Decarbonizing Canada's Remote Communities

Presented by:
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Schneider Electric Canada

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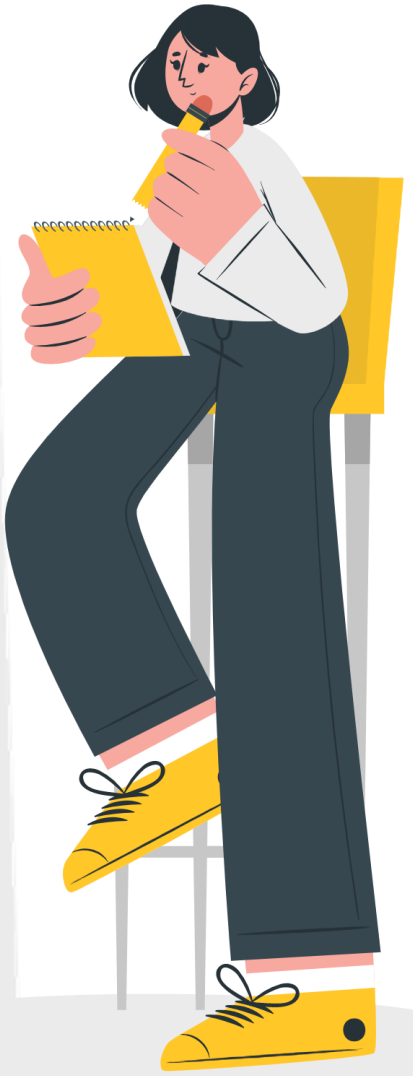
Agenda

- ☑ Energy Landscape : Canadian Remote Communities
- ☑ Impacts of current source of power
- ☑ Microgrid Solution
- ☑ Schneider Products and Services
- ☑ Q & A



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Energy Landscape in Canada's Remote Communities

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Did you know?

276

Remote Communities

169

Indigenous Communities

61%

of the Communities don't have road access

BC has the highest count of remote communities

174,605 GWh

Highest annual energy requirements

187 GWh

Highest annual energy requirements (Indigenous)

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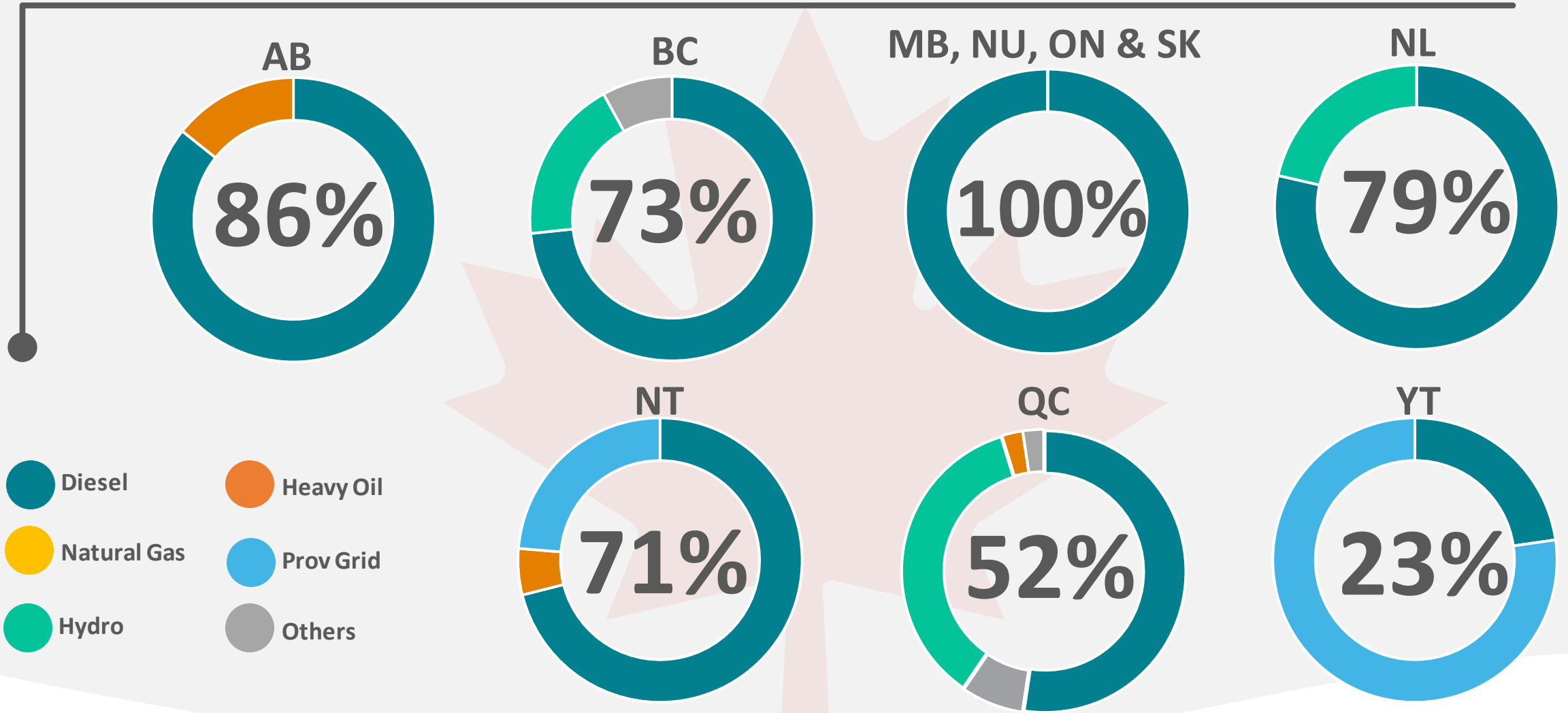
How communities get electricity?



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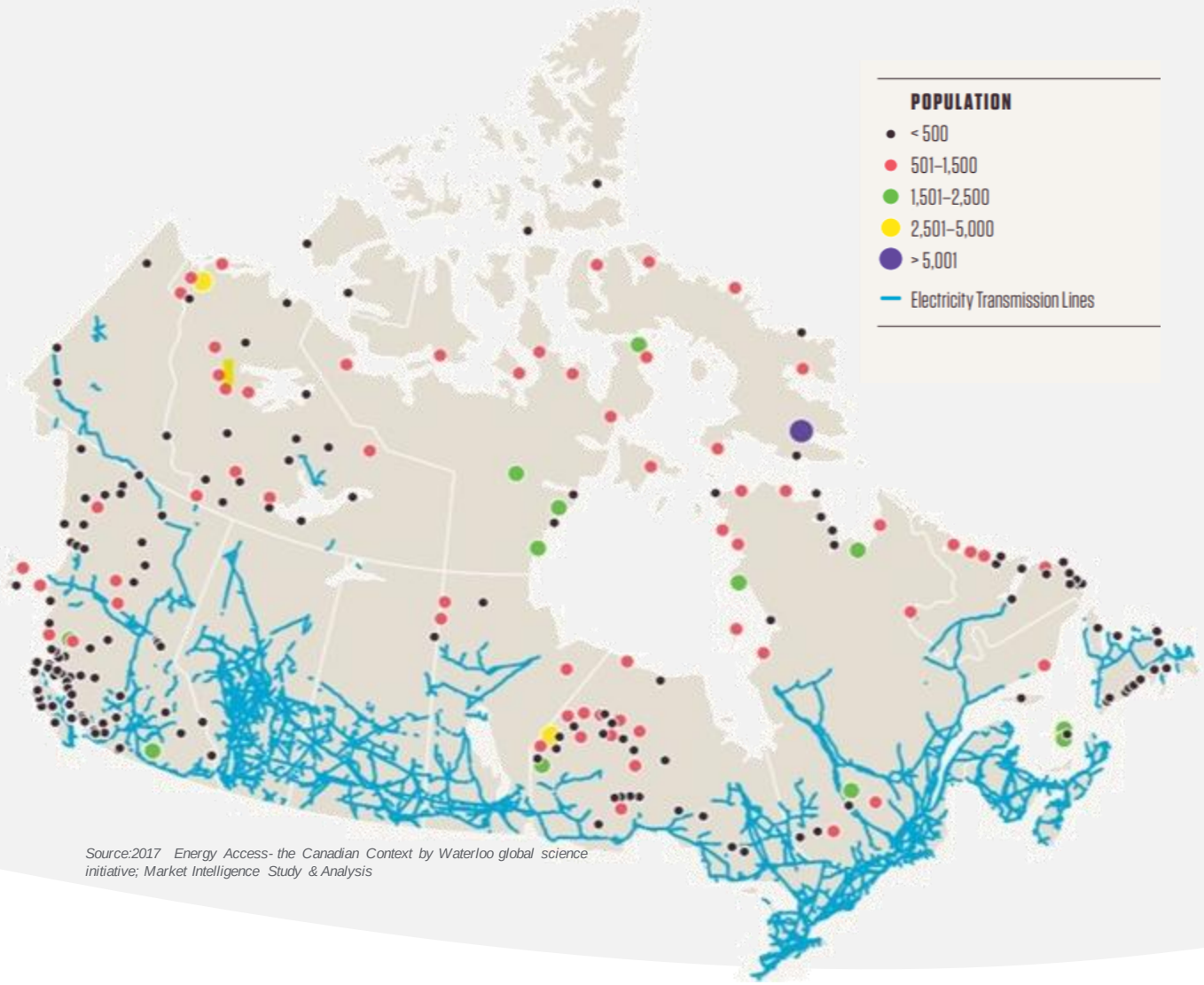
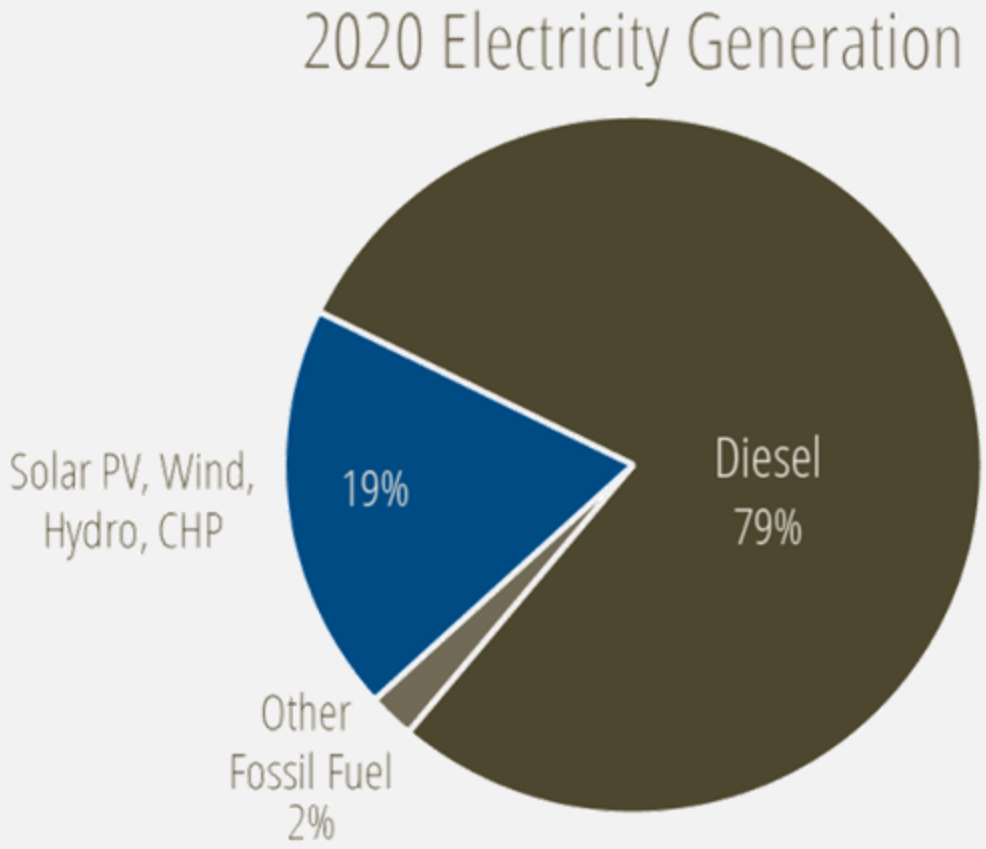
How communities get electricity?

