

RESILIENT

The Flexible Way to Leverage Microgrids Within a District Energy System

Newer Approaches to Solve Resiliency, Efficiency and Sustainability Challenges

Chris Dunlap, Power Generation BDM, Americas



Chris Dunlap

Power Generation

Business Development Manager, Americas

- 30 years Power Generation Experience
- 2018 Power-Gen International Microgrid Chairman
- ISA Boston (Past-President; Executive Board)
- Senior level sales management and engineering positions at multiple Fortune 500 companies:
 - Emerson
 - Siemens
 - Rockwell Automation
- Based at Schneider Electric's North American headquarters in Boston, MA USA

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Schneider
Electric

Energy Megatrends – Creating New Energy Landscape



More ELECTRIC

2X faster growth of electricity demand compared to energy demand by 2040

Source : IEA WEO 2014

DIGITIZATION

10X more incremental connected devices than connected people by 2020

Source : Cisco, Internet World Statistics

DECARBONIZATION

82% of the economic potential of energy efficiency in buildings and more than half in industry, remains untapped

Source : World Energy Outlook 2012, Internal Analysis

DECENTRALIZATION

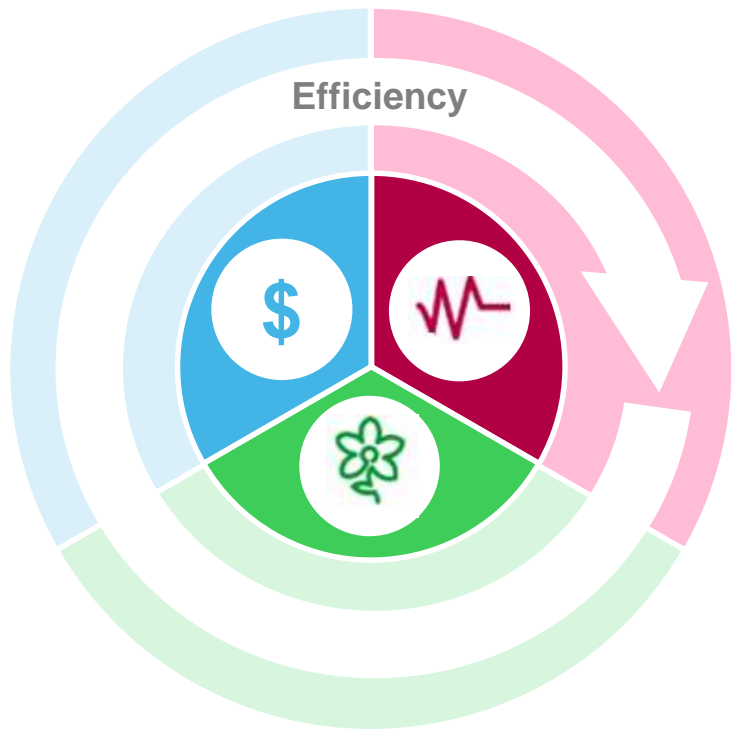
70% of new capacity additions will be in Renewables by 2040

Source : BNEF

Microgrid Megatrends: Smart Districts, Smart Cities & Campuses

- Thermal vs Electric priority
- District Energy:
 - Traditional context: Thermal Distribution
 - New Context: Thermal plus Electrical Resilience
- Resilient Cities
 - Rockefeller Foundation: 100 Resilient Cities
 - Member Cities Include: Vancouver, BC; Calgary, AB; Toronto, ON; Seattle, WA; Washington, DC; Boston, MA
 - Protect against hurricanes, disasters (e.g. Hurricane Maria, Sandy, etc...)
 - Resilience for cities is great marketing tool for business, events, commercial properties
- Sustainable Companies
 - RE100 group of companies – Committed to 100% Renewable Power
 - Member Companies: Schneider Electric, ABInBev, AstraZeneca, Coca-Cola, Facebook, GM, HP, J&J, Nike, P&G

What New Energy “Prosumers” are looking for



Cost

- Lower / More Predictable Energy Costs
- Energy / Fuel Source Arbitrage
- Flexibility drives savings / incremental revenue

Resilience

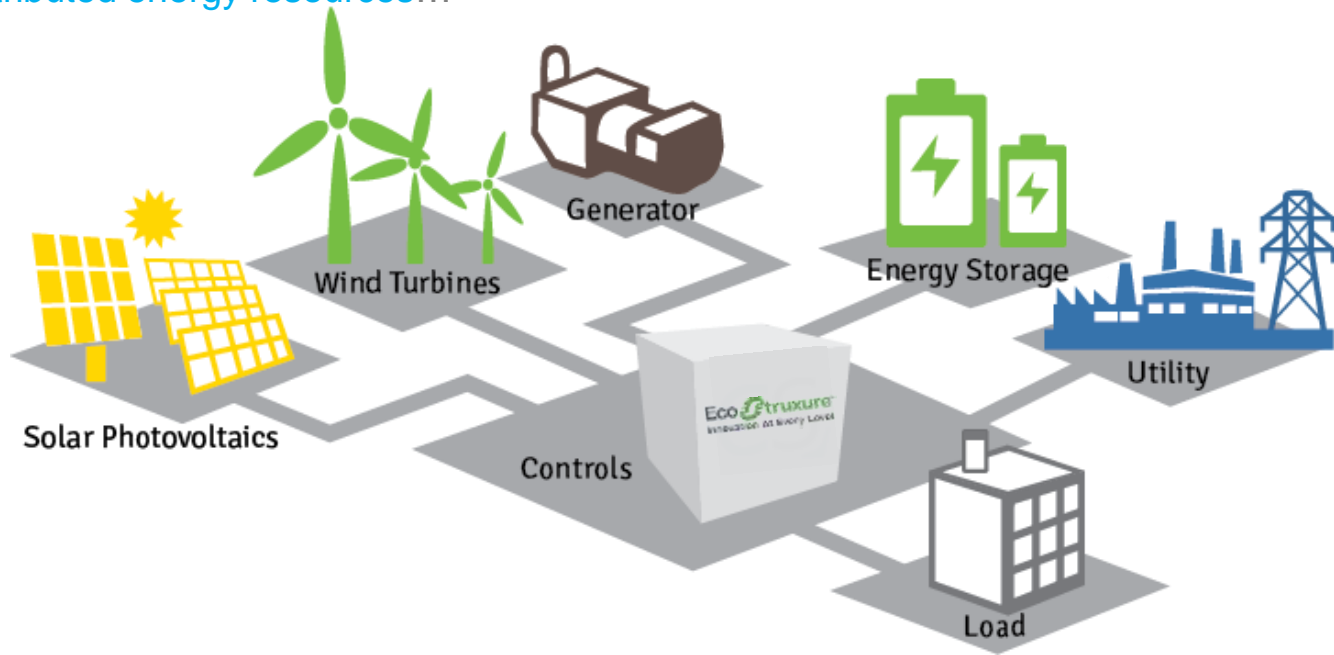
- Serve loads during times of grid instability
- Oasis for employees / customers – shelter in place
- Protect power sensitive / critical assets from poor power quality

