Prosumer solution

Economic Dispatch Opportunities

Connecting Distributed Energy Resources to the Smart Grid

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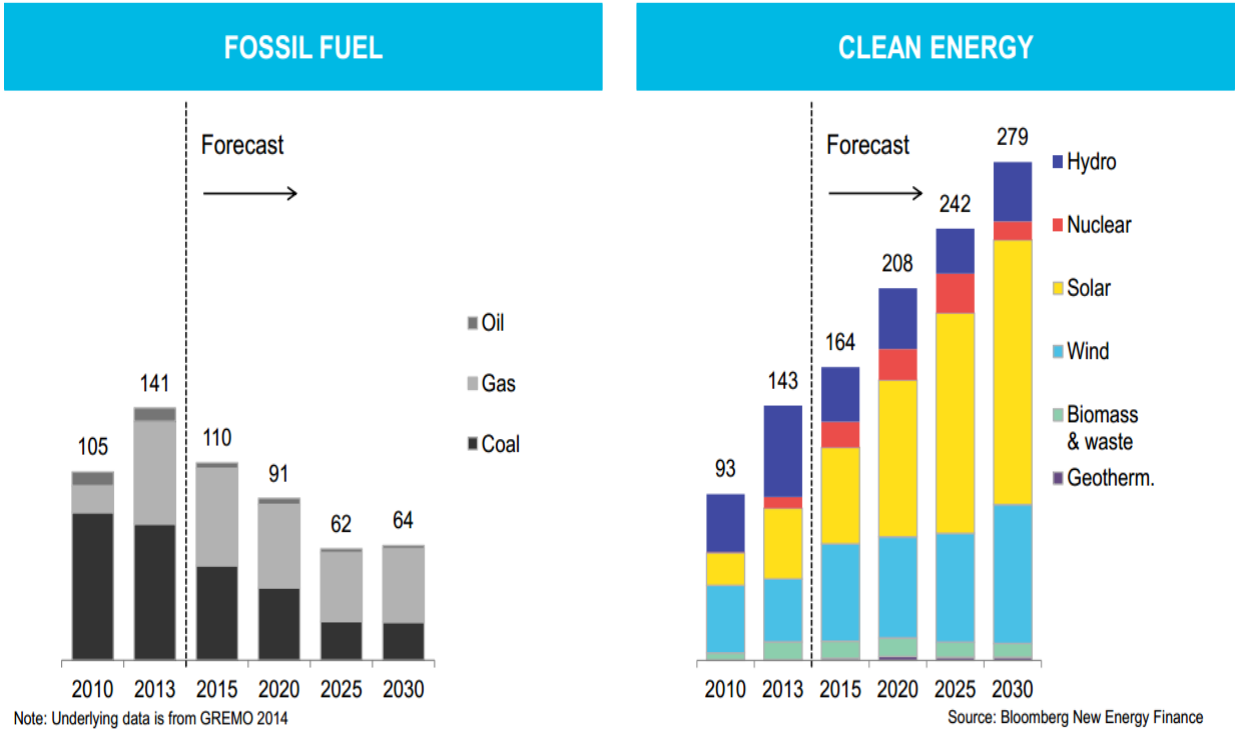
Energy trends



