

Power to reduce poverty



The direct link between access to electricity and the reduction of poverty

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The various development communities around the world recognize the important role infrastructure investment has in poverty reduction. Having access to electricity has proven to positively influence sustainable economic development and it has a clear link to achieving many of the Millennium Development Goals formulated by The United Nations and subscribed to by world leaders. A recent study by the International Energy Agency has assessed the required investment needs in energy related infrastructure. The study concludes that substantial amounts of capital will be required during the next 30 years to maintain and expand existing grids and develop new ones. ABB, its know-how, its products and its people have a definite role to play in progressing the agenda of eradicating world poverty in the next decades.

The United Nations has formulated the world's development tasks for the next 15 years in eight Millennium Development Goals (MDGs) subscribed to by world leaders at the Millennium Summit in September 2000. At this event, sustainable development was moved onto the global agenda with clearly expressed targets for the reduction of poverty, hunger, disease, illiteracy, environmental degradation and discrimination against women by 2015. Each goal is listed in **Box 1**. To achieve this ambitious agenda the improvement of infrastructure is high up on the priority list. According to James Wolfensohn, President of the World Bank **1**, "There is now a strong recognition within the development community of the key role that infrastructure plays in achieving the Millennium Development Goals."

Mr Wolfensohn is referring to a number of infrastructure services such as electricity, transport, water supply and sanitation, telecom, and oil and gas. The quality of these services in the developing world¹⁾ as compared with OECD countries indicates significant differences – energy losses are twice as large, water losses are four times as high, faulty communication lines are ten times more common, and only 30% of roads are paved. In addition:

- 1.2 billion people lack clean water
- 2.0 billion people lack sanitation
- 2.3 billion people lack modern energy services including 1.6 with no access to electricity
- 4.0 billion people have never made a phone call. (Though mobile phones are rapidly removing this statistic).

Staggering numbers!

Footnotes

¹⁾ Developing countries: China, India, other Asia, Middle East, Africa and Latin America.
(Source: IEA – World Energy Outlook 2004)

1	James Wolfensohn, President of the World Bank
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Box 1	Millennium Development Goals
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Goal 1	Eradicate extreme poverty and hunger
Goal 2	Achieve universal primary education
Goal 3	Promote gender equality and empower women
Goal 4	Reduce child mortality
Goal 5	Improve maternal health
Goal 6	Combat HIV/AIDS, malaria and other diseases
Goal 7	Ensure environmental sustainability
Goal 8	Develop a Global Partnership for Development

According to the World Bank, 7% of the GDP of low-income countries needs to be invested annually in infrastructure services over the next decades. This value represents twice the current level and is more than seven times that of high-income countries **2**! Such a value is not at all surprising when one compares the GDP per capita of low, medium and high income economies:

- The GDP per capita in low-income countries can be lower than US\$ 400 per year.
- That of medium income countries is of the order US\$ 2,000.
- In high-income countries, the GDP per capita can be over US\$ 30,000.

A major question is how developing nations are going to afford the required infrastructure expansion and how the investment needs can be financed. High risks in the form of economic and politi-

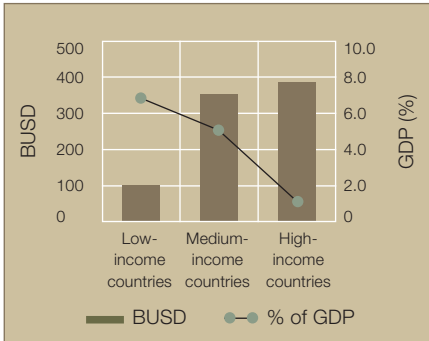
cal instability, security, corruption, exchange rate volatility, and uncertain legal and regulatory frameworks contribute enormously to many countries' increasing difficulties in attracting investment capital. These must be addressed if capital is to be made available from public and private partnerships. The world community must share their wealth by devoting increasing sums to development.

Multilateral institutions have an important role to play, not only in providing funding, but also in guiding the process of reform, competence building and project selection. As work and income are the main drivers for sustainable development, the private sector can contribute to the alleviation of poverty by job creation. The World Bank has recently reported that "research suggests that the lack of economic opportunity and resulting competition for scarce resources, more than ethnic, political and ideological issues, lie at the root of most conflicts over the last 30 years".

