RFP #7001
PROPOSAL SUBMITAL

County of Santa Barbara
Renewable Energy Systems Project
RFP# 7001

OCTOBER 27, 2017

PRIMARY CONTACT:

Randy Arntson
Endelos Energy, Inc.
593 Avenue of the Flags, Suite #105
Buellton, CA 93427
Phone: (805) 886-4788
Email: rarntson@endelosenergy.com

ENDELOS ENERGY, INC.
Energy Efficiency & Renewable Energy
593 Avenue of the Flags, Suite# 105
Buellton, CA 93427
Telephone: (805) 886-4788
Fax: (805) 617-1718
License No. CA 767787 C-10

October 27, 2017

Mr. Roy Hapeman
County of Santa Barbara
General Services Department, Facilities Services Office
4555 Santa Barbara Street, 2nd Floor
Santa Barbara, California 93101

Subject: RFP #7001 Renewable Energy System

Dear Mr. Roy Hapeman

Endelos Energy, Inc. is pleased to submit our proposal in response to the County of Santa Barbara's Renewable Energy Project (RFP# 7001). Our proposed Zero Net Energy solution provides the County of Santa Barbara with an extremely competent and highly experienced clean energy "*Local ZNE Contractor*" who will Engineer, Procure and Construct and Maintain the entire system utilizing 100% of local contractors residing within County of Santa Barbara.

Endelos Energy, Inc., (Endelos) www.endelosenergy.com is a fast growing Energy Efficiency and Renewable Energy Company located in Buellton and Santa Barbara, California. Endelos combines energy efficiency technologies with renewable energy power generation sources to create a "Zero Net Energy" (ZNE) building solution, which provides our customers with highly energy efficient facilities which produces as much energy as they consume

Our approach for a successfully On-Time, On Budget delivery of the Renewable Energy System is based on highly experienced Construction Management Team and Methodology for managing our Local ZNE subcontractor Electrical Engineering, Solar, Solar Thermal, LED Lighting, Plumbing-Piping and Roofing experts. Our proposal utilizes 100% of local Santa Barbara County businesses to provide an *"All Santa Barbara County Zero Net Energy Solution"* for the Renewable Energy System Project. This local contractor approach will help sustain county wide existing businesses and or spur new jobs creation within the County of Santa Barbara. The following local businesses below will provide the majority of the project's expertise, including labor, materials, environmental compliance, engineering, permitting, installation, and commissioning of the Renewable Energy System:

1. Endelos Energy Inc, Energy Efficiency & Renewable Systems (Buellton & Goleta)
2. Taylor International, Financial & Bonding Guarantor, Construction Management (Buellton)
3. Imperial Electric, Electrical Contractor (Goleta & Buellton)
4. John Maloney JMPE, Electrical and Lighting Engineering (Santa Barbara)
5. Tanner Engineering, Solar System Engineering (Buellton & San Diego, CA)

6. Sylvania Lighting Solutions, LED Lighting and Controls (Santa Barbara)
7. The Solar Energy Company, Solar Thermal Systems (Carpinteria)
8. California Electric Supply, Electrical Materials (Santa Maria)
9. Graybar, Electrical Materials (Santa Maria)
10. Todd Pipe & Supply, Plumbing & Piping Materials. (Buellton, CA)
11. Cal Portland Company Ready Mix, Concrete Material (Santa Maria)
12. Hayward Lumber, Building Materials (Santa Maria)

Endelos acknowledges receipt of RFP# 7001 and any and all amendments and accepts the terms and condition of this governing procurement.

We look forward to assisting the County of Santa Barbara in meetings their Sustainability Goals. Please do not hesitate to contact me should you have any questions regarding our proposal at (805) 886-4788.

Sincerely

Randy Arntson
President & CEO
Endelos Energy, Inc.
593 Avenue of the Flags #105
Buellton, CA 93427
CSLB: #767787
Email: rarntson@endelosenergy.com
Websites: www.endelosenergy.com

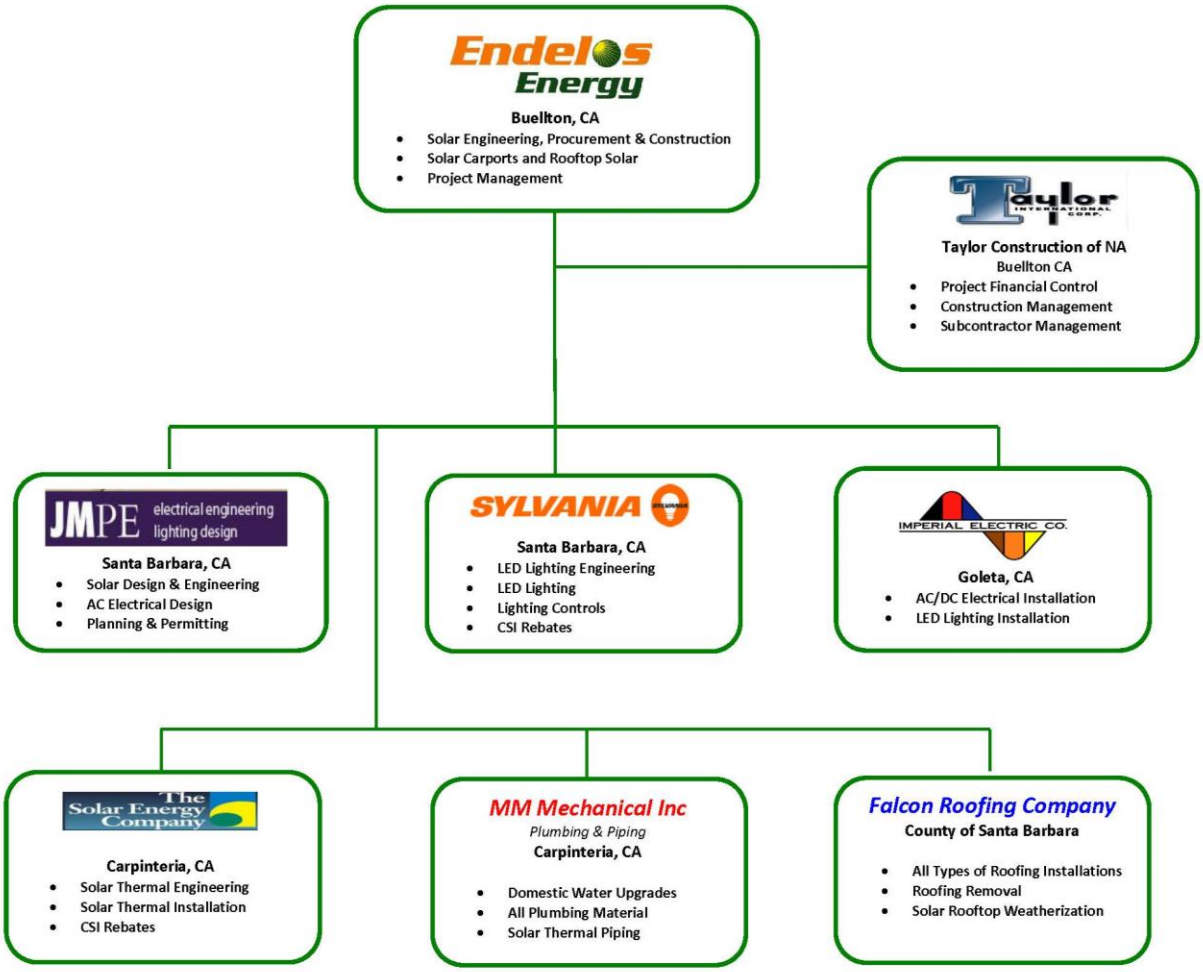
SECTION 1 - EXECUTIVE SUMMARY

Section 1 Executive Summary

Endelos Energy, Inc., (Endelos) www.endelosenergy.com is a fast growing Energy Efficiency and Renewable Energy Company located in Buellton and Santa Barbara, California. Endelos combines energy efficiency technologies with renewable energy power generation to create a "Zero Net Energy" (ZNE) building solution which provides our customers with highly energy efficient facilities which produces as much energy as they consume.