-Increasing distributed generation to integrate with the grid

– Non dispatchable renewables provide the biggest growth

Source: Bloomberg New Energy Finance Summit 2015

Energy trends

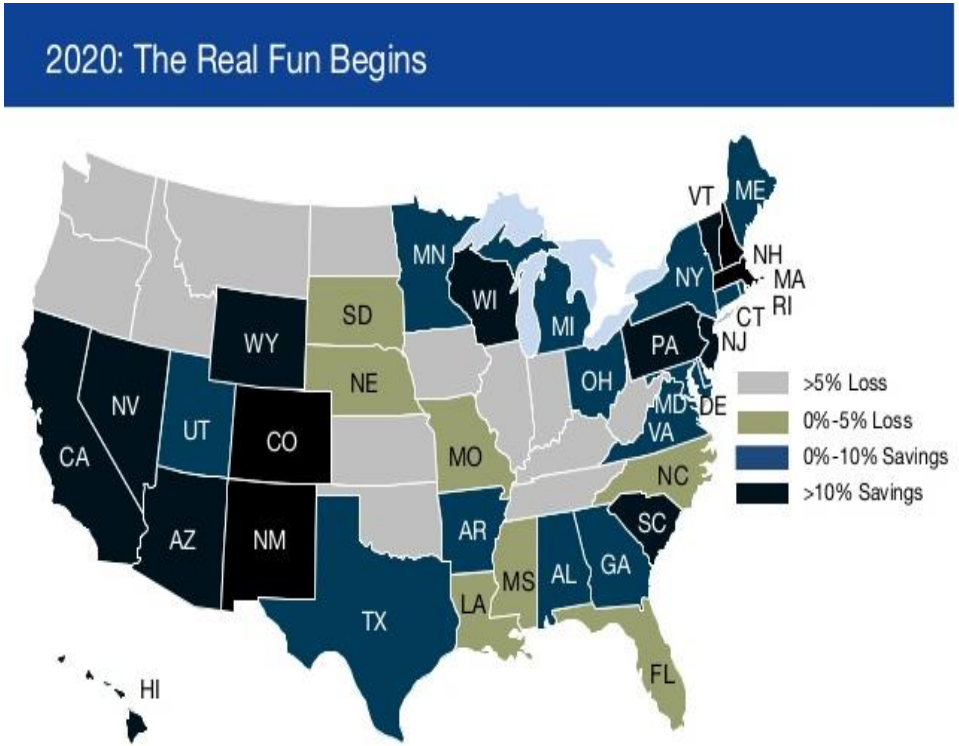
Distributed generation, grid parity, aging infrastructure, climate change…

-The arrival of “Grid Parity” will be a significant market driver-

- Falling prices of storage will “change the game”

- High penetration of renewables will drive new markets

  - i.e The Duck Curve



Energy trends

Distributed generation, grid parity, aging infrastructure, climate change…

-Climate change effects are more and more visible

- Resiliency requests are on the rise

-New political trends (COP 21 Paris)

Source: Bloomberg New Energy Finance Summit 2015

How do we face these challenges?

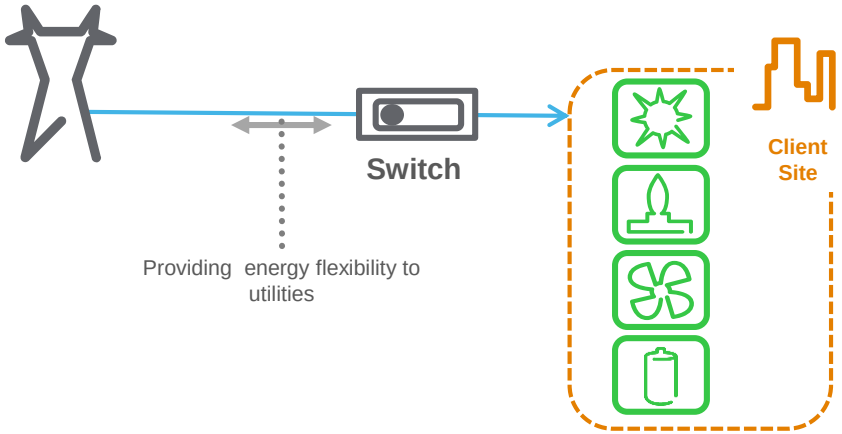
While improving comfort, energy costs, grid reliability, and environmental stewardship…

Microgrids with Distributed Energy Resources can be an answer

An integrated energy system consisting of interconnected Distributed Energy Resources (controllable loads, energy storage, production sources)…

DER (Distributed Energy Resources)

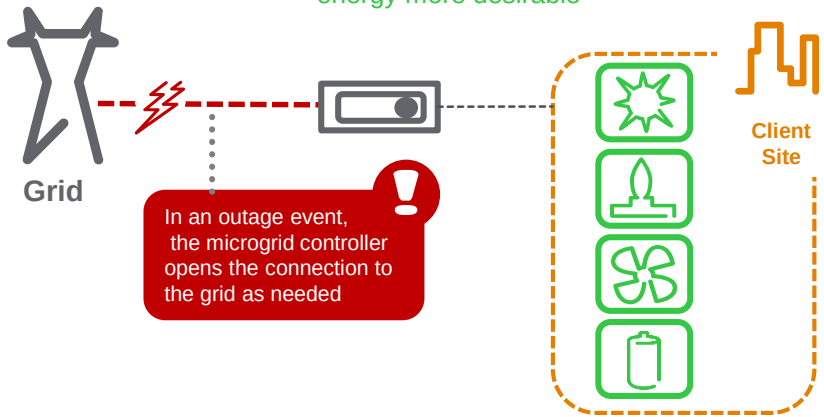
On-site renewables, energy storage and power generation facilities utilized in parallel with grid



