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Energy Performance Services

SI RSS-AM SSP DES
2019

Agenda

- Battery Energy Storage Business Cases
- What is Battery Energy Storage?
- Applications
- Storage + ?
- Integration….bring it all together

Business Cases

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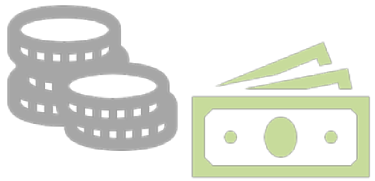

Energy Cost Savings

- Demand Reduction
- TOU – Time of Use
- Global Adjustment Factor

Spinning Reserve Frequency Regulation

- Capacity Release
- Selling reserves

Lower Emissions

- Reduce CO2
- Operate with other Sustainable Renewable Generation

Blackstart

- Improve Grid Reliability
- Customer Cited Generation

Decrease minimum load Increase ramp rate

- Vertically Integrate Utility Resources
- Wholesale Markets

Overview of Application Functionality

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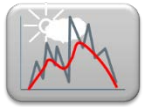
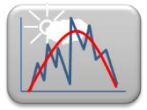


Ramp Rate Control

Frequency Regulation / Support

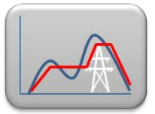
Time of Use

Power Factor Control



Renewable Firming / Smoothing

Microgrid Operation
- Island Operation
- Grid Parallel Operation
- Blackstart

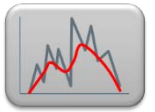


Renewable Shaping

Renewable Time Shift / Peak Shaving

Renewable Time Shift

Energy Time Shift (Arbitrage)

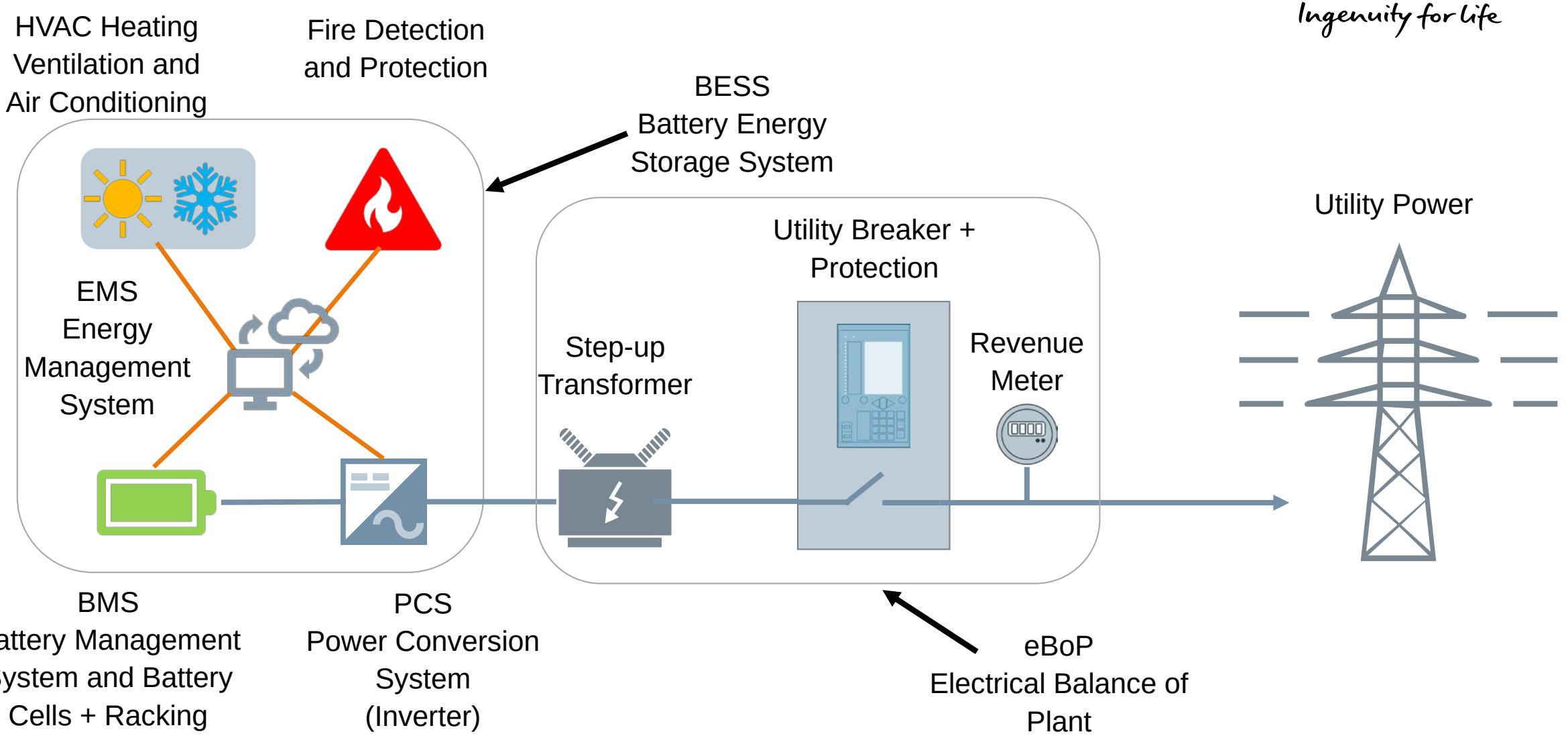


Load Following

Demand Charge Reduction / Peak Shifting

Reactive Power Control
- Voltage Regulation
- Q-Setpoint

What is Battery Energy Storage?



