FINAL Solar PV Feasibility Study

San Rafael City School District

April 2018

Sage Renewable Energy Consulting, Inc.
1719 5th Avenue, San Rafael, CA 94901
(415) 663-9914 | www.sagerenew.com

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 3

2 KEY POINTS & FINDINGS 4

2.1 Energy Consumption 4

2.2 Preferences/Constraints 4

2.3 Current Solar Landscape 4

2.4 Financial 5

2.5 Battery Energy Storage Systems 5

2.6 Environmental & Ancillary Benefits 6

3 RECOMMENDATIONS & NEXT STEPS 6

4 METHODOLOGY 8

5 MODEL INPUTS & ASSUMPTIONS 8

5.1 SENSITIVITY AND RISK ANALYSIS 10

6 SYSTEM SITING, SIZING & PERFORMANCE 11

7 UTLITIY TARIFF ANALYSIS 12

7.1 Net Energy Metering (NEM) 13

8 FINANICAL ANALYSIS 13

ATTACHMENTS

Attachment A 25 Year Financial – Environmental Model Summary

Attachment B Financial Sensitivity Analyses

Attachment C Site Detail PV Layouts

Attachment D Preliminary Project Schedule Details

Attachment E Canopy and Shade Structure Example Photos

1 EXECUTIVE SUMMARY

This study reviews the feasibility of installing solar photovoltaic (PV) systems at thirteen public school facilities operated by the San Rafael City School District (District). The objective of the study is to conceptualize the siting and sizing of PV systems and estimate financial performance of a solar PV project. The scope of the study included a site assessment, evaluation of historical electrical consumption, conceptual designs of potential PV systems, and a financial analysis of the proposed solar PV project. The conceptual layout of the PV systems assumed a combination of rooftop, ground-mounted and elevated shade canopies.

Based on the site assessment, utility tariff analysis, and financial modeling, Table 1-1 and 1-2, below, summarize the key findings of the feasibility study. Attachment A provides a more detailed 25-year financial savings and environmental benefit model summary. Attachment B provides financial sensitivity analyses and Attachment C illustrates current PV system conceptual designs.

Table 1-1: Summary of Findings

Optimal System Size	2,255 kWp
Evaluated Sites	13 Sites
Targeted Sites	8 Sites
Energy Consumption Offset – Targeted Sites	92%
Estimated Capital Cost	$8,500,000
Estimated Project Development Costs, Including a 5% Contingency	$847,000
Financing Alternatives Evaluated	Cash Purchase, Power Purchase Agreement (PPA), Tax-Exempt Municipal Lease (TEML)
Environmental Benefits, Avoided CO_2 Emissions, 25-years	21,000 tons CO_2 avoided, or 3,750 passenger cars avoided, or 850,000 trees planted
Square feet of Shade Created	91,000

Table 1-2: 25 Year Project Financial Summary

	No PV (Utility Only)	PV Cash Financed	PV PPA Financed ($0.17/kWh)	PV TEML Financed
Energy Cost, Nominal $	$26,761,000	$12,940,000	$23,466,000	$26,356,000
Out-of-Pocket Project Development Costs $	$0	$9,347,000	$211,000	$0
Savings vs. Utility, Nominal $	$0	$13,821,000	$3,295,000	$405,000
Simple Payback	N/A	17.1 years	6.9 years	N/A
Lifetime Energy Savings @ 2% D.R.	$0	$1,361,000	$2,154,000	-$261,000

2 KEY POINTS & FINDINGS

2.1 Energy Consumption

- The District is in the process of a major campus renovation as part of its Bond Program. Sage intends to incorporate the anticipated new energy consumption estimates, post Bond Program construction, into the solar PV analysis, prior to the issuance of the RFP. Doing so will ensure the solar PV systems are accurately sized.
- The District has also secured Proposition-39 (P-39) funding for solar shade projects at Bahia Vista ES and Venetia Valley ES. Sage recommends looking into the possibility of resubmitting the P-39 Energy Expenditure to match the proposed solar design of this Feasibility Report. The new P-39 grant money could be used to offset the total construction price.

2.2 Preferences/Constraints

- The District is open to a variety of solar layouts if they do not take up valuable real estate for campus expansions and are not too close to neighboring parcels.
- Sage recommends a 100% projected energy consumption offset target through solar, taking into account any future opportunities for efficiency, conservation, or planned expansions.
- Coleman Elementary School (ES) and San Rafael High School are the only targeted sites that are unable to meet the offset target.
- Sage recommends Laurel Dell ES, Gallinas ES, San Pedro ES, the Maintenance and Operations Building and Short ES be excluded from the onsite solar PV project portfolio. These sites are either being considered for closure and/or have limited space and shading constraints for solar.
- The District can lower the estimated project costs by grouping shade structures together and near the electrical service tie-in.

2.3 Current Solar Landscape

- Net Energy Metering (NEM): Under NEM, when a PV system produces more power than is used at the site at any instant, the excess energy is fed back into the utility system grid and the customer is credited for the cost of the excess electricity generated at retail rate. Any future proposed solar project by the District would be interconnected under the NEM 2.0 Guidelines. NEM 2.0 is grandfathered for 20 years

from the date of initial operation of the additional solar PV system, after which point, exported energy is likely to have a lower value. Sage models a significant drop in the value of PV energy after year 20. The value of energy exported is a result of the District's current electricity costs with Marin Clean Energy (MCE) and Pacific, Gas and Electric (PG&E).

- MCE Feed-In-Tariff (FIT): MCE offers a wholesale energy purchase program for local renewable energy projects. Currently, the program offers 20-year agreements and purchase prices between $0.08 - $0.09/ per kWh of energy generated. Comparatively, this value is lower than what the District should expect from NEM projects and based on Sage's modeling would not yield a positive financial return.
- Investment Tax Credit (ITC): The ITC provides a 30% Federal tax credit that can offset a solar customer's tax liability. This credit is available to taxable entities and can be claimed against the installed system cost. As a tax-exempt entity, the District cannot claim this credit. However, under a PPA arrangement, the private contractor can receive this credit and pass those savings onto the District in the PPA price. The current ITC is set to step down to 26% in 2020, 22% in 2021, and finally to 10% after 2021. If the District elects to use PPA financing, the most favorable rates will be for projects completed prior to the end of 2019, when the ITC begins to reduce.
- Modified Accelerated Cost Recovery System (MACRS): Established in 1986, MACRS is a tax deduction method used to depreciate the cost of tangible property over a specified time-period. The specified time-period for qualifying solar systems is five years. Similar to the ITC, MACRS is available only to tax paying entities.
- Self-Generation Incentive Program (SGIP): The SGIP program provides financial incentives to business and residential customers for the adoption of distributed energy resources and energy storage. This program is especially beneficial to customers seeking to invest in battery storage. Under a PPA scenario with battery storage, the contractor can claim these incentives to lower capital costs of battery storage. The District can also apply to receive these incentives if the proposed battery storage is cash financed.

2.4 Financial

- "Solar" was not included in the original language of the bond, so for the purpose of this study, funding from the implemented bond is not an option.
- This study evaluated three financing options for a solar PV project: 1) purchasing the project with cash; 2) financing through a Power Purchase Agreement (PPA) where a third-party finances, owns and operates the systems and the District purchases all energy generated by the PV systems from the third party owner; or 3) financing through a Tax-Exempt Municipal Lease (TEML, where the District would be responsible to pay back the borrowed amount with interest, functioning as a standard lease-purchase.
- A PPA financed project would allow the District to develop a solar project with minimal up-front cost, while fixing the cost of electricity below the average current cost and hedging against utility rate increases over time. Additionally, a PPA provided a better net present value (NPV) energy savings over the lifetime of the project than a TEML or cash purchase.

2.5 Battery Energy Storage Systems

- Battery Energy Storage Systems (BESS) are poised to become a dominant technology in the energy sector, given the flexibility they lend to reducing peak demand and mitigating the intermittency of solar. Battery costs have declined by nearly 70%, from $1000/kWh to $273/kWh between 2010 and 2016. The installed cost of BESS systems is decreasing rapidly and estimated to decline 30-40% over the next five years, making battery storage a more financially viable investment in the coming years. The industry has yet to

settle on standard forms of financing/payment, from "shared savings" to integration with solar PV PPAs. Each vendor has their own financing mechanisms that require individual analyses.

- With battery costs decreasing rapidly, new financing mechanisms becoming available, and utilities trending toward increased demand charges, BESSs are increasingly important when considering strategies to reduce energy costs. However, utility tariffs which favor solar PV are not necessarily favorable to BESS systems, particularly when much of the utility bill is offset by a PV system. At this time, BESS value for California school sites is derived from reducing demand charges.
- If the District is interested, Sage can analyze the financial feasibility of battery storage for appropriate District sites. Moreover, if the District moves forward with a Request for Proposal (RFP), Sage recommends including BESS as an additive alternate option to the solar procurement.

2.6 Environmental & Ancillary Benefits

- This proposed solar project would offset 1,000 tons of $C0_2$ in the first year, and over 21,000 tons during the 25-year system lifetime. This is the equivalent of removing 150 cars from the road each year or planting 34,000 trees each year.
- In addition to the financial and environmental benefits, this project also offers ancillary benefits in the form of shade for students and staff. The proposed project would add approximately 91,000 square feet of shade throughout the District.

3 RECOMMENDATIONS & NEXT STEPS

Based on the findings of this study, Sage concludes that a solar PV project is viable at eight of the District's thirteen sites. Sage does not recommend implementing onsite solar at Laurel Dell ES, San Pedro ES, Short ES, the Maintenance and Operations Building or Gallinas ES. The solar PV project will save the District money over the life of the project utilizing cash, a PPA or TEML financing, with PPA financing providing a better 25-year NPV project savings. If the District pursues the implementation of solar PV at the eight District sites, Sage recommends the following steps for implementation:

- District review this solar PV Feasibility Study Report and assess if the financial scenario savings and environmental targets meet District goals, expectations and means.
- District and Board decide on which financing option to move forward with on the project.
- Generate a project milestone schedule in coordination with District review schedule, Board schedule and District construction timeline. Sage recommends installing solar over summer break, to avoid disruption to school activities.
- Utilize a Request for Proposals (RFP) to solicit competitive design-build proposals from pre-qualified solar vendors for the project under California Government Code Section 4217.10 et seq.
- Evaluate proposals for qualitative and quantitative items and rank vendors with a committee of stakeholders.
- Conduct contract negotiations with the highest ranked solar vendor with the assistance of District legal counsel and solar PV project consultant.
- Enlist expertise during design, construction and commissioning to represent the District and ensure adherence to the RFP requirements.

Table 3-1: Timeline to Implementation

Phase	Duration Months	Cumulative Months	Calendar (Assuming 5/1/2018 Start) Start	End
RFP Preparation/Vendor Proposals	3	3	5/1/2018	8/1/2018
Proposal Review/Contracting	2	5	8/1/2018	10/1/2018
Design & Over-the-Counter (OTC) DSA Process	4	9	10/1/2018	2/1/2019
Construction	3	12	6/1/2019	9/1/2019
Commissioning & Closeout	5	17	9/1/2019	2/1/2020

- Note: DSA closeout typically extends for several months beyond the end date shown.

4 METHODOLOGY

The following process was used to develop this feasibility study.

Scope & Goals	Corresponded with the District and the District's bond consultant and construction manager, Van Pelt Construction Services, to assess the scope, constraints, and goals of the potential project.
Site Visit	Performed site visits to evaluate site conditions, collect information about the existing electrical infrastructure and to meet with District stakeholders.
Data Collection	Obtained historical electricity consumption data from PG&E for the main services.
Conceptual Design	Created conceptual system designs and generated simulated solar PV production data using industry-standard solar design software, HelioScope. Performed multiple iterations of conceptual designs with District input.
Tariff Modeling	Performed modeling of each site using Sage's proprietary modeling and applicable utility tariffs to optimize system sizing and cost offsets for each site. Modeling included projected electricity consumption and simulated PV production for conceptual designs.
Financial Modeling	Performed financial and sensitivity analysis of District wide solar project utilizing the results of the tariff modeling, including lifecycle cost analysis and analysis of the cash, PPA and TEML financing options.
Report	Provided a written report summarizing the feasibility study and its findings.

5 MODEL INPUTS & ASSUMPTIONS

The solar PV financial models are greatly influenced by the assumptions. Sage uses conservative pricing assumptions based on market knowledge from other similar projects, current industry trends and utility escalation rates based on historical averages over the past thirty years. If utility rates increase more over time in the future due to increased regulations, demand, and finite resources, the financial performance of the systems will be affected positively. Conversely, if rates increase slower than historical averages, the financial performance will be negatively affected.

Table 5-1 summarizes the key model inputs and assumptions used in the feasibility study evaluation. Modeling assumptions take into account risks associated with changes proposed by PG&E in January of 2017 to their time-of-use (TOU) periods, as described in more detail in Section 5.1. These changes have the potential of reducing the value of the District's solar PV project by approximately 15 percent.

Table 5-1: Assumptions and Data

Utility Information, for the eight targeted sites	
Annual Electric Consumption	3,748,000 kWh/year, 2016 for the eight targeted sites
Annual Electric Cost	$734,000 (2016 dollars)
Average Cost of Electricity	$0.196 per kWh
Solar Production Modeling	
Solar Insolation Data	USA CA Napa Airport (TMY3)
Shading Assumption	Minimal based on-site visits and siting
Soiling Assumption	Moderate, seasonal soiling – 2%
PV Modules used in Helioscope	LG Electronics, LG 340 S2W-G4 (340W)
Inverters used in Helioscope	SMA Sunny Tripower string inverters (15kW, 20kW, 24 kW)
Installation type	Rooftop solar arrays, ground-mounted solar and elevated shade canopy (typical DSA Pre-Check structures)
PV System Lifetime	25 years
Financial Information	
Turnkey Project Cost	$3.75/kWp (Weighted average, each site priced individually. Pricing based on recent market pricing and conceptual layouts at each site)
PPA Price	$0.167 per kWh (Weighted average, each site priced individually. Pricing based on recent market pricing and conceptual layouts at each site)
Project Development Soft Costs	10.5% for Cash and TEML Financing 2.5% for PPA Financing (PPA prices adjusted to include contingency and consulting fees)
PPA Price Escalator	0%
PPA Term	25 Years
NEM 2.0 Export Energy Rate	Full retail rate, minus non-bypassable charges, for 20 years
Annual Utility Inflation Rate	3.0%
NPV Discount Rate	2.0%

5.1 SENSITIVITY AND RISK ANALYSIS

To assess the impacts of key project variables on the economic outcomes of projects, Sage conducts both a sensitivity analysis and a probability distribution risk analysis. The sensitivity analysis allows us to identify which variables have the most significant impact on the financial performance of the project. We then run a multivariable Monte Carlo analysis to establish a 90 percent probability envelope for financial performance over the lifetime of the project. The key project variables included in our sensitivity analysis for this project are:

1. Utility tariff change over time
2. Installed System Cost
3. PPA Base Price
4. System Production Degradation per Year
5. Tariff Rate Change Value Risk per Year
6. Total Project Development Overhead Costs

Worthy of note for PV projects in California is the significant risk of utility tariffs changing over time, lowering the value of solar energy produced and impacting financial returns from a project.

In January 2017, the California Public Utilities Commission (CPUC) issued a rulemaking to allow school solar projects completed by the end of 2017 to be grandfathered for 10-years on existing Time-of-Use (TOU) periods. This CPUC also released a Purposed Decision (PD) extending the project deadline out for the TOU grandfathering, as long as certain interconnection application milestones were reached by March 31st, 2017.

On October 26th, 2017, the CPUC amended the January 19th TOU decision for public agencies (including schools) in two ways:

- The Grace Period End Date was eliminated.
- The System Eligibility date for initial interconnection application submittal was extended for 60 days after the October 26 ruling to December 25th, 2017.

For this study, Sage assumed the District is now eligible for grandfathering of TOU rates and the financial modeling reflects that change.

Sage has evaluated these potential changes, as well as the transition to NEM 2.0, in assessing the tariff-based risks to project returns. Our probability modeling, expressed as Conservative, Expected and Optimistic returns, reflect conservative assumptions about these and other risks to significant project variables.

Results of the sensitivity modeling are presented as Attachment B.

6 SYSTEM SITING, SIZING & PERFORMANCE

During the conceptual design phase, elevated carport, shade canopies, rooftop and ground mounted solar arrays were considered based on District preferences. In general, the target sites contain sufficient available space to meet the PV production targets with standard solar PV equipment.

Table 6-1 shows future annual electrical usages and modeled system sizing for each of the eight sites. Currently future electricity consumption from building changes are not factored in but will be re-analyzed as the Bond Program moves forward. Attachment C shows the site details, proposed siting and layout of the solar arrays for each site. Table 6.2 provides a summary of the system siting, sizing, and performance findings.

Table 6-1: Future Consumption

Site	Meter Number	Future Annual Consumption for PV Design (kWh)*
Bahia Vista ES	1006716893	284,000
Coleman ES	1009412545	163,000
Davidson ES	1008819641	552,000
Glenwood ES	1008819570	134,000
San Rafael ES	1009485433 1009543041	1,082,000
Sun Valley ES	1005513204	165,000
Terra Linda HS	1010185536	1,057,000
Venetia Valley ES	1009542177	311,000
Total	--	3,748,000

*Electricity consumption will be adjusted after new campus construction has been implemented.

