

DER-VET Task Force

ESIC Working Group 1: Grid Services and Analysis

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June 4, 2020



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- Confidential market strategies or business plans;
- Other competitively sensitive information;
- Advise or try to influence others on their business decisions (except to the extent that they are already public);
- Complaints or disparaging remarks concerning customers/suppliers/competitors.

DO NOT AGREE...

- To discriminate against or refuse to deal with a supplier (boycott);
- To only do business on certain terms and conditions;
- To set (or fix) prices;
- To divide markets or technologies;
- To allocate customers/suppliers/territories;
- To suppress a technology;
- To the use, promotion or endorsement of particular vendors, contractors, consultants or products.

Webcast and Recording Notification

- The webcast is being recorded along with all Q&A. Your participation provides consent to that recording.
- As a result, please make sure your phone is on mute throughout the webcast unless speaking. Do not place your phone on hold.

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Agenda

- StorageVET 2.1 Github
- DER-VET Forum
- DER-VET Feature Highlight

StorageVET 2.1 Release

StorageVET 2.1 Release

- www.github.com/epri-dev/storagevet
- Online now!

Changelog

- New Inputs:
 - nsr_max_ramp_rate
 - sr_max_ramp_rate
 - fr_response_time
 - fr_max_ramp_rate
 - Response time for all technologies (used for reliability and market services)
- Added check that requires energy market when including ancillary services
- Added self.startup_time attributes for each Technology in technology class
- Added non-controllable load
- added data growth/removal helper function; removed separate_constraints attribute from Scenario
- added fill_and_drop_extra_data, add/removes data for analys and creates optimization levels and initializes degradation iff battery is initialized
- added calc_cba method that calculates all financial outputs
- added version to model parameter template name

Changelog

- Changed:
 - Changed Model_Parameters_Template to allow for 0 min response time / startup_time
 - Replaced 'Original Net Load' with 'Total Load' in Results post-opt calculations
 - Changed RA to find events per year, in addition to the mode set by the user
 - Changed technology to aggregate the state of energy of each ESS in the system
 - Derate based on 'usable' energy capacity instead of rated energy capacity
 - Replaced 'Original Net Load' with 'Total Load' in Results post-opt calculations
 - Collecting total SOE in results output
 - Changed Params to read in referenced data before case building

Changelog

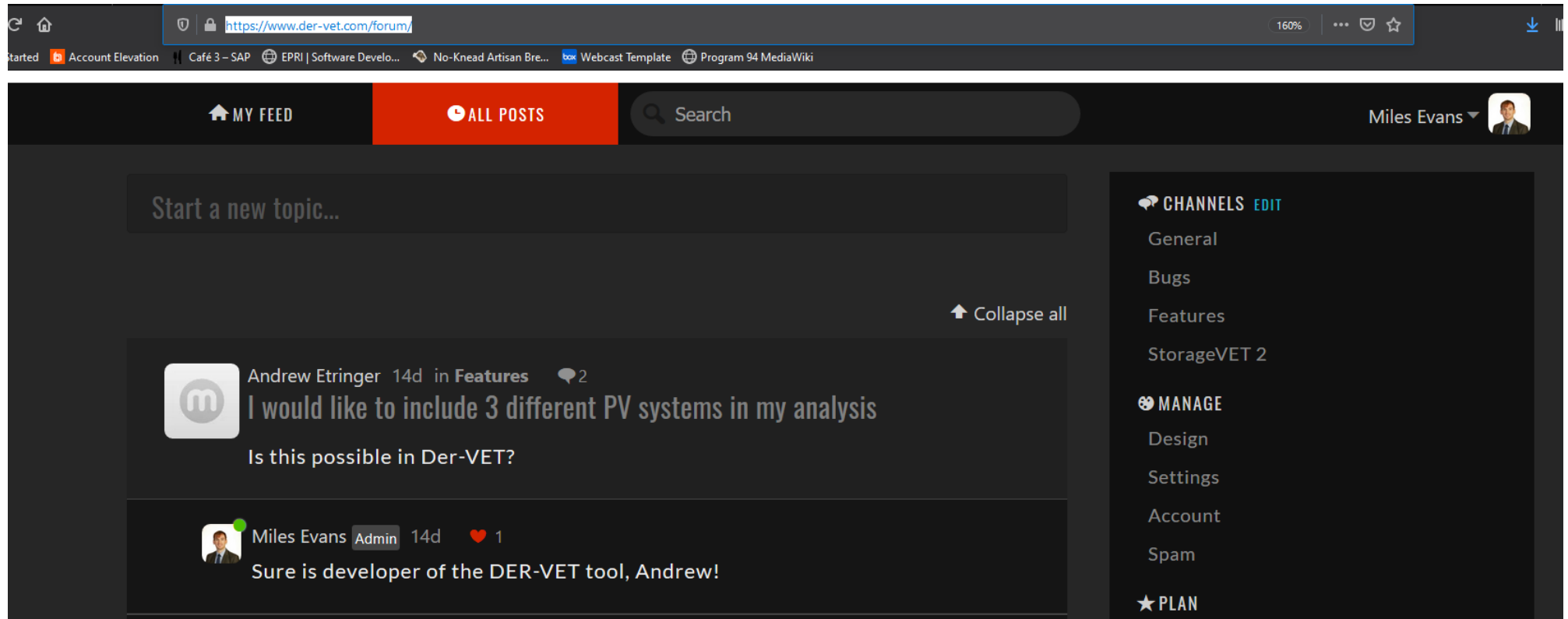
- Fixed

- Generalized children of DER classes to inherit the startup_time attribute from the DER class
- Completed testing of controllable load
- Fixed RA validation check error and DR reporting error
- Fixed multi-year post optimization analysis bug

DER-VET Forum

DER-VET Forum

- www.der-vet.com/forum
- Questions, comments, problems, requests, and discussions
- StorageVET thread too!



