Clean Coalition

Seminole Springs
Medium Energy Use Single Unit
30473 Mulholland HWY, Agoura Hills, CA 93101

Solar Microgrid Analysis

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Solar Microgrid Methodology (SMM)

Clean Coalition

Step 1

Load Profiles

- Baseline: recent annual loads.
- Master: adds future expected loads, e.g. EV charging.
- Critical: loads required to be maintained during outages.

Industry Tools:
- Clean Coalition: load analysis calculators.
- UtilityAPI: 15-minute load intervals.

Step 2

Resource Scenarios

- Optimal solar, storage, and other potential onsite resources.
- Sizing and combinations to achieve the required critical load and economic outcomes.

Industry Tools:
- Helioscope: solar siting.
- Energy Toolbase: resource sizing.

Step 3

Site Layouts

- Specific locations & sizing for solar, storage, and any other viable resources.
- Location of key electrical assets, e.g. panels, etc.
- Energy usage profiles including load profiles.

Industry Tools:
- Clean Coalition: site layout tool.

Step 4

Economic Analysis

- Costs and financing options covering each viable resource scenario.
- Added resilience value.

Industry Tools:
- Energy Toolbase: economic analysis.
- Clean Coalition: resilience calculator (e.g. avoided diesel).

Step 5

Reporting & Recommendations

- Project Review Meetings.
- Reports and Presentations.
- Recommended options & next steps.

Methodology steps

1. Load profiles
2. Resource scenarios
3. Site layouts
4. Economic analyses
5. Reporting and Recommendations

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Load profile types

Load Type	Definition
Baseline load profile	The historical annual usage of electrical loads per site that forms the basis for creating the master load profile.
Adjustment load profile	Adjustments for anticipated EV Charging Infrastructure (EVCI), electrification, energy efficiency, and new facilities.
Master load profile	The forecasted annual load profile used for this study's analysis, created from the baseline load profile plus adjustments for anticipated EV Charging Infrastructure (EVCI), electrification, energy efficiency, and new facilities.
Critical load profile	Annual load profile of the critical loads.
Critical loads	Electrical loads that are necessary to be provided with 100% energy resilience during grid outages
Total Critical Load Required (TCLR)	Total amount of energy required to serve the critical loads over the specified time period.

