StruxureWare Demand Side Operation

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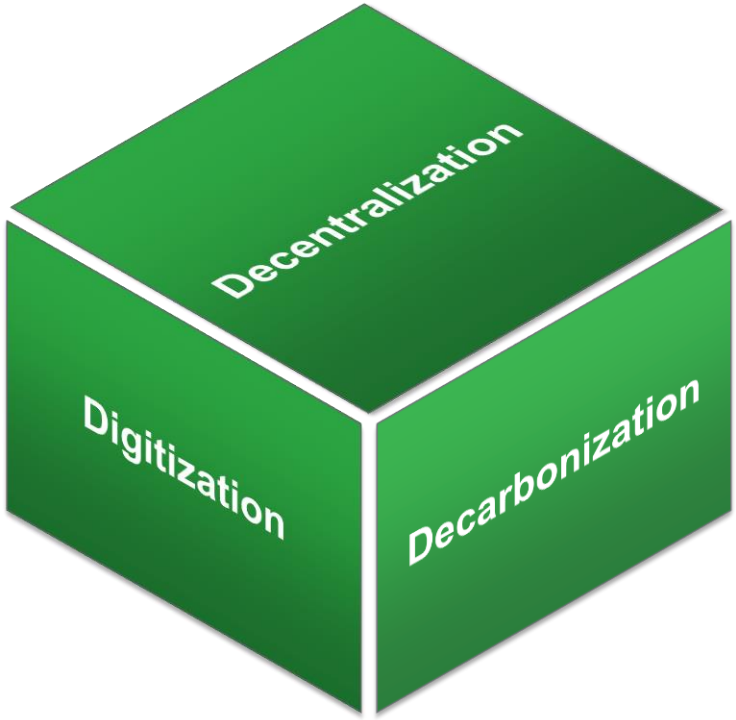
Agenda

Thursday, February 23rd, 2017

	The New Energy World
	What is a Microgrid?
	Why Microgrids?
	Microgrid Architecture
	Optimization Software
6	Shedd Aquarium Case Study
7	Questions?

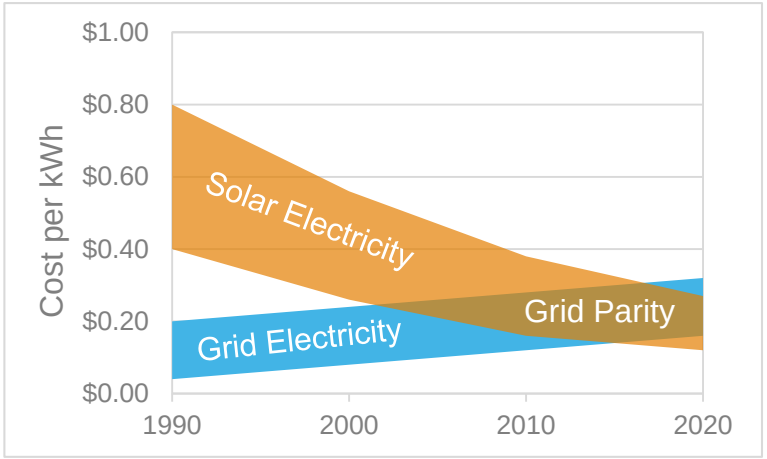
The New World of Energy in 3Ds



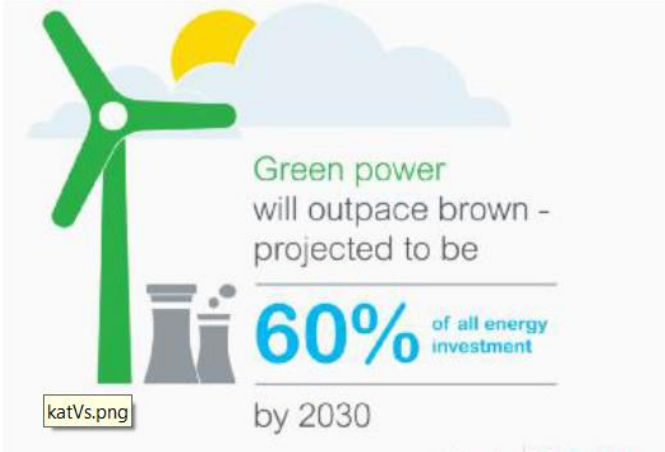
Megatrends

Decarbonization | Digitization | Decentralization

Reduced Cost for Renewable Energy



Make Renewable Energy Attractive



& Carbon Reduction Policy

COP21 **EPA Clean Power Plan**

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Megatrends

Decarbonization | **Digitization** | **Decentralization**

Proliferating automated devices connecting the “grid of things”

Big data integration
Internet of Things will connect

50Bn devices
by 2020

Data source: IDC

- more / better data unlocks better / faster decision making
- reduced investment to achieve situational awareness required for microgrid
- improved root cause analysis / troubleshooting
- better lifecycle management

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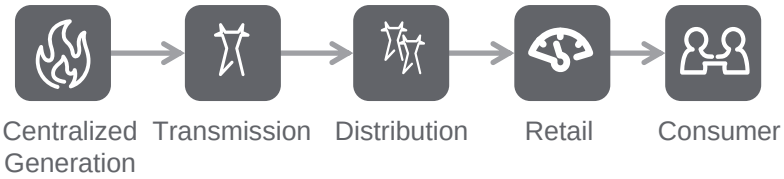
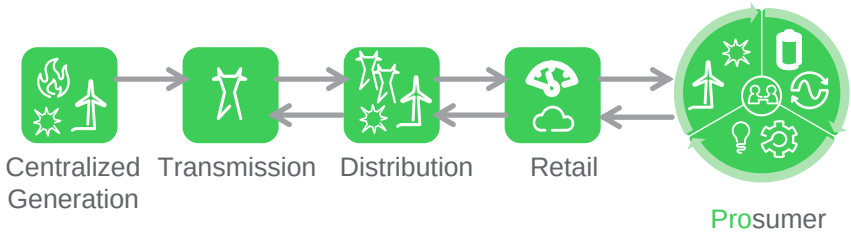
Decarbonization | **Digitization** | **Decentralization**

