



 OCTOBER 8 & 9  DOWNEY, CA

ET Summit Fall 2018

COMMERCIAL + RESIDENTIAL BUILDINGS

Emerging Technology: Battery Energy Storage Systems

Measurement & Verification Study of 5.47 MW Deployed at 21 Public School Sites

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ET Program M&V Study

Background



- IES was contracted by SDG&E Emerging Technology Program to evaluate the Green Charge, now Engie, Energy Storage System (ESS).
- Fleet of 27 ESSs installed at 21 public schools, total capacity 5.47 MW.
 - Group 1 is presented here: **4.46 MW**, 20 Systems.
 - Group 2 is in progress: 1.01 MW, 7 additional Systems.

Group 1: Project Timeline

July 2015 – January 2016	March 1, 2016	June 2016 – Feb. 2017	Feb. 2017 – June 2017	July 2017 – October 2017
M&V Plan & Revisions	M&V Contract Execution	Installation & Metering Cx	Peak Savings Evaluation	DR Simulations



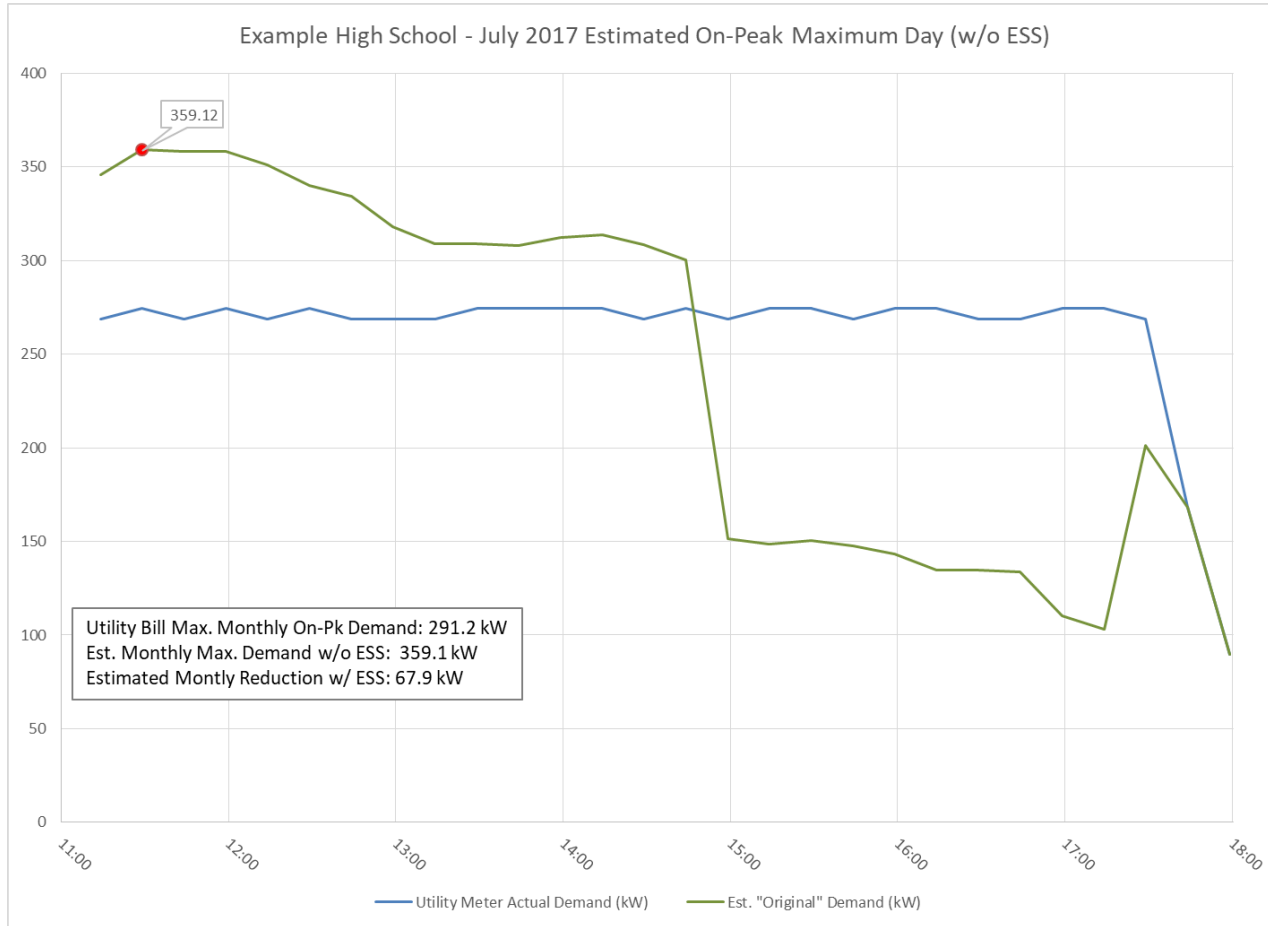
Results of this 5-month analysis period are presented today

