THE ENERGY STORAGE PLAYBOOK: YOUR STEP-BY-STEP GUIDE TO GEAR UP AND SAVE MONEY

Brett Cullen, Business Development

June 11, 2019

ENGIE Storage

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We build turnkey energy storage solutions that serve consumers and producers on both sides of the meter.

- US Storage Division HQ in Silicon Valley
- Over 170 energy storage projects (88 MWh)
- Ranked #1 provider by Navigant Research
- Pioneer of innovative commercial structures
- Backing of world's largest energy services company

Key Services

- Energy Site Analysis & System Design
- Hardware Integration, Interconnection & Operations
- Software Service Stacking & Aggregation
- Performance-based Financing Options & Guarantees

Customer Examples

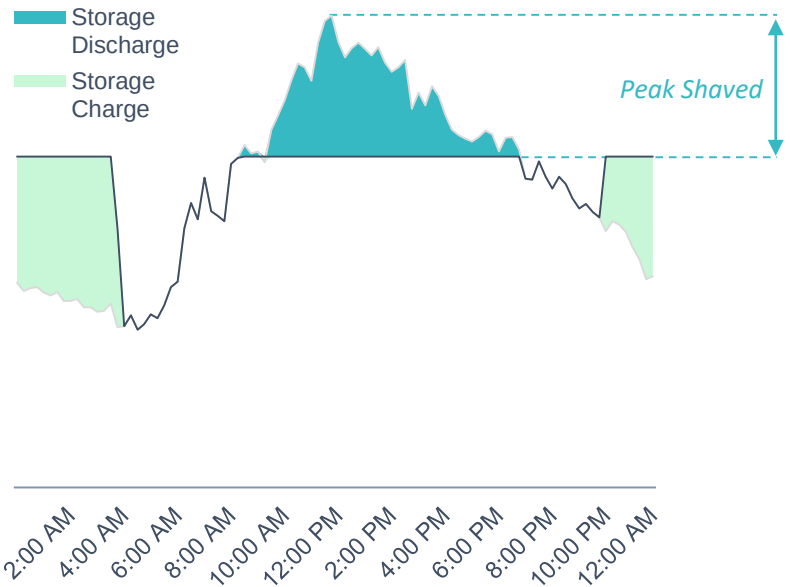
Businesses & Government

SAFEWAY, UPS, Walgreens, KAISER PERMANENTE, 7-ELEVEN, MVLA HIGH SCHOOL DISTRICT, The County of Santa Cruz, SIERRA NEVADA

Utilities & Network Operators

SDGE, PG&E, conEdison, HG&E, Alliant Energy, Hawaiian Electric Maui Electric Hawai'i Electric Light, California ISO

