

Introduction to Energy Storage

Presentation to Clean Energy 805

Alex Pugh, Hecate Energy

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Introduction to Energy Storage Overview

Hecate Introduction

Changes to the Electric Grid

What Energy Storage Does

How Energy Storage Works

Definitions

Examples

Who is Hecate?

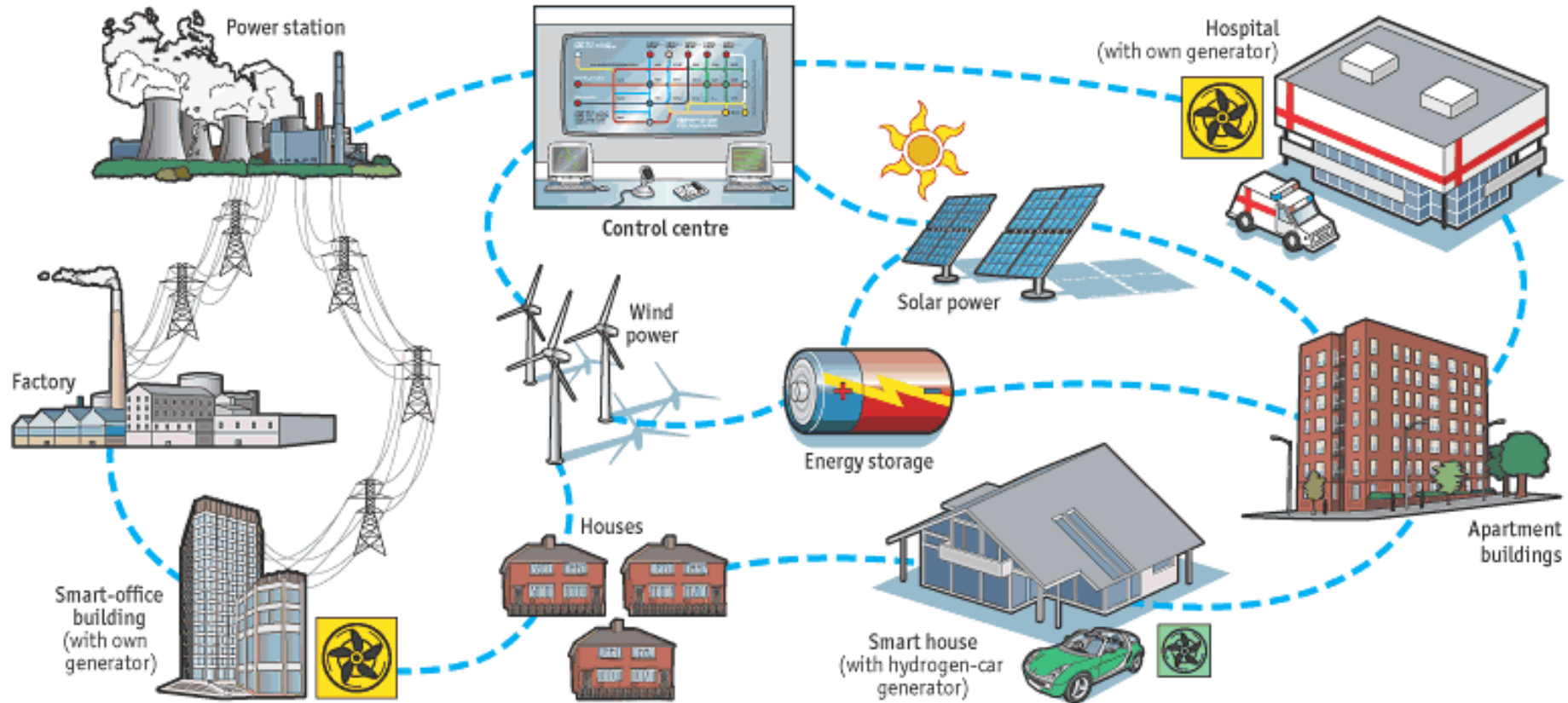
Hecate Energy: /hek uh tee/ - A developer of solar power plants, natural gas-fired power plants, and energy storage solutions, Hecate Energy is driven by a mission to develop, own, and operate power-generating facilities in the United States and select international markets. In total Hecate Energy has entered into PPAs or is in final negotiations for PPAs totaling over 432 MW-ac of solar power and 118 MWh of energy storage.



