



Town of Moraga
Facility Energy Generation Study

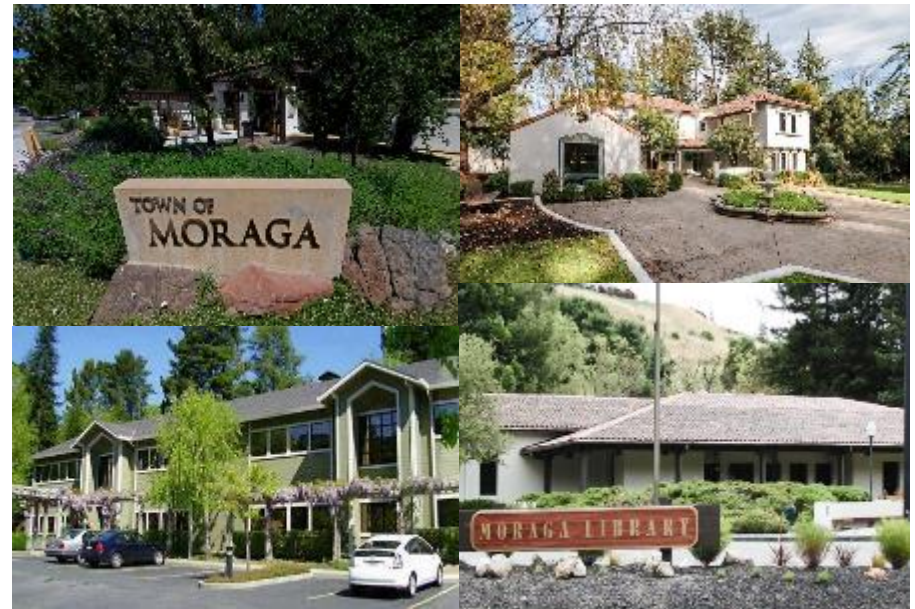
Community Meeting

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Agenda

1. Project Overview
2. Resilience and Resource Scenarios
3. Analysis Results
4. Recommendations & Next Steps



Moraga Facility Energy Generation Study: Project Overview

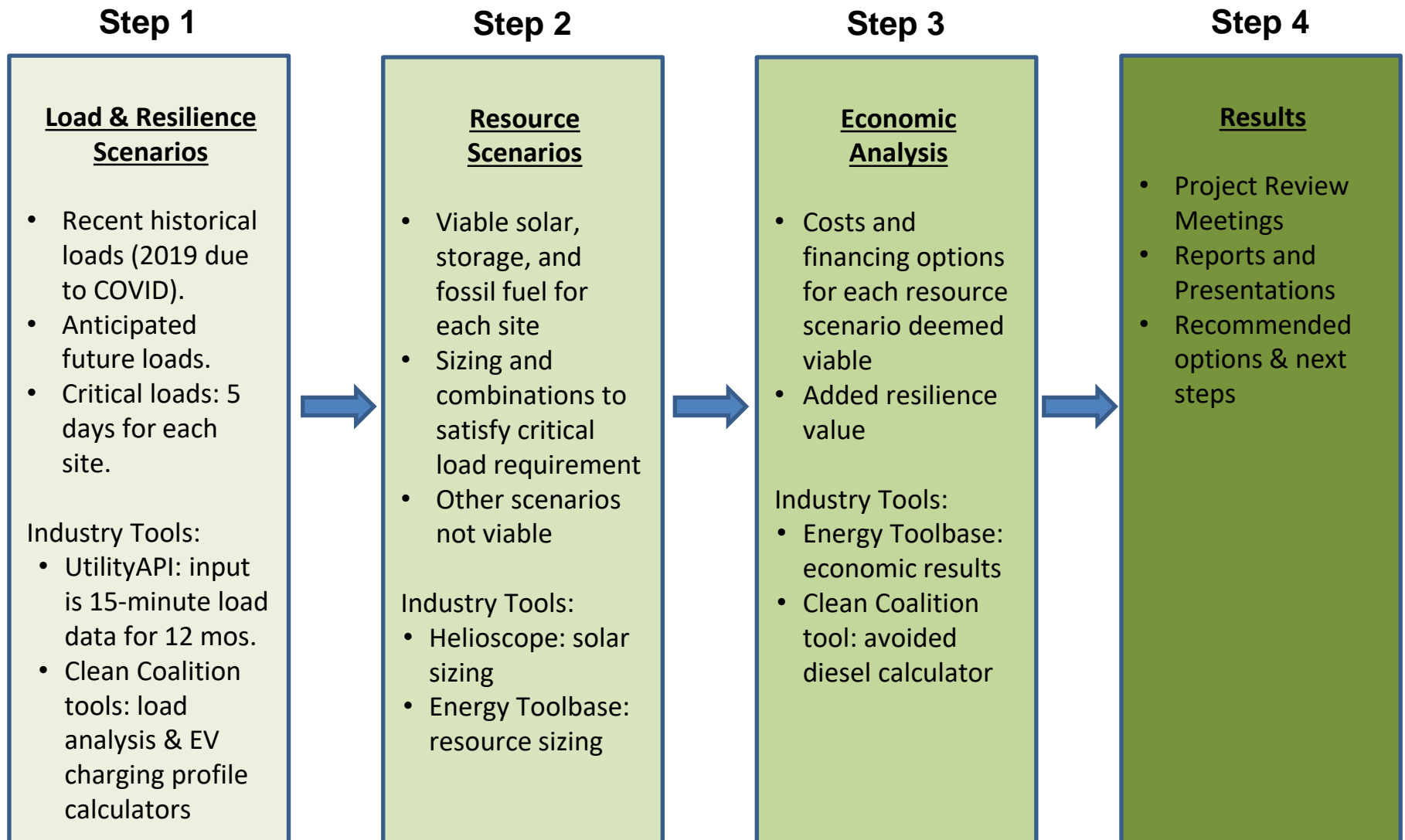
Obtain and analyze energy usage at each of the four Town properties. Study and model various options to provide resilience at each site. Consider renewable energy and fossil fuel resources.

