INSOURCE RENEWABLES

PROPOSAL

Solar Photovoltaic (PV) System

PREPARED FOR:

Whitney King

84 West River Rd
Waterville, ME 04901

PREPARED BY:

INSOURCE RENEWABLES

www.insourcerenewables.com | (207) 659-1054

INSOURCE RENEWABLES

SOLAR PHOTOVOLTAIC (PV) SYSTEM PROPOSAL

Client name(s)	Whitney King
Site address	84 West River Rd
Town	Waterville
Zip Code	04901
Prepared by	Vaughan Woodruff
Date	March 4, 2016

SYSTEM SUMMARY

5.04 kW roof-mounted system

Modules	18 REC	TP280
Inverter(s)	1 SolarEdge	SE7600A-US
Racking	SnapNRack Series 100UL	

Installed price	$15,595.00
Federal tax credit	-$4,678.50
Net cost	$10,916.50

Cost of doing nothing*	$19,623.14

* the "Cost of Doing Nothing" represents the projected cost of buying electricity for the next 25 years from the utility instead of generating it yourself

SYSTEM LAYOUT

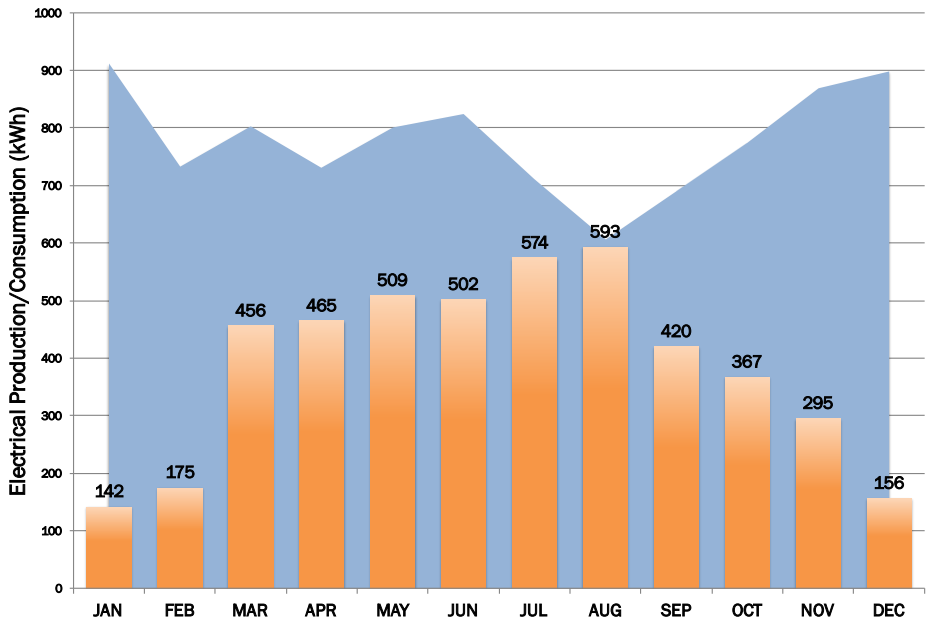
SYSTEM DESCRIPTION

The proposed system is a 5.04 kW roof-mounted system on the southeast-facing garage roof. The array is comprised of 18 REC TP280 modules installed on SnapNRack Series 100UL mounting hardware. The system utilizes a SolarEdge SE7600A-US inverter with DC optimizers.

The proposed array is arranged as illustrated in the aerial photo above.

This system is expected to offset roughly 40-50% of your existing electricity consumption

COMPARISON OF ESTIMATED PV SYSTEM PRODUCTION TO EXISTING ELECTRICITY CONSUMPTION



The chart to the left illustrates the estimated production of the solar photovoltaic (PV) system in comparison to your projected electrical consumption.

The columns in the chart represent the projected electrical generation of the PV system; the shaded area in the background represents your projected electrical consumption.

Months where the columns are taller than the shaded area represent months where solar generation exceeds your electrical consumption. "Net metering" allows you to utilize this excess generation during months when your electricity demand exceeds the generation from your PV system. You have up to 12 months to use this excess electricity, which is accounted for on your electricity bill.

When you generate more electricity than you use, you will still owe the electrical utility a minimum monthly service charge.

