

**The first three pages are courtesy of Pat Mathieu.**

Pat moderated the Panel session on using two-way satellite while on solar power and using solar power, in general.

Links

<http://www.backwoodssolar.com/interests/RV-Marine.htm>

<http://www.rvsolarelectric.com/custom.htm>

<http://www.altenergystore.com/cart/university/tools/load.html>

**System Loads Worskheet**

Use this work sheet to determine the total amp-hours per day used by all the loads in your system.

**Step 1. Calculate your AC loads. If no AC loads, skip to Step 2.**

1. List all AC loads, wattage and hours of use per week in the space below. Add up all the watt-hours per week to determine AC watt-hours per week.

Description of Load Watts x Hrs/Wk = WH/WK

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Total AC watt-hours per week: \_\_\_\_\_

Note: Wattage of appliances can usually be determined from tags on the back of the appliance or from the owner's manual. If an appliance is rated in amps, multiply amps by operating voltage (120 or 240) to find watts.

2. Actual AC watt-hours per week. Multiply line 1 by 1.15 to correct for inverter loss. \_\_\_\_\_

3. Inverter DC input voltage; usually 12 or 24 volts. This is DC system voltage. \_\_\_\_\_

4. Divide line 2 by line 3. This is total amp-hours per week used by AC loads. \_\_\_\_\_

**Step 2. Calculate your DC loads**

5. List all DC loads in the spaces below:

Description of Load Watts x Hrs/Wk = WH/WK

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Total watt-hours per week: \_\_\_\_\_

6. DC system voltage. Usually 12 or 24 volts. \_\_\_\_\_

7. Total amp-hours per week used by DC loads. Divide line 5 by line 6. \_\_\_\_\_

8. Total amp-hours per week used by AC loads from line 4. \_\_\_\_\_

9. Add lines 7 and 8. This is total amp-hours per week used by all loads. \_\_\_\_\_

10. Divide line 9 by 7 days. \_\_\_\_\_

**This is total average amp-hours per day.**

## Battery Sizing Worksheet

**Use this worksheet to determine what size battery is required for your system.**

1. Total solar array amp hours per day required from Systems Load Worksheet, line 10, page 7. \_\_\_\_\_
2. Maximum number of continuous days of cloudy weather expected in your area during one year. (5 to 10 days in most areas) \_\_\_\_\_
3. Multiply line 1 by line 2. \_\_\_\_\_
4. Divide line 3 by 0.8 to maintain a 20% reserve after deep discharge period. If no special condition, skip to line 10. \_\_\_\_\_
5. Select multiplier below which corresponds to the batteries' wintertime average ambient temperature.

Battery Temperature Multiplier

Battery Temperature	Multiplier
80°F/26.7°C	1.00
70°F/21.2°C	1.04
60°F/15.6°C	1.11
50°F/10.0°C	1.19
40°F/4.4°C	1.30
30°F/-1.1°C	1.40
20°F/-6.7°C	1.59

6. Multiply line 4 by line 5. This is your optimum battery size. \_\_\_\_\_
7. Amp-hours of battery chosen (i.e. L16 is 360. amp hours) \_\_\_\_\_
8. Divide line 6 by line 7. This is the total number of batteries in parallel required. \_\_\_\_\_
9. Round off to the next highest whole number. \_\_\_\_\_
10. Divide the system voltage by the battery voltage. \_\_\_\_\_
11. Multiply line 9 by line 10. \_\_\_\_\_

**This is the total number of batteries required.**

## Array Sizing Worksheet

Use this worksheet to figure the total number of solar modules required for your system.