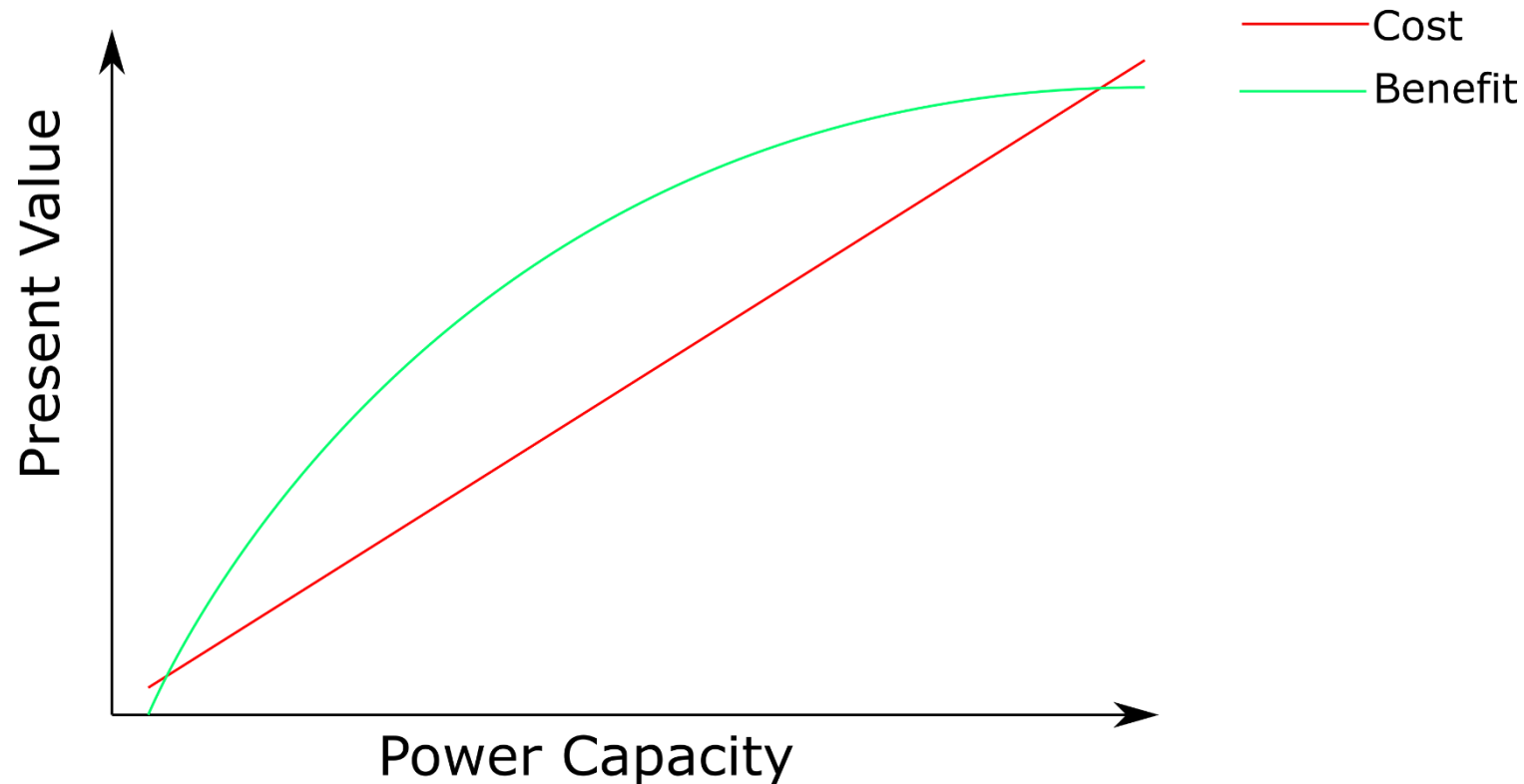
DER-VET Feature Highlight

Storage Duration Optimization for Market Services

Intro to Size Optimization

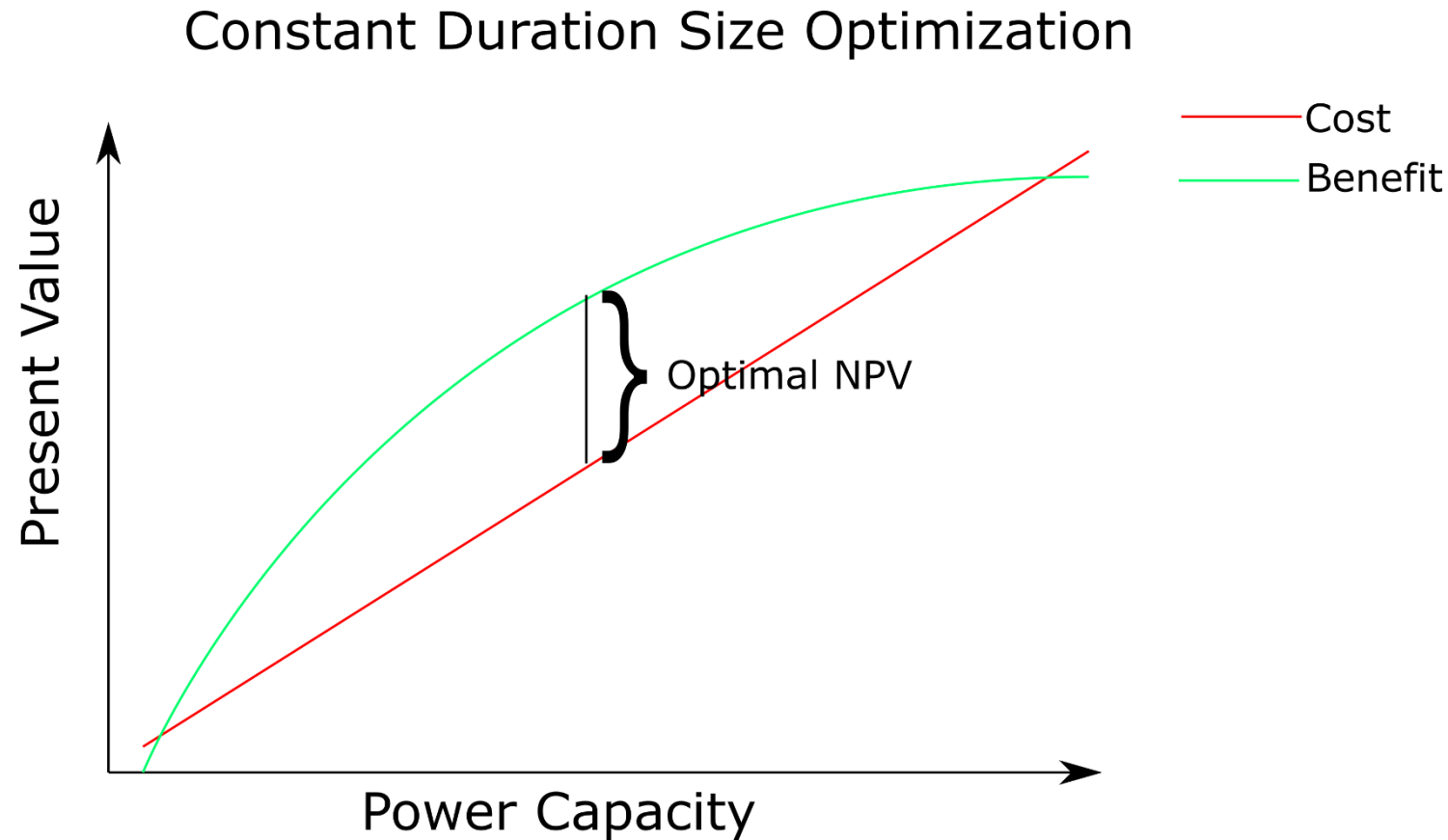
- DER-VET implements an NPV-maximizing size optimization