PHOTOVOLTAIC (PV) SYSTEM BENEFITS

FINANCIAL BENEFITS

The most tangible benefits of a solar photovoltaic (PV) system are the federal tax credit and the cost savings from generating your own electricity. These benefits help to offset the initial investment for the system installation.

Through December 31, 2019, a 30% **federal tax credit** is available based upon the total installed cost of the system and any site preparation (e.g. tree cutting) required. This tax credit serves to offset the tax liability you have to the IRS based upon your income tax filing for the year the system is installed. The federal tax credit value presented here is the maximum tax credit you can receive from your project. The actual value of the tax credit is heavily dependent upon your specific tax situation, and you should inquire with your tax preparer to determine this value.	$4,678.50 FEDERAL TAX CREDIT
The value of the **electrical savings from your system** is estimated by utilizing PV Watts, a program developed by the U.S. Department of Energy. This model uses historical climate data for selected cities in the U.S. and information regarding the orientation of your solar array, the type of equipment being used, and the amount of shading at your site. WIth this information, PV Watts provides monthly estimates of system production for the first year of the system.	4,654 kWh ESTIMATED ELECTRICAL SAVINGS - YEAR ONE
Your PV system is expected to have a service life of 35-40 years. During this time, the inverter(s) may need to be replaced. When considering the lifetime savings of your system, we typically use a conservative service life of 25 years, which coincides with the performance guaranty for the modules. The **total estimated 25-year electrical savings** accounts for the expected degradation in solar module performance over time.	107,079 kWh TOTAL ESTIMATED 25-YEAR ELECTRICAL SAVINGS
The rate structure for Maine's electrical utilities varies by provider and the type of account you have with the utility. We analyze your existing monthly electrical usage and compare it to the monthly output provided by PV Watts to determine the most accurate **estimated cost savings** we can. The actual value will depend upon the amount of available solar radiation, which varies each year, and your ongoing electrical usage.	$629.84 ESTIMATED COST SAVINGS - YEAR ONE
Historically, electricity rates have increased over time. The **total estimated 25-year cost savings** is based upon these historical trends and the estimated annual degradation of the solar modules used in the system.	$19,623.14 TOTAL ESTIMATED 25-YEAR COST SAVINGS
One method for evaluating the cost effectiveness of a system installation is to calculate the system's **simple payback**. This is determined by dividing the net cost of the system by the estimated cost savings in year one. This simple metric for considering system payback ignores a number of key considerations, including any increase in property value due to the system installation, the increasing cost of electricity, the degradation of module performance, and the effects of inflation. This is considered a conservative measure for determining cost effectiveness.	17.3 years SIMPLE PAYBACK
The **equivalent rate of return** is an estimate of the annual increase in your investment based upon the value of the electricity generated by the system and is based upon a 25-year service life. The savings from a solar investment are tax-free.	2.37% EQUIVALENT RATE OF RETURN

ENVIRONMENTAL BENEFITS

Another important benefit of PV systems is their ability to avoid the use of dirtier fuels to provide electricity. This is especially important in the summer, when the output of a PV system often coincides directly with the peak demand required to reduce air conditioning. This peak requires some of the dirtiest power plants to meet the high electrical demand.

We estimate the **avoided carbon emissions in year one** by comparing the estimated electrical savings to the Carbon Dioxide Emissions Factors published by the Efficiency Maine Trust based upon our electrical supply. Currently, the generation of a kilowatt-hour of electricity through conventional means releases an average of 1.026 pounds of CO_2 in Maine.	4,775 lbs ESTIMATED AVOIDED CARBON EMISSIONS - YEAR ONE
The total estimated **25-year avoided carbon emissions** accounts for the expected degradation in solar module performance.	109,863 lbs ESTIMATED 25-YEAR AVOIDED CARBON EMISSIONS
The avoided carbon emissions from a PV system over its lifetime are quite impressive. One method for understanding the scale of the avoided carbon emissions from a PV system is to compare its CO_2 benefits to other measures. The savings can be compared to the **equivalent gasoline consumption** by an automobile with average fuel efficiency or by considering the **number of mature trees that would be required to remove the equivalent amount of CO_2**.	27,197 gallons EQUIVALENT GASOLINE CONSUMPTION 92 NUMBER OF MATURE TREES TO REMOVE EQUIVALENT CO_2

