

LIGHTING & POWER ARE ABSOLUTE NECESSITY FOR ANY SOCIETY

Power is an absolute necessity for any society, developing or developed. Without power one cannot operate machines, computers, lighting, etc., essentially needed for growth of the nation and its people. However, power needs for people and business are different.

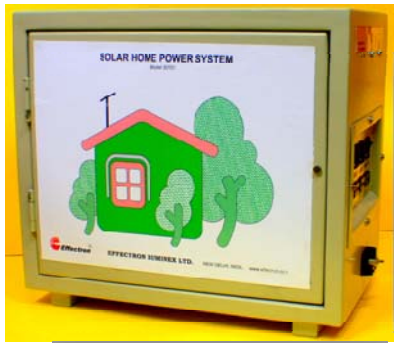
For **Business & Industry** power is needed to run machines and production shops. Power requirements are large and are generally provided by large Generators operating on Fossil fuels as well as on Hydro power. Power generating stations are rated in Mega Watt power, as each Industrial unit requires several Kilowatt of Mains power to run electric motors, machines, Owen, etc. A 20 Megawatt power station will cost several 100 millions of dollar, to setup and requires constant supply of Fossil fuel like Oil, Coal or Gas at substantially high and variable costs. Fossil fuel when burnt, in the process of generating power also generate CO and CO₂ gases which damage the environment.

To circumvent this problem of Carbon gases production, one needs to revert to Solar, Wind and Biomass technologies for Power generation. These processes, though environment friendly, are expensive to establish, i.e., Capital costs are high but with little or no running costs. Power generated is compatible with Power generated using Fossil fuels. Present technology for Solar Power generation is still not matured enough to be used for large scale adoption. A High reliability Inverter is required to convert SPV power into Sine Wave AC to make it compatible with Large Power generating stations. Solar Power plants of about 20 Megawatt power are being installed on experimental basis all over. Their cost per unit power generated vis-à-vis its life is being evaluated, Since the Technology is still in its infancy and will take some time to mature for large scale commercial use.

For **Residential and Small businesses**, power needs are mainly for Lighting and small appliance, like Radio, TV and Mobile charging, etc. Power required is also small in 100's of watt only. Power needed for people living “**at the Bottom of Pyramid**” is even less. This power can be economically produced from the Sun by SPV, Solar Photovoltaic panels and simpler electronics and a Battery. Being of small capacity they are small and compact and costs far less. An individual can afford such a system to meet his needs. Such small systems can also be grown to enhance capacity when the need arises. These systems are not inter-connected; they work as independent power stations.



LIGHTING & POWER ARE ABSOLUTE NECESSITY FOR ANY SOCIETY



When considering small power system (less than 1KW), we should desist from converting SPV DC power into mains 230VAC power. Conversion wastes precious energy, due to poor conversion efficiency. We need to think that as we generate low voltage DC from SPV, generally 12VDC, the entire power system should be built for low voltage DC distribution and low voltage DC appliances like LED bulb, Fan, Radio and TV all working on low voltage DC system. This way we avoid loss of power due to conversion efficiency.

Low voltage DC operated cooling devices are also available like Bottle cooler, A cooling chamber which works on principle of Peltier, has no compressor or like can be used. This fully Solid state Cooling device will work with solar power and cool a small chamber of say 20cuft to approx. 4 degree C temperature, enough to keep Cold drinks cool, same cooling device can also be used for storing lifesaving medicines in a primary health centre.

Systems built using 60W SPV panel, charge controller and Battery of 40Ah capacity can provide a Business/ Residence with following equipment;

1. 12VDC LED lamp 3W or 5W, wired in the house, for 10 Hrs use, 5 nos.
2. Mobile charging 1 no
3. Portable LED lantern, good for 5 Hrs of operation per day 1 no.
4. TV or Radio 4 Hrs. per day 1 no.
5. Table Lamp for reading, 3W LED lamp, 3 Hrs/day 1 no.

Such a system will cost approximately **USD 90.00**. No technical assistance shall be needed for installation or operation.

For larger loads a system could be built at approx. **USD 200.00**. This will give uninterrupted power for at least 2 days of use for 8 LED lamps, Mobile charging, AM/FM Radio, TV, Cooling Chamber, Portable lantern and Table lamp, etc.

LIGHTING & POWER ARE ABSOLUTE NECESSITY FOR ANY SOCIETY

One important aspect of the design of such a system is that the Battery, Charge Controller and other Electronic circuit cards should be housed in a metal body so that it is safe for children who might want to play with it and is safe from damage by mishandling. Plastic built cabinets, though good looking have a shorter life because of the Chemistry of Plastic material. All load connections need to be rigid either by appropriately rated terminals or Polarized plug and sockets. DC supply has + and – terminals making it mandatory to use Polarized plug and sockets, otherwise equipment you will use may get damaged due to wrong connection polarity.



Being an OFF Grid system, it supplies power through stored energy in the Battery. It is therefore important that the Battery is maintained in proper condition, To achieve longer Battery life it is recommended that Solid Maintenance Free (SMF) battery be avoided, they have shorter life, instead Tubular Lead Acid batteries should be used and maintained as prescribed. Simple topping up of Distilled water, once in three months, and cleaning of the Battery terminals is all that is needed for good maintenance. Tubular Lead Acid Battery will comfortably give a life span of 3-5 years, before replacement.



One can also use Automobile (Car) battery, if tubular Battery is not available or is very expensive. Car batteries will also last approximately the same, only problem is loss of marginal charging efficiency. The Charge Controller built as part of the system should be suitable for charging all types of Batteries, Viz; SMF, Tubular or Plate. In this way a user in remote areas shall be able to maintain and upgrade their system themselves or with little help from local technicians.