Conventional Power Grid Operation



New Smart Power Grid Operation



Sources: *The Economist*; ABB

Where do Batteries Fit into the New Grid - IFOM

In Front of the Meter Applications

Frequency Regulation

Load Shifting

Spinning Reserve

Dispatchable Generation

Controllable Demand

Grid Operations Support

Improves efficiency and reliability



Where do Batteries Fit into the New Grid - BTM

Behind the Meter Applications

Demand Response

Peak Shaving

Load Shifting

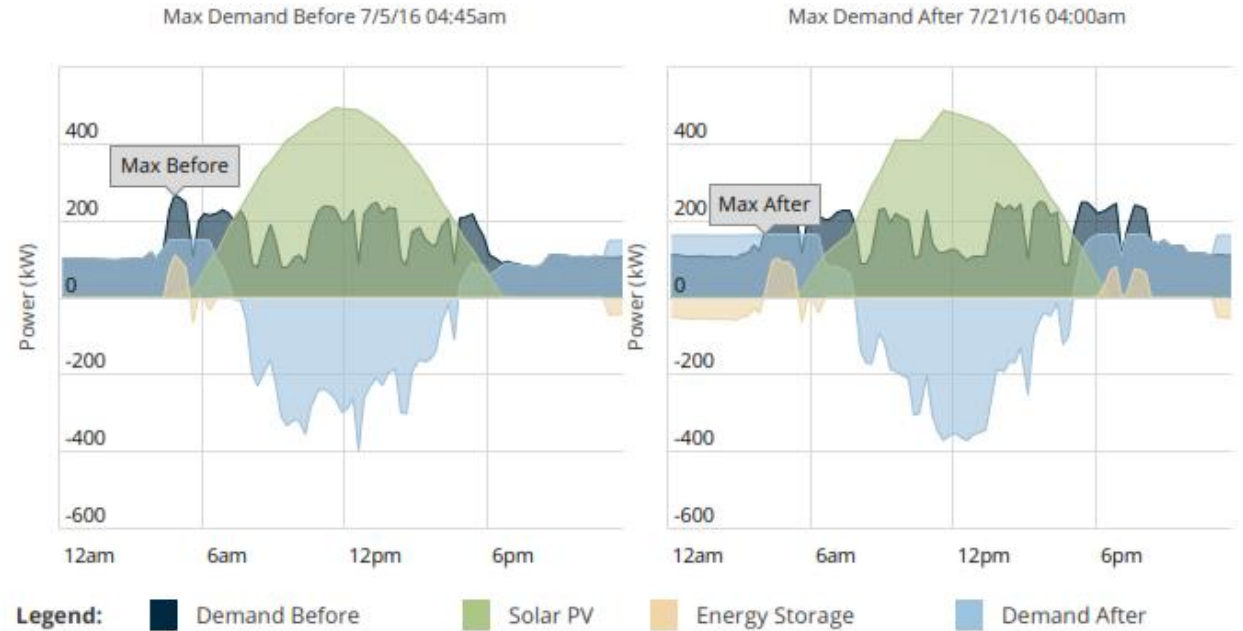
Back-up Power

Solar Integration

Power Quality Improvement

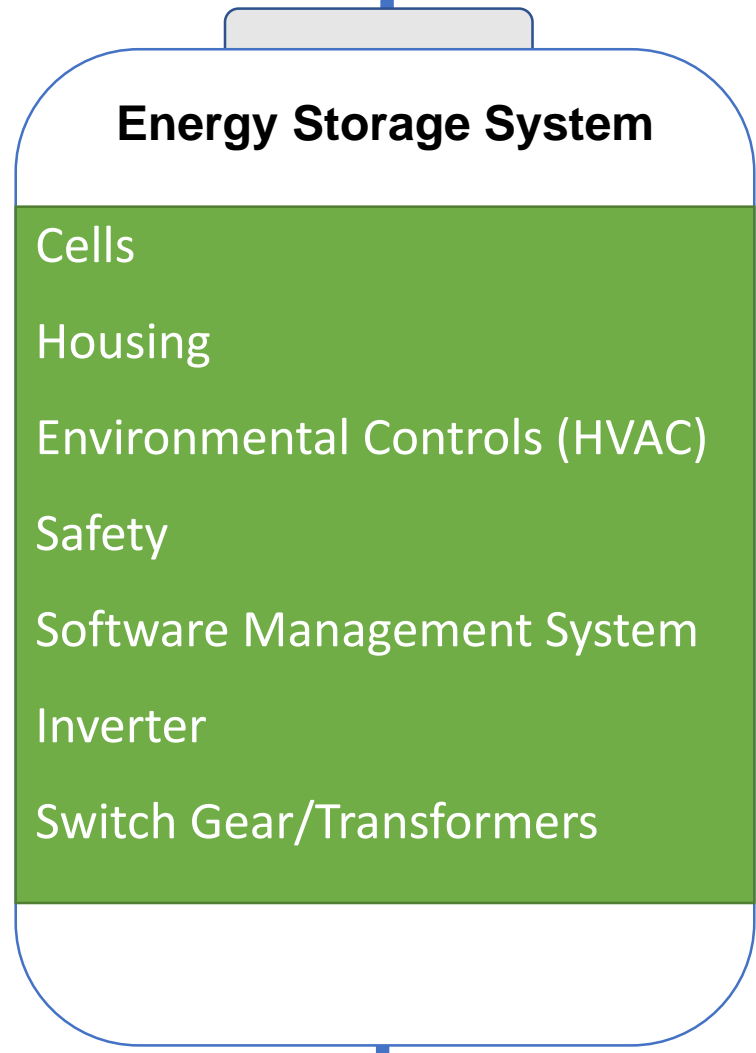
Facility Operations Support

Increased Control of Energy Use to Reduce Cost



IFOM

BTM

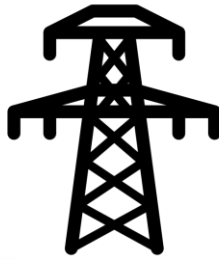
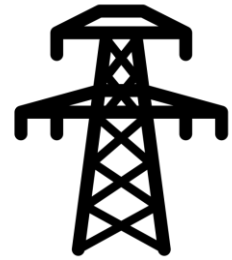
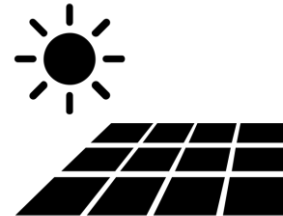
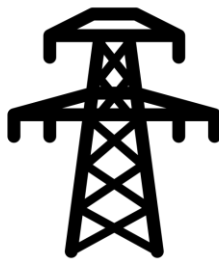


Charge

Charge

Discharge

Discharge



Energy Storage Definitions

System Size (2 Measures)

1. Capacity – Amount of power (i.e. 1 MW)
2. Duration – Length of output (i.e. 4 hours)

Response Rate

Time to start charging/discharging (<2 seconds)

Cycles

Time to completely discharge and recharge (1 Cycle)

Efficiency

Amount of power lost during 1 cycle (Typical 80-90%)

Degradation

Amount of capacity lost during a cycle

Capacity Maintenance

Products or efforts to eliminate degradation

Lithium Ion System Configurations

| | Outdoor | | Indoor |
|---------------------|--------------------|-----------------|--------------------|
| | Shipping Container | Utility Cabinet | Electrical Cabinet |
| Building Block (kW) | 350 | 100 | 10 |
| Footprint (feet) | 40 x 8 x 7 | 5 x 12 x 8 | 2 x 3 x 8 |
| Thermal Controls | Yes | Yes | No |

