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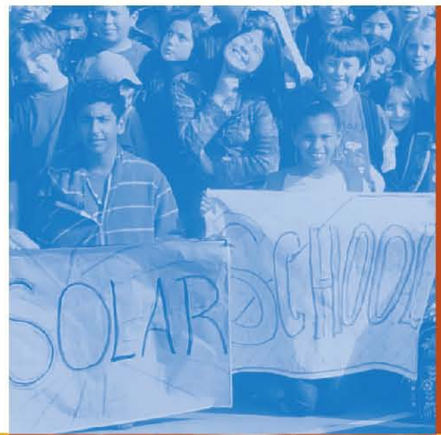
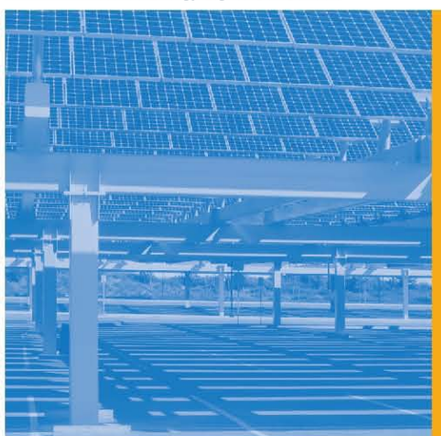
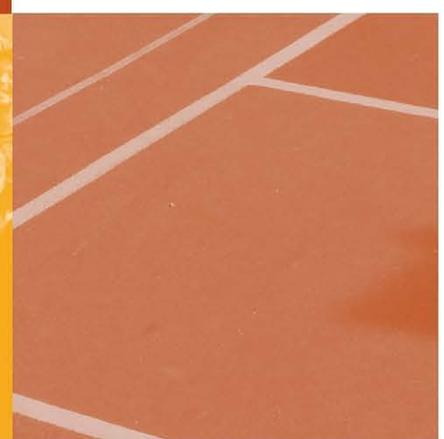
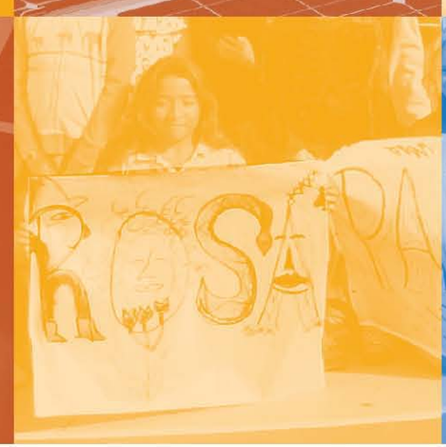
Solar Master Plan

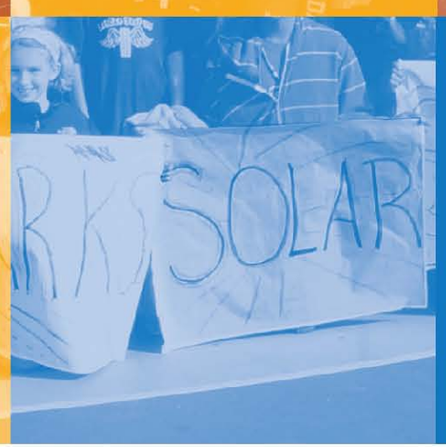
Alameda Unified School District











Alameda Unified School District Solar Master Plan

Prepared by KyotoUSA
May 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

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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/ft^2.

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

Solar Yields (kWh/kW)	
Roof Mounted	1,560
South Facing Carport	1,670
West Facing Carport	1,570
East Facing Carport	1,540

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 $0.14554/kWh which is Alameda Municipal Power's MU-1 tariff (eff. 1 July 2013), 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.

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Table 1: Offsetting the Value of Electricity Consumed

Key Inputs

Avoided Cost	0.14554	$/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	130	
Earhart Elementary	400 Packet Landing Rd, Alameda, CA 94502	222,000	$31,591	222,000	143	
Edison Elementary (Meter#C1777)	2700 Buena Vista Ave, Alameda, CA 94501	75,253	$11,002	75,253	48	*
Franklin Elementary (Meter#C0596)	1433 San Antonio Ave, Alameda, CA 94501	61,939	$9,055	61,939	40	*
Henry Haight Elementary (Meter#C1435)	2025 Santa Clara Ave, Alameda, CA 94501	343,338	$48,960	343,338	220	*
Lum Elementary	1801 Sandcreek Way, Alameda, CA 94501	244,080	$34,842	244,080	157	
Maya Lin Elementary	825 Taylor Ave, Alameda, CA 94501	190,800	$27,177	190,800	122	
Otis Elementary (Meter#C0566)	3010 Fillmore St, Alameda, CA 94501	141,994	$20,390	141,994	91	*
Paden Elementary	444 Central Ave, Alameda, CA 94501	134,600	$20,976	134,600	86	
Ruby Bridges Elementary	351 Jack London Ave, Alameda, CA 94501	442,560	$62,886	442,560	277	
Lincoln Middle	1250 Fernside, Alameda, CA 94501	650,800	$92,509	650,800	417	
Wood Middle	420 Grand St, Alameda, CA 94501	216,240	$30,816	216,240	140	
Alameda High (Meter#C1420)	2201 Encinal Ave, Alameda, CA 94501	995,670	$141,286	995,670	639	*
Encinal High (Meter#C1728)	210 Central Ave, Alameda, CA 94501	672,520	$95,700	672,520	432	*
Academy of Alameda	401 Pacific Ave, Alameda, CA 94502	337,560	$47,944	337,560	216	
	Totals	**4,932,634**	**$704,136**	**4,932,634**	**3,157**	