Financial Impacts / Peak Shaving Effectiveness



#	System Name	System Size		Cumulative Bill Reduction (5-month)	Portion Customer Keeps	Cumulative Customer Value (5-month)	Customer Value (annualized)	Target Value to Customer Value (5-month)	% Customer Target Value Achieved (5-month)
		kW	kWh						
1	Training Center	30	60	\$ 805.56	30%	\$ 241.67	\$ 580.01	\$ 759.00	32%
2	High School A	250	500	\$ 8,084.13	35%	\$ 2,829.44	\$ 6,790.67	\$ 5,028.77	56%
3	Adult School	60	120	\$ 2,829.34	20%	\$ 565.87	\$ 1,358.08	\$ 873.92	65%
4	High School B	250	500	\$ 12,221.97	40%	\$ 4,888.79	\$ 11,733.09	\$ 5,888.50	83%
5	High School C	250	500	\$ 9,553.03	45%	\$ 4,298.86	\$ 10,317.27	\$ 7,443.75	58%
6	High School D, Sys.1	250	500	\$ 12,218.41	30%	\$ 3,878.25	\$ 9,307.79	\$ 3,928.63	99%
7	High School D, Sys.2	250	500	\$ 19,477.58	30%	\$ 6,104.64	\$ 14,651.15	\$ 4,419.00	138%
8	Middle School A	250	500	\$ 12,972.23	25%	\$ 3,243.06	\$ 7,783.34		
9	High School E, Sys.2	500	1000	\$ 43,110.15	25%	\$ 10,777.54	\$ 25,866.09	\$ 9,355.10	115%
10	High School E, Sys.1	60	120						
11	Elementary School A	250	500	\$ 14,519.74	25%	\$ 3,629.94	\$ 8,711.85	\$ 3,404.58	107%
12	Elementary School B	60	120	\$ 3,665.94	25%	\$ 916.48	\$ 2,199.56	\$ 1,199.69	76%
13	Middle School B	250	500	\$ 14,077.57	25%	\$ 3,519.39	\$ 8,446.54	\$ 3,717.92	95%
14	Elementary School C	250	500	\$ 11,377.81	25%	\$ 2,844.45	\$ 6,826.69	\$ 2,711.67	105%
15	Elementary School D	250	500	\$ 9,750.04	25%	\$ 2,437.51	\$ 5,850.02	\$ 2,867.08	85%
16	Elementary School E	250	500	\$ 10,888.84	25%	\$ 2,722.21	\$ 6,533.30	\$ 3,143.33	87%
17	Elementary School F	250	500	\$ 10,008.17	35%	\$ 3,502.86	\$ 8,406.86	\$ 3,652.54	96%
18	Elementary School G	250	500	\$ 10,992.29	25%	\$ 2,748.07	\$ 6,595.38	\$ 3,643.13	75%
19	Elementary School H	250	500	\$ 9,610.60	35%	\$ 3,363.71	\$ 8,072.90	\$ 3,689.00	91%
20	District Office	250	500	\$ 9,645.20	25%	\$ 2,411.30	\$ 5,787.12	\$ 2,103.17	115%
		4.46 MW		\$ 225,808.59		\$ 64,924.05	\$ 155,817.72	\$ 67,828.77	91%

1	High School D: The Customer Share of Savings changed from 40% to 30% on 3/10/2017.
2	Middle School A was not in original projections, therefore no target value available.
3	Systems at High School E shown as combined b/c vendor billing statements were initially combined.

