



New Paltz Village Hall Fire Department & Police Department Photovoltaic Systems

The roof mounted solar array consists of 90 Sharp 165 watt modules, total 14,850 watts, in 6 horizontal rows by 15 vertical columns. Dimensions of the array are 79 feet horizontally by 17 feet vertically.

The roof faces 48 degrees east of south. The roof pitch is 9/12 and the module tilt angle is 37°. The array is virtually un-shaded with less than 2% annual shading year round.

Estimated average annual energy output for the total system is 15.5 Mwh, which is equivalent to the electricity used by about 2 average homes.

The system is totally silent, has no moving parts, emits no pollution and uses sunlight as its only fuel source. The expected life of the solar modules is 50+ years.

The solar system actually consists of three independent systems, each supplying power to the Village Hall, Fire Department, and Police Department.

The west-most 9 columns provide input to Sunny Boy 2500U and Sunny Boy 6000U high voltage inverters located in the attic. The top two rows and the 2500U feed the Village Hall. The bottom 4 rows and the 6000U supply the Police Department.

The east-most 6 columns provide input to a Beacon M5 low voltage inverter and battery bank, also in the attic. This system feeds power to the Fire Department, and the battery bank supplies power to radio chargers, garage doors, and some lights in the event of a power failure.

Environmental Benefits: ***(AVOIDED Per Year)***

- **8.5 tons** of CO2 (greenhouse gas)
- **7.8 tons** of burned coal
- **1,140 gallons** of crude oil

Environmental Benefits: ***(AVOIDED Over 25 Year module warranty period)***

- **211.6 tons** of CO2 (greenhouse gas)
- **193.8 tons** of burned coal
- **28,493 gallons** of crude oil



New Paltz System Overview – As Built

Engineer: Jeff Irish, Hudson Valley Clean Energy, Inc.

Date: 1 October 2005

This information is supplemental to the three One Line Drawings.

1. PV array is 90 Sharp 165 modules in landscape, total 14,850 Wp, in 6 horizontal rows by 15 vertical columns. Dimensions 78'8" horizontally by 16'8" vertically. The array is centered horizontally on the front or SE roof of the DPW building, and mounted up high with the top edge of the modules within 12" of the roof peak.
2. Roof azimuth is +48 degrees (east of south). Roof pitch is 9/12. Module tilt is 37 degrees.
3. Solar pathfinder analysis shows the upper half of the roof to be virtually unshaded with less than 2% annual shading year round.
4. Estimated average annual energy output for the total system is 15.5 Mwh. Actual output over any 12 month period may be within plus or minus 10% of this number due to normal climatic variations.
5. Mounting hardware is Unirac SolarMount aluminum rails, L-feet and top down clips. Rails run vertically up the roof to permit airflow under the modules. One pair of rails supports each column of modules. 10 L-feet on 48" centers support each pair of rails (5 per rail).
6. The west-most 9 columns provide input to the SB2500U and SB6000U high voltage inverters. Each row of 9 in this field is wired in series. The top two rows feed the SB2500U and the bottom four rows feed the SB6000U. Six junction boxes under column 9, one box per row, terminate the PV leads and are the entry point into the attic below. Metal clad cable AWG#12-2+G feeds from each box down the rafter closest to column 9 to a high voltage fused combiner box mounted about 5 feet off the attic floor. From there 1" EMT takes the combined outputs to the outside DC disconnects.
7. The east-most 6 columns provide input to the Beacon M5 low voltage inverter. Each pair of columns feeds one of the three DC inputs of the M5. Modules are wired 2 in series and a junction box terminates the PV leads of each pair on the roof and provides entry to the attic below. Metal clad cable AWG#10-2+G feeds from each box down the rafter closest to the east to low voltage fused combiner boxes mounted about 5 feet off the attic floor. From there 2" EMT takes the combined outputs to the outside DC disconnect.

New Paltz System Solar Electric System
Checking Operation
Disconnecting Means

Engineer: Jeff Irish, Hudson Valley Clean Energy, Inc.

