



Solar Master Plan



Alameda Unified
School District

Alameda Unified School District Solar Master Plan

Prepared by KyotoUSA
July 2014

The purpose of this analysis is to assess the current feasibility of solar projects in the district. It is intended to provide the district with estimates of PV systems sizes, costs, and benefits.

Contents of the Assessment

2-4 Summary:
Offsetting the Value of Electricity Consumed

5-6 Financial Analysis:
Using a General Obligation Bond and a Blended Financial Analysis

7-21 School Analysis:
Individual School Analysis of PV Potential

Technical Assumptions

Rooftop and Parking Lot Potential:

Google Earth Pro is used to estimate the area of roofs and parking lots. The **usable area percentage** is dependent on the size and location of each measured location and the potential for shadows cast by surrounding objects. It is assumed that trees casting shadows over potential PV areas will be removed. The proximity of the PV system to electric meters and streets also influences a site’s potential for PV, but these conditions have not been taken into account in this analysis.

Panel Type:

Electricity production from a solar array also depends on panel type, panel efficiency, array orientation, location, and maintenance. In this analysis, panels are assumed to have a power density of 17.7 Watts/ft².

The **yield** of a panel is the theoretical amount of electricity it can produce.

Solar Yields (kWh/kW)	
Roof Mounted	1,486.8
South Facing Carport	1,593.2
West Facing Carport	1,503.7
East Facing Carport	1,465.5

PV Installation Cost Assumptions

The price of a PV system is estimated based on the solar vendor’s cost per Watt (\$/Wp) and is dependent upon the panel type and efficiency. The “turn-key” cost in this analysis includes equipment, design, permitting, installation, labor, commissioning, and equipment guarantees.

Contracts can also include an Operations and Maintenance (O&M) option, a Performance Guarantee (PeGu) for the system’s electricity output, and an educational component.

The pricing assumes that SunPower Corporation’s high efficiency panels are used. The pricing assumes that no structural improvements or roof upgrades will be required to support the standard racking system.

Vendors now offer ballasted PV systems that sit on the roof without requiring penetrations to secure it.

Key Financial Assumptions

The purpose of the financial analysis is to estimate the value of the PV system over 20 years. The goal in designing a PV system is to “zero out” a site’s electricity costs. It is estimated that **100% of current annual consumption** will achieve this target for this district. The analysis shows three approaches for reaching this target: offsetting electricity consumption using roofs only, parking only, and a combination of the two.

The 2013 annual consumption and cost for schools indicated with a red asterisk reflects only the value of electricity consumed on the meter with the largest load.

The **avoided cost** is the value of the electricity that no longer needs to be purchased from the utility because the school is producing its electricity on site. The value of the avoided cost is assumed to be \$0.14851/kWh which is Alameda Municipal Power’s MU-1 tariff (eff. 1 July 2014), but a more rigorous analysis is necessary to determine the actual value of electricity generated at each site.

Proposition 39 will provide grants and low interest loans for energy projects, including solar. Prop 39 funding has not been taken into consideration in this analysis.

Environmental Benefits

The environmental benefits described in this analysis include **annual avoided greenhouse gas (GHG) emissions** (metric tons) and **annual renewable energy credits** earned (RECs).

RECs represent the environmental and social benefits of renewable power and have a value in addition to that of the electricity produced.

Table 1: Offsetting the Value of Electricity Consumed

Key Inputs

Avoided Cost	0.14851	\$/kWh
Offset Usage Target	100%	Schools

System Size	Cost (\$/W) December 2013
Roof (100-250 kWp)	\$4.80
Roof (250-500 kWp)	\$4.00
Roof (500-750 kWp)	\$3.80
Roof (750-1000 kWp)	\$3.60
Carport (100-250 kWp)	\$4.90
Carport (250-500 kWp)	\$4.70

Offsetting Annual Electricity Consumption	Location	Address	2013 Annual Consumption (kWh)	2013 Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
	Bay Farm Elementary	200 Aughinbaugh Way, Alameda, CA 94502	203,280	\$29,002	203,280	136
	Earhart Elementary	400 Packet Landing Rd, Alameda, CA 94502	222,000	\$31,591	222,000	151
	Edison Elementary (Meter#C1777)	2700 Buena Vista Ave, Alameda, CA 94501	75,253	\$11,002	75,253	51*
	Franklin Elementary (Meter#C0596)	1433 San Antonio Ave, Alameda, CA 94501	61,939	\$9,055	61,939	42*
	Henry Haight Elementary (Meter#C1435)	2025 Santa Clara Ave, Alameda, CA 94501	343,338	\$48,960	343,338	231*
	Lum Elementary	1801 Sandcreek Way, Alameda, CA 94501	244,080	\$34,842	244,080	165
	Maya Lin Elementary	825 Taylor Ave, Alameda, CA 94501	190,800	\$27,177	190,800	128
	Otis Elementary (Meter#C0566)	3010 Fillmore St, Alameda, CA 94501	141,994	\$20,390	141,994	96*
	Paden Elementary	444 Central Ave, Alameda, CA 94501	134,600	\$20,976	134,600	91
	Ruby Bridges Elementary	351 Jack London Ave, Alameda, CA 94501	442,560	\$62,886	442,560	291
	Lincoln Middle	1250 Fernside, Alameda, CA 94501	650,800	\$92,509	650,800	437
	Wood Middle	420 Grand St, Alameda, CA 94501	216,240	\$30,816	216,240	147
	Alameda High (Meter#C1420)	2201 Encinal Ave, Alameda, CA 94501	995,670	\$141,286	995,670	669*
	Encinal High (Meter#C1728)	210 Central Ave, Alameda, CA 94501	672,520	\$95,700	672,520	453*
	Academy of Alameda	401 Pacific Ave, Alameda, CA 94502	337,560	\$47,944	337,560	226
	Totals		4,932,634	\$704,136	4,932,634	3,312

* Calculations for these schools are based on the electricity consumption recorded at the meter with the largest load.

Woodstock Child Development Center and Island High School are excluded from our assesement because the proposed changes to these sites make it difficult to assess the facilities for PV systems.

