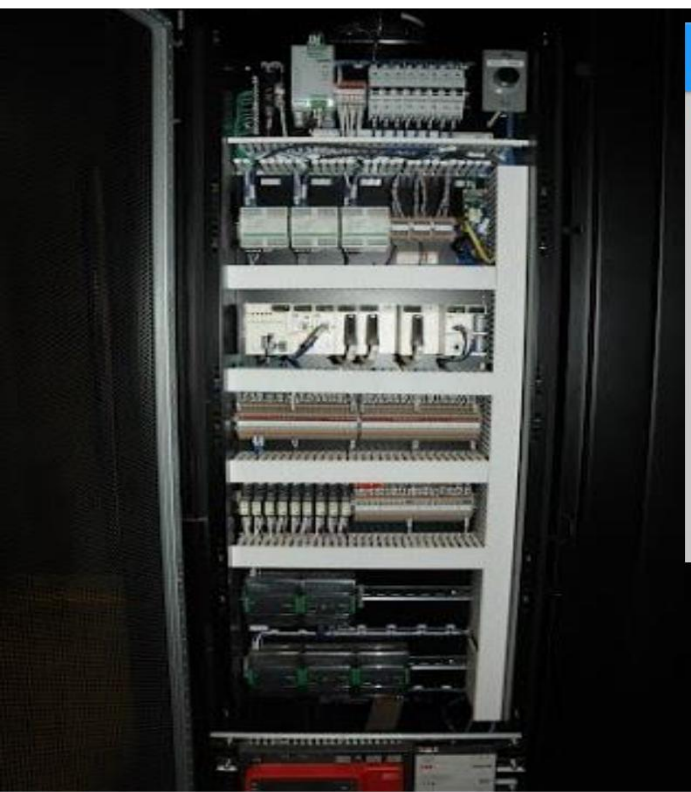
Solar, Storage, Visualization Pictures



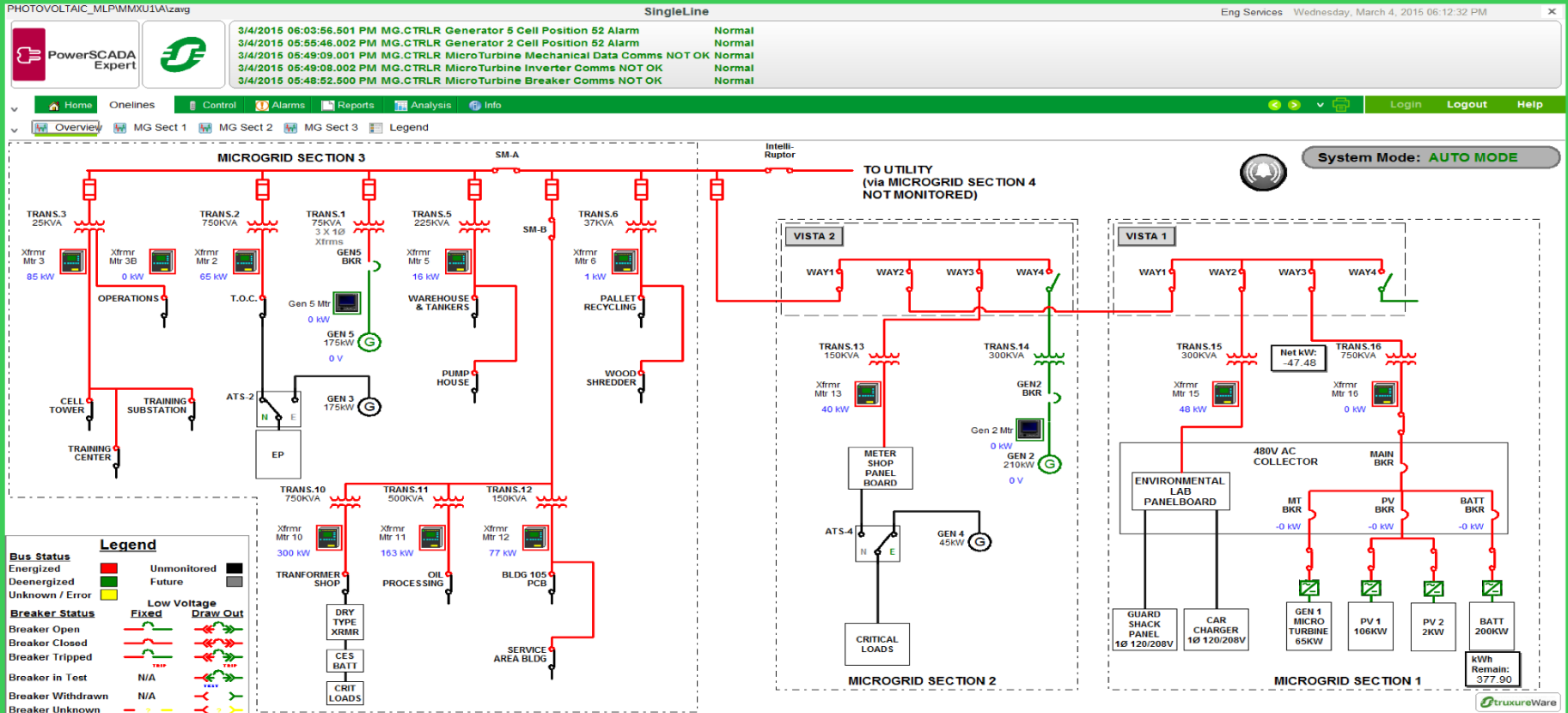
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Microgrid Controller & DSO interface



