

Providing affordable solar systems in Northern Tanzania

Summary

Tanzania has one of the lowest rates of electrification in the world. Only 10% of the population has access to the electricity grid, and in rural areas only 2% has access, leaving people dependant on increasingly expensive kerosene for lighting. The recently expanded mobile phone network is opening up new business opportunities for people and enabling them to stay in touch with family, provided that they can recharge their phones.

Even small solar PV systems are able to provide people with enough power to light their homes, and larger models can run televisions. These services also bring great benefits in health care, education and social welfare. As well as eliminating kerosene lamps, the use of solar PV allows businesses such as mobile phone charging to be started, and cafes can bring in more business when they have good lighting and TV in the evening.

Zara Solar and its sister company Mona-Mwanza Electrical & Electronics, both based in Mwanza provide high-quality, affordable PV systems in Northern Tanzania. Zara Solar is a rapidly growing business that uses a network of self-employed technicians to reach out to the remote rural areas. Recognising that the customer base is poor and difficult to reach for servicing, Zara Solar insists on high-quality equipment that is less likely to break down, but buys it in bulk to get good prices. The next step is offering micro-credit facilities to make solar PV available to people who can afford monthly payments but do not have the money to pay up-front. To date over 3,600 systems have been sold.

The organisation

Zara Solar, based in Mwanza, is the leading provider of solar PV in north Tanzania, and has recently opened a second branch in the capital Dar-es-Salaam. The company was launched in 2005 from Mona-Mwanza Electrical & Electronics, an established family business. Zara Solar is managed by Mohamedrafik Parpia and Mona Parpia, and employs five full-time technicians. A network of 25 self-employed technicians spread around the region reaches rural customers.

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Context

Statistical information	
Population (2004)	37.6 million
Urban population (2004)	23.8%
GDP per capita US\$ (2004)	\$ 288
- at purchasing power parity	\$ 674
Population living on less than \$1 a day (2004)	57.8%
Population living on less than \$2 a day (2004)	89.9%
Population with access to grid electricity (2000)	10.5%
Annual electricity consumption per person (2003)	78 kWh
Annual CO ₂ emissions per person (2003)	0.1 tonnes
Population undernourished (2001-03)	44%
Population with access to an improved water supply (2004)	62%

Sources: UNDP, World Resources Institute

Mwanza, with a population of around 717,000, is the largest city in the north of Tanzania, and the second largest city overall. The population of the whole Mwanza region is about 3.7 million. People are drawn to the town for employment in fishing, fish processing, manufacture and trading, and many live in informal settlements on the hills around the city, with no mains services. The rural population in the surrounding areas are involved in subsistence agriculture growing rice, maize, fruit and vegetables, and selling an surplus in the city.

Only 10.5% of the population of Tanzania has access to grid electricity and this is mainly in the cities, in rural areas the access is only 2%. Even in Mwanza where there is grid supply, there is a large backlog of applications for grid connection, and it may take many years to get connected. Many people are therefore dependent on expensive kerosene for lighting.

There is considerable demand for the services of electricity in the region, for homes, health centres, schools and businesses. The recent arrival of mobile phone and television networks has increased demand. The availability of mobile phones increases business opportunities, and enables people in rural areas to keep in touch with family members who have moved to paid employment in the towns and cities. Zara Solar and its sister company Mona-Mwanza Electrical & Electronics, both based in Mwanza provide high-quality, affordable PV systems in Northern Tanzania.

Technology and use

Solar-home-systems (SHS) are small stand-alone electrical systems. They consist of a photovoltaic (PV) module which generates electricity from sunlight; a re-chargeable battery which stores electricity so that it can be used during both day and night; a charge controller which prevents the battery from being over-charged or deep-discharged; and a number of fluorescent lamps, wiring and fixtures.

The technology used by Zara Solar is standard solar PV equipment. The most popular system for homes uses a 14 Wp amorphous silicon solar panel, a lead-acid battery of 25-50 Ah and two fluorescent lights, which can be used for about three hours each night. Although Zara Solar always recommends buying a charge controller it adds about 17% to the system price so many customers choose not to use one. Customers who choose not to buy one are given careful instructions about how to avoid over-discharging the battery. Flooded batteries tend to be used, supplied dry, and the acid is purchased separately. Zara Solar encourages customers to buy sealed lead-acid batteries if they can afford them, as they are designed for deep discharge and are safer. Most domestic users buy systems in the 14-60 Wp range, while systems of 100W and above are usually bought by institutions, and may include an inverter for powering mains devices such as televisions.

