The Daily Load Calculator

Introduction

The daily load calculator is a simple yet informative tool that can show us (and you) critical information about your boat's energy cycles and how to optimize your systems. These load calculations ultimately dictate solar charging input needs, inverter sizing, and ideal battery bank size & chemistry. The more accurate and in-depth you are while filling it, the more effective the planning and design process will be, and the more you can enjoy your time on the water.

You may wish to fill this sheet out several times for different scenarios:

- **Battery only (omitting what will be run through a generator or shore power)**
- **Underway vs. at Anchor (for our purposes, we need whichever loads are highest)**
- **See “Additional Information” below**

Instructions

Step 1: List and quantify all of the power consumers on your vessel.

Step 2: Find out how much power (amps) each item consumes when operating. Use the amp calculator to the right if needed.

Step 3: Determine how many hours a day the consumers are running.

Example - Follow Along

AC Loads

The sheet begins with calculating AC loads.

Let's start with a microwave. Its power usage is listed as 1150 watts at 120v. Since we know we need amps, we use the amp calculator on the right.

Amps Calculator

If your device is listed in watts, convert to amps and then enter in yellow **Amps** column at left

Watts	Volts (110/220)	Amps
1150	120	9.583

Now, we enter the amps in the appropriate column, and select how many hours a day we use it. 0.1 hours a day comes out to 6 minutes.

Description of AC Loads run by an inverter	Qty	Volts (110/220)	Amps	Watts	Hrs/Day of Use	Watt Hrs/Day
Microwave	1	110	9.583	1054.13	0.1	105.41

Now we add a TV, an electric kettle, and an ice maker.

Description of AC Loads run by an inverter	Qty	Volts (110/220)	Amps	Watts	Hrs/Day of Use	Watt Hrs/Day
Microwave	1	110	9.583	1054.13	0.1	105.41
Television	1	110	0.6	66	1.5	99.00
Electric Kettle	1	110	12.5	1375	0.5	687.50
Ice Maker	1	110	1	110	1	110.00

And at the bottom we get our AC loads results.

Results for AC loads	
Total Watt Hrs/Day for listed AC loads	1,001.91
Corrected Watt Hrs/Day for AC loads	1,152.20
Corrected Amp Hrs/day for AC loads	96.02

DC Loads

Generally speaking, most of our onboard consumers are going to be DC loads. The tricky part can be identifying all of them. Don't rush this process, it's easy to forget about items that are drawing power. Additionally, some are only used for very short times once or several times a day, such as bilge pumps, freshwater pumps, and so on. It may be helpful to go room-by-room or general category by general category (for example, all the loads in the head, or all the parts of the navigation systems, all the interior lighting, etc)

Let's start with a cabin fan as an example. It's a 12 volt DC fan that draws .41 amps, and we run it 24 hours a day. We've already entered our battery voltage (12) at the top of the calculator, which is used for all calculations within the spreadsheet.

Description of DC loads run from house battery	Qty		Amps	Watts	Hrs/Day of Use	Watt Hrs/Day
Cabin Fan	1		0.41	4.92	24	118.08

Now let's use cabin fans in different areas with different hourly usage. Say there are two in the main cabin, and one in the stateroom/berth. We may not run the berth fan while we aren't in there, and we won't be running the cabin fans while we are sleeping. So, we enter them as separate loads.

Description of DC loads run from house battery	Qty		Amps	Watts	Hrs/Day of Use	Watt Hrs/Day
Cabin Fan (stateroom)	1		0.41	4.92	8	39.36
Cabin Fan (main cabin)	2		0.41	9.84	16	157.44

Now, continue down our list of DC consumers.