Oncor SCADA System Overview



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Oncor SCADA System Control



3/4/2015 06:03:56.601 PM MG.CTRLR Generator 5 Cell Position 52 Alarm Normal
3/4/2015 05:55:46.002 PM MG.CTRLR Generator 2 Cell Position 52 Alarm Normal
3/4/2015 05:49:09.001 PM MG.CTRLR MicroTurbine Mechanical Data Comms NOT OK Normal
3/4/2015 05:49:08.002 PM MG.CTRLR MicroTurbine Inverter Comms NOT OK Normal
3/4/2015 05:48:52.600 PM MG.CTRLR MicroTurbine Breaker Comms NOT OK Normal

Eng Services Wednesday, March 4, 2015 06:15:07 PM

Home Onlines Control Alarms Reports Analysis Info Login Logout Help

Mode Selector

Auto Manual



Storm Mode

Normal Emergency



Transfer Test

NORMAL

OFF

TEST

Microgrid Section 2

Vista 2 In Remote Control

Way 1 Utility Prot	Way 2 Utility Prot	Way 3 Utility Prot	Way 4 Utility Prot
Open	Open	Open	Open
Close	Close	Close	Close
Closed	Closed	Closed	Open

Gen 2	Gen 2 Exercise
Stop	OFF
Start	OFF
Stopped	AUTO
0.00 V	
0.00 kW	

Microgrid Section 1

Vista 1 In Remote Control

Way 1 Utility Prot	Way 2 Utility Prot	Way 3 Utility Prot	Way 4 Utility Prot
Open	Open	Open	Open
Close	Close	Close	Close
Closed	Closed	Closed	Open

MicroTurbine	PV 1	Battery
Stop	Stop	Stop
Start	Start	Start
Stopped	Running	Stopped
Value: -0.79 kW	Value: 0.00 kW	Value: 0.00 kW
Setpoint: 0 kW	Setpoint: 110 kW	Setpoint: 0 kW

Microgrid Section 3

Gen 5	Gen 5 Exercise	SCADAmate A	SCADAmate B	IntelliRupter
Stop	OFF	Open	Open	Open
Start	OFF	Close	Close	Close
Stopped	AUTO	Closed	Closed	Closed
0.00 V		In Local Control	In Local Control	
0.00 kW				

System Mode: **AUTO MODE**

PLC Clock

3/4/2015 06:15:03 PM

Server Clock

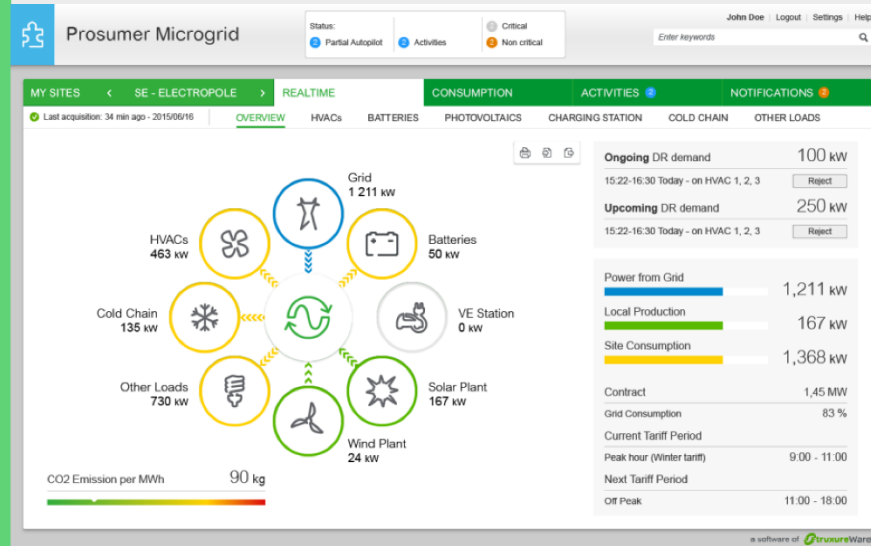
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truxureWare

