DER-VET Task Force

ESIC Working Group 1: Grid Services and Analysis

Miles Evans | EPRI
Andrew Etringer | EPRI
Suma Jothibasu | EPRI
Ram Ravikumar | EPRI

July 1, 2021

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- Sales territories, market shares, future product offerings;
- 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.

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- To allocate customers/suppliers/territories;
- To suppress a technology;
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- 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

- DER-VET Update Notice (Andrew E.)
- DER-VET Reliability Sizing (Suma J.)
- RA Update (Ram R.)

DER-VET Update V1.1

Version 1.1 Release in late-July (tentative)

- BUG FIXES
  - Downloading Sample CSV files from the GUI
  - Allow negative Day-Ahead energy price time series data when optimal sizing is turned OFF
  - Saving the Optimization Horizon value
  - Upload support for timeseries CSV file saved in Excel on a Mac
  - Demand Response input parameter fixes
  - Optimal battery sizing with Reliability fix
  - Deferral proforma fix (should have a value beyond analysis year)

Version 1.1 Release in late-July (tentative) (II)

- NEW FEATURES
  - Less restrictive importing of Retail Tariff file
  - Less restrictive process to import an existing project, and error messaging
  - Validation on timeseries data received from project import .json file
  - Add another pre-defined case (Electric Vehicles)
  - GUI support for negative growth rates

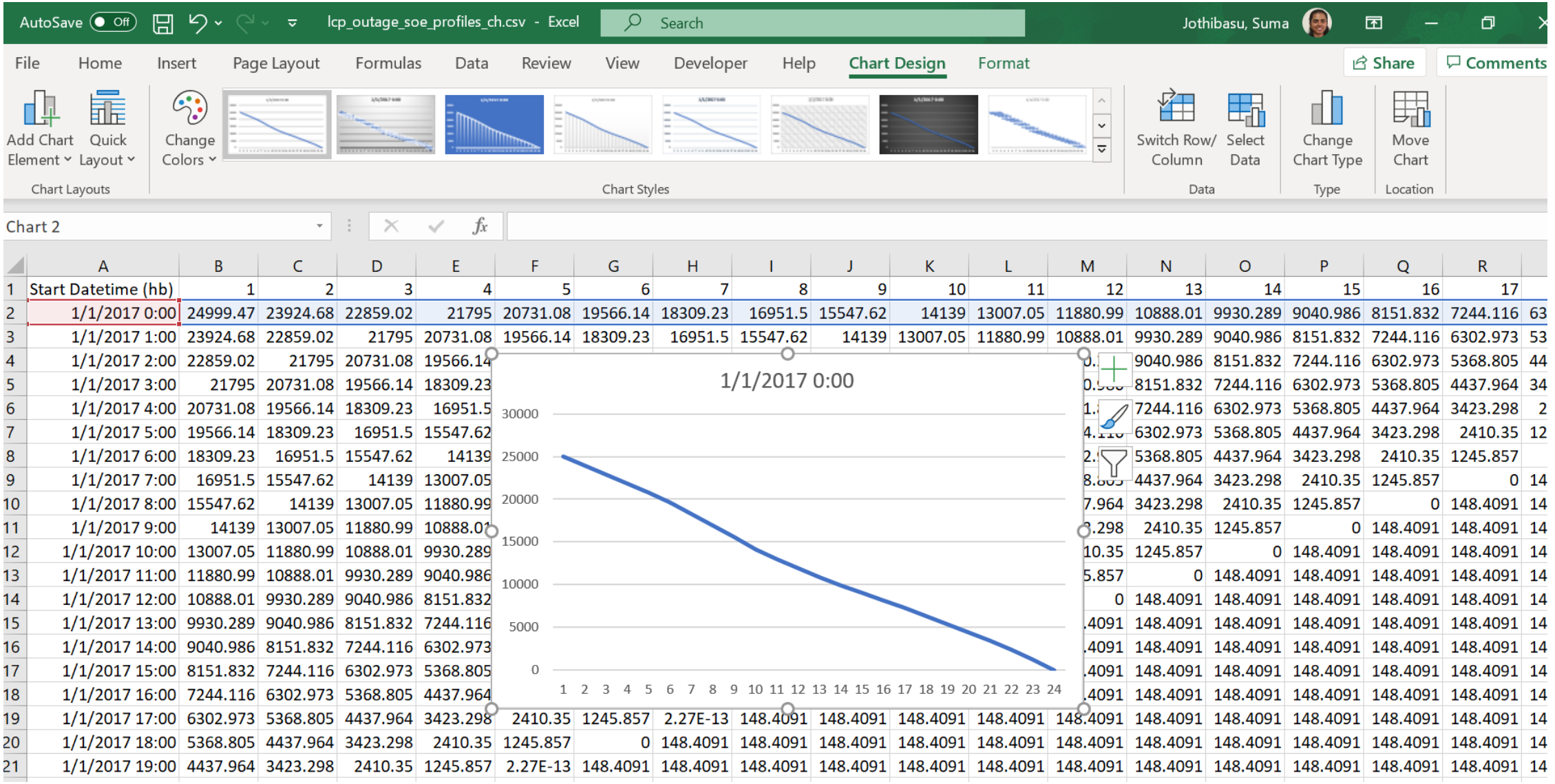
- IMPROVEMENTS
  - How-To video for installation on a Mac
  - Better instructions (README) for building DER-VET from source code
  - Dispatch plot sign convention update

