StorageVET 2.0 Task Force

ESIC Working Group 1: Grid Services and Analysis

Miles Evans | EPRI
Ram Ravikumar | EPRI
Halley Nathwani | EPRI
Giovanni Damato | WG1 Chair, EPRI

December 5, 2019

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Agenda

- StorageVET Update 1.0.1
- StorageVET 2.0 Reference Case #1 – Deferral
- DER-VET Validation
- Documentation

StorageVET Update 1.0.1

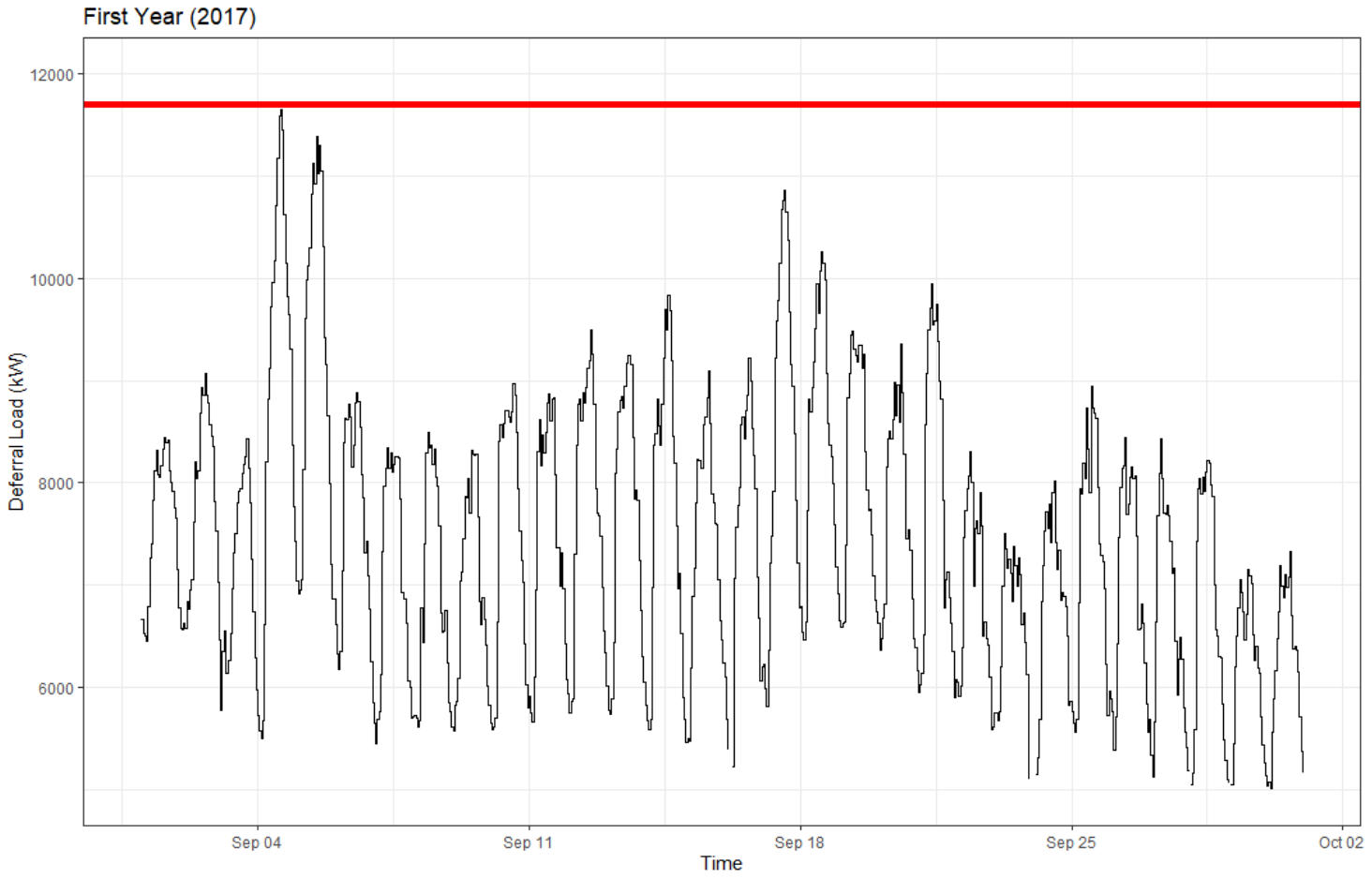
Version 1.0.1

- New version available for download
- Bug fixes
  - Deferral service
  - Assorted changes
- Usability changes
  - Slightly reorganized model parameters
  - More coherent default data/parameters