Historical Energy Value Chain



- one-way energy flow
- suboptimal utilization of centralized generation
- passive consumers / inelastic demand
- limited choice
- limited communication

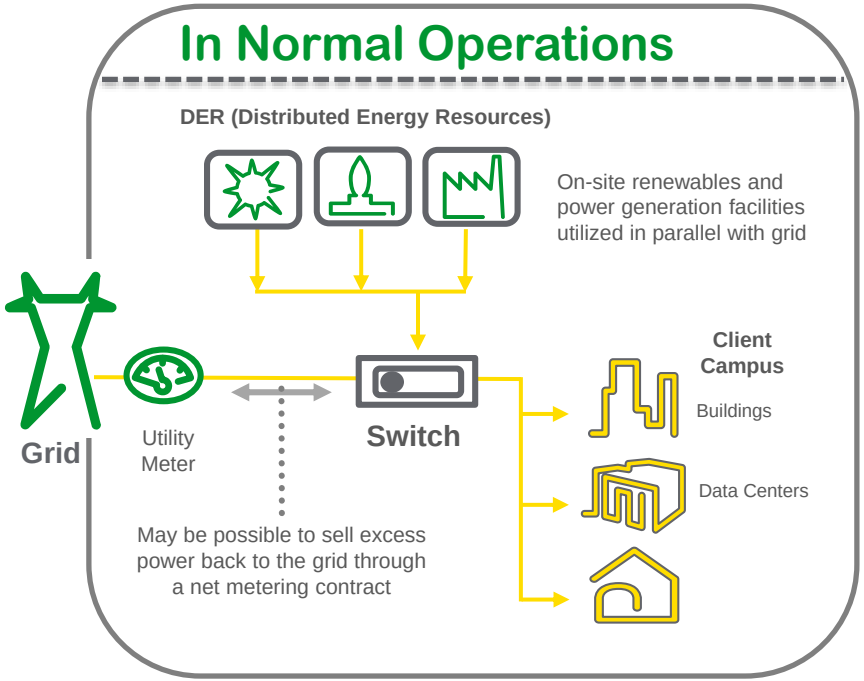
The New Energy Landscape

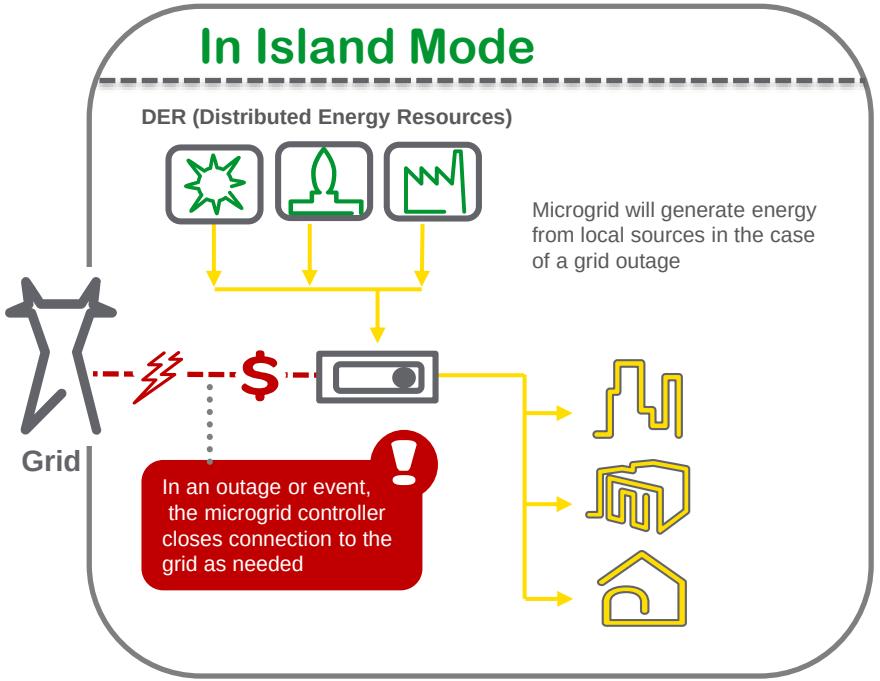


- n-way energy flow
- generation is local and green
- integrated and tailored energy supply chain
- connected, aware, and empowered consumers and suppliers

What is a Microgrid?

An integrated energy system consisting of interconnected Distributed Energy Resources (controllable loads, energy storage, production sources) which as an integrated system can operate in parallel with the grid or in an intentional islanded mode.





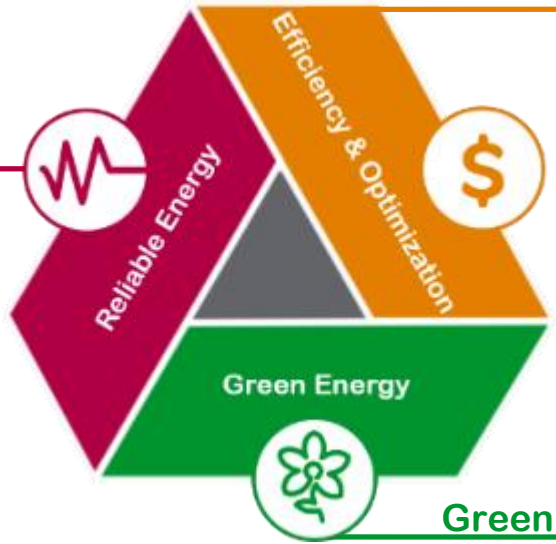
…which as an integrated system can be controlled as a single entity and operate in parallel with the grid or in an intentional *islanded* mode.

