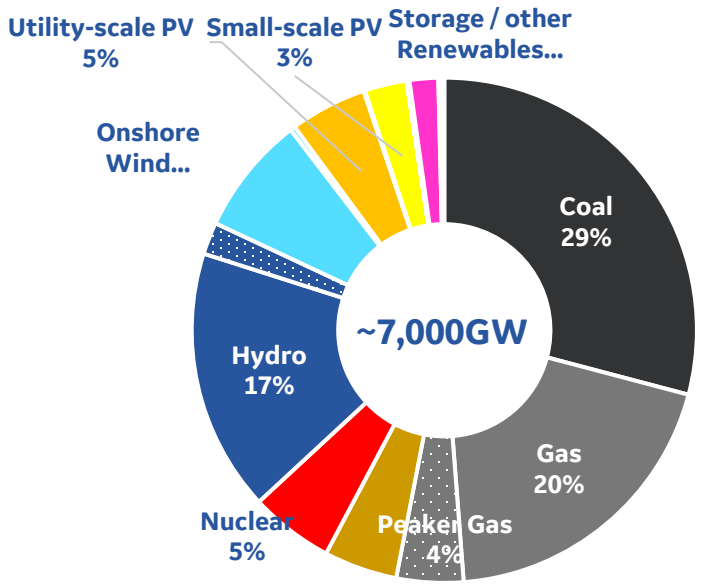
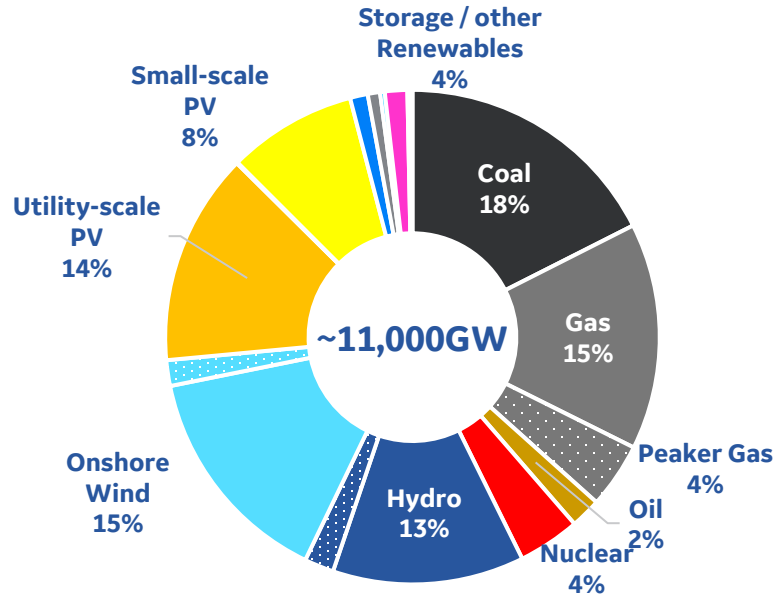
BAU – “*Storage +*” - the different roles of storage – a global view

~70% of new global generation capacity will be renewable

Total Installed Capacity ‘18



Total Installed Capacity ‘30



Source: BNEF NEO July 2019

- Wind & Solar are the cheapest source of energy for 2/3 of the world, renewable penetration will continue to increase
- Gas, steam and nuclear still prevalent in ‘30, with 4,600 GW installed capacity
- ***Hybrid systems integrating storage (BESS, PSP)*** can provide improved dispatchability, grid stability & efficiency

Source: BNEF

WHY ENERGY STORAGE?

