Solar Publication

A regular and saveable module to build knowledge of solar power, build on Zimbabwe's experiences and build the Zimbabwean Solar Industry

Vol 1
Issue 2

Some basic terminology to start.

AC / DC

AC electricity = Alternating Current. The electricity that comes from ZESA. 250 V AC power. The science we will leave for later.

DC electricity = Direct Current. What comes from your solar panels. 12 V DC power, (usually). It is also the power you get from batteries, and how the power is stored in your batteries. Most car and motorcycle batteries too. (D cells, etc. are 1.5 V, there are also 9 V, and many larger trucks have 24 V DC systems.)

Your inverter converts (inverts) from 12 V DC power to 250 V AC power to run your appliances - your fridge, your freezer, your TV, your computer, your lights. There are 12 V appliances you can get, and many details around the question – "Why not just use 12 V panels and 12 V batteries, to run a 12 V fridge and lights?" This is one aspect I want to learn about, but for this issue, we can start with this knowledge.

Volts / Amps / Watts

Volt

The measure of "electrical potential". Perhaps the best analogy is 'pressure'. As in water in a pipe.

Amp

An amp, (Ampere) is the measure of current. With the above analogy, it is the 'amount'. While voltage in most systems is constant, the amperage will change depending on how much work is needed to be done by the appliance. For example, while they are both 250 V, a light bulb will take far less amperage than a water heater or electric iron.

Ohm

Resistance (which produces heat) also results from amperage. The higher the amperage, the greater the resistance, and heat. And resistance is basically lost power.

Watt

A **Watt** is the measure of power. It is volts times amps. 1000 Watts = 1 KW. And we buy power by the KiloWatt Hour (KHh).

If I have an 800 Watt heater plugged in for thirty minutes it will use 0.8 KW x 0.5 hours = 0.4 KWh. If my 800 Watt heater is running on 12 V, it is taking 67 Amps. If it is running on 250 V, it is using 3.2 Amps. (A fair bit less amperage and therefore a fair bit less resistance in the wire getting the power to the appliance…)

When you do an energy audit, you will be measuring Watts. Everything is 'rated' at the factory. However what the factory rating is and the rating in the real world, away from the laboratory testing bench, will not be the same. It is a good indication, but certain differences will occur and allowances need to be made.

Technical assistance has been sought and is acknowledged!
Technical inputs received with pleasure

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Connections

One thing done to assist with the amperage / resistance aspect is to connect several 12 V batteries (or smaller) together to get the same Watts, with higher voltage and lower amperage. There are two connections – Series and Parallel.

Series

The positive terminal of one battery is connected to the negative terminal of the second battery, then the positive terminal of the second is connected to the negative of the third, etc. So the batteries are connected: + to - to + to - to + to -Rather liking sliding a line of D cells into a torch.

The voltage of this battery is the sum of the battery voltages of the individual batteries. So a 6 V torch is run by 4 x 1.5 V batteries. With the capacity the same as only one battery.

Parallel

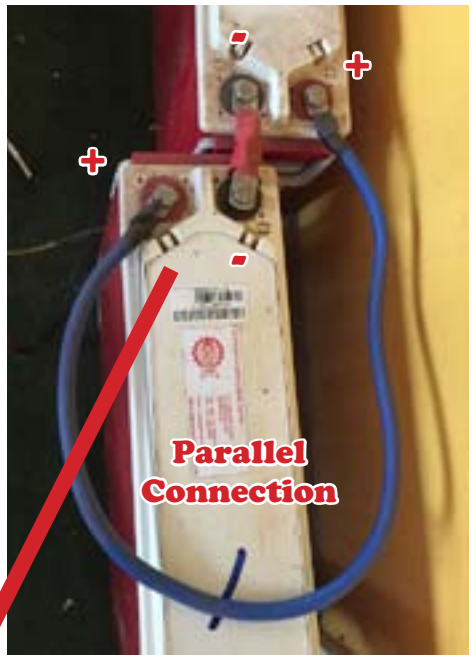
The positive terminal of one battery is connected to the positive terminal of another, and another. The negative terminal of one is connected to the negative terminal of another, and another. So the batteries are connected: + to + to + and - to - to -.

The voltage is unchanged. The

capacity is the sum of the capacities of the individual batteries. So I connect two 12 V, 120 AH batteries in parallel, and I still have a 12 V 'battery', but 240 AH!

Inverters

An inverter is a device that turns DC power into AC power. A rectifier does the opposite. It will also turn one voltage into another. That is all. However when people say "inverter" they generally mean a lot more. For example, a UPS (Uninterrupted Power Supply) to save



your computer when the power fails, is basically an inverter, but includes a battery charger. When the power is on, it charges your battery, when the power goes off, it automatically discharges the battery to produce power to keep your computer running.

And then there are many more 'inverters', dealing with sine waves, and modified sine waves. Smart inverters. Grid inverters. String inverters. There are probably more inverter kinds than there are batteries! And they all have their strengths and weaknesses. Understanding the best for your situation takes us back to the initial question – why are you doing this?

Inverters are measured in Watts. The amount of power they can get out of whatever battery or solar supply they are connected to. 300 W, 600 W, 1500 W (1.5 KW), 3 KW, 5 KW, to much larger for large or industrial applications. The inverter size you need will depend on what you want it all for. A 600 W inverter will not give you toast from an 800 W toaster. A 1.5 KV will not give you toast either if your 500 W freezer and 350 W fridge are plugged in (and running) at the same time. Understanding is important.

Grid inverters

These only accept solar panel power and do not have an input for batteries, it is designed mainly to sell power back to the grid and power critical loads during the day.

Off-grid inverters

These are inverters that accept battery power only and do not recharge said batteries via Zesa. As such, no zesa/grid input hence their name.

String inverters

These are designed for high voltage DC inputs then convert it to our conventional AC power that we use in our homes but on a much larger solar plant scale.

Smart inverters

These are bi-directional. Can be grid or solar (or both) and can "decide" whether to charge batteries or take power from batteries.