

ENERGY

Bidding Batteries – Enabling bankable storage in microgrids

HOMER International Microgrid Conference 2020

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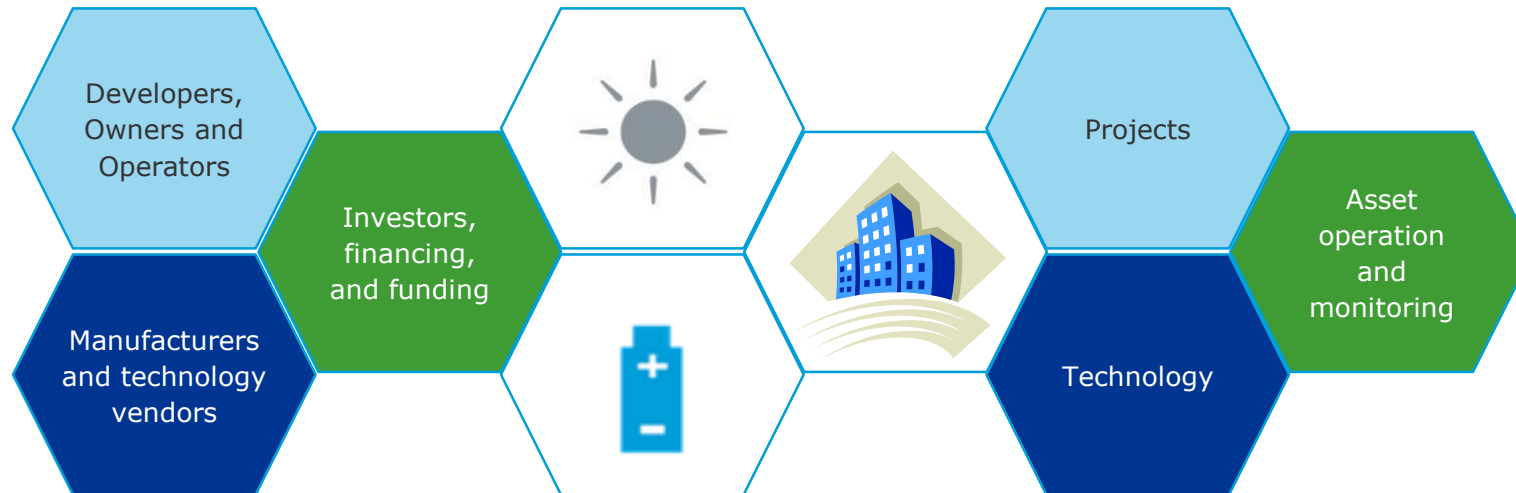
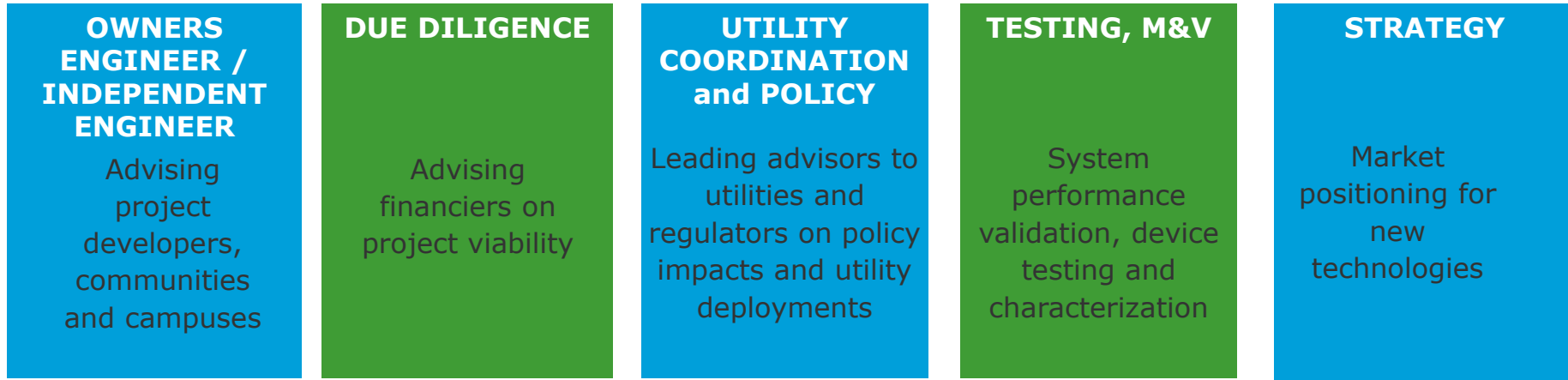
HOMER International
MICROGRID Conference | 8th Annual | #HIMC2020

