SOLAR BACKUP SYSTEMS FOR COMPUTER NETWORKS

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INTRODUCTION:

Continuous and uninterruptible power supply is a critical requirement in the operation of modern day information technology systems which employ powerful computers and computer networks, high speed and long distance communication and data-transmission systems. Without continuous power supply, none of these systems will function satisfatorily and the loss in efficiency and time could make the whole difference between a successful operation and the total failure that could render the entire system useless and ineffective.

Last century's power made available through heavily overloaded grid-supply with its frequent blackouts, brownouts, and voltage spikes, has proven inadequate. The requirement is for smooth, clean and continuous power to match the tasks for which modern computer networks and communication facilities are set up in a highly digitallized environment.

Almost as if by coincidence (or perhaps as a by-product of the satellite/space technology) today's modern autonomous (modular) power systems have arrived on the scene to provide the power source with the required characteristics that can be said to precisely match the requirements for the tasks we perform in a computerized environment. These power sources are reliable, continuous, clean, quiet, and above all they derive from sources with which we are familiar, and which are part of our immediate environment.
We are all understand quite well the the renewable resources commonly described as follows:

(a) Solar power or energy generated from irradiation of the sun
(b) Wind power

(c) Other less universally available and less familiar sources, i.e ; geothermal, tidal wave energy, biogas, etc.

These energy resources are renewable as a result of the continuous cycle of the powerful natural resources around us. In addition, they are eco-friendly, a factor which coincides with our new consciousness of environmental protection.

SOLAR ENERGY: AN OVERVIEW

In our location here in tropical Afica the sun is of particular significance as an energy resource because of the abudance of solar or sun irradiation. Although, this abundance varies from location to location and also according to the prevailing season, it is predictable.

The technology most central to harnessing energy from the sun is the solar collector popularly known as the solar module. The solar module is a wide-area, semi-conductor diode made out pure silicon to which impurities are added in a controlled "doping process". The module absorbs photons of sunlight to create a potential difference across a junction. Power generated from solar modules has the following advantages over the power generation of traditional sources:

(a) Solar modules produce power passively when exposed to sunlight without any moving parts. This makes them maintenance-free and therefore long-lasting. (Some warranties are for up to 20 years.)
(b) The fuel required for them to operate is free sunshine.
(c) They are harmless to the environment.

Various manufacturers of solar modules exist and some of the best of these are manucatured under the trade names: (a) Siemens (b) British Petroleum (BP) (c) Kyocera (d) Solarex (e) Helios (f) Solec (g) ASE (h) Unisolar; etc. Most of these brands are of very high quality and the manufacturers offer attractive warranties, some for as long as 20years. Solar modules are expected to go on for even longer than the warranties offered by the manufacturers which makes them good value for money. It is easy to estimate how much solar energy can contribute to our national energy requirement by a quick calculation as follows:

A small 55 watt solar module can produce up to 440 watts in 8 hours of peak sunshine. We assume the population of Nigeria is 120 million with an average of 10 persons/household. If each household installs one 55 watt solar module, the total amount of power generated daily, for an average of 20 years is:

12,000,000 Ξ 440 = approximately 5,300 MW (megawatts) daily

This is a substantial amount of power which can be fed into the utility via utility-interconnect devices.

System Components in a Solar Installation

Other peripheral equipment is required for harnessing solar energy.They are:

Batteries

(1) Storage systems or (batteries) provide continuity of power once power generation ceases at night or during overcast weather. Storage systems remain one of the biggest challenges confronting the R.E (renewable energy) industry. Batteries still remain the most popular way to store the power generated from solar modules. There are different types of batteries but the ones specified for solar energy usage are the *deep cycle* type. These are scarce in Nigeria and also very expensive. For this reason, in most of the installations that we have carried out in the University of Jos, we have mostly employed an over-sized system of diesel truck batteries.In this type of configuration, in which they are not too deeply discharged (not more than 10%) they can last for a reasonable length of time while providing adequate backup power during power outages.

(2) Power input /output control equipment.

Inverters

(3) Power conditioning equipment popularly known as inverters which convert the power to the form required for most household appliances. The choice of equipment to balance the system is very important. It is usually best to

stay on the side of reliability but sometimes this comes at a price .