Digital Inertia - Energy Storage vs. Thermal Peaker

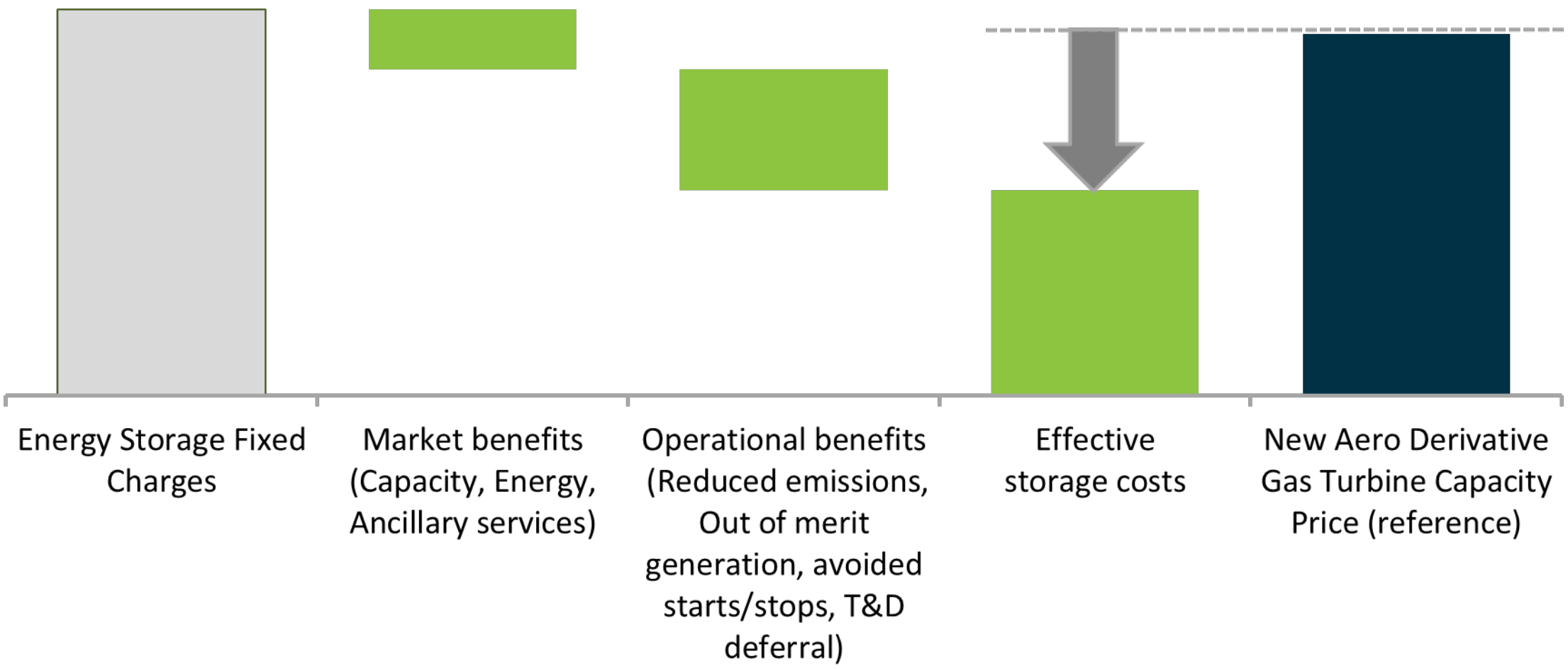
ENERGY STORAGE RESPONSE

- Energy storage responds with rapid increase of output from 0MW to 20MW
- Autonomous response according to programmed profile
- Output sustained until stability restored

THERMAL UNITS

- Thermal unit responds with burst, then output drops off
- Gradually ramps up in oscillating manner to 7MW output increase over 4 minutes