Table 6-2: Siting, Sizing & Performance Findings

Site	System Size (kWp)	Year 1 Yield (kWh/kWp)	Year 1 Production (kWh)
Bahia Vista ES	180	1,573	284,000
Coleman ES	107	1,568	140,000
Davidson MS NEMA	360	1,552	558,000
Glenwood ES	85	1,584	134,000
San Rafael HS	504	1,592	802,000
Sun Valley ES	104	1,572	165,000
Terra Linda HS	682	1,549	1,057,000
Venetia Valley ES	233	1,332	311,000
Total	**2,255**	--	**3,451,000**

7 UTLITIY TARIFF ANALYSIS

The main electric meters at the eight District sites were used for the tariff analysis. Table 7-1 shows the current utility tariffs for each site meter as well as the expected utility tariff with PV.

Table 7-1: Utility Tariff Analysis

Site	Meter Number	Future Annual Usage (kWh)	Usage Offset (%)	Bill Offset (%)	Modeled PV Production (kWh)	Existing Tariff	Current Average $/kWh	Post-PV Tariff
Bahia Vista ES	1006716893	283,200	100%	98%	283,000	A1X	$ 0.233	A1X
Coleman ES	1009412545	185,500	91%	64%	169,000	A10S	$ 0.249	A10S
Davidson MS	1008819641	551,400	100%	77%	552,000	A10S	$ 0.213	A10S
Glenwood ES	1008819570	134,000	100%	72%	134,000	A10S	$ 0.219	A10S
San Rafael HS	1009485433 1009543041	1,143,500	75%	80%	1,131,000	A10S, A1	$ 0.195	A10S, A1
Sun Valley ES	1005513204	164,300	100%	98%	164,000	A1	$ 0.228	A1
Terra Linda HS	1010185536	1,056,600	100%	82%	1,057,000	A10SX	$ 0.187	A10SX
Venetia Valley ES	1009542177	310,900	100%	75%	311,000	A10S	$ 0.234	A10S

7.1 Net Energy Metering (NEM)

This proposed solar project would be under the Net Energy Metering (NEM) 2.0 Guidelines. Under NEM, when a PV system produces more power than is used at the site at any instant, the excess energy is fed back into the utility system grid and the customer is credited for most of the retail cost of the excess electricity generated. NEM 2.0 is grandfathered for 20 years from the date of initial operation of the additional solar PV system.

8 FINANICAL ANALYSIS

This financial analysis evaluated three different financing options for a solar PV project: 1) Purchasing the system in cash, 2) financing the system through a Power Purchase Agreement (PPA) and 3) financing the project through a Tax-Exempt Municipal Lease (TEML). The evaluation indicated that a PPA financing provides the District with a better annual energy savings over the course of 25 years, on a NPV basis. This section compares the three financing scenarios evaluated in this study. Cumulative energy costs and savings for the Cash financing, PPA and TEML financing are shown in Table 8-1 below.

Table 8-1: Cumulative Energy Cost and Savings Over Time

	Do Nothing	PV Cash Financed		PV PPA Financed		PV TEML Financed	
	Utility	% Savings		% Savings		$ Savings	
Year-1	$734,000	$260,000	65%	$753,000	-3%	$931,000	-27%
Year-5	$3,897,000	$1,422,000	64%	$3,827,000	2%	$4,776,000	-23%
Year-10	$8,414,000	$3,251,000	61%	$7,915,000	6%	$9,959,000	-18%
Year-15	$13,652,000	$5,605,000	59%	$12,378,000	9%	$15,667,000	-15%
Year-20	$19,723,000	$8,823,000	55%	$17,552,000	11%	$22,238,000	-13%
Year-25	$26,761,000	$12,940,000	52%	$23,466,000	12%	$26,356,000	2%

Figure 8-2: Annual Energy Costs

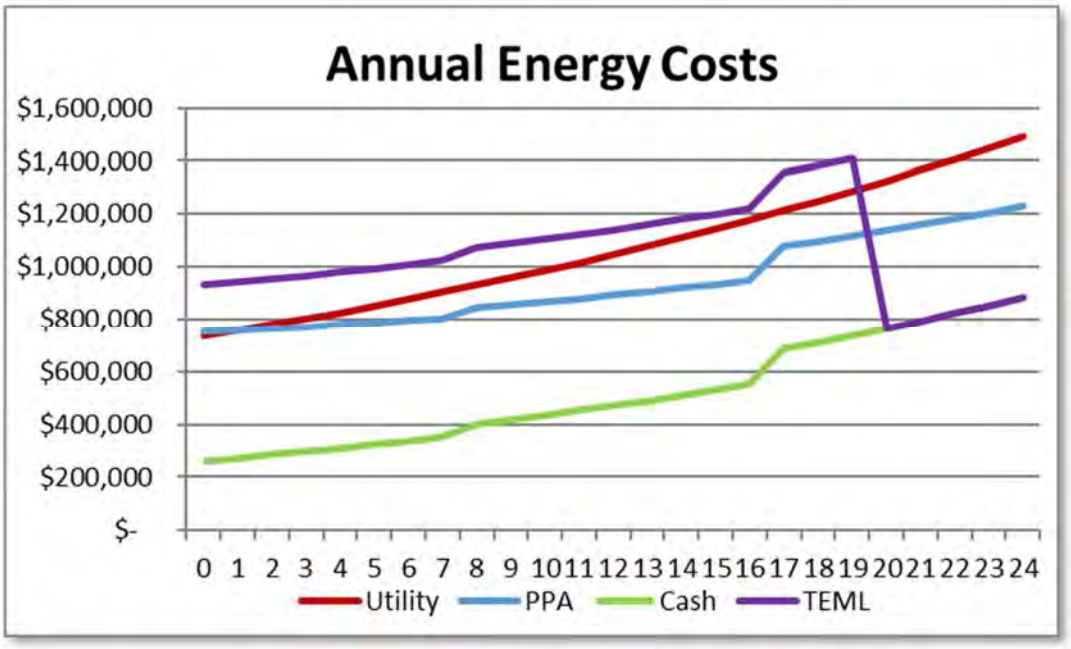
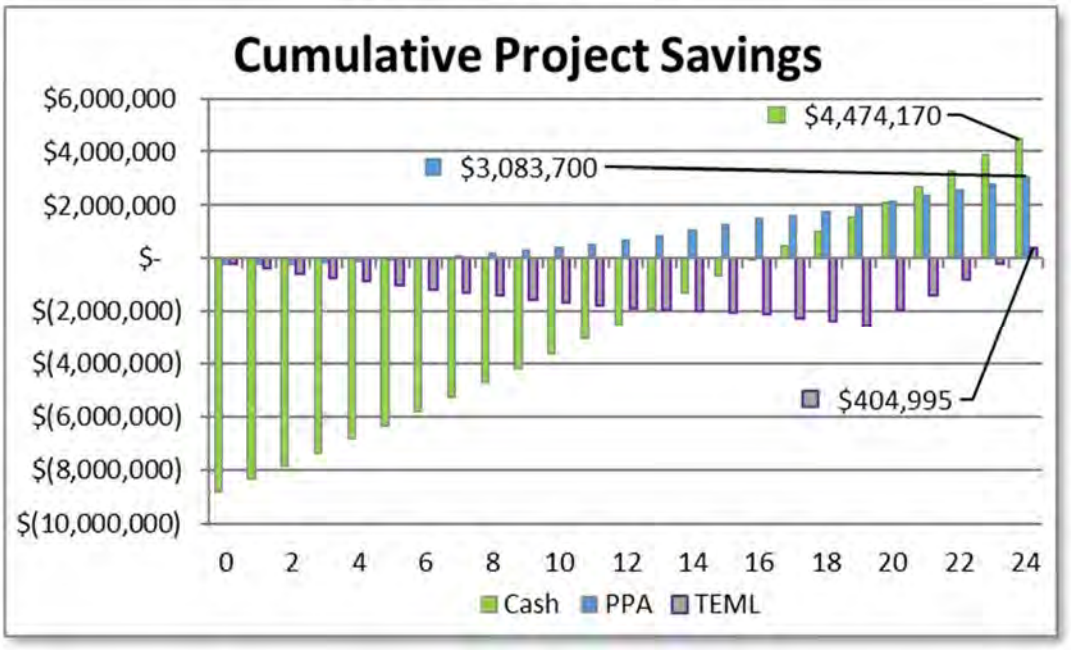


Figure 8-2: Cumulative Project Savings



Attachment A

25-Year Financial Model Summary

1: 25-Year Financial Summary

- 1A: 25-Year Financial Summary Elementary Schools
- 1B: 25-Year Financial Summary High Schools

2: Cash Flow Table – Cash Financing

3: Cash Flow Table – PPA Financing

4: Cash Flow Table – TEML Financing

25-year Financial-Environmental Summary

San Rafael City Schools - All Schools

Assumptions

System Assumptions	
System Size	2,255.5 kW DC
Installation Price per Watt DC	$3.75 per Watt
Installed System Cost	$8,458,000
PV Yield, Yr 1	1,529 kWh/kW
PV Production, Yr 1	3,448,000 kWh
Annual Electricity Consumption	3,748,000 kWh
Incentives/Rebates	$0.0000 per kWh
NEM 2.0 Ends	1/1/2037
Current Average Utility Energy Cost	$0.1960 per kWh

Financing Assumptions	
NPV Discount Rate Investments	2.00%
PPA	
PPA Contract Term	25.0 years
PPA Base Price	$0.1675 per kWh
PPA Annual Rate Escalator	0.00%
TEML	
TEML Bond Term	20.0 years
TEML All-In Interest Rate	3.50%
TEML Cost of Issuance	2.00%

Financial Performance Analysis

25-Year Project Financial Performance

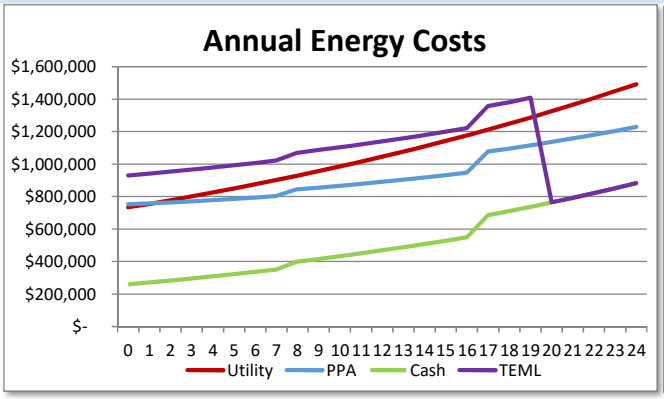
	No PV (Utility Only)	PV Cash Financed	PV PPA Financed	PV TEML Financed
Energy Cost, Nominal $	$26,761,000	$12,940,000	$23,466,000	$26,356,000
Project Development Costs $	$0	$9,347,000	$211,000	$0
Savings vs. Utility, Nominal $	$0	$13,821,000	$3,295,000	$405,000
Simple Payback	N/A	17.1 years	6.9 years	N/A
Net Present Value @ 2% D.R.	$0	$1,361,000	$2,154,000	-$261,000

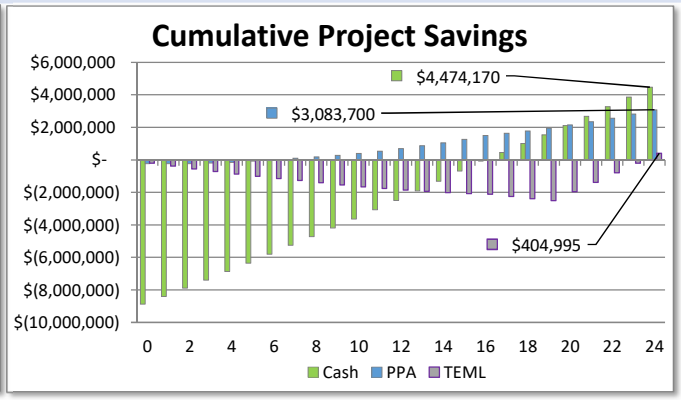
Energy Cost and Savings Over Time

Cumulative Energy Cost, Nominal $, Not Including Development Cost

	No PV (Utility Only)	PV Cash Financed		PV PPA Financed		PV TEML Financed	
	Utility	Cash	% Savings	PPA	% Savings	TEML	% Savings
Year 1	$734,000	$260,000	65%	$753,000	-3%	$931,000	-27%
Year 5	$3,897,000	$1,422,000	64%	$3,827,000	2%	$4,776,000	-23%
Year 10	$8,414,000	$3,251,000	61%	$7,915,000	6%	$9,959,000	-18%
Year 15	$13,652,000	$5,605,000	59%	$12,378,000	9%	$15,667,000	-15%
Year 20	$19,723,000	$8,823,000	55%	$17,552,000	11%	$22,238,000	-13%
Year 25	$26,761,000	$12,940,000	52%	$23,466,000	12%	$26,356,000	2%

Financial Performance Charts





Environmental and Ancillary Benefits

CO_2 Offset per Year (Avg)	800	Tons per Year
CO_2 Offset Total	21,000	Tons Total
Passenger Car Emissions	150	Equivalent Cars
Equivalent Trees Planted	34,000	Trees per year

25-year Financial-Environmental Summary

San Rafael City Schools - Elementary Schools Only

Assumptions

System Assumptions	
System Size	1,069.7 kW DC
Installation Price per Watt DC	$3.93 per Watt
Installed System Cost	$4,206,000
PV Yield, Yr 1	1,486 kWh/kW
PV Production, Yr 1	1,590,000 kWh
Annual Electricity Consumption	1,609,000 kWh
Incentives/Rebates	$0.0000 per kWh
NEM 2.0 Ends	1/1/2037
Current Average Utility Energy Cost	$0.2103 per kWh

Financing Assumptions	
NPV Discount Rate Investments	2.00%
PPA	
PPA Contract Term	25.0 years
PPA Base Price	$0.1750 per kWh
PPA Annual Rate Escalator	0.00%
TEML	
TEML Bond Term	20.0 years
TEML All-In Interest Rate	3.50%
TEML Cost of Issuance	2.00%

Financial Performance Analysis

25-Year Project Financial Performance

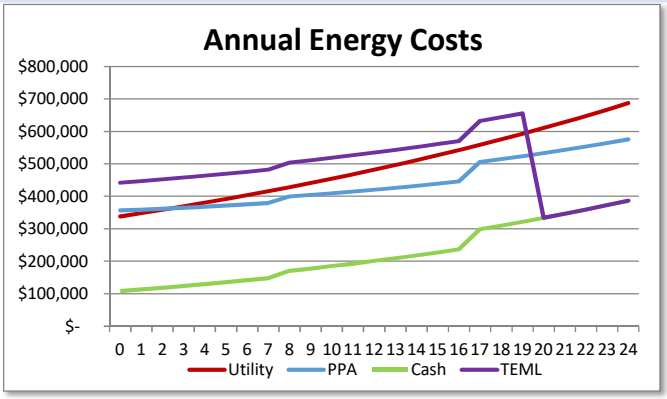
	No PV (Utility Only)	PV Cash Financed	PV PPA Financed	PV TEML Financed
Energy Cost, Nominal $	$12,323,000	$5,568,000	$11,041,000	$12,239,000
Project Development Costs $	$0	$4,647,000	$105,000	$0
Savings vs. Utility, Nominal $	$0	$6,755,000	$1,282,000	$84,000
Simple Payback	N/A	17.5 years	9.3 years	N/A
Net Present Value @ 2% D.R.	$0	$581,000	$800,000	-$226,000

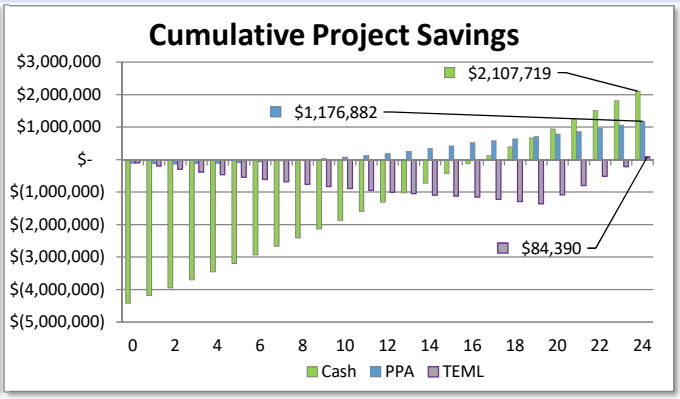
Energy Cost and Savings Over Time

Cumulative Energy Cost, Nominal $, Not Including Development Cost

	No PV (Utility Only)	PV Cash Financed		PV PPA Financed		PV TEML Financed	
	Utility	Cash	% Savings	PPA	% Savings	TEML	% Savings
Year 1	$338,000	$108,000	68%	$357,000	-6%	$442,000	-31%
Year 5	$1,794,000	$595,000	67%	$1,812,000	-1%	$2,262,000	-26%
Year 10	$3,875,000	$1,369,000	65%	$3,742,000	3%	$4,704,000	-21%
Year 15	$6,286,000	$2,376,000	62%	$5,844,000	7%	$7,379,000	-17%
Year 20	$9,082,000	$3,770,000	58%	$8,273,000	9%	$10,441,000	-15%
Year 25	$12,323,000	$5,568,000	55%	$11,041,000	10%	$12,239,000	1%

Financial Performance Charts





Environmental and Ancillary Benefits

CO_2 Offset per Year (Avg)	400	Tons per Year
CO_2 Offset Total	10,000	Tons Total
Passenger Car Emissions	70	Equivalent Cars
Equivalent Trees Planted	16,000	Trees per year