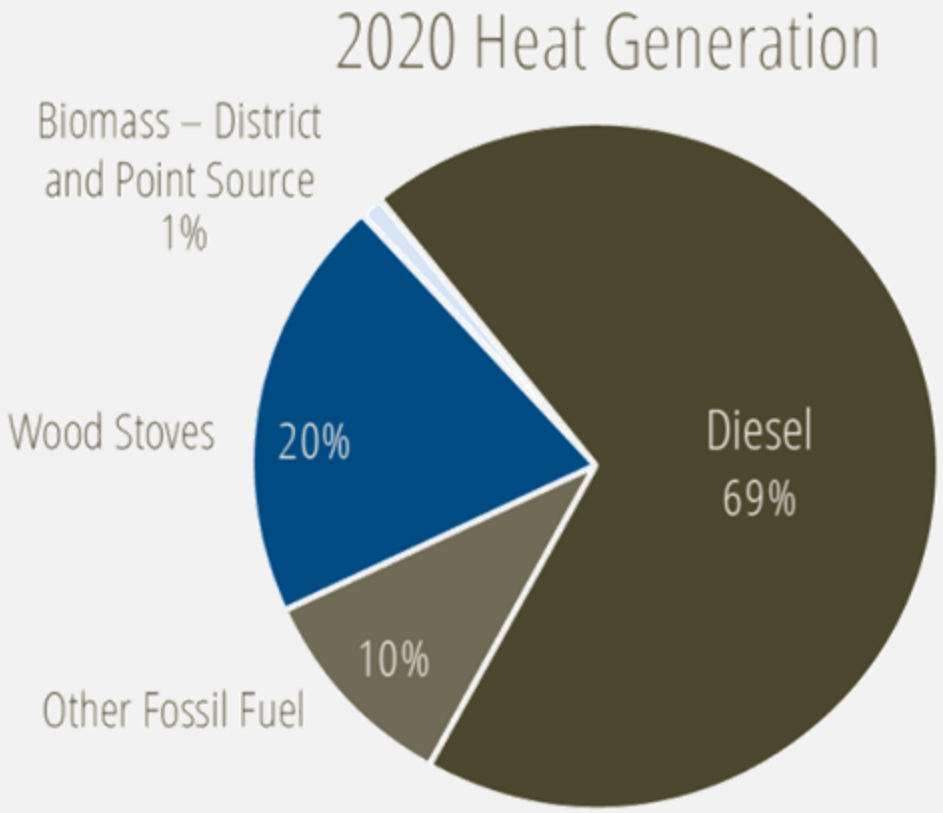


Source:2017 Energy Access- the Canadian Context by Waterloo global science initiative; Market Intelligence Study & Analysis

- Difficult Fuel accessibility
- Cold & Harsh Climate
- High Variance in Demand
- Limited Generation Capacity

Current Renewable Energy Penetration





Source: Pembina Institute - Diesel Reduction Progress in Remote Communities

Impacts of Diesel Power Generation

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Impacts

- Increasing and fluctuating cost of fuel, including high delivery costs.
- Economic burden of subsidized electricity.
- Higher maintenance costs and higher scalability cost.
- Existing capacity limitations on local economic growth potential.

Impacts

- Greenhouse gas emissions from diesel combustion and transportation.
- Risk of diesel spills in-situ and in transit, causing contamination of soil and ground water.
- Health implications to the local population and wildlife.

Impacts

- Capacity limits growth and economic potential of communities, and other critical infrastructure development
- Noise and local air pollution emissions affect well-being of local population
- Effects of diesel contamination on local population’s health and well-being

Microgrids Solution: Diesel Consumption Reduction

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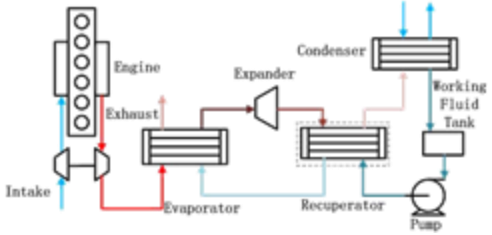
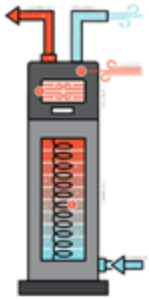
Progress on Diesel reduction

9% Energy Efficiency

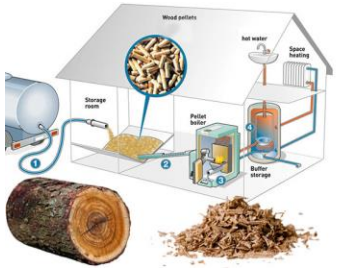


Waste heat recovery



Electric heat pumps

33% Renewable Heat



Electric heat pumps

Biofuel CHP (Heat)

28% Renewable Electricity

Wind

PV

Small Hydro

Biofuel CHP (Power)

29% Grid Connection

Source: Pembina Institute - Diesel Reduction Progress in Remote Communities

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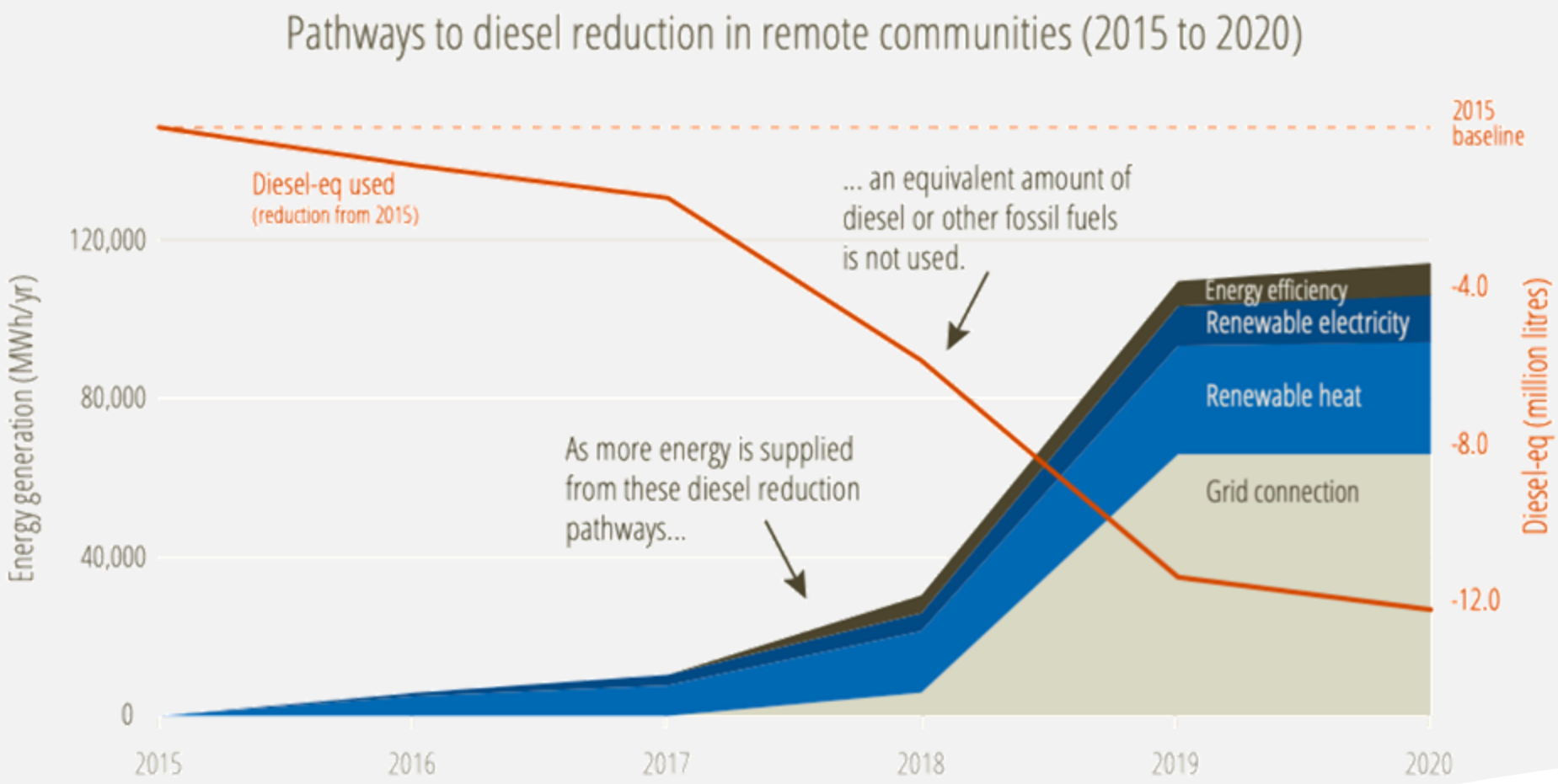
Progress on Diesel reduction



Source: Pembina Institute - Diesel Reduction Progress in Remote Communities

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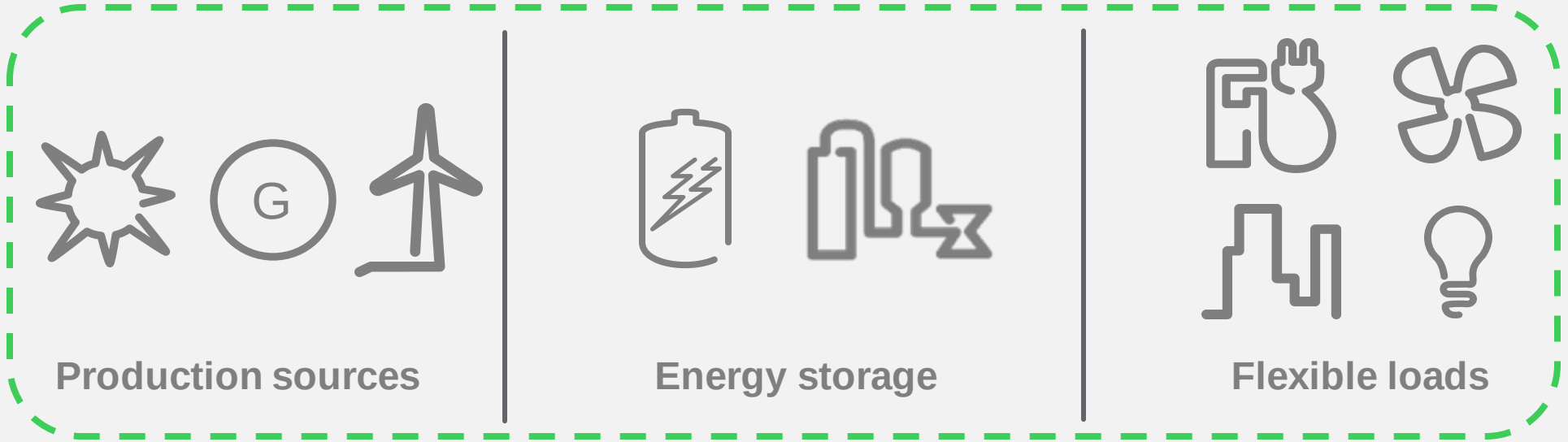
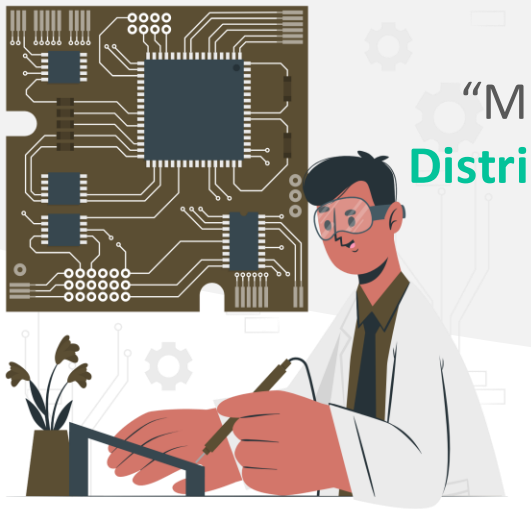
Microgrid Solution