* 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 assessement 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	161,953	80%	$498,316	$23,571	73	162
	Earhart Elementary	101	157,314	71%	$484,043	$22,895	71	157
	Edison Elementary (Meter#C1777)	48	75,253	100%	$231,548	$10,952	34	75
	Franklin Elementary (Meter#C0596)	40	61,939	100%	$190,582	$9,015	28	62
	Henry Haight Elementary (Meter#C1435)	220	343,338	100%	$1,056,425	$49,969	156	343
	Lum Elementary	96	149,005	61%	$458,478	$21,686	68	149
	Maya Lin Elementary	122	190,800	100%	$587,077	$27,769	87	191
	Otis Elementary (Meter#C0566)	91	141,994	100%	$436,905	$20,666	64	142
	Paden Elementary	86	134,600	100%	$414,154	$19,590	61	135
	Ruby Bridges Elementary	284	442,560	100%	$1,134,769	$64,410	201	443
	Lincoln Middle	417	650,800	100%	$1,668,718	$94,717	295	651
	Wood Middle	139	216,240	100%	$665,354	$31,472	98	216
	Alameda High (Meter#C1420)	551	859,874	86%	$2,094,564	$125,146	390	860
	Encinal High (Meter#C1728)	431	672,520	100%	$1,724,410	$97,879	305	673
	Academy of Alameda	216	337,560	100%	$1,038,646	$49,128	153	338
	Totals	**2,946**	**4,595,749**		**$12,683,987**	**$668,865**	**2,085**	**4,596**

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

Offsetting Electricity Consumption Using Parking Lots	Location's Parking Profile			Financial Information		Environmental Benefits	
Location	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	129	203,280	100%	$634,441	$29,585	92	203
Earhart Elementary	121	186,456	84%	$593,268	$27,137	85	186
Lum Elementary	45	68,554	28%	$218,126	$9,977	31	69
Ruby Bridges Elementary	155	259,292	59%	$760,796	$37,737	118	259
Lincoln Middle	242	378,853	58%	$1,185,946	$55,138	172	379
Wood Middle	140	216,240	100%	$688,036	$31,472	98	216
Alameda High (Meter#C1420)	293	456,506	46%	$1,377,210	$66,440	207	457
Encinal High (Meter#C1728)	144	222,272	33%	$704,334	$32,349	101	222
Academy of Alameda	15	25,243	7%	$74,067	$3,674	11	25
Totals	**1,285**	**2,016,695**		**$6,236,225**	**$293,510**	**915**	**2,017**

Offsetting Electricity Consumption Using Parking and/or Roof	Location's Parking and Roof Profile				Financial Information		Environmental Benefits	
Location	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	129	0	203,280	100%	$634,441	$29,585	52	203
Earhart Elementary	121	23	222,000	100%	$702,620	$32,310	101	222
Edison Elementary (Meter#C1777)	0	48	75,253	100%	$231,548	$10,952	34	75
Franklin Elementary (Meter#C0596)	0	40	61,939	100%	$190,582	$9,015	28	62
Henry Haight Elementary (Meter#C1435)	0	220	343,338	100%	$1,056,425	$49,969	156	343
Lum Elementary	45	96	217,559	89%	$676,604	$31,664	99	218
Maya Lin Elementary	0	122	190,800	100%	$587,077	$27,769	87	191
Otis Elementary (Meter#C0566)	0	91	141,994	100%	$436,905	$20,666	64	142
Paden Elementary	0	86	134,600	100%	$414,154	$19,590	61	135
Ruby Bridges Elementary	155	117	442,560	100%	$1,323,225	$64,410	201	443
Lincoln Middle	242	174	650,800	100%	$2,022,700	$94,717	295	651
Wood Middle	140	0	216,240	100%	$688,036	$31,472	98	216
Alameda High (Meter#C1420)	293	346	995,670	100%	$2,759,682	$144,910	452	996
Encinal High (Meter#C1728)	144	289	672,520	100%	$1,858,787	$97,879	305	673
Academy of Alameda	15	200	337,560	100%	$1,034,710	$49,128	153	338
Totals	**1,285**	**1,852**	**4,906,113**		**$14,617,494**	**$714,036**	**2,185**	**4,906**

Table 2a: General Obligation Bond

Key Energy Saving Inputs and Assumptions	
System Size (kWp)	3,136
Price ($/Wp)	$4.66
Solar Yield (kWh/kWp)	1,564
Annual Rate of PV Degradation	0.50%
Estimated Avoided Cost ($/kWh)	$0.14554
Annual Electricity Cost Inflation	3.00%
Operations & Maintenance Cost: Year 1	$77,063
Annual O&M Escalation Rate	3.00%

Key Financing Inputs and Assumptions	
Solar Contract Turnkey Price	$14,617,494
Performance Guarantee: Years 0-10	$219,650
Bond Issuance Cost (2.0%)	$297,000
Total GO Bond	$15,134,144

Projected Results	
Total General Fund Savings	$16,141,571
Average Annual Savings	$807,079
General Fund NPV (3%)	$11,729,170