Reliability Sizing – Results Folder

Reliability Sizing – Results folder

Name	Date modified	Type	Size
cost_benefit_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
ecc_breakdown_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
equipment_lifetimes_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
lcp_outage_soe_profiles_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	2,938 KB
load_coverage_prob_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
monthly_data_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
npv_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
outage_energy_contributions_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	249 KB
payback_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
pro_forma_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
size_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
technology_summary_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	1 KB
timeseries_results_ch.csv	6/2/2021 7:37 PM	Microsoft Excel Com...	507 KB

LCP Outage SOE Profile



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
1	Start Datetime (hb)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
2	1/1/2017 0:00	24999.47	23924.68	22859.02	21795	20731.08	19566.14	18309.23	16951.5	15547.62	14139	13007.05	11880.99	10888.01	9930.289	9040.986	8151.832	7244.116	63
3	1/1/2017 1:00	23924.68	22859.02	21795	20731.08	19566.14	18309.23	16951.5	15547.62	14139	13007.05	11880.99	10888.01	9930.289	9040.986	8151.832	7244.116	6302.973	53
4	1/1/2017 2:00	22859.02	21795	20731.08	19566.14										9040.986	8151.832	7244.116	6302.973	5368.805	44
5	1/1/2017 3:00	21795	20731.08	19566.14	18309.23										8151.832	7244.116	6302.973	5368.805	4437.964	34
6	1/1/2017 4:00	20731.08	19566.14	18309.23	16951.5										7244.116	6302.973	5368.805	4437.964	3423.298	2
7	1/1/2017 5:00	19566.14	18309.23	16951.5	15547.62										6302.973	5368.805	4437.964	3423.298	2410.35	12
8	1/1/2017 6:00	18309.23	16951.5	15547.62	14139										5368.805	4437.964	3423.298	2410.35	1245.857	
9	1/1/2017 7:00	16951.5	15547.62	14139	13007.05										4437.964	3423.298	2410.35	1245.857	0	14
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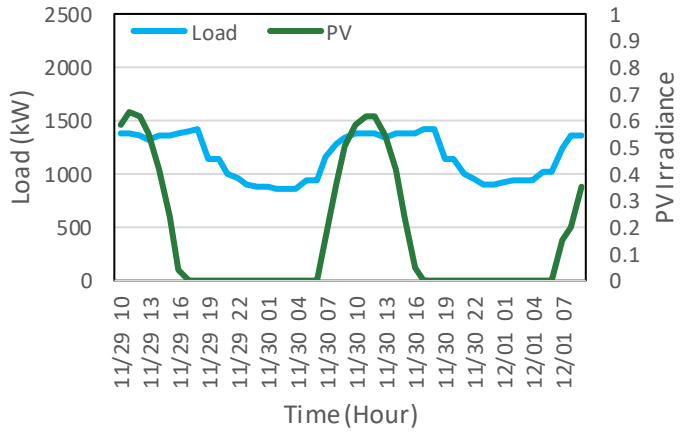
11	1/1/2017 9:00	14139	13007.05	11880.99	10888.01										2410.35	1245.857	0	148.4091	148.4091	14
12	1/1/2017 10:00	13007.05	11880.99	10888.01	9930.289										1245.857	0	148.4091	148.4091	148.4091	14
13	1/1/2017 11:00	11880.99	10888.01	9930.289	9040.986										0	148.4091	148.4091	148.4091	148.4091	14
14	1/1/2017 12:00	10888.01	9930.289	9040.986	8151.832										148.4091	148.4091	148.4091	148.4091	148.4091	14
15	1/1/2017 13:00	9930.289	9040.986	8151.832	7244.116										148.4091	148.4091	148.4091	148.4091	148.4091	14
16	1/1/2017 14:00	9040.986	8151.832	7244.116	6302.973										148.4091	148.4091	148.4091	148.4091	148.4091	14
17	1/1/2017 15:00	8151.832	7244.116	6302.973	5368.805										148.4091	148.4091	148.4091	148.4091	148.4091	14
18	1/1/2017 16:00	7244.116	6302.973	5368.805	4437.964										148.4091	148.4091	148.4091	148.4091	148.4091	14
19	1/1/2017 17:00	6302.973	5368.805	4437.964	3423.298	2410.35	1245.857	2.27E-13	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	14
20	1/1/2017 18:00	5368.805	4437.964	3423.298	2410.35	1245.857	0	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	14
21	1/1/2017 19:00	4437.964	3423.298	2410.35	1245.857	2.27E-13	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	148.4091	14