SOCIETAL BENEFITS

In 2014, the Maine Public Utilities Commission completed a study to determine the benefit of PV electricity generated in Maine. The study considered the numerous benefits provided by solar, which include the reduction in carbon emissions, the ability to reduce wear and tear on our existing electrical infrastructure, and the coincidence of solar production with the most expensive electricity provided to the grid by conventional power plants. The study concluded that over the next 25 years the total societal benefits of solar electricity is 33.8 cents per kilowatt-hour.

When you install a grid-tied PV system, you are providing benefits to your neighbors that do not show up on your electrical bill. The **additional benefit to Maine of electricity generated by the proposed system** represents the additional unpaid value that your system is expected to add to the grid during the next 25 years.	$16,569.58 ADDITIONAL BENEFIT TO MAINE

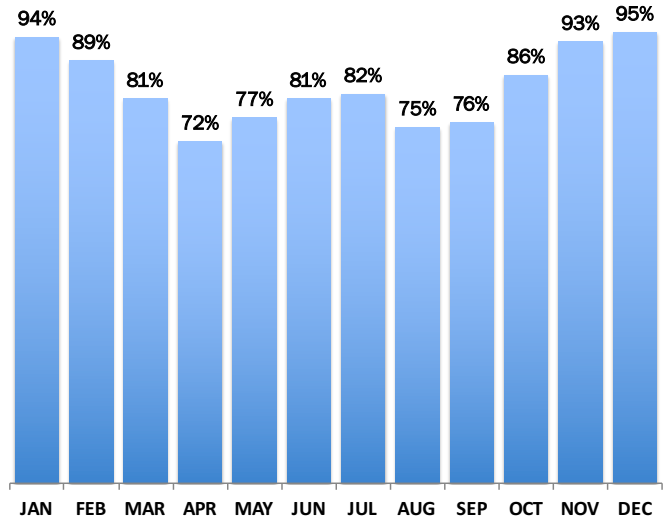
SYSTEM SPECIFICATION SUMMARY

Mounting type	roof-mounted system
Tilt	34
Azimuth[1]	135
Roof type	Asphalt shingle
Solar access[2]	81%
PV Watts derating[3]	15%
Current electrical rate	$0.13

Inverter type	String inverter with optimizers
Number of modules	18
Module output[4]	280 W
System size[5]	5.04 kW
PV Watts annual output[6]	4,654 kWh
Full annual retail value[7]	$598.49

SOLAR ACCESS[2]	
January	94%
February	89%
March	81%
April	72%
May	77%
June	81%
July	82%
August	75%
September	76%
October	86%
November	93%
December	95%
Weighted Average[8]	81%

SOLAR ACCESS[2]



SHADING NOTES

Shading due primarily to trees to east of house; some shading occurs from upper house roof

Notes:

1 *Azimuth:* the angle that the solar array faces in respect to true north; an azimuth of 180 degrees is true south and an azimuth of 90 degrees is east

2 *Solar access:* the percentage of solar radiation that strikes an array in comparison to a fully unshaded site

3 *PV Watts derating:* the efficiency losses due to various factors, including voltage drop in wiring, inverter efficiency, minimal shading, and soiling

4 *Module output:* rated output of each solar module based upon standard test conditions of temperature and solar radiation; used to compare modules

5 *System size:* rated output of the array based upon standard test conditions

6 *PV Watts annual output:* the adjusted output from PV Watts after considering shading (including that from snow)

7 *Full annual retail value:* the total electricity generated by the system in a year multiplied by the current electrical rate; this value is often used to calculate the system payback, though this full benefit may not be realized due to the electrical rate structure of the utility (see "System Benefits" for a more precise calculation)

8 *Weighted average:* based upon the solar access for each month based upon the available solar radiation for that month; i.e. shading in July is more significant than shading in December due to the amount of solar radiation available in summer

ENERGIZING LIFE TOGETHER

REC

REC TWINPEAK BLK SERIES

PREMIUM SOLAR PANELS WITH SUPERIOR PERFORMANCE

REC TwinPeak BLK Series solar panels feature an innovative design with high panel efficiency and power output, enabling customers to get the most out of the space used for the installation.

