Storage Only Grid Export GHG Emission Reductions Under NEM

by Tom Rust

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Getting to 100% renewables

- We cannot get to 100% renewables without energy storage, and we currently have far less storage than solar
- Solar+Storage
- Wind+Storage

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2019 Total System Electric Generation

Fuel Type	California In-State Generation (GWh)	Percent of California In-State Generation	Northwest Imports (GWh)	Southwest Imports (GWh)	Total Imports (GWh)	Percent of Imports	Total California Energy Mix (GWh)	Total California Power Mix
Coal	248	0.12%	219	7,765	7,985	10.34%	8,233	2.96%
Natural Gas	86,136	42.97%	62	8,859	8,921	11.55%	95,057	34.23%
Oil	36	0.02%	0	0	0	0.00%	36	0.01%
Other (Waste Heat / Petroleum Coke)	411	0.20%	0	11	11	0.01%	422	0.15%
Nuclear	16,163	8.06%	39	8,743	8,782	11.37%	24,945	8.98%
Large Hydro	33,145	16.53%	6,387	1,071	7,458	9.66%	40,603	14.62%
Unspecified	0	0.00%	6,609	13,767	20,376	26.38%	20,376	7.34%
Non-Renewables and Unspecified Totals	136,139	67.91%	13,315	40,218	53,533	69.32%	189,672	68.30%
Biomass	5,851	2.92%	903	33	936	1.21%	6,787	2.44%
Geothermal	10,943	5.46%	99	2,218	2,318	3.00%	13,260	4.77%
Small Hydro	5,349	2.67%	292	4	296	0.38%	5,646	2.03%
Solar	28,513	14.22%	282	5,295	5,577	7.22%	34,090	12.28%
Wind	13,680	6.82%	9,038	5,531	14,569	18.87%	28,249	10.17%
Renewables Totals	64,336	32.09%	10,615	13,081	23,696	30.68%	88,032	31.70%
System Totals	200,475	100.00%	23,930	53,299	77,229	100.00%	277,704	100.00%

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October 2020 report on outages to Governor Newsom

- 2) In transitioning to a reliable, clean and affordable resource mix, resource planning targets have not kept pace to lead to sufficient resources that can be relied upon to ***meet demand in the early evening hours.*** This makes balancing demand and supply more challenging. These challenges were amplified by the extreme heat storm.

Current Solar+Storage 2020

- Peak 15.5 Gw Solar CAISO grid tied FTM
- Estimated 9.8Gw Solar NEM BTM
- 4.2Gw of storage, but vast majority of that is hydro
- 216Mw of battery storage to increase to 923Mw by end of 2020
- *Even at 1Gw, that is less than 1/50th of what is needed to balance the existing solar generation*
- *We need at least 50Gwh more storage just to offset the existing solar*

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Storage Only Under NEM

- Charge Only during non-peak rate periods
- Discharge during peak emissions periods – which generally now coincide with peak rate periods
- Export excess power during peak rate periods to support grid and maximize GHG savings
- Resiliency - have capacity to operate off-grid for hours or days

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New customers served

- Customers with shading issues
- Customers in fire zones who don't qualify for equity resiliency rebates
- Apartment dwellers with insufficient roof space for adequate solar
- Renters with landlords who refuse solar
- Microgrid adaptors – a path to compensation

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Annual Savings Example 1 Residential EV2 midnight-4pm charge

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- Under EV2 rate - $77/kwh
- Under TOU-C rate - $6/kwh – not enough differential
- 37.4 kg/kwh GHG emissions savings
- With $1000/kwh storage cost, 7 year simple payback
- Charge midnight to 4pm
- Discharge 4-9pm (peak rate period)

Annual Savings Example 1

Models by: **Custom Power Solar** Analysis

Load year 2019

Annual

	EV2	E-TOU-C			CCA	PG&E
Loads only cost	$1,522.64	$2,268.65	$0.00	$0.00	$1,522.64	$1,522.64
Cost with storage	-$25.04	$2,146.55	$0.00	$0.00	$202.02	$39.74
Total Value batteries	**$1,547.68**	**$122.10**	**$0.00**	**$0.00**	**$1,320.62**	**$1,482.89**
$/kwh storage only	$77.38	$6.10	$0.00	$0.00	$66.03	$74.14

Total usage 7,203 kwh — 4.00 kw Battery

20.00 kwh Battery — 86.7% RTE

GHG savings battery 748 kgs/CO2 — 7,409 kwh Battery use — 3650 full cycles life

GHG savings battery per kwh 37.4 kg/kwh — 10.15% % of Life used

Annual Demand Charges — Max Demand

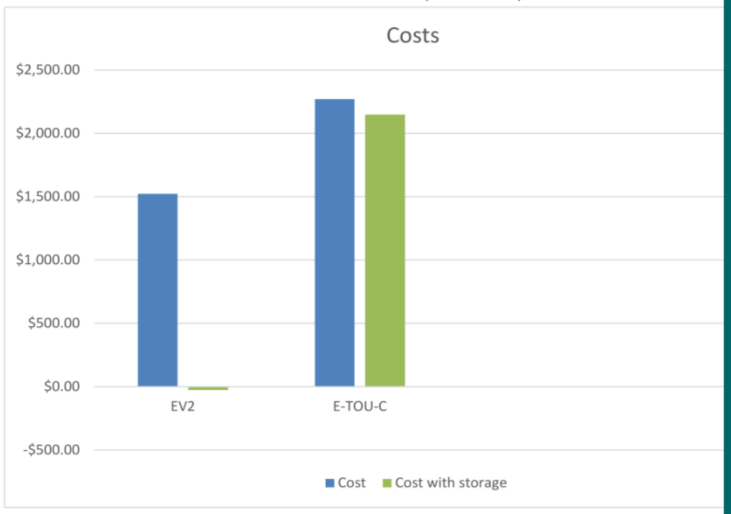
	EV2	E-TOU-C			
Loads only cost	$0.00	$0.00	$0.00	$0.00	12.40
Cost with storage	$0.00	$0.00	$0.00	$0.00	12.41

Annual Energy Charges

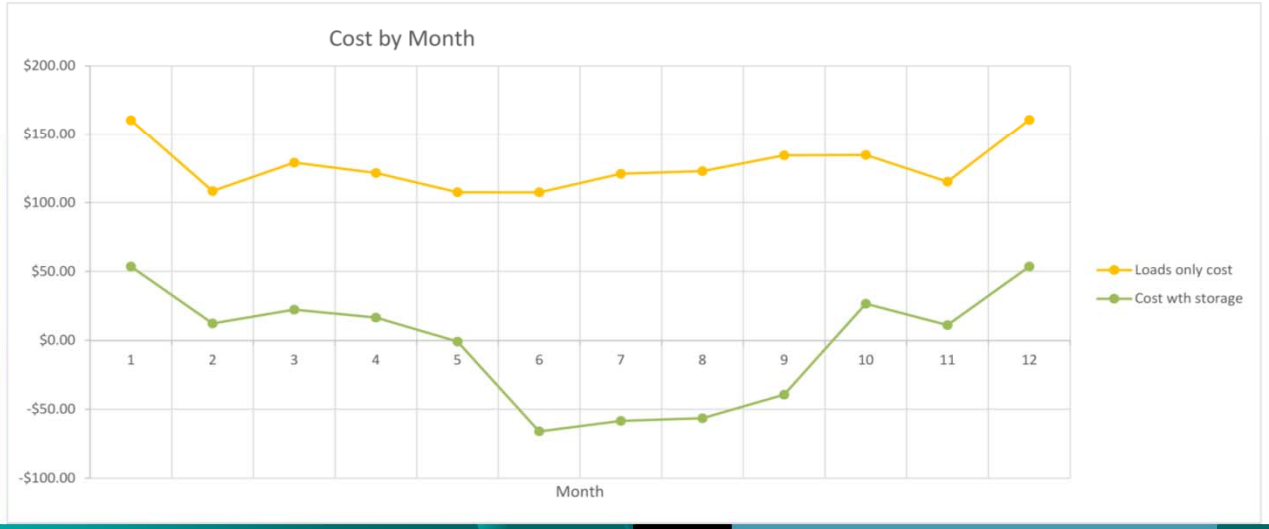
	EV2	E-TOU-C		
Loads only cost	$1,522.64	$2,268.65	$0.00	$0.00
Cost with storage	-$25.04	$2,146.55	$0.00	$0.00

Max daily usage 56 kwh — Average load 19.7 kwh

Solar Data — Lat, Lon: 37.81, -122.26



		Raw cost	$20,000
Storage rate $/kwh	$1,000	Final Cost	$10,800
SGIP rebate rate $/wh	$0.20	Simple payback	7.0
ITC	26%		



