

PARAMETRIC OPTIMIZATION OF ENERGY STORAGE RESOURCES TO DRIVE ASSET VALUE

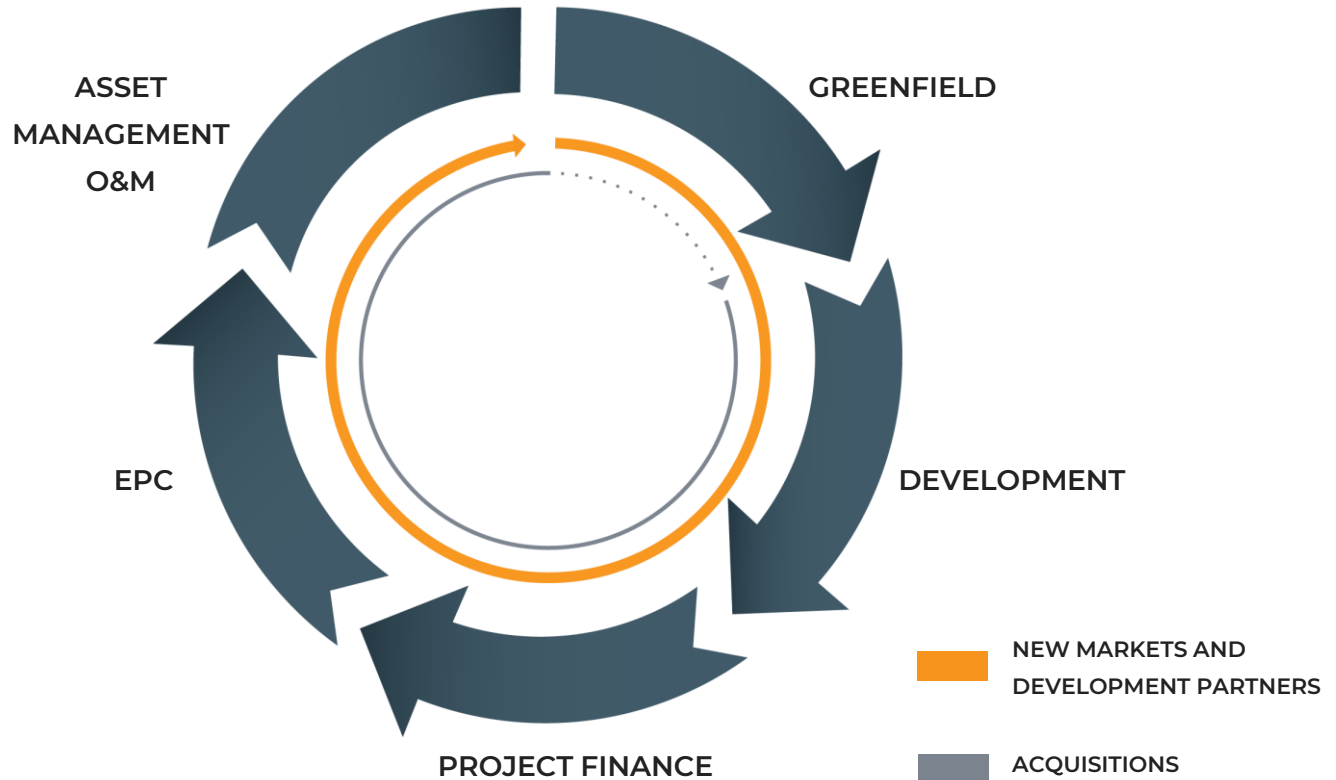
Raafe Khan
Director, Energy Storage





PINE GATE RENEWABLES

Our vertically-integrated approach creates and captures value at every stage of a project, allowing it to adapt to changing market conditions and take advantage of various opportunities in an ever-evolving market.





MILESTONES AND ACHIEVEMENTS

1,370MW

Operating &
Construction
Asset Portfolio

15.7GW

Active
Development
Pipeline

85

Operating
Sites

20

Active
Markets

\$3.1B

Capital
Raised

Pipeline
Generation:

177

projects in active
development

462 MW

NTP assets by
end of 2021

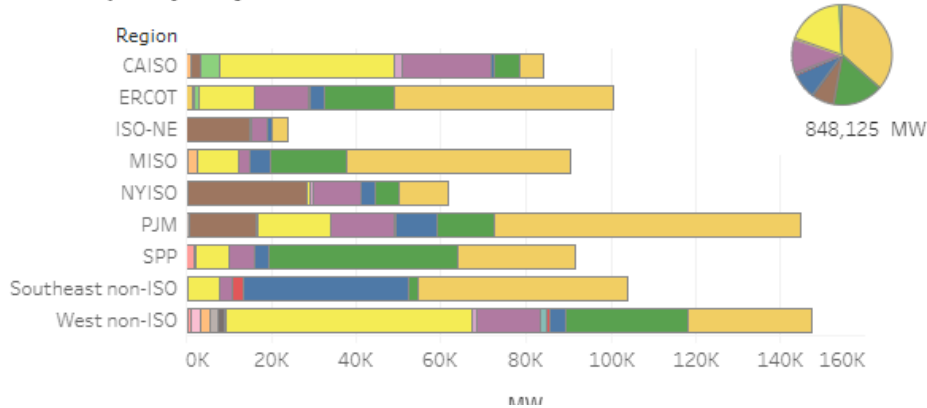
As of 9/2021





PUBLIC POLICY

Total Capacity in Queue at End of 2020



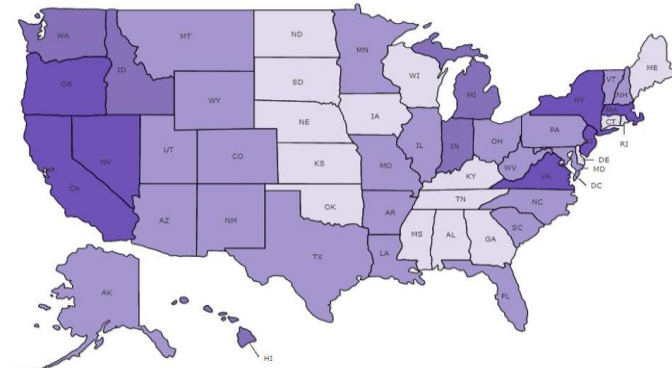
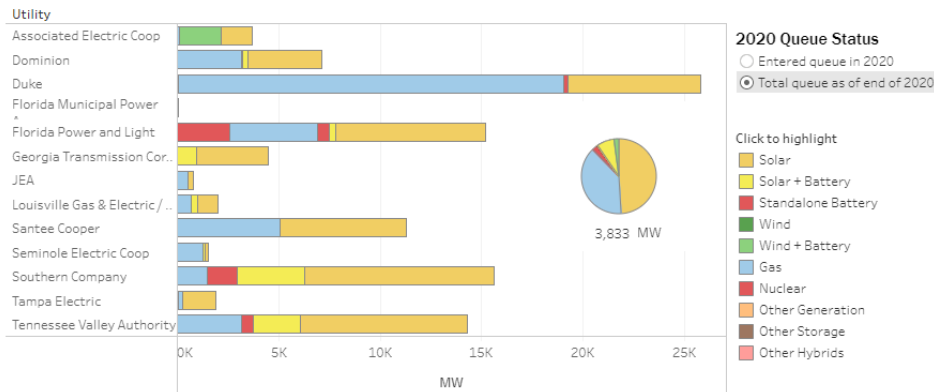
Hybrid plant data included from 2018 to 2020 only.

Click to Highlight

- Solar
- Solar + Battery
- Wind
- Wind + Battery
- Offshore Wind
- Nuclear
- Coal
- Geothermal
- Other Generation
- Battery
- Other Storage
- Pumped Storage + ...
- Hydro
- Solar + Wind
- Solar + Wind + Bat...
- Gas
- Gas + Battery
- Gas + Solar



Non-ISO regions: Southeast



The following was taken into account to measure the degree of energy storage implementation in a state:

- The existence of an energy storage state mandate and/or target
- Any PUC dockets and legislation dealing with energy storage in the state
- Any Integrated Resources Plan (IRP) mentioning energy storage in the state
- Any initiatives launched by the state to promote energy storage
- The number of utilities in the state which have settled an energy storage target goal
- The capacity (in MW) of battery projects (lithium-ion, flow and other/ unspecified battery projects) installed and in development.





RISKS ENTAILED

SUPPLY CHAIN

ENVIRONMENTAL
HEALTH AND
SAFETY

HARDWARE AND
SOFTWARE

CONSTRUCTION

COST

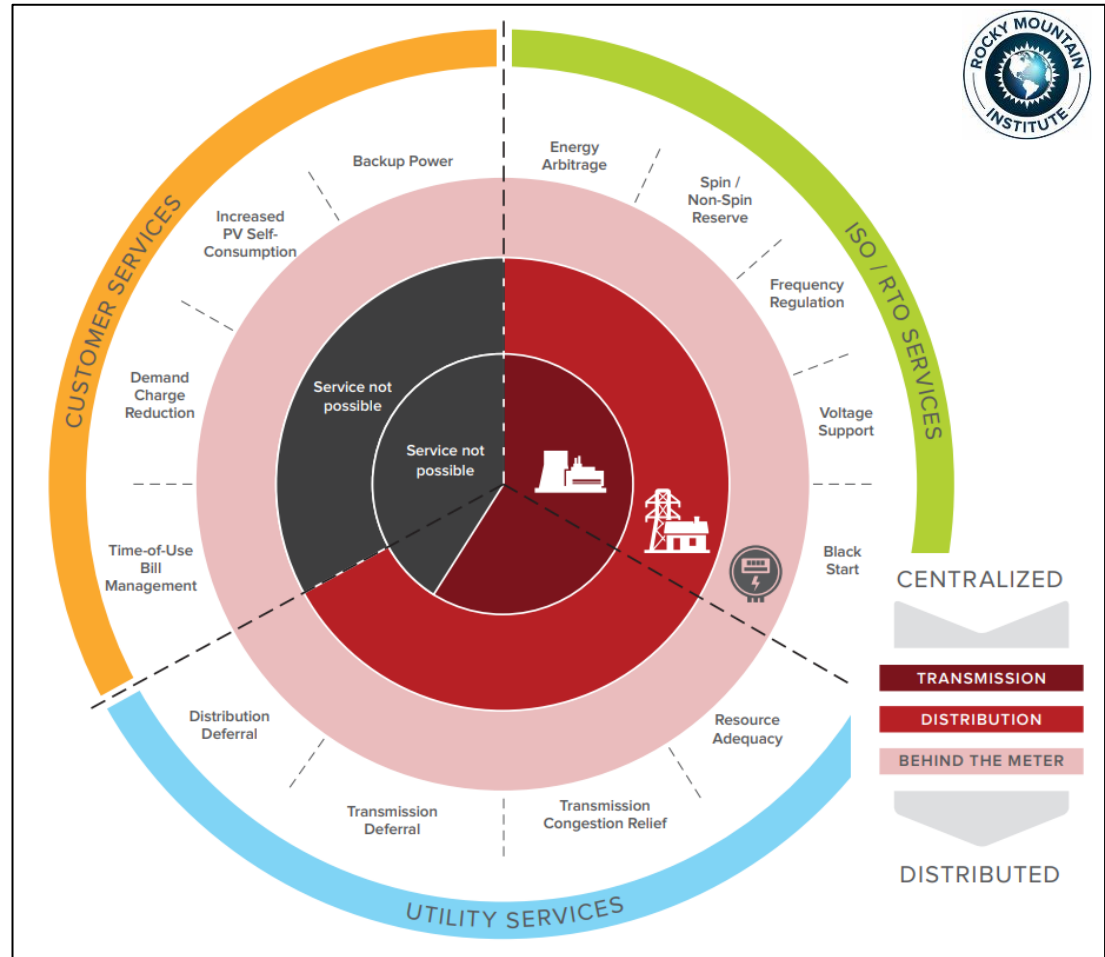
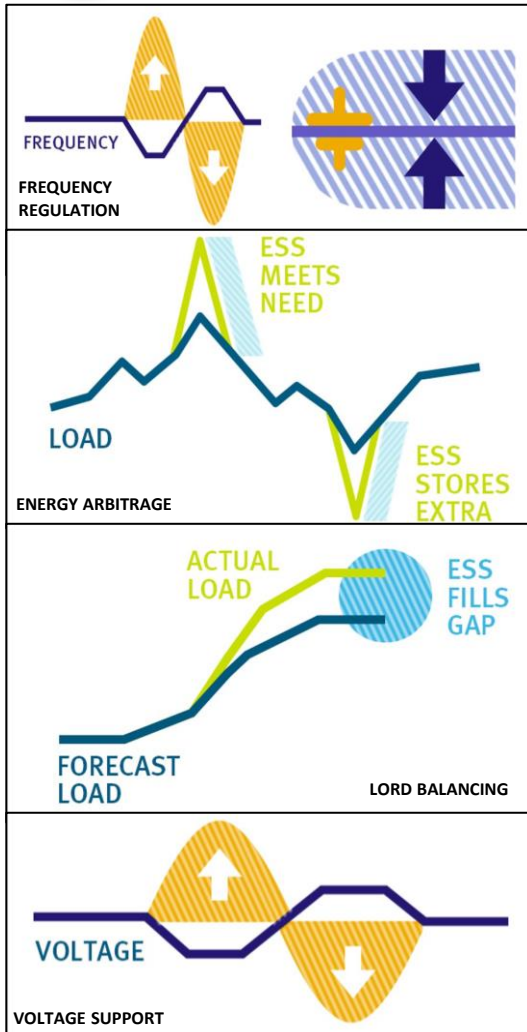
REGULATORY
AND PERMITTING