Net Cost of Capacity – Energy Storage vs. Traditional Peaker



Peak Load Relief – Indicative Value Comparison

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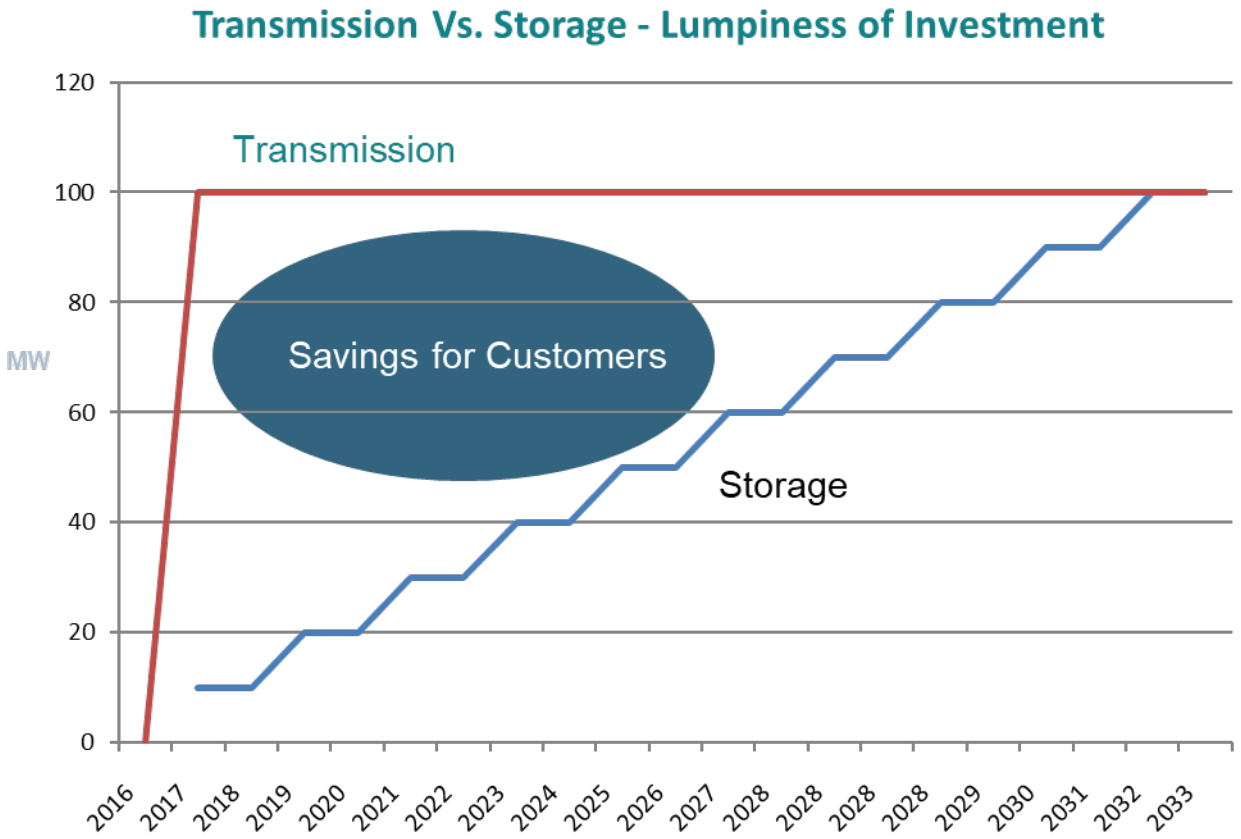
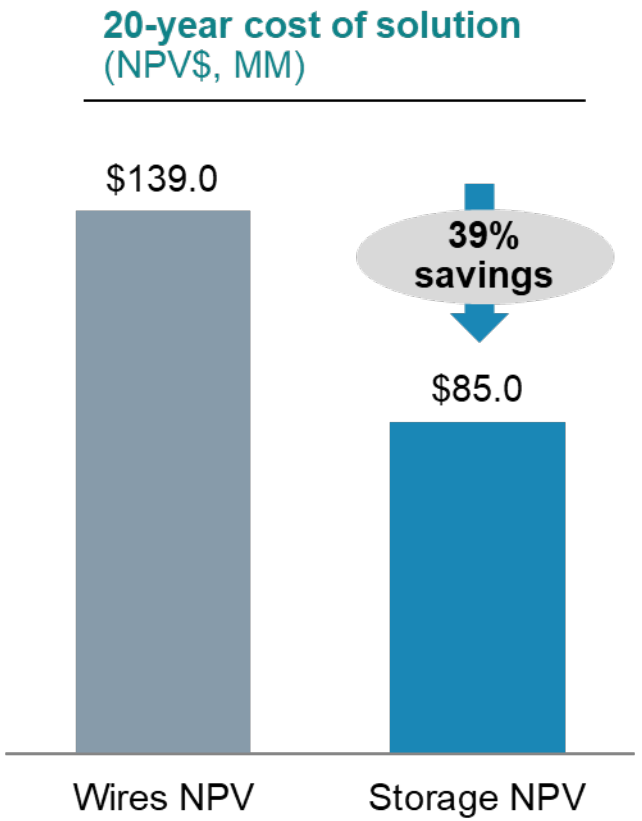
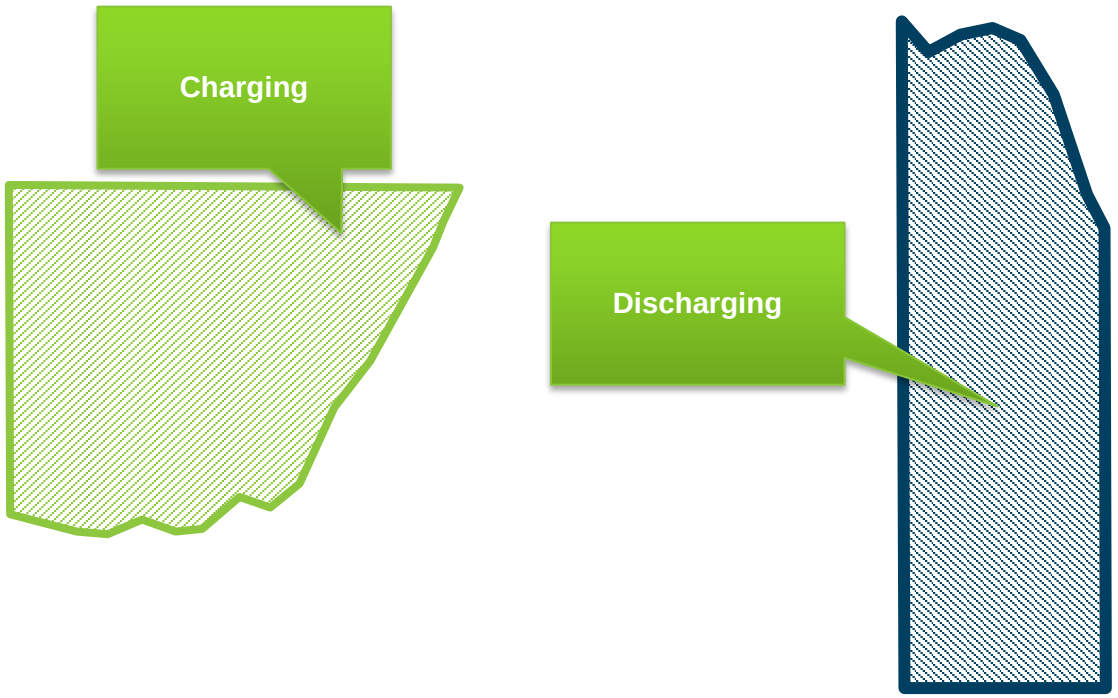




Value Applicability Areas – Urban and dense areas with high capital costs of building transmission, NIMBY issues (customer sentiment), environmentally sensitive regions. Utilities with spending pressure on high capex transmission in near-term (rate-freezes).

Demand Charge Reduction – Coincident Peaks



Battery Energy Storage charges during off-peak times and discharges during likely system peak times to avoid high coincident peak charges.