Date: 1 October 2005

Checking Operation:

The Village of New Paltz Solar Electric Systems are fully automatic and basically maintenance free. On a daily basis, a DPW person should perform the following quick checks during daylight hours:

1. Make sure that all handles on the 5 external disconnects are "UP" indicating closed contacts and normal operation.
2. Verify that the four glass bulb meters on the NE wall are spinning from left to right, keeping in mind that movement may be very slow on cloudy days or in case of snow cover.
3. If the meters are not all spinning and the modules are uncovered by snow in bright daylight, then check the inverters in the attic. Verify that the two on the left have only a green light on and that the inverter on the right has its RUN light on. If not, then call Hudson Valley Clean Energy at 876-3767 and ask for Jeff.

Disconnecting Means:

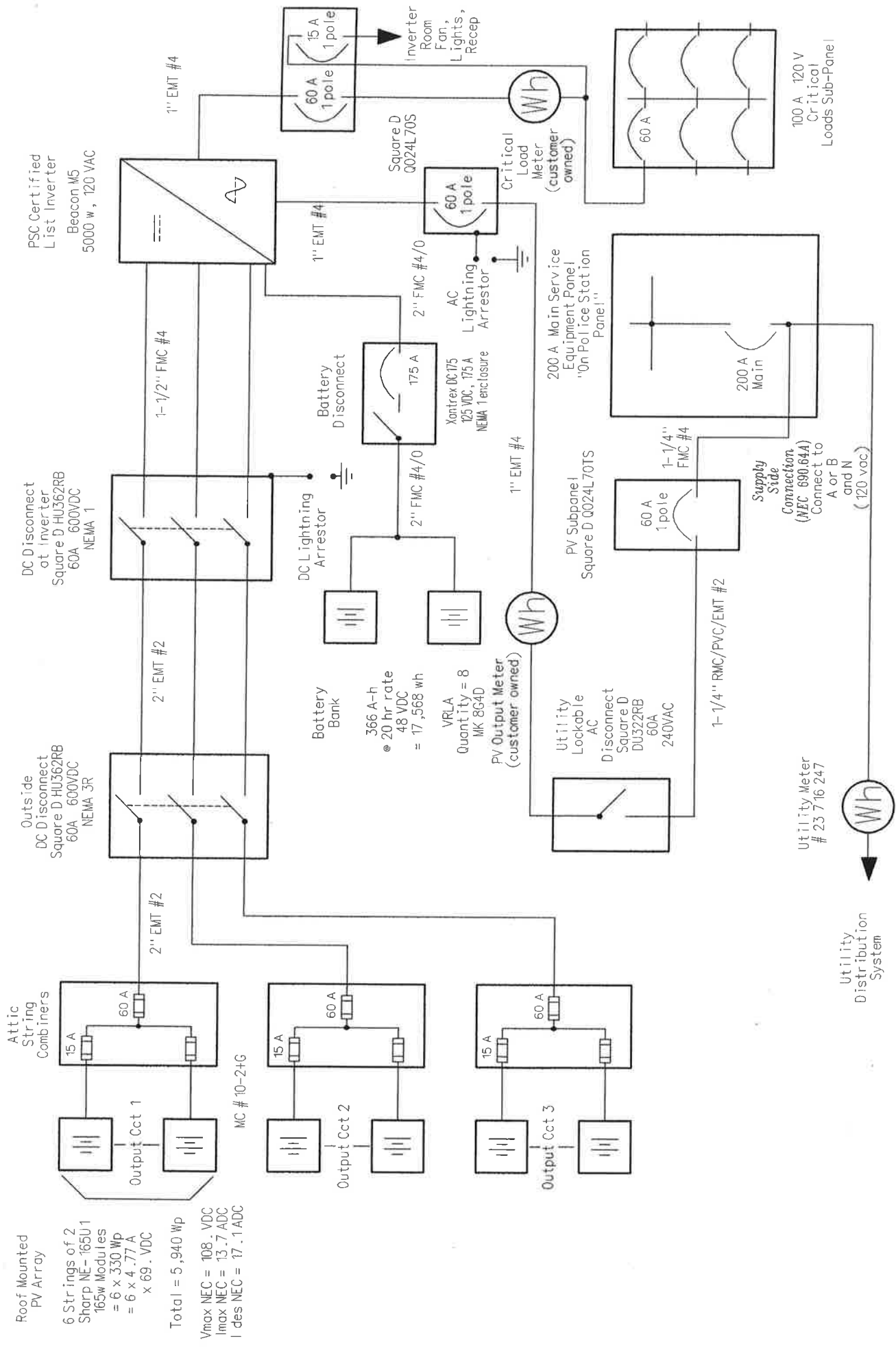
There are multiple ways to shut down the system, any one of which will be sufficient.

