
# Moraga Facilities Energy Reliability

## Town Council Meeting

## August 28, 2024

# Staff Recommendations

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

Receive Energy Generation Project update and approve resolution to do the following:

1. $75,000 Professional Services Agreement Amendment No. 1 with Clean Coalition.

2. Authorize a 15% contingency of $11,250 for Clean Coalition contract.

3. Find California Environmental Quality Act exempt.

# Facilities Energy Reliability alignments with Town Goals & Facility Needs

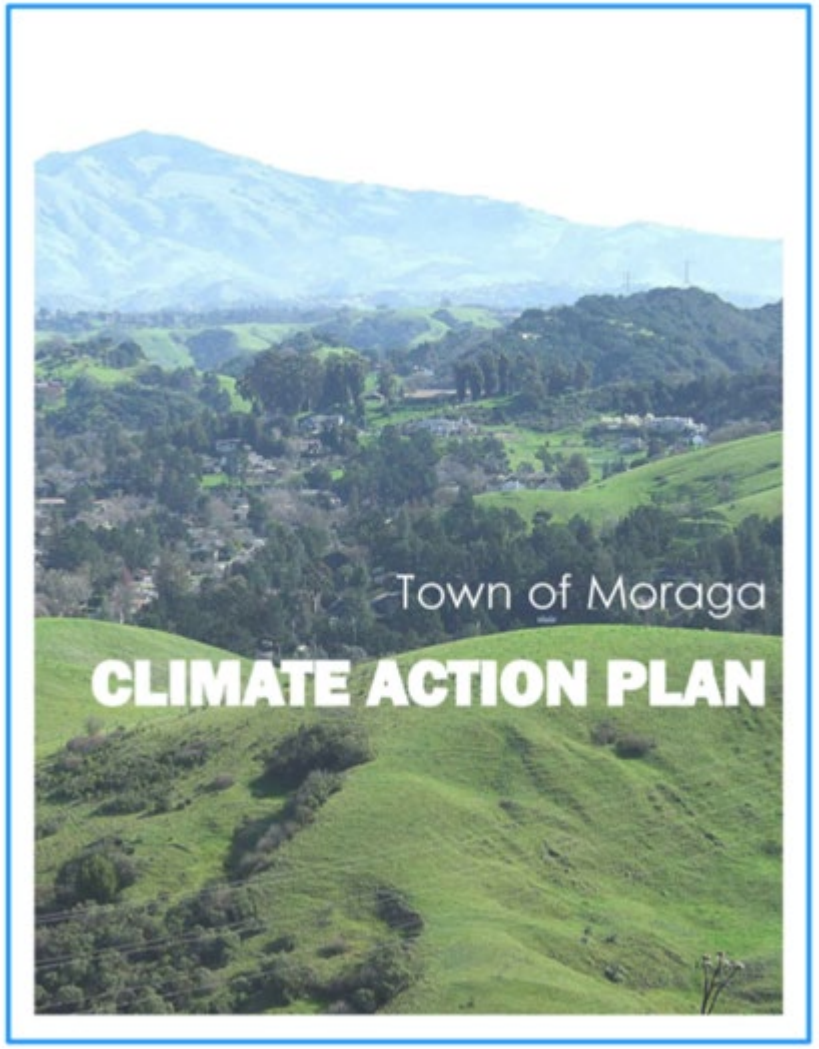
**2024-25 Town Goal :** Lessen the Town's impact on the environment

**Emergency Responses**

- Power Outages
- Wildfires
- Other Natural or Manmade Disasters

**Facility Needs for Emergency Response**

- Facility Energy Reliability
- Facility Energy Generation Resiliency
- Vehicle Fleet Resiliency



# Facility Needs and Project Background

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

- 2019 – 2024 – Public Safety Power Shutoffs (PSPS).
- June 2021 – Town Facilities Energy Generation Study.
- January 2022 – Clean Coalition a Study Agreement.
- May 2022 – Study Report and Presentation – PG&E NEM2 Utility Rates.

  Project Options:

  1. Stay with PG&E & MCE.
  2. Power Purchase Agreement (PPA).
  3. Town Purchase Option.

- June 2023 – Updated Study Report and Presentation – PG&E NEM3 Utility Rates.

# Energy resource scenario benefits

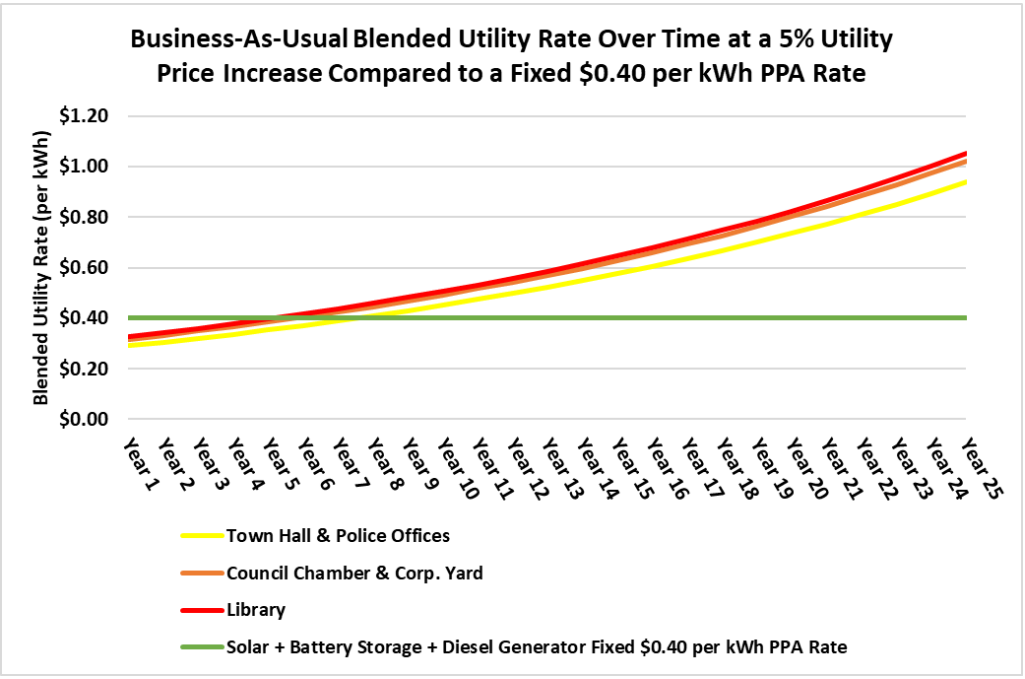
| Benefits | Solar + Storage + Diesel Generator PPA | Solar + Storage + Diesel Generator Cash Purchase | Solar + Diesel Generator PPA | Solar + Diesel Generator Cash Purchase | Diesel Generator Only Cash Purchase | Business-as-usual |
|---|---|---|---|---|---|---|
| **Economic** | | | | | | |
| Direct economic value | X | **X** | X | X | | |
| Local economic stimulation | **X** | **X** | X | X | | |
| No burden Moraga capex & opex | X | | X | | | |
| **Environmental** | | | | | | |
| 100% Renewables | X | X | X | X | X | X |
| Efficiency (no transmission losses) | **X** | **X** | X | X | | |
| Preservation of Habitat | **X** | **X** | X | X | | |
| **Resilience** | | | | | | |
| Indefinite energy supply | **X** | **X** | | | | |
| Self-reliance | **X** | **X** | | | | |
| **Grid Citizenship** | | | | | | |
| Dispatchable load profile | **X** | **X** | | | | |
| Grid services opportunities (Demand Response) | **X** | **X** | | | | |
| **Operational** | | | | | | |
| Low Moraga burden O&M | **X** | | **X** | | | |

**Microgrid Energy Generation System (Solar + Storage + Diesel Generator) is recommended**

# Cash Purchase vs. PPA Economic Microgrid (Solar + Battery Storage + Diesel Generator)

| Solar + Battery Storage + Diesel Generator Economic Analysis Results, 25 Years | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Electrical Bill Savings | Finance Option A Cash Purchase | | | | | Finance Option B $0.40/kWh PPA | | |
| | | Total Capex | Total 25 Year Opex | 30% ITC Direct Pay | Total Cost | 25 Year Net Savings | 25 Year PPA Cost | 25 Year Net Savings | Savings Year 1 |
| Town Hall & Police Offices | $2,275,810 | ($1,234,753) | ($237,724) | $305,967 | ($1,166,510) | $1,109,300 | ($2,503,411) | ($227,601) | ($53,655) |
| Council Chamber & Corp. Yard | $1,181,890 | ($787,813) | ($233,678) | $176,140 | ($845,351) | $336,539 | ($875,343) | $306,547 | ($8,975) |
| Library | $1,887,452 | ($1,048,806) | ($242,055) | $245,068 | ($1,045,793) | $841,659 | ($1,671,010) | $216,442 | ($27,206) |
| **Totals** | **$5,345,152** | **($3,071,372)** | **($713,457)** | $727,175 | **($3,057,654)** | **$2,287,498** | **($5,049,764)** | **$295,388** | **($89,836)** |

A single PPA price for all three sites would be solicited from PPA providers during the RFP process, similar to how we have presented the PPA price above. This PPA price may appear high for the larger sites and low for the smaller sites.




| Diesel Generator - Economic Analysis Results, 25 Years | | | |
|---|---|---|---|
| Site | Finance Option A Cash Purchase | | |
| | Total Capex | Total 25 Year Opex | Total 25 Year Cost |
| Town Hall & Police Offices | ($214,864) | ($83,279) | ($298,143) |
| Council Chamber & Corp. Yard | ($200,680) | ($83,279) | ($283,959) |
| Library | ($231,912) | ($83,279) | ($315,191) |
| **Total** | **($647,456)** | **($249,836)** | **($897,292)** |

# PPA Microgrid Economic Analysis
(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

Clean Coalition's 25-year updated economic analysis included PG&E NEM3 Utility Rates and focused primarily :

1. PG&E annual electricity rate increase of 5%.

2. PPA provider electricity rate of $0.40 per kilowatt-hour versus $0.31 per kilowatt-hour (2022 Town cost).

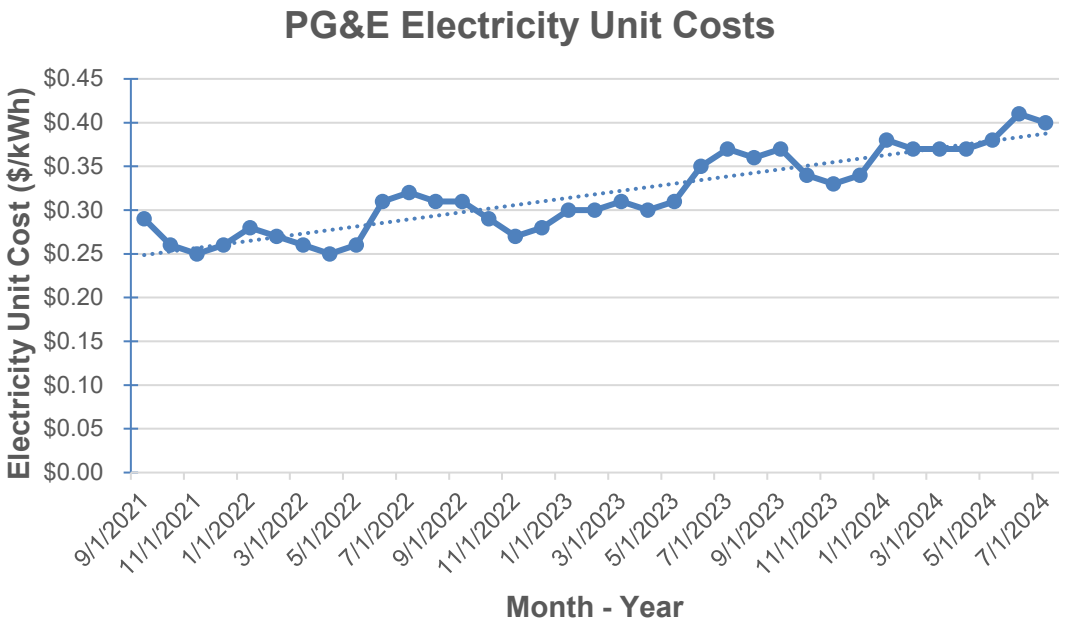
3. PPA total microgrid system cost approx. $5 million over 25-year period.

