



Residents of Sandwip Island, Bangladesh, need reliable electricity to grow their shops and businesses.

## DEVELOPING WORLD

# Grids of all sizes

*Solar minigrids in Bangladesh are changing the lives of people in remote rural areas.*

BY LUCAS LAURSEN

Sandwip Island in southern Bangladesh almost has it all. It sits in the estuary of the Meghna River, which washes the island with rich, fertile silt, while plentiful sunlight helps coconuts, mangoes and pineapples to grow. It was once home to pirates but now thrives on honest trade. The main downside is that none of the 350,000 people living on the island have a connection to the national grid.

For years, only the wealthier Sandwip residents could generate electricity, by buying small diesel generators. About a decade ago, Bangladesh began promoting solar home systems (SHS): small, stand-alone, rooftop photovoltaic devices that can reach poorer households. But power generation on an individual scale has drawbacks. There is a limited supply of subsidized diesel, so generators cannot be on all day, and they are noisy, polluting and have high maintenance costs owing to the low-quality fuel that is often used. And a typical SHS provides a maximum output of just 500 watts — enough for a few light bulbs and a

mobile-phone charger, but too little for a hand blender or water pump.

To thrive, small enterprises need dependable electricity around the clock. So in the absence of the national grid, Sandwip went for the next best thing: a hybrid solar–diesel minigrid.

The Sandwip-based private utility company Purobi Green Energy chose Enam Nahar market in the centre of the island as the location for its first minigrid. It's a vibrant area full of traders, mosques, police stations and homes, and its density and relative prosperity made it a good site to host a minigrid, says Purobi chair Asma Huque. In 2009, with 200 people having registered an interest, Purobi installed Bangladesh's first minigrid on Sandwip Island. Other companies have since built nine minigrids around Bangladesh, and are planning dozens more.

Hybrid fossil-fuel–renewable minigrids like Sandwip's could solve some of the problems faced by people using only SHSs or unreliable connections at the national grid's ragged edge. "There are remote areas where grid extension is not feasible, but it could be feasible for minigrids," says Huque. The minigrids she means

are primarily solar powered and provide businesses with higher-quality, more predictable, longer-lasting electricity supplies thanks to their battery banks, inverters and backup diesel generators. But, Huque says, Sandwip has shown that for minigrids to succeed, they must become larger, and they need support from a wide swathe of society, including government planners and rural electrification boards.

## NEIGHBOURHOOD WATCH

Bangladesh's unreliable, oil- and gas-powered grid cannot reach every island or farmer's well in a country of around 160 million people — but the Sun does. The Sandwip project was the first in a government-supported plan to build 50 solar minigrids by 2020. Purobi is a private company, part-financed by the Bangladeshi government and foreign aid agencies. Such approaches, with multiple stakeholders and sources of support, are becoming more common, says energy-policy researcher Benjamin Sovacool of the University of Sussex in Brighton, UK.

In addition, many factors are aiding the



Solar panels on Sandwip Island, Bangladesh (left), can provide 13 hours of electricity a day, so businesses such as Sandwip Digital Lab (right) can open longer.

spread of electrification. Appliances are becoming more efficient, so they require less electricity; the installation costs of solar hardware are dropping; and governments in developing countries are grasping that it can cost less to encourage solar power rather than diesel generators. In 2015, in Bangladesh alone, diesel pumps consumed some US\$280 million in government subsidies, and more in user costs.

The minigrid has already changed Enam Nahar. Nur Computer, a computer training centre, added more hardware after it connected. “As the number of electric appliances like photocopiers and computers increased, the services provided by the shop increased,” says the owner, Nurul Islam Dulal. “This resulted in increased income.” Just up the road, the Rupali Credit Cooperative Society, which gives small loans to individuals and businesses, was able to move away from manual paperwork to use banking software. This allowed the society to take on more clients.

Clinics that once offered only blood tests can now provide sonograms and X-ray scans. And traders can work more hours, because the minigrid delivers 13–14 hours of current a day. The minigrid’s electricity is also more reliable than that offered by most diesel generators, which are often run for only a few hours a day and provide varying voltage that can harm appliances.

### ELECTRICITY FOR ALL

Both the United Nations and the government of Bangladesh are pushing for wider electrification, but there is little consensus on how to achieve it. According to the report *Poor People’s Energy Outlook 2017* by international development organization Practical Action, 7.2 million households in Bangladesh do not have access to the national grid or are under-electrified. Perhaps 2.4 million of these are in the right locations to one day be connected, but the remaining 4.8 million are too widely scattered for connection to ever be cost-effective. The report says that Bangladesh would be better

off spending some 82% of its electrification financing on local minigrids and stand-alone electrification for the most remote off-grid citizens — much more than the 25% it now spends.

For minigrids to work, the established, government-subsidized electricity giants must avoid stomping on them. On Sandwip, not long after Purobi installed the solar–diesel hybrid minigrid, a rural electrification board built a diesel-powered electricity plant. The new plant offered a subsidized price of 10 taka (US\$0.1) per kilowatt-hour, undercutting the minigrid’s rate of 30 taka. The minigrid lost 153 of its 278 customers, endangering its viability, until the diesel-plant operators agreed to avoid competing in the same area.

It would also help to use larger minigrids. Electrical engineer Shahriar Ahmed Chowdhury at United International University in Dhaka says the original Sandwip minigrid has a capacity of 100 kW, but the ones he is building today have a capacity of 140–250 kW. “We are getting offers from private entrepreneurs to expand to 500 kW, which we couldn’t imagine a few years ago,” he says. The larger size makes it easier for investors to recover their investment and for operators to meet demand and spread their initial instalment costs. Bigger battery banks make it possible to store more energy for overnight use or for a rainy day.

Further complicating things, the national grid is planning an undersea cable to Sandwip. The minigrid could be attached, although it would need some sort of subsidy or feed-in tariff at first. But it could help to wean Sandwip residents off local diesel generators altogether.

### SMART PROGRESS

For small-scale electricity providers, billing represents a large proportion of operating costs — Purobi employees still visit clients on Sandwip to read meters and bill customers. But utility companies elsewhere in Bangladesh benefit from smart-metering systems that improve record-keeping and allow mobile-phone

prepayments. This helps utility companies to conserve capacity for their paying customers and save time chasing payments. If Purobi was not threatened with the arrival of the national grid on Sandwip, or if it could count on selling its electricity to the grid at a profit, it might be able to get a loan to install such smart meters, says Huque. But for now, it cannot.

**“As the number of electric appliances increased, the services provided by the shop increased.”**

This uncertainty is also keeping Purobi from expanding the minigrid with more and better solar panels and replacing its batteries, something Huque would like to do, she says. In the meantime, the company must wait for battery prices to drop and hope that the government will renegotiate its loan so that the business can stay afloat.

Compounding the problem, Huque says, is that part of the government “thinks we are competition” and devotes most of its help to “the megawatt people”. For minigrids to succeed, the government will have to come around to seeing minigrid builders as allies, which requires educating its staff and the companies it works with. Sovacool says that most of the successful projects he has studied devoted more than half of their resources to the human side: training, enforcement and education. They also recruit allies across the system: “There’s always more than one actor to create synergies, share burdens and create a safety net,” he says.

Chowdhury says that the government has asked him to help set up a metering policy that would pay fair rates to small and medium producers when the national grid reaches minigrids such as Sandwip’s. The country as a whole, he says, is “headed toward distributed generation”. ■

**Lucas Laursen** is a freelance science writer based in Madrid.