Charge midnight – 4pm

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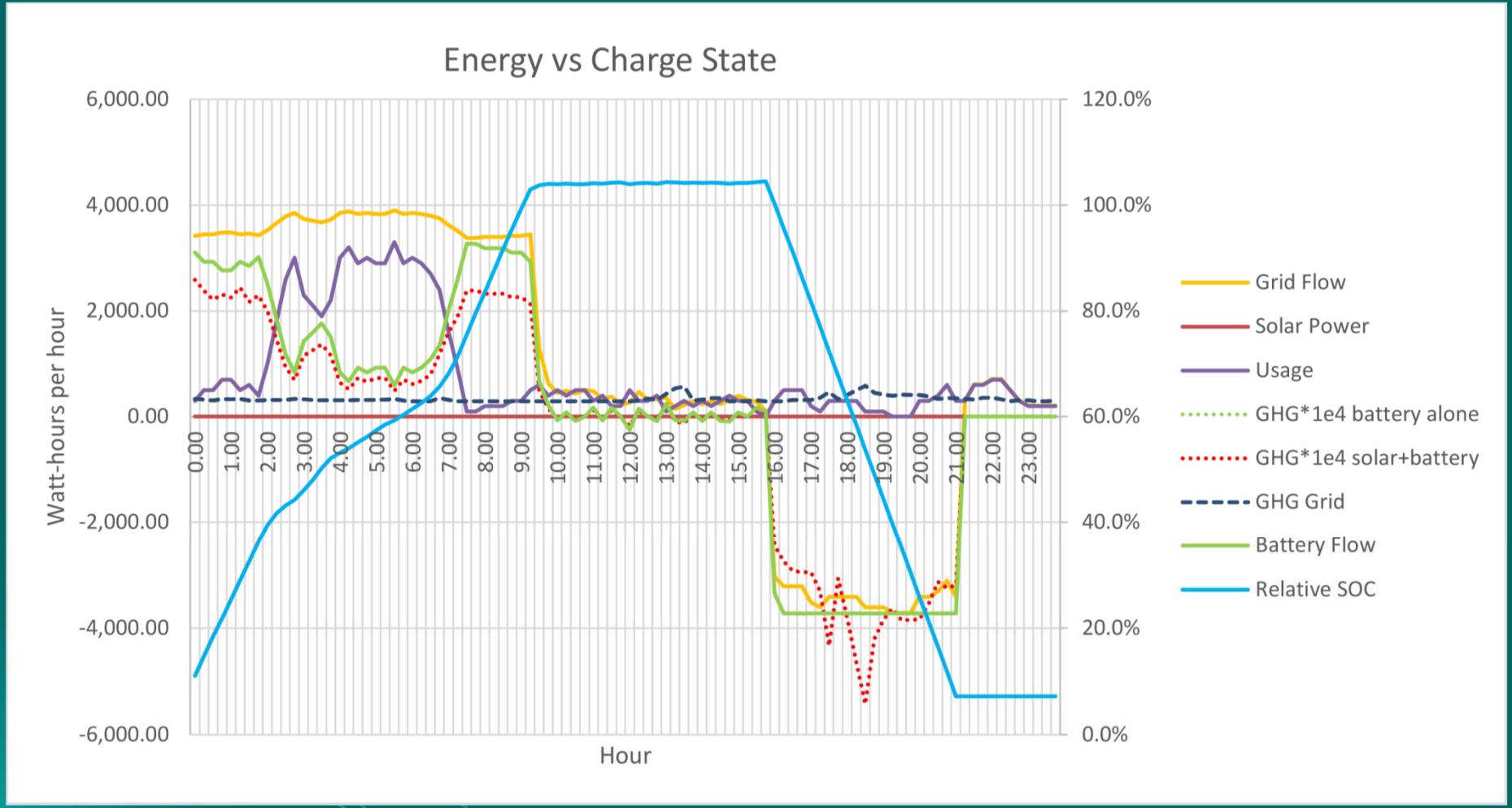
Discharge 4pm-9pm

Example Charge/Discharge 1



Residential wih EV 8/18
Charge midnight-4pm

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Discharge 4pm-9pm

Annual Savings Example 2 Residential EV2 – Daylight charge

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- Under EV2 rate - $74/kwh
- Under TOU-C rate - $6/kwh – not enough differential
- 46.2 kg/kwh GHG emissions savings
- With $1000/kwh storage cost, 7.3 year simple payback
- Charge 7am to 4pm
- Discharge 4-9pm (peak rate period)

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Annual Savings Example 2

Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	EV2	E-TOU-C			CCA	PG&E
Loads only cost	$1,522.64	$2,268.65	$0.00	$0.00	$1,522.64	$1,522.64
Cost with storage	$46.33	$2,141.17	$0.00	$0.00	$267.29	$118.30
Total Value batteries	**$1,476.31**	**$127.47**	**$0.00**	**$0.00**	**$1,255.35**	**$1,404.34**
$/kwh storage only	$73.82	$6.37	$0.00	$0.00	$62.77	$70.22

Total usage 7,203 kwh — 4.00 kw Battery — 20.00 kwh Battery — 86.7% RTE

GHG savings battery 923 kgs/CO2 — 6,987 kwh Battery use — 3650 full cycles life

GHG savings battery per kwh 46.2 kg/kwh — 9.57% % of Life used

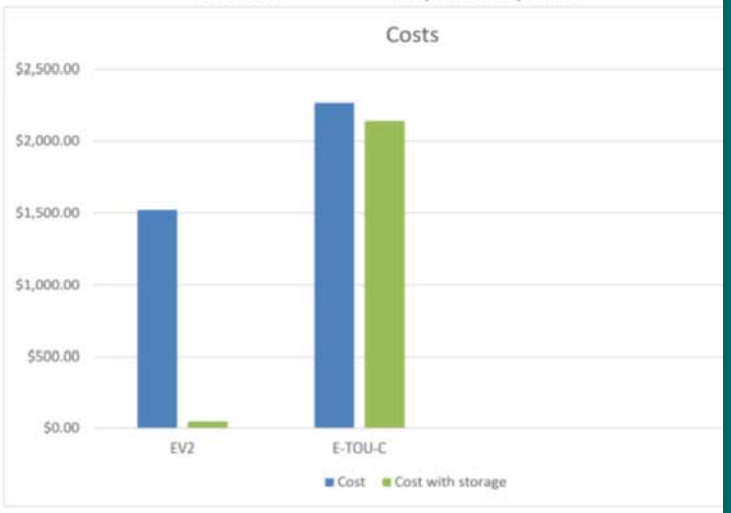
Annual Demand Charges

	EV2	E-TOU-C			Max Demand
Loads only cost	$0.00	$0.00	$0.00	$0.00	12.40
Cost with storage	$0.00	$0.00	$0.00	$0.00	12.41

Annual Energy Charges

	EV2	E-TOU-C		
Loads only cost	$1,522.64	$2,268.65	$0.00	$0.00
Cost with storage	$46.33	$2,141.17	$0.00	$0.00

Max daily usage 56 kwh Average load 19.7 kwh



		Raw cost	$20,000
Storage rate $/kwh	$1,000	Final Cost	$10,800
SGIP rebate rate $/wh	$0.20	Simple payback	7.3
ITC	26%		

Charge 7am – 4pm

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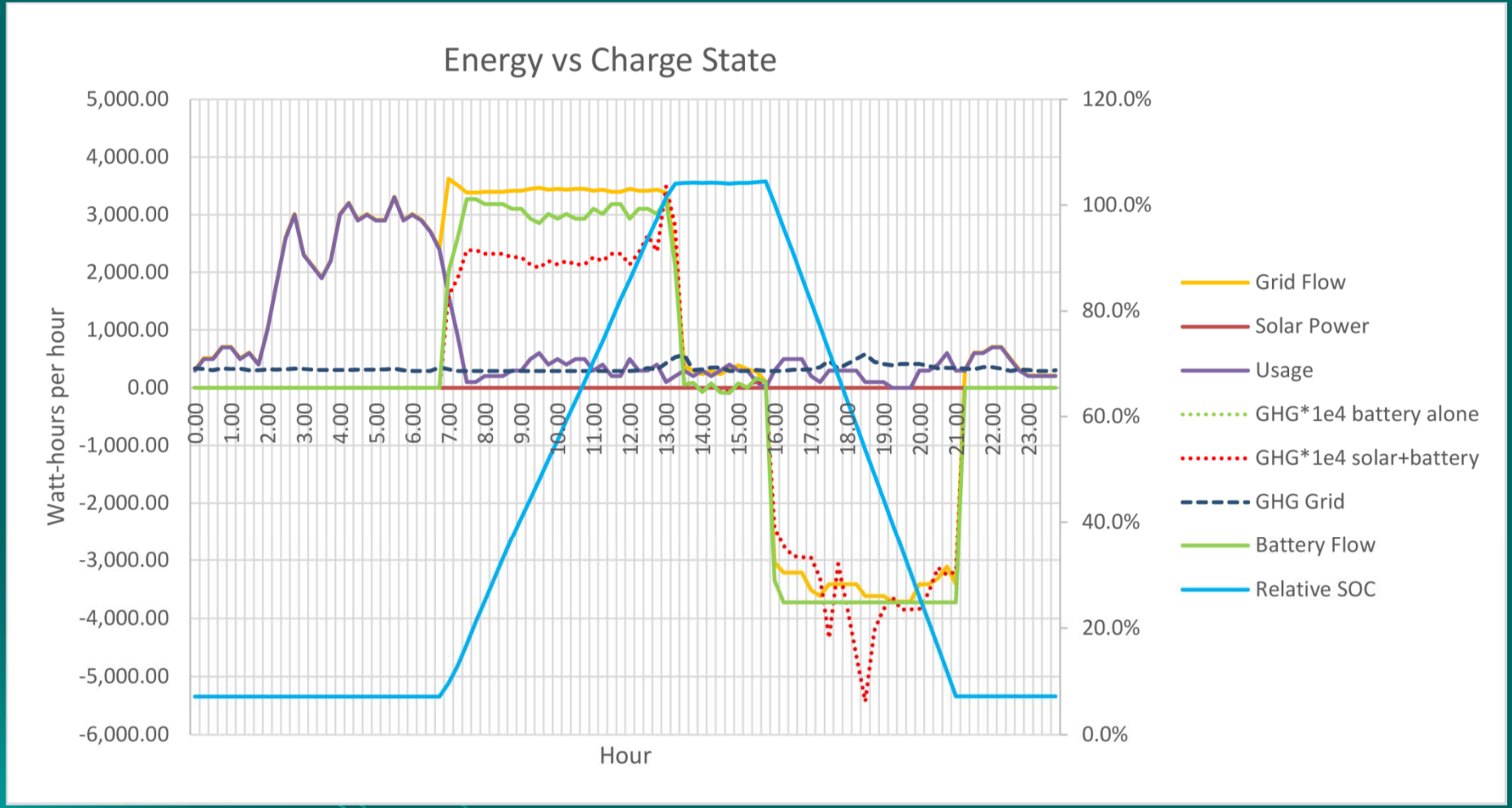
Discharge 4pm-9pm