Provide a detailed report analyzing the power needs for each property and proposing various alternatives for independent and emergency backup power generation for each site.

Recommend the best options considering the Town's program and project goals for climate change, energy provider mix of resources, sustainability, financing, affordability.



- 1) Town Hall offices: 329 Rheem Boulevard
- 2) Corp Yard/Town Council
Chambers/Emergency Operations: 335
Rheem Boulevard
- 3) Hacienda de las Flores Park: 2100 Donald
Drive
- 4) Moraga Library: 1500 St. Mary's Road



Baseline load profile	The historical annual usage of electrical loads per site that forms the basis for creating the master load profile.
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 loads	Electrical loads that are necessary to be provided with 100% energy resilience during grid outages
Critical load profile	Annual load profile of the critical loads.
Total Critical Load Required (TCLR)	Total amount of energy required to serve the critical loads over the specified time period, e.g. 5 consecutive days.



Resilience Scenarios Analyzed – Total Critical Load Required (TCLR)

<u>Moraga Site</u>	<u>TCLR Calculation</u>
Town Hall & Police Station	Electrical loads from the <u>highest five consecutive days</u> using the Master Load Profile
Corporation Yard & Council Chambers	Electrical loads from the <u>highest day and repeat for five days</u> using three options: 1) Baseline Load Profile; 2) Baseline + two Level 2 (L2) EV charging ports; 3) Master Load Profile – Baseline + two L2 EV charging ports + two Level 3 (L3) charging ports that are managed to provide charging simultaneously but at the rate of one L3 port.
Library	Electrical loads from the <u>highest day and repeat for 5 days</u> using the Baseline Load Profile.
Hacienda	Electrical loads from the <u>highest 5 consecutive days</u> using the Baseline Load Profile combining the Hacienda main building and the Pavilion

- EV charging will be included in the TCLR for Town Hall & Police Station and considered for the Corp Yard & Council Chambers, but not for the other sites. Nonetheless, EV charging can be available for all sites when solar is abundant.
- Where available, the peak load test details provided by Moraga were considered in sizing the TCLRs.