About DNV GL



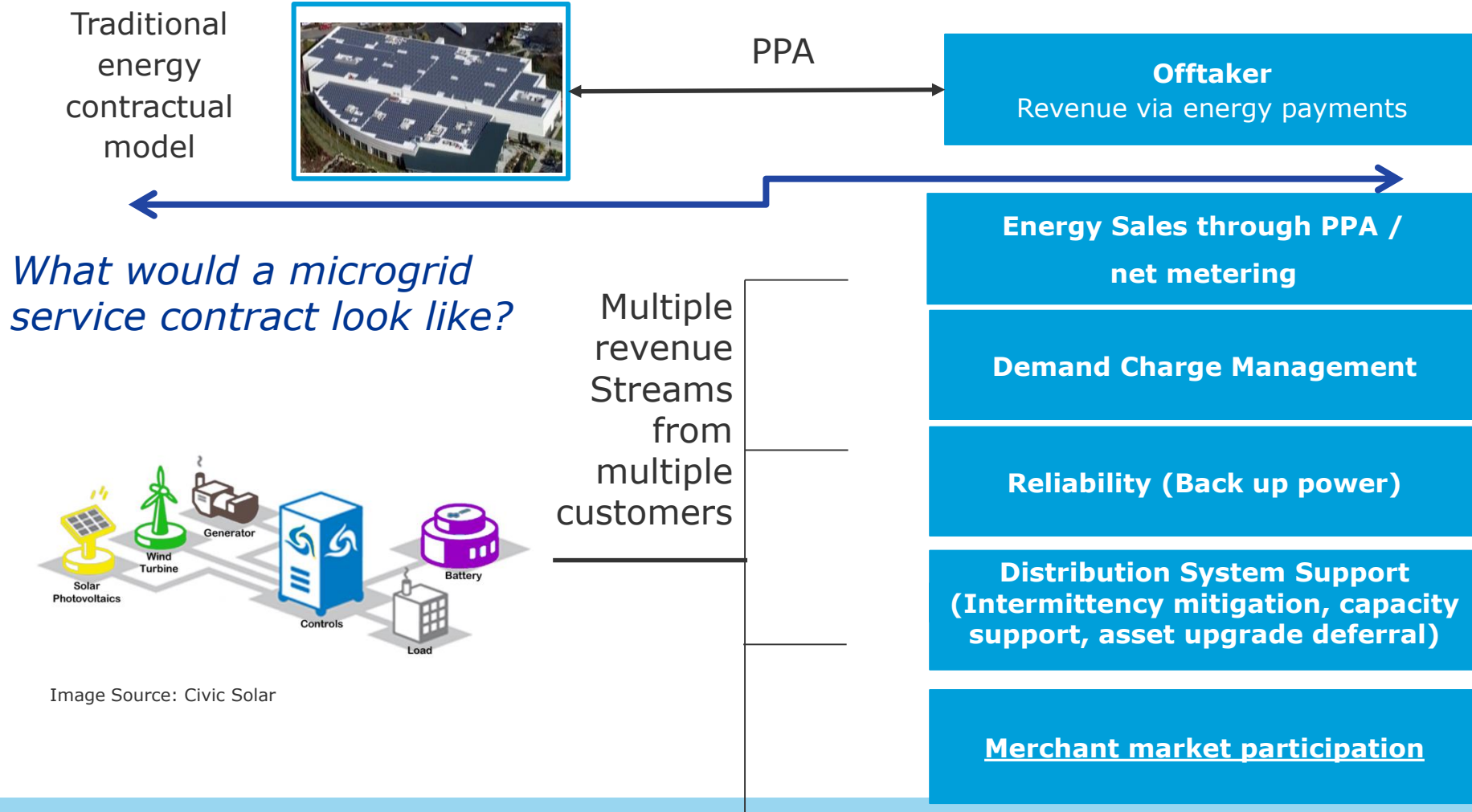
Energy Storage Engineering: Microgrids, Energy Storage, and Energy Access

