SOLAR FEASIBILITY STUDY

Prepared for:
Moraga School District

Prepared by:
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San Francisco, CA

1. INTRODUCTION

Purpose of this Report

ARC Alternatives was hired by the Moraga Elementary School District to develop a Strategic Energy Plan (SEP) and analyze opportunities to reduce electric costs with solar.

This report contains the feasibility results of our analysis of solar opportunities.

Specifically, this report presents the following:

- Detailed site assessment outlining the required solar system sizes and all potential locations for solar at each site.
- Financial analysis for the implementation of solar throughout the District using a PPA financing structure.

SOLAR SYSTEM SIZING AND SITE LAYOUTS

Solar Sizing Analysis

ARC Alternatives performed a site visits at each of the Moraga Elementary School District schools and identified areas suitable for solar. Areas that can accommodate shade structure systems, roof mounted systems, and ground mounted systems were all considered. Sufficient area for appropriately size solar arrays were found at each site. A summary of the capacities identified of each system type is below. A detailed site assessment is included on the following slides for each site.

The ideal solar system size for each site targets an annual electrical output of roughly 80% of the load. ARC Alternatives developed a conceptual system for each site to include all of the areas identified. Using the industry standard tool HelioScope, we modeled projected system output, considering appropriate de-rate factors (such as soiling and line losses) and expected performance degradation. HelioScope provides a great deal of flexibility and accuracy by enabling us to model system designs with specific equipment, configurations, and condition sets (e.g., weather files, shading, soiling, etc.).

Necessary Capacity	
Approx. Required Size (4 sites)	**297 kW**
Identified Capacity	
Shade Structure	431 kW
Roof Mount	38 kW
Ground Mount	221 kW
Total	**690 kW**

Camino Pablo Elementary School

Site Usage Summary	
Current Baseline (kWh/year)	171,092
Anticipated Prop 39 Savings (kWh)*	38,299 (22%)
Post-Prop 39 Consumption (kWh/year)	132,973
Solar Production Target (80% Post Prop 39)	106,378

*Assumes implementation of recommended projects per expenditure plan

Necessary Capacity	
Approx. Ideal Size	67 kW
Available Capacity	
Shade Structure	56 kW
Roof Mount	38 kW
Ground Mount	0 kW

Both shade structure (SS) and and roof mount (RM) systems were identified at Camino Pablo Elementary. The approximate ideal size is slightly larger than either of the two system areas on their own, so a combination of the two areas would likely be necessary. Alternatively, higher efficiency solar panels, if specified, may be able to meet the target with just one of the systems.

Donald L. Rheem Elementary School

Site Usage Summary	
Current Baseline (kWh/year)	163,923
Anticipated Prop 39 Savings (kWh)*	34,479 (21%)
Post-Prop 39 Consumption (kWh/year)	129,453
Solar Production Target (80% Post Prop 39)	103,562

*Assumes implementation of recommended projects per expenditure plan

Necessary Capacity	
Approx. Ideal Size	65 kW
Available Capacity	
Shade Structure	218 kW
Roof Mount	0 kW
Ground Mount	0 kW

Two shade structure (SS) locations were identified at Donald Rheem Elementary. Both of the shade structures boarder the play field and would provide shade for play break times or for spectators at the field. The identified size for this site is much smaller than the available areas and would only require a portion of one the locations.

Los Perales Elementary School

Site Usage Summary	
Current Baseline (kWh/year)	182,795
Anticipated Prop 39 Savings (kWh)*	47,690 (26%)
Post-Prop 39 Consumption (kWh/year)	135,105
Solar Production Target (80% Post Prop 39)	108,084

*Assumes implementation of recommended projects per expenditure plan

Necessary Capacity	
Approx. Ideal Size	66 kW
Available Capacity	
Shade Structure	0 kW
Roof Mount	0 kW
Ground Mount	221 kW

