



Solar Master Plan



Novato Unified
School District

Novato Unified School District Solar Master Plan

Prepared by KyotoUSA
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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.

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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 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	1,489.4
South Facing Carport	1,565.9
West Facing Carport	1,456.6
East Facing Carport	1,463.4

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 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 **75% of current annual consumption** will achieve this target for schools, but the exact value will vary at each site (an offset of 95% is estimated for office buildings). The analysis shows three approaches for reaching this target: offsetting electricity consumption using roofs only, parking only, and a combination of the two.

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 \$0.19/kWh, 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	0.19	\$/kWh
Offset Usage Target	75%	Schools
	95%	Office/Warehouse

System Size	Cost (\$/W)
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	Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
	Hamilton Elementary	5530 Nave Dr, Novato, CA 94949	284,929	\$54,301	213,697	140
	Hill Education Center	720 Diablo Ave, Novato, CA 94945	121,342	\$22,862	91,006	61
	Loma Verde Elementary	399 Alameda de la Loma, Novato, CA 94949	101,366	\$19,618	76,025	51
	Lu Sutton Elementary	1800 Center Rd, Novato, CA 94947	93,052	\$21,292	69,789	47
	Lynwood Elementary	1320 Lynwood Dr, Novato, CA 94947	146,973	\$32,787	110,230	74
	Novato Charter	936 C St, Novato, CA 94949	29,215	\$5,791	21,911	14
	Novato High	625 Arthur St, Novato, CA 94947	586,825	\$102,700	440,119	294
	Olive Elementary	629 Plum St, Novato, CA 94945	88,446	\$17,077	66,335	44
	Pleasant Valley Elementary	755 Sutro Ave, Novato, CA 94947	117,544	\$23,223	88,158	60
	Rancho Elementary	1430 Johnson St, Novato, CA 94947	111,970	\$22,250	83,977	56
	San Jose Middle	1000 Sunset Parkway, Novato, CA 94949	177,036	\$34,640	132,777	90
	San Marin High	15 San Marin Dr, Novato, CA 94945	569,682	\$103,056	427,262	292
	San Ramon Elementary	45 San Ramon Way, Novato, CA 94945	182,702	\$38,464	137,027	93
	Sinaloa Middle	2045 Vineyard Rd, Novato, CA 94947	248,066	\$51,288	186,050	126
	Warehouse	819 Olive Ave, Novato, CA 94945	103,936	\$20,983	98,739	66
	District Admin	1015 7th St, Novato, CA 94945	317,642	\$57,995	301,760	199
	Totals	3,280,727	\$628,325	2,544,861	1,709	

Offsetting Electricity Consumption Using Roofs	Location
	Hamilton Elementary
	Hill Education Center
	Loma Verde Elementary
	Lu Sutton Elementary
	Lynwood Elementary
	Novato Charter
	Novato High
	Olive Elementary
	Pleasant Valley Elementary
	Rancho Elementary
	San Jose Middle
	San Marin High
	San Ramon Elementary
	Sinaloa Middle
Warehouse	
District Admin	
Totals	

Location's Roof Profile		
Actual System Size (kWp)	kWh Production	Meets Target
69	102,797	36%
61	91,006	75%
51	76,025	75%
47	69,789	75%
74	110,230	75%
0	0	0%
296	440,119	75%
45	66,335	75%
51	76,293	65%
56	83,977	75%
89	132,777	75%
84	125,498	22%
38	56,692	31%
125	186,050	75%
66	98,739	95%
40	59,172	19%
1,192	1,775,499	

Financial Information	
Estimated System Cost	Value of avoided Electricity: Year 1
\$331,293	\$19,532
\$293,292	\$17,291
\$245,011	\$14,445
\$224,914	\$13,260
\$355,247	\$20,944
\$0	\$0
\$1,182,003	\$83,623
\$213,782	\$12,604
\$245,874	\$14,496
\$270,640	\$15,956
\$427,911	\$25,228
\$404,452	\$23,845
\$182,706	\$10,772
\$599,597	\$35,349
\$318,213	\$18,760
\$190,697	\$11,243
\$5,485,631	\$337,345

Environmental Benefits	
Annual avoided GHGs (tons)	Annual RECs earned (mWh)
18	103
16	91
13	76
12	70
20	110
0	0
78	440
12	66
14	76
15	84
24	133
22	125
10	57
33	186
17	99
10	59
314	1,775

The annual avoided GHGs is based on PG&E's emissions factor forecast for 2015.

Offsetting Electricity Consumption Using Parking Lots	Location
	Hamilton Elementary
	Hill Education Center
	Loma Verde Elementary
	Lu Sutton Elementary
	Lynwood Elementary
	Novato Charter
	Novato High
	Olive Elementary
	Pleasant Valley Elementary
	Rancho Elementary
	San Jose Middle
	San Marin High
	San Ramon Elementary
	Sinaloa Middle
	Warehouse
District Admin	
Totals	

Location's Parking Profile		
Actual System Size (kWp)	kWh Production	Meets Target
139	213,697	75%
62	91,006	75%
52	76,025	75%
0	0	0%
75	110,230	75%
14	21,911	75%
293	440,119	75%
43	66,335	75%
60	88,158	75%
39	57,529	51%
91	132,777	75%
293	427,262	75%
86	125,470	69%
119	173,151	70%
66	98,739	95%
72	109,587	35%
1,505	2,231,995	

Financial Information	
Estimated System Cost	Value of avoided Electricity: Year 1
\$683,340	\$40,602
\$305,138	\$17,291
\$254,559	\$14,445
\$0	\$0
\$369,091	\$20,944
\$70,772	\$4,163
\$1,376,645	\$83,623
\$212,274	\$12,604
\$295,186	\$16,750
\$192,627	\$10,930
\$446,662	\$25,228
\$1,374,870	\$81,180
\$420,120	\$23,839
\$582,479	\$32,899
\$321,170	\$18,760
\$351,083	\$20,822
\$7,256,015	\$424,079

Environmental Benefits	
Annual avoided GHGs (tons)	Annual RECs earned (mWh)
38	214
16	91
13	76
0	0
20	110
4	22
78	440
12	66
16	88
10	58
24	133
76	427
22	125
31	173
17	99
19	110
395	2,232

Offsetting Electricity Consumption Using Parking and Roofs	Location
	Hamilton Elementary
	Hill Education Center
	Loma Verde Elementary
	Lu Sutton Elementary
	Lynwood Elementary
	Novato Charter
	Novato High
	Olive Elementary
	Pleasant Valley Elementary
	Rancho Elementary
	San Jose Middle
	San Marin High
	San Ramon Elementary
	Sinaloa Middle
	Warehouse
	District Admin
Totals	