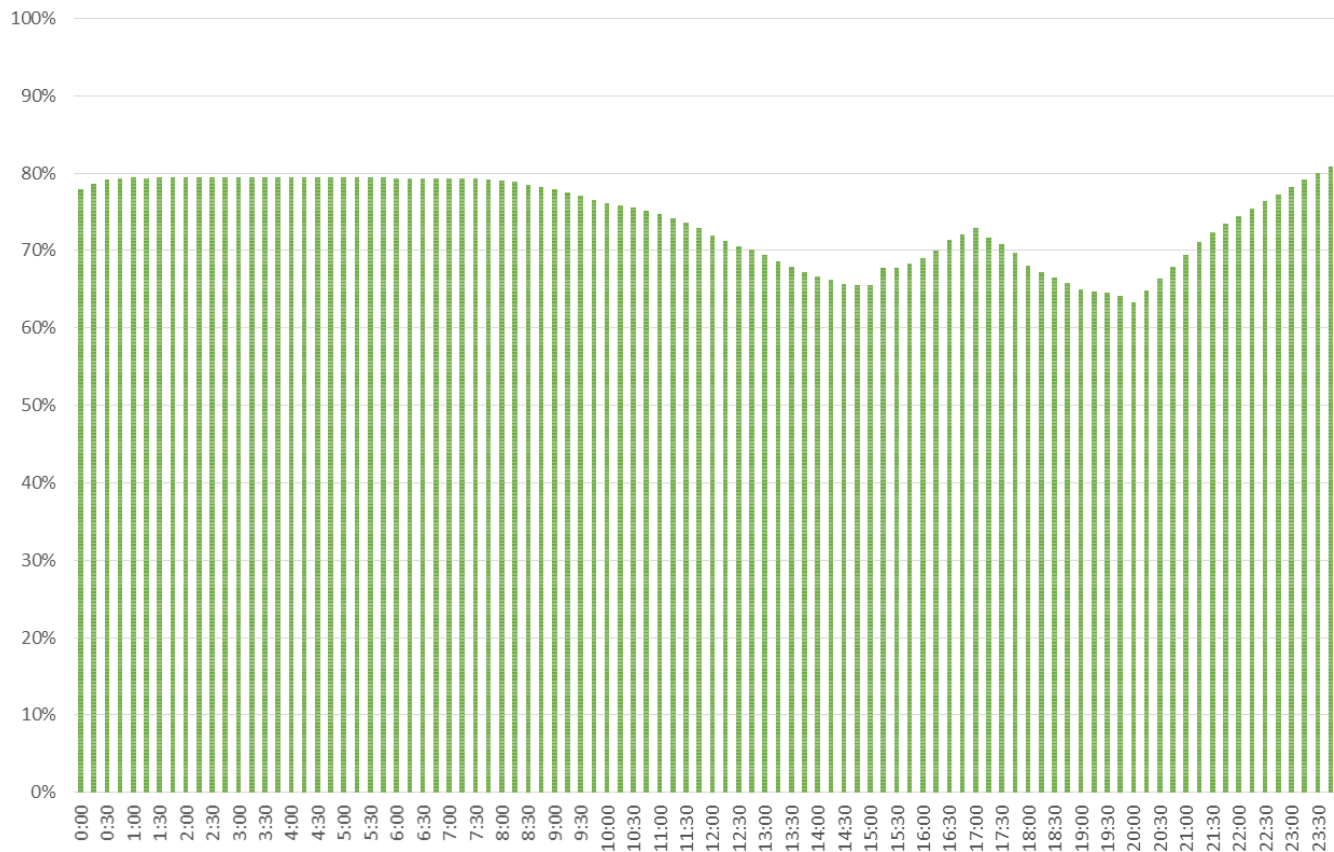


Load Profile

Round Trip Efficiency

ESS EFFICIENCY SUMMARY: by System Type								
#	Qty. of Type in Study	System Base Type	System Type		Total kWh Consumed	Total kWh Discharged	Total kWh Lost	Efficiency (Avg.) (%)
			kW	kWh				
1	1	Single GS 30-60	30	60	3,046	2,215	830	73%
2	3	Double GS 30-60	60	120	19,024	14,562	4,462	77%
3	15	Single GS 250-500	250	500	353,958	334,610	19,348	95%
4	1	Double GS 250-500	500	1000	47,959	44,671	3,288	93%
	TOTAL				423,986	396,058	27,928	93%

AVG. FLEET STATE OF CHARGE (%)



Average Fleet
State of
Charge by
time of day

Fleet Size:
4.46 MW
8.92 MWh

Demand Response Summary



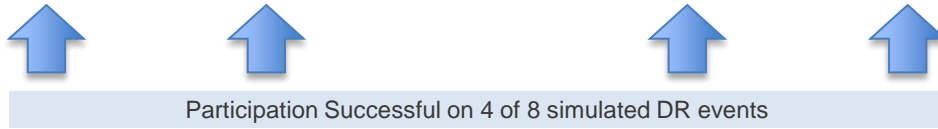
DR-1	DR-2	DR-3	DR-4	DR-5	DR-6	DR-7	DR-8
7/27/2017	8/15/2017	8/16/2017	10/10/2017	10/11/2017	10/20/2017	10/24/2017	10/25/2017
Notification Type							
Day-Ahead	Day-Ahead	Same-Day	30-Minute	Same-Day	Same-Day	30-Minute	Same-Day
Simulated Event Duration (hrs.)							
2	4	2	2	4	2	2	4
Total kW Curtailed / Vendor Projection							
124.5 / 630	1160.6 / 1170	1097.9 / N/A	104.4 / N/A	1268.8 / 1300	2736.9 / 2550	-414.0 / 1450	-563.3 / 1600

- Average kW Curtailed per Event: 689.5 kW (15% of Fleet kW)
- Maximum kW Curtailed: 2,736.9 kW (61% of Fleet kW)

Demand Response Summary



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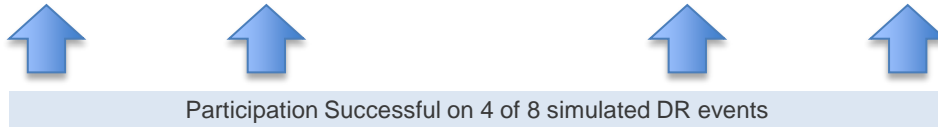


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- Average kW Curtailed per Event: 689.5 kW (15% of Fleet kW)
- Maximum kW Curtailed: 2,736.9 kW (61% of Fleet kW)
