

The On-board Energy System

Energy Consumers (System Loads)



Add up the consumption \leftarrow in Watts of all the consumers over a 24 hour period - for example a 12V fridge may consume 15W and be on for 24 hours so that = 360W, a pump that uses 120W might run for 15 seconds, 8 x per day = 4W, a TV that consumes 30W might be on for 3 hours so that = 90W etc.

Once you add all these up, you'll have a consumption figure in Watt Hours (Wh). Divide this by your system nominal voltage eg 12V or 24V etc) and that will give you the capacity required in Ah. For example;

say you have a total of 1420Wh/12V = 119Ah. If you have or plan a lead-acid battery, you should only use 50% of the capacity to give the best compromise of usage/life expectancy, so you would need a battery bank of 238Ah (2x120Ah) batteries.

Energy Storage (Battery/s)



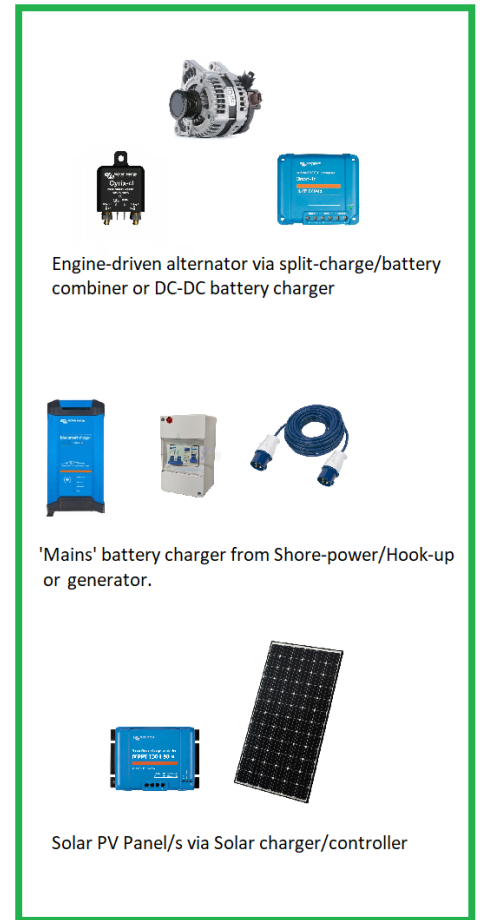
So, in our example, you are going to use 119Ah of battery capacity over a 24 hour period. You need to replace that from your charging sources \leftarrow

Batteries are not very efficient and it's not just a simple case of putting 119Ah back into the battery, so we need to apply a factor to our calculation. For Sealed lead-acid batteries, that would be a factor of 1.25, so we would need to 'put back' around 149Ah. For a quality AGM, the factor would be 1.15 and for LiFePO4 "Lithium-Ion" batteries which have very little internal resistance, 1.05.

We have various options to charge the batteries up - 'fixed' options where we know the charge rate such as the engine alternator driven split-charge/combiner or battery-to-battery charger and 'variable' charge from solar and/or wind etc.

As a general rule of thumb, you want a charger to be capable of delivering a charge equal to 10-20% of the battery capacity. So for a 240Ah battery bank, a charger rated at 25A-50A would be ideal.

Charging Sources



Important! Please Note:

There are a number of other variables that need to be taken into account when designing your system. If you have or plan 230V appliances/devices on board, then you will need a Power Inverter (12V to 230V for a 12V system). Selecting an inverter is a minefield with many fake and down-right dangerous units available on-line (eBay/Amazon/Wish etc) so go for a known brand and/or take professional advice. Power Inverters are not overly efficient - some are only 75%, quality brands can be over 90%. This is important because they will consume energy just being 'on' and will take more energy from your battery than the appliance demands.

Some 230V appliances have a motor in them (coffee machines, 230V refrigerators, Microwave ovens etc). When they start, they can momentarily draw as much as 10X their rating. It's not unusual for a 230V 100W refrigerator to pull 1000W on start up. This peak load, whilst only momentarily needs to be allowed for when specifying a suitable Power Inverter. Some units have a Peak Load rating the same or not much more than the continuous rating whereas some (quality) brands have a Peak Load rating double the continuous rating.

When it comes to Solar systems, as we've mentioned, these are a variable source of charging obviously dependant on the levels of daylight (the solar irradiance) so the output of the controller/charger will vary a lot with cloud-cover, shadow on the panels etc. the time of year and the position of the panels relative to the position of the sun. Temperature of the panels also affects the output by quite a margin as does the efficiency of the controller/charger and the quality of the installation itself.

It is possible to calculate for all of these variables and come up with a realistic expectation of what your yield (how much energy your panels can 'capture') and therefore the charge going back to your batteries is likely to be. However, those calculations if done correctly are much more sophisticated. Be aware that the vast majority of "Solar Calculators" you'll see on-line and from resellers are extremely basic and usually miles out in their predictions!

If you want some help to start working out what you actually need, we have a spreadsheet called "Energy Audit - Customer input Document" available to freely download in the 'Information' section of our website. Fill it in, send it back to us with your contact details and we'll do the basic calculations for you free of any charge.

We can also run the solar calculations and provide a complete system design. Depending on how involved that is (time) this may be free or there may be a nominal charge - for more information, please get in touch.

The link to the Energy Audit is: <http://www.offgridhappy.com/Information> - scroll down the page to find it!



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