



ABOUT THE PV PROJECT

Atkinson Electronics developed this larger-sized solar project to gain experience with photovoltaic (PV) commercial solar systems. The Atkinson Electronics engineering team designed the system and the structural design and collector installation was provided by Gardner Engineering of Ogden, Utah. The electrical installation was provided by Atkinson's in-house electricians. Since the system was started up in August of 2009, the solar production has averaged 50 kilowatts per day and is projected to meet about 20% of Atkinson Electronics' yearly electric bill with a 20-year payback at current electric rates.

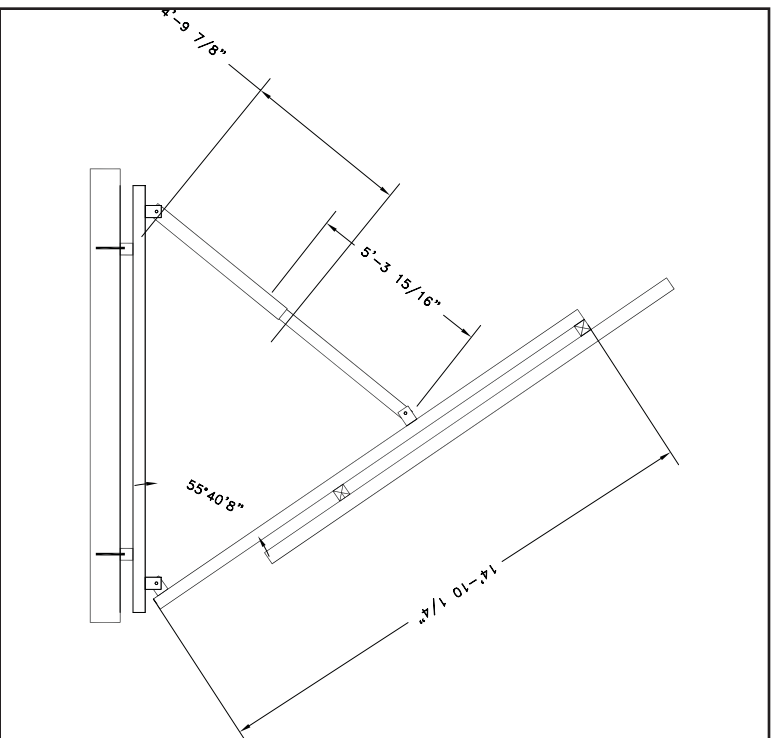
This grid-tie PV solar system installed on the roof of the Atkinson Electronics office building has 48 Evergreen 205 watt PV panels divided into three strings of 16 panels each, or 3.3 KW per string. A total of 9.9 KW feeds a 208 VAC three-phase electrical system. Each string with its own inverter provides one phase converting the 300 volt DC to 208 volt AC. The system uses inverters from three different manufacturers to not only compare the inverter performance, but to also showcase the Atkinson Electronics Solar Performance Automation system by communicating live, electrical production data to be displayed on the Internet. Murray City Power has partnered with Atkinson Electronics in this project by providing a bi-directional meter that displays both the kilowatts of consumption and power sold back to their power grid. It also furnishes data to the Atkinson Electronics automation server for instantaneous web display of the building electrical consumption compared to the power generated by each of the three inverters. For further information, visit www.atkinsonelectronics.com/solar.asp to view this real-time data.

ABOUT ATKINSON ELECTRONICS

Atkinson Electronics was started in 1976 to provide control systems for solar energy projects. Incorporated in 1980, Atkinson has focused on control systems and building automation for large commercial customers. With the current resurgence of solar energy systems, Atkinson has been able to combine its pioneering solar experience with its modern, leading-edge automation technology to reduce complex solar systems to user-friendly, Internet web screens. Atkinson Electronics offers a wide variety of solar energy systems including thermal, photovoltaic, and battery charging. Atkinson Electronics also partners with solar suppliers to provide the automation and energy calculation web servers to validate their system performance.



Evergreen 205 W PV Panel



Adjustable Angle PV Rack

OUR GRID-TIE PV SOLAR PROJECT

The adjustable photovoltaic panel mounting frames provide three angle positions to optimize seasonal solar energy collection. The whole array can be easily tilted to 55° for optimum winter collection, 40° for spring and fall collection, and 25° for summer collection. Tie-down bolts were recently installed on the roof structure during a roof renovation project allowing the solar collectors to be securely attached to the roof trusses without requiring the heavy ballasting often installed on other large arrays. After one year of operation we expect to know what additional energy collection is enabled by the adjustable angles.

