

MPAs need power for a range of activities and provide an opportunity to demonstrate alternative, environmentally sound energy sources. Where an MPA is remote from the mains electricity supply, such sources may be the only option. However the use of such systems has to be balanced against a range of other factors such as cost, availability of technical expertise, and reliability. This sheet provides some general principles and an overview of the issues to be considered, assuming that in general an MPA manager will wish to invest in 'renewable' energy sources.

The management of an MPA requires a reliable energy supply to provide power for many activities and facilities, ranging from remote radio communications to staff accommodation, offices, and visitors' centres. Energy requirements are likely to include lighting, charging batteries, air compressors, computers, fridges and possibly laboratories.

Many MPAs do not have access to mains electricity supplies and, although generators are available in every size, they require fuel and regular maintenance, and produce noise and pollution. Traditional electricity generation from fossil fuels contributes to carbon emissions and thus to global climate change. An MPA will wish to conserve energy, reduce costs and contribute to environmental sustainability. The two sources of small scale renewable energy most likely to be available to an MPA in the WIO region are solar and wind. They can be combined in what is called a hybrid energy system.

Before investing in a solar or wind energy system, an estimate should be made of the likely maximum load and total daily power needs. Electrical equipment usually has a label indicating the load in Watts or current in Amps. Multiplying the current by the voltage gives the power in Watts. For example, a desktop PC will need 200-300 Watts, a low energy light, 10-20 Watts. The total power needs in Watt Hours for a typical 24 hour period can be estimated by multiplying the average load in Watts by the expected hours that the equipment is being used. A supplier of solar or wind energy equipment will then be able to offer the optimal solution. If the basic design is correct, additional solar panels and batteries can usually be added later if there is a need to increase the capacity of the system. As long as a solar or wind energy system is properly designed and installed, it should offer many years of trouble free operation with minimal, but careful, maintenance.



S. Wells

However, not all appliances may be suitable for such systems, and this will need to be checked carefully. Some standard office equipment, such as photocopiers and laser printers, has thermal elements with a high temporary power load. It is also useful to invest in energy efficient appliances. For example, fluorescent lights are four times more efficient than ordinary light bulbs. Another way to conserve energy and reduce costs is through landscaping and careful building design. For example, buildings can be designed so that they stay cool, and they can be shaded with vegetation.

An MPA manager should also be aware that the set-up costs of many of the alternative systems are high, and a back-up generator is usually essential where alternative sources of energy are being used.

WIND ENERGY

Although wind speeds in the tropics are generally lower than in temperate latitudes, making wind energy less attractive, in parts of the WIO region, seasonal 'trade' winds are reliable and strong enough to make wind energy feasible (Beaufort 4 and above). Before investing in wind energy, guidance should be sought on local wind speeds and duration to be expected during a full year. Local knowledge, weather station data, plus site measurements with an anemometer can contribute this information.

Wind energy can be used for physically powering water pumps or for generating electricity through turbines. A wind turbine should be mounted as high as possible and away from the 'wind shadow' of buildings and trees. It is recommended that 'marine' turbines, available from a number of manufacturers, are used in an MPA as the components of these are selected to withstand the corrosive operating environment of salt-laden wind. The advantages of wind energy over solar include the ability to generate power at night, and a lower unit cost, as wind turbines are cheaper than the equivalent power generated from solar panels. They do however produce some noise and may disturb birds if wrongly sited.

SOLAR ENERGY

The WIO region is blessed with reliable and plentiful sunshine, and solar energy is the logical choice for most MPA renewable energy installations, possibly supplemented by wind.

Solar panels used to generate electricity on Cousin Island in the Seychelles.