TOU – Time of Use Energy Management for Commercial & Industrial Example

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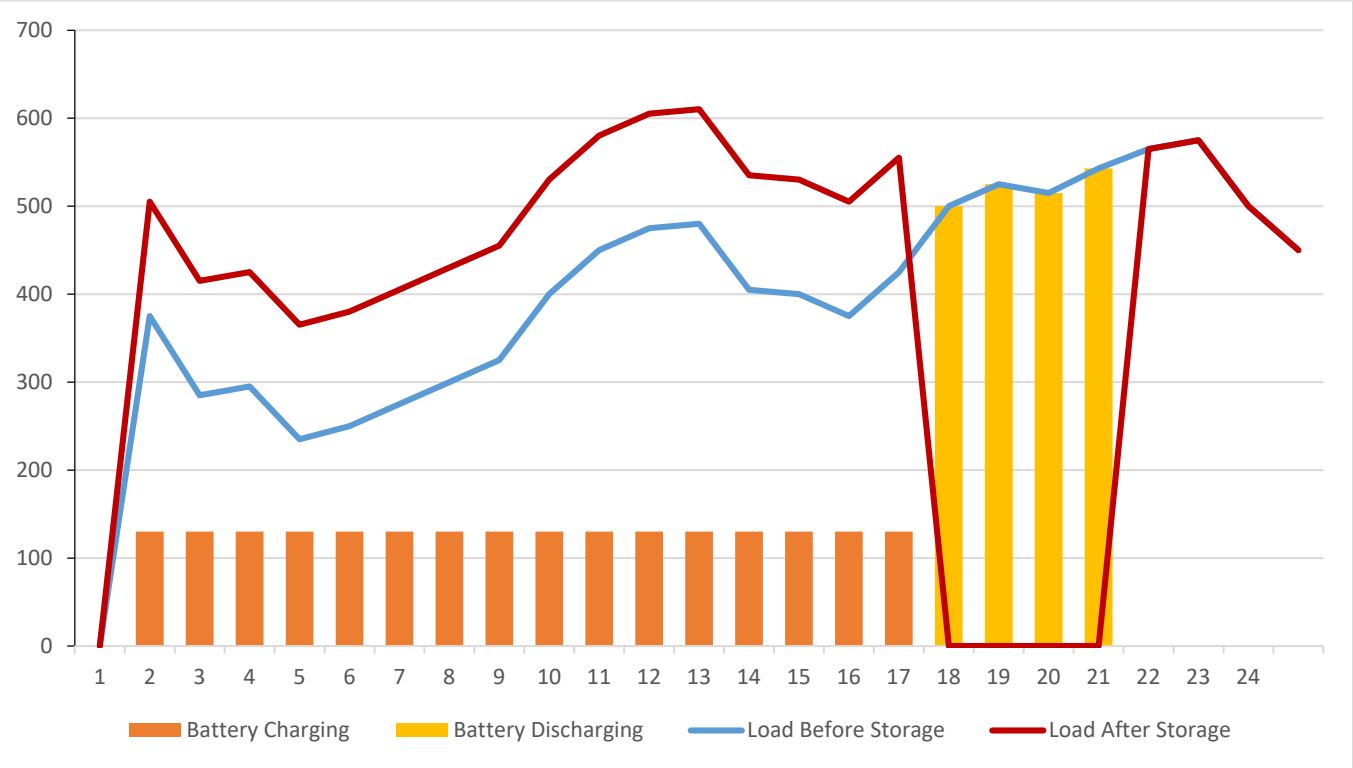

Battery Energy Storage reduces net consumption at more expensive rates by charging during cheaper times of the day and discharging when rates are more expensive.

Onsite Generation Self Consumption

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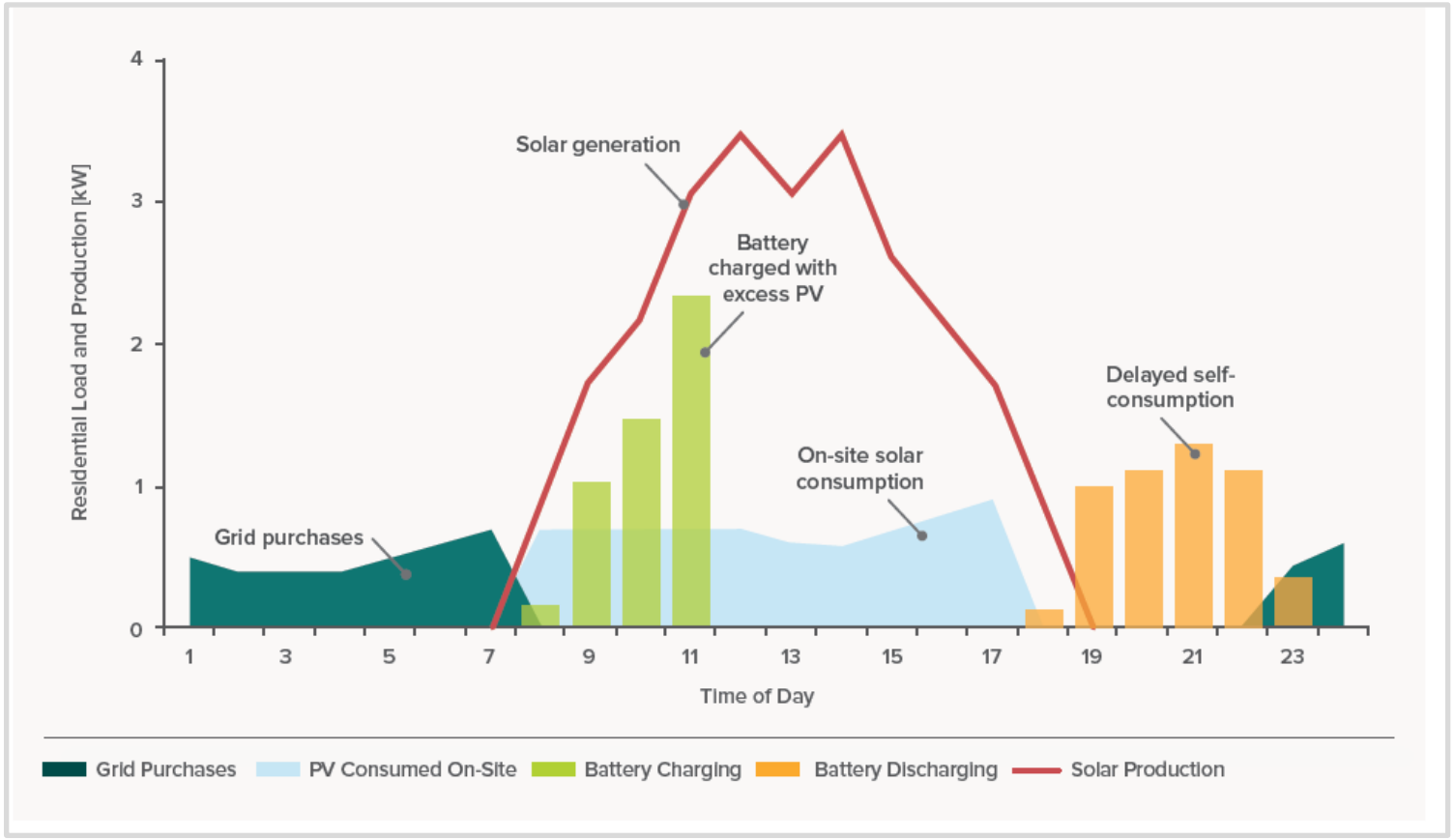
Battery Energy Storage stores excess energy from onsite generation for later use improving the financial benefit of onsite generation. This is common where it is not attractive or allowed to inject energy back into the grid.