# PPA Microgrid Economic Analysis
(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

Table 1. PG&E Commercial Energy Rate Increases by Percentages

| Year | 2014-2015 | 2015-2016 | 2016-2017 | 2017-2018 | 2018-2019 | 2019-2020 | 2020-2021 | 2021-2022 | 2022-2023 | Avg. | Cumulative Change |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PG&E | 3.6% | 3.2% | 3.7% | 2.2% | 3.9% | 8.5% | 0.7% | 8.1% | 19.1% | 5.2% | 65.8% |

Chart 1. Town Offices Monthly PG&E Electricity Blended Cost Rate per kWh ($/kWh) over last three years



# PPA vs. Town Purchase Microgrid

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

| Cost Items | PPA | Town | Difference |
|---|---|---|---|
| Construction | $5,000,000 | $3,071,000 | ($1,929,000) |
| Estimated Auxiliary Project Costs | 1,200,000 | 1,200,000 | 0 |
| Operating Costs | 0 | 713,000 | 713,000 |
| Federal Investment Tax Credit (ITC) | 0 | (727,000) | (727,000) |
| Total 25-year Cost | $6,200,000 | $4,257,000 | ($1,943,000) |
| Estimated Energy Savings | (5,350,000) | (5,350,000) | 0 |
| Initial Cost/(Savings) | $850,000 | ($1,093,000) | $1,943,000 |
| Cost of Debt Issuance & Lost Revenues | 0 | TBD | TBD |

# Benefits

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

Clean Coalition

## Microgrid System Environmental and Non-Economic Benefits

- Installation of EVC stations for Town vehicles and for public use (via a fee).
- Microgrid systems provide clean energy generation.
- Resiliency of independent energy generation for emergencies, power outages, and PG&E temporary Public Safety Power Shutoff (PSPS) outage events.

# Next Steps

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

If the proposed resolution is approved by Town Council, then the following next steps will take place:

- Clean Coalition Professional Services Agreement execution -- Early September 2024.
- Clean Coalition prepares PPA RFP -- By early December 2024.
- Town Council review and approval of PPA RFP – By end of January 2025.
- PPA RFP solicitation period -- February 2025 to May 2025.
- Clean Coalition and Town staff review of PPA Proposals – May/June 2025
- PPA Provider recommendation to Town Council – June/July 2025.

END

# Staff Recommendations

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

Receive Town Facilities Energy Generation Project update and approve proposed resolution to do the following:

1. Approve Professional Services Agreement Amendment No. 1 with Clean Coalition in the amount of $75,000 to prepare a Request for Proposals document to solicit proposals from firms to develop a Power Purchase Agreement to design and install microgrid energy generation systems at three Town Facilities.

2. Authorize a 15% contingency of $11,250 to augment the Clean Coalition contract amount for potential additional professional services.

3. Find that preparation of a Power Purchase Agreement Request for Proposals is exempt from review per California Environmental Quality Act Guidelines Section 15306.

# June 3, 2023 Town Council Direction

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

- 2019 – 2024 Pacific Gas and Electric Company's (PG&E) Public Safety Power Shutoffs (PSPS)
  - Planned power outages begun October 2019 in California and other caused power outages become more frequent in Moraga
- June 2021 – Town Council approved funding for Town Facilities Energy Generation Study (CIP 21-109)
- January 2022 – Town Council awards Clean Coalition a Study Agreement
- May 2022 – Town Council receives formal Study Report and Presentation
- June 2023 – Town Council receives updated Study Report and Presentation

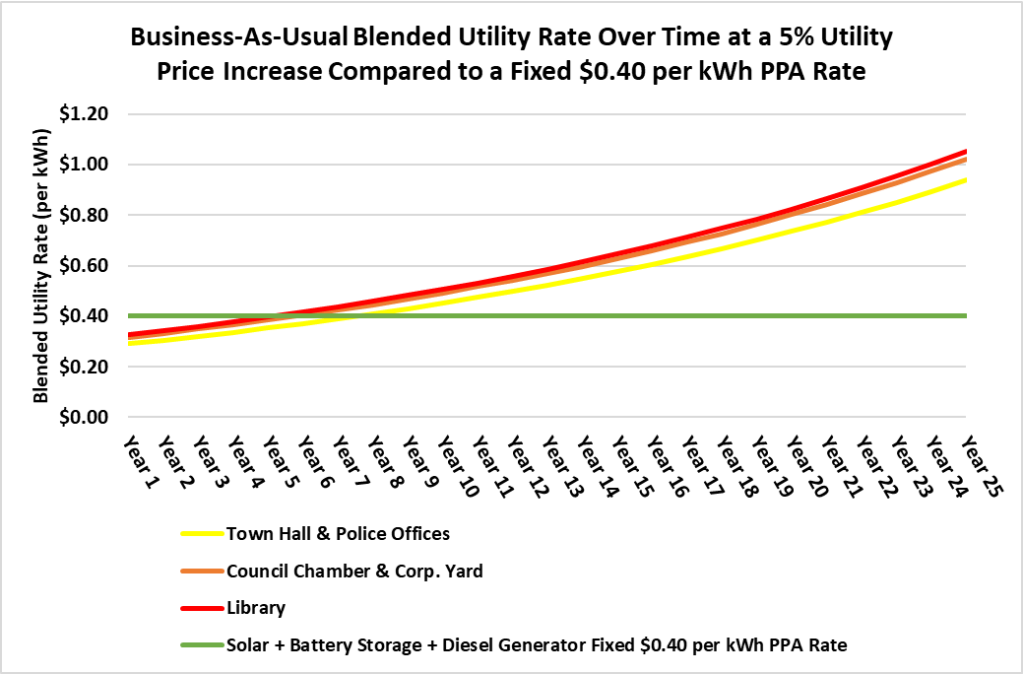
# Solar will comply with Moraga Code and Architectural Preferences

Roof mount solar on angled roof

Example of solar canopy architectural design in Montecito, CA.

# PPA Economic details

| Moraga PPA Economic Details | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Scenario Options | Site | Business-As-Usual Blended Utility Rate Over Time at a 5% Utility Price Increase (per kWh) | | | Fixed PPA Pricing (per kWh) | PPA Economic Details | | | |
| | | Year 1 | Year 10 | Year 25 | | 25 Year Electrical Bill Savings | 25 Year PPA Cost | 25 Year Net Savings | Value of Resilience (VOR) |
| Solar + Battery Storage + Diesel Generator | Town Hall & Police Offices | $0.291 | $0.451 | $0.939 | $0.40 | $2,275,810 | ($2,503,411) | ($227,601) | $92,626 |
| | Council Chamber & Corp. Yard | $0.317 | $0.492 | $1.022 | $0.40 | $1,181,890 | ($875,343) | $306,547 | $52,612 |
| | Library | $0.326 | $0.506 | $1.051 | $0.40 | $1,887,452 | ($1,671,010) | $216,442 | $79,934 |
| | **Total and Averages** | **$0.311** | **$0.483** | **$1.004** | **$0.40** | **$5,345,152** | **($5,049,764)** | **$295,388** | **$225,172** |
| Solar + Diesel Generator | Town Hall & Police Offices | $0.291 | $0.451 | $0.939 | $0.40 | $1,818,041 | ($1,752,388) | $65,653 | $0 |
| | Council Chamber & Corp. Yard | $0.317 | $0.492 | $1.022 | $0.40 | $689,948 | ($612,740) | $77,208 | $0 |
| | Library | $0.326 | $0.506 | $1.051 | $0.40 | $1,491,955 | ($1,169,707) | $322,248 | $0 |
| | **Total and Averages** | **$0.311** | **$0.483** | **$1.004** | **$0.40** | **$3,999,944** | **($3,534,835)** | **$465,109** | **$0** |




| Diesel Generator - Economic Analysis Results, 25 Years | | | |
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| Site | Finance Option A Cash Purchase | | |
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| **Total** | **($647,456)** | **($249,836)** | **($897,292)** |

# Recommendation Rankings

(covering Town Hall & Police, Council Chambers & Corp Yard, and Library)

Clean Coalition

## Solar + Battery Storage + Diesel Generator

- Total 25-Year value: $520,560
  - 25-Year Net Bill Savings: $295,388
  - Value of Resilience: $225,172 (avoided diesel-related costs)
- Indefinite resilience for the most critical loads with substantial resilience for all other loads too
- Continued operation if diesel fuel runs dry

## Solar + Diesel Generator

- Total 25-Year value : $465,109
  - 25-Year Net Bill Savings: $465,109
  - Value of Resilience: $0
- Solar turns off during grid outages
- If onsite diesel fuel cannot be resupplied, it will be “lights out” when the diesel runs dry

## Diesel Generator

- 25-Year Total Cost: $897,292 (this is the cost of achieving the 5-day resilience requirements)
- If onsite diesel fuel cannot be resupplied, it will be “lights out” when the diesel runs dry

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# Solar will comply with Moraga Code and Architectural Preferences

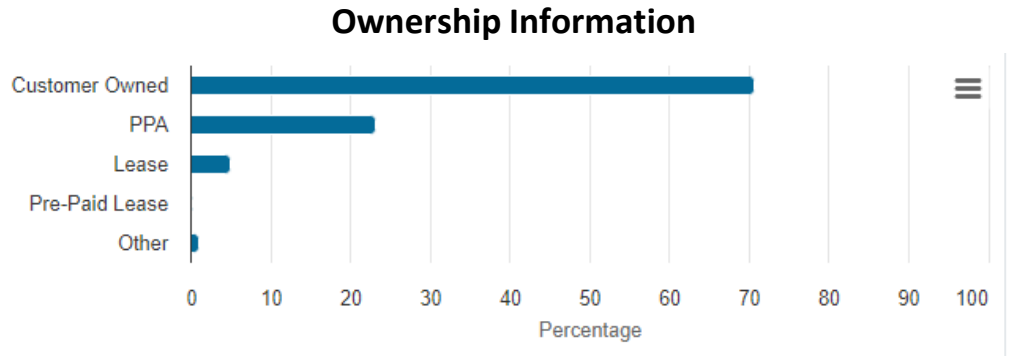
Roof mount solar on angled roof

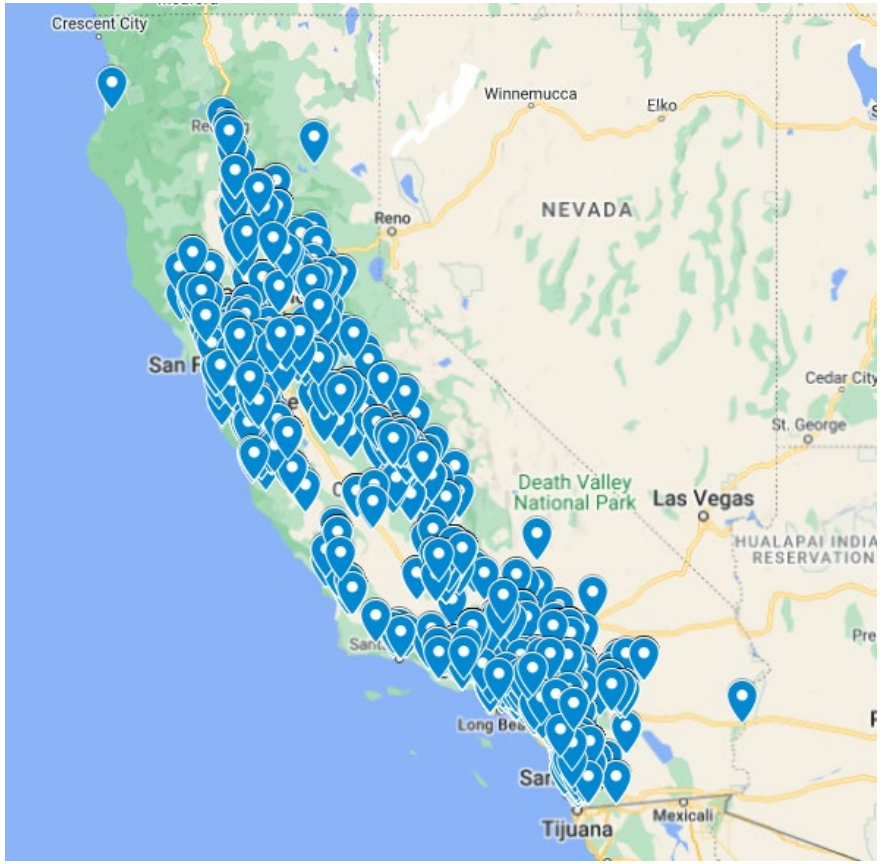
Example of solar canopy architectural design in Montecito, CA.