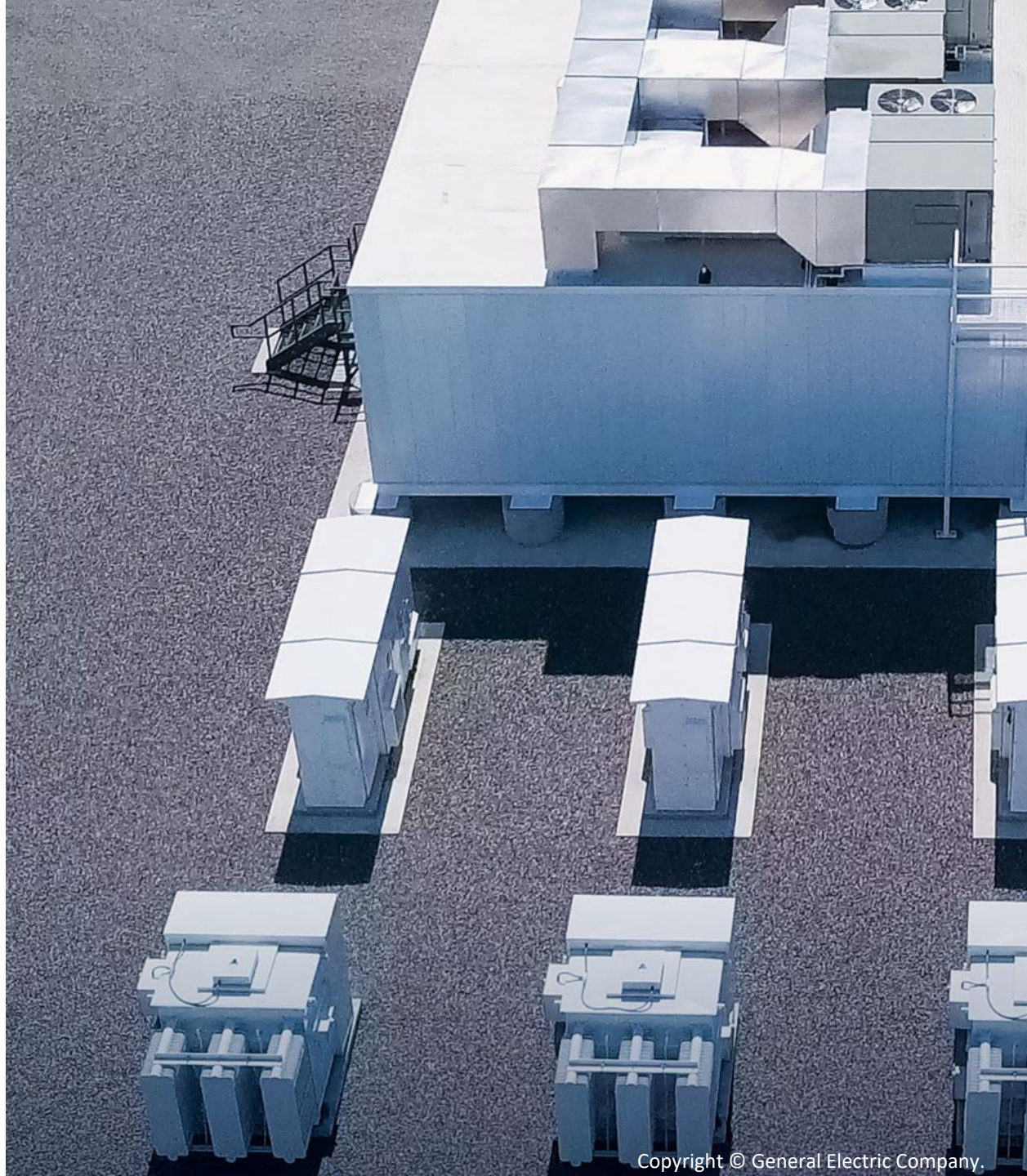
A battery energy storage solution offers new application flexibility and unlocks new business value across the energy value chain.
Energy storage supports diverse applications including firming renewable production, stabilizing the electrical grid, controlling energy flow, optimizing asset operation and creating new revenue by delivering:

Active Power Services

- Frequency regulation
- Frequency response
- Peak shaving/firming
- Remote power commands
- Ramp rate control
- Curtailment avoidance
- Scheduled dispatch/shifting
- Scheduled power commands
- State of charge management
- Islanding
- Black start