In normal operations

DER (Distributed Energy Resources)

Microgrid will generate energy from local sources in the case of a grid outage OR other external event which makes local energy more desirable



In Island mode

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

Values brought by microgrids

For all actors

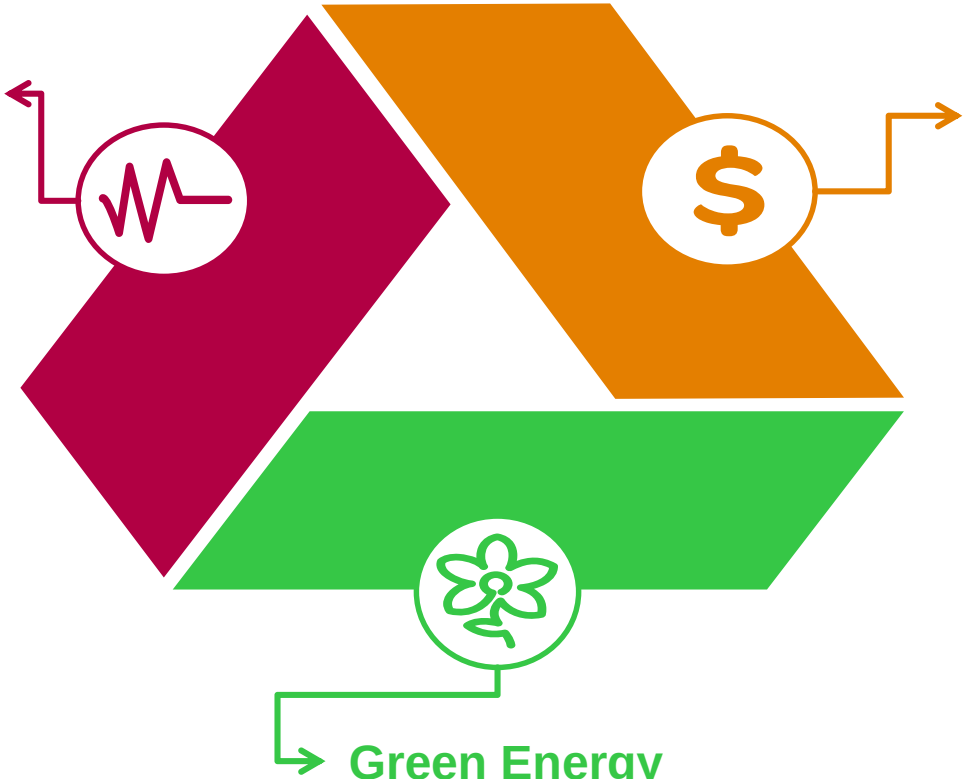
Reliable energy

✓*For utilities*

Reinforce the grid infrastructure with reliability “zones” across the grid

✓*For end user*

Leverage on site generation during grid power outage (islanding)