# Distributed Energy Project PPAs are abundant throughout California

There are over **310,000 Distributed Solar, Battery Storage, and Fuel Cell PPAs** in California.

PPA's are the second most common financing method, behind customer ownership.



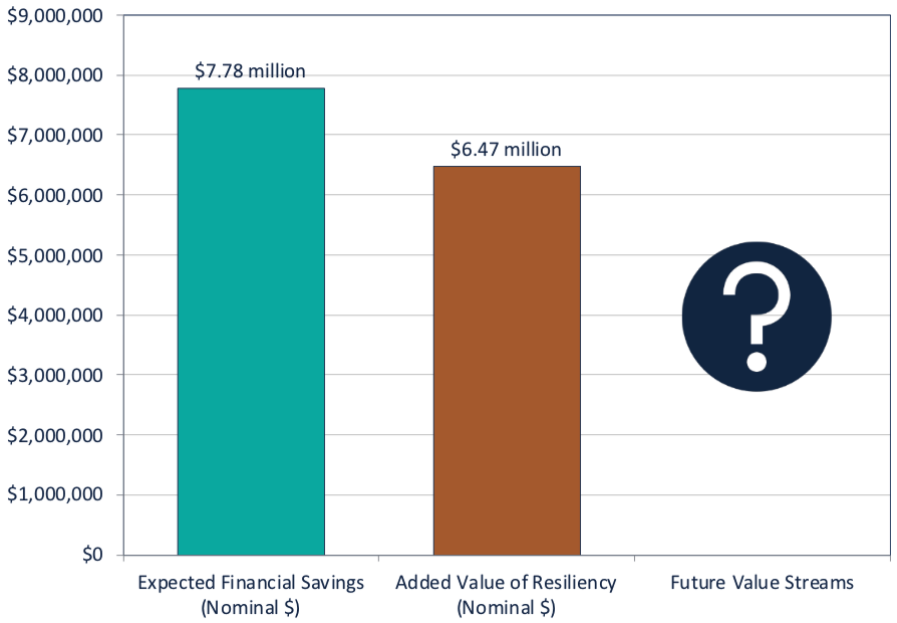

[California Distributed Generation Statistics](www.californiadgstats.ca.gov)

www.californiadgstats.ca.gov

# Solar & Solar Microgrid PPAs for the Santa Barbara Unified School District

Project details

- 28-year power purchase agreement (PPA)
- $7.78 million in expected financial savings
- $6.47 million in Value of Resilience (VOR)
- 14 solar projects
- 6 Solar Microgrids
- 4.2 MWdc solar
- 1.9 MW / 3.8 MWh battery storage
- The Solar Microgrid sites will provide their Tier 1 loads (10% of the site's loads) with indefinite resilience during a grid outage, along with significantresilience for the rest of the loads.



# Recommendation Rankings

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Diesel Generator

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# Sizing results of recommended scenario: Solar + Battery Storage + Diesel Generator

| Solar + Battery Storage + Diesel Generator Sizing | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Site | Peak Demand (kW) | Solar Sizing | | Battery Storage Sizing | | Diesel Generator Sizing | | | Indefinite Resilience | |
| | | System Size (kW) | Percentage of Net Zero Energy | Power Capacity (kW) | Energy Capacity (kWh) | Capacity Rating (kW) | Minimum Fuel Tank Size (gal) | Gallons Needed to Meet Resilience | Percentage of Baseline Load | Percentage of Master Load |
| Town Hall & Police Offices | 63 | 173 | 100% | 65 | 172 | 80 | 510 | 311 | 42% | 20% |
| Council Chamber & Corp. Yard | 79 | 61 | 46% | 80 | 211 | 100 | 350 | 213 | 100% | 13% |
| Library | 80 | 113 | 100% | 80 | 211 | 100 | 350 | 211 | 31% | 22% |
| **Totals & Averages** | **74** | **348** | **82%** | **225** | **594** | **280** | **1,210** | **735** | **58%** | **18%** |


# Economic details

## Moraga PPA Economic Details

| Scenario Options | Site | Business-As-Usual Blended Utility Rate Over Time at a 5% Utility Price Increase (per kWh) | | | Fixed PPA Pricing (per kWh) | PPA Economic Details | | | |
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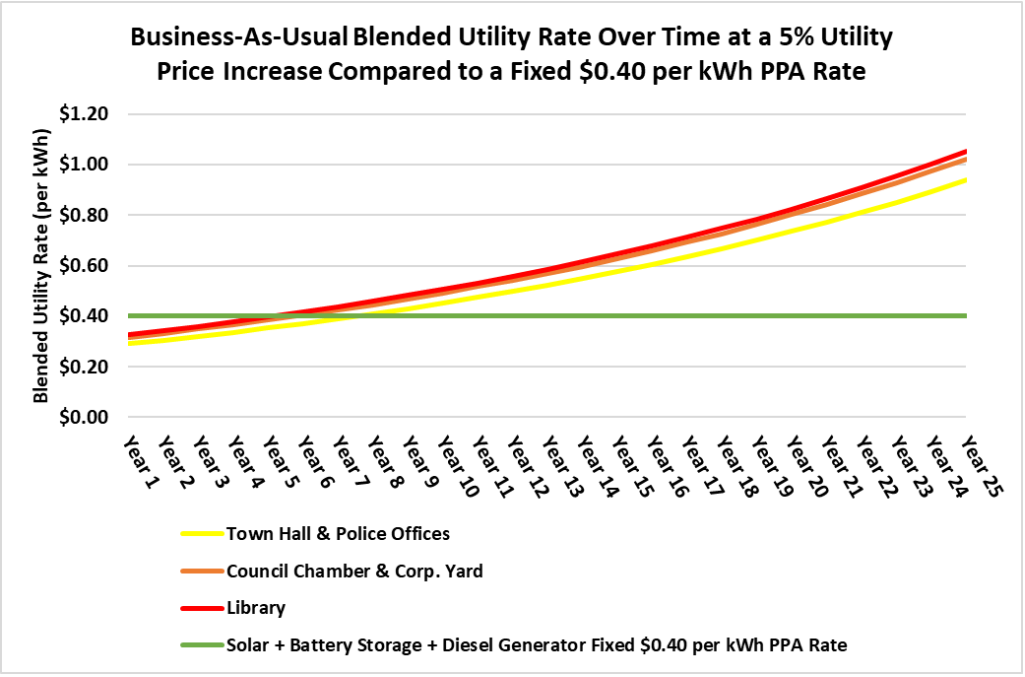


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# Energy resource scenario benefits

| Benefits | Solar + Storage + Diesel Generator PPA | Solar + Storage + Diesel Generator Cash Purchase | Solar + Diesel Generator PPA | Solar + Diesel Generator Cash Purchase | Diesel Generator Only Cash Purchase | Business-as-usual |
|---|---|---|---|---|---|---|
| **Economic** | | | | | | |
| Direct economic value | X | **X** | X | X | | |
| Local economic stimulation | **X** | **X** | X | X | | |
| No burden Moraga capex & opex | X | | X | | | |
| **Environmental** | | | | | | |
| 100% Renewables | X | X | X | X | X | X |
| Efficiency (no transmission losses) | **X** | **X** | X | X | | |
| Preservation of Habitat | **X** | **X** | X | X | | |
| **Resilience** | | | | | | |
| Indefinite energy supply | **X** | **X** | | | | |
| Self-reliance | **X** | **X** | | | | |
| **Grid Citizenship** | | | | | | |
| Dispatchable load profile | **X** | **X** | | | | |
| Grid services opportunities (Demand Response) | **X** | **X** | | | | |
| **Operational** | | | | | | |
| Low Moraga burden O&M | **X** | | **X** | | | |

Solar + Storage + Diesel Generator is recommended

Clean Coalition

# Appendix – analytical details

# Moraga Facilities Energy Generation Study (CIP 21-109)

## Town Council Meeting

## June 14, 2023

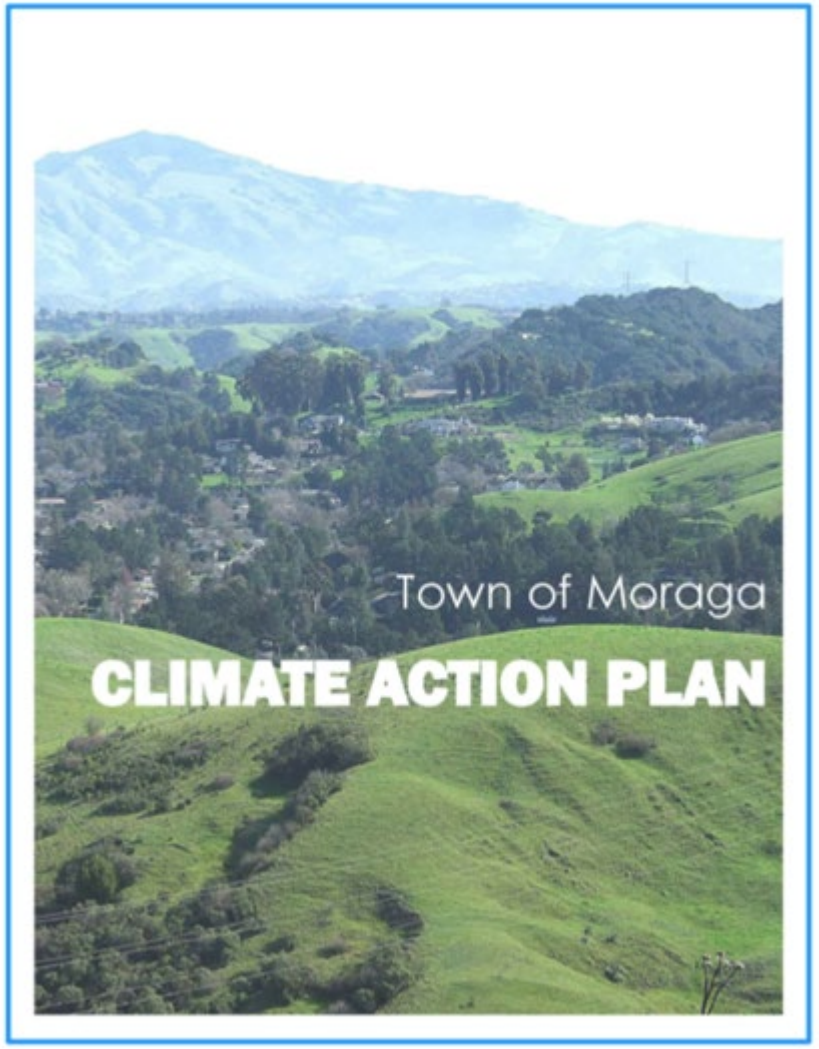
# Study's Alignment with Town Goals and Facility Needs

**2023 Town Goal 5:** Support high-quality police and emergency response services, including by securing energy alternatives for emergencies, and coordinate with MOFD on fire safety and planning.

**2023 Town Goal 12:** Lessen the Town's impact on the environment by continuing to implement sustainability and resiliency initiatives and viable strategies in Moraga's Climate Action Plan and in the Town's Facility Energy Generation Study.

**Emergency Response Capabilities**

- Power Outages
- Wildfires
- Other Natural or Manmade Disasters



# Moraga Facility Resiliency Deficiencies

## Town Hall and Police Offices:

- Police Generator – Propane 15 kW
- Town Hall – Army Surplus Diesel 23 kW

## Council Chambers, Corp Yard and EOC:

- Building – propane 16kW

## Library:

- No generator

# Moraga Facility Energy Generation Study: Project Overview

Obtain and analyze energy usage at each of the three Town properties. **Study and model options to provide energy resilience for critical and essential services 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, resilience, sustainability, financing, and affordability.