Reactive Power Services

- Voltage control
- Voltage droop
- Power factor control
- VAR control



ENERGY STORAGE: UNPRECEDENTED FLEXIBILITY IN GRID OPTIMIZATION

1 Baseload cause renewables to be curtailed

Energy Storage is charged with free or negative priced energy

2 Peak Load

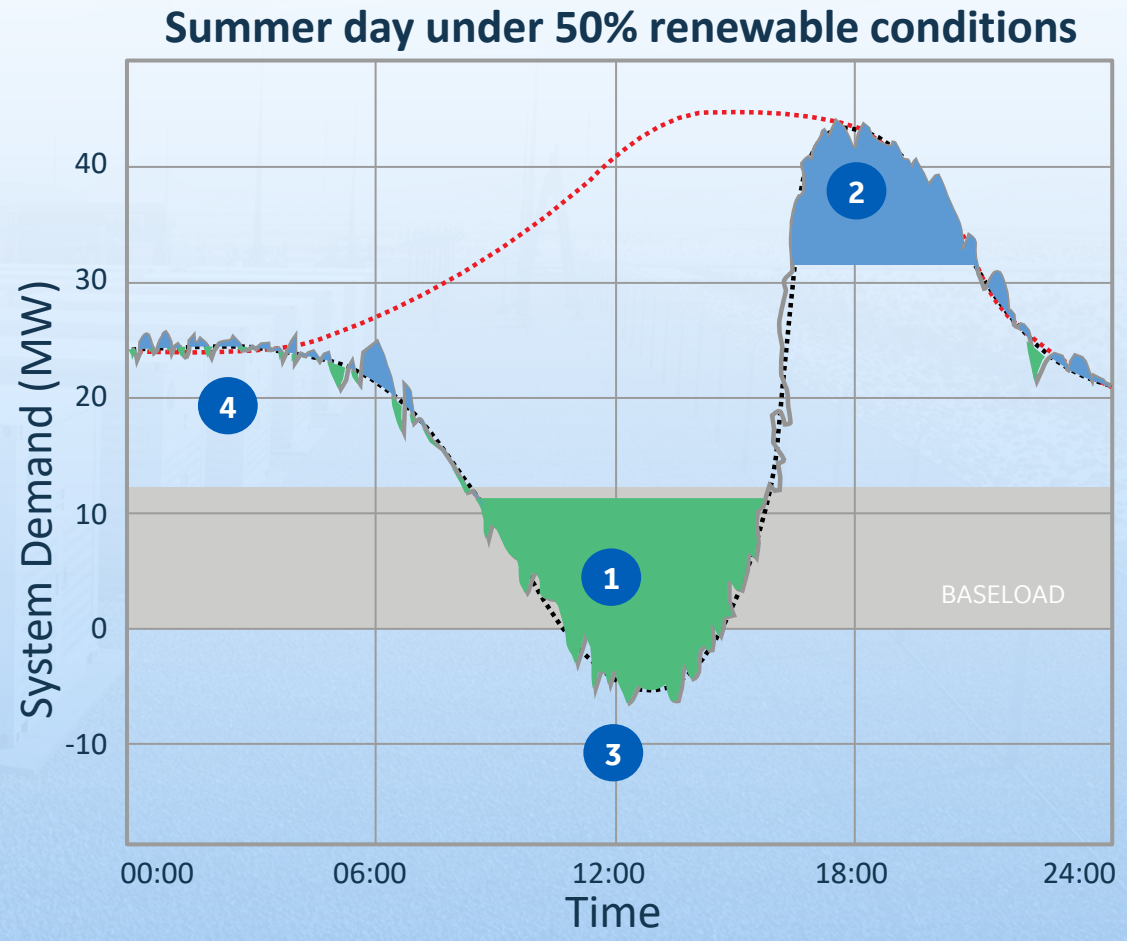
Energy Storage is discharged during peak demand periods

3 Spinning Reserve

Energy Storage discharges during dynamic events (clouds)

4 Frequency Regulation

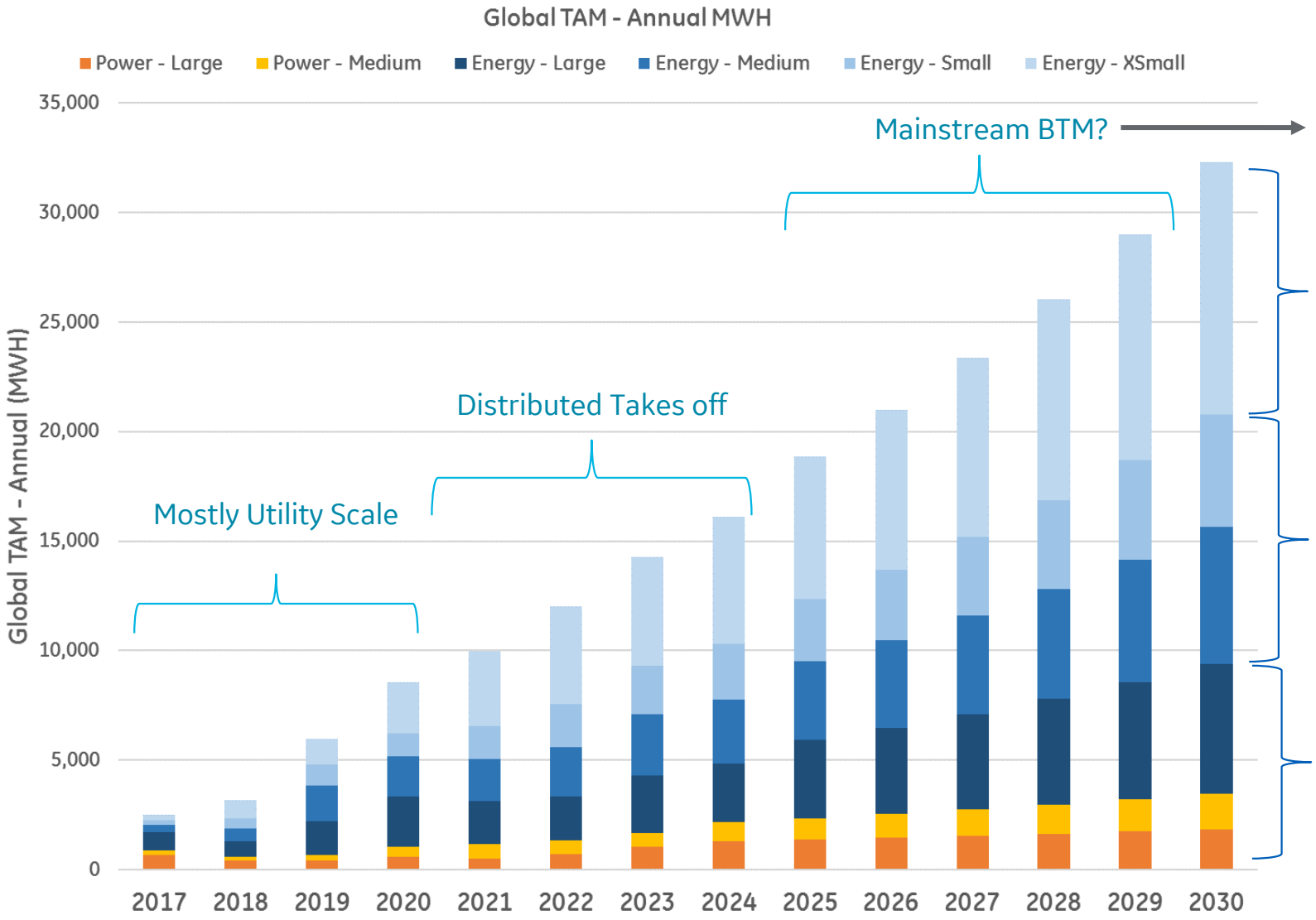
Energy Storage continuously charges and discharges to maintain grid stability