Solar + storage	<u>Feasible for detailed study.</u>
Solar + storage + diesel generator	<u>Feasible for detailed study.</u>
Solar + diesel generator	<u>Feasible for detailed study.</u>
Diesel only	<u>Feasible for detailed study.</u>

Solar only	<u>Not feasible.</u> No resilience due to solar being automatically shut off when the grid goes out.
Battery only	<u>Not feasible.</u> Too large and costly to provide resilience without onsite energy generation.
Run of river hydro	<u>Not feasible.</u> Insufficient local hydro resources.
Geothermal	<u>Not feasible.</u> Insufficient local resources, uneconomical.
Biofuel	<u>Not feasible.</u> Nonexistent local supply, uneconomical to create.
Pipeline fueled generators	<u>Not feasible.</u> Pipes disrupted in earthquakes & extreme weather
Propane	<u>Not feasible.</u> Requires extra, separate tank vs. diesel

Resource Scenario Site Layouts & Profiles

Town Hall & Police Station – site layout & profile



Town Hall & Police Station Offices

- Address: 329 Rheem Boulevard
- Meter: 1009541102
- Tariff: B10S

Total annual load:

- Baseline load profile: 116,338 kWh
- Master load profile: 260,640 kWh

Total solar siting potential

- 178 kWdc

Solar sizing by recommended location:

- R-1 (Rooftop): 39.2 kWdc
- C-1 (Carport): 56.7 kWdc
- C-2: 66.2 kWdc
- C-3 (Carport): 10.9 kWdc

Solar to NZE:

- Baseline load profile: 76 kWdc
- **Master load profile: 173 kWdc**

Battery size

- Depends on scenarios

Electric Vehicles

- EV-1: Two existing L2 SemiConnect ports
- EV-2 Two new L2 ports for police station use.
- Estimated annual load of four L2 charging ports – 144,302 kWh
- Two EV charging ports for employee and public & two EV charging ports for police station.

Critical loads

- Police station, Town offices, and Emergency Operation Center for Town functions.
- 100% of load is critical.

Notes

- ADA requires some ratio of shading and EVCI coverage.
- Solar carports would require tree removal or trimming.
- Existing generators should be replaced

- Meter
- Potential BESS location
- EVCI

Corp Yard & Council Chamber – site layout & profile



Corp Yard & Council Chamber
 Address: 335 Rheem Boulevard
 • Meter: 1009510796
 • Tariff: B1

Total annual load:
 • Baseline load profile: 14,521 kWh
 • Baseline load profile+L2: 82,032 kWh
 • Master load profile: 191,532 kWh

Total solar siting potential
 • 61 kWdc

Solar sizing by recommended location:
 • R-1 (Rooftop): 6 kWdc
 • C-1 (Carport): 23 kWdc
 • C-2 (Carport): 32 kWdc

Solar to NZE:
 • Baseline load profile: 10 kWdc
 • **Baseline+L2 load profile: 61kWdc**
 • Master load profile: 113 kWdc

Battery energy storage:
 • Depends on scenarios

Electric vehicle charging:
 • EV-1: Two new L2 ports
 • EV-2: Two new L3 ports
 • Estimated annual load of two new L2 ports: 67,510 kWh
 • Estimated annual load of two new L3 ports as managed as one: 109,500 kWh
 • All EV charging is employee & municipal fleet only

Critical loads:
 • Town council chambers, repair facilities, and Emergency Operation Center
 • 100% of baseline load is critical as is some EV charging in specific scenarios

Notes
 • Solar carports might require tree trimming.
 • Existing generator too small

Meter
 Potential BESS location
 EVCI

Existing propane generator and tank

Library – site layout & profile



Library

- Address: 1500 St. Mary's Road
- Meter: 1009510796
- Tariff: B1

Total annual load:

- Baseline load profile: 107,619 kWh
- Master load profile: 175,470 kWh

Total solar siting potential

- 176 kWdc

Solar sizing by recommended location:

- C-1 (Carport): 46.2 kWdc
- C-2 (Carport): 39.9 kWdc
- C-3 (Carport): 27.3 kWdc

Solar to NZE:

- Baseline load profile: 69 kW
- **Master load profile: 113.4 kW**

Battery energy storage:

- Depends on scenarios.

Electric vehicle charging:

- EV-1: Two new level-2 EV charging ports
- EV-2: Two new level-2 EV charging ports
- Estimated annual load of four new Level-2 charging ports: 67,851 kWh
- All EV charging is employee and public

Critical loads:

- Cooling center, internet, lighting, and plug loads
- 100% of load is critical

Notes:

- ADA requires some ratio of shading and EVCI coverage.
- Solar carports would require tree removal or trimming.