Location's Parking and Roof Profile			
Actual Parking System Size (kWp)	Actual Roof System Size (kWp)	kWh Production	Meets Target
139	0	213,697	75%
62	0	91,006	75%
52	0	76,025	75%
0	47	69,789	75%
75	0	110,230	75%
14	0	21,911	75%
293	0	440,119	75%
43	0	66,335	75%
60	0	88,158	75%
39	18	83,977	75%
91	0	132,777	75%
293	0	427,262	75%
86	8	137,027	75%
119	9	186,050	75%
66	0	98,739	95%
72	40	168,759	53%
1,505	121	2,411,860	

Financial Information	
Estimated System Cost	Value of avoided Electricity: Year 1
\$683,340	\$40,602
\$305,138	\$17,291
\$254,559	\$14,445
\$224,914	\$13,260
\$369,091	\$20,944
\$70,772	\$4,163
\$1,376,645	\$83,623
\$212,274	\$12,604
\$295,186	\$16,750
\$277,847	\$15,956
\$446,662	\$25,228
\$1,374,870	\$81,180
\$457,353	\$26,035
\$624,030	\$35,349
\$321,170	\$18,760
\$541,780	\$32,064
\$7,835,630	\$458,253

Environmental Benefits	
Annual avoided GHGs (tons)	Annual RECs earned (mWh)
38	214
16	91
13	76
12	70
20	110
4	22
78	440
12	66
16	88
15	84
24	133
76	427
24	137
33	186
17	99
30	169
427	2,412

Table 2a: General Obligation Bond

Key Energy Saving Inputs and Assumptions	
System Size (kWp)	1,625
Price (\$/Wp)	\$4.82
Solar Yield (kWh/kWp)	1,484
Annual Rate of PV Degradation	0.50%
Estimated Avoided Cost (\$/kWh)	\$0.190
Annual Electricity Cost Inflation	3.00%
Operations & Maintenance Cost: Year 1	\$68,010
Annual O&M Escalation Rate	3.00%

Key Financing Inputs and Assumptions	
Solar Contract Turnkey Price	\$7,835,630
Performance Guarantee: Years 0-10	\$130,183
Bond Issuance Cost (2.0%)	\$159,000
Total GO Bond	\$8,124,813

Projected Results	
Total General Fund Savings	\$9,860,809
Average Annual Savings	\$493,040
General Fund NPV (3%)	\$7,167,292

Year	Savings of Utility Bill	Cost of O&M Contract (Years 0-20)	Net Energy Savings
1	\$458,253	(\$68,010)	\$390,243
2	\$469,641	(\$70,050)	\$399,591
3	\$481,312	(\$72,152)	\$409,160
4	\$493,272	(\$74,317)	\$418,956
5	\$505,530	(\$76,546)	\$428,984
6	\$518,092	(\$78,842)	\$439,250
7	\$530,967	(\$81,208)	\$449,759
8	\$544,162	(\$83,644)	\$460,518
9	\$557,684	(\$86,153)	\$471,531
10	\$571,542	(\$88,738)	\$482,805
11	\$585,745	(\$91,400)	\$494,345
12	\$600,301	(\$94,142)	\$506,159
13	\$615,218	(\$96,966)	\$518,252
14	\$630,507	(\$99,875)	\$530,631
15	\$646,175	(\$102,871)	\$543,303
16	\$662,232	(\$105,958)	\$556,275
17	\$678,689	(\$109,136)	\$569,552
18	\$695,554	(\$112,410)	\$583,144
19	\$712,839	(\$115,783)	\$597,056
20	\$730,553	(\$119,256)	\$611,296
Total	\$11,688,267	(\$1,827,458)	\$9,860,809

Annual General Fund Benefit	Cumulative General Fund Benefit
\$390,243	\$390,243
\$399,591	\$789,834
\$409,160	\$1,198,993
\$418,956	\$1,617,949
\$428,984	\$2,046,933
\$439,250	\$2,486,183
\$449,759	\$2,935,942
\$460,518	\$3,396,460
\$471,531	\$3,867,991
\$482,805	\$4,350,795
\$494,345	\$4,845,140
\$506,159	\$5,351,299
\$518,252	\$5,869,552
\$530,631	\$6,400,183
\$543,303	\$6,943,486
\$556,275	\$7,499,761
\$569,552	\$8,069,313
\$583,144	\$8,652,457
\$597,056	\$9,249,513
\$611,296	\$9,860,809
\$9,860,809	

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 sites and PV system sizes have been identified by the district.

The net energy cost savings equals the utility bill savings less the cost of the Operations and Maintenance (O&M). The Solar Turnkey Price, the Performance Guarantee (PeGu), and the Bond Issuance Cost make up the total GO Bond amount required to install PV systems at all assessed sites. The annual utility bill savings assumes an annual panel degradation rate of 0.50% and an annual electricity cost increase of 3.00%.

Table 2b: GO Bond and California Energy Commission Loan

Key Energy Saving Inputs and Assumptions	
System Size (kWp)	1,625
Price (\$/Wp)	\$4.82
Solar Yield (kWh/kWp)	1,484
Annual Rate of PV Degradation	0.50%
Estimated Avoided Cost (\$/kWh)	\$0.190
Annual Electricity Cost Inflation	3.00%
Operations & Maintenance Cost: Year 1	\$68,010
Annual O&M Escalation Rate	3.00%

Key Financing Inputs and Assumptions	
Solar Contract Turnkey Price	\$7,835,630
Performance Guarantee: Years 0-10	\$130,183
Total CEC Loan	\$3,000,000
Bond Issuance Cost (2.0%)	\$99,000
Interest	0.00%
Term (years)	20
GO Bond	\$5,064,813

Projected Results	
Total General Fund Savings	\$6,860,809
Average Annual Savings	\$343,040
General Fund NPV (3%)	\$5,103,575

Year	Savings of Utility Bill	Cost of O&M Contract (Years 0-20)	Net Energy Savings
1	\$458,253	(\$68,010)	\$390,243
2	\$469,641	(\$70,050)	\$399,591
3	\$481,312	(\$72,152)	\$409,160
4	\$493,272	(\$74,317)	\$418,956
5	\$505,530	(\$76,546)	\$428,984
6	\$518,092	(\$78,842)	\$439,250
7	\$530,967	(\$81,208)	\$449,759
8	\$544,162	(\$83,644)	\$460,518
9	\$557,684	(\$86,153)	\$471,531
10	\$571,542	(\$88,738)	\$482,805
11	\$585,745	(\$91,400)	\$494,345
12	\$600,301	(\$94,142)	\$506,159
13	\$615,218	(\$96,966)	\$518,252
14	\$630,507	(\$99,875)	\$530,631
15	\$646,175	(\$102,871)	\$543,303
16	\$662,232	(\$105,958)	\$556,275
17	\$678,689	(\$109,136)	\$569,552
18	\$695,554	(\$112,410)	\$583,144
19	\$712,839	(\$115,783)	\$597,056
20	\$730,553	(\$119,256)	\$611,296
Total	\$11,688,267	(\$1,827,458)	\$9,860,809