INSURANCE



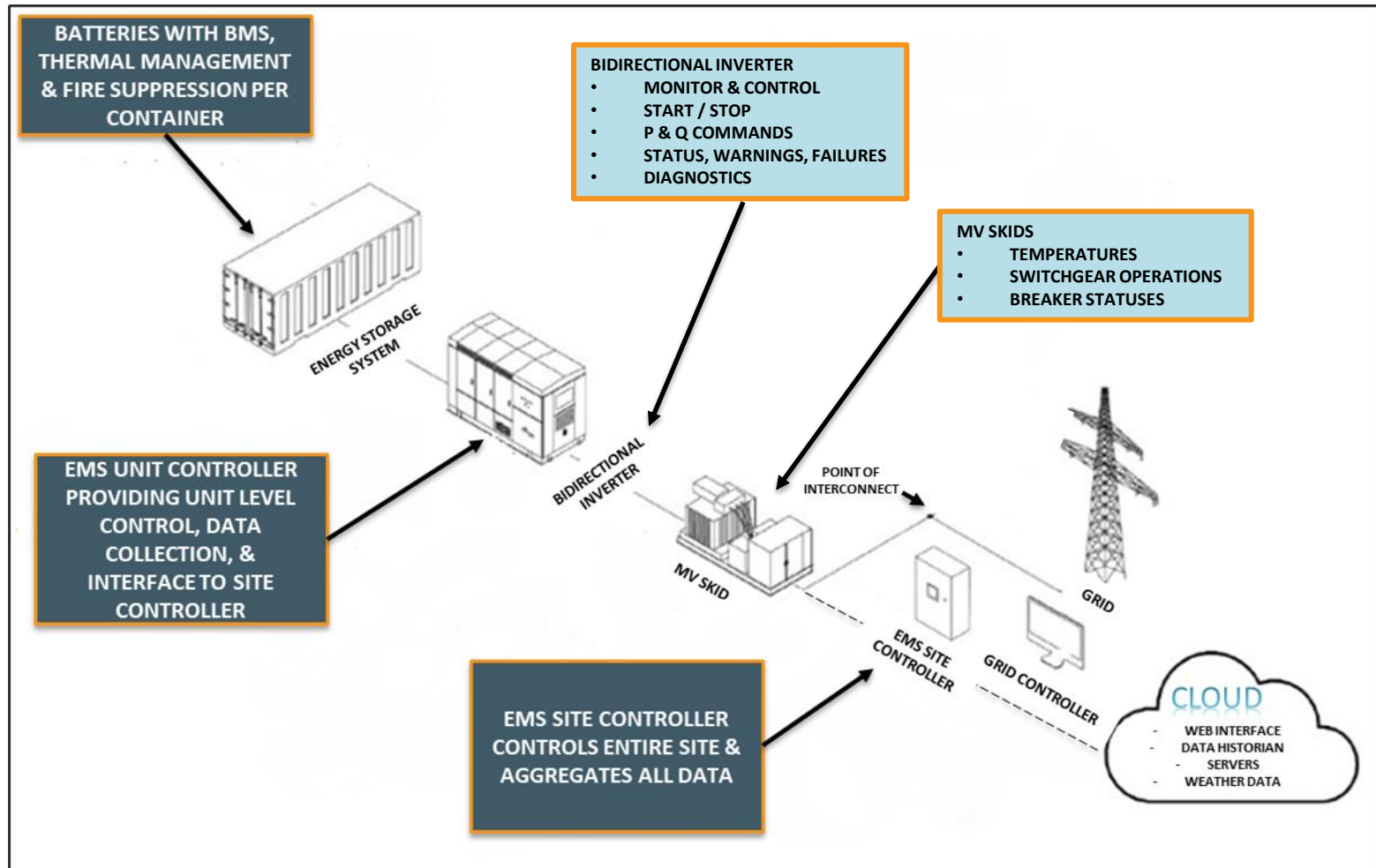


REVENUE STACK





STANDALONE STORAGE ARCHITECTURE





STANDALONE STORAGE

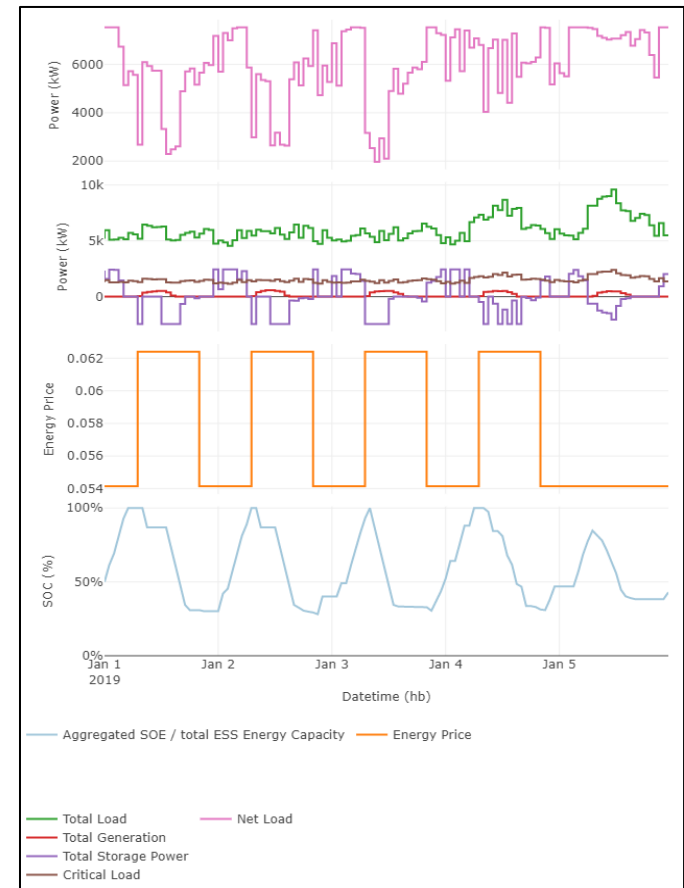
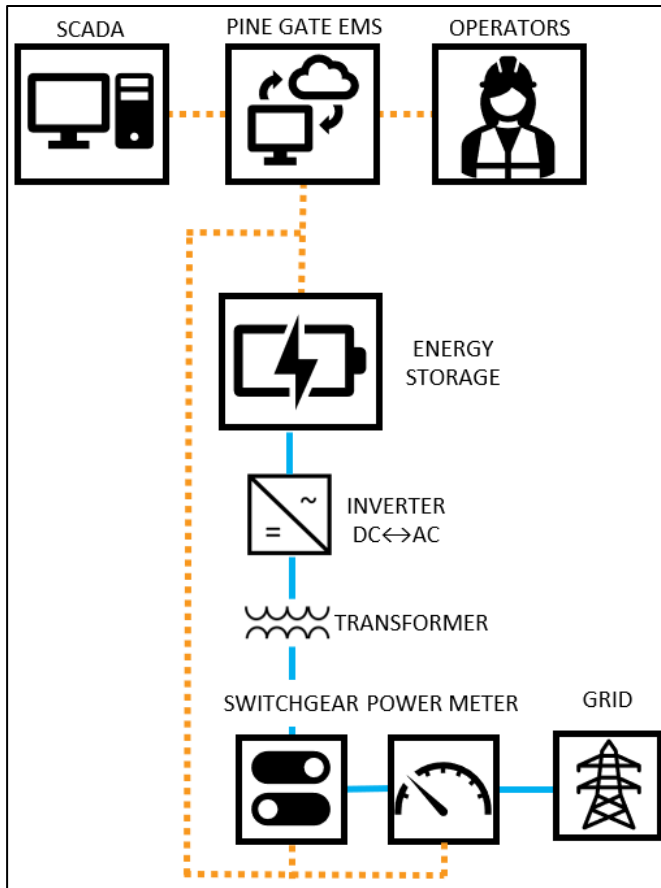


