

# HISTORIC AND DESIGN REVIEW COMMISSION

February 3, 2016

Agenda Item No: 6

**HDRC CASE NO:** 2015-464  
**ADDRESS:** 639 MISSION ST  
**LEGAL DESCRIPTION:** NCB 2914 BLK 3 LOT 21 22, S 10 FT OF 20  
**ZONING:** RM4 H HS  
**CITY COUNCIL DIST.:** 1  
**DISTRICT:** King William Historic District  
**LANDMARK:** House  
**APPLICANT:** Daniel Hudson/Texas Solar Systems  
**OWNER:** Michael Villareal  
**TYPE OF WORK:** Solar panel installation

## REQUEST:

The applicant is requesting a Certificate of Appropriateness for approval to install a total of forty-five (45) black Axitec Solar Panels at 639 Mission. Within this request, the applicant is proposing to:

1. Install fifteen (15) solar panels on the rear (west facing) roof slope of the accessory structure located at the rear of the property behind the primary historic structure, noted as sub-array 3.
2. Install seventeen (17) solar panels on the rear (west facing) roof slope of the primary historic structure, noted as sub-array 2.
3. Install thirteen (13) solar panels on the southern roof slope, noted as sub-array 1.

## APPLICABLE CITATIONS:

*Historic Design Guidelines, Chapter 3, Guidelines for Additions*

6. Designing for Energy Efficiency

### C. SOLAR COLLECTORS

- i. Location*—Locate solar collectors on side or rear roof pitch of the primary historic structure to the maximum extent feasible to minimize visibility from the public right-of-way while maximizing solar access. Alternatively, locate solar collectors on a garage or outbuilding or consider a ground-mount system where solar access to the primary structure is limited.
- ii. Mounting (sloped roof surfaces)*—Mount solar collectors flush with the surface of a sloped roof. Select collectors that are similar in color to the roof surface to reduce visibility.
- iii. Mounting (flat roof surfaces)*—Mount solar collectors flush with the surface of a flat roof to the maximum extent feasible. Where solar access limitations preclude a flush mount, locate panels towards the rear of the roof where visibility from the public right-of-way will be minimized.

## FINDINGS:

- a. The applicant has proposed to install a total of forty-five solar panels on the property at 639 Mission. Fifteen solar panels will be located on a rear accessory structure while a total of thirty solar panels will be located on the primary historic structure.
- b. This request was last heard by the HDRC on January 20, 2016, where the applicant withdrew the request in order to obtain additional information regarding the proposed mounting mechanism.
- c. 639 Mission is a unique property in the fact that it is located at the corner of Mission Street and Eagleland Drive on a double lot. Architecturally, the structure features a wrap-around porch that fronts both Mission Street and Eagleland Drive. Previously, a request for fencing was approved by the HDRC in which the applicant proposed to construct a privacy fence along the property line at Eagleland drive to be both six (6) feet in height and three (3) feet in height. At that time, staff noted that the appropriate transition from the side yard to the rear yard along Eagleland drive is at, or

to the rear of, the wrap-around porch.

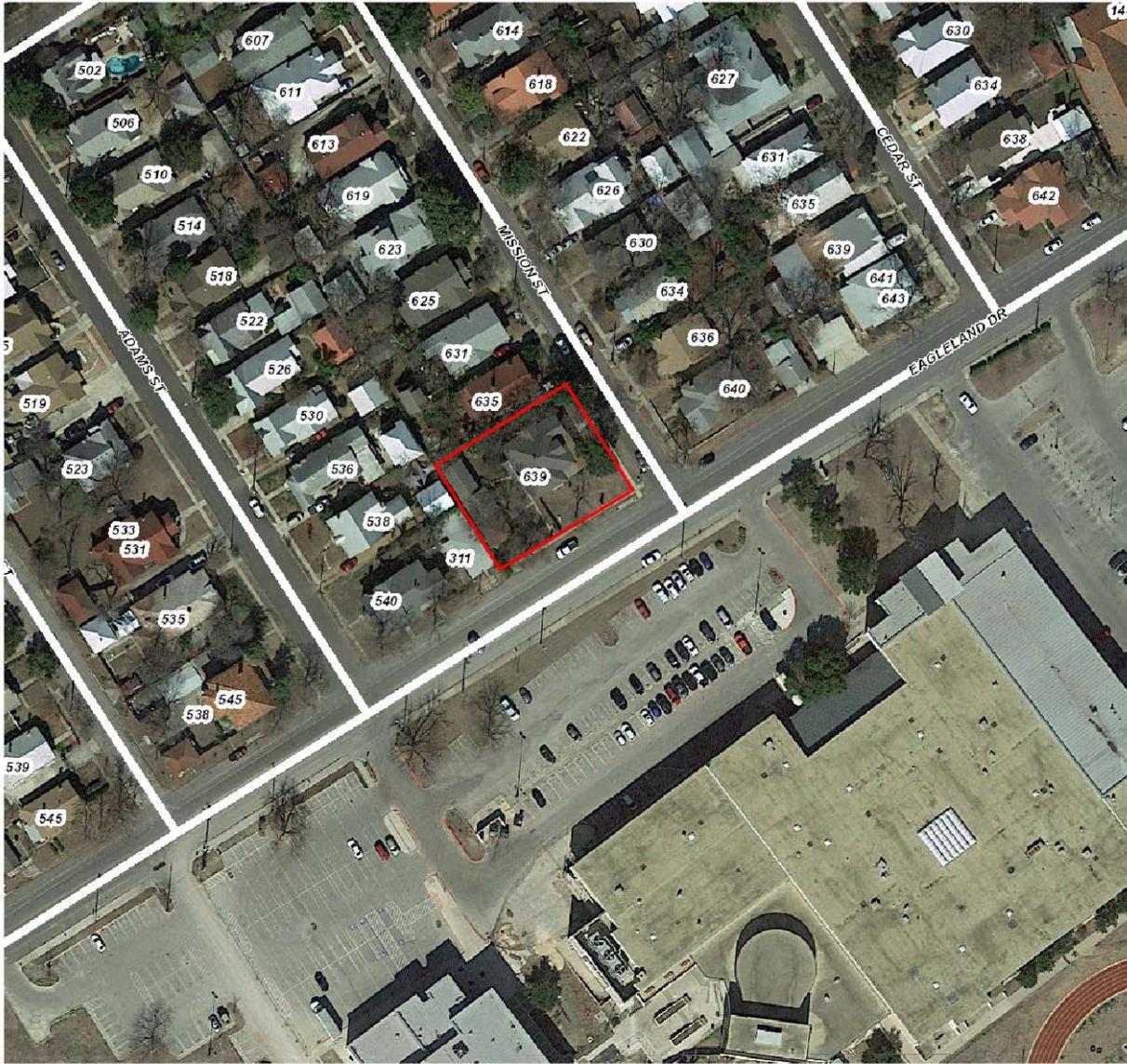
- d. According to the Guidelines for Additions, siting solar panels towards the rear of a visible roof surface of on a garage located at the rear of the property is preferred to minimize the visual impact on the public right of way; however, where solar access is insufficient a more visible location may be considered if panels are of a low profile and similar in color as the roof surface.
- e. The applicant proposes to install 30 solar panels on the roof of the main structure on the rear and side slopes of the roof. The panels proposed on the side roof are behind the side transition point as noted in finding b.
- f. The applicant submitted additional specifications to staff since the last hearing. The proposed panels feature a low profile, a mounting system that will not negatively impact the historic structure, and a color comparable to the existing roofing materials. This is consistent with the design guidelines.
- g. The applicant has proposed installation of 15 panels on the accessory structure to the rear of the property. Staff finds that this is consistent with the guidelines.