SHAPING LOAD

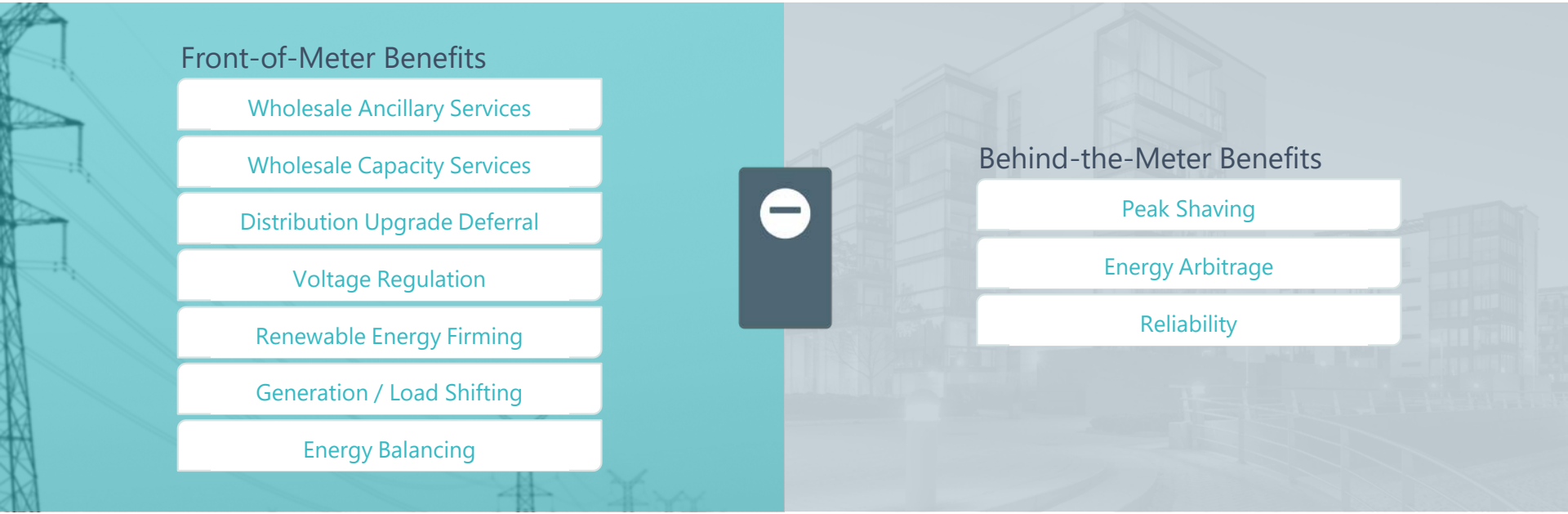


Intelligent energy storage is best used to shape load by regulating draw from the grid.

Value drivers for shaping load with energy storage differ depending on which side of the meter a system is operated.

DISTRIBUTED ENERGY STORAGE SERVICES

Benefits on both sides of the meter are fueling the growth in distributed energy storage adoption.



PROJECT DEVELOPMENT PROCESS

End-to-End Energy Storage Project Process

Vet
- Utility
- Tariff
- Max Load
- Solar profile

Analyze
- BESS Size
- Cost
- Savings

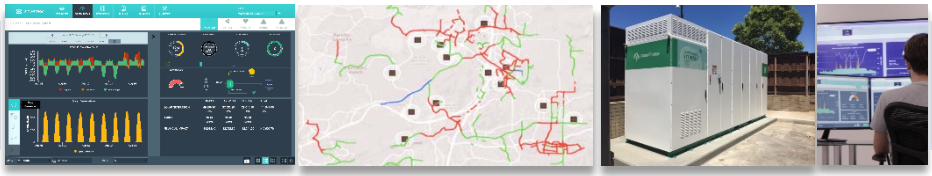
Site Walk
- Location
- EPC Price

Contract
- System Sale Agreement
- Warranty
- Performance Guaranty

Finance
- Increase PPA
- Fixed Payment

Build
- Design
- Utility Interconnect
- Build/Install
- Incentives

Operate
- Monitor
- O&M
- Performance reporting



KEY CONSIDERATIONS DURING PROJECT EVALUATION

Project Analysis

Clipping

If solar-paired, and DC clipping recapture or energy shifting is required, does the developer have the analytical capabilities to provide anticipated 8760?

Sizing / Electrical Design

Does the developer have the engineering expertise to appropriately size the system and incorporate the correct metering regime?

Degradation

Has the developer provided a degradation curve – both anticipated and warranted?

Indicative AC/DC BESS Sizing Analysis – Payback Period

	No ESS	AC 5/2h	AC 5/3h	AC 5/4h	DC 5/2h	DC 5/3h	DC 5/4h
1.3 (F)	15.6	9.4	9.2	9.0	8.9	8.5	8.8
1.5 (F)	16.1	9.7	9.4	9.3	9.5	9.2	9.5
1.7 (F)	16.8	10.1	9.9	9.8	9.6	9.5	9.6
1.9 (F)	17.5	10.5	10.3	10.2	9.9	9.6	9.9
2.1 (F)	18.6	11.1	10.8	10.7	10.3	10.1	10.2
1.3 (T)	15.4	10.0	10.0	10.0	9.6	9.3	9.6
1.5 (T)	16.1	10.5	10.6	10.6	10.3	10.2	10.7
1.7 (T)	17.2	11.3	11.3	11.3	10.7	10.4	10.7
1.9 (T)	18.0	11.9	11.8	11.8	11.2	10.7	11.0
2.1 (T)	19.0	12.7	12.4	12.4	11.8	11.4	11.7

KEY CONSIDERATIONS DURING PROJECT EVALUATION

Financial

Attributes

Who owns the rights to the value streams of the BESS – capacity, energy, etc? Split ownership may allow for a "buy-down" of the energy storage service agreement price.