1. Turn off the 5 disconnects on the NE wall of the DPW building by pulling the handles down.
2. Turn off the breakers and disconnects in the attic inverter room.
3. Turn off the breakers labeled "Photovoltaic Power Source" in the Boiler Room and Police Equipment Room.

When the system is turned back on, it will take a minimum of 5 minutes to reconnect and produce power as required by state law, and could take up to 10 minutes.

8. The DC output circuits pass through outside DC disconnects located on the NE wall of the DPW garage then to DC disconnects located at the inverters in the inverter room.
9. A small inverter room approximately 9' x 6' x 8' high is constructed at the NE end of the attic to house the inverters and batteries. This room is insulated. A vent has been cut into the building soffit to provide intake air, and another vent in the wall of the room to provide exhaust into the attic. A thermostatically controlled fan moves the air in the summer to help keep the inverter and battery temperatures down. In the winter the room will warm up somewhat from the heat given off by the inverters.
10. A lighting and receptacle circuit has been installed in the inverter room to provide work lighting. It runs off the M5 battery back-up critical load circuit.
11. The inverter room contains the inside DC disconnects, the three inverters, the batteries and battery disconnect, and inside AC disconnects.
12. AC outputs (SB2500U, SB6000U, M5 intertie, and M5 critical loads) and the RS-485 DAS output leave the inverter room and pass through the soffit on the NE side of the building. The 3 intertie outputs pass through 3 subpanels in the inverter room, serving as local disconnects, then 3 AC disconnects mounted on the NE wall. The outputs exit the bottom of the AC disconnects and run underground to the SW corner of the Village Hall Building, then up the wall onto the roof. From there they branch off to the Village electrical room (M5 intertie and SB2500U), the Fire Department subpanel (M5 critical loads), and the Police Department electrical room (SB6000U). Four customer-owned analog "glass bulb" meters are located on the NE wall. They measure cumulative energy for the SB2500U, SB6000U, M5 intertie, and M5 critical loads.
13. The DAS consists of a Sunny Boy Control Plus (SBC+) located inside the lobby. It is linked to the SB2500U and SB6000U by an RS-485 cable. An RS232C cable from the SBC+ feeds data to a BetaBrite display in the Village Hall lobby.
14. The PV array and equipment in the attic are grounded to two ground rods that are installed on the NE end of the building. The inverters are also bonded to the existing ground system in the Police, Fire Department, and Village Hall.

One Line Diagram - Village of New Paltz PV System # 3 (Fire Department)



One Line Diagram - Village of New Paltz PV System # 2 (Police Department)

Pole Mounted PV Arrays

4 Strings of 10 Modules Each
= 1750 Wp x 4
= 7000 Wp total

4 Strings of 9 Sharp NE-165U1 165w Modules
= 4 x 1,485 Wp
= 4 x 4.77 A x 3.11 VDC

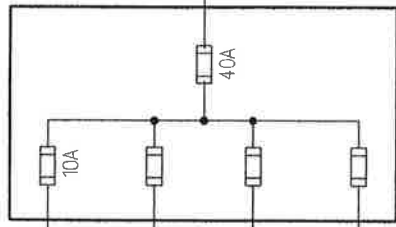
Total = 5,940 Wp

Vmax NEC = 485 VDC

I_{max} NEC = 27.3 ADC

Design NEC = 34.1 ADC

Fused Combiner Box

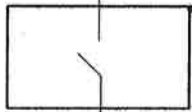


Outside DC Disconnect Square D HU562RB 60A 600VDC NEMA 3R



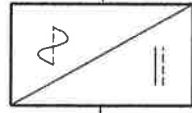
1" EMT #6

DC Disconnect at Inverter Square D HU562 60A 600VDC NEMA 1



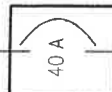
1" FMC #8

PSC Certified List Inverter SMA 6000 U 6000 W 208 VAC



1" FMC #8

Square D Q024L70S



AC Lightning Arrester

1" EMT #4, #8

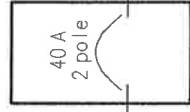
Utility Meter # 15 0 18 353



C-H Distribution System

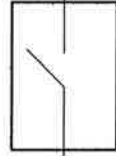
Supply Side Connection (NEC 690.64A)
Connect across any 2 phases