Endelos Energy has organized and assembled a "*Local ZNE Team*" of highly experienced trade specific contractors that are well known within County General Services. These entities are currently successfully delivering projects for the County of Santa Barbara General Services, Fire Department and Child Support Services.

Our proposal utilizes 100% of local Santa Barbara County businesses to provide an *"All Santa Barbara County Zero Net Energy Solution"* for the Renewable Energy System Project. This local contractor approach will help sustain county wide existing businesses and or spur new jobs creation within the County of Santa Barbara. The local businesses below now teamed together ("Local ZNE Team") has a vast amount of ZNE



experience that will allows us to successfully complete an On-Time, On Budget delivery of the Renewable Energy System.

Additionally, the majority of the building, electrical, plumbing and mechanical materials will be procured at local vendors keeping materials tax revenue within city and county.

1. California Electric Supply, Electrical Materials (Santa Maria & Santa Barbara, CA)
2. Graybar, Electrical Materials (Santa Maria, CA)
3. Todd Plumbing & Pipe Supply (Buellton, CA)
4. Cal Portland Company Ready Mix, Concrete Material (Santa Maria, CA)
5. Hayward Lumber, Building Materials (Santa Maria, CA)

Construction Management Organization

Endelos Energy has teamed up again with Taylor Construction of North America, a California entity owned by Taylor International. This is same business organization Endelos-Taylor used in the successful completion of the Calle Real 1MW Solar PV Project.

Taylor Construction of North America will provide overall project financial control, bonding agent, and construction management of the subcontractors. As financial controller, Taylor assist Endelos with project schedule of values, receive all project progress payments, and assure all subcontractors are paid in a professional and timely manner

Project Approach

Our approach for a successfully On-Time, On Budget delivery of the Renewable Energy System is based on highly experienced Construction Management Team and Methodology for managing our Local ZNE subcontractor Electrical Engineering, Solar, Solar Thermal, LED Lighting, Plumbing-Piping and Roofing experts. The Endelos-Taylor Team will manage the entire Renewable Energy System Project. We will be working with each subcontractor to coordinate all project job site activities including moving labor and materials, on and off jobsite. Preform daily safety meetings which includes subcontractor notification of any County activities that will be going on during the day. Additionally, Endelos-Taylor will manage and coordinate the environmental compliance, engineering, permitting, installation, and commissioning of the Renewable Energy System

Upon Contract Award Endelos-Taylor will work with the County Project Manager to generate a project plan and schedule for this project. Our approach will be to immediately start all of the Energy Efficiency projects not requiring a Permit such as LED Lighting Retrofits.

SECTION 5 – PRELIMINARY DESIGN

5.1 – Solar Arrays Preliminary Design

The Solar Array Systems Preliminary system designs, to adhere to design specifications in Attachments B and C, this includes:

a) Site overview with module layout, including proposed azimuth and tilt

b) Product spec sheets for proposed racking, modules, inverters, and monitoring.

c) Product warranty information for proposed racking, modules, and inverter.

OVERALL SITE OVERVIEW

	Betterevia Carport	Lompoc DSS	Lompoc PH	Lompoc Wellness	Fire Station 12	Fire Station 23	TOTAL
SYSTEM							
System Size DC-STC (kW)	871	158	191	30	30	11	1290
System Size AC-CEC (kW)	740	140	160	24	27	10	1100
System Type	Fixed Tilt	Fixed Tilt	Fixed Tilt	Fixed Tilt	Fixed Tilt	Fixed Tilt	
Area covered (sqft)	52,402	14,042	17,000	1,800	1,810	647	87,701
Tilt (net deg from ground)	10.0	5.0	5.0	20.0	20.0	20.0	
Azimuth (deg from north)	210.0	180.0	180.0	270.0	95.0	180.0	
PV Module	SolarWorld SW 300 Mono (Qty 2,904)	SolarWorld SW 300 Mono (Qty 525)	SolarWorld SW 300 Mono (Qty 635)	SolarWorld SW 300 Mono (Qty 100)	SolarWorld SW 300 Mono (Qty 100)	SolarWorld SW 300 Mono (Qty 36)	4,300
Inverter	SMA STP20000TL-US-10 (480V), ,	SMA STP20000TL-US-10 (480V), ,	SMA STP20000TL-US-10 (480V), ,	SMA STP12000TL-US-10 (480V), ,	SMA SB9000TL-US (208V), ,	SMA SB10000TL-US-12 (240V), ,	
OFFSET							

Please note that equipment selection is subject to change per market availability and prevailing conditions at the time of procurement. System sizes are subject to change per equipment selection and detailed design, engineering and permitting.