Efficiency and Optimization

✓*For utilities*

Leveraging cheap energy flexibility of customers through DR and TOU

✓*For end user*

Optimize local production vs consumption vs grid consumption

Green Energy

✓*For end user and utility*

Better integration of intermittent renewable sources

Avoid starting polluting peak power plant

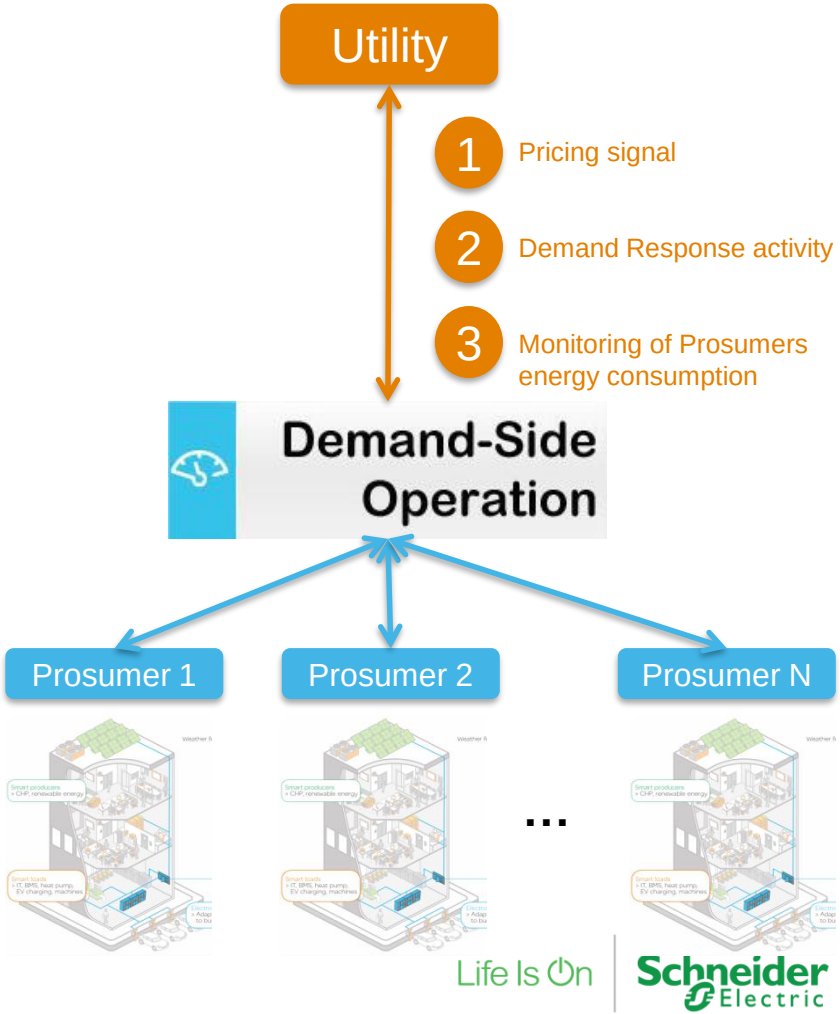
Prosumer Solutions

A Solution for Site Managers

- Ease of Operation
  - Automation and optimization of when to *consume, produce, store, or sell* energy using the best intelligence
- Remote monitoring of DER
- Save money while increasing comfort
- Be greener
- Contribute to the grid stability (DR) while earning revenue

A Solution For Utilities

- Access valuable Distributed Energy Resources
  - Optimize integration of renewable energy
  - Make your customers' DER an asset for strengthening your grid
  - Get access to cost-effective and flexible energy for balancing your grid



What use cases are available?

- Remote monitoring of DER
  - Peace of mind for monitoring
- Tariff Management
  - Consume or produce energy at the most advantageous time
- Demand Control
  - Reduce demand charges
- Self consumption
  - Leverage your on site production capability
- Demand Response
  - Participate into the grid balancing mechanisms
- Island mode
  - Ride through blackout leveraging DER

Detailed architecture with Microgrid Controller

Cloud

HMI

StruxureWare
Demand Side Operation

Customer constraints

Weather forecast

Energy market pricing

Demand response requests

VPN/HTTPS

Customer site

DER Box

Microgrid Controller

Modbus, Bacnet etc

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 72 hour ahead DER dispatch and optimization schedules

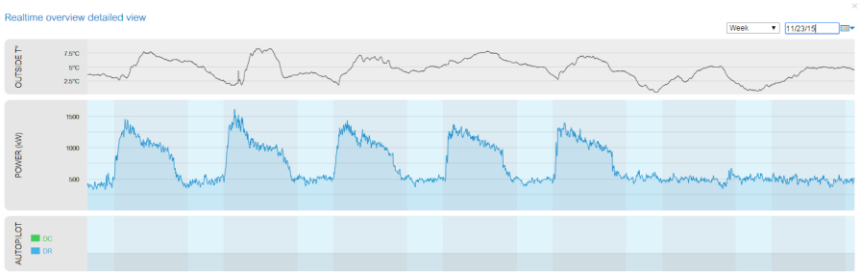
3 Optimizes DER operation

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

Remote monitoring of DER

- Monitoring in real time (5minutes refreshment rate) of all the DER connected to the platform
  - *Example 1:* monitoring your DER energy consumption/production from anywhere with an internet connection on your computer, tablet, or smart phone