Station Service and Round Trip Efficiency

Who is providing station service? Is the developer requesting a separate station service retail agreement with the PPA (if a financed BESS)? Are there Round Trip Efficiency guarantees?

Liquidated Damages

Availability-based? Calls-based irrespective of uptime? Cap?

Operations

Cycle Ownership / Allocation

If the BESS is optimizing across a number of signals, ownership of cycle count and permissible hours is critical.

Operation

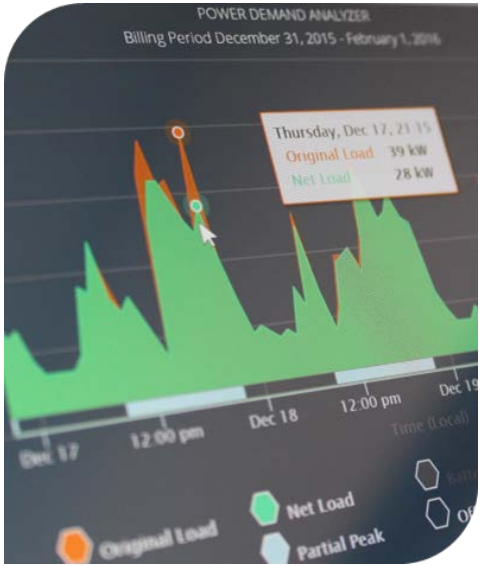
Who is controlling the dispatch of the BESS? Is it integrated with SCADA, or through lower-resolution cellular connection?

Degradation

Does the developer warrant the degradation of the BESS? If over-cycled, who is responsible?

SIZING A SYSTEM

- Factors in determining the right sized system
  - Shape of the substation profile
  - Volatility and consistency of load shape
  - Size and dispatch profile of other nearby generators
  - Financial returns
- Risk in under sizing and over sizing



RESULTS: WHAT TO EXPECT

Storage Analysis Results:

1. Recommended Size of ESS
2. Expected Savings
   - Demand Shaving
   - Energy Arbitrage
   - Tariff Optimization
3. Price: Hardware, Software and Ongoing Support
   - Proforma also provides:
     - Indicative shipping and EPC
     - Incentives (SMART, ITC)
     - Estimated sales tax

Indicative AC/DC BESS Sizing Analysis – Payback Period

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QUESTIONS?

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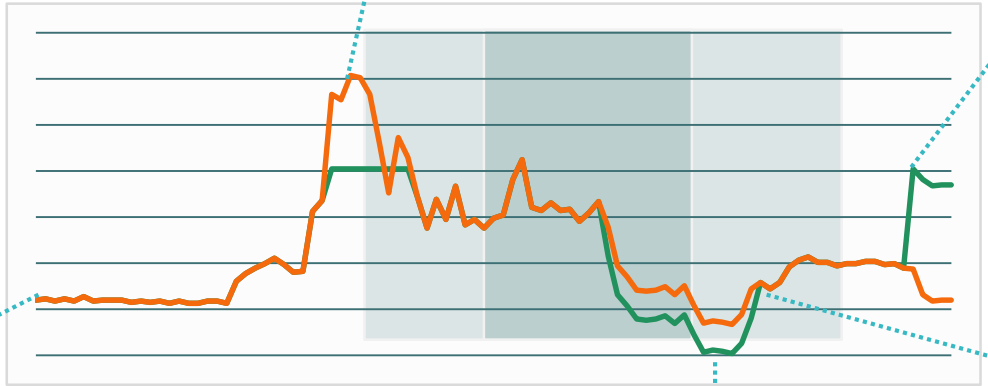
LATEST TRENDS