StorageVET 2.0 Deferral Reference Case

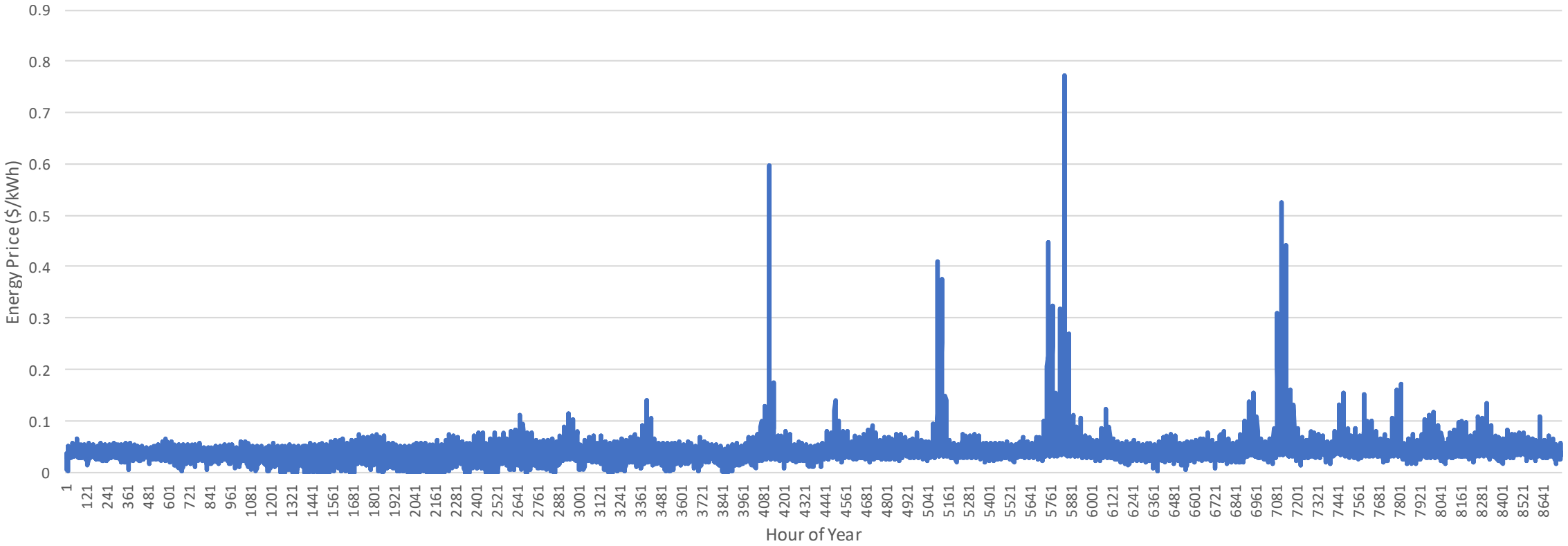
Case Summary – Primary Service

- Load growth-based N-0 upgrade deferral case
- ~12 MW load (hourly)
- 2%/year load growth



Case Summary - Secondary Service

- Energy Time Shift
  - Southern California energy prices from 2017



Case Summary – Battery System

- Power Capacity: **2 MW**
- Energy Capacity: **8 MWh**
- Installed Cost: **$1600/kW**
- O&M Costs: **$10/kW-yr**
- 1 cycle/day limit

StorageVET 2.0 Setup

Tag	Key	Value
Battery	name	Deferral Battery
Battery	ccost	0
Battery	ccost_kw	0
Battery	ccost_kwh	0
Battery	startup	0
Battery	fixedOM	0
Battery	OMexpenses	0
Battery	ch_max_rated	2000
Battery	dis_max_rated	2000
Battery	ch_min_rated	0
Battery	dis_min_rated	0
Battery	ene_max_rated	8000
Battery	ulsoc	100
Battery	llsoc	0
Battery	rte	85
Battery	sdr	0
Battery	install_date	1/1/2017
Battery	soc_target	50
Battery	yearly_degrade	0
Battery	incl_cycle_degrade	0
Battery	p_start_ch	0
Battery	p_start_dis	0
Battery	daily_cycle_limit	1
Battery	hp	0