CASE STUDY

Lessons Learned from Solar Energy Systems in the Seychelles

Diesel generators have served the electricity needs of protected areas in Seychelles for many years, because of noise and pollution, a few MPAs have opted for solid state solar panels. Cousin Special Reserve, Aride Special Reserve and Curieuse Marine Park, for example, have introduced modern integrated systems recently. The high cost of the equipment (which had to be imported) meant that external funding was sought, from the Italian Government and from the Dutch Trust Fund for Seychelles for Curieuse and Cousin respectively. As the MPA management authorities had insufficient expertise to design the systems, staff of the Energy Affairs Division in the Ministry of Industry and International Business assisted in ordering appropriate equipment, and installing the systems.

Since 2000, these MPAs have had electricity 24 hours a day, a big improvement on the previous systems where noisy diesel generators provided power for only a few hours in the evening. On Cousin Island, each building has a set of solar panels as well as a bank of batteries to store the energy for use after sundown. The new systems provide enough power for each house to run several lights and a TV. However, initial problems with some of the systems, burnt lights and inverters, and the difficulty of procuring spare parts in Seychelles, emphasise the need for proper design and installation, by personnel suitably experienced in renewable energy systems.



M. Richmond

Solar cooker in use for boiling water.

<http://energy.sourceguides.com> - lists worldwide renewable energy suppliers by country and by specialisation.

www.bpsolar.com - a major supplier of solar equipment worldwide.

www.dulas.org.uk - consultants in renewable energy with worldwide small scale power experience.

www.greenbuilder.com - Sustainable Building Technology.

www.unep.org/pc/tourism/library/energy.htm - a handbook on renewable energy

www.windenergy.com - a major low power wind turbine manufacturer.

Solar energy can be used directly to heat water for washing and cooking. The simplest method is a black plastic container but, for a continuous supply, thermal solar panels are available comprising an array of water pipes under a glass cover which can be connected to the water supply. Many good products are available to meet any of these requirements, including more sophisticated heat exchange systems.

Electricity generated by solar energy has relatively high capital outlay costs but low operating costs. Photovoltaic panels, which generate electricity when exposed to light, are available in many sizes and when linked together, form an array. Individual panels are typically rated at 60-80 Watts. The panel rating represents the maximum power output which occurs when the panel is perpendicular to direct sunlight. Solar panels mounted so as to 'track' the sun, for example with morning, midday and afternoon positions, greatly increases efficiency. They need to be kept clean if they are to remain efficient. This may occur naturally through rain, but cleaning may need to be made part of the maintenance schedule.

BATTERIES

Whilst both solar panels and wind turbines can directly drive small loads, including borehole water pumps, normally the energy generated is used to charge batteries and the load drawn from them. This means that power will still be available when the sun is not shining and the wind not blowing. Batteries can be ordinary lead acid vehicle batteries but preferably should be deep cycle batteries, designed for a renewable energy installation. Batteries are 12 volt or 24 volt if linked together. For small-scale uses, like radios, power can be drawn directly from the batteries. For larger uses, like computers and lighting, an inverter is normally used to convert DC to AC. This takes low voltage direct current from batteries and produces mains voltage alternating current, allowing ordinary domestic equipment to be powered. Suitable inverters come in output power sizes of between 1 and 3 kilowatts.

KEY POINTS FOR THE MPA

- ❑ Investigate alternative energy options carefully.
- ❑ Ensure that adequate expertise is brought in to design, choose and install the appropriate system.
- ❑ Be aware that both solar and wind systems can be relatively expensive to purchase.
- ❑ Ensure that staff are adequately trained in the use and up-keep of the system.
- ❑ All the equipment, particularly solar panels, must be robust and adapted to withstand the harsh environmental conditions prevalent in tropical MPAs.

Sources of further information

Corfield, T. 1993. *The Wilderness Guardian: A Practical Handbook*. African Wildlife Foundation/The David Sheldrick Wildlife Trust. Longman, Kenya. 701pp.

Grange, N. & Odendaal, F. 1999. *Guidelines for the Environmental Assessment of Coastal Tourism*. Chapter 6. SEACAM, Maputo, Mozambique. 197pp.