PV Subpanel Square D Q024L70S



1" EMT /FMC #4

Utility Lockable AC Disconnect Square D DU322RB 60A 240VAC



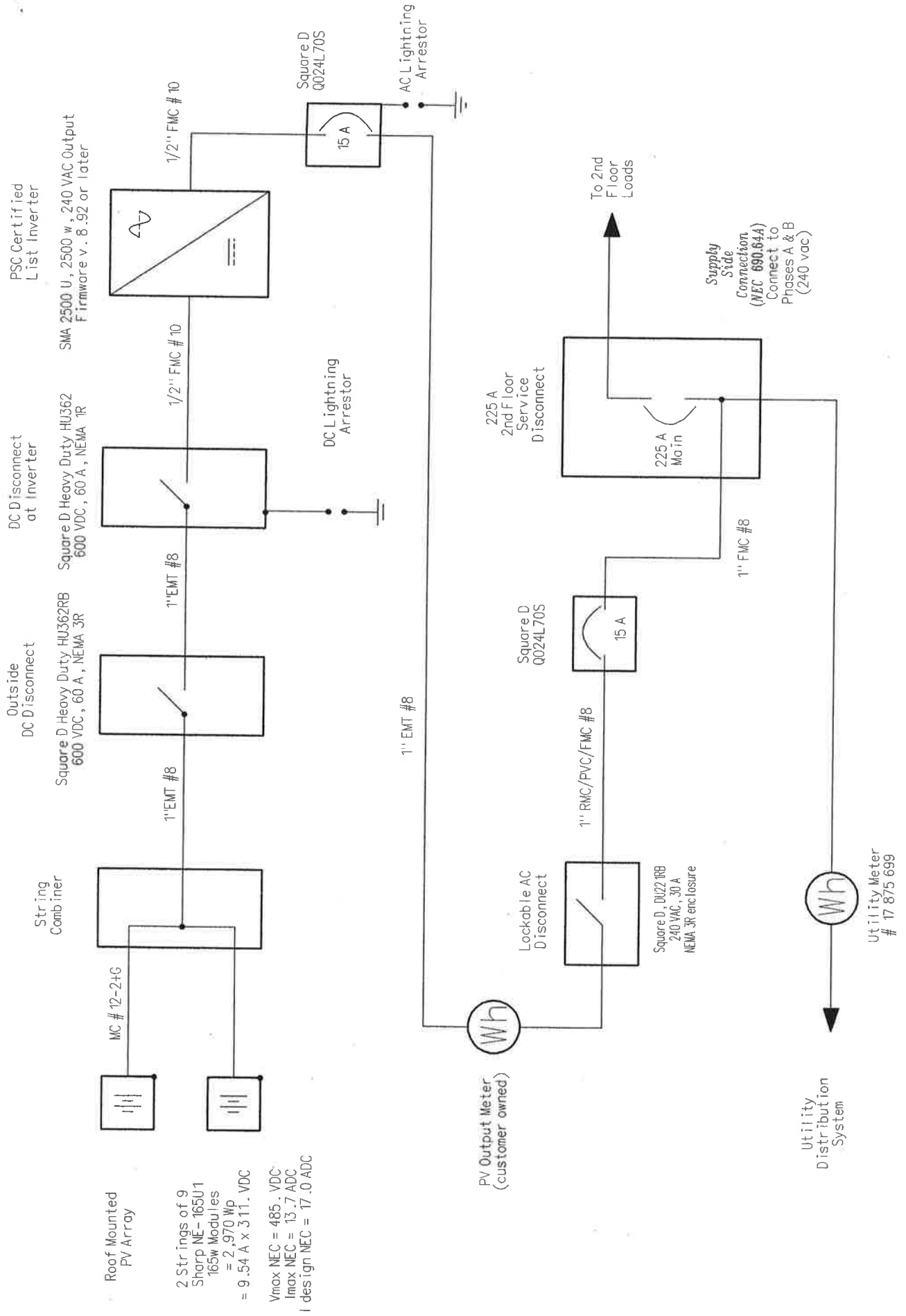
1" EMT / FMC #4, #8

Total System PV Output Meter (customer owned)

