AJ's technical tips: Small solar PV systems should have small batteries

Mr. Arne Jacobson

This article is the first of what *Solarnet* editor Moses Agumba and I hope will be a regular feature in this magazine. The idea is to create a column for discussing technical issues related to solar energy systems that will provide useful information for solar technicians, shopkeepers who sell solar equipment, and people who are interested in buying or operating a solar energy system. Because this column is meant as a discussion, I invite your technical questions (send them to "Technical Tips", Solarnet Magazine, P.O.Box 76406, Nairobi, Kenya; you can also send them to me using electronic mail at this address: "arne@socrates.berkeley.edu").

I am happy to answer questions that you have about the design or installation of solar or other renewable energy systems. I am especially interested to hear about any difficult problems that you face in your work. You can also offer suggestions or ask me questions about anything you do not understand about any of my articles. Please remember to include as many details as possible in your questions as this information will help me to give an accurate answer.

Before turning to the first technical topic, I will take a moment to introduce myself. I have been doing research on solar energy in Kenya for the last two years (you may have noticed articles that I have written in this magazine).

I started working in the solar energy field 10 years ago when I began my apprenticeship as an electrician in the Southwest of the United States. After working for several years as a solar technician, I later got a degree in engineering with a focus on the design of renewable energy systems. Now I am a solar energy researcher at the University of California at Berkeley in the USA.

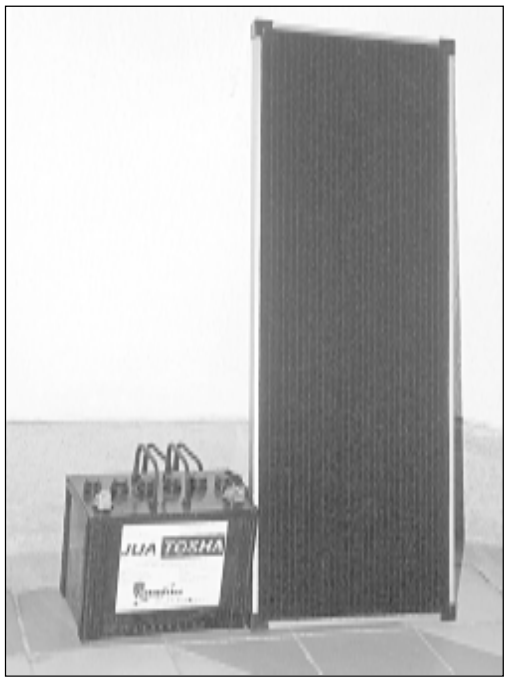
In addition to my current research work in Kenya over the past decade, I have worked with renewable energy systems in the USA, Central & South America, and India. I have particular experience working with solar electric (PV) systems, micro-hydroelectric systems, and solar water heating systems.

In writing this column, I will draw from my experiences working with these technologies as a technician, an engineer, and a researcher. I will do my best to answer your questions, and will turn to my many expert colleagues in Kenya and around the world when I get a question that I cannot answer myself. Of course, space in the magazine is limited so I may not be able to answer all of your questions right away, but I will answer as many as I can.

One of the things that I have noticed over the last two years of working in Kenya is that for small household solar PV systems, the battery is often larger than it needs to be. Here I am referring to systems that have a solar panel that is 20 watts or less (for systems with larger solar panels the battery size is usually OK). In most cases, these small systems work well with a solar battery that is 20 amp-hours to 40 amp-hours in size. However, a survey by 108 Kenyan solar technicians who had installed small solar PV systems recently showed that in 87% of cases the battery was larger than 40 amp-hours. In other words, for most of the systems the battery was larger (and more expensive) than it needed to be.

System users (that is, the family) often use too much electricity and the solar panel is not able to keep the battery charged. This problem is especially bad when the battery is too large since the battery will almost never get a full charge. This damages the battery quickly. With a smaller battery, the solar panel is more likely to give the battery a full charge from time to time (though it is still important for the family to be careful not to use too much electricity). This helps the battery last longer.

As an example, for a 12 watt solar panel in a system with a black



Matched 12 W amorphous panel with 20 amp-hours Jua Tosha battery

& white television, one 7 watt fluorescent tube lamp, and a small radio, I would recommend a solar battery that is between 20 and 30 amp-hours in size. In the Mount Kenya region, this system should provide enough electricity for each of the appliances for approximately 1.5 hours per day in cloudy months (May to August), and 2 or 2.5 hours per day during the rest of the year. Near Nakuru the same system would give 2 to 2.5 hours of electricity per day, depending on the time of year. The performance in other regions will vary a little bit, but my recommendation for the battery size will still be the same.