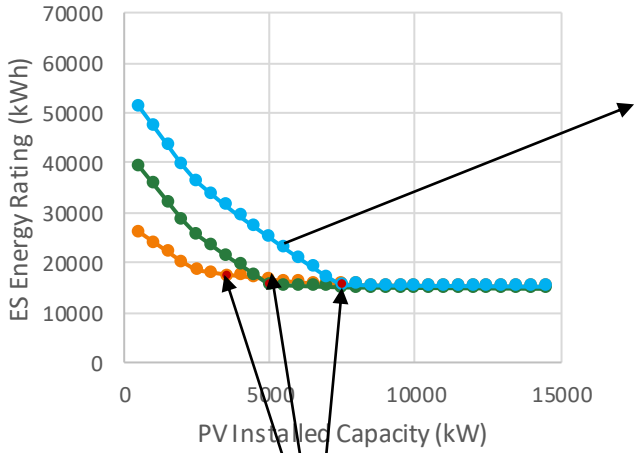
LA Hospital — Solar plus storage Microgrid sizing

The peak 24 hour period chosen



Peak load – 1.4 MW
24hr load requirement – 28.024MWh
36hr load requirement – 42.916MWh
48hr load requirement – 55.338MWh

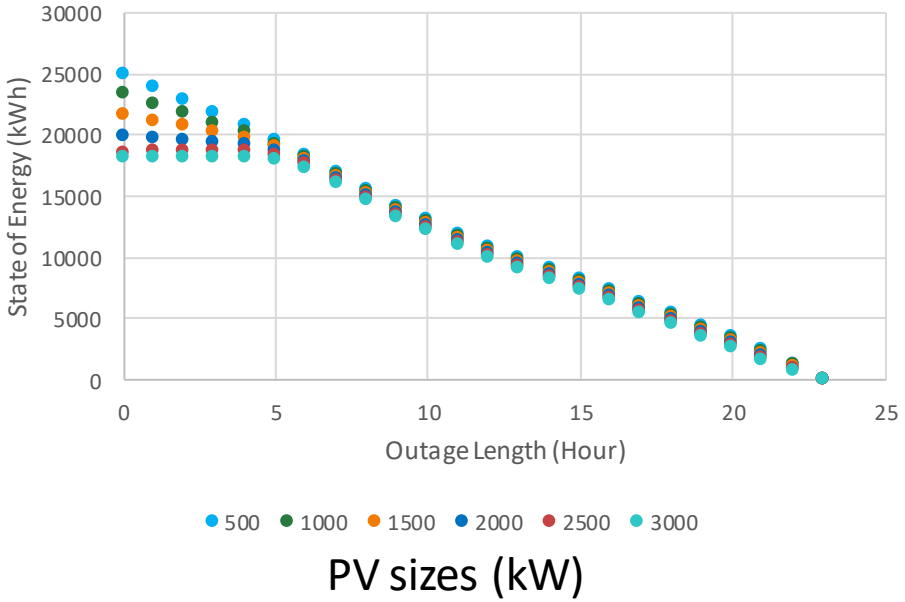
Solar plus storage is sized for the given 24 hour period



