

## Keeping the lights on

### How Mabunji Aboriginal Resource Centre is leading the way in the long term sustainability of RE systems in remote Australia

Over the last decade Bushlight has been working with Indigenous people and their service providers to develop energy solutions in remote communities across Central and Northern Australia. This Case Study showcases the work of Mabunji Aboriginal Resource Centre, based in Borroloola, Northern Territory. Mabunji have established a unique structure to assist Aboriginal communities to replace expensive battery banks without relying on external funding.

### Background

Well designed renewable energy (RE) systems can offer the most reliable and cost effective way to provide energy services in remote areas. Systems that are user friendly, designed to meet the requirements of users, are built using robust materials and require minimal maintenance are ideal for small Indigenous communities (homelands) that are not connected to the grid power supply.

Bushlight's Repair and Maintenance Program provides scheduled and unscheduled maintenance for 247 RE systems, including both Bushlight systems and those systems installed by other service providers. The life-span of the battery bank presents the biggest single issue in ensuring the longevity of a RE system.

Homelands living with a Bushlight system can expect up to 10 years from the battery bank, however the average life-span in a "non-Bushlight" system varies widely and without the built in protection is often well short of the Bushlight standard. Regardless of the type of system, once a battery bank has reached its end of life, Bushlight is not funded to replace it. Bushlight is however committed to working with service providers to seek external funding.

One service provider is leading the way having established a very effective structure to ensure funds are available for battery bank replacements for all the systems on their books.



**Mabunji Aboriginal Resource Centre** was established in September 1982 and supports 26 Aboriginal homelands across the Gulf Region of the Northern Territory. They provide services in areas such as transport, housing, water and power. Based in the township of Borroloola, Mabunji also looks after a range of town-based facilities including the aged care centre, arts centre, crèche, night patrol, housing and Community Development Employment Project activities. Mabunji employs over 120 full time staff, 85% of which are local Aboriginal people. ***There are 15 communities with RE systems in the region that are on the Bushlight Repair and Maintenance Program.***

## About the Energy Maintenance Trust Fund

In late 2004, Mabunji established the Energy Maintenance Trust Fund to ensure communities have reliable energy services into the future. The Fund was set up in recognition that community members needed to plan and prepare for the maintenance and replacement of system components, the most costly being individual batteries and eventually, entire battery banks. Under the guidance of a pro-active Board that holds representatives from all homelands and town camps, Mabunji worked with community members to develop a contingency fund that would serve to address the high capital cost of replacing battery banks.

With a view to making the scheme equitable and fair for every community, the Energy Maintenance Trust Fund works under the premise that *“everyone’s got to live somewhere, so everyone’s got to make a contribution”*, Alison Doyle, CEO, Mabunji.

As part of the regular \$65, fortnightly rent payments made by homeland residents, \$15 is set aside for energy maintenance and deposited into the fund.

Alison Doyle, Chief Executive Officer for Mabunji describes how she facilitated the process between residents, particularly those initially reluctant to contribute money to the fund and having the Board manage their money,

*“When I started doing the sums and drawing pictures on the boards with community members then people slowly came around to the idea and we started talking about how much. And that’s grown and grown and grown over the years. We’ve replaced I think 2 or 3 battery banks already.”*



*Selma Hoosan cleaning the solar panels during Bushlight RE System Maintenance training at Sandridge in June 2012*



*A typical Bushlight RE system battery bank*

## Leadership and Representation

Central to the success of the Mabunji Energy Maintenance Trust Fund is the structure of the organisations' Board, which provides equal representation to all homeland and town camp residents that come under Mabunji's responsibility. When time comes for a decision to be made on the allocation of money from the fund, it is these Board members that have the final say. Additionally, when it comes to justifying the contribution made to the fund through rental payments, Mabunji relies on the respect and authority commanded by the Board representatives;

*"All the decisions of what is purchased out of the Energy Maintenance Fund are a full Board decision, not at the management committee level, so everybody knows what's going in and out of the fund."*

As with any initiative, the Mabunji Energy Maintenance Trust Fund has not been without its challenges and significant work has been done to reassure people that their money is being properly managed. Mabunji recognises how much that contribution represents in an area where the majority of people subsist below the minimum wage. Again the representative structure of the Mabunji board plays a large part in the success of this approach,

*"Because their (communities) respected people have made that decision for Mabunji and so the people who work for, or live with, or are family of, those people get asked to do so. It's all about being fair and preparing for the future."*



Wendy from Sandridge community filling in the RE system log book



Bushlight staff carrying out training for homeland residents from across Mabunji region on the system at Sandridge in June 2012



Selma Hoosan and William Coolwell cleaning array panels at Sandridge community.

*"It took about six Board meetings to first of all, plant the seed of the idea that we should start saving for the future and then talking about it. It's always very difficult to extract dollars for the future from people's pockets, especially when 90% of the people in this region are living on or below the poverty line but they soon saw the sense of if they wanted energy into the future, if they wanted their lights and fans they soon realised that 'hey, yeah, we can't afford a battery at whatever its cost these days, let alone a whole have a bank of them!'"*

**Mabunji CEO, Alison Doyle**

## Battery Bank Basics

### What is a battery bank?

A battery bank is a group of batteries that work together to store electricity. If you use lots of batteries together they can store more electricity than just one.

For example, your car only needs a little bit of power, so it uses just one battery or 'cell', but a house or an homeland needs a lot of electricity, so it needs lots of batteries.