Image Courtesy: NY Times



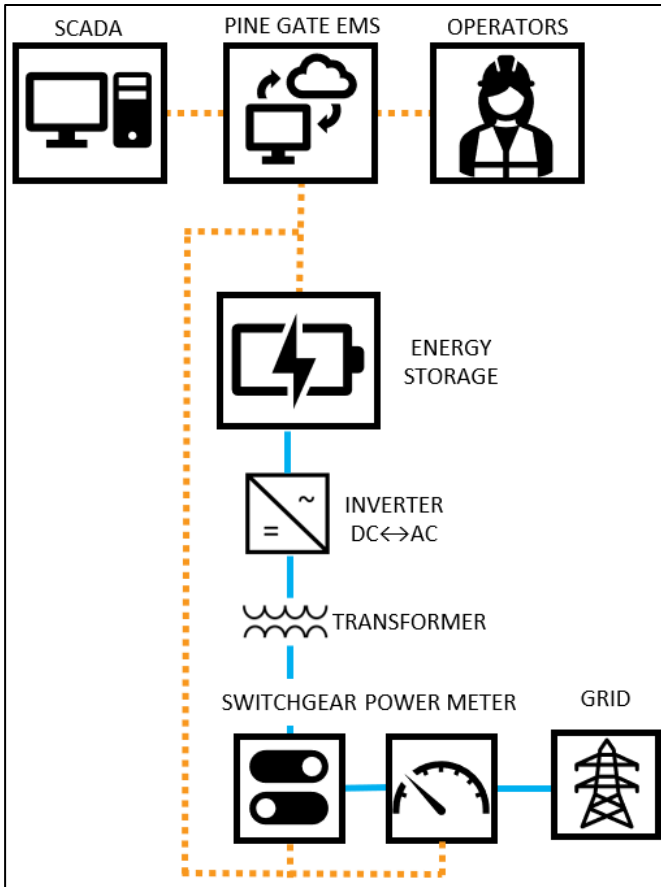


CAPITAL STACK

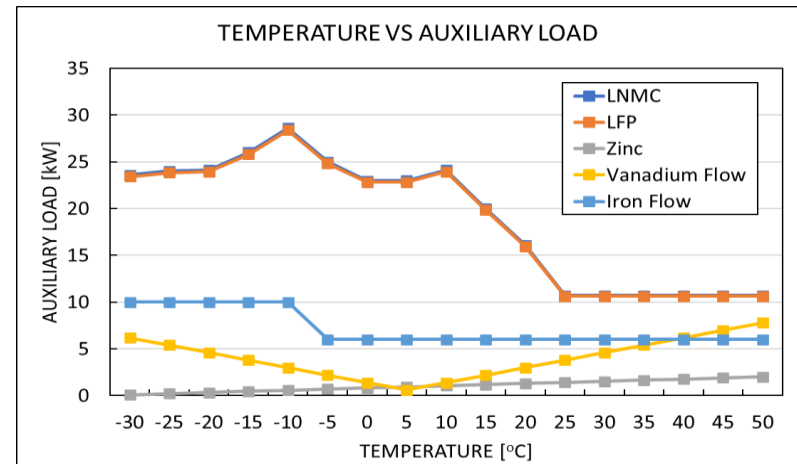




CAPITAL STACK



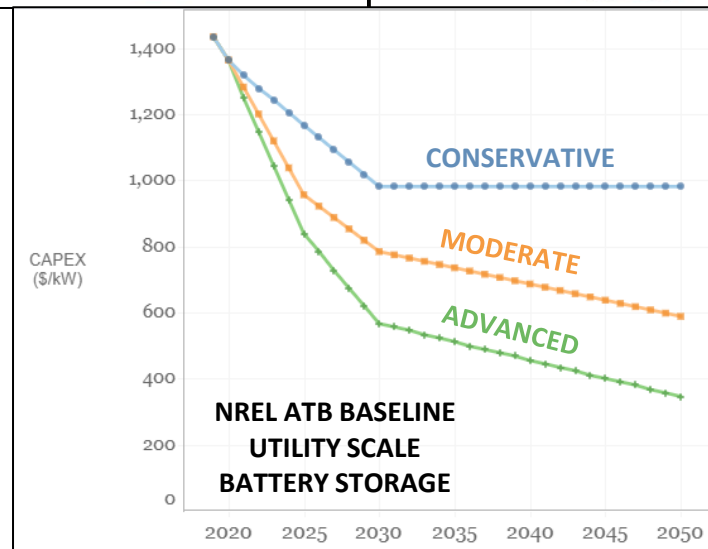
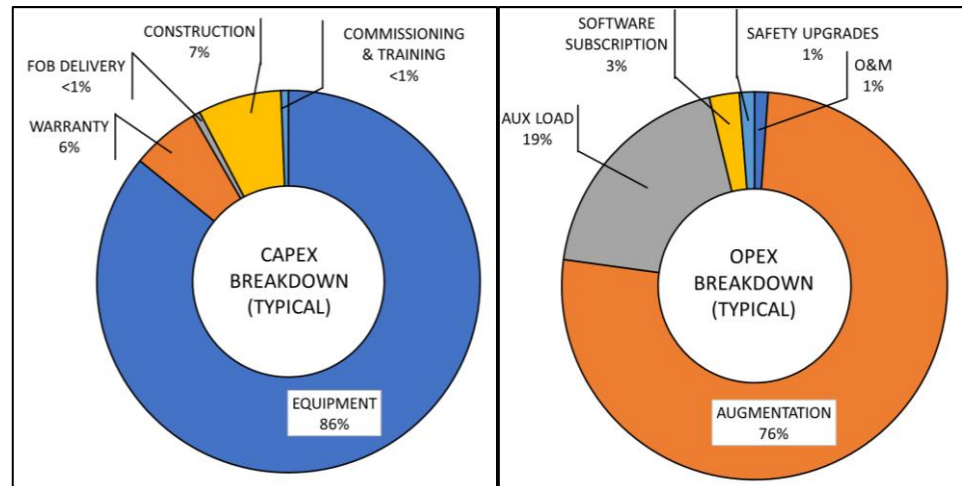
ANNUAL AVERAGE AMBIENT TEMPERATURE												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	39.09	40.91	50.34	52.10	58.49	68.08	74.37	72.19	64.59	57.62	48.72	35.75
1	38.69	40.34	49.55	51.11	57.08	66.67	72.79	70.98	63.71	56.49	47.94	35.27
2	38.49	39.86	48.90	50.24	56.10	65.78	71.62	70.00	62.97	55.50	47.25	34.78
3	38.35	39.44	48.37	49.39	55.29	64.97	70.59	69.17	62.35	54.64	46.67	34.33
4	38.22	39.05	47.96	48.62	54.72	64.23	69.71	68.46	61.71	53.93	46.20	33.98
5	38.10	38.71	47.54	47.98	54.31	63.57	68.98	67.81	61.14	53.40	45.69	33.65
6	37.91	38.45	47.17	47.39	53.93	62.98	68.42	67.27	60.60	52.98	45.22	33.39
7	37.59	38.22	46.77	46.90	53.62	62.48	67.90	66.76	60.10	52.61	44.90	33.22
8	37.19	38.00	46.47	46.41	53.41	62.11	67.48	66.34	59.61	52.28	44.72	33.08
9	36.78	37.80	46.33	45.87	53.12	61.98	67.24	65.92	59.20	51.95	44.54	32.95
10	36.42	37.60	46.25	45.84	53.97	63.41	68.74	66.52	59.02	51.76	44.28	32.85
11	36.18	37.79	47.27	47.55	56.50	66.27	72.14	68.96	60.43	52.57	44.04	32.83
