Access to Electricity

- White Paper on ABB's initiative for Access to Electricity

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Introduction

Access to electricity is a key enabler in the fight against poverty and a precursor for sustainable development.

ABB focuses its contribution to common efforts on its Access to Electricity initiative. This is a multi-dimensional program where we work with partners from other industries, governments, non-governmental organizations, development aid and financial institutions, to bring the benefits of electricity to those in need of it. We aim at improving our ability to respond to the needs of developing regions and to explore new ways to make use of our technical and commercial expertise to contribute to real economic and social development.

Access to Electricity is ABB's response to the UN Global Compact's invitation to its corporate signatories to make efforts for economic growth in the world's least developed countries.

FACTS:

- 1.6 billion people have no access to electricity.
  - → 50% in South Asia (35% in India alone)
  - → 32% in sub-Sahara Africa
  - → 14% in East Asia (not including China)
- In absence of new policies 1.4 billion will still lack electricity 2030.
- 99% of people without electricity live in developing countries.
- Four out of five without electricity live in rural areas.

Access to electricity and other modern energy sources is a necessary, but not sufficient, requirement for economic and social development.

Source: IEA World Energy Outlook 2002

Electrification and poverty

Electricity is a major contributor in meeting global goals for economic development, poverty alleviation and social development.

Traditionally, women and children in developing countries spend many hours every day to collect wood for heating and cooking - time that could have been used for productive work or education. In many areas it gets dark early and electricity makes the hours after dark available for learning for women and children and gives more time for doing homework.

Electricity helps small enterprises to start up and grow and thereby to improve living conditions, increase incomes and ultimately to break the cycle of poverty by creating enhanced opportunities for education, employment and improved livelihoods. The development of small business initiatives producing goods and services has been identified as a key component in job generation, income growth and cash generation in rural communities.

The energy cost for people in remote and rural areas in developing countries amounts to approximately $1 to $3 per month. Sometimes as much as up to 20-30% of the disposable income is used for energy, essentially for charcoal, kerosene and dry batteries. In areas where electricity replaces other commercial fuels, households' energy costs fall rather than rise. In developed countries people spend approximately 2-3% of their income on electricity.

Socio-economic studies among rural households and especially rural enterprises show a willingness to pay for access to electricity, if only reasonably reliable and 24h services were available. Recent estimates indicate

that poor households once electrified, would initially consume about 30-200 W during 5 hours per day, corresponding to 55–360 kWh per year.

The dilemma of rural electrification

Rural electrification has been a dilemma to many governments. It is a complex process that deals with energy policy, technological, economical and institutional aspects. Rural electricity schemes are usually more costly to implement than urban or peri-urban schemes.

The conventional model with centralized utilities, large-scale power plants and transmission systems, has largely failed to reach the rural poor. In many countries national monopoly utilities are unable to expand services due to limited economic resources.

Bottom-up versus top-down

In contrast to the general belief, many developed countries underwent a bottom-up development when being electrified.

Local electricity producers started up as a result of an emerging demand for electric power. A country like Sweden experienced a generic and organic development of a geographically scattered electricity market. The country was pretty well electrified before a national grid was established.

Once that larger production units were needed to support growing consumption, an integrated network started to evolve. The large power plants and national grid were built to support a market that already existed, to cope with a demand that had already materialized bottom-up.

However, looking in the mirror, it is easy to conclude that the electrification process would have been faster with a combination of top-down activities and the organic, market-driven, local bottom-up business.

Low coverage of electricity grids in Africa

In the early 1960s Africa's population was about 300 million. 10% of the rural and 50% of the urban African households were grid-connected.

Today, Africa has about 800 million people. Less than 5% of the rural and less than 40% of the urban households have access to grid electricity.

In the past most subsidized rural and remote electrification schemes have been run by high-cost, centralized public utilities charging tariffs that do not cover costs. 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 are not conducive to private investment in decentralized rural settings. Thus, despite a growing demand, the supply response is lacking and the electrification rates remain extremely low in many developing countries.