Example Charge/Discharge 2



Residential wih EV 8/18
Charge 7am-4pm

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Discharge 4pm-9pm

Annual Savings Commercial Example 3

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- Under B-1ST rate - $44/kwh
- Under B-19S rate - $28/kwh
- 38.7 kg/kwh GHG emissions savings
- With $500/kwh storage cost, 2.7 year simple payback under B-1ST
- Charge midnight to 4pm
- Discharge 4-9pm (peak rate period)

Annual Savings Example 3

Models by: **Custom Power Solar**

Analysis Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	B-1ST	B-19R(S)			CCA	PG&E
Loads only cost	$90,536.32	$56,219.45	$0.00	$0.00	$90,536.32	$90,536.32
Cost with storage	$46,161.97	$28,545.82	$0.00	$0.00	$53,621.60	$51,442.23
Total Value batteries	**$44,374.35**	**$27,673.63**	**$0.00**	**$0.00**	**$36,914.72**	**$39,094.09**
$/kwh storage only	$44.37	$27.67	$0.00	$0.00	$36.91	$39.09

Total usage **366,627 kwh** **200.00 kw Battery**

1,000.00 kwh Battery **86.7% RTE**

GHG savings battery **38,689 kgs/CO2** **349,796 kwh Battery use** **3650 full cycles life**

GHG savings battery per kwh **38.7 kg/kwh** **9.58% % of Life used**

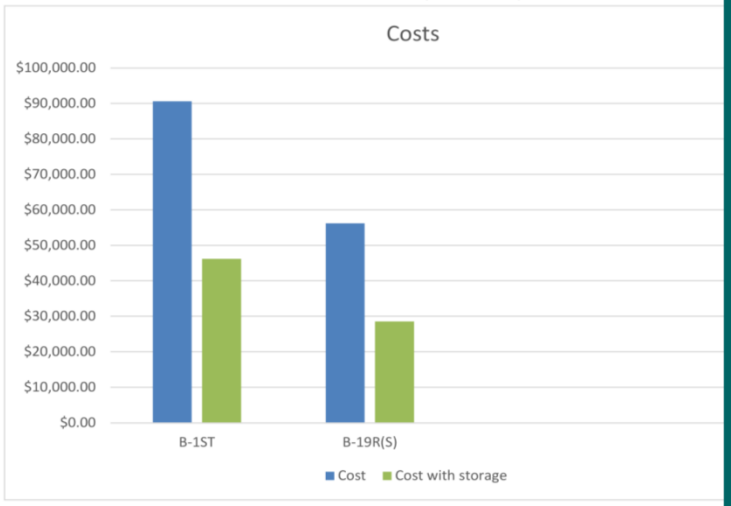
Annual Demand Charges **Max Demand**

	B-1ST	B-19R(S)			
Loads only cost	$2,649.32	$10,115.54	$0.00	$0.00	68.37
Cost with storage	$4,997.68	$18,282.40	$0.00	$0.00	122.51

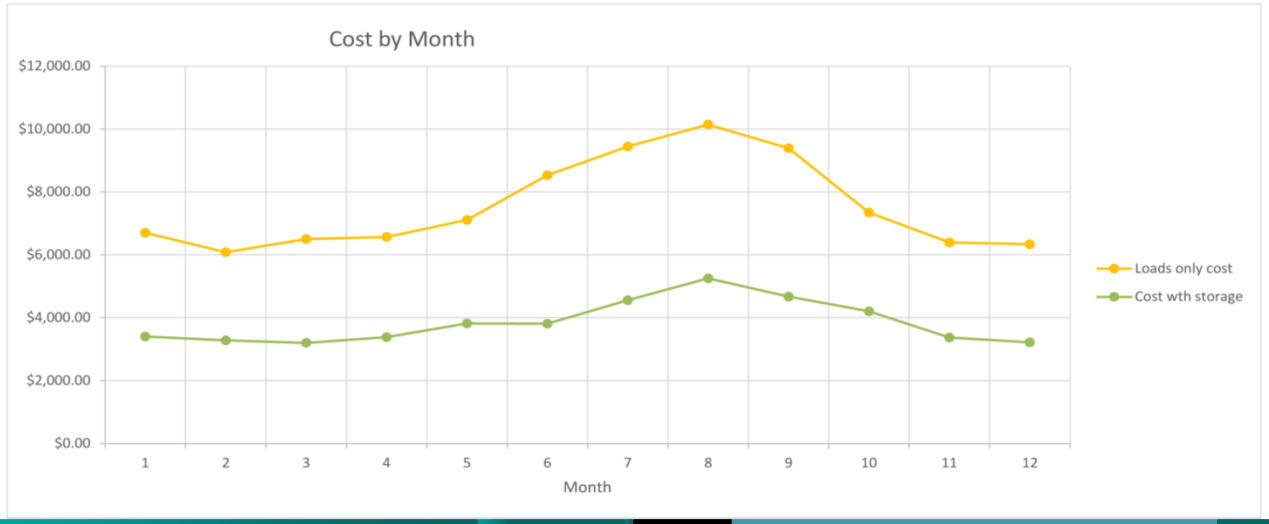
Annual Energy Charges

	B-1ST	B-19R(S)		
Loads only cost	$87,887.01	$46,103.91	$0.00	$0.00
Cost with storage	$41,164.29	$10,263.42	$0.00	$0.00

Max daily usage 1,346 kwh Average load 1,004.5 kwh



		Raw cost	$500,000
Storage rate $/kwh	$500	Final Cost	$120,000
SGIP rebate rate $/wh	$0.25	Simple payback	2.7
ITC	26%		



Charge midnight-4pm

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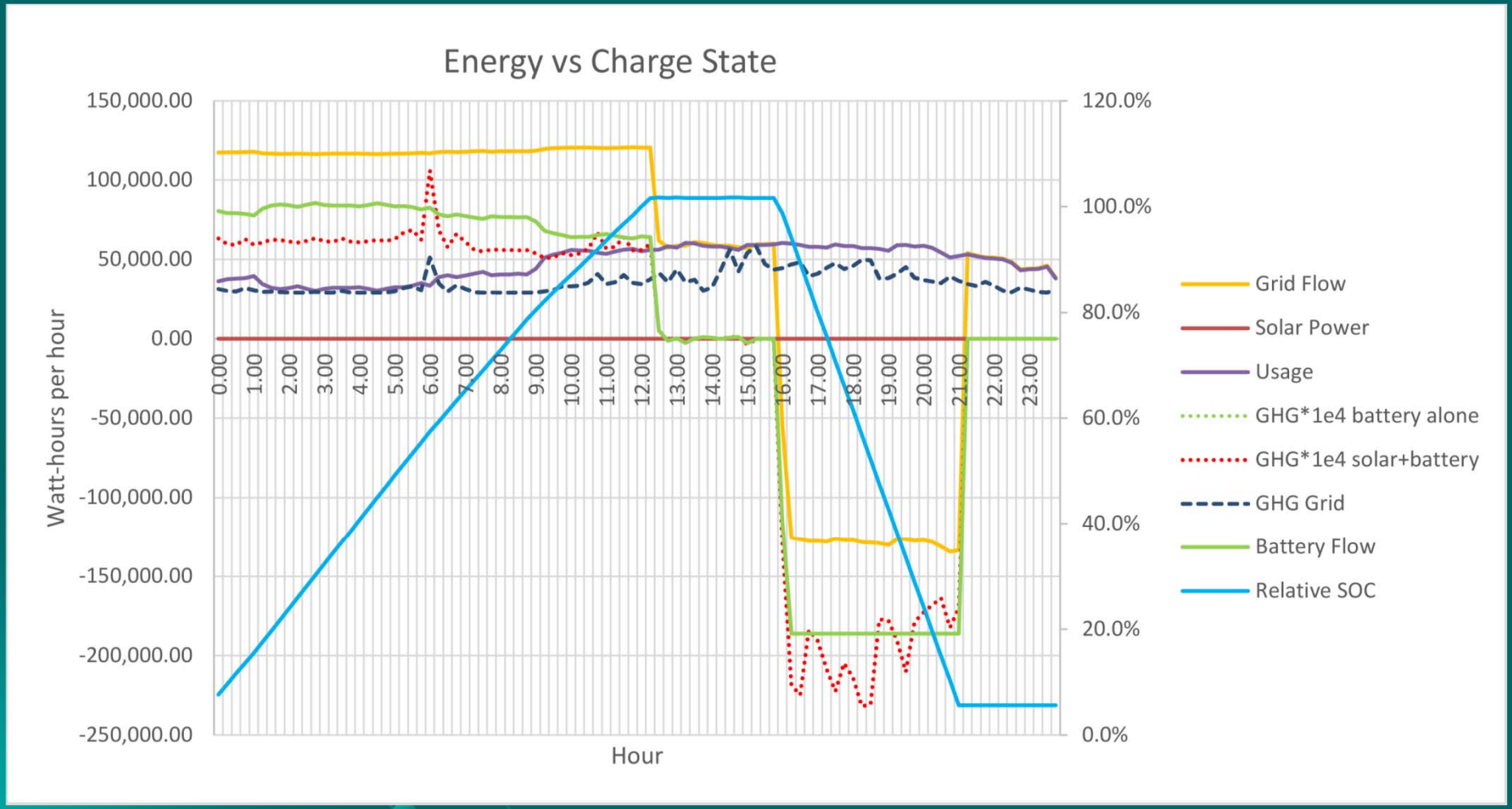
Discharge 4-9pm