**RECOMMENDATION:**

Staff recommends approval based on findings a through g.

**CASE MANAGER:**

Edward Hall



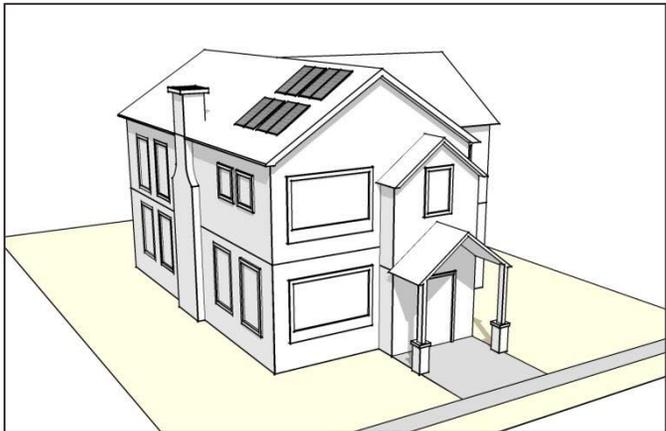
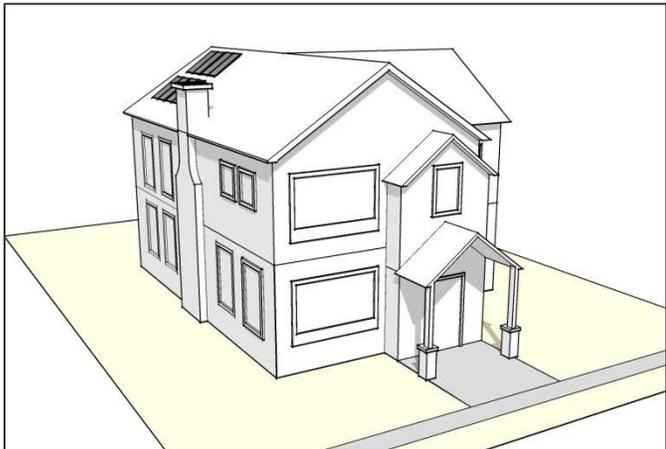
## Flex Viewer

Powered by ArcGIS Server

Printed: Nov 23, 2015

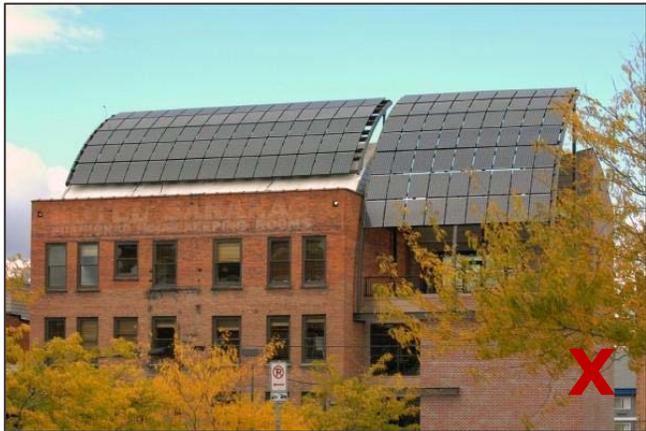
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This



Siting solar panels towards the rear of a visible roof surface or on a garage located at the rear of the property (top) is preferred to minimize the visual impact on the public right-of-way; however, where solar access is insufficient a more visible location (bottom) may be considered if panels are of a low profile and similar color as the roof surface.

Not This



Solar panels should be mounted flush with the surface of the roof to minimize their visibility from the public right-of-way, regardless of the building type they are attached to. The design and placement of solar panels should not create a visual distraction that detracts from the historic building they are mounted to.

**Additional Resources**

*Incorporating Solar Panels in a Rehabilitation Project*, ITS #52, by Jenny Parker.  
<http://www.nps.gov/tps/standards/applying-rehabilitation/its-bulletins/ITS52-SolarPanels.pdf>

**Did you know?**

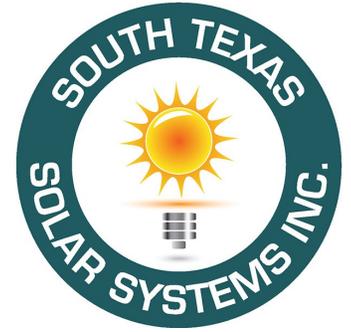
The greenest building is one that is already built. Take care to preserve materials, and avoid damaging the historic structure when installing new sustainable technologies.







SHELBI JARY  
Sales Representative  
10203 Kotzebue St, Suite 226  
San Antonio, TX 78217



MIKE VILLAREAL

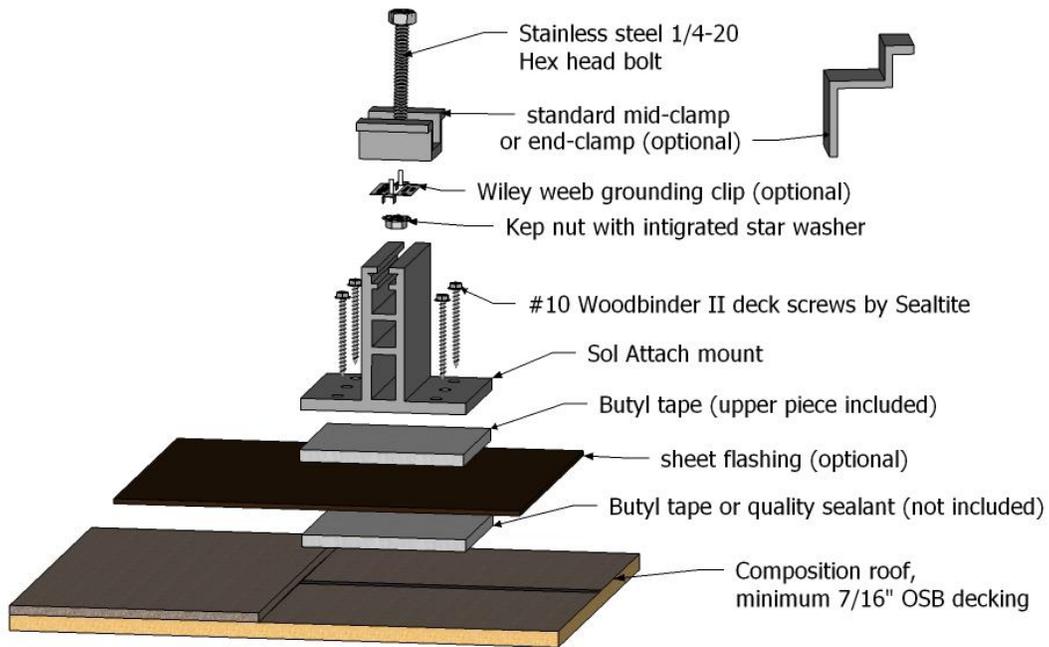
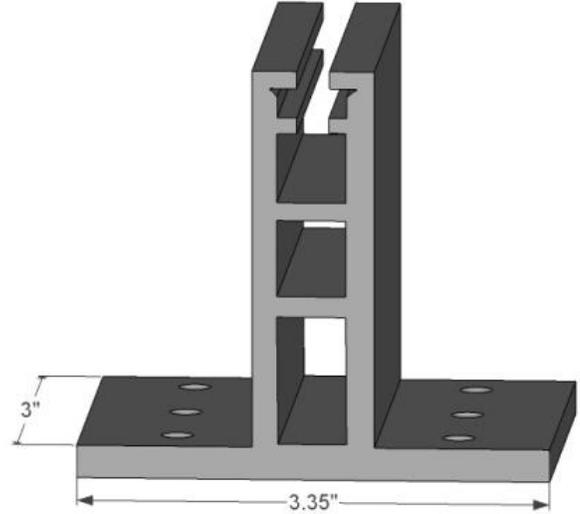
45 Panels