Why Microgrids & Optimization Software?

Customized DERs deliver enhanced reliability; efficiency and optimization; and environmental benefits.

Reliable Energy

- Ability to intentionally “island” from utility
- Preserve critical loads 24/7/365
- Repurpose grid tied inverters for island mode operation



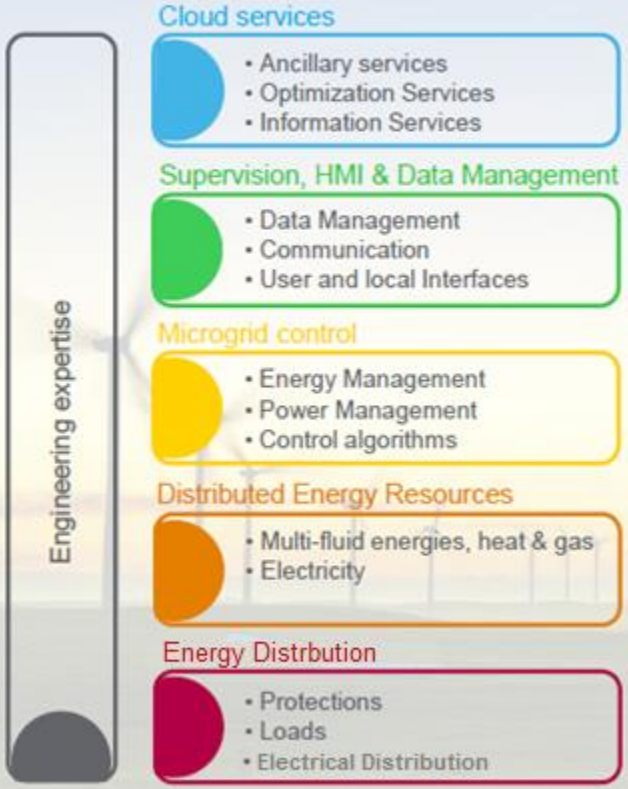
Efficiency & Optimization

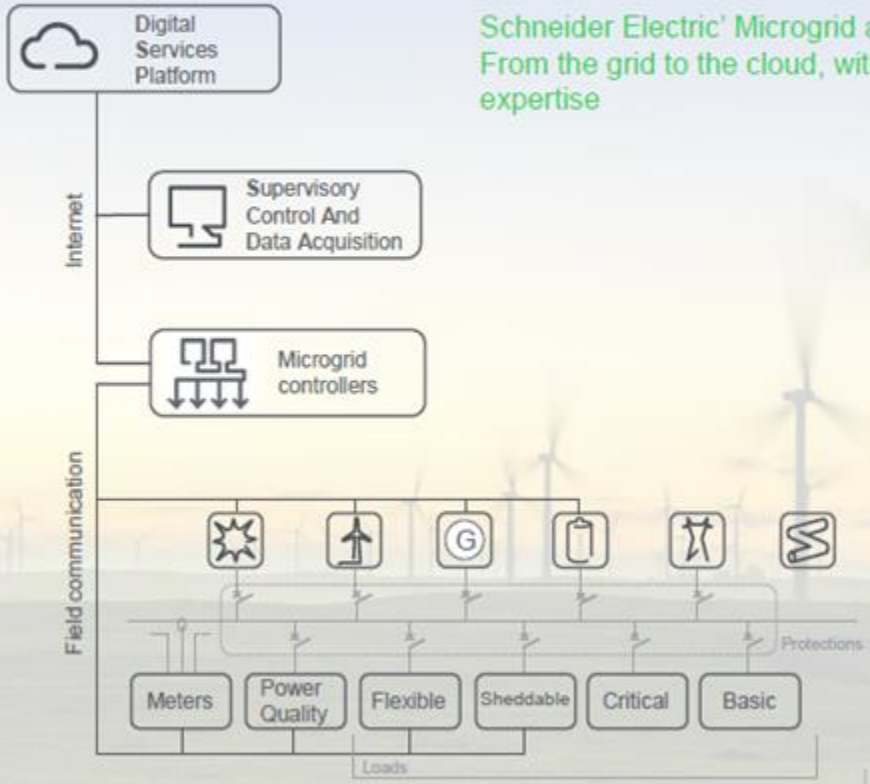
- Minimize energy costs
- Harness combined heat and power, maximize incentives
- Monetize energy flexibility with the grid

Green Energy

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

Microgrid Architectures





Schneider Electric' Microgrid architecture: From the grid to the cloud, with engineering expertise