Year	Savings of Utility Bill	Cost of O&M Contract (Years 0-20)	Net Energy Savings	Annual General Fund Benefit	Cumulative General Fund Benefit
1	$714,036	($77,063)	$636,973	$636,973	$636,973
2	$731,780	($79,375)	$652,405	$652,405	$1,289,377
3	$749,964	($81,756)	$668,208	$668,208	$1,957,585
4	$768,601	($84,209)	$684,392	$684,392	$2,641,977
5	$787,701	($86,735)	$700,965	$700,965	$3,342,943
6	$807,275	($89,337)	$717,938	$717,938	$4,060,881
7	$827,336	($92,017)	$735,318	$735,318	$4,796,199
8	$847,895	($94,778)	$753,117	$753,117	$5,549,316
9	$868,965	($97,621)	$771,344	$771,344	$6,320,661
10	$890,559	($100,550)	$790,009	$790,009	$7,110,670
11	$912,689	($103,566)	$809,123	$809,123	$7,919,793
12	$935,370	($106,673)	$828,696	$828,696	$8,748,489
13	$958,614	($109,873)	$848,740	$848,740	$9,597,230
14	$982,435	($113,170)	$869,266	$869,266	$10,466,495
15	$1,006,849	($116,565)	$890,284	$890,284	$11,356,779
16	$1,031,869	($120,062)	$911,807	$911,807	$12,268,587
17	$1,057,511	($123,663)	$933,847	$933,847	$13,202,434
18	$1,083,790	($127,373)	$956,417	$956,417	$14,158,850
19	$1,110,722	($131,195)	$979,528	$979,528	$15,138,378
20	$1,138,324	($135,130)	$1,003,193	$1,003,193	$16,141,571
Total	**$18,212,283**	**($2,070,712)**	**$16,141,571**	**$16,141,571**	

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.

Table 2b: Combined Financing Method

Key Energy Saving Inputs and Assumptions	
System Size (kWp)	3,136
Price ($/Wp)	$4.66
Solar Yield (kWh/kWp)	1,564
Annual Rate of PV Degradation	0.50%
Estimated Avoided Cost ($/kWh)	$0.14554
Annual Electricity Cost Inflation	3.00%
Operations & Maintenance Cost: Year 1	$77,063
Annual O&M Escalation Rate	3.00%

Key Financing Inputs and Assumptions	
Solar Contract Turnkey Price	$14,617,494
Performance Guarantee: Years 0-10	$219,650
Total	$14,837,144
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	$3,084,105

Projected Results	
Total General Fund Savings	$3,251,499
Average Annual Savings	$162,575
General Fund NPV (3%)	$2,031,107

Year	Savings of Utility Bill	Cost of O&M Contract (Years 0-20)	Net Energy Savings	Principal Repayment	Supplemental Interest	Net Payment	Annual General Fund Benefit	Cumulative General Fund Benefit
1	$714,036	($77,063)	$636,973	($472,177)	($113,790)	($585,966)	$51,006	$51,006
2	$731,780	($79,375)	$652,405	($492,244)	($109,154)	($601,398)	$51,006	$102,013
3	$749,964	($81,756)	$668,208	($512,903)	($104,298)	($617,202)	$51,006	$153,019
4	$768,601	($84,209)	$684,392	($534,170)	($99,216)	($633,386)	$51,006	$204,025
5	$787,701	($86,735)	$700,965	($556,060)	($93,899)	($649,959)	$51,006	$255,032
6	$807,275	($89,337)	$717,938	($578,590)	($88,341)	($666,931)	$51,006	$306,038
7	$827,336	($92,017)	$735,318	($601,777)	($82,535)	($684,312)	$51,006	$357,044
8	$847,895	($94,778)	$753,117	($625,637)	($76,473)	($702,111)	$51,006	$408,051
9	$868,965	($97,621)	$771,344	($650,189)	($70,148)	($720,338)	$51,006	$459,057
10	$890,559	($100,550)	$790,009	($675,451)	($63,552)	($739,003)	$51,006	$510,063
11	$912,689	($103,566)	$809,123	($701,441)	($56,676)	($758,117)	$51,006	$561,070
12	$935,370	($106,673)	$828,696	($728,177)	($49,513)	($777,690)	$51,006	$612,076
13	$958,614	($109,873)	$848,740	($755,681)	($42,053)	($797,734)	$51,006	$663,083
14	$982,435	($113,170)	$869,266	($783,970)	($34,289)	($818,259)	$51,006	$714,089
15	$1,006,849	($116,565)	$890,284	($813,067)	($26,211)	($839,278)	$51,006	$765,095
16	$1,031,869	($120,062)	$911,807	($842,991)	($17,810)	($860,801)	$51,006	$816,102
17	$1,057,511	($123,663)	$933,847	($873,787)	($9,076)	($882,863)	$50,984	$867,086
18	$1,083,790	($127,373)	$956,417	($180,195)	$0	($180,195)	$776,222	$1,643,307
19	$1,110,722	($131,195)	$979,528	($184,868)	$0	($184,868)	$794,660	$2,437,967
20	$1,138,324	($135,130)	$1,003,193	($189,661)	$0	($189,661)	$813,532	$3,251,499
Total	**$18,212,283**	**($2,070,712)**	**$16,141,571**	**($11,753,039)**	**($1,137,034)**	**($12,890,073)**	**$3,251,499**	

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	1,570	52,632
2	2,411	100%	2,411	43	1,570	66,999
3	2,147	100%	2,147	38	1,570	59,663
4	2,126	100%	2,126	38	1,570	59,079
	8,578		**8,578**	**152**	**1,570**	**238,374**

ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	3,024	40%	1,210	21	1,560	33,399
B	1,872	50%	936	17	1,560	25,845
C	2,821	50%	1,411	25	1,560	38,947
D	2,876	40%	1,150	20	1,560	31,765
E	2,897	40%	1,159	21	1,560	31,997
	13,490		**5,865**	**104**	**1,560**	**161,953**