25-year Financial-Environmental Summary

San Rafael City Schools - High Schools Only

Assumptions

System Assumptions	
System Size	1,185.8 kW DC
Installation Price per Watt DC	$3.59 per Watt
Installed System Cost	$4,253,000
PV Yield, Yr 1	1,567 kWh/kW
PV Production, Yr 1	1,858,000 kWh
Annual Electricity Consumption	2,139,000 kWh
Incentives/Rebates	$0.0000 per kWh
NEM 2.0 Ends	1/1/2037
Current Average Utility Energy Cost	$0.1857 per kWh

Financing Assumptions	
NPV Discount Rate Investments	2.00%
PPA	
PPA Contract Term	25.0 years
PPA Base Price	$0.1608 per kWh
PPA Annual Rate Escalator	0.00%
TEML	
TEML Bond Term	20.0 years
TEML All-In Interest Rate	3.50%
TEML Cost of Issuance	2.00%

Financial Performance Analysis

25-Year Project Financial Performance

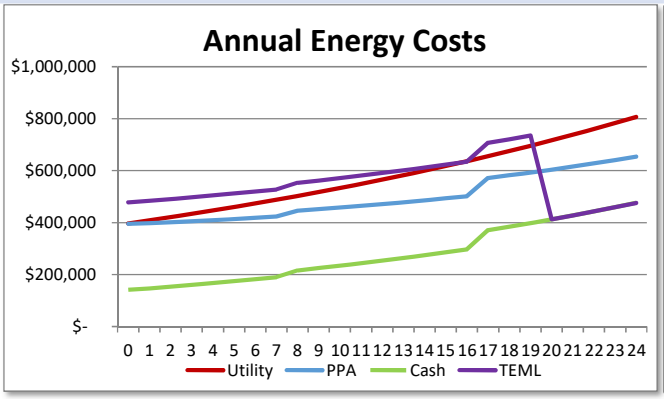
	No PV (Utility Only)	PV Cash Financed	PV PPA Financed	PV TEML Financed
Energy Cost, Nominal $	$14,474,000	$6,986,000	$12,414,000	$13,731,000
Project Development Costs $	$0	$4,699,000	$106,000	$0
Savings vs. Utility, Nominal $	$0	$7,488,000	$2,060,000	$743,000
Simple Payback	N/A	16.0 years	5.2 years	N/A
Net Present Value @ 2% D.R.	$0	$1,100,000	$1,391,000	$285,000

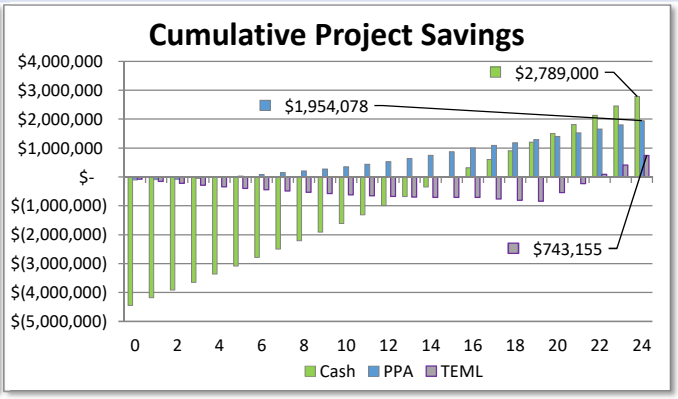
Energy Cost and Savings Over Time

Cumulative Energy Cost, Nominal $, Not Including Development Cost

	No PV (Utility Only)	PV Cash Financed		PV PPA Financed		PV TEML Financed	
	Utility	Cash	% Savings	PPA	% Savings	TEML	% Savings
Year 1	$397,000	$141,000	64%	$395,000	1%	$478,000	-20%
Year 5	$2,108,000	$771,000	63%	$2,012,000	5%	$2,457,000	-17%
Year 10	$4,551,000	$1,760,000	61%	$4,166,000	8%	$5,133,000	-13%
Year 15	$7,384,000	$3,031,000	59%	$6,525,000	12%	$8,090,000	-10%
Year 20	$10,668,000	$4,767,000	55%	$9,269,000	13%	$11,512,000	-8%
Year 25	$14,474,000	$6,986,000	52%	$12,414,000	14%	$13,731,000	5%

Financial Performance Charts





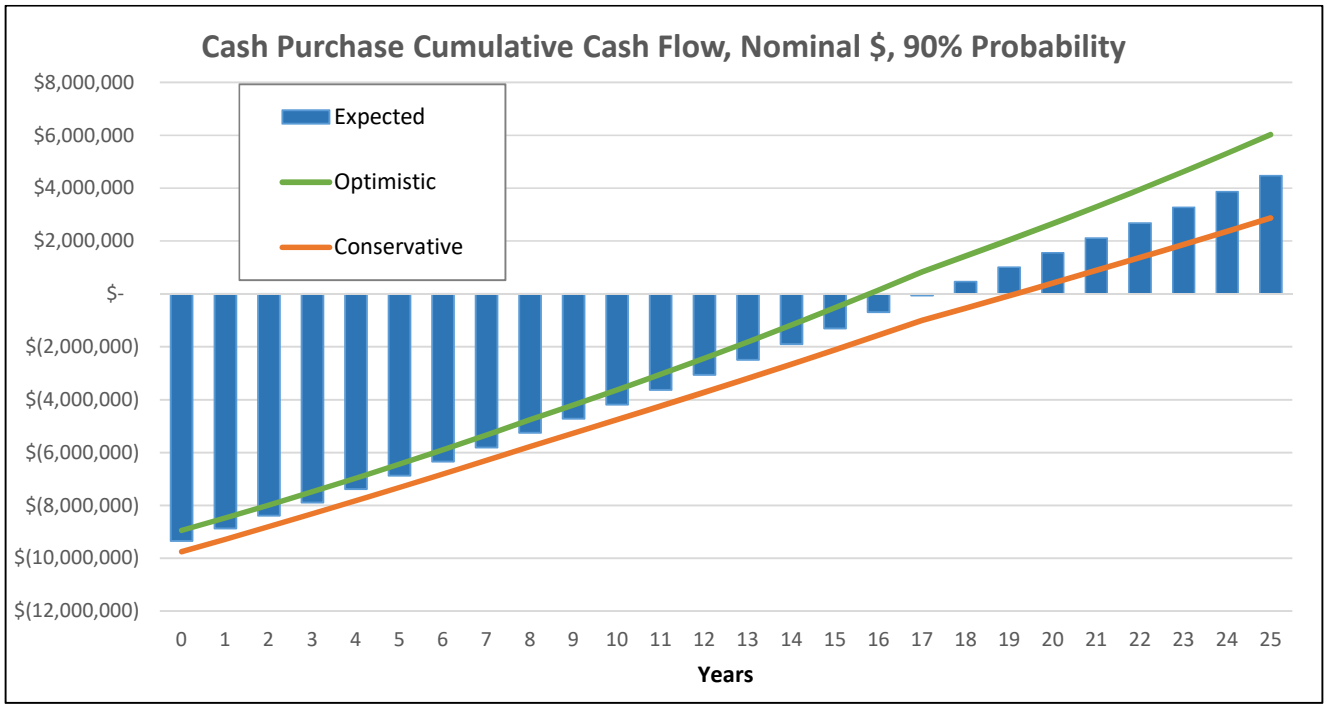
Environmental and Ancillary Benefits

CO_2 Offset per Year (Avg)	400	Tons per Year
CO_2 Offset Total	11,000	Tons Total
Passenger Car Emissions	80	Equivalent Cars
Equivalent Trees Planted	19,000	Trees per year

SAGE RENEWABLES

25 Year Cash Flow - NEM 2.0 Assumptions, Cash Financed - All Sites

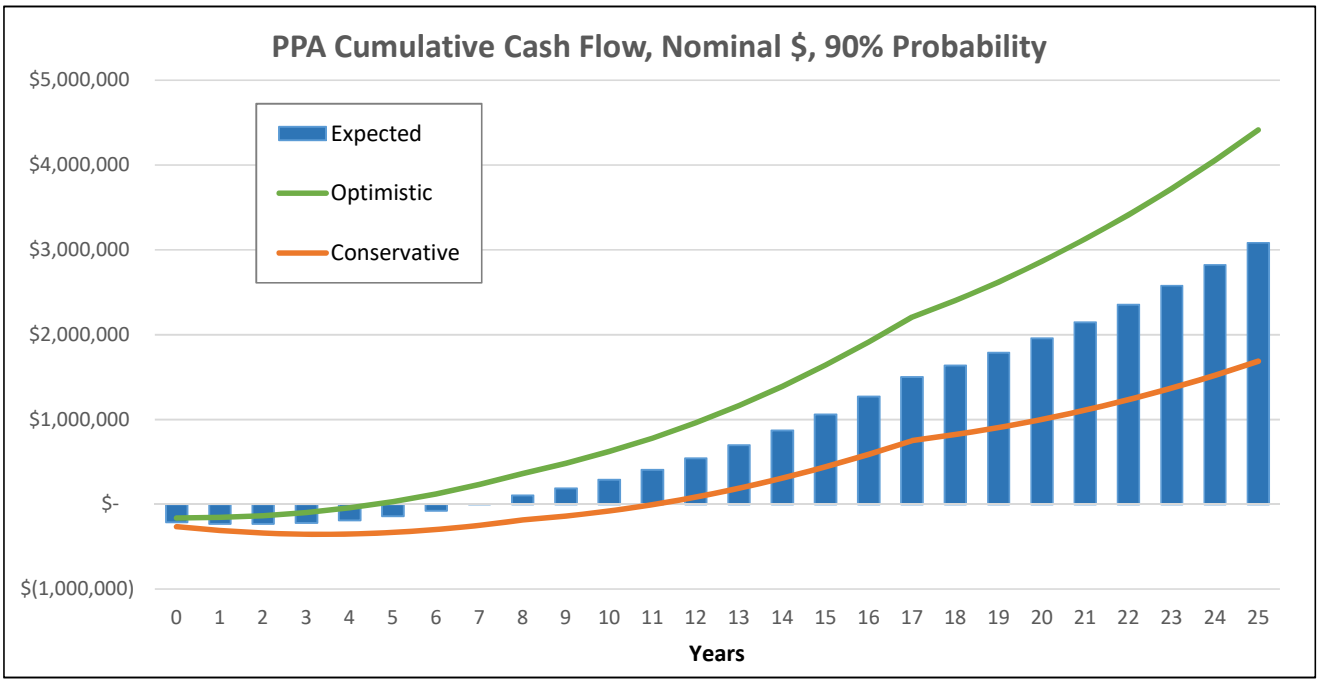
Year	Estimated Utility Usage (kWh)	Annual Estimated Utility Cost w/o PV	PV Output %	Expected Output (kWh)	Annual Gross Savings	Net Annual Energy Costs	Net Annual Savings	Cumulative Project Cash Flow
1	3,748,000	$734,000	100.00%	3,448,000	$560,000	$260,253	$473,747	($8,872,814)
2	3,748,000	$756,020	99.25%	3,422,140	$571,832	$271,876	$484,144	($8,388,670)
3	3,748,000	$778,701	98.51%	3,396,474	$583,913	$283,961	$494,740	($7,893,930)
4	3,748,000	$802,062	97.77%	3,371,000	$596,249	$296,524	$505,538	($7,388,392)
5	3,748,000	$826,123	97.03%	3,345,718	$608,844	$309,583	$516,541	($6,871,852)
6	3,748,000	$850,907	96.31%	3,320,625	$621,706	$323,153	$527,754	($6,344,097)
7	3,748,000	$876,434	95.58%	3,295,720	$634,838	$337,254	$539,181	($5,804,917)
8	3,748,000	$902,727	94.87%	3,271,002	$648,247	$351,902	$550,825	($5,254,091)
9	3,748,000	$929,809	94.16%	3,246,470	$628,842	$400,215	$529,595	($4,724,497)
10	3,748,000	$957,704	93.45%	3,222,121	$642,123	$416,715	$540,988	($4,183,509)
11	3,748,000	$986,435	92.75%	3,197,955	$655,684	$433,838	$552,597	($3,630,911)
12	3,748,000	$1,016,028	92.05%	3,173,971	$669,531	$451,602	$564,426	($3,066,486)
13	3,748,000	$1,046,508	91.36%	3,150,166	$683,669	$470,031	$576,478	($2,490,008)
14	3,748,000	$1,077,904	90.68%	3,126,540	$698,106	$489,146	$588,758	($1,901,250)
15	3,748,000	$1,110,241	90.00%	3,103,091	$712,846	$508,971	$601,270	($1,299,979)
16	3,748,000	$1,143,548	89.32%	3,079,818	$727,897	$529,529	$614,019	($685,960)
17	3,748,000	$1,177,855	88.65%	3,056,719	$743,265	$550,846	$627,008	($58,952)
18	3,748,000	$1,213,190	87.99%	3,033,794	$645,113	$686,791	$526,399	$467,447
19	3,748,000	$1,249,586	87.33%	3,011,040	$658,732	$712,106	$537,480	$1,004,928
20	3,748,000	$1,287,073	86.67%	2,988,457	$672,637	$738,309	$548,765	$1,553,693
21	3,748,000	$1,325,686	86.02%	2,966,044	$686,836	$765,429	$560,257	$2,113,949
22	3,748,000	$1,365,456	85.38%	2,943,799	$701,333	$793,497	$571,960	$2,685,909
23	3,748,000	$1,406,420	84.74%	2,921,720	$716,136	$822,543	$583,877	$3,269,786
24	3,748,000	$1,448,612	84.10%	2,899,807	$731,250	$852,600	$596,013	$3,865,799
25	3,748,000	$1,492,071	83.47%	2,878,059	$746,682	$883,700	$608,371	$4,474,170



SAGE RENEWABLES

25 Year Cash Flow - NEM 2.0 Assumptions, PPA Financed - All Sites

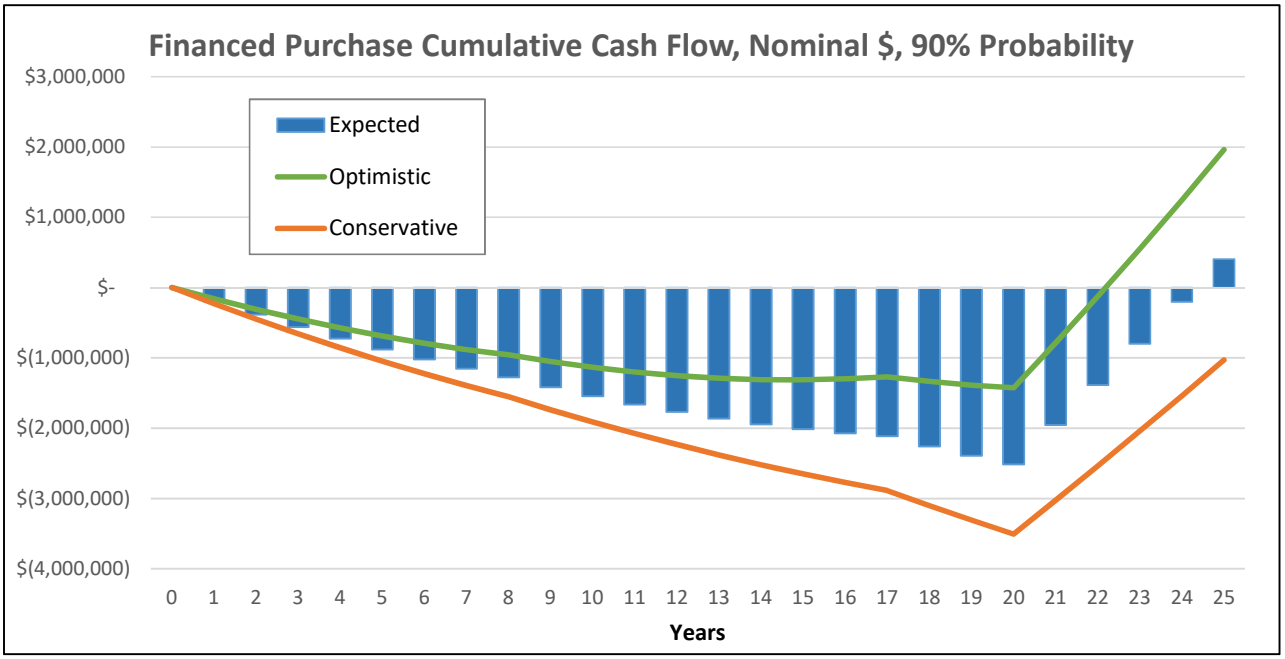
Year	Estimated Utility Usage (kWh)	Annual Estimated Utility Cost w/o PV	PV Output %	Expected Output (kWh)	Annual Gross Savings	Net Annual Energy Costs	Net Annual Savings	Cumulative Project Cash Flow
1	3,748,000	$734,000	100.0%	3,448,000	$560,000	$752,636	($18,636)	($230,096)
2	3,748,000	$756,020	99.3%	3,422,140	$571,832	$758,527	($2,507)	($232,603)
3	3,748,000	$778,701	98.5%	3,396,474	$583,913	$764,862	$13,839	($218,764)
4	3,748,000	$802,062	97.8%	3,371,000	$596,249	$771,657	$30,405	($188,359)
5	3,748,000	$826,123	97.0%	3,345,718	$608,844	$778,925	$47,198	($141,161)
6	3,748,000	$850,907	96.3%	3,320,625	$621,706	$786,683	$64,224	($76,936)
7	3,748,000	$876,434	95.6%	3,295,720	$634,838	$794,945	$81,489	$4,553
8	3,748,000	$902,727	94.9%	3,271,002	$648,247	$803,730	$98,998	$103,550
9	3,748,000	$929,809	94.2%	3,246,470	$628,842	$846,149	$83,660	$187,210
10	3,748,000	$957,704	93.4%	3,222,121	$642,123	$856,727	$100,976	$288,186
11	3,748,000	$986,435	92.7%	3,197,955	$655,684	$867,894	$118,541	$406,727
12	3,748,000	$1,016,028	92.1%	3,173,971	$669,531	$879,668	$136,359	$543,086
13	3,748,000	$1,046,508	91.4%	3,150,166	$683,669	$892,070	$154,438	$697,524
14	3,748,000	$1,077,904	90.7%	3,126,540	$698,106	$905,120	$172,783	$870,308
15	3,748,000	$1,110,241	90.0%	3,103,091	$712,846	$918,839	$191,402	$1,061,709
16	3,748,000	$1,143,548	89.3%	3,079,818	$727,897	$933,249	$210,299	$1,272,009
17	3,748,000	$1,177,855	88.7%	3,056,719	$743,265	$948,371	$229,483	$1,501,492
18	3,748,000	$1,213,190	88.0%	3,033,794	$645,113	$1,078,073	$135,117	$1,636,609
19	3,748,000	$1,249,586	87.3%	3,011,040	$658,732	$1,097,095	$152,491	$1,789,100
20	3,748,000	$1,287,073	86.7%	2,988,457	$672,637	$1,116,952	$170,121	$1,959,221
21	3,748,000	$1,325,686	86.0%	2,966,044	$686,836	$1,137,671	$188,014	$2,147,235
22	3,748,000	$1,365,456	85.4%	2,943,799	$701,333	$1,159,280	$206,176	$2,353,412
23	3,748,000	$1,406,420	84.7%	2,921,720	$716,136	$1,181,806	$224,614	$2,578,025
24	3,748,000	$1,448,612	84.1%	2,899,807	$731,250	$1,205,279	$243,333	$2,821,359
25	3,748,000	$1,492,071	83.5%	2,878,059	$746,682	$1,229,729	$262,341	$3,083,700



