

# Shidhulai Swanirvar Sangstha, Bangladesh

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## Using solar photovoltaics on boats to provide education and information services to waterside communities

### Summary

The remote Rajshahi region of Bangladesh is difficult to access by road, and most travel is by boat. Many people have no land with which to support themselves and no access to education, training or modern energy supplies.

Shidhulai Swanirvar Sangstha is a charitable organisation working to improve quality of life and opportunities in the Rajshahi region by taking services to the people by boat, sometimes on a daily basis. These services include children's education, libraries, training in sustainable agriculture, health advice, mobile phones and Internet access. Electrical equipment such as lights, computers, DVD/CD players and video projectors is used to deliver these services, that the boats use on-board solar PV modules to generate all the electricity needed. On some boats the PV supply is mainly used to charge batteries for the solar home lighting systems that Shidhulai has supplied to families. Solar lanterns have also been distributed, particularly for use in fishing boats, and are recharged when Shidhulai boats visit. To supplement the agricultural training, Shidhulai also provides bicycle water pumps, and makes micro-enterprise loans available.

Through the work of Shidhulai many thousands of water-side families are benefiting from improved education, a greater understanding of sustainable agriculture practices, clean solar-powered lighting and communication with the outside world.

### The organisation

Shidhulai Swanirvar Sangstha is a charitable organisation which grew out of a self-help group in a small village (Shidhulai) in 1989. It has now grown to have 180 staff and 2,000 volunteers. The mission of Shidhulai is to provide education and training to poor and marginalised people in Bangladesh, with a particular emphasis on environmental protection, and thus enable them to develop their own sustainable livelihoods. The headquarters of Shidhulai is in Dhaka, but most of the work is in the remote Rajshahi region. Shidhulai has an annual budget of between £0.5 m and £1 m, mostly from charitable sources.

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### Context

Bangladesh ranked 137<sup>th</sup> (out of 177) in the 2006 UNDP Human Development Index, 36% of its population live on less than \$1 a day and almost 83% live on less than \$2 a day. The average

annual electricity consumption per capita is 145 kWh, compared to a global average of 2,490 kWh, and only 48% of the population have access to the electricity grid. 61% of the population do not have access to improved sanitation, and 26% do not have access to an improved water source.

Shidhulai works mainly in the Rajshahi region of Bangladesh, where road access is very limited and boats are the only means of transport that is viable throughout the year. Many communities are near rivers or canals. The agriculture in the region is monsoon-fed, producing rice, pulses, wheat, vegetables and poultry; allowing production to continue in the dry season if land is irrigated. Many families are landless and work as day labourers, earning only T 12,000 to T 20,000 (£100 to £160) per year. Fishing is also popular to supplement income and food supply. The villages have no mains electricity, very basic sanitation, and use water from wells or rivers. There are almost no telephone lines, though there are a few mobile phones in use, sometimes rented out by an entrepreneur for individual calls. Although all children are meant to get free education, it is difficult to find teachers who will stay in the region, transport is limited, and schools get flooded in the monsoon. In addition, many parents are reluctant to let girls go to school.

In order to bring regular education and information services to the families of Rajshahi, Shidhulai used a fleet of specially built boats, the only viable year-round transport. Photovoltaic electricity is the ideal way of powering the educational technology on the boats.

## Technology and use

Photovoltaic (PV) modules generate electricity from sunlight. With re-chargeable batteries to store electricity, they can provide an independent d.c. electricity supply system which can be used during both day and night. A PV system incorporates a charge controller which prevents the battery from being over-charged or deep-discharged, and may also include an inverter to convert d.c. power to a.c., thus allowing the use of a.c. appliances.

Shidhulai uses PV systems to help provide services to improve the lives of people in waterside communities in Bangladesh. The foundation of its work is a fleet of boats, which are designed with a flat bottom to allow easy passage through shallow rivers and canals, and even to travel over flooded land. The roofs are multi-layered to keep out the monsoon rain and also the heat, and there are side windows that can be opened for ventilation. A metal truss takes the weight of the roof, so the interior of the boat is not obstructed by pillars, allowing the accommodation to be made spacious and comfortable.