Sustainability

- Reduce carbon footprint
- Improve brand image
- Attract / Service carbon sensitive customers

What is a Microgrid?

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



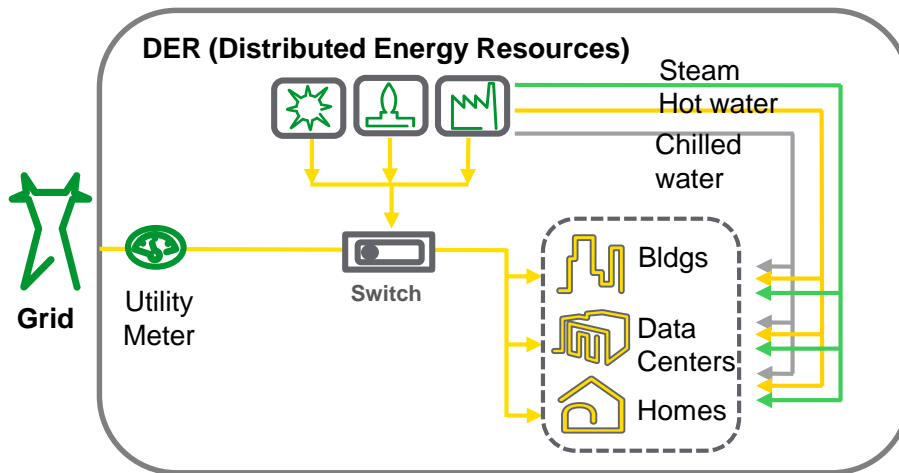
...which as an integrated system can be **controlled as a single entity** and operate in **parallel with the grid** or in an intentional **islanded** mode.

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Combined Heat and Power & Microgrids

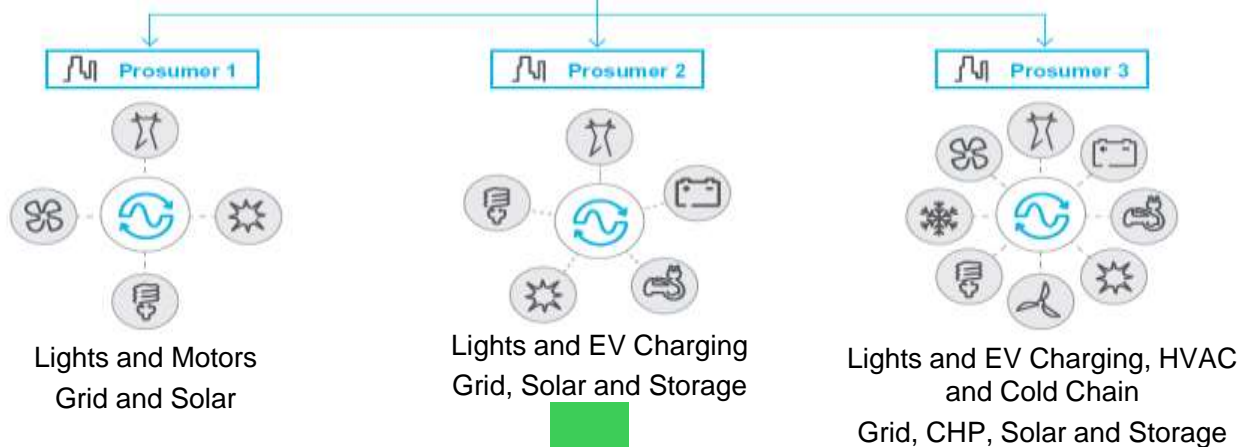
CHP provides superior reliability, meeting a site's thermal needs in addition to its electrical needs, round-the-clock, even in the event of a grid outage.