12	37.23	39.43	49.72	50.79	59.60	69.46	76.08	72.74	63.45	55.67	45.66	33.89
13	39.72	42.30	52.85	54.18	62.58	72.60	79.37	76.45	66.82	60.00	49.39	36.69
14	42.46	45.13	55.92	57.38	65.17	75.09	81.73	79.33	70.02	63.87	53.23	40.07
15	44.90	47.40	58.31	59.95	67.29	76.74	83.45	81.36	72.57	66.88	56.56	43.24
16	46.77	49.00	59.96	61.96	68.82	77.71	84.61	82.74	74.50	68.98	59.08	45.74
17	47.97	50.01	60.89	63.39	69.78	78.13	85.15	83.43	75.76	70.29	60.67	47.30
18	48.43	50.36	61.07	64.06	70.13	78.13	85.04	83.43	76.16	70.68	61.17	47.75
19	48.02	49.87	60.65	63.88	69.80	77.63	84.61	82.74	75.69	70.14	60.59	47.12
20	46.43	48.46	59.56	62.86	68.93	76.71	84.14	81.98	74.47	68.63	58.69	44.87
21	43.48	46.03	57.62	61.04	67.53	75.60	83.30	80.85	72.50	65.63	54.84	40.99
22	40.80	43.30	54.63	57.91	65.26	73.87	81.17	78.07	69.11	61.47	51.06	37.97
23	39.98	42.05	52.86	55.93	63.78	72.75	79.57	76.12	66.93	59.33	49.83	37.25





COSTS

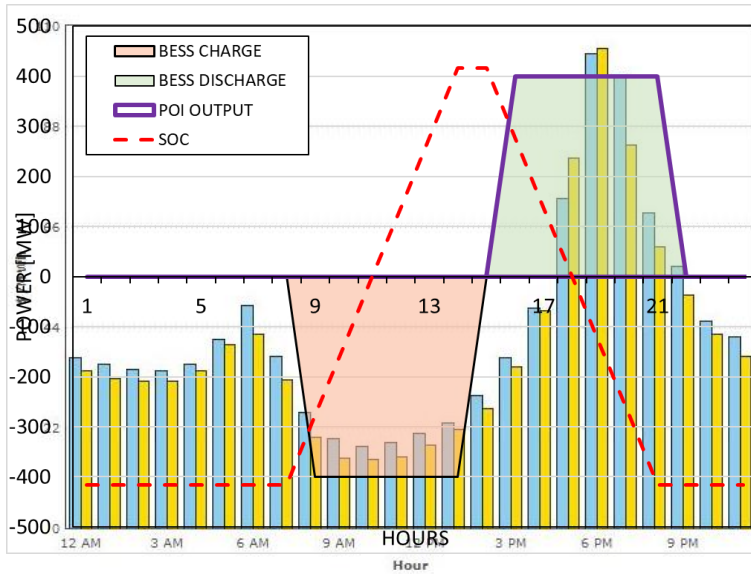
- After qualified equipment selection, project possible configuration are evaluated on a cost basis:
 - Use defensible and well-educated assumptions
 - Assuring all project needs are captured and met in an efficient, cost-effective manner