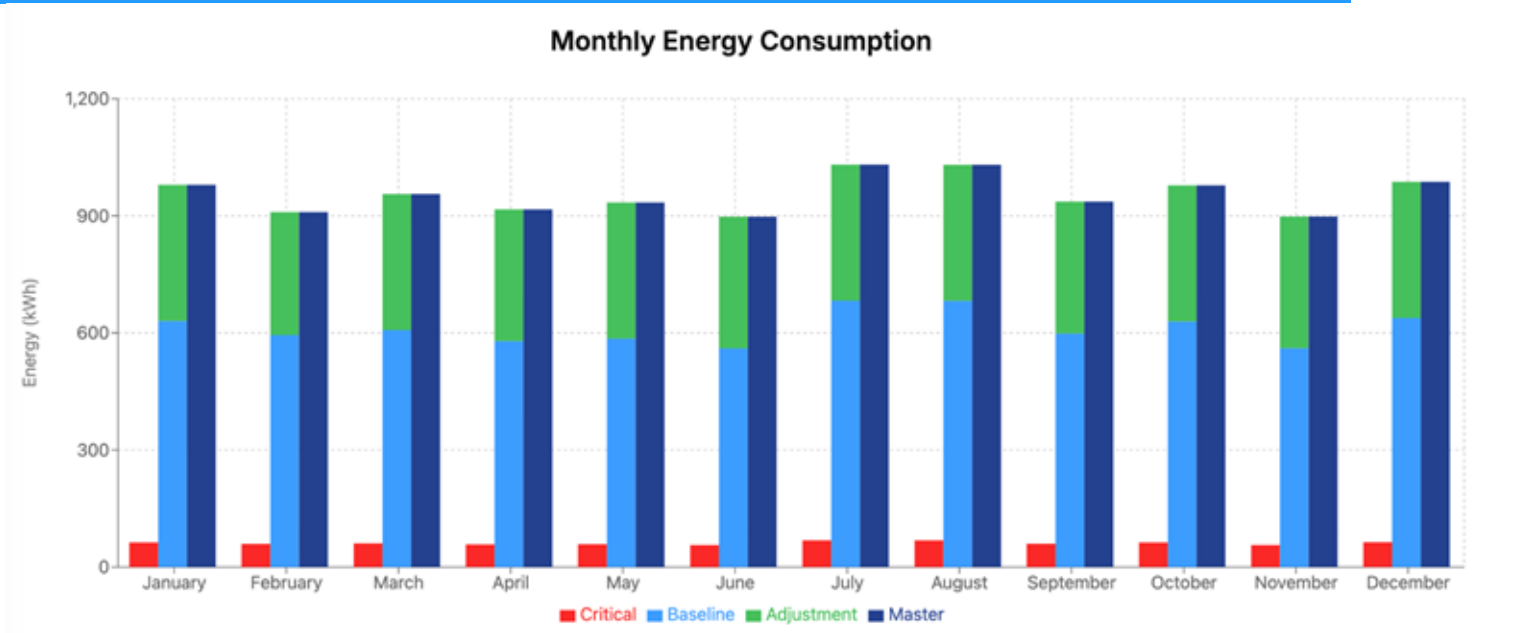
Key analysis steps

1. Collect site information to stage effective modeling & analyses:
   - Solar Generation Profile based on a model of a solar array of a Seminole Springs resident.
1. Create load profiles:
   a. Baseline Load Profile (BLP) based on the energy use of an average fully electric mobile home in the greater Santa Barbara area taken from ResStock.
   b. Adjustments Load Profile (ALP) based on an EV charging load profile of one Level-2 (7.5 kW) charging port, with charging for 1.5 hours daily, at the same time every day.
   c. Master Load Profile (MLP) is the combination of the BLP and ALP at every 15-minute interval, used to analyze economics.
   d. Critical Load Profile (CLP) based on an estimated 10% of the BLP that requires 100% energy resilience during grid outages.
   e. Total Critical Load Required (TCLR) determined by calculating the maximum daily load of the BLP and/or MLP and subtracting the average daily solar generation for applicable month. The relative size of the BESS vs the maximum daily TCLRs determine overall resilience durations in the worst-case scenario. The average resilience durations will be much longer than the worst-case.
2. Size solar & storage resources:
   - Modeled after existing Solar System and Battery Energy Storage System (BESS) of a Seminole Springs resident.
1. Analyze the economics of the Solar Microgrid.
2. Present findings & recommendations to Seminole Springs residents.

Baseline Load Profile Estimation

Seminole Springs Electricity Usage compared to ResStock Fully Electrified Mobile Homes in coastal Southern California (kWh)				
Month	Seminole Springs Residence	Fully Electric Low Use	Fully Electric Medium Use	Fully Electric High Use
January	-	306	631	876
February	-	290	594	905
March	-	302	607	882
April	-	290	579	692
May	-	259	585	692
June	-	259	560	576
July	272	391	683	607
August	405	397	682	634
September	251	321	599	555
October	343	337	629	650
November	412	304	561	768
December	424	300	638	955
Monthly Average	351	313	612	733
Annual Total	-	3,758	7,349	8,793
Annual Peak (kW)	6.3	2.0	5.2	8.7