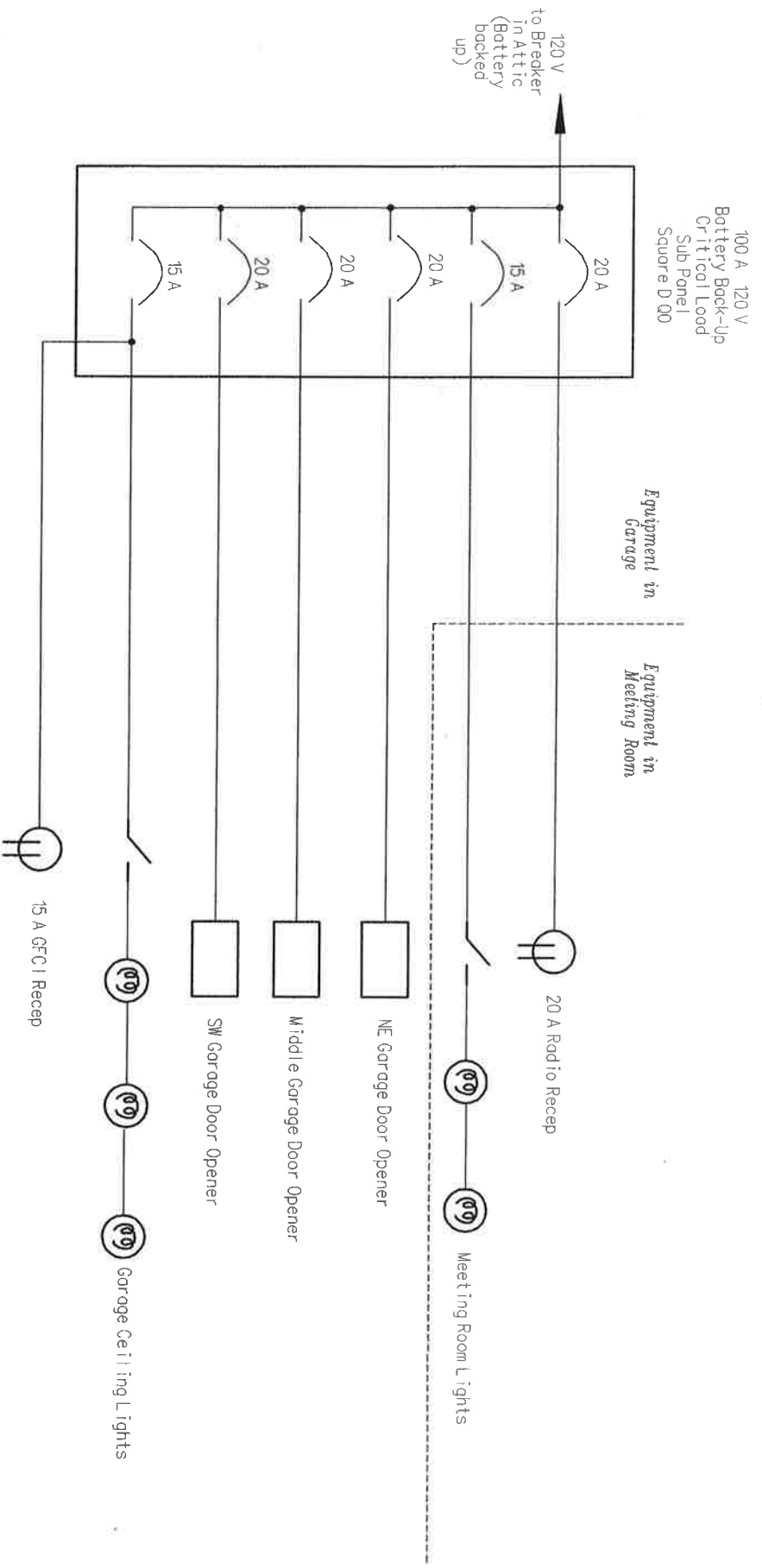


1" RMC/PVC #4, #8

One Line Diagram - Village of New Paltz PV System # 1 (Village Hall)



