



Off grid Solar

Description

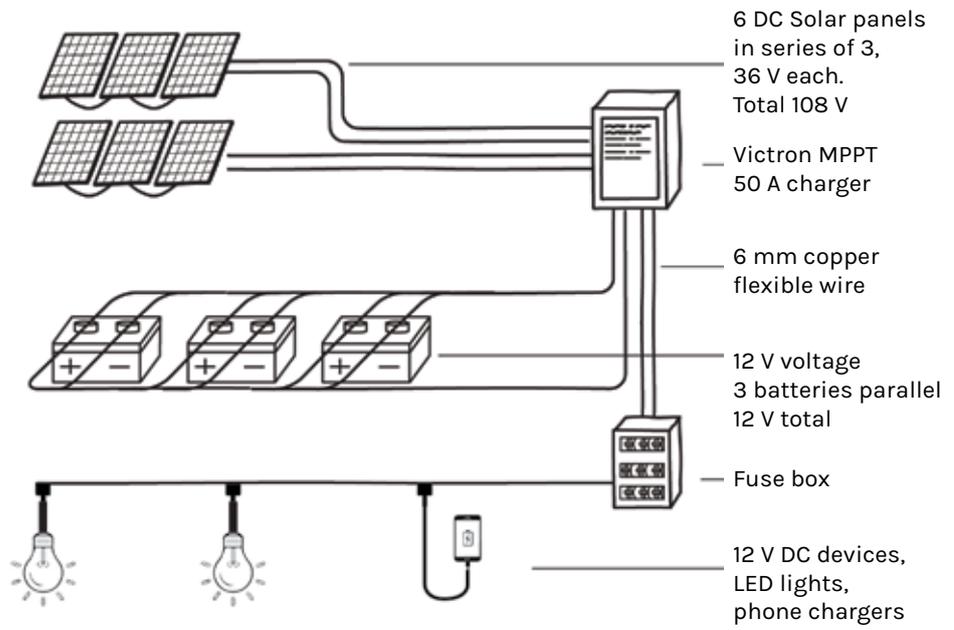
Off-grid versus grid production: the debate is long, and the answers are not obvious. What is certain is that it largely depends on how much storage you need for your solar production. If the storage need is high and grid connection close, then the decision is quickly made. Storage is (and will remain for some time) expensive, not environmentally friendly and high maintenance. However, the price for a grid connection and related monthly costs are relatively high, and the waiting time for a new connection can be long. The exciting thing is that we have discovered two tricks to limit storage need, and if you manage to apply them in a disciplined way, you might not want to consider a grid connection, even if the grid is around the corner!

It must be noted that it is NOT easy to depend on DIY solar energy production. Failures and malfunctions are difficult to detect, analyse and repair. And mistakes, misjudgements and mismanagement can turn out to be very expensive.

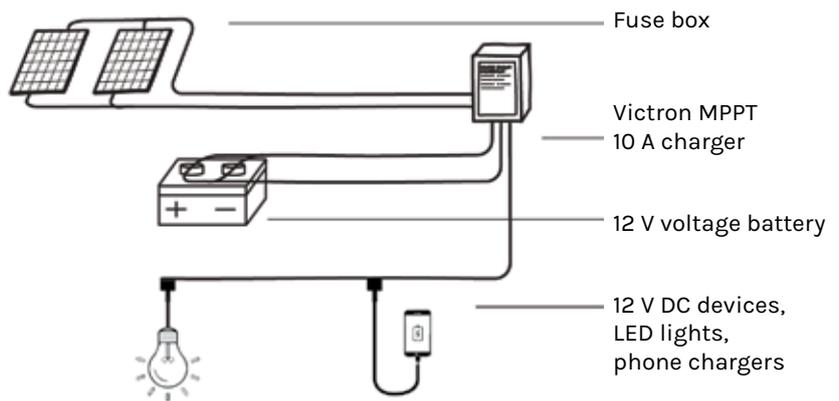
However, these limitations are also true for the professional sector. Thus, as we increasingly depend on solar energy, we will continue to pay the costs of counteracting this complexity one way or the other. Therefore, we have opted for another strategy: making the base system (a set of solar panels connected to a controller and battery) as simple as possible, and linking several base systems together, instead of one