Energy savings



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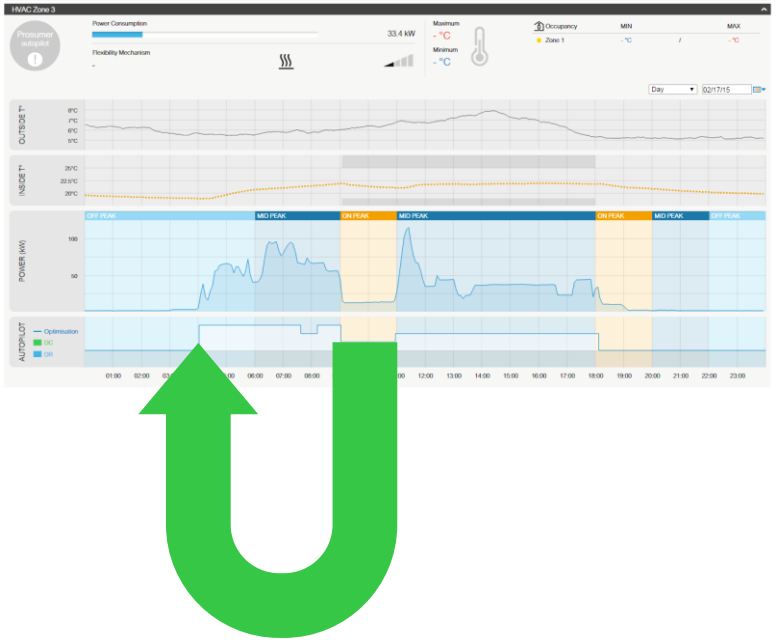
Tariff management – Load shifting

- Shifting the electrical consumption from on peak hour to off peak hour, while ensuring the comfort of the occupant

  - *Example 1:* charging an energy storage system during off peak period and discharging it during on peak period

  - *Example 2:* consuming electricity with a HVAC during off peak period (pre heating or pre cooling) and reducing its electrical consumption during peak period

Energy bill optimization



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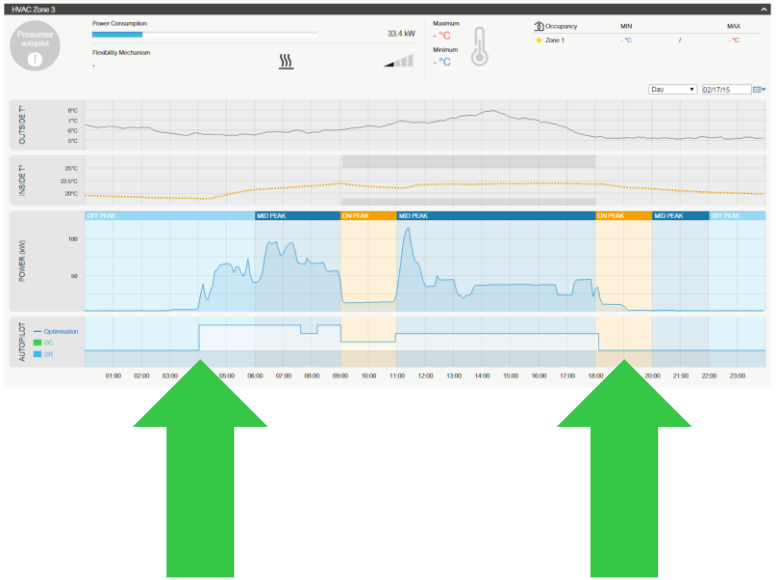
Tariff management – optimum start/stop

- Optimizing DER Start/Stop based on electricity tariff and building occupancy

  - *Example 1:* starting and stopping an HVAC system at the right time during the day for ensuring the comfort of the building occupant and avoiding wasting energy

Energy savings and energy bill optimization



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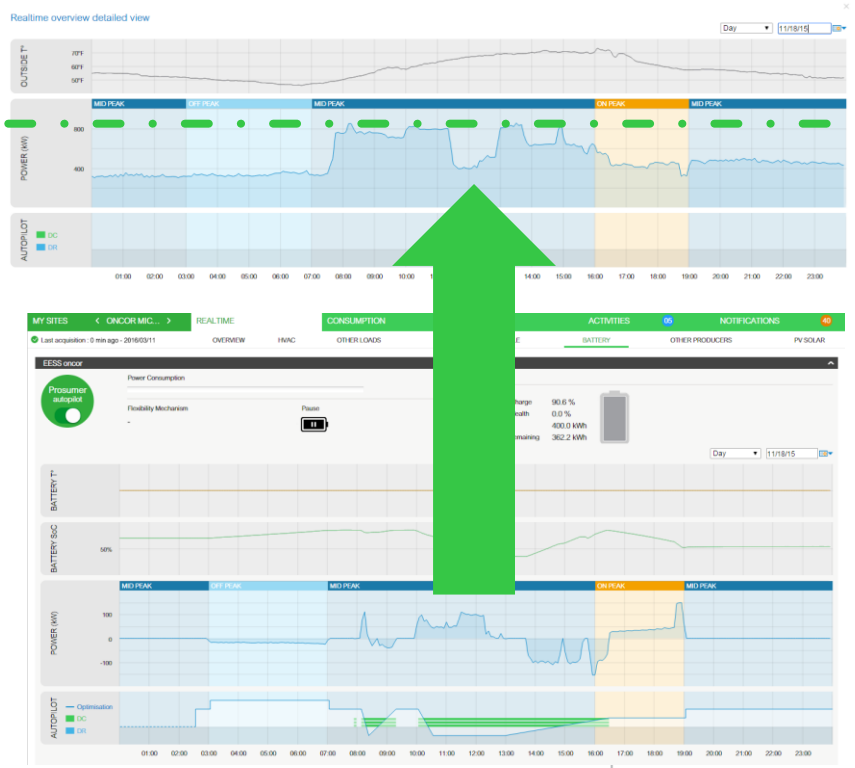
Demand charge – peak shaving