Example Charge/Discharge Summer

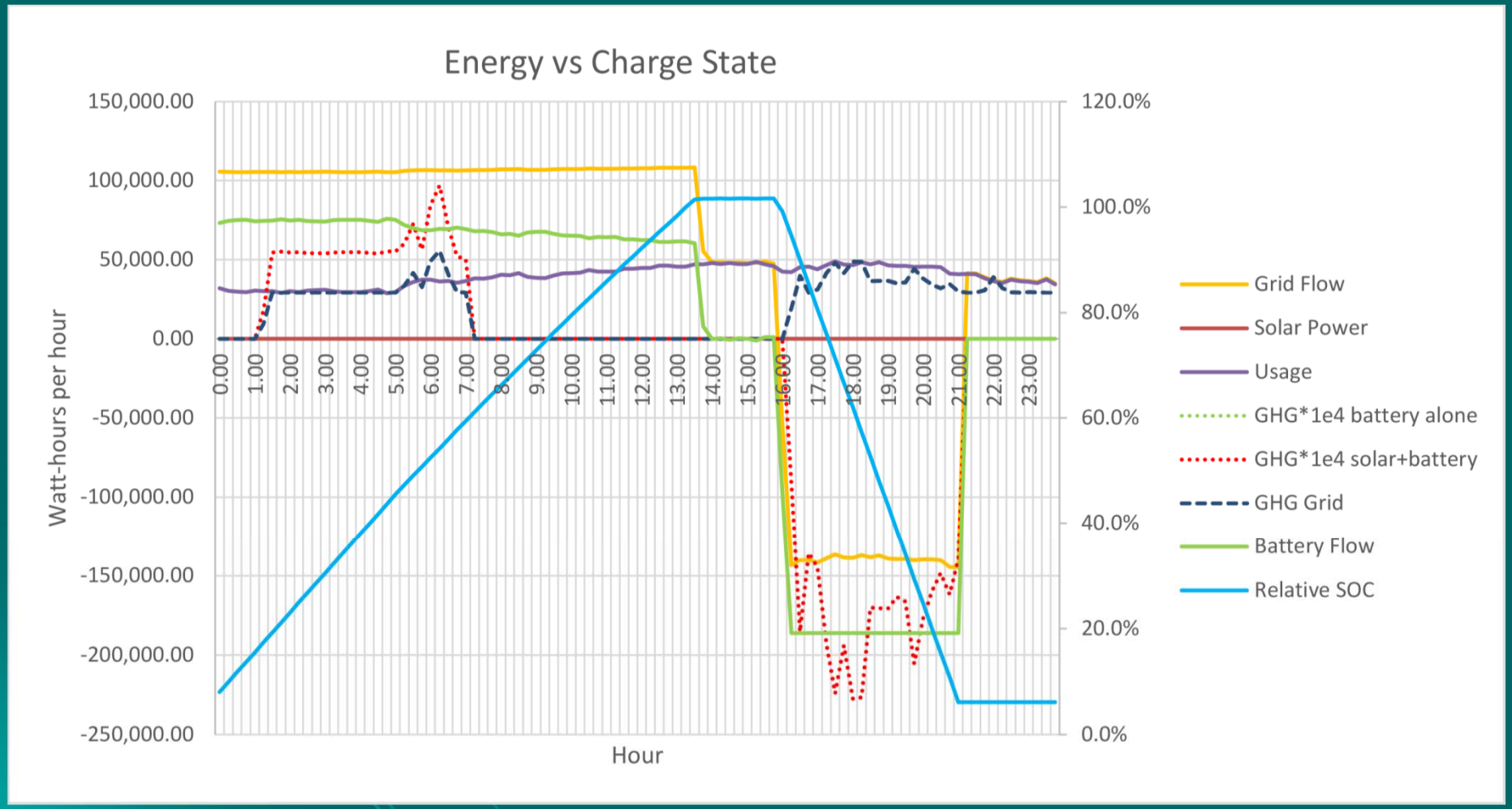


Large grocery 8/18
Charge midnight-4pm

Custom Power Solar

Discharge 4pm-9pm

Example Charge/Discharge Winter



Large grocery 3/1
Charge midnight-4pm

Custom Power Solar

Discharge 4pm-9pm

Annual Savings Example 4 Charge Daylight only hours

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- Under B-1ST rate - $42/kwh
- Under B-19S rate - $17/kwh
- 47.5 kg/kwh GHG emissions savings
- With $500/kwh storage cost, 2.8 year simple payback under B-1ST
- Charge 7am to 4pm
- Discharge 4-9pm (peak rate period)

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Annual Savings Example 4

Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	B-1ST	B-19R(S)			CCA	PG&E
Loads only cost	$90,536.32	$56,219.45	$0.00	$0.00	$90,536.32	$90,536.32
Cost with storage	$48,067.58	$38,689.45	$0.00	$0.00	$56,663.58	$52,417.84
Total Value batteries	**$42,468.75**	**$17,529.99**	**$0.00**	**$0.00**	**$33,872.74**	**$38,118.48**
$/kwh storage only	$42.47	$17.53	$0.00	$0.00	$33.87	$38.12

Total usage **366,627 kwh** **200.00 kw Battery**

1,000.00 kwh Battery **86.7% RTE**

GHG savings battery **47,511 kgs/CO2** **357,054 kwh Battery use** **3650 full cycles life**

GHG savings battery per kwh **47.5 kg/kwh** **9.78% % of Life used**

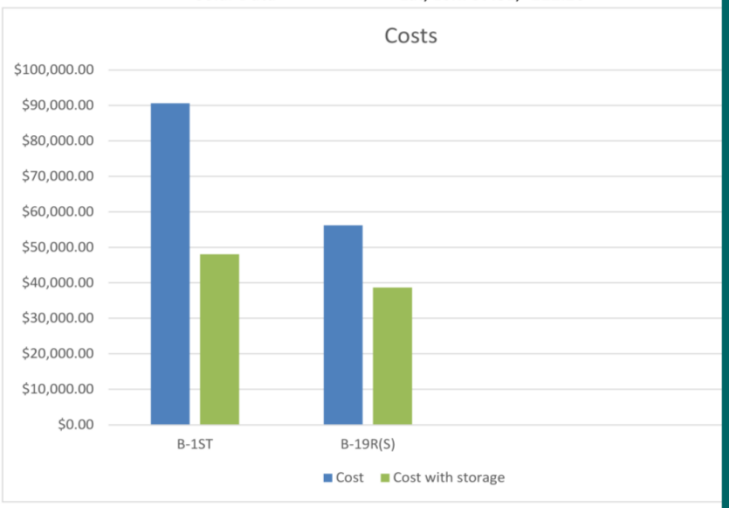
Annual Demand Charges **Max Demand**

	B-1ST	B-19R(S)			
Loads only cost	$2,649.32	$10,115.54	$0.00	$0.00	68.37
Cost with storage	$8,494.50	$30,543.69	$0.00	$0.00	204.62

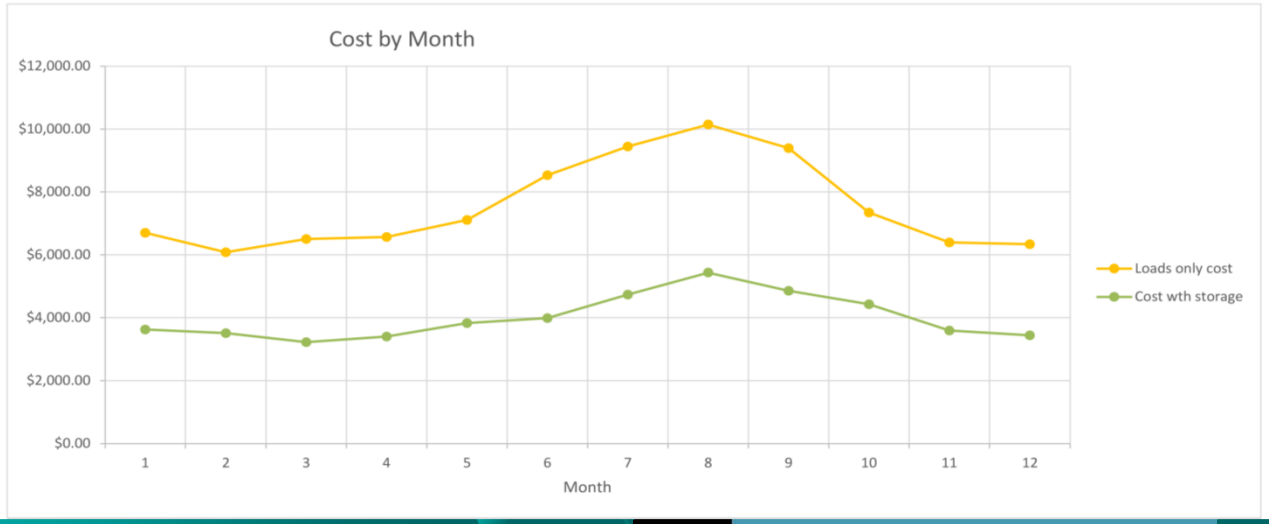
Annual Energy Charges

	B-1ST	B-19R(S)		
Loads only cost	$87,887.01	$46,103.91	$0.00	$0.00
Cost with storage	$39,573.08	$8,145.77	$0.00	$0.00