PV modules are installed on the roofs of the boats, providing between 500 Wp and 2 kWp of power, depending on the electrical demand. The PV modules charge an array of lead-acid batteries through a charge controller, and power the electrical equipment on the boat. All boats have PV-powered lighting, using 10 W compact fluorescent bulbs, and mobile phone services from the Grameen mobile phone network. The mobile phone connection allows people to make personal phone calls, and also to talk to health experts and get agricultural advice. Boats are equipped as:

- floating classrooms seating about 30 children or adults, and each has 500 books, up to four computers with internet access via the mobile phone network, a DVD/CD player, and locally produced educational media.
- libraries, each housing about 1,500 books, four PV-powered computers with internet access, a DVD/CD player and a wide range of information and training materials.
- 'mobile education and information centres' which in addition to computers, internet access and DVD/CD players have a mirror projector and a sail-like sheet which can be used as a screen for night-time film shows. During the day they are sometimes used for training programmes for farmers, on issues such as sustainable agriculture.
- battery charging stations, to charge batteries for small solar home systems, and portable solar lanterns: all other boats provide some level of battery charging service, The solar home systems provided by Shidhula are portable, allowing users to fix the lamps to tables, walls, ceilings, or wherever suits them. The system uses a 4 Ah lead-acid battery to power two or three LED lamps for 30 hours, which is sufficient to last between the weekly visits of the battery-charging boat.

- health care and other services.

In addition to the solar technology, Shidhulai has also distributed about 15,000 water pumps based on a modified standard bicycle, which can deliver 60-100 litres per minute, providing sufficient water to irrigate half a hectare of land during the dry season. Water is drawn up from tube wells or rivers near the location where it will be used.

The boats are all built in the region, using locally available materials, and are expected to last for about 10-15 years before a major rebuild is needed. Most of the batteries are made in Bangladesh, although some are from India. PV modules are imported to Bangladesh and bought from local markets, and have an expected lifetime of 15 years. LEDs, come from India, China and Japan. The solar homes systems, lanterns and bicycle pumps are assembled in local workshops. ,

## How users pay

£1 = T 125 (Bangladeshi Taka) [March 2007]

Shidhulai is a charitable organisation with funding from a range of donors, and the majority of its users pay nothing for the services. The people that Shidhulai is working with are among the most disadvantaged in the country, and are often too poor to access the microfinance schemes that are available in many regions of Bangladesh. In particular, Shidhulai believes that everyone has a right to free education, and also to information that helps improve sustainability. The only exceptions at present is payment for some mobile phone calls.

This approach may change for some products in future, for example where solar home systems are helping people to set up a profitable business, and are creating an ability to pay. If people pay for technology and services where they can, this will allow more funds to be diverted to projects helping people who cannot afford to pay. Users might pay about T 20 to 25 per month for the battery charging service, but this can easily be covered by the T 400 month savings on kerosene for lighting. Education and information will always be free, however.

As well as energy, education and water pumping, Shidhulai also provides micro-enterprise loans, so that mainly landless women can borrow from T 4,000 to T 15,000 (£30 to £110) to set up small businesses, including agriculture, craftwork and computing.

## Training, support and quality control

The PV systems and other equipment on the boats are maintained by Shidhulai's own trained technicians. Users of the solar home systems are given basic training, but as they are simply using a sealed battery and LED lights, this only needs to be at a basic level. Users of the bicycle pumps are given training in the use of the pump, and the best way to apply the water to the land.

For Shidhulai, training and support goes beyond the technology installed on the boats and distributed in the communities, as their prime goal is education and training of children and adults, including primary education for children; computer education and library services for all ages; education on women's rights; and training in sustainable agriculture.

## Benefits

The services provided by the Shidhulai boats are currently helping many thousands of water-side families, and the benefits are wide ranging. PV-powered electricity is a key factor in the delivery of many of these benefits.

Primary education is benefiting children mainly aged 5 to 8, although also older children. The focus is on educating girls who in the past often missed out because parents could not afford to send them to school, or would not let their girls leave the village. The PV-powered computers and media facilities provide access to a wide range of interesting and relevant materials, and the curriculum is externally reviewed and updated. Attendance is high and after three years of regular education on the boats, children are encouraged to attend the nearest primary school – by this time, their parents can often afford to send them there, as Shidhulai has helped them increase their income. Support to girls is taken further through the Girl Children's Rights Association, a distance education

programme which provides information to girls and young women on topics such as domestic abuse, child trafficking and prostitution.