Offsetting Electricity Consumption Using Roofs	Location	Location's Roof Profile			Financial Information		Environmental Benefits	
		Actual Roof System Size (kWp)	kWh Production	Meets Target	Estimated System Cost	Value of avoided Electricity: Year 1	Annual avoided GHGs (tons)	Annual RECs earned (mWh)
	Bay Farm Elementary	104	154,353	76%	\$498,316	\$22,923	70	154
	Earhart Elementary	101	149,932	68%	\$484,043	\$22,266	68	150
	Edison Elementary (Meter#C1777)	51	75,253	100%	\$242,948	\$11,176	34	75
	Franklin Elementary (Meter#C0596)	42	61,939	100%	\$199,991	\$9,199	28	62
	Henry Haight Elementary (Meter#C1435)	223	331,318	96%	\$1,069,774	\$49,204	150	331
	Lum Elementary	96	141,995	58%	\$458,478	\$21,088	64	142
	Maya Lin Elementary	128	190,800	100%	\$616,064	\$28,336	87	191
	Otis Elementary (Meter#C0566)	96	141,994	100%	\$458,477	\$21,088	64	142
	Paden Elementary	91	134,600	100%	\$434,602	\$19,989	61	135
	Ruby Bridges Elementary	298	442,560	100%	\$1,190,798	\$65,725	201	443
	Lincoln Middle	438	650,800	100%	\$1,751,110	\$96,650	295	651
	Wood Middle	145	216,240	100%	\$698,205	\$32,114	98	216
	Alameda High (Meter#C1420)	551	819,415	82%	\$2,094,564	\$121,691	372	819
	Encinal High (Meter#C1728)	452	672,520	100%	\$1,809,552	\$99,876	305	673
	Academy of Alameda	227	337,560	100%	\$1,089,929	\$50,131	153	338
	Totals	3,041	4,521,279		\$13,096,849	\$671,455	2,051	4,521

The annual avoided GHGs are based on AMP's emissions factor for 2010.

Offsetting Electricity Consumption Using Parking Lots	Location	Location's Parking Profile			Financial Information		Environmental Benefits	
		Actual Parking System Size (kWp)	kWh Production	Meets Target	Estimated System Cost	Value of avoided Electricity: Year 1	Annual avoided GHGs (tons)	Annual RECs earned (mWh)
	Bay Farm Elementary	135	203,280	100%	\$662,414	\$30,189	92	203
	Earhart Elementary	151	222,000	100%	\$742,272	\$32,969	101	222
	Lum Elementary	45	65,237	27%	\$218,126	\$9,688	30	65
	Ruby Bridges Elementary	155	247,367	56%	\$760,796	\$36,737	112	247
	Lincoln Middle	242	362,497	56%	\$1,185,946	\$53,834	164	362
	Wood Middle	148	216,240	100%	\$723,013	\$32,114	98	216
	Alameda High (Meter#C1420)	293	436,110	44%	\$1,377,210	\$64,767	198	436
	Encinal High (Meter#C1728)	144	211,812	31%	\$704,334	\$31,456	96	212
	Academy of Alameda	15	24,082	7%	\$74,067	\$3,576	11	24
Totals		1,328	1,988,626		\$6,448,179	\$295,331	902	1,989

Offsetting Electricity Consumption Using Parking and/or Roof	Location	Location's Parking and Roof Profile				Financial Information		Environmental Benefits	
		Actual Parking System Size (kWp)	Actual Roof System Size (kWp)	kWh Production	Meets Target	Estimated System Cost	Value of avoided Electricity: Year 1	Annual avoided GHGs (tons)	Annual RECs earned (mWh)
	Bay Farm Elementary	135	0	203,280	100%	\$662,414	\$30,189	52	203
	Earhart Elementary	151	0	222,000	100%	\$742,272	\$32,969	101	222
	Edison Elementary (Meter#C1777)	0	51	75,253	100%	\$242,948	\$11,176	34	75
	Franklin Elementary (Meter#C0596)	0	42	61,939	100%	\$199,991	\$9,199	28	62
	Henry Haight Elementary (Meter#C1435)	0	223	331,318	96%	\$1,069,774	\$49,204	150	331
	Lum Elementary	45	96	207,232	85%	\$676,604	\$30,776	94	207
	Maya Lin Elementary	0	128	190,800	100%	\$616,064	\$28,336	87	191
	Otis Elementary (Meter#C0566)	0	96	141,994	100%	\$458,477	\$21,088	64	142
	Paden Elementary	0	91	134,600	100%	\$434,602	\$19,989	61	135
	Ruby Bridges Elementary	155	131	442,560	100%	\$1,389,418	\$65,725	201	443
	Lincoln Middle	242	194	650,800	100%	\$2,116,804	\$96,650	295	651
	Wood Middle	148	0	216,240	100%	\$723,013	\$32,114	98	216
	Alameda High (Meter#C1420)	293	376	995,670	100%	\$2,882,819	\$147,867	452	996
	Encinal High (Meter#C1728)	144	310	672,520	100%	\$1,943,933	\$99,876	305	673
	Academy of Alameda	15	211	337,560	100%	\$1,085,893	\$50,131	153	338
Totals		1,328	1,947	4,883,766		\$15,245,026	\$725,288	2,175	4,884

Table 2a: General Obligation Bond

Key Energy Saving Inputs and Assumptions		
System Size (kWp)	3,275	
Price (\$/Wp)	\$4.66	
Solar Yield (kWh/kWp)	1,491	
Annual Rate of PV Degradation	0.50%	
Estimated Avoided Cost (\$/kWh)	\$0.14851	
Annual Electricity Cost Inflation	3.00%	
Operations & Maintenance Cost: Year 1	\$78,223	
Annual O&M Escalation Rate	3.00%	

Key Financing Inputs and Assumptions	
Solar Contract Turnkey Price	\$15,245,026
Performance Guarantee: Years 0-10	\$228,162
Bond Issuance Cost (2.0%)	\$309,000
Total GO Bond	\$15,782,188

Projected Results	
Total General Fund Savings	\$16,397,402
Average Annual Savings	\$819,870
General Fund NPV (3%)	\$11,915,062

Year	Savings of Utility Bill	Cost of O&M Contract (Years 0-20)	Net Energy Savings
1	\$725,288	(\$78,223)	\$647,065
2	\$743,311	(\$80,570)	\$662,742
3	\$761,783	(\$82,987)	\$678,796
4	\$780,713	(\$85,477)	\$695,237
5	\$800,114	(\$88,041)	\$712,073
6	\$819,997	(\$90,682)	\$729,315
7	\$840,374	(\$93,402)	\$746,971
8	\$861,257	(\$96,205)	\$765,052
9	\$882,659	(\$99,091)	\$783,568
10	\$904,593	(\$102,063)	\$802,530
11	\$927,072	(\$105,125)	\$821,947
12	\$950,110	(\$108,279)	\$841,831
13	\$973,720	(\$111,527)	\$862,193
14	\$997,917	(\$114,873)	\$883,044
15	\$1,022,715	(\$118,319)	\$904,396
16	\$1,048,130	(\$121,869)	\$926,261
17	\$1,074,176	(\$125,525)	\$948,651
18	\$1,100,869	(\$129,291)	\$971,578
19	\$1,128,226	(\$133,170)	\$995,056
20	\$1,156,262	(\$137,165)	\$1,019,098
Total	\$18,499,286	(\$2,101,884)	\$16,397,402

Annual General Fund Benefit	Cumulative General Fund Benefit
\$647,065	\$647,065
\$662,742	\$1,309,807
\$678,796	\$1,988,602
\$695,237	\$2,683,839
\$712,073	\$3,395,912
\$729,315	\$4,125,227
\$746,971	\$4,872,198
\$765,052	\$5,637,250
\$783,568	\$6,420,818
\$802,530	\$7,223,348
\$821,947	\$8,045,295
\$841,831	\$8,887,126
\$862,193	\$9,749,318
\$883,044	\$10,632,362
\$904,396	\$11,536,758
\$926,261	\$12,463,019
\$948,651	\$13,411,670
\$971,578	\$14,383,248
\$995,056	\$15,378,304
\$1,019,098	\$16,397,402
\$16,397,402	

The cost analysis assumes the PV systems are financed with a General Obligation Bond (GO Bond). This analysis is intended only to provide an estimate of the savings the District can achieve. A more rigorous analysis should be done when actual sites have been identified by the District.