Load Profiles - ResStock Medium Use Mobile Home Load Profile



Total Monthly and Daily Max, Average, and Min Electricity Usage by Profile Type

	Baseline				Adjustment				Master				Critical			
Month	Max Daily [kWh]	Average Daily [kWh]	Min Daily [kWh]	Monthly Total [kWh]	Max Daily [kWh]	Average Daily [kWh]	Min Daily [kWh]	Monthly Total [kWh]	Max Daily [kWh]	Average Daily [kWh]	Min Daily [kWh]	Monthly Total [kWh]	Max Daily [kWh]	Average Daily [kWh]	Min Daily [kWh]	Monthly Total [kWh]
January	25	20	17	631	11	11	11	349	37	32	28	979	3	2	2	63
February	27	21	17	594	11	11	11	315	38	32	28	909	3	2	2	59
March	24	20	14	607	11	11	11	349	35	31	25	956	2	2	1	61
April	27	19	16	579	11	11	11	338	38	31	27	917	3	2	2	58
May	22	19	14	585	11	11	11	349	33	30	25	934	2	2	1	59
June	22	19	15	560	11	11	11	338	33	30	26	898	2	2	2	56
July	27	22	17	683	11	11	11	349	39	33	28	1,031	3	2	2	68
August	25	22	19	682	11	11	11	349	37	33	30	1,031	3	2	2	68
September	23	20	15	599	11	11	11	338	34	31	26	936	2	2	2	60
October	24	20	17	629	11	11	11	349	35	32	29	978	2	2	2	63
November	23	19	14	561	11	11	11	338	34	30	25	898	2	2	1	56
December	26	21	17	638	11	11	11	349	37	32	28	987	3	2	2	64
Annual Total				7,348				4,110				11,454				735

Summary of Load Profiles

Load Profiles Summary for ResStock Medium Use Mobile Home Load Profile				
Metric	**Baseline Load Profile**	**Adjustments Load Profile**	**Master Load Profile**	**Critical Load Profile**
Total Annual Load (kWh)	7,349	4,106	11,455	735
Peak Load (kW)	5	8	13	1

Methodology steps

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BLP & MLP of ResStock Medium Use Mobile Home Load Profile and 3.78 kW solar (Year 15)