Principal Repayment	Supplemental Interest	Net Payment
(\$47,203)	\$0	(\$47,203)
(\$56,550)	\$0	(\$56,550)
(\$66,119)	\$0	(\$66,119)
(\$75,915)	\$0	(\$75,915)
(\$85,944)	\$0	(\$85,944)
(\$96,210)	\$0	(\$96,210)
(\$106,719)	\$0	(\$106,719)
(\$117,477)	\$0	(\$117,477)
(\$128,490)	\$0	(\$128,490)
(\$139,764)	\$0	(\$139,764)
(\$151,305)	\$0	(\$151,305)
(\$163,119)	\$0	(\$163,119)
(\$175,212)	\$0	(\$175,212)
(\$187,591)	\$0	(\$187,591)
(\$200,263)	\$0	(\$200,263)
(\$213,234)	\$0	(\$213,234)
(\$226,512)	\$0	(\$226,512)
(\$240,103)	\$0	(\$240,103)
(\$254,016)	\$0	(\$254,016)
(\$268,252)	\$0	(\$268,252)
(\$3,000,000)	\$0	(\$3,000,000)

Annual General Fund Benefit	Cumulative General Fund Benefit
\$343,040	\$343,040
\$343,040	\$686,080
\$343,040	\$1,029,121
\$343,040	\$1,372,161
\$343,040	\$1,715,201
\$343,040	\$2,058,241
\$343,040	\$2,401,282
\$343,040	\$2,744,322
\$343,040	\$3,087,362
\$343,040	\$3,430,402
\$343,040	\$3,773,443
\$343,040	\$4,116,483
\$343,040	\$4,459,523
\$343,040	\$4,802,563
\$343,040	\$5,145,604
\$343,040	\$5,488,644
\$343,040	\$5,831,684
\$343,040	\$6,174,724
\$343,040	\$6,517,764
\$343,044	\$6,860,809
\$6,860,809	

The cost analysis assumes the PV systems are financed with a General Obligation Bond and a California Energy Commission (CEC) loan (0% interest and a payoff period of 20 years). This analysis is intended only to provide the District with a reasonable estimate of the savings the district can achieve. A more rigorous analysis should be done by an independent procurement consultant once the District has decided to move forward on the project.

The net energy cost savings equals the utility bill savings less the cost of the Operations and Maintenance (O&M). The Solar Turkey Price, the Performance Guarantee (PeGu), and the Bond Issuance Cost (less the CEC Loan), make up the total GO Bond contribution. 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 20 years in which the loan is repaid.

Table 2c: GO Bond and Clean Renewable Energy Bond

Key Energy Saving Inputs and Assumptions	
System Size (kWp)	1,625
Price (\$/Wp)	\$4.82
Solar Yield (kWh/kWp)	1,484
Annual Rate of PV Degradation	0.50%
Estimated Avoided Cost (\$/kWh)	\$0.190
Annual Electricity Cost Inflation	3.00%
Operations & Maintenance Cost: Year 1	\$68,010
Annual O&M Escalation Rate	3.00%

Key Financing Inputs and Assumptions	
Solar Contract Turnkey Price	\$7,835,630
Performance Guarantee: Years 0-10	\$130,183
GO Bond	\$2,000,000
Bond Issuance Cost (2.0%)	\$159,000
Total CREB	\$6,124,813
Interest	1.50%
Term (years)	17

Projected Results	
Total General Fund Savings	\$2,808,629
Average Annual Savings	\$140,431
General Fund NPV (3%)	\$1,809,176

Year	Savings of Utility Bill	Cost of O&M Contract (Years 0-20)	Net Energy Savings
1	\$458,253	(\$68,010)	\$390,243
2	\$469,641	(\$70,050)	\$399,591
3	\$481,312	(\$72,152)	\$409,160
4	\$493,272	(\$74,317)	\$418,956
5	\$505,530	(\$76,546)	\$428,984
6	\$518,092	(\$78,842)	\$439,250
7	\$530,967	(\$81,208)	\$449,759
8	\$544,162	(\$83,644)	\$460,518
9	\$557,684	(\$86,153)	\$471,531
10	\$571,542	(\$88,738)	\$482,805
11	\$585,745	(\$91,400)	\$494,345
12	\$600,301	(\$94,142)	\$506,159
13	\$615,218	(\$96,966)	\$518,252
14	\$630,507	(\$99,875)	\$530,631
15	\$646,175	(\$102,871)	\$543,303
16	\$662,232	(\$105,958)	\$556,275
17	\$678,689	(\$109,136)	\$569,552
18	\$695,554	(\$112,410)	\$583,144
19	\$712,839	(\$115,783)	\$597,056
20	\$730,553	(\$119,256)	\$611,296
Total	\$11,688,267	(\$1,827,458)	\$9,860,809

Principal Repayment	Supplemental Interest	Net Payment
(\$238,560)	(\$91,872)	(\$330,432)
(\$251,486)	(\$88,294)	(\$339,780)
(\$264,827)	(\$84,522)	(\$349,349)
(\$278,596)	(\$80,549)	(\$359,145)
(\$292,803)	(\$76,370)	(\$369,173)
(\$307,461)	(\$71,978)	(\$379,439)
(\$322,582)	(\$67,366)	(\$389,948)
(\$338,179)	(\$62,527)	(\$400,707)
(\$354,265)	(\$57,455)	(\$411,720)
(\$370,853)	(\$52,141)	(\$422,994)
(\$387,956)	(\$46,578)	(\$434,534)
(\$405,589)	(\$40,759)	(\$446,348)
(\$423,767)	(\$34,675)	(\$458,441)
(\$442,502)	(\$28,318)	(\$470,821)
(\$461,812)	(\$21,681)	(\$483,492)
(\$481,710)	(\$14,754)	(\$496,464)
(\$501,865)	(\$7,528)	(\$509,393)
-	-	\$0
-	-	\$0
-	-	\$0
(\$6,124,813)	(\$927,366)	(\$7,052,179)

Annual General Fund Benefit	Cumulative General Fund Benefit
\$59,811	\$59,811
\$59,811	\$119,622
\$59,811	\$179,433
\$59,811	\$239,243
\$59,811	\$299,054
\$59,811	\$358,865
\$59,811	\$418,676
\$59,811	\$478,487
\$59,811	\$538,298
\$59,811	\$598,109
\$59,811	\$657,920
\$59,811	\$717,730
\$59,811	\$777,541
\$59,811	\$837,352
\$59,811	\$897,163
\$59,811	\$956,974
\$60,160	\$1,017,134
\$583,144	\$1,600,277
\$597,056	\$2,197,333
\$611,296	\$2,808,629
\$2,808,629	

The cost analysis assumes the PV systems are financed with Clean Renewable Energy Bonds (CREBs). 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 cost savings equals the utility bill savings less the cost of the Operations and Maintenance (O&M). The Solar Turnkey Price, the Performance Guarantee (PeGu) and the Bond Issuance Cost (less the GO Bond contribution) make up the total CREB 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 years in which the bond is repaid.