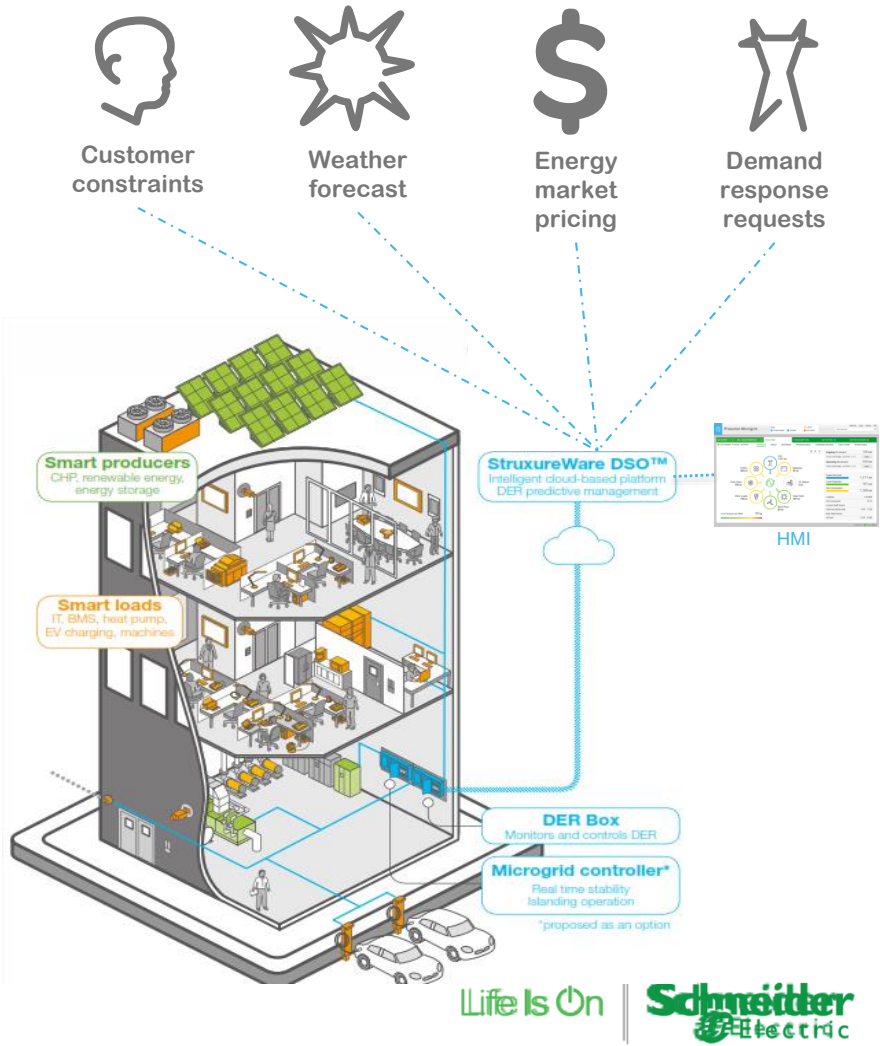
StruxureWare Demand Side Operation

(Software as a Service)

forecast and optimize

when to

consume, produce, store, or sell energy

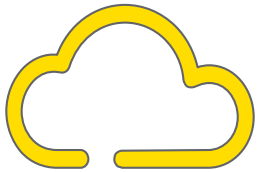


A Solution for Site Managers

- **Remote monitoring of DER**
  - Peace of mind for monitoring and visualization
- **Tariff Management**
  - Consume or produce energy at the most advantageous time based on variable utility rates
- **Demand Control**
  - Reduce demand charges
- **Self consumption**
  - Leverage your on site production capability
- **Demand Response**
  - Participate into the grid balancing mechanisms
- **Island mode**
  - Leverage weather forecasts to anticipate black-outs

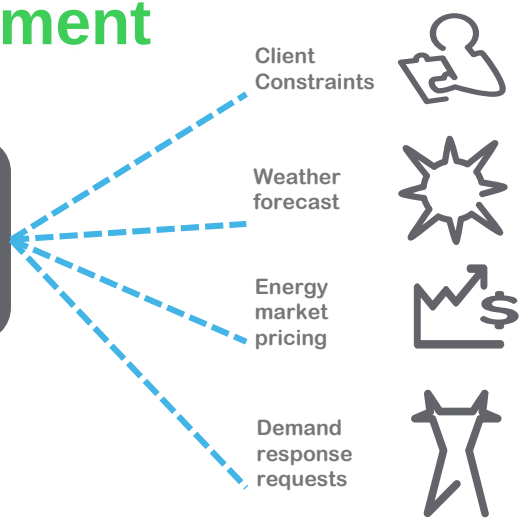
Microgrid Controller & Event Management

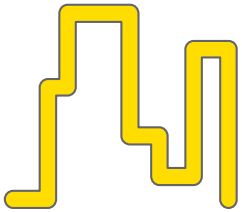
>**Predictive** DER management
>Forecast when to **produce, store or sell energy**
>Interface with energy **markets**
>**Accessible** from anywhere