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

Energy bill optimization

Power Limit



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Self consumption

- Consume energy produced locally first, import energy second
  - *Example 1:* charging an energy storage system with the extra amount of electricity produced by a PV system and consuming it later during the day

Being greener and energy bill optimization

Demand Response – Load curtailment

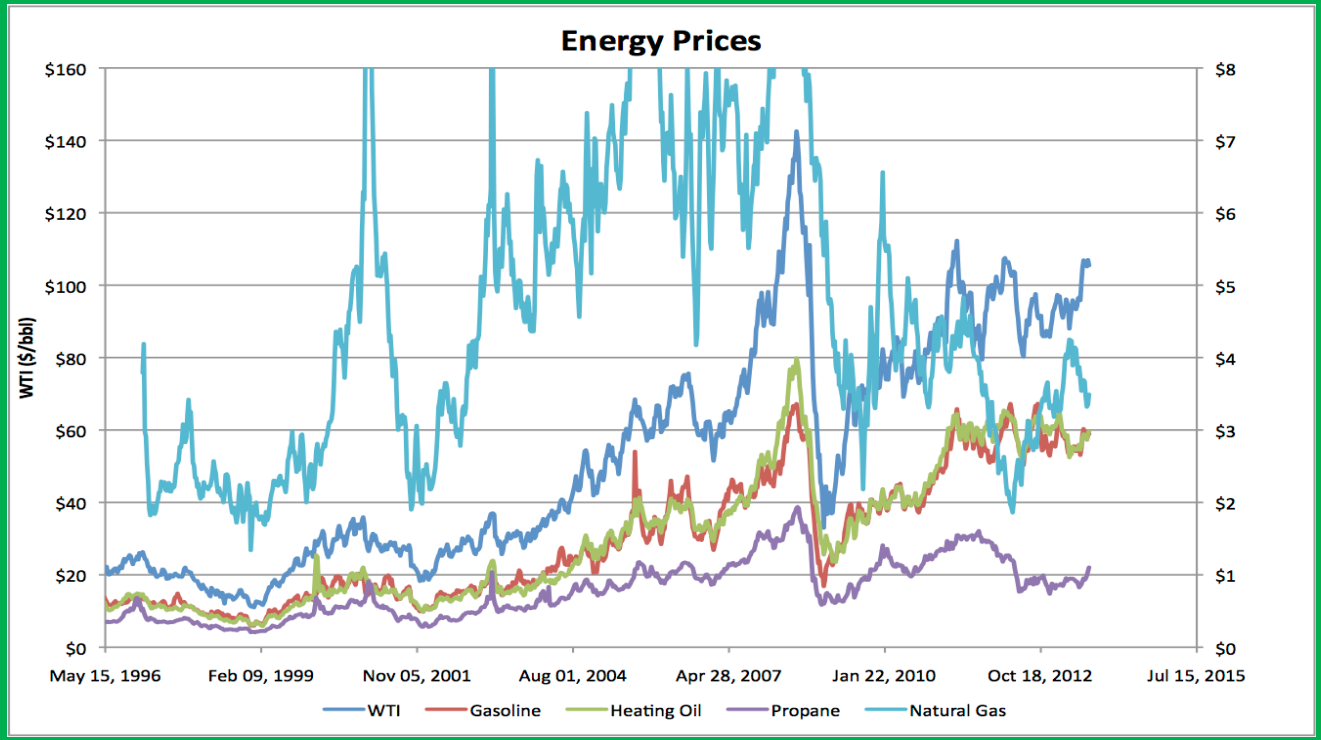
- Performing load curtailment following a Demand Response request
- Can be performed as demo “manually” or via OPEN ADR with a utility / commercial aggregator who can bid on the energy market
  - *Example 1:* answering and performing Automatic Demand Response requests (for instance load curtailment with a HVAC or an energy storage system) sent by a commercial aggregator through OPEN ADR