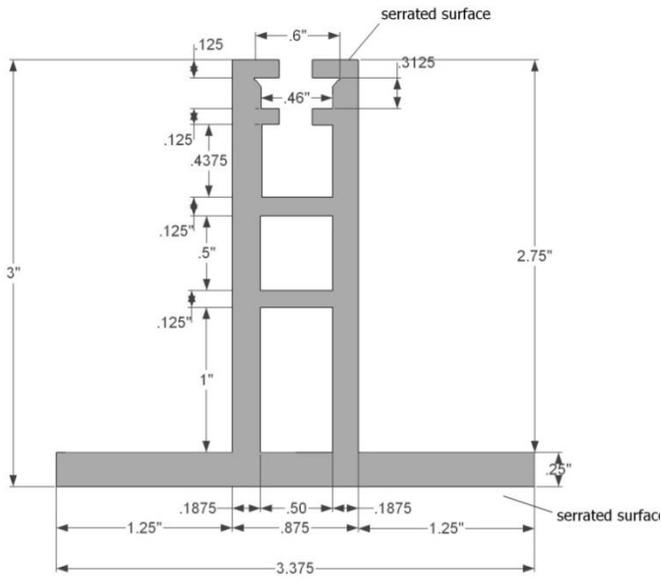


MISSION ST  
SAN ANTONIO, TX 78210

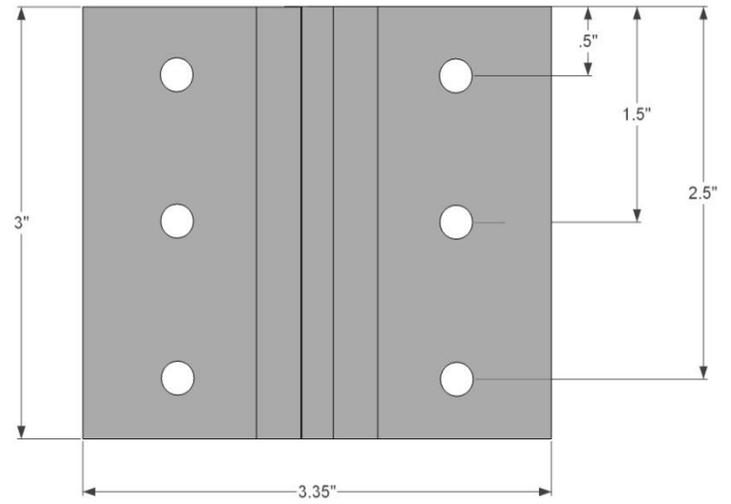
# SOL ATTACH

Sol Attach, LLC  
**Composition roof mounting foot**  
Extrusions made of 6061-T6 alloy  
Patent Pending



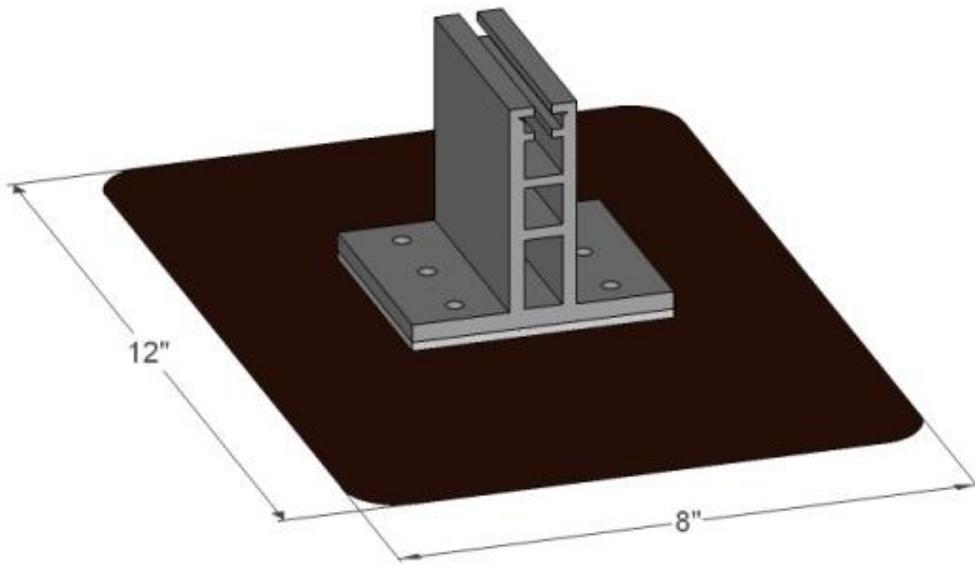


**Front View**



**Top View**

**Flat flashing**



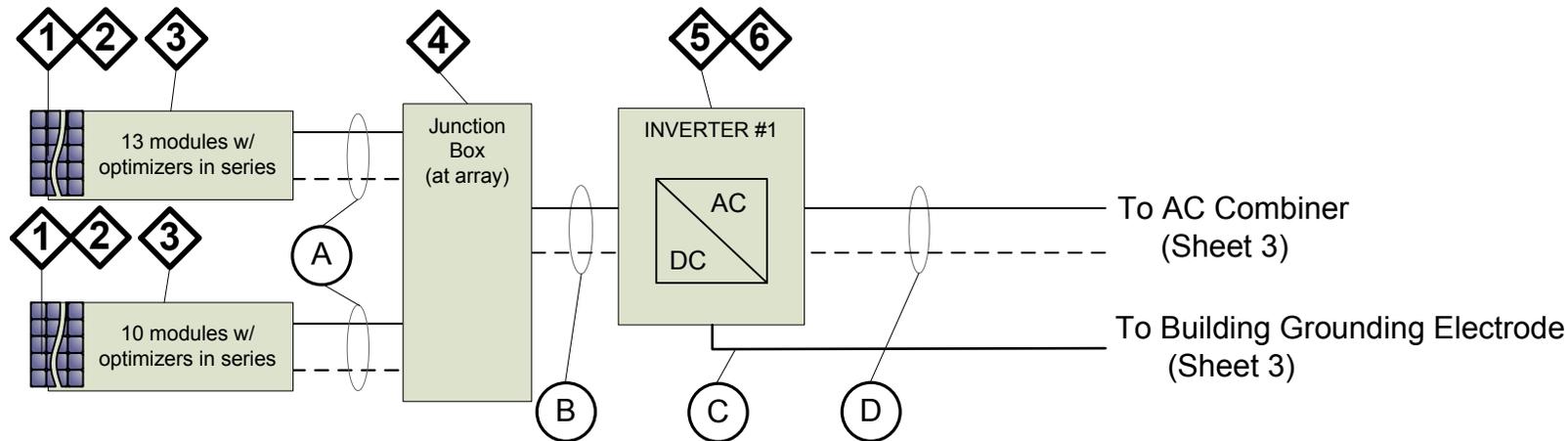
System Information			
PV Module Ratings		Inverter Ratings	
Module Make	LG Solar	Inverter Make	SolarEdge
Module Model	LG365N2W-B3	Inverter Model	SE7600A-US
Max Power	= 365 W	Max. Output Power	= 8350 W
Open Circuit Voltage	= 48.4 V	Max. DC Voltage	= 500 V
Max Power Point Voltage	= 38.6 V	Normal AC Voltage	= 240 V
Short Circuit Current	= 9.89 A	Max. AC Current	= 32 A
Max Power Point Current	= 9.46 A	CEC Inverter Efficiency	= 97.5%

Labels	
Photovoltaic DC Disconnect	
Rated MPP Current	= 23.0 A
Rated MPP Voltage	= 350.0 V
Max. System Voltage	= 500.0 V
Max. System Current	= 30.0 A
Photovoltaic AC Disconnect	
AC Output Current	= 32 A
Nominal AC Voltage	= 240 V



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Label at Inverter #1



PV System meets requirements for Rapid Shutdown as defined in 690.12.