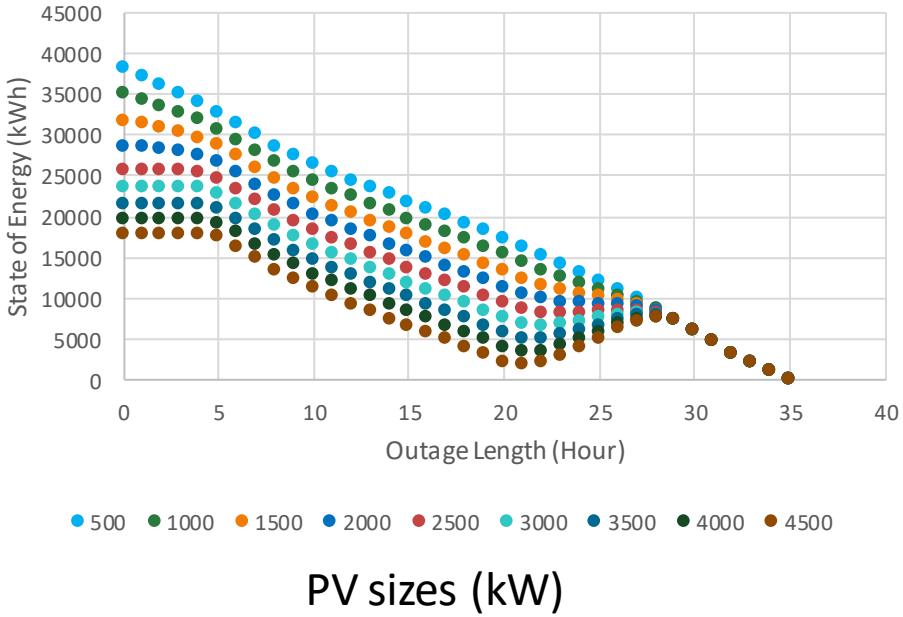
Each datapoint is a DER-VET run

24h – 3.5MW PV+1.4MW/17MWh ES
36h – 5MW PV+1.6MW/15MWh ES
48h – 7.5MW PV+3MW/15MWh ES

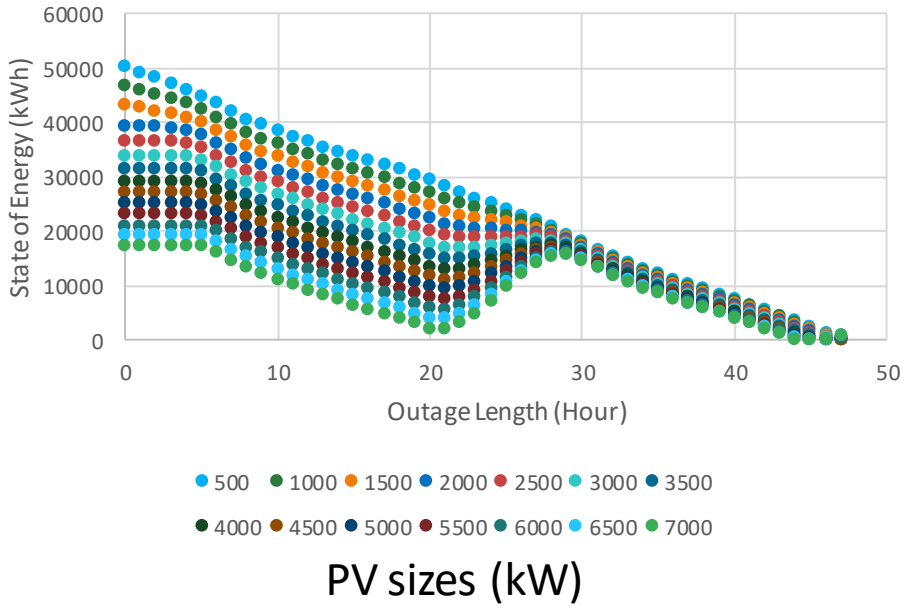
24 Hour Outage – Battery Energy Evolution