1) Town Hall & Police Offices: 329 Rheem Boulevard
2) Council Chamber & Corp. Yard: 335 Rheem Boulevard
3) Library: 1500 St. Mary's Road

# Recommendation & Results

The specific recommendations in this analysis enable the Town of Moraga to proceed with onsite energy generation at the three targeted community facilities that will provide these **two substantial benefits**:

1. **Keeping critical and essential services such as town operations, healthcare, police, comfort, food, internet access, etc. active during grid outages**, which are becoming more frequent and intense – **AND**

2. **Improving the Town's budget by saving substantial costs on the Town's utility bills, resulting in a projected net savings of over $500k.**


# Changes Made Since May 2022

Since the last presentation on May 24 2022, changes have been made to this presentation in order to reflect current electricity rates, solar policies, solar & storage costs, PPA pricing, and incentives:

1. **Updated utility rates, which have increased 16% since May 2022.**
2. **Solar industry has transition from Net Energy Metering 2 (NEM2) to NEM3, a policy change that reduced the economic value of solar.**
3. **Updated cash purchase costs for the solar and battery storage systems, along with PPA pricing due to the current economy.**
4. **The Direct Pay 30% Investment Tax Credit (ITC) has been made available to municipalities from the Inflation Reduction Act.**


# Moraga Facility Energy Generation Study: Project Steps/Methodology

## 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.

# Key load related terms

| 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. |
| **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 Load Type & Scenarios

| Sites | Resilience Load Type | Resilience Scenario |
|---|---|---|
| **Town Hall & Police Offices** | Master Load Profile | Resource scenarios for these sites were designed to provide energy resilience for five consecutive days. |
| **Council Chambers & Corp. Yard** | Master Load Profile | |
| **Library** | Baseline Load Profile | |

**Town of Moraga Annual Loads, Peak Demands, and Electric Vehicle (EV) Charging Station Counts**

| Site | Baseline Load Profile Peak Demand & Annual Load | | Existing & New EV Charging Stations Counts | | | New EV Charging Station's Peak Demand & Annual Load | | Master Load Profile Peak Demand & Annual Load | |
|---|---|---|---|---|---|---|---|---|---|
| | Peak Demand (kW) | Total Annual Load (kWh) | Existing Level 2 EV Charging Station Ports | New Level 2 EV Charging Station Ports | New Level 3 EV Charging Station Ports | New Level 2 EV Charging Station's Peak Demand | Total Annual Load from New EV Charging (kWh) | Peak Demand (kW) | Total Annual Load (kWh) |
| Town Hall & Police Offices | 43 | 116,337 | 2 | 2 | 0 | 20 | 144,303 | 63 | 260,640 |
| Council Chamber & Corp. Yard | 15 | 14,523 | 0 | 2 | 2 | 64 | 177,012 | 79 | 191,535 |
| Library | 52 | 107,621 | 0 | 4 | 0 | 28 | 67,852 | 80 | 175,473 |
| **Totals & Averages** | 37 | 238,481 | 2 | 8 | 2 | 37 | 389,167 | 74 | 627,648 |

# Resource Scenarios

| Resource Scenarios | Feasible for Study? |
|---|---|
| **Solar + battery storage** | Yes, feasible for detailed study. |
| **Solar + battery storage + diesel generator** | Yes, feasible for detailed study. |
| **Solar + diesel generator** | Yes, feasible for detailed study. |
| **Diesel generator only** | Yes, feasible for detailed study. |
| Solar only | Not feasible. No resilience due to solar being automatically shut off when the grid goes out. |
| Battery storage only | Not feasible. Too large and costly to provide resilience without onsite energy generation. |
| Run of river hydro | Not feasible. Insufficient local hydro resources. |
| Geothermal | Not feasible. Insufficient local resources, uneconomical. |
| Biofuel | Not feasible. Nonexistent local supply, uneconomical to create. |
| Pipeline fueled generators | Not feasible. Pipes disrupted in earthquakes & extreme weather |
| Propane | Not feasible. Requires extra, separate tank vs. diesel |

# Key economic related terms

| Economic term | Definition |
|---|---|
| **Electrical Bill Savings** | The amount of utility bills savings occurring over a 25 year period.<br>• This includes energy savings from using solar energy in real-time, instead of energy from the grid, or from NEM credits.<br>• It also includes demand savings from demand reduction, which is reducing the demand charges associated to sites max demand.<br>• A 5% annual utility cost escalator was also included, assuming that utility rates for electricity will likely go up 5% a year for the next 25-Years. |
| **Capital Expenditure (Capex)** | The total amount of money needed to design and build the solar, storage, and/or diesel generators. |
| **Operational Expenditure (Opex)** | The operations and maintenance expenses for the solar, storage, and/or diesel generators over a 25 year period. In terms of solar & storage, the Opex includes annual panel cleanings to remove soiling and equipment replacement, which typically happens on average at year 15. |
| **30% Direct Pay Investment Tax Credit (ITC)** | The Inflation Reduction Act (IRA) of 2022 contains a "direct pay" provision that enables certain tax-exempt customers, including state and local government, to receive a direct cash payment in lieu of an investment tax credit (ITC). Entities that qualify for direct pay are eligible to receive a 30% direct payment, assuming they meet the IRA established prevailing wage and apprenticeship requirements in order to qualify for the full 30% “increased rate”, rather than a 6% “base rate”.<br><br>The 30% Direct Pay ITC only applies to solar and storage. |
| **Cash Purchase Net Savings** | The sum of the electrical bill savings, Capex, Opex, and 30% ITC over a 25 year period. |
| **Power Purchase Agreement (PPA) Cost** | The total 25 Year cost under a Power Purchase Agreement, where The Town agrees to pay the PPA provider a fixed $/kWh for energy that’s delivered to them. The Town does not pay if no energy is delivered. |
| **PPA Net Savings** | The sum of the electrical bill savings and PPA costs over a 25 year period. |
| **Value of Resilience (VOR)** | Clean Coalition's VOR Methodology states that a typical Solar Microgrid that meets Net Zero Energy is generally worth a 25% adder to the annual electricity bill. |

# Electric Vehicle (EV) Policy and Regulatory Drivers

**Existing Electric Vehicle Policies**

- Executive Order B-48-18 - This executive order implements the Governor Brown's call for a new target of 5 million ZEVs in California by 2030, announced in his State of the State address on Jan 25 2018, and will help significantly expand vehicle charging infrastructure.

- Executive Order N-79-20 - This rule establishes a year-by-year roadmap so that by 2035 100% of new cars and light trucks sold in California will be zero-emission vehicles (ZEVs), including plug-in hybrid electric vehicles. The regulation on August 25 2022 realizes and codifies the light-duty vehicle goals set out by Governor Newsom.

- CARB Advanced Clean Trucks (ACT) – requires OEMs to sell minimum % of MD/HD ZEVS each year based on body type and weight class

- CARB Innovative Clean Transit (ICT) – transit must be 100% ZE by 2040, cannot purchase ICE after 2028

**Electric Vehicle Policies in Development**

- CARB Advanced Clean Fleets (ACF) – still under development but will require large MD/HD fleets 50+ vehicles and ALL public MD/HD fleets to go all electric, 100% ZEV goals 2035-2045

- CARB developing off-road ZE requirement legislation

# Resource Scenario Site Layouts

# Town Hall & Police Offices – recommended site layout


## Town Hall & Police Station Offices

329 Rheem Boulevard

**Solar sizing by location:**

- R-1 (Rooftop): 39.2 kWdc
- C-1 (Carport): 56.7 kWdc
- C-2: 66.2 kWdc
- C-3 (Carport): 10.9 kWdc
- **TOTAL: 173 kWdc**

**Solar to NZE:**

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

**Battery Storage Sizing:**

- 65 kW / 172 kWh

**Critical loads**

- Police offices, Town offices, and Emergency Operations Services for Town functions.
- 100% of load is critical.

**Electric vehicle charging**

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

**Notes**

- ADA requires some ratio of shading and EVCI coverage.
- Solar carports require tree trimming or removal.
- Existing generators should be replaced; insufficient for critical load requirement, requires manual connections – not automatic, must manually shut down circuits

# Council Chamber & Corp. Yard – recommended site layout


## Council Chamber & Corp. Yard

335 Rheem Boulevard

**Solar sizing by location:**

- R-1 (Rooftop): 6 kWdc
- C-1 (Carport): 23 kWdc
- C-2 (Carport): 32 kWdc
- **TOTAL: 61 kWdc**

**Solar to NZE:**

- Baseline load profile: 10 kWdc
- **Baseline+L2 load profile: 61kWdc**
- Master load profile: 113 kWdc

**Battery Storage Sizing:**

- 80 kW / 211 kWh

**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

**Electric vehicle charging:**

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

**Notes:**

- Solar carports require tree trimming or removal.
- Existing generator insufficient; public meetings can not be televised currently during outages; circuits must be manually turned off

# Library – recommended site layout


## Library

1500 St. Mary's Road

**Solar sizing by location:**

- C-1 (Carport): 46.2 kWdc
- C-2 (Carport): 39.9 kWdc
- C-3 (Carport): 27.3 kWdc
- **TOTAL: 113.4 kWdc**

**Solar to NZE:**

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

**Battery Storage Sizing:**

- 80 kW / 211 kWh

**Critical loads:**

- Can operate during outages for Town with internet, lighting, cooling/heating, plug loads
- 100% of load is critical

**Electric vehicle charging:**

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

**Notes:**

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

# Visual examples

Roof mount solar on angled roof

Source: Pablo Davis Elder Living Center

Solar in parking lot as carport

# Visual examples

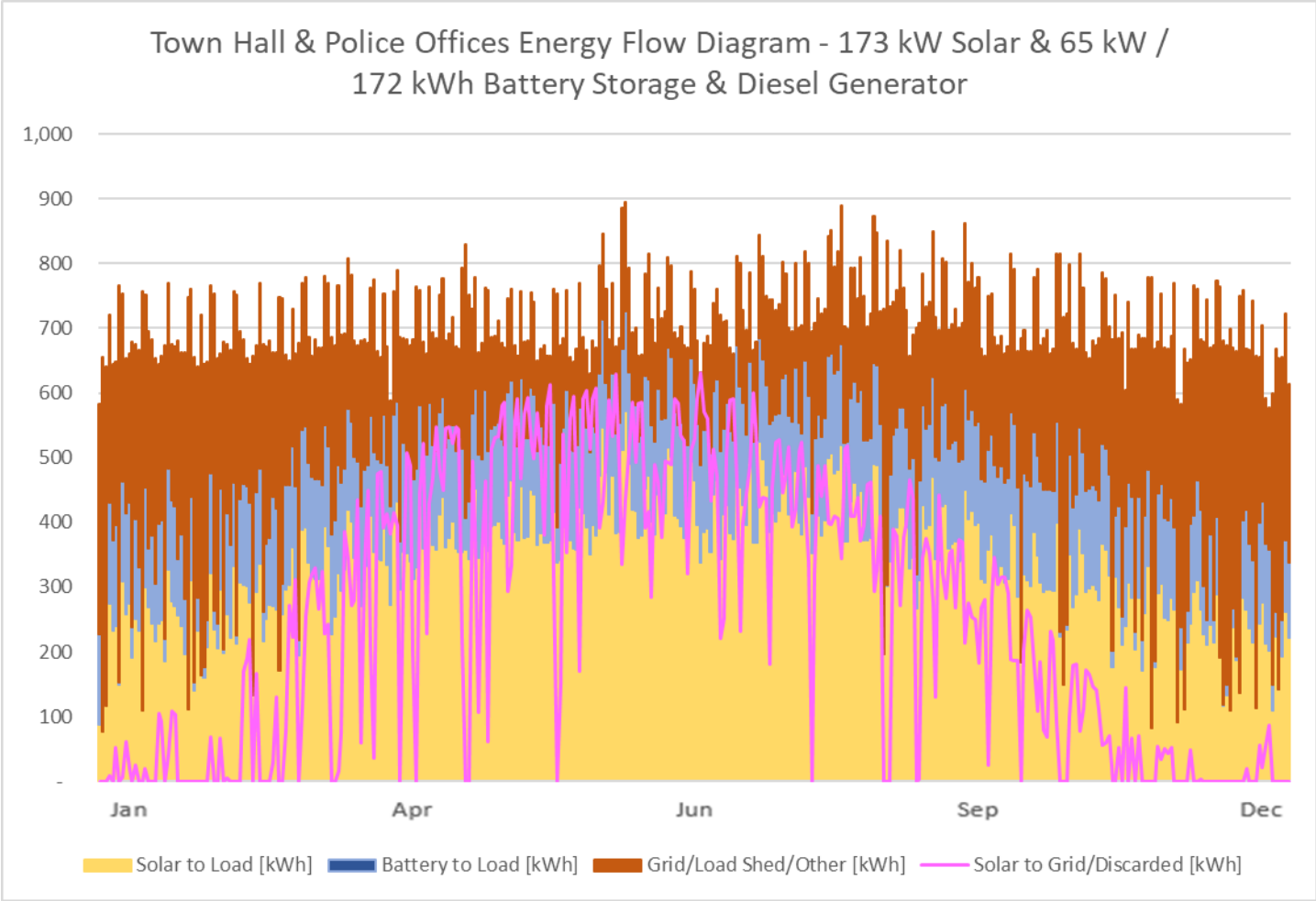
Example of solar canopy architectural design in Montecito, CA.