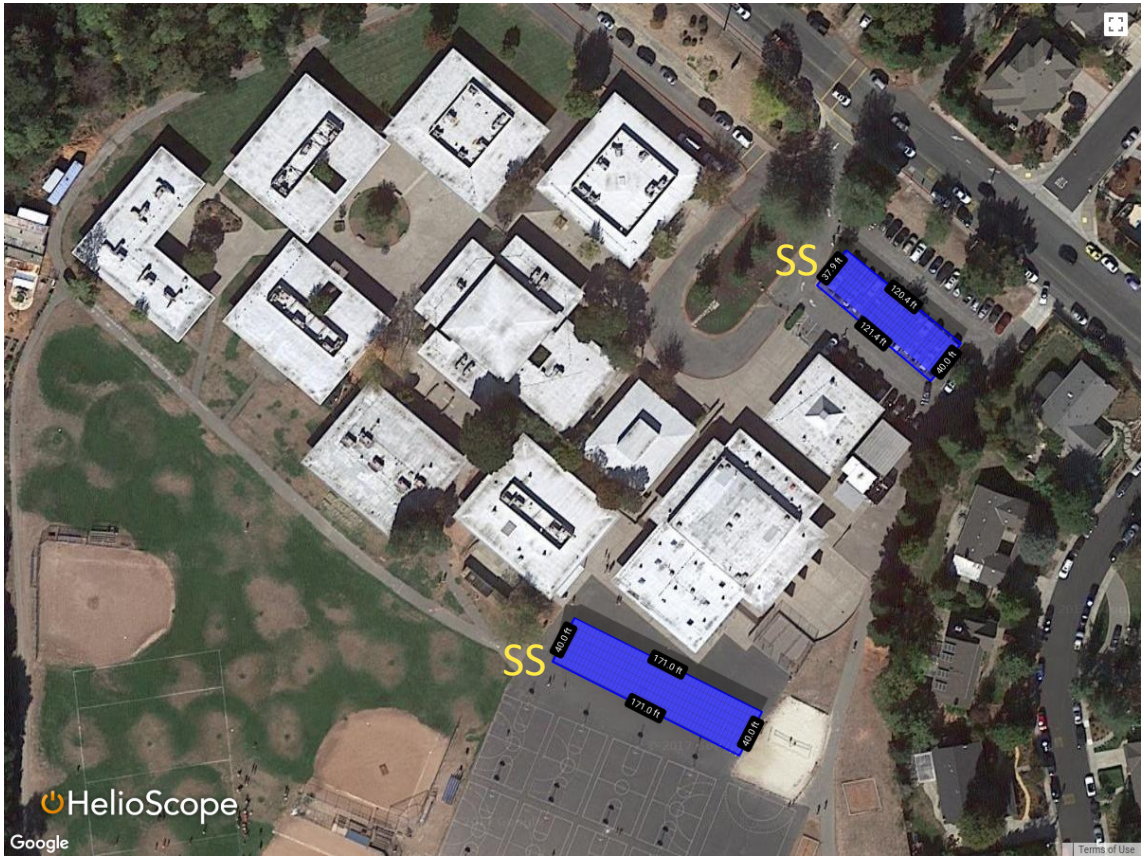
A large ground mount (GM) area was identified at Los Perales Elementary. The playfields, parking and roof surfaces at this site were not suitable for shade structures nor roof tops. The needed capacity is roughly a quarter of the size of the identified capacity on the site map. The District could place the system within that area to best suit its needs.

Joaquin Moraga Intermediate School

Site Usage Summary	
Current Baseline (kWh/year)	255,021
Anticipated Prop 39 Savings (kWh)*	56,644 (22%)
Post-Prop 39 Consumption (kWh/year)	198,377
Solar Production Target (80% Post Prop 39)	158,701

*Assumes implementation of recommended projects per expenditure plan

Necessary Capacity	
Approx. Ideal Size	98 kW
Available Capacity	
Shade Structure	157 kW
Roof Mount	0 kW
Ground Mount	0 kW



Two shade structure (SS) locations were identified at Joaquin Moraga Intermediate. The southern most shade structure is roughly equal to the ideal size and is recommended as the primary location to minimize construction costs. However, if shade for the parking area is a priority for the District, the Northern area can be incorporated with roughly half of the Southern area to reach the ideal capacity.

FINANCIAL ANALYSIS

Tariff and Production Compensation Options

Relevant Tariffs (rate schedules)

The majority of benefits generated by a solar PV system are from achieving utility bill savings. In order to maximize bill savings, the District must take advantage of the best combination of tariff and utility program under which the system will be connect to the grid.

In PG&E service territory, the best tariff for most commercial and government customers is the A-6 tariff. This is often refereed to as a "solar friendly" tariff because it consists almost entirely of energy charges (kWh) and has zero demand charges (kW). Additionally, the energy charges in the A-6 tariff are based on Time of Use (TOU), with energy costing a great deal more during the peak than in off-peak periods. This works extremely well for solar because solar PV peak production aligns with the peak period in PG&E's tariff.

Each system in this study is sized to take advantage of the A-6 tariff and no other tariffs were considered in the analysis.