Hacienda & Pavilion– site layout & profile



Lamp post with potential conduit back to Hacienda

- Meters
- Potential battery location
- EVCI

Hacienda & Pavilion

- Address: 2100 Donald Dr.
- Hacienda meter: 5000111250
- Pavilion meter: 1004453420
- Tariff: B1

Total annual load:

- Baseline load profile: 37,295 kWh
- Master load profile: 68,065 kWh

Total solar siting potential

- 87.5 kWdc

Solar sizing by recommended location:

- C-1 (Carport): 25 kWdc
- C-2 (Carport): 28 kWdc

Solar to meet NZE:

- Hacienda baseline load profile: 25 kWdc
- Hacienda master load profile: 49 kWdc
- Hacienda & Pavilion baseline load profile: 27kWdc
- **Hacienda & Pavilion master load profile: 53kWdc**

Battery energy storage

- Depends on scenarios.

Electric vehicle charging:

- EV-1 or EV-2: Two new L2 EV charging ports
- Estimated annual load of two new L2 charging ports – 33,926 kWh
- All EV charging is employee & public

Critical loads

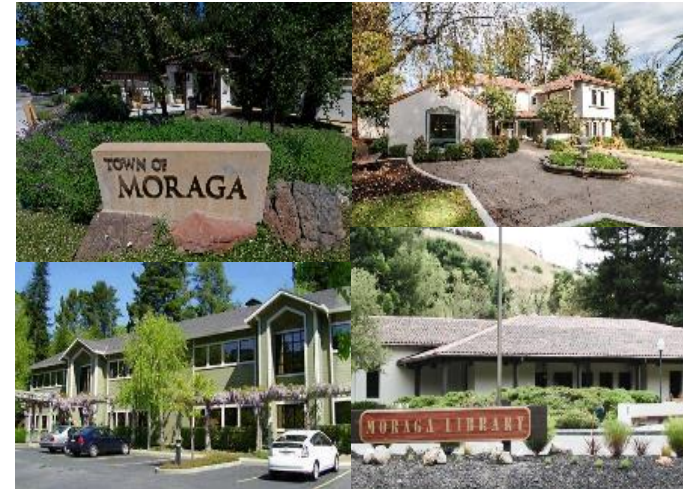
- Critical load only to cover weddings, walk-in refrigerator/freezer, server, and pavilion baseline loads.

Notes

- Possible master metering opportunity to tie Pavilion into the Hacienda meter.
- ADA requires some ratio of shading and EVCI coverage.
- Solar carports would require tree removal or trimming.
- Lamp post in north parking lot could provide possible conduit for C-2 parking canopy

Economic Assumptions

1. Each resource scenario satisfies the TCLR for each site during an outage; thus, the evaluation can focus on the other key criteria – the economic results.
2. The economic analysis considers financing each scenario via a “cash” option – paying the capital expenditure (Capex) and operating expenditure (Opex) costs for each system – compared with a Power Purchase Agreement (PPA).
3. A PPA is an established, industry-standard financial solution enabling site owners to pay for solar and solar + storage systems using a comprehensive, energy services contract based on the amount of solar energy (kWh) the system delivers, whether via solar in real-time or time-shifted via a battery, and with no upfront cash nor any operating or maintenance expenditures.
4. Moraga will likely not choose the cash option and will therefore select the PPA.



Economic assumptions

The following economic assumptions apply to ALL scenarios:

- All sites have been modeled using rates to achieve the best economic savings. PG&E rate B-10S is used due to adding EV charging stations. For solar + diesel scenarios either B-19S Option R or B-10S is used, whichever yielded greater economic savings. For solar + storage + diesel scenarios B-19S Option S is used for greater economic savings. All use the MCE Light Green energy generation service.
- Electricity Bill Cost Escalation: 3% (very conservative – could reach 10%).
- Battery replacement occurs at Year 16 and is included in the economic results
- Battery Storage state subsidy (SGIP) is included in the scenarios with storage
- The diesel generator costs are based on industrial-quality models which are appropriate for providing municipal backup power function. The operations and maintenance costs are based on market-based annually required costs for diesel generators.
- The most conservative estimates for solar generation during outages

Rate Schedule Details				
Site name	Baseline Load Profile		Master Load Profile	
	Current rate schedule	Current rate schedule	Rate schedule switch with solar that yields greatest economic savings	Rate schedule switch with solar+storage that yields greatest economic savings
Town Hall Offices and Police Station	B-10	B-10	B-10	B-19 Option S
Corp Yard and Council Chamber	B-1	B-10	B-19 Option R	B-19 Option S
Library	B-1	B-10	B-10	B-19 Option S
Hacienda+Pavilion	B-1	B-10	B-10	B-19 Option S
Hacienda	B-1	B-10	B-10	B-19 Option S