Microgrids and Distributed Energy Resources



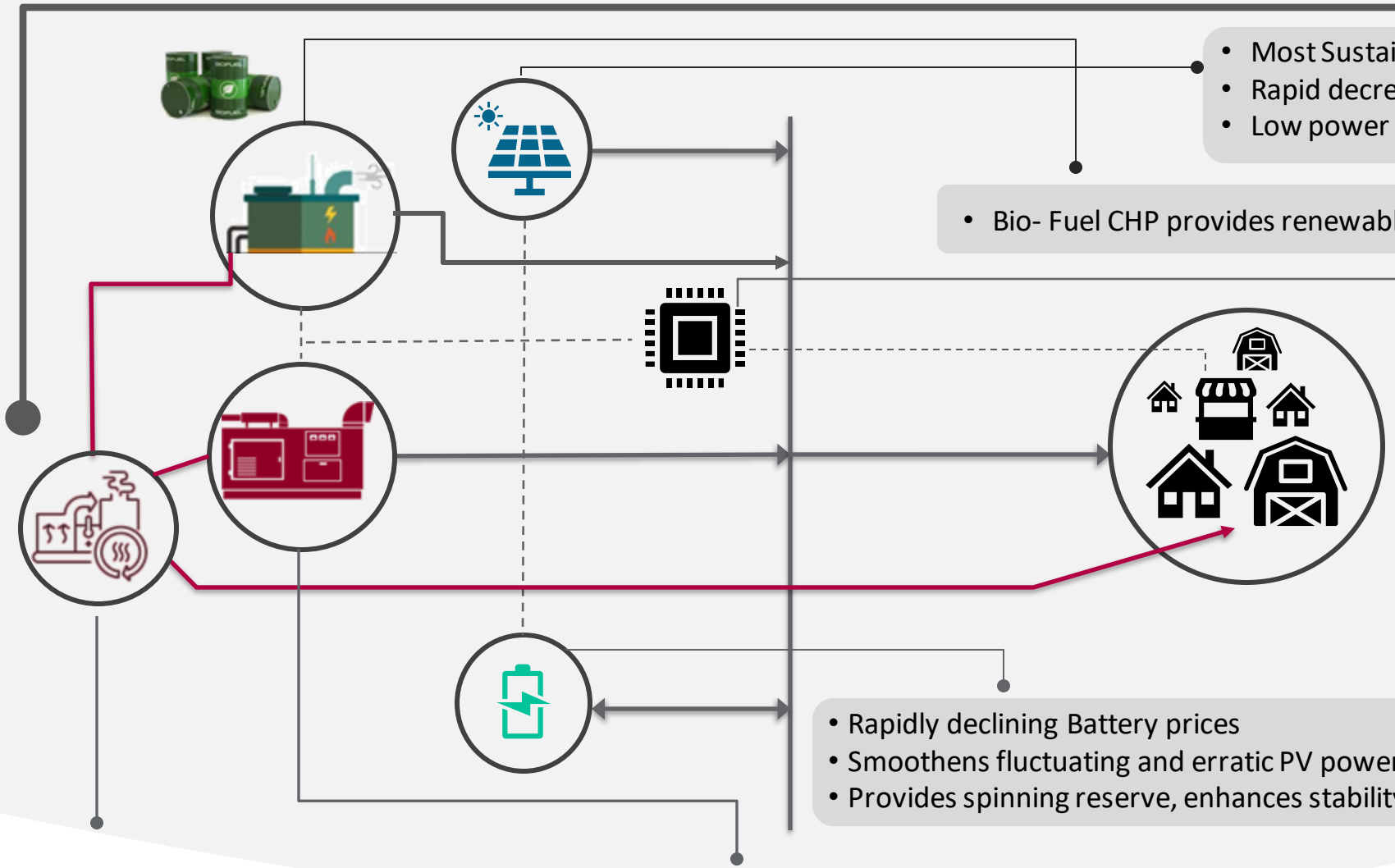


Microgrids

"Microgrids are an **integrated energy system** consisting of a group **interconnected Distributed Energy Resources** within **clearly defined electrical boundaries** that act as a **single controllable entity** with respect to the grid"

- as per US Department of Energy

Microgrid Solution



- Most Sustainable renewable energy generation
- Rapid decrease in PV LCOE
- Low power generation OPEX

- Bio- Fuel CHP provides renewable heat and power.

- Microgrid control Maximizes utilization of renewable generation
- Utilizes existing & new gensets to provide a stable system as compared to only PV.
- Optimizes DG operation to reduce fuel cost and OPEX.
- Ensures energy independence fulfilling UN SDG-7

- Rapidly declining Battery prices
- Smoothens fluctuating and erratic PV power
- Provides spinning reserve, enhances stability

- Heat recovery unit improves thermal efficiency

- Environmental and Noise pollution
- Lower efficiency
- Fluctuating fuel prices, results in high power generation costs

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Case Study – Ogoki Post, ON

Case Study – Ogoki Post, ON

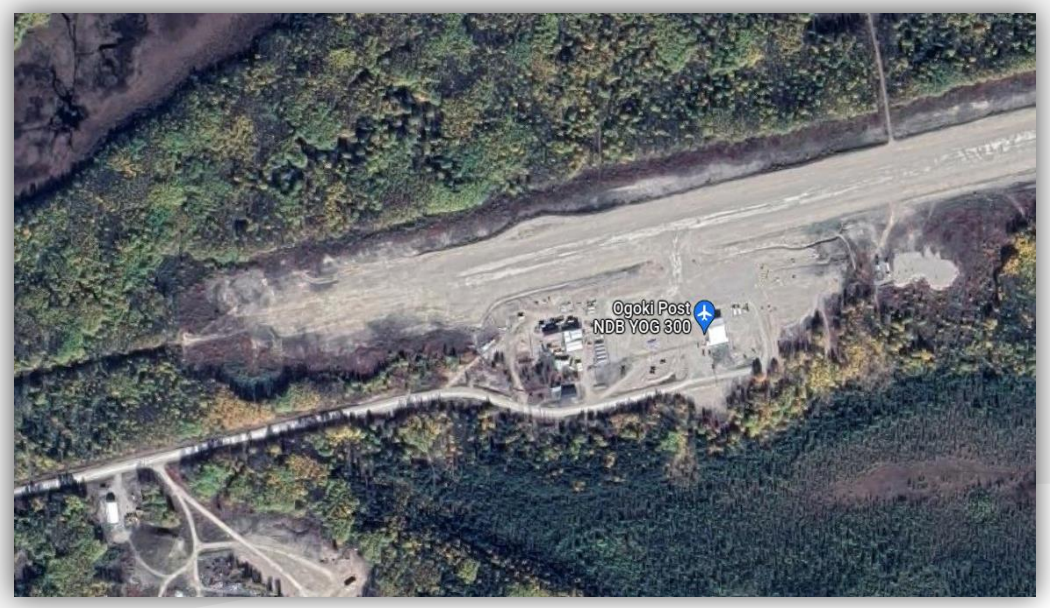
600
Peak Load (kW)

2.02
Annual Energy Use (GWh)

1.46
Diesel Cost ($/l)

$1.13 M
Annual Energy Cost ($)

1485
Annual CO2 Emissions (metric tons)



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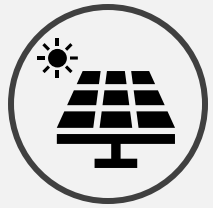
Case Study – Ogoki Post, ON

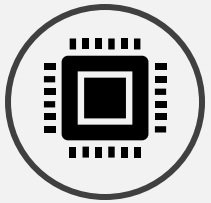


1.2 MW

+

2.7 MWh

+



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Initial CAPEX

$6.1M

OPEX Savings (%) (fuel costs)

67%

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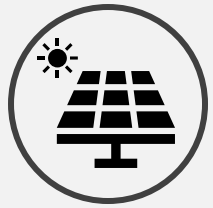
Case Study – Ogoki Post, ON

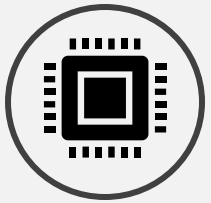


1.2 MW

+

2.7 MWh

+



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Initial CAPEX

$6.1M

Total Savings (%) (incl. annualized capital costs) **24%**

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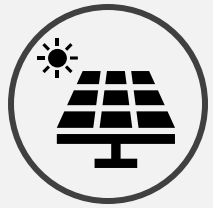
Case Study – Ogoki Post, ON

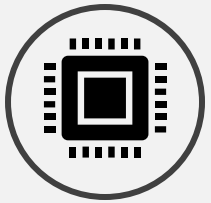


1.2 MW

+

2.7 GWh

+



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Initial CAPEX

$6.1M

Payback (years) **9 yrs.**

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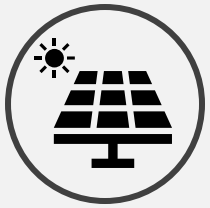
Case Study – Ogoki Post, ON

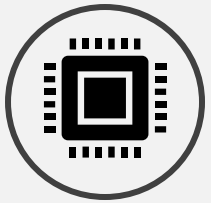


1.2 MW

+

2.7 MWh

+



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Initial CAPEX

$6.1 M

Diesel Fuel Saved annually (kilo-liter) **389 kl**

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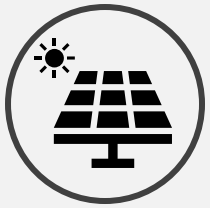
Case Study – Ogoki Post, ON

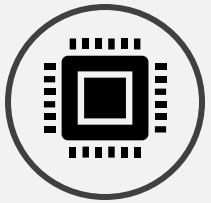


1.2 MW

+

2.7 MWh

+



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Initial CAPEX

$6.1M

Total Annual Savings
CO_2 Emissions

70%

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1.2 MW + **2.7 GWh** + = Initial CAPEX **$6.1 M**

Energy Independence

Create Jobs

Living in harmony with nature

60%

Economic Development

Role Model

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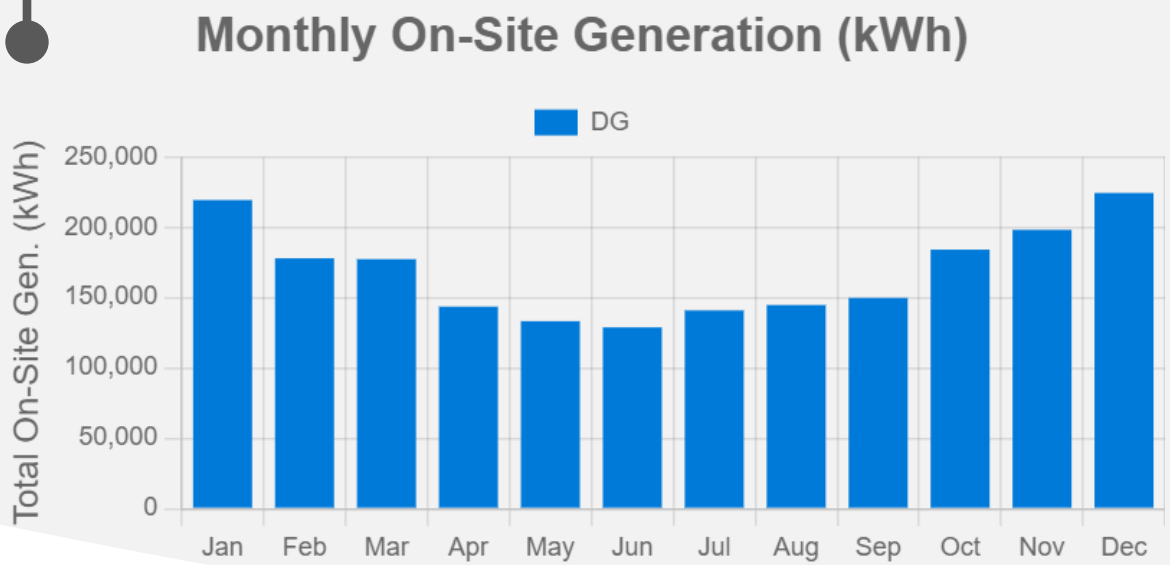
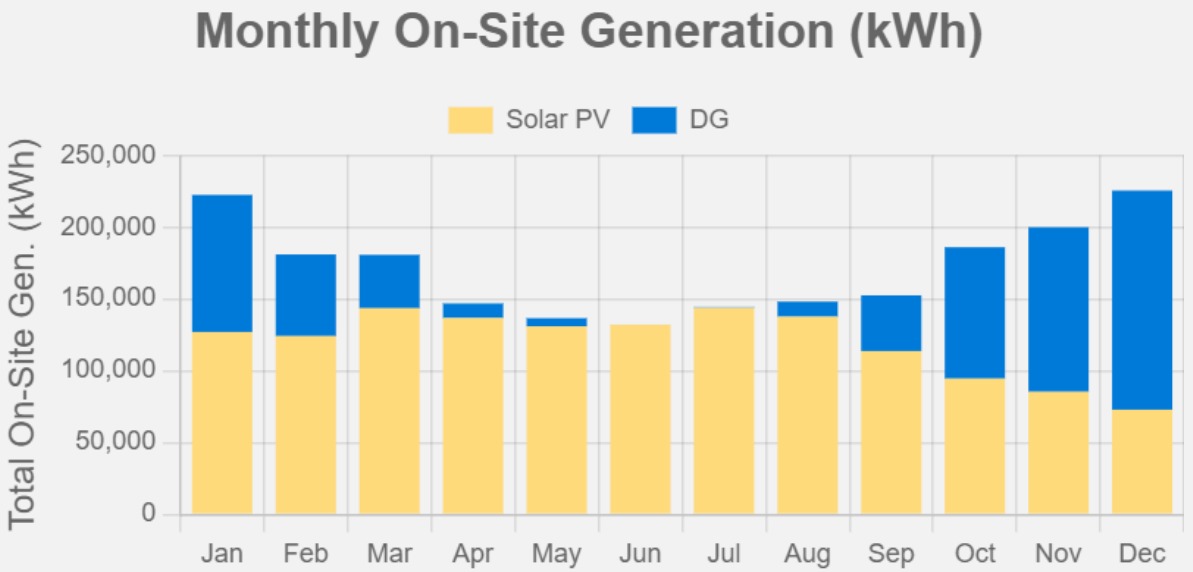
Case Study – Ogoki Post, ON