Max daily usage 1,346 kwh Average load 1,004.5 kwh



		Raw cost	$500,000
Storage rate $/kwh	$500	Final Cost	$120,000
SGIP rebate rate $/wh	$0.25	Simple payback	2.8
ITC	26%		



Charge 7am – 4pm

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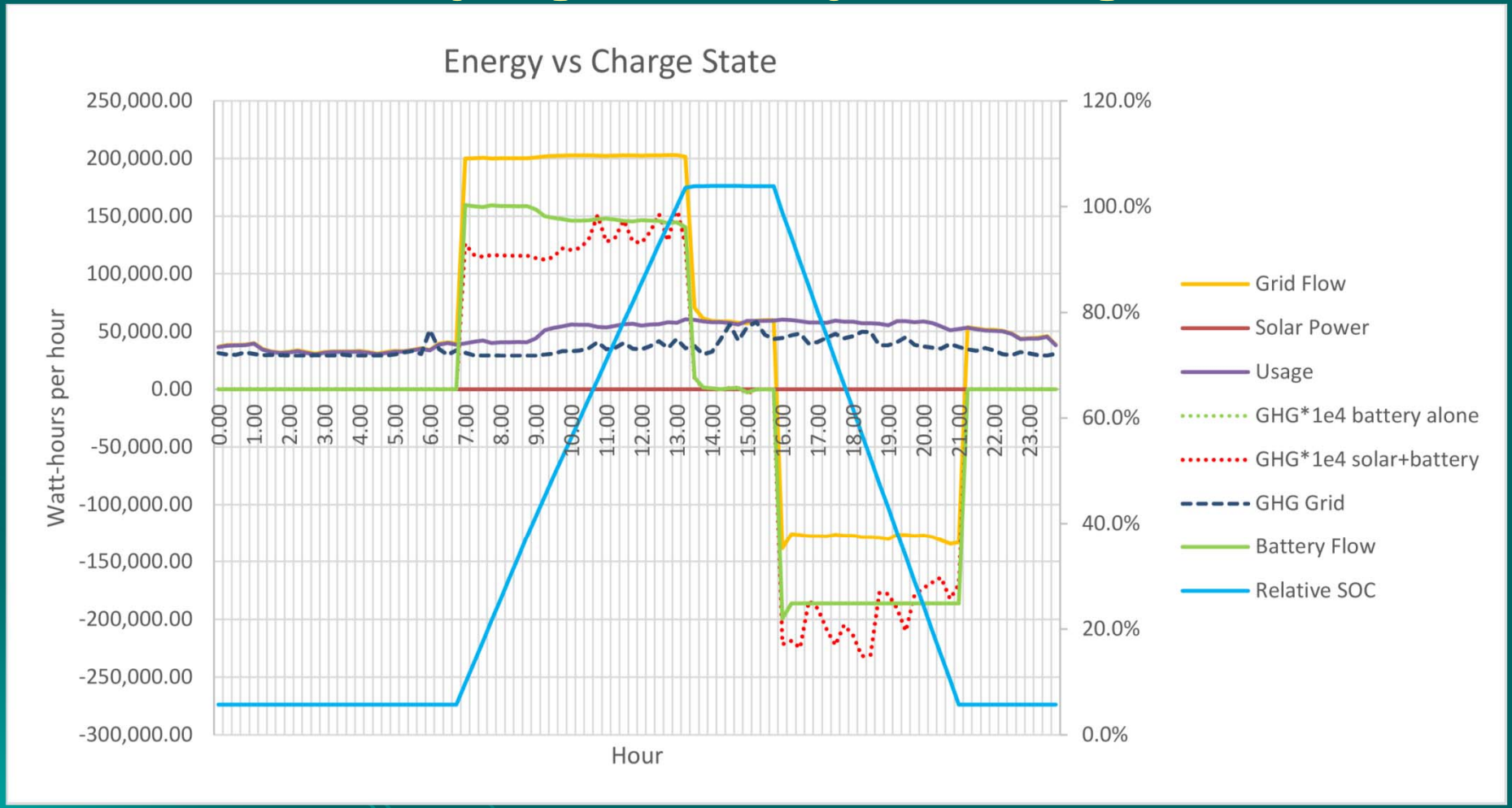
Discharge 4pm-9pm

Example Charge/Discharge Daylight only charge



Large grocery 8/18
Charge 7am-4pm

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Discharge 4pm-9pm

Resiliency

- Storage only systems can provide backup for PSPS events, storms, potential fire events, any grid outage.
- Storage capacity = daily average load provides roughly 24 hours of backup
- Loads can be reduced to extent backup time

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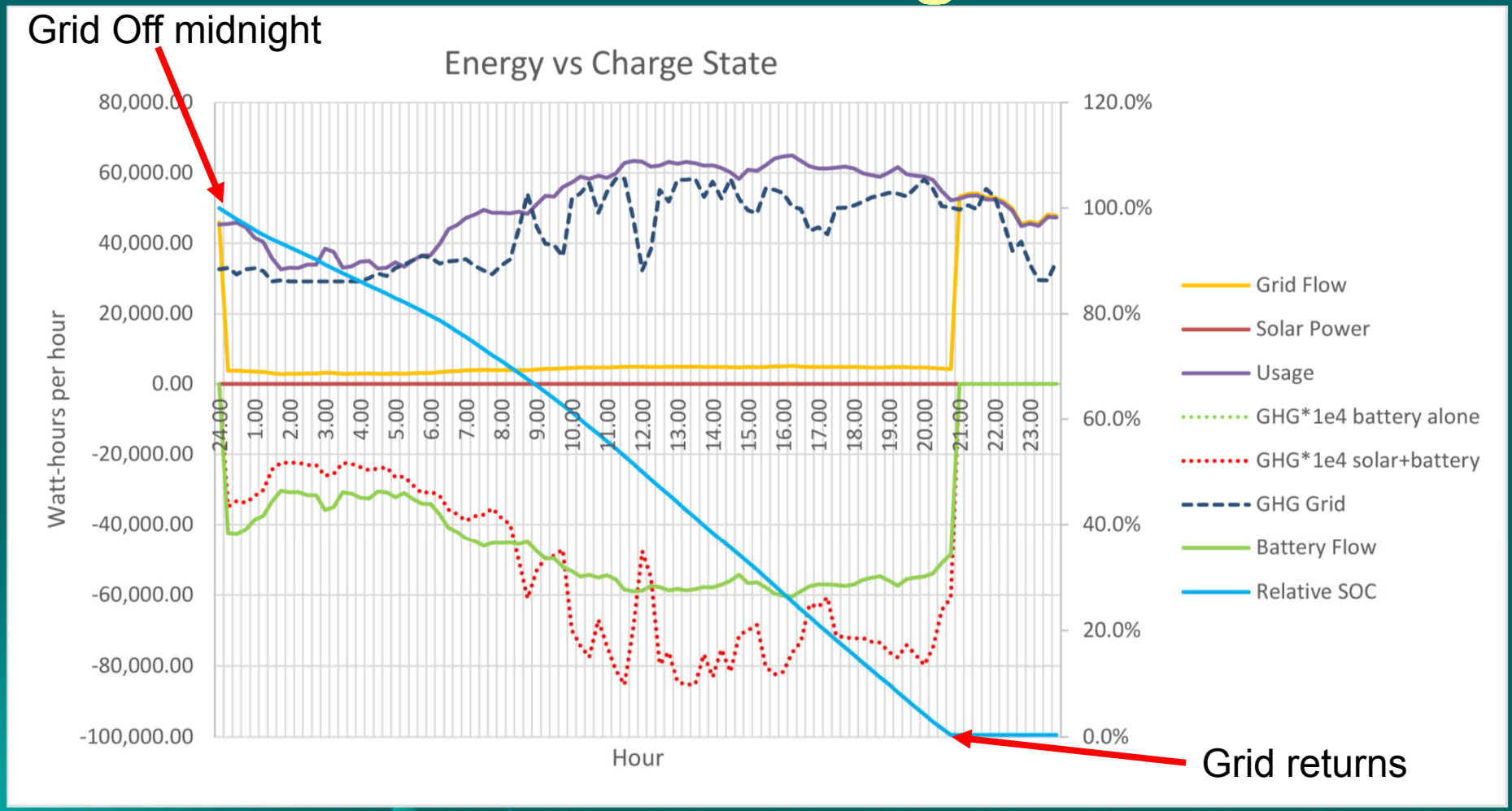
Resiliency Example
Grid Outage