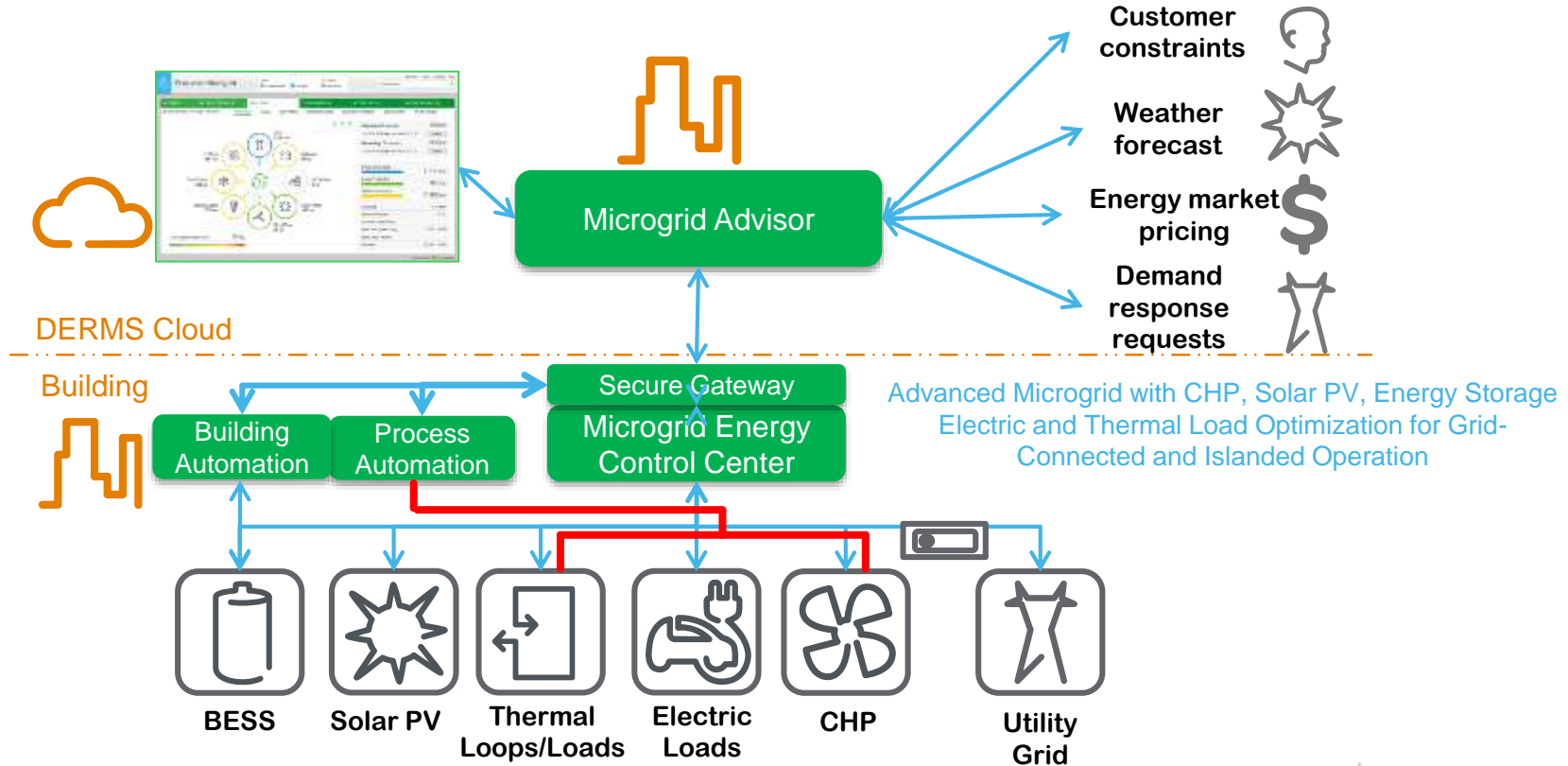
- Steam, hot water and chilled water is produced at District Energy Centers
- Environmentally Sound
- Individual buildings do not need their own chillers/boilers
- Easy to operate and maintain
- Comfortable and Convenient
- Provides Architectural Flexibility
- Take advantage of incentives (gov't: Fed, State, local utility)

**Prosumers have varying
degrees of supply and
demand flexibility**

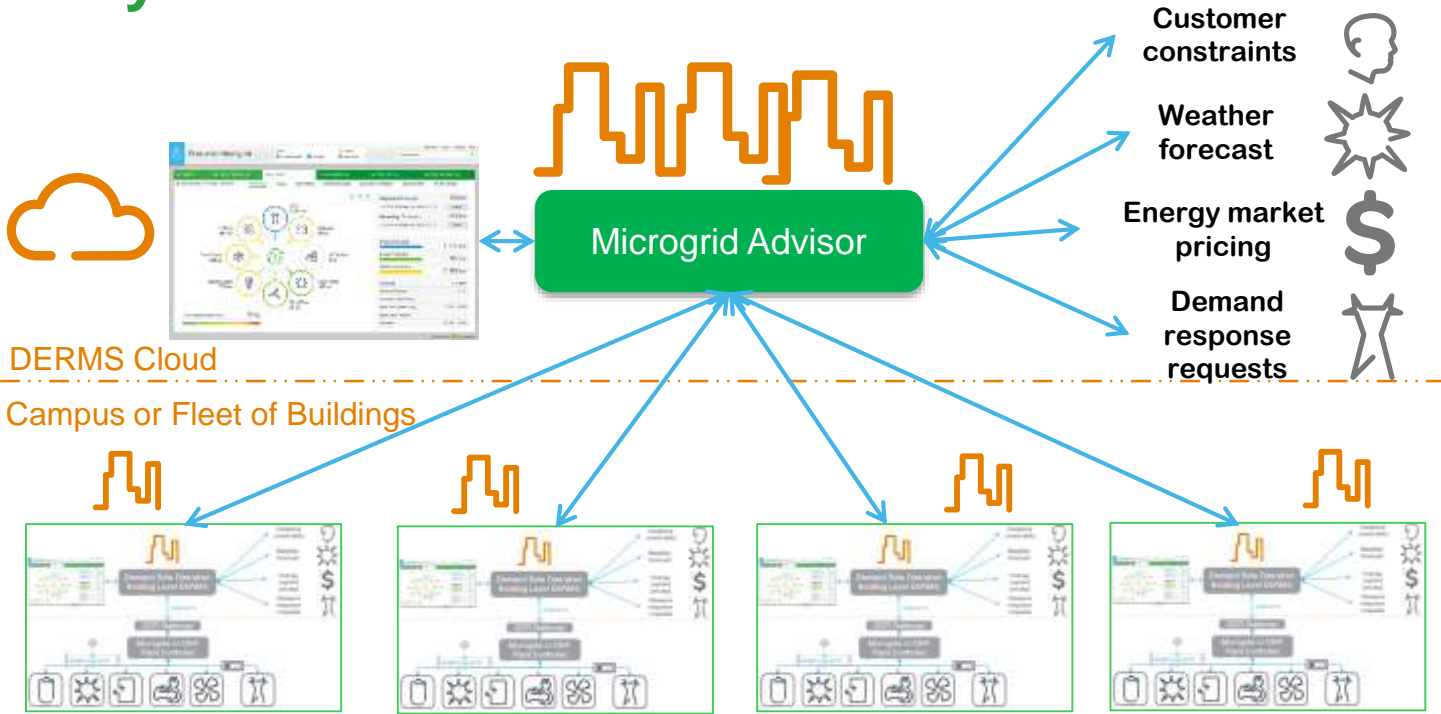
**The more flexibility
the better the optimization**



