



## System Loads Worksheet

**Helpful Formulas: Watts = Volts times Amps; Amps = Watts divided by Volts**

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

Description of AC Loads Run by an inverter	<b>Watts</b>	<b>X</b>	<b>Hrs/Wk</b>	<b>=</b>	<b>WH/Wk</b>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>
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<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>

line 1 -->

Total WH/Wk

2. Multiply line 1 by 1.25 to correct for inverter loss and battery efficiency.

**Step 2** Calculate your DC loads.

3. List all DC loads in the spaces below.

Description of DC Loads	<b>Watts</b>	<b>X</b>	<b>Hrs/Wk</b>	<b>=</b>	<b>WH/Wk</b>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>
<input style="width: 100%;" type="text"/>	<input style="width: 50%;" type="text"/>	X	<input style="width: 50%;" type="text"/>	=	<input style="width: 50%;" type="text"/>

line 3 -->

Total WH/Wk

4. Total watt hours per week used by AC loads from line 4

5. Add lines 2 and 4. This is total amp hours per week used by all loads.

6. Divide line 5 by Seven days/week. This is total average watt hours per day.



## Battery Size Worksheet –

1. Total average Load Watt hours per day from the System Loads Worksheet, From line 6, on page 2.

2. Maximum number of continuous cloudy days expected in your area or number of days you would like to run without using your generator. Days of Autonomy

3. Multiply line 1 by line 2.

4. Divide line 3 by (maximum) 0.8 to maintain a 20% reserve after deep discharge period. To prevent less than a maximum 80% discharge divide by a lesser number ie 0.5 or 50%.

5. If you are using a lead-acid battery, select the multiplier below which corresponds to the battery's winter time average ambient temperature:

(where batteries are located and within their enclosure)

Battery Temperature	Multiplier
80°F/25.0°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 5 by line 4. This is your optimum **battery size** in watt-hours.

7. Amp-hours of battery chosen at the appropriate rate (100hr/20hr rate) Note: The faster the discharge the less total reserve amp-hour capacity)

8. Voltage of battery chosen (2V, 6V, 12V)

9. Choose your System Battery Bank Voltage (12V, 24V, 48V) Note: The Battery Bank Voltage is typically determined by the inverter selected

10. Multiply line 7 by line 8. This is the watt-hours of each battery required.

11. Divide line 6 by line 10. This is the total number of batteries estimated.

12. Divide line 9 by line 8. This is the number of batteries required in **series** to make up the system voltage (4x6v=24v).

13. Divide line 11 by line 12. This is the number of batteries required in **parallel**. Must round up to the nearest whole number.

14. Multiply line 12 by line 13. This is the total number of batteries estimated.



### Solar Array Sizing Worksheet -

This worksheet helps you figure the total number of solar modules required for your system. If you want year-round reliability, you would need to use the sun hours per day in December (lowest month) at a 90 degree tilt. Typically the solar array is sized to be optimized for summer usage at a Latitude degree tilt, then you would use the average sun hours for April to October (Typically 4 to 5 sun hours per day). (Line 4)

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1. Total average watt hours per day from the System Loads Worksheet, line 6.
  2. Multiply line 1 by 1.2 to compensate for loss from battery charge/discharge, wire, heat, soiling, etc..
  3. Select your tilt angle for the best annual generation to match your load (Dec 90 or summer 45 degrees).
  4. Average full/peak sun hours per day in your area at the tilt angle above in the desired month.
  5. Divide line 2 by line 4. This is the total solar array watts required.
  6. Optimum or peak watts of solar module used. See module specifications.
  7. Divide line 5 by 6. This is the estimated number of solar modules required.
  8. Round off to the next highest whole number.
  
