Introduction to the MDG$_{10,000}$PVP

The attached sheet, reading across, demonstrates how the power of the Sun is converted into useful applications which improve the quality of life.

Solar Energy

Solar photovoltaic technology converts light energy into electricity, while solar thermal technology uses direct heat from the sun (typically to heat water). The insolation map[2] shows the distribution of solar energy in Nigeria. The lowest insolation is greater than 3kWh/m^2/day. Six highlighted states in the adjoining map, are the EU-PRIME focal states. The third figure is a compartment layout of an MDG$_{4,000}$PVP unit. [A] Holds 1 solar vaccine refrigerator, [B] A refrigerator or freezer, to make ice and cool beverages for sale. [C] Solar and automobile batteries are charged here. Battery charging is a necessary application to sustain operations. [D & E] Multi-purpose room(s) have a movable partition. [F) is the unit's storage compartment with a 4,400Ah deep-cycle solar battery capacity. The Maiduguri MDG$_{10,000}$PVP needs a 10,000 watt (10 kWp) array to power the additional load of a large submersible water pump[3], to produce 70,000 litres of drinking water daily from a borehole.

Solar Systems

A typical solar pv system comprises an *array (modules*) producing direct current (DC) electricity which is regulated by *controllers* and stored in *batteries* to be used by *loads* (e.g. refrigerators, pumps, fans, phone,TVs, drills, etc). Shown in the next picture is a schematic of the communication system at a pv site which is being monitored, in order to validate its real time energy production data and automatically to track pv system performance.

Applications

Respectively; a Sunfrost vaccine refrigerator, a Sundanzer refrigerator, an 800W$_p$ Grundfos SQ Flex pv water pumping system, a multiple battery charging system and several internet-connected PCs.

Benefits

Pictures show a barrow water-vendor distributing water, deep-cycle 2V solar batteries (of high capacity and exceptional endurance), small solar home system kit with 2 fluorescent lamps and a 14W$_p$ solar panel (battery required), and satellite phones for communication outside GSM coverage and via GSM networks where available.

8 MDGs

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development

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[1] The MDG$_{4,000}$PVP is the basic unit for small remote communities.
[2] PVGIS © European Communities, 2002-2006.
[3] In collaboration with the University of Maiduguri (responsible for the borehole) and KSB Pumps of Germany (inverter, pump and specialist trainer).

Harnessing Technologies of the Sun for Millennium Development Goals in Africa

The National Programme on Immunisation (NPI) is distributing solar photovoltaic (pv) vaccine refrigeration systems nationwide, and intends to install them in every local government district over the next few years. The primary use of the equipment is to strengthen routine immunisation.
The size of the application, ideally reaching every community in Africa's most populous nation, provides a unique opportunity to supply even the remotest locations with the electricity to run appliances and services on a sustainable basis. Applying renewable energy under one roof[1], to supply services in refrigeration, battery charging, communication and water pumping, contributes to the 8 Millennium Development Goals, and reinforces healthcare delivery by creating frequent reasons for people to visit the centres. Cold chain performance will be improved by timely fault communication through wireless satellite/GSM phones and on-site spare battery charging. This power platform will boost rural earnings through increased farming productivity, new jobs and social inclusion based on the availability of electricity and mobile phones.

The MDG$_{10,000}$PVP "PV power platform", shown here, illustrates a prototype to be built and installed on the KXN "Solar Technology Park" site, at the University of Maiduguri, Nigeria. This configuration, utilising 4 converted 12m.shipping containers will provide solar technical and applications training facilities, warehousing, and accommodation for visiting trainers and specialists collaborating globally. It will provide a creative and comprehensive solar-powered environment for capacity building – a necessary prerequisite for the success of large scale national and regional programme deployment.

Figure 1 The MDG10,000PVP - To support Regional Capacity Building

The container in the foreground, with doors marked A to E has the facilities described overleaf. Behind it, on the ground, is a warehouse unit to store modules and balance-of-system components. On the next level are two residential containers, with bedroom and office facilities. Both levels are separated by an insulated floor with a ventilation atrium.

The third level is a tank container, holding 24,000 litres of water. Water is automatically pumped from the borehole during the day, and the tank acts as a buffer while water is discharged to water tanker lorries. The buffer ensures that no water is wasted.

Total energy (kWh) generated and used, and water volume (litres) pumped, is monitored and information transmitted via GSM or VSAT to the national network operator, who can monitor all systems on a PC.