Microgrid Architecture – Building or Facility

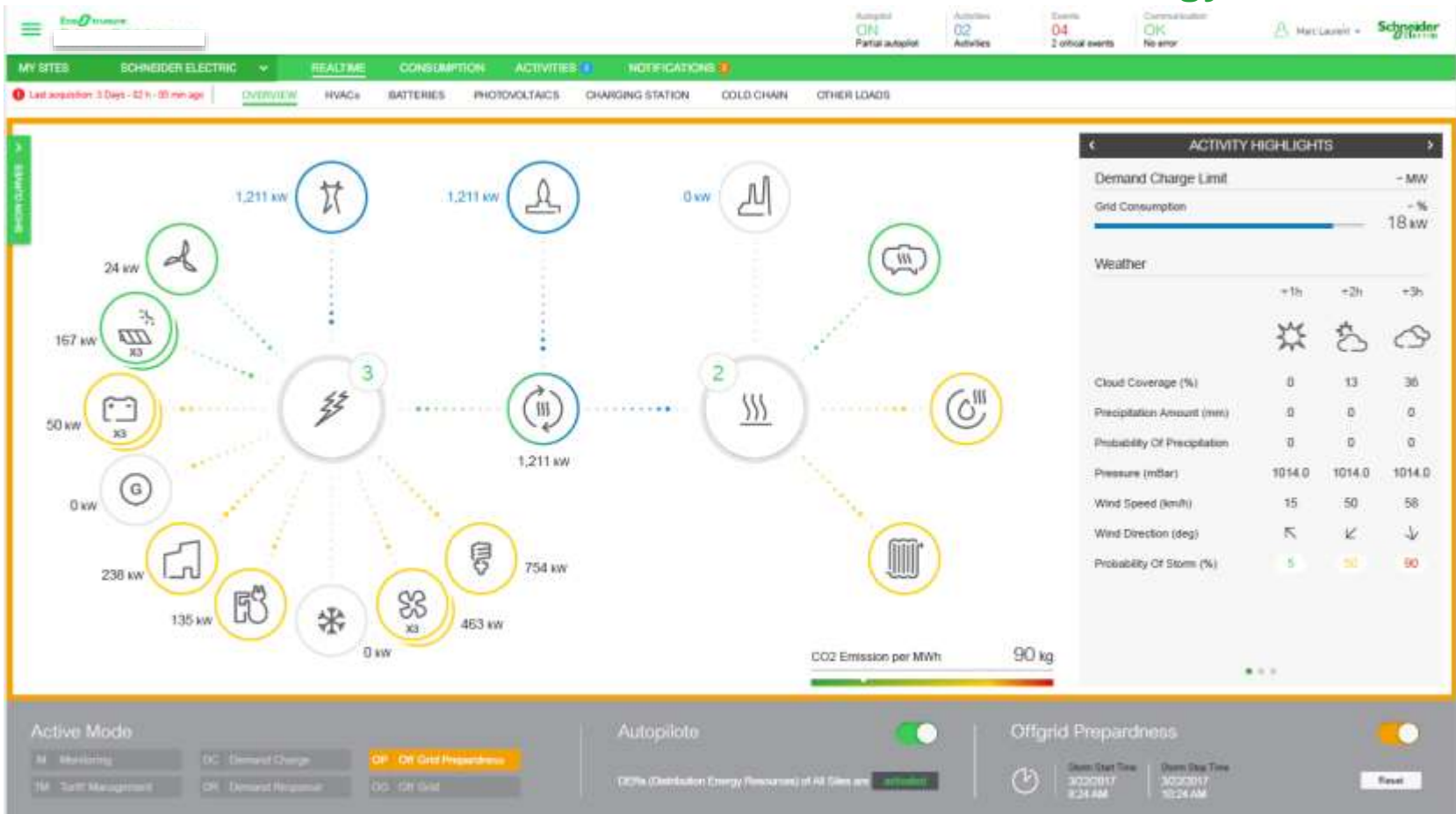


Microgrid Architecture – City, Complex, Campus or Facility Fleet



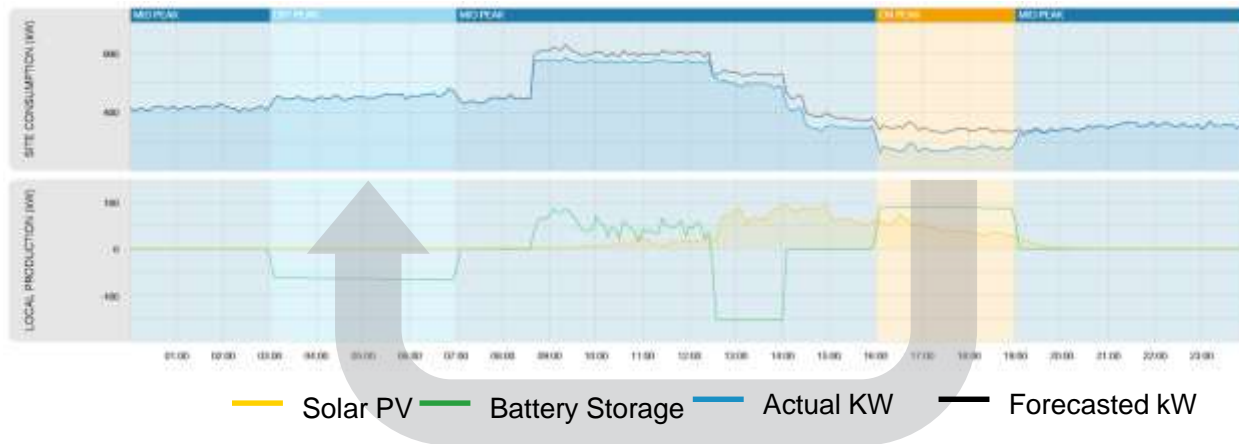
EcoStruxure Microgrid Advisor

Monitor, Predict and Control Electrical and Thermal Energy



Peak Electric, Thermal or Gas Pricing – Tariff Optimization

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



Mixed Use Case at the Prosumer Microgrid

- Prosumer optimization of battery charge, discharge and peak shaving
- However a utility demand response (DR) event may “interrupt” prosumer operation and execute based on what utility wants.
- Algorithm abandons Peak Shaving, and must recharge to prepare for DR event. We have left the Prosumer benefit and shifted to the Utility benefit.

Demand Limit Management – Peak Shaving

Minimize / avoid fees by shaving peak demand



— Solar PV — Battery Storage — Actual kW — Forecasted kW

- *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

IMT Campus Microgrid (Institute of Jobs and Techniques)

Type: Smart District

Location: Grenoble, France

Size: 7 buildings

Completed: Under execution

Customer pain point

Better integrating local energy generation, managing all energy flow (thermal and electrical), training students about energy

Solution

EcoStruxure Microgrid Advisor leveraging DEMIS features for forecasting and optimizing when to produce consume store energy, regarding all energy flows in the whole campus

Scope