The technical standards issued by authorities in developing countries are quite often very similar to those in European or other developed countries and not adjusted to the local conditions, which lead to unnecessarily high electrification costs. Rural power demand is initially very low: e.g. less than 200W for rural households, 2-4 kW for many small and medium sized enterprises and shops, 3-5 kW for health clinics and schools, 5-20 kW for a maize-mill, water irrigation system and so on.

The cost per connection needs to be lowered significantly over the coming years in order to enable a rapid scale-up of access to electricity in rural and remote areas. This includes developing new technical standards. It also includes the adaptation of proven technologies and the development of new low-cost technologies for transmission and

distribution networks, house wiring, customer connections, metering and billing.

Procurement regulations of goods and services could be made more flexible to stimulate innovation. The existing practice normally calls for bids that are based on a given detailed specification of the prescribed technical solution; in contrast to a specification of the desired functionality, leaving the technical realization to be worked out in competition by the actors on the market. Procurement regulations based on detailed technical specifications therefore tend to conserve technology. Complementing traditional specifications with functional requirements could stimulate innovation and the development of new, low-cost solutions.

Most often price is the sole criterion when evaluating tenders. This is not a satisfying practice, since other factors may be more important for the sustainable success of a project, and gain the end-customers more. Even though it is recognized in procurement regulations that other criteria are important, and a more multifaceted evaluation is allowed, it is rarely applied in practice. Examples of such criteria are payment terms, construction or delivery periods, technical performance, technical expertise and capability of the tenderer, technical compatibility with other equipment, local presence, availability of service and spare parts, operation and maintenance costs, etc.

Current trends

Over the next three decades, the investment needed in new electricity generating capacity in developing countries is projected to reach 2.1 trillion US$, of which 40% in China, 15% in South Asia, 10% in Africa and 5% in the Middle East.[1] Domestic funding in the countries, foreign development aid and private capital should cover these investments. Even if private investments in electricity infrastructure increased in the 1990s there has been a decline in recent years. In addition, private investments are small in the least developed countries and do not reach the rural poor regions. Clearly, the international donor community still has an important role to play in the development of electric power infrastructure. We note with satisfaction that this recently has been recognized e.g. by the World Bank Group.

Electricity sector reforms in the developing world, may lead to the break up of public monopolies and privatization of generation, transmission and distribution. This may provide opportunities for alternative ways to electrify poor rural areas.

Several countries are now implementing or developing rural electrification schemes using elements of so-called output-based contracting. Subsidies are provided as capital grants for extending or creating an isolated grid or for installing small generators. Subsidies can be provided for connecting consumers, or for rehabilitating networks. The focus on outputs gives operators the flexibility and the incentive to innovate and to respond to consumer preferences.

In general, it is better to subsidize investments and not consumption or operation of power systems, since consumption and operation subsidies tend to erode operational efficiency and require long term funding commitments. The subsidies should be designed to encourage cost-efficiency, commercial drivers and a customer focus.

Implementing rural transformation

A demand driven bottom-up approach to rural electrification poses a promising alternative route to reach the rural poor, focusing on improved income generation through the

[1] IEA World Energy Outlook, 2002

productive use of affordable electricity. The electrification scheme should be based on a socio-economic analysis of what revenues can be generated from the new grid and what capital and maintenance costs the operator can bear on a sustained basis, including subsidies and development assistance. The power may be supplied from the regular grid or in deep rural settings a stand-alone mini-grid. The approach should be least-cost and the power system should be designed to meet actual needs and allow for easy expansion with increasing demand. With an emphasis on affordability and a strong discipline in payment of bills, the foundation can be laid for a sustainable system that could grow organically.

Electrification efforts need to be well planned with a long-term planning horizon. Grid expansion will continue to play an important role, and we may foresee the aggregation of expanding stand-alone networks and eventually their integration into the national grid.