3 container units system



1 container unit system



Greenhouse, Grey water filter



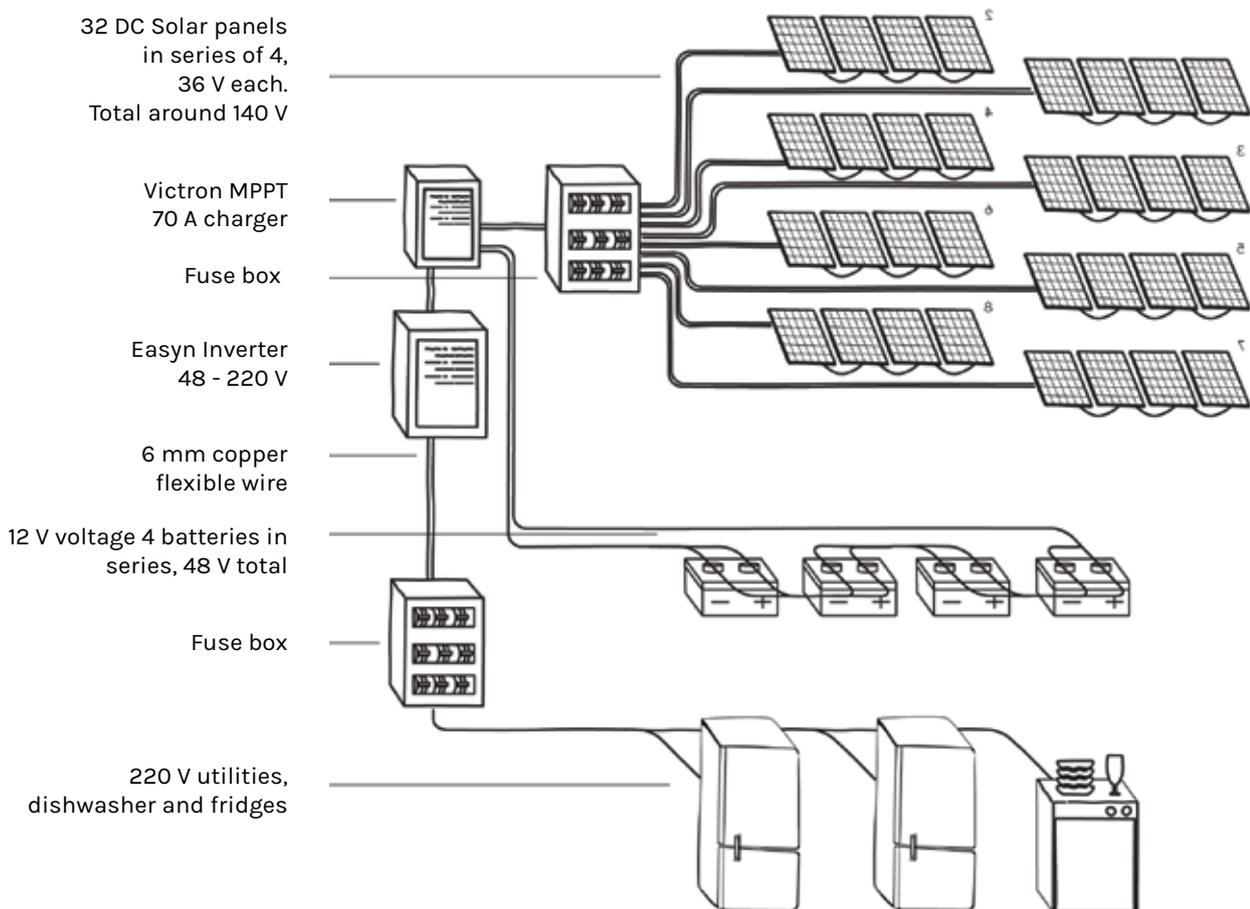
Greenhouse, Grey water filter



Next page Fig 3.15 Solar panels survivor units, 12 V units
 Below Fig 3.16 Solar panels kitchen units, 220 V units
 Illustration by Alessandro Rosa

central system. It is also critical to cut down on storage needs wherever possible. The different systems are interconnected with *network switches*, and most base systems are operating without batteries and solar controllers - the so called *direct applications*. With this modular system we are much more happy and relaxed in our day-to-day life!