Table 3: Aerial Assessments



Location: Hamilton Elementary
Address: 5530 Nave Dr, Novato, CA 94949

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	5,552	100%	5,552	98	1,463.4	143,809
2	1,578	100%	1,578	28	1,565.9	43,737
3	3,883	100%	3,883	69	1,565.9	107,623
4	4,377	100%	4,377	77	1,565.9	121,315
5	1,571	100%	1,571	28	1,565.9	43,543
16,961			16,961	300	1,532.3	460,026

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	815	60%	489	9	1,489.4	12,891
B	780	60%	468	8	1,489.4	12,338
C	842	60%	505	9	1,489.4	13,318
D	860	60%	516	9	1,489.4	13,603
E	772	60%	463	8	1,489.4	12,211
F	874	60%	524	9	1,489.4	13,824
G	764	60%	458	8	1,489.4	12,085
H	792	60%	475	8	1,489.4	12,527
6,499			3,899	69	1,489.4	102,797

TOTAL	23,460		20,860	369		562,823
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
284,929	\$54,301	213,697	140

	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						
Roof		69	102,797	\$331,293	\$19,532	18	103	36%
Parking	139		213,697	\$683,340	\$40,602	38	214	75%



Location: Hill Education Center
Address: 720 Diablo Ave, Novato, CA 94945

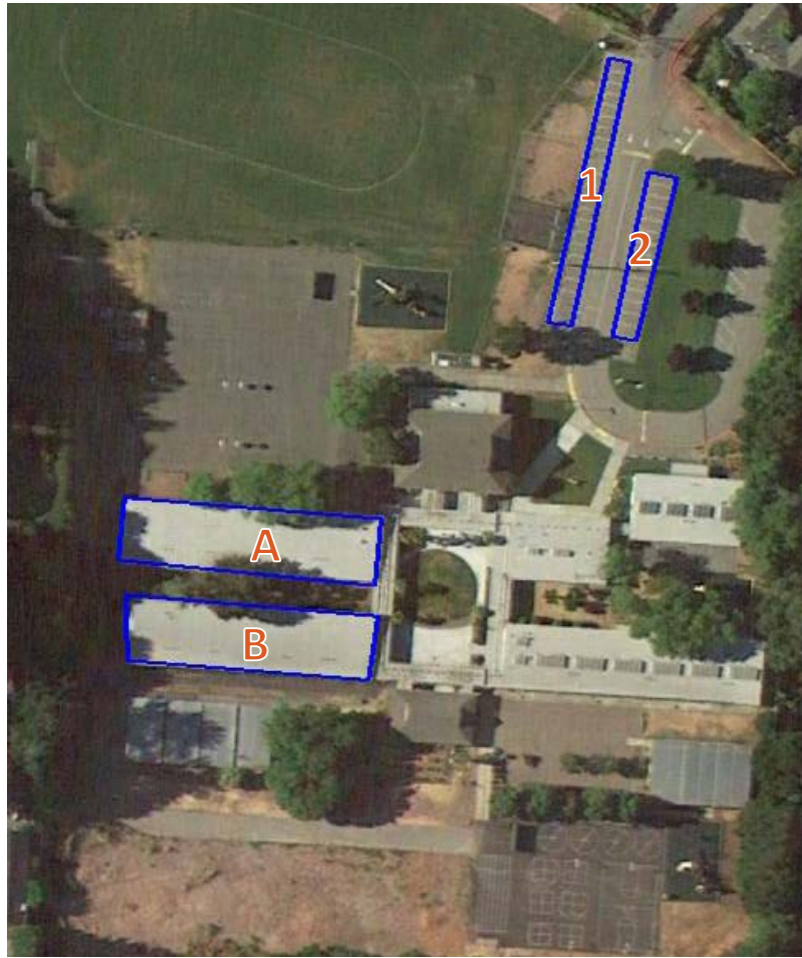
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	1,732	100%	1,732	31	1,463.4	44,863
2	1,313	100%	1,313	23	1,456.6	33,852
3	1,433	100%	1,433	25	1,463.4	37,118
	4,478		4,478	79	1,461.4	115,832

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	7,671	50%	3,836	68	1,489.4	101,113
B	9,180	50%	4,590	81	1,489.4	121,003
C	10,315	50%	5,158	91	1,489.4	135,964
D	5,491	45%	2,471	44	1,489.4	65,140
E	2,617	40%	1,047	19	1,489.4	27,596
F	2,213	40%	885	16	1,489.4	23,336
G	1,911	40%	764	14	1,489.4	20,151
	39,398		18,750	332	1,489.4	494,304

TOTAL	43,876		23,228	411		610,136
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
121,342	\$22,862	91,006	61

	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						
Roof		61	91,006	\$293,292	\$17,291	16	91	75%
Parking	62		91,006	\$305,138	\$17,291	16	91	75%



Location: Loma Verde Elementary
Address: 399 Alameda de la Loma, Novato, CA 94949

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	3,281	100%	3,281	58	1,463.4	84,985
2	2,417	100%	2,417	43	1,463.4	62,606
	5,698		5,698	101	1,463.4	147,591

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	9,086	60%	5,452	96	1,489.4	143,717
B	8,690	60%	5,214	92	1,489.4	137,453
	17,776		10,666	189	1,489.4	281,171

TOTAL	23,474		16,364	290		428,761
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
101,366	\$19,618	76,025	51

	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						
Roof		51	76,025	\$245,011	\$14,445	13	76	75%
Parking	52		76,025	\$254,559	\$14,445	13	76	75%



Location: Lu Sutton Elementary
Address: 1800 Center Rd, Novato, CA 94947

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

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	6,907	60%	4,144	73	1,489.4	109,251
B	7,201	60%	4,321	76	1,489.4	113,901
C	7,870	50%	3,935	70	1,489.4	103,736
D	6,620	60%	3,972	70	1,489.4	104,711
E	11,069	55%	6,088	108	1,489.4	160,493
	39,667		22,460	398	1,489.4	592,092