SAGE RENEWABLES

25 Year Cash Flow - NEM 2.0 Assumptions, TEML Financed - All Sites

Year	Estimated Utility Usage (kWh)	Annual Estimated Utility Cost w/o PV	PV Output %	Expected Output (kWh)	Annual Gross Savings	Net Annual Energy Costs	Net Annual Savings	Cumulative Project Cash Flow
1	3,748,000	$734,000	100.0%	3,448,000	$560,000	$931,040	($197,040)	($197,040)
2	3,748,000	$756,020	99.3%	3,422,140	$571,832	$942,663	($186,643)	($383,683)
3	3,748,000	$778,701	98.5%	3,396,474	$583,913	$954,747	($176,047)	($559,730)
4	3,748,000	$802,062	97.8%	3,371,000	$596,249	$967,311	($165,249)	($724,979)
5	3,748,000	$826,123	97.0%	3,345,718	$608,844	$980,369	($154,246)	($879,225)
6	3,748,000	$850,907	96.3%	3,320,625	$621,706	$993,940	($143,033)	($1,022,257)
7	3,748,000	$876,434	95.6%	3,295,720	$634,838	$1,008,040	($131,606)	($1,153,863)
8	3,748,000	$902,727	94.9%	3,271,002	$648,247	$1,022,689	($119,961)	($1,273,825)
9	3,748,000	$929,809	94.2%	3,246,470	$628,842	$1,071,001	($141,192)	($1,415,017)
10	3,748,000	$957,704	93.4%	3,222,121	$642,123	$1,087,502	($129,799)	($1,544,815)
11	3,748,000	$986,435	92.7%	3,197,955	$655,684	$1,104,624	($118,190)	($1,663,005)
12	3,748,000	$1,016,028	92.1%	3,173,971	$669,531	$1,122,389	($106,361)	($1,769,366)
13	3,748,000	$1,046,508	91.4%	3,150,166	$683,669	$1,140,817	($94,309)	($1,863,675)
14	3,748,000	$1,077,904	90.7%	3,126,540	$698,106	$1,159,932	($82,029)	($1,945,704)
15	3,748,000	$1,110,241	90.0%	3,103,091	$712,846	$1,179,757	($69,516)	($2,015,220)
16	3,748,000	$1,143,548	89.3%	3,079,818	$727,897	$1,200,316	($56,768)	($2,071,988)
17	3,748,000	$1,177,855	88.7%	3,056,719	$743,265	$1,221,633	($43,778)	($2,115,766)
18	3,748,000	$1,213,190	88.0%	3,033,794	$645,113	$1,357,578	($144,387)	($2,260,154)
19	3,748,000	$1,249,586	87.3%	3,011,040	$658,732	$1,382,892	($133,306)	($2,393,460)
20	3,748,000	$1,287,073	86.7%	2,988,457	$672,637	$1,409,095	($122,022)	($2,515,482)
21	3,748,000	$1,325,686	86.0%	2,966,044	$686,836	$765,429	$560,257	($1,955,225)
22	3,748,000	$1,365,456	85.4%	2,943,799	$701,333	$793,497	$571,960	($1,383,266)
23	3,748,000	$1,406,420	84.7%	2,921,720	$716,136	$822,543	$583,877	($799,388)
24	3,748,000	$1,448,612	84.1%	2,899,807	$731,250	$852,600	$596,013	($203,376)
25	3,748,000	$1,492,071	83.5%	2,878,059	$746,682	$883,700	$608,371	$404,995



Attachment B

Financial Sensitivity Analysis

1: Cash Financing

2: PPA Financing

3: TEML Financing

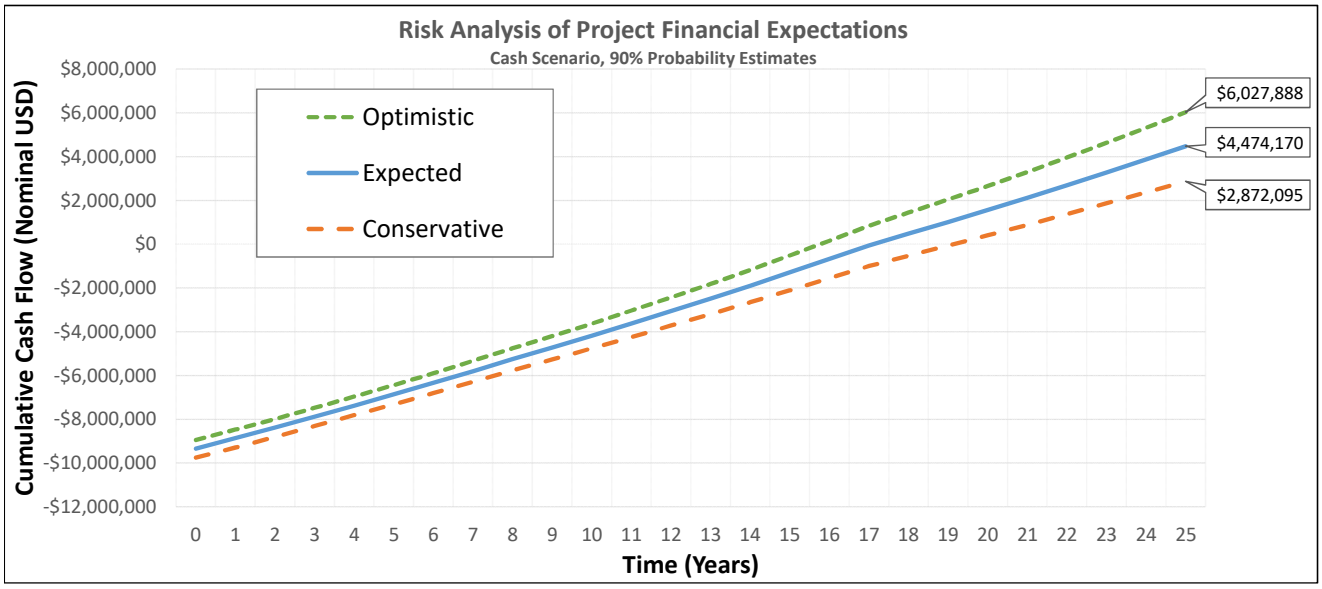
25-year Sensitivity Analysis Cash

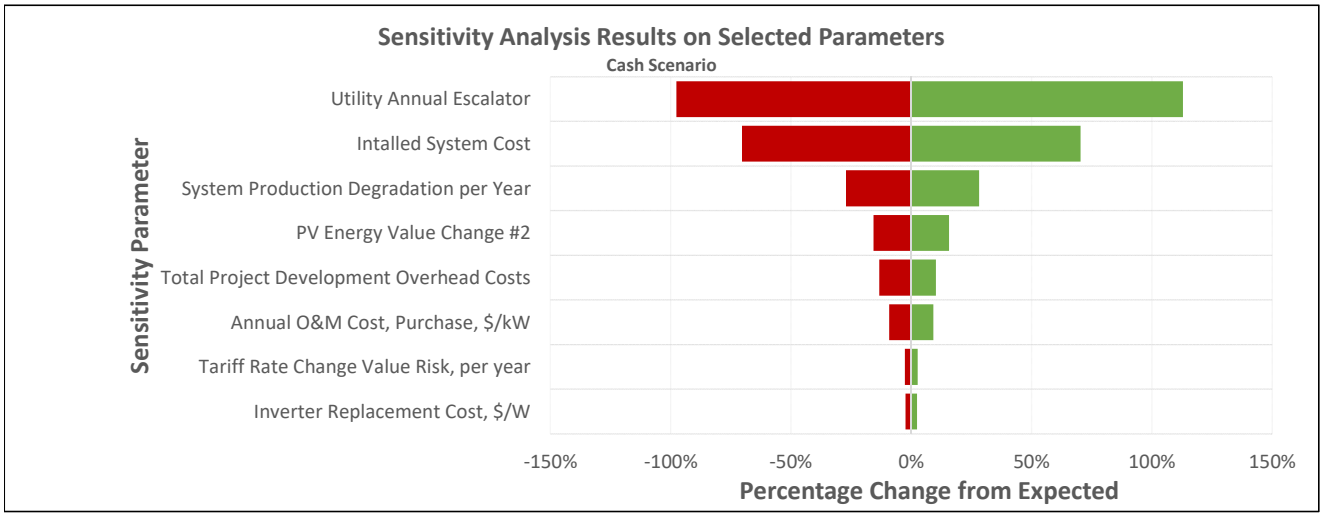
San Rafael City Schools

Parameters

Cash Sensitivity Parameter	Values	NPV Savings			Range of Parameter Variation	
		Optimistic (P10)	Expected (P50)	Conservative (P90)	Minimum	Maximum
Intalled System Cost	$8,458,426	$2,318,637	$1,360,617	$402,596	-70.4%	70.4%
Total Project Development Overhead Costs	$888,135	$1,500,181	$1,360,617	$1,178,760	-13.4%	10.3%
System Production Degradation per Year	0.75%	$1,744,712	$1,360,617	$990,690	-27.2%	28.2%
Annual O&M Cost, Purchase, $/kW	$20.00	$1,485,218	$1,360,617	$1,236,015	-9.2%	9.2%
Utility Annual Escalator	3.00%	$2,896,265	$1,360,617	$32,032	-97.6%	112.9%
Tariff Rate Change Value Risk, per year	-0.10%	$1,397,459	$1,360,617	$1,323,911	-2.7%	2.7%
PV Energy Value Change #2	-15.00%	$1,573,983	$1,360,617	$1,147,250	-15.7%	15.7%
Inverter Replacement Cost, $/W	$0.11	$1,393,564	$1,360,617	$1,327,669	-2.4%	2.4%

Risk Analysis Results





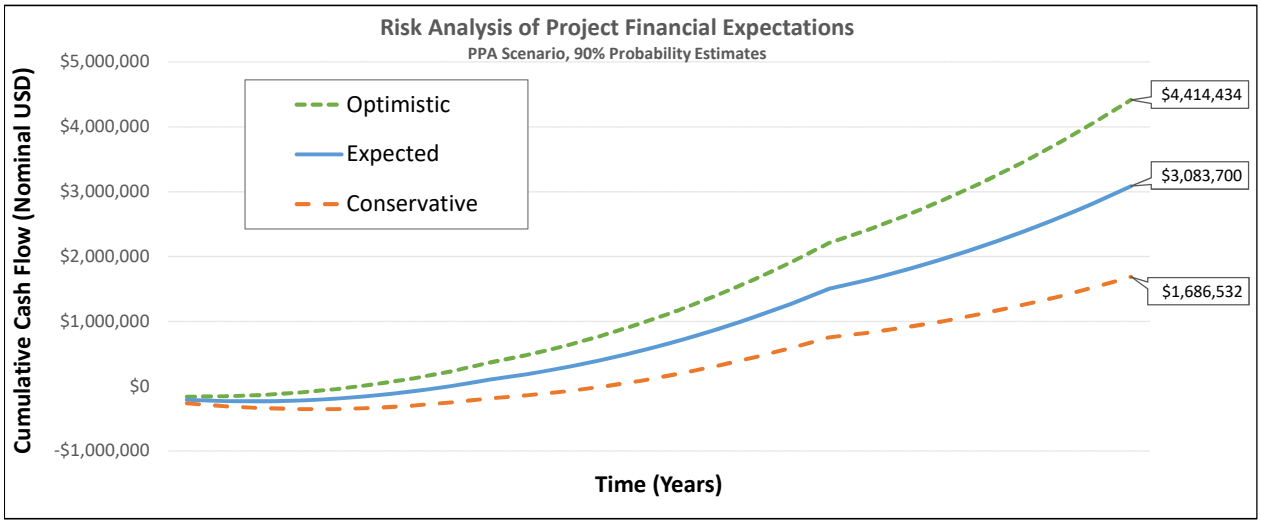
25-year Sensitivity Analysis PPA

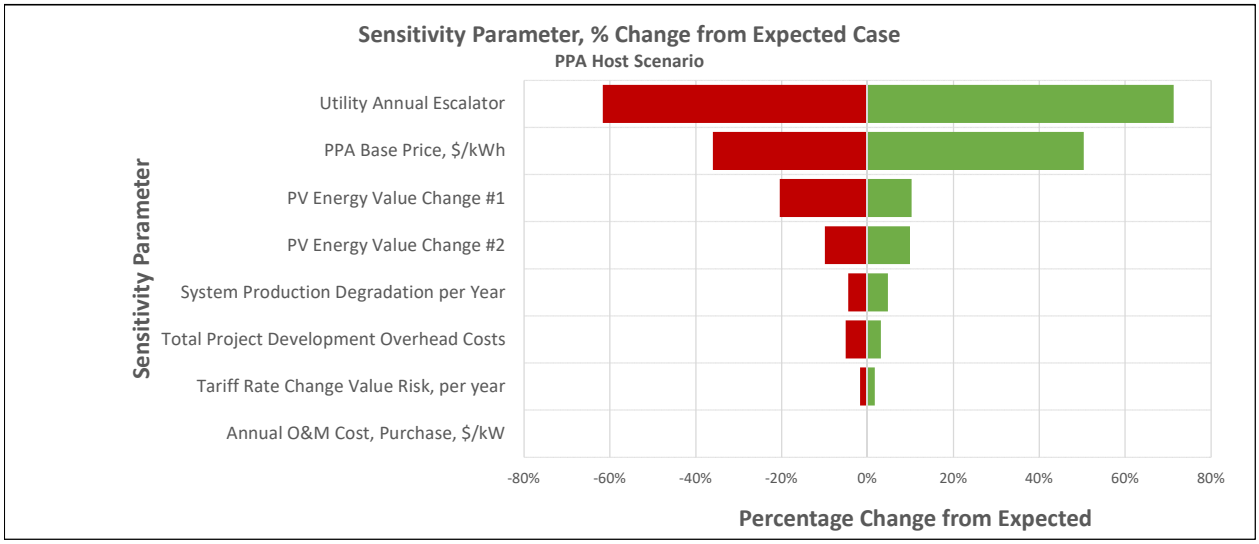
San Rafael City Schools

Parameters

PPA Sensitivity Parameter	Values	NPV Savings			Range of Parameter Variation	
		Optimistic (P10)	Expected (P50)	Conservative (P90)	Minimum	Maximum
Total Project Development Overhead Costs	$211,461	$2,221,999	$2,154,331	$2,044,372	-5.1%	3.1%
System Production Degradation per Year	0.75%	$2,256,028	$2,154,331	$2,056,752	-4.5%	4.7%
Annual O&M Cost, Purchase, $/kW	$20.00	$2,154,331	$2,154,331	$2,154,331	0.0%	0.0%
Utility Annual Escalator	3.00%	$3,689,980	$2,154,331	$825,747	-61.7%	71.3%
Tariff Rate Change Value Risk, per year	-0.10%	$2,191,174	$2,154,331	$2,117,626	-1.7%	1.7%
PV Energy Value Change #1	-5.0%	$2,374,956	$2,154,331	$1,713,083	-20.5%	10.2%
PV Energy Value Change #2	-15.0%	$2,367,698	$2,154,331	$1,940,965	-9.9%	9.9%
PPA Base Price, $/kWh	$0.167	$3,239,958	$2,154,331	$1,377,894	-36.0%	50.4%