Combined with industry-leading product quality and the reliability of a strong and established European brand, REC TwinPeak BLK panels are ideal for residential and commercial rooftops worldwide.

inter solar award 2015 WINNER

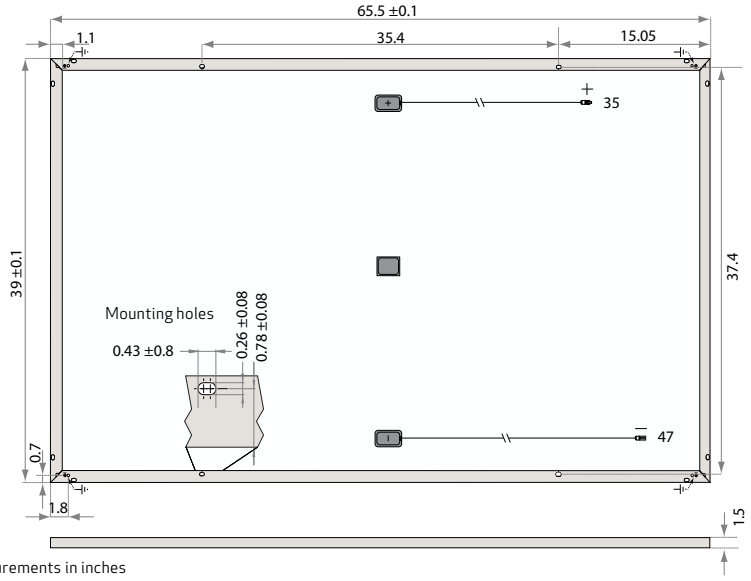
MORE POWER OUTPUT PER M²

HIGHER ENERGY YIELD

100% PID FREE

REDUCES BALANCE OF SYSTEM COSTS

REC TWINPEAK BLK SERIES



All measurements in inches

17.0% EFFICIENCY

10 YEAR PRODUCT WARRANTY

25 YEAR LINEAR POWER OUTPUT WARRANTY

DUTY FREE — US IMPORT DUTY FREE

TEMPERATURE RATINGS

Nominal Operating Cell Temperature (NOCT)	44.6°C (±2°C)
Temperature Coefficient of P_{MPP}	-0.39 %/°C
Temperature Coefficient of V_{OC}	-0.31 %/°C
Temperature Coefficient of I_{SC}	0.045 %/°C

ELECTRICAL DATA @ STC	REC265TP	REC270TP	REC275TP	REC280TP
Nominal Power - P_{MPP} (Wp)	265	270	275	280
Watt Class Sorting - (W)	0/+5	0/+5	0/+5	0/+5
Nominal Power Voltage - V_{MPP} (V)	31.1	31.2	31.4	31.9
Nominal Power Current - I_{MPP} (A)	8.53	8.66	8.76	8.78
Open Circuit Voltage - V_{OC} (V)	38.3	38.6	38.8	39.2
Short Circuit Current - I_{SC} (A)	9.21	9.29	9.40	9.44
Panel Efficiency (%)	16.1	16.4	16.7	17.0

Analysed data demonstrates that 99.7% of panels produced have current and voltage tolerance of ±3% from nominal values.
Values at standard test conditions STC (airmass AM 1.5, irradiance 1000 W/m², cell temperature 25°C).
At low irradiance of 200 W/m² (AM 1.5 and cell temperature 25°C) at least 94% of the STC panel efficiency will be achieved.

GENERAL DATA

Cell type:	120 REC HC multi-crystalline 6 strings of 20 cells (6" x 3")
Glass:	1/8" (3.2 mm) solar glass with anti-reflective surface treatment
Back sheet:	Double layer highly resistant polyester (white)
Frame:	Anodized aluminum (black)
Junction box:	3-part with bypass diodes IP67 rated 4 mm² solar cable, 35" + 47"
Connectors:	Multi-Contact MC4 (4 mm²)

ELECTRICAL DATA @ NOCT	REC265TP	REC270TP	REC275TP	REC280TP
Nominal Power - P_{MPP} (Wp)	195	198	202	205
Nominal Power Voltage - V_{MPP} (V)	28.8	28.9	29.0	29.5
Nominal Power Current - I_{MPP} (A)	6.77	6.87	6.95	6.97
Open Circuit Voltage - V_{OC} (V)	35.2	35.5	35.7	36.1
Short Circuit Current - I_{SC} (A)	7.32	7.38	7.47	7.50

Nominal operating cell temperature NOCT (800 W/m², AM 1.5, windspeed 1 m/s, ambient temperature 20°C).