Without Microgrid



With Microgrid



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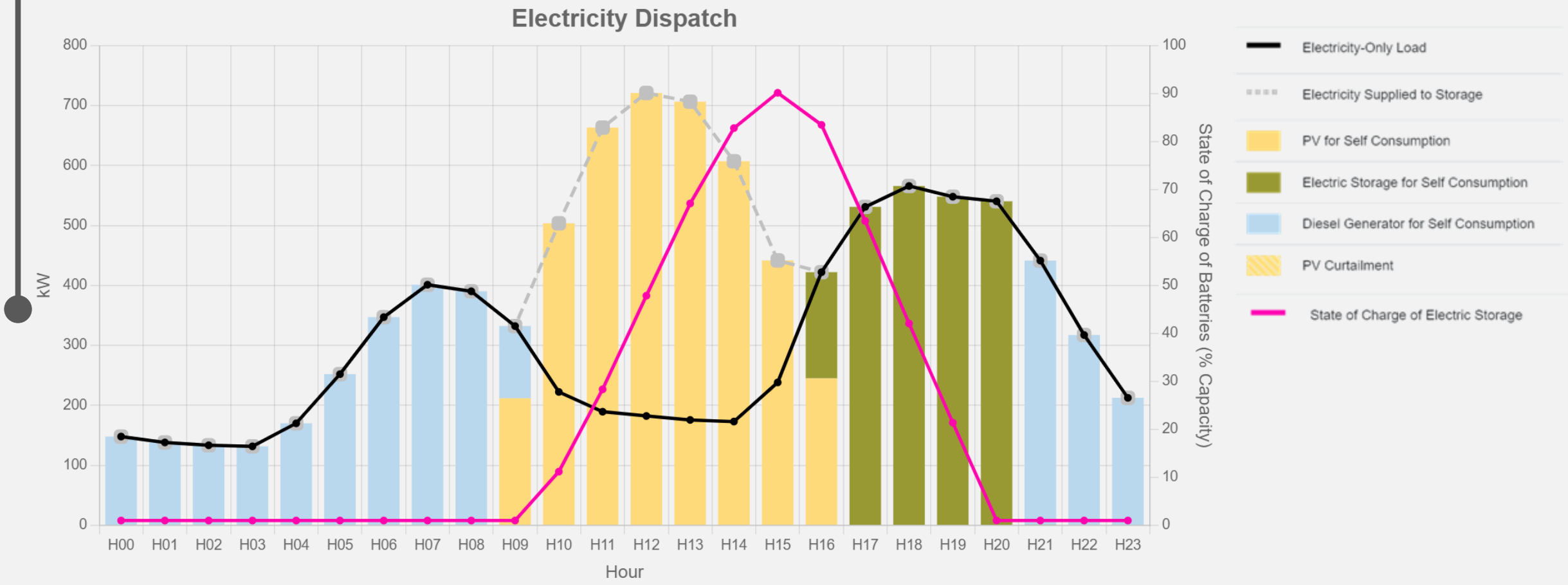
Case Study – Ogoki Post, ON



January - Weekday

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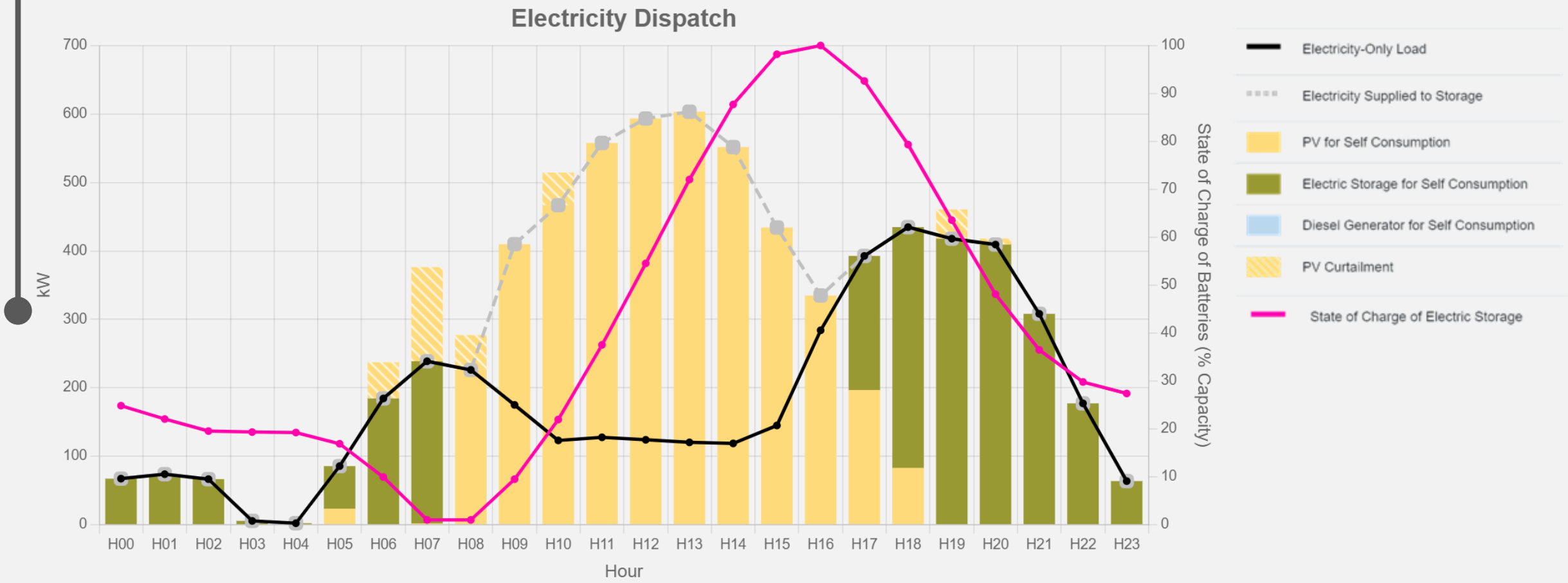

June - Weekday

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Schneider Electric- Off Grid Microgrid Solutions

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Microgrid Technology Bricks

Apps, Analytics & Services

EcoStruxure Microgrid Advisor

Edge Control

EcoStruxure Microgrid Operation Large Sites

EcoStruxure Power SCADA Operation

Fuel Saver- EcoStruxure Microgrid Operation

EcoStruxure Microgrid Operation Medium Sites

Connected Products

Galaxy UPS

Solar Inverter

ECC

Power Quality Products

BESS

Metering, control & protection

LV Distribution products

MV Distribution products

EMS Energy Management System	3rd Party Systems	
PMS Power Management System	3rd Party Systems	
ED Electrical Distribution	3rd Party Systems	

Other DERs
Distributed Energy Resources

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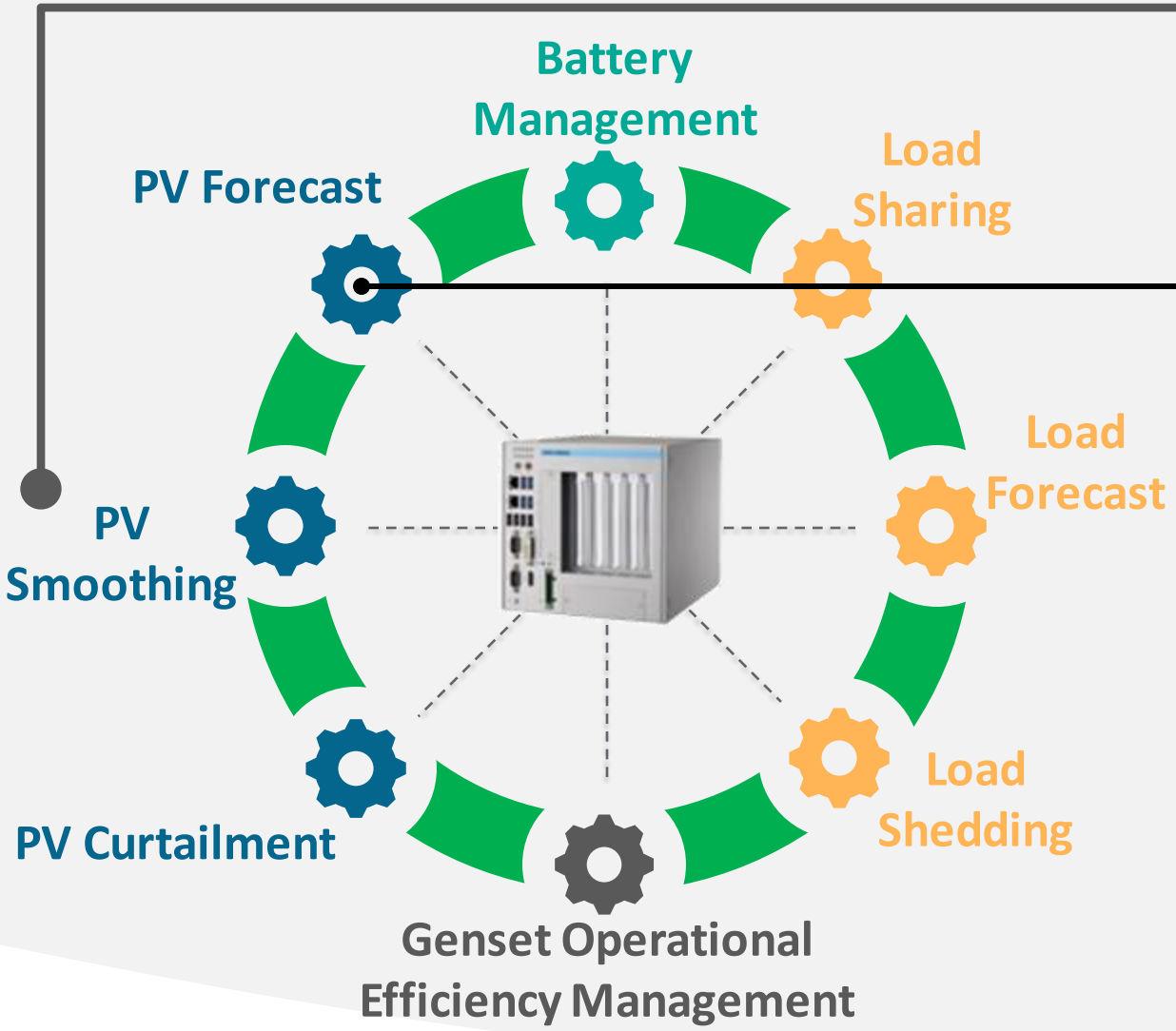
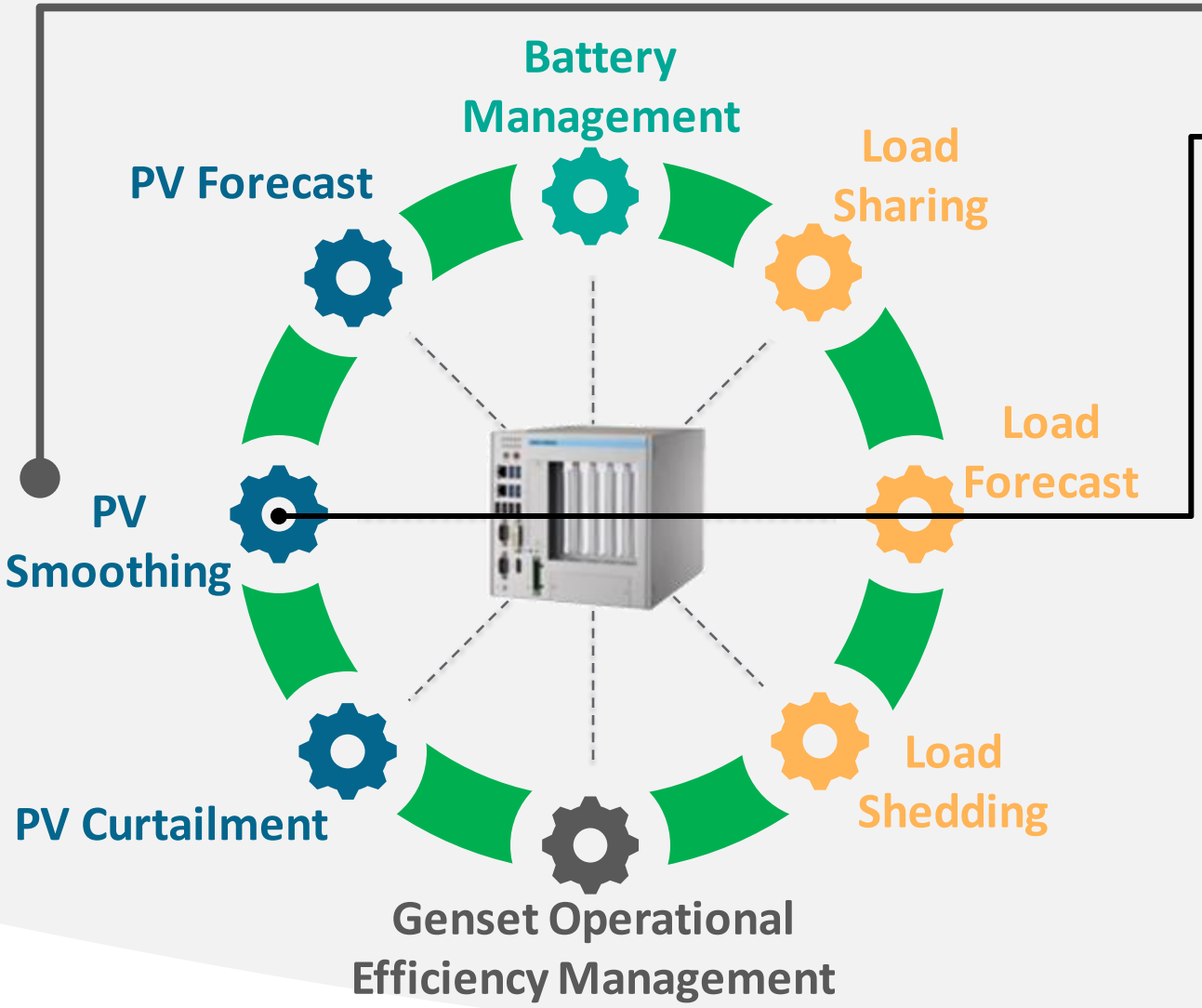
EcoStruxure Microgrid Operation- Fuel Saver