# Solar + Battery Storage + Diesel Generator

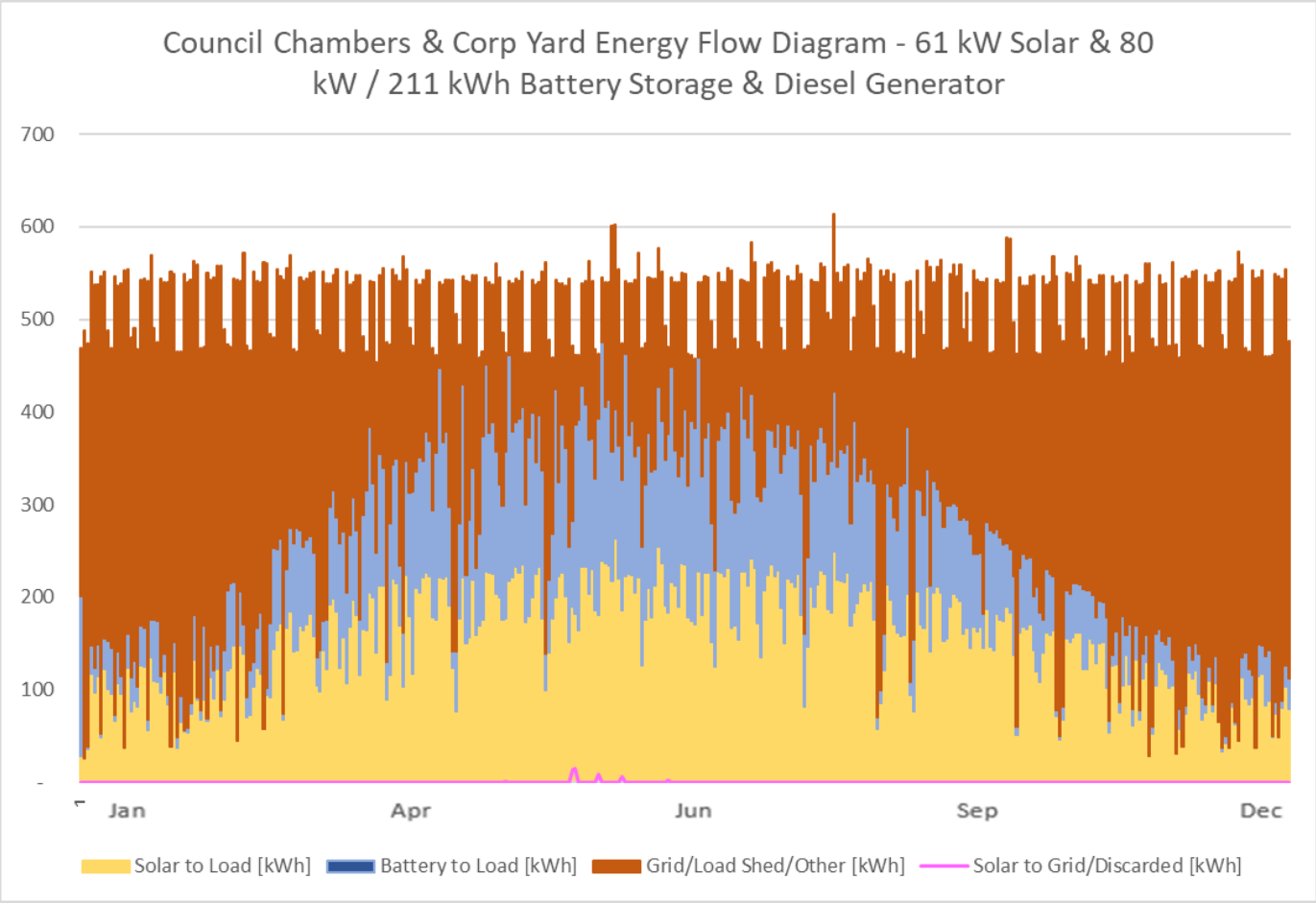
# Sizing results of recommended scenario: Solar + Battery Storage + Diesel Generator

| Solar + Battery Storage + Diesel Generator Sizing | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Site | Peak Demand (kW) | Solar Sizing | | Battery Storage Sizing | | Diesel Generator Sizing | | | Indefinite Resilience | |
| | | System Size (kW) | Percentage of Net Zero Energy | Power Capacity (kW) | Energy Capacity (kWh) | Capacity Rating (kW) | Minimum Fuel Tank Size (gal) | Gallons Needed to Meet Resilience | Percentage of Baseline Load | Percentage of Master Load |
| Town Hall & Police Offices | 63 | 173 | 100% | 65 | 172 | 80 | 510 | 311 | 42% | 20% |
| Council Chamber & Corp. Yard | 79 | 61 | 46% | 80 | 211 | 100 | 350 | 213 | 100% | 13% |
| Library | 80 | 113 | 100% | 80 | 211 | 100 | 350 | 211 | 31% | 22% |
| **Totals & Averages** | **74** | **348** | **82%** | **225** | **594** | **280** | **1,210** | **735** | **58%** | **18%** |

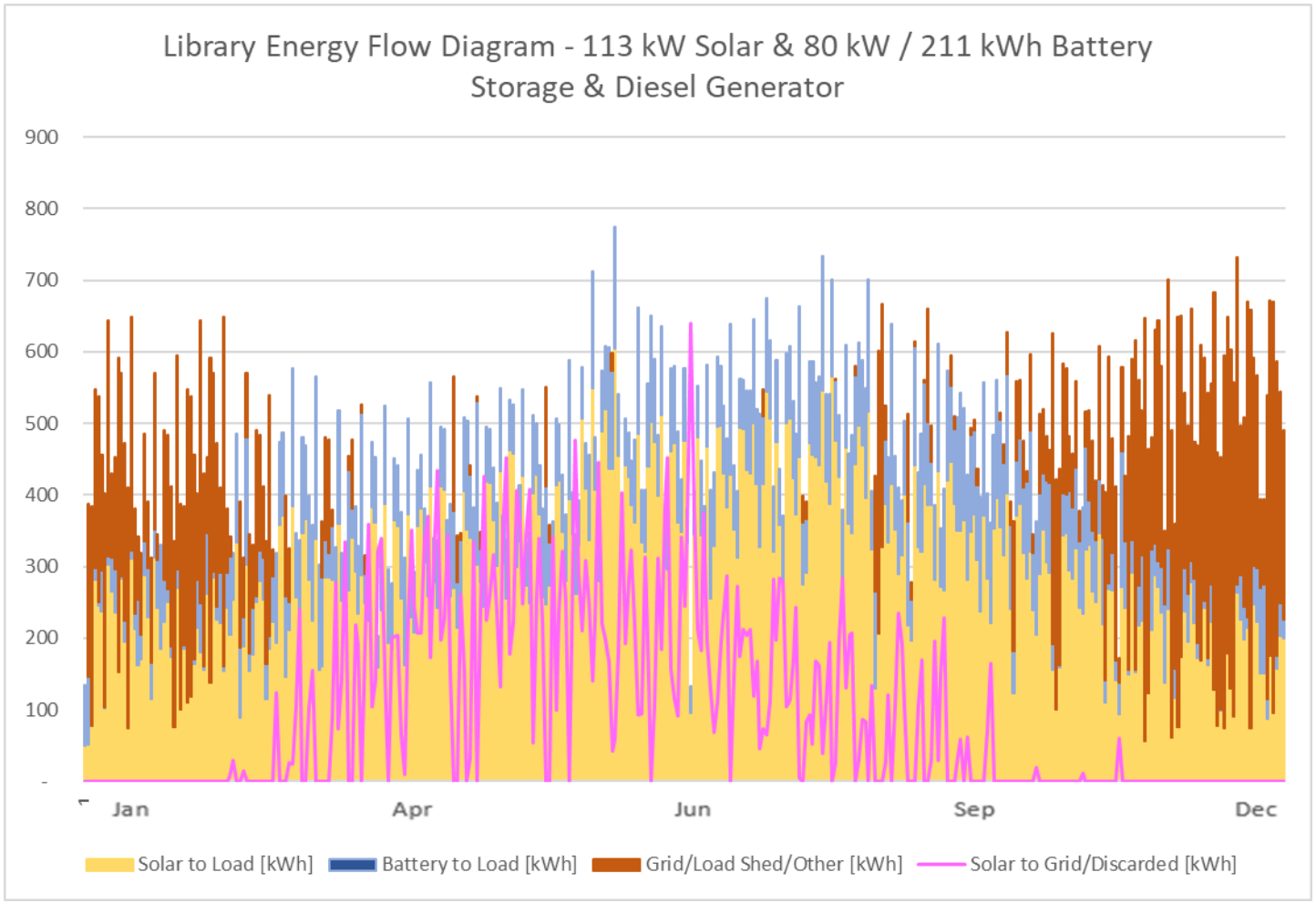

# Town Hall & Police Offices Solar + Storage + Diesel Generator energy flow diagram



# Council Chambers & Corp Yard Solar + Battery Storage + Diesel Generator energy flow diagram



# Library Solar + Storage + Diesel Generator energy flow diagram



# Economic results: Solar + Battery Storage + Diesel Generator

| Solar + Battery Storage + Diesel Generator Economic Analysis Results, 25 Years | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Electrical Bill Savings | Finance Option A Cash Purchase | | | | | Finance Option B $0.40/kWh PPA | | |
| | | Total Capex | Total 25 Year Opex | 30% ITC Direct Pay | Total Cost | 25 Year Net Savings | 25 Year PPA Cost | 25 Year Net Savings | Savings Year 1 |
| Town Hall & Police Offices | $2,275,810 | ($1,234,753) | ($237,724) | $305,967 | ($1,166,510) | $1,109,300 | ($2,503,411) | ($227,601) | ($53,655) |
| Council Chamber & Corp. Yard | $1,181,890 | ($787,813) | ($233,678) | $176,140 | ($845,351) | $336,539 | ($875,343) | $306,547 | ($8,975) |
| Library | $1,887,452 | ($1,048,806) | ($242,055) | $245,068 | ($1,045,793) | $841,659 | ($1,671,010) | $216,442 | ($27,206) |
| **Totals** | **$5,345,152** | **($3,071,372)** | **($713,457)** | $727,175 | **($3,057,654)** | **$2,287,498** | **($5,049,764)** | **$295,388** | **($89,836)** |

A single PPA price for all three sites would be solicited from PPA providers during the RFP process, similar to how we have presented the PPA price above. This PPA price may appear high for the larger sites and low for the smaller sites.