Solar Data Sheets – are provided in Attachment 2 Solar Equipment Product Sheets

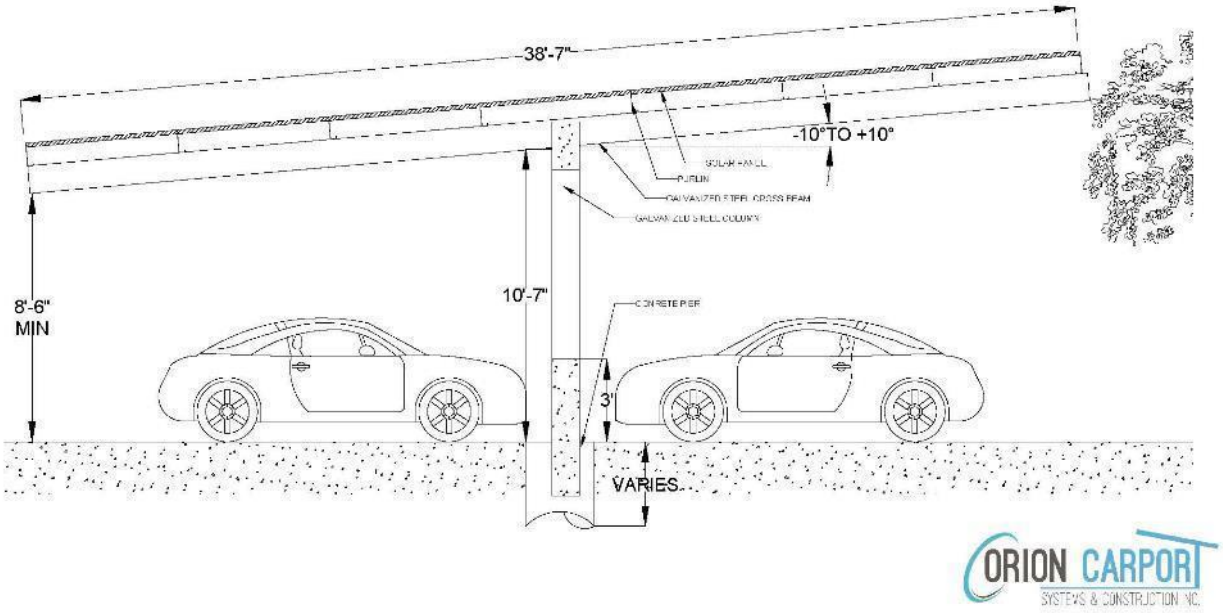
Product Warranty Information

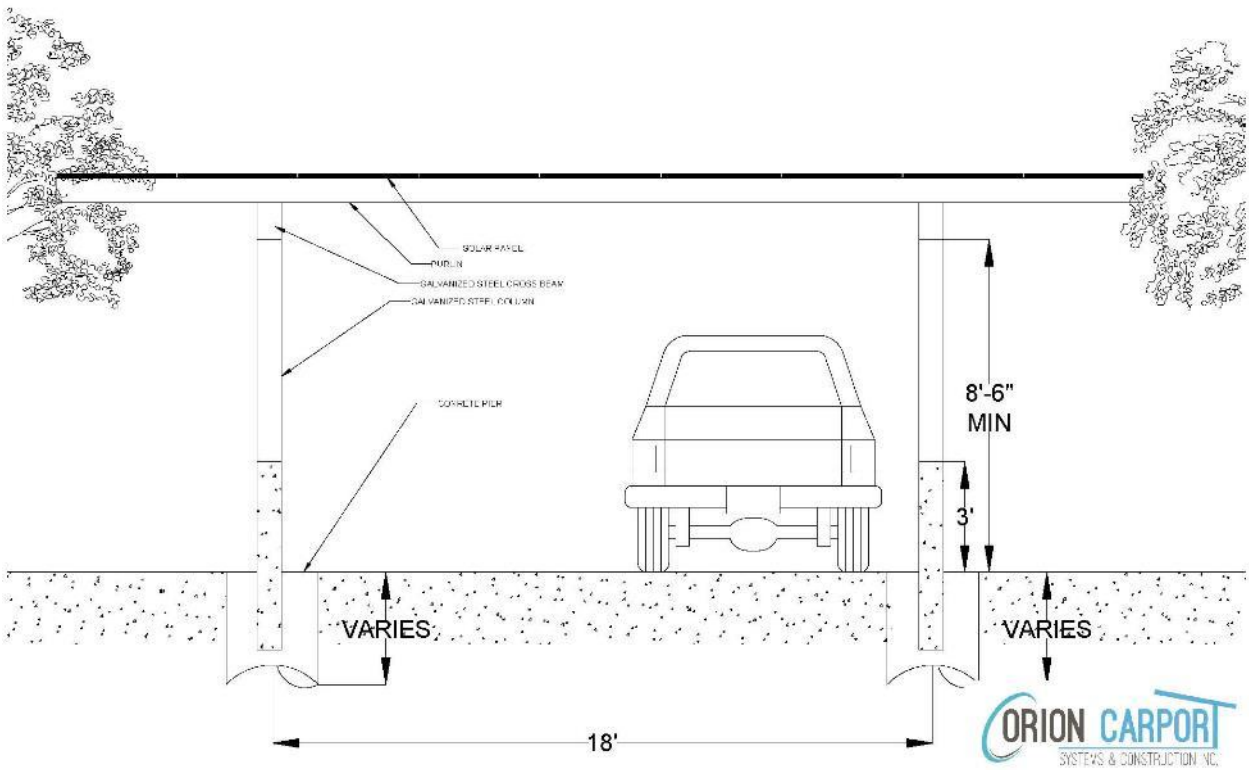
PV Modules: 20-year workmanship warranty, 30-year 86% performance warranty

Inverters/Charge Controllers: 20 years

Racking: 20 years

5.1.2 Betteravia Solar Carports Design


38'-7"
-10° TO +10°
SOLAR PANEL
PURLIN
GALVANIZED STEEL CROSS BEAM
GALVANIZED STEEL COLUMN
8'-6"
MIN
10'-7"
CONCRETE PIER
3'
VARIES
ORION CARPORT
SYSTEMS & CONSTRUCTION INC.


SOLAR PANEL
PURLIN
GALVANIZED STEEL CROSS BEAM
GALVANIZED STEEL COLUMN
CONCRETE PIER
8'-6"
MIN
3'
VARIES
VARIES
18'
ORION CARPORT
SYSTEMS & CONSTRUCTION INC.

TITAN HSS STEEL CARPORT SYSTEM

PRELIMINARY DESIGN CRITERIA

Modular Designs up to 110mph wind
Custom Engineering available for higher wind speeds
All codes compliant with ASCE 7-10

COLUMNS

A500-B round
A53 Grade A

BEAM

HSS AISC Grade A-36
Coating Options: Primed or Hot Dip Galvanized

PURLINS

16 GA. AISI Cold Rolled G-90 Galvanized Steel

FOUNDATION (BELLOW GRADE)

Footing Type: Reinforced concrete caisson foundation
or spread footing, structurally designed per soil conditions.
Concrete Strength: 2,500 psi (minimum)
Note: Structural foundation design is not included
Additional Engineering Services Available in Select Locations upon Request

RACKING:

Fixed Tilt Slope Up to 10˚
Site Specific Layout and Configuration
Hot Dip Galvanizing
Solar Racking Clamps
Soft Lit Under Sheeting
LED Lighting

OPTION

ADD ChargePoint Charging Stations

5.2 LED Lighting Preliminary Design

LED Lighting Data Sheets – are provided in Attachment 3 LED Product Sheets

County of Santa Barbara

Public Health, Wellness Center, Social Services, Firestation 12, Firestation 23 and Betteravia Admin. Bldg.

Audit Furnished by:

SYLVANIA LIGHTING SERVICES

a subsidiary of OSRAM SYLVANIA INC.

Sales Rep:	Peter Alpert
Address:	1236 Coast Village Circle, Suite F
City, St:	Santa Barbara, California 93108
Phone:	805-695-8882
Email:	peter.alpert@sylvania.com
Fax:	805-265-5068
Auditor:	Peter Alpert
Date:	September 19,2017