TOTAL	**22,068**		**14,443**	**256**	**400,327**

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
203,280	$29,002	203,280	130

	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		104		104	161,953	$498,316	$23,571	73	162	80%
Parking	152		129		203,280	$634,441	$29,585	92	203	100%

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

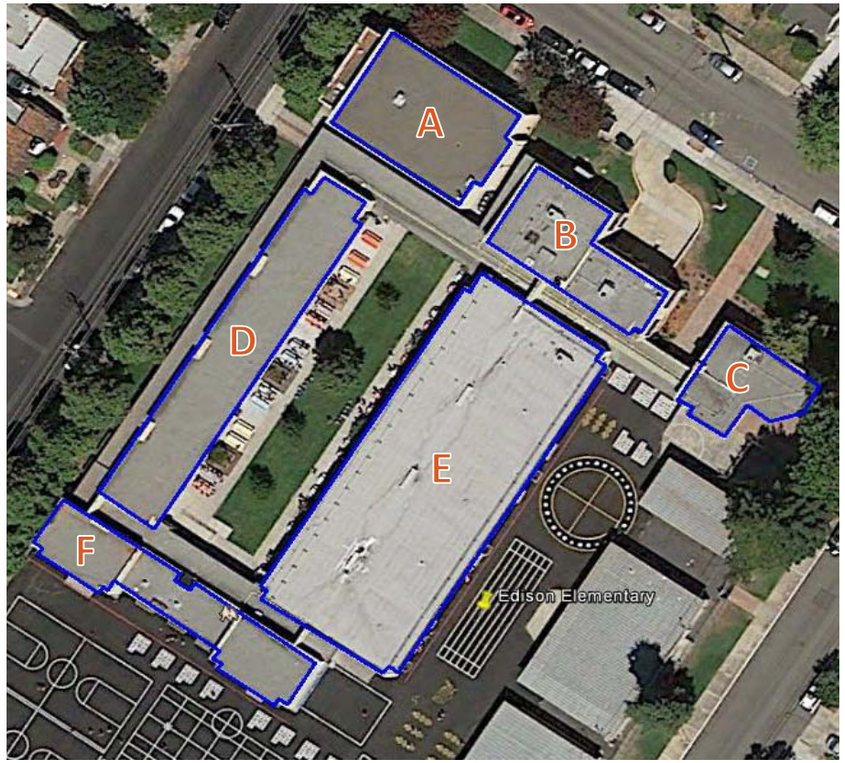
PARKING						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**Kwh**
1	2,720	70%	1,904	34	1,540	51,899
2	3,402	70%	2,381	42	1,540	64,912
3	3,650	70%	2,555	45	1,540	69,644
	9,772		**6,840**	**121**	**1,540**	**186,456**

ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	3,622	40%	1,449	26	1,560	40,004
B	1,734	40%	694	12	1,560	19,152
C	3,584	40%	1,434	25	1,560	39,585
D	4,714	45%	2,121	38	1,560	58,573
	13,654		**5,697**	**101**	**1,560**	**157,314**

TOTAL	**23,426**		**12,538**	**222**		**343,769**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
222,000	$31,591	222,000	143

	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	157,314	$484,043	$22,895	71	157	71%
Parking	121		121		186,456	$593,268	$27,137	85	186	84%
Blended	121	101	121	23	222,000	$702,620	$32,310	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	1,560	50,613
B	2,332	45%	1,049	19	1,560	28,976
C	1,482	40%	593	10	1,560	16,368
D	4,621	60%	2,773	49	1,560	76,557
E	11,393	55%	6,266	111	1,560	173,021
F	2,761	30%	828	15	1,560	22,871
	25,644		**13,342**	**236**	**1,560**	**368,406**

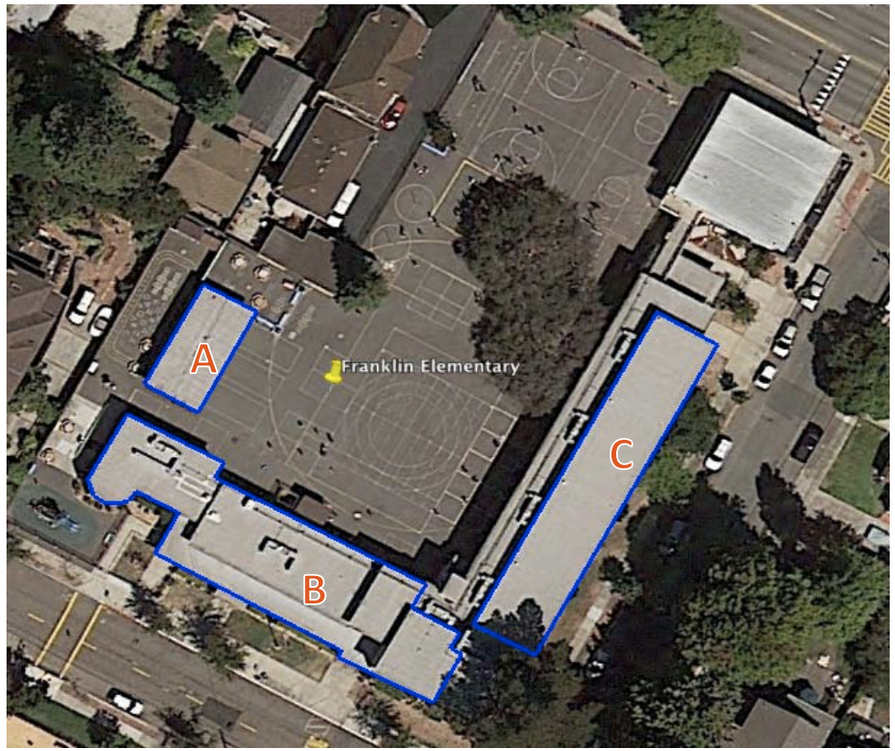
TOTAL	**25,644**		**13,342**	**236**		**368,406**