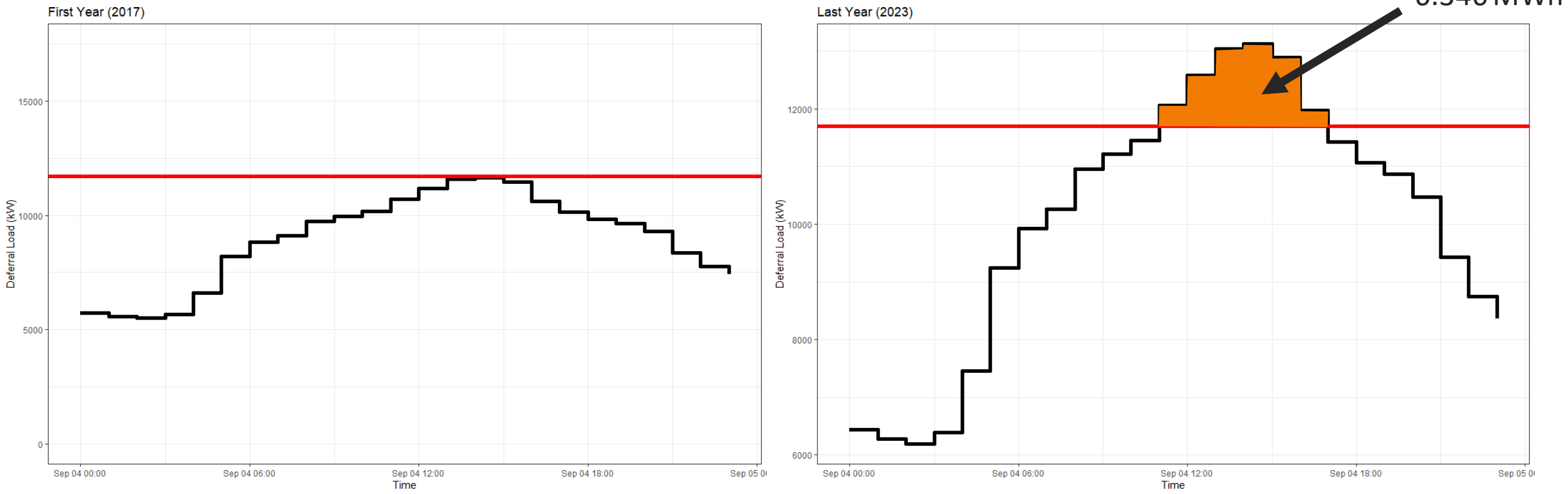
StorageVET 2.0 Setup

- Energy price required but no other services included

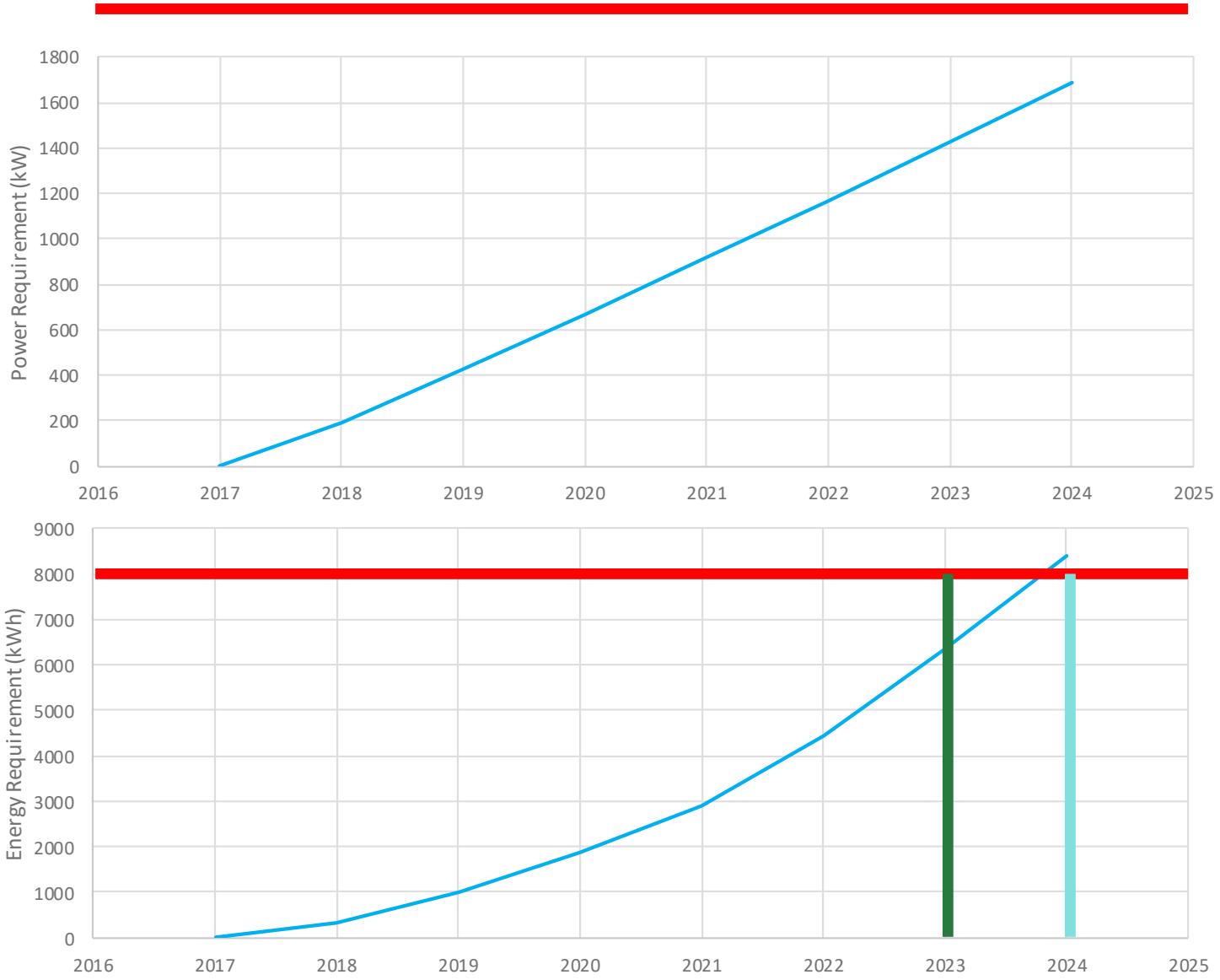
Tag	Key	Value
DA	growth	0
Deferral	planned_load_limit	11700
Deferral	reverse_power_flow_limit	-15000
Deferral	growth	2
Deferral	price	0

Deferral Results

- Energy-limiting day not necessarily power-limiting day
  - In this case, we are energy-limited
- 2 MW, 4hr battery can defer upgrade from 2018 to 2024