Access to electricity

An inextricable link between progress in achieving the MDGs and access to energy exists. In 2000, one billion people consumed 50% of the world's energy supply compared with the one billion poorest people who used only 4%. No one finds poverty acceptable. The MDGs have been established to eradicate world poverty and access to electricity is a crucial factor in achieving this. Electricity vastly enhances opportunities for industrial and agricultural development, job creation, health and education. There is a big difference in the education levels of children from areas with access to electricity and those from areas without.

Although each individual MDG may have a primary driver that does not directly



reflect its link to electricity a slightly deeper analysis will reestablish the dependence. For example eradicating AIDS not only calls for pragmatic approaches involving information and education, but also improved hygiene requiring clean water and facilities to take care of those already sick. This necessitates better energy services, since medicine must be kept refrigerated, clean water must be pumped, electrical lighting and heating/cooling must be available.

There are multiple links between energy, poverty and the environment. While low energy consumption is not a cause of poverty, the lack of stable and sustainable energy services correlates closely with many poverty indicators. The poorest households and communities are often forced to use many different energy sources, which are relatively more expensive and more polluting than if they were provided with energy services derived from electricity or gas delivered through modern networks. Searching for something to burn might use 60% of the energy supplied by the evening meal and up to 7 hours each day can be spent gathering biofuel, hence little energy and time is available to cultivate the land or educate the children. Burning such fuel in open fires is highly inefficient (up to 85%

of energy generated by an open fire is wasted). When burnt in confined spaces it creates indoor particulate and carbon monoxide concentrations that are many times higher than the WHO standard. This leads to indoor air pollution and according to a WHO estimate, some 2.5 million people (mostly women and young children) die each year because of respiratory illnesses. Collecting wood for fuel without any replanting policy causes irrevocable harm to the environment with mud-slides, sand storms and other soil eroding consequences. Although access to electricity cannot by itself eradicate these issues, it can certainly help to prevent some of them from occurring.

To properly address poverty, its multifaceted root causes such as health care, sanitation, access to clean and uninterrupted water supply and opportunities for education must first be tackled. An

initial step towards improvement is, without doubt, an increase in energy services.

Energy consumption is strongly correlated with national income. As wealth increases, more energy is consumed, but its cost as a portion of the growing household income decreases. This means a greater portion of the dispos-

able income is available for spending on other amenities. To get the income spiral to grow in a positive and

Accumulated investment needs in the electricity sector by the year 2030 are estimated at US \$10 trillion.

sustainable fashion, however, a significant portion of the GDP must be spent on energy services. Households in low-income countries might spend 10–20% of their earnings on energy, while rich country households might spend as little as 2%. In this spiral, access to electricity plays a central role by creating jobs and opportunities for small and medium sized enterprises and extending the day beyond the tropical darkness giving

extra time for education and learning, especially for women and children. For more details see *International Energy Agency, IEA – World Energy Outlook 2004, chapter 10.*

Energy consumption and climate change

According to the UN, by 2030 the global population will have increased by 2.2 billion people to reach a staggering 8.2 billion **3**! This estimate equates to an annual net increase of 80 million people, who will burden the already scarce energy resources and overstretched service infrastructures.

Relevant questions need to be answered such as:

- Will the world have sufficient energy resources?
- Will climate change have to be part of any future strategy?

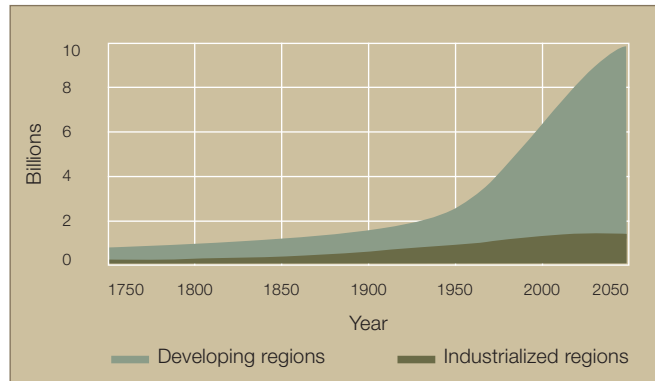


The answer to both is yes. According to the IEA in its *World Energy Investment Outlook* from 2004, the required energy resources are available as long as substantial investments in exploration and production are forthcoming. This comprehensive study suggests that the investment requirement in the energy sector aggregated during the period leading up to 2030 will be US\$ 16 trillion, which is equivalent to half the world's annual income or roughly 1.5 times the annual GDP of the USA. Of this amount, US\$ 10 trillion is needed for electricity alone.