DNV GL is independent and technology, vendor agnostic

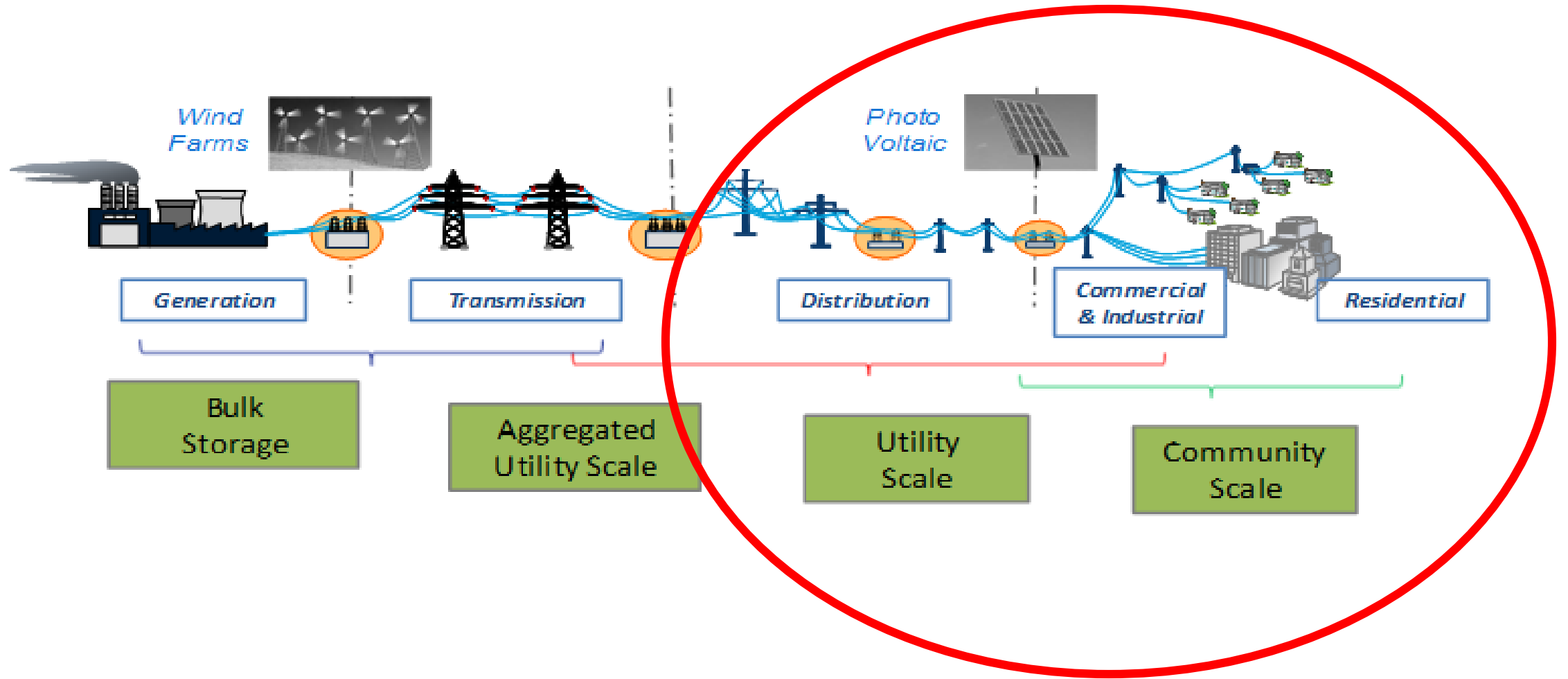


Monetization of multiple services

How to monetize multiple microgrid services?