- EcoStruxure Microgrid Advisor with DEMIS
- DER: PV, BMS (HVAC), EV, Energy storage, CHP
- Delivering a learning platform dedicated to students



Logistic center - Finland

Type: Industrial facility, grid connected

Location: Europe

Size: 2 MW

Completed: Under execution

Customer pain point

Having a single control solution for optimizing electrical usage, thermal usage and performing advanced frequency regulation use case

Solution

EcoStruxure Microgrid Advisor for monitoring, forecasting and optimizing when to produce, consume, store both electrical and thermal energy. Participation as well into frequency regulation mechanisms

Scope

- EcoStruxure Microgrid Advisor
- DER: PV, BMS (HVAC), EV, Energy storage, genset, connection to electrical grid and thermal grid



Large Corporate Facility

Type: Industrial facility, grid connected

Location: Foxboro, MA USA

Size: 1.1 MW

Completed: Under execution

Customer pain point

Having a single control solution for optimizing electrical usage, thermal usage and “islanding” during local Utility outage.

Solution

EcoStruxure Microgrid Advisor for monitoring, forecasting and optimizing when to produce or consume electrical energy. Termis and EcoStruxure Profit Advisor to optimize thermal production and distribution.

Scope

- EcoStruxure Microgrid Advisor, Energy Control Center
- EcoStruxure Hybrid DCS, Termis,
- DER: PV, BMS (HVAC), genset, new absorption chiller CHP connection to electrical grid and thermal grid

