



Photovoltaic grid-tied system in Swaziland

By E. Schultz, SAR Electronic GmbH

In the far North-West of Swaziland, on the border with South Africa, lies the almost forgotten town of Bulembu. Once home to a thriving Chrysotile mine, the town was effectively shut down overnight when the mine closed in 2001, leaving thousands unemployed.

The town was bought in 2006 by Bulembu Ministries Swaziland (BMS) with the vision to re-establish a self-sustaining community, and provide holistic support for orphans and vulnerable children. Various enterprises have been established around the town, providing employment for residents as well as much needed funding for BMS. The community enterprises include Bulembu Timber, Dairy, Honey, Bakery and Bulembu Tourism, among others.

Power supply

Power to the town comes from the Swaziland Electricity Company (which in turn sources 60 - 80% of its energy - produced primarily by the burning of non-renewable fossil fuels - from Eskom). Due to the long powerline and the geographical location of the town, the electricity supply is unpredictable and often encounters extreme frequency fluctuations and power outages. In addition, steep electricity prices ensure that the town is burdened with enormous monthly bills (R 253 000 - August 2011).

These factors formed the basis for plans to establish a solar PV (photovoltaic) plant for the town. Since BMS is a non-profit organisation it needed to obtain external funding to undertake this project, and this was done through the Development Bank of South Africa (DBSA) and the Energy and Environment Partnership (EEP).

Installation by SAR

SAR Electronic SA was tasked with the design and the installation of the plant. The plant consists of 108 Bosch mono-crystalline solar

modules and two SMA STP12000 inverters. The system is designed to produce 25 kW of electricity, calculated to be 8% of the electricity requirement of the town.

The installation is a ground mounted system, and the frame supporting the solar modules is fixed to the ground through a system of TerraFix ground anchors.

These anchors are inserted into the ground by a specialised drilling machine to provide a solid and sturdy mounting point for the framework and make concrete redundant. Different types of anchors are available for different soil types, and the installation time for these anchors varies depending on the hardness of the ground, and whether there are rocks present. Rocks in the ground may require pre-drilling before anchors can be inserted. For the BMS project the soil wasn't very hard thus anchors with wider screws were used and the drilling of all 24 anchors took no longer than a few hours.

The solar module that was used for this project was the Bosch Mono-crystalline 235 W. The 108 solar modules were arranged on six plates supported by the TerraFix mounting structure, in such a way that there would be 18 modules per plate placed in a grid of two rows consisting of nine modules each. They are also tilted at a 25° angle facing North. This is done to ensure that the maximum amount of light can be converted into electricity. Six strings run from the modules to the inverters, each containing 18 modules. This string configuration was chosen to ensure maximum power production. The two SMA Sunny TriPower inverters are 12 kW three-phase inverters that deliver an impressive 97% inverter efficiency. This power plant is expected to deliver around 46,326 MWh of power annually to the community of Bulembu.



Conclusion

The installation took a record time to complete and was done in a little more than a week with a team of five technicians. The mechanical installation took around five days and the electrical installation around three days.

A BMS employee stated: "When you're in the non-profit business, every bit helps. The installation of these solar panels is an exciting step forward in realising our goal of self-sustainability and moving to clean renewable energy. SAR's technical aptitude, care for the client, and professional demeanour was clearly recognised." It is without doubt that this installation will bring some relief, however small, to the power challenges faced by the town.

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Erhard Schultz is the international sales and project manager at SAR Electronic GmbH. After studying electronic engineering at the University of Pretoria he moved to Germany. With 10 years international experience within SAR and several MW of solar projects, he is supporting the South African subsidiary SAR Automation SA to realise solar projects in Southern Africa. Enquiries: SAR Electronic SA. Tel. 012 523 9300 or email erhard.schultz@sar.biz.

schultz@sar.biz. Visit solar@sar.biz.

About the author