EQUIPMENT SCHEDULE			
REF	DESCRIPTION	PN	NOTES
1	SOLAR PV MODULE	LG365N2W-B3	LG SOLAR 365W MONOCRYSTALLINE MODULE
2	PV MODULE OPTIMIZER	P400	SOLAREGE 400W PV MODULE OPTIMIZER
3	ARRAY MOUNTING HARDWARE	TBD	UNIRACE ROOF MOUNTING SYSTEM W/ TILE HOOKS
4	JUNCTION BOX	SDS-P-3-DC	SAFE-D PASS-THRU BOX, 3-STRINGS
5	A/C/DC INVERTER	SE7600A-US	SOLAREGE 7.6KW INVERTER W/ A/C/DC DISCONNECT
6	WIRELESS COMM	SE1000-ZBGW	SOLAREGE ZIGBEE WIRELESS COMMUNICATIONS

CONDUIT & CONDUCTOR SCHEDULE					
REF	DESCRIP. / CONDUCTOR TYPE	CONDUCTOR GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
A	PV-WIRE & BARE GROUND	#12 / #6	2 / 1	IN FREE AIR	
B	THWN-2	#10 / #6	4 / 1	EMT	1"
C	BARE GROUND	#6	1	IN FREE AIR	
D	THWN-2	#8 / #10	3 / 1	EMT	3/4"

Notes:

- Equipment, conductors & conduit as listed or equivalent.
- Expected nominal string voltage: 350Vdc.
- Expected nominal optimizer output voltage:  
String of 10 – 35.0Vdc  
String of 13 – 26.9Vdc

ONE-LINE STANDARD ELECTRICAL DIAGRAM
PROJECT REF: Mike Villareal
SITE ADDRESS: 639 Mission St, San Antonio, TX 78210
SUB-SYSTEM SIZE: 8.395kW
1 String of 13 & 1 String of 10 Modules / Optimizers (LG Solar 365W / P400)

Sheet 1 of 11  
Date: September 29, 2015

NOT TO SCALE

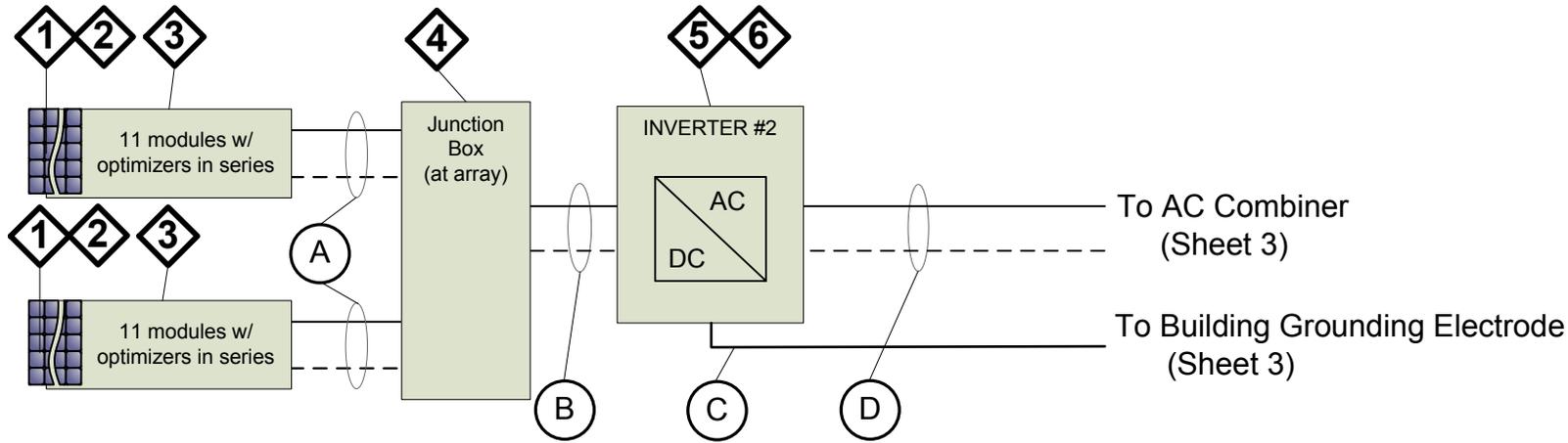
System Information			
PV Module Ratings		Inverter Ratings	
Module Make	LG Solar	Inverter Make	SolarEdge
Module Model	LG365N2W-B3	Inverter Model	SE7600A-US
Max Power	= 365 W	Max. Output Power	= 8350 W
Open Circuit Voltage	= 48.4 V	Max. DC Voltage	= 500 V
Max Power Point Voltage	= 38.6 V	Normal AC Voltage	= 240 V
Short Circuit Current	= 9.89 A	Max. AC Current	= 32 A
Max Power Point Current	= 9.46 A	CEC Inverter Efficiency	= 97.5%

Labels	
Photovoltaic DC Disconnect	
Rated MPP Current	= 22.9 A
Rated MPP Voltage	= 350.0 V
Max. System Voltage	= 500.0 V
Max. System Current	= 30.0 A
Photovoltaic AC Disconnect	
AC Output Current	= 32 A
Nominal AC Voltage	= 240 V



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Label at Inverter #2



PV System meets requirements for Rapid Shutdown as defined in 690.12.

EQUIPMENT SCHEDULE			
REF	DESCRIPTION	PN	NOTES
1	SOLAR PV MODULE	LG365N2W-B3	LG SOLAR 365W MONOCRYSTALLINE MODULE
2	PV MODULE OPTIMIZER	P400	SOLAREDGE 400W PV MODULE OPTIMIZER
3	ARRAY MOUNTING HARDWARE	TBD	UNIRACE ROOF MOUNTING SYSTEM W/ TILE HOOKS
4	JUNCTION BOX	SDS-P-3-DC	SAFE-D PASS-THRU BOX, 3-STRINGS
5	AC/DC INVERTER	SE7600A-US	SOLAREDGE 7.6KW INVERTER W/ AC/DC DISCONNECT
6	WIRELESS COMM	SE1000-ZBGW	SOLAREDGE ZIGBEE WIRELESS COMMUNICATIONS

CONDUIT & CONDUCTOR SCHEDULE					
REF	DESCRIP. /CONDUCTOR TYPE	CONDUCTOR GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
A	PV-WIRE & BARE GROUND	#12 / #6	2 / 1	IN FREE AIR	
B	THWN-2	#10 / #6	4 / 1	EMT	1"
C	BARE GROUND	#6	1	IN FREE AIR	
D	THWN-2	#8 / #10	3 / 1	EMT	3/4"

Notes:

- Equipment, conductors & conduit as listed or equivalent.
- Expected nominal string voltage: 350Vdc.
- Expected nominal optimizer output voltage: String of 11: 31.8Vdc