Location and Applications

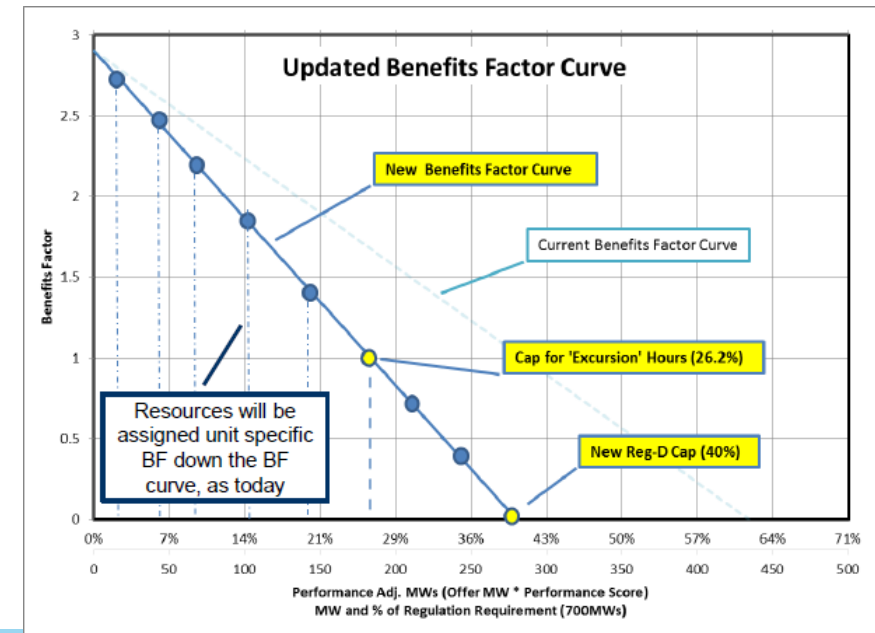


Market Incentives – Frequency Regulation

- FERC Order 755, Oct 2011 mandated ISO's to initiate storage – specific regulation markets.
- Large – scale transmission connected storage participating in fast regulation has seen the largest volume of storage deployments in 2011 – 2015.
- Markets – PJM Reg D (Dynamic Regulation), CAISO REM (Regulation Energy Management)
- PJM Regulatory Updates
 - Proposed new rules reduce % of Reg D participation (as % of total Reg) to 26.2% from 42%
 - Zero-bid and self-dispatch resources will be based on performance scores.
 - **September 2020:** PJM votes to approve reforming capacity valuation ELCC method, further enabling storage to participate

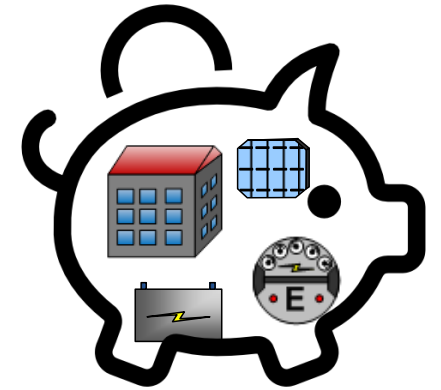
PJM Reg D Registered Technologies

Regulation D	
Resource Type	Offer MW
Battery/Storage	136
DSR	15
Hydro	420
CT	110



Considering Merchant Revenue - Building on HOMER

- HOMER can be used to determine initial sizing and optimize based on revenues from the grid
- Many batteries are IDLE!
- Based on the HOMER outputs, the consideration of additional revenue streams can be considered
- The revenue results can determine the IRR of a project considering more diverse revenue streams