Risk Analysis Results





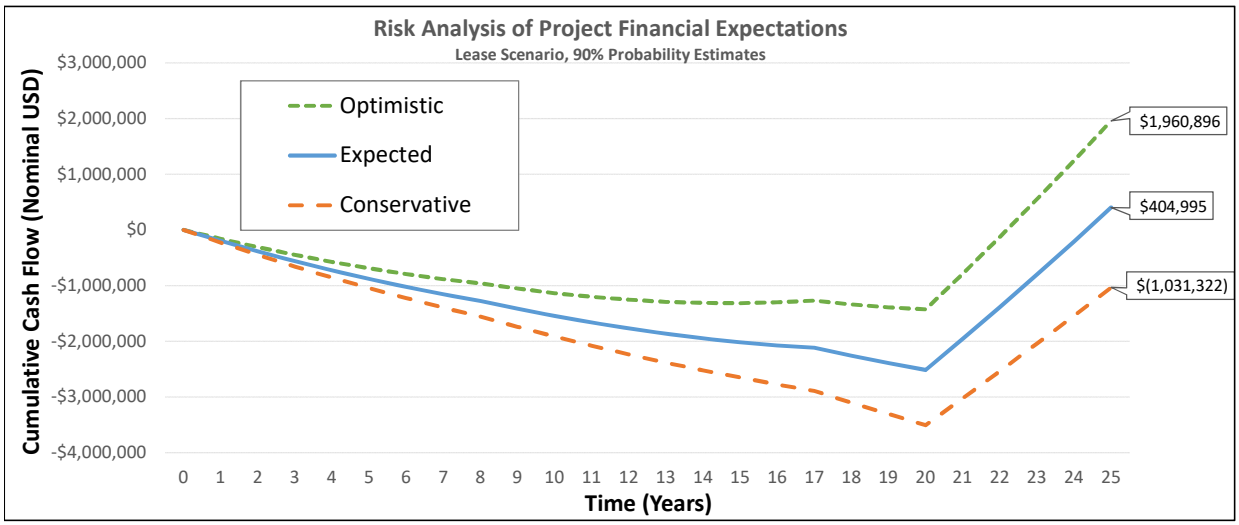
25-year Sensitivity Analysis Lease

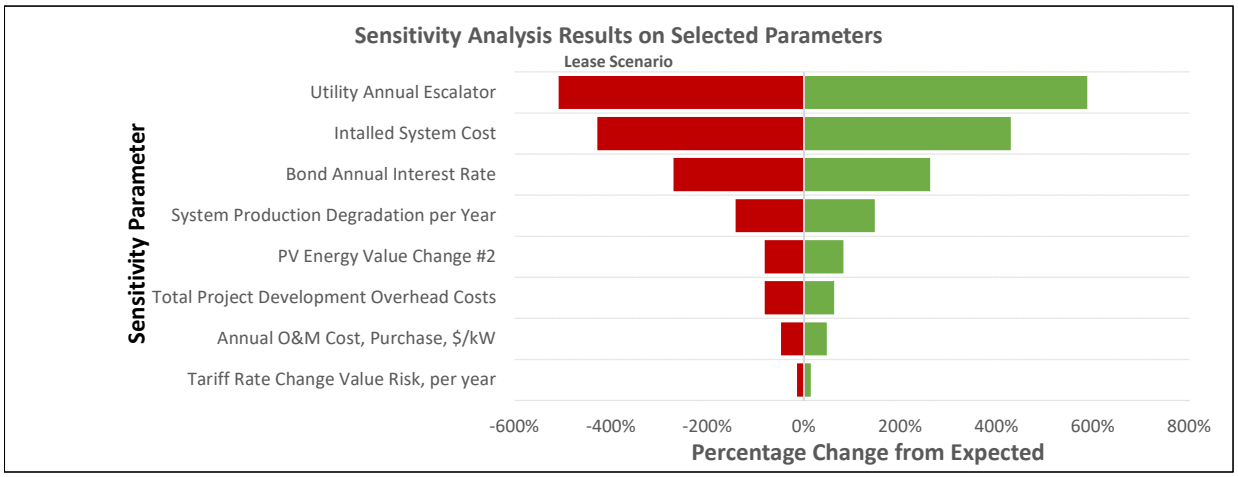
San Rafael City Schools

Parameters

TEML Sensitivity Parameter	Values	NPV Savings			Range of Parameter Variation	
		Optimistic (P10)	Expected (P50)	Conservative (P90)	Minimum	Maximum
Intalled System Cost	$8,458,426	$859,049	-$261,148	-$1,381,344	-429.0%	429.0%
Total Project Development Overhead Costs	$888,135	-$97,367	-$261,148	-$474,559	-81.7%	62.7%
System Production Degradation per Year	0.75%	$122,948	-$261,148	-$631,074	-141.7%	147.1%
Annual O&M Cost, Purchase, $/kW	$20.00	-$136,547	-$261,148	-$385,749	-47.7%	47.7%
Utility Annual Escalator	3.00%	$1,274,501	-$261,148	-$1,589,732	-508.7%	588.0%
Tariff Rate Change Value Risk, per year	-0.10%	-$224,305	-$261,148	-$297,853	-14.1%	14.1%
Bond Annual Interest Rate	3.50%	$421,961	-$261,148	-$967,262	-270.4%	261.6%
PV Energy Value Change #2	-15.0%	-$47,781	-$261,148	-$474,514	-81.7%	81.7%

Risk Analysis Results





Attachment C

Site Details

For each site evaluated in this study, site detail packet includes:

1: Conceptual Design PV Layout

2: Annual Production Report for the System

Target Size - 185 kWp **PV Shown** - 215 kWp (116%)
Rev. 1/27/2018

Solar Array Location (C-Canopy, R-Roof, GM-Groundmount)
Main Electrical Service *Preliminary Conduit Routes*
N

SAGE RENEWABLES

Bahia Vista ES

San Rafael City Schools Solar PV Feasibility Study

SAGE RENEWABLES

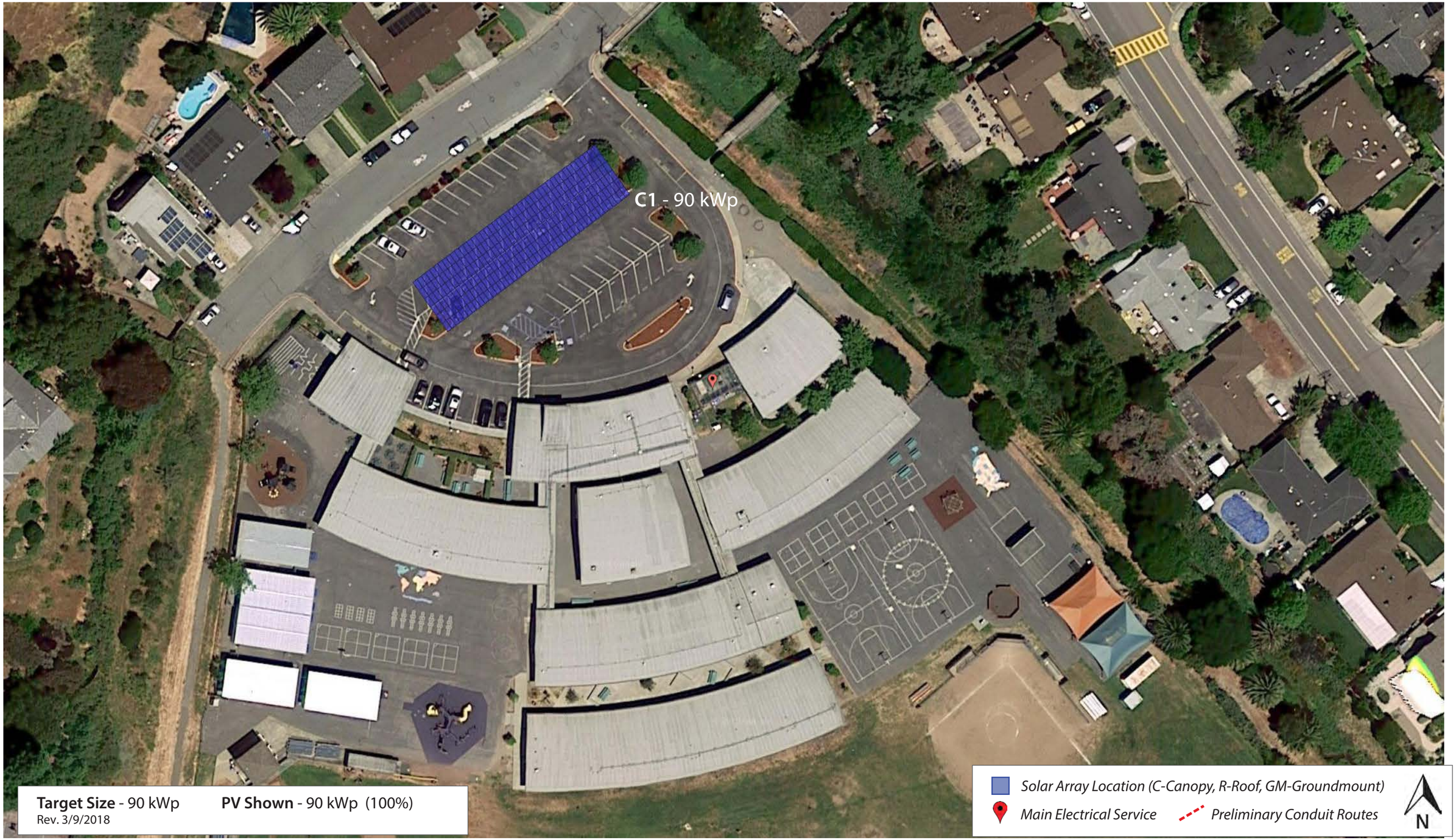
Coleman ES

San Rafael City Schools Solar PV Feasibility Study

SAGE RENEWABLES

Davidson MS & Annex

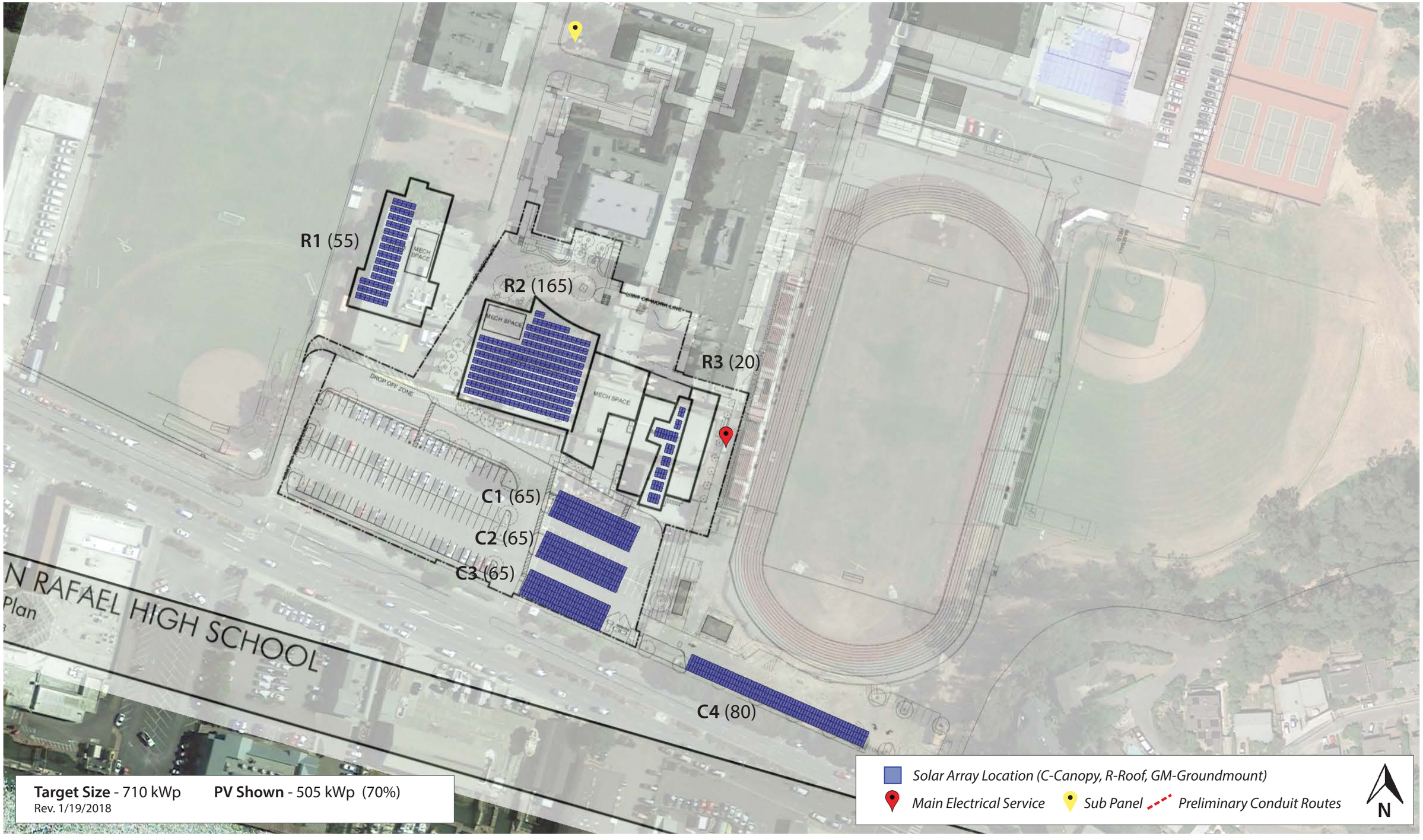
San Rafael City Schools Solar PV Feasibility Study