The net energy savings equals the utility bill savings less the cost of the Operations and Maintenance (O&M). The Performance Guarantee (PeGu) and the solar turnkey price make up the total GO Bond amount. The annual utility bill savings assumes an annual panel degradation rate of 0.50% and an annual electricity cost increase of 3.00%.

The systems are assumed to be constructed with a blend of carport and rooftop structures with a priority on carport placement.

AUSD schools are on AMP's MU-1 tariff. As of July 1, 2014 the cost per kWh of electricity defined by AMP is \$0.14851 regardless of the time of day the electricity is consumed.

Table 2b: Combined Financing Method

Key Energy Saving Inputs and Assumptions			
	System Size (kWp)		3,275
	Price (\$/Wp)		\$4.66
	Solar Yield (kWh/kWp)		1,491
	Annual Rate of PV Degradation		0.50%
	Estimated Avoided Cost (\$/kWh)		\$0.14851
	Annual Electricity Cost Inflation		3.00%
	Operations & Maintenance Cost: Year 1		\$78,223
	Annual O&M Escalation Rate		3.00%

Key Financing Inputs and Assumptions			
	Solar Contract Turnkey Price		\$15,245,026
	Performance Guarantee: Years 0-10		\$228,162
	Total		\$15,473,188
	Total CEC Loan		\$3,000,000
	Interest		0.00%
	Term (years)		20
	Total QZAB		\$8,753,039
	Interest		1.30%
	Term (years)		17
	GO Bond		\$3,720,149

Projected Results			
	Total General Fund Savings		\$3,505,293
	Average Annual Savings		\$175,265
	General Fund NPV (3%)		\$2,217,597

Year	Savings of Utility Bill	Cost of O&M Contract (Years 0-20)	Net Energy Savings
1	\$725,288	(\$78,223)	\$647,065
2	\$743,311	(\$80,570)	\$662,742
3	\$761,783	(\$82,987)	\$678,796
4	\$780,713	(\$85,477)	\$695,237
5	\$800,114	(\$88,041)	\$712,073
6	\$819,997	(\$90,682)	\$729,315
7	\$840,374	(\$93,402)	\$746,971
8	\$861,257	(\$96,205)	\$765,052
9	\$882,659	(\$99,091)	\$783,568
10	\$904,593	(\$102,063)	\$802,530
11	\$927,072	(\$105,125)	\$821,947
12	\$950,110	(\$108,279)	\$841,831
13	\$973,720	(\$111,527)	\$862,193
14	\$997,917	(\$114,873)	\$883,044
15	\$1,022,715	(\$118,319)	\$904,396
16	\$1,048,130	(\$121,869)	\$926,261
17	\$1,074,176	(\$125,525)	\$948,651
18	\$1,100,869	(\$129,291)	\$971,578
19	\$1,128,226	(\$133,170)	\$995,056
20	\$1,156,262	(\$137,165)	\$1,019,098
Total	\$18,499,286	(\$2,101,884)	\$16,397,402

Principal Repayment	Supplemental Interest	Net Payment
(\$470,241)	(\$113,790)	(\$584,030)
(\$490,516)	(\$109,191)	(\$599,707)
(\$511,394)	(\$104,368)	(\$615,761)
(\$532,888)	(\$99,314)	(\$632,202)
(\$555,016)	(\$94,022)	(\$649,038)
(\$577,795)	(\$88,485)	(\$666,280)
(\$601,241)	(\$82,695)	(\$683,936)
(\$625,372)	(\$76,645)	(\$702,018)
(\$650,207)	(\$70,327)	(\$720,534)
(\$675,762)	(\$63,733)	(\$739,495)
(\$702,058)	(\$56,854)	(\$758,912)
(\$729,114)	(\$49,682)	(\$778,796)
(\$756,949)	(\$42,209)	(\$799,158)
(\$785,584)	(\$34,425)	(\$820,009)
(\$815,040)	(\$26,322)	(\$841,361)
(\$845,337)	(\$17,889)	(\$863,226)
(\$876,333)	(\$9,118)	(\$885,451)
(\$179,403)	\$0	(\$179,403)
(\$183,955)	\$0	(\$183,955)
(\$188,834)	\$0	(\$188,834)
(\$11,753,039)	(\$1,139,070)	(\$12,892,109)

Annual General Fund Benefit	Cumulative General Fund Benefit
\$63,035	\$63,035
\$63,035	\$126,069
\$63,035	\$189,104
\$63,035	\$252,138
\$63,035	\$315,173
\$63,035	\$378,207
\$63,035	\$441,242
\$63,035	\$504,277
\$63,035	\$567,311
\$63,035	\$630,346
\$63,035	\$693,380
\$63,035	\$756,415
\$63,035	\$819,449
\$63,035	\$882,484
\$63,035	\$945,519
\$63,035	\$1,008,553
\$63,200	\$1,071,753
\$792,175	\$1,863,928
\$811,101	\$2,675,030
\$830,264	\$3,505,293
\$3,505,293	