Inputs – System, Market, and Architecture

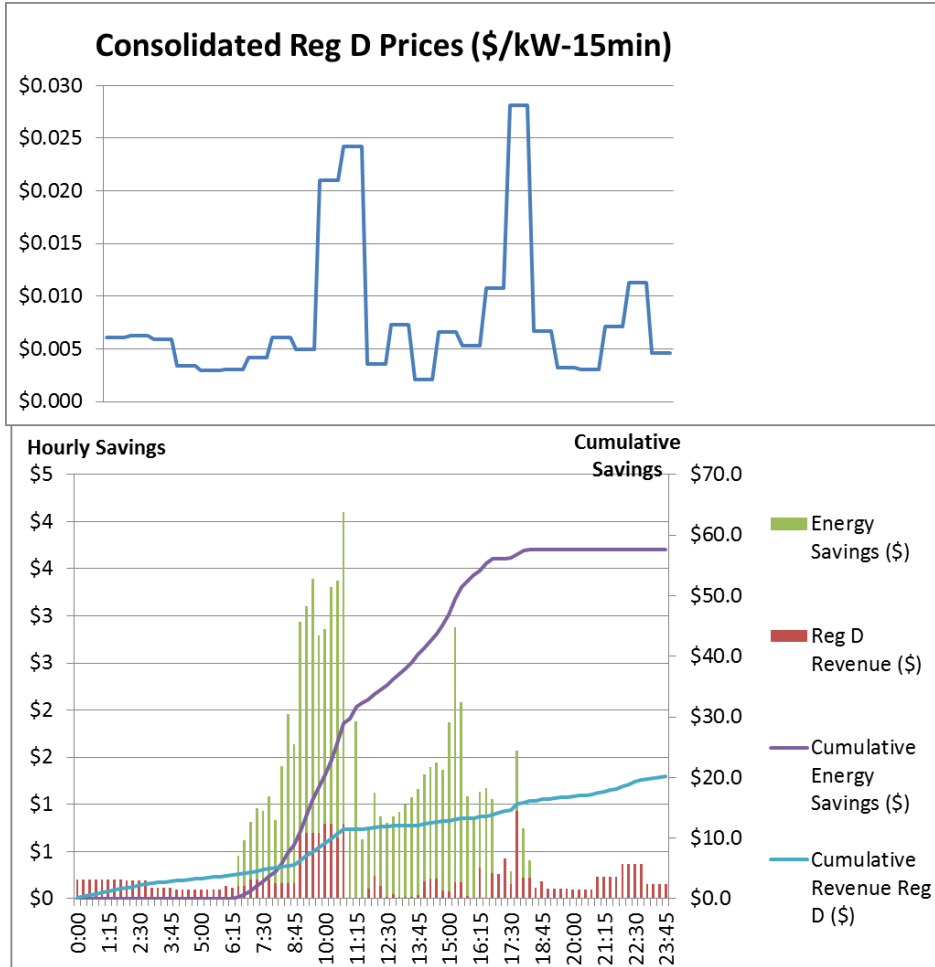
Model Parameters		
Project Name	DCPV_40MW	
Project Start Date	01/01/2021	mm/dd/yyyy
Project End Date	12/31/2040	mm/dd/yyyy
Project Life	20	1-30
Select Configuration	dc-coupled with Solar PV	
Year to Run	User Selected Year(s)	
ISO or BA	NYISO	
Interconnection capacity	150	MW

Solar PV		
DC Capacity	165.90	MW
AC Capacity	128.00	MW
Annual derating	0.64%	%/Year
DC-AC Inverter efficiency	98.20%	%
AC Electrical efficiency	97.82%	%

Storage		
Inverter Power Capacity	40.00	MW
Storage Energy Capacity	80.00	MWh
Storage Max Discharge Power	40.00	MW
Storage Max Charge Power	40.00	MW
Storage Charge/Discharge Efficiency	99.90%	%
DC Line Efficiency	99.65%	%
DC-DC Converter Efficiency	98.50%	%
DC-AC Inverter Efficiency	98.20%	%
AC Electrical Efficiency	97.82%	%
Auxiliary Power Loss	2.20%	%
Minimum State of Charge	5.00%	%
Maximum State of Charge	95.00%	%
Initial State of Charge	50.00%	%
Max Discharge Power for Reg Up	40.00	MW
Max Charge Power for Reg Down	40.00	MW
Max Discharge Power for Spin	40.00	MW