MAXIMUM RATINGS

Operational Temperature:	-40 ... +85°C
Maximum System Voltage:	1000 V
Design Load*:	75.2 lbs/ft² (3600 Pa) 33.4 lbs/ft² (1600 Pa) *Refer to installation manual
Max Series Fuse Rating:	15 A
Max Reverse Current:	15 A

CERTIFICATION

C SA US · CE · DVE

UL 1703, - Fire classification Type 2
IEC 61215, IEC 61730;
IEC 61701 (Salt Mist - severity levels 1 & 6)

WARRANTY

10 year product warranty.
25 year linear power output warranty
(max. degression in performance of 0.7% p.a.).

MECHANICAL DATA

Dimensions:	65 1/2 x 39 x 1 1/2 in
Area:	17 3/4 ft²
Weight:	39 1/2 lbs

Note! All given specifications are subject to change without notice at any time.

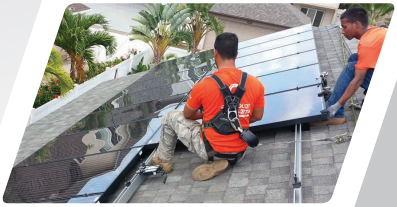
REC is the largest European brand of solar panels, with more than 15 million high-quality panels produced at the end of 2014. With integrated manufacturing from polysilicon to wafers, cells, panels and turnkey solar solutions, REC strives to help meet the world's growing energy needs. In partnership with a sales channel of distributors, installers, and EPCs, REC panels are installed globally. Founded in 1996, REC is a Bluestar Elkem company with headquarters in Norway and operational headquarters in Singapore. REC's 1,800 employees worldwide generated revenues of USD 680 million in 2014.

REC

www.recgroup.com

Ref: NE-05-07-04-D 11.15

Making PV Modules **Smarter**



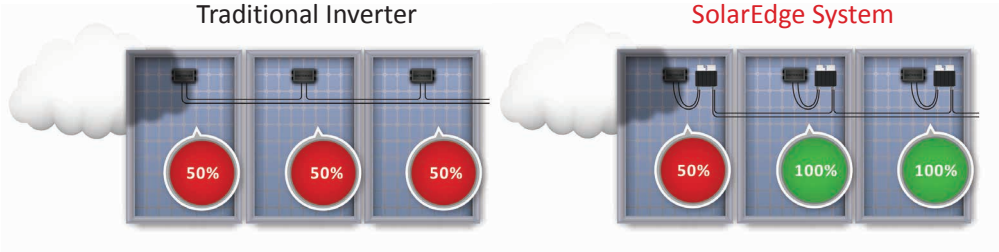
Connecting SolarEdge power optimizers to PV modules makes them **SMART MODULES** that produce **MORE POWER**

More Energy From The Sun

MAXIMUM POWER FROM EACH MODULE

In a PV system, each module has an individual maximum power point. Differences between neighboring modules results in power loss. For example:

With traditional inverters, the weakest module reduces the performance of all modules. **With SolarEdge, each module produces the maximum energy, and power losses are eliminated.**



MORE MODULES ON YOUR ROOF; AND MORE SAVINGS ON YOUR BILL

Traditional Inverter

SolarEdge System

With SolarEdge

Installers can place more modules on the rooftop with SolarEdge and give you the design that you want:

- ✓ Shaded areas
- ✓ Multiple roof angles
- ✓ More options to fit the roof size
- ✓ Free from electrical constraints

> SolarEdge For Your Peace of Mind

CONNECT ON THE GO

> Full visibility of system performance
> Monitor your system, from anywhere using free iPhone and Android applications