Constant Duration Size Optimization



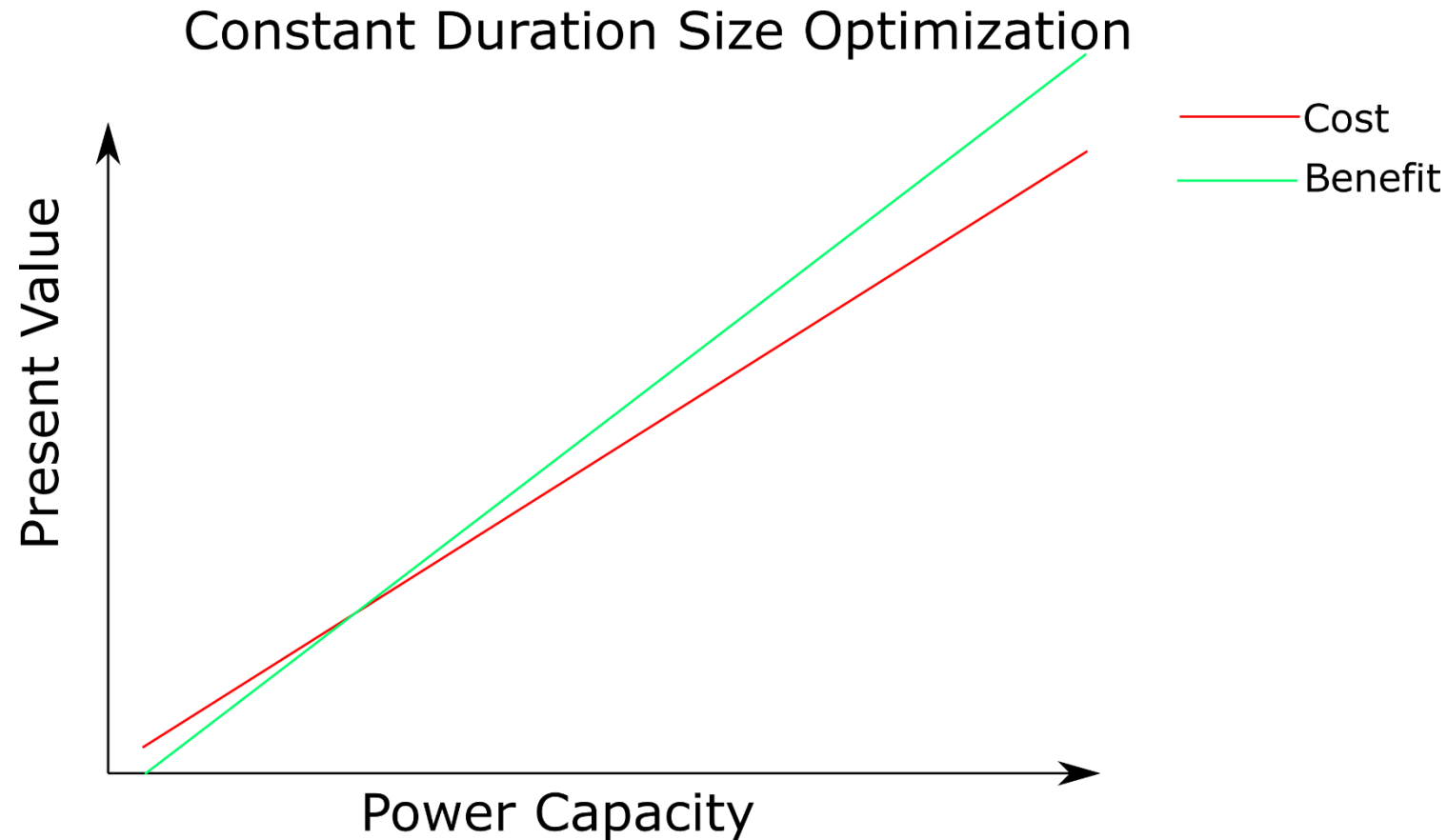
Intro to Size Optimization

- Diminishing returns on size means that an optimal size exists



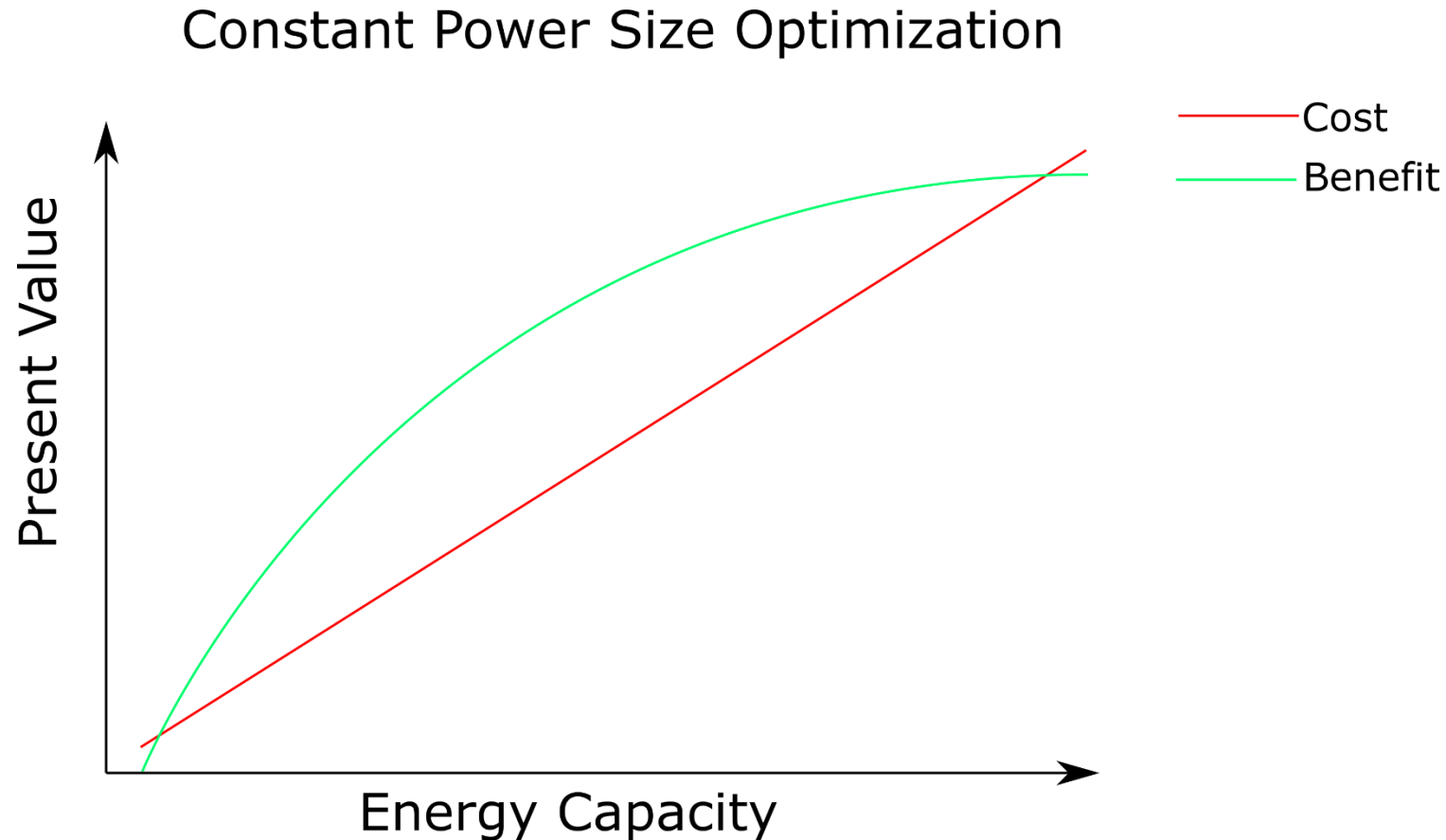
Intro to Size Optimization

- Price-taker market model means there are no diminishing returns



Intro to Size Optimization

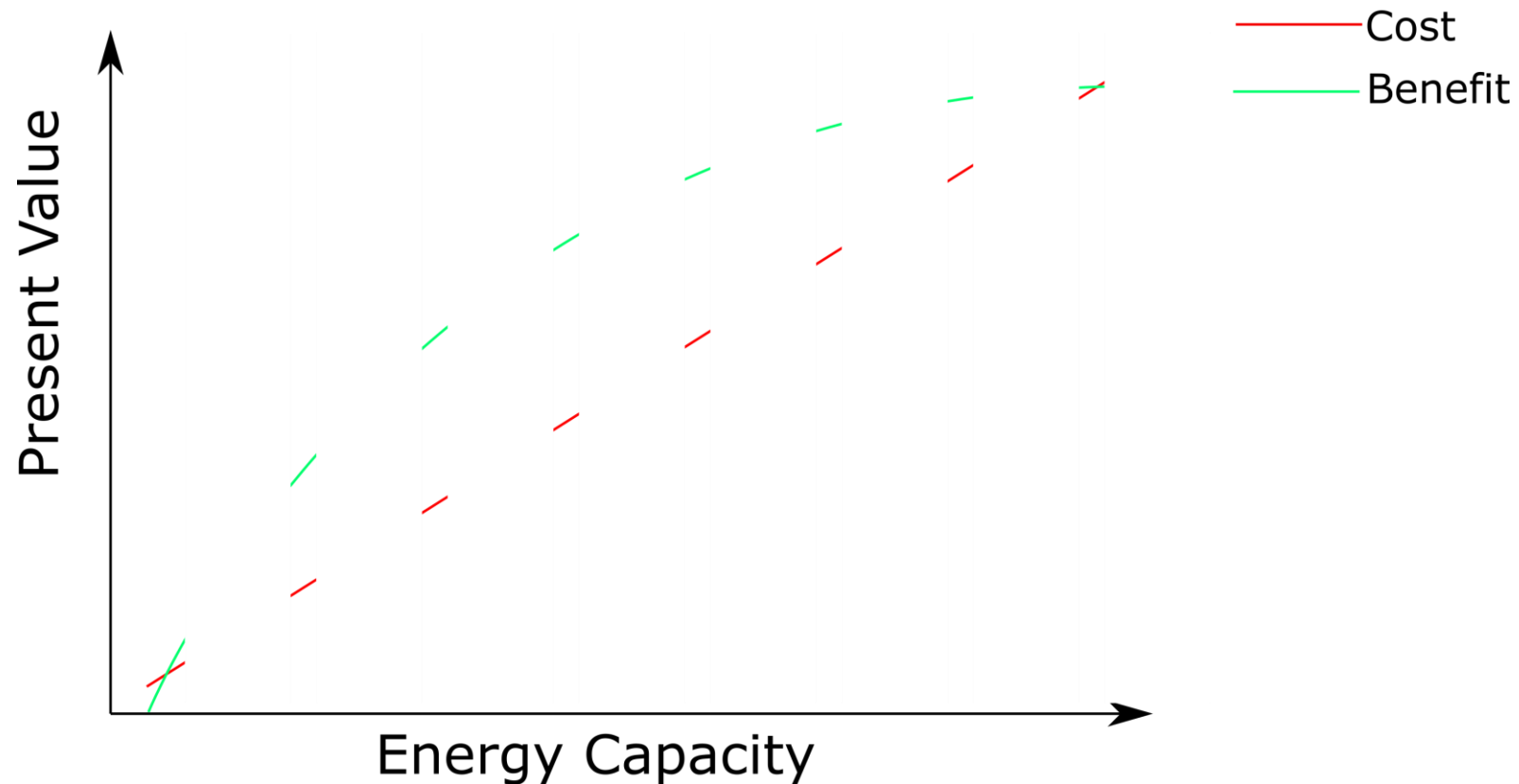
- There are diminishing returns with respect to energy capacity



Intro to Size Optimization

- Alternative – test a bunch

Constant Power Size Optimization



Example Case – energy only

- Day ahead energy time shift only using 2019 PG&E DLAP energy prices
- Fix power capacity at 1MW (arbitrary)
- Optimize energy capacity using \$200/kWh marginal cost of energy capacity