Library services allow people to educate themselves, consult reference texts and also read for enjoyment. The PV-powered internet and telephone access has helped people stay in touch with distant relatives, get advice on health and agricultural issues, and learn more about what is happening outside their local region. Being able to make a phone call or read a magazine is something which city-dwellers take for granted, and is now a possibility for rural riverside communities as well. The ability to gain IT experience and skills using the PV-powered computers has improved the career prospects of young people, giving them more options when they go to seek work.

Sustainable agriculture training is a main focus of Shidhulai, and PV-powered equipment has broadened the range of materials available and delivery methods – for instance, using evening film shows to make educational material interesting for people who have been working all day in the field. The training focuses on subjects such as water management, reducing run-off, pest control and reduction of chemical inputs. Surveys suggest that farmers have been able to increase income by 45% on average, and that the average use of synthetic pesticides has decreased by 60%, with about one third of farmers eliminating their use altogether. Water quality in the rivers has improved, as run-off has been reduced by the planting of 80 hectares of trees and grasses along riverbanks, resulting in improvements in aquatic life. The tree planting should also reduce flooding.

Using PV electricity to charge batteries for off-boat use extends the range of service which Shidhulai can offer. Solar home systems provide families with good-quality light in the evening for children to study and adults to do craftwork to earn extra income. They also save the cost of kerosene, and eliminate the pollution and fire risk of using a kerosene lamp. Solar lanterns have been particularly useful for night fishing, and surveys suggest that they have raised the average fisherman's income by T 300 (£2) per month – a significant increase in a region where earnings are typically only T 1,200 (£10) per month. Lamps also improve safety on boats, which are now having fewer accidents at night, and give them the ability to signal to other boats in a way that they could not with a kerosene lamp.

Bicycle water pumps have improved irrigation, allowing dry season crops to be grown and the area of cultivated land to be increased. Farmers report that this had allowed them to more than double their income.

## **Potential for growth and replication**

There is significant potential within Bangladesh for Shidhulai to expand its work, as there are approximately 20 million people living in villages accessible only by boat. Shidhulai plans to extend its work into the northeast and south of Bangladesh by 2008, and three other NGOs in Bangladesh are replicating its work

There are other countries where the model of using boats equipped with solar PV to deliver services will also work well. Similar projects to Shidhulai have been started in Andhra Pradesh, India, and Mali, West Africa.

The success of Shidhulai shows the enormous potential of PV for providing educational services. With a small amount of reliable power, remote communities can have access to information, education and training, as well as lighting for homes, boats and businesses. However, it is important to recognise that PV electricity alone does not provide the services – what is crucial is how the PV is used within a well planned and integrated programme, and how it is maintained in good condition so that these services have continuity. Shidhulai has used the availability of electricity to support its excellent educational materials and dedicated staff, not just provided the PV. In addition, the PV systems and most of the electrical equipment are kept on the boats under the management of Shidhulai staff, so that maintenance can be carried out promptly if problems occur and the possibility of theft is reduced.

## **Management, finance and partnerships**

Shidhulai has a staff of 180 and 2,000 volunteers – it has grown rapidly over the past few years. In addition to working directly with communities, Shidhulai has also helped set up various organisations, such as a Girl Children's Rights Association and Water User Associations. Shidhulai also uses outside expertise where needed, and has a range of well-qualified people who are prepared to give advice.

The work of Shidhulai is funded by a variety of organisations, including the Levi Strauss Foundation, the Gates Foundation, the Global Fund for Children, Direct Relief International (for medical products) and the Commonwealth of Learning. Shidhulai is assisted in its work by preferential prices from Grameen Phone for mobile phone network use and from Microsoft for software. It also has good relations with a battery supplier, [Rahimafrooz](#), who won an Ashden Award in 2006.

Shidhulai currently raises about 25% of its funds through income-generation activities. The main activity is a waste collection business, where Shidhulai pays landless people to collect recyclables such as plastic, iron, tin and glass, and resells them in bulk to recycling operations in Dhaka and elsewhere.

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

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