36 Hour Outage – Battery Energy Evolution



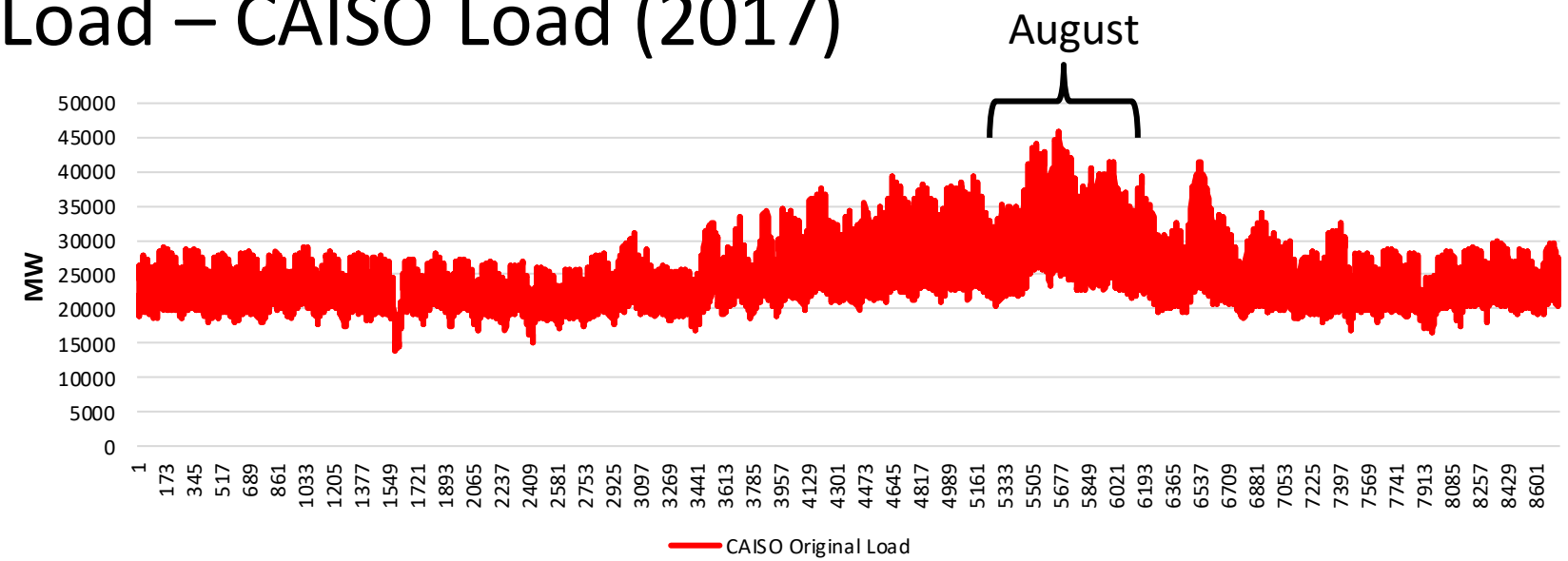
48 Hour Outage – Battery Energy Evolution



DER-VET Resource Adequacy Reference Case

Case Summary – Primary Service

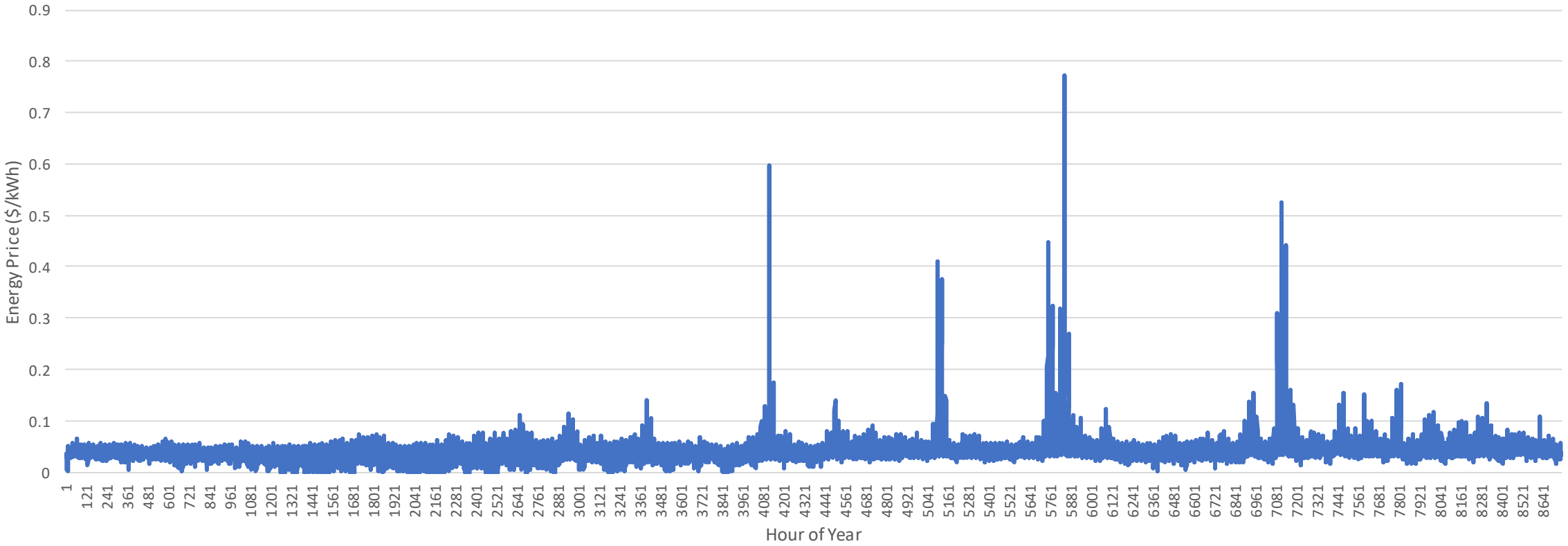
- System Load – CAISO Load (2017)