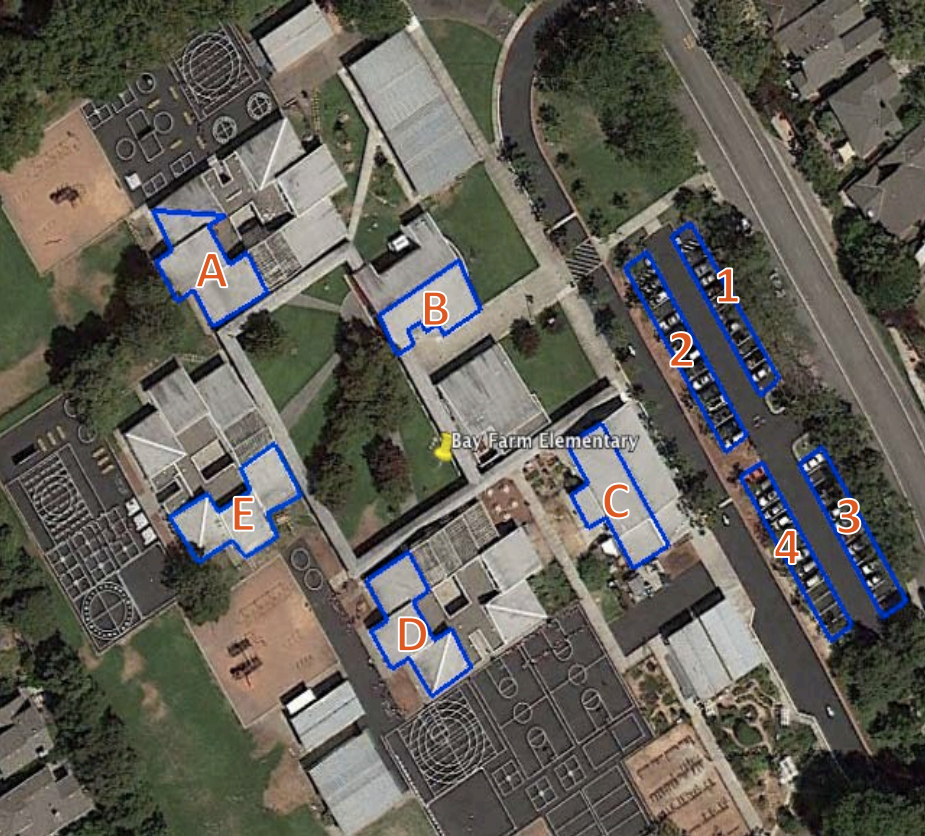
The cost analysis assumes the PV systems are financed with a "blended" portfolio of potential sources, i.e. a California Energy Commission (CEC) loan, a Qualified Zone Academy Bond (QZAB), and a General Obligation (GO) Bond. The CEC loan has an interest rate of 0% and a payoff period of 20 years. The QZAB has an interest rate of 1.3% and a payoff period of 17 years. This analysis is intended only to provide an estimate of the savings the District can achieve. A more rigorous analysis should be done when sites and PV system sizes have been identified by the District.

The net energy savings equals the utility bill savings less the cost of the Operations and Maintenance (O&M). The Performance Guarantee (PeGu) and the solar turnkey price make up the total financed amount. The annual utility bill savings assumes an annual panel degradation rate of 0.50% and an annual electricity cost increase of 3.00%.

The repayment method is designed to see the same annual general fund benefit during the 17 period in which the QZAB is repaid.

The following schools may qualify for QZABs: Henry Haight Elementary, Lum Elementary, Maya Lin Elementary, Paden Elementary, Ruby Bridges Elementary, Wood Middle, Encinal High, and Academy of Alameda. The analysis assumes that the PV systems built at these sites are financed with QZABs.

Table 3: Aerial Assessments



Location: Bay Farm Elementary
Address: 200 Aughinbaugh Way, Alameda, CA 94502

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	1,894	100%	1,894	34	1503.7	50,410
2	2,411	100%	2,411	43	1503.7	64,170
3	2,147	100%	2,147	38	1503.7	57,143
4	2,126	100%	2,126	38	1503.7	56,585
8,578			8,578	152	1,503.7	228,308
ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	3,024	40%	1,210	21	1,486.8	31,832
B	1,872	50%	936	17	1,486.8	24,632
C	2,821	50%	1,411	25	1,486.8	37,119
D	2,876	40%	1,150	20	1,486.8	30,274
E	2,897	40%	1,159	21	1,486.8	30,495
13,490			5,865	104	1,486.8	154,353
TOTAL			22,068	14,443	256	382,661

The soils around this area may present issues for carport structures.

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
203,280	\$29,002	203,280	136	Parking	Roof	Parking	Roof						
				Roof	104		104	154,353	\$498,316	\$22,923	70	154	76%
				Parking	152		135	203,280	\$662,414	\$30,189	92	203	100%



Location: Earhart Elementary
Address: 400 Packet Landing Rd, Alameda, CA 94502

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,720	100%	2,720	48	1,465.5	70,555
2	3,402	100%	3,402	60	1,465.5	88,246
3	3,650	100%	3,650	65	1,465.5	94,679
	9,772		9,772	173	1,465.5	253,479

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	3,622	40%	1,449	26	1,486.8	38,127
B	1,734	40%	694	12	1,486.8	18,253
C	3,584	40%	1,434	25	1,486.8	37,727
D	4,714	45%	2,121	38	1,486.8	55,825
	13,654		5,697	101	1,486.8	149,932

TOTAL	23,426		15,469	274		403,412
-------	--------	--	--------	-----	--	---------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
222,000	\$31,591	222,000	151

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		101		101	149,932	\$484,043	\$22,266	68	150	68%
Parking	173		151		222,000	\$742,272	\$32,969	101	222	100%



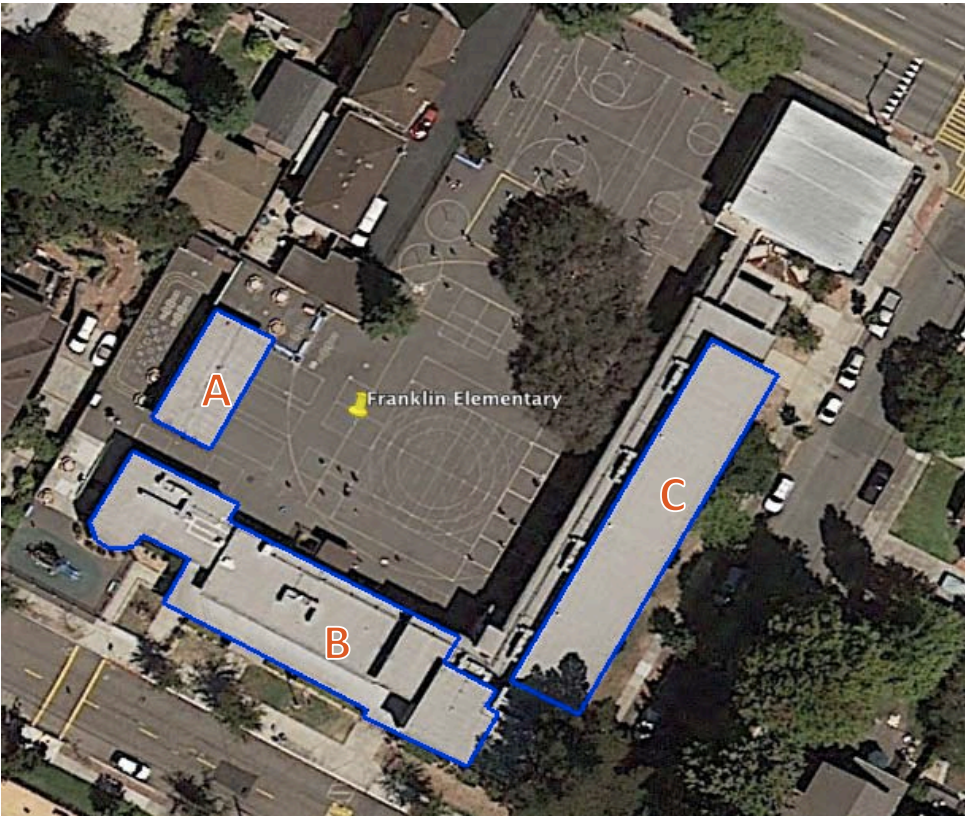
Location: Edison Elementary (Meter#C1777)
Address: 2700 Buena Vista Ave, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
-	-	-	-	-	-	-
ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	3,055	60%	1,833	32	1,486.8	48,238
B	2,332	45%	1,049	19	1,486.8	27,616
C	1,482	40%	593	10	1,486.8	15,600
D	4,621	60%	2,773	49	1,486.8	72,965
E	11,393	55%	6,266	111	1,486.8	164,902
F	2,761	30%	828	15	1,486.8	21,798
25,644			13,342	236	1,486.8	351,119
TOTAL						
25,644			13,342	236		351,119

The roofs at this site need to be replaced. Rooftop mechanical units may be placed on top of these buildings.