PEACE OF MIND

> With SolarEdge, whenever AC power is off, DC wires are designed to automatically de-energize providing automatic protection to installers, maintenance personnel, firefighters and property
> Installers, maintenance personnel and firefighters are automatically protected from high voltage

SYSTEM LIFETIME WARRANTY

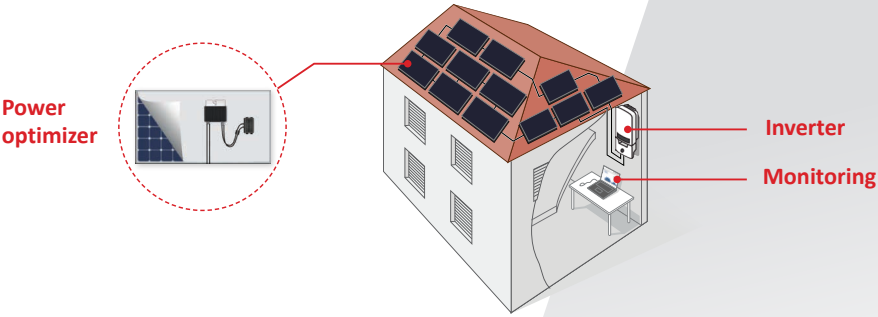
> Backed by best in class warranties: 25 years standard for optimizers; 12 years standard extendable to 25 years for inverters
> Monitoring: free for 25 years

solaredge

Making PV Modules Smarter

THE SOLAREDGE SOLUTION

As a PV inverter and power optimization leader, SolarEdge has shipped more than 2.5 GW of its DC optimized inverter solutions to more than 91 countries. SolarEdge's cutting edge technology gives you smart system control that manages your array for maximum performance.



POWER OPTIMIZER

By connecting a SolarEdge power optimizer to a PV module it becomes a smart module. This allows:

- Harvest of up to 25% more energy from each module
- Constant feedback on the performance of each module
- Designed to automatically shutdown each module for maximum safety in case of an emergency

INVERTER

A simpler and more reliable inverter:

- Responsible only for DC to AC conversion, as all other functions are handled separately for each module by the power optimizers
- Compact, light weight and simple design

MONITORING

By displaying real-time performance data, the monitoring portal allows:

- Visibility of your system's performance
- Easy access from a computer, smartphone, or tablet

solaredge

solaredge

INVERTERS

SolarEdge Single Phase Inverters

For North America

SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US /
SE7600A-US / SE10000A-US / SE11400A-US

The best choice for SolarEdge enabled systems

- Integrated arc fault protection (Type 1) for NEC 2011 690.11 compliance
- Superior efficiency (98%)
- Small, lightweight and easy to install on provided bracket
- Built-in module-level monitoring
- Internet connection through Ethernet or Wireless
- Outdoor and indoor installation
- Fixed voltage inverter, DC/AC conversion only
- Pre-assembled Safety Switch for faster installation
- Optional – revenue grade data, ANSI C12.1

Single Phase Inverters for North America

SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US / SE7600A-US / SE10000A-US / SE11400A-US

