REDARC - Solar FAQ's

Key
Green = Useful
Blue = Not Useful

ATL Link

This Shows Thinking skills has I am investigation various options for powering my lighting systems

Link to Criteria

"To incorporate outdoor lighting into the landscape feature"

Global Context

Human Innovation has helped to create exciting solutions to existing problems using technology.

Solar is one of these exciting solution to the problem of finding a way to provide energy sustainable for our use.

Learner Profile Links

Inquirers
Thinkers
Open-Minded
Risk Takers

Why did I select this resource

Simple Information about solar power is hard to come across especially for my kind of applications in mind, most information is for automotive and camping uses. REDARC is a south Australian Solar manufacturer and their FAQ's section is easy to understand and is written in general terms for a variety of applications

How I can apply this information

This information will give a guide and some background knowledge on the types of solar panels and their various advantages as well as what kinds of systems I will need if I decide to use solar power.

Bibliography

REDARC, 2016, 'SOLAR FAQ's', REDARC [Online] Available https://www.redarc.com.au/solar-faqs, Accessed 16 December 2016.

Solar Regulators Will protect batteries

SOLAR FAQ'S

Why do I need a regulator?
A 12V solar panel is designed to output at least enough voltage to charge a 12V battery under worst case conditions (low light level, high temperature etc). A 12V battery needs at least 13.6 volts to charge, therefore under worst case conditions a solar panel needs to output at least 13.6 volts. This means that in perfect conditions a 12V solar panel may output around 17V or more. If you plug a solar panel, which is generating 17V, straight into your battery it is easy to understand how this can cause damage. Solar regulators are designed to accept the voltage from the solar panel, and output a voltage that is safe and useable to charge a battery. A good regulator will incorporate a 3 stage charging output.

Formula to work out required solar system size

How many solar panels do I need?
The amount of solar panels you require will be determined by the amount of charge that you need to return to your system during the sunlight hours of each day. For a 12V system, if you need to replace 100A/h of charge to your batteries each day, and you have 8 sunlight hours in each day you will need...
100AH x 12V = 1200WH
1200WH / 8H = 150W of solar panels.
In reality it is recommended that you always overrate your requirements by at least 20%, therefore you would need 180W of solar panels.

How many watts do I need?
The number of watts or the amount of Power you need is determined by the requirements of your system with regards to both charging and to running particular loads.
The power rating or wattage of your panels determines the rate at which you can deliver charge to your system. You need to ensure that you have enough solar panels to cope with the amount of power you plan to use. A good rule is to overrate your system so that it can cope with cloudy days and unexpected power usage.

My system will be a very low power draw

The power rating of your inverter determines what appliances you can run from your inverter. If you want to run a1800W microwave from your inverter you would need at least an 1800W inverter. It is important to keep in mind that running an appliance such as this from an inverter will drain your battery bank considerably. As a general rule of thumb, if you divide the amount of watts an appliance uses by 10 for a 12V system or 20 for a 24V system, this will give you the current draw on that system. For example, an 1800W microwave will draw 1800/10 = 180A from a 12V system.

1.5 Amps per day for an 80W is a good bassline

What can I run on my 80 Watt Panel?

An **80W solar panel** can realistically supply between 4 and 5 Amps on a sunny day, for most of the sunlight hours of the day. If we assume that only 1/3 of the day is sunlight hours then it is safe to assume that the panel can supply between 4 and 5 Amps for this period.

Given that there are 24 hours in a day, an 80W panel can effectively run a load of around 1.5A continuously throughout the day/night running at no loss.

Let's assume that the solar panels are charging a 100A/h battery. You wish to run a 50L Fridge which draws on average 3A, and 2 x LED camp lights which draw 0.25A each when running. You want to run the fridge 24 hours a day, and the camp light for 6 hours each night.

Fridge: 3A x 24h = 72Ah
Lights: 0.25A x 6h = 1.5Ah x 2 lights = 3Ah
Total: 75Ah per day.

Your panels can supply:
4.5A x 8h = 36Ah each day.

Extra information I can work out but my system will need to run at no loss

Therefore the battery is being discharged by:
75Ah – 36Ah = 39Ah each day.

So you could run your fridge and lights for:
100Ah / 39Ah = 2.5 days without any other form of charge.

What can I run on my 120 Watt Panel?

A **120W solar panel** can supply between 6 and 7.5 Amps on a sunny day, for most of the sunlight hours of the day. If we assume that only 1/3 of the day is sunlight hours then it is safe to assume that the panel can supply between 6 and 7.5 Amps for this period.

Given that there are 24 hours in a day, a 120W panel can effectively run a load of around 2.75A continuously throughout the day/night running at no loss.

Let's assume that the solar panels are charging a 100A/h battery. You wish to run a 50L Fridge which draws on average 3A, and 2 x LED camp lights which draw 0.25A each when running. You want to run the fridge 24 hours a day, and the camp light for 6 hours each night.