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target		Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
					Parking	Roof	Parking	Roof						
75,253	\$11,002	75,253	51											
* Calculations are based on the meter with the largest load.				Roof		236		51	75,253	\$242,948	\$11,176	34	75	100%

* Calculations are based on the meter with the largest load.



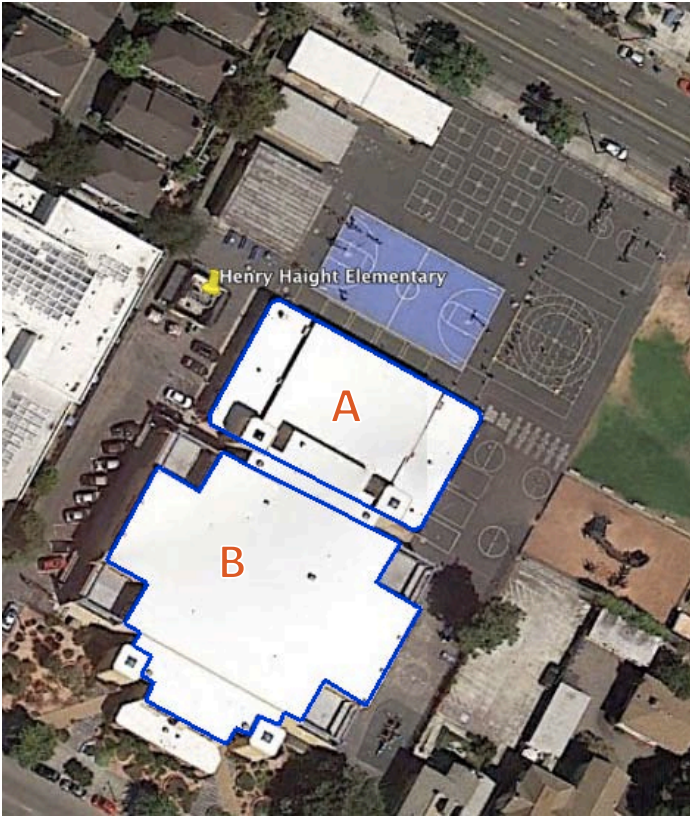
Location: Franklin Elementary (Meter#C0596)
Address: 1433 San Antonio Ave, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
	-		-	-	-	-
ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	1,143	55%	629	11	1,486.6	16,542
B	5,988	35%	2,096	37	1,486.6	55,146
C	4,087	60%	2,452	43	1,486.6	64,524
	11,218		5,177	92	1,486.6	136,212
TOTAL	11,218		5,177	92		136,212

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
61,939	\$9,055	61,939	42

*Calculations are based on the meter with the largest load.

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity- Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		92		42	61,939	\$199,991	\$9,199	28	62	100%



Location: Henry Haight Elementary (Meter#C1435)
Address: 2025 Santa Clara Ave, Alameda, CA 94501

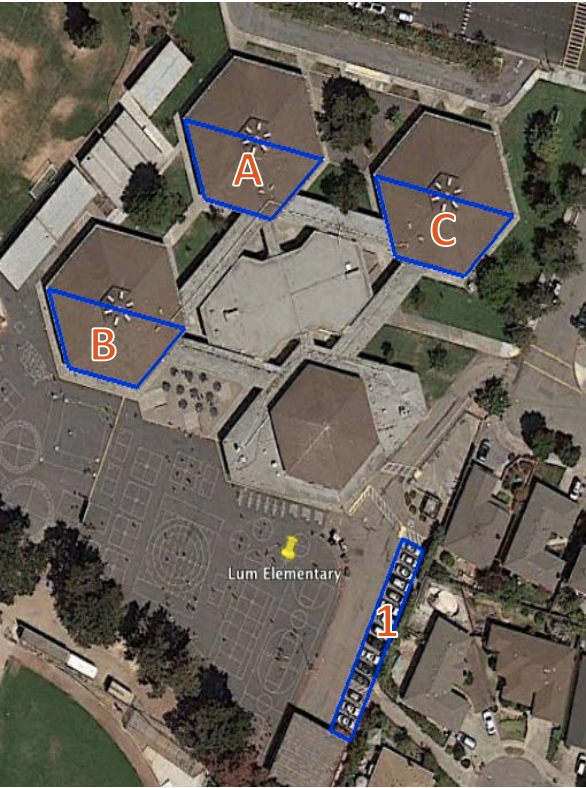
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
-	-	-	-	-	-	-
ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	9,905	40%	3,962	70	1,486.6	104,251
B	17,259	50%	8,630	153	1,486.6	227,066
	27,164		12,592	223	1,486.6	331,318
TOTAL	27,164		12,592	223		331,318

We discussed the possibility of ballasted solar systems for roofs A and B.

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
343,338	\$48,960	343,338	231

*Calculations are based on the meter with the largest load.

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity- Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		223		223	331,318	\$1,069,774	\$49,204	150	331	96%



Location: Lum Elementary
Address: 1801 Sandcreek Way, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,515	100%	2,515	45	1,465.5	65,237
	2,515		2,515	45	1,465.5	65,237

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	3,999	45%	1,800	32	1,486.6	47,351
B	3,920	45%	1,764	31	1,486.6	46,416
C	4,073	45%	1,833	32	1,486.6	48,227
	11,992		5,396	96	1,486.6	141,995

TOTAL	14,507		7,911	140		207,232
-------	--------	--	-------	-----	--	---------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
244,080	\$34,842	244,080	165

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		96		96	141,995	\$458,478	\$21,088	64	142	58%
Parking	45		45		65,237	\$218,126	\$9,688	30	65	27%
Blended	45	96	45	96	207,232	\$676,604	\$30,776	94	207	85%



Location: Maya Lin Elementary
Address: 825 Taylor Ave, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
-	-	-	-	-	-	-

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	4,092	55%	2,251	40	1,486.6	59,220
B	7,874	50%	3,937	70	1,486.6	103,594
C	19,379	55%	10,658	189	1,486.6	280,454
D	3,951	45%	1,778	31	1,486.6	46,783
	35,296		18,624	330	1,486.6	490,050

TOTAL	35,296		18,624	330		490,050
-------	--------	--	--------	-----	--	---------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
				Parking	Roof	Parking	Roof						
190,800	\$27,177	190,800	128		330		128	190,800	\$616,064	\$28,336	87	191	100%



Location: Otis Elementary (Meter#C0566)
Address: 3010 Fillmore St, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
-	-	-	-	-	-	-

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	3,491	40%	1,396	25	1,486.6	36,743
B	5,098	40%	2,039	36	1,486.6	53,657
C	6,024	40%	2,410	43	1,486.6	63,403
D	5,522	25%	1,381	24	1,486.6	36,325
E	6,750	55%	3,713	66	1,486.6	97,686
F	2,685	55%	1,477	26	1,486.6	38,857
29,570			12,415	220	1,486.6	326,672

TOTAL	29,570		12,415	220		326,672
-------	--------	--	--------	-----	--	---------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
141,994	\$20,390	141,994	96

*Calculations are based on the meter with the largest load.