### How do they work?

Batteries work a bit like a water tank; you have to fill them up with electricity when you have some spare so that you can use it later on. And just like a rainwater tank - you need to fill it up when it's raining so that when it stops raining, you've still got some water to use.

### How expensive are they?

Battery banks can comprise nearly 50% of the total cost of a system.

### Why are they important?

Batteries are very important, especially for a remote community that relies on solar power because without batteries, you would only have electricity when the sun is shining.

If you have a good battery bank, you can store up some electricity when the sun is shining and use it at night when the sun has gone down. This means that you can keep the fans on at night when it's hot and keep your food fresh in the fridge.

## The Life of a Battery

Battery banks, whilst robust and durable, still require regular maintenance and attention in order to ensure they keep operating at their most efficient including topping up (for wet cells), regular servicing and regulating the amount of power draining from the batteries each cycle or day. From a maintenance perspective, battery banks are the most commonly neglected or damaged component of an RE system and are often seen as its weak point. Without proper protection, like that provided by a Bushlight Energy Management Unit (EMU), there is no way of ensuring their integrity and longevity.

Poorly maintained batteries, individually called cells, can cause damage to the entire battery bank, resulting in degradation and eventually total failure depending on the type and length of the poor maintenance.

Damaged battery banks can result in:

- Low efficiencies, where energy goes into the batteries but not out
- Degrading and inefficient battery performance.

- Negative efficiency, where energy goes into the batteries to hold the system voltage, allowing the system to operate but nothing comes out. A portion of the available power must go into the batteries to hold the system on in this case, i.e the community only has access to 60% of the array power. The system then shuts down when the sun goes down.
- Failed cells, which can destroy a battery bank from within, consuming power from the other batteries even when the system has shutdown from low voltage.

With the huge capital required to repair and replace battery banks it is more and more important to ensure there is adequate planning for what will happen when a battery bank begins to operate inefficiently. Bushlight have an established network of technical contractors qualified to provide repair and maintenance services to the RE systems, including battery banks and components. Regular servicing and correct usage can help ensure the health and longevity of battery bank and system components.

## Designing for Reliability

It is widely recognised that Bushlight systems provide a high level of reliability and longevity. This is predominantly because of the great lengths Bushlight goes to when designing systems to ensure there are built in protections to preserve the batteries and ensure it remains as efficient as possible for as long as possible. Batteries themselves don't tend to just stop, rather their performance degrades, and some systems will continue to operate despite a considerable degradation in performance.

“Non-Bushlight systems” vary widely in their reliability and efficiency and while the accepted battery bank life for a Bushlight system is up to 10 years the variation for non-Bushlight systems is well below that average, often lasting no more than 4-5 years.

Through the use of appropriate technology, Bushlight systems are built with the intention that they will be standing for 20 years. For example, the use of wet-cell battery banks, that require regular topping up with de-ionised (DI) water, would be inappropriate for remote locations given the maintenance requirements of such a system.

It is the design and support that Bushlight provides that makes sure Bushlight systems continue to operate at their most efficient throughout their lifetime.



*Selma Hoosan cleaning cobwebs from the gel cell batteries on a Bushlight system during training*

### How does Bushlight protect batteries?

**Bushlight batteries are expected to last up to 10 years. To achieve this Bushlight designs systems to strict manufacturer requirements:**

- 1 cycle per day
- Average daily depth of discharge of 20%
- Maximum depth of discharge of 60%, 4 times per year

**Exceeding these basic requirements has a dramatic effect on battery life.**

Bushlight's **Energy Management Units** or EMU's to ensure the integrity of the battery bank by providing each house with an agreed daily '**energy budget**'. This budget is negotiated with residents during Community Energy Planning and is managed at the discretion of each household and reset each day.

The energy budget is made up of an 'essential' and a 'discretionary' component. Through the EMU, supply to 'discretionary circuits' (for all non-essential solar friendly appliances) is disconnected if the agreed energy budget is exceeded within a 24 hour period. The EMU is designed to ensure power remains to essential circuits (for fridges, freezers, a light and any medical equipment) regardless of whether the energy budget is consumed.



*The Bushlight Energy Management Unit user interface helps household residents manage their energy consumption*

## Support and the role of user training

Bushlight RE systems are designed to be user-friendly and are built to provide maximum reliability and system life. Systems are built specifically for remote areas with extremes in temperature and other conditions. They are very reliable and provide residents with a 'daily energy budget' designed to meet their day to day power needs.

The impact of conservative system design in maximising battery life is only part of the story. Bushlight has a strong focus on community engagement, education and training before during and after the installation of a RE system. Bushlight staff use the Community Energy Planning Model to work intensively with residents to build up a good understanding of the communities energy requirements and ensure residents are equipped to make good decisions about their energy use. Much time is invested in working with residents on things like which appliances are suitable for solar systems and which need to be run on the generator. All our training materials are image based and easy to follow (see example below).



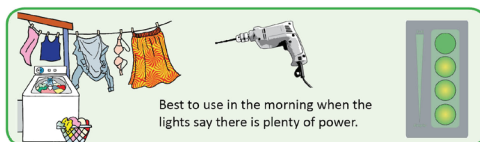
*Bushlight discussing demand side management with residents of Garrinjini*

For Bushlight, the work done by Mabunji and its community members on establishing and successfully administering the Energy Maintenance Trust Fund over a number of years provides an excellent example of a service provider working with communities to prepare for the future and ensure their energy services remain clean, reliable, and affordable.

Use these on Solar Power

**BUSHLIGHT**

Use these on Generator Power



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