SCE Savings Example 5 Residential – Daylight charge

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- E-TOU-PRIME rate - $27/kwh
- TOU-4-9pm rate - $15/kwh
- 46.2 kg/kwh GHG emissions savings
- With $1000/kwh storage cost, 20.1 year simple payback
- Charge 7am to 4pm
- Discharge 4-9pm (peak rate period)

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SCE Savings Example 5

Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	E-TOU-D-PRIME	E-TOU-D-4-9pm			CCA	SCE
Loads only cost	$787.54	$1,351.68	$0.00	$0.00	$787.54	$787.54
Cost with storage	$249.44	$1,043.30	$0.00	$0.00	$1,202.50	$244.64
Total Value batteries	**$538.10**	**$308.38**	**$0.00**	**$0.00**	**-$414.96**	**$542.90**
$/kwh storage only	$26.90	$15.42	$0.00	$0.00	-$20.75	$27.15

Total usage **7,203** kwh **4.00** kw Battery

20.00 kwh Battery **86.7%** RTE

GHG savings battery **923** kgs/CO2 **6,987** kwh Battery use **3650** full cycles life

GHG savings battery per kwh **46.2** kg/kwh **9.57%** % of Life used

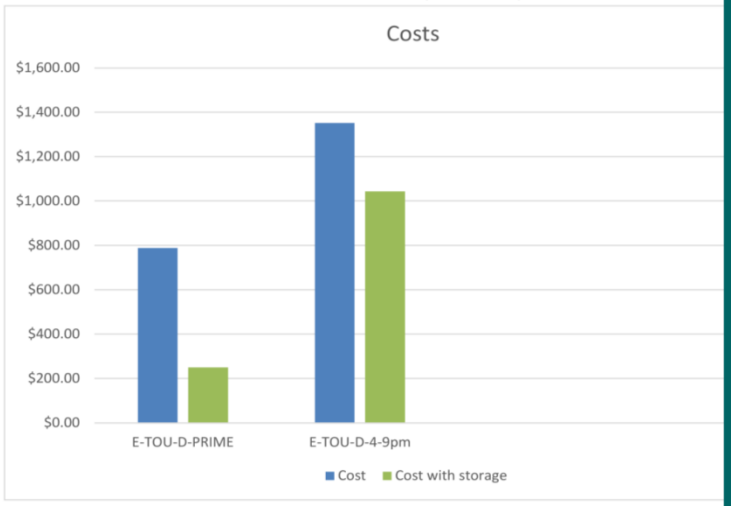
Annual Demand Charges **Max Demand**

	E-TOU-D-PRIME	E-TOU-D-4-9pm			
Loads only cost	$0.00	$0.00	$0.00	$0.00	12.40
Cost with storage	$0.00	$0.00	$0.00	$0.00	12.41

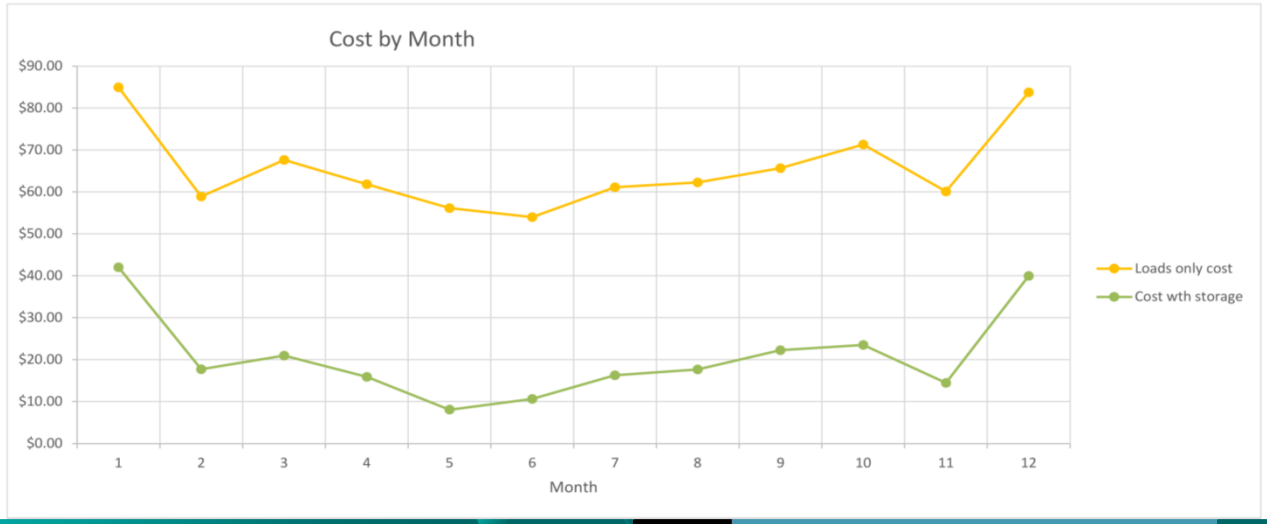
Annual Energy Charges

	E-TOU-D-PRIME	E-TOU-D-4-9pm		
Loads only cost	$787.54	$1,351.68	$0.00	$0.00
Cost with storage	$249.44	$1,043.30	$0.00	$0.00

Max daily usage 56 kwh Average load 19.7 kwh



		Raw cost	$20,000
Storage rate $/kwh	$1,000	Final Cost	$10,800
SGIP rebate rate $/wh	$0.20	Simple payback	20.1
ITC	26%		



Charge 7am – 4pm

Custom Power Solar

Discharge 4pm-9pm

SCE Savings Example 6 Residential – midnight-4pm charge

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- E-TOU-PRIME rate - $28/kwh
- TOU-4-9pm rate - $15/kwh
- 37.4 kg/kwh GHG emissions savings
- With $1000/kwh storage cost, 19.5 year simple payback
- Charge midnight to 4pm
- Discharge 4-9pm (peak rate period)

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SCE Savings Example 6

Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

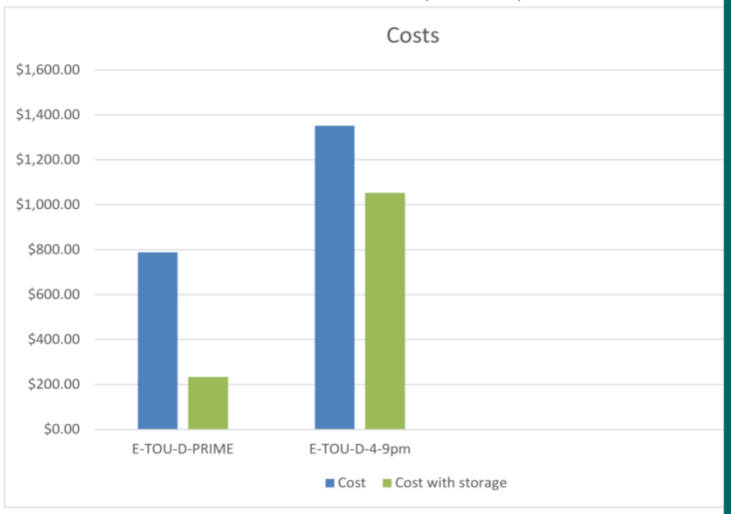
	E-TOU-D-PRIME	E-TOU-D-4-9pm			CCA	SCE
Loads only cost	$787.54	$1,351.68	$0.00	$0.00	$787.54	$787.54
Cost with storage	$233.26	$1,053.15	$0.00	$0.00	$1,213.97	$323.76
Total Value batteries	**$554.28**	**$298.53**	**$0.00**	**$0.00**	**-$426.43**	**$463.78**
$/kwh storage only	$27.71	$14.93	$0.00	$0.00	-$21.32	$23.19

Total usage **7,203** kwh **4.00** kw Battery

20.00 kwh Battery **86.7%** RTE

GHG savings battery **748** kgs/CO2 **7,409** kwh Battery use **3650** full cycles life

GHG savings battery per kwh **37.4** kg/kwh **10.15%** % of Life used



Annual Demand Charges **Max Demand**

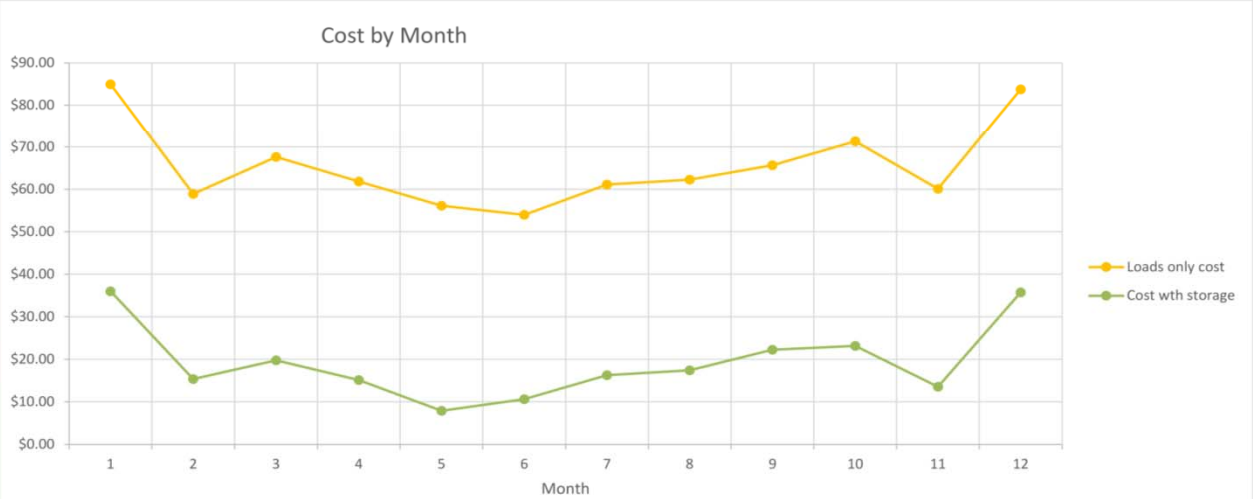
	E-TOU-D-PRIME	E-TOU-D-4-9pm			
Loads only cost	$0.00	$0.00	$0.00	$0.00	12.40
Cost with storage	$0.00	$0.00	$0.00	$0.00	12.41