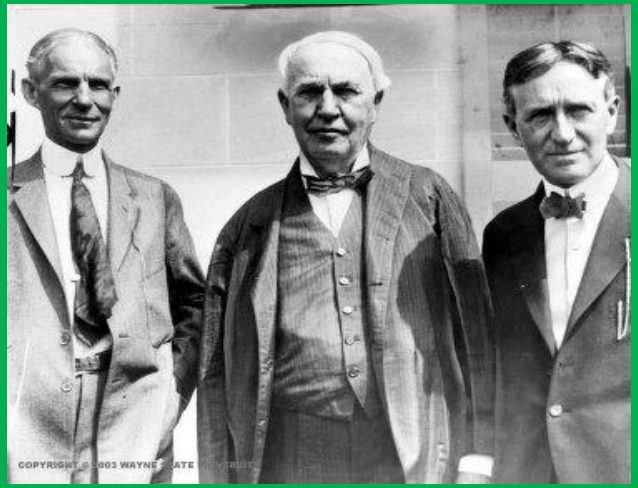
Energy bill optimization and contributing to the grid reliability

Compounding and Compelling Savings For DER

- Increased energy security/surety
- Improved overall system reliability
- Ability to increase % renewables utilized
- Sustainability and carbon goals
- Allowing higher % penetration of renewables on utility feeders
- Hedge against volatility/price escalation of energy costs

Renewables Help Avoid Price Variability





We are like tenant farmers chopping down the fence around our house for fuel when we should be using Nature's inexhaustible sources of energy — sun, wind and tide. ... I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that.

-Thomas Edison in conversation with Henry Ford and Harvey Firestone (1931)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Thank you
Source: Bloomberg New Energy Finance Summit 2018
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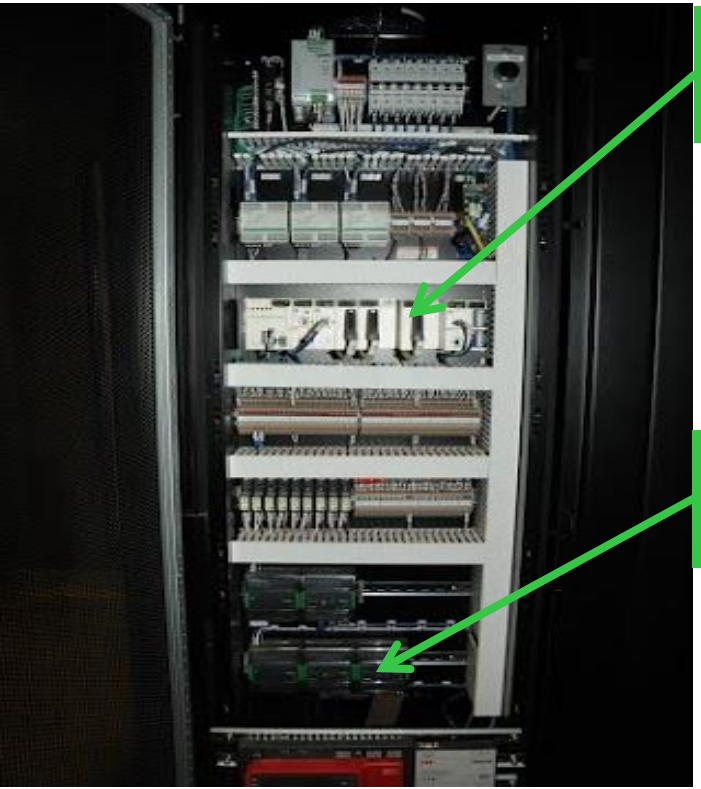
Additional Info

Microgrid Controller (as an option)

Adding a microgrid contorller to the Prosumer solution will increase the reliability, stability and efficiency