Acuity Base Bid

☐ Use Demand Rate

TOTAL ITEMS SURVEYED	3,229	$ -	AVERAGE KW DEMAND COST
RETROFIT LAMP AND BALLAST	80	$ 0.15	AVERAGE COST/KWH
RETROFIT FIXTURES WITH KIT	242	$ 1.00	AVERAGE COST/THERM
NEW FIXTURES INSTALLED	2272	2,402	ANNUAL LIGHTING HOURS AVG.
FIXTURES REMOVED	0	12.2	ANNUAL A/C WEEKS
FIXTURES EXCLUDED	163		
LIGHTING UPGRADE	0	$ 55.00	IN-HOUSE MAINT. LABOR RATE
TOTAL ECM FIXTURES	2594		
ANNUAL LIGHTING ENERGY SAVINGS	$ 59,924.09	185.41	EXISTING LOAD (KW)
ANNUAL A/C ENERGY SAVINGS	$ 1,577.03	95.22	PROPOSED LOAD (KW)
FIRST YEAR LAMP RECYCLE SAVINGS	$ 1,073.41	90.19	LOAD SAVINGS (KW)
FIRST YEAR LAMP MAT'L SAVINGS	$ 2,270.86	48.65%	LOAD REDUCTION
FIRST YEAR BALLAST MAT'L SAVINGS	$ 2,353.27	654,985.72	EXISTING USAGE (KWH)
FIRST YEAR LABOR SAVINGS	$ 13,858.90	255,491.77	PROPOSED USAGE (KWH)
REBATE AMOUNT (ESTIMATED)	$ 45,432.00	399,493.95	USAGE SAVINGS (KWH)
EPACT GROSS TAX DEDUCTION	$ -	60.99%	USAGE REDUCTION (KWH)
FACILITY SQUARE FOOTAGE	300,000	#DIV/0!	EXISTING INTERIOR WATTS/SF
EPACT QUALIFYING SQUARE FOOTAGE	-	#DIV/0!	PROPOSED INTERIOR WATTS/SF
		14.01	SIMPLE PAYBACK (YRS) (PROJECT COST/ANNUAL SAVINGS)
TOTAL 1ST YEAR SAVINGS (EXCLUDING REBATE AND EPACT)	$ 81,057.56	13.45	1st YEAR PAYBACK AFTER REBATE (PROJECT COST-REBATE AMOUNT/ANNUAL SAVINGS)
PROJECT COST	$ 1,135,296.37	7.14%	RETURN ON INVESTMENT (ROI)
		$ 168.50	LOST ENERGY SAVINGS/DAY

Exceptions/Exclusions:
Quoted pricing assumes 1 for 1 replacement only, any change in layout or unforeseen electrical issues are not included in the pricing
Electrical repairs, replacement, rework or modifications beyond the initial fixture connection are expressly excluded
Asbestos/leaking PCBs/Lead removal is not included in the quoted price above and will need to be removed by a qualified contractor if encount
Quoted pricing excludes electrical circuitry and conduit work
Attic stock or material to be left onsite after the job has been completed is not included in the quoted pricing
Pre/post M&V services are not included in the quoted pricing
Post award re-design services (CAD drawings/reflective ceiling plans/stamped electrical drawings) are not included in the quoted pricing
Pricing completed at 2nd CA prevailing wage rates for Santa Barbara County. Any deviation will require a revision to the quote
Quoted pricing assumes universal voltage (120/277). If 480V is needed, a revision to the quote will be required
Emergency drivers/ballast are expressly excluded unless noted otherwise
Due to frequently changing rebate programs, rebate estimates will need to verified post award of project and pre-installation
Quoted pricing assumes reuse of existing pole base, conduit, and wiring already in place
Quoted pricing assumes estimated Tritium exit sign counts. Actual cost will need to be field determine and verified based on NRC registration
Quoted pricing includes up to 35ft power run for new exit fixtures and no more than 2 wall penetrations per sign
SLS will leave packaged signs with the on-site FM upon completion of work. FM will be accountable for scheduling and meeting FedEx or UPS
Quoted pricing excludes attachment detail and assumes that existing seismic bracing will be reused
Quoted pricing excludes new ceiling tiles and regrid of t-bar
Quoted pricing excludes paint, repair, and patching

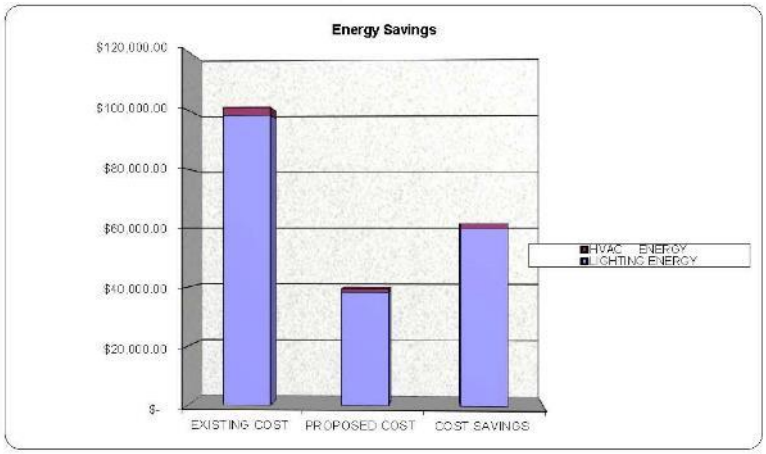
Sylvania Lighting Services Corp. Confidential SANTA BARBARA COUNTY 4439 - 10-6-17 BASE BID - SELL PRICING.xlsb Coversheet

POLLUTION SAVINGS				
UTILITY FUEL SOURCE	SULFUR DIOXIDE* (lbs.)	NITROUS OXIDE** (lbs.)	CARBON DIOXIDE*** (lbs.)	TOTAL POLLUTANTS (tons)
GAS	0	2,113	499,367	251
OIL FIRED	3,260	1,322	677,542	341
COAL FIRED	7,926	3,875	855,716	434
US AVERAGE SOURCE	4,666	2,465	613,223	310

Source: R. Arnold Tucker, Microcomputer Software for Evaluating Lighting Operations, Energy Engineering, Vol. 90, No. 1, 1993.

Source: U.S. Environmental Protection Agency, Green Lights Lighting Upgrading Manual, September 30, 1994

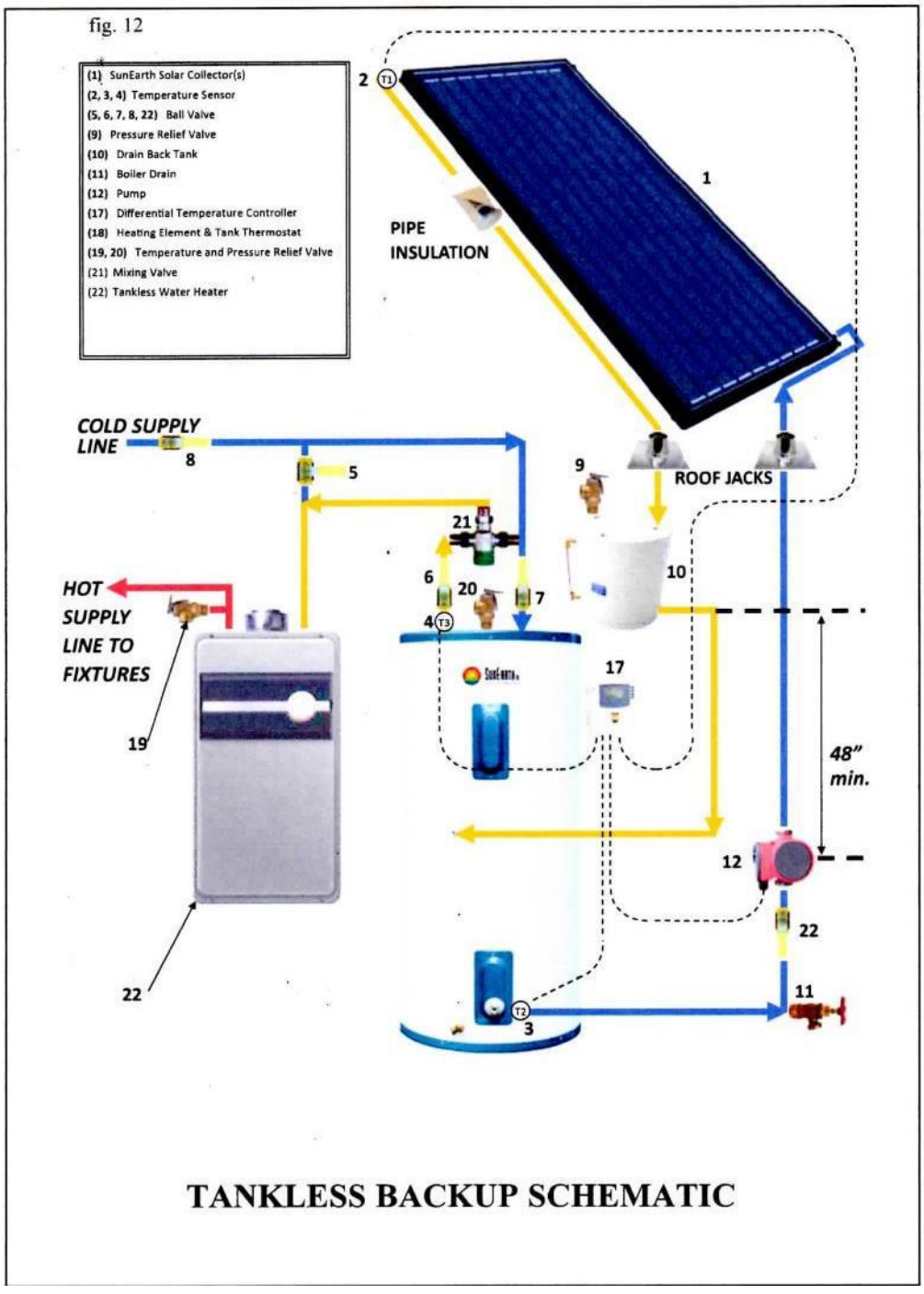
* Sulfur Dioxide - Main contributor to acid rain
** Nitrous Oxide - Primary smog producer
*** Carbon Dioxide - Contributes to global warming



