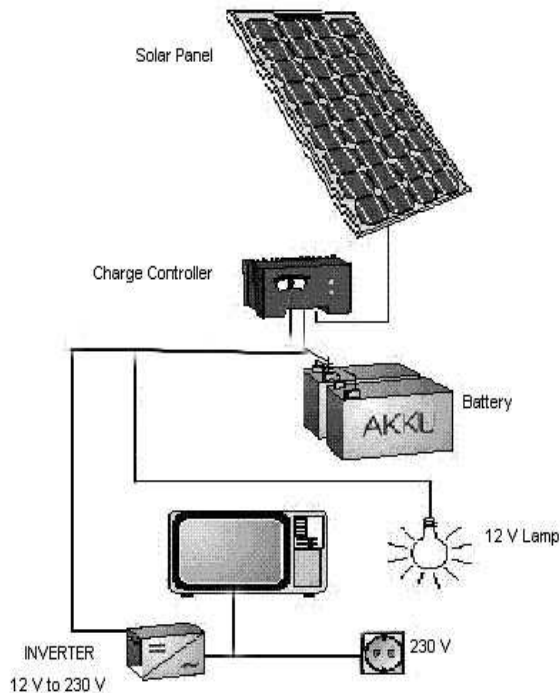


## **Basic Information on Solar Systems**



### **Environmental Aspects:**

Energy security has become one of the hottest political topics in the last few years with the prospects of skyrocketing oil prices and shortages. Along with the looming dangers of climate change, the urgency of alternatives to CO<sub>2</sub> emitting energy sources is becoming more obvious by the day. One of the most important actions to counter these challenges is the establishment of alternative energy sources such as solar energy. Solar power has traditionally been differentiated into solar thermal and solar

photovoltaic (or PV for short) systems. The photo-voltaic effect is a phenomenon that depends on quantum physics, and allows specific materials to directly convert solar radiation to electricity. The photo-voltaic effect is used in solar panels, that have been powering spacecraft for decades and have recently been making their presence felt in supplying electricity to free-standing locations on earth, like telephone towers and pump systems on farms.

### **Basic Technical Information:**

Solar panels in the southern hemisphere are facing north with a tilt angle of approximately 22° to compensate for summer and winter sun radiation and can be mounted either on the roof itself (if facing north) or attached to the chimney or elsewhere suitable (i.e. on a pole in the garden).

The solar panels produce an electrical current during sunshine which feeds through a control unit into the batteries. The control unit or control charger takes care of the charge and makes sure your batteries are always fully charged and also block the current from feeding the solar panels by reversing the current at night when there is no charge from the sun. The batteries are necessary to store the power once the sun does not supply an electrical charge anymore.

Your lighting system internally and externally should be secured through a fuse and is connected straight to the battery. The inverter which transforms a 12 Volt current into 220 Volt mains quality is also connected to the batteries. Your electrical appliances according to the inverters output (Watt) can now be plugged in into the inverter.

### **Control Charger:**

Modern control chargers are PWM or MPPT chargers (pulse width modular/maximum power point tracking – which basically stands for sophisticated, optimised battery charging and include a micro-processor)

PWM or MPPT charge controllers optimise battery charging on the basis of its actual state of charge (SOC) and set the voltage threshold to the SOC and ambient temperature. They

recognise the battery current/voltage status, age, operating temperature; hence disconnect the modules only when the battery is effectively 100 % charged. The resulting effect is batteries receive between 25% and 40% additional charge depending on the situation.

### **Inverter:**

The PURE SINE INVERTER-MT-Series (Made in Germany) is the ideal solution for operation of all 220 V mains consumers with a power consumption of up to either 250 or 1500 Watts continuous rating. Household appliances, such as blenders, toasters, coffee makers, a fridge, deep freezer, microwave ovens, vacuum cleaners etc., as well as TV- sets, video recorders, DSTV's, computers and battery chargers can be operated in regard to the size of the unit (250/1500 Watt output)

Even appliances with electronic control and power control, such as fully automatic coffee makers, can be operated without any problems.

The pure sine MT inverters convert 12 V Direct Voltage (DC) of a battery into 230 V / 50 Hz Sinusoidal Alternating Voltage (AC).

The units are designed according to state of the art in clock pulse-controlled execution ("switch mode"). Due to the microprocessor control in connection with modern SMD technology, an extremely compact design has been realized.

The solid housing is designed according to the state of the art of fluid mechanics. Easily running fans (with speed control) being noise-optimised and friction-optimised combined with the optimised air conduction system ensure perfect cooling and thus unproblematic continuous operation, even at full capacity.

Furthermore, the thermal and electric load as well as short-circuit of the output circuit are supervised by integrated protective circuits. The inverters are equipped with an intelligent control for power saving with automatic disconnection, which ensures minimised power consumption during idle time. An integrated under voltage protection protects the batteries by disconnecting the inverter in case of dropped battery voltage.

### **Lighting:**

Our light bulbs consist of 12V/DC 11/15 Watt energy saver light bulbs. They are the equivalent to incandescent bulbs of 60W with a B22 socket (common in Zimbabwe and the UK).

Energy saver light bulbs convince with bright light and very low power consumption. Each light bulb has a life expectancy of approximately 6000 hrs (manufacturer) and consumes as little as 0,9 Amps/hr.