Each of the PV panels in its string is wired in series with the others so that a total of 300 volt DC, at approximately 10 amps, feeds into the inverters. Each inverter converts the DC to AC, providing electrical power at 208 V so that it forms one phase of the three-phase electrical system. The PV panels in the solar array are all mounted at the same angle and southern exposure so that the input power to each inverter is as close to identical as possible. In case of an electrical outage from the power grid the inverters shut down to prevent back-powering the grid, which could prove fatal to electrical linemen. This type of PV system is in contrast to PV panels that charge batteries that power inverters to provide backup electrical power during a power outage.

Our office building also has two specialized inverters that serve as a UPS to our network servers, telephone system, and emergency power circuits. These inverters are powered by 24 and 48V battery banks that are charged by other PV solar panels that are separate from this grid-tie network.

OUR 208V 3 PHASE SYSTEM INVERTERS



Sunny Boy SB4000 US



Fronius IG Plus 3.8



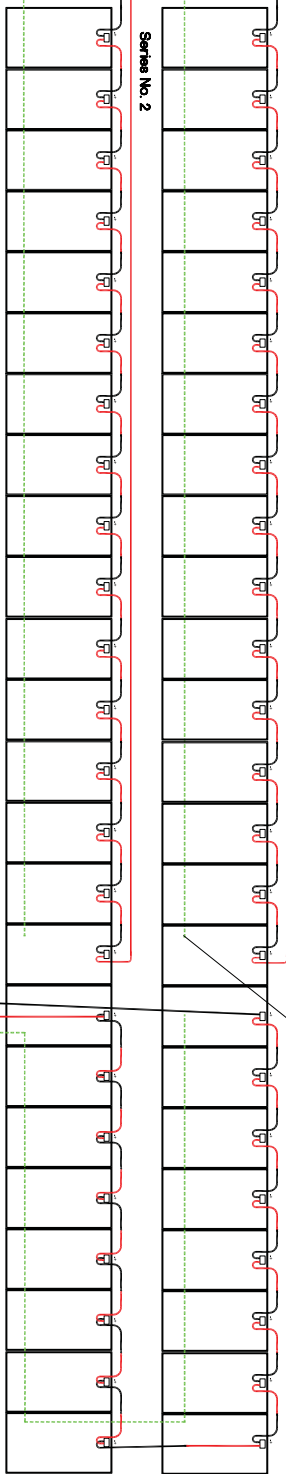
Xantrex GT 3.3N

Series No. 1

3 SETS OF 16- "ENERGREEN" 205 WATT SOLAR PANELS IN SERIES

Series No. 2

6 AWG bare copper solar panel and frame grounding wire (continuous)

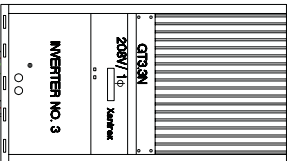
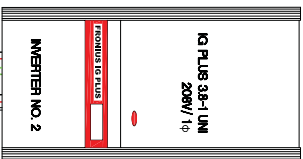
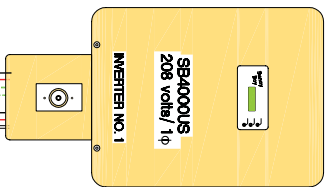


Plaque wording

WARNING ROOFTOP PHOTOVOLTAIC (SOLAR) SYSTEM
 ELECTRIC SHOCK HAZARD, DO NOT TOUCH TERMINALS. TERMINALS ON BOTH LINE IN OPEN POSITION MAY BE ENERGIZED.
 3 - 3,280 WATT SOLAR CIRCUITS
 1) WATT CIRCUIT DATA
 2) WATT VOLTAGE = 338.40 VOLTS DC
 3) WATT VOLTAGE = 423 VOLTS DC
 4) MAX CIRCUIT CURRENT = 10.12 AMPS DC