One Line Diagram - New Palitz Fire Department Critical Loads



All Branch Circuits in # 12 AWG THHN

Monthly Log for Photovoltaic Meters

2019

Readings to be done 1st week of each month

Date	Fire Dept.	Village Hall	Village Hall	Critical load FD	Initials
JAN 3, 2019	15721	42420	78615	27353	RNC
FEB 5, 2019	15473	42420	78958	27589	RNC
MARCH 1 2019	15291	42420	79382	27762	RNC
April 2 2019	15051	42420	80094	27991	RNC
MAY 1 2019	14848	42420	80690	28184	RNC
JULY 1 2019	14384	42420	82031	28629	RNC
Aug. 1, 2019	14111	42420	82808	28894	RNC
Sep 3 2019	13827	42420	83610	29168	RNC
OCT, 2019	13595	42420	84252	29392	RNC
NOV 1 2019	13344	42420	84692	29634	RNC

Fire Dept. 69 920 342

Village Hall 92 174 543

Village Hall 89 597 425

Critical Load F.D. (Battery back-up) 69 601 062

Monthly Log for Photovoltaic Meters

2018

Readings to be done 1st week of each month

Date	Fire Dept.	Village Hall	Village Hall	Critical load FD	Initials
1-3-18	1855.3	4242.0	72518	24699	JNG
2-2-18	18309	4242.0	72831	24872	RNC
3-1-18	18112	42420	73134	25059	RNC
4-2-18	17907	42420	73718	25253	RNC
5-1-18	17706	42420	7427.6	25444	RNC
6-1-18	17456	42420	74934	25686	RNC
7-2-18	17220	42420	75670	25913	RNC
8-1-18	16956	42420	76451	26168	RNC
9-4-18	16662	42420	77171	26453	RNC
10/2/18	16438	42420	77572	26677	RNC
11/1/18	16199	42420	78064	26897	RNC
12/3/18	15955	42420	78291	27130	RNC

total

6,097 produced for the yr

Fire Dept. 69 920 342
 Village Hall 92 174 543
 Village Hall 89 597 425
 Critical Load F.D. (Battery back-up) 69 601 062

Monthly Log for Photovoltaic Meters

2017

Readings to be done 1st week of each month

Date	Fire Dept.	Village Hall	Village Hall	Critical load FD	Initials
1-3-17	21505	40251	65735	21804	RNC
2-2-17	21262	40385	66023	22036	RNC
3-3-17	21035*	40643	66548	22251	RNC
4-3-17	20821*	40959	67154	22455	RNC
6-1-17	20340*	41553	68344	22918	JAG
8-1-17	19818*	41802	69789	23423	RNC
9-6-17	19514*	42059	70626	23717	RNC
10-2-17	19307*	42244	71222	23915	RNC
11-1-17	19065*	42401	71760	24148	RNC
12-1-17	18822*	42419	72180	24382	RNC

? Low

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 Critical Load F.D. (Battery back-up) 69 601 062

Monthly Log for Photovoltaic Meters

2016

Readings to be done 1st week of each month

Date	Fire Dept.	Village Hall	Village Hall	Critical load FD	Initials
1/4/2016	24471	36539	58438	18955	RWC
2/1/2016	* 24243	36745	58857	19173	RWC
3/1/2016	* 24017	36966	59299	19408	RWC
4/1/2016	* 23755	37318	59998	18 639	RWC
5/4/2016	* 23486	37685	60709	19897	RWC
6/1/2016	* 23401	38026	61376	20084	RWC
7/1/2016	* 23075	38447	62181	20311	RWC
8/1/2016	* 22797	38859	62988	20560	RWC
9/6/2016	* 22478	39325	63892	20869	RWC
10/4/2016	* 22244	39606	64449	21095	RWC
12/1/2016	21773	40676	65397	21547	RWC

* SPINNING BACKWARDS

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Village Hall 89 597 425

Critical Load F.D. (Battery back-up) 69 601 062