Production Compensation Options

Net Energy Metering (NEM) –The NEM program allows customers to receive financial credit for electricity that is fed into the grid. These credits are used to offset the customer's electricity bill. Under this program, there is an annual true-up when the utility and the customer settle all outstanding credits and payments. Exported and purchased electricity is valued based on the time of use specified in the Option-R tariff. NEM is limited to systems up to 5 MW in size for local governments. The customer retains ownership of the Renewable Energy Credits (RECs).

Net Energy Metering-Aggregation (NEM-A) – This program is similar to RES-BCT, except financial credits can be applied to other meters on the same or adjacent properties at the full retail electricity rate. NEM-A is extremely useful at large sites with multiple meters.

Renewable Energy Self-Generation-Bill Credit Transfer (RES-BCT) – This program allows a solar system to offset use at a meter, then all excess energy is credited to other accounts owned by same public agency. However, credit is only given for the generation component of the utility rate (approximately half the retail rate), so the economics are inferior to NEM systems.

Pending Time of Use Period Changes

PG&E is currently going through the process of changing the time of use bins for all of their tariffs. If accepted, the changes would be the first changes to the time of use definitions in several decades. The proposed changes represent a significant departure from the status-quo. Currently the peak-period (typically most expensive) runs from 12pm-5pm weekdays during the summer. PG&E is proposing to change the peak period to run from 5pm-9pm. This shift reduces the value of solar generation and has a negative impact on overall solar financial performance. The PG&E proposal is being reviewed by the CPUC and is receiving push-back from the energy-efficiency and solar industries and will likely be revised to a less dramatic shift. As the final outcome of PG&E's proposal is unknown, **this report assumes PG&E's proposed changes are implemented. This represents a "worst-case" scenario and therefore a conservative analysis.**

Assumptions Used in Economic Analysis

Key assumptions used in the analysis are shown in the tables below. Only PPA financing is assumed for the projects. All project management and project overhead costs are assumed to financed through the PPA rate. Additionally, with the structure of a PPA the ongoing maintenance costs and any performance guarantees are also included in the PPA rate. We regularly see PPA rates proposed with 0% future-year escalation rates and this is what is assumed in our analysis. An escalating PPA rate can be introduced into the analysis to lower project costs in the early years if that is desired.

Perhaps the most important assumption in the analysis is the rate of utility cost escalation. We use a conservative rate based on CPUC studies and our past experience with performing analysis for clients. This rate should be discussed with District staff to confirm it strikes the right balance between being conservative enough and showing an accurate picture of future expectations of the financial performance of the system.

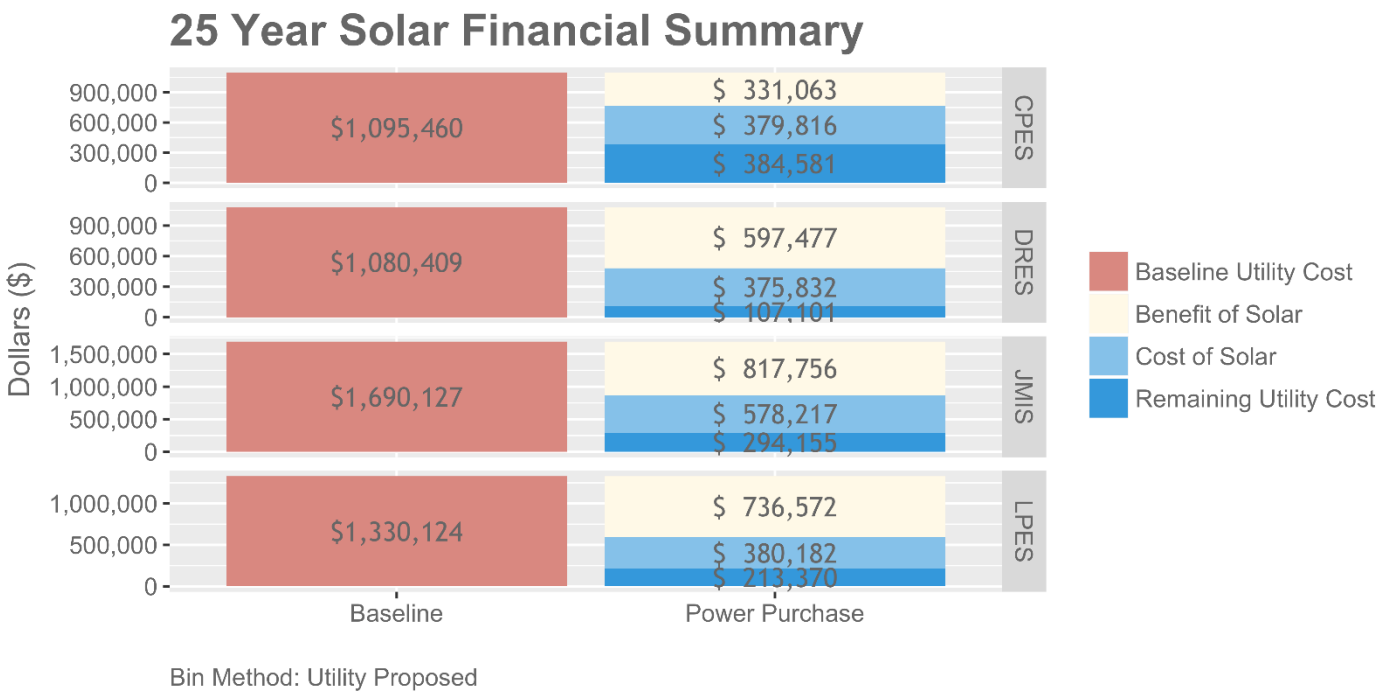
General Assumptions		PPA Assumptions	
Project Life	25	PPA Rate	$0.149/kWh
Utility Escalation Rate	3.0%	PPA Escalation Rate	0%
Solar Production Degradation Rate	0.5%	Project Management Costs	Included in rate
Over-generation Credit	$0.05/kWh	O&M Costs	Included in rate
Non-Bypassable Rate	$0.02/kWh	Performance Guarantee Costs	Included in rate