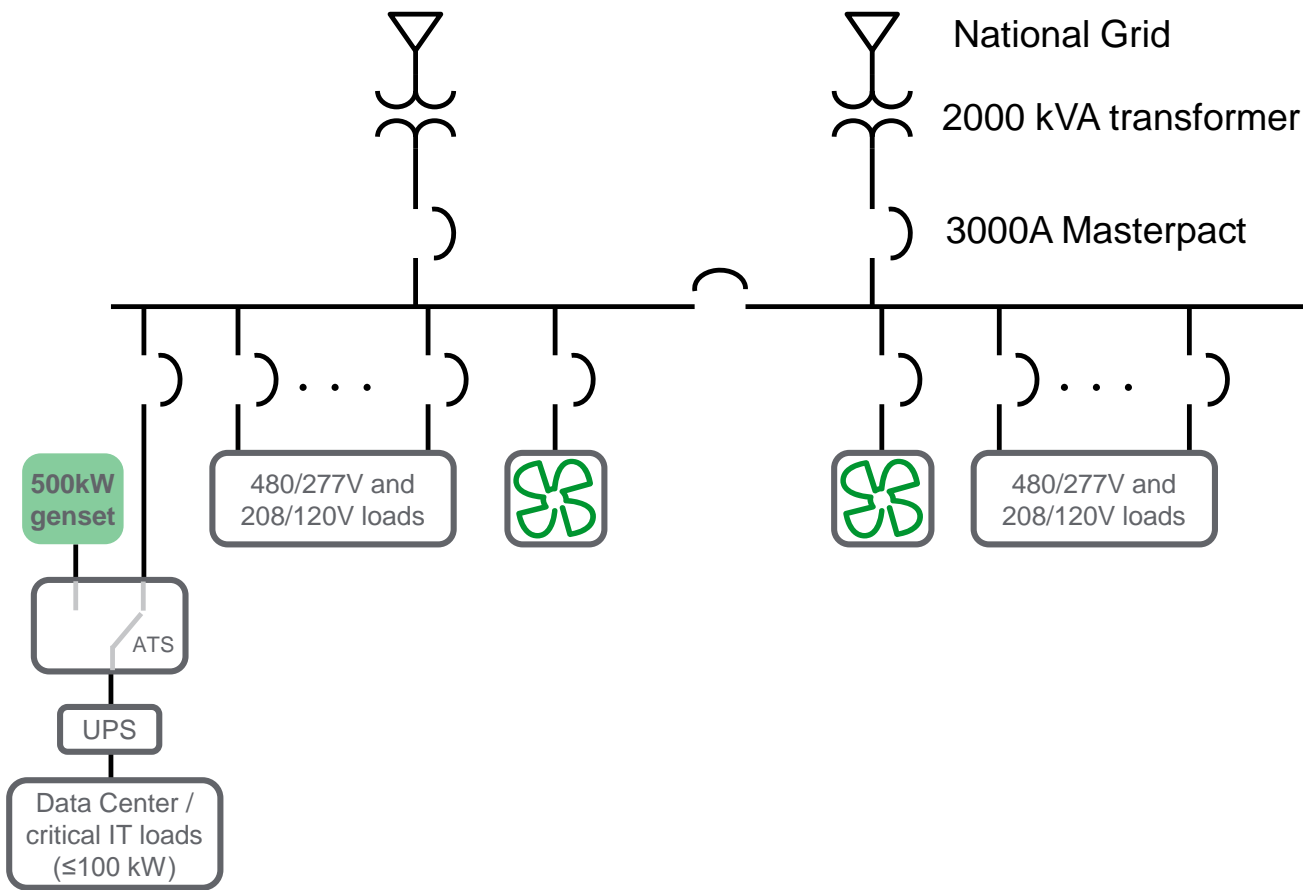


North American Power Generation Headquarters

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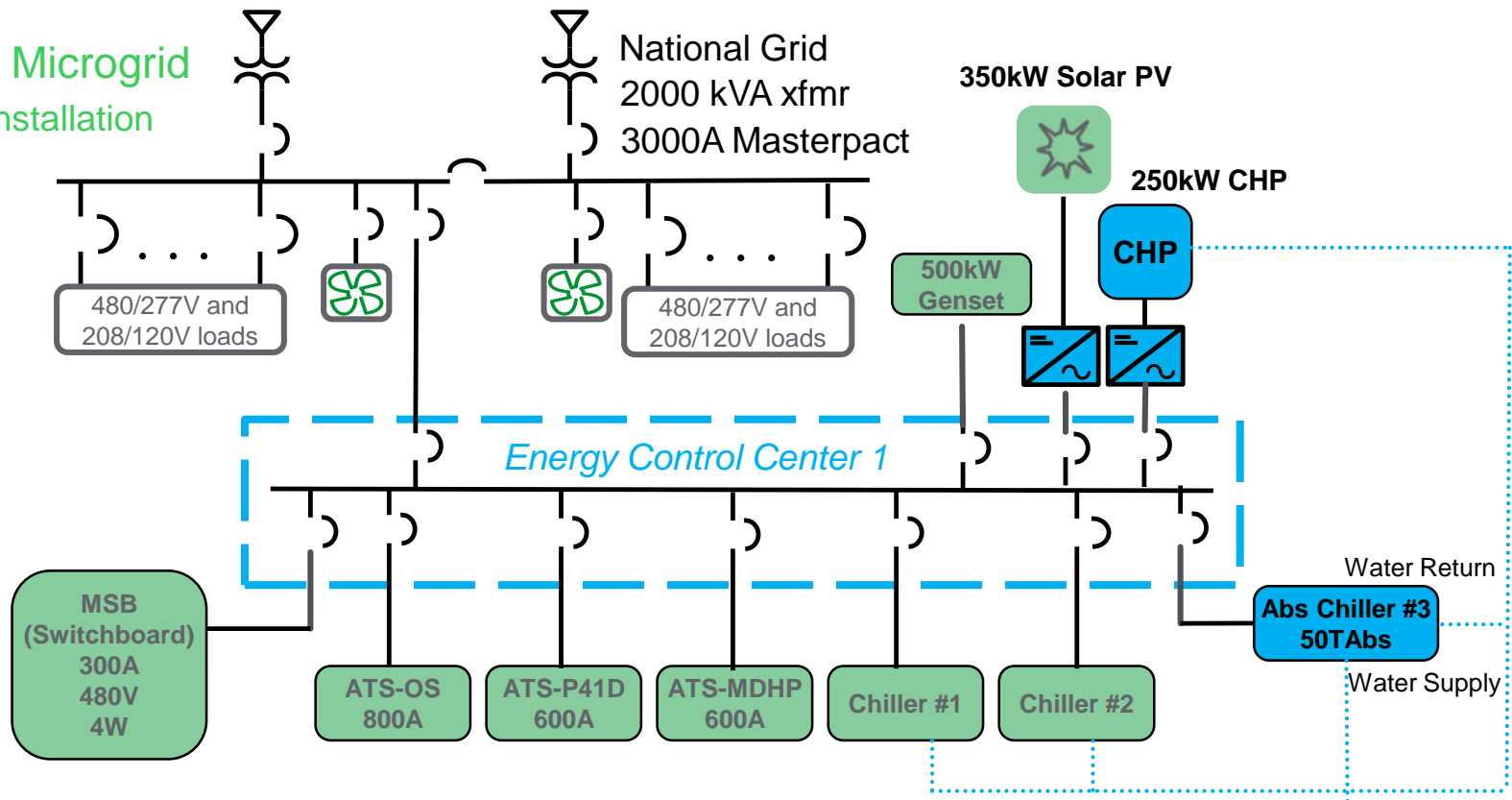
Cocasset – Initial State