Most manuals for DIY energy production start by asking the user to identify their exact energy needs, and to identify when and for what they need power. If you have unlimited resources, this is a straight-forwards approach. However, in practice, it is necessary to find a middle ground between what we want to use and what we can reasonably obtain and generate. Being used to grid connections, we are conditioned to expect a seemingly endless supply of energy.



Materials and construction

Choice of panels

Obviously we go for second hand or dumped solar panels. The development of solar technology is still progressing rapidly, and people are changing their solar panels before the end of their life cycle in order to profit from the higher efficiency of the newest panels, which are also becoming cheaper. Sometimes a whole set of panels are replaced because they are underperforming, and the insurance contract forbids selling on the second hand market, but can be given to "good causes". For the offgrid, small scale applications that we have in our experiment, they will perform perfectly! The choice is clear: get what you can get and don't pay too much (much less than 50% of the initial value for second hand)!

There is one drawback: if you want to build a bigger system, you need your panels to have more or less the same performance, so that one lesser panel is not functioning as an obstruction for the rest. So, you need to test the panels. We recommend testing them with an adjustable resistor, and seeing how much capacity they have with 2 or 3 different levels of resistance. For one system, you then choose the panels with more or less the same curves.

Choice of solar controllers and inverters

If you can get hold of a good second hand European brand (like Victron): take it! Stuff from AliExpress is dirt cheap, but most of it doesn't last long, and it might lead to problems that are not easy to identify. Guarantees are also complicated, sending back material takes a long time and it is difficult to communicate with the factory.

Choice of cables and cable connectors

With low voltage there is considerable loss of energy during transport through the wires. But thick cables are very expensive. We choose for 4 or 6 mm² wires. Make sure to have DC adapted wires, which are stranded, not solid.

Choice of batteries

If you can get hold of cheap second hand lithium batteries: take them! They last longer and are easier to maintain. Otherwise, semi-traction LED batteries are clearly still the cheapest option. If you decide for a system that heavily depends on batteries, it might be good to invest in a battery tester. If you buy a second hand battery you can ask to test them first.

Fig 3.17 Victron MPPT 70A charger
 Fig 3.18 batteries 12 V in series
 Fig 3.19 fuse box
 Fig 3.20 Victron MPPT 10 A charger
 Fig 3.21 fuse box
 Fig 3.22 Easyn Inverter 48- 220 V
 Fig 3.23 Greenhouse roof with 12 DC Solar panels in series of 4,
 Photos by Alessandro Rosa



Fig 3.17



Fig 3.18



Fig 3.19



Fig 3.20



Fig 3.21



Fig 3.22

Fig 3.23



Most important warnings for direct current (DC) systems

Making mistakes with electricity is expensive and risky, for yourself and for others.

1. Make a clear operating board, with disentangled cables, firmly attached controllers and batteries in an open box, with a lid to protect against falling (iron) objects
2. Use coloured cables as prescribed
3. Use cable pipes in walls, and ground cables in the ground
4. In case of disconnecting the system, always disconnect the solar panels first