SAGE RENEWABLES

Glennwood ES

San Rafael City Schools Solar PV Feasibility Study



SAGE RENEWABLES

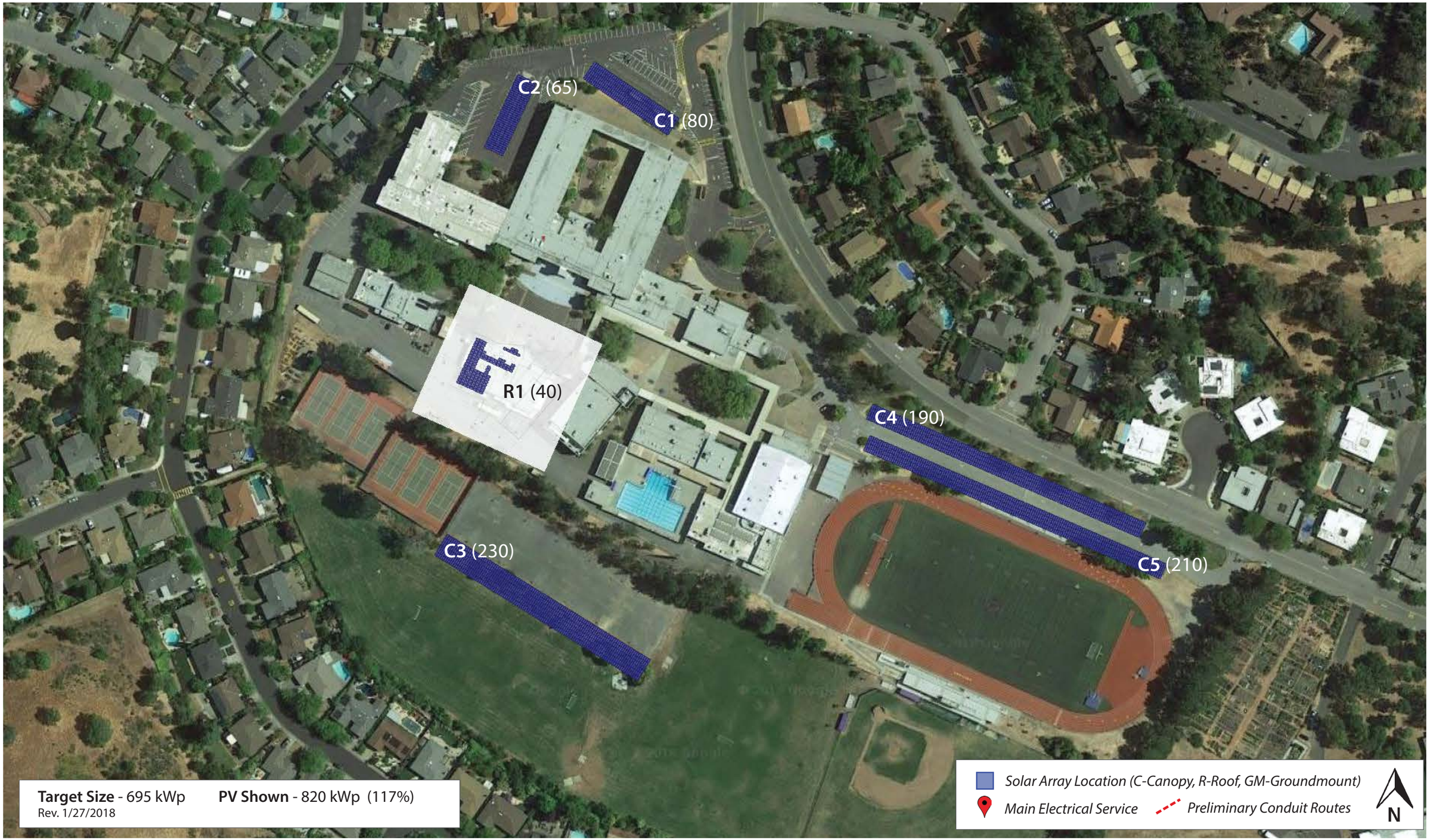
San Rafael HS

San Rafael City Schools Solar PV Feasibility Study

SAGE RENEWABLES

Sun Valley ES

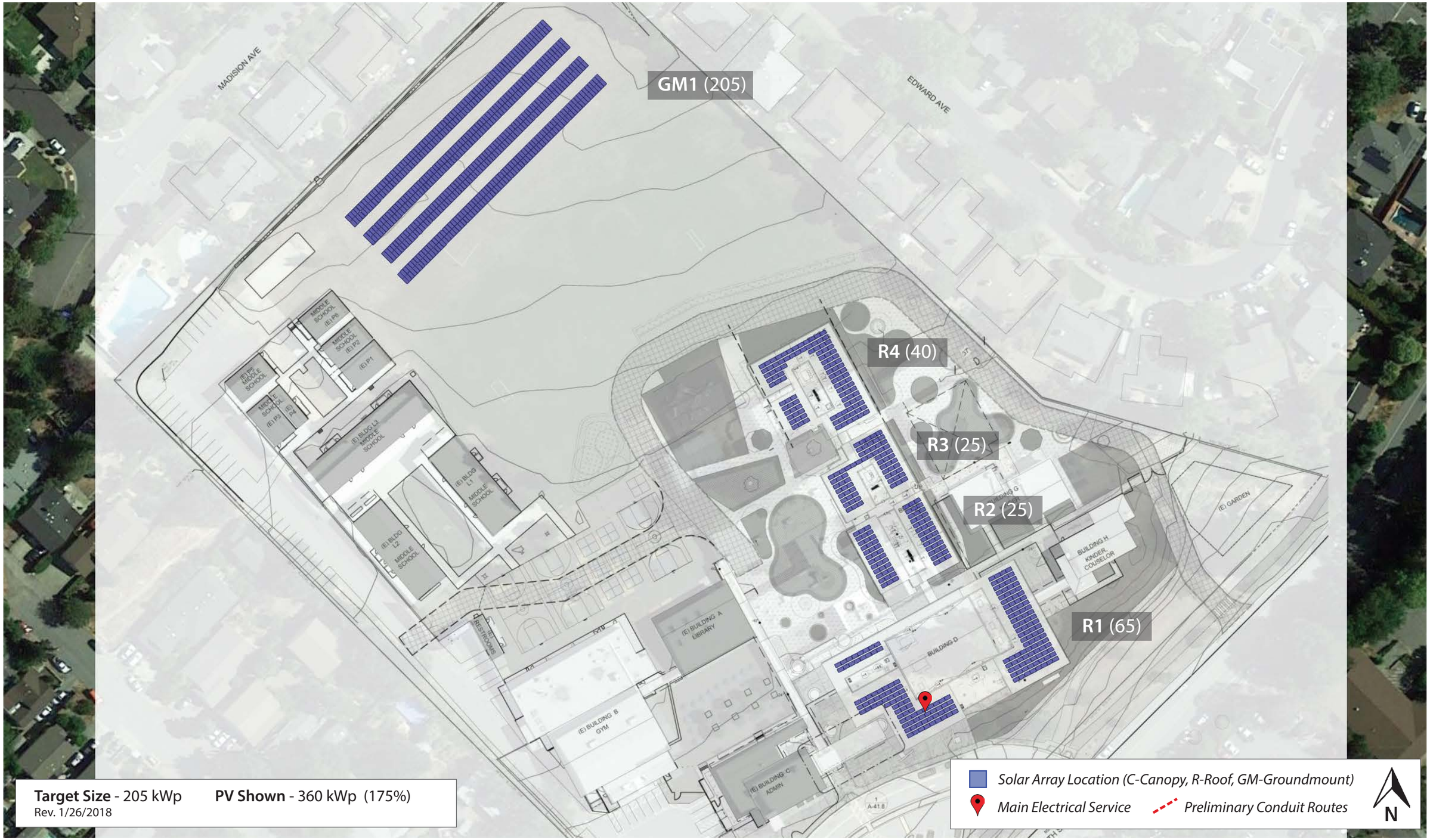
San Rafael City Schools Solar PV Feasibility Study



SAGE RENEWABLES

Terra Linda HS

San Rafael City Schools Solar PV Feasibility Study



Target Size - 205 kWp **PV Shown** - 360 kWp (175%)
Rev. 1/26/2018

SAGE RENEWABLES

Venitia Valley ES

San Rafael City Schools Solar PV Feasibility Study

Glenwood ES V2 (90) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

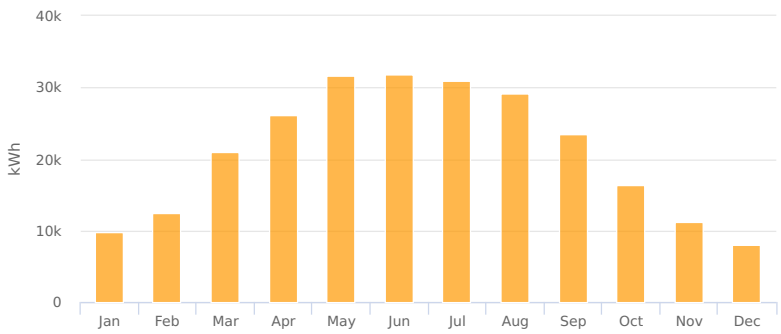
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

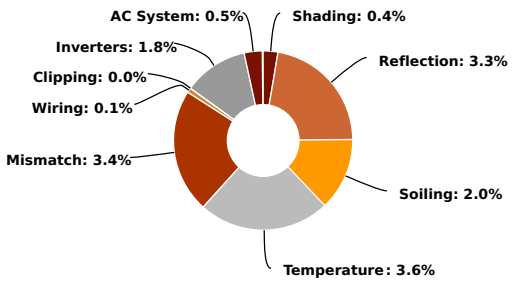
Design	Glenwood ES V2 (90)
Module DC Nameplate	159.1 kW
Inverter AC Nameplate	144.4 kW Load Ratio: 1.10
Annual Production	252.0 MWh
Performance Ratio	85.8%
kWh/kWp	1,583.6
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	51e9f83c6a-ca43eb0e5b-c60d1dff2d-899790e3cd

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,845.2	4.1%
	Shaded Irradiance	1,837.7	-0.4%
	Irradiance after Reflection	1,776.3	-3.3%
	Irradiance after Soiling	1,740.8	-2.0%
	Total Collector Irradiance	**1,740.7**	**0.0%**
Energy (kWh)	Nameplate	277,018.8	
	Output at Irradiance Levels	277,078.7	0.0%
	Output at Cell Temperature Derate	267,133.4	-3.6%
	Output After Mismatch	258,108.8	-3.4%
	Optimal DC Output	257,779.3	-0.1%
	Constrained DC Output	257,772.4	0.0%
	Inverter Output	253,238.0	-1.8%
	Energy to Grid	**251,987.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		25.8 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Characterization										
	LG 340 S2W-G4_Rev2_5 (LG Electronics)	Manufacturer R&D, PAN										
Component Characterizations	Device	Characterization										
	Sunny Tripower 24000TL-US (SMA)	Modified CEC										

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	6 (144.4 kW)
AC Panels	6 input AC Panel	1
AC Home Runs	1/0 AWG (Aluminum)	6 (1,224.1 ft)
AC Home Runs	350 MCM (Copper)	1 (699.3 ft)
Home Runs	500 MCM (Copper)	12 (624.3 ft)
Home Runs	1/0 AWG (Aluminum)	12 (121.5 ft)
Combiners	1 input Combiner	12
Combiners	2 input Combiner	12
Strings	10 AWG (Copper)	24 (725.2 ft)
Module	LG Electronics, LG 340 S2W-G4_Rev2_5 (340W)	468 (159.1 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
C1	Carport	Portrait (Vertical)	7.5°	143.839°	0.0 ft	6x1	44	264	89.8 kW
C2	Carport	Portrait (Vertical)	7.5°	143.839°	0.0 ft	6x1	34	204	69.4 kW

Detailed Layout

Sun Valley ES V3 (110) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

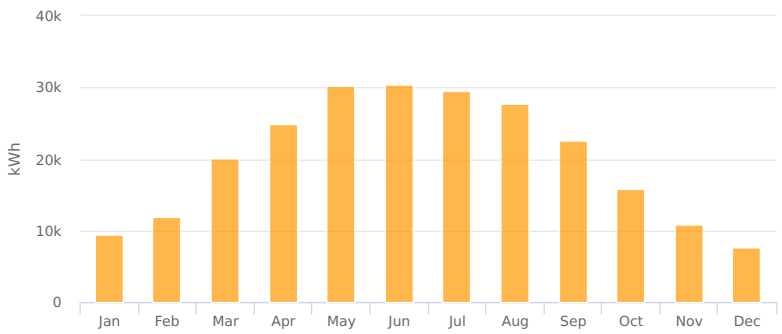
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

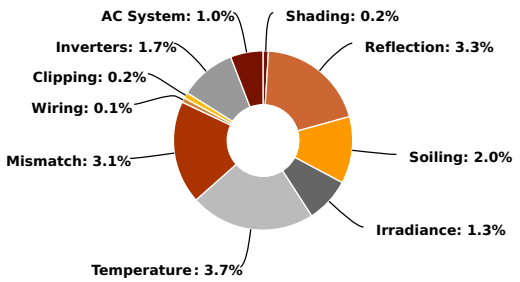
Design	Sun Valley ES V3 (110)
Module DC Nameplate	153.2 kW
Inverter AC Nameplate	140.0 kW Load Ratio: 1.09
Annual Production	240.9 MWh
Performance Ratio	84.4%
kWh/kWp	1,572.3
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	bb8b0ef10a-d0d294bfdf-3dca186786-c431adea72

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,861.9	5.0%
	Shaded Irradiance	1,858.9	-0.2%
	Irradiance after Reflection	1,798.1	-3.3%
	Irradiance after Soiling	1,762.2	-2.0%
	Total Collector Irradiance	**1,762.2**	**0.0%**
Energy (kWh)	Nameplate	269,726.6	
	Output at Irradiance Levels	266,094.0	-1.3%
	Output at Cell Temperature Derate	256,144.2	-3.7%
	Output After Mismatch	248,255.5	-3.1%
	Optimal DC Output	247,907.3	-0.1%
	Constrained DC Output	247,477.8	-0.2%
	Inverter Output	243,309.0	-1.7%
	Energy to Grid	**240,939.0**	**-1.0%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		25.9 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Characterization										
	YL310P-35b (Yingli)	Default Characterization (pre 2017), PAN										
	LG 340 S2W-G4_Rev2_5 (LG Electronics)	Manufacturer R&D, PAN										
Component Characterizations	Device	Characterization										
	Sunny Tripower STP 20000TLHE-10 (SMA)	Default Characterization										

Components

Component	Name	Count
Inverters	Sunny Tripower STP 20000TLHE-10 (SMA)	7 (140.0 kW)
AC Panels	7 input AC Panel	1
AC Home Runs	1/0 AWG (Aluminum)	7 (4,428.0 ft)
AC Home Runs	350 MCM (Copper)	1 (1,316.0 ft)
Home Runs	500 MCM (Copper)	8 (152.1 ft)
Combiners	1 input Combiner	8
Combiners	2 input Combiner	2
Combiners	4 input Combiner	6
Strings	10 AWG (Copper)	28 (1,029.5 ft)
Module	LG Electronics, LG 340 S2W-G4_Rev2_5 (340W)	210 (71.4 kW)
Module	Yingli, YL310P-35b (310W)	264 (81.8 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone 2	12	16-20	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
C1	Carport	Portrait (Vertical)	10°	129.18°	0.0 ft	6x1	35	210	71.4 kW
C2	Carport	Portrait (Vertical)	10°	215.773°	1.3 ft	6x1	44	264	81.8 kW

Detailed Layout

Coleman ES V3 (120) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

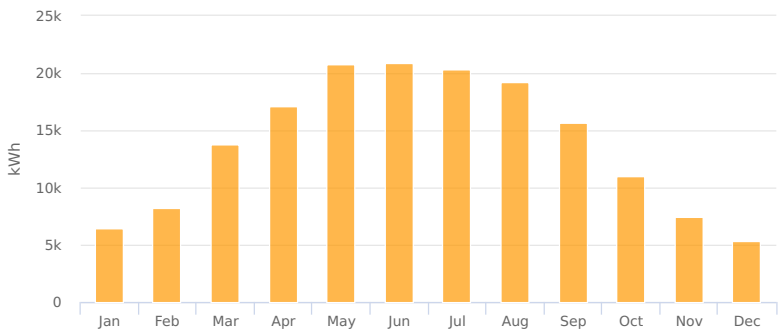
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

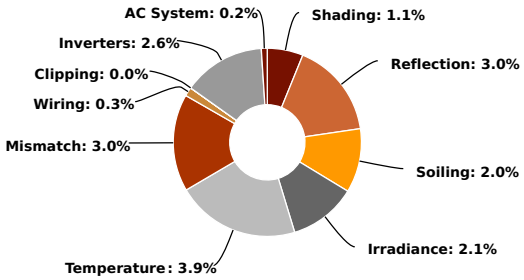
Design	Coleman ES V3 (120)
Module DC Nameplate	105.9 kW
Inverter AC Nameplate	114.1 kW Load Ratio: 0.93
Annual Production	166.3 MWh
Performance Ratio	83.1%
kWh/kWp	1,569.8
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	bb8b0ef10a-d0d294bfdf-3dca186786-c431adea72

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,889.5	6.6%
	Shaded Irradiance	1,868.4	-1.1%
	Irradiance after Reflection	1,812.3	-3.0%
	Irradiance after Soiling	1,776.0	-2.0%
	Total Collector Irradiance	**1,776.0**	**0.0%**
Energy (kWh)	Nameplate	187,892.2	
	Output at Irradiance Levels	183,927.3	-2.1%
	Output at Cell Temperature Derate	176,825.5	-3.9%
	Output After Mismatch	171,443.0	-3.0%
	Optimal DC Output	170,967.8	-0.3%
	Constrained DC Output	170,967.6	0.0%
	Inverter Output	166,572.0	-2.6%
	Energy to Grid	**166,261.0**	**-0.2%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		26.0 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Characterization
YL310P-35b (Yingli)	Default Characterization (pre 2017), PAN
LG 340 S2W-G4_Rev2_5 (LG Electronics)	Manufacturer R&D, PAN

Component Characterizations

Device	Characterization
Sunny Tripower 24000TL-US (SMA)	Modified CEC
Sunny Tripower 15000TL-US (SMA)	Modified CEC

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	1 (24.1 kW)
Inverters	Sunny Tripower 15000TL-US (SMA)	6 (90.0 kW)
AC Panels	1 input AC Panel	2
AC Panels	2 input AC Panel	1
AC Panels	3 input AC Panel	1
AC Home Runs	1/0 AWG (Aluminum)	7 (1,058.2 ft)
AC Home Runs	350 MCM (Copper)	4 (4,541.4 ft)
Home Runs	500 MCM (Copper)	9 (222.8 ft)
Combiners	1 input Combiner	11
Combiners	2 input Combiner	2
Combiners	3 input Combiner	5
Strings	10 AWG (Copper)	21 (1,742.4 ft)
Module	Yingli, YL310P-35b (310W)	289 (89.6 kW)
Module	LG Electronics, LG 340 S2W-G4_Rev2_5 (340W)	48 (16.3 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	5-20	Along Racking
Wiring Zone 2	12	5-20	Along Racking
Wiring Zone 3	12	5-20	Along Racking
Wiring Zone 5	12	4-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
R1	Fixed Tilt	Landscape (Horizontal)	10°	196.603°	1.3 ft	1x1	78	78	24.2 kW
R2-A	Fixed Tilt	Landscape (Horizontal)	10°	175.576°	1.3 ft	1x1	15	15	4.65 kW
R2-B	Fixed Tilt	Landscape (Horizontal)	10°	175.576°	1.3 ft	1x1	21	21	6.51 kW
R3-B	Fixed Tilt	Landscape (Horizontal)	10°	194.928°	1.3 ft	1x1	21	21	6.51 kW
R3-C	Fixed Tilt	Landscape (Horizontal)	10°	195.236°	1.3 ft	1x1	15	15	4.65 kW
R4-A	Fixed Tilt	Landscape (Horizontal)	10°	218.073°	1.3 ft	1x1	15	15	4.65 kW
R4-B	Fixed Tilt	Landscape (Horizontal)	10°	218.073°	1.3 ft	1x1	21	21	6.51 kW
R4-C	Fixed Tilt	Landscape (Horizontal)	10°	218.073°	1.3 ft	1x1	18	18	5.58 kW
R3-A	Fixed Tilt	Landscape (Horizontal)	10°	196.033°	1.3 ft	1x1	15	15	4.65 kW
R2-C	Fixed Tilt	Landscape (Horizontal)	10°	175.983°	1.3 ft	1x1	12	12	3.72 kW
R7	Fixed Tilt	Landscape (Horizontal)	10°	195.602°	1.3 ft	1x1	44	44	13.6 kW
R5	Fixed Tilt	Landscape (Horizontal)	10°	195.602°	1.3 ft	1x1	14	14	4.34 kW
R6	Fixed Tilt	Landscape (Horizontal)	7.5°	195.762°	1.0 ft	1x1	48	48	16.3 kW

Detailed Layout

Davidson MS and Annex V3 (360) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

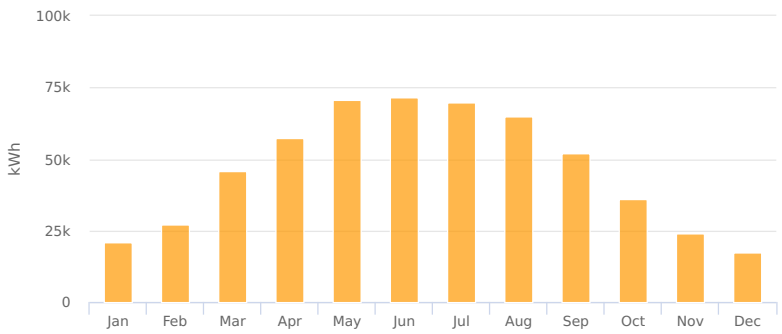
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