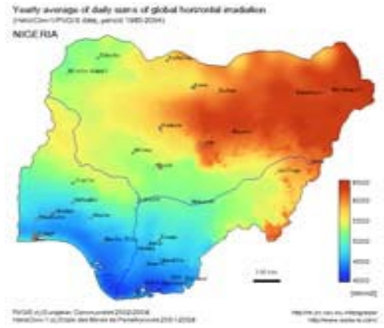
SOLAR ENERGY
Photovoltaic
Thermal

SOLAR SYSTEMS
PV modules (solar panels)
Mounting structures
Batteries
Controllers
Inverters
Loads (e.g. fridges, phones, pumps)

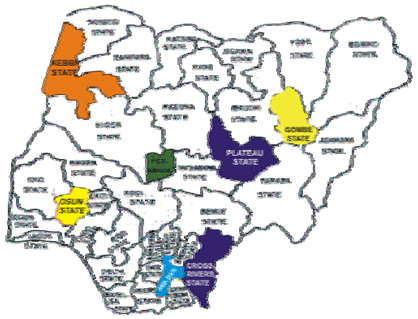
APPLICATIONS
Refrigeration
Water Pumping
Battery Charging
Telecommunications
Lighting
Rural Electrification
Education
Maintenance & Monitoring

BENEFITS
Improved Healthcare
Sustainable Coldchain Reliability
Improved Routine Immunization
Empowering the underserved
Communications Everywhere
Environment & Climate
Rural Jobs & Earnings
Accessibility

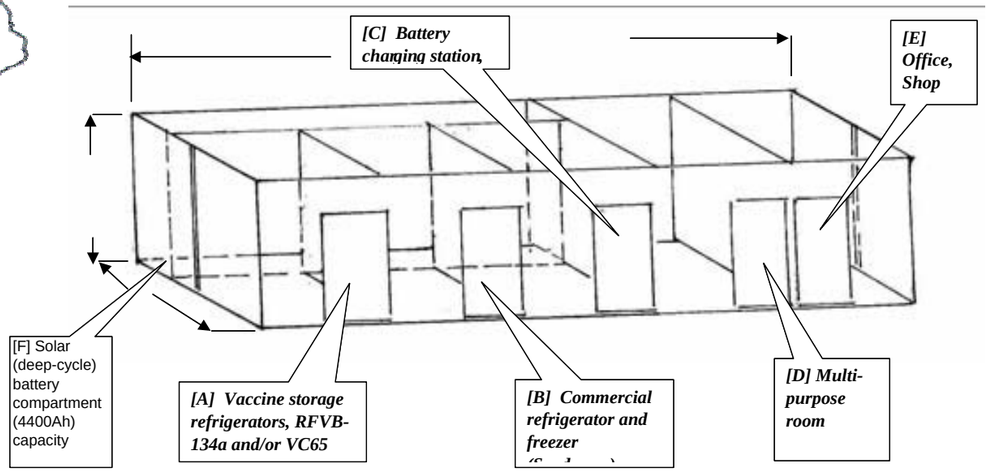
8 MDGs



Solar Insolation on Nigeria

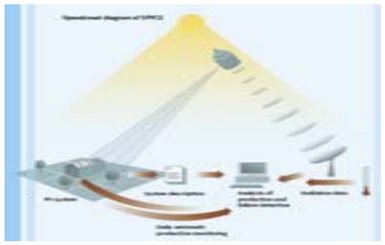


EU-PRIME Focal States



PV MDG Platform for Community Development (4000Wp, 4400Ah) Schematic

Solar PV System with refrigerator load


Remote PV Sytem Performance Monitoring


Solar photovoltaic vaccine refrigerator


Solar pv commercial refrigeration


Water pumping from a borehole


Battery charging

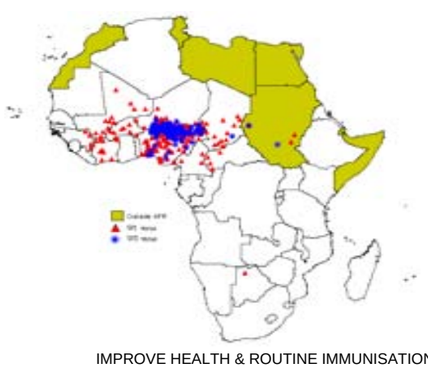

ICT (information, communication eqpt)

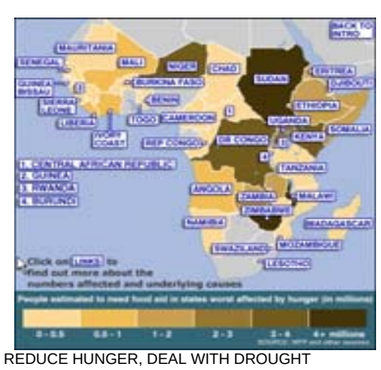

Enterprise and drinking water


Solar deep-cycle batteries


Solar Home System (battery-powered) kit


Remote telecommunications


IMPROVE HEALTH & ROUTINE IMMUNISATION



REDUCE HUNGER, DEAL WITH DROUGHT