Example Case – Energy Only Results

- No Results (zero size found to be optimal)
- Adjust cost to be \$100/kWh

Size Results

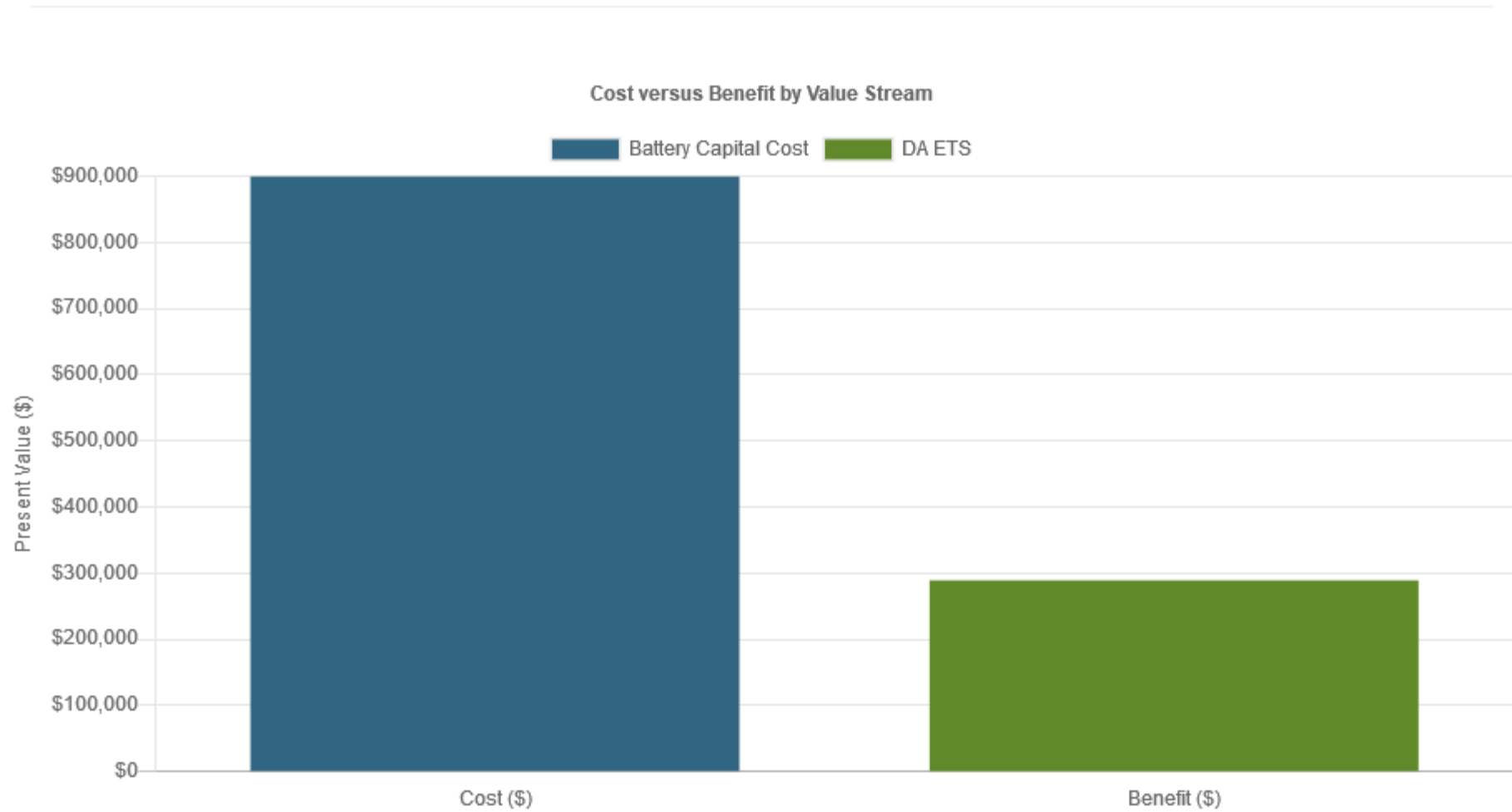
System Name	Energy Rating (kWh)	Charge Rating (kW)	Discharge Rating (kW)	Duration (hours)	Power Capacity (kW)	Quantity
Battery	2,000.0000	1,000.0000	1,000.0000	2.0000	0.0000	1