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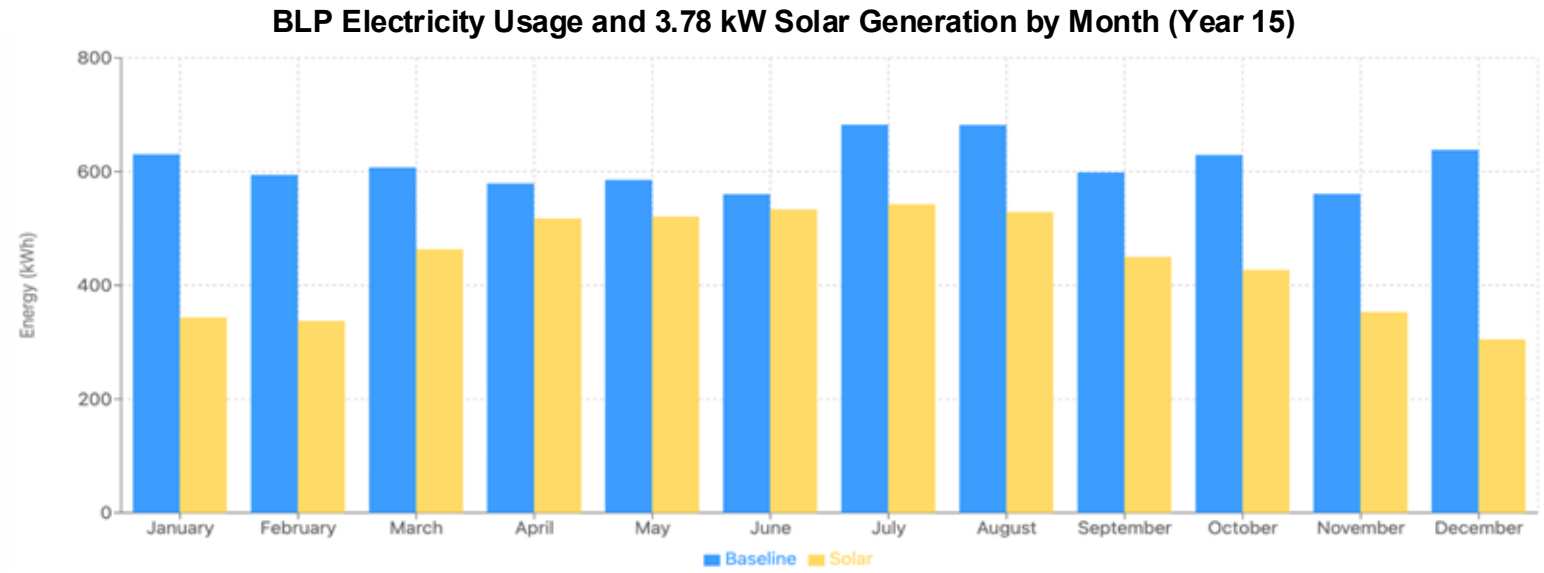
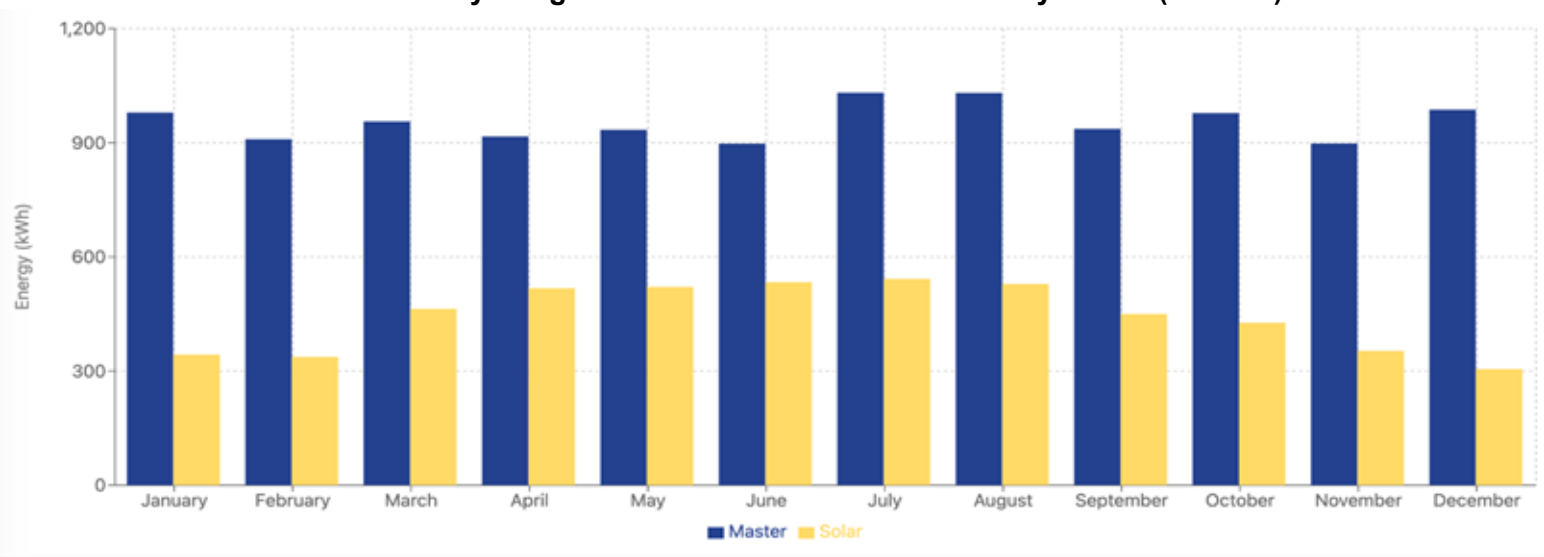




