Turning wind turbines in Ghana

In its newsletter, What Works, EnterpriseWorks Worldwide recently alerted us to a pilot wind energy project in Ghana where local technicians have been trained to manufacture small-scale wind turbines using locally available materials. The project set out to install ten of these locally made turbines in various off-grid communities, mainly along the coast where wind conditions are suitable to drive wind-generated power. After monitoring their operation over a period of time, the intention is to arrange for transfer of ownership of the turbines to local business or community organisations that are keen to buy them.

The project began with the training of 18 craftsmen and technicians in mid-2004 and, by the end of the year, nine of the wind turbines they had made had been installed.

Access to electricity

EnterpriseWorks Worldwide (EWW) reports that 48% of communities, or 83% of rural households, in Ghana are not connected to the national electricity grid and most are not likely to be in the near future. As in other African countries where this sort of disparity exists, the difference between villages with access to electricity and those without it is stark. In Ghana, villages without electricity remain isolated and are limited in the quality and quantity of services they can offer. Entrepreneurs, artisans and traders tend to move to where the electrical power (and the money) is.

Villages with electricity become more active in the economy while those without it shrink and become increasingly marginalised.

Power to the Poor

EWW's pilot wind power project is being implemented in partnership with two private sector organisations: Rural Energy and Environment Systems (REEES) of Ghana, and UK-based Scoraig Wind Electric. The project, with a budget figure of about US$180,000, is funded by the World Bank's Development Marketplace Competition.

Training

In mid-2004 consultant Hugh Piggott from Scoraig Wind Electric was in Accra to train a group of technical artisans in the design, construction, installation and operation of the 500-watt wind turbines. The model used, designed by Piggott, is a standard 2.4 m diameter axial flux machine, with a few small modifications. The group of trainees was selected from four local enterprises that had demonstrated electrification project. As a village loses touch with its more developed neighbours and loses skilled entrepreneurs to better economic prospects elsewhere, it becomes poorer, less likely to attract grid extension schemes and less able to contribute to the costs.

At present, all other standalone electricity generating devices in Ghana, such as solar panels and fuel-powered generators, are imported and are therefore expensive and difficult to maintain.

Left: The turbine blades are carved from a smooth, lightweight, close-grain timber called emory. Right: Fitting the turbine to the top of the tower before it was winched up to a standing position. Note the tail vane which the trainees cut in the form of the African continent. The first locally made turbine was erected at the CSIR in Accra.
their interest in renewable energy and a capacity and enthusiasm to break into this new market.

The first step in the training programme was to source the required materials locally. A tour of Accra’s markets uncovered suitable materials and various mechanical components— including automotive wheel bearings and axles—that could be recycled and adapted to their new use. The turbine blades are carved from a smooth, lightweight, close-grain timber that is called ‘emory’ and is widespread in Ghana. All the materials are thus readily available locally, with the exception of the high-strength magnets which are imported from China.

Following a video presentation of the turbine model and how it works, Piggott and the trainees moved to the workshop facilities at the Accra Polytechnic where they began work on production. Piggott notes that the trainees offered numerous innovative suggestions in the manufacturing process. In considering the construction of the controller for the turbine, for example, one of the trainees suggested that they install a multi-meter permanently in the controller to display battery voltage at the push of a button. This was useful because it would provide low-cost accurate readings, without exhausting the battery in the meter.

The first locally manufactured turbine was erected by the group of trainees at the Council for Scientific and Industrial Research (CSIR) in Accra. This occasion was celebrated by government dignitaries, members of the technical education and research community, representatives from the EWW-REES-Scoraig partnership, and other

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**EnterpriseWorks Worldwide**

EWW is a Washington DC-based non-profit organisation that seeks to fight poverty in the developing world through business development programmes that allow small entrepreneurs and agricultural producers to increase their productivity and income, pursue sustainable business opportunities, and create jobs that benefit their families, communities and the regions in which they live.

EWW recognises that there is a serious gap in the emerging global economy. On one hand, globalisation is linking the world’s commercial interests as capital, goods, services, and information are traded across international boundaries on an unprecedented scale. On the other, two billion self-employed farmers, traders and other ‘small producers’ in the developing world— a third of the earth’s population— live in poverty, often in communities that lack adequate water, health care and basic education for their children.

EWW endeavours to provide a practical answer to this growing problem, with the hope of creating a more inclusive global economy. Its projects and programmes are directed at increasing the earning power and income of the world’s two billion small producers, building on their own hard work and entrepreneurial drive and enabling them to add commercial value to the goods they’re producing so they can sell their products on lucrative domestic, regional and international markets. EWW has been described in the USA as a “Peace Corps with a business plan”. It defines its approach as “fighting poverty with profit”.

The organisation has been in operation for over 25 years (formerly as Appropriate Technology International) working with small producers in more than 60 countries in Africa, Asia and Latin America.
interested parties. The performance of this turbine is being monitored by the CSIR and EWW. Initial reports indicate that it is generating a steady output of power. The turbine does produce a whistling sound and Piggott attributes this to one of the blades being slightly warped because they were cut from unseasoned timber. This pointed to the need for the wood to be properly treated before the blades are carved from it.

**An affordable energy option**

The manufacture of small-scale wind turbines in Ghana introduces an affordable and reliable source of electricity for off-grid communities where the wind resource is high enough to support wind-generated electricity. It can help to drive economic development in these remote and mostly economically marginalized areas. Local manufacture also provides an additional source of revenue for the trained turbine technicians, with scope to extend the business enterprise by training others and delivering maintenance as well as manufacturing services.

Since the first turbine was erected, another eight (of ten planned in total) have been produced and installed at selected demonstration sites in six off-grid communities. The sites are in villages along the Ghanaian coast and include a school, a church, a battery-charging centre and a tailor’s shop. The turbines will be monitored by EWW and KEES over a period of six months, to ascertain their reliability, ease of operation, power output and other particular impacts in the locality of each installation.

The demonstration turbines will expose the respective communities to the workings of wind power and, it is hoped, will heighten their confidence in wind energy as a source of electricity. If after six months the users are convinced of the benefits of the wind-generated electricity for their business or community enterprise, the turbines will be made available for sale from the trained manufacturers. An alternative credit-to-purchase option has also been considered. This would involve providing the local enterprise with assistance in developing a business plan and repayment schedule for the purchase of the wind turbine on credit through AREED – which is part of the United Nations Environment Programme.

**Supporting economic development**

EWW suggests that countless business innovations are possible with electricity provided by wind generators. This is the core of the Power to the Poor project: creating local capacity to solve local problems and promote local economic development. Power to the Poor, it says, will demonstrate that it is possible for locally built wind-power systems to stimulate economic growth in some of the most remote communities in Ghana.

*Reported by Leigh Darroll*

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The project set out to use locally available materials for construction of the turbines. Most materials were sourced from Accra’s markets and included automotive parts which could be recycled for new use in the turbines.