Annual Energy Charges

	E-TOU-D-PRIME	E-TOU-D-4-9pm		
Loads only cost	$787.54	$1,351.68	$0.00	$0.00
Cost with storage	$233.26	$1,053.15	$0.00	$0.00

Max daily usage 56 kwh Average load 19.7 kwh

		Raw cost	$20,000
Storage rate $/kwh	$1,000	Final Cost	$10,800
SGIP rebate rate $/wh	$0.20	Simple payback	19.5
ITC	26%		



Charge midnight – 4pm

Custom Power Solar

Discharge 4pm-9pm

SCE Savings Example 7 Commercial

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- TOU-GS-3E rate - $6.59/kwh
- TOU-GS-2E rate - $6.62/kwh
- 19.6 kg/kwh GHG emissions savings
- With $500/kwh storage cost, 18.2 year simple payback
- Charge midnight to 4pm
- Discharge 4-9pm (peak rate period)

Custom Power Solar

SCE Savings Example 7

Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	TOU-GS-3E	TOU-GS-2E			CCA	SCE
Loads only cost	$30,551.67	$31,408.43	$0.00	$0.00	$30,551.67	$30,551.67
Cost with storage	$23,959.05	$24,789.89	$0.00	$0.00	$23,707.89	$30,446.18
Total Value batteries	**$6,592.61**	**$6,618.55**	**$0.00**	**$0.00**	**$6,843.78**	**$105.49**
$/kwh storage only	$6.59	$6.62	$0.00	$0.00	$6.84	$0.11

Total usage **366,627 kwh** **200.00 kw Battery**

1,000.00 kwh Battery **86.7% RTE**

GHG savings battery **19,647 kgs/CO2** **183,958 kwh Battery use** **3650 full cycles life**

GHG savings battery per kwh **19.6 kg/kwh** **5.04% % of Life used**

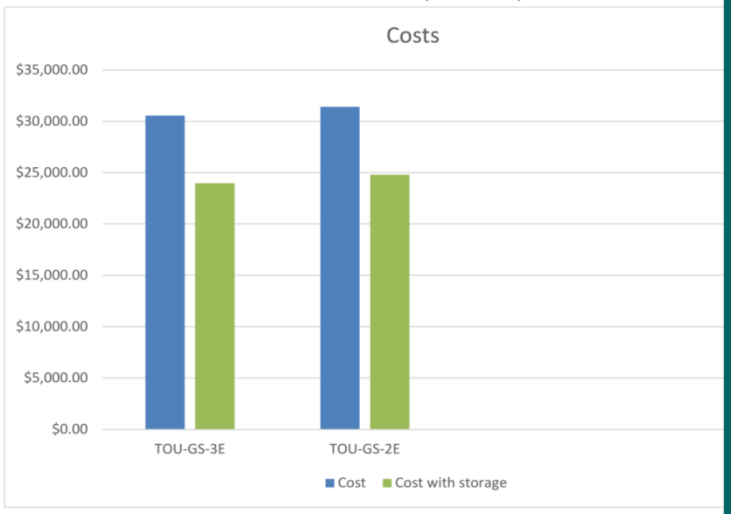
Annual Demand Charges **Max Demand**

	TOU-GS-3E	TOU-GS-2E			
Loads only cost	$7,785.86	$7,460.67	$0.00	$0.00	68.37
Cost with storage	$10,312.97	$9,960.34	$0.00	$0.00	109.01

Annual Energy Charges

	TOU-GS-3E	TOU-GS-2E		
Loads only cost	$22,765.80	$23,947.76	$0.00	$0.00
Cost with storage	$13,646.08	$14,829.55	$0.00	$0.00

Max daily usage 1,346 kwh Average load 1,004.5 kwh



		Raw cost	$500,000
Storage rate $/kwh	$500	Final Cost	$120,000
SGIP rebate rate $/wh	$0.25	Simple payback	18.2
ITC	26%		

Charge midnight – 4pm

Custom Power Solar

Discharge 4pm-9pm

SCE Commercial Example

- No financial benefit outside of months June-September
- However, still GHG benefits if operated year around
- Limiting use to summer months would increase lifetime of battery by reducing annual use

Custom Power Solar

SDG&E Savings Example 8 Residential – Daylight charge

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- DR-SES rate - $30/kwh
- EV-TOU rate - $29/kwh
- 46.2 kg/kwh GHG emissions savings
- With $1000/kwh storage cost, 18.1 year simple payback
- Charge 7am to 4pm
- Discharge 4-9pm (peak rate period)

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SDG&E Savings Example 8

Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	DR-SES	EV-TOU			CCA	SDG&E
Loads only cost	$1,952.20	$2,176.24	$0.00	$0.00	$1,952.20	$1,952.20
Cost with storage	$1,356.88	$1,605.40	$0.00	$0.00	$2,210.42	$1,517.98
Total Value batteries	**$595.32**	**$570.85**	**$0.00**	**$0.00**	**-$258.22**	**$434.23**
$/kwh storage only	$29.77	$28.54	$0.00	$0.00	-$12.91	$21.71

Total usage **7,203** kwh **4.00** kw Battery

20.00 kwh Battery **86.7%** RTE

GHG savings battery **923** kgs/CO2 **6,987** kwh Battery use **3650** full cycles life

GHG savings battery per kwh **46.2** kg/kwh **9.57%** % of Life used

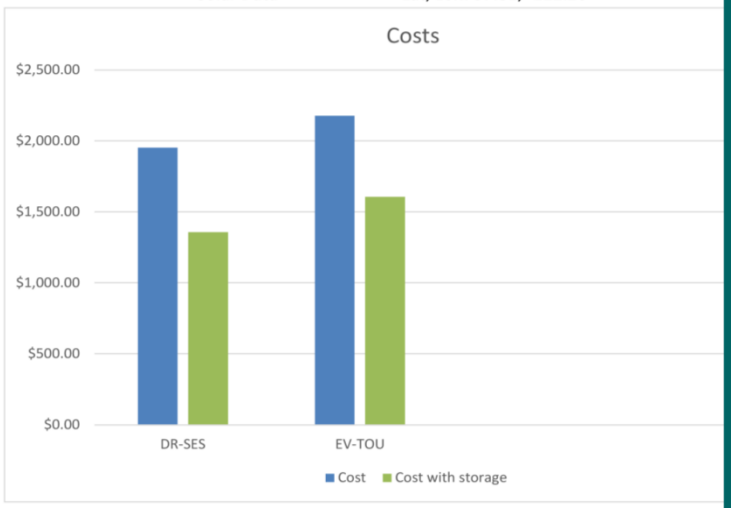
Annual Demand Charges **Max Demand**

	DR-SES	EV-TOU			
Loads only cost	$0.00	$0.00	$0.00	$0.00	12.40
Cost with storage	$0.00	$0.00	$0.00	$0.00	12.41

Annual Energy Charges

	DR-SES	EV-TOU		
Loads only cost	$1,952.20	$2,176.24	$0.00	$0.00
Cost with storage	$1,356.88	$1,605.40	$0.00	$0.00

Max daily usage 56 kwh Average load 19.7 kwh



		Raw cost	$20,000
Storage rate $/kwh	$1,000	Final Cost	$10,800
SGIP rebate rate $/wh	$0.20	Simple payback	18.1
ITC	26%		

Charge 7am – 4pm

Custom Power Solar

Discharge 4pm-9pm

SDG&E Residential Example

- No financial benefit outside of months June-October
- However, still GHG benefits if operated year around
- Limiting use to financial benefit months would increase lifetime of battery by reducing annual use

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SDG&E Savings Example 9 Residential – midnight-4pm charge

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- DR-SES rate - $36/kwh
- EV-TOU rate - $36/kwh
- 37.4 kg/kwh GHG emissions savings
- With $1000/kwh storage cost, 15.1 year simple payback
- Charge midnight to 4pm
- Discharge 4-9pm (peak rate period)