Diesel Generator CAPEX + Installation												
Site	Generator Size (kW)	ATS Rated Amps	Generator and fuel Tank (\$)	Add Level 2 Sound Enclosure (\$)	Service Entrance Grade ATS (\$)	Tax and Shipping (\$)	Total Equipment Cost (\$)	Estimated Base Installation Cost (\$)	Total Baseline Installed Cost (\$)	Additional PG&E Service Upgrade Costs (\$)	Additional Cost to Replace or Upgrade Man Electrical Distribution Panel (\$)	Total Cost W/O PG&E Costs (\$)
Town Hall Offices and Police Station	80	800	\$32,000	\$3,200	\$16,000	\$5,120	\$56,320	\$56,320	\$112,640	N/A	\$28,800	\$141,440
Corp Yard and Council Chamber Baseline	20	200	\$20,000	\$2,000	\$8,300	\$3,030	\$33,330	\$33,330	\$66,660	N/A	-	\$66,660
Corp Yard and Council Chamber Baseline+L2	50	200	\$23,000	\$2,300	\$8,300	\$3,360	\$36,960	\$36,960	\$73,920	N/A	-	\$73,920
Corp Yard and Council Chamber Baseline+L2+L3	100	400	\$36,000	\$3,600	\$9,600	\$4,920	\$54,120	\$54,120	\$108,240	Not estimated	\$17,280	\$125,520
Library	100	800	\$36,000	\$3,600	\$16,000	\$5,560	\$61,160	\$61,160	\$122,320	N/A	\$28,800	\$151,120
Hacienda (Main Building + Pavilion)	50	800	\$23,000	\$2,300	\$16,000	\$4,130	\$45,430	\$45,430	\$90,860	Not estimated	\$28,800	\$119,660
Main Building	50	400	\$23,000	\$2,300	\$9,600	\$3,490	\$38,390	\$38,390	\$76,780	N/A	-	\$76,780
Pavilion	20	400	\$20,000	\$2,000	\$9,600	\$3,160	\$34,760	\$34,760	\$69,520	N/A	\$17,280	\$86,800

Included in the PPA cost analysis:

- No PPA rate escalation
- All solar canopies and structures needed for parking areas
- EV chargers
- Required upgrades in electrical equipment

Not included in the PPA cost analysis:

- Additional required site preparation such as re-grading, full ADA compliance

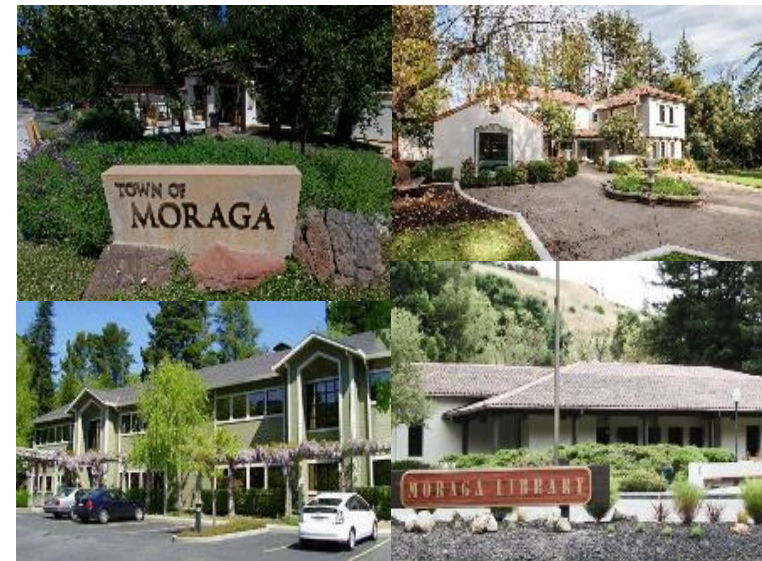
Assumptions that apply ONLY to a cash purchase option:

- Discount rate: 5%
- Federal Income Tax Rate: 30%
- State Income Tax Rate: 8%
- O&M Escalation Rate: 2%