Parameter	Value
No. of RA Events	10 per year
RA Event Duration	4 hrs
Contracted Capacity	2000 kW, 8000 kWh
RA Monthly Payment	$10/kW-month

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**

Step 1: DER Technical Specification & Activation

Tag	ID	Key	Optimizat	Units	Type
Scenari	.	monthl	.\data\	N/A	string
Battery	1	name	ES		string
Battery	1	startup_ti	10	min	int
Battery	1	ccost	0	$	float
Battery	1	ccost_kw	1600	$/kW	float
Battery	1	ccost_kwh	0	$/kWh	float
Battery	1	nsr_respo	0	minutes	int
Battery	1	sr_respon	0	minutes	int
Battery	1	startup	0	N/A	bool
Battery	1	fixedOM	10	$/kW-yr	float
Battery	1	OMexpen	0	$/MWh	float
Battery	1	ch_max_r	2000	kW	float
Battery	1	dis_max_r	2000	kW	float
Battery	1	ch_min_ra	0	kW	float
Battery	1	dis_min_r	0	kW	float
Battery	1	ene_max_	8000	kWh	float
Battery	1	duration_	0	hr	float
Battery	1	ulsoc	100	%	float
Battery	1	llsoc	0	%	float
Battery	1	rte	85	%	float
Battery	1	sdr	0	%/hr	float

Step 2: Service Selection

Tag	ID	Key	Optimization Value	Units
Scenari	.	monthl	.\data\monthly_D	N/A
RA	1	days	10	Count
RA	1	length	4	hours
RA	1	dispmode	1	N/A
RA	1	idmode	Peak by Year	N/A
RA	1	growth	0	%/yr

Year	Month	RA Capacity Price ($/kW)
2017	1	10
2017	2	10
2017	3	10
2017	4	10
2017	5	10
2017	6	10
2017	7	10
2017	8	10
2017	9	10
2017	10	10
2017	11	10
2017	12	10

Parameter	Value
No. of RA Events	10 per year
RA Event Duration	4 hrs
Contracted Capacity	2000 kW, 8000 kWh
RA Monthly Payment	$10/kW-month