PV Forecasting

- Maintains a database of the real time PV Inverter power values
- Historical database used for PV production forecast
- Forecasts used for determining optimum set-point for BESS

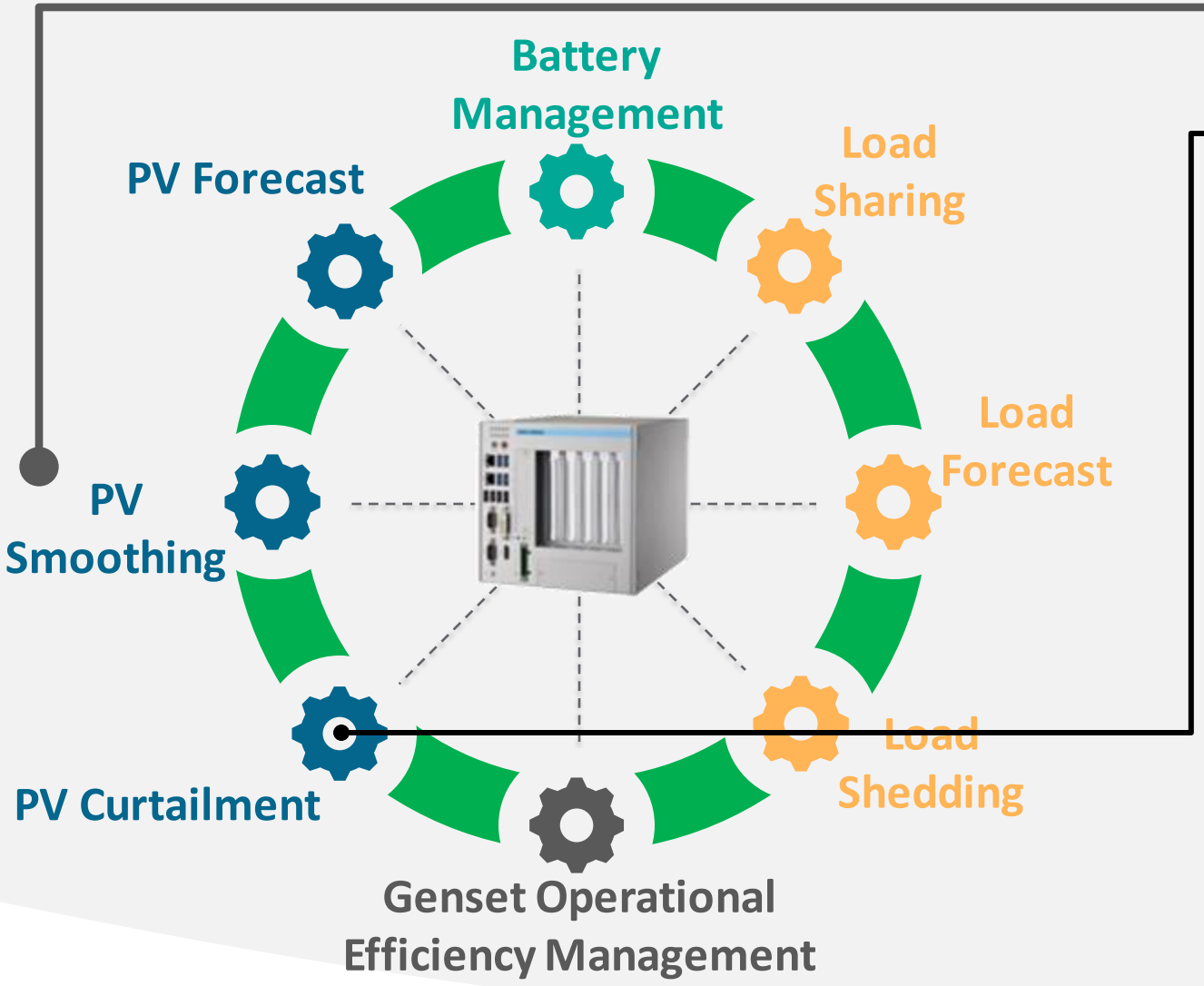
EcoStruxure Microgrid Operation- Fuel Saver



PV Smoothing

- PV active power measurements are filtered into high – low frequency records
- Low frequency data points used to compute genset setpoints.
- High Frequency data points to harden setpoint of BESS

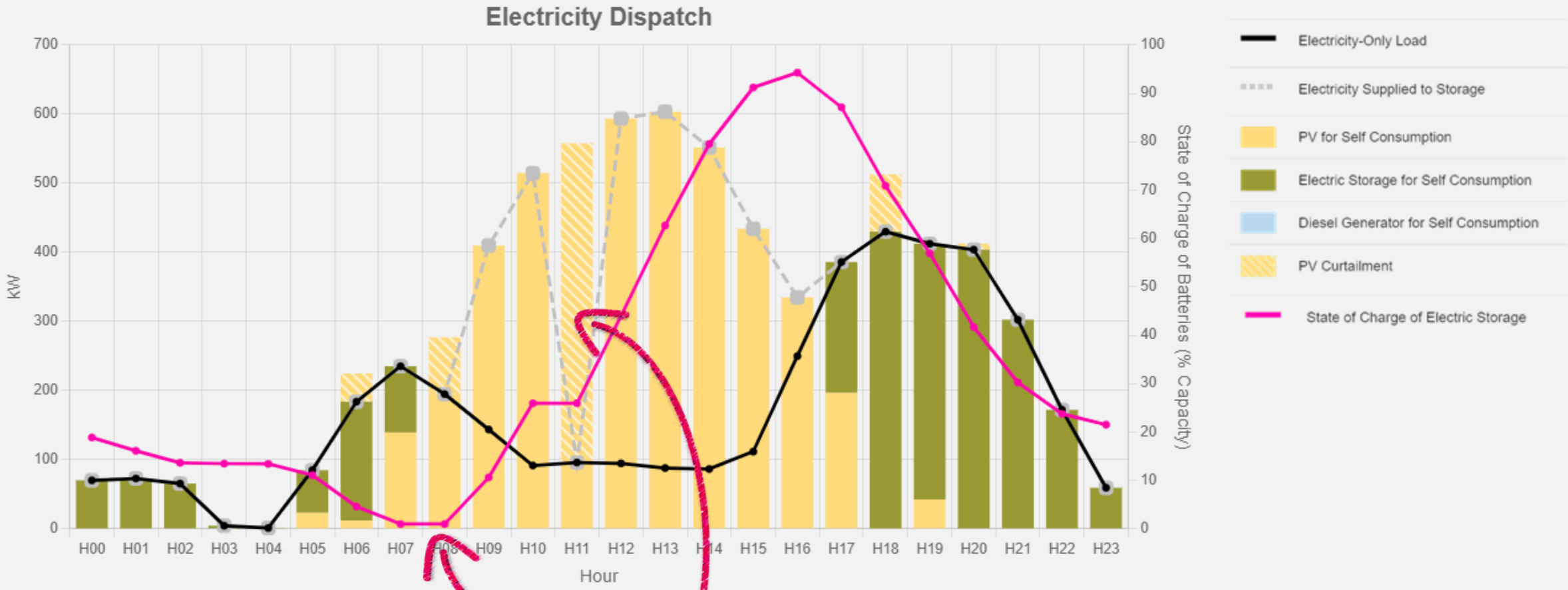
EcoStruxure Microgrid Operation- Fuel Saver



PV Curtailment

- PV power production curtailment to maintain system stability or excess energy production
- EMO Fuel Saver prioritizes the usage of available renewable energy instead of other sources.

EcoStruxure Microgrid Operation- Fuel Saver



June - Weekend

PV Curtailment to stabilize system

PV Forecasting helps manage BESS setpoints

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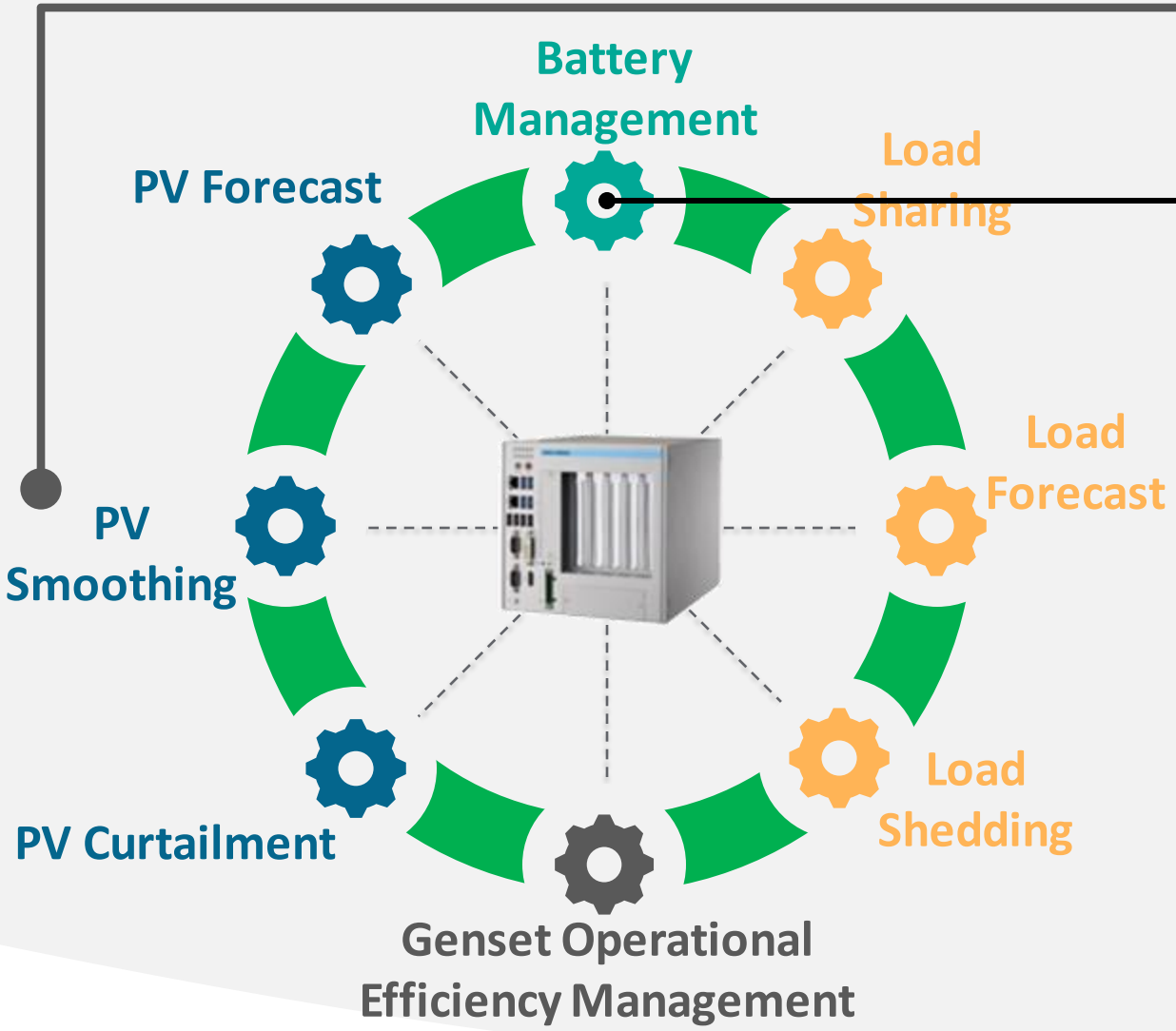
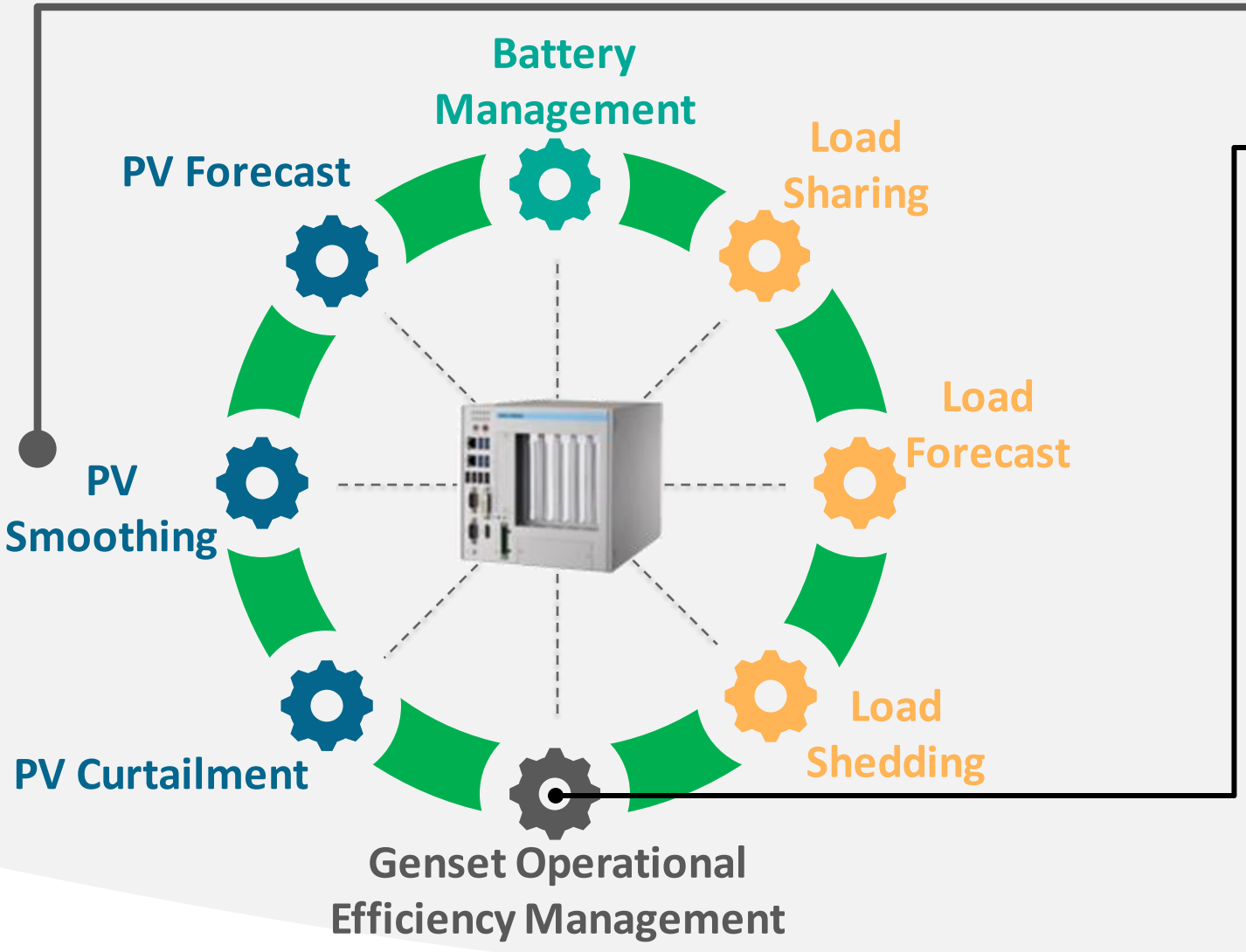