ONE-LINE STANDARD ELECTRICAL DIAGRAM
PROJECT REF: Mike Villareal
SITE ADDRESS: 639 Mission St, San Antonio, TX 78210
SUB-SYSTEM SIZE: 8.03kW
2 Strings of 11 Modules / Optimizers (LG Solar 365W / P400)

Sheet 2 of 11  
Date: September 29, 2015

NOT TO SCALE

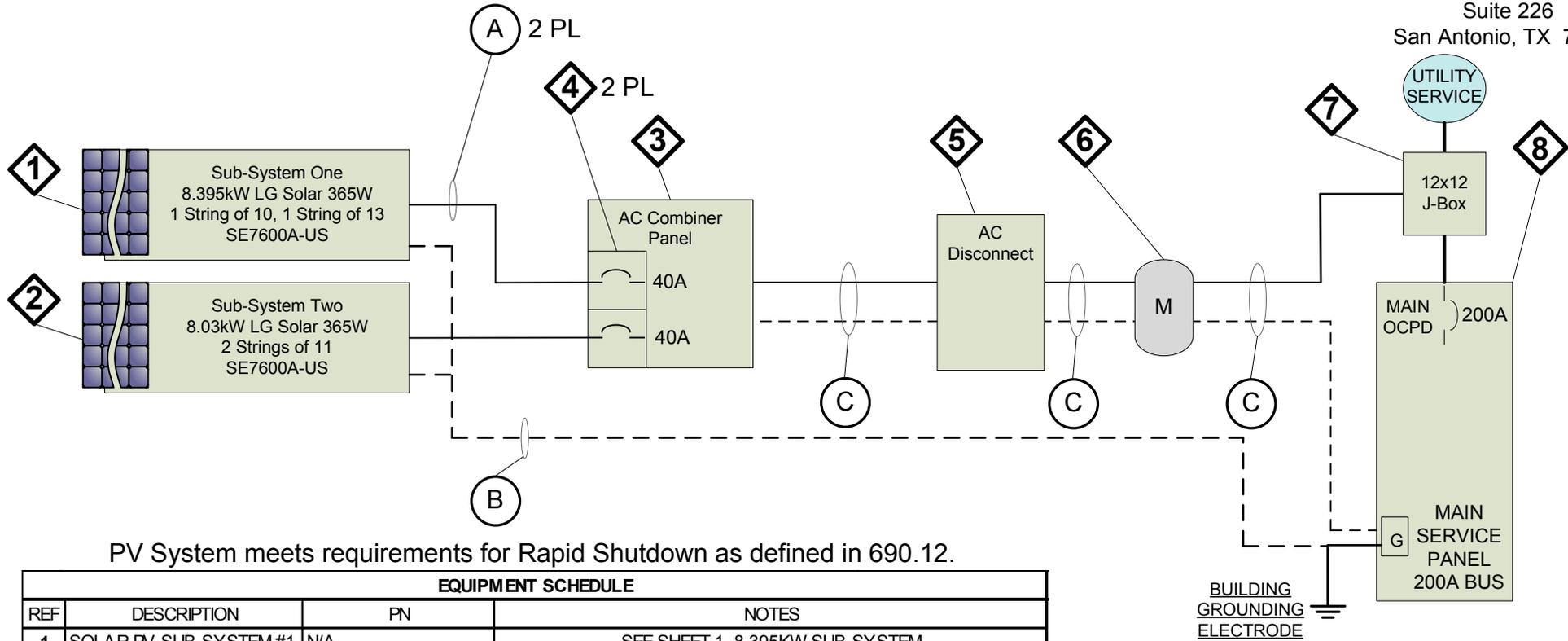
Notes:

- Equipment, conductors and conduit as listed or equivalent.
- AC Combiner panel should be labeled, "Solar Photovoltaic output circuits only. No load circuits permitted."

Label	
<b>Photovoltaic AC Disconnect</b>	
AC Output Current	= 64 A
Nominal AC Voltage	= 240V



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PV System meets requirements for Rapid Shutdown as defined in 690.12.

**EQUIPMENT SCHEDULE**

REF	DESCRIPTION	PN	NOTES
1	SOLAR PV SUB-SYSTEM #1	N/A	SEE SHEET 1, 8.395KW SUB-SYSTEM
2	SOLAR PV SUB-SYSTEM #2	N/A	SEE SHEET 2, 8.03KW SUB-SYSTEM
3	AC COMBINER	TBD	240VAC, 100A, MAIN BUS ONLY
4	SOLAR OCPD	TBD	240VAC, 40A, 2-POLE CIRCUIT BREAKER (BACK-FED)
5	MAIN AC DISCONNECT	D223NRB	SQUARE D, SAFETY SWITCH, 240V, 100A, 2-POLE, 80A FUSING
6	GENERATION METER	TBD	
7	JUNCTION BOX	TBD	12x12 NEMA 3R FOR LINE-SIDE TAP
8	SERVICE PANEL	NA	240V, 200A BUS, 200A MAIN BREAKER (EXISTING)

**CONDUIT & CONDUCTOR SCHEDULE**

REF	DESCRIP. / CONDUCTOR TYPE	CONDUCTOR GAUGE	NUMBER OF CONDUCTORS	CONDUIT TYPE	CONDUIT SIZE
A	THWN-2	#8 / #10	3 / 1	EMT	3/4"
B	BARE GROUND	#6	1	IN FREE AIR	
C	THWN-2	#4 / #8	3 / 1	EMT	1-1/4"

**ONE-LINE STANDARD ELECTRICAL DIAGRAM**

PROJECT REF: Mike Villareal
SITE ADDRESS: 639 Mission St, San Antonio, TX 78210
SYSTEM SIZE: 16.425kW
1 String of 13, 1 String of 10 & 2 Strings of 11 Modules / Optimizers (LG Solar 365W / P400)

Sheet 3 of 11  
Date: September 29, 2015

**NOT TO SCALE**

**KELLY AFB**



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Elev.	High Temp		Distance above roof			Extreme
	0.4%	2% Avg.	0.5"	3.5"	12"	Min
208 m	39 °C	37 °C	59 °C	54 °C	51 °C	-6 °C

**Correction Temperatures**

$\Delta T_{cold} = -6^{\circ}C - 25^{\circ}C = -31^{\circ}C$        $\Delta T_{hot} = (37^{\circ}C + 35^{\circ}C) - 25^{\circ}C = 47^{\circ}C$   
Flush roof mount

**Module Voltage Calculations**

LG Neon 72 Cell 365W (LG365N2W-B3)  
Voc = 48.4V      Vmp = 38.6V      Voc Temp Coefficient = -0.28%/°C  
Isc = 9.89A      Imp = 9.46A      Pmax Temp Coefficient = -0.39%/°C

Cold Voc = 48.4V + (48.4V x -0.28%/°C x -31°C) = 48.4V + 4.02V = **52.6V**  
Hot Vmp = 38.6V + (38.6V x -0.39%/°C x 47°C) = 38.6V - 7.08V = **31.5V**

SolarEdge P400 Optimizer      Maximum Power per String: 5250W  
Max Input DC Power: 400W      Max Input DC Voltage: 80V  
MPPT Operating Range: 8-80V      Max Input Isc Current: 10A  
Maximum DC Output: 15A      Min/Max Input String Length: 8/25

**String Sizing**

10 x 365W = 3650W      11 x 365W = 4015W      13 x 365W = 4745W

SolarEdge SE7600A-US Inverter  
Max DC Input (V): 500V      Max DC Input (A): 23.0A  
Nominal DC Input: 350V  
Output voltage: 240Vac      Max Output current: 32.0A