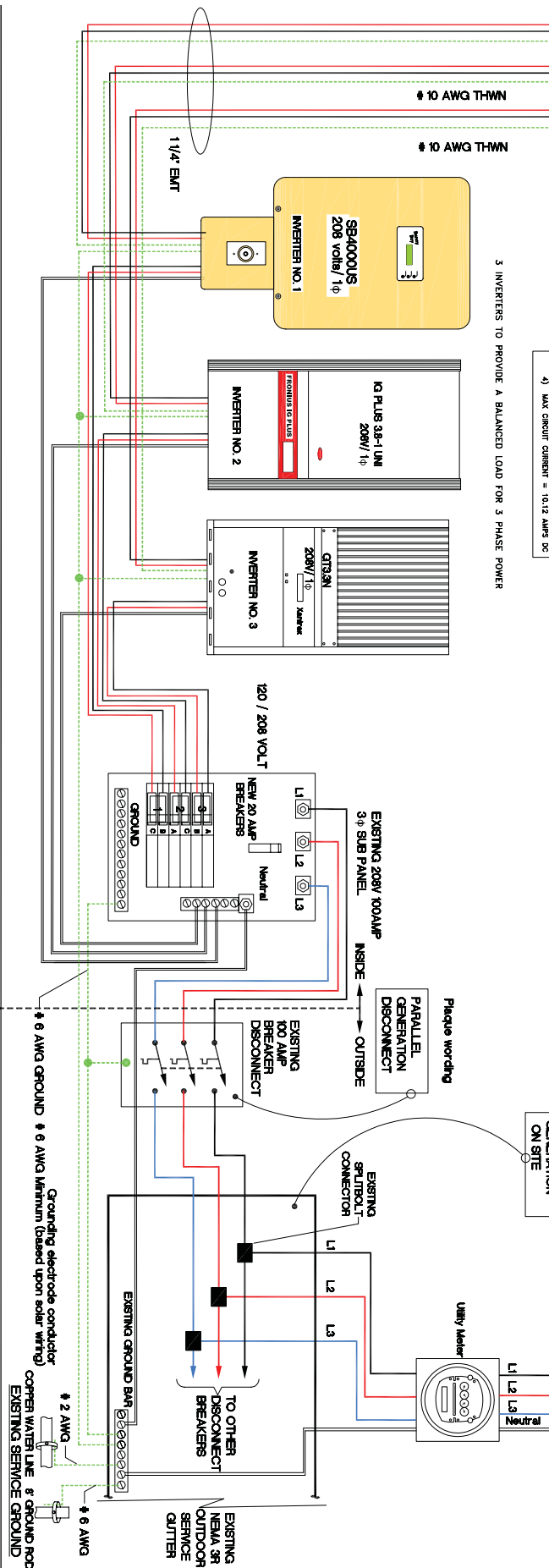
ROOF TOP 600 VOLT RATED DISCONNECTS MOUNT MORE THAN 10' FROM EDGE OF ROOF

10 AWG THWN # 10 AWG THWN
 3 INVERTERS TO PROVIDE A BALANCED LOAD FOR 3 PHASE POWER



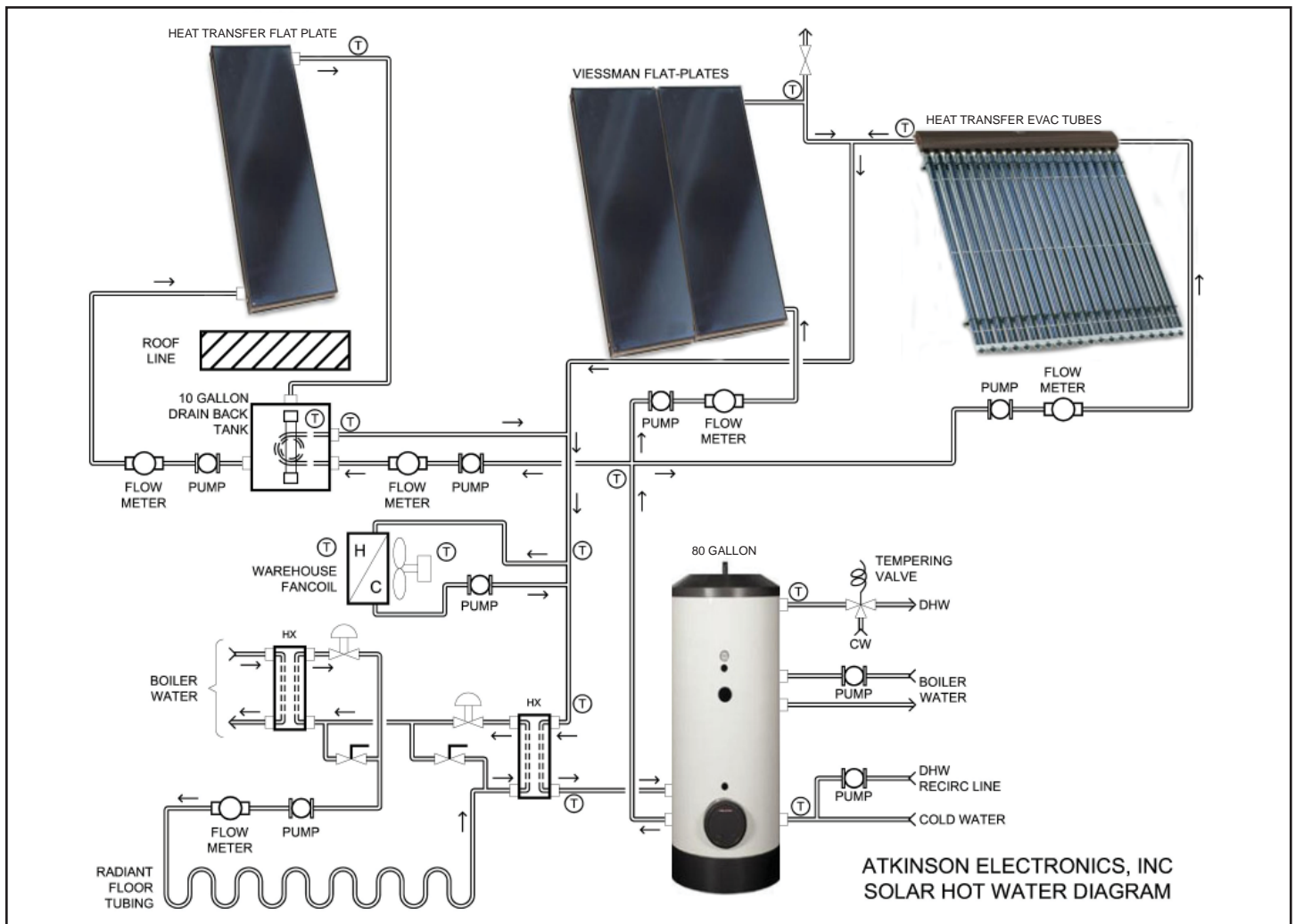
NOTES

1. PV Array contains 3 strings of 16, 205-watt modules in series
2. PV Array wiring #10 AWG USE-2 with factory installed MC connectors
3. Ground - Fault Protection provided in DC/AC Inverter.



KEN GARDNER, P. E., I. S.
 SENIOR ENGINEER ALTERNATIVE ENERGY SERVICES
 OGDEN, UTAH
 PROFESSIONAL CIVIL ENGINEER - UTAH 154270-2202
 PROFESSIONAL LAND SURVEYOR - UTAH 154271-2200
 LICENSED SOLAR CONTRACTOR - UTAH 6399860-5501
 LICENSED ELECTRICIAN - UTAH 154270-5505
 (801) 475-0202 EX. 201 OFFICE
 (801) 589-0447 CELL

 Gardner Engineering 5875 S. Adams Ave. Parkway Suite 200 Ogdens, Utah 84405 (801) 476-0202	ATKINSON ELECTRONICS 9.9 KILOWATT GRID-TIE SOLAR SYSTEM ELECTRICAL LINE DRAWING 14 WEST VINE STREET, MURRAY, UTAH		<table border="1"> <thead> <tr> <th colspan="2">REVISIONS</th> </tr> </thead> <tbody> <tr> <td>DATE</td> <td>DESCRIPTION</td> </tr> <tr> <td>06/24/08</td> <td>CHANGE SERVICE</td> </tr> <tr> <td>06/30/08</td> <td>DETAIL GROUND</td> </tr> </tbody> </table>	REVISIONS		DATE	DESCRIPTION	06/24/08	CHANGE SERVICE	06/30/08	DETAIL GROUND	<table border="1"> <thead> <tr> <th colspan="2">SCALE: N.T.S.</th> </tr> </thead> <tbody> <tr> <td>DATE:</td> <td>MAY 2009</td> </tr> <tr> <td>DESIGN:</td> <td>K.E.G.</td> </tr> <tr> <td>DRAWN:</td> <td>K.E.G.</td> </tr> <tr> <td>CHECKED:</td> <td></td> </tr> </tbody> </table>	SCALE: N.T.S.		DATE:	MAY 2009	DESIGN:	K.E.G.	DRAWN:	K.E.G.	CHECKED:	
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Our Solar Thermal Test Stands

The solar-heated hot water, used for year-round domestic hot water and radiant floor and space heating during the winter, allows the manufacturers to view the actual seasonal and daily BTU production totals for their panels, calculated by the Atkinson Electronics BTU metering and solar performance monitoring software. This showcases the ability of the Atkinson Electronics automation system to control and/or monitor any type of solar systems. In addition, the systems are used for training Atkinson Electronics employees and other interested parties.

OUR SOLAR THERMAL SYSTEM

In addition to the PV array, the roof structure on the Atkinson Electronics office building also has three test stands for solar thermal panels. Different types of thermal collectors have been provided by solar manufacturers and connected into the Atkinson Electronics automation and metering system. This is a joint development project that provides hot water for the Atkinson Electronics office building and real-time solar performance BTU metering data for the benefit of the manufacturers. Currently we are comparing glycol flat plate collectors, glycol evacuated tube collectors, and distilled-water-filled, drain-back, flat plate collectors.