Rated Power and Energy Cost

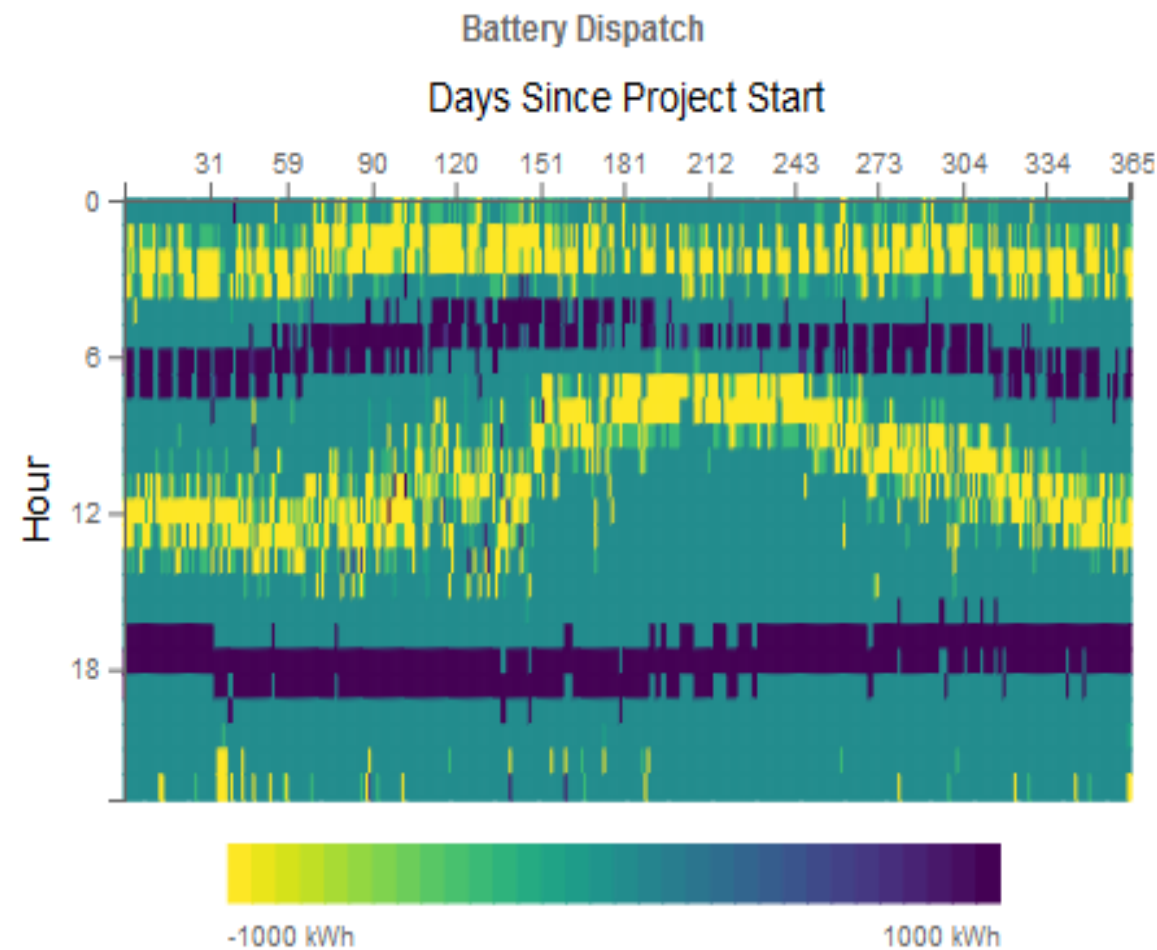
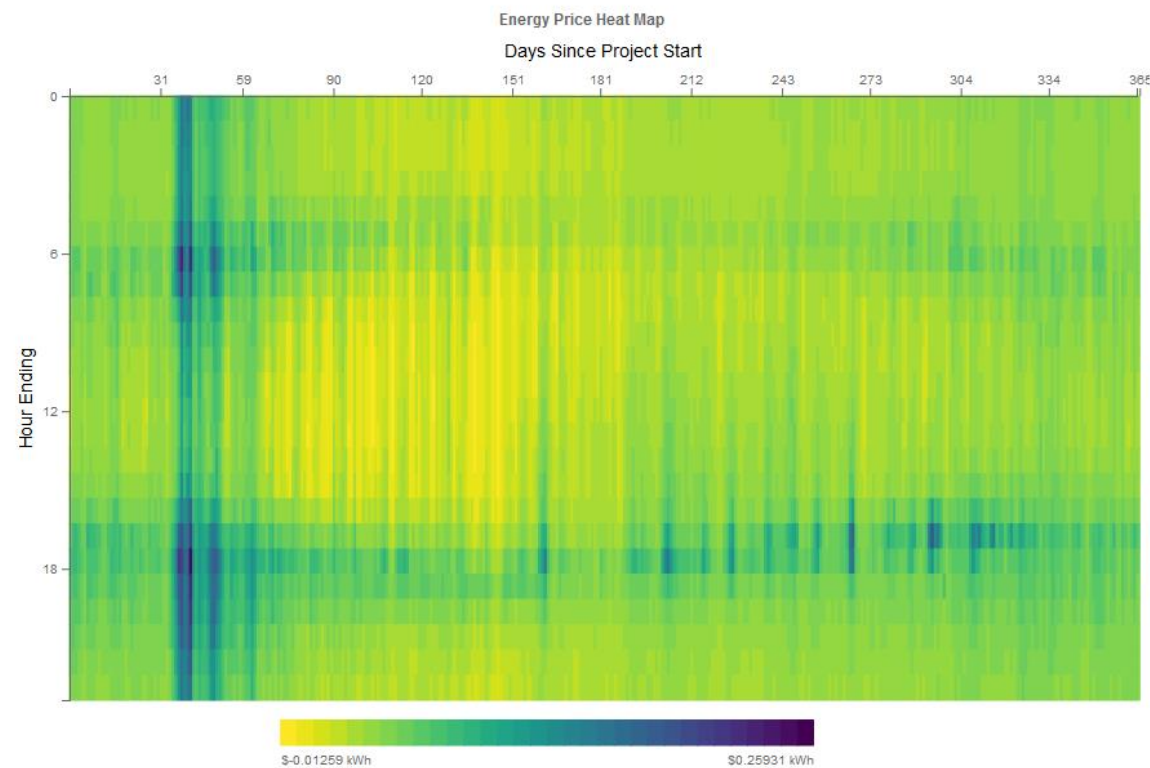
Costs for Battery	
\$900,000.00	Total Cost
\$0.00	Fixed Cost
\$200,000.00	Cost per kWh
= 2,000.0 kWh x \$100/kWh	
\$700,000.00	Cost per kW
= 1,000.0 kW x \$700/kW	

Example Case – energy only

Results: Financials



Energy Price vs Dispatch



From: 02/05/2019

To: 02/09/2019



Example Case – Stacked Services

- Add in CAISO regulation and spinning reserves prices from 2019
- Reset cost function to be \$200/kWh

Size Results

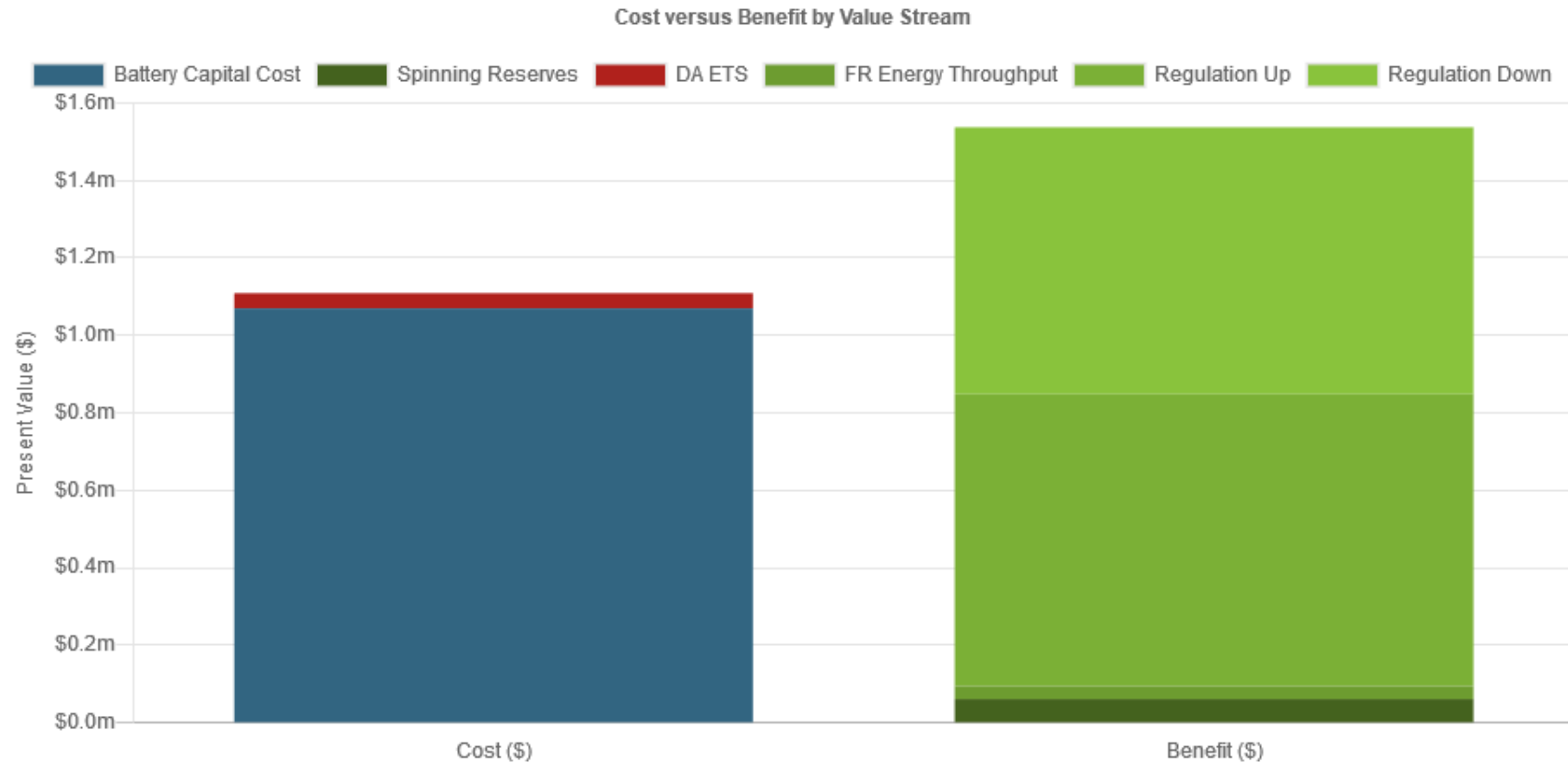
System Name	Energy Rating (kWh)	Charge Rating (kW)	Discharge Rating (kW)	Duration (hours)	Power Capacity (kW)	Quantity
Battery	1,849.0000	1,000.0000	1,000.0000	1.8490	0.0000	1