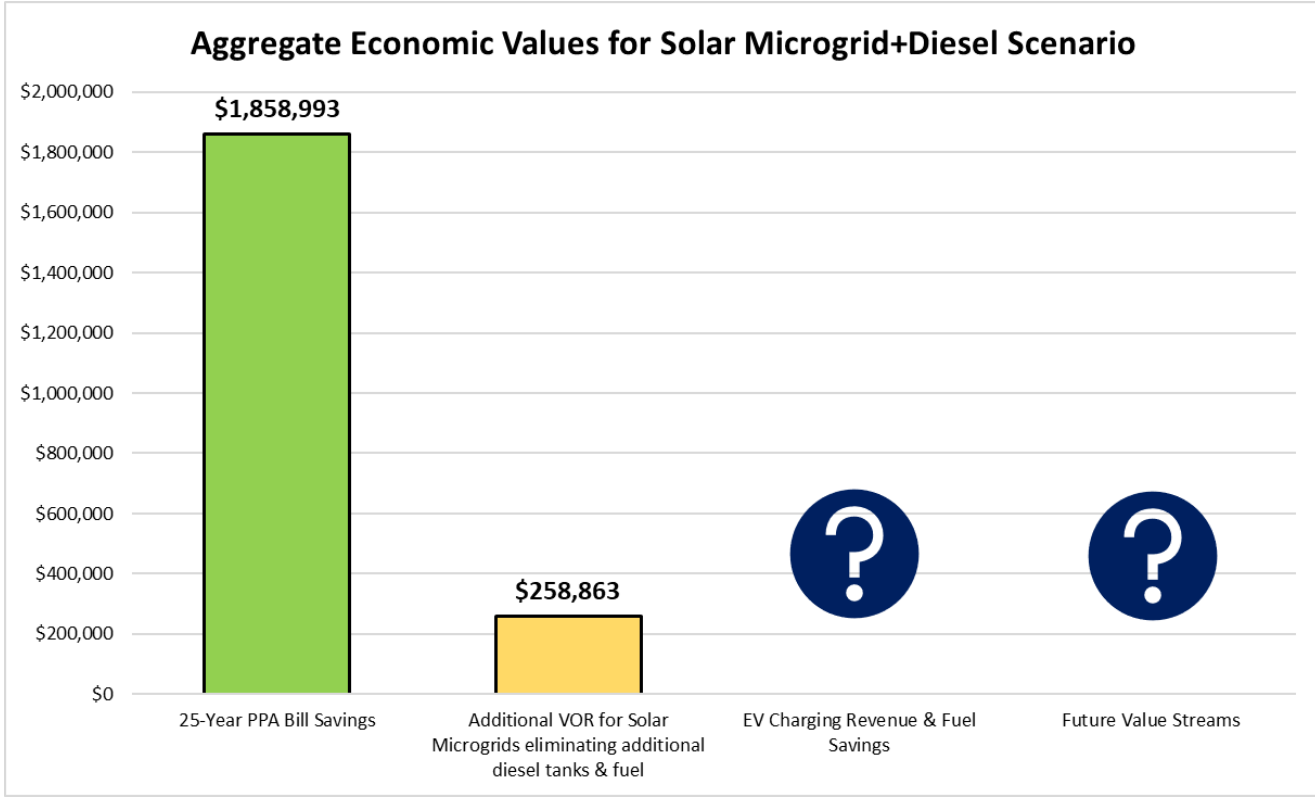
Key Findings

Key Findings

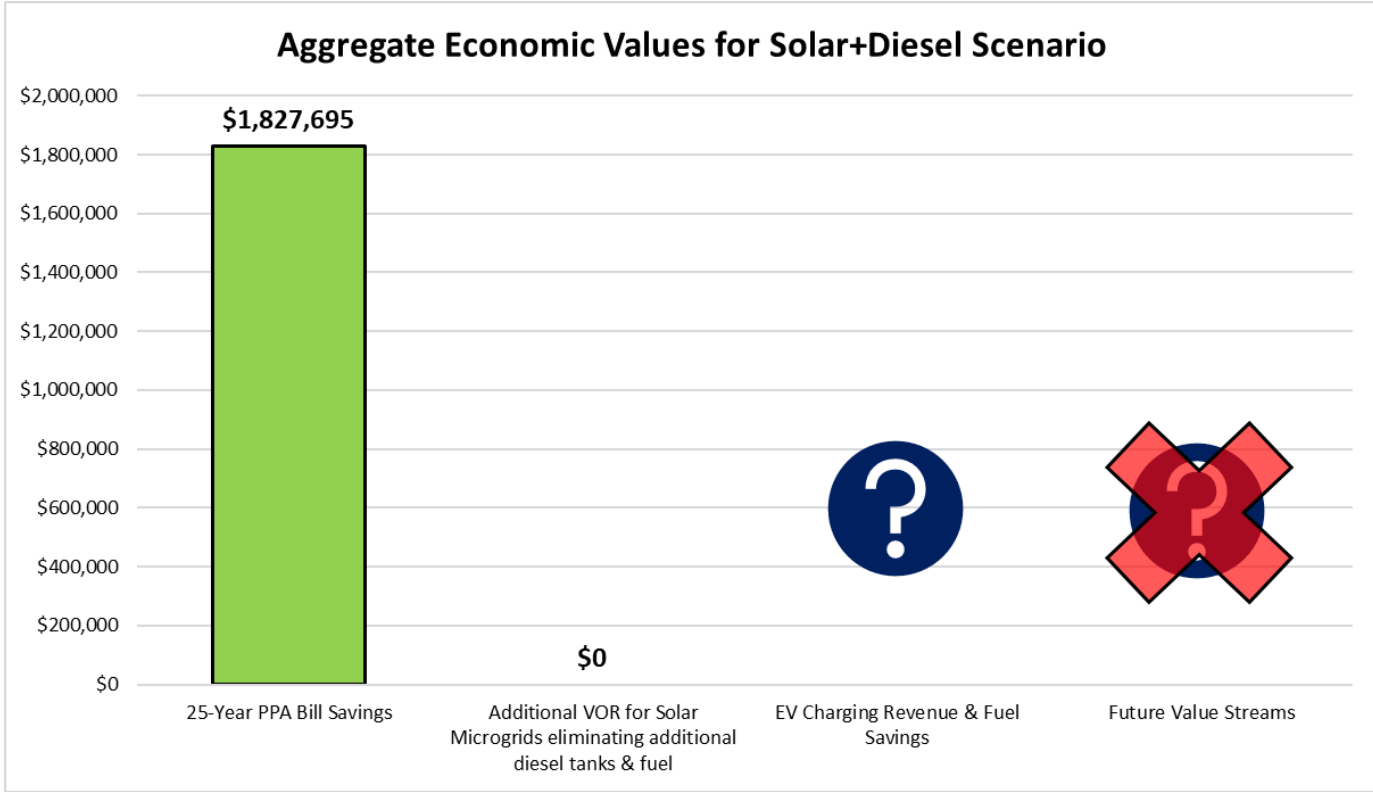
- Based on the detailed economic analysis, solar + storage and diesel-only are considered not preferable due to the cost and lack of savings each of these options would impose on Moraga. Solar + storage would cost over \$8M; diesel-only would cost over \$800K; most importantly, both options provide zero savings.
- By contrast, solar + diesel and solar + storage + diesel would each save Moraga over \$1.8 million over the 25-year duration of these scenarios, utilizing the PPA option with no upfront cash and all maintenance and operations costs included.
- In addition, due to the addition of storage, the solar + storage + diesel option provides ongoing, indefinite support for a percentage of loads during outages, while also providing additional Value-of-Resilience (VOR) of over \$250,000, thus bringing the total savings to Moraga for this scenario at over \$2.1 million.