  9. Ensure the module estimate from line 8 will work in series and parallel strings for your system
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10. Total number of solar modules required after series and parallel check.
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LOAD	WATTS		
CD Player	85	Television Cable (TV) Box	23
Christmas Lights	800	Television, Color (Tube)	286
Clock	2	Television, Color (Solid state)	175
Clothes Dryer	2,790	Television, B & W (Tube)	100
Computers	240	Television, B & W (Solid State)	45
Dishwasher	1,201	Television, Screen (45")	147
Electric Blanket	177	Television, Video Games	45
Fan (Attic)	370	Toothbrush	1.1
Fan (Ceiling or Circulating)	88	Typewriter	52
Fan (Furnace)	500	Vacuum Cleaner	630
Fan (Rollaway)	171	Video Tape Rec.	175
Fan (Window)	200	Washing Machine	512
Fish Tank	4	Water Heater	2,475
Floor Polisher	305	water Heater (Quick-Recovery)	4,474
Freezer-Upright (18 cu. Ft.)		Waterbed Heater	450
Manual Defrost	540	Water Softener	1.5
Automatic Defrost	700	Well Pump	2,238
Hair Blow dryer	1,000	<b>Kitchen Appliances</b>	
Hand Iron	1,100	Broiler	1,140
Heat Lamp	250	Can Opener	100
Heating Pad	65	Carving Knife	92
Humidifier	177	Coffee Maker	1,200
Jacuzzi/Spa Pump	1,300	Deep Fat Fryer	1,448
Kiln	5,760	Food Blender	300
Lighting (Avg. Resd. Use)		Food Mixer	127
Radio (Solid State)	15	Frying Pan	1,196
Radio/Recorder (Solid State)	26	Garbage Disposal	445
Range (with Oven)	12,200	Hot Plate	1,200
Range (with self-cleaning)	12,200	Microwave Oven	1,450
Refrigerator-Freezer		Roaster	1,333
16 cu. Ft.	380	Slow Cooker	200
20 cu. Ft.	420	Toaster	1,146
Refrigerator-Freezer (frostless)		Toaster Oven	1,550
16 cu. Ft.	600	Trash Compactor	400
20 cu. Ft.	800	Waffle Iron	1,200
Sewing Machine	75		
Shaver (none rechargeable)	15		
Sun Lamp	279		
Swimming Pool Pump Motor	2,000		



Municipality	Month	South-facing vertical (tilt=90°)	South-facing tilt=latitude	South-facing tilt=lat+15°	South-facing tilt=lat-15°	Two-axis sun-tracking	Horizontal (tilt=0°)
Victoria	January	1.84	1.86	1.95	1.66	2.18	0.92
Victoria	February	2.49	2.73	2.78	2.54	3.27	1.68
Victoria	March	3.2	4.07	3.93	3.97	5.25	3.08
Victoria	April	3.15	4.77	4.36	4.95	6.73	4.58
Victoria	May	2.88	5.05	4.4	5.45	7.83	5.51
Victoria	June	2.81	5.25	4.49	5.79	8.63	5.97
Victoria	July	3.01	5.58	4.81	6.1	9.16	6.33
Victoria	August	3.39	5.53	4.96	5.82	8.42	5.46
Victoria	September	4.05	5.46	5.2	5.39	7.48	4.16
Victoria	October	3.26	3.75	3.76	3.53	4.68	2.34
Victoria	November	2	2.07	2.16	1.88	2.44	1.06
Victoria	December	1.71	1.67	1.78	1.46	1.97	0.74
Victoria	Annual	2.82	3.99	3.72	4.05	5.68	3.49

Calgary	January	3.54	3.35	3.59	2.93	4	1.16
Calgary	February	4.28	4.4	4.55	4.02	5.39	2.12
Calgary	March	4.46	5.24	5.15	5.06	6.75	3.54
Calgary	April	3.91	5.57	5.13	5.74	8.07	4.85
Calgary	May	3.15	5.19	4.56	5.63	8.34	5.7
Calgary	June	3.07	5.46	4.67	6.05	9.26	6.18
Calgary	July	3.26	5.71	4.91	6.25	9.58	6.39
Calgary	August	3.51	5.46	4.89	5.76	8.36	5.41
Calgary	September	4.03	5.21	4.96	5.18	7.13	3.69
Calgary	October	4.27	4.72	4.76	4.41	5.94	2.39
Calgary	November	3.48	3.43	3.61	3.04	4.11	1.24
Calgary	December	3.05	2.85	3.07	2.46	3.38	0.9
Calgary	Annual	3.66	4.72	4.48	4.71	6.7	3.64

Barrie	January	2.83	2.76	2.94	2.46	3.35	1.5
Barrie	February	3.77	3.99	4.12	3.66	4.86	2.47
Barrie	March	3.99	4.94	4.86	4.78	6.31	3.63
Barrie	April	3.28	5.18	4.76	5.34	7.3	4.54
Barrie	May	2.8	5.28	4.63	5.69	8.06	5.46
Barrie	June	2.6	5.37	4.6	5.93	8.73	6.01
Barrie	July	2.69	5.43	4.69	5.95	8.81	6.08
Barrie	August	2.9	5.06	4.55	5.34	7.46	5.08
Barrie	September	3.07	4.41	4.18	4.41	5.95	3.81
Barrie	October	3.08	3.67	3.67	3.47	4.56	2.46
Barrie	November	2.21	2.34	2.43	2.13	2.79	1.35
Barrie	December	2.23	2.17	2.31	1.92	2.59	1.16
Barrie	Annual	2.95	4.22	3.98	4.26	5.9	3.63