Battery Management

- **Load Shifting**: Manage stored energy dispatch to maximize use of PV Generation
- Reduce diesel power generation during non sunny hours

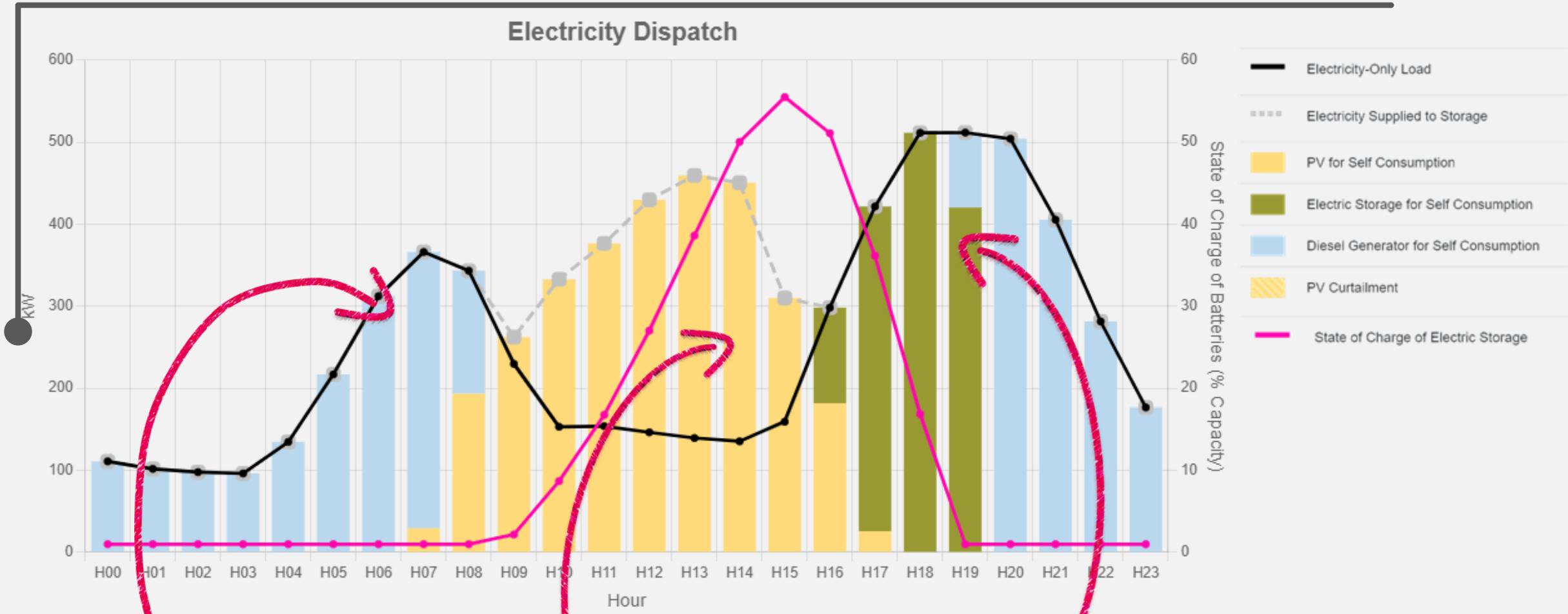
EcoStruxure Microgrid Operation- Fuel Saver



Optimal start/stop and multi-genset management

- Real time load monitoring to facilitate optimal connection of gensets to the grid
- Energy dispatch based on the BESS SOC and size to reduce fuel consumption
- Maintain grid stability

EcoStruxure Microgrid Operation- Fuel Saver



October - Weekday

Optimal and stable operation of DG sets

Excess PV Generation stored in BESS

BESS Energy Dispatch to reduce fuel consumption

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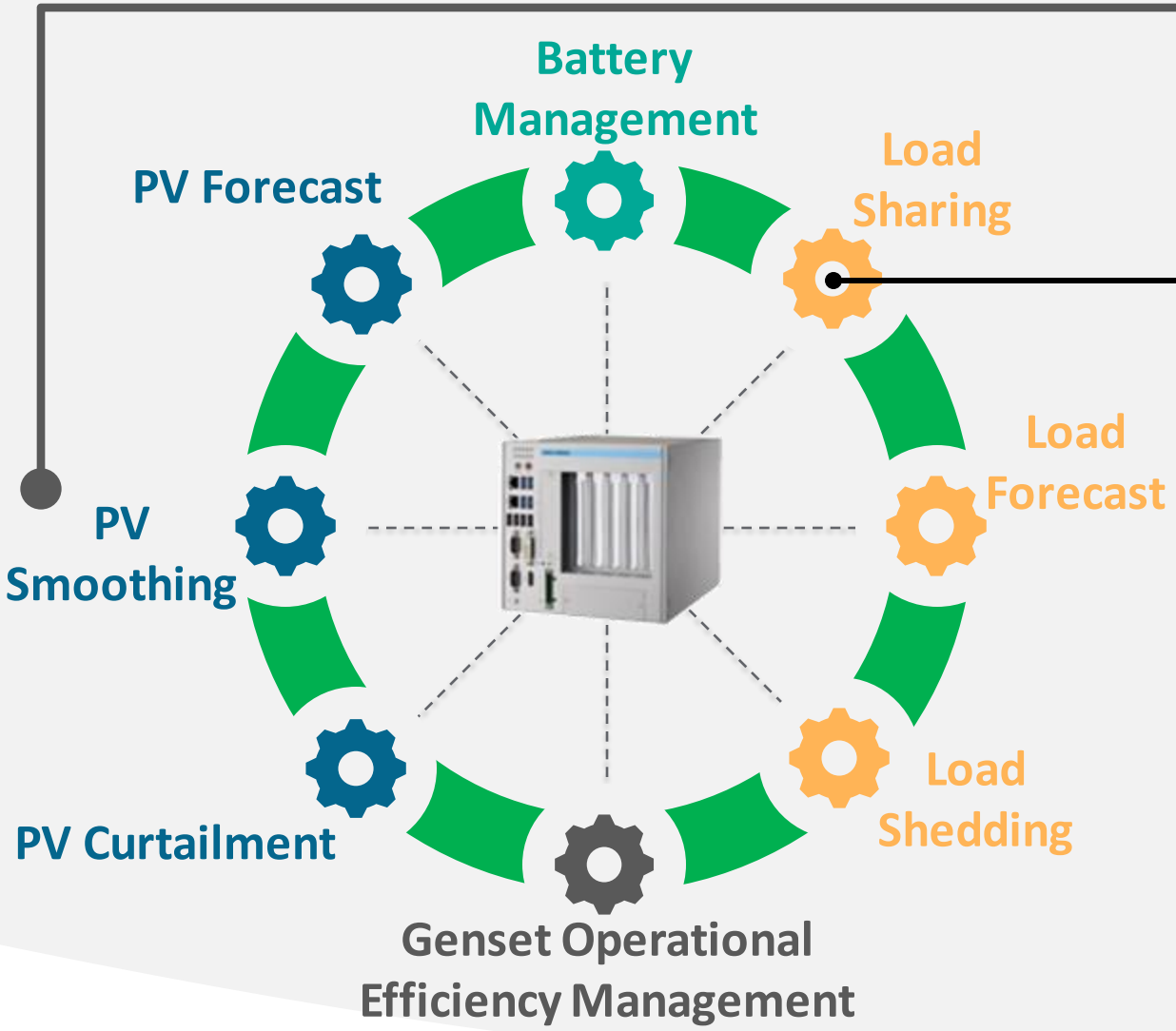
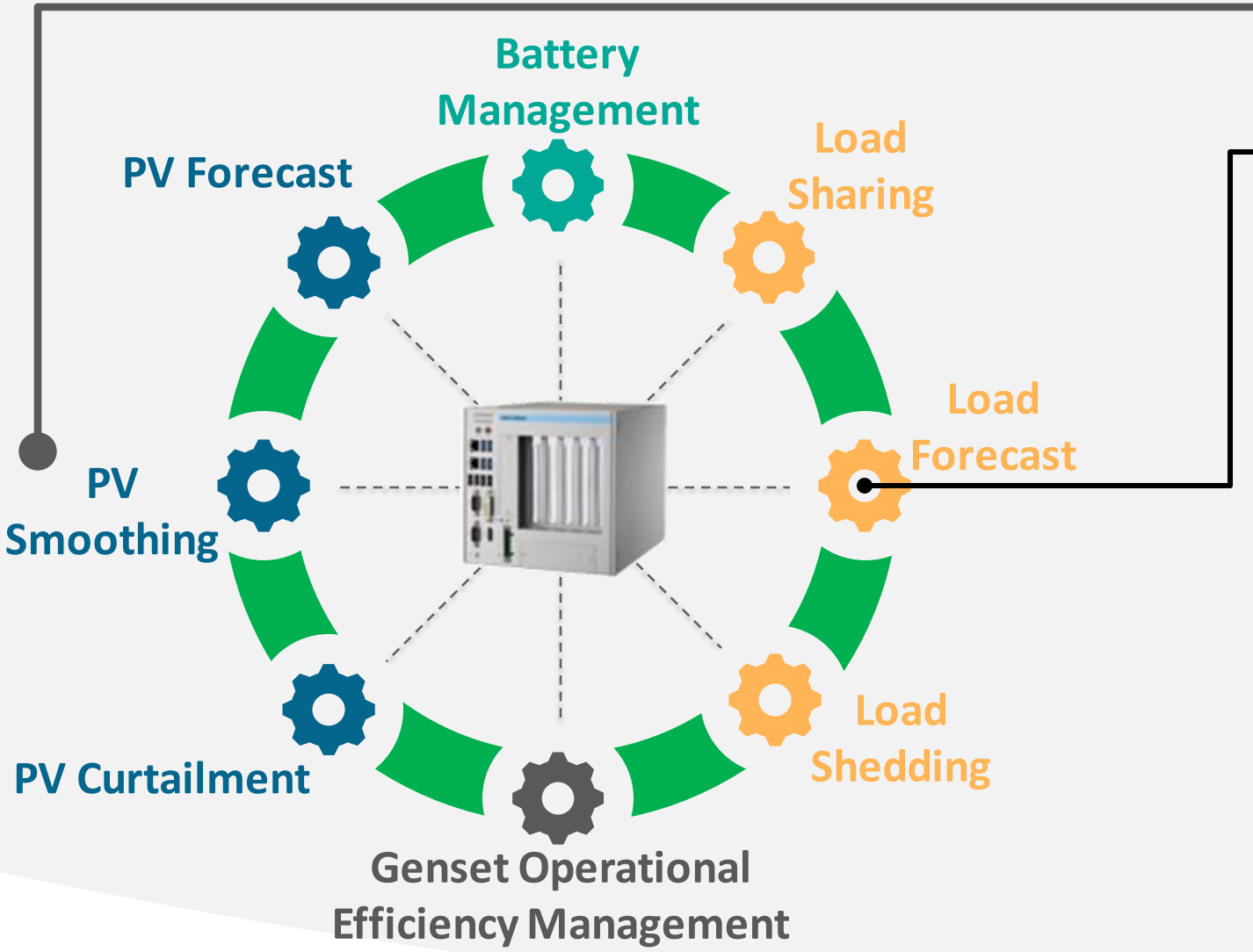
EcoStruxure Microgrid Operation- Fuel Saver