Key factors

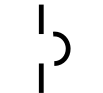
- Several outages since moving into building
- Total load ranges from ~350kW to ~1.5MW
- Existing 500 kW genset feeds critical load through an Automatic Transfer Switch (ATS)
- Stranded genset capacity: > 400kW

Cocasset Microgrid
With CHP installation



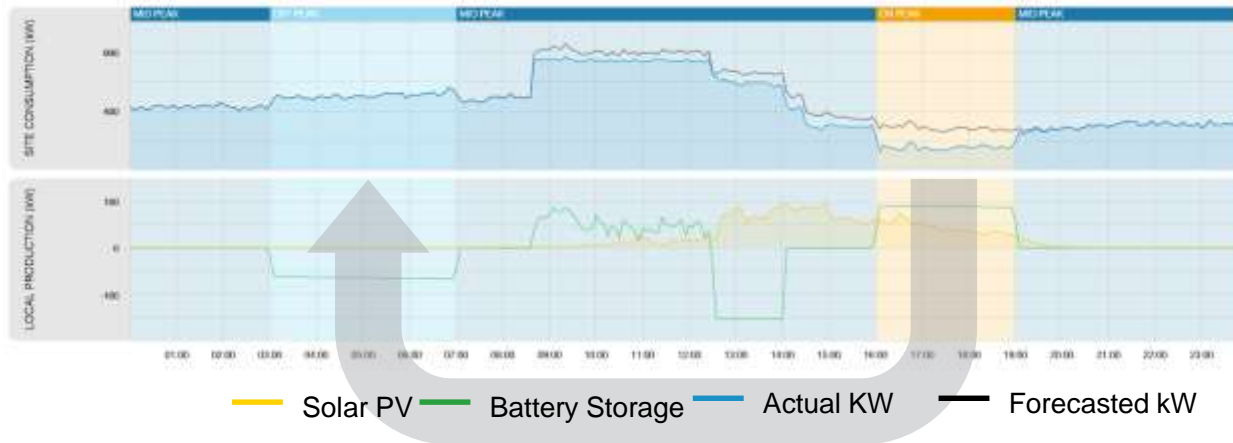
 Part of current project

 Process Lines

 Elec. One line

Peak Electric or Gas Pricing – Tariff Optimization

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



Source: Oncor – May 27, 2015

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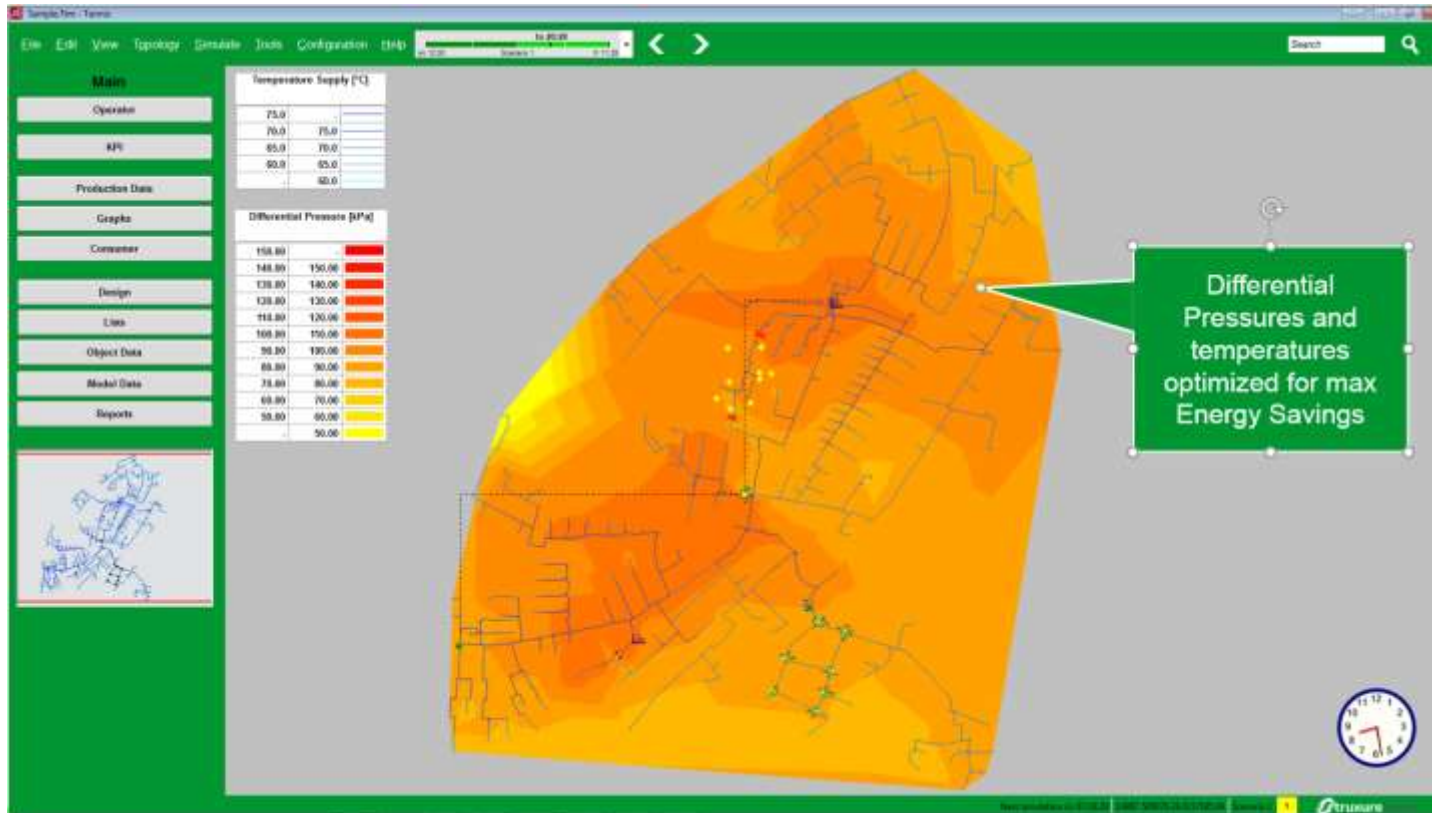


