Let everyone climb the energy ladder

Access to modern energy services for everyone is a reasonable goal for global society. The development benefits are clear. But many obstacles must be overcome and no single solution fits all. Anders Nordström, group advisor, sustainability affairs, ABB discusses the challenge.

Modern energy services – electricity in particular – are a key enabler of economic and social development. According to the International Energy Agency (IEA), there are 1.6 billion people living without access to electricity and 2.5 billion people relying on traditional biomass for cooking and heating – a truly global challenge.

Today’s forecasts would require huge power-infrastructure investment in developing countries over the coming decades. The proportion of the global population connected to electricity will rise and more than four-out-of-five people will have access to power. The electricity infrastructure will reach more people, with higher capacity and more reliable supply. In parallel, a better power infrastructure allows industrial expansion, increased productivity and economies to grow. People and nations climb the energy ladder.

However, looking at absolute figures, the number of people relying on traditional energy will remain at an almost constant level. Unless policies are changed, as many as 1.4 billion people will still lack electricity access and 2.7 billion will still be cooking with biomass fuel by 2030. Progress and investment does not reach the most deprived. Starting the climb up the energy ladder is difficult.

Regions and communities without electricity and other modern sources of energy often suffer from extreme poverty, limited freedom of choice and opportunities, high unemployment rates and insufficient health and education services. Collecting wood for cooking and heating ties up women’s and children’s time. Indoor air pollution from cooking on open fires causes respiratory illnesses that are responsible for the premature death of 1.3 million people a year says the IEA – similar to the number of deaths from malaria or tuberculosis.

Most people without electricity live in poor, rural parts of developing countries. Bringing power to these areas is usually more expensive than urban or semi-urban electrification and many governments cannot raise enough capital. Misdirected subsidy policies, political interference and the distortion of commercial incentives worsen an already difficult situation. In many cases, this is combined with a policy environment and institutional structure that is not conducive to private-sector investments in rural settings.

This long-standing problem needs attention and concerted action to achieve change. Its causes and effects have been analysed for years and various strategies have been applied by governments, donors and other parties to bring the issue towards a sustainable solution. The establishment of the UN Millennium Development Goals placed more focus on the role of energy in development, even if it is not explicitly expressed in any of the goals.

Deterrents to investment

Financing investments in power infrastructure is challenging in many developing countries. Financial markets may be poorly developed and domestic savings low. High risks in the form of economic and political instability, corruption, exchange-rate volatility, and weak legal and institutional frameworks for the power sector are some of the factors that deter investment capital.

In general, about 80% of overall development investment (all sectors) originates within the developing countries themselves, according to Roy Smith and Ingo Walter, authors of Global Banking. A more detailed look at power-infrastructure investments reveals large variations between different developing countries. In China, the share of domestic financing of electricity infrastructure is very large; while India, to a large extent, relies on multilateral development financing; and in sub-Saharan Africa, bilateral development assistance is important for investments.

International-development co-operation is vital for the progress of power infrastructure in many developing countries, especially in rural areas. Not only for financing
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and developing innovative electrification schemes, but also for assisting a general, market-based sound development that can attract investments.

Most energy use causes some degree of environmental degradation: unsustainable use of biomass for traditional fuels; sulphur emissions and particulates from combustion of fossil fuels; and the great challenge of climate change resulting from CO₂ emissions. The electricity sector accounts for 24% of man-made greenhouse-gas (GHG) emissions and close to 40% of energy-related emissions. And electricity use is growing worldwide, which is why firm action is needed to curb the increasing emissions.

However, the consequences of excessive GHG emissions should not burden those at the bottom of the energy ladder. The African continent contributes to 3.7% of the global total of man-made CO₂ emissions – and excluding South Africa, less than 2%.

The environmental Kuznets curve theory suggests that, in the long run, economic growth will reduce certain types of environmental degradation. The theory predicts a characteristic inverted-U shape of the degradation versus growth curve. This appears to be true, for example, for local sulphur emissions and some other pollutants. It seems likely that Kuznets-type relations will develop for GHG emissions from power generation, once awareness leads to firm action and low-carbon-emitting generation technologies are sufficiently developed and applied in wealthier countries.