**Label Calculations**

Sub-System 1 - MPPT DC Current:  
365W x 23 ÷ 350V = 24.0A ← Limited to 23.0A by the inverter  
Sub-System 2 - MPPT DC Current:  
365W x 22 ÷ 350V = 22.9A

**Conductor Ampacity**

PV Source Circuit (Optimizer Output):  
15A x 125% = 18.8A (continuous duty)  
18.8A ÷ 1.00 = 18.8 (PV Wire in free air)  
#12 AWG (rated for 25A into 75° terminals)  
18.8A ÷ 0.71 ÷ 0.8 = 33.1A (conditions of use – temp and conduit fill)  
#10 AWG (rated for 35A into 75° terminals)

Inverter Output Circuit:  
32.0A x 125% = 40.0A  
#8 AWG (rated for 50A into 75° terminals and required OCPD)

AC Combiner Output Circuit:  
32.0A x 2 x 125% = 80.0A  
#4 AWG (rated for 85A into 75° terminals and required OCPD)

**OCPD & Disconnects**

*DC fusing not required. Only two strings per inverter, with each string landing on dedicated input terminals in the corresponding inverter.*

*DC/AC Disconnect functions integral to inverter.*

Inverter OCPD:  
32.0A x 125% = 40.0A → 40A, 240V, 2-Pole Back-Fed Circuit Breaker

Main Solar OCPD & Disconnect:  
32.0A x 2 x 125% = 80.0A → 80A Fuses  
100A, 2-Pole, 240V Fused Disconnect

**Voltage Drop calculations:**

Worst case combination of distance and amperage:  
PV Nominal String Voltage: 350Vdc  
PV MPPT String Current: 365W x 11 ÷ 350V = 11.5A  
DC conductor run is 100 ft (estimated)  
DC Voltage Drop  
(2 x 100ft x 11.5A x 1.24Ω/kft x 100) / (1000ft/kft x 350V) = 0.81%

Inverter Output is 240Vac, 32A  
AC conductor run is 10 ft (estimated)  
AC Voltage Drop  
(2 x 10ft x 32.0A x 0.778Ω/kft x 100) / (1000ft/kft x 240V) = 0.21%

AC Combiner Output is 240Vac, 64A  
AC conductor run is 15 ft (estimated)  
AC Voltage Drop  
(2 x 15ft x 64.0A x 0.308Ω/kft x 100) / (1000ft/kft x 240V) = 0.25%

<b>ELECTRICAL CALCULATIONS</b>
PROJECT REF: Mike Villareal
SITE ADDRESS: 639 Mission St, San Antonio, TX 78210
SYSTEM SIZE: 16.425kW
1 String of 13, 1 String of 10 & 2 Strings of 11 Modules / Optimizers (LG Solar 365W / P400)

Sheet 4 of 11  
Date: September 29, 2015

## Notes:

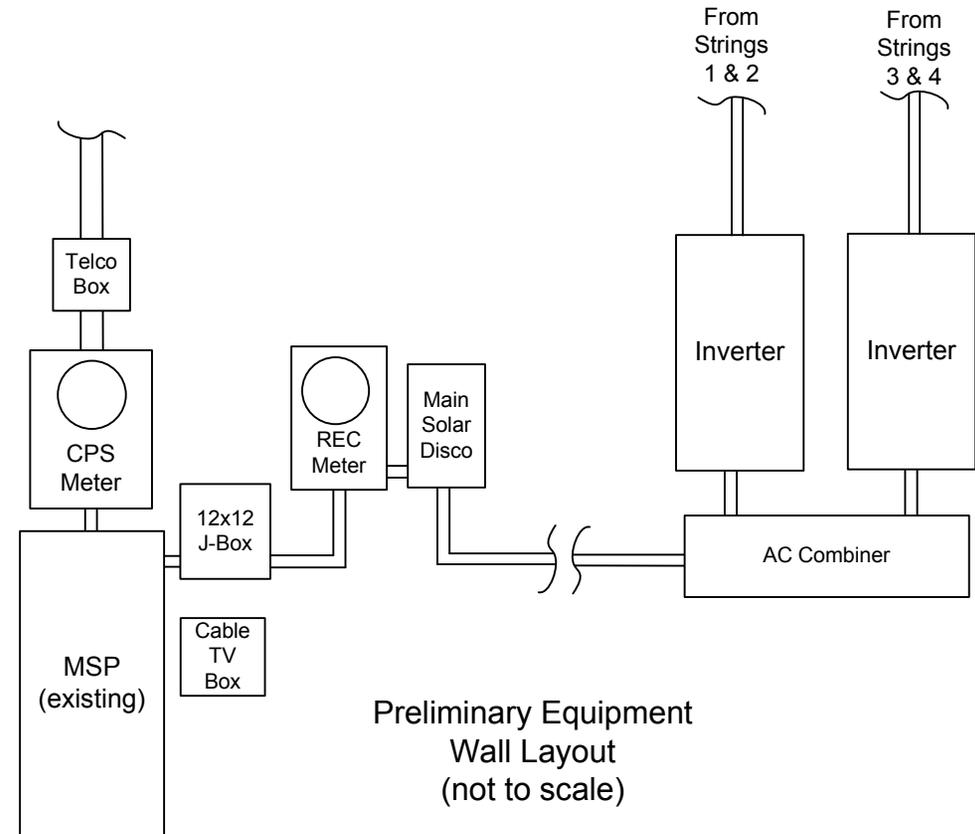
- PV System meets requirements for Rapid Shutdown as defined in 690.12.
- Each PV module is connected to a dedicated optimizer. The voltage generated by a string of modules/optimizers is controlled to 350Vdc at the inverter DC inputs.
- Calculations for the System Labeling based on SolarEdge Tech Note, *PV Power Source Labeling in a SolarEdge system*.
- Inverters, AC Combiner, AC Disconnect and REC Meter located near the service entrance near NE corner of residence. Location of equipment may be adjusted to maintain required clearance from existing gas meter. Some equipment may need to be placed on the opposite of the window near the service entrance.
- Ensure clearances around the inverters complies with Chapter 3 of the Solar Edge Installation Guide. The inverters should be installed to minimize exposure to sunlight, rainfall and direct water spray.
- Each module/optimizer string is run to a separate input on the corresponding inverter. Only two strings per conduit (one conduit per inverter).
- Interconnection to the main service via a line-side tap in a 12x12 Junction Box installed inline between the Utility Meter and the Main Service Panel. Complies with 705.12.
- Layout/location of array may be adjusted to avoid vent stacks, skylights and other roof protrusions. Adequate clearances should be maintained from roof eaves and ridge to allow for safe access.
- Conductor sizing listed is minimum required based on NEC ampacity calculations and a conduit fill of not more than 4 current carrying conductors. Minimum conductor size required for REC meter base typically #6 AWG.
- Conduit sizing is based upon NABCEP recommended maximum conduit fill of 25%. Conduit may be sized to comply with Annex C of NEC.
- Voltage drop calculations should be verified on-site based on actual wire run lengths. Recommended worst case system voltage drop – 2% total.
- All electrical work must be made in accordance with the local and applicable *National Electrical Code ANSI/NFPA 70*.
- PV System to be installed and labeled per National Electric Code 2014. Specifically:
  - 690.4(B)(1),(2) and (3)
  - 690.4(H)
  - 690.5
  - 690.17
  - 690.31
  - 690.35(C) and (F)
- Inverter listed to UL-1741 for grid-interactive use and GFDI protection.
- All equipment used UL listed.
- Equipment, conductors & conduit as listed or equivalent.