Load Sharing

- Manage the frequency and voltage regulation by controlling DERs
- Balances active and reactive powers between the DERs, by computing and sending using P & Q targets

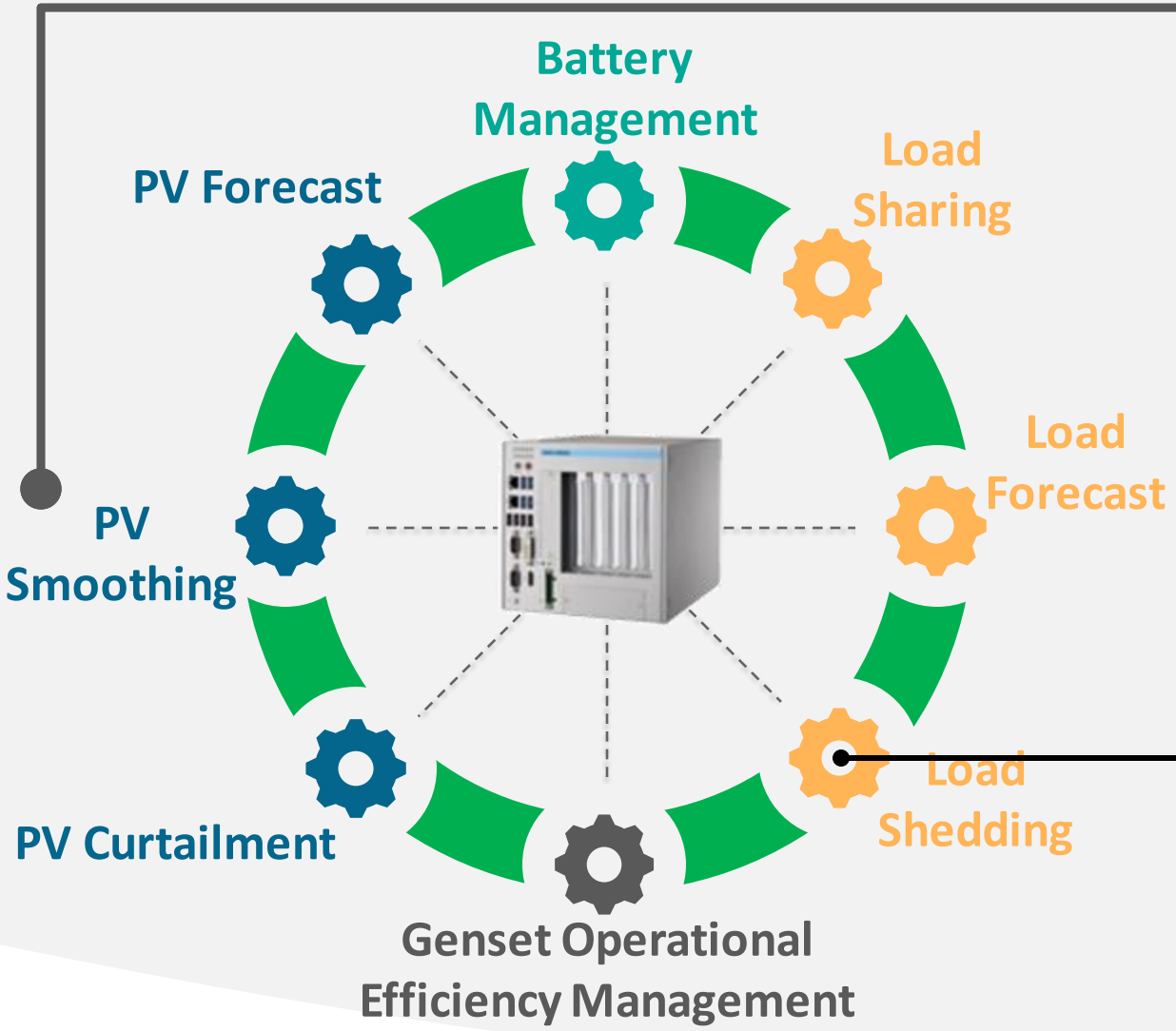
EcoStruxure Microgrid Operation- Fuel Saver



Load Forecasting

- Maintains a real time database of the grid load.
- This time stamped data is used for forecasting load in the future and computing set-points

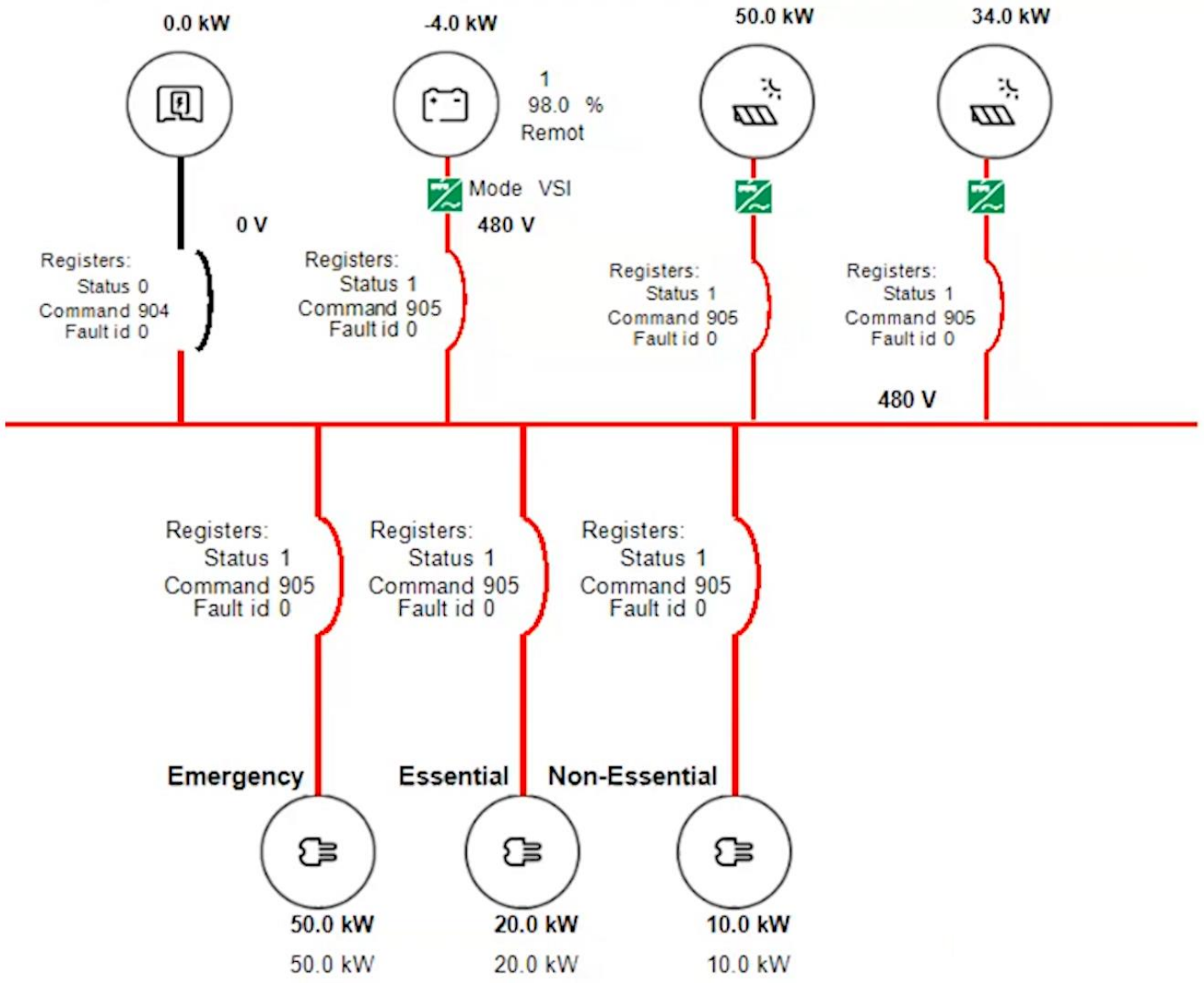
EcoStruxure Microgrid Operation- Fuel Saver



Load Shedding

- Triggered by excess load demand which is higher than the generation capacity.
- Avoids overload and loss of generation DERs.
- Real-time automation function that helps shed non-critical loads when the electricity production or consumption becomes inadequate

EcoStruxure Microgrid Operation- SOO



Battery Energy Storage System

Power Block

SE branded

- IP44 enclosure
- Inverter
- System controller
- Auxiliary power
- Balance of system

Power block
150-1200kW increments

Energy block
Liquid cooled 373kWh increments

Energy Block

CATL branded

- IP66 enclosure
- Battery Management System
- Liquid cooled
- Gas detection
- Fire suppression

Tested and validated with EcoStrxure Platform

Best in Class Footprint

Flexible – Lego block architecture

Economical

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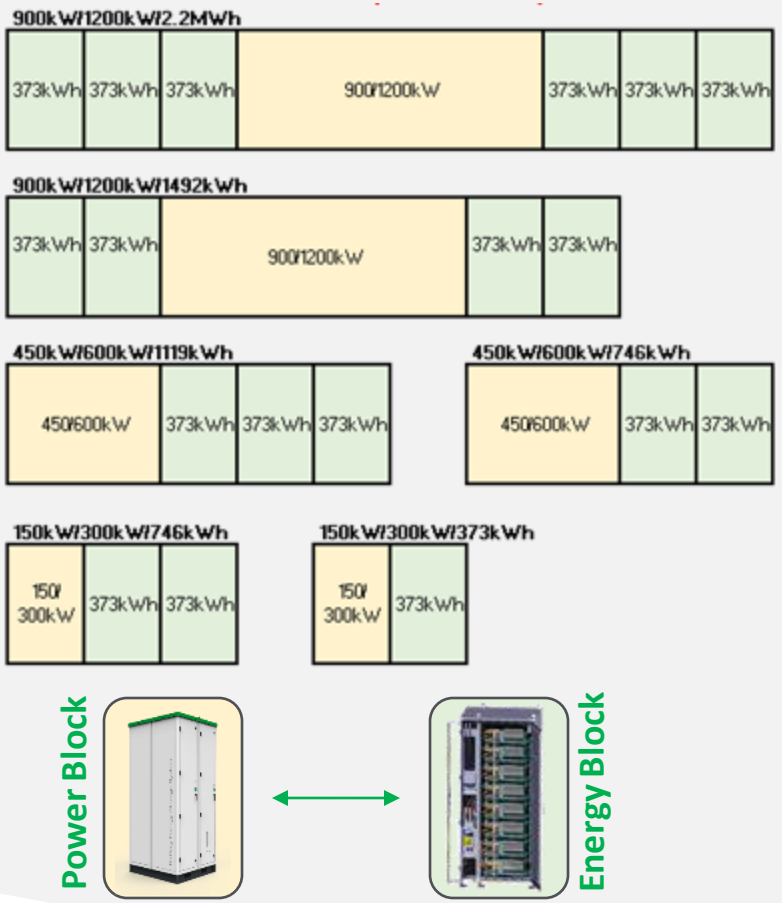
Battery Energy Storage System