Cloud

StruxureWare Demand Side Operation



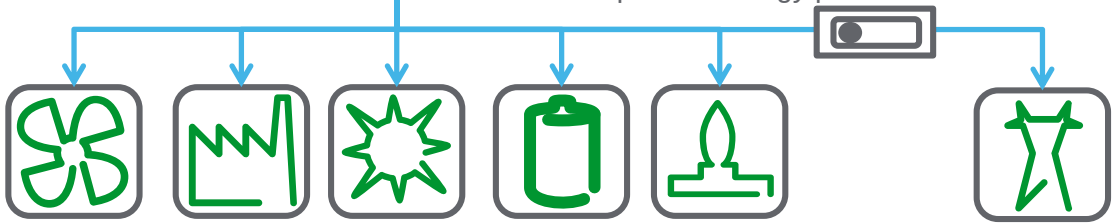


Client site

DER Box

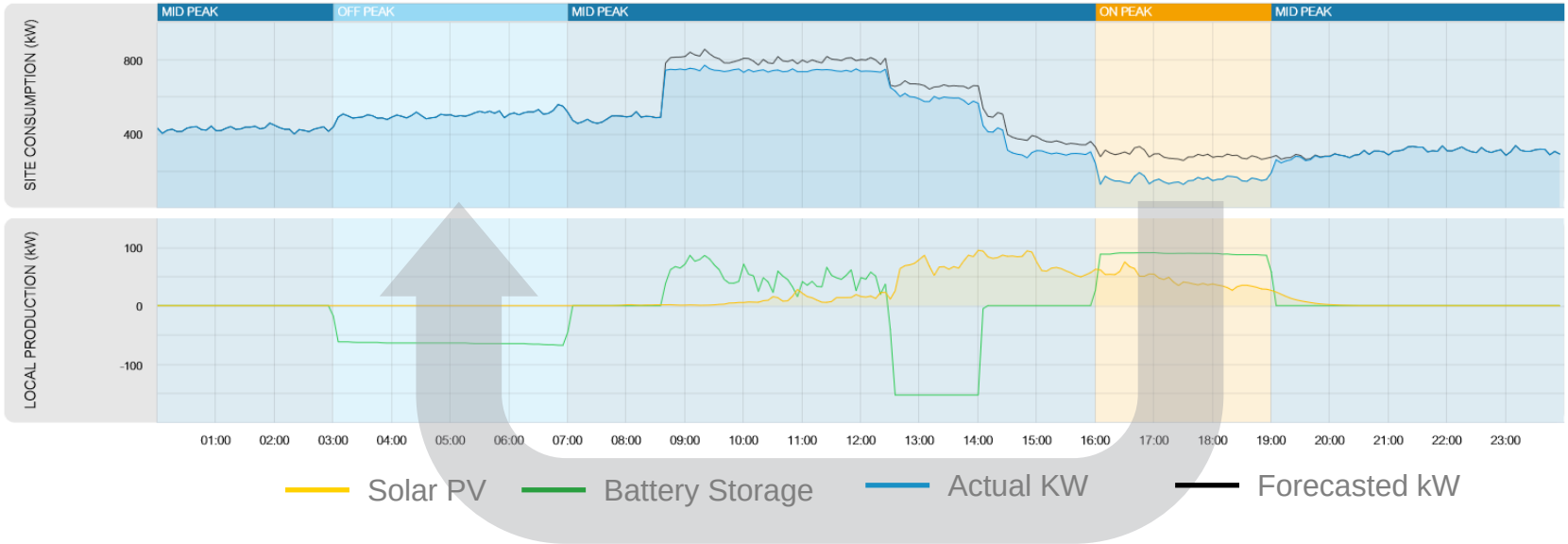
Microgrid Controller

>Reactive DER management
>Ensures microgrid real time stability & reliability
>Manage of connect/disconnect from the grid
>Optimize energy production & use



Tariff Management

Shift consumption from times of high cost to times of low cost



- *Example 1:* charge an energy storage system during “off peak” period and discharge it during “on peak” period
- *Example 2:* consume energy with HVAC during “off peak” period (pre heating or pre cooling) and coast to reduce energy consumption during “on peak” period

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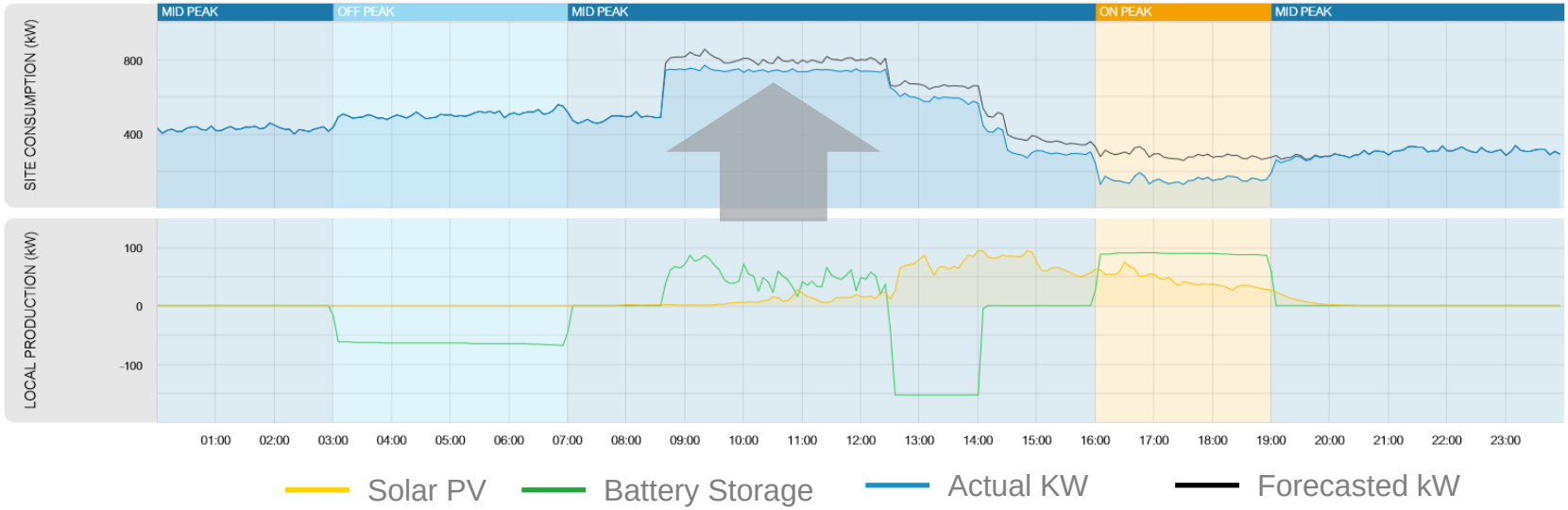
Demand Management

Minimize / avoid fees by shaving peak demand



- *Example 1:* dispatch energy storage to supply some load to avoid a peak
- *Example 2:* shed loads (HVAC, EV Chargers, etc.) to avoid setting a peak
- *Example 3:* Sequence the start of large loads to avoid coincident peak demand