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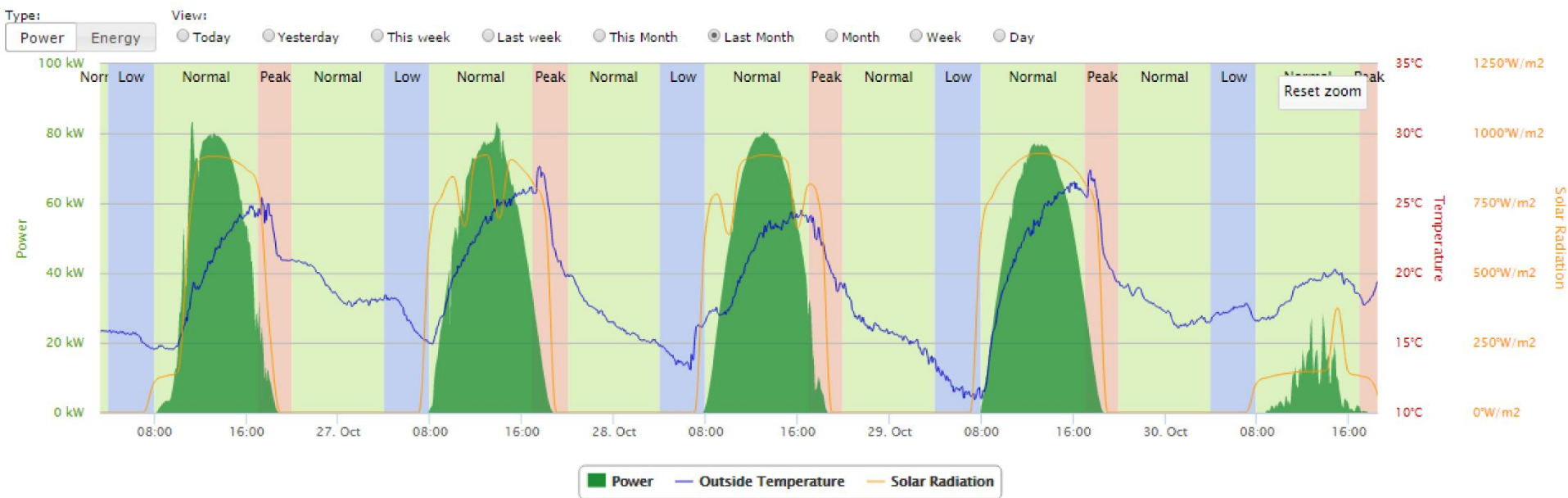
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Controller HMI



Solar Array #1

Temperature (blue) and solar forecast (orange)

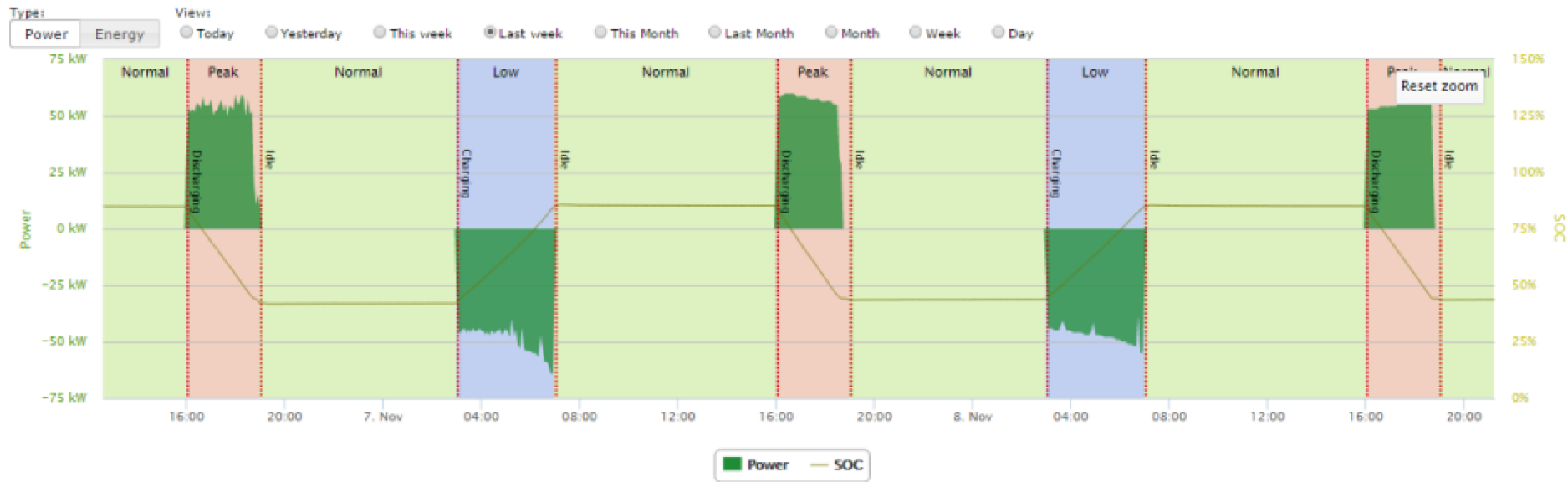


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Battery Storage State of Charge

Tariff Management: charging ESS during low price period and discharging it during peak price period



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Thank you!

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