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
75,253	$11,002	75,253	48

*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		236		48	75,253	$231,548	$10,952	34	75	100%



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

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

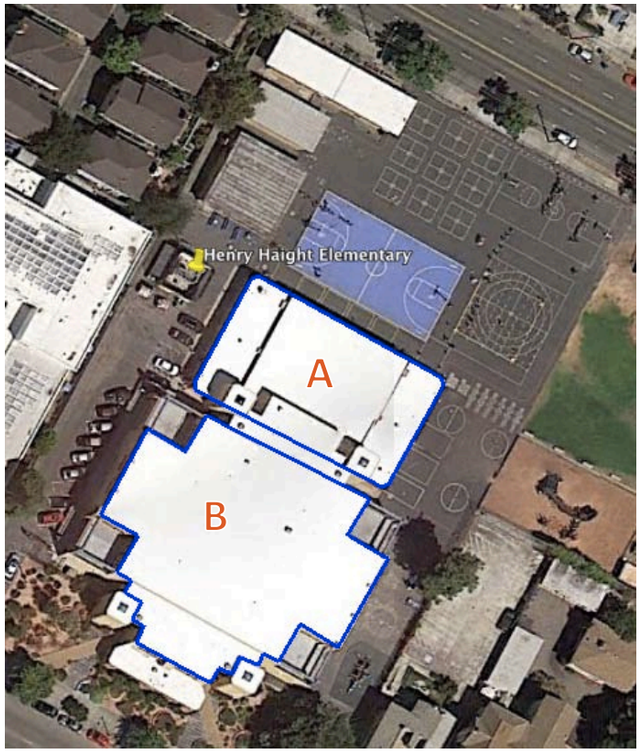
ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	1,143	55%	629	11	1,560	17,358
B	5,988	35%	2,096	37	1,560	57,869
C	4,087	60%	2,452	43	1,560	67,710
	11,218		**5,177**	**92**	**1,560**	**142,938**

TOTAL	**11,218**		**5,177**	**92**		**142,938**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
61,939	$9,055	61,939	40

*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		40	61,939	$190,582	$9,015	28	62	100%



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

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

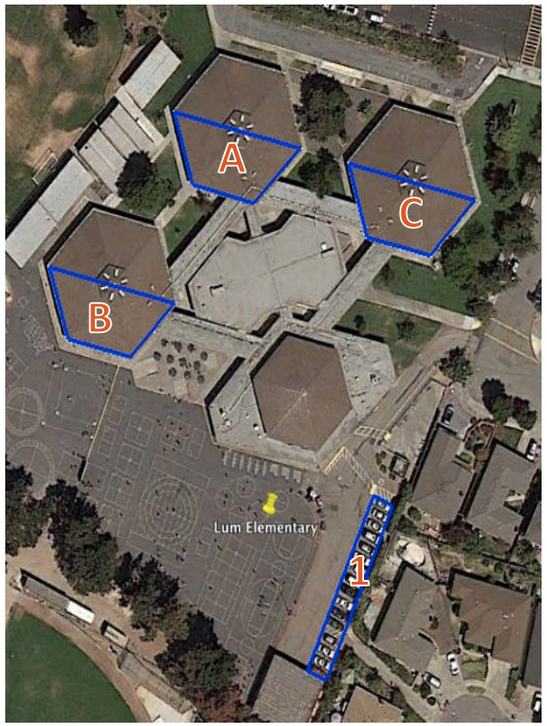
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	9,905	40%	3,962	70	1,560	109,399
B	17,259	50%	8,630	153	1,560	238,278
	27,164		**12,592**	**223**	**1,560**	**347,676**

TOTAL	27,164		12,592	223		347,676

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
343,338	$48,960	343,338	220

*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		220	343,338	$1,056,425	$49,969	156	343	100%



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	1,540	68,554
	2,515		**2,515**	**45**	**1,540**	**68,554**

ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	3,999	45%	1,800	32	1,560	49,689
B	3,920	45%	1,764	31	1,560	48,708
C	4,073	45%	1,833	32	1,560	50,609
	11,992		**5,396**	**96**	**1,560**	**149,005**

TOTAL	**14,507**		**7,911**	**140**		**217,559**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
244,080	$34,842	244,080	157

	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	149,005	$458,478	$21,686	68	149	61%
Parking	45		45		68,554	$218,126	$9,977	31	69	28%
Blended	45	96	45	96	217,559	$676,604	$31,664	99	218	89%

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	1,560	62,144
B	7,874	50%	3,937	70	1,560	108,708
C	19,379	55%	10,658	189	1,560	294,301
D	3,951	45%	1,778	31	1,560	49,093
	35,296		**18,624**	**330**	**1,560**	**514,246**

TOTAL	**35,296**		**18,624**	**330**		**514,246**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
190,800	$27,177	190,800	122

	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		330		122	190,800	$587,077	$27,769	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	1,560	38,557
B	5,098	40%	2,039	36	1,560	56,306
C	6,024	40%	2,410	43	1,560	66,534
D	5,522	25%	1,381	24	1,560	38,118
E	6,750	55%	3,713	66	1,560	102,510
F	2,685	55%	1,477	26	1,560	40,776
	29,570		**12,415**	**220**	**1,560**	**342,802**