1. Total average amp-hours per day from the System Loads Worksheet, line 10. \_\_\_\_\_
2. Multiply line 1 by 1.2 to compensate for loss from battery charge/discharge. \_\_\_\_\_
3. Average sun hours per day in your area. \_\_\_\_\_
4. Divide line 2 by line 3. This is total solar array amps required. \_\_\_\_\_
5. Optimum or peak amps of solar module used. See module specifications. \_\_\_\_\_
6. Total number of solar modules in parallel required. Divide line 4 by 5. \_\_\_\_\_
7. Round off to the next highest whole number. \_\_\_\_\_
8. Number of modules in each series string to provide DC Battery voltage: \_\_\_\_\_

DC Battery Voltage	Number of Modules in Each String
12	1
24	2
36	3
48	4

9. Multiply line 7 by line 8. \_\_\_\_\_

**This is the total number of solar modules required.**

**Solar Energy Wire Charts are courtesy of James Turner**

**Wire Size Chart For 12 Volt D.C. Wiring For RV or Ham Radio Use**

This chart is for use with wire sizes #18 through 4/0 exclusively.

Enter the desired maximum allowable percent voltage drop in the box provided below.

This chart is for a voltage drop of  % maximum. 0.36 volts at 12 volts.

Guideline: Use 1.5% for inverter circuits, 2% for charging circuits and 3% for general purpose loads.

**Length of the wire from the battery to the device & back to the battery in feet (both ways)**

Amps		5	10	15	20	25	30	35	40	45	50	55	60	65	70
▼	1	18	18	18	18	18	18	18	18	18	18	18	16	16	16
	2	18	18	18	18	18	16	16	16	14	14	14	14	14	12
	5	16	16	16	14	14	12	12	12	10	10	10	10	10	10
	10	14	14	12	12	10	10	10	8	8	8	8	6	6	6
	15	14	12	10	10	8	8	8	6	6	6	6	4	4	4
	20	12	12	10	8	8	6	6	6	4	4	4	4	4	4
	25	10	10	8	8	6	6	6	4	4	4	4	2	2	2
	30	8	8	8	6	6	4	4	4	4	2	2	2	2	2
	40	6	6	6	6	4	4	4	2	2	2	2	1	1	1
	50	6	6	6	4	4	2	2	2	2	1	1	1/0	1/0	1/0
	60	4	4	4	4	2	2	2	1	1	1/0	1/0	1/0	2/0	2/0
	70	4	4	4	4	2	2	1	1	1/0	1/0	2/0	2/0	3/0	3/0
	80	2	2	2	2	2	1	1	1/0	1/0	2/0	2/0	3/0	3/0	3/0
	90	2	2	2	2	2	1	1/0	1/0	2/0	2/0	3/0	3/0	4/0	4/0
	100	2	2	2	2	1	1/0	1/0	2/0	2/0	3/0	3/0	4/0	4/0	4/0
	125	1	1	1	1	1/0	2/0	2/0	3/0	3/0	4/0	4/0	NR	NR	NR
	150	2/0	2/0	2/0	2/0	2/0	2/0	3/0	4/0	4/0	NR	NR	NR	NR	NR
	175	3/0	3/0	3/0	3/0	3/0	3/0	4/0	4/0	NR	NR	NR	NR	NR	NR
	200	4/0	4/0	4/0	4/0	4/0	4/0	4/0	NR	NR	NR	NR	NR	NR	NR
	225	4/0	4/0	4/0	4/0	4/0	4/0	NR	NR	NR	NR	NR	NR	NR	NR

Notes:

If this is a critical circuit or the load current is greater than 10 amps consider running a separate ground conductor. At levels higher than 10 amps the chassis of the vehicle may have excessive voltage drop.

NR Means Not Recommended.

J. Turner AE6BG SKP # 52081  
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**Wire size in Circular Mils**

	5	10	15	20	25	30	35	40	45	50	55	60	65	70
1	147.2	294.4	441.7	588.9	736.1	883.3	1031	1178	1325	1472	1619	1767	1914	2061
2	294.4	588.9	883.3	1178	1472	1767	2061	2356	2650	2944	3239	3533	3828	4122
5	736.1	1472	2208	2944	3681	4417	5153	5889	6625	7361	8097	8833	9569	10306