Source Graphic: RMI The Economics Of Battery Energy Storage, October 2015

Grid Services – C&I Solutions Can Improve “Grid Health”

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Battery Energy Storage enables the generation of additional revenue through participation in demand response and ancillary services programs sponsored by your local utility.

Demand Response

Reducing your net energy at request of the utility during times of high demand

Frequency Regulation

Injecting electricity into the grid to correct local deviations in electricity frequency

Spinning Reserve

Providing a “reserve” of energy available to the grid in case of an emergency

Examples of Utility Services Provided by C&I Customers

Hybrid Power Solution – Generation Optimization

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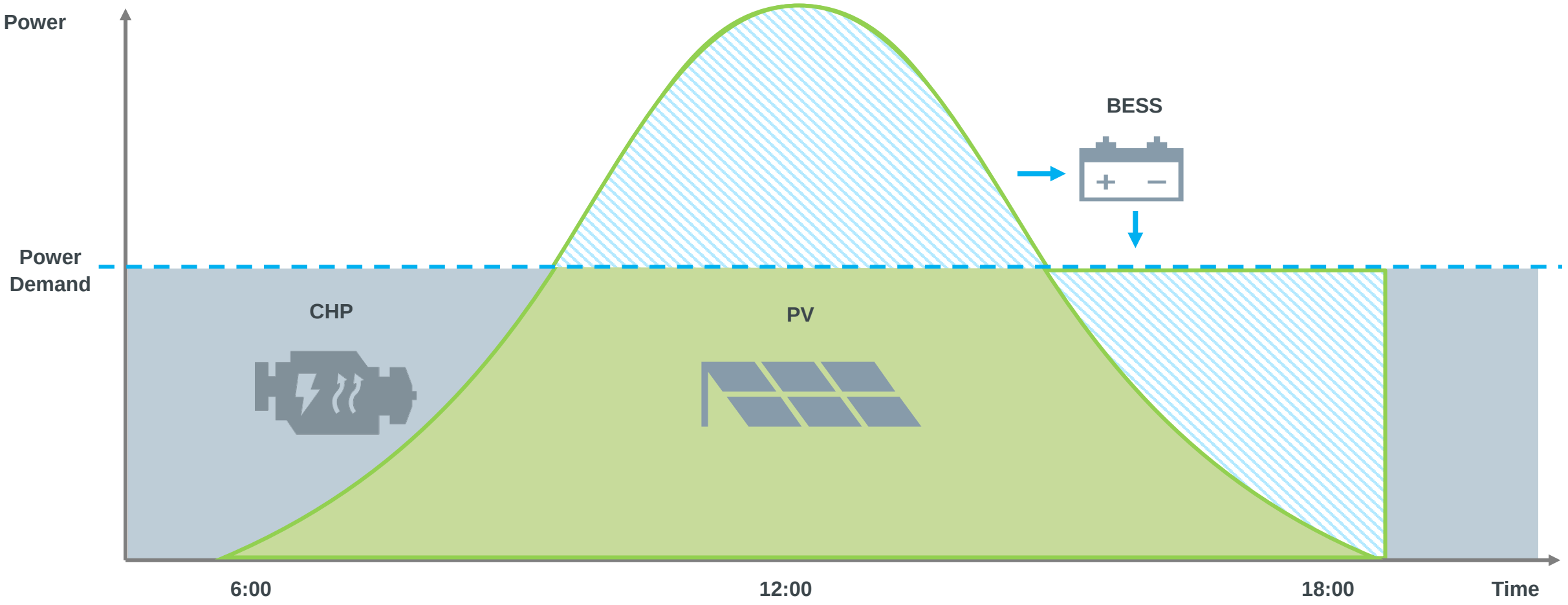

What is Hybrid Power?

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Description

Hybrid Power

Power generation created by combining renewable and traditional generation resources.

Benefits

- Minimize fuel consumption
- Optimize use of renewables
- Operate within system constraints
- Use batteries for multiple revenue streams
- Ensure system reliability (operation reserve, grid-forming, n-1 redundancy, ...)