TOTAL	39,667		22,460	398		592,092
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
93,052	\$21,292	69,789	47

	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						
Roof		47	69,789	\$224,914	\$13,260	12	70	75%



Location: Lynwood Elementary
Address: 1320 Lynwood Dr, Novato, CA 94947

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	5,117	100%	5,117	91	1,463.4	132,541
	5,117		5,117	91	1,463.4	132,541

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	4,797	45%	2,159	38	1,489.4	56,907
B	9,746	45%	4,386	78	1,489.4	115,617
C	9,301	45%	4,185	74	1,489.4	110,338
D	9,218	45%	4,148	73	1,489.4	109,354
E	2,053	30%	616	11	1,489.4	16,237
	35,115		15,494	274	1,489.4	408,453

TOTAL	40,232		20,611	365		540,995
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
146,973	\$32,787	110,230	74

	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						
Roof		74	110,230	\$355,247	\$20,944	20	110	75%
Parking	75		110,230	\$369,091	\$20,944	20	110	75%



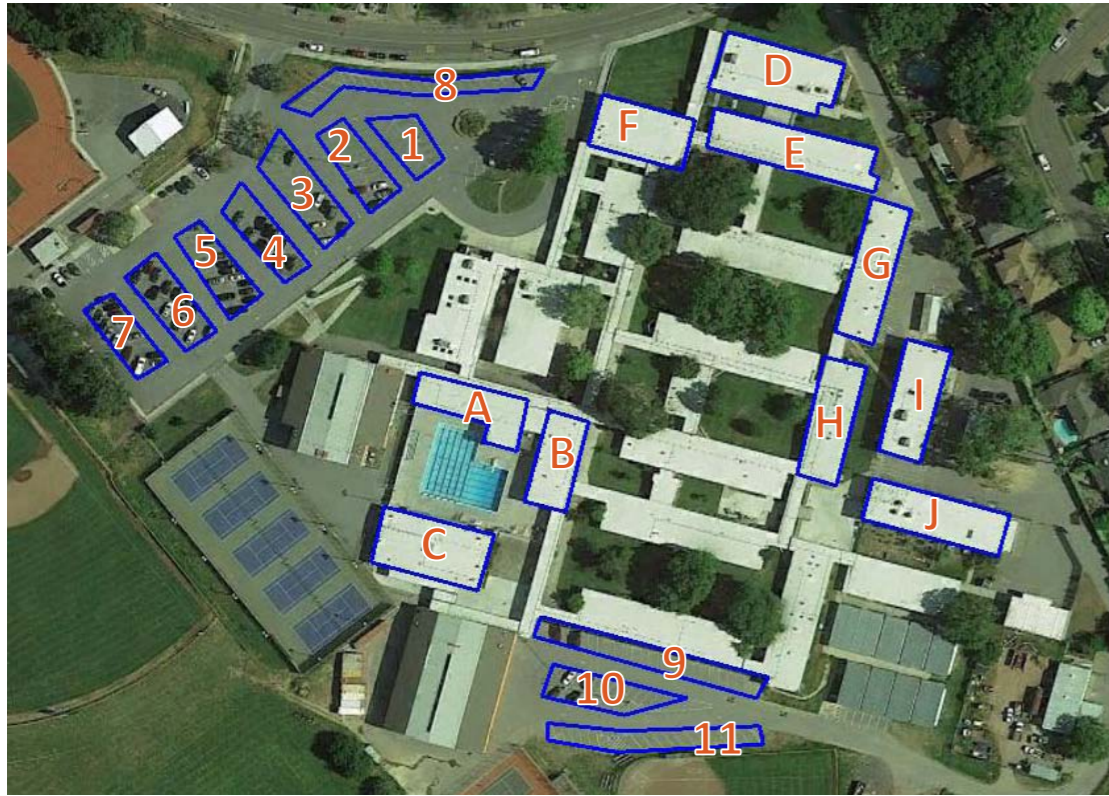
Location: Novato Charter
Address: 936 C St, Novato, CA 94949

PARKING							
Array #	Total Area	Use (%)	Usable Area	Watts/ft ²	kWp	Yield	Kwh
1	1,620	100%	1,620	17.7	29	1,565.9	44,901
2	3,421	100%	3,421	17.7	61	1,565.9	94,818
3	2,916	100%	2,916	17.7	52	1,565.9	80,821
4	1,884	100%	1,884	17.7	33	1,565.9	52,218
5	2,864	100%	2,864	17.7	51	1,463.4	74,184
6	4,811	100%	4,811	17.7	85	1,463.4	124,615
7	1,135	100%	1,135	17.7	20	1,456.6	29,262
	18,651		18,651		330	1,517.1	500,819

ROOF							
Array #	Total Area	Use (%)	Usable Area	Watts/ft ²	kWp	Yield	kWh
-	-	-	-	-	-	-	-
TOTAL	18,651		18,651		330		500,819

Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
29,215	\$5,791	21,911	14

	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	14		21,911	\$70,772	\$4,163	4	22	75%