	LIGHTING ENERGY	HVAC ENERGY	LAMP MAINT.	BALLAST MAINT.	TOTAL
EXISTING COST	$ 98,247.86	$ 2,648.29	$ 12,223.39	$ 6,259.65	$ 119,379.18
PROPOSED COST	$ 38,323.77	$ 1,071.26	$ -	$ -	$ 39,395.03
COST SAVINGS	$ 59,924.09	$ 1,577.03	$ 12,223.39	$ 6,259.65	$ 79,984.15

5.3 Solar Thermal Preliminary Design

Solar Thermal Data Sheets – are provided in Attachment 4 Solar Thermal Product Sheets



5.3.1 Betteravia Solar Thermal

Building A-The Probation Building

Occupancy 85 People

This is an electric water heater and is included the electric load analysis for the photovoltaic system. It will not receive a gas company rebate. However, the end result is the same, both systems produce hot water. Even after the rebate the PV system will do the same thing, heating water, at a fraction of the cost of a thermal system. At present, you have two technologies competing against each other to heat water, in this case PV wins!

Building B-The Medical Clinic

Occupancy 71 People

The layout of this utility room is very similar to the room in the Probation building. There is direct access to the roof with ample space for the 3(4x8) black chrome thermal collectors, subject to the layout of the PV system. Our bid includes removing all the old equipment and installing a new 119-gallon stainless steel solar tank and flash water heater. In addition to this water heater, there are two other heaters on the lower stories of the building. Those other smaller water heaters supply a kitchen and 2 bathrooms, with no real draw to speak of. We will not be running plumbing lines inside the walls or ceilings to connect these water heaters to the solar tank.

Probation C- Social Services

Occupancy 198 People

The existing water heater is electric. This is a picture of the main water heater on the third floor of the Social Services building. This is an electric water heater and will not qualify for a Gas Company rebate. However, this building will be addressed as part of the photovoltaic solar electric system

Building D-Administration

Occupancy 23 People

This is a 30-gallon electric water heater is on the first floor of the Administration building. This is the main water heater in the building. In addition, there are two very small flash heaters that serve two sinks in the men's and woman's restrooms they are also electric. These water heaters are covered by the PV system and will not receive a SoCalGas rebate because it's electric.

5.3.4 Firestation 12 - Solar Thermal

Fire Station 12

Occupancy 3-4 People at any given time.

This gas water heater is doing more than just heating hot water. The water heater has 3" copper lines running off it, perhaps for running a recirculating pump to deliver hot water to every fixture in the building. In any case there is no room to remove this tank and add a solar tank with a flash heater. The existing water heater would remain as is and a shed would be constructed on the outside of the building behind his room.

Fire Station 12 Shed Location

Occupancy 3-4 People at any given time.

There is no room inside the building to support a solar storage tank, so a metal shed must be assembled against this wall in the back of the building. There are 3-4 people in this building at any given time. The best system for this facility based on load demand has 2 (4x8) SunEarth Chrome collectors with an 80-gallon HTP stainless steel solar tank. The CSI Thermal Rebate Program will support the system based on the actual demand.

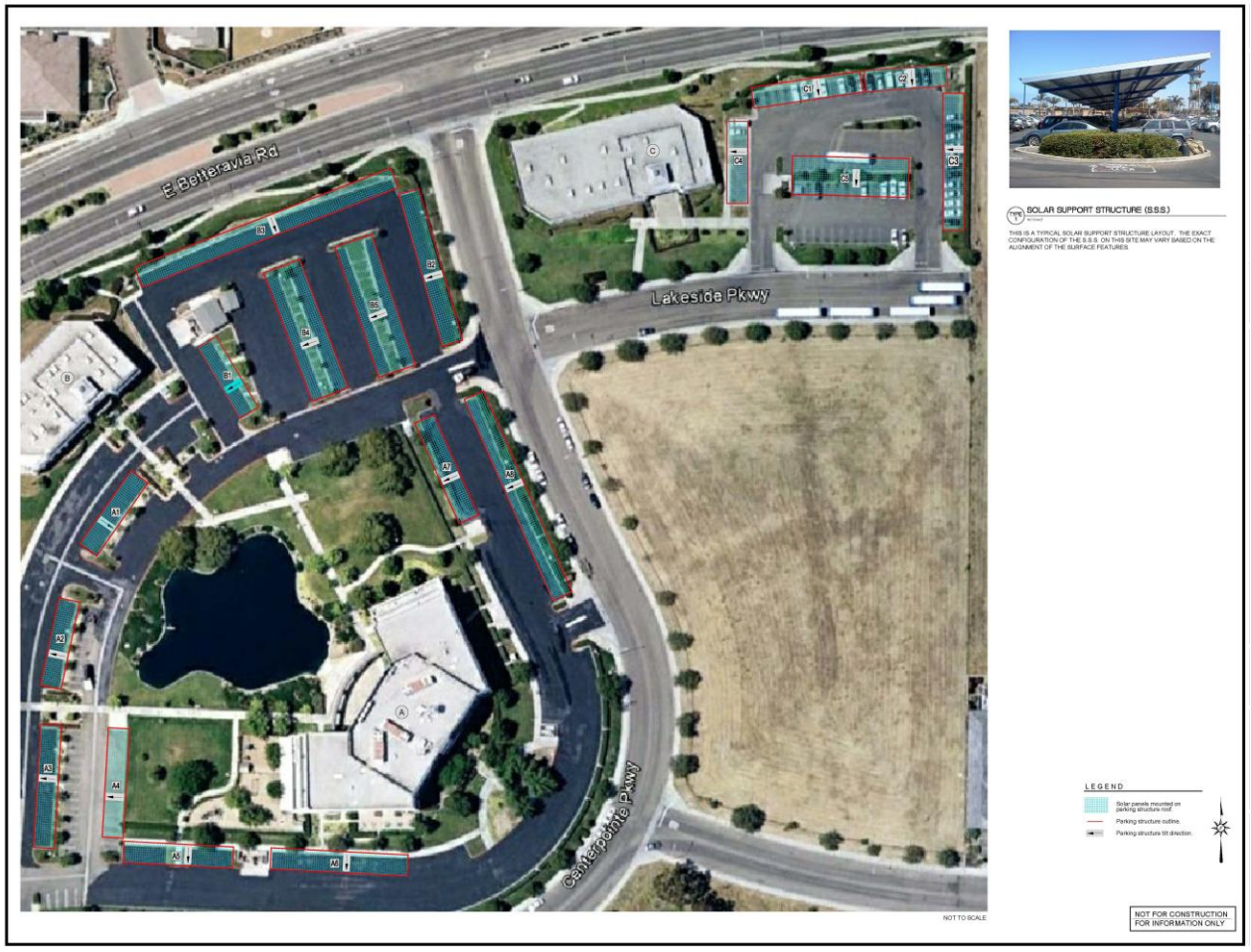
SECTION 6 – FIRST YEAR PRODUCTION ESTIMATE