Factors

- Fuel prices
- Industry trends
- Market demands
- System availability
- Generation asset mix
- Transmission and distribution conditions

Results

- Security
- Reliability
- Resiliency
- Operability
- Sustainability
- Affordable Energy
- Financial Performance

Note: Target Market, Behind the Meter

Hybrid Plant Use Cases

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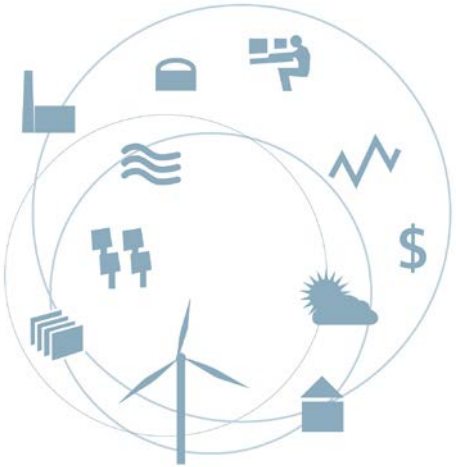
Hybrid Plant Benefits

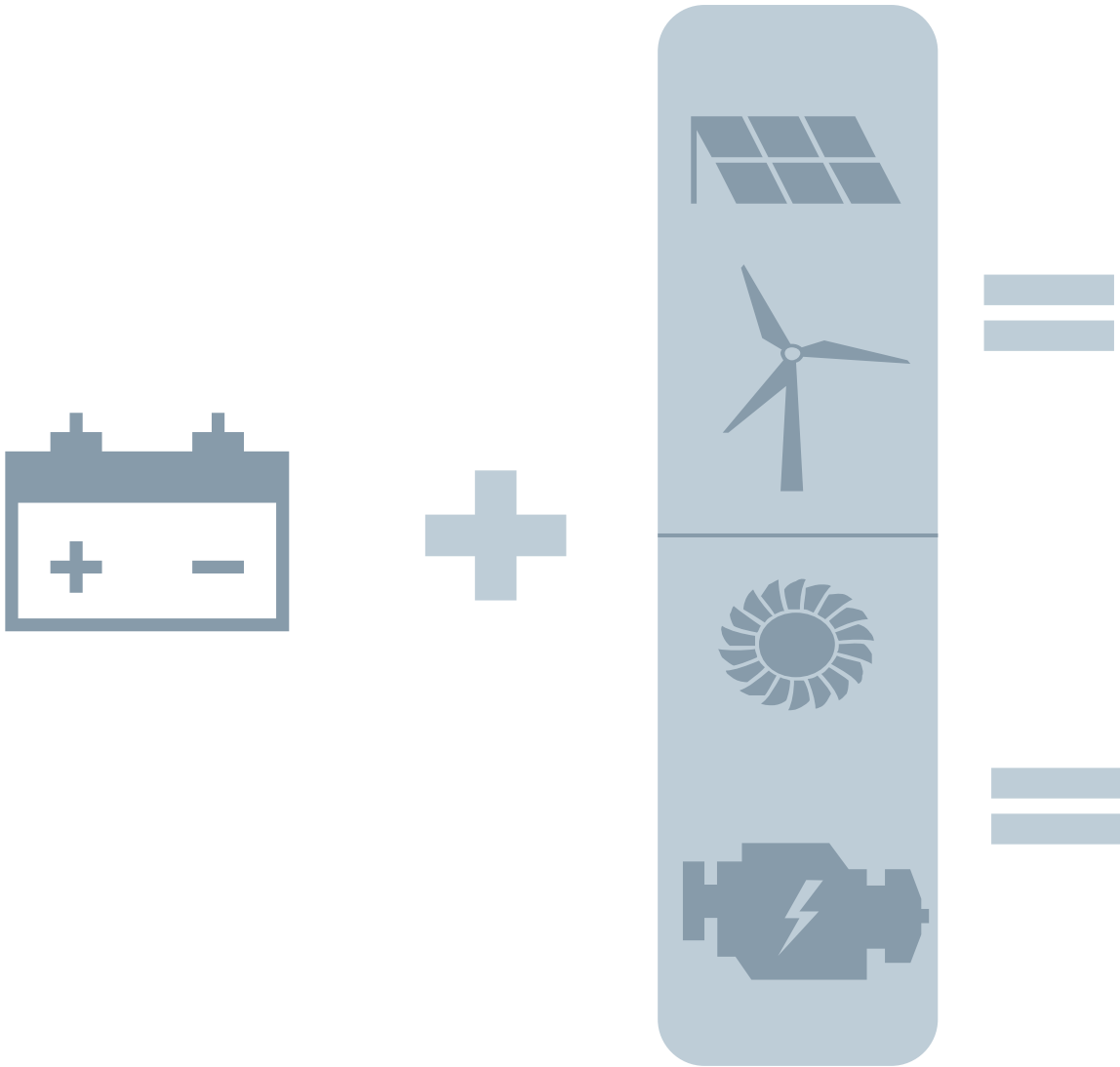
- Electricity anywhere
- New revenue streams
- Reduce impacts to the grid
- Integration with renewables
- Add-on to existing infrastructure



→ = DER Focus Area

Technology	Microgrid	Renewable Dispatch	Peak Shaving	Ramping	CAPEX/ OPEX	T&D Deferral
→ PV+Storage+Recip/CHP	o				o	o
GT+Wind/PV+Storage		o			o	o
Recip+Wind/PV+Storage		o				o
Wind+Storage		o	o	o		o
→ PV+Storage		o	o	o		o
Wind+PV+Storage		o	o	o		o
Hydro+Storage		o	o	o		o
Hydro+PV		o	o	o		o
GT/CCGT+Storage			o	o	o	o
→ Recip/CHP+Storage			o	o	o	o