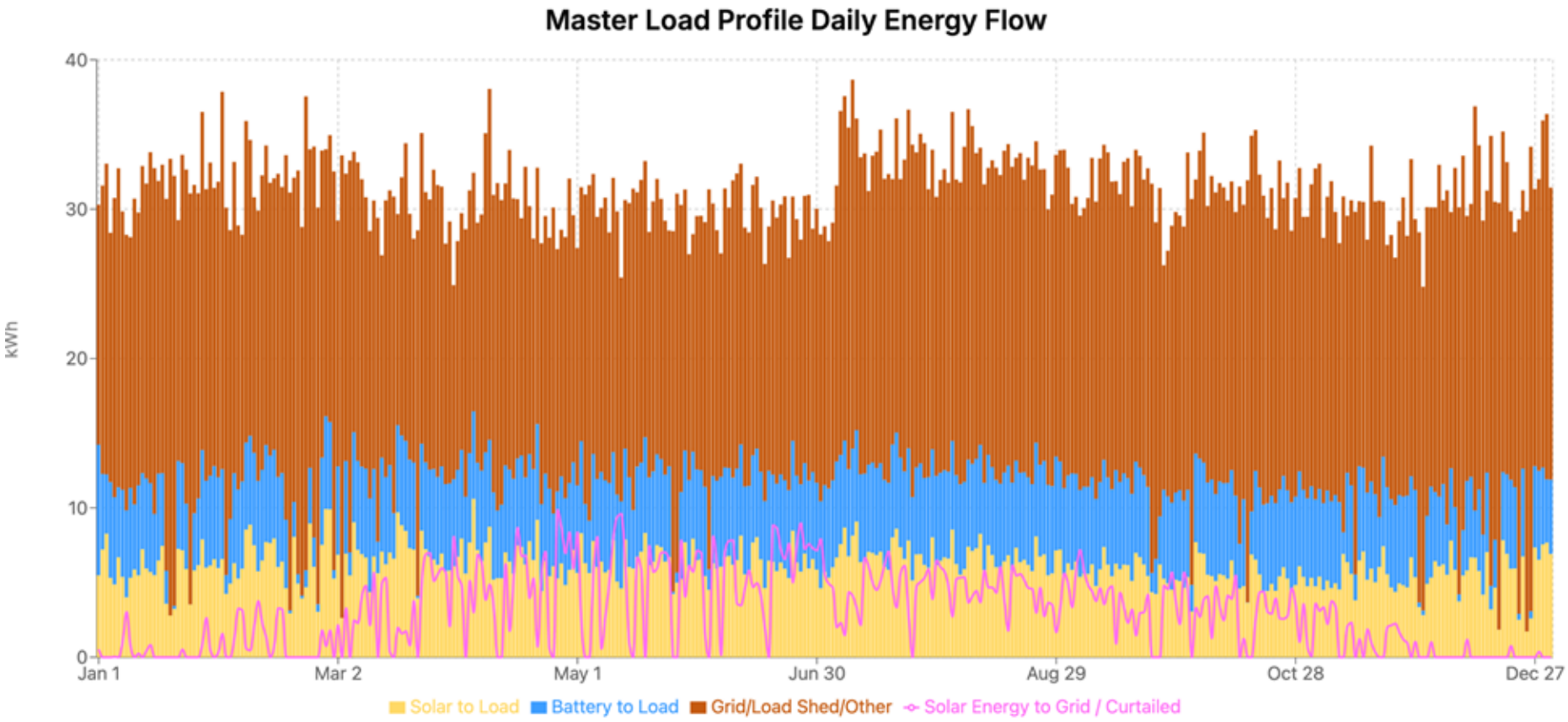
ResStock Medium Use Mobile Home Load Profile BESS sizing and resilience

Seminole Springs - BESS Sizing and Resilience						
BLP Peak Load (kW)	ALP Peak Load (kW)	MLP Peak Load (kW)	Solar System Size (kW)	Year 1 Standard Option BESS Power Capacity (kW)	Year 1 Standard Option BESS Energy Capacity (kWh)	Year 15 Standard Option BESS Energy Capacity (kWh)
5	8	13	3.78	7.68	10	6.48

Solar Microgrid resilience results at year-15 (after 15 years of 0.5% solar & 3% BESS degradation)

- **BLP minimum resilience duration**: 9.72 hours
- **MLP minimum resilience duration**: 5.76 hours
- **CLP resilience duration**: Indefinite, as the BLP percentage for indefinite resilience exceeds that of the CLP.
- **BLP percentage of indefinite resilience: 27%**
- **MLP percentage of indefinite resilience: 16%**