	SE3000A-US	SE3800A-US	SE5000A-US	SE6000A-US	SE7600A-US	SE10000A- US	SE11400A-US	
OUTPUT								
Nominal AC Power Output	3000	3800	5000	6000	7600	9980 @ 208V 10000 @240V	11400	VA
Max. AC Power Output	3300	4150	5400 @ 208V 5450 @240V	6000	8350	10800 @ 208V 10950 @240V	12000	VA
AC Output Voltage Min.-Nom.-Max.[1] 183 - 208 - 229 Vac	-	-	✓	-	-	✓	-	
AC Output Voltage Min.-Nom.-Max.[1] 211 - 240 - 264 Vac	✓	✓	✓	✓	✓	✓	✓	
AC Frequency Min.-Nom.-Max.[1]	59.3 - 60 - 60.5 (with HI country setting 57 - 60 - 60.5)							Hz
Max. Continuous Output Current	12.5	16	24 @ 208V 21 @ 240V	25	32	48 @ 208V 42 @ 240V	47.5	A
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							Yes
INPUT								
Maximum DC Power (STC)	4050	5100	6750	8100	10250	13500	15350	W
Transformer-less, Ungrounded	Yes							
Max. Input Voltage	500							Vdc
Nom. DC Input Voltage	325 @ 208V / 350 @ 240V							Vdc
Max. Input Current[2]	9.5	13	16.5 @ 208V 15.5 @ 240V	18	23	33 @ 208V 30.5 @ 240V	34.5	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity							
Maximum Inverter Efficiency	97.7	98.2	98.3	98.3	98	98	98	%
CEC Weighted Efficiency	97.5	98	97.5 @ 208V 98 @ 240V	97.5	97.5	97 @ 208V 97.5 @ 240V	97.5	%
Nighttime Power Consumption	< 2.5					< 4		W
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, RS232, Ethernet, ZigBee (optional)							
Revenue Grade Data, ANSI C12.1	Optional[3]							
Rapid Shutdown – NEC 2014 690.12	Functionality enabled when SolarEdge rapid shutdown kit is installed[4]							
STANDARD COMPLIANCE								
Safety	UL1741, UL1699B, UL1998 , CSA 22.2							
Grid Connection Standards	IEEE1547							
Emissions	FCC part15 class B							
INSTALLATION SPECIFICATIONS								
AC output conduit size / AWG range	3/4" minimum / 16-6 AWG					3/4" minimum / 8-3 AWG		
DC input conduit size / # of strings / AWG range	3/4" minimum / 1-2 strings / 16-6 AWG					3/4" minimum / 1-2 strings / 14-6 AWG		
Dimensions with Safety Switch (HxWxD)	30.5 x 12.5 x 7.2 / 775 x 315 x 184					30.5 x 12.5 x 10.5 / 775 x 315 x 260		in / mm
Weight with Safety Switch	51.2 / 23.2		54.7 / 24.7			88 .4 / 40.1		lb / kg
Cooling	Natural Convection				Natural convection and internal fan (user replaceable)	Fans (user replaceable)		
Noise	< 25					< 50		dBA
Min.-Max. Operating Temperature Range	-13 to +140 / -25 to +60 (-40 to +60 version available[5])							˚F / ˚C
Protection Rating	NEMA 3R							

(1) For other regional settings please contact SolarEdge support.
(2) A higher current source may be used; the inverter will limit its input current to the values stated.
(3) Revenue grade inverter P/N: SExxxxA-US000NNR2 (for 7600W inverter:SE7600A-US002NNR2).
(4) Rapid shutdown kit P/N: SE1000-RSD-S1.
(5) -40 version P/N: SExxxxA-US000NNU4 (for 7600W inverter:SE7600A-US002NNU4).

SUNSPEC ALLIANCE RoHS

SnapNrack™
Solar Mounting Solutions

snapnrack.com

Series 100 Residential Roof Mount System

The SnapNrack Series 100 Roof Mount System is an efficient, visually appealing, photovoltaic (PV) module installation system. Series 100 is listed to the UL 2703 for grounding/bonding and fire classification. The System provides an adequate bonding path which has eliminated the need for grounding lugs and washers at each module, and bonding jumpers between splices. In addition to grounding and bonding, the roof mount system, Series 100, is Class A Fire Rated when installed with Type I and Type II Modules. SnapNrack's UL 2703 Certification and Compliance ensures that SnapNrack installers can continue to provide the best in class installations in quality, safety and efficiency.

- Appealing design with built-in aesthetics
- No grounding lugs required for modules
- All bonding hardware is fully integrated
- Rail splices bond rails together, no rail jumpers required
- Proprietary SnapNrack grounding lug snaps in the rail channel
- No drilling of rail or reaching for other tools required
- Class A Fire Rating for Type 1 and 2 modules