Location: Novato High
Address: 625 Arthur St, Novato, CA 94947

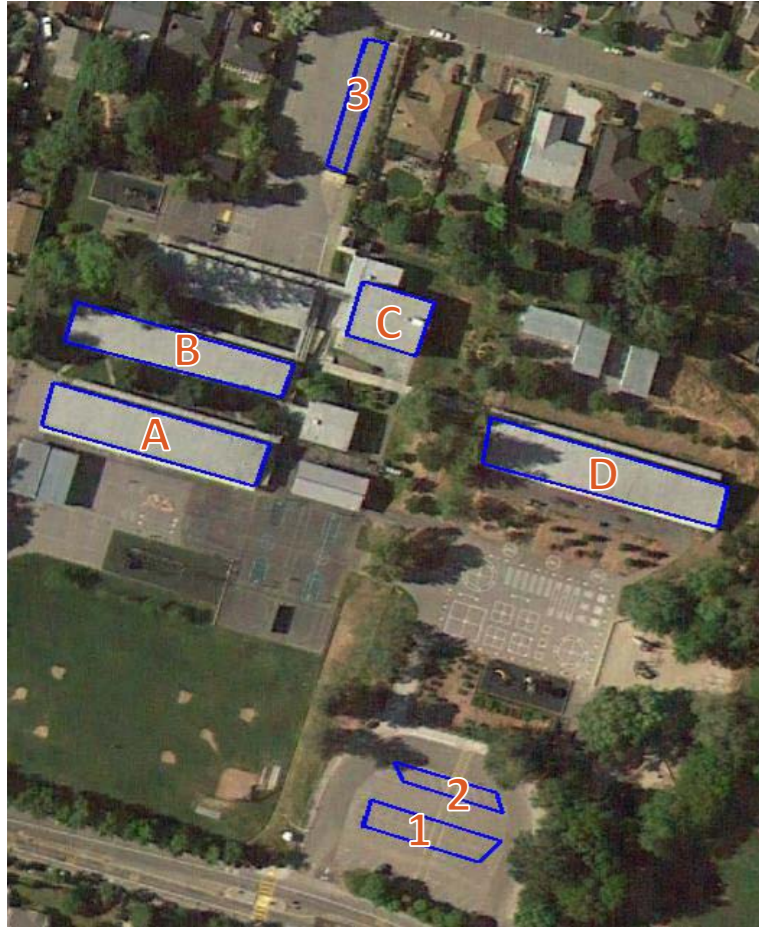
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,711	100%	2,711	48	1,456.6	69,895
2	3,505	100%	3,505	62	1,456.6	90,365
3	4,707	100%	4,707	83	1,456.6	121,355
4	3,522	100%	3,522	62	1,456.6	90,804
5	3,695	100%	3,695	65	1,456.6	95,264
6	3,976	100%	3,976	70	1,456.6	102,509
7	3,151	100%	3,151	56	1,456.6	81,239
8	4,743	100%	4,743	84	1,565.9	131,459
9	5,558	100%	5,558	98	1,565.9	154,048
10	3,871	100%	3,871	69	1,565.9	107,290
11	4,195	100%	4,195	74	1,565.9	116,270
43,634			43,634	772	1,502.6	1,160,497

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	4,567	60%	2,740	49	1,489.4	72,238
B	4,186	50%	2,093	37	1,489.4	55,176
C	6,877	65%	4,470	79	1,489.4	117,841
D	7,496	65%	4,872	86	1,489.4	128,448
E	7,426	65%	4,827	85	1,489.4	127,249
F	5,372	55%	2,955	52	1,489.4	77,890
G	6,047	40%	2,419	43	1,489.4	63,765
H	5,485	40%	2,194	39	1,489.4	57,839
I	5,509	40%	2,204	39	1,489.4	58,092
J	6,418	60%	3,851	68	1,489.4	101,516
59,383			32,624	577	1,489.4	860,056

TOTAL	103,017		76,258	1,350		2,020,552
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
586,825	\$102,700	440,119	294

	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						
Roof		296	440,119	\$1,182,003	\$83,623	78	440	75%
Parking	293		440,119	\$1,376,645	\$83,623	78	440	75%



Location: Olive Elementary
Address: 629 Plum St, Novato, CA 94945

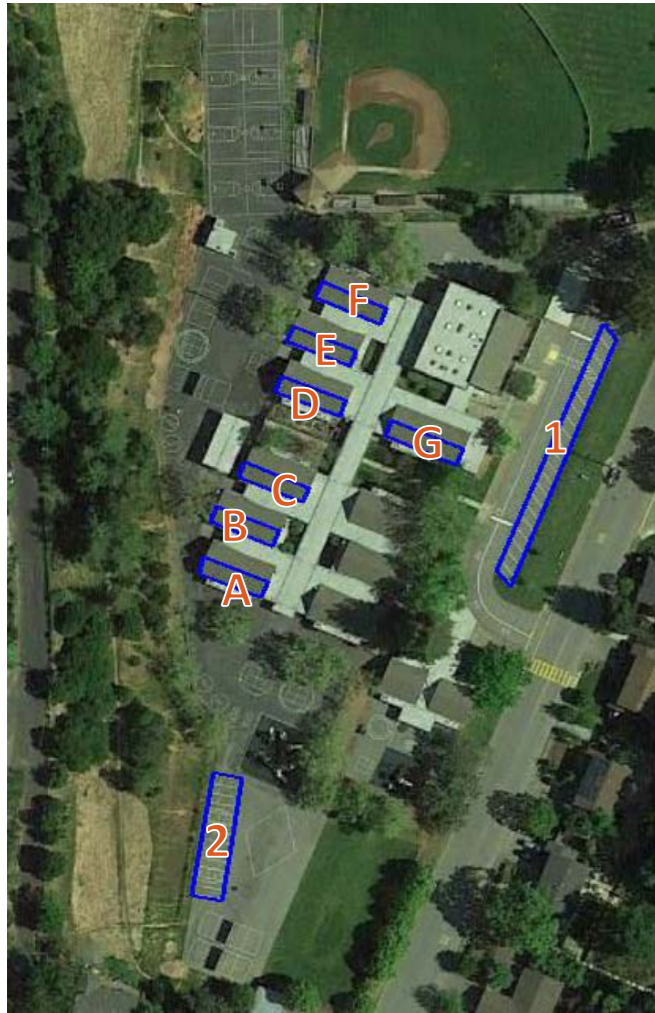
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,537	100%	2,537	45	1,565.9	70,317
2	1,283	100%	1,283	23	1,565.9	35,560
3	1,953	100%	1,953	35	1,463.4	50,587
	5,773		5,773	102	1,531.2	156,464

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	7,264	60%	4,358	77	1,489.4	114,898
B	6,253	60%	3,752	66	1,489.4	98,906
C	2,951	45%	1,328	24	1,489.4	35,008
D	7,859	60%	4,715	83	1,489.4	124,309
	24,327		14,154	251	1,489.4	373,121

TOTAL	30,100		19,927	353		529,585
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
88,446	\$17,077	66,335	44

	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						
Roof		45	66,335	\$213,782	\$12,604	12	66	75%
Parking	43		66,335	\$212,274	\$12,604	12	66	75%



Location: Pleasant Valley Elementary
Address: 755 Sutro Ave, Novato, CA 94947

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	3,567	100%	3,567	63	1,463.4	92,393
2	2,659	100%	2,659	47	1,463.4	68,874
	2,659		6,226	110	1,463.4	161,267

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	829	50%	415	7	1,489.4	10,927
B	791	50%	396	7	1,489.4	10,426
C	774	50%	387	7	1,489.4	10,202
D	831	50%	416	7	1,489.4	10,954
E	780	50%	390	7	1,489.4	10,281
F	858	50%	429	8	1,489.4	11,309
G	925	50%	463	8	1,489.4	12,193
	5,788		2,894	51	1,489.4	76,293

TOTAL	8,447		9,120	161		237,560
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
117,544	\$23,223	88,158	60

	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						
Roof		51	76,293	\$245,874	\$14,496	14	76	65%
Parking	60		88,158	\$295,186	\$16,750	16	88	75%