Description of DC loads run from house battery	Qty		Amps	Watts	Hrs/Day of Use	Watt Hrs/Day
Cabin Fan (stateroom)	1		0.41	4.92	8	39.36
Cabin Fan (main cabin)	2		0.41	9.84	16	157.44
Cabin Lights (LED)	7		1	84	6	504.00
Cockpit Lights (LED)	2		0.75	18	2	36.00
Companionway Courtesy Light (LED)	1		0.5	6	6	36.00
Refrigerator	1		5	60	12	720.00
Freezer	1		6.6	79.2	8	633.60
Stereo	1		2.5	30	4	120.00
USB Charging hub/Phone Charging station	2		3.4	81.6	3	244.80
12v Power Supply ("cigarette lighter")	1		10	120	1	120.00
Running Lights	1		4	48	0.3	14.40
Bilge Pump	2		10	240	0.4	96.00
Windlass	1		200	2400	0.2	480.00
Radar	1		5	60	8	480.00
Chartplotter	1		2	24	24	576.00
Sonar	1		0.5	6	8	48.00
AIS and transmitter	1		2	24	12	288.00
Anchor Light	1		2.5	30	12	360.00
VHF Transmit and Receive	1		5	60	0.5	30.00
VHF Transmit and Receive	1		0.5	6	12	72.00

Which supplies us with our total DC loads:

Results for DC loads Battery Bank 1: House	
Total Watt Hrs/Day for listed DC loads	5,055.60
Corrected Watt Hrs/Day for DC loads	5,813.94
Corrected Amp Hrs/day for DC loads	484.50

And below that, our total AC and DC loads:

Total for AC + DC loads	
Corrected Watt Hrs/Day for AC and DC loads	6,966.14
Corrected Amp Hrs/day for AC and DC loads	580.51

Congratulations! You've successfully completed your load calculations. This information will help us size your battery bank, calculate your solar array, configure your inverter/charger systems, and identify areas and loads where efficiency improvements can be done. Remember, no two vessels are the same, and these loads are unique to you. Keep a copy for yourself and your boat, and change it as needed.

Additional Info

Identifying consumption information for your equipment

-Device consumption data can be found via user's manuals, specification/data sheets, device badges by the power input, internet searches, or the use of an amp clamp while the device is running.

- Keep in mind that some consumers, such as some refrigerators, can have both a compressor and a circulator, meaning they have two power draws - be sure to quantify both. Also, items like a VHF will have different power consumption depending on whether they are transmitting or receiving - again, include both.

-Be sure not to forget anything, particularly high loads, like power winches, bow thrusters, and windlasses.

- The amount of time a device runs is critical. Use your best guess to estimate the run time. Even though the refrigerator is on 24 hours a day, it's probably only drawing power for half or less of that time.

-This is a 24 hour load calculator. So when giving hours per use per day, it's out of 24 hours - not just time underway, or time on the boat. Some loads are intermittent, such as a windlass, while others are used daily (AIS, nav systems, cabin lights, and so on).

Understand the difference between AC and DC loads

-**AC** loads will be run off a generator using fuel, an inverter using DC power, or through shore power connections. AC voltage is 120v, 240v (110/220v while running, USA) or 230v (Europe).

-**DC** loads run off of power stored in the batteries or created through DC charging sources such as solar panels or the engine's alternator. Most power consumers are run through the DC system. DC voltage on boats is often 12v, however it is increasingly common to see boats with 24v or 48v systems.

Run out of rows to add consumers?

-If you've filled all the rows, but haven't added all of your power consumers, you may opt to add all your small loads under one row, named "miscellaneous small loads" or similar. If, however, you have many more loads, let us know and we can send you a copy with expanded rows.

Total consumption vs battery only

When filling out the load calculator, you may choose to make several copies with different scenarios. A "total load" calculation offers a broad view of total power consumption in a 24 hour period.

A "battery only" load calculation can be used to size a battery bank. In this situation, you only fill out the loads that you wish to operate on a single battery charge. The total amp hours will tell you how much battery bank capacity you need to power your vessel in between battery charges.

Underway and At anchor

You will have different loads at anchor than you will underway.

For example, we won't be running our anchor light while we are underway with our running lights. While at anchor, we won't be using our autopilot. In most cases, your underway loads will be higher than your at anchor loads; however, this is not always the case. The scenario with

your highest potential loads is what we will use to design your system. If you're unsure, we recommend filling out the calculator once for underway, copying it, and then adjusting it for an at anchor scenario (or vice versa).

Plan for the future

It's important to not just calculate what energy consumers you currently have, but those that you are hoping to install as well (such as a watermaker or washing machine).