TYPES OF APPLICATION:

Being modular, renewable (i.e, solar) power systems can be tailored to a wide variety of applications, tasks or situations, some large and some small. Within the university system the size range varies from the small battery backup one-unit inverter/charger for single unit computers, to the sophisticated solar/utility system in the VSAT (NuNet area). Both quality, scale and sophistication are on the upward trend, the most recently installed system in the library has nearly 10,000 watts of inverting capacity and over 4000ah battery power.

NON-BATTERY SYSTEMS.

Some renewable systems require no power storage facility at all; these employ the direct use of the sun in which solar modules generate electricity for immediate use, as in community borehole water pumping applications. In this case enough electricity is generated during the day to fill the tank for continuous usage. A typical 32 module system will cost about N3 million.

BATTERY BASED BACKUP SYSTEMS

There are also systems which are not wholly renewable as they consist of batteries charged by grid power or generators (without the solar modules) for use during power outages. These backup systems are affordable to a wider number of people for providing continunity during power outages for lights, computers, televisions, etc.

PV-GENERATOR OR PV-UTILITY HYBRIDS

Hybrid systems which take power from the generator or the grid when it is available to supplement what is being generated from a solar array which would not otherwise provide the entire power requirement. This obviously is a cost-saving device in today's cash–strapped environment; moreover solar power helps to keep storage sysems in top conditions much better than rectifiers or chargers.

Other possibilities that exist are the standalone PV systems in which the solar modules are the sole source of power for residence or office.

There are other hybrid systems such as the the solar–wind hybrid systems in which solar power and small wind–driven turbines provide the power requirement complementing one another for continuity.

Whichever option one chooses certain principles apply:

(a) The system can always be re-engineered in either direction being modular to suit the task at hand.
(b) Absolute efficiency is required in application of power for best results.

Installations at the University of Jos.

The academic environment at the University of Jos with the pioneering and leadership spirit of key members of the university has provided us, at Solar Electric Systems Ltd, an opportunity to deploy solar power backup systems in many of its departments.

At the time we carried out a demonstration of solar power at the University of Jos as far back 1999, the initial response was cautious. This was perhaps because most of the departments found the cost of the systems much higher than the cost of generators. However, a combination of factors have combined to give the University of Jos the pioneer status in the deployment of solar energy:

(1) First is the foresight of its key members of staff and their will.
(2) The generally unreliable power situation around the country.
(3) The introduction of small battery-based systems which are relatively inexpensive to buy and to run and offer long hours of uninterruptible power for crucial computing tasks.

At the beginning, our strategy was to install relatively inexpensive small standalone systems as a means of providing immediate solutions to the obvious power problem. This was so as to introduce the system gradually. However, in the university environment, where key members not only have lots of information at their disposal, spreading the awarness about recent technological practices is usually not a problem. Therefore, the installation of one system lead to the eventual installation of others.

Naturally, the pioneers are those departments for which power requirement is absolutely crucial, i.e, Bursary, Accounts, Computer centre/Nunet (VSAT), Library, and of course ,the Central Administration. We expect that other departments and universities may follow suit eventually.

Our most recent installation in the library features some of the best engineering materials in the world manufactured to very high standards, producing purely sinusoidal wave electricity (superior to electricity from the grid) with the staggered configuration of several, approximately 1,000 watt units stacked to provide power to different parts of the library. This ensures that the entire system can hardly go down all at once. As we go on we intend to gradually incorporate very powerful and durable battery storage in our systems.

CONCLUSION:

The versality of small independent power systems can be described as power made available as and when required and wherever it is needed. They can be as small as a milliamp system providing just enough power for a mobile phone or laptop, or huge multiwatt systems providing power for an entire village. This certainly matches the freedom and versatility that the computer age has made available to all of us.

Solar Electric Systems Ltd: Corporate Profile

Solar Electric Systems Ltd was established seven years ago and has since then successfully engineered a large number of solar energy/backup/hybrid plants in various parts of the country.
These include: small to medium-scale rural stand-alone PV systems for private residences and clinics, large scale rural village electrification, community borehole water pumping facilities, innumerable backup/hybrid systems for private residences and institutions.

Solar Electric Systems is also the first indigenous company to manufacture locally a solar-powered DC refigerator/freezer for vaccine storage in rural locations. Several of these are currently in use within the country.

In November 2001, the Solar Energy Society of Nigeria conferrred on **Solar Electric Systems** the "CORPORATE AWARD FOR INITIATIVE IN THE PRODUCTION OF SOLAR PV SYSTEMS" in recognition of its acheivements in the sphere of renewable energy in Nigeria.