Microgrid Controller

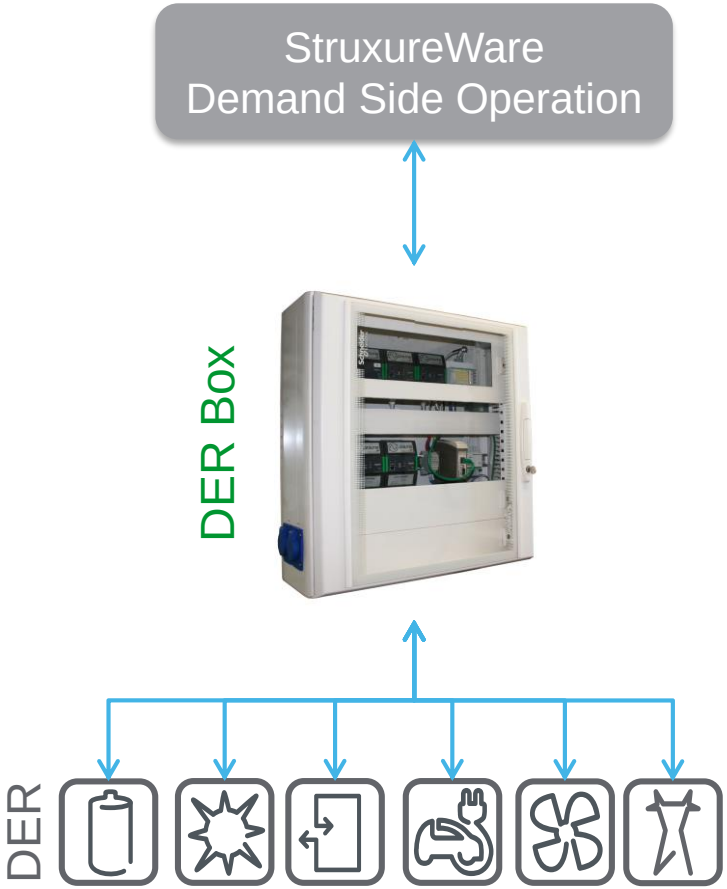
- ✓ DER Real time management (ms, s, minute)
- ✓ Dispatches orders and collects DER data
- ✓ Data storage for improving reliability
- ✓ Management of Islanding Disconnection/Reconnection to the Grid
- ✓ Black start capability
- ✓ On demand use case development

DER Box connected to Demand Side Operation

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

DER Box

- Automation cabinet installed at the customer site for connecting the DER to StruxureWare Demand Side Operation
- Features
  - Monitor and operate DER (EESS, solar, CHP, HVAC, BMS…)
  - Secured https connection t uxureWare Demand Side Operation 
  - Arbitrage between the different use cases
    - Demand control
    - Tariff management
    - Demand Response
    - Self consumption
  - DER manufacturer agnostic



Zoom on use cases

Oncor Microgrid

- Oncor is the biggest utility in Texas, serving about 10 millions of customer
- Most advanced microgrid in the USA, located near Dallas, Texas

  - Management of Energy storage system, monitoring and forecast of 2 PV, monitoring of HVAC, Microturbine, EV charging station,
  - Predictive and real time control of Distributed Energy Resources
  - 4 separate Microgrids, autonomous and dynamic
  - Possibility to tour the installation

Prosumer Microgrid DER Box
+
Microgrid controller

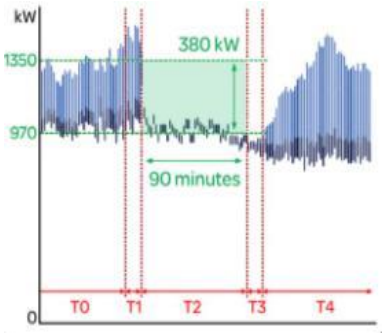
Greenlys

- Building smart grids in Grenoble and Lyon, France, to benefit C&I and residential end users
  - Standardize and showcase a functional smart grid that integrates consumer, facilities renewable energies (solar, CHP ...), electric vehicles, and smart meters
  - Ultimately involving 1,000 residential customers and 40 commercial building sites
  - 43 million Euros investment over 4 years (2012-2016)

Issygrid

- France’s first district smart grid in Issy les Moulineaux, Paris
  - Demonstrate how energy consumption peaks can be smoothed across an eco-neighbourhood of prosumers
  - Operational since 2013, it proves that intelligent management of energy resources can benefit landlords, building managers, and renters
  - 9,000 employees and 3,000 inhabitants are concerned by this project
  - 2 million Euros investment

IssyGRID
le 1er réseau de quartier intelligent



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SDEM

- First smart grid-ready energy storage and management system for an office building in France
  - Management of a microgrid including: EV, energy storage, PV, wind farm, loads
  - Maximize consumption from solar and wind energy production
  - Ride through blackout by using the onsite produced energy

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EQI Prosumer smart building

- Biggest Schneider Electric R&D Center EQI, located in Grenoble, France, is running the Prosumer solution since 2013
  - Management of HVAC, EESS, EV charging station, monitoring and forecast of PV
  - Possibility to tour the installation