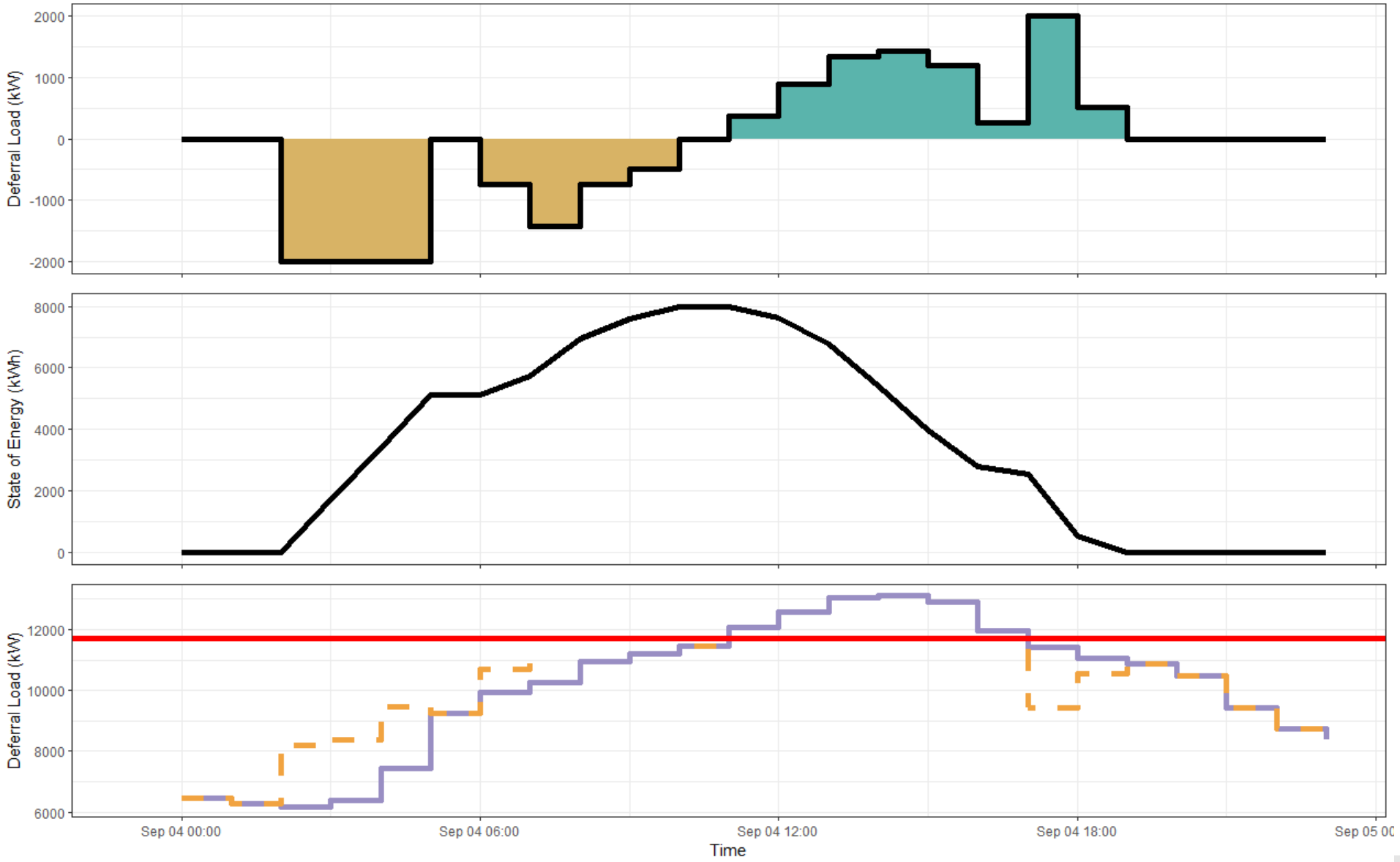


Storage System Requirements Over Time

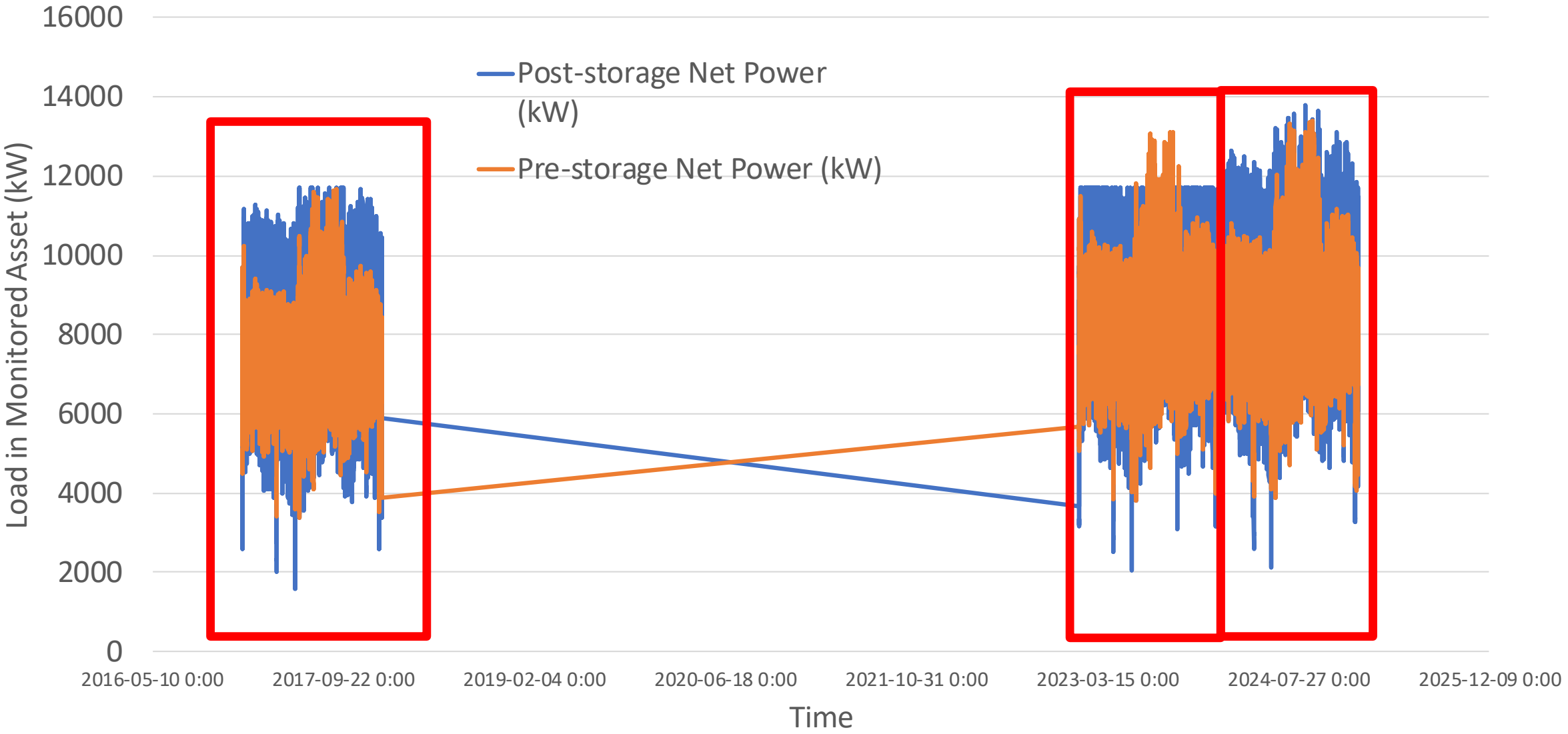



```
current year: 2017
min power : 0.0
min energy: 0.0
current year: 2018
min power : 187.82645640000192
min energy: 301.30850940000164
current year: 2019
min power : 425.5829855280026
min energy: 989.5517177760048
current year: 2020
min power : 668.0946452385633
min energy: 1871.208957438008
current year: 2021
min power : 915.4565381433349
min energy: 2877.4005613495683
current year: 2022
min power : 1167.7656689062023
min energy: 4430.627766414917
current year: 2023
min power : 1425.1209822843266
min energy: 6346.338001905107
current year: 2024
min power : 1687.6234019300136
min energy: 8398.128459764173
```