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		220		96	141,994	\$458,477	\$21,088	64	142	100%



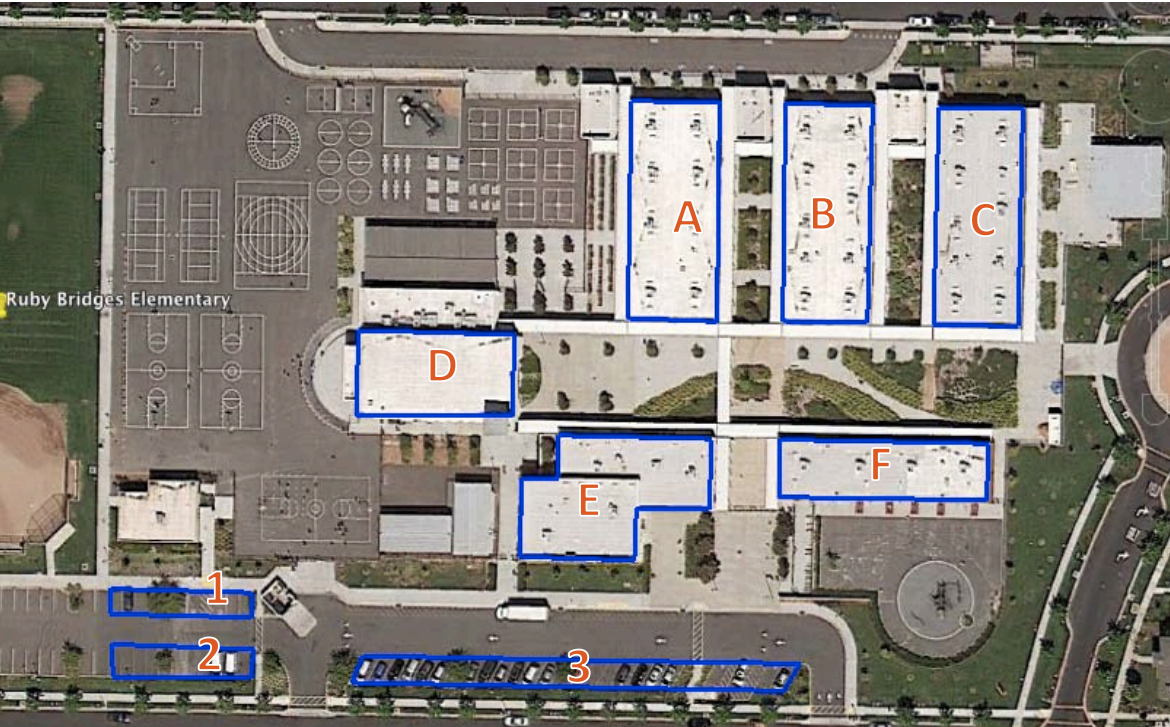
Parking is not included because areas will be shaded by surrounding trees and buildings.

Location: Paden Elementary
 Address: 444 Central Ave, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
-	-	-	-	-	-	-
ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	8,564	30%	2,569	45	1,486.6	67,603
B	14,393	45%	6,477	115	1,486.6	170,424
C	1,341	45%	603	11	1,486.6	15,878
D	3,120	55%	1,716	30	1,486.6	45,153
27,418			11,366	201	1,486.6	299,058
TOTAL						
27,418			11,366	201		299,058

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
134,600	\$20,976	134,600	91

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		201		91	134,600	\$434,602	\$19,989	61	135	100%



Location: Ruby Bridges Elementary
Address: 351 Jack London Ave, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	1,585	100%	1,585	28	1,593.2	44,696
2	1,948	100%	1,948	34	1,593.2	54,933
3	5,239	100%	5,239	93	1,593.2	147,738
8,772			8,772	155	1,593.2	247,367

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	8,630	35%	3,021	53	1,486.6	79,478
B	8,325	35%	2,914	52	1,486.6	76,669
C	8,148	35%	2,852	50	1,486.6	75,039
D	5,785	55%	3,182	56	1,486.6	83,721
E	7,908	40%	3,163	56	1,486.6	83,233
F	5,298	45%	2,384	42	1,486.6	62,732
44,094			17,515	310	1,486.6	460,872

TOTAL	52,866		26,287	465		708,239
-------	--------	--	--------	-----	--	---------

The parking areas to the west of Parking 1 and 2 are city owned.

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
442,560	\$62,886	442,560	291

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity- Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		310		298	442,560	\$1,190,798	\$65,725	201	443	100%
Parking	155		155		247,367	\$760,796	\$36,737	112	247	56%
Blended	155	310	155	131	442,560	\$1,389,418	\$65,725	201	443	100%