Section 6 – First Year Production Estimate

First-year system production estimates, as demonstrated and detailed by industry-recognized **PVSyst** modelling tool. Our Production estimates accurately reflect location and proposed system specifications detailed in Section 5 above (components, azimuth, tilt, under-module clearance, etc.), and shall be performed for each site in the bundle(s) being proposed. Production estimates from the modeling tool was used for completing Attachment G, and as noted in Sections 7 and 8 below.

First-year system production estimates were arrived at using PVSyst. The estimates are given in Attachment G. The following pages provides PVSyst reports Betteravia, Lompoc and all Firestations Sites.

6.1 BETTERAVIA COMPLEX PVSYST PRODUCTION ESTIMATES



PVSYST V5.74		17/10/17	Page 1/3

Grid-Connected System: Simulation parameters

Project : **SBC Bundles RFP 2017 - Betterevia**

Geographical Site	**SANTA MARIA**		**Country**	**United states**
Situation	Latitude	34.9°N	Longitude	120.4°W
Time defined as	Legal Time	Time zone UT-8	Altitude	72 m
	Albedo	0.20		

Meteo data : SANTA MARIA, NREL US TMY2

Simulation variant : **Betterevia_SMA**

Simulation date 17/10/17 01h03

Simulation parameters

Collector Plane Orientation	Tilt	10°	Azimuth	30°
Horizon	Free Horizon			
Near Shadings	No Shadings			

PV Array Characteristics

PV module	Si-mono	Model	**Sunmodule SW 300 Mono**		
		Manufacturer	SolarWorld		
Number of PV modules		In series	22 modules	In parallel	132 strings
Total number of PV modules		Nb. modules	2904	Unit Nom. Power	300 Wp
Array global power		Nominal (STC)	**871 kWp**	At operating cond.	789 kWp (50°C)
Array operating characteristics (50°C)		U mpp	633 V	I mpp	1246 A
Total area		Module area	**4869 m²**	Cell area	4286 m²

Inverter		Model	**Sunny Tripower 20000 TLHE**		
		Manufacturer	SMA		
Characteristics		Operating Voltage	580-800 V	Unit Nom. Power	20.0 kW AC
Inverter pack		Number of Inverter	37 units	Total Power	740.0 kW AC

PV Array loss factors

Thermal Loss factor	Uc (const)	27.7 W/m²K	Uv (wind)	0.0 W/m²K / m/s
=> Nominal Oper. Coll. Temp. (G=800 W/m², Tamb=20°C, Wind=1 m/s.)			NOCT	46 °C
Wiring Ohmic Loss	Global array res.	8.4 mOhm	Loss Fraction	1.5 % at STC

Array Soiling Losses

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
0.1%	0.1%	0.2%	0.3%	0.4%	0.5%	0.1%	0.2%	0.3%	0.4%	0.3%	0.2%

Module Quality Loss			Loss Fraction	0.0 %
Module Mismatch Losses			Loss Fraction	0.0 % at MPP
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Parameter	0.05

System loss factors

AC wire loss inverter to transfo	Inverter voltage	400 Vac tri		
	Wires	224 m 3x1000 mm²	Loss Fraction	2.7 % at STC
External transformer	Iron loss (24H connection)	4312 W	Loss Fraction	0.5 % at STC
	Resistive/Inductive losses	1.9 mOhm	Loss Fraction	1.0 % at STC

User's needs : Unlimited load (grid)

Grid-Connected System: Main results

Project : **SBC Bundles RFP 2017 - Betterevia**

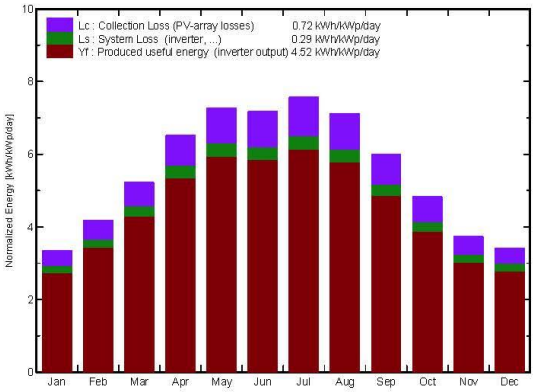
Simulation variant : **Betterevia_SMA**

Main system parameters	System type	**Grid-Connected**			
PV Field Orientation	tilt	10°	azimuth	30°	
PV modules	Model	Sunmodule SW 300 Mono	Pnom	300 Wp	
PV Array	Nb. of modules	2904	Pnom total	**871 kWp**	
Inverter	Model	Sunny Tripower 20000 TLHE	Pnom	20.00 kW ac	
Inverter pack	Nb. of units	37.0	Pnom total	**740 kW ac**	
User's needs	Unlimited load (grid)				

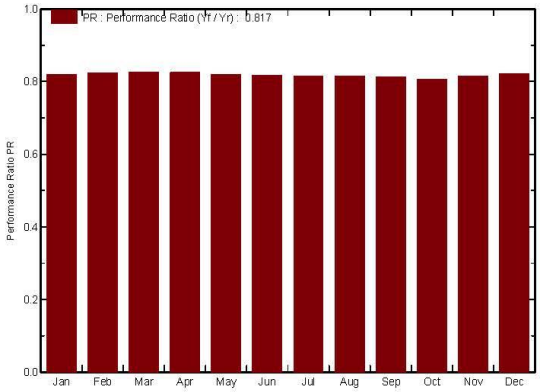
Main simulation results

System Production	**Produced Energy**	**1439 MWh/year**	Specific prod.	1651 kWh/kWp/year
	Performance Ratio PR	81.7 %		