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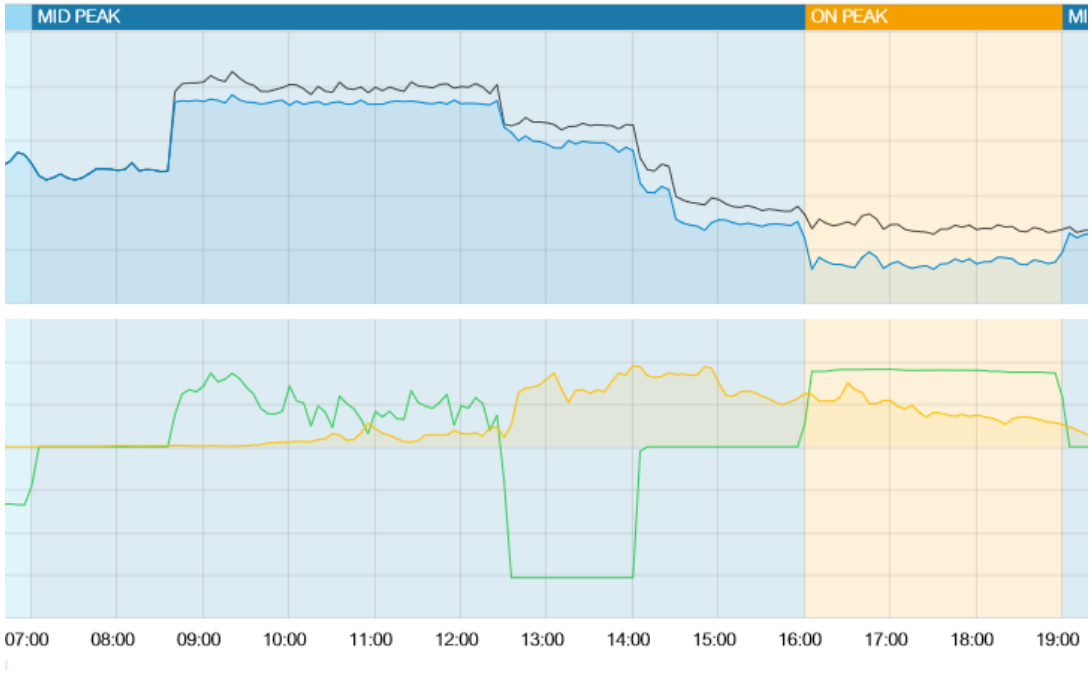
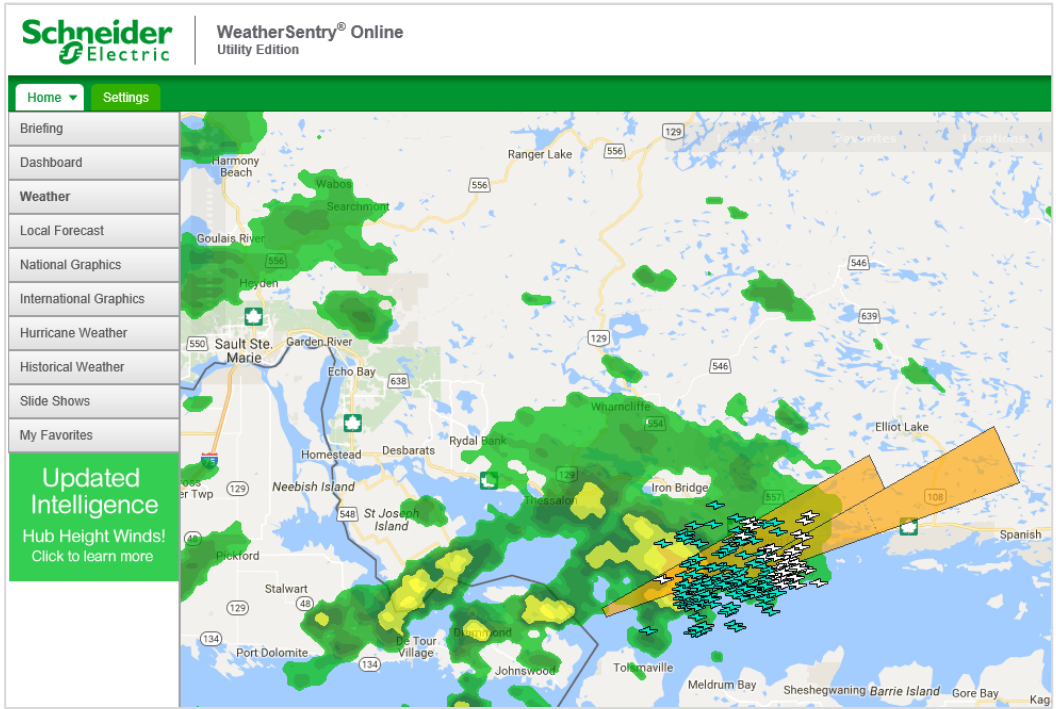
Illustrating the benefit



Subtracting actual energy procured vs. modeled consumption allows us to calculate the financial savings and net carbon reduction

Storm Hardening

Optimize for resiliency when weather threatens site operation



Weather prediction and power quality monitoring can proactively trigger resiliency optimization measures including:

- Charge the battery to full capacity
- Warm and pre-lube emergency generation
- Adjust protective relay settings
- Proactively island the site
- Shed non essential load
- Electrically isolate sensitive equipment

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Key features of Optimization Software Solutions

- Fully comprehensive and integrated solution (EMS, PMS) with Demand Side Operation and Microgrid Controller
  - Optimization in both grid tied and off grid modes
  - DER agnostic (3rd party)
  - Scalable design that accompany your microgrid journey
  - Expertise on design and creation of your microgrid
- Software as a Service (SaaS) Business Model on Demand Side Operation
  - Continuous support and updates for customers
- Intuitive and easy to use user interface
  - Simplify user experience
- Forecast and automatic optimization of DER
  - Simplify user experience
- Connection with third party platform (web services)
  - Easily collect information from improving DER management
- Integration of third party Matlab algorithm (Matlab factory)
  - Solution customization