Plug-n-play approach



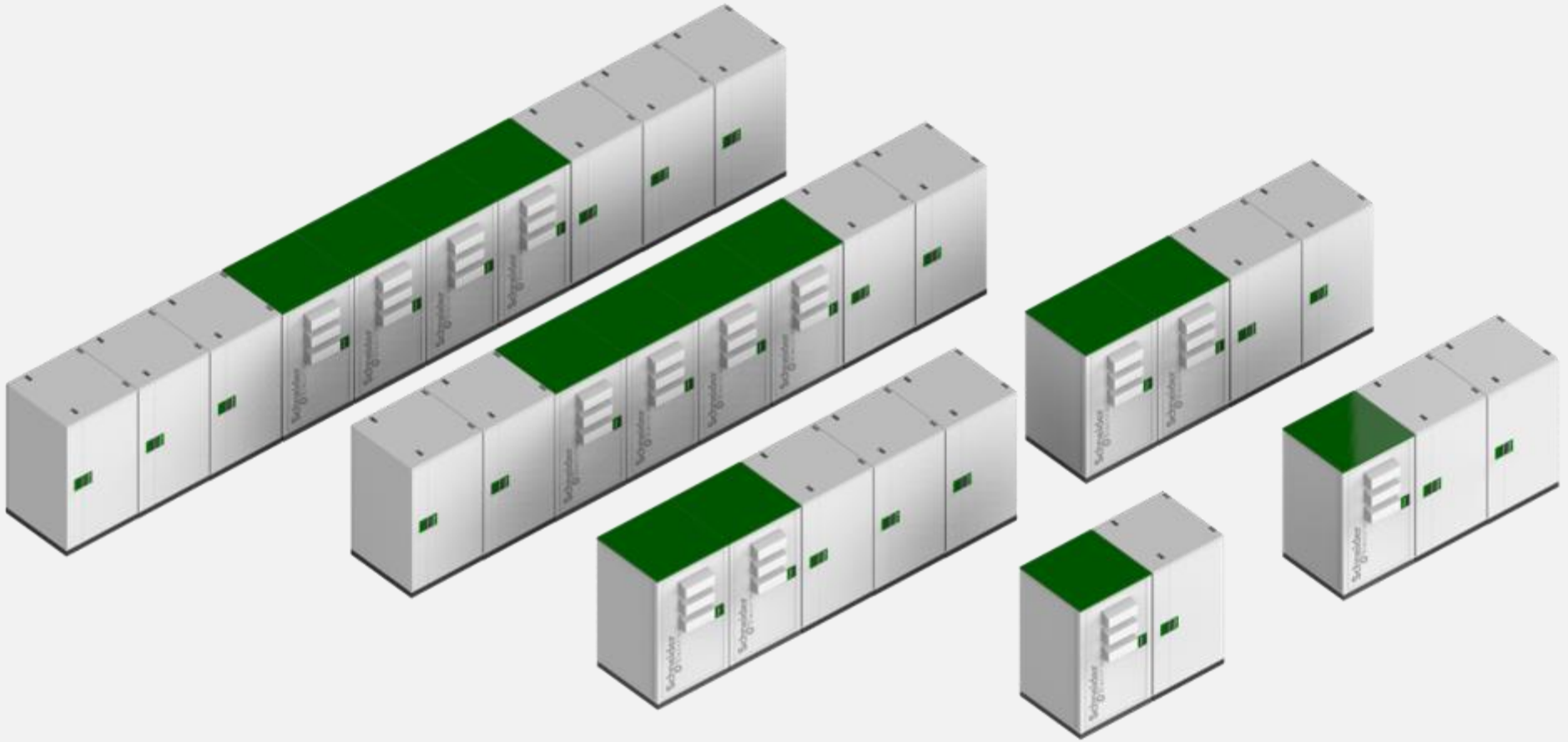
Hardware productization

- Schneider branded and designed 150-1200kW Power Blocks & controller panel
- Fully integrated and standard Energy Block (e.g., CATL's standard offer) shipped with modules installed
- Modular up to 1.2MW with UL9540

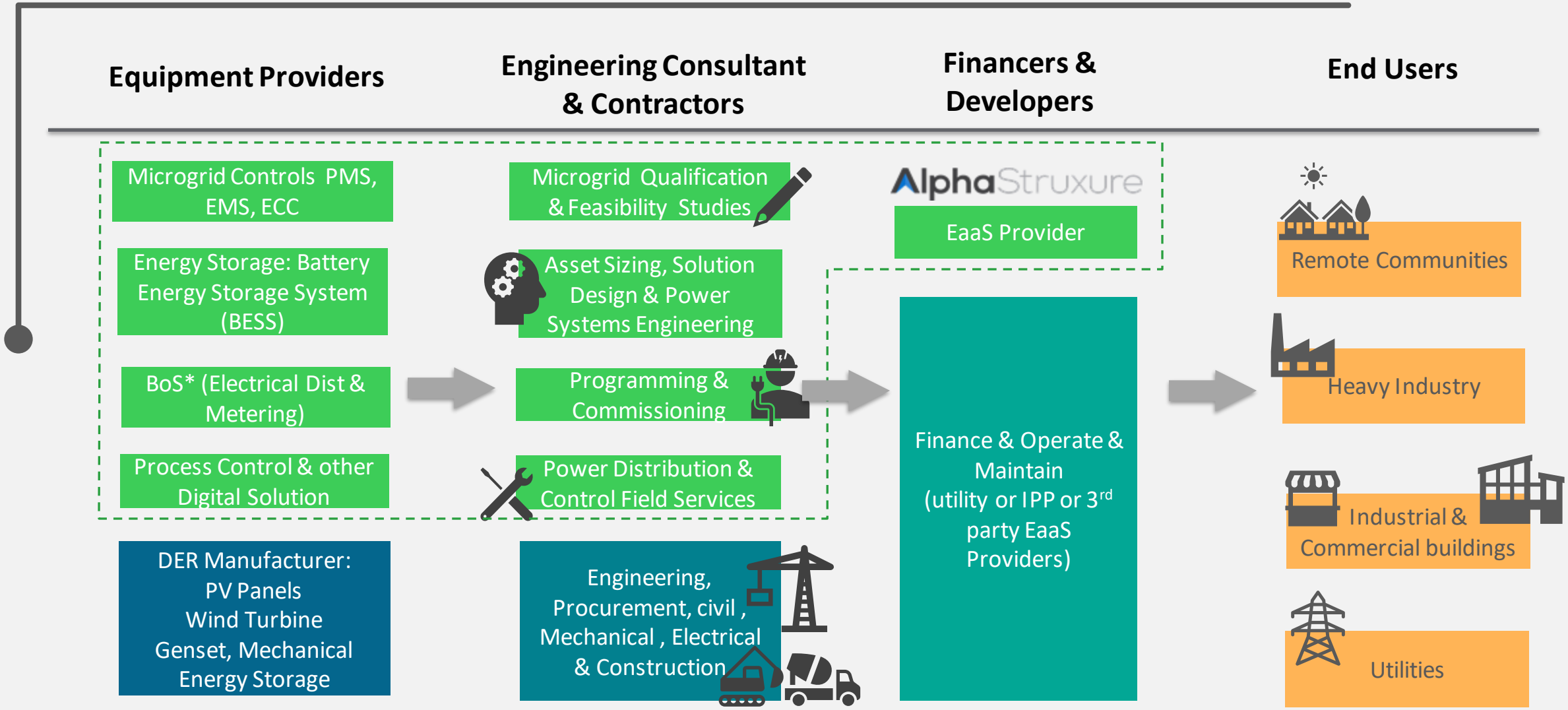
Software and services productization

- Web based configurator for sales, partners and integrator
- Cloud based services platform for commissioning and maintenance
- Integration with EMO/EMA

Battery Energy Storage System



Microgrid Services – Schneider Electric



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Small Off-grid Site

Provide access to reliable and affordable clean energy to households and businesses in off-grid and unreliable grid communities

Remote Communities / Offgrid Households & Commercial

Type: Offgrid Microgrid
Location: Nigeria
Size: 5 sites x 187 kW
Status: completion forecasted in 2021

Customer pain point

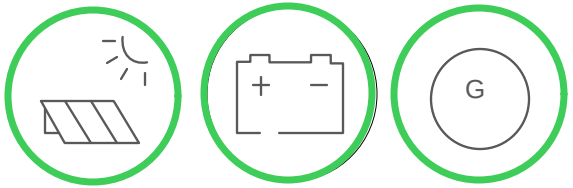
- Provide reliable, affordable and clean energy to remote population
- Cost savings vs fuel powered solution
- Monitor and track energy production remotely (=> RBF)

Solution

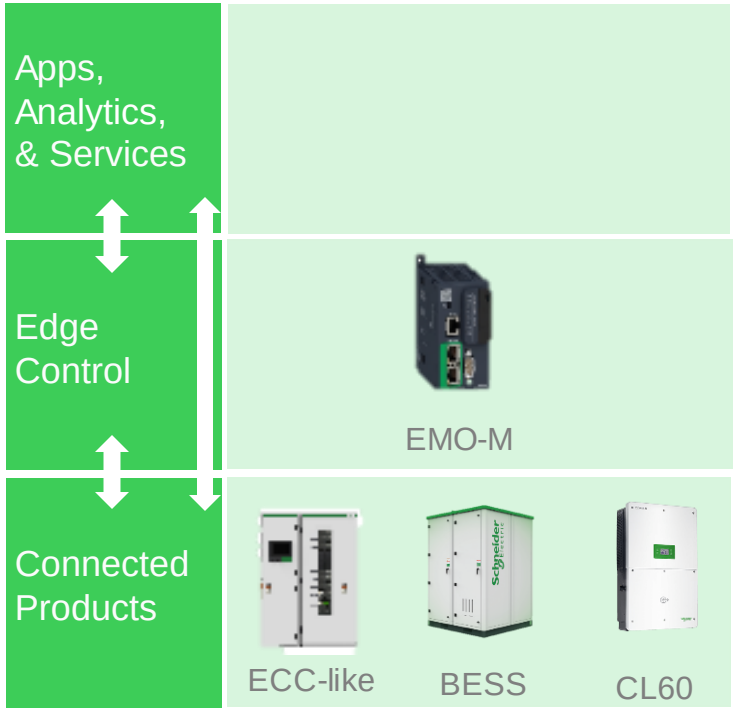
- Hybrid microgrid with Solar PV (120 kW), Storage (183kW/208kWh), Gensets (250 kVA) able to run in standalone mode
- Schneider Electric's Power Management System (EMO-M) realizes the interface with the DER, controls the DERs for real time actions.

Scope

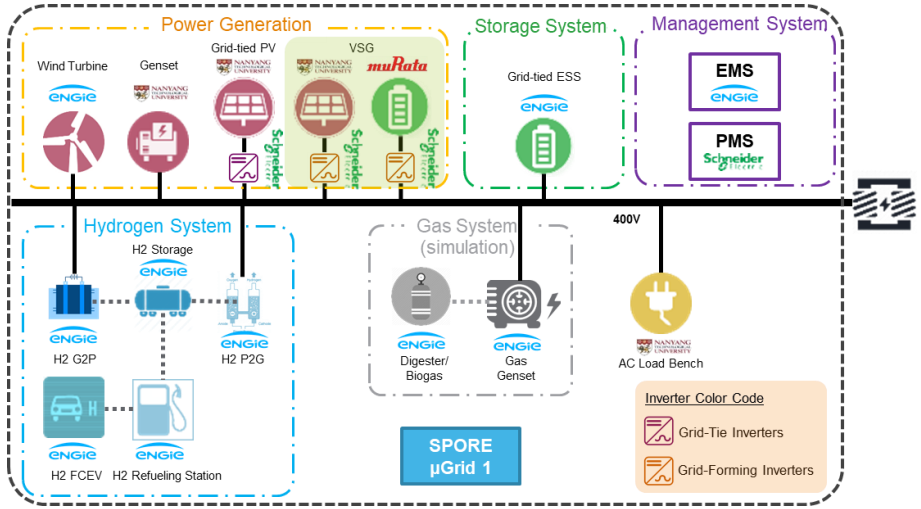
- Edge (EMO-M)
- Connected product: ECC, PCS (187 kW), inverters (CL60x10)



EcoStruxure
Innovation At Every Level



Large Offgrid Site



REIDS Project

Renewable Energy Integration Development Singapore

Type: Island, off grid microgrid
Location: Semakau Island, Singapore
Completed: Under execution

Customer pain point

Break the 30% renewable penetration limit, with a plug & play, scalable approach compatible with use of generators and inverters forming together a Microgrid

Solution

EcoStruxure Microgrid Operation that ensures the stability will be provided by Schneider Electric as well as smart inverters for PV. Other partners provide DER, EMS etc.

Scope

- EcoStruxure Microgrid Operation
- Smart PV inverter with VSM capabilities
- DER: Solar PV, Wind, Marine, Bioenergy, Genset, Battery, Hydrogen, Desalination, fish hatchery, H2 production

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make the most of our energy and resources
bridging progress and sustainability for all.
At Schneider, we call this Life Is On
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Q & A