Energy storage provides instantaneous local capacity, and continuous ancillary services with no fuel consumption or emissions

Energy Storage Market

Energy – "2 to 6 Hours"
Mid Power – "1 Hour"
High Power "30 Minute"



Source: GE conversion of BNEF Energy Storage Forecast (11/17)

Magnitude of Market Driven by Benefits vs Cost
Split between segments is uncertain . . .

Set by Policy, Rate Structures, Business Models, etc
Distributed may cannibalize residential in some regions

Residential (10 kW – 100 KW)

- Retail & TOU Rates
- FIT for Self-Consumption
- Net metering
- Community Programs

Distributed (100 kW – 2 MW)

- Community Programs
- WireCo Ownership
- Renewable Penetration
- Demand Charges

Utility Scale (2 MW – 100 MW+)

- Economies of Scale
- Transmission Costs & Constraints
- Wholesale Market Pricing

Use cases cover wide range of power and energy – Driven by policy & rate structures

Energy Storage … Select competitors

AES
"Utility System"

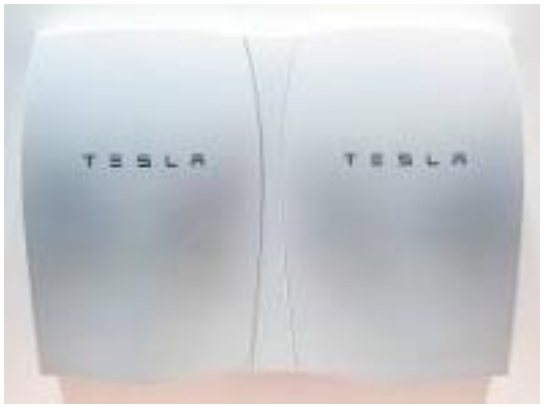
Leading utility scale … 116MW, integrate @ wind, GT's + stand alone

Tech leadership… source battery, own controls + integration + dev't

Global reach… installs in US, LATAM, EU, India; MHI partner to reach Asia

Turnkey utility solution with scale

Tesla
"EVs + residential storage"



Scale from EV to Resi… leverage scale, partner w/ Solar city

Gigafactory … $5B, 50GW/yr battery packs, 5.8MM sqft

Challenging economics… ~$.3/kWh, including installation & PV charging

Creating substantial "buzz" but costs must fall for scale

Sonnen
"C&I Storage platform"