Step 3: Load Data Input

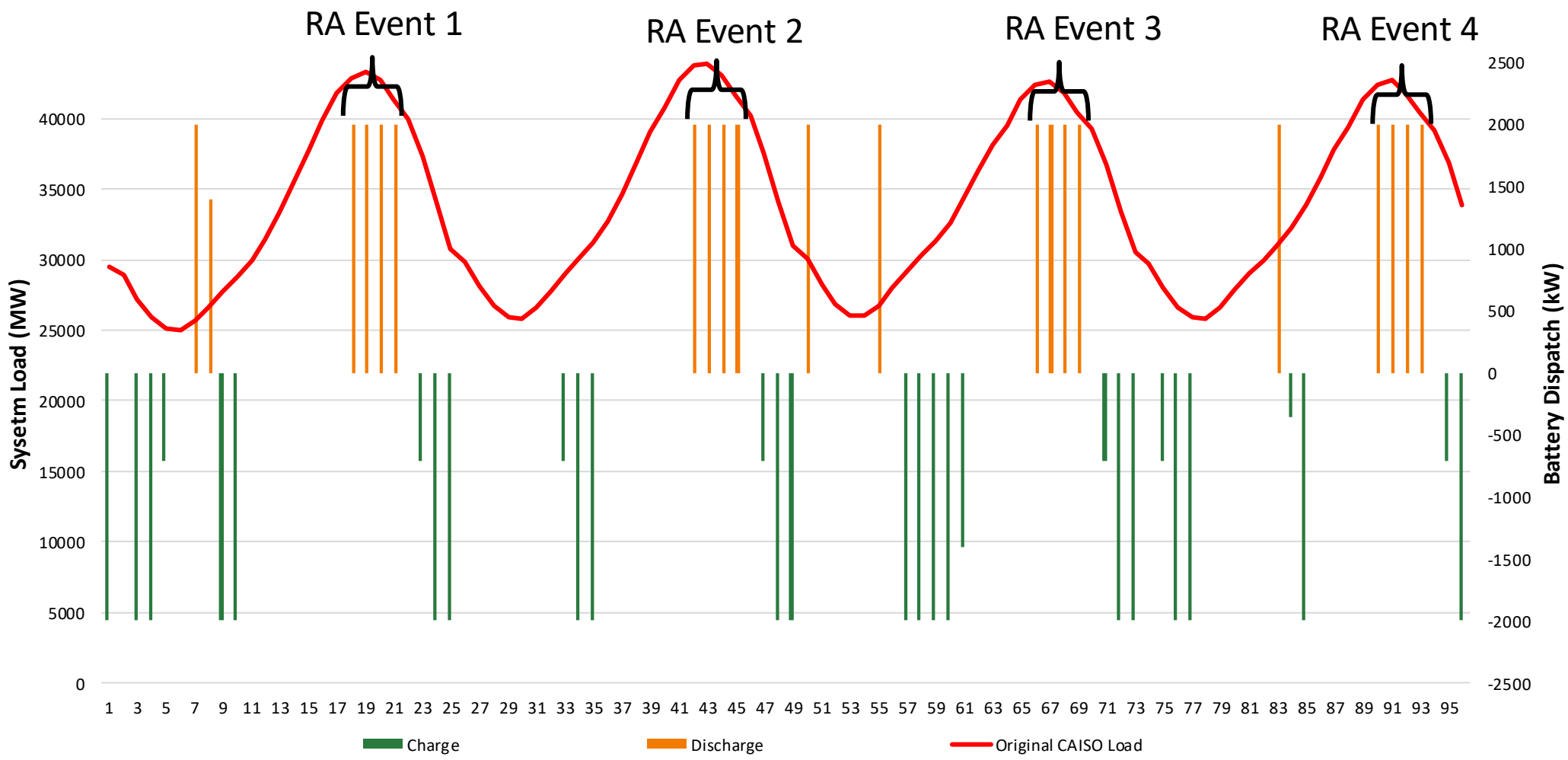
Datetime (he)	System Load (kW)	Deferral Load (kW)
1/1/2017 1:00	21812.31	5029.073415
1/1/2017 2:00	20992.72	4930.803404
1/1/2017 3:00	20327.95	4828.833403
1/1/2017 4:00	19906.7	4638.483417
1/1/2017 5:00	19851.31	4506.686747
1/1/2017 6:00	20208.33	4582.341744
1/1/2017 7:00	20903.74	4742.603424
1/1/2017 8:00	20815.84	4617.09007
1/1/2017 9:00	20441.81	4609.116736
1/1/2017 10:00	19901.58	4805.845076
1/1/2017 11:00	19403.42	4937.158403
1/1/2017 12:00	19011.37	5049.786745
1/1/2017 13:00	18927.21	5104.970076
1/1/2017 14:00	19018.48	5049.75342
1/1/2017 15:00	19536.32	4954.536739
1/1/2017 16:00	20564.12	4936.285065
1/1/2017 17:00	22554.9	5118.051729
1/1/2017 18:00	25671.05	5986.315094
1/1/2017 19:00	26378.57	6847.430137
1/1/2017 20:00	26096.41	6842.025167
1/1/2017 21:00	25421.79	6562.218469
1/1/2017 22:00	24417.9	6230.191779
1/1/2017 23:00	22996.57	6009.540084
1/2/2017 0:00	21622.58	5662.053402
1/2/2017 1:00	20737.81	5393.065074
1/2/2017 2:00	20078.27	5368.981744
1/2/2017 3:00	19687.79	5216.530074
1/2/2017 4:00	19658.84	5335.063407
1/2/2017 5:00	20265.33	5647.631744
1/2/2017 6:00	21796.73	6426.5218
1/2/2017 7:00	24446.08	7549.238497
1/2/2017 8:00	25590.51	8459.823767