Hecate Energy IFOM Examples

Ontario, Canada

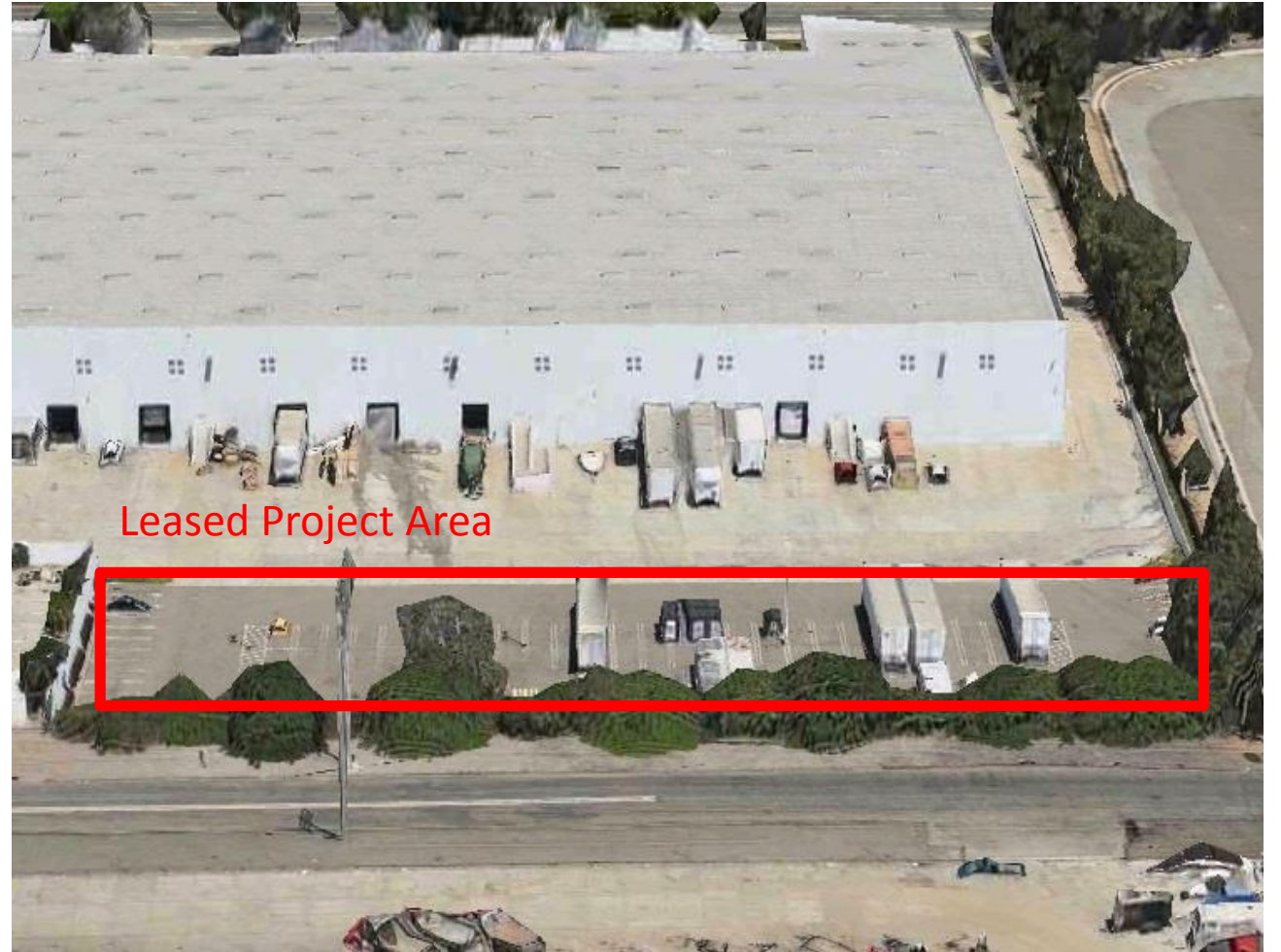
- 14.8 MW IFOM
- IESO Offtaker
- 7 sites, complete and in construction



Hecate Energy IFOM Examples

Southern California

- 20 MW IFOM
- SCE Offtaker
- Leased area in storage/parking at active logistics center.
- Standard Commercial Lease Rates
- Completing all zoning and permitting.
No impact to operations



Questions?

Contact Information

Alex Pugh

Hecate Energy

APugh@HecateEnergy.com