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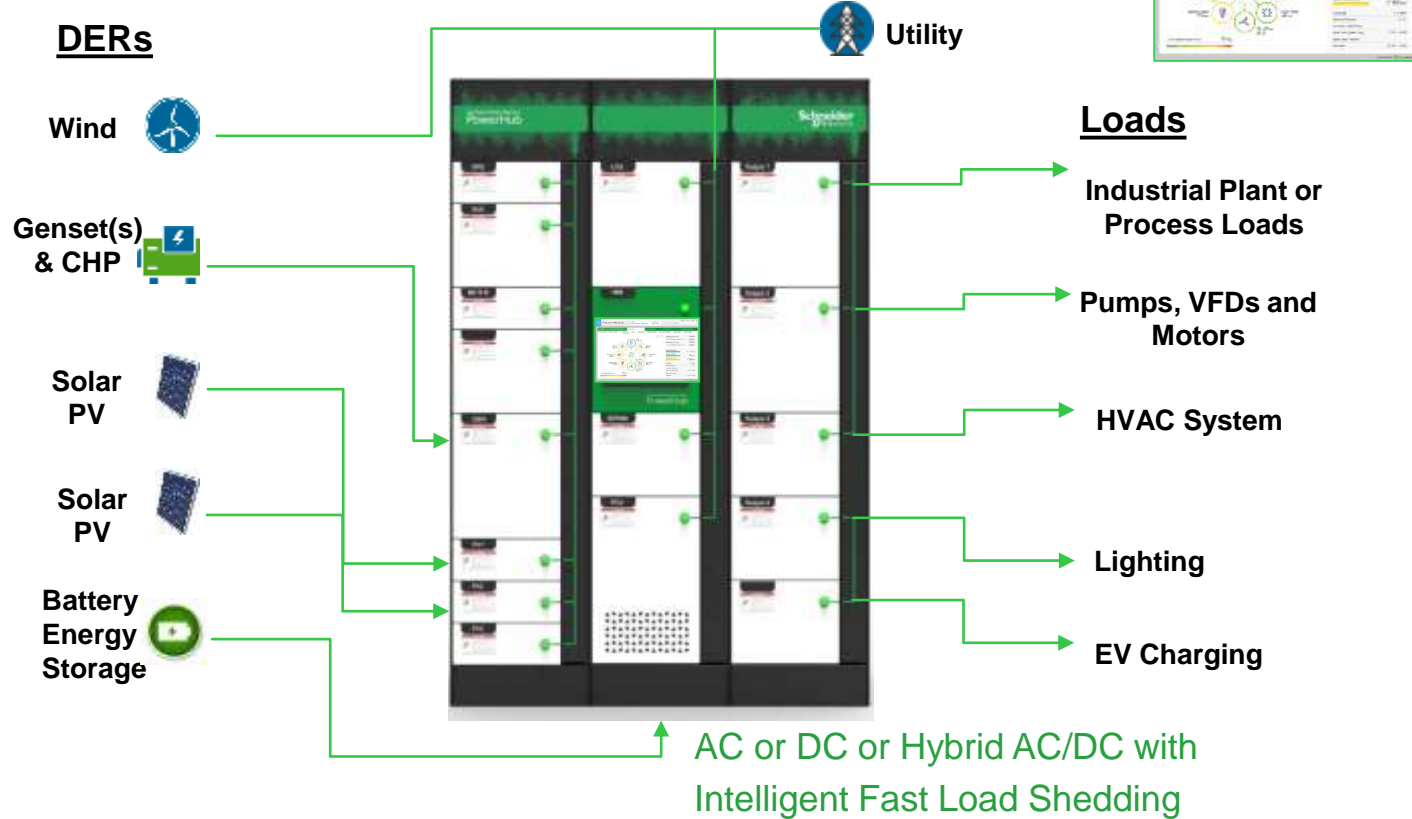
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Termis Software: CHP/District Heating and Cooling Optimization



Microgrid Energy Control Center



EcoStruxure Battery Energy Storage System - NEW

Configuration	125kW/250kWh	250kW/500kWh	500kW/1MWh	1MW/2MWh
Power Cabinets	1	1	1	2
Battery Cabinets	2	3	6	11
Power Cabinet Est. Weight - kg	400	500	700	1400
Battery Cabinet Est. Weight - kg	2990	5850	11700	21450
BESS Est. Weight - kg	3390	6350	12400	22850
Est. SQ. FT	37.5 (3 x 2.5' x 5')	50 (4 x 2.5' x 5')	87.5 (7 x 2.5' x 5')	162.5 (13 x 2.5' x 5')



Note: If bumpless “UPS quality” BESS is needed, we have Galaxy VM series
Used on 60%+ of datacenters globally.



Closing Thoughts

- A New Energy Landscape is here – be ready !
- Energy Optimization requires integrated electrical and thermal (CHP) systems
- Dynamic Microgrid operation needed to achieve optimal:
 - Resiliency
 - Efficiency
 - Sustainability



Questions? Thank you !

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