## Module string assignments:

- String of 13 – all modules from sub-array 1
- String of 10 – 10 modules from sub-array 2
- String of 11 – 7 modules from sub-array 2 & 3 modules from sub-array 3
- String of 11 – 11 modules from sub-array 3



10203 Kotzebue St  
Suite 226  
San Antonio, TX 78217



### SPECIAL NOTES

PROJECT REF: Mike Villareal

SITE ADDRESS: 639 Mission St, San Antonio, TX  
78210

SYSTEM SIZE: 16.425kW

1 String of 13, 1 String of 10 & 2 Strings of 11  
Modules / Optimizers (LG Solar 365W / P400)

Sheet 6 of 11

Date: September 29, 2015



An Investment as Consistent as the Texas Sun

## Performance & Financial Analysis

Prepared September 16, 2015 for

**Mike Villareal**

, Mission St  
San Antonio, TX 78210

**Prepared by STSS EGE**

Aberration, Inc.  
South Texas Solar Systems, Inc.  
10203 Kotzebue st  
Suite 226  
San Antonio, TX 78217  
Phone: 210-829-5420 \* Email: [j.hiebert@txsolarsystems.com](mailto:j.hiebert@txsolarsystems.com)



An Investment as Consistent as the Texas Sun

## Executive Summary

**Electric Utility Savings:** Anticipate a savings of approximately \$2,798 in electric bills (99%) at current utility rates in the first year. Savings will grow as electric utility rates are expected to rise 3.78% a year. The purchase of electric energy (kWh) from your utility is expected to be reduced by 99%.

Over 25 years, annual utility savings are anticipated to average \$4,693, for a total utility savings of \$117,313.

### **Performance Summary**

Solar Electric (PV) System: 16.425 kW DC (16.014 kW AC) producing 23,309 kWh/Year.

#### **Purchase Price & Net Cost**

**Contract Price: \$57,804**

Incentives to Customer: (\$33,735)

Net Purchase Cost: \$24,069

#### **Financial Ratios (Unlevered)**

Customer's Profitability Index: 1.7

Internal Rate of Return (IRR): 10.2%

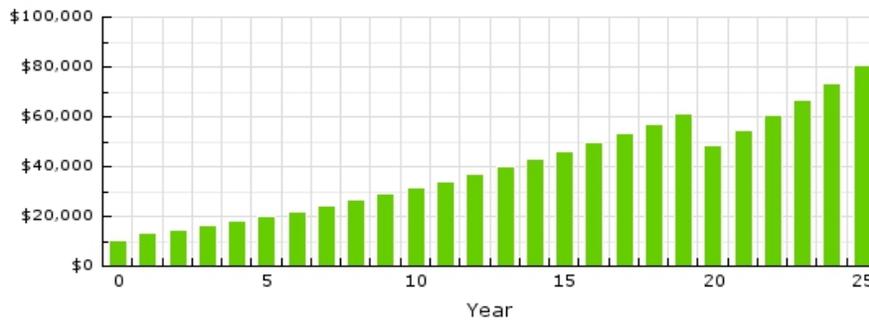
Net Present Value (NPV): \$16,407

Cash Gained over Life: \$80,571

- Property Value Appreciation: \$58,080 (first-year utility savings x 20 years)
- CO2 Saved over System Life: 478 tons. Equivalent to driving 956,000 auto miles

**Finance:** Loan: "Same-As-Cash". \$34,385 interest free with no monthly payments if principal repaid within 12 months. Loan: "Fully-Amortized". \$34,385 at 4.990% apr. Repaid: \$234 per month over 228 months. Commences month 12. Interest tax deductible. Advance principal payment of \$10,316 made in month 1 of loan term (assumed). Re-amortized payment of \$164 thereafter. Initial Cash Proceeds: \$10,316.

Cumulative Cash Flow





An Investment as Consistent as the Texas Sun

## The Cost of Doing Nothing

Utility Cost over Time

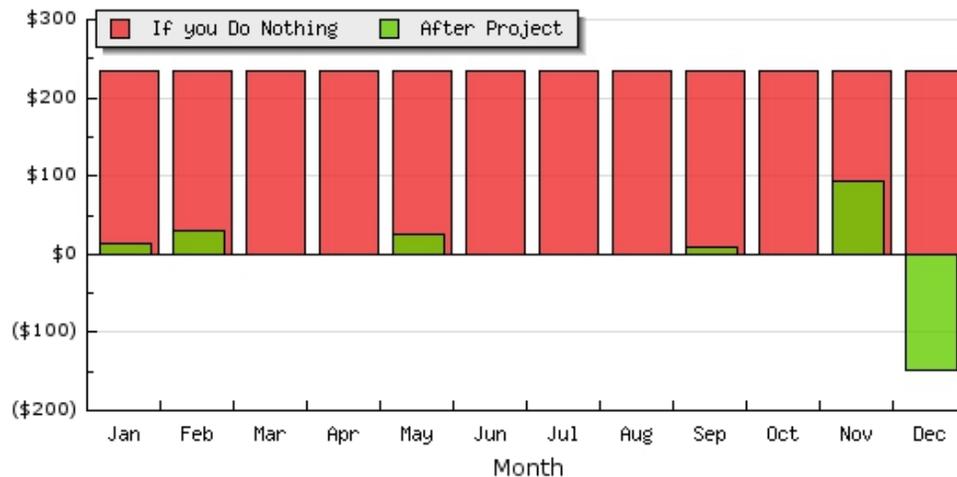


Your Hedge Against Utility Inflation: Your investment in this project will protect you from utility rate inflation.

## Utility Cost by Month

December includes a Net-Metering "True-Up" payment to reconcile any net-meter credits accumulated over the prior year.

Utility Cost by Month (typical): Reduced 99%





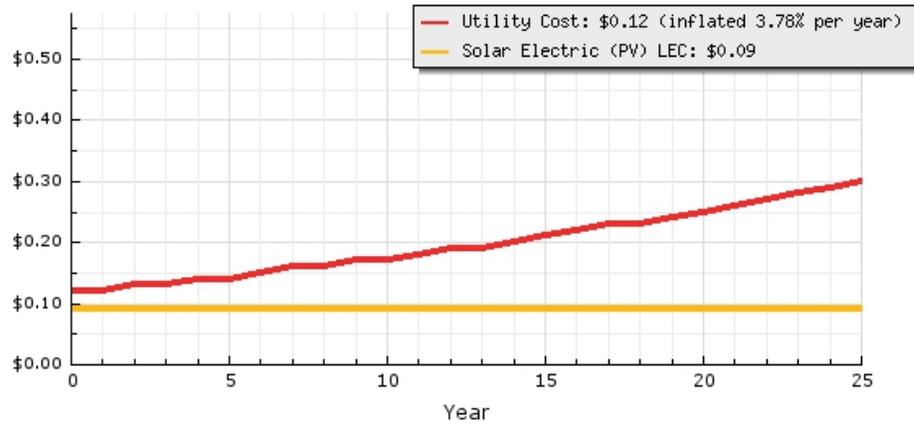
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## Levelized Energy Cost (LEC)

Your Hedge Against Utility Inflation: Your investment in this project will protect you from utility rate inflation. Levelized Energy Cost (LEC) analysis provides us with a "hurdle rate" (the levelized energy cost) which can be compared to the expected change in utility rates (by way of utility rate inflation). LEC is the average lifetime cost of energy produced by a particular system. We can compare the LEC to the current utility rate and its expected change in price as time goes on. In this manner one can judge the investment as a "better bet" than utility rates to contain energy costs. Represented below is the average cost of utility energy versus the cost of energy produced (LEC) by your system over time.