Wind		
AC Capacity	0	MW
Total Efficiency	100.00%	%

Typical installation – Microgrid for Bill Management + Frequency Response

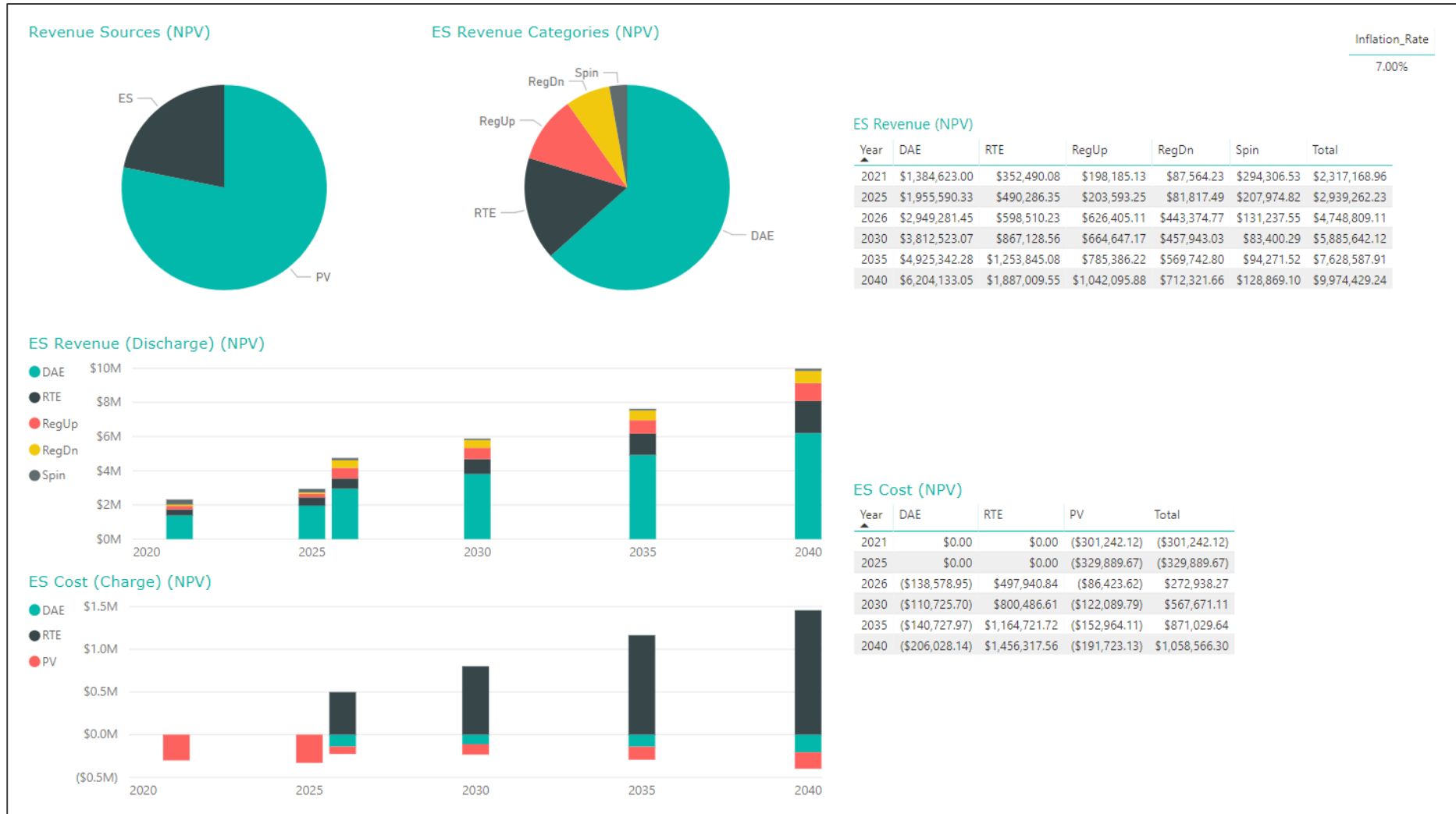


- On day, prices range from 0.2c – 2.8c / kW-15 (\$8 - \$112 / MWhr).
- Cumulative savings over day
 - \$58 from energy (PV)
 - \$20 from RegD
- Effect on net-load over day is minimal