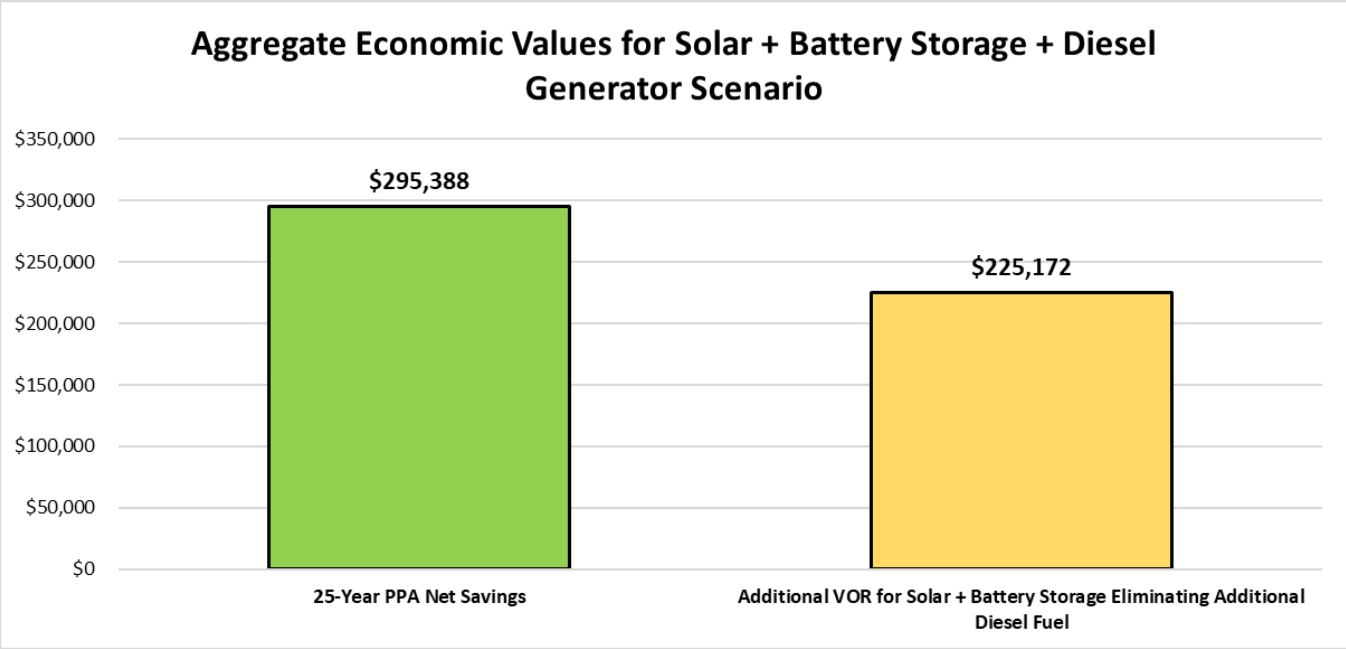

# Value of Resilience (VOR): avoided diesel tanks and fuel costs due to onsite solar + battery storage

With this VOR calculation, the Town of Moraga would receive an additional value per site in the table below, equating to a total additional value across the sites of $ $225,172 over the 25 years.

**Town of Moraga - Value of Resilience (VOR) Avoided Diesel Tanks and Fuel Costs**

| Site | Load Profile | Annual Load [kWh] | 30-day highest load [kWh] | Indef % load supported from solar + storage | 30-day TCLR (indef %) [kWh] | 30-day full load diesel fuel required [gal] | Genset rating [kW] | 30-day TCLR (indef %) fuel required [gal] | 30-day TCLR (indef %) tank size [gal] | Add'l tank purchase price [$] | Add'l tank install cost [$] | Maintenance [$/yr] | 30-day TCLR (indef %) fuel cost [$] | 25 yr total VOR [$] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Town Hall + Police Station | Master | 260,640 | 23,204 | 20% | 4,641 | 1,928 | 80 | 386 | 500 | $ 5,065 | $ 5,065 | $ 600 | $ 2,700 | $ 92,626 |
| Corp Yard | Master | 191,535 | 16,072 | 13% | 2,089 | 1,336 | 100 | 174 | 250 | $ 3,612 | $ 3,612 | $ 600 | $ 1,216 | $ 52,612 |
| Library | Master | 175,473 | 17,128 | 22% | 3,768 | 1,423 | 100 | 313 | 500 | $ 5,065 | $ 5,065 | $ 600 | $ 2,192 | $ 79,934 |
| Totals and Averages | - | 627,648 | 56,404 | 18% | 10,498 | 4,688 | 280 | 873 | 1,250 | $13,742 | $13,742 | $1,800 | $6,108 | $225,172 |

# Economic value: Solar + Battery Storage + Diesel Generator




Note: additional potential values from EV charging and energy storage services to utilities

| Solar + Battery Storage + Diesel Generator Aggregate Economic Values | | | |
|---|---|---|---|
| **Site** | **PPA Savings Year 1** | **25-Year PPA Net Savings** | **Additional VOR for Solar + Battery Storage Eliminating Additional Diesel Fuel** |
| Town Hall and Police Offices | ($53,655) | ($227,601) | $92,626 |
| Council Chamber & Corp. Yard | ($8,975) | $306,547 | $52,612 |
| Library | ($27,206) | $216,442 | $79,934 |
| Total | ($89,836) | $295,388 | $225,172 |

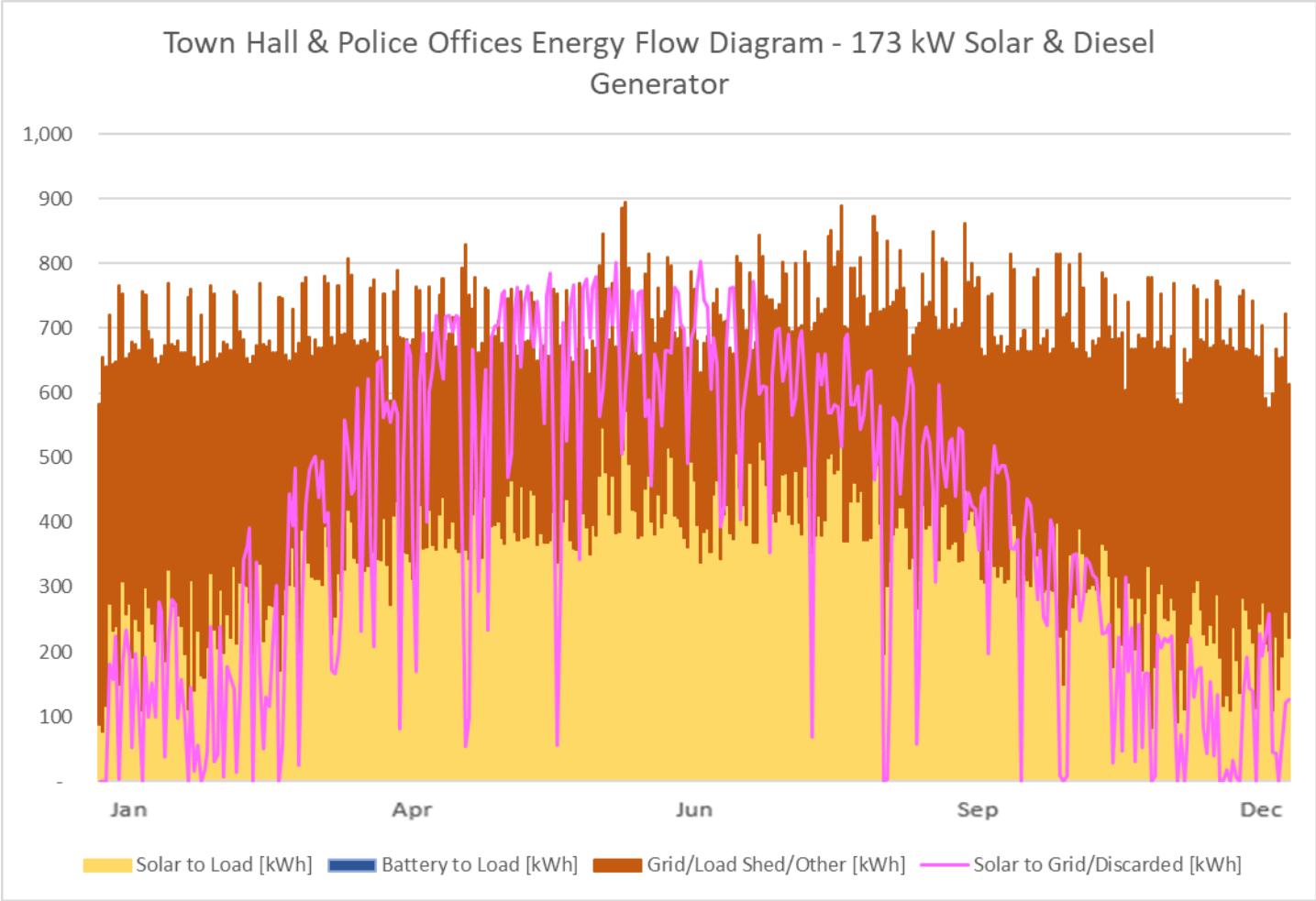
# Solar + Diesel Generator

# Sizing results: Solar + Diesel Generator

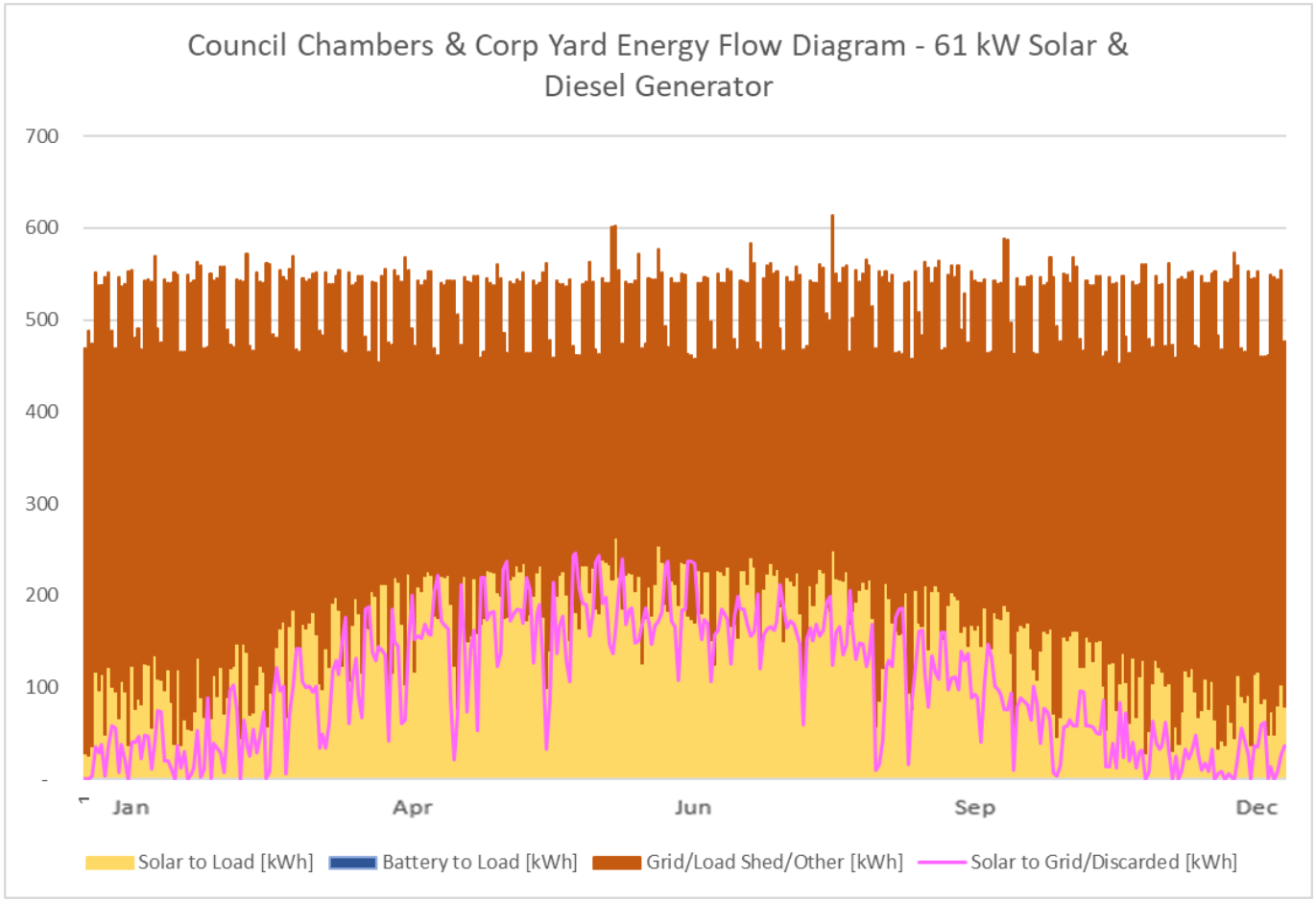
| Solar + Diesel Generator Sizing | | | | | | |
|---|---|---|---|---|---|---|
| Site | Peak Demand (kW) | Solar Sizing | | Diesel Generator Sizing | | |
| | | System Size (kW) | Percentage of Net Zero Energy | Capacity Rating (kW) | Minimum Fuel Tank Size (gal) | Gallons Needed to Meet Resilience |
| Town Hall & Police Offices | 63 | 173 | 100% | 80 | 510 | 388 |
| Council Chamber & Corp. Yard | 79 | 61 | 46% | 100 | 350 | 238 |
| Library | 80 | 113 | 100% | 100 | 350 | 233 |
| **Total** | **74** | **348** | **82%** | **280** | **1,210** | **859** |

An extra 144 gallons of diesel fuel will be needed to meet the resilience requirements when compared to the Solar + Storage + Diesel Generator scenario