Normalized productions (per installed kWp): Nominal power 871 kWp



Performance Ratio PR



Betterevia_SMA

Balances and main results

	GlobHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	EffArrR %	EffSysR %
January	88.4	9.53	103.9	98.9	79.6	74.0	15.74	14.63
February	103.9	10.53	117.1	112.5	89.7	83.9	15.74	14.72
March	150.6	10.84	161.8	156.5	124.1	116.4	15.75	14.78
April	186.9	11.84	195.3	189.7	149.1	140.3	15.68	14.75
May	222.8	13.32	225.4	219.5	170.8	160.9	15.56	14.66
June	213.6	14.37	215.2	209.7	162.6	153.2	15.52	14.62
July	231.9	16.07	234.4	228.9	176.2	166.1	15.44	14.55
August	212.5	16.09	220.6	215.3	166.2	156.5	15.47	14.57
September	167.3	15.74	179.8	174.5	135.3	127.3	15.46	14.54
October	134.0	14.99	149.6	144.2	111.9	105.0	15.36	14.41
November	94.8	12.07	111.7	106.9	85.0	79.3	15.62	14.58
December	86.8	9.39	105.8	100.5	81.2	75.5	15.76	14.67
Year	1893.5	12.91	2020.6	1957.2	1531.7	1438.5	15.57	14.62

Legends:
GlobHor Horizontal global irradiation
T Amb Ambient Temperature
GlobInc Global incident in coll. plane
GlobEff Effective Global, corr. for IAM and shadings
EArray Effective energy at the output of the array
E_Grid Energy injected into grid
EffArrR Effic. Eout array / rough area
EffSysR Effic. Eout system / rough area

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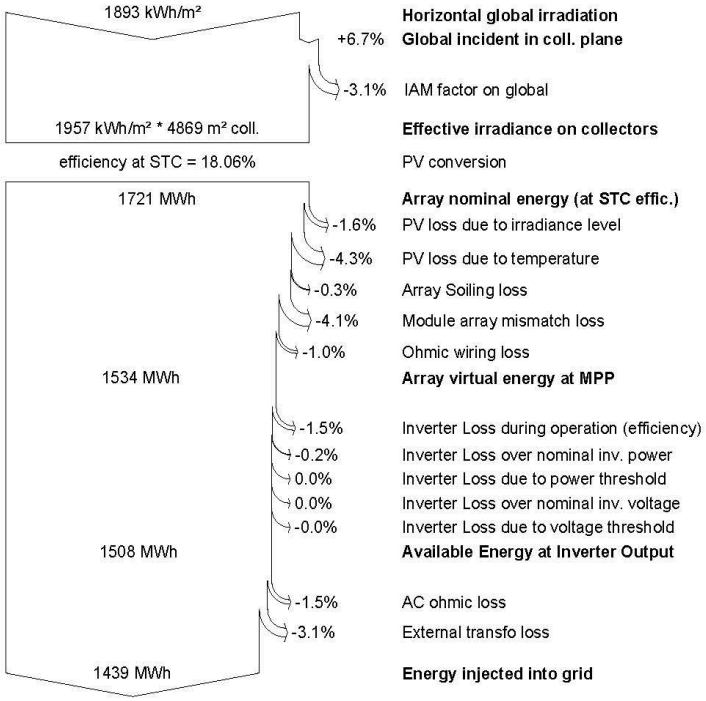
Grid-Connected System: Loss diagram

Project : **SBC Bundles RFP 2017 - Betterevia**

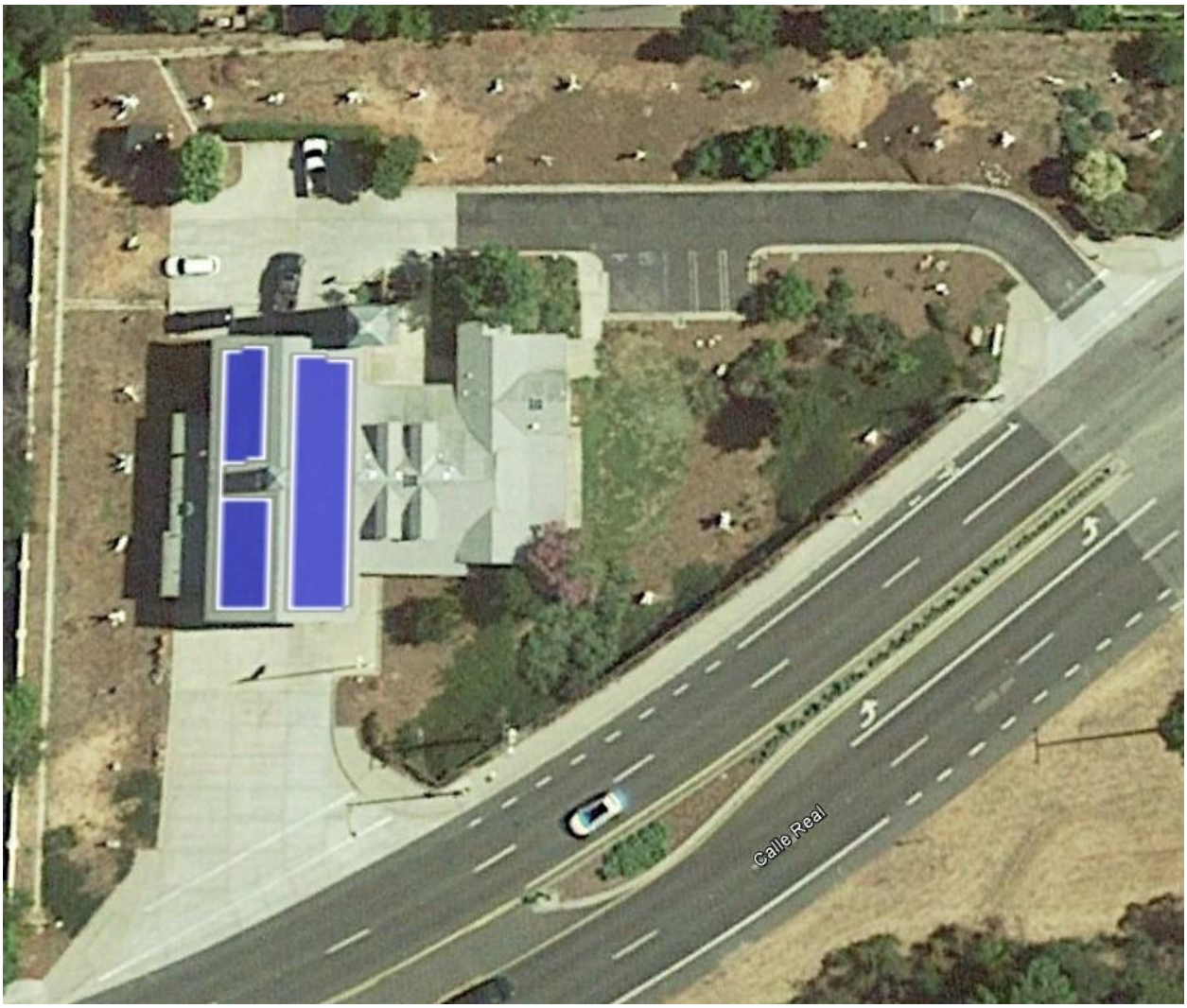
Simulation variant : **Betterevia_SMA**

Main system parameters					
	System type	**Grid-Connected**			
PV Field Orientation	tilt	10°	azimuth	30°	
PV modules	Model	Sunmodule SW 300 Mono	Pnom	300 Wp	
PV Array	Nb. of modules	2904	Pnom total	**871 kWp**	
Inverter	Model	Sunny Tripower 20000 TLHE	Pnom	20.00 kW ac	
Inverter pack	Nb. of units	37.0	Pnom total	**740 kW ac**	
User's needs	Unlimited load (grid)				