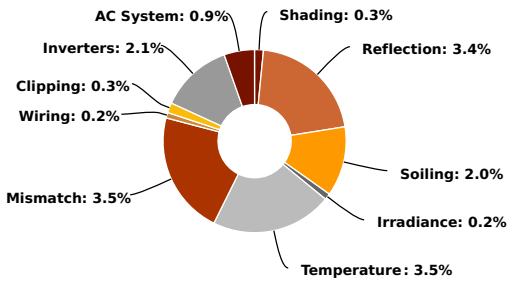
Design	Davidson MS and Annex V3 (360)
Module DC Nameplate	359.3 kW
Inverter AC Nameplate	336.8 kW Load Ratio: 1.07
Annual Production	557.6 MWh
Performance Ratio	84.9%
kWh/kWp	1,552.0
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	ebc2749da7-27789324a5-982b06d286-50f73722bd

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,828.9	3.2%
	Shaded Irradiance	1,824.2	-0.3%
	Irradiance after Reflection	1,762.4	-3.4%
	Irradiance after Soiling	1,727.1	-2.0%
	Total Collector Irradiance	**1,727.2**	**0.0%**
Energy (kWh)	Nameplate	620,714.8	
	Output at Irradiance Levels	619,612.5	-0.2%
	Output at Cell Temperature Derate	598,090.7	-3.5%
	Output After Mismatch	576,995.7	-3.5%
	Optimal DC Output	576,088.6	-0.2%
	Constrained DC Output	574,448.3	-0.3%
	Inverter Output	562,545.0	-2.1%
	Energy to Grid	**557,635.0**	**-0.9%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		25.7 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Characterization										
	LG 340 S2W-G4_Rev2_5 (LG Electronics)	Manufacturer R&D, PAN										
	LG350Q1C-A5 (LG)	Default Characterization (pre 2017), PAN										
Component Characterizations	Device	Characterization										
	Sunny Tripower 24000TL-US (SMA)	Modified CEC										

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	14 (336.8 kW)
AC Panels	2 input AC Panel	1
AC Panels	3 input AC Panel	1
AC Panels	4 input AC Panel	1
AC Panels	5 input AC Panel	1
AC Home Runs	1/0 AWG (Aluminum)	14 (3,853.0 ft)
AC Home Runs	350 MCM (Copper)	4 (6,576.5 ft)
Home Runs	500 MCM (Copper)	20 (1,163.4 ft)
Home Runs	1/0 AWG (Aluminum)	20 (201.4 ft)
Combiners	1 input Combiner	22
Combiners	2 input Combiner	6
Combiners	3 input Combiner	4
Combiners	4 input Combiner	8
Strings	10 AWG (Copper)	58 (3,038.5 ft)
Module	LG Electronics, LG 340 S2W-G4_Rev2_5 (340W)	960 (326.4 kW)
Module	LG, LG350Q1C-A5 (350W)	94 (32.9 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone 2	12	4-21	Along Racking
Wiring Zone 3	12	4-21	Along Racking
Wiring Zone 4	12	4-21	Along Racking
Wiring Zone 4	12	5-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
C-1	Carport	Portrait (Vertical)	5°	305.797°	0.0 ft	4x1	21	84	28.6 kW
C-2	Carport	Portrait (Vertical)	5°	277.806°	0.0 ft	4x1	27	108	36.7 kW
C-3	Carport	Portrait (Vertical)	5°	277.848°	0.0 ft	4x1	49	196	66.6 kW
C-4	Carport	Portrait (Vertical)	7.5°	214.282°	0.0 ft	6x1	70	420	142.8 kW
C-5	Carport	Portrait (Vertical)	7.5°	187.668°	0.0 ft	4x1	38	152	51.7 kW
R1	Fixed Tilt	Landscape (Horizontal)	10°	180.297°	1.2 ft	1x1	18	18	6.30 kW
R2	Fixed Tilt	Landscape (Horizontal)	10°	180.297°	1.2 ft	1x1	18	18	6.30 kW
R3	Fixed Tilt	Landscape (Horizontal)	10°	180.297°	1.2 ft	1x1	18	18	6.30 kW
R4	Fixed Tilt	Landscape (Horizontal)	10°	180.621°	1.2 ft	1x1	20	20	7.00 kW
R5	Fixed Tilt	Landscape (Horizontal)	10°	180.621°	1.2 ft	1x1	20	20	7.00 kW

Detailed Layout

San Rafael HS V4 (710) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

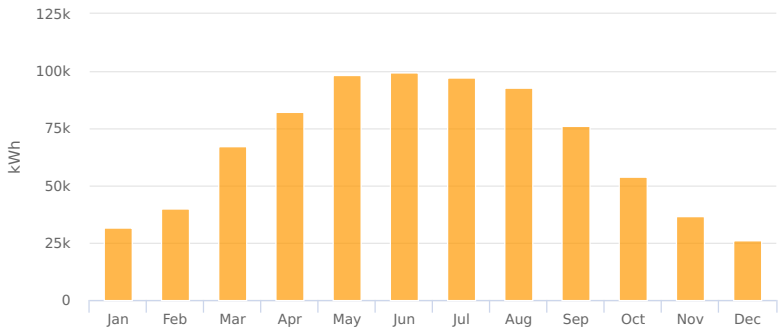
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

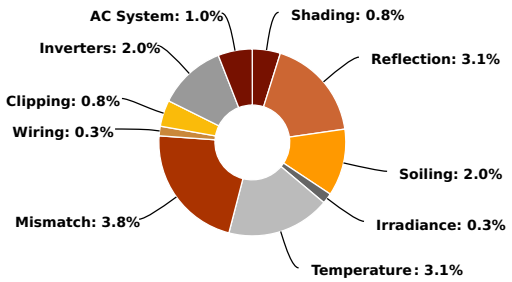
Design	San Rafael HS V4 (710)
Module DC Nameplate	503.7 kW
Inverter AC Nameplate	409.0 kW Load Ratio: 1.23
Annual Production	801.7 MWh
Performance Ratio	84.0%
kWh/kWp	1,591.8
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	668a2f96b2-4d02f9e315-cd9f690cdf-46185030e3

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,893.9	6.8%
	Shaded Irradiance	1,878.1	-0.8%
	Irradiance after Reflection	1,820.2	-3.1%
	Irradiance after Soiling	1,783.8	-2.0%
	Total Collector Irradiance	**1,783.7**	**0.0%**
Energy (kWh)	Nameplate	899,174.3	
	Output at Irradiance Levels	896,353.5	-0.3%
	Output at Cell Temperature Derate	868,679.9	-3.1%
	Output After Mismatch	835,614.4	-3.8%
	Optimal DC Output	833,233.4	-0.3%
	Constrained DC Output	826,686.7	-0.8%
	Inverter Output	809,983.0	-2.0%
	Energy to Grid	**801,698.0**	**-1.0%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		26.0 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Characterization
LG395N2W-A5_Rev002 (LG Electronics)	LG395N2W-A5_Rev002.pan, PAN
LG350Q1K-A5 (LG Electronics)	Spec Sheet Characterization, PAN
LG350Q1C-A5 (LG)	Default Characterization (pre 2017), PAN

Component Characterizations

Device	Characterization
Sunny Tripower 24000TL-US (SMA)	Modified CEC

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	17 (409.0 kW)
AC Panels	5 input AC Panel	1
AC Panels	6 input AC Panel	2
AC Home Runs	1/0 AWG (Aluminum)	17 (9,802.9 ft)
AC Home Runs	350 MCM (Copper)	3 (3,703.9 ft)
Home Runs	500 MCM (Copper)	24 (2,054.6 ft)
Home Runs	1/0 AWG (Aluminum)	24 (293.0 ft)
Combiners	1 input Combiner	24
Combiners	2 input Combiner	7
Combiners	3 input Combiner	7
Combiners	4 input Combiner	10
Strings	10 AWG (Copper)	75 (8,894.1 ft)
Module	LG Electronics, LG395N2W-A5_Rev002 (395W)	669 (264.3 kW)
Module	LG Electronics, LG350Q1K-A5 (350W)	532 (186.2 kW)
Module	LG, LG350Q1C-A5 (350W)	152 (53.2 kW)

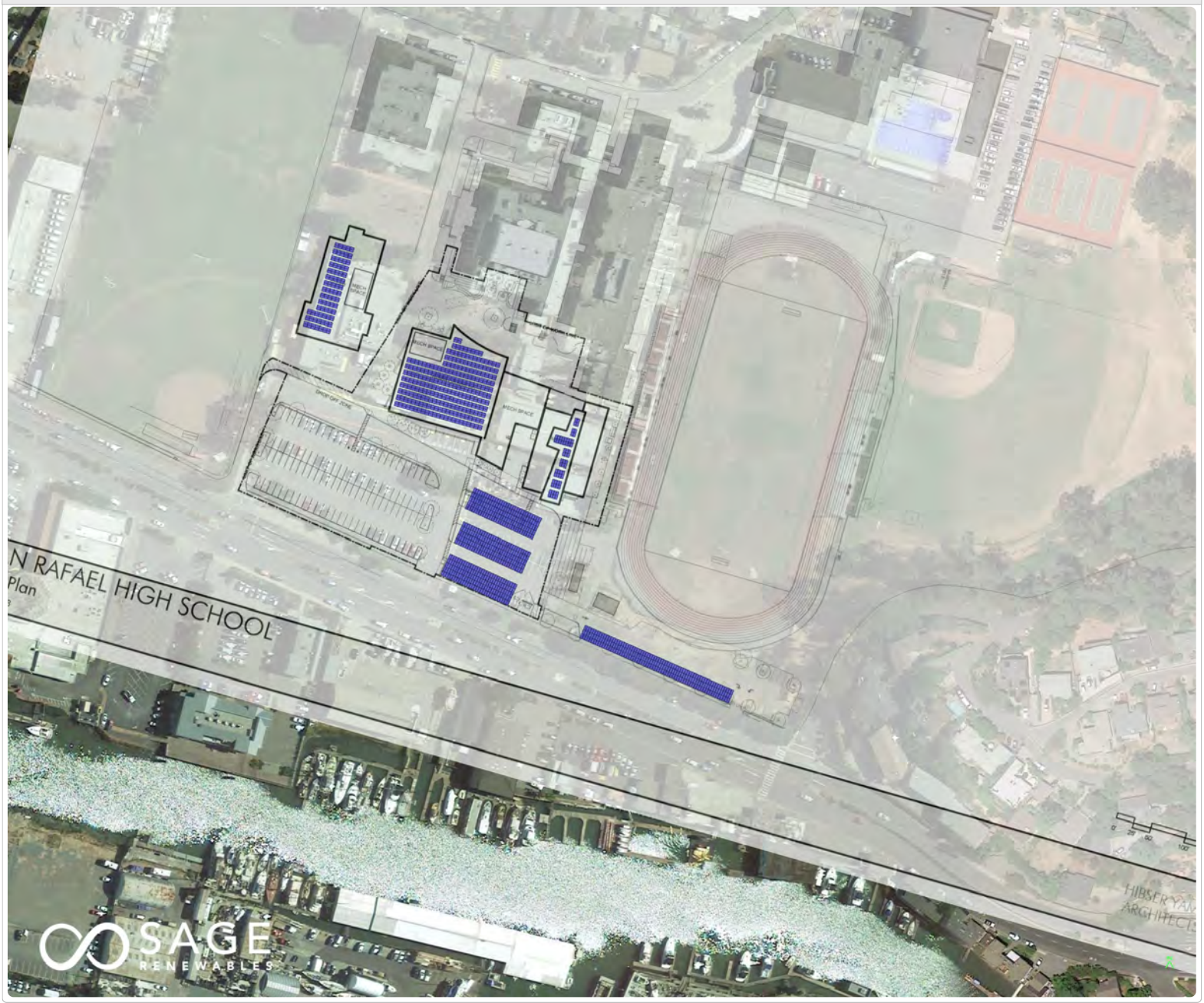
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	5-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
C4	Carport	Portrait (Vertical)	10°	203.706°	1.3 ft	3x1	68	204	80.6 kW
C1	Carport	Portrait (Vertical)	10°	204.717°	1.3 ft	5x1	31	155	61.2 kW
C2	Carport	Portrait (Vertical)	10°	204.717°	1.3 ft	5x1	31	155	61.2 kW
C3	Carport	Portrait (Vertical)	10°	204.717°	1.3 ft	5x1	31	155	61.2 kW
R2	Fixed Tilt	Landscape (Horizontal)	10°	195.95°	2.6 ft	2x1	236	472	165.2 kW
R1	Fixed Tilt	Landscape (Horizontal)	10°	196.165°	2.6 ft	2x1	76	152	53.2 kW
R3	Fixed Tilt	Portrait (Vertical)	10°	196.165°	4.4 ft	2x1	30	60	21.0 kW

Detailed Layout



Venitia Valley ES V5 (205) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

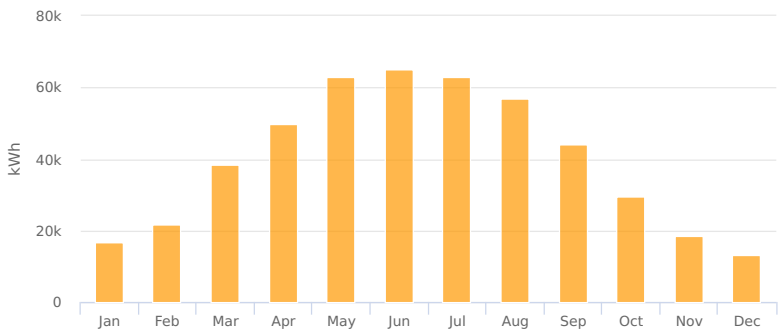
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

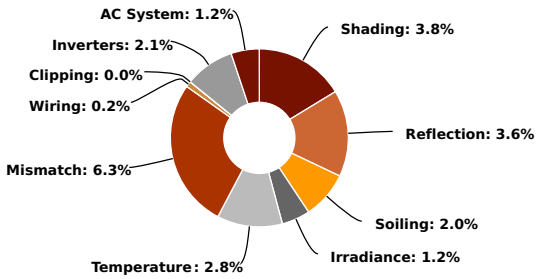
Design	Venitia Valley ES V5 (205)
Module DC Nameplate	359.4 kW
Inverter AC Nameplate	336.8 kW Load Ratio: 1.07
Annual Production	479.7 MWh
Performance Ratio	79.1%
kWh/kWp	1,334.7
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	668a2f96b2-4d02f9e315-cd9f690cdf-46185030e3

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,688.1	-4.8%
	Shaded Irradiance	1,624.2	-3.8%
	Irradiance after Reflection	1,565.0	-3.6%
	Irradiance after Soiling	1,533.7	-2.0%
	Total Collector Irradiance	**1,533.3**	**0.0%**
Energy (kWh)	Nameplate	551,906.3	
	Output at Irradiance Levels	545,307.0	-1.2%
	Output at Cell Temperature Derate	530,287.3	-2.8%
	Output After Mismatch	496,986.0	-6.3%
	Optimal DC Output	495,805.8	-0.2%
	Constrained DC Output	495,805.1	0.0%
	Inverter Output	485,427.0	-2.1%
	Energy to Grid	**479,653.0**	**-1.2%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		24.6 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Characterization										
	LG 340 S2W-G4_Rev2_5 (LG Electronics)	Manufacturer R&D, PAN										
	LG350Q1C-A5 (LG)	Default Characterization (pre 2017), PAN										
Component Characterizations	Device	Characterization										
	Sunny Tripower 24000TL-US (SMA)	Modified CEC										

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	14 (336.8 kW)
AC Panels	3 input AC Panel	1
AC Panels	4 input AC Panel	1
AC Panels	7 input AC Panel	1
AC Home Runs	1/0 AWG (Aluminum)	14 (2,838.1 ft)
AC Home Runs	350 MCM (Copper)	3 (4,703.2 ft)
Home Runs	500 MCM (Copper)	27 (2,432.6 ft)
Home Runs	1/0 AWG (Aluminum)	27 (129.6 ft)
Combiners	1 input Combiner	29
Combiners	2 input Combiner	17
Combiners	3 input Combiner	8
Strings	10 AWG (Copper)	60 (4,177.8 ft)
Module	LG Electronics, LG 340 S2W-G4_Rev2_5 (340W)	602 (204.7 kW)
Module	LG, LG350Q1C-A5 (350W)	442 (154.7 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-21	Along Racking
Wiring Zone 2	12	5-21	Along Racking
Wiring Zone 3	12	5-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
GM-1	Fixed Tilt	Portrait (Vertical)	20°	314.93°	10.9 ft	2x1	301	602	204.7 kW
R1	Fixed Tilt	Landscape (Horizontal)	10°	152.408°	1.5 ft	1x1	189	189	66.2 kW
R2	Fixed Tilt	Landscape (Horizontal)	10°	151.384°	1.5 ft	1x1	75	75	26.3 kW
R3	Fixed Tilt	Landscape (Horizontal)	10°	151.384°	1.5 ft	1x1	68	68	23.8 kW
R4	Fixed Tilt	Landscape (Horizontal)	10°	151.384°	1.5 ft	1x1	110	110	38.5 kW

Detailed Layout

Bahia Vista ES V3 (185) (V2) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