TOTAL	**29,570**		**12,415**	**220**		**342,802**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
141,994	$20,390	141,994	91

*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		91	141,994	$436,905	$20,666	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

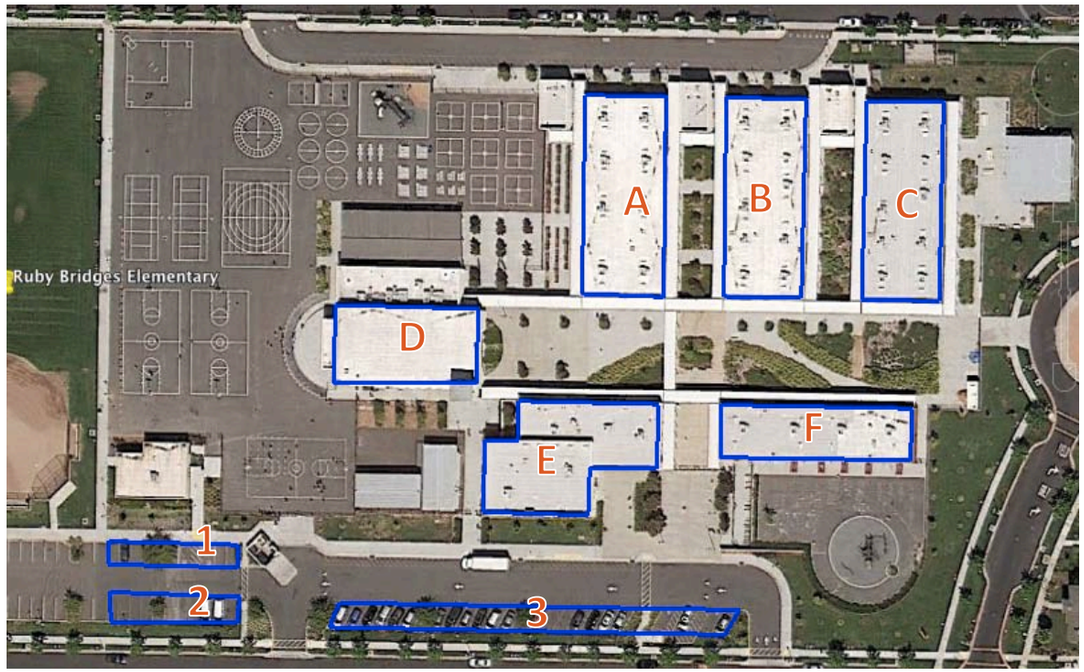
PARKING						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**Kwh**
	-		-	-	-	-

ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	8,564	30%	2,569	45	1,560	70,941
B	14,393	45%	6,477	115	1,560	178,839
C	1,341	45%	603	11	1,560	16,662
D	3,120	55%	1,716	30	1,560	47,382
	27,418		**11,366**	**201**	**1,560**	**313,824**

TOTAL	**27,418**		**11,366**	**201**		**313,824**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
134,600	$20,976	134,600	86

	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		86	134,600	$414,154	$19,590	61	135	100%



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

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	1,670	46,851
2	1,948	100%	1,948	34	1,670	57,581
3	5,239	100%	5,239	93	1,670	154,860
	8,772		**8,772**	**155**	**1,670**	**259,292**

ROOF

Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	8,630	35%	3,021	53	1,560	83,402
B	8,325	35%	2,914	52	1,560	80,454
C	8,148	35%	2,852	50	1,560	78,744
D	5,785	55%	3,182	56	1,560	87,854
E	7,908	40%	3,163	56	1,560	87,342
F	5,298	45%	2,384	42	1,560	65,830
	44,094		**17,515**	**310**	**1,560**	**483,627**

TOTAL	**52,866**		**26,287**	**465**		**742,918**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
442,560	$62,886	442,560	277

	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		284	442,560	$1,134,769	$64,410	201	443	100%
Parking	155		155		259,292	$760,796	$37,737	118	259	59%
Blended	155	310	155	117	442,560	$1,323,225	$64,410	201	443	100%

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

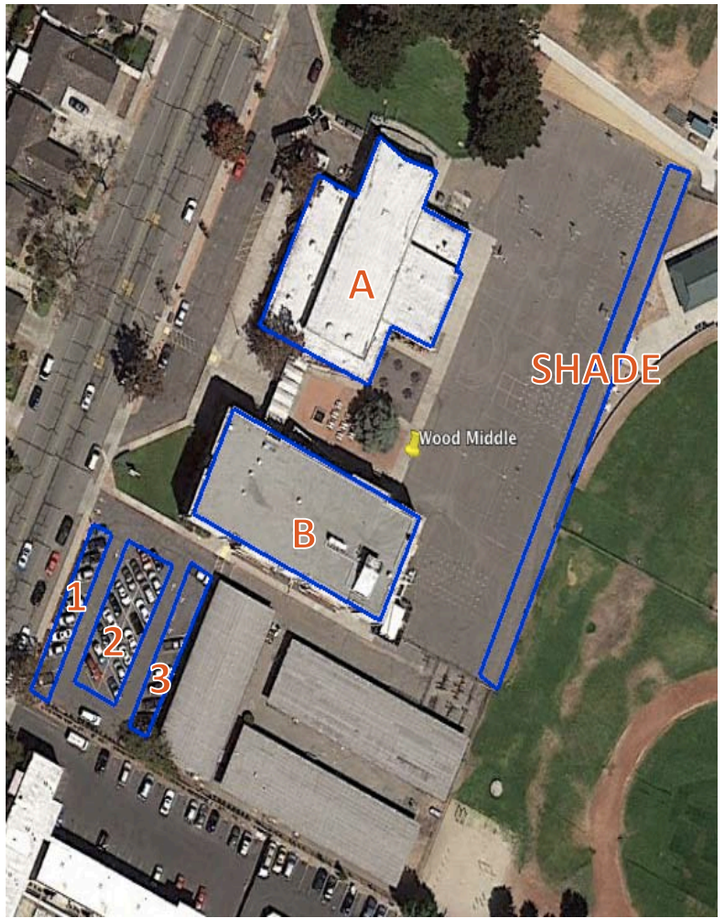
PARKING						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**Kwh**
1	2,135	100%	2,135	38	1,540	58,196
2	1,789	100%	1,789	32	1,570	49,715
3	2,975	100%	2,975	53	1,570	82,672
4	1,132	100%	1,132	20	1,570	31,457
Shade	5,643	100%	5,643	100	1,570	156,813
	13,674		**13,674**	**242**	**1,565**	**378,853**

ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	14,042	50%	7,021	124	1,560	193,864
B	12,719	50%	6,360	113	1,560	175,599
C	9,771	45%	4,397	78	1,560	121,409
D	4,640	25%	1,160	21	1,560	32,030
E	3,599	60%	2,159	38	1,560	59,625
F	3,602	60%	2,161	38	1,560	59,675
G	1,597	55%	878	16	1,560	24,253
H	1,863	55%	1,025	18	1,560	28,293
I	1,632	55%	898	16	1,560	24,785
J	948	50%	474	8	1,560	13,088
K	893	50%	447	8	1,560	12,329
	55,306		**26,979**	**478**	**1,560**	**744,948**

TOTAL	**68,980**		**40,653**	**720**		**1,123,801**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
650,800	$92,509	650,800	417

	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		417	650,800	$1,668,718	$94,717	295	651	100%
Parking	242		242		378,853	$1,185,946	$55,138	172	379	58%
Blended	242	478	242	174	650,800	$2,022,700	$94,717	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	1,540	49,446
2	3,586	100%	3,586	63	1,540	97,747
3	1,898	100%	1,898	34	1,540	51,736
Shade	5,923	100%	5,923	105	1,540	161,449
	13,221		**13,221**	**234**	**1,540**	**360,378**

ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	14,318	25%	3,580	63	1,560	98,837
B	11,586	50%	5,793	103	1,560	159,956
	25,904		**9,373**	**166**	**1,560**	**258,793**

TOTAL	**39,125**		**22,594**	**400**		**619,171**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
216,240	$30,816	216,240	140

	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		139	216,240	$665,354	$31,472	98	216	100%
Parking	234		140		216,240	$688,036	$31,472	98	216	100%

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	1,570	38,238
2	2,728	100%	2,728	17.7	48	1,570	75,808
3	3,478	100%	3,478	17.7	62	1,570	96,650
4	3,302	100%	3,302	17.7	58	1,540	90,006
5	2,016	100%	2,016	17.7	36	1,540	54,952
6	1,351	100%	1,351	17.7	24	1,540	36,826
Shade	2,304	100%	2,304	17.7	41	1,570	64,026
	16,555		**16,555**		**293**	**1,558**	**456,506**

ROOF

Array #	Total Area	Use (%)	Usable Area	Watts/ft^2	kWp	Yield	kWh
A	16,298	45%	7,334	17.7	130	1,560	202,509
B	20,350	15%	3,053	17.7	54	1,560	84,286
C	13,828	50%	6,914	17.7	122	1,560	190,909
D	6,463	50%	3,232	17.7	57	1,560	89,228
E	53,046	20%	10,609	17.7	188	1,560	292,941
	109,985		**31,141**		**551**	**1,560**	**859,874**

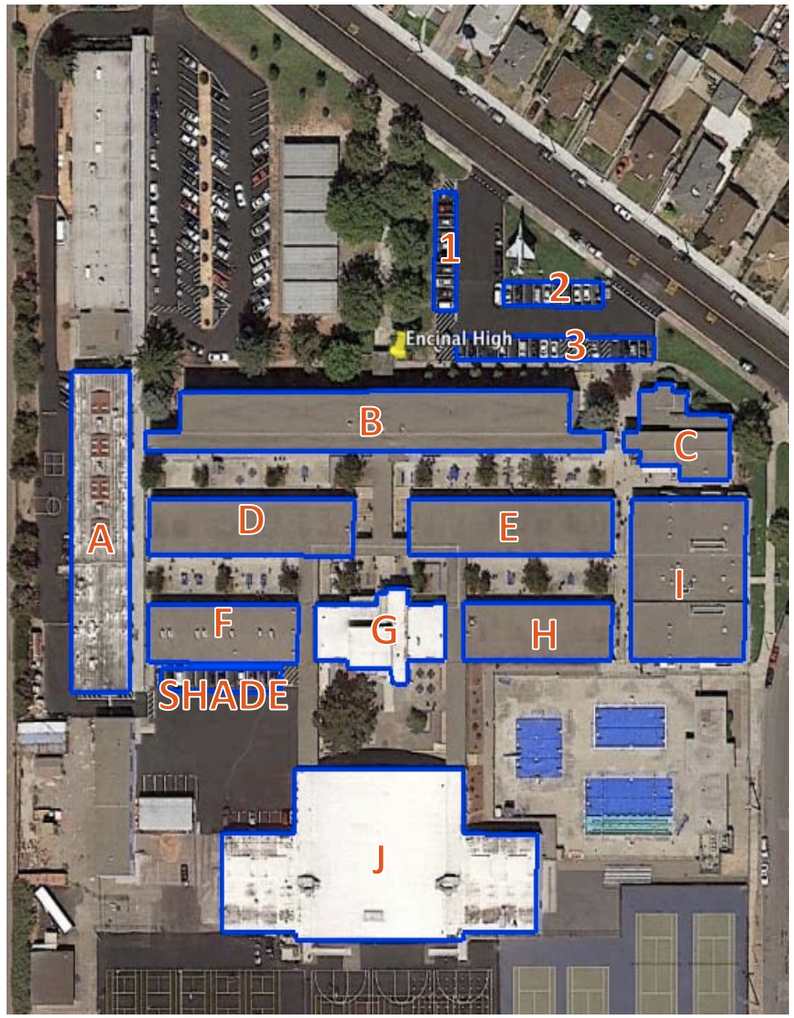
TOTAL	**126,540**		**47,696**		**844**		**1,316,379**