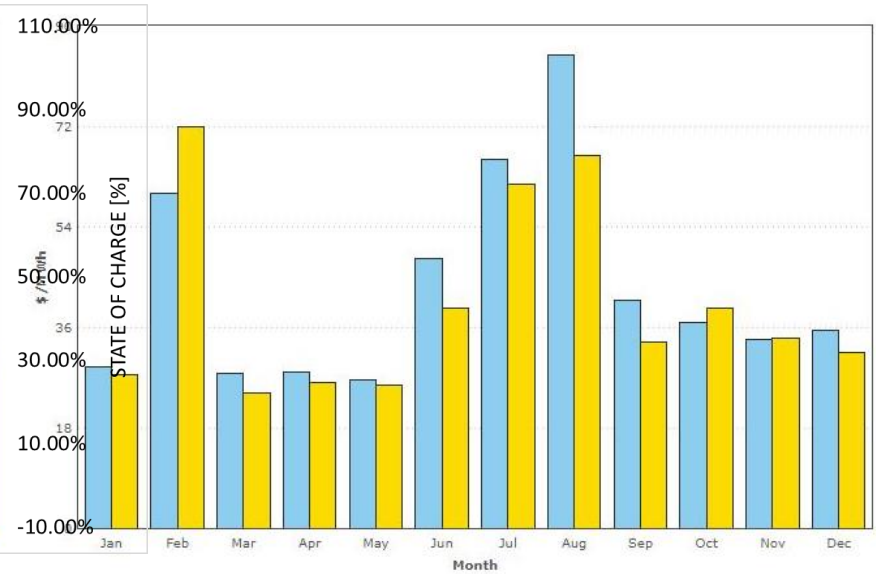


VALUE ENGINEERING

Daily Variation



Monthly Variation



Pricing Type

Day Ahead Real Time

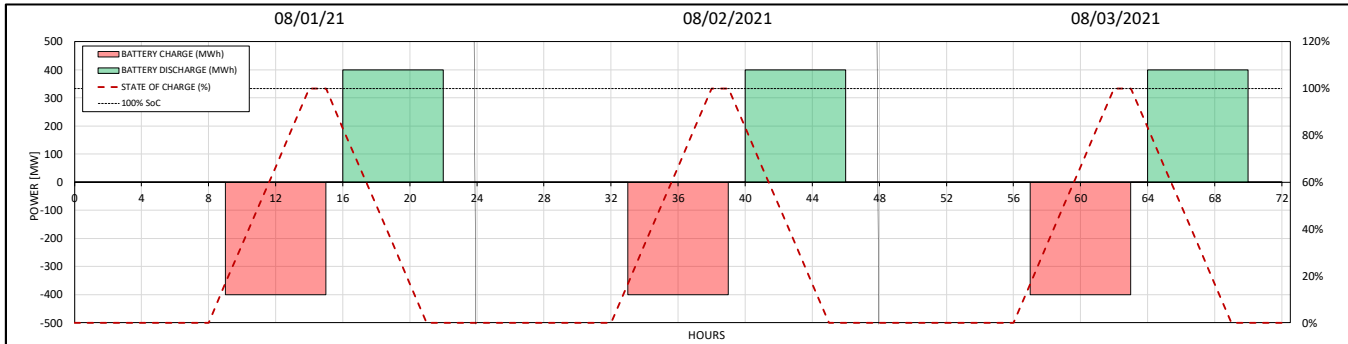
Type	Node	ISO	State	Real Time LMP Avg.					Day Ahead LMP Avg.				Day Ahead-Real Time Spread Avg.			Negative LMP Hours		
				AllHours	EA Solar-Weighted	EA Wind-Weighted	Peak	OffPeak	AllHours	EA Solar-Weighted	EA Wind-Weighted	Peak	OffPeak	AllHours	Peak	OffPeak	RealTime	DayAhead
NODE	NGILA_5_N012	CAISO	AZ	39.80	27.99	37.98	43.31	35.30	43.00	30.51	40.82	46.90	37.99	3.20	3.59	2.69	339	166