Location: Rancho Elementary
Address: 1430 Johnson St, Novato, CA 94947

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	1,139	100%	1,139	20	1,463.4	29,503
2	1,082	100%	1,082	19	1,463.4	28,026
	2,221		2,221	39	1,463.4	57,529

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	5,256	60%	3,154	56	1,489.4	83,136
B	10,325	65%	6,711	119	1,489.4	176,925
C	8,642	65%	5,617	99	1,489.4	148,085
D	6,665	60%	3,999	71	1,489.4	105,423
E	2,990	50%	1,495	26	1,489.4	39,412
	33,878		20,976	371	1,489.4	552,981

TOTAL	36,099		23,197	411		610,510
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
111,970	\$22,250	83,977	56

	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						
Roof		56	83,977	\$270,640	\$15,956	15	84	75%
Parking	39		57,529	\$192,627	\$10,930	10	58	51%
Blended	39	18	83,977	\$277,847	\$15,956	15	84	75%



Location: San Jose Middle
Address: 1000 Sunset Parkway, Novato, CA 94949

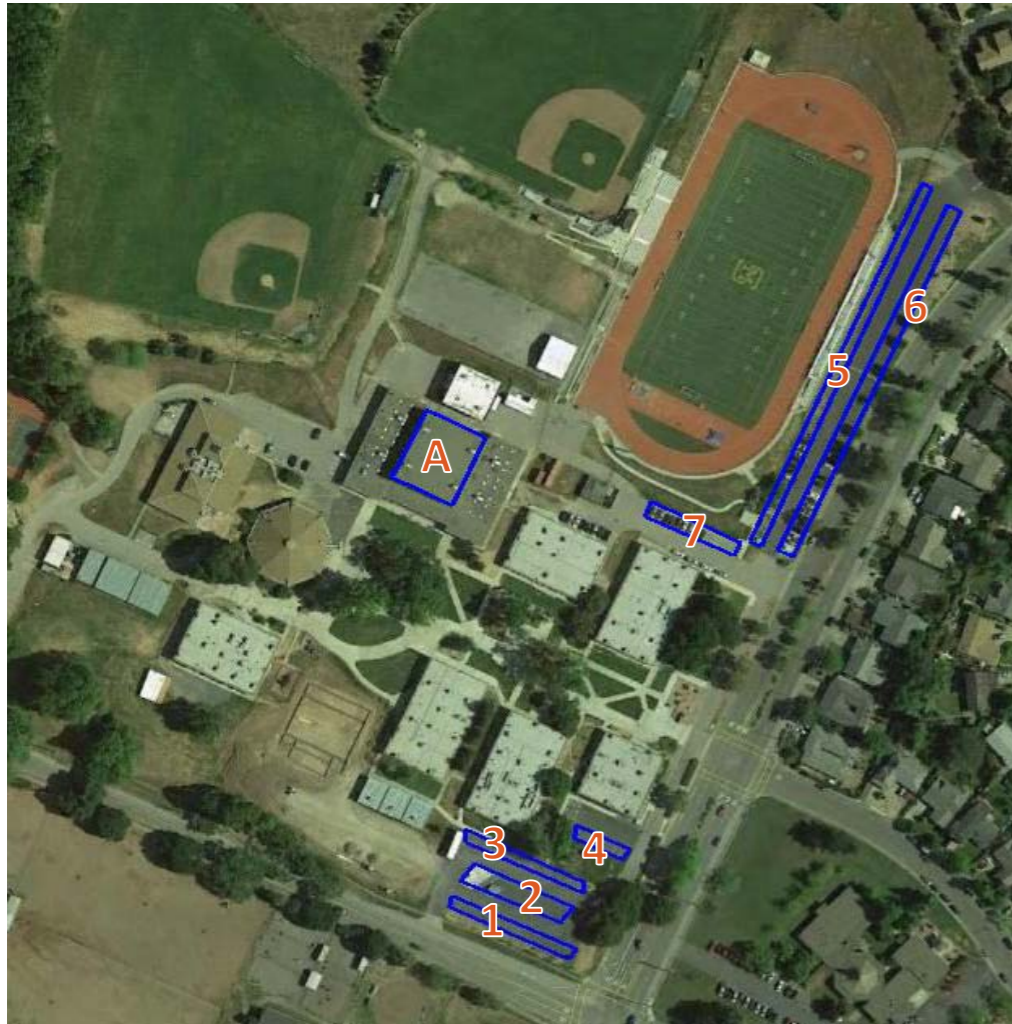
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	6,405	100%	6,405	113	1,456.6	165,133
	6,405		6,405	113	1,456.6	165,133

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	7,320	55%	4,026	71	1,489.4	106,135
B	3,510	55%	1,931	34	1,489.4	50,893
C	3,404	55%	1,872	33	1,489.4	49,356
	14,234		7,829	139	1,489.4	206,383

TOTAL	20,639		14,234	252		371,516
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
177,036	\$34,640	132,777	90

	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						
Roof		89	132,777	\$427,911	\$25,228	24	133	75%
Parking	91		132,777	\$446,662	\$25,228	24	133	75%



Location: San Marin High
Address: 15 San Marin Dr, Novato, CA 94945

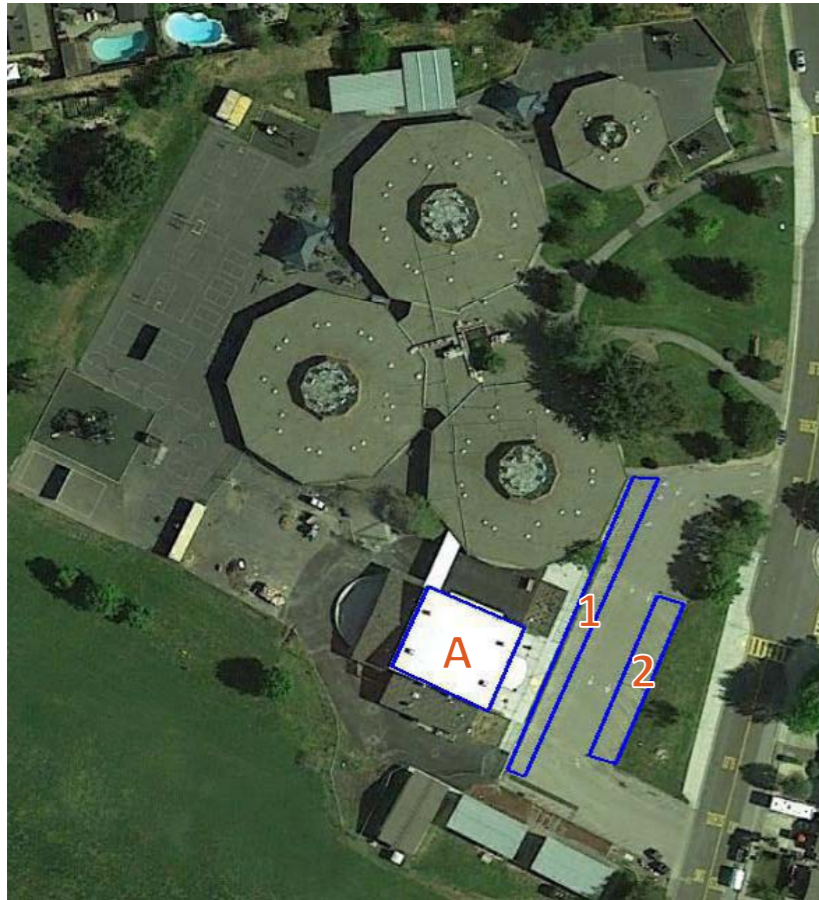
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,993	100%	2,993	53	1,456.6	77,165
2	4,222	100%	4,222	75	1,456.6	108,851
3	2,696	100%	2,696	48	1,456.6	69,508
4	1,345	100%	1,345	24	1,456.6	34,677
5	8,746	100%	8,746	155	1,463.4	226,540
6	11,387	100%	11,387	202	1,463.4	294,948
7	2,864	100%	2,864	51	1,456.6	73,839
	34,253		34,253	606	1,460.6	885,528