Location: Lincoln Middle
Address: 1250 Fernside, Alameda, CA 94501

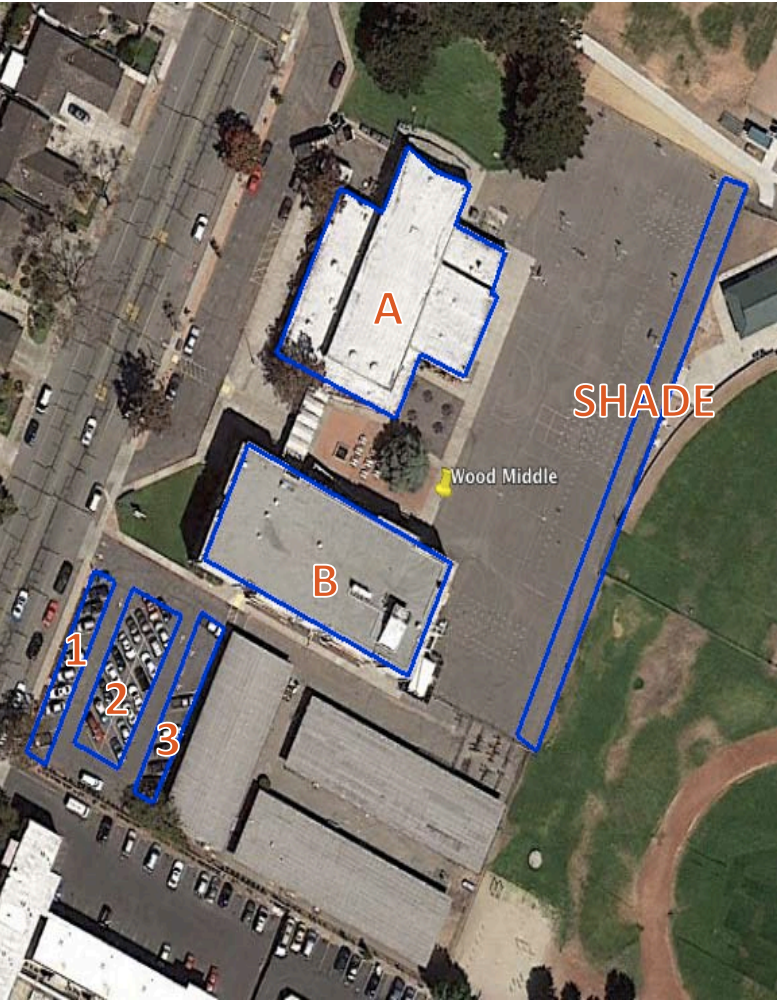
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,135	100%	2,135	38	1,465.5	55,381
2	1,789	100%	1,789	32	1,503.7	47,615
3	2,975	100%	2,975	53	1,503.7	79,181
4	1,132	100%	1,132	20	1,503.7	30,129
Shade	5,643	100%	5,643	100	1,503.7	150,191
13,674			13,674	242	1,497.7	362,497

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	14,042	50%	7,021	124	1,486.6	184,742
B	12,719	50%	6,360	113	1,486.6	167,336
C	9,771	45%	4,397	78	1,486.6	115,696
D	4,640	25%	1,160	21	1,486.6	30,523
E	3,599	60%	2,159	38	1,486.6	56,820
F	3,602	60%	2,161	38	1,486.6	56,867
G	1,597	55%	878	16	1,486.6	23,112
H	1,863	55%	1,025	18	1,486.6	26,961
I	1,632	55%	898	16	1,486.6	23,618
J	948	50%	474	8	1,486.6	12,472
K	893	50%	447	8	1,486.6	11,749
55,306			26,979	478	1,486.6	709,898

TOTAL	68,980		40,653	720		1,072,394
-------	--------	--	--------	-----	--	-----------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
650,800	\$92,509	650,800	437

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		478		438	650,800	\$1,751,110	\$96,650	295	651	100%
Parking	242		242		362,497	\$1,185,946	\$53,834	164	362	56%
Blended	242	478	242	194	650,800	\$2,116,804	\$96,650	295	651	100%



Location: Wood Middle
Address: 420 Grand St, Alameda, CA 94501

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	1,814	100%	1,814	32	1,465.5	47,054
2	3,586	100%	3,586	63	1,465.5	93,019
3	1,898	100%	1,898	34	1,465.5	49,233
Shade	5,923	100%	5,923	105	1,465.5	153,639
	13,221		13,221	234	1,465.5	342,944

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	14,318	25%	3,580	63	1,486.6	94,187
B	11,586	50%	5,793	103	1,486.6	152,430
	25,904		9,373	166	1,486.6	246,617

TOTAL	39,125		22,594	400		589,561
-------	--------	--	--------	-----	--	---------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
216,240	\$30,816	216,240	147

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		166		145	216,240	\$698,205	\$32,114	98	216	100%
Parking	234		148		216,240	\$723,013	\$32,114	98	216	100%



Although Roof E is included in our assessment, there is not enough usable area for solar. The soils at this site need to be assessed before installing carport solar systems.

Location: Alameda High (Meter#C1420)
Address: 2201 Encinal Ave, Alameda, CA 94501

PARKING							
Array #	Total Area	Use (%)	Usable Area	Watts/ft ²	kWp	Yield	Kwh
1	1,376	100%	1,376	17.7	24	1,503.7	36,623
2	2,728	100%	2,728	17.7	48	1,503.7	72,607
3	3,478	100%	3,478	17.7	62	1,503.7	92,569
4	3,302	100%	3,302	17.7	58	1,465.5	85,652
5	2,016	100%	2,016	17.7	36	1,465.5	52,294
6	1,351	100%	1,351	17.7	24	1,465.5	35,044
Shade	2,304	100%	2,304	17.7	41	1,503.7	61,322
16,555			16,555		293	1,488.3	436,110

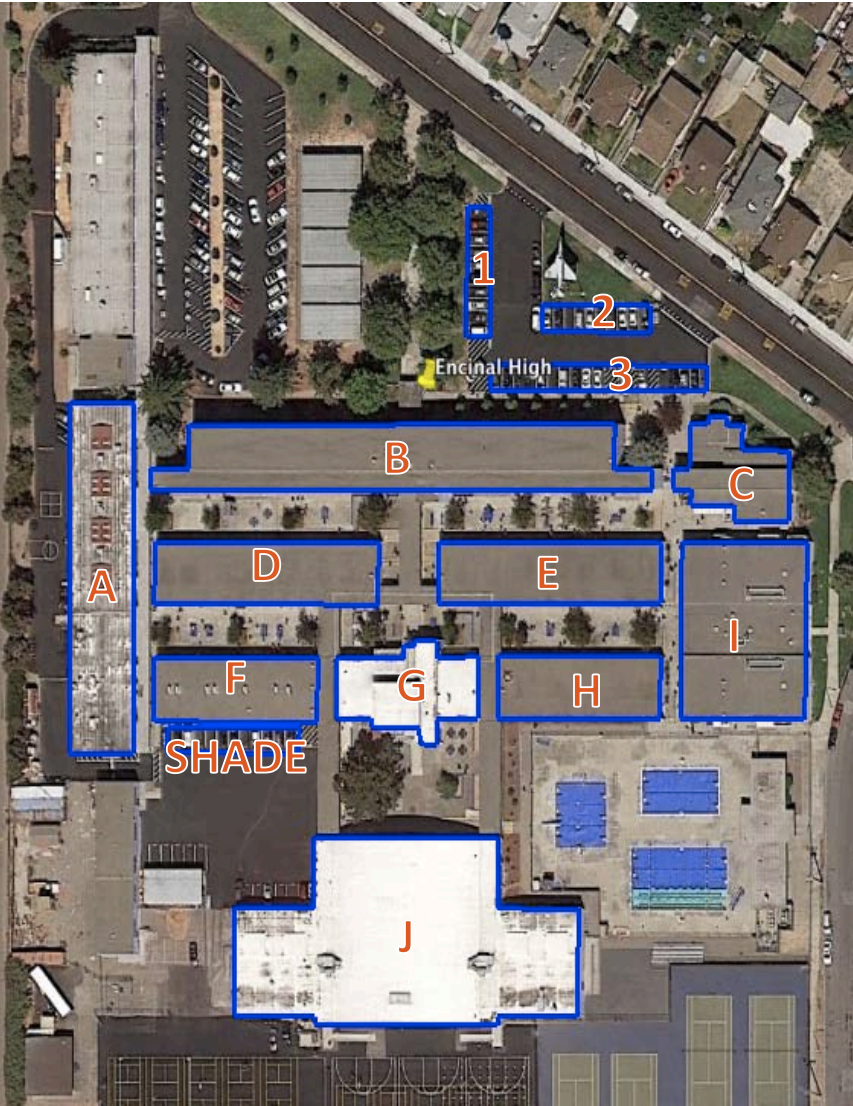
ROOF							
Array #	Total Area	Use (%)	Usable Area	Watts/ft ²	kWp	Yield	kWh
A	16,298	45%	7,334	17.7	130	1,486.6	192,981
B	20,350	15%	3,053	17.7	54	1,486.6	80,320
C	13,828	50%	6,914	17.7	122	1,486.6	181,927
D	6,463	50%	3,232	17.7	57	1,486.6	85,030
E	53,046	20%	10,609	17.7	188	1,486.6	279,158
109,985			31,141		551	1,486.6	819,415