### Electric: Levelized Energy Cost (LEC)

\$/kWh: Utility vs. System Levelized Energy Cost (LEC)





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## Carbon Footprint

Your carbon footprint will be reduced. Over the life of your system 478 tons of carbon dioxide (CO<sub>2</sub>) will be eliminated from your footprint. Equivalent to:



**Planting 11,137 trees.**



**Driving reduced by 956,000 auto miles, or 48,756 gallons of gasoline.**



**Recycling 1,510 tons of waste instead of sending it to landfill.**



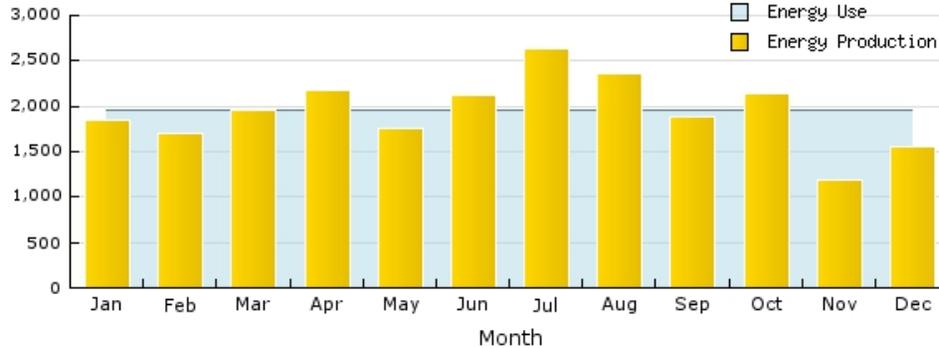
**465,773 pounds (232.9 tons) of coal burned.**



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## Solar Electric (PV) System Summary

Solar Electric (PV) kWh Production by Month (typical)



### Array #1

Tilt: 30° Azimuth: 240° 3" Air Gap  
Shade reduces production: 0%

PV Panels: 32 x LG Electronics, Model: LG365N2C-B3

Inverters: 1 x SolarEdge Technologies, Model: SE 10000A-US (240V)

### Array #2

Tilt: 30° Azimuth: 149° 3" Air Gap  
Shade reduces production: 0%

13 x LG Electronics, Model: LG365N2C-B3

1 x SolarEdge Technologies, Model: SE 10000A-US (240V)

Total Panel Area: 921 sq-ft

System Peak Power: 16.425 kW DC (16.014 kW AC, 14.637 kW CEC)

Annual Production: 23,309 kWh. Supplying 99% of annual electric use

### Contract Price Summary: Solar Electric (PV) System

**Contract Amount: \$57,804** (\$3.52 per watt DC)

#### Incentives available to Customer in 1st Year

CPS Energy - Solar PV Rebate: Residential (Tier2) Local installer: \$1.60/watt AC (\$23,419)  
(max. \$ 25k or 50% of cost):

Federal Tax Credit (30% of Net Cost at Installation): (\$10,316)

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**Net Cost at Install (after incentives): \$24,069**

Net Installed Price per Watt: \$1.47 per watt DC (\$1.50 per watt AC)



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## Cash Flow Details for the System

Cash Flows in Year	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Gross Cost: PV	(57,804)				
O&M Cost: PV	0	(59)	(61)	(63)	(65)
Utility Bill Savings with Inflation Applied	0	2,904	3,013	3,127	3,245
<u>Solar Electric (PV) Incentives</u>					
CPS Energy - Solar PV Rebate: Residential (Tier2) Local installer: \$1.60/watt AC (max. \$ 25k or 50% of cost)	23,419	0	0	0	0
Federal Tax Credit (30% of Net Cost at Installation)	10,316	0	0	0	0
Total Incentives	33,735	0	0	0	0
Loan Principal & Payments	34,385	0	(1,968)	(1,968)	(1,968)
Tax Savings on Loan Interest Paid	0	0	564	560	555
<b>Net Annual Cash Flow</b>	<b>10,316</b>	<b>2,845</b>	<b>1,548</b>	<b>1,656</b>	<b>1,767</b>
Cumulative Cash Flow	10,316	13,161	14,709	16,365	18,132

Net Annual Cash Flow is the sum of values in gray lines.

Cash Flows in Year	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
O&M Cost: PV	(66)	(68)	(70)	(72)	(74)
Utility Bill Savings with Inflation Applied	3,368	3,494	3,626	3,764	3,905
Loan Principal & Payments	(1,968)	(1,968)	(1,968)	(1,968)	(1,968)
Tax Savings on Loan Interest Paid	550	545	540	535	529
<b>Net Annual Cash Flow</b>	<b>1,884</b>	<b>2,003</b>	<b>2,128</b>	<b>2,259</b>	<b>2,392</b>
Cumulative Cash Flow	20,016	22,019	24,147	26,406	28,798

Cash Flows in Year	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>
O&M Cost: PV	(76)	(78)	(81)	(83)	(85)
Utility Bill Savings with Inflation Applied	4,053	4,205	4,365	4,529	4,700
Loan Principal & Payments	(1,968)	(1,968)	(1,968)	(1,968)	(1,968)
Tax Savings on Loan Interest Paid	523	516	509	502	495
<b>Net Annual Cash Flow</b>	<b>2,532</b>	<b>2,675</b>	<b>2,825</b>	<b>2,980</b>	<b>3,142</b>
Cumulative Cash Flow	31,330	34,005	36,830	39,810	42,952



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## Cash Flow Details for the System

Cash Flows in Year	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>
O&M Cost: PV	(87)	(90)	(92)	(95)	(98)
Utility Bill Savings with Inflation Applied	4,878	5,062	5,253	5,451	5,657
Loan Principal & Payments	(1,968)	(1,968)	(1,968)	(1,968)	(1,968)
Tax Savings on Loan Interest Paid	487	479	470	461	451
<b>Net Annual Cash Flow</b>	<b>3,310</b>	<b>3,482</b>	<b>3,663</b>	<b>3,849</b>	<b>4,042</b>
Cumulative Cash Flow	46,262	49,744	53,407	57,256	61,298

Cash Flows in Year	<u>20</u>	<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>
O&M Cost: PV	(17,369)	(103)	(106)	(109)	(112)
Utility Bill Savings with Inflation Applied	5,870	6,092	6,321	6,560	6,807
Loan Principal & Payments	(1,968)	0	0	0	0
Tax Savings on Loan Interest Paid	441	0	0	0	0
<b>Net Annual Cash Flow</b>	<b>(13,026)</b>	<b>5,989</b>	<b>6,215</b>	<b>6,451</b>	<b>6,695</b>
Cumulative Cash Flow	48,272	54,261	60,476	66,927	73,622

Cash Flows in Year	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>
O&M Cost: PV	(115)	0	0	0	0
Utility Bill Savings with Inflation Applied	7,064	0	0	0	0
<b>Net Annual Cash Flow</b>	<b>6,949</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Cumulative Cash Flow	80,571	0	0	0	0











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**River Road  
Neighborhood Association  
Historic Resources Committee  
Award  
for  
Outstanding Historic Restoration**

CLOSED  
CIRCUIT  
TELEVISION  
ON PREMISES

River Road  
Neighborhood Association  
Historic Resources Committee  
Award  
for  
Outstanding Historic Restoration





  
River Park  
Neighborhood  
Historic Resource  
Award  
for  
Outstanding History









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