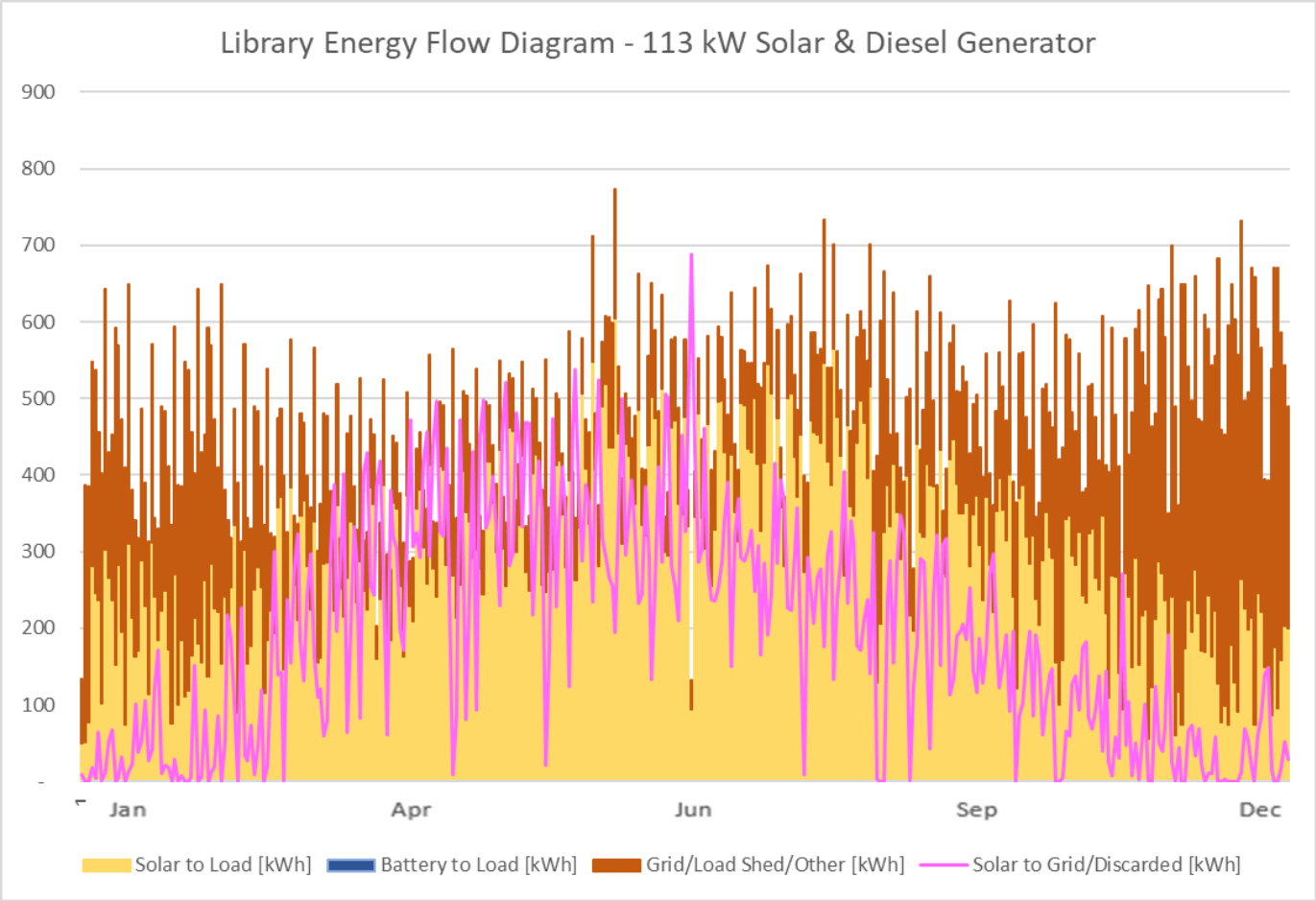

# Town Hall & Police Offices Solar + Diesel Generator energy flow diagram



# Council Chambers & Corp Yard Solar + Diesel Generator energy flow diagram



# Library Solar + Diesel Generator energy flow diagram

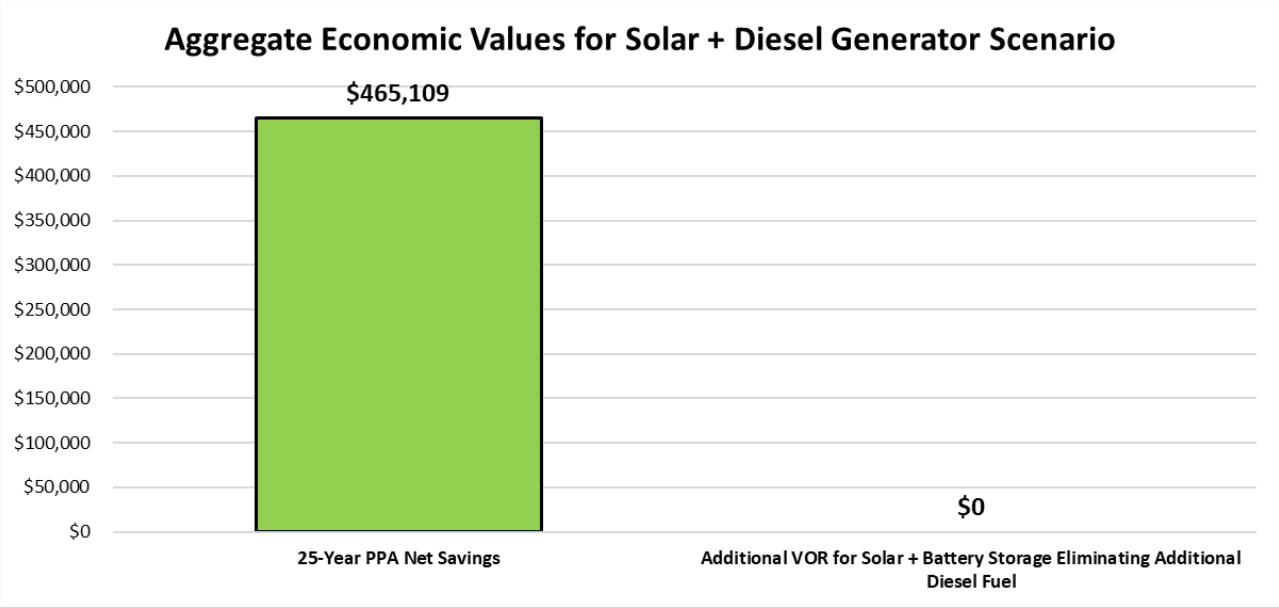


# Economic results: Solar + Diesel Generator

| Solar + Diesel Generator Economic Analysis Results, 25 Years | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | 25 Year Electrical Bill Savings | Finance Option A Cash Purchase | | | | | Finance Option B $0.28/kWh PPA | | |
| | | Total Capex | Total 25 Year Opex | 30% ITC Direct Pay | Total Cost | 25 Year Net Savings | 25 Year PPA Cost | 25 Year Net Savings | Savings Year 1 |
| Town Hall & Police Offices | $1,818,041 | ($977,353) | ($146,334) | $228,747 | ($894,940) | $923,101 | ($1,752,388) | $65,653 | ($33,505) |
| Council Chamber & Corp. Yard | $689,948 | ($471,013) | ($121,198) | $81,100 | ($511,111) | $178,837 | ($612,740) | $77,208 | ($10,490) |
| Library | $1,491,955 | ($732,006) | ($129,575) | $150,028 | ($711,553) | $780,402 | ($1,169,707) | $322,248 | ($16,075) |
| **Total** | **$3,999,944** | **($2,180,372)** | **($397,107)** | $459,875 | **($2,117,604)** | **$1,882,340** | **($3,534,835)** | **$465,109** | **($60,070)** |

A single PPA price for all three sites would be solicited from PPA providers during the RFP process, similar to how we have presented the PPA price above. This PPA price may appear high for the larger sites and low for the smaller sites.


# Economic value: Solar + Diesel Generator




Note: additional potential values from EV charging and energy storage services to utilities

| Solar + Diesel Generator Aggregate Economic Values | | | |
|---|---|---|---|
| **Site** | **PPA Savings Year 1** | **25-Year PPA Net Savings** | **Additional VOR for Solar + Battery Storage Eliminating Additional Diesel Fuel** |
| Town Hall and Police Offices | ($33,505) | $65,653 | $0 |
| Council Chamber & Corp. Yard | ($10,490) | $77,208 | $0 |
| Library | ($16,075) | $322,248 | $0 |
| Total | ($60,070) | $465,109 | $0 |

# Diesel Generator

# Sizing results: Diesel Generator

| Diesel Generator Sizing | | | | |
|---|---|---|---|---|
| Site | Peak Demand (kW) | Diesel Generator Sizing | | |
| | | Capacity Rating (kW) | Minimum Fuel Tank Size (gal) | Gallons Needed to Meet Resilience |
| Town Hall & Police Offices | 63 | 80 | 510 | 388 |
| Council Chamber & Corp. Yard | 79 | 100 | 350 | 238 |
| Library | 80 | 100 | 350 | 233 |
| **Total** | **74** | **280** | **1,210** | **859** |


# Diesel Generator Costs

| Diesel Generator Equipment, Design, Permitting, Installation, and Main Panel Upgrade Costs | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Sizing | | Costs | | | | | | Total Cost |
| | Generator Size (kW) | ATS Rating (Amps) | Generator and Fuel Tank | Add Level 2 Sound Enclosure | Service Entrance Grade ATS | Tax and Shipping | Estimated Base Design, Permitting, and Installation Cost | Additional Cost to Replace or Upgrade Main Electrical Distribution Panel | Total Project Cost W/O PG&E Costs |
| Town Hall And Police Offices | 80 | 800 | $40,373 | $4,037 | $16,000 | $6,041 | $119,612 | $28,800 | $214,864 |
| Council Chamber & Corp. Yard | 100 | 400 | $45,405 | $4,541 | $9,600 | $5,955 | $117,900 | $17,280 | $200,680 |
| Library | 100 | 800 | $45,405 | $4,541 | $16,000 | $6,595 | $130,572 | $28,800 | $231,912 |
| Totals | 280 | 2,000 | $131,183 | $13,118 | $41,600 | $18,590 | $368,085 | $74,880 | $647,456 |

# Economic results: Diesel Generator

| Diesel Generator - Economic Analysis Results, 25 Years | | | |
|---|---|---|---|
| Site | Finance Option A Cash Purchase | | |
| | Total Capex | Total 25 Year Opex | Total 25 Year Cost |
| Town Hall & Police Offices | ($214,864) | ($83,279) | ($298,143) |
| Council Chamber & Corp. Yard | ($200,680) | ($83,279) | ($283,959) |
| Library | ($231,912) | ($83,279) | ($315,191) |
| **Total** | **($647,456)** | **($249,836)** | **($897,292)** |


# Recommendation Rankings

(Town Hall & Police Offices, Council Chambers & Corp. Yard, & Library),

Solar + Battery Storage + Diesel Generator

- Total 25-Year value: $520,560
  - 25-Year Net Bill Savings: $295,388
  - Value of Resilience: $225,172 (avoided diesel-related costs)
- Indefinite Resilience for a percentage of the load
- Continued operation without the need of diesel fuel