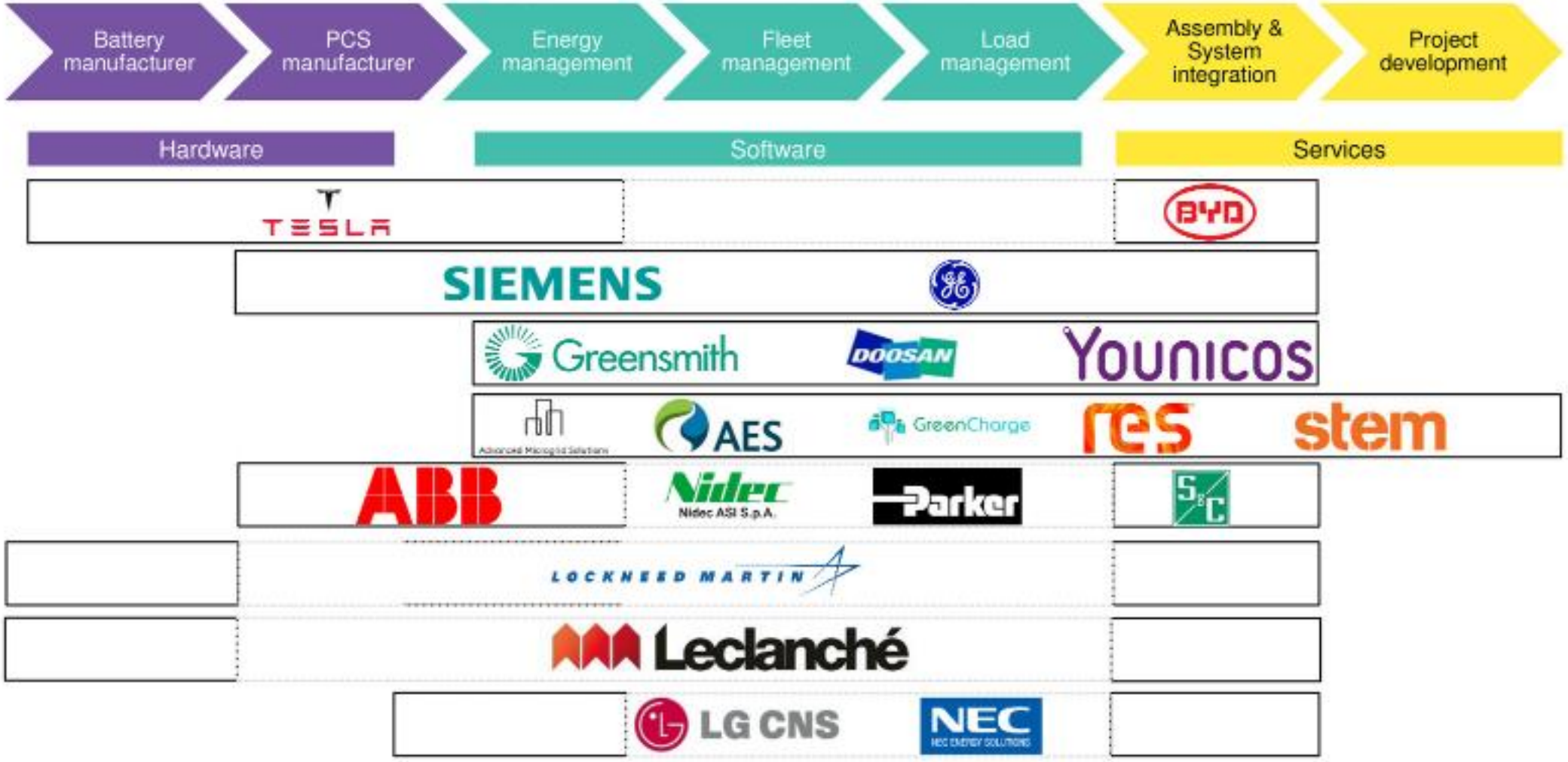
10K batteries shipped… German dereg mkt, expanding to US/Aus

Energy trading platform… bypass utility, $.23/kWh (20% saving)

Select opportunities … Hawaii 4kWh @ $10K, ~6.5yr payback

Platform & product to enable grid defection

Storage solutions provider value chain



Different needs drive different storage applications

Captive Generation

- Large industrial consumers to maximize self consumption
- Replacement of more expensive captive thermal generation
- Matching specific load requirements

Dispatchable peak power solutions

- SECI 1.2GW tender for guaranteed peak power supply
- Bid must have 1 renewable asset component & 1 storage component
- Two-part tariffs: Peak Tariff & OffPeak Tariff

Thermal Hybrids

- Coupling older aged gas units with storage to enhance peakers
- Thermal hybrids with larger array of grid services being feasible
- CO2 improvements & lower OPEX on gas units

Island grid - stability

- Weaker grids / island grids with power quality issues as renewables penetration rises
- Several island grids requiring mandatory coupling of storage with renewables