Cases Study

Frequency Regulation with Battery Storage & PV Monitoring / Forecasting

Project at a Glance

- 1MW / 250kWh Battery Storage System
- 265 kW PV System
- Utility Feed and Building Load Monitoring

✓ Largest building battery installation in the state of Illinois and the first of its kind to be installed at a zoo or aquarium in the nation

✓ Connected to Shedd's electrical distribution system and provides frequency regulation services, peak-load demand and the need for emergency back-up power

✓ Funded by a grant from the Illinois Department of Commerce & Economic Opportunity and installed by Schneider Electric

✓ *Project brings Shedd Aquarium one step closer to being the nation's first clean-energy-powered cultural institution in the nation*

Efficiency & Optimization

- StructureWare Demand Side Operation for remote monitoring load forecasting
- Frequency Regulation using Reg D signal every 4 seconds
- PV monitoring for peak shaving and Peak Load Contribution avoidance

Green Energy

- Solar Energy producing approx. 315 kWh per year
- Battery Storage helping maintain grid stability
- Serves as a best practice to deploying an environmentally sustainable PV and Battery Storage System in Chicago, IL

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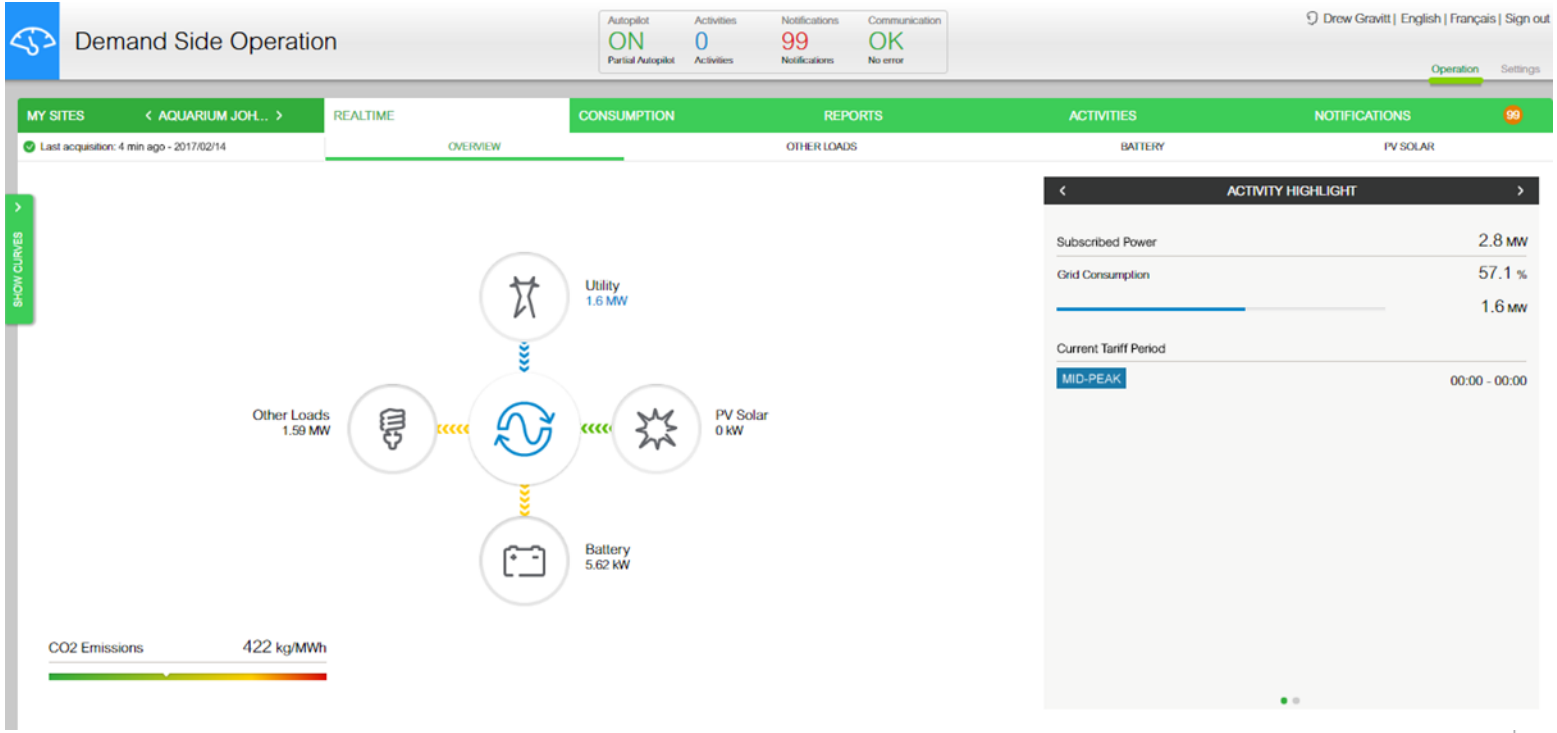
Real Time Site Overview