RA Hours Identification

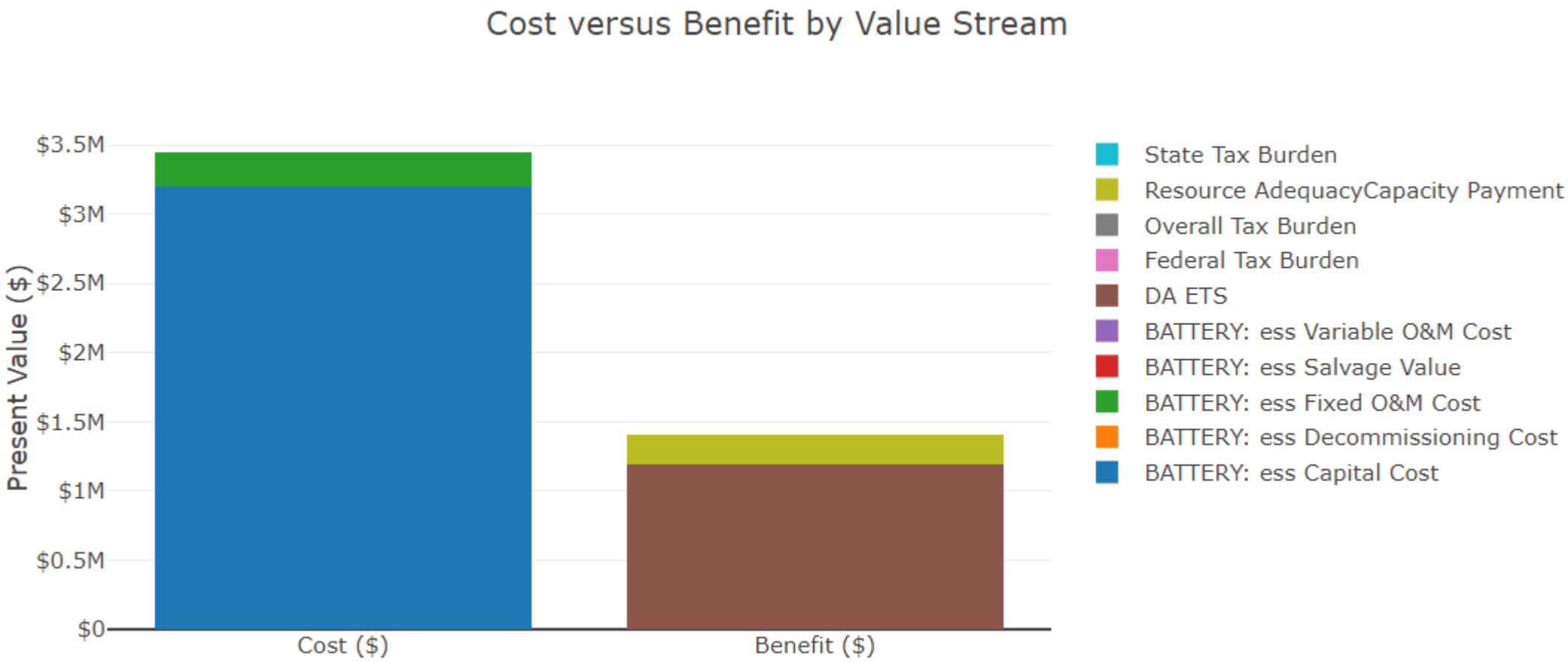
- Total RA Hours: 10 events/yr X 4 hours/event = 40 hrs

Start Datetime (hl	RA Eve
8/18/2017 16:00	TRUE
8/18/2017 17:00	TRUE
8/18/2017 18:00	TRUE
8/18/2017 19:00	TRUE
8/19/2017 16:00	TRUE
8/19/2017 17:00	TRUE
8/19/2017 18:00	TRUE
8/19/2017 19:00	TRUE
8/20/2017 16:00	TRUE
8/20/2017 17:00	TRUE
8/20/2017 18:00	TRUE
8/20/2017 19:00	TRUE
8/21/2017 16:00	TRUE
8/21/2017 17:00	TRUE
8/21/2017 18:00	TRUE
8/21/2017 19:00	TRUE
8/24/2017 16:00	TRUE
8/24/2017 17:00	TRUE
8/24/2017 18:00	TRUE
8/24/2017 19:00	TRUE

Battery Operation during RA Events #1 - #4 (Aug 18 – Aug 21)



Financial Results



Next Meeting

Next Meeting

- Next meeting is **Thursday, August 6, 11:00 a.m. Pacific Time**