Captive Generation – a Case Study

CUSTOMER CHALLENGE

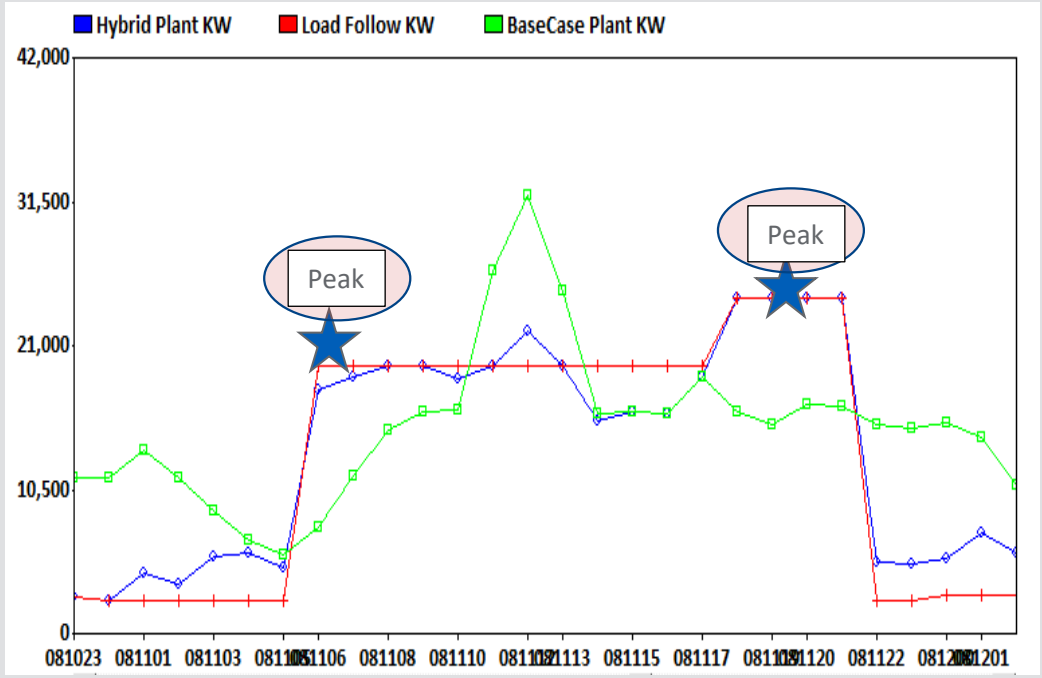
- Matching a specific load profile (high-energy consuming Cement plant)
- Reduce transmission charges
- Interconnect limited to 25MWs of capacity

PROJECT DESCRIPTION

- 17.5 MW Wind, 25 MW solar AC and 20MWH/5MW battery – particular to shift MWHs to most expensive peak hrs
- Integrated control system

APPROACH

- Analyze best technical and economic hybrid system
- Design controls and optimization architecture



LCOE Thermal: $c 5.0/kwH

LCOE Hybrid: $c 4.2/kwH

BUSINESS CASE

- ~12 pts. of CF increase
- Savings on substation
- 7.5MWs of inverters and unit transformers removed
- ~Avoided transmission charges, reduced OPEX and cost of night charging for solar plant

Dispatchable peak power – a Case Study

CUSTOMER CHALLENGE

SECI requirements (1st 10 years):

- >40% plant CUF
- >85% of 50MWac output during peak hours.
- >50% of POI = Storage power rating
- PV + BESS or Wind + PV + BESS

PROJECT DESCRIPTION

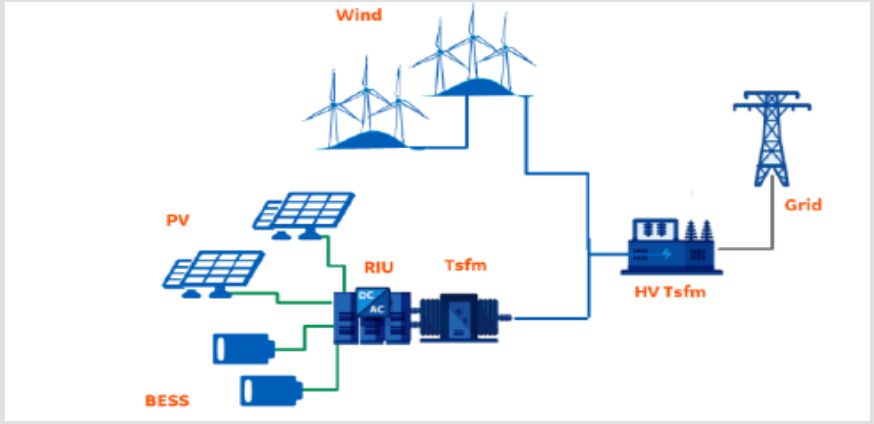
- 50MWac Solar + 140MW Wind + 50MW/150MWh BESS
- DC/AC ratio up to 2.2 for higher CUF