April 4th - Standalone Investment Tax Credit applicable to energy storage continues to gain steam in Washington



Record 148 MW in Q1 installed, a 232% increase in volume YoY

May 17h – FERC issues sweeping denial of ISO requests to delay FERC Order 841 implementation, keeping ISOs on track to implement market rules to allow for storage participation

Early 2019 – Utility procurement announcements continue, with Florida Power and Light, Southern California Edison, Oklahoma Municipal Power Authority, Tennessee Valley Authority issuing a GW of new solicitations

May 14th – Trump Administration announces new 25% tariffs on various Chinese products, including lithium ion batteries

PAIRING WITH SOLAR: DC- OR AC-COUPLED?

AC Coupling

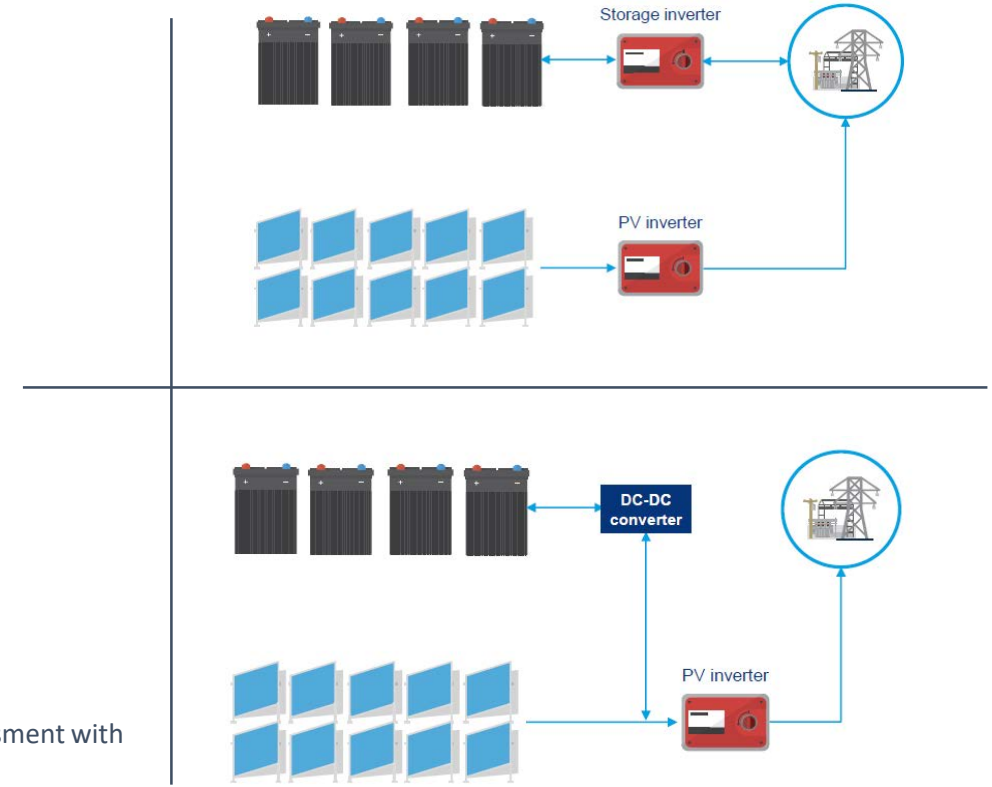
Advantages
- Higher availability (dual inverters)
- Greater grid services support
- Retrofit optionality

Disadvantages
- Higher capex due to greater equipment
- Dual inverter losses yielding lower net energy
- Lower LCOEs – depending on use case!

DC Coupling

Advantages
- Lower capex – less BoP, inverters
- Clipping recapture – higher CF
- Higher LCOE – depending on use case!

Disadvantages
- Lower availability – single point of failure
- Relatively slow adoption – utilities exploring technical assessment with caution
- Few supply options at present



ENGIE Storage Capabilities