West Marine Electrical Budget Worksheet

1. Calculate your DC Loads:

The basis for creating a functional marine electrical system is to understand how much electricity you consume in a day. This number, expressed in Amp-Hours, is what determines the size of the rest of your electrical components.

Start by examining how much electricity each of your DC loads consumes. The current (amps) times the time of operation (hours) produces amp-hours per day.

For example, if you have four interior lights which each draw 1.5 amps, and they are on for three hours per night, your AH/Day consumption would be 4 x 1.5 x 3 = 18 AH/Day.

Lighting

	Amps	Hours	AH/Day
Running Lights			
Anchor Light			
Interior Lights			
Instrument Lights			
Other:			
	Lighting AH	**1A**	

Galley

	Amps	Hours	AH/Day
Refrigeration			
Propane Solenoid			
Other:			
	Galley AH	**1B**	

Electronics

	Amps	Hours	AH/Day
VHF			
SSB			
Loran/GPS			
Instruments			
Weather fax			
Radar			
Depth sounder			
Computer			
Energy Monitors			
Stereo			
Other			
Other			
	Electronics AH	**1C**	

Plumbing

	Amps	Hours	AH/Day
Electric Head			
Fresh Water Pump			
Bilge Pump(s)			
Sanitation System			
Shower sump			
Other			
Other			
	Plumbing AH	**1D**	

Inverter

Inverters are loads just like other DC loads, but the amount of electricity which they draw depends on the type of AC appliance which is drawing on **them**. For example, if you have a computer which draws 40 watts AC, the inverter will have to draw approximately 4 amps DC to power it. The rule, therefore, is that AC watts x hours /10 = AH/Day.

	Watts	Div/10	Hours	AH/Day
Computer				
Microwave				
Heaters/dryers				
Chargers (NiCad)				
Stereo				
TV/Video				
Other				
Other				
	Inverter AH		**1E**	

Calculate your total energy consumption per day

Add lines 1A through 1E together.

Gross Energy Consumption AH/Day	**Total 1T**	

Alternative Energy Sources

Alternative energy sources, like solar panels and wind generators, produce amp-hours each day which replace the amp-hours drawn out of batteries by DC loads. Like DC loads, you need to estimate the amount of current (Amps) and amount of time (Hours) that the devices will be in use. In general, you should underestimate the output of these devices, since it is very difficult to anticipate the number of hours of sunshine, or the average speed of the wind.

	Amps	Hours	AH/Day
Solar, avg.			
Wind, avg.			
Water, avg.			
	AES AH/Day	**Sum 2A**	

Net Energy Consumption, AH/Day

Subtract AES line from Gross consumption to find out how much energy must be made up using other sources.

Gross Energy Consumption AH/Day	**Enter 1T**	
Subtract AES AH/Day	**Enter 2A**	
Net Energy Consumption, AH/Day	**Compute 3A**	

Desired Days Between Charging

For most boat owners, this value will be one day, since they will start and run their engines for battery charging purposes every day, or will change anchorages and charge while underway. If you plan on staying “on the hook” for longer periods without using the engine, enter the appropriate number of days here:

Number of days without engine use:	**Enter 4A**	

Range of Battery Use

Most battery manufactures recommend that you discharge your batteries no more than 50-60% of their capacity for greatest energy storage over the life of the batteries.

Also, most boaters find it too time consuming to charge their batteries fully (100%), since batteries accept less current as they near 100% charged. A reasonable range of battery use is generally thought to be 35%, which is the range of capacity from 50% to 85% state of charge.

You may choose to cycle batteries more deeply, or to charge more completely, resulting in a different range of battery use.

Range of battery use in normal conditions:	**Enter 5A**	

Recommended Battery Capacity

Your need for battery capacity is determined by how much energy you use daily, how deeply you want to discharge your batteries, and how many days between charge cycles. Line 3A x Line 4A / Line 5A equals your recommended battery capacity.

Net Energy Consumption per Day:	**Enter 3A**	
Enter number of days without engine use:	**Enter 4A**	
Range of battery use in normal conditions (e.g. .45):	**Enter 5A**	
Battery Capacity Needed:	**Compute 6A**	

Alternator Output, Amps

Your alternator will be the primary method of recharging your batteries, after taking into effect the impact of Alternative Energy Sources. Base your alternator output on how much it produces at normal engine RPM, not on its maximum output.

Alternator output at normal charging RPMs:	**Enter 7A**	

Charge Efficiency Factor (CEF)

Batteries are not 100% efficient when they are recharged. Flooded batteries, in good condition, are about 85% efficient, while gel batteries are about 95% efficient. If you know your CEF, based on an Amp-Hour meter, enter it here; otherwise use the suggested values.

Enter 85% for flooded; 95% for gel batteries:	**Enter 8A**	

Minimum Time to Charge

Alternators will reduce their rate of charge when they reach the maximum voltage allowed by the regulator. As discussed above, many boaters will cease charging when this high voltage point is reached, and will maximize the energy returned to the batteries in the shortest period of time. If batteries are charged to 100% of capacity, the rate at which subsequent amp-hours are returned gets smaller over time.

The rule for figuring time to charge is to take Line 3A x Line 4A to find total Ah used. Then divide the result by the alternator output, Line 7A. Finally, divide the result by the CEF, Line 8A. For example, if you need to recharge 150 AH, your alternator puts out 75 amps, and you have flooded batteries, it will take (150/75)=2. 2/.85=2.35 hours. This should be regarded as a **minimum**, as your batteries may not be able to accept full alternator output.

Net Energy Consumption, AH/Day	**Enter 3A**	
Number of days without engine use:	**Enter 4A**	
Multiply together for Total AH used before charging	**Compute 9A**	
Alternator output at normal charging RPMs:	**Enter 7A**	
85% for flooded; 95% for gel batteries:	**Enter 8A**	
Time to recharge based on normal alternator output:	**Compute 10A**	