Fridge: 3A x 24h = 72Ah
Lights: 0.25A x 6h = 1.5Ah x 2 lights = 3Ah
Total: 75Ah per day.

Your panels can supply:
6.75A x 8h = 54Ah each day.

Therefore the battery is being discharged by:
75Ah – 54Ah = 21Ah each day.

So you could run your fridge and lights for:
100Ah / 21Ah = just under 5 days without any other form of charge.

This information is aimed at camping and automotive uses

What do I need to run my Fridge?

This depends on the size of your fridge, how long you plan to stay away from any other power sources and the size of your battery bank. Please refer to the Typical Usage Calculator for more accurate information.

What do I need to run my Inverter?

This depends on the size of your inverter, how long you plan to stay away from any other power sources and the size of your battery bank. Please refer to the Typical Usage Calculator for more accurate information.

What is a typical setup for my camper trailer?
The typical setup for a camper trailer would involve a 80L fridge and a couple of LED lamps. We would recommend 2 x **80W solar panels** mounted on the roof of the camper trailer if the space is available. If not we would recommend 2 x **90W Folding Solar panels.**

What is a typical setup for my caravan?
The typical setup for a caravan would involve a fridge, inverter, television, lighting and possibly some other equipment. We would recommend 3 x **120W solar panels** mounted on the roof of the caravan.

What is a typical setup for camping?
Typically a camper would require a 40 – 50L fridge and a couple of camp lights. We would recommend an **80W solar panel**, a **72W thin film folding solar panel** or 2X **36W thin film folding solar panels.**

What is the difference between amorphous and crystalline silicon panels?
Amorphous type solar technology uses Silicon in a non-crystalline, random form. It can be deposited onto many different substrates to give effects like flexibility for use in different applications. Amorphous type solar technology falls under the 'thin-film' category of solar modules. Amorphous type solar panels have a typical efficiency of around 6 – 7%.
Crystalline silicon type solar technology refers to monocrystalline and polycrystalline panels. These panels are created from silicon in a tetrahedral lattice type structure. This structure gives crystalline silicon type solar modules a higher efficiency per square meter than amorphous type modules.

Crystalline is more efficient but not as flexible making it better for more permanent uses like my use

How long will it take to recharge my battery?
The time needed to fully recharge your battery with solar depends on 1) how much stored energy you need to replace in your battery/battery bank, 2) the efficiency of your solar regulator and the charging method it uses and 3) the amount of solar energy you can provide. For the following example we will assume the regulator is 100% efficient.
Let's say you need to replace 50A/h of stored energy into your battery via 300W of solar panels.
300W @ 12V = 300/12 = 25A
50A/h @ 25A = 50/25 = 2 hours
So as a rough estimate it would take around 2 hours to recharge your battery. In a real life situation you would need to take into account the efficiency of your regulator and its ability to charge the battery to 100% (multi-stage charging), and the fact that the charger will output at least 13V to charge the battery (not 12V).

Formula to work out the wattage I will require

What's the best time of day to use my panel?
Your panels will provide the most power at peak sunlight. This requires no Cloud Cover and occurs at the middle of the day. Your panels will continue to provide power at a reduced rate before and after this peak sunlight period at any time whilst the sun is out. Your panels will obviously not provide any power before dawn or after dusk.

They will be active all day so this is irrelevant

Can I leave my panel out in the weather?
Both Redarc thin film and rigid type panels are protected against the elements and will be fine if left out in the weather. Redarc solar panels are tested to handle rain and hail, and our portable panels can be tied or pegged down so as not to lose them in windy conditions. Having said that, generally when the weather is stormy, rainy or there is hail, sunlight levels are not high enough to generate power from your solar panels. Therefore if possible it would be best to bring your panels out of the weather during these conditions.

This is important as my panels will ideally left out almost all the time

So it will work on a cloudy day

Will my panel work when it's cloudy?

Solar panels do generate electricity in cloudy weather although their output is diminished. The output can drop to as low as 10% of the full sun intensity. The use of a MPPT regulator will help get the most out of your panels during these conditions.

Good info to know

How do I clean my solar panels?

You should clean your solar panels on a regular basis for best performance as anything that may be blocking sunlight from the photovoltaic material will reduce the efficiency of the panel. Panels should be cleaned using a microfiber cloth as scratches may reduce the performance of your panels.

Not going to expanind my solar power requires but a camper might

Can I upgrade my solar system?

Redarc solar modules are designed to be upgradable and expandable. All Redarc panels, thin film, portable or fixed, are designed to be interconnected regardless of their type. There is also adaptor plugs available should you wish to add Redarc solar modules to an existing non-Redarc solar setup.

My panel has stopped working, what do I do?

If your panel has stopped working please run through the steps outlined in the troubleshooting guide. If after completing the troubleshooting guide you have not solved the problem, please contact Redarc on (08) 8322 4848 for further assistance.

So I need a regulator

How do I connect my panel to my battery?