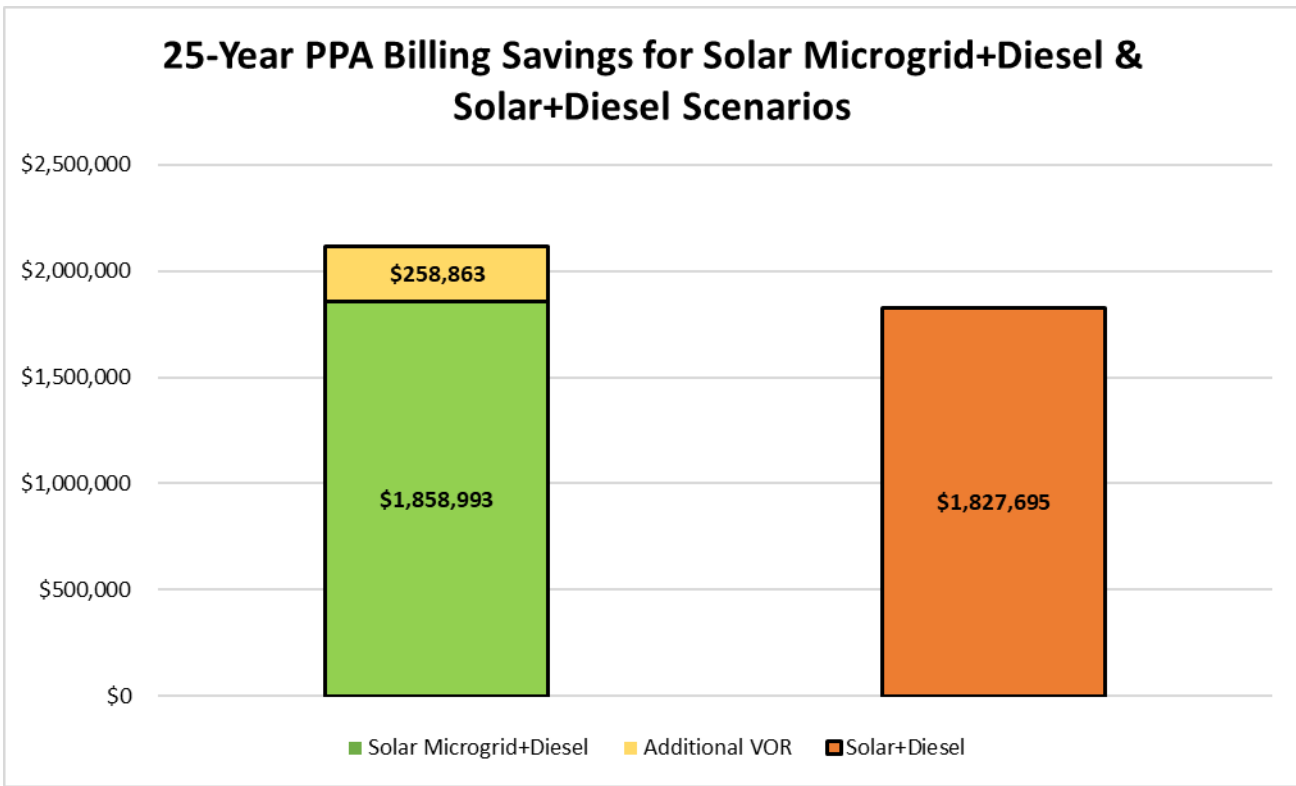
Economic value: solar + storage + diesel



Solar Microgrid+Diesel Aggregate Economic Values					
Site name	Year 1 PPA Savings	25-Year PPA Bill Savings	Additional VOR for Solar Microgrids eliminating additional diesel tanks & fuel	EV Charging Revenue & Fuel Savings	Future Value Streams
Town Hall Offices and Police Station	\$2,026	\$622,069	\$82,502	?	?
Corp Yard and Council Chamber	\$9,537	\$539,575	\$50,275	?	?
Library	\$6,210	\$572,158	\$79,934	?	?
Hacienda+Pavilion	(\$1,636)	\$125,192	\$46,152	?	?
Total	\$16,137	\$1,858,993	\$258,863	?	?



Solar+Diesel Aggregate Economic Values		
Site name	Year 1 PPA Savings	25-Year PPA Bill Savings
Town Hall Offices and Police Station	\$11,214	\$828,367
Corp Yard and Council Chamber	\$727	\$210,396
Library	\$9,757	\$630,154
Hacienda+Pavilion	\$326	\$158,779
Total	\$22,024	\$1,827,695



Recommendations & Next Steps

- Seek detailed proposals providing the optimal solution for Moraga based on this analysis.
- This is NOT the standard design, bid, build process. This requires a specially-skilled, highly-qualified consultant working alongside Moraga staff.
- An external consultant would produce the Request for Proposal (RFP) documents, administer the RFP process, review and score the proposal responses ensuring they comply with the requirements (not lowest bid), prepare the contract, facilitate contract negotiations, and manage the construction process to ensure adherence to performance requirements in the RFP and associated contract agreements.
- The PPA option is an energy services contract for 25 years and thus the contracts and ongoing operations are negotiated as such, requiring specific external expertise.