Energy Storage = Driver for Hybrid Power Solutions



Renewable Integration

- PV AC or (**DC coupling)
- Production firming
- Time shifting
- Arbitrage

Flexible Generation

- Instant on
- Fast start
- Black start
- Peak demand

Economic Benefits

- Resiliency
- Efficiency
- Sustainability (CO2)
- Energy savings

**Future offering

Defining Characteristics for Hybrid Power Microgrid Controls

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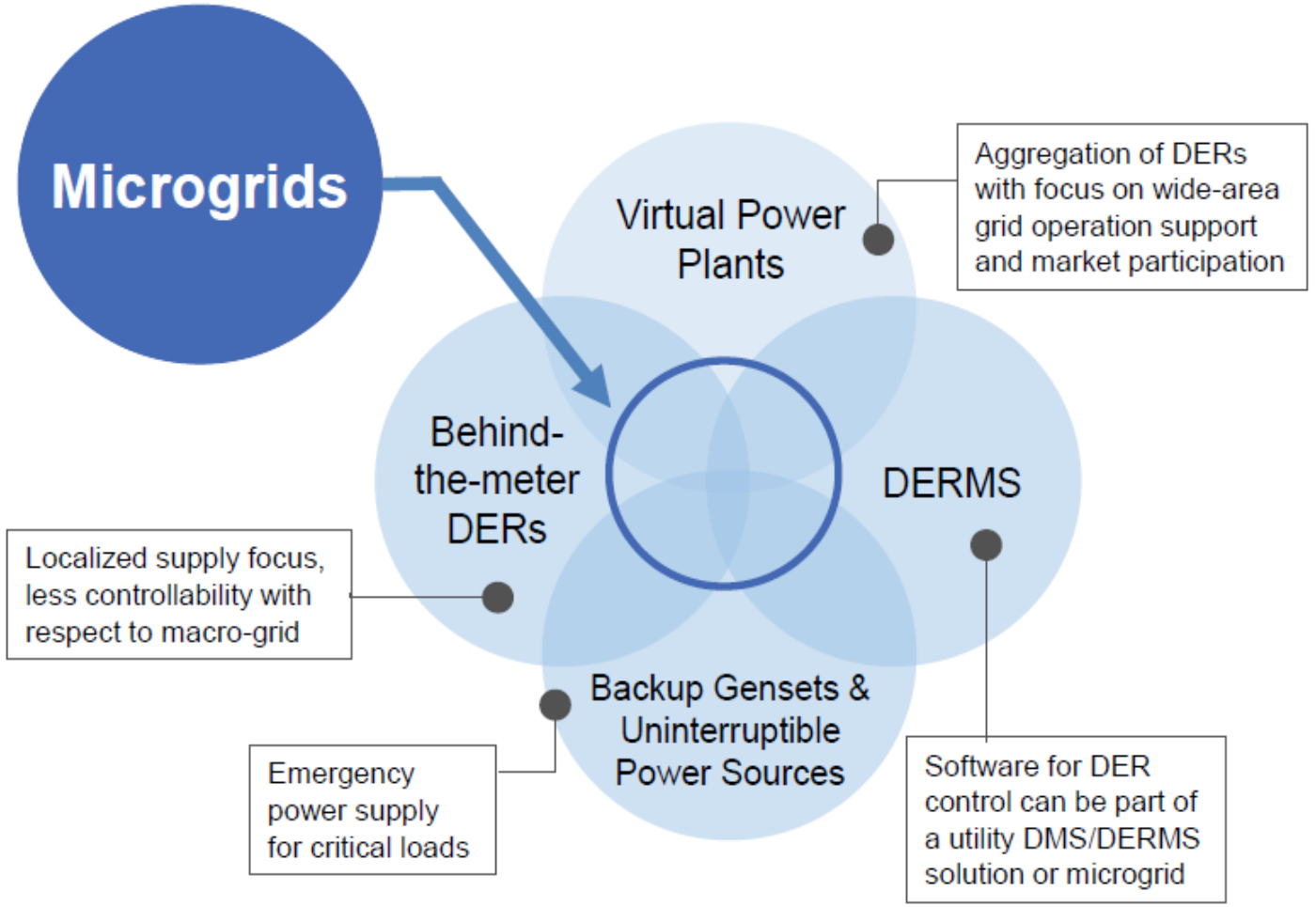
- Advanced DER (distributed energy resource), grid asset control, monitoring and dispatch
- Electricity and/or heating co-optimization
- Islanding capability
- Mixed generation assets
- Close proximity of generation and loads



Source: GTM Research

Microgrid Control – SICAM MGC A8000 applications

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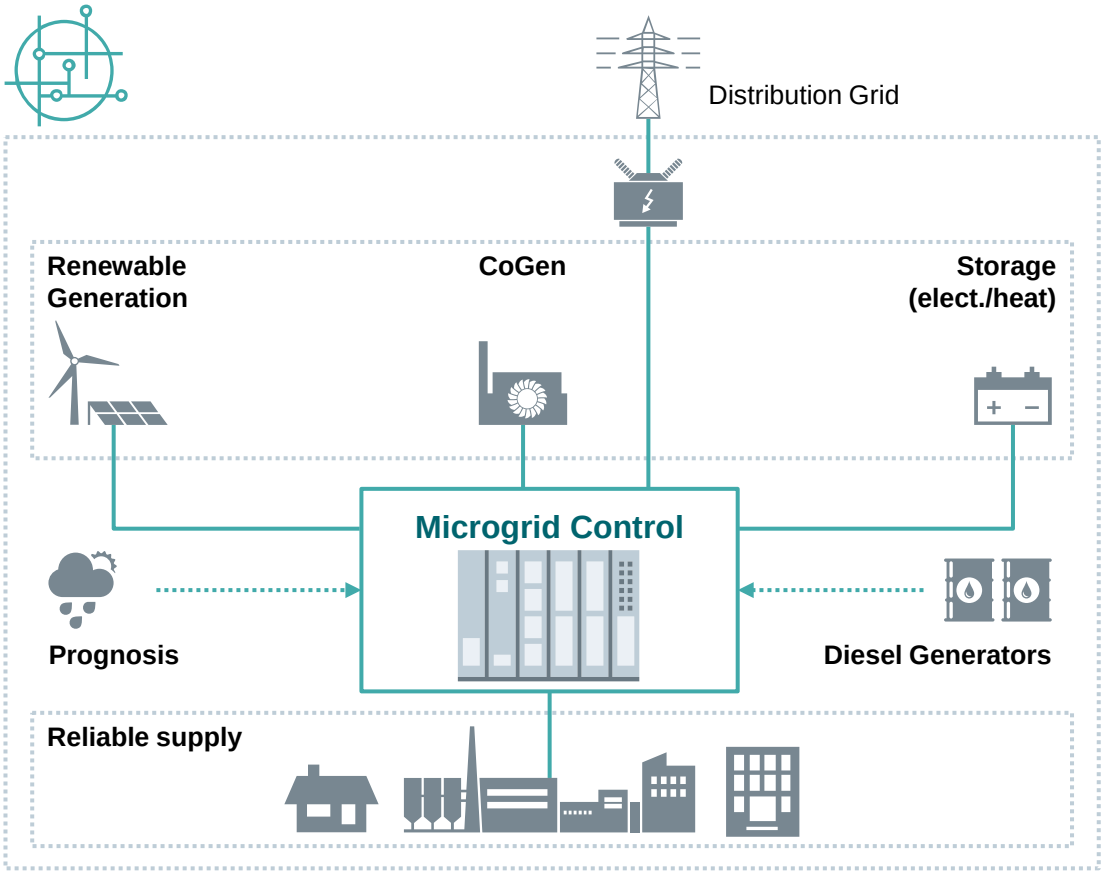
Basic Features