However, rural electrification should be part of broader programs for economic and social development in poor communities. A synergetic approach to other sectors is more likely to achieve a sustainable rural transformation. In many cases, the synergies with electrification are obvious:

- Water
- Agriculture
- Small & medium sized enterprises
- Information and telecommunication
- Roads and transport
- Health and education

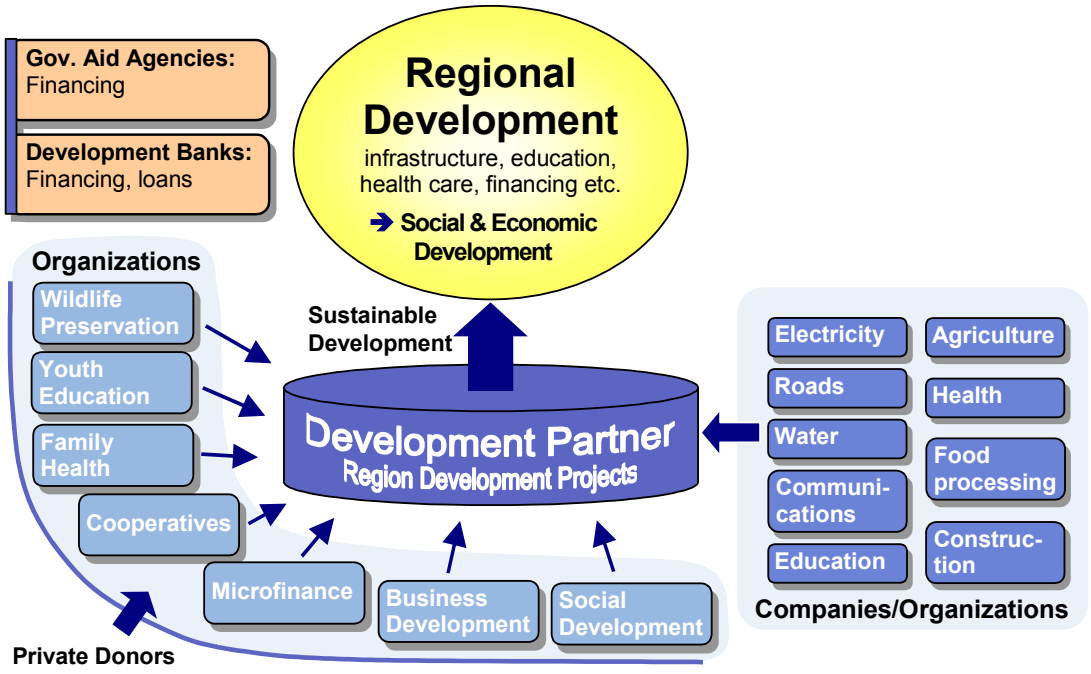

Figure 1: The Development Partner concept of ABB's Access to Electricity program.

ABB'S APPROACH AND COMMITMENT

Strategy

Sustainability is at the heart of ABB's business and through the Access to Electricity program ABB contributes to common efforts close to its core of technical and commercial expertise where it is best placed to make a difference. The program aims at improving the situation of those communities in developing regions that are left on the margins of sustainable development. The focus is on the productive use of affordable electricity and promotion of local economic growth.

ABB has a broad experience of electrification projects all over the world, not the least in developing countries where ABB faces their challenges in its daily operations. ABB has also a significant local presence in these countries. In Access to Electricity ABB aims to take this experience one or several steps further by taking action and increasing its efforts in areas and markets where ABB presently only acts in a limited way.

Partnership pays off in Bangladesh

ABB is carrying out an electrification project in an area of Bangladesh, in cooperation with partners in Norway, to boost industrial development and improve living standards.

ABB employees from Norway are working with local partners to build three new substations and refurbish two existing substations in an area 200 kilometers from the capital Dhaka, which is not connected to the national grid.

Partnerships are key to the success of the project. Funding and financial guarantees have come from private institutions in Norway and the Norwegian Agency for Developing Cooperation.

The work, commissioned by the Bangladesh Power Development Board, is due to be completed by July 2004.

It is ABB's ambition that Access to Electricity shall contribute to the speed-up of electrification in poor rural and peri-urban areas, and to a more reliable supply of electricity to the many poor people in the rapidly expanding cities in the developing world. ABB will strive to grow its long-term business engagement in these parts of the world to the benefit of all parties.