APPROACH

- Determine ideal mix between PV+BESS, Wind + BESS or PV+Wind+BESS
- Optimize for CUF compliance and lowest LCOE during peak period

	Annual Plant CUF	Monthly Average Output (MW) in Peak Hours											
Year	%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	53.4%	55.7	63.6	59.9	55.4	66.1	78.4	92.2	84.6	61.7	43.7	50.9	49.1
2	53.3%	55.1	63.4	59.8	55.2	65.9	78.3	92.2	84.5	61.6	43.5	50.8	49.0
3	53.2%	55.0	63.2	59.6	55.0	65.8	78.2	92.1	84.4	61.4	43.4	50.6	48.9
4	53.1%	54.8	63.0	60.0	55.6	66.1	78.5	92.2	84.6	61.8	43.6	51.1	49.2
5	52.9%	55.4	63.8	60.1	55.5	66.0	78.5	92.1	84.6	61.7	43.5	51.0	49.1
6	52.8%	55.2	63.6	59.9	55.3	65.9	78.4	92.1	84.5	61.6	43.3	50.9	49.0
7	52.7%	55.1	63.4	59.7	55.2	65.8	78.3	92.1	84.5	61.5	43.2	50.8	49.1
8	52.5%	55.6	64.2	60.4	55.7	66.0	78.5	92.1	84.6	61.8	43.5	51.1	49.1
9	52.4%	55.5	64.0	60.3	55.5	65.9	78.5	92.1	84.6	61.7	43.4	50.9	49.0
10	52.3%	55.3	63.9	60.1	55.4	65.8	78.4	92.1	84.5	61.6	43.3	50.8	48.9
11	52.2%	55.2	63.7	59.9	55.2	65.7	78.3	92.1	84.5	61.5	43.3	51.1	49.1
12	52.0%	55.7	64.5	60.6	55.7	66.0	78.5	92.1	84.6	61.9	43.3	51.0	49.0
13	51.8%	55.6	64.3	60.4	55.5	65.9	78.4	92.0	84.6	61.8	43.2	50.9	48.9
14	51.7%	55.5	64.2	60.3	55.4	65.7	78.4	92.0	84.5	61.7	43.1	50.8	48.9
15	51.7%	55.3	64.1	60.1	55.2	65.6	78.3	92.0	84.5	61.8	43.3	50.9	48.9
16	51.4%	55.7	64.7	60.8	55.6	65.9	78.4	92.0	84.5	61.9	43.1	50.8	48.8
17	51.3%	55.6	64.5	60.6	55.5	65.8	78.4	92.0	84.5	61.8	43.0	50.7	48.8
18	51.3%	55.5	64.4	60.5	55.3	65.7	78.3	92.0	84.4	61.7	42.9	50.6	48.7
19	51.1%	55.4	64.3	60.3	55.2	65.6	78.3	92.0	84.4	61.9	43.0	50.7	48.7
20	50.9%	55.7	64.8	60.9	55.6	65.7	78.4	92.0	84.4	61.8	42.9	50.6	48.7
21	50.8%	55.6	64.7	60.7	55.4	65.6	78.3	91.9	84.4	61.7	42.8	50.6	48.6
22	50.7%	55.5	64.6	60.6	55.3	65.5	78.3	91.9	84.3	61.6	42.7	50.5	48.5
23	50.6%	55.3	64.4	60.4	55.2	65.4	78.2	91.9	84.3	61.7	42.7	50.5	48.6
24	50.4%	55.7	64.9	60.9	55.4	65.5	78.3	91.9	84.3	61.6	42.6	50.4	48.5
25	50.3%	55.5	64.8	60.8	55.3	65.4	78.3	91.9	84.3	61.5	42.5	50.3	48.4

Comply with SECI requirement
Not meet SECI requirement



BUSINESS CASE

- >62% Year 1 CUF – room for non-compliance
- Peak compliance annual > 40% the entire year
- PV+Wind+BESS solution most ideal in terms of annual CUF and LCOE/tariff
- Peak Tariff for 14% equity hurdle rate ($/MWh) $89.6/MWh (6.5 Rs /kWh) < current baseload facilities

Thermal Hybrids – a Case Study

CUSTOMER CHALLENGE

- Reducing system energy costs on aged gas units
- CO2 footprint reduction while providing same level of ancillary services (spinning reserves, PFR) to the grid

PROJECT DESCRIPTION

- LM6000 GT retrofitted with 10 MW / 4.3 MWh Li-Ion battery storage system
- Integrated control system

