

Worksheet for Designing a Solar System Based on Power Consumption

Input fields in Grey

Daily Power Consumption Analysis					
Appliance DC	Amps	Hours		Daily AH *1*	
		At Anchor	On Passage	At Anchor	On Passage
Refrigeration	5	10	10	50	50
Radar	4		4	0	16
Computer - Laptop	4	1	10	4	40
Autopilot	4		10	0	40
Cabin Lights (LED)	1	4		4	0
Nav/Anchor Lights	0.2	10	10	2	2
Stereo	1	3	3	3	3
VHF Radio	0.5	10	10	5	5
Instruments	1		8	0	8
Pressure Water	6	0.25	0.1	1.5	0.6
Phone Charger	1	2	2	2	2
Other				0	0
Other				0	0
Total Amp Hours				71.5	166.6
AC - Equipment powered by an Inverter (Watts)					
Microwave (Watts)	1100	0.1	0.1	10.2	10.2
Other				0.0	0.0
Other				0.0	0.0
Windlass *2*				0.0	0.0
Total Amp Hours				10.2	10.2
Total Amp Hours Consumed per Day				81.7	176.8
Battery Charging Voltage			<input type="text" value="13"/>		
Total Watt Hours Consumed per Day				1,061.5	2,297.8

1 AH - Amp Hours - Amps of current consumed in one hour
 2 Windlass is often not considered because engine alternator is running when used
 3 5 is a good estimate number for horizontal panels, 7 for panels with tilt & rotate
 See <http://www.bigfrogmountain.com/SunHoursPerDay.html> for hours in your area.
 4 Charge efficiency factor - Lead Acid ≈ 1.2, AGM ≈ 1.1, LiFePO4 ≈ 1.04
 5 Solar efficiency - Partly cloudy ≈ 70%, Mostly cloudy ≈ 50%, Very cloudy ≈ 30%
 6 Battery useable capacity - Lead Acid ≈ 50%, AGM ≈ 60%, LiFePO4 ≈ 95%

Solar Power Requirement Analysis (Full Sun)		At Anchor	On Passage
Average Hours of Sun per Day	<input type="text" value="5"/>	*3*	
Battery Charge Inefficiency Factor	<input type="text" value="1.2"/>	*4*	
Watts of Solar to Replenish Battery Bank Daily		254.8	551.5

Solar System Design Analysis (MPPT Controller)			
Capacity of Each Solar Panel (Watts)	<input type="text" value="130"/>		
Number of Solar Panels Required		2.2	4.7
Number of Solar Panels Installed	<input type="text" value="4"/>		
Minimum Capacity of Solar Controller (Amps)	40.0		
Daily Useable Solar Power in Full Sun (Watt Hrs)	2,340.0		
Daily Power Drawn from Battery Bank (Watt Hrs)		1,061.5	2,297.8
Excess or (Deficit) of Power (Watt Hrs)		1,278.5	42.2
Factor for Cloudy Days			
Solar Efficiency on Cloudy Days (percentage)	<input type="text" value="30%"/>	*5*	
Solar Power Generated on a Cloudy Day	702.0		
Power Drawn from Batteries on a Cloudy Day (Wh)		359.5	1,595.8
Number of Continuous Cloudy Days	<input type="text" value="2"/>		
Sunny Days to Make Up Battery Draw Down		0.6	75.6

Battery Capacity Analysis		Amp Hrs at Anchor	Amp Hrs on Passage
Scenario 1 - Based on Cloudy Days			
Ah Drawn from Batteries on Cloudy Days		55.3	245.5
% of Battery Capacity Useable	<input type="text" value="50%"/>	*6*	
Battery Rated Capacity Required (AH)		110.6	491.0
Scenario 2 - Based on Days of Reserve Capacity (no solar)			
Number of Days of Reserve Battery Capacity	<input type="text" value="2"/>	*6*	
% of Battery Capacity Useable	<input type="text" value="50%"/>		
Battery Rated Capacity Required (AH)		326.6	707.0

Custom Marine Products
 custommarineproducts.com
 info@custommarineproducts.com 248 705-8337

- Steps to use this worksheet
1. Determine the average daily power consumption both at anchor and on passage.
 2. Configure the solar system (battery and solar panel inefficiencies are considered).
 3. Modify the solar system configuration to accommodate anticipated cloudy days.
 4. Analyze the capacity of the battery bank.

Note: This methodology does not take into consideration power generation from other sources such as engine alternator, generator, wind generator, fuel cell or shore power.