Remote Monitoring and Load Forecasting



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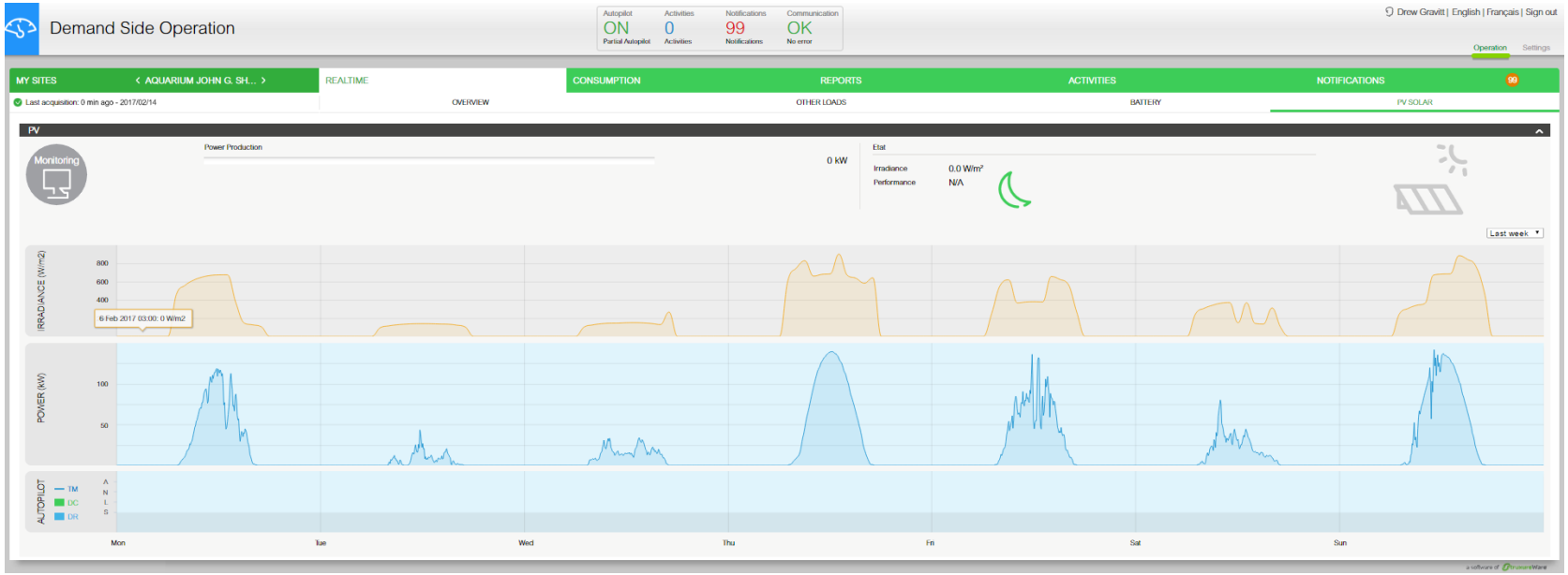
PV Monitoring and Forecasting

Minimize / avoid fees by shaving peak demand



PV Irradiance

Actual KW

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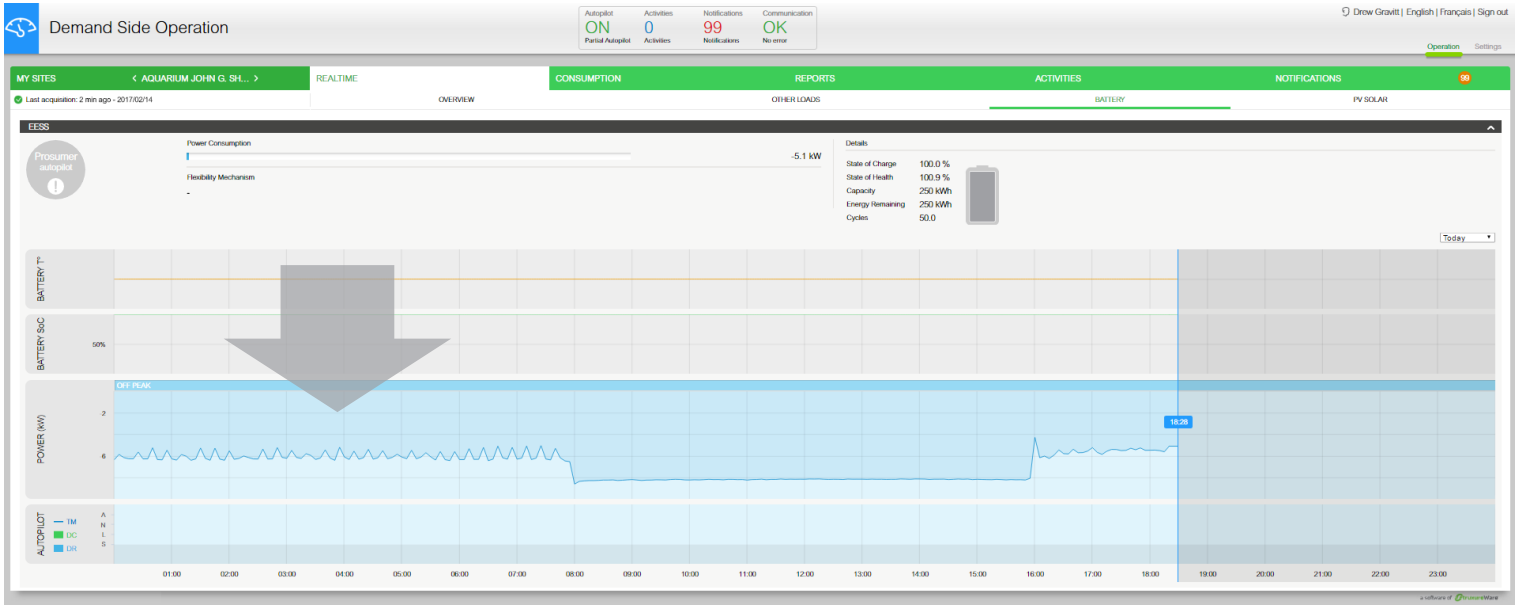
Frequency Regulation

Generate Revenue in PJM Market



Battery Temperature — Battery State of Charge — Actual KW

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Thank you

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