Operational Results

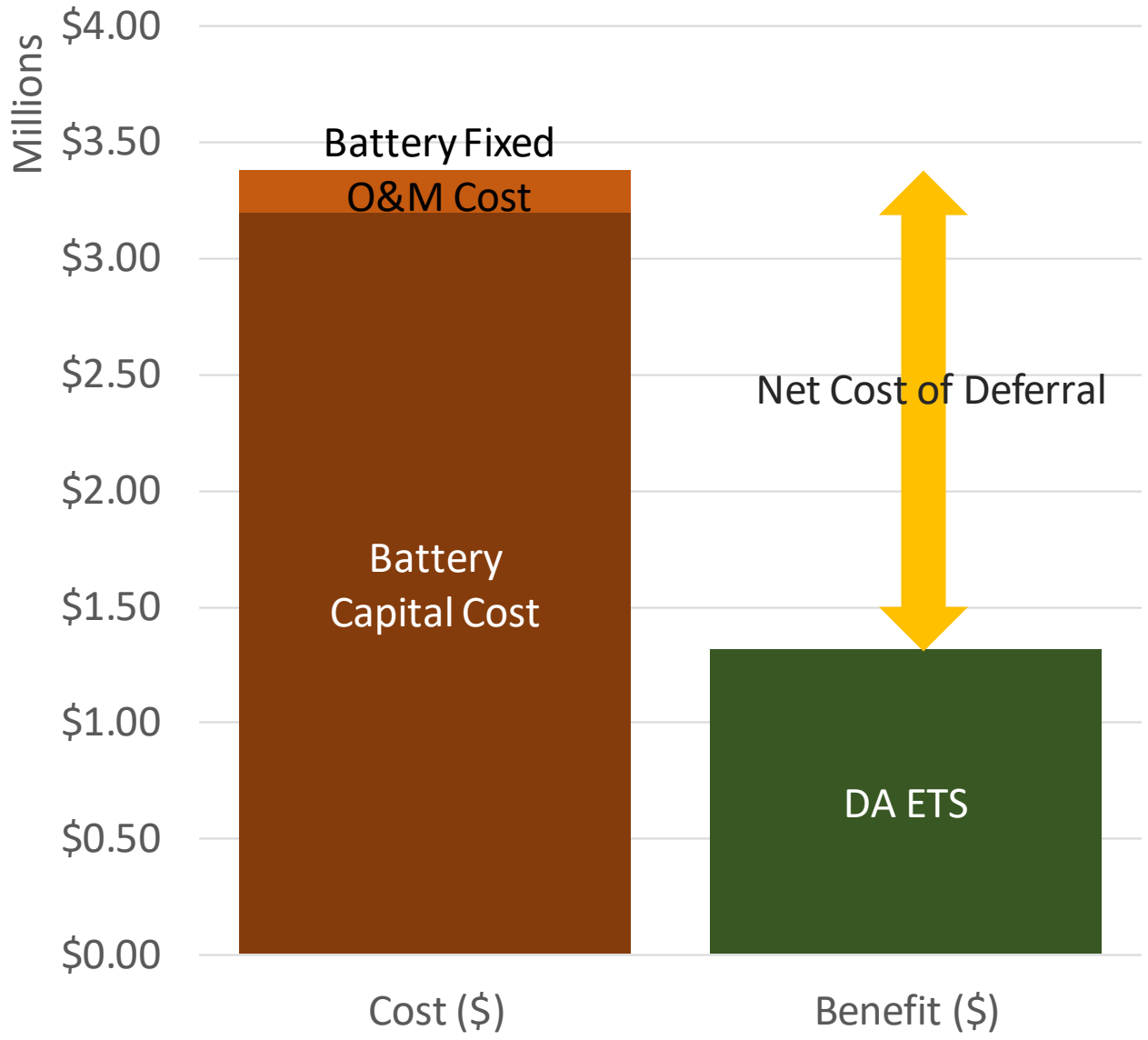


Plotting Directly in Results Folder



Financial Results

- Benefits do not overcome battery installed costs
  - Does not include deferral benefit
- Net cost of deferral = **$2.07 Million**
  - Needs to be overcome by benefit of deferring upgrade by 6 years
  - Or, avoided economic carrying cost could be counted as a benefit



DER-VET Validation

Problem Statement

- Optimize the size and cost of a microgrid with long-duration storage technologies that offers a desired level of reliability for grid outages lasting between 0 and 168 hours relative to the provided baseline microgrid

- Analyze the cost-effectiveness of the optimally designed microgrid, to determine if any of the storage technologies under consideration yields a positive business case

- Estimate the expected economic benefits from *stacking services* from grid services

Baseline & Investment Cases Overview

- **Location:** Southern CA (SCE Service Territory)

- **Baseline Microgrid:** A diesel generator based microgrid system designed to serve a certain critical load onsite with a specific amount of reliability

- **Battery enabled Microgrid** (Investment Case): A microgrid with a combination of DER (diesel generator+ battery) that could potentially help us retire a few generators without compromising on the reliability of the baseline microgrid

Identifying Primary and Secondary objectives

- **Primary Objective:** To serve the critical load at the site with a minimum reliability

- **Secondary Objective:** To explore the additional possibility of offering “stacked benefits” either at the distribution level or customer level