Your solar panels should always be connected through a regulator and then the regulator connected to the battery/s. A regulator is required to ensure that none of the high voltages present at the output of a solar panel during good light level conditions can damage the battery/s. Each panel/regulator comes with a set of instructions outlining how the panel/regulator should be connected to the system. If after reading the instructions you are still unsure of how to connect your devices please contact a qualified auto-electrician or Redarc electronics on (08) 8322 4848.

Good to know but irrelevant

How are Solar panels created?

Solar panels (Mono or Poly crystalline) are created from multiple 'wafers' of silicon connected together in series and/or parallel to form a solar 'module'. These wafers are created from silicon ingots. The ingots are either block-cast from multiple silicon crystals (poly-crystalline) or grown to form a single crystalline structure (mono-crystalline). The ingots are cut into slices around 180 to 350 micrometers thick to form the wafers. The ingots are generally made from p-type doped silicon, and n-type silicon is then applied as a surface layer to the wafer. This creates the n-p junction which allows the flow of electrons. Anti-reflective layers are then applied to the wafer before metallic connections are made in a grid-like pattern on the front side of the panel and a plate across the full area of the wafer on the back side. These metallic connections are screen printed using a silver paste on the front and an aluminium paste on the back. The wafer is then fried at a few hundred degrees celsius to create contact between the silicon and the metal electrodes. The wafers are now ready to be connected to form the solar module.

Where do I place my panel with regards to the sun?

Ideally your solar panel should be in direct sunlight for best performance. This means that as much as possible your solar panel should be perpendicular to the direction of the sun rays. In practice this is not easily achievable or convenient and so we recommend that you orient your panels so that they are facing north at about a 45° angle.

Orientation will be important as were I wish to place them their are some obstacles

What are Watts?

The Watt is the basic unit of power. It is named after the eighteenth-century Scottish inventor James Watt. Power = Voltage x Current, so Watts = Volts x Amps.

This information will help in working out power requirements and what effects my components will have

What are Volts?
Volts is a unit of electromotive force, the volt measures how much "potential" there is in an electric circuit. The higher the voltage, the more electrical current will flow in the circuit.

What are Amps?
Amperes (or Amps), is the measure of electric current. One Amp is equal to a number of electrons passing a point in a circuit each second at a certain voltage.

What are Amp hours?
Amp hours is a measure of stored power. Amp hours is the number of Amps drawn, for the amount of time in hours that you draw that current. Amps x hours = AH

What sized wiring do I need for my system?
The wiring size for your system is determined by the overall length of cable involved in the system, and the amount of current drawn over that length of cable. The amount of current drawn by the system is related to the amount of current your solar panels can output for the cable between the solar panels and the battery, and is related to the amount of load you are planning to use for the cable between the battery and your loads. Required cable thickness can be easily worked out using our cable size and voltage drop calculator.

small waterproof cables should work

Check if their is bypass diodes on any panels I may order

Can I charge with my solar panels partially in the shade?
When a solar panel is partially shaded the cells that are in the shade will not output any power. A solar panel with bypass diodes will ensure that if a cell is in the shade and not providing any power, the other cells and therefore the panel as a whole will still provide an output. Panels without bypass diodes will lose all power when partially shaded.
Each cell in an 80W solar array provides about 0.5V output. Therefore every 2 cells lost will mean a 1V drop in output. An 80W panel will output around 16V – 18V, which means that if more than about 6 cells are shaded the panel is less likely to charge a 12V battery.

That is an excellent lifetime

How long will my solar panel last?
Redarc rigid solar panels are designed to resist environmental conditions such as rain, hail and strong winds. Redarc rigid panels come with a 5 year warranty to back up this claim. Redarc rigid panels also offer a 12 year 90% efficiency warranty and a 25 year 80% efficiency warranty to ensure a useable output for years to come.

Overheating might be an issue then

My solar panel gets very hot when I leave it out in the sun, is this normal?
Solar panels when left in the sun will get hot for two reasons. Firstly, the sun beating down on the surface of the panel will cause the panel to increase in temperature, as it will with most surfaces. Secondly, free electrons that do not flow to generate electricity, after being excited by sunlight will actually release heat as they return to an unexcited state.

Deep Cycle Battery as this is true for my setup

What type of battery do I need for my solar setup?
The type of battery you choose depends on the application for which you are using it. It is recommended that a deep cycle battery be used as an auxiliary battery because generally an auxiliary battery is discharged to a lower level and then recharged as opposed to a starter battery which is generally kept at a particular charge level.
It is important to ensure that your regulator is designed to charge the type of battery you plan to install in your setup. Most regulators will have specific charging profiles for the four different types of automotive batteries commonly used today.
It is also important to consider where the battery is mounted. If you plan to have the battery inside a caravan for example, you must get a sealed battery because an unsealed battery will generate harmful gases during charging.
Your best bet is to contact a battery supplier and discuss your requirements with them.

We don't won't harmful gasses