For Home lighting one can do permanent wiring in their dwelling wall or roof, using two color wires and lamp holders. A number of lamps can be connected in one circuit to enhance the light level. Normally 3W LED Bulb gives sufficient light for a living room. There should be no need to enhance light output with more lamps. For a larger dwelling 4



LIGHTING & POWER ARE ABSOLUTE NECESSITY FOR ANY SOCIETY

rooms and a Kitchen, two or more circuits could be laid out and all wires terminated on Polarized plug and connected to Home Light System. Switches for lights could be placed in the room itself or can be used as provided on Home Light system box.

Most Home Light systems provide a jack for Mobile charging where an appropriate charging plug could be inserted. Since Mobile charging is done from internal Battery of the Home Light system, there should be no chance of the Mobile getting damaged. When not charging the mobile, same Jack can be used to power an AM/FM radio.

All portable LED lanterns have a small internal battery, which needs to be charged regularly. These lanterns are designed to be charged from SPV. Some Lanterns are designed to be charged from 12V Battery as well, so if you have a LED lantern of this variety you can charge it from any 12V DC output of Home Light system, thus avoiding need for additional SPV panel.

LED lanterns are more convenient and economical to operate than the Torch, which invariably use replaceable Dry Batteries. A local Businessman can use it while moving from his Business, after closing, to home and back, for charging at his Business, at no extra cost.

It is a common knowledge that LED's consume little power and last a life time, provided the unit is built with Good Engineering design and practice. This is a challenging requirement, generally designer and manufacturers in order to cut down on cost try to adopt short cut methods at the cost of reliability and the lifespan of product. A good designed product saves money on the long run, so the user should check before buying about the engineering of product. Assistance of local technical personnel may be taken in this respect. There are many little known brands which are excellently built but are less popular because they are not known. So the best way to differentiate between good and poor quality products is to discuss with your dealer about the plus and minus points of each product you intent to compare, or take the help of a technical personnel known to you.



Some products in market offer added features which permit use of Fan, TV, Cooling chamber (Mini fridge), etc. These added features can be used when Home Lighting system uses large SPV panel and large Battery.

Basic concept of this presentation is that if we don't have grid connectivity, but we still want to take the benefit of improved living, we



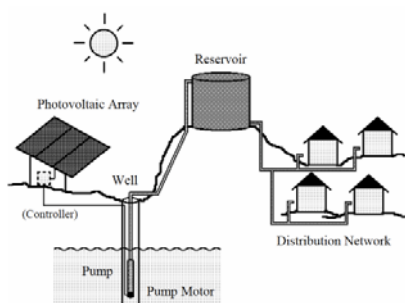
LIGHTING & POWER ARE ABSOLUTE NECESSITY FOR ANY SOCIETY

should go for solar power with Battery storage. Do not convert stored power to mains power at 230V AC, by inverters and then using normally available mains operated appliances. The process wastes enormous amount of solar power, due to poor conversion efficiency, at Battery charging and then converting into mains power.

It must be appreciated that the person who has no available power from Grid and opts for Solar Power has no existing appliance with him. He has to buy every piece of appliance for his use, so he should buy only those appliances which works on low voltage DC, like LED Bulbs, Radio, TV, Lantern, Fan, Mini Fridge, etc. In my opinion, it is the wrong approach to convert battery storage power to 230V Mains AC and then run a lamp or CFL. You will lose large amount of stored power in the conversion process.



Clean Drinking Water is also a major concern of Rural Populace. Normal practice of converting solar power into 230V AC or 415V AC, 3 phase by large capacity Inverters running in tandem then running water pump like submersible or centrifugal type. For



people **"at the Bottom of the Pyramid"**, the bare need is Clean Drinking Water, in smaller quantities. If a small capacity 12V DC Diaphragm type submersible pump is directly connected to Solar PV Panel, without Battery, it can deliver from about 1000 liters to 2000 liters/day depending upon the depth from which it is pumped out. If 3-4 such systems with storage water tank are setup in a rural cluster, it can provide enough clean drinking water for a rural cluster. Cost for a single

system with SPV Panel, Submersible Pump, PVC Storage Tank and steel structure, piping etc. will be USD 1500/- . These systems normally do not require routine maintenance. Diaphragm change is required once in 5 years, any village level technician can change the diaphragm with standard tools. Pumps are made by companies specializing in fine engineering and cost about USD 500-800/-. Since system cost is relatively high, I suggest that money for this should come from Govt. or financed by Political parties and elected representatives.

Area Lighting for Weekly market, Bazar, Village level governing bodies, where villagers often meet to exchange views, need a larger source of light. We can do it by providing a street light fixture with built-in Light Head, Battery and Solar Panel, all mounted on a Pole, of approx. 4 mtr. Height, to provide adequate area of illumination. An



LIGHTING & POWER ARE ABSOLUTE NECESSITY FOR ANY SOCIETY

ordinary Galvanized Water Pipe of 50-75 mm diameter could be used to act as a pole for supporting Light and Panel. Battery could be inside the Light head or mounting in a box at the bottom of Pole.

Solar opportunities are immense and are within the reach of "Common Man", if properly and adequately utilized. Enough material is available on the internet to explore. However, for first hand practical information, if required, may be obtained from the author of this article at the contact details given below;

Gopal Darbari

Director, Managing

Effectron Luminex Ltd.

A-68 DDA Sheds, Okhla Phase 2

New Delhi 110020, India.

Email: gopal.darbari@effectron.co.in

Mobile: 00919810057373