Site-by-Site Financial Analysis Results

The figure below shows the cumulative 25 year results of the solar financial analysis for each site considered in this study. The pre-solar "Baseline" costs are shown in red. The post-solar "Power Purchase" costs and benefit are shown in blue and yellow, respectively. The post-solar costs are broken into remaining utility costs and the cost associated with the PPA. The benefit of solar (e.g., savings) is shown in yellow stacked above the post-solar costs. Sites are abbreviated on the right side of the figure as follows:

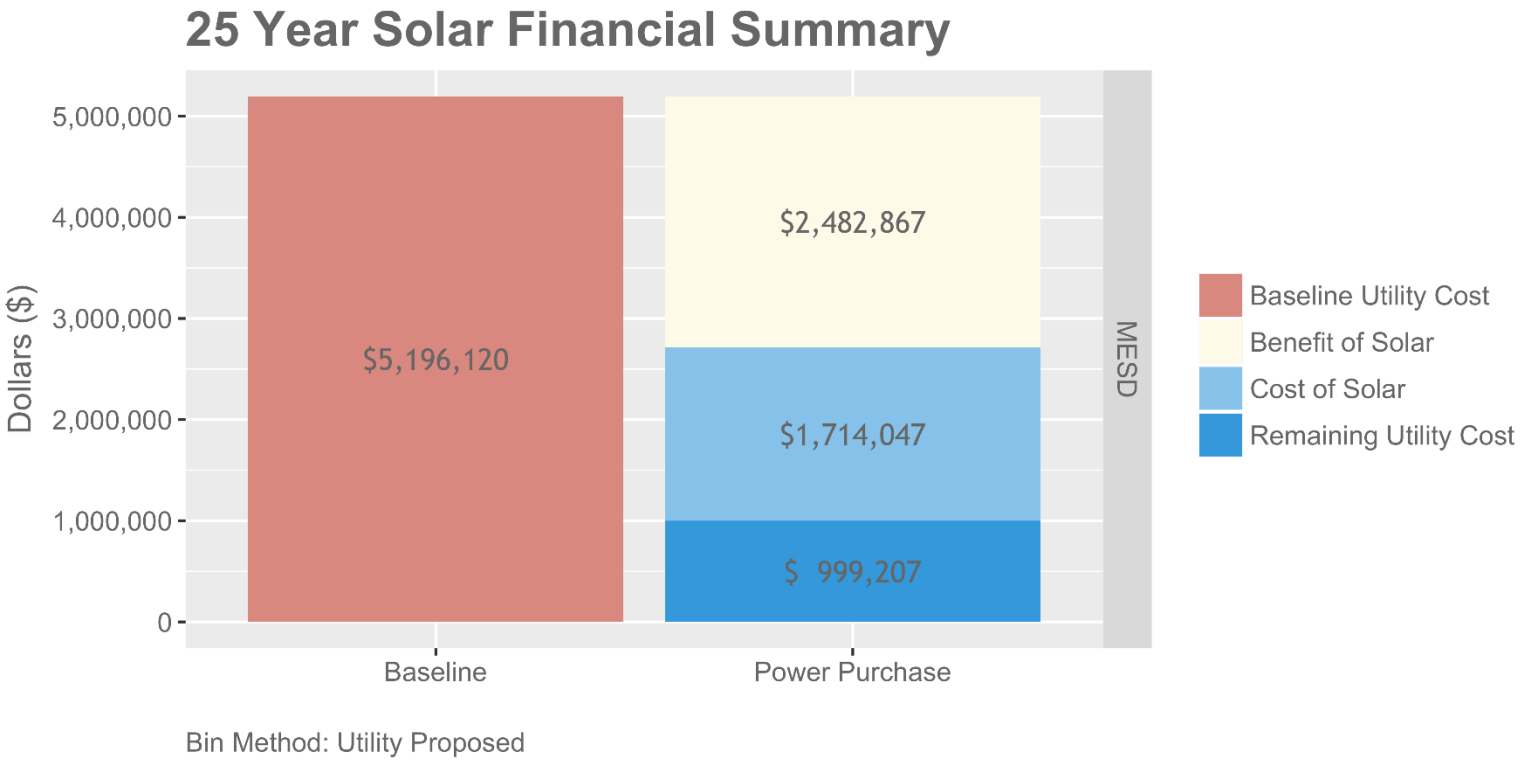
- Camino Pablo Elementary School: CPES
- Donald L. Rheem Elementary School: DRES
- Joaquin Moraga Intermediate School: JMIS
- Los Perales Elementary School: LPES