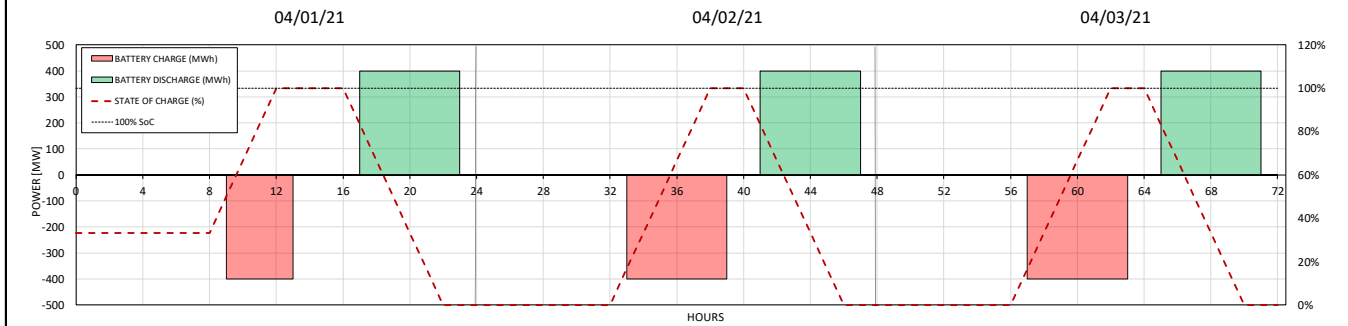


VALUE ENGINEERING

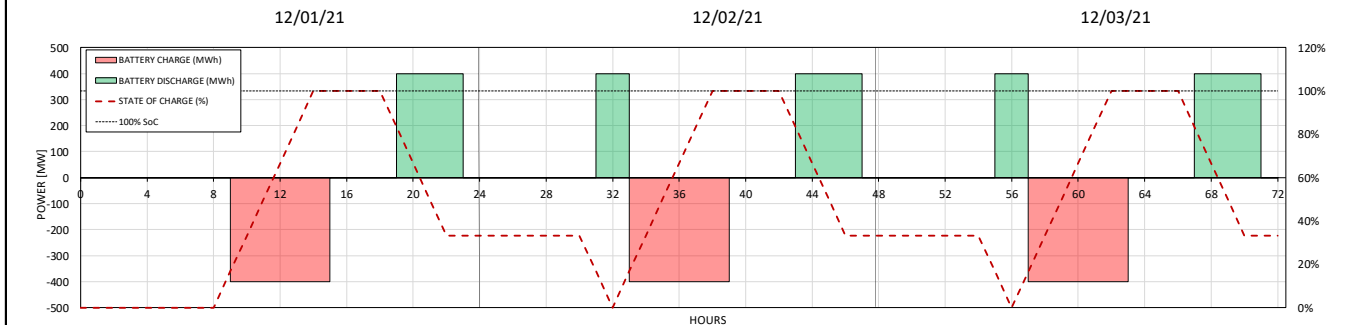
SUMMER DISPATCH



SHOULDER DISPATCH



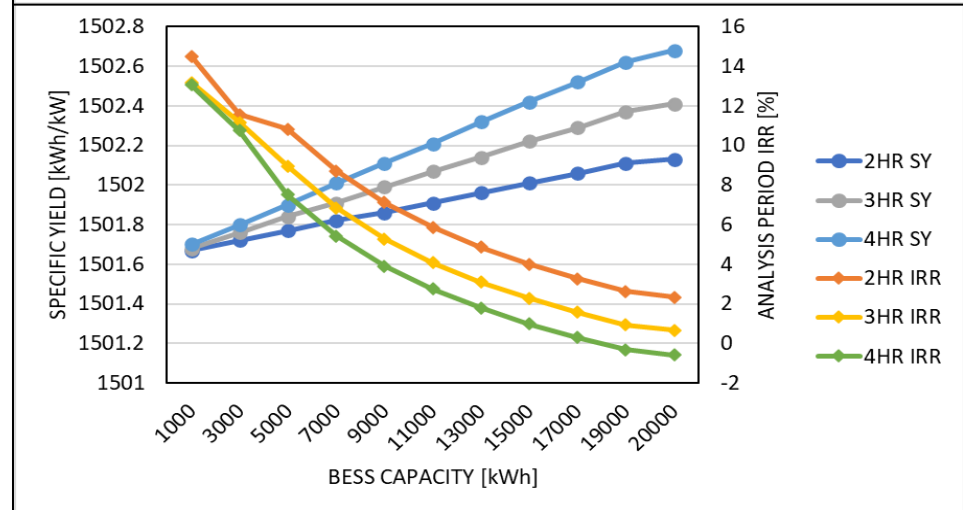
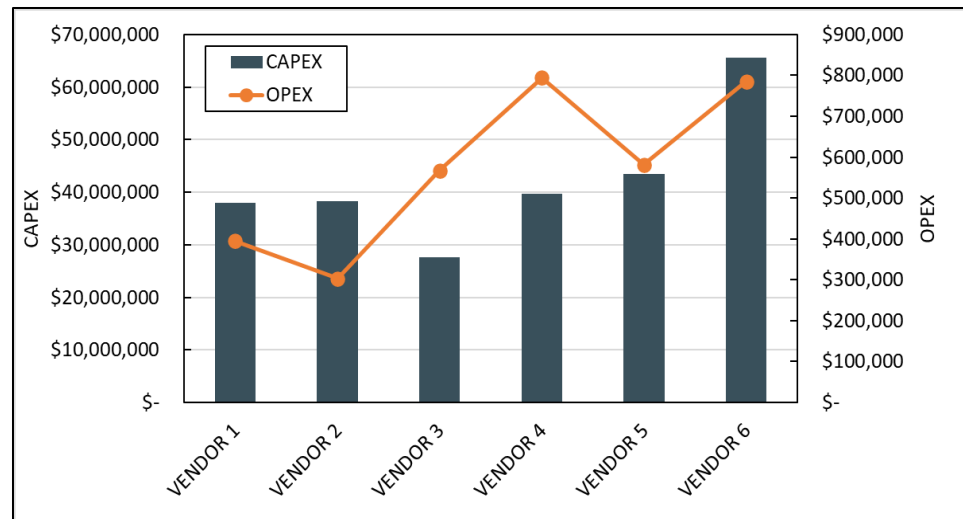
WINTER DISPATCH