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SDG&E Savings Example 9

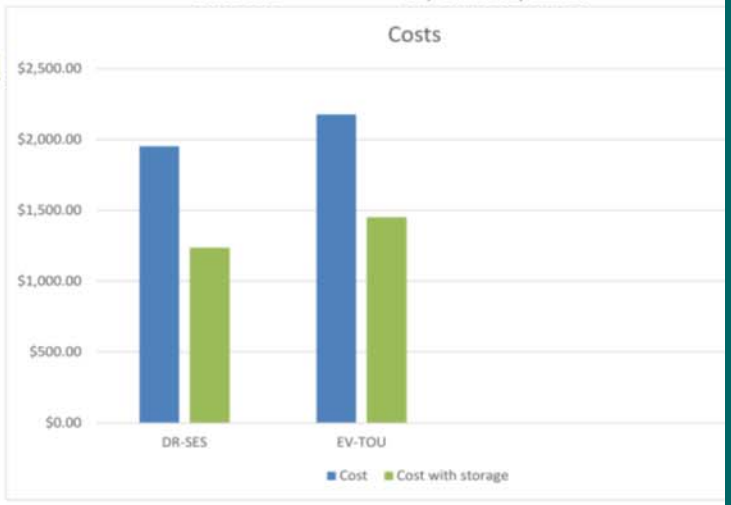
Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	DR-SES	EV-TOU			CCA	SDG&E
Loads only cost	$1,952.20	$2,176.24	$0.00	$0.00	$1,952.20	$1,952.20
Cost with storage	$1,236.50	$1,451.37	$0.00	$0.00	$2,240.28	$1,385.57
Total Value batteries	**$715.71**	**$724.88**	**$0.00**	**$0.00**	**-$288.07**	**$566.63**
$/kwh storage only	$35.79	$36.24	$0.00	$0.00	-$14.40	$28.33
Total usage	7,203 kwh		4.00 kw Battery			
			20.00 kwh Battery		86.7% RTE	
GHG savings battery	748 kgs/CO2		7,409 kwh Battery use		3650 full cycles life	
GHG savings battery per kwh	37.4 kg/kwh		10.15% % of Life used			



Annual Demand Charges **Max Demand**

	DR-SES	EV-TOU			
Loads only cost	$0.00	$0.00	$0.00	$0.00	12.40
Cost with storage	$0.00	$0.00	$0.00	$0.00	12.41

Annual Energy Charges

	DR-SES	EV-TOU		
Loads only cost	$1,952.20	$2,176.24	$0.00	$0.00
Cost with storage	$1,236.50	$1,451.37	$0.00	$0.00

Max daily usage 56 kwh Average load 19.7 kwh

		Raw cost	$20,000
Storage rate $/kwh	$1,000	Final Cost	$10,800
SGIP rebate rate $/wh	$0.20	Simple payback	15.1
ITC	26%		

Charge 7am – 4pm

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Discharge 4pm-9pm

SDG&E Residential Example 9

- Some financial benefit outside of months June-October – better value than daylight only charging
- Slightly lower GHG benefits

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SDG&E Savings Example 10 Commercial

- Battery capacity large enough to operate 24 hours off-grid where capacity = average daily load
- DG-R rate - $51/kwh
- TOU-M rate - $51/kwh
- 38.3 kg/kwh GHG emissions savings
- With $500/kwh storage cost, 2.3 year simple payback!
- Charge midnight to 4pm
- Discharge 4-9pm (peak rate period)

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SDG&E Savings Example 10

Models by: **Custom Power Solar** Analysis

Load year 2019

Solar Data Lat, Lon: 37.81, -122.26

Annual

	DG-R	AL-TOU			CCA	SDG&E
Loads only cost	$40,753.31	$41,015.81	$0.00	$0.00	$40,753.31	$40,753.31
Cost with storage	-$10,350.10	-$9,732.21	$0.00	$0.00	-$15,324.05	$4,081.74
Total Value batteries	**$51,103.41**	**$50,748.03**	**$0.00**	**$0.00**	**$56,077.36**	**$36,671.57**
$/kwh storage only	$51.10	$50.75	$0.00	$0.00	$56.08	$36.67

Total usage **366,627 kwh** **200.00 kw Battery**

1,000.00 kwh Battery **86.7% RTE**

GHG savings battery **38,262 kgs/CO2** **345,815 kwh Battery use** **3650 full cycles life**

GHG savings battery per kwh **38.3 kg/kwh** **9.47% % of Life used**

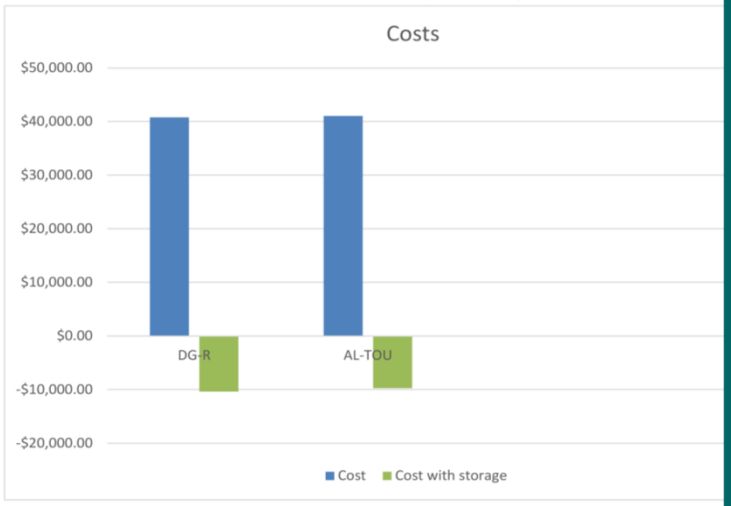
Annual Demand Charges **Max Demand**

	DG-R	AL-TOU			
Loads only cost	$11,379.84	$11,379.84	$0.00	$0.00	68.37
Cost with storage	$19,399.88	$19,399.04	$0.00	$0.00	117.28

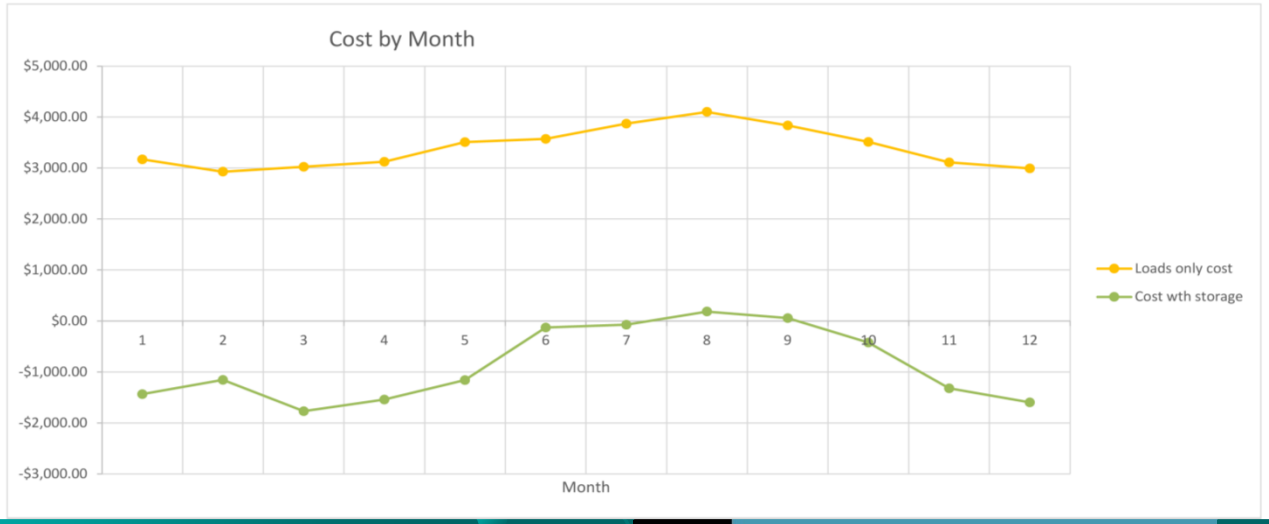
Annual Energy Charges

	DG-R	AL-TOU		
Loads only cost	$29,373.47	$29,635.98	$0.00	$0.00
Cost with storage	-$29,749.98	-$29,131.25	$0.00	$0.00

Max daily usage 1,346 kwh Average load 1,004.5 kwh



		Raw cost	$500,000
Storage rate $/kwh	$500	Final Cost	$120,000
SGIP rebate rate $/wh	$0.25	Simple payback	2.3
ITC	26%		



Charge midnight – 4pm

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Discharge 4pm-9pm

Summary

- Export storage only under NEM provides a compensation path with massive GHG reductions with relatively short payback 2-7 years in most cases
- All rates have better value charging midnight-4pm vs daylight only
- Rates with demand charges provide better GHG savings charging midnight-4pm vs daylight only
- Rates without demand charges provide better GHG savings charging daylight only vs midnight-4pm
- Rate differential peak vs other main value driver
- Demand reduction distant second in value
- All cases discharge during peak periods 4-9pm
- Manage resiliency by “storm watch” mode – turn off export when grid off events anticipated – leaves full capacity of battery for powering local loads 24+ hours

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Drivers

- Cost savings come from differential between peak and off-peak rates – larger = greater savings
- As grid storage levels increase to match solar levels (at least 2x the total peak power of solar in kwh), decrease differential – reduce incentives for more storage – self limiting by market forces

Notes

- All commercial models use the same grocery model normalized for average 1000kwh daily load
- All residential models use the same home model normalized for average 20kwh daily load
- Left two columns in summary are NEM retail rates
- Left most column in summary is the optimized rate
- 2nd to left column uses same operational parameters as left most rate but is not optimized
- CCA values may not reflect true rate costs – algorithm is set for CCAs under PG&E
- Right most column is IOU value – set for PG&E algorithm so may not reflect true value under other IOUs
- 2017 GHG values

Custom Power Solar

Thank You!

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