- Measuring
- Monitoring/ Reporting
- Storage Control
- Generation Control
- Archiving
- Load Control

Advanced Features

- Islanding / Black start
- Peak shaving
- Load forecasting
- Generation forecasting
- Load Management

Microgrid – Distribution grid with renewable generation, grid infeed and storage



Benefits of Microgrid Control

Own generation

- Ensures continuous load supply and production processes
- Increased independence from grid instabilities

Energy mix/value streams

Lower energy costs

- Economic optimization main grid supply vs. own generation

Decreasing CO_2 emissions

- Environmental optimization renewable vs. fossil generation

Microgrid Management System – Spectrum Power 7 based application for advanced microgrids

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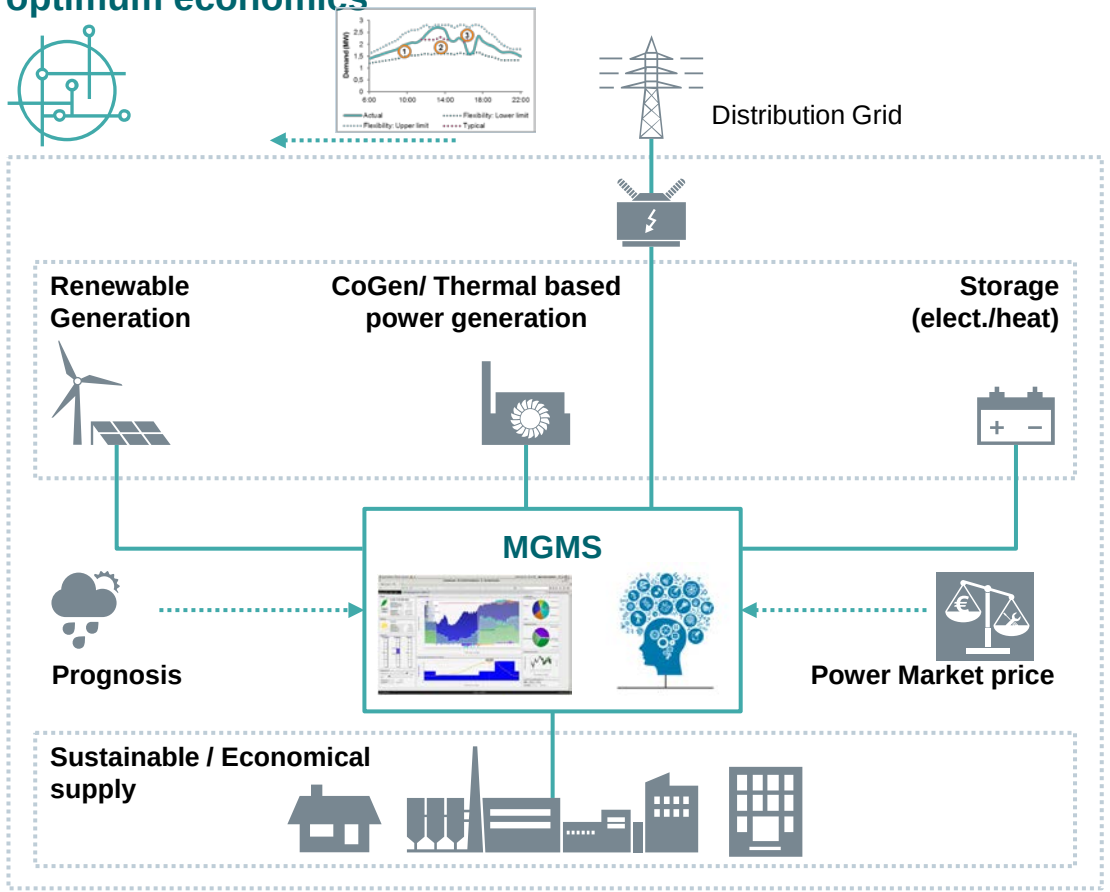
Basic Features

- Measuring
- Monitoring/ Reporting
- Storage Control
- Archiving
- Load Control
- Islanding / Black start
- Peak shaving
- Load forecasting
- Generation forecasting
- Load Management

Advanced Features

- Dynamic Energy Market interaction
- Day ahead optimization
- Sector coupling optimization (Power, Heat, cooling)
- Demand Response

Microgrid Management System – handling complexity for optimum economics



Benefits of MGMS

Own generation

- Ensures continuous load supply and production processes
- Increased independence from grid instabilities

Energy mix/value streams

- Handles complex generation and consumption mix

Lower energy costs

- Economic optimization of combined Power, Heat and cooling

Decreasing CO_2 emissions

- Environmental optimization renewable vs. fossil generation

Bring It All Together With Integration

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FLUENCE
A Siemens and AES Company

powered by
MindSphere

KACO
Future Grid

Digital Grid

SIM

Russelectric
A Siemens Business

SINACON PV
Future Grid

Siemens Cogeneration

eMobility

Discussion, Wrap-up

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