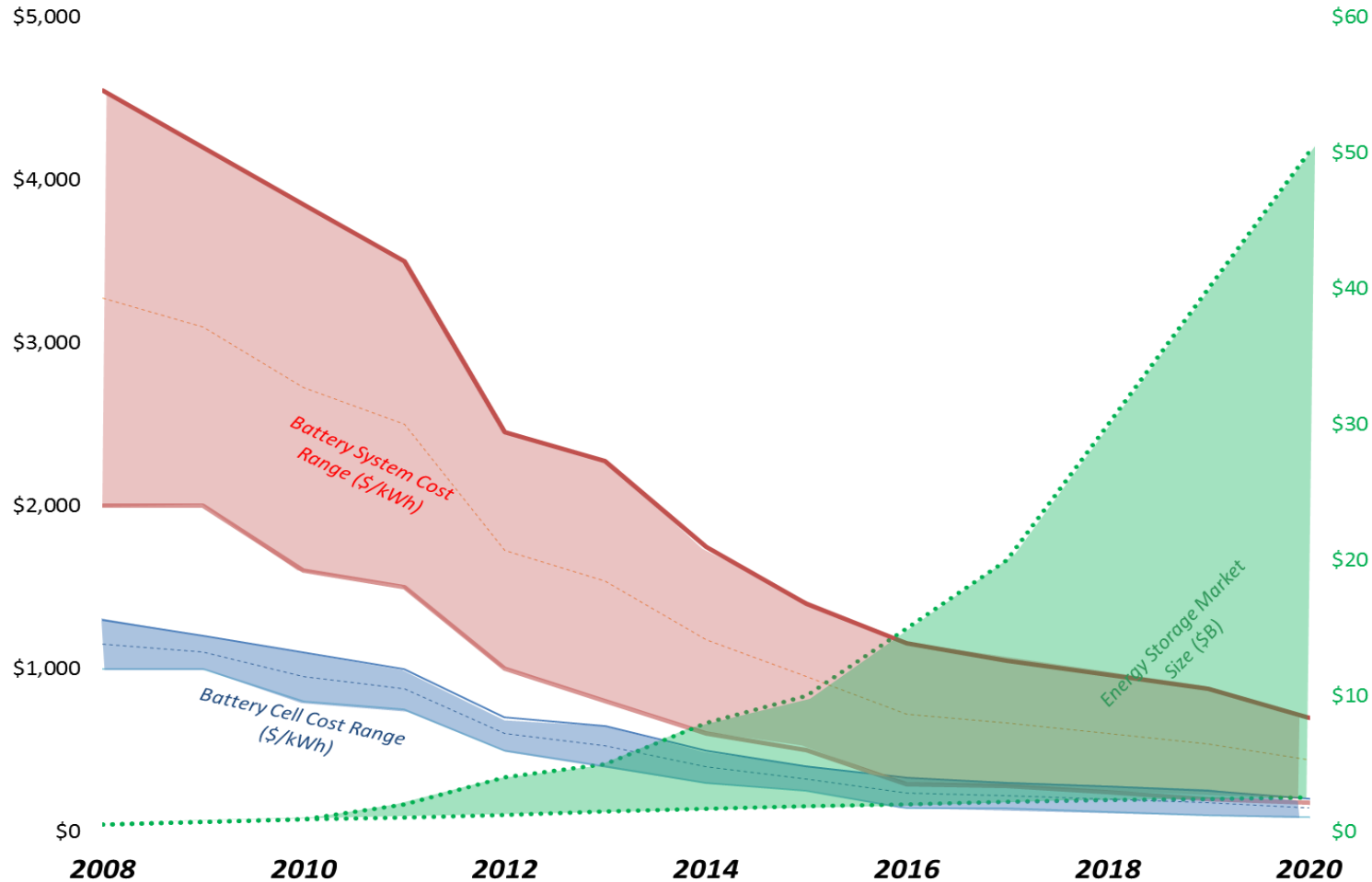
Peak demand increases slightly over the day



Typical results of an IRR analysis of BESS revenue



Looking forward - Prices fall and markets grow



- Aliso Canyon was deployed in 2016 @ **\$550/kWh**
- In 2020, we are seeing examples of 4-hour projects @ **\$250/kWh**

Thank you.

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