Energy intensity follows a Kuznets curve and efficiency measures in emerging economies are low-hanging fruit towards a more sustainable supply system. Energy-efficiency measures could release large amounts of power and be a key enabler in electrification efforts for unserved or poorly served people in emerging economies.

An industry response
For the past few years, ABB has addressed access to power in its Access to Electricity programme, part of the company’s corporate social responsibility efforts. The programme aims to help develop and implement successful models for electrification of rural and semi-urban societies.

ABB has engaged in partnerships and co-operation with UN agencies, governmental and non-governmental (NGO) and branch organisations to help advance poor people’s access to power both on a practical level and also by raising the understanding and recognition of the poverty-power problem. The emphasis has been on bottom-up electrification projects that trigger economic and social development in the local community through a productive use of electricity. The ambition was to establish sustainable power systems that respective communities can operate and maintain with little or no outside intervention.

Another area of interest was the supply of power – or strengthening of power supply – to rural growth spots resulting from tourism, agriculture and other small and medium-sized enterprises. Settlements and households in and around growth spots may be connected at a low marginal cost. Applying a broader perspective than pure electrification may increase the socio-economic output of such a project by attracting a broader scope of partners, investors, financiers and donors.

**Access to Electricity programme**
As a first result of its Access to Electricity programme, ABB electrified the remote village of Ngarambe, just outside the Selous Game Reserve in southern Tanzania. The village, with around 275 homesteads and a population of about 1,800 people, supports itself through hunting and subsistence farming. The Selous Game Reserve covers an area the size of Switzerland. The electrification project was carried out in partnership with the local community, the District Council and the WWF – which is involved in development activities in the reserve and neighbouring areas.

The power system was designed in a robust way, partly to resist elephants that may pass through the village at night. Power is supplied from a modern diesel generator protected in a brick building. Underground cables are used to distribute the power to consumers. Pricing is based on low-cost current limiters, with an automatic reset and a fixed-tariff system that allows easy collection of fees and encourages efficient use of energy.

The mini-grid, which provides four hours of electrical power after dark, has led to tangible changes in
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Ngarambe. It started in mid-2004, with power being supplied to the school, dispensary, local-government office, mosque, small businesses and a number of houses. During the first years of operation, services have expanded and today 75 homes and 15 public and commercial buildings are connected to the grid.

When planning and building the power system, it was agreed to subsidise the fuel cost over a transition period. At present, the diesel cost is covered by the people in the village together with the district government and WWF/ABB. In the long run, the system must carry its own operating and maintenance costs. The village has set out a two-way approach to reach self-sustainability:

- Increase village revenues, for example through the productive use of electricity – a small sawmill is part of the plans; and
- Run the generator on locally produced biofuels. A recent expert study found that the production of pure plant oil for local electricity generation forms an excellent opportunity to reduce electricity costs in the village.

Electric light has made a large difference to the children in the village. Time devoted to study and learning has been greatly extended. Before electrification, only two out of 15 students passed the secondary-school exam; in the year after power was turned on, 13 out of 15 passed. The number of pupils rose from 250 to 350 in the first year.

Today, there are more than 15 businesses in the village, including small restaurants, clothes shops and general stores. A new guesthouse has been established to house an increasing number of visitors. Some come from neighbouring villages, attracted by the village’s television set and satellite dish that gives access to news and entertainment. Before electrification Ngarambe had three small businesses.

Several new, brick houses have been built in the village, reflecting a growth in prosperity. There are 25 new households in Ngarambe because of immigration to the village. People are attracted by the social services and the development efforts. Civil servants from nearby Kingupira wildlife-research centre build houses in Ngarambe to live there after retirement.

In the second half of 2006, the village community organisation was promoted to an Authorised Association by Tanzania’s wildlife-management authority. The community organisation now has the right to manage the wildlife in its area and the business opportunities linked to the wildlife, such as tourism, establishing a lodge, limited hunting and sustainable logging. This will generate more income for the village. Nine young people from the village community organisation and the local government have also been trained in business and entrepreneurship at the University in Dar Es Salaam, sponsored by a donor organisation.