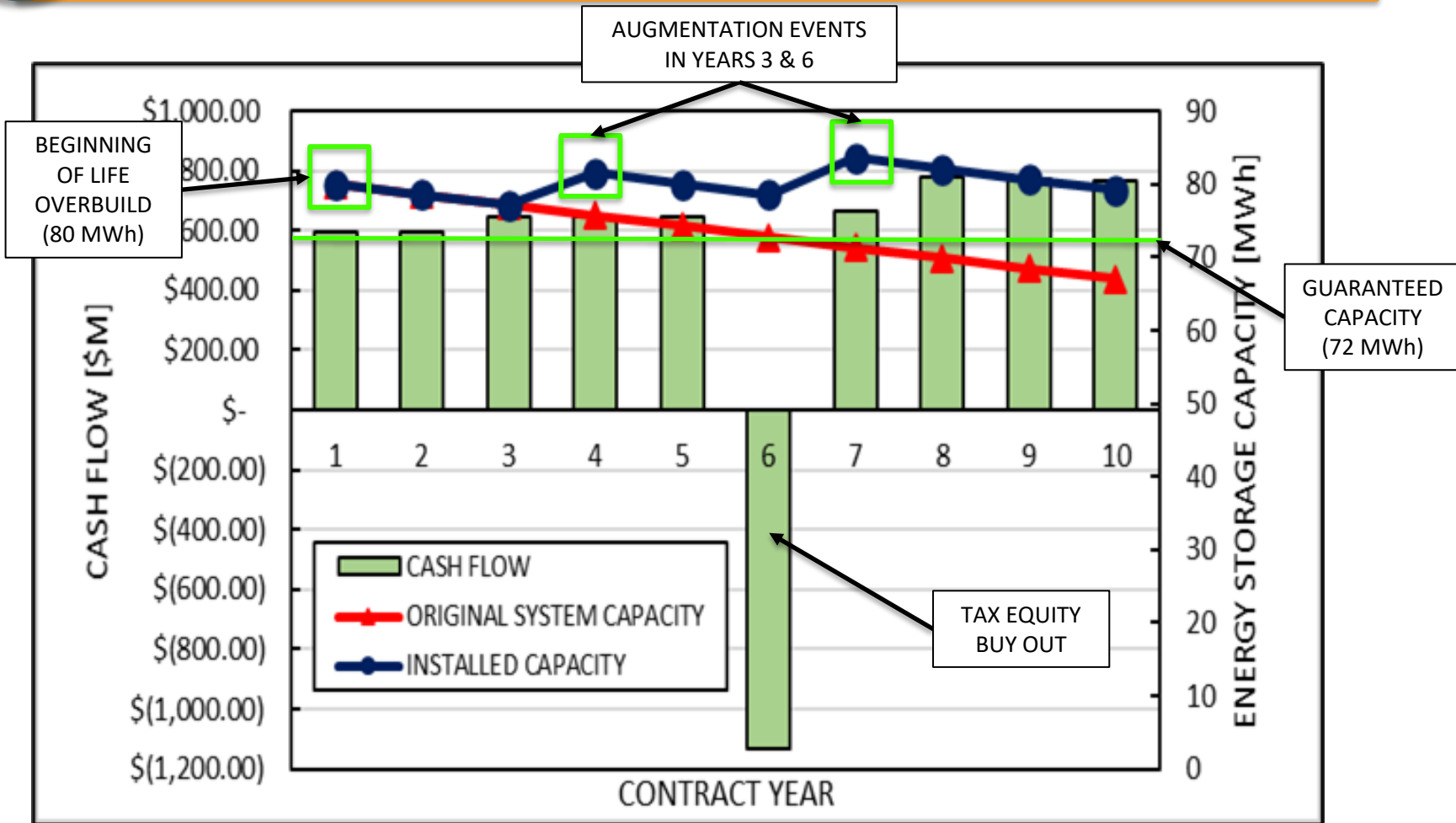
TECHNO-ECONOMIC SENSITIVITIES

- Techno-economic analyses are conducted in the earliest stages of development
- Both system performance and cost are optimized simultaneously to provide the highest quality end project





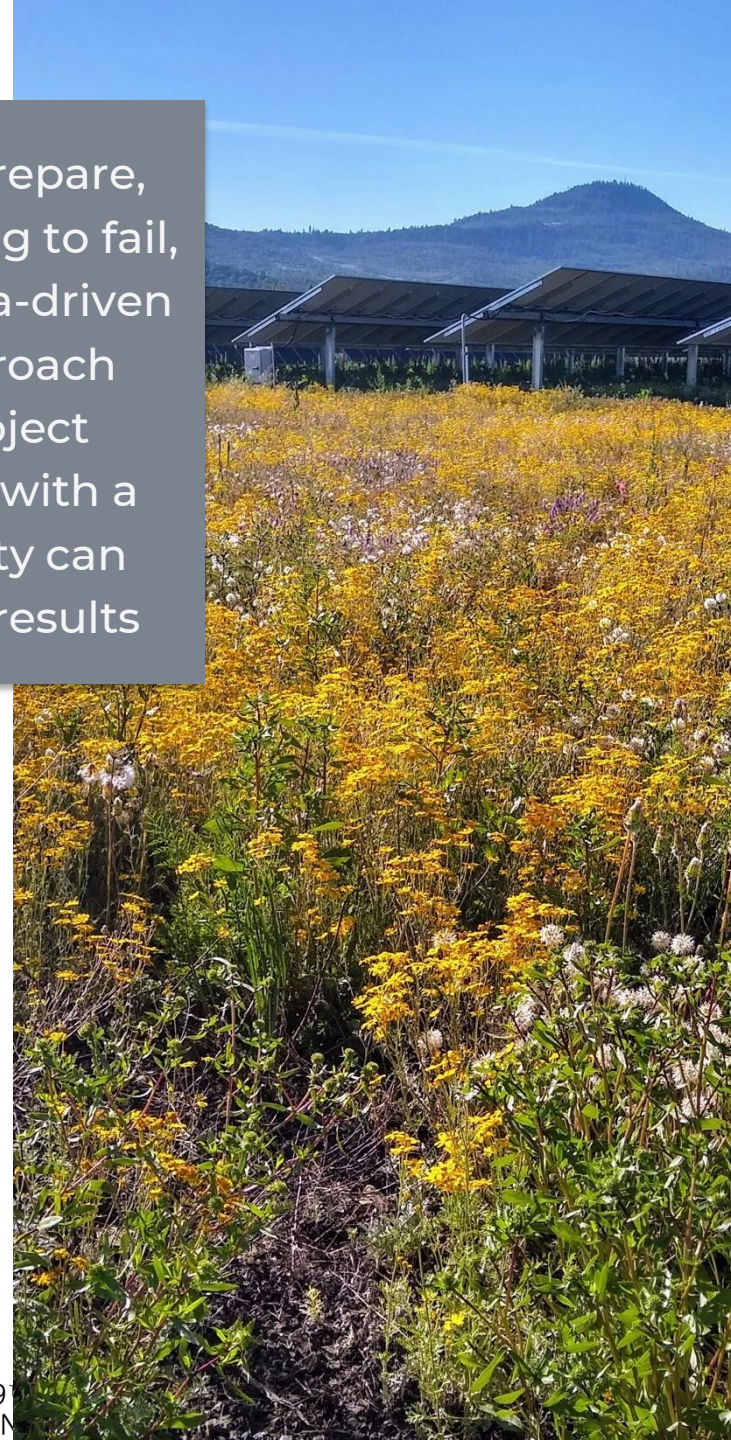
CASH FLOW & SYSTEM OPTIMIZATION



Key Takeaways

- Track public policy changes and quantify how those affect project design or how storage gets compensated
- Identify risk factors that could pose a threat to project execution
- Have defensible revenue and capital assumptions
- Use models to guide decision making and run several iterations to find the right solution (and do your own research!)
- Don't be afraid to ask questions – every project is unique and there could be levers that might be available to the project to help it across the finish line

By failing to prepare, we are preparing to fail, therefore a data-driven lifecycle approach towards project development with a touch of agility can yield positive results





Financial Value Throughout the Project Lifecycle Delivering Long-term Returns



In-house Expertise to Handle Every Stage of a Project



Elimination of Greenhouse Emissions from the Environment



Contact Information

Raafe Khan
Director, Energy
Storage
C: (317) 514-2097

Headquarters
130 Roberts Street
Asheville, NC 28801
info@pgrenewables.com