



Solar, Storage, and ZNE

June 22, 2021

Mendocino High School Project



Overview

Energy Goals & Constraints

Potential Project

Financing and Financial Performance

Procurement Method

What It Looks Like

Energy Storage and Resiliency

Energy Goals and Constraints

Energy Goals

- ZNE – Zero Net Energy
 - Produce as much energy as is used in a year
 - Campus-wide
- Eliminate Diesel and Propane usage

Project Constraints

- Cost neutral or better
- Physical (trees, setback, DSA)
- Aesthetic
- Market – things are expensive right now
- NEM 3.0 – November Interconnection Applications



Potential Project

Target Offset	Modeled Annual Usage kWh/year	Equivalent Array Size kW DC	Recommended Array Combination	Notes
Main HS w/ EV+STLTG	144,424	103.2	C-1, C-2	HS building with EV and streetlight loads
Main HS w/o EV	126,860	90.6	"	HS building with streetlight loads
Main HS w/o EV or STLTG	112,039	80.0	"	HS building ONLY
Gym & Perf Arts	76,615	54.7		
Tech Center	43,248	30.9		
Industrial Arts	36,751	26.3		
Community HS	35,428	25.3		
Total Campus w/ EV+STLTG	336,466	240.3	GM TS, C-1, C-2	All buildings
Total Campus w/o EV	318,903	227.8	GM TS, C-1, C-2	All buildings w/o EV loads
Total Campus w/o EV or STLTG	304,081	217.2	GM TS, C-1, C-2	All buildings w/o EV and streetlight loads

Potential Project

Solar Panel Array Areas Considered

No Roofs

Array Name	Array Size kW DC	Priority
C-1	63.0	+
C-2	42.8	+
C-3	47.9	+/-
C-4	47.9	-
GM Front	52.9	-
GM Cypress Trees	201.6	-
GM Track	225.1	-
GM Track Slope	113.4	+
Total	794.6	



Potential Project

ZNE

High School Building ONLY

Array Name	Array Size kW DC	Priority
C-1	63.0	+
C-2	42.8	+
Total	105.8	

Potential Project

ZNE

Full Campus

Array Name	Array Size kW DC	Priority
C-1	63.0	+
C-2	42.8	+
GM Track Slope	113.4	+
Total	219.2	



Project Financing



Cash Purchase with GO Bonds

- **Best Financial Performance** of all Financing types
- All energy cost savings (minus M&O) go to General Fund
- ~\$1.2M Solar PV Project Cost

District must maintain the system, which requires a separate M&O Contract



Power Purchase Agreement (PPA)

- (Almost) **No upfront cost** to District
- Third-party finances, constructs, owns and operates the system
- **District buys all electricity** produced at contracted price **for 20-25 years**

Incentives are well aligned – if the system does not perform, the owner does not get paid



Pre-Paid PPA

- Prepayment of some of the energy costs up front
- **Reduces the PPA rate** to allow the District to save money

Prepayment means the District takes more risk; requires careful contracting and financial analysis

Financial Modeling Assumptions

High School Building ONLY - ZNE

Project Overview

Number of Sites	Sites	1
Solar PV System Size	kW-DC	80.00
Solar PV Year 1 Production	kWh	109,000
Solar PV Yield	kWh/kW/Year	1,363
Energy Storage System Size	kW/kWh	110kW/220kWh
Modeled System Lifetime	Years	25

Electricity Usage

Annual Electricity Consumption	kWh	112,000
Annual Electricity Cost	\$, Current Tariffs	\$30,000
Average Cost of Electricity	\$/kWh	\$0.2642
Annual Utility Inflation Rate	%	3.00%

Cash - Financial Modeling Inputs

Turnkey Project Cost	\$	\$440,000
Project Soft Costs	\$	\$174,000
NPV Discount Rate	%	2.50%

PPA - Financial Modeling Inputs

PPA Price, PV	\$/kWh	\$0.21
PPA Price Adder, Soft Costs	\$/kWh	\$0.0615
PPA Price Adder, BESS	\$/kWh	\$0.0975
PPA Price Escalator	%	0%

Full Campus - ZNE

Project Overview

Number of Sites	Sites	1
Solar PV System Size	kW-DC	217.20
Solar PV Year 1 Production	kWh	296,000
Solar PV Yield	kWh/kW/Year	1,363
Energy Storage System Size	kW/kWh	110kW/220kWh
Modeled System Lifetime	Years	25

Electricity Usage

Annual Electricity Consumption	kWh	304,000
Annual Electricity Cost	\$, Current Tariffs	\$79,000
Average Cost of Electricity	\$/kWh	\$0.2603
Annual Utility Inflation Rate	%	3.00%

Cash - Financial Modeling Assumptions

Turnkey Project Cost	\$	\$977,000
Project Soft Costs	\$	\$212,000
NPV Discount Rate	%	2.50%

PPA - Financial Modeling Assumptions

PPA Price, PV	\$/kWh	\$0.19
PPA Price Adder, Soft Costs	\$/kWh	\$0.0271
PPA Price Adder, BESS	\$/kWh	\$0.036
PPA Price Escalator	%	0%

Financial Performance Comparison

**Cash Purchase
w/ GO Bonds**

**Power Purchase
Agreement (PPA)**

Pre-Paid PPA

Financial Results		Cash	PPA	PPA Pre-Pay
Year 1				\$500k Pre-Payment
Value of Solar	\$/kWh	\$0.1858	\$0.1858	\$0.1858
Value of Solar	\$	\$55,000	\$55,000	\$55,000
Annual Energy Cost After Solar	\$	\$24,000	\$24,000	\$24,000
Value of Energy Storage	\$	\$6,000	\$6,000	\$6,000
Annual Energy Cost After Solar+Storage	\$	\$18,000	\$18,000	\$18,000
Diesel, Propane Systems Avoided Cost	\$	\$31,384	\$31,384	\$31,384
25-year P50 Results, Solar PV				
Simple Payback, Solar	Years	8.7	<1	3.3
Nominal Returns	\$	\$2,501,000	\$2,463,000	\$2,478,000
NPV Returns, 2.5% Discount Rate	\$	\$1,515,000	\$1,768,000	\$1,650,000
25-year P50 Results, Solar+Storage				
Simple Payback, Solar	Years	13.1	<1	3.5
Nominal Returns	\$	\$2,126,000	\$2,422,000	\$2,437,000
NPV Returns, 2.5% Discount Rate	\$	\$1,152,000	\$1,731,000	\$1,614,000

Procurement Method

Request for Proposals (RFQ/P)

- Standard public procurement
- Combined Qualification and Proposal
- Term sheet, specs, criteria, 10% design in RFQ/P
- Under authority of GC 4217.10-18
 - Allows for selection of “best value” bid

Design-Build Delivery

- Selected vendor does final engineering and design, permitting, construction, commissioning



What It Looks Like

Carport Shade Structure



What It Looks Like

Ground Mounted

DSA requires a minimum 6' fence around the array

Students cannot interact With the solar equipment



What It Looks Like

Ground Mounted





Energy Storage and Resiliency

Battery Energy Storage Systems (BESS)

- With current prices, incentives, and tariffs, BESS adds little \$ value
- Resiliency to Electrical Grid Outages
 - Critical Loads
 - Duration of Outage
 - **Avoided Cost of Diesel Generator (\$250k)**
- Value of Resilience (VOR)
 - Cost of closing schools
 - Staff time
 - Curricular impacts
 - Community impacts
 - **Community emergency services**



THANK YOU

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