Rated Power and Energy Cost

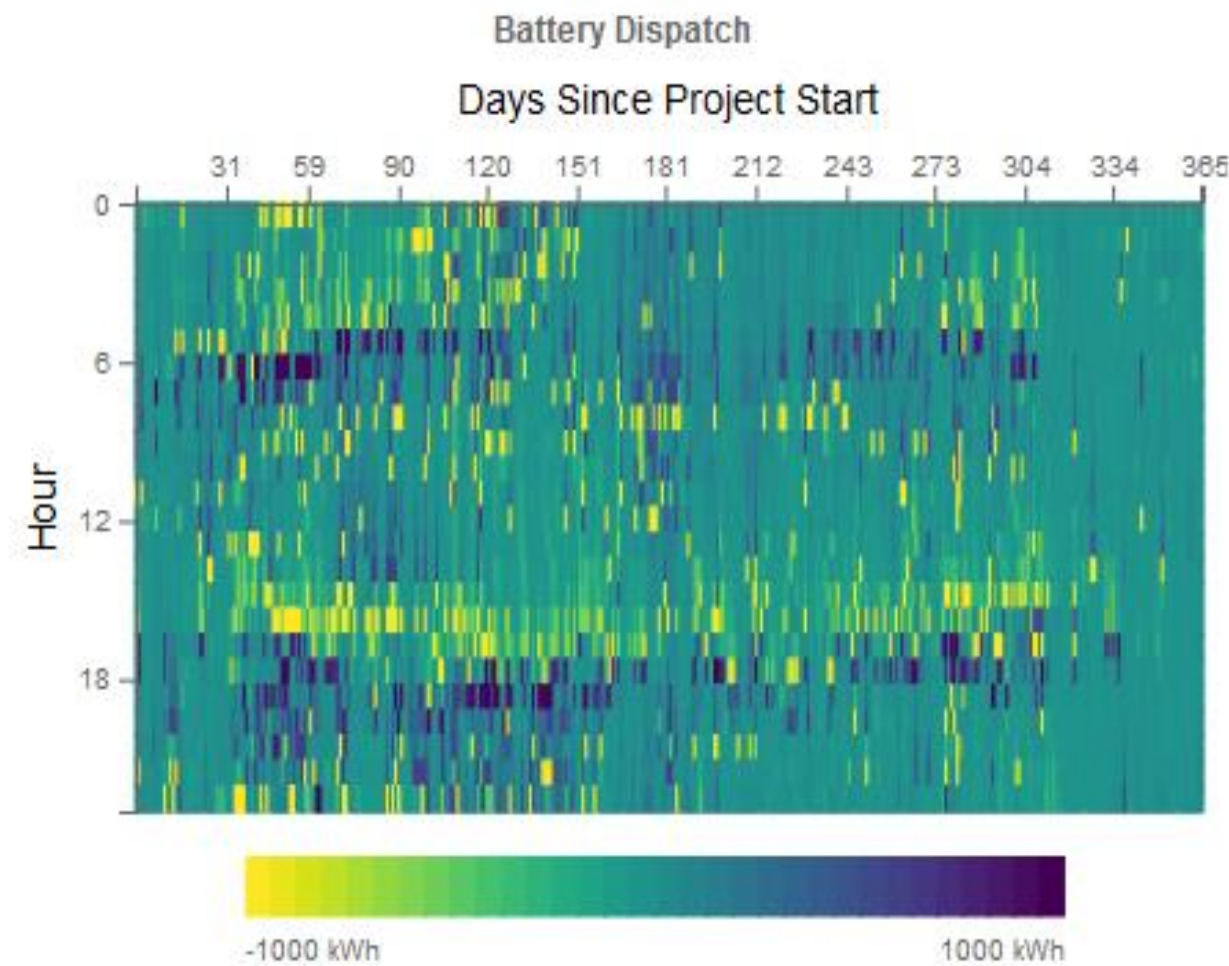
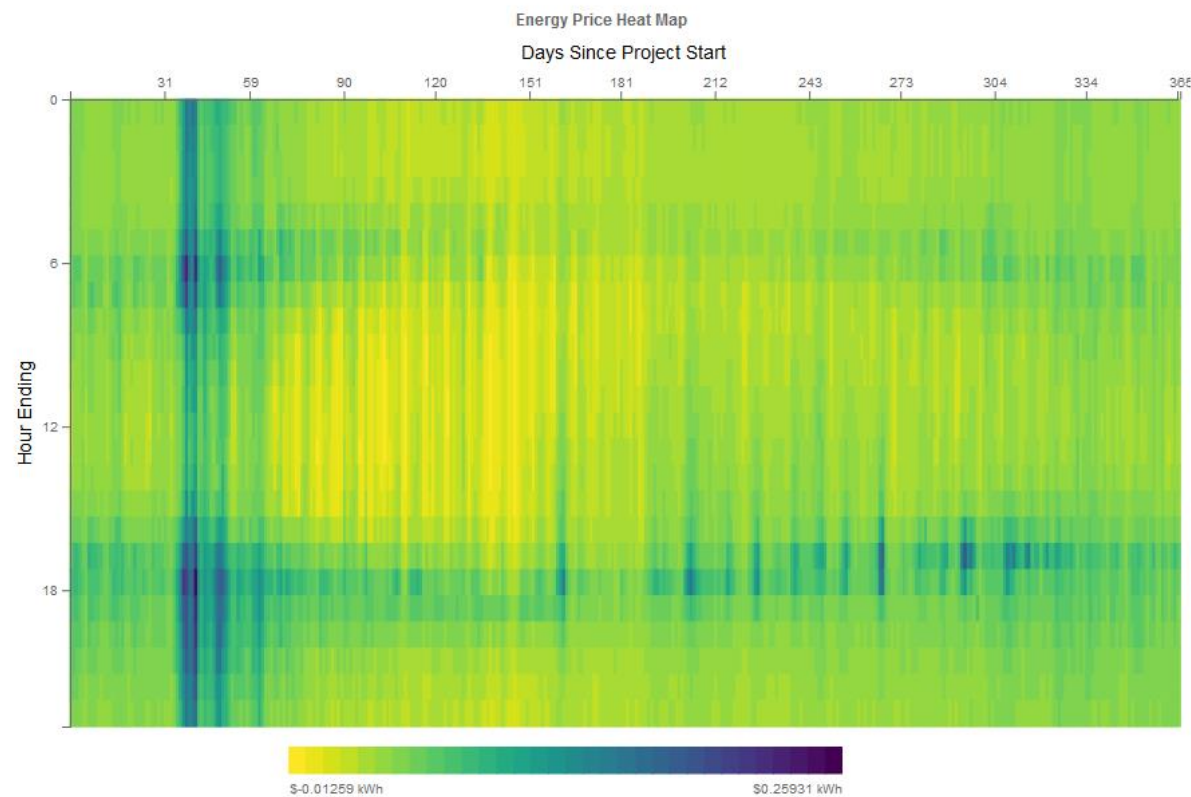
Costs for Battery	
\$1,069,800.00	Total Cost
\$0.00	Fixed Cost
\$369,800.00	Cost per kWh
= 1,849.0 kWh x \$200/kWh	
\$700,000.00	Cost per kW
= 1,000.0 kW x \$700/kW	