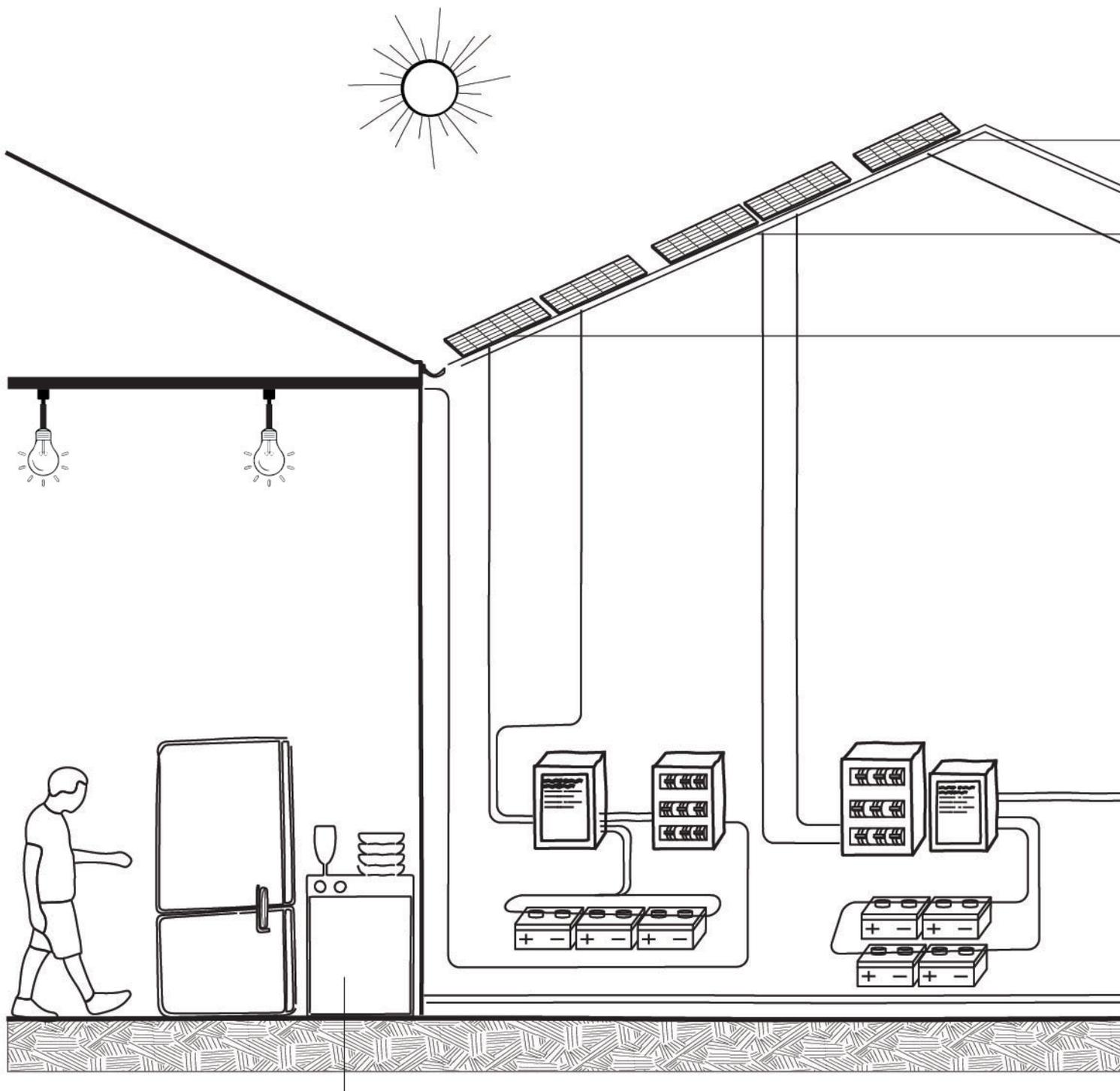


Fig 3.24 Solar Panels and electric system integrated,
Illustration by Alessandro Rosa

We recommend having different simple systems instead of one complex system.

Lighting requires so little energy compared to cooling or power tools, that we recommend to run one or a few 12 volt LED light systems on a few solar panels with a few old batteries and cheap solar controllers. These systems are very trustworthy and easy to repair. If the central system fails, there is still light!

For the central system, use the best batteries and the best controller. In this set-up, only the cooling runs on it, and occasionally the power tools.

For ventilation, and pumping, 12 volt applications are recommended. They can be connected directly to a solar panel, with only a 12 volt regulator in-between. If there is sun, it runs!