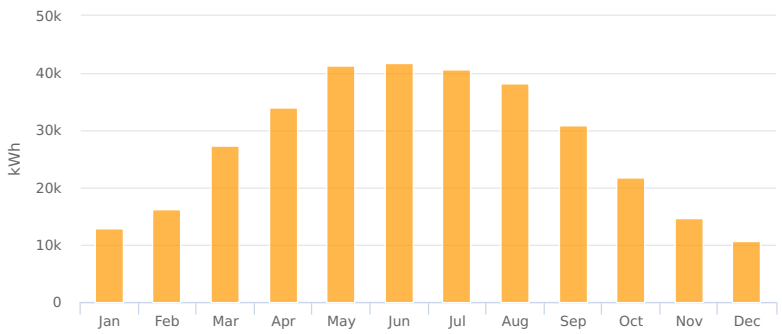
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

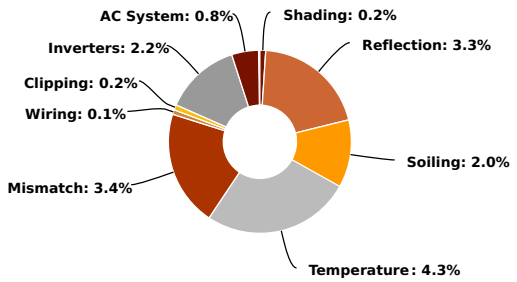
Design	Bahia Vista ES V3 (185) (V2)
Module DC Nameplate	210.1 kW
Inverter AC Nameplate	195.0 kW Load Ratio: 1.08
Annual Production	330.4 MWh
Performance Ratio	84.7%
kWh/kWp	1,572.3
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	e6151cde99-0628ca2d84-2a3af99198-ff599d4bae

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,857.0	4.8%
	Shaded Irradiance	1,853.9	-0.2%
	Irradiance after Reflection	1,792.6	-3.3%
	Irradiance after Soiling	1,756.7	-2.0%
	Total Collector Irradiance	**1,756.8**	**0.0%**
Energy (kWh)	Nameplate	369,195.3	
	Output at Irradiance Levels	369,325.8	0.0%
	Output at Cell Temperature Derate	353,368.1	-4.3%
	Output After Mismatch	341,461.5	-3.4%
	Optimal DC Output	341,004.8	-0.1%
	Constrained DC Output	340,492.7	-0.2%
	Inverter Output	332,980.0	-2.2%
	Energy to Grid	**330,376.0**	**-0.8%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		26.9 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations	Module	Characterization
	LG 340 S2W-G4_Rev2_5 (LG Electronics)	Manufacturer R&D, PAN

Component Characterizations	Device	Characterization
	Sunny Tripower 15000TL-US (SMA)	Modified CEC
	Sunny Tripower STP 20000TLHE-10 (SMA)	Default Characterization

Components

Component	Name	Count
Inverters	Sunny Tripower 15000TL-US (SMA)	9 (135.0 kW)
Inverters	Sunny Tripower STP 20000TLHE-10 (SMA)	3 (60.0 kW)
AC Panels	2 input AC Panel	1
AC Panels	3 input AC Panel	1
AC Panels	7 input AC Panel	1
AC Home Runs	1/0 AWG (Aluminum)	12 (2,146.1 ft)
AC Home Runs	350 MCM (Copper)	3 (5,417.7 ft)
Home Runs	500 MCM (Copper)	19 (847.7 ft)
Home Runs	1/0 AWG (Aluminum)	19 (323.8 ft)
Combiners	1 input Combiner	26
Combiners	2 input Combiner	9
Combiners	3 input Combiner	3
Strings	10 AWG (Copper)	34 (1,053.1 ft)
Module	LG Electronics, LG 340 S2W-G4_Rev2_5 (340W)	618 (210.1 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	16-21	Along Racking
Wiring Zone 2	12	4-21	Along Racking
Wiring Zone 3	12	4-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
C-1	Carport	Portrait (Vertical)	7.5°	200.142°	1.0 ft	5x1	36	180	61.2 kW
C-4	Carport	Portrait (Vertical)	7.5°	200.142°	1.0 ft	4x1	43	172	58.5 kW
C-3 A	Flush Mount	Portrait (Vertical)	7.5°	104.899°	1.0 ft	2x1	17	34	11.6 kW
C-3 B	Flush Mount	Portrait (Vertical)	7.5°	284.783°	1.0 ft	2x1	17	34	11.6 kW
C-4 (copy)	Carport	Portrait (Vertical)	7.5°	200.108°	1.0 ft	6x1	33	198	67.3 kW

Detailed Layout

Glenwood ES V3 (90) San Rafael USD, 1719 5th Ave, San Rafael, CA

Report

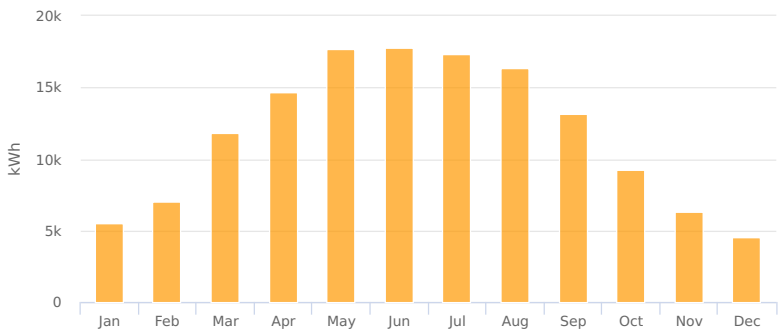
Project Name	San Rafael USD
Project Address	1719 5th Ave, San Rafael, CA
Prepared By	David Williard david@sagerenew.com

System Metrics

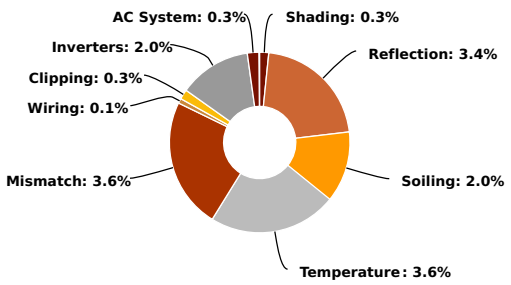
Design	Glenwood ES V3 (90)
Module DC Nameplate	89.8 kW
Inverter AC Nameplate	72.2 kW Load Ratio: 1.24
Annual Production	141.5 MWh
Performance Ratio	85.4%
kWh/kWp	1,575.9
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)
Simulator Version	e6151cde99-0628ca2d84-2a3af99198-ff599d4bae

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,772.7	
	POA Irradiance	1,845.2	4.1%
	Shaded Irradiance	1,840.5	-0.3%
	Irradiance after Reflection	1,778.8	-3.4%
	Irradiance after Soiling	1,743.2	-2.0%
	Total Collector Irradiance	**1,743.3**	**0.0%**
Energy (kWh)	Nameplate	156,510.0	
	Output at Irradiance Levels	156,544.1	0.0%
	Output at Cell Temperature Derate	150,931.0	-3.6%
	Output After Mismatch	145,427.2	-3.6%
	Optimal DC Output	145,233.2	-0.1%
	Constrained DC Output	144,836.3	-0.3%
	Inverter Output	141,906.0	-2.0%
	Energy to Grid	**141,450.0**	**-0.3%**
Temperature Metrics			
	Avg. Operating Ambient Temp		16.5 °C
	Avg. Operating Cell Temp		25.9 °C
Simulation Metrics			
	Operating Hours		4335
	Solved Hours		4335

Condition Set

Description	Condition Set 1											
Weather Dataset	TMY, NAPA CO. AIRPORT, NSRDB (tmy3, II)											
Solar Angle Location	Meteo Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Sandia Model											
Temperature Model Parameters	Rack Type	a	b	Temperature Delta								
	Fixed Tilt	-3.56	-0.075	3°C								
	Flush Mount	-2.81	-0.0455	0°C								
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2
Irradiation Variance	5%											
Cell Temperature Spread	4° C											
Module Binning Range	-2.5% to 2.5%											
AC System Derate	0.50%											
Module Characterizations	Module	Characterization										
	LG 340 S2W-G4_Rev2_5 (LG Electronics)	Manufacturer R&D, PAN										
Component Characterizations	Device	Characterization										
	Sunny Tripower 24000TL-US (SMA)	Modified CEC										

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	3 (72.2 kW)
AC Panels	3 input AC Panel	1
AC Home Runs	1/0 AWG (Aluminum)	3 (346.5 ft)
AC Home Runs	350 MCM (Copper)	1 (820.0 ft)
Home Runs	500 MCM (Copper)	6 (183.9 ft)
Home Runs	1/0 AWG (Aluminum)	6 (70.0 ft)
Combiners	1 input Combiner	6
Combiners	2 input Combiner	3
Combiners	3 input Combiner	3
Strings	10 AWG (Copper)	15 (644.6 ft)
Module	LG Electronics, LG 340 S2W-G4_Rev2_5 (340W)	264 (89.8 kW)

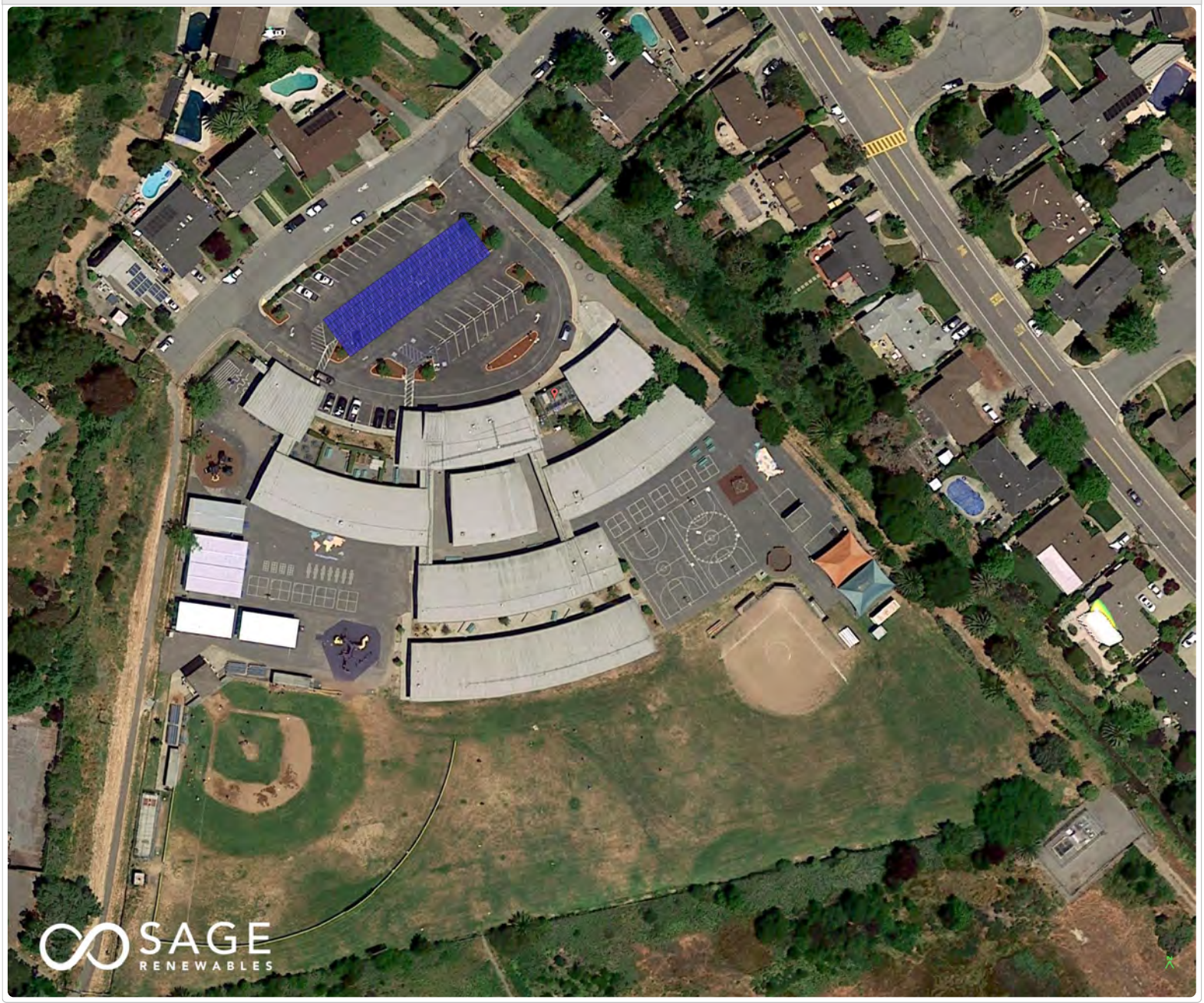
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	4-21	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
C1	Carport	Portrait (Vertical)	7.5°	143.839°	0.0 ft	6x1	44	264	89.8 kW

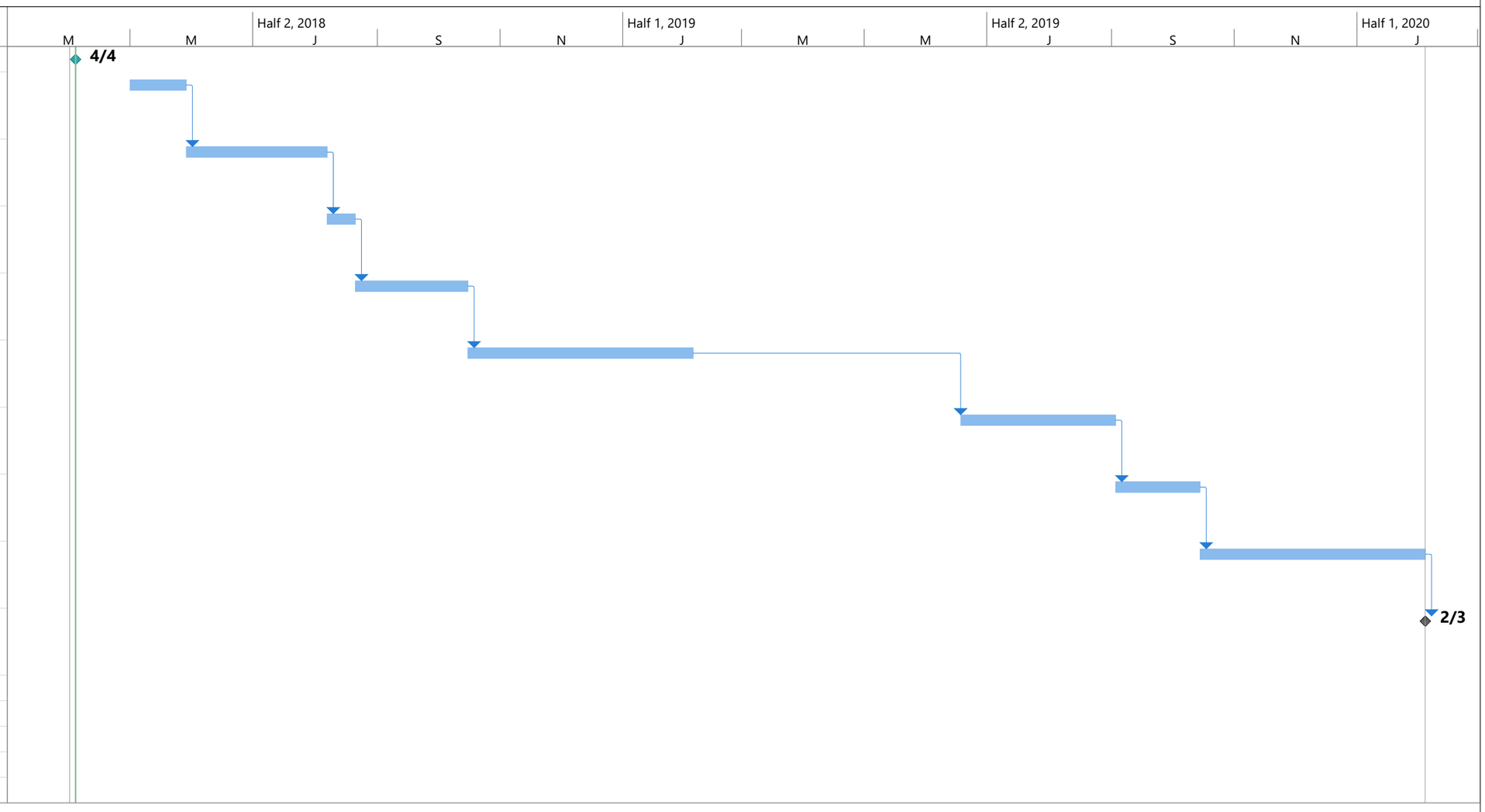
Detailed Layout



Attachment D

Preliminary Project Schedule

ID	Task Name	Start	Finish
1	Final Feasibility Stu	Wed 4/4/18	Wed 4/4/18
2	RFP Prep	Tue 5/1/18	Mon 5/28/18
3	RFP	Tue 5/29/18	Mon 8/6/18
4	Vendor Selection	Tue 8/7/18	Mon 8/20/18
5	Contracting	Tue 8/21/18	Mon 10/15/18
6	Design	Tue 10/16/18	Mon 2/4/19
7	Construction	Tue 6/18/19	Mon 9/2/19
8	Cx	Tue 9/3/19	Mon 10/14/19
9	Punchlist/Closeout	Tue 10/15/19	Mon 2/3/20
10	Complete	Mon 2/3/20	Mon 2/3/20
11			
12			
13			
14			
15			



Attachment E

Canopy and Shade Structure Example Photos

Solar PV Example Photos

SAGE RENEWABLES

PV SHADE STRUCTURES

PV SHADE STRUCTURES 2

PV ROOF-MOUNTED