Energy Flow Diagram (Year 15)



Master Profile Energy Flow Summary

	MLP Total Annual Load (kWh)	Annual Solar Generation (kWh)	Total Solar to Load (kWh)	Total Battery to Load (kWh)	Grid Import/Load Shed/Other (kWh)	Solar Energy to Grid/Curtailed (kWh)
Energy	11,455	5,323	2,243	1,926	7,286	1,121
Percentage of Load	100.0%	46.5%	19.6%	16.8%	63.6%	9.8%
Percentage of Solar	215.2%	100.0%	42.1%	36.2%	136.9%	21.1%

Project resources

Project Resources (Year 1)

- **Solar PV:** 3.78 kWdc via 9 REC SOLAR, REC420AA PURE 2 (420W) modules
  - Racking: Fixed Tilt
  - Orientation: Landscape
  - Tilt: 14°
  - Azimuth: 180°
- **Inverters:** 3.42 kWac via 9 Enphase IQ8X-80-M-US (240V) inverters
- **Battery Energy Storage System:** 7.68 kW / 10 kWh via 2 Enphase IQBATTERY-5P-1P-NA batteries

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Site layout - % NZE based on BLP

Seminole Springs
Meter# 222014-809145
30473 Mulholland HWY
Agoura Hills, CA 93101

Total annual load:
- BLP: 7,349 kWh
- ALP: 4,106 kWh
- MLP: 11,455 kWh
- CLP: 735 kWh

Peak Load:
- BLP: 5 kW
- ALP: 8 kW
- MLP: 13 kW
- CLP: 1 kW

Solar annual generation (3.78 kW)
- Year 1: 5,709 kWh
- Year 15: 5,323 kWh

Battery Storage Sizing:
- Year 1: 7.68 kW / 10 kWh
- Year 15: 7.68 kW / 6.48 kWh

Electric vehicle charging
- One Level 2 (7.5 kW)

Methodology steps

1. Load profiles

1. Resource scenarios

1. Site layouts

4. Economic analyses

1. Reporting and Recommendations

Total project costs

Seminole Springs - Solar Microgrid System Costs						
Solar System Size (kW)	Solar System Cost per Wdc	Solar System Cost	BESS Energy Capacity (kWh)	BESS Cost per kWh	BESS Cost (with microgrid capabilities)	Total Project Cost
3.78	$3.66	$13,826	10	$1,610	$16,050	$29,876

Current electric bill vs bill after Solar Microgrid (Year 1)

Seminole Springs - Solar Microgrid System Savings Based on Medium Energy Use Profile (Year 1)					
Electric Bill Cost		**Energy Cost**		**Demand Cost**	
Before / After	Savings	Before / After	Savings	Before / After	Savings
$5,353 / $2,778	$2,575	$5,138 / $2,563	$2,575	$0 / $0	$0