Amorphous silicon PV modules are used because for small power demand they are cheaper than crystalline modules. Amorphous silicon has a poor reputation in some parts of the world because in the past modules degraded rapidly in use, usually because poor sealing of the edges led to water absorption into the thin layer of silicon. Zara Solar will buy amorphous modules only from reputable manufacturers who offer a warranty on their products, and currently imports from Europe and the USA. The batteries, charge controllers, inverters and lights are also imported. Zara Solar buys in bulk to keep costs low.

There is still a problem in Tanzania with many small electrical shops offering cheap, low quality amorphous silicon modules, and fluorescent lights, which are made to look exactly like well-known brands. They tend to fail after a short time, and give a bad name to solar PV technology, as well as wasting customers' money. Zara Solar is working to combat the problem of this 'fake' equipment by having some examples in the shop to show people and help them identify 'fakes' if they see them for sale elsewhere.

In total, approximately 3,600 solar PV systems have been sold by Zara Solar and its sister company Mona-Mwanza Electrical & Electronics. Sales have accelerated rapidly in the past year

How users pay

£1 = 2,500 Tsh (Tanzanian Shillings) [April 2007]

The popular 14 Wp system, with battery, charge controller and two lights, costs 234,000 Tsh (£94), while a 70 Wp system costs 964,000 Tsh (£390); an additional 10% is usually charged for installation by Zara Solar or by one of their freelance technicians. Customers are given a detailed price list to allow them to select the system that best suits their needs and budget. At present most customers pay outright for the systems, although institutions such as health centres have had government assistance or finance from donors to help with the cost. However, Zara Solar has recently started selling through Savings and Credit Co-Operative Societies (SACCOS), and hopes to provide micro-credit facilities to them in future.

An important point for institutional customers is that although they usually receive some financial assistance, they are also usually required to pay some proportion of the cost themselves. This is essential to ensure that the system is maintained and used properly, as on the occasions when systems have been fully funded by donors, the institution has not felt any obligation to make the most of them, and some have broken down.

Training, support and quality control

All the technicians used by Zara Solar have been fully trained on a course set up by the UNDP at one of the local technical colleges, which has trained over 160 solar technicians so far. Customers are always given sufficient training to maintain the system properly once it is installed

The customers of Zara Solar are scattered over a wide region, making it impractical and uneconomic to include follow-up visits or maintenance as part of the sales package. Instead, the approach taken is to use the highest quality components to reduce the risk of any failures, to always use properly trained technicians, and to put a strong emphasis on user training.

Benefits

The 3,600 systems sold by Zara Solar and Mona-Mwanza Electrical & Electronics bring electric light and power for small appliances to about 18,000 people. Most users report that the availability of adequate lighting, mobile phone charging and television are the key benefits of using solar PV. Mobile network coverage has recently reached this part of Tanzania, as has the availability of TV, so there is a growing demand for access to these services in rural areas, especially as fixed-line telephone communications are so poor. Quite a number of Zara Solar's customers are in places which are covered by the grid and have applied for grid connection and had grid wiring installed in their homes. However, because of the long delays in getting a connection they have bought a PV system instead.

Because of the poor road access, the cost of kerosene for lighting – around 1,000 Tsh/litre in Mwanza – is much higher in the rural areas, typically 2,000 Tsh/litre. For a typical family using 6 - 9 litre/month (as found in a UNDP survey) this represents a monthly cost of 12,000 to 18,000 Tsh (£4.80 to £7.20), a substantial burden in a region where the minimum employed wage is only 50,000 Tsh (£20) a month. Thus the cost of a 14 Wp system could easily be paid off in less than two years from savings in kerosene alone, if suitable financing methods were available. Some other companies in Mwanza sell similar systems through hire purchase agreements, but they cost between two and four times as much as the Zara Solar systems depending on the repayment time.