Loss diagram over the whole year



6.3 FIRESTATION 12 PVSYST PRODUCTION ESTIMATES



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Grid-Connected System: Simulation parameters

Project : **SBC Bundles RFP 2017 - Betterevia**

Geographical Site	**SANTA MARIA**		**Country**	**United states**
Situation	Latitude	34.9°N	Longitude	120.4°W
Time defined as	Legal Time	Time zone UT-8	Altitude	72 m
	Albedo	0.20		
Meteo data :	SANTA MARIA, NREL US TMY2			

Simulation variant : **Firestation 12_SMA**

Simulation date 18/10/17 01h11

Simulation parameters

Collector Plane Orientation	Tilt	20°	Azimuth	-85°
Horizon	Free Horizon			
Near Shadings	No Shadings			

PV Array Characteristics

PV module Si-mono	Model	**Sunmodule SW 300 Mono**		
	Manufacturer	SolarWorld		
Number of PV modules	In series	20 modules	In parallel	5 strings
Total number of PV modules	Nb. modules	100	Unit Nom. Power	300 Wp
Array global power	Nominal (STC)	**30.0 kWp**	At operating cond.	27.17 kWp (50°C)
Array operating characteristics (50°C)	U mpp	576 V	I mpp	47 A
Total area	Module area	**168 m²**	Cell area	148 m²

Inverter	Model	**Sunny Tripower12000 TL**		
	Manufacturer	SMA		
Characteristics	Operating Voltage	150-800 V	Unit Nom. Power	12.0 kW AC
Inverter pack	Number of Inverter	3 units	Total Power	36.0 kW AC

PV Array loss factors

Thermal Loss factor	Uc (const)	27.7 W/m²K	Uv (wind)	0.0 W/m²K / m/s
=> Nominal Oper. Coll. Temp. (G=800 W/m², Tamb=20°C, Wind=1 m/s.)			NOCT	46 °C
Wiring Ohmic Loss	Global array res.	202 mOhm	Loss Fraction	1.5 % at STC

Array Soiling Losses

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
0.1%	0.1%	0.2%	0.3%	0.4%	0.5%	0.1%	0.2%	0.3%	0.4%	0.3%	0.2%

Module Quality Loss			Loss Fraction	0.0 %
Module Mismatch Losses			Loss Fraction	0.0 % at MPP
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Parameter	0.05

System loss factors

AC wire loss inverter to transfo	Inverter voltage	400 Vac tri		
	Wires	35 m 3x10 mm²	Loss Fraction	1.4 % at STC
External transformer	Iron loss (24H connection)	148 W	Loss Fraction	0.5 % at STC
	Resistive/Inductive losses	53.9 mOhm	Loss Fraction	1.0 % at STC

User's needs : Unlimited load (grid)

Grid-Connected System: Main results

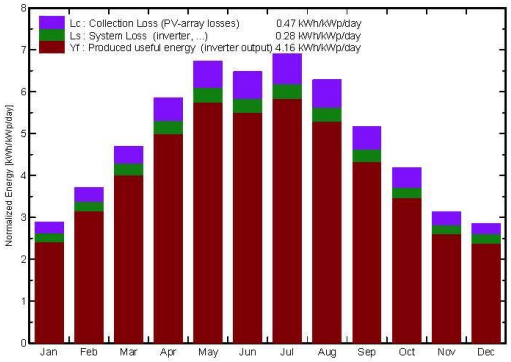
Project : **SBC Bundles RFP 2017 - Betterevia**

Simulation variant : **Firestation 12_SMA**

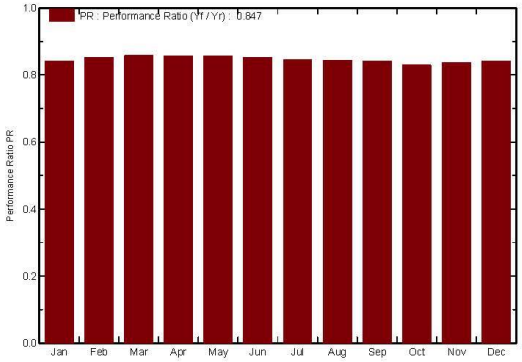
Main system parameters					
	System type	**Grid-Connected**			
PV Field Orientation	tilt	20°	azimuth	-85°	
PV modules	Model	Sunmodule SW 300 Mono	Pnom	300 Wp	
PV Array	Nb. of modules	100	Pnom total	**30.0 kWp**	
Inverter	Model	Sunny Tripower12000 TL	Pnom	12.00 kW ac	
Inverter pack	Nb. of units	3.0	Pnom total	**36.0 kW ac**	
User's needs	Unlimited load (grid)				

Main simulation results				
System Production	**Produced Energy**	**45545 kWh/year**	Specific prod.	1518 kWh/kWp/year
	Performance Ratio PR	84.7 %		

Normalized productions (per installed kWp): Nominal power 30.0 kWp



Performance Ratio PR



Firestation 12_SMA

Balances and main results

	GlobHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	EffArrR %	EffSysR %
January	88.4	9.53	89.4	84.6	2451	2254	16.35	15.03
February	103.9	10.53	103.7	99.3	2854	2651	16.41	15.25
March	150.6	10.84	145.5	140.3	3999	3743	16.39	15.34
April	186.9	11.84	175.3	169.4	4789	4503	16.29	15.32
May	222.8	13.32	208.7	203.0	5684	5357	16.25	15.31
June	213.6	14.37	194.2	188.8	5269	4961	16.18	15.24
July	231.9	16.07	214.1	208.6	5762	5431	16.05	15.13
August	212.5	16.09	194.8	189.2	5238	4927	16.03	15.08
September	167.3	15.74	154.9	149.6	4168	3908	16.05	15.05
October	134.0	14.99	129.9	124.3	3465	3229	15.91	14.83
November	94.8	12.07	93.7	89.1	2549	2351	16.23	14.96
December	86.8	9.39	88.5	83.5	2429	2232	16.37	15.04
Year	1893.5	12.91	1792.7	1729.7	48657	45545	16.19	15.15

Legends:

GlobHor	Horizontal global irradiation	EArray	Effective energy at the output of the array
T Amb	Ambient Temperature	E_Grid	Energy injected into grid
GlobInc	Global incident in coll. plane	EffArrR	Effic. Eout array / rough area
GlobEff	Effective Global, corr. for IAM and shadings	EffSysR	Effic. Eout system / rough area

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Grid-Connected System: Loss diagram

Project : **SBC Bundles RFP 2017 - Betterevia**

Simulation variant : **Firestation 12_SMA**

Main system parameters	System type	**Grid-Connected**		
PV Field Orientation	tilt	20°	azimuth	-85°
PV modules	Model	Sunmodule SW 300 Mono	Pnom	300 Wp
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Inverter	Model	Sunny Tripower12000 TL	Pnom	12.00 kW ac
Inverter pack	Nb. of units	3.0	Pnom total	**36.0 kW ac**
User's needs	Unlimited load (grid)			

Loss diagram over the whole year