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.

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
995,670	$141,286	995,670	639

*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	859,874	$2,094,564	$125,146		390	860	86%
Parking	293		293		456,506	$1,377,210	$66,440		207	457	46%
Blended	293	551	293	346	995,670	$2,759,682	$144,910		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	1,570	47,603
2	1,590	100%	1,590	28	1,540	43,340
3	3,000	100%	3,000	53	1,540	81,774
Shade	1,818	100%	1,818	32	1,540	49,555
	8,121		**8,121**	**144**	**1,546**	**222,272**

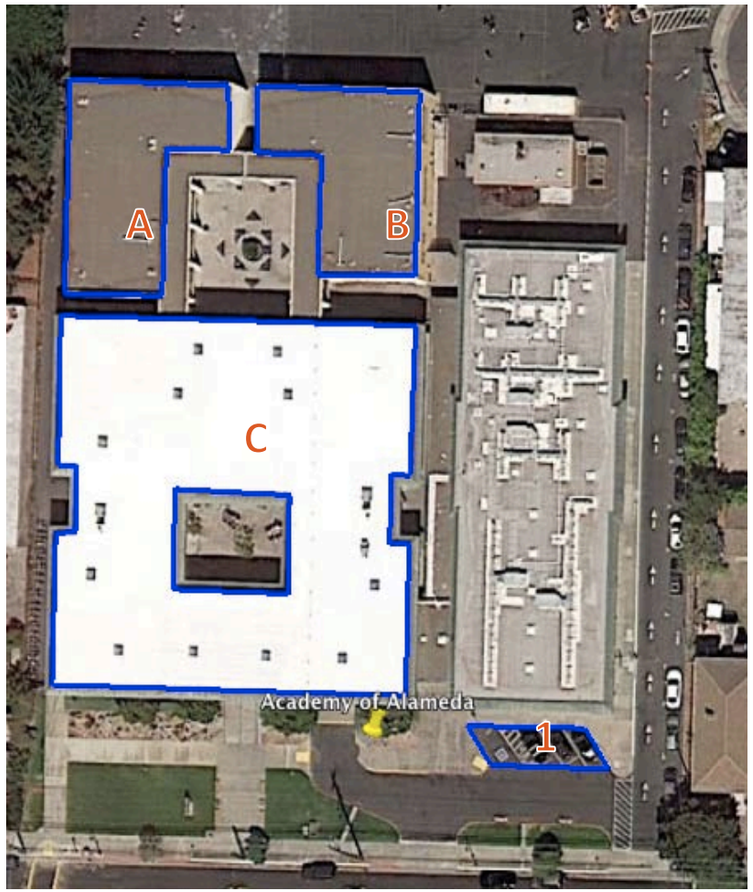
ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	12,261	15%	1,839	33	1,560	50,783
B	15,957	55%	8,776	155	1,560	242,333
C	4,430	15%	665	12	1,560	18,348
D	7,558	60%	4,535	80	1,560	125,215
E	7,369	60%	4,421	78	1,560	122,084
F	5,694	55%	3,132	55	1,560	86,473
G	5,459	15%	819	14	1,560	22,610
H	5,495	50%	2,748	49	1,560	75,864
I	12,045	45%	5,420	96	1,560	149,664
J	28,243	40%	11,297	200	1,560	311,938
	104,511		**43,652**	**773**	**1,560**	**1,205,311**

TOTAL	**112,632**	**51,773**	**916**	**1,427,583**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
672,520	$95,700	672,520	432

*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		431	672,520	$1,724,410	$97,879	305	673	100%
Parking	144		144		222,272	$704,334	$32,349	101	222	33%
Blended	144	773	144	289	672,520	$1,858,787	$97,879	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	1,670	25,243
	854		**854**	**15**	**1,670**	**25,243**

ROOF						
Array #	**Total Area**	**Use (%)**	**Usable Area**	**kWp**	**Yield**	**kWh**
A	4,554	55%	2,505	44	1,560	69,160
B	4,082	55%	2,245	40	1,560	61,992
C	21,282	50%	10,641	188	1,560	293,819
	29,918		**15,391**	**272**	**1,560**	**424,971**

TOTAL	**30,772**		**16,245**	**288**		**450,214**

Current Annual Consumption (kWh)	Current Annual Cost ($)	Target kWh	kWp Needed to Reach Target
337,560	$47,944	337,560	216

	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		216	337,560	$1,038,646	$49,128	153	338	100%
Parking	15		15		25,243	$74,067	$3,674	11	25	7%
Blended	15	272	15	200	337,560	$1,034,710	$49,128	153	338	100%