Beside the contribution to common efforts, ABB expects that Access to Electricity will strengthen its ability to meet the needs of these markets and that this may become a substantial part of ABB's regular business. Already today ABB has undertaken a number of business contracts in developing countries in the spirit of Access to Electricity, as exemplified in the text boxes below.

Partnerships

Current and previous ABB common effort projects have always drawn on the support and collaboration of strategic partners. The Access to Electricity initiative will build on this experience and bring in partners who can both contribute to a development project and share in its benefits.

Within its scope of competence, ABB will work together with other companies that are specialists in infrastructure activities, such as roads, transportation, telecommunications, water and sanitation, as well as development assistance organizations, multilateral and financial institutions, national and regional government authorities and non-governmental organizations.

In ABB's Access to Electricity program partnerships can be formed to address a multitude of societal issues at the same time. Within such a partnership, all involved partners concentrate on their special fields of infrastructure expertise, or other demands.

The aim is to create synergies such that the installation of complementary infrastructure services can be efficiently coordinated to enhance the end result and assure the sustainable development of a particular region.

ABB is prepared to take on non-traditional partnerships and work more closely with UN agencies, governmental and non-governmental organizations and other civil actors. ABB believes that win-win situations will emerge if the private sector is allowed to play a broader role in regional development programs, than merely being a traditional supplier on a strictly framed project-by-project basis without an overall view on the prospects for economic and social development from a wider perspective.

Access to Electricity is ABB's response to the UN Global Compact's invitation to its corporate signatories to make efforts to grow a proportion of their business over the next five years in some of the forty-nine countries currently designated by the UN as the least developed countries in the world. ABB shares the ambition of the Global Compact to promote sustainable development and economic growth in these countries through the involvement of business in partnership with other actors.

The Global Compact was launched as a voluntary, operational initiative in July 2000 at UN Headquarters. The compact seeks to contribute to more sustainable and inclusive markets and foster more beneficial relationships between business and society, paying particular attention to the world's poorest people.

Capacity building

ABB will participate in international capacity building with partners and renowned organizations like the UN, World Bank, World Energy Council, development aid organizations, WWF and other NGOs. ABB already participates in the Global Village Energy Partnership.

Being a well-known global company with a large local participation, ABB believes it has an important role to play l in developing countries. ABB can help to build local capacity through education and training of our customers in managing and maintaining technical equipment and systems.

Bringing electricity to 100 villages in Laos

ABB has expanded the power grid in northern Laos, designing and building a 340-kilometer transmission line and a 282-kilometer power distribution network through rugged and dangerous terrain to bring electricity to around 100 rural villages.

Working with the national power utility, ABB planned and implemented a sustainable electrification program.

The difficult terrain of rice fields, mountainous areas and thick forests, called for adapted technology and extensive local labor, sometimes using elephants and other traditional methods.

The project, nearing completion, is bringing benefits to some of the poorest communities in one of the world's least developed nations.

Alternative business models

Electrification from an initially extremely low level - for instance in rural areas in Africa - is most efficiently carried out as a combination of top-down and bottom-up activities. If one rightly looks at electrification as a crucial component in the fight against poverty, one could say that ABB believes in a battle on two fronts, from the top and from the bottom.

Since the top-down element has traditionally attracted virtually all interest, ABB's Access to Electricity aims at stimulating local initiatives. The ambition is to trigger and cultivate an organic development of truly commercial markets, markets that gradually will be integrated and/or connected to national grid. The sooner the front line being pushed from the top and the one pulled from the bottom meet, the sooner will poverty be reduced.

ABB will actively seek to engage in a broad array of projects that improve our ability to meet the needs of the rural poor in a sustainable way. A bottom up approach based on the local affordability, focusing on increased productivity and income generation, offers an attractive challenge for electrification and other infrastructure development projects in poor areas. With a strong focus on costs and affordability, ABB will seek investment synergies together with our partners and strive for involvement of the local workforce, business and sub-suppliers.