- kW Curtailed when participation was successful: 1,175.8 kW (26% of Fleet kW)

Rate Tariffs & DR Programs



- **General Electric Service** is provided to all non-residential customers with a demand higher than 20-kW under Schedule AL-TOU.
 - Under Schedule AL-TOU the amount a customer pays is primarily based upon the maximum non-coincident demand metered.
- **Commodity Electric Schedule CPP-D** is the default commodity schedule for bundled commercial & industrial customers with demand above 20-kW.
 - Under Schedule CPP-D, there is an ‘Event Day Adder’ of over \$2.00 per kWh in addition to energy rates that vary by time of day and season. This schedule allows customers to save money by shifting energy use to off peak times and especially by curtailing as much as possible whenever an event is called.
- **Capacity Bidding Program (CBP)** is a voluntary demand response program, in which customers or aggregators earn incentives in exchange for reducing energy consumption when called upon to do so by the utility.

- Vendor's Shared Savings Model:
- Significant Financial Performer for Customer (with current tariffs)
- Not aligned for Demand Response (financial agreement with existing customers)

- Significant opportunity for improved grid resiliency if Automated Demand Response can be utilized.

The Emerging Technology has been shown to function (proof of concept) and the fleet has energy reserves of 60%+ of its capacity available at all times of day.

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