Example Case – Stacked Services

- Most benefit from regulation
- Energy time shift in the cost column



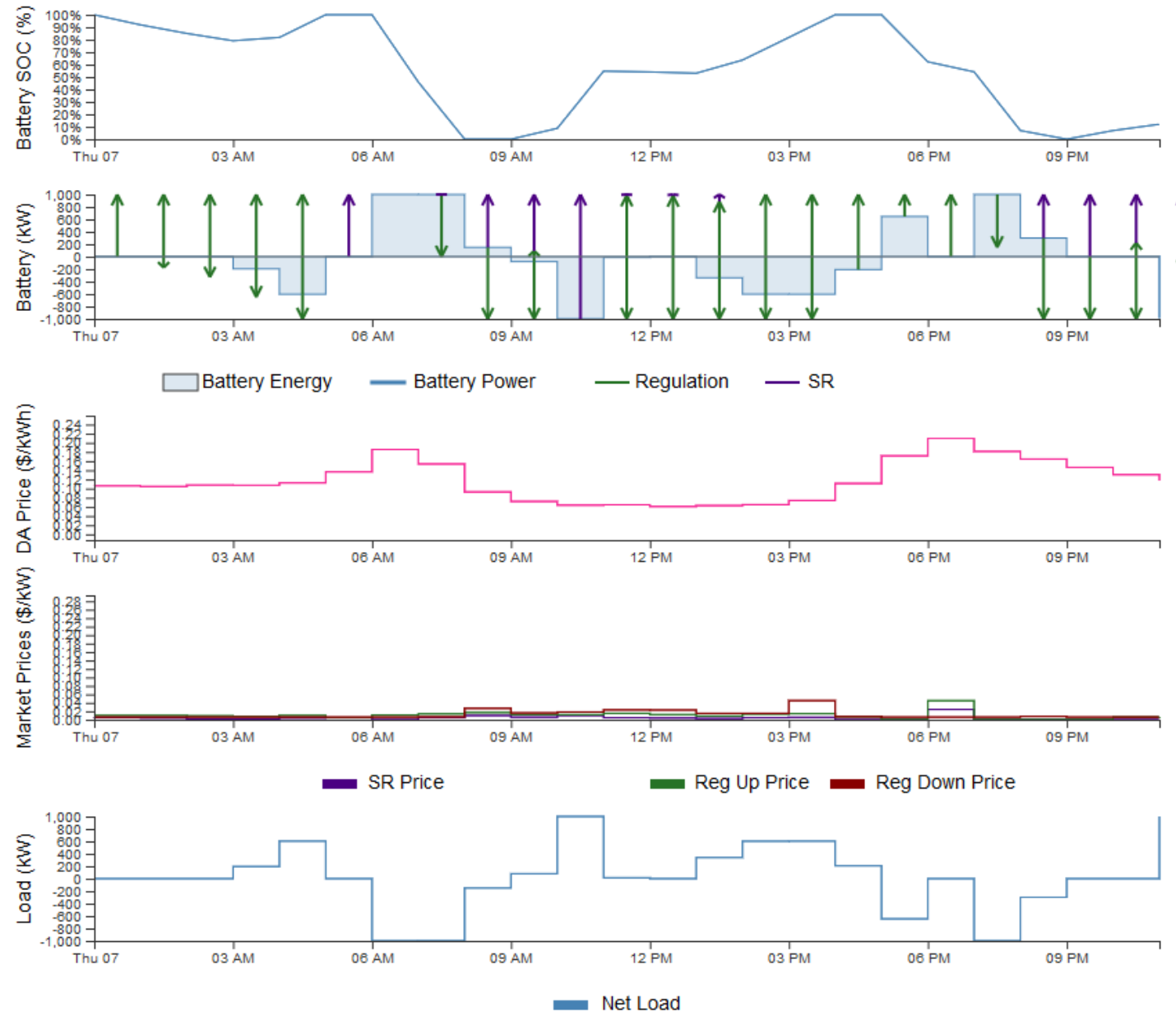
Example Case – Stacked Services



From: 02/05/2019 To: 02/09/2019



From: 02/07/2019 To: 02/07/2019



Next Meeting

Regularly-Scheduled Meetings

- **Next Meeting – Thursday July 2, 11:00 am Pacific Time**

Together...Shaping the Future of Electricity