The use of PV provides significant social benefits for health, welfare and education. In health centres, improved lighting and mobile phone charging are very useful: one centre found that more women came to give birth after kerosene lamps were replaced by PV lighting in the delivery room. Where solar PV is used in schools the students benefit from better lighting in the evening and the use of some electrical equipment. One of the many organisations caring for street children has used PV-powered TV as one way to make life more attractive off the streets.

Several customers of Zara Solar are earning extra income from their solar PV systems, due in part to the UNDP having provided 60% loans to people buying the equipment to set up or support a small business. Some people are using their solar PV to provide mobile phone charging, which may mean the system pays for itself in only a few months, such is the demand for the service. A number of bars and cafes use their solar PV to operate lights and a TV, attracting more customers and increasing their trade. A novel example is a business producing small fish for use as bait, where the pump to aerate the pond water in the hatching tanks is operated by the solar PV system.

A battery manufacturer has set up a recycling facility in Mwanza, so most people sell back their spent PV batteries and other batteries, avoiding the problem of lead pollution.

Potential for growth and replication

Sales at Zara Solar have been increasing rapidly since the business started in 2005, and the new branch which opened in Dar-es-Salaam is already bringing in approximately 50% as much business as the main office after only six months of operation. It has been difficult for small businesses like Zara Solar to buy PV modules over the past two years, because of the enormous world market demand, and without this the business might have grown even faster. The very low level of electrification in Tanzania, especially in rural areas, means that this large demand for solar PV will be sustained for many years. Many people have no realistic hope of grid connection in their lifetime. The demand from small businesses should also continue to grow, as there are many opportunities in mobile phone charging, lighting and other low-power applications, and the equipment can pay for itself quite quickly.

The model of using a distributed network of self-employed trained technicians has worked well for Zara Solar, and is inherently scaleable. Zara Solar is hoping to increase capacity further still by using a new loan to enable some of the technicians to hold a small stock of components, so they can satisfy their local customers more quickly. The technicians may also be offered commission when they refer customers to Zara Solar.

The use of bulk buying by Zara Solar to get good prices can also be expanded and replicated, and should work better still as volumes increase. Zara Solar has often combined orders with other solar PV dealers, and also sells wholesale to smaller dealers, so helping other solar PV businesses grow.

The main limitation on future growth is the availability of consumer finance. The cheapest systems sold by Zara Solar could be paid for within two years worth of typical kerosene use, so many people could afford to pay for the system over time, even if they cannot accumulate the capital to pay up-front. It is for this reason that Zara Solar is planning to work with some SACCOS groups to offer credit facilities.

Management, finance and partnerships

Zara Solar grew out of Mona-Mwanza Electrical & Electronics, a family business which was founded in 1999. Mona-Mwanza Electrical & Electronics started out as a shop selling electrical equipment, and stocked a small amount of solar PV equipment as a sideline. The social finance organisation e+co made loans available to Mona-Mwanza Electrical & Electronics to help build the solar PV business and by 2005 it had grown to represent about one third of the turnover of the company. With the encouragement of e+co, the solar PV part of the business was split off to form Zara Solar in 2005, although Mona-Mwanza Electrical & Electronics has also continued selling solar PV systems, albeit on a smaller scale. A new loan from e+co is now supporting the next stage of the expansion of Zara Solar. The two businesses are located next door to each other, share technicians when they need to, and often club together for bulk buying to get good discounts.

Zara Solar and Mona-Mwanza Electrical & Electronics each employ five technicians, who also help to run the shop when required. Zara Solar also has a widespread network of 25 self-employed technicians around the North of Tanzania, which it uses to reach the remote rural areas. Whenever an installation is too far for Zara Solar's own technicians to perform, it will be referred to one of the self-employed technicians. The arrangement is simple and informal with no referral fee charged.

The UNDP 'market transformation for photovoltaics' programme in Tanzania has been very helpful to Zara Solar, with the main outcomes being a raised awareness of solar PV in government, the removal of VAT on PV modules and components, the technician training programme and various promotional activities. As Chair of the Mwanza branch of the Tanzania Solar Energy Society, Mohamedrafik Parpia provided considerable information and assistance to the UNDP programme, and Zara Solar have been actively supportive through participating in promotional activities and preparing material for the government.

This report is based on information provided to the Ashden Awards judges by Zara Solar, and findings from a visit by one of the judges to see their work.

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May 2007

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