Many people may complain that small batteries do not give enough electricity. However, the correct way to increase the number of hours per day that the family can use its electric appliances is to get another solar panel (or a larger solar panel). Buying a larger battery will not help them to increase the amount of electricity they can use if they only have a small solar panel, though the larger battery will cost them more money. The 20 to 30 amp-hour solar battery that I recommend for this system will save the customer money (it costs less to buy than a larger battery) and it is the right size for use with a small solar panel. If the customer wants to spend extra money, I would recommend that they spend it on a larger solar panel instead of a larger battery.

I would like to return briefly to the 108 technicians who had installed the small panels with the big batteries. I should point out that it is usually unfair to blame the technician for the large size of the battery. For example, many times a customer will ask a technician to do the installation only after buying the equipment. In these cases it is the salesperson at the shop who has the opportunity to advise the customer about which equipment to buy. In other cases, the customer will ask the technician for advice about which things to buy before going to the shop. This points out the need for both solar technicians and salespeople to learn the basics of sizing solar electric systems. Of course, customers may still insist on buying the larger batteries, even if they are advised to buy the smaller ones.

To summarise the main message of this article, for household solar PV systems with a solar panel that is smaller than 20 watts, a solar battery that is between 20 amp-hours and 40 amp-hours in size is usually the best choice. At present, two solar batteries are available in Kenya in this size range. These are the 20 amp-hour and 30 amp-hour batteries made by Voltmaster in their "Jua Tosha" line of batteries. Although I do not know of small solar batteries that are made by other battery companies, I hope that they will choose to offer them soon. Note that you should always insist on using "solar" type batteries for use in a solar panel system. Do not accept lower quality "automotive" type batteries, as these do not last long.

In the next issue of *Solarnet*, I will provide details on how to make design calculations for small solar power systems. (This will be in addition to answering questions that I may receive from you, the reader). In addition, those readers who are interested in learning more about solar system design and maintaining

Continued on page 24

New Award for Renewable Energy

THE Ashden Trust is pleased to announce the second annual award for innovative, community-based renewable energy, in partnership with the Whitley Laing Foundation. Full details of the award can be found on the Website: www.whitleyaward.org

The Ashden Trust is one of the Sainsbury Family Charitable Trusts and was established in 1989. It has been funding environmental and sustainable development projects – both in the UK and in the developing world – for the last 10 years. The Trust has increasingly focused its grants within developing countries on those projects that encourage the use of renewable energy.

The Ashden Award is offering up to £30,000 for an outstanding renewable energy project. The Award's aim is to support a project that will work with a rural community in a developing country, in a way that alleviates poverty and improves the quality of life, while remaining fully responsive to existing cultural values. The project would need to provide an energy source either for income-generating or agricultural activities or for improving educational or healthcare facilities. The project should have an exemplary value, that could encourage the use of environmentally friendly, sustainable sources of energy in similar contexts.

The aim is to support community based projects that can act as a valuable model for others and demonstrate a real potential for dissemination. Awards will not be made for renewable energy technology per se, but the application of technology in a way that has a positive impact on the quality of life of a community. Projects should represent an innovative approach to technology as an energy service and should meet a clearly demonstrated need rather than being technology led. Detailed criteria can be found on the above mentioned Website (www.whitleyaward.org).

Individuals or organisations working in developing countries anywhere in the world are welcome to apply and indigenous applicants will generally be favoured. Commercial organisations are not excluded so long as they fully comply with the charitable objects of the Award. Applicants will need to provide strong evidence of a past and continuing commitment to the field of community-based renewable energy. They will also need to demonstrate sufficient experience of project implementation, as well as an understanding of the role that renewable energy technology can play in development, including the necessary institutional and management conditions to make a project successful and sustainable in the long term.

Depending on the geographical location, a panel representative may wish to visit short-listed candidates to discuss their proposals in greater detail and find out more about their work first hand. Independent references will be requested.

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From page 23

solar PV systems should consider getting a copy of the book, *Solar Electric Systems for Africa*, by Mark Hankins. It costs Ksh.1950 and is available at the Energy Alternatives Africa office in Nairobi (Rose Ave. off Ngong Road). The book is also available at some solar shops in Kenya, including Solagen Ltd. (Nakuru and Nairobi) and Sollatek Ltd. (Nairobi shop).

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