System Features Include

Snap in Hardware

Single Tool Installation

Easy Leveling

No Cutting or Drilling

Integrated Wire Management

Preassembled hardware

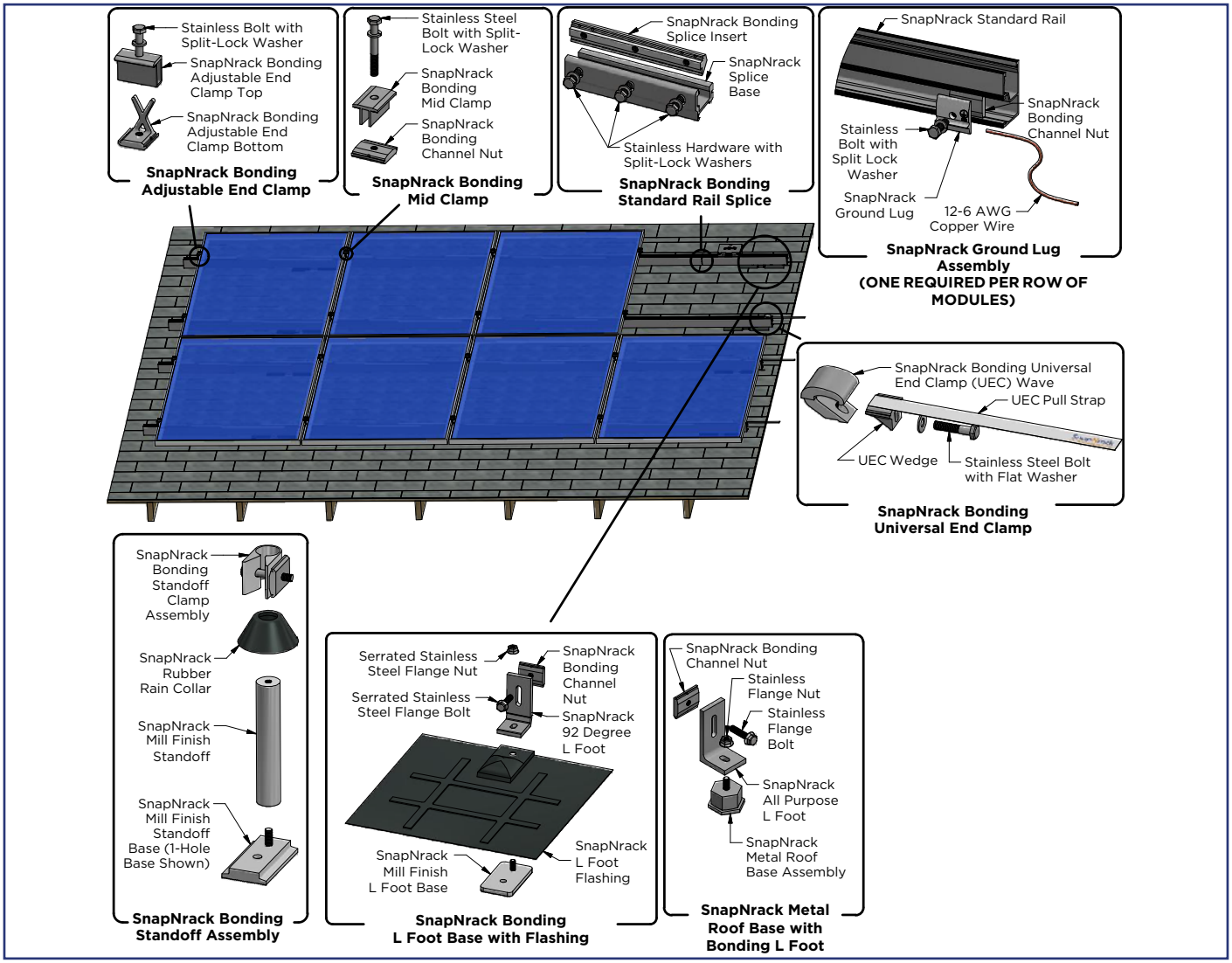
Integrated bonding

UL 2703 Certified

Resources snapnrack.com/resources | **Design** snapnrack.com/configurator | **Where to Buy** snapnrack.com/where-to-buy

SnapNrack™
Solar Mounting Solutions

snapnrack.com



SERIES 100 TECHNICAL DATA

Materials	• 6000 Series aluminum • Stainless steel • Galvanized steel and aluminum flashing
Material Finish	• Clear and black anodized aluminum • Mill finish on select products • Clear of black coated hardware Note: Appearance of mill finish products may vary and change over time.
Wind Loads	110 – 190 mph (ASCE 7-10)
Snow Loads	0 – 120 psf
Roof Pitches	0 – 60 degrees

877-732-2860 | **www.snapnrack.com** | **contact@snapnrack.com**