APPROACH

- Analyze best technical and economic sizing of the storage system
- Design controls and optimization architecture between gas unit and storage system

Ribbon cutting, April 17, 2017

BUSINESS CASE

- Emissions reduced by 60%
- Two million gallons of water saved annually
- Increased dispatch rate
- >$250k reduction in annual lifecycle costs*
- GHG emissions reduction CAISO $59k/yr
- Improved grid stability for new customers

Island grid stability – a Case Study

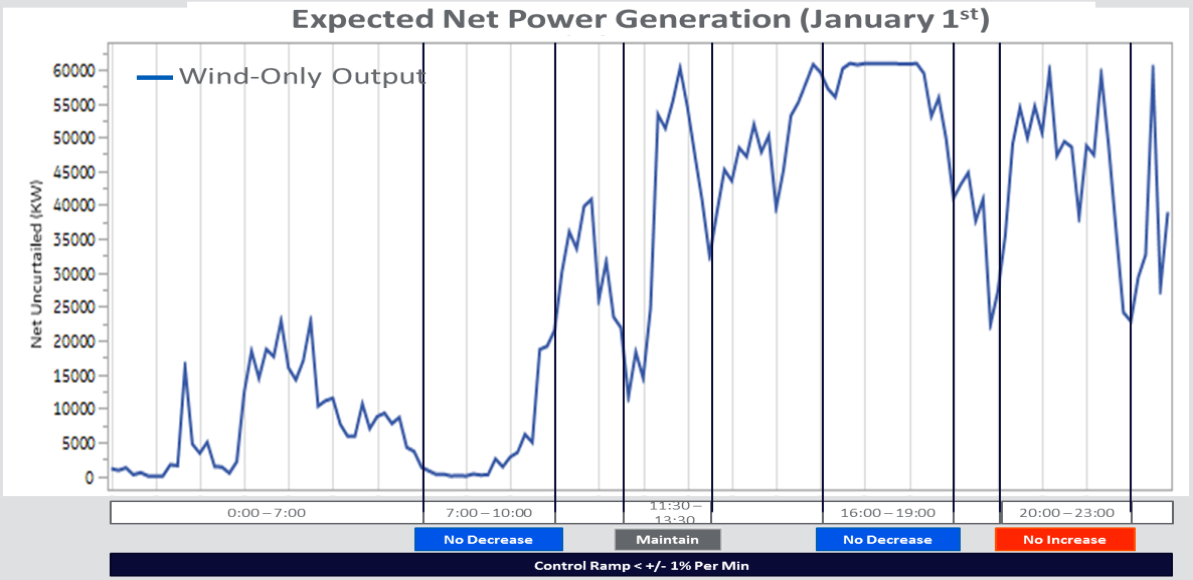
CUSTOMER CHALLENGE

- Strict ramp requirements from Hokkaido Electric in order to grant 63MW Wind Project grid Interconnection:
  i. Ramp < +/-1%/min at all times
  ii. 4 blocks of day

Time of Day	7:00 – 10:00	11:30 – 13:30	16:00 – 19:00	20:00 – 23:00
Requirement	No decrease	Maintain	No decrease	No increase

APPROACH

- Analyze best technical and economic hybrid system that meets HEPCO compliance
- Battery sized to minimize CAPEX & curtailment while achieving grid compliance

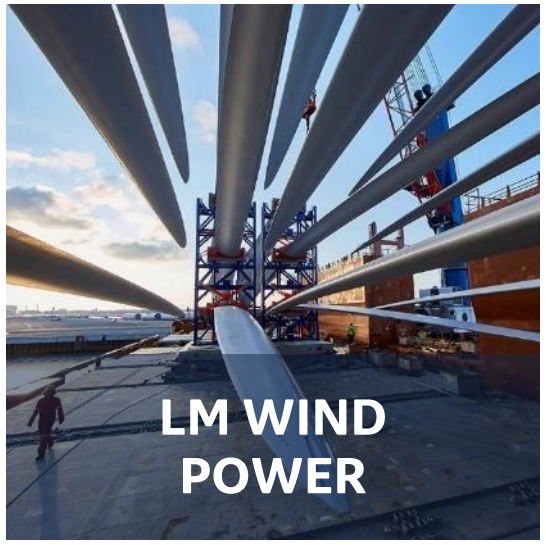


Business Case

- Decision had to be made on pursuing onsite storage vs. upgrading grid network to secure grid connection
- Unclarity on non-compliance penalties made storage case unviable/unpredictable as 100% compliance significantly increased storage CAPEX; technically 100% compliance was achievable

GE Renewable Energy

$15B revenue • 40,000 employees



Broadest portfolio in the industry; gives us scale, scope and capability to fulfill our mission