Identifying Costs and Benefits of Operating Microgrids

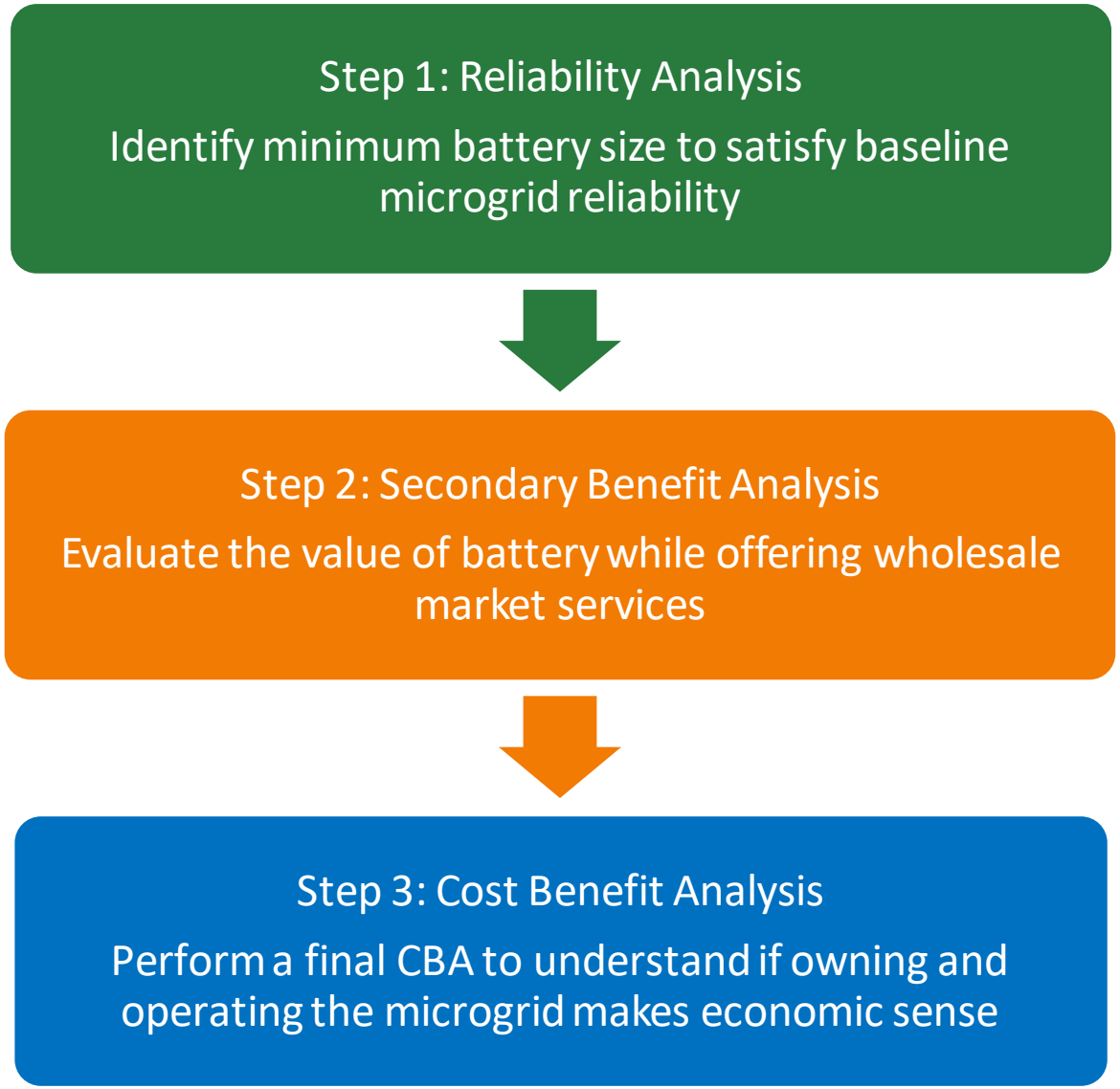
Baseline Microgrid

Cost	Benefit
CAPEX and OPEX cost of operating the generators **(N)**	None
Cost of serving the total load of the customer (utility bill)	

Investment Case Microgrid

Cost	Benefit
CAPEX and OPEX cost of operating the generators **(N-1)**	Offer Wholesale Market services
Cost of serving the total load of the customer (utility bill)	
CAPEX and OPEX cost of operating the battery	

Modeling Methodology (Investment Case)



Documentation

Additional Documentation

- Youtube videos/reference cases
- Inputs descriptions
- Outputs descriptions
- As-built formulation
- New-user-friendly user guide

Regularly Scheduled Meetings

- Next meeting – Thursday **January 9, 2020** 11:00 am PT

Together…Shaping the Future of Electricity