Economic analysis

Years	Project Costs	PV & Storage O&M / Equipment Replacement	Electric Bill Savings	PV Generation (kWh)	Total Cash Flow	Cumulative Cash Flow
Upfront	-$29,876	-	-	-	-$29,876	-$29,876
1	-	-$19	$2,575	6,351	$2,556	-$27,320
2	-	-$19	$2,649	6,319	$2,630	-$24,690
3	-	-$20	$2,725	6,287	$2,705	-$21,985
4	-	-$20	$2,801	6,256	$2,781	-$19,204
5	-	-$21	$2,878	6,224	$2,857	-$16,347
6	-	-$21	$2,956	6,192	$2,935	-$13,412
7	-	-$22	$3,035	6,160	$3,013	-$10,399
8	-	-$22	$3,114	6,129	$3,091	-$7,308
9	-	-$23	$3,193	6,097	$3,170	-$4,138
10	-	-$24	$3,272	6,065	$3,249	-$890
11	-	-$24	$3,352	6,033	$3,327	$2,438
12	-	-$25	$3,431	6,002	$3,406	$5,843
13	-	-$25	$3,509	5,970	$3,484	$9,327
14	-	-$26	$3,587	5,938	$3,561	$12,888
15	-	-$27	$3,664	5,906	$3,637	$16,526
16	-	-$6,715	$5,194	5,875	-$1,521	$15,004
17	-	-$28	$5,341	5,843	$5,313	$20,317
18	-	-$29	$5,489	5,811	$5,461	$25,778
19	-	-$29	$5,639	5,779	$5,610	$31,387
20	-	-$30	$5,790	5,748	$5,760	$37,148
21	-	-$31	$5,943	5,716	$5,912	$43,059
22	-	-$32	$6,096	5,684	$6,064	$49,123
23	-	-$33	$6,249	5,652	$6,217	$55,340
24	-	-$33	$6,403	5,621	$6,369	$61,709
25	-	-$34	$6,556	5,589	$6,522	$68,231
Totals:	**-$29,876**	**-$7,334**	**$105,440**	**149,248**	**$68,231**	-

Financial Metrics

Payback:	10.3 Years
ROI:	228.4%
10 Year IRR:	(0.5%)
20 Year IRR:	8.2%

Assumptions

Utility Escalator:	5.0%
Federal tax rate:	30.0%
State tax rate:	8.0%
Modeling:	Before Tax

- 5% Utility Cost Escalator
- No rate switch
- Southern California Edison; Clean Power Alliance

Value of Resilience (VOR)

When at least 10% of the total load can be maintained indefinitely and an additional 15% or more of the load can be maintained for at least 80% of the time, then a 25% VOR adder is warranted. In the case of Seminole Springs, since 16% of the Master Load Profile (MLP) can be maintained indefinitely, the VOR is calculated by multiplying what the utility electricity bill would be in Year 1 for the MLP, without the Solar Microgrid, by 25%.

The 5% annual utility bill escalator is applied to the SCE electricity bills, which accounts for the annual increases in the VOR calculations.

More information on the Clean Coalition's VOR123 methodology can be found here:

https://clean-coalition.org/disaster-resilience/

25 Year
Value of Resilience (VOR)

Year	VOR
1	$ 1,338
2	$ 1,405
3	$ 1,475
4	$ 1,549
5	$ 1,627
6	$ 1,708
7	$ 1,793
8	$ 1,883
9	$ 1,977
10	$ 2,076
11	$ 2,180
12	$ 2,289
13	$ 2,403
14	$ 2,523
15	$ 2,650
16	$ 2,782
17	$ 2,921
18	$ 3,067
19	$ 3,221
20	$ 3,382
21	$ 3,551
22	$ 3,728
23	$ 3,915
24	$ 4,110
25	$ 4,316
Totals	**$ 63,871**

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Resilience & economics summary

Solar Microgrid system sizing

- Solar system: 3.78 kWdc
- Battery Energy Storage System (with Microgrid capabilities): 7.68 kW / 10 kWh

Economic results:

- Cash Purchase ($3.66/Wdc solar, $1,610/kWh BESS) :
  - Total project cost: ($29,876)
  - Total 25 Year O&M cost: ($7,334)
  - 25 Year electric bill savings: $105,440
  - **25 Year net cumulative savings: $68,231**
  - 25 Year Value of Resilience (VOR): $63,871

Resilience results at year-15 (after 15 years of solar & BESS degradation):

- **BLP resilience duration:** 9.72 hours (6.48 kWh / 16 kWh)
- **MLP resilience duration:** 5.76 hours (6.48 kWh / 27 kWh)
- **CLP resilience duration:** Indefinite, as the BLP percentage for indefinite resilience exceeds that of the CLP.
- **BLP percentage of indefinite resilience:** 27%
- **MLP percentage of indefinite resilience:** 16%

Recommendations:

- Move forward with developing a Solar Microgrid at Seminole Springs to take advantage of the trifecta of economic, environmental, and resilience benefits.

Backup slides