**As an example:** One light bulb connected to a **100 AH battery** would last in theory about 100 hrs of light non-stop without recharge. That much to theory because in reality only 50% of the battery capacity is in fact usable. That provides a real time of about 50 hrs or roughly two days. Two light bulbs reduce non-stop lighting to 25 hrs and so on. Our lighting systems are independent of the use of inverters and solar panels. They can also be used purely with a standby battery and recharge with an ordinary battery charger.

### **Solar Panels:**

We currently offer 50 Watt (Rated Power) Poly-Crystalline Solar Module which produce around 3,2 Amp load current under ideal conditions. The modules are permanently laminated within a pottant and encapsulated between a tempered glass cover plate and a back sheet. The entire laminate is secured within an anodised aluminium frame for structural strength; ease of installation, and to protect the cells from the most severe environmental conditions (even hail to a certain extend).

Our modules are a reliable, virtually maintenance-free direct current (DC) power source, designed to operate most efficiently in sunlight. Live expectancy is 20-25 years after which output will slowly decrease. They are ideal to power remote homes, recreational vehicles, water pumps, telecommunication systems and many other applications either with or without

the use of storage batteries. A weatherproof versatile junction box on the back allows connecting several modules in series to up to a maximum system voltage of 600 VDC. Operational temperature ranges from -40° to +90°C.

### **Batteries:**

The Batteries are necessary to store electricity for lighting or inverter use at night when there will be no load delivered from the solar modules.

Ideally we would recommend the use of lead acid deep cycle **maintenance free** batteries which are specifically designed for use in solar systems. Deep cycle batteries are designed to recover easily from low voltage points and a good quality battery will last up to 10 years if charged and monitored by our control chargers. The number of batteries you will need depends on the size of your system, in regard to the power consumption of either your solar lighting system or/and your electrical appliances connected to the inverter.

We do not recommend the use of ordinary starter batteries.

### **System Set-up Guideline:**

The size of a recommended PV system totally depends on your needs and if you are able to supply us with your most urgent requirements we will do our best to design a customised system for your personal needs.

Unfortunately the capacity of a basic solar PV system is limited to a certain extend. You will **not** be able to connect your stove or respectively your geysers to an inverter. These heat producing devices will simply overload the system. I.e. a stove requires around 3-4 KVA or 3000-4000 Watt power alone. A microwave oven on the other hand is easily possible since they "only" require between 700-1000 Watt. In order to use an inverter accordingly to its output capacity you will need to know the power consumption of the electrical appliances you intend to use on the system. All electrical appliances have a label (commonly on the back or underneath the item) which informs you about the electrical Power (Watt) needed. It might sound complicated but in fact a solar system is much easier to operate than a generator once you made yourself familiar with it.

To keep matters simple following you will find three different scenarios of a basic system which should give you an idea of the components involved.

### **Example 1:**

Situation: Lighting system only, without any other electrical appliances needed.

Depending on the location (flat/house/warehouse) you will need a certain number of solar light bulbs for sufficient illumination inside and perhaps for security purposes outside the building.

**Option 1:** The lighting system is connected to a stand by battery and you will have to charge the batteries manually with an ordinary battery charger whenever there is power available from the mains.

**Requirements:** Solar light bulbs, Battery (100 Ah), Battery charger, wiring.

**Option 2:** The lighting system is connected to a solar system with Solar modules which charge your system automatically.

**Requirements:** Solar light bulbs, Solar panel (at least two depending on the number of light bulbs connected), control charger, Batteries (100Ah - at least one depending on the number of light bulbs connected), wiring.

**Example 2:**

Situation: Lighting system with the need to connect small electrical appliances (i.e. TV, DSTV, wireless phone, Notebook, printer, phone charger etc. up to a total of 250 Watt) Depending on the location (flat/house/warehouse) you will need a certain number of solar light bulbs for sufficient illumination inside and perhaps for security purposes outside the building.

**Requirements:** Solar light bulbs, Solar panels (at least two, ideally four or more depending on the number of light bulbs and usage of electrical appliances connected) control charger, Batteries (at least two depending on the number of light bulbs connected)

Small size inverter (250 Watt permanent output), wiring.

**Example 3:**

Situation: Lighting system with the need to connect bigger electrical appliances (i.e. TV, DSTV, wireless phone, Notebook, printer, phone charger and in addition a Fridge, deep freezer, microwave, vacuum cleaner etc. up to a total of 1500 Watt) Depending on the location (flat/house/warehouse) you will need a certain number of solar light bulbs for sufficient illumination inside and perhaps for security purposes outside the building.

**Requirements:** Solar light bulbs, Solar panels (at least four, ideally six or more depending on the number of light bulbs and usage of electrical appliances connected) control charger, Batteries (at least four depending on the number of light bulbs connected) Big size inverter (1500 Watt permanent output), wiring.

**Closing Remarks:**

Solar systems are virtually maintenance free and very simple to operate. There will be **no** further costs in the long run opposed to generators which require expensive fuel/oil or wasting precious time in fuel queues, maintenance costs, change over switch, permanent attention and sometimes complicated operating skills.

Also shortages of energy are not exclusively a Zimbabwean problem but a global challenge. Green or renewable Energy is certainly the way forward and you also contribute to a cleaner environment with less green house effect. Our basic solar systems are ideal for the current situation of short time power cuts and load shedding.

The systems are easily upgradeable at any time.

Feel free to contact us for further information if you seriously contemplate a solar set-up.

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