The road from this remote village to the district’s main town has improved and can now be used all year round. Lorries go back and forth to the village picking up crops and delivering goods to the shops several times a week. Promising development has taken place in Ngarambe, albeit from a low level. More is needed to increase the economic activity, diversity of skills and income levels. This would help make life in the village less vulnerable.

Solar power in the desert

In the desert region of Rajasthan, India, ABB engaged in a public-private partnership with a local NGO, the state government and the local people to provide basic solar power to poor communities in remote areas. As a first step, a hamlet with 82 households and a school 125 km southwest of Jodhpur received electricity. The families in the hamlet typically live in scattered huts with compounds that are spread out in the desert landscape forming a dispersed village. The main occupation in the pilot village is tailoring and handicraft, and the simple power supply extends hours for working and studying. It also strengthens security at night.

Each household had a solar panel on the thatched roof of their hut. A battery unit and a stationary light were installed in the hut and a portable lamp was provided for flexible use. An initial warranty and maintenance plan for two years was included in the contract with the equipment supplier. The villagers raised 20% of the total cost of the system, which ensures ownership and sustainability. ABB has expanded this collaboration and, to date, 500 rural households in Rajasthan have received basic electricity services through the programme.
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The Growing sustainable business in the least developing countries (GSB) concept was launched within the UN Global Compact as a platform where the public and private sectors could work together to overcome poverty. In the GSB initiative, Global Compact companies develop sustainable business opportunities in the least developed countries. ABB takes an active part in the UN Global Compact. Together with the UN Development Programme and other partners, ABB initiated the launch of the GSB initiative in Tanzania. An objective was to render a series of concrete pro-poor projects with clear benefits for the receivers and reasonable conditions for the participants. The projects should foster economic development and the creation of markets, and eventually lead to demand-pull. Such cases would hopefully go to scale and act as stimulants to others. ABB committed an engineer full time over nine months to identify suitable projects, carry out feasibility studies and work out strategies for action.

ABB teamed up with a large sugar plantation in Tanzania and its community trust and developed a business model to extend the service of electricity to some larger settlements of out-growers in the vicinity of the plantation estate. An initial phase would connect around 1250 households, businesses and public services. The plantation meets most of its electricity needs, using bagasse (the fibrous material remaining after sucrose has been extracted from sugarcane) as fuel. Additionally, for much of the year electricity production exceeds internal demand and power is exported to the national electricity company.

A large percentage of the population in the surrounding settlements remains outside the formal economic system. The plantation’s community trust supports the out-growers’ economic and social development. Trust activities include husbandry, business and computer training, support to the local savings and co-operative credit societies, and infrastructure improvement including rural electrification.

The cost of energy is relatively high in the area. A household will spend $16-38 a month on cooking and lighting needs, depending on size and income. Electricity would provide a significantly cheaper energy source, in particular for lighting. It would greatly benefit the small diesel-driven industries in the area. A switch to electricity by the 12 maize mills in the area would more than halve their expenditure on energy and increase their level of service by eliminating maize-fourescent diesel odour.

The project qualified as a GSB project by solidly addressing poverty reduction, job creation and private-sector development through access to energy. The UNDP co-financed a detailed, independent feasibility study for the project and a final report was delivered earlier this year.

The study recommended significant changes to the original business plan. It proposed that the new energy-services company not only manage the new electricity customers outside the estate, but also the supply to already connected households within the estate. These households had so far received power for free. By starting off with a large energy-efficiency and demand-side management campaign, enough power would be freed up to supply the villages outside the estate in a cost-effective way. The independent study concludes that the project should be supported with a high priority and finds it a great opportunity for public-private partnership.

Rural electrification

Today, rural electrification represents only a small part of ABB’s regular business on most markets, with one important exception: India. ABB in India is focusing on a range of products and solutions to facilitate rural electrification, an important area for the government in a country where almost half of villages still do not have access to power. In recent years, ABB has extended power grids and connected thousands of villages in rural India on a commercial basis.

Even if most of ABB’s business is conducted further up in the electricity chain than on the individual household level, transmission and distribution products and systems help strengthen power grids, enable efficient power transmission and safe operation of power systems. This constitutes the backbone of a safe and reliable electricity supply also to the smallest power consumers.