TOTAL	126,540		47,696		844		1,255,526
-------	---------	--	--------	--	-----	--	-----------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
995,670	\$141,286	995,670	669

*Calculations are based on the meter with the largest load.

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)		Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof							
Roof		551		551	819,415	\$2,094,564	\$121,691		372	819	82%
Parking	293		293		436,110	\$1,377,210	\$64,767		198	436	44%
Blended	293	551	293	376	995,670	\$2,882,819	\$147,867		452	996	100%



Parking 1, 2 & 3 will be redesigned in the future.

Location: Encinal High (Meter#C1728)
Address: 210 Central Ave, Alameda, CA 94501

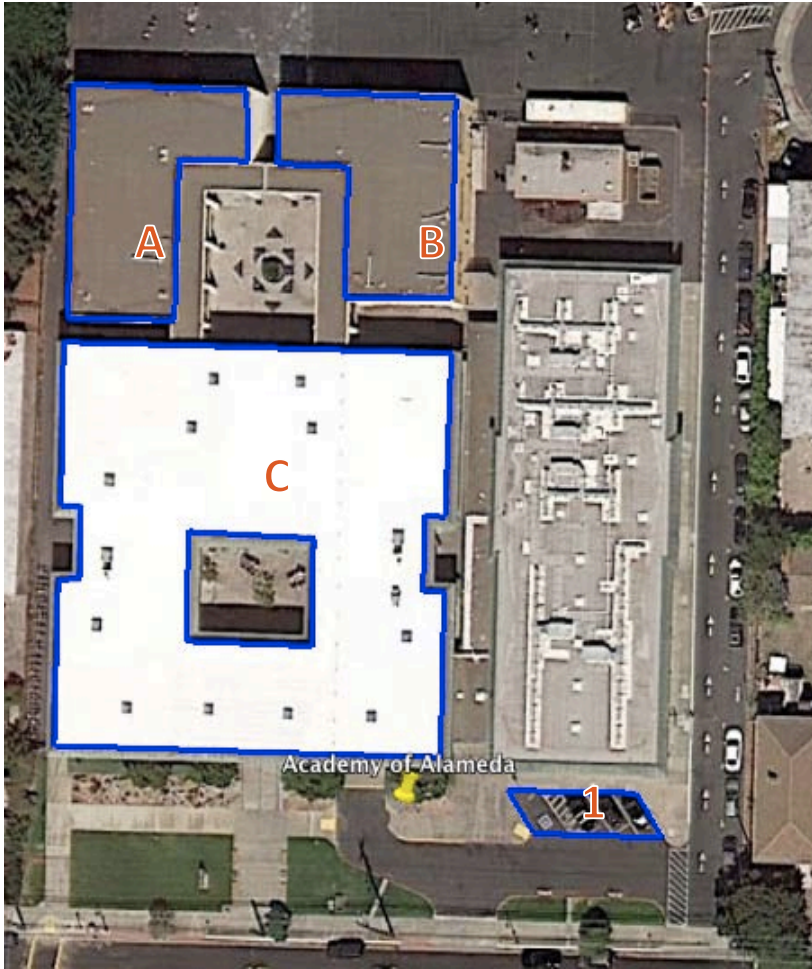
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	1,713	100%	1,713	30	1,503.7	45,592
2	1,590	100%	1,590	28	1,465.5	41,244
3	3,000	100%	3,000	53	1,465.5	77,818
Shade	1,818	100%	1,818	32	1,465.5	47,158
	8,121		8,121	144	1,473.6	211,812

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	12,261	15%	1,839	33	1,486.6	48,393
B	15,957	55%	8,776	155	1,486.6	230,931
C	4,430	15%	665	12	1,486.6	17,485
D	7,558	60%	4,535	80	1,486.6	119,323
E	7,369	60%	4,421	78	1,486.6	116,340
F	5,694	55%	3,132	55	1,486.6	82,404
G	5,459	15%	819	14	1,486.6	21,546
H	5,495	50%	2,748	49	1,486.6	72,294
I	12,045	45%	5,420	96	1,486.6	142,622
J	28,243	40%	11,297	200	1,486.6	297,261
	104,511		43,652	773	1,486.6	1,148,599
TOTAL	112,632		51,773	916		1,360,411

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
672,520	\$95,700	672,520	453

* Calculations are based on the meter with the largest load.

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		773		452	672,520	\$1,809,552	\$99,876	305	673	100%
Parking	144		144		211,812	\$704,334	\$31,456	96	212	31%
Blended	144	773	144	310	672,520	\$1,943,933	\$99,876	305	673	100%



Location: Academy of Alameda
Address: 401 Pacific Ave, Alameda, CA 94502

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	854	100%	854	15	1,593.2	24,082
	854		854	15	1,593.2	24,082

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	4,554	55%	2,505	44	1,486.6	65,906
B	4,082	55%	2,245	40	1,486.6	59,075
C	21,282	50%	10,641	188	1,486.6	279,995
	29,918		15,391	272	1,486.6	404,975

TOTAL	30,772		16,245	288		429,058
-------	--------	--	--------	-----	--	---------

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
337,560	\$47,944	337,560	226

	Potential System Size (kWp)		Actual System Size (kWp)		kWh Production (kWh)	Estimated System Cost (\$)	Value of Avoided Electricity-Year 1 (\$)	Annual Avoided GHGs (tons)	Annual RECs Earned (mWh)	Meets Target
	Parking	Roof	Parking	Roof						
Roof		272		227	337,560	\$1,089,929	\$50,131	153	338	100%
Parking	15		15		24,082	\$74,067	\$3,576	11	24	7%
Blended	15	272	15	211	337,560	\$1,085,893	\$50,131	153	338	100%