The analysis projects the bills for the site with and without solar using PG&E's proposed new time-of-use definitions and accounts for Proposition 39 energy savings. The cumulative benefit is positive for all sites, with Joaquin Moraga being the most beneficial at $817,000.



District Wide Financial Analysis Results

The District can expect to save roughly $2.4 million over the 25 year period with the installation of solar across all four sites. Solar will reduce the District's utility bill by roughly 80% over that time. These results show that pursuing a PPA will produce electrical cost savings starting in year one of the project and return a significant total benefit of over the lifetime of the projects. The full annual cash-flow from the District-wide perspective is included on the next slide.



District-Wide Financial Analysis Cash Flow Table

Year	Solar Production	Generation Savings Rate	Self-Generation Savings	Total Cost of PPA	Annual Benefit	Cumulative Benefit
1	488,355	$0.2368	$115,629	$72,765	$42,864	$42,864
2	485,913	$0.2451	$119,091	$72,401	$46,690	$89,554
3	483,484	$0.2537	$122,652	$72,039	$50,613	$140,167
4	481,066	$0.2626	$126,314	$71,679	$54,635	$194,802
5	478,661	$0.2718	$130,081	$71,321	$58,760	$253,562
6	476,268	$0.2813	$133,954	$70,964	$62,991	$316,553
7	473,886	$0.2911	$137,939	$70,609	$67,330	$383,882
8	471,517	$0.3012	$142,037	$70,256	$71,781	$455,663
9	469,159	$0.3117	$146,251	$69,905	$76,347	$532,010
10	466,814	$0.3226	$150,586	$69,555	$81,031	$613,041
11	464,480	$0.3338	$155,045	$69,207	$85,838	$698,879
12	462,157	$0.3454	$159,631	$68,861	$90,770	$789,649
13	459,846	$0.3574	$164,349	$68,517	$95,832	$885,480
14	457,547	$0.3698	$169,201	$68,175	$101,026	$986,506
15	455,259	$0.3826	$174,192	$67,834	$106,358	$1,092,864
16	452,983	$0.3959	$179,325	$67,494	$111,831	$1,204,695
17	450,718	$0.4096	$184,606	$67,157	$117,448	$1,322,143
18	448,465	$0.4238	$190,037	$66,821	$123,216	$1,445,359
19	446,222	$0.4384	$195,624	$66,487	$129,137	$1,574,496
20	443,991	$0.4535	$201,371	$66,155	$135,217	$1,709,713
21	441,771	$0.4692	$207,283	$65,824	$141,459	$1,851,172
22	439,562	$0.4854	$213,365	$65,495	$147,870	$1,999,042
23	437,365	$0.5021	$219,620	$65,167	$154,453	$2,153,495
24	435,178	$0.5195	$226,055	$64,841	$161,214	$2,314,709
25	433,002	$0.5374	$232,675	$64,517	$168,158	$2,482,867
Total	**11,503,672**	**$0.3648**	**$4,196,914**	**$1,714,047**	**$2,482,867**	

DATA SOURCES

Data used in this Analysis is Sourced From:

Utility Data	Utility data was supplied by PG&E and covers meter read dates from January 2015 through January 2017, though not consistently for each site.
PGE Rate Structure Changes	Proposed changes to the PGE time-of-use rate structure were gathered from PG&E's General Rate Case Phase 2 fillings to the CPUC found at: http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=164885204