Solar + Diesel Generator

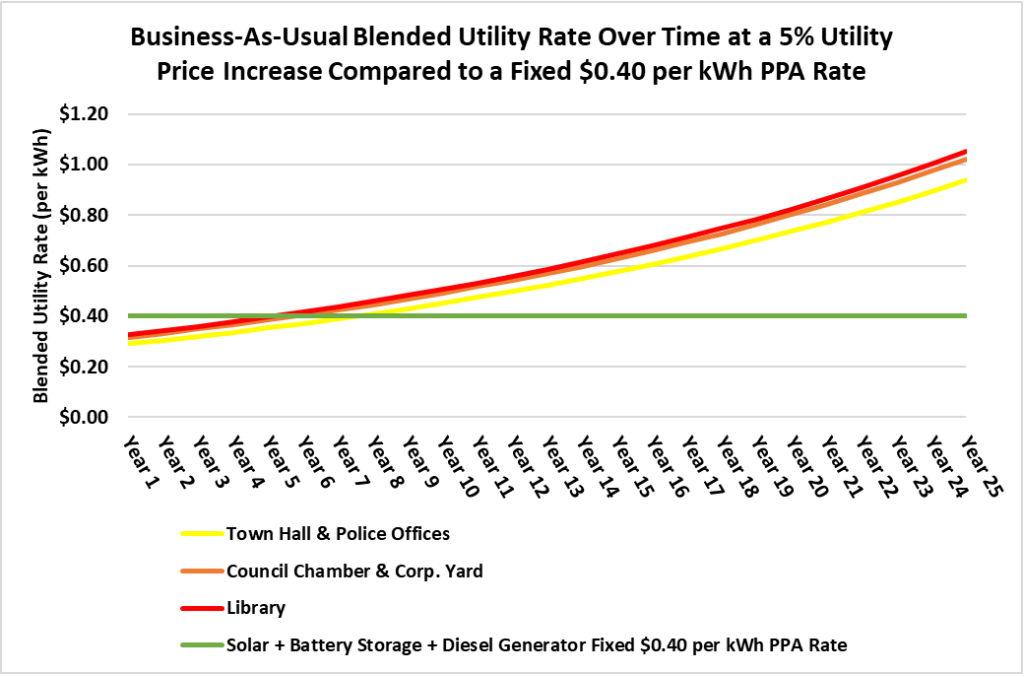
- Total 25-Year value : $465,109
  - 25-Year Net Bill Savings: $465,109
  - Value of Resilience: $0
- During a grid outage the solar will turn off
- If onsite diesel fuel cannot be resupplied all sites will be lights out

Diesel Generator

- 25-Year Total Cost: $897,292 (this is the cost of achieving resilience requirements)
- If onsite diesel fuel cannot be resupplied all sites will be lights out

# Economic details

| Moraga PPA Economic Details | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Scenario Options | Site | Business-As-Usual Blended Utility Rate Over Time at a 5% Utility Price Increase (per kWh) | | | Fixed PPA Pricing (per kWh) | PPA Economic Details | | | |
| | | Year 1 | Year 10 | Year 25 | | 25 Year Electrical Bill Savings | 25 Year PPA Cost | 25 Year Net Savings | Value of Resilience (VOR) |
| Solar + Battery Storage + Diesel Generator | Town Hall & Police Offices | $0.291 | $0.451 | $0.939 | $0.40 | $2,275,810 | ($2,503,411) | ($227,601) | $92,626 |
| | Council Chamber & Corp. Yard | $0.317 | $0.492 | $1.022 | $0.40 | $1,181,890 | ($875,343) | $306,547 | $52,612 |
| | Library | $0.326 | $0.506 | $1.051 | $0.40 | $1,887,452 | ($1,671,010) | $216,442 | $79,934 |
| | **Total and Averages** | **$0.311** | **$0.483** | **$1.004** | **$0.40** | **$5,345,152** | **($5,049,764)** | **$295,388** | **$225,172** |
| Solar + Diesel Generator | Town Hall & Police Offices | $0.291 | $0.451 | $0.939 | $0.40 | $1,818,041 | ($1,752,388) | $65,653 | $0 |
| | Council Chamber & Corp. Yard | $0.317 | $0.492 | $1.022 | $0.40 | $689,948 | ($612,740) | $77,208 | $0 |
| | Library | $0.326 | $0.506 | $1.051 | $0.40 | $1,491,955 | ($1,169,707) | $322,248 | $0 |
| | **Total and Averages** | **$0.311** | **$0.483** | **$1.004** | **$0.40** | **$3,999,944** | **($3,534,835)** | **$465,109** | **$0** |




| Diesel Generator - Economic Analysis Results, 25 Years | | | |
|---|---|---|---|
| Site | Finance Option A Cash Purchase | | |
| | Total Capex | Total 25 Year Opex | Total 25 Year Cost |
| Town Hall & Police Offices | ($214,864) | ($83,279) | ($298,143) |
| Council Chamber & Corp. Yard | ($200,680) | ($83,279) | ($283,959) |
| Library | ($231,912) | ($83,279) | ($315,191) |
| **Total** | **($647,456)** | **($249,836)** | **($897,292)** |

# Energy resource scenario benefits

| Benefits | Solar + Storage + Diesel Generator PPA | Solar + Storage + Diesel Generator Cash Purchase | Solar + Diesel Generator PPA | Solar + Diesel Generator Cash Purchase | Diesel Generator Only Cash Purchase | Business-as-usual |
|---|---|---|---|---|---|---|
| **Economic** | | | | | | |
| Direct economic value | X | **X** | X | X | | |
| Local economic stimulation | **X** | **X** | X | X | | |
| No burden Moraga capex & opex | X | | X | | | |
| **Environmental** | | | | | | |
| 100% Renewables | X | X | X | X | X | X |
| Efficiency (no transmission losses) | **X** | **X** | X | X | | |
| Preservation of Habitat | **X** | **X** | X | X | | |
| **Resilience** | | | | | | |
| Indefinite energy supply | **X** | **X** | | | | |
| Self-reliance | **X** | **X** | | | | |
| **Grid Citizenship** | | | | | | |
| Dispatchable load profile | **X** | **X** | | | | |
| Grid services opportunities (Demand Response) | **X** | **X** | | | | |
| **Operational** | | | | | | |
| Low Moraga burden O&M | **X** | | **X** | | | |

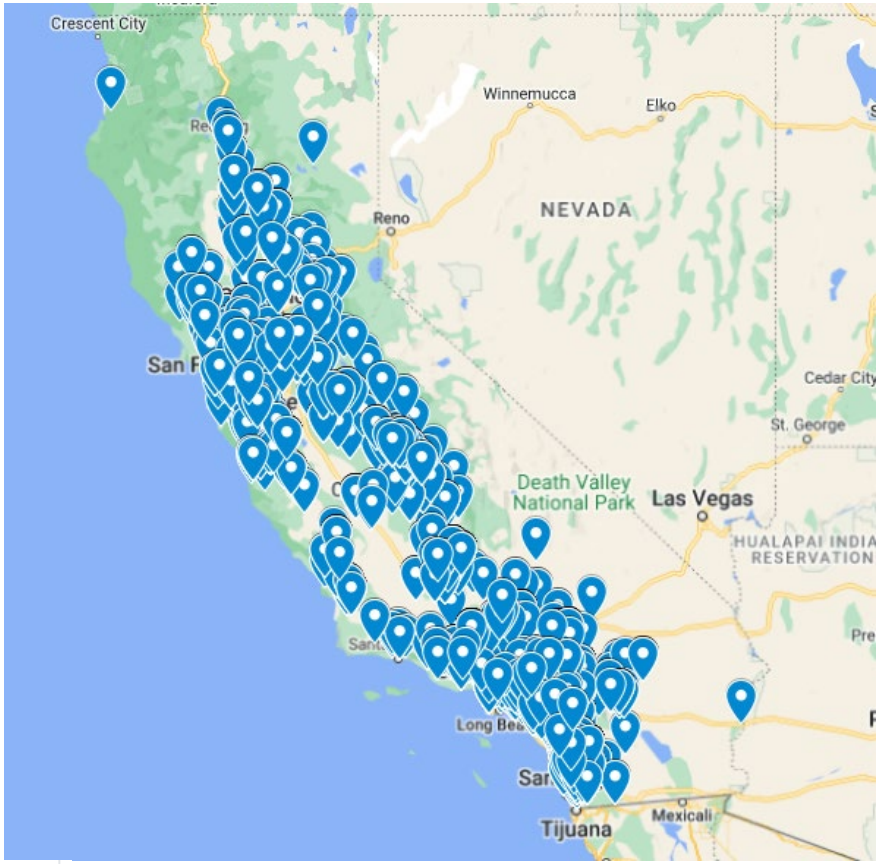
Solar + Storage + Diesel Generator is recommended

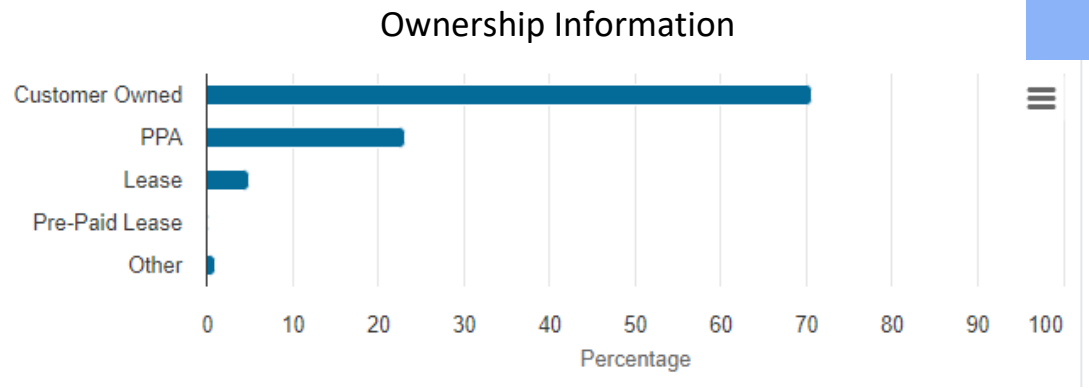
# Solar Microgrid & Solar PPA examples

# Distributed Energy Project PPAs are abundant throughout California

There are over **310,000 Distributed Solar, Battery Storage, and Hydrogen PPAs** in California.

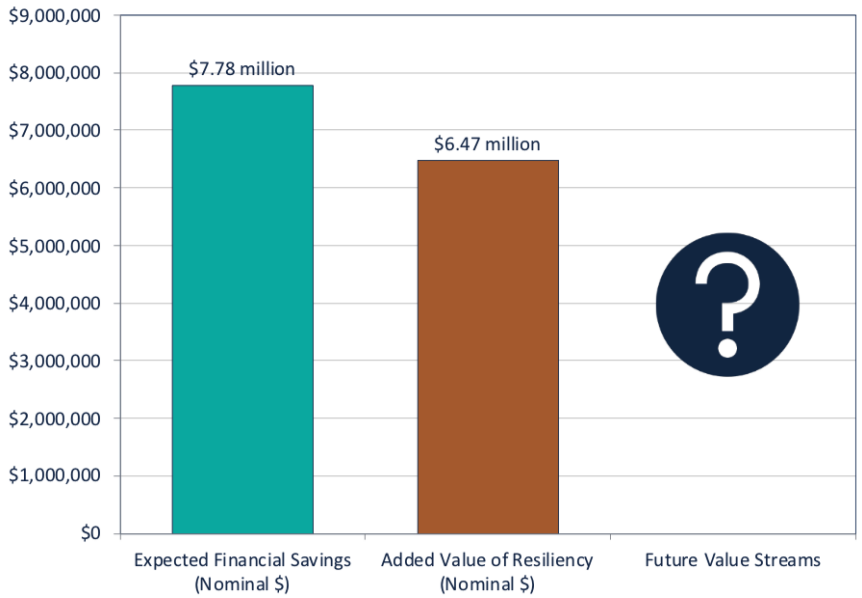
PPA's are the second most common financing method, behind customer ownership.




[California Distributed Generation Statistics]

# Santa Barbara Unified School Districts




- Santa Barbara Unified School District Solar Microgrids
  - On 12 January, the SBUSD Board voted unanimously on a contract with Engie Systems for Solar Microgrids at six school sites and standalone solar at another eight sites. Engie will build, own, and operate the systems under a 28-year power purchase agreement (PPA), and the District will reap massive benefits in guaranteed bill savings from the deployments, while enjoying an almost equivalent amount of free resilience value from the Solar Microgrids.
  - System details
    - 4,152 kWdc Solar
    - 1,896 kW / 3,791 kWh Battery Storage

# City of Goleta

- City of Goleta Monarch 1 Solar Project
  - The Monarch 1 Solar project will generate 210 kw of solar power, which will power nearly 100% of City Hall's energy usage with clean, renewable energy produced on-site. Monarch 1 is wired to be micro-grid ready and includes pre-wiring for six electric vehicle charging stations to be installed in the future. Anticipated savings for the City over the 25-year lifespan of the project are estimated to be more than $270,000.

# Montecito School District

- Montecito School District Solar
  - Looking to create an immersive indoor and outdoor environment for students to experience and explore STEAM activities, the Montecito Union School District (USD) partnered with Ameresco to design and install a Nature Lab “Collaboratory.” The solar installation will generate more than 300,000 kWh per year, creating an environmentally sustainable learning space while exposing the many benefits of renewable energy to the next generation.