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	9,521	50%	4,761	84	1,489.4	125,498
	9,521		4,761	84	1,489.4	125,498

TOTAL	43,774		39,014	691		1,011,026
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
569,682	\$103,056	427,262	292

	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						
Roof		84	125,498	\$404,452	\$23,845	22	125	22%
Parking	293		427,262	\$1,374,870	\$81,180	76	427	75%



Location: San Ramon Elementary
Address: 45 San Ramon Way, Novato, CA 94945

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,835	100%	2,835	50	1,463.4	73,433
2	2,009	100%	2,009	36	1,463.4	52,037
	4,844		4,844	86	1,463.4	125,470

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	3,910	55%	2,151	38	1,489.4	56,692
	3,910		2,151	38	1,489.4	56,692

TOTAL	8,754		6,995	124		182,162
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
182,702	\$38,464	137,027	93

	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						
Roof		38	56,692	\$182,706	\$10,772	10	57	31%
Parking	86		125,470	\$420,120	\$23,839	22	125	69%
Blended	86	8	137,027	\$457,353	\$26,035	24	137	75%



Location: Sinaloa Middle
Address: 2045 Vineyard Rd, Novato, CA 94947

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	3,856	100%	3,856	68	1,456.6	99,415
2	2,860	100%	2,860	51	1,456.6	73,736
	6,716		6,716	119	1,456.6	173,151

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	17,486	55%	9,617	170	1,489.4	253,535
B	17,516	55%	9,634	171	1,489.4	253,970
	35,002		19,251	341	1,489.4	507,505

TOTAL	41,718		25,967	460		680,656
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
248,066	\$51,288	186,050	126

	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						
Roof		125	186,050	\$599,597	\$35,349	33	186	75%
Parking	119		173,151	\$582,479	\$32,899	31	173	70%
Blended	119	9	186,050	\$624,030	\$35,349	33	186	75%



Location: Warehouse
Address: 819 Olive Ave, Novato, CA 94945

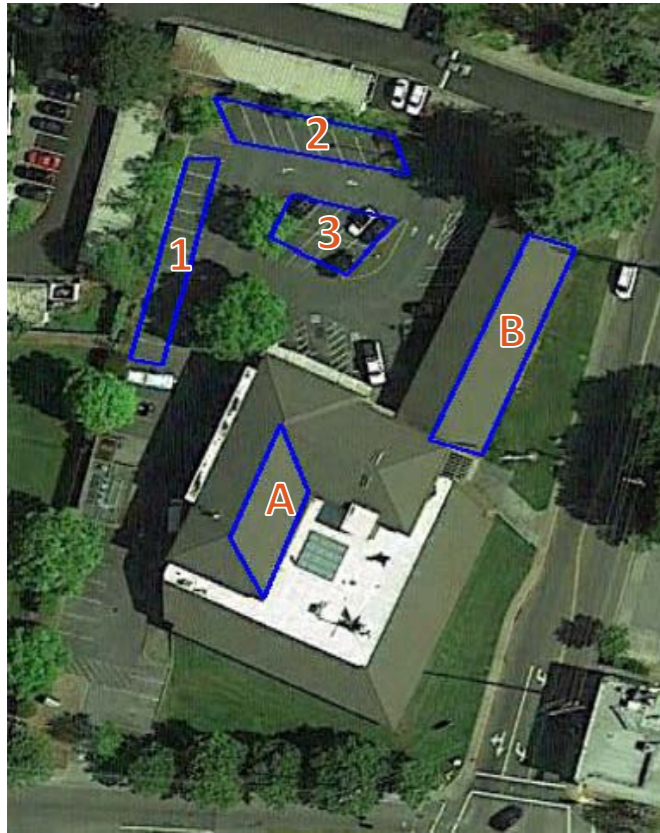
PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	2,421	100%	2,421	43	1,565.9	67,101
2	3,346	100%	3,346	59	1,463.4	86,669
	5,767		5,767	102	1,506.4	153,770

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	15,697	60%	9,418	167	1,489.4	248,286
	15,697		9,418	167	1,489.4	248,286

TOTAL	21,464		15,185	269		402,056
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
103,936	\$20,983	98,739	66

	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						
Roof		66	98,739	\$318,213	\$18,760	17	99	95%
Parking	66		98,739	\$321,170	\$18,760	17	99	95%



Location: District Admin
Address: 1015 7th St, Novato, CA 94945

PARKING						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	Kwh
1	1,438	100%	1,438	25	1,463.4	37,247
2	1,438	100%	1,438	25	1,565.9	39,856
3	1,172	100%	1,172	21	1,565.9	32,484
	4,048		4,048	72	1,529.5	109,587

ROOF						
Array #	Total Area	Use (%)	Usable Area	kWp	Yield	kWh
A	1,393	55%	766	14	1,489.4	20,198
B	2,464	60%	1,478	26	1,489.4	38,974
	3,857		2,245	40	1,489.4	59,172

TOTAL	7,905		6,293	111		168,759
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Current Annual Consumption (kWh)	Current Annual Cost (\$)	Target kWh	kWp Needed to Reach Target
317,642	\$57,995	301,760	199

	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						
Roof		40	59,172	\$190,697	\$11,243	10	59	19%
Parking	72		109,587	\$351,083	\$20,822	19	110	35%
Blended	72	40	168,759	\$541,780	\$32,064	30	169	53%