Demand-driven technical solutions

ABB can offer a broad range of products and services for all kinds of applications in power technology. Within the Access to Electricity program, ABB will assess suitable technical solutions applicable to rural areas where the affordability is limited. This could mean bringing about new technical standards and technology adapted to low electrical loads, small but intermittent consumption patterns and so on. It can mean simple and more robust technology that can withstand e.g. severe climatic conditions, be resistant to vandalism and theft, and also simple to operate and maintain.

Towards rural transformation in Mozambique

ABB has supplied equipment to electrify the village Eduardo Mondlane in Mozambique. The rural village has a population of 8000, with most inhabitants involved in agriculture. There is one primary school and one health center.

Since the area is expected to have a relatively low load, ABB adapted the technology to suit local conditions. The use of dual-phase and small transformers will minimize the required investment and long-term operating costs while maximizing the quality of energy.

Dual phase medium and low voltage technology reduces the cost of project investment and operation for rural electrification. Relatively small service transformers reduce the amount of investment needed at small and medium-sized isolated sites.

The electrification of Eduardo Mondlane promotes economic, social and cultural transformation of the village. It improves the quality of life for the inhabitants, creates new small-scale industries, attracts new government services, and brings more people from neighboring areas to the village.

Project characteristics

Within the Access to Electricity program ABB strives for business applications and demonstration projects that are characterized by:

- A focus on the development of poor communities in developing regions.
- Seek synergies with other infrastructure and a focus on growth of local business.
- Local involvement and partnership with companies and organizations.
- Alternative business models that are adapted to the local conditions.

- Opportunities for ABB to contribute with its technical and commercial expertise.
- Projects which are profitable, since otherwise the efforts will not be sustainable.
- Projects which support the intentions of UN Global Compact's program for Growing Sustainable Business in the Least Developed Countries.

Revamping power networks in India

India is revamping its power networks in a nationwide effort to cut energy losses in transmission and distribution networks.

ABB has supplied SCADA (Supervisory Control and Data Acquisition) systems for the twin cities of Hyderabad and Secunderabad. and for the city of Chennai

These are the first city-wide SCADA systems ever for power distribution networks in India.

The immediate benefits of the SCADA systems include increased network uptime and optimal resource allocation. The systems also enable immediate action to be taken to restore power if outages occur, and load shedding in a systematic manner to avoid grid collapse and complete black out.

Summary

Access to Electricity is ABB's response to the UN Global Compact's appeal to its corporate signatories to contribute to economic growth in the world's least developed countries. It is ABB's ambition to improve its ability to meet the needs of the poor and to increase its long-term business engagement in these regions.

ABB believes that access to modern energy services, like electricity, is an important key to economic and social development. However, many electrification programs in developing countries have largely failed to reach the rural poor.

Within the Access to Electricity program, ABB aims at facilitating new forms of cooperation, participate in capacity building, explore alternative business models and work for adapted technical solutions.

References

Barnes, D. and Foley, G., "Rural electrification in the developing world: Lessons from successful programs", World Bank Infrastructure Knowledge Base on the internet.

IEA World Energy Outlook 2002

Zomers, A. N., "Rural Electrification", Ph..D. thesis, University of Twente, 2001.

ABB INFORMATION

ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in more than 100 countries and employs about 139 000 people worldwide. We rank number one, two or three in almost all our activities.

- **Total revenues in 2002: $18.3 billion**
  - **Power Technologies: $7.1 billion**
  - **Automation Technologies: $8.4 billion**
- **Orders received in 2002: $18.1 billion**

Listed on New York (NYSE), London/Zürich (Virt-x), Stockholm (Stockholm Exchange) and Frankfurt (Xetra).
Member of Dow Jones Sustainability Index

Headquarter: Zürich, Switzerland

ABB has activities in thirty-eight of the forty-nine countries currently designated by the United Nations as the least developed countries in the world and has local representation in ten of them.
Commitment to sustainability is key to ABB's value creation. Sustainability is about securing our common future.

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