With increasing energy consumption comes escalating CO₂ emissions. The International Panel on Climate Change's (IPCC's) development scenarios show that if there is no international intervention to manage the situation, the future CO₂ level will lead to an unacceptable impact on the world's climate. Therefore, any future energy strategy will have to include a comprehensive change in energy infrastructure. A holistic view must be adopted which takes into account the negative effect of the green house gas generation which must be mitigated by energy conservation and technological progress. Reducing green house gas emissions is already of serious concern and calls for immediate action.

The world demand for electricity will double during the next 26 years from 3.5 terawatts to 7.1 terawatts, which is equivalent to a 2.4% annual growth rate. **3** shows the different energy sources that will provide this growth. It is interesting to note that gas as a prime resource will grow by a

3 World's population growth.
(Source: The United Nations)



4 Electricity generation per fuel type year 2000 and 2030.
(Source: International Energy Agency)

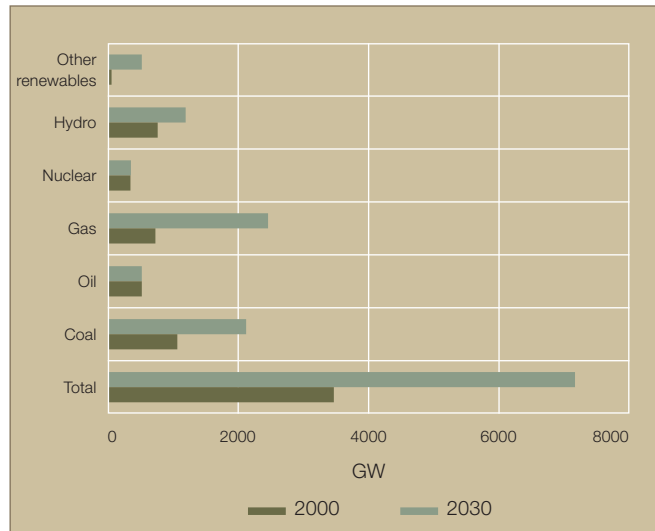


Table 1 GDP and kWh per capita for selected regions
(Source: World Bank, CIA World Factbook)

Country/Region	GDP / Capita US\$ Year 2000	kWh / Capita Year 2000
World	6,145	2,200
OECD	26,985	8,300, max 25,000
Russia	2,680	4,200
Developing	1,362	900, min < 100
Low income	475	50
Middle income	2,000	1,500
China	1,040	800
India	500	360

factor of three. Coal will double – assuming that clean coal technologies are being developed – while it is assumed that both oil and nuclear energy will decline in percentage terms (though remaining constant in absolute terms). Although hydro power is growing in absolute terms its contribution will fall from a current level of 22% to 17% by 2030. This shortfall is compensated by other renewable sources such as wind, solar, tidal, geothermal, wave and fuel cells. As a group, renewables will provide a constant percentage contribution, which is slightly less than a quarter of installed capacity over the period. Hence in this scenario based on IEA data and subscribed to by ABB, fossil fuels will remain the prime source of raw material for electricity generation. As a consequence the CO₂ emissions from the power sector might double during the period with significant uncertainties related to the ability of modern technologies to reduce its effect on climate change. The WWF takes a more optimistic view on the importance of renewables in the near future. See article on page 12.

Electricity for all

Today 1.6 billion people or 26% of the world's population do not have access to electricity. The uneven global distribution of energy access is also reflected in the numbers in *table 1*, which relates per capita GDP to per capita electricity consumption measured in kWh for 2000. Norway and Iceland, which are among the countries with the highest GDP per capita, consume almost 25,000 kWh/capita, while several developing countries use only 10–100 kWh/capita.

Most development agencies in the world agree that access to electricity is essential for sustainable economic and social development. It is a necessary but not a sufficient condition to escape from poverty.

The base scenario presented by the IEA estimates the accumulated capital requirement in the global electricity sector by 2030 to be US\$ 10 trillion, ie, 0.6% of the world's GDP aggregated over the period. However, this still leaves 1.4 billion people without electricity. The investment burden on countries varies significantly; for example, the US\$ 4 trillion to be invested in the OECD region is approximately 0.3% of its accumulated GDP, while an investment of US\$ 5.2 trillion in the developing world equates to a figure of more than 5 times the size **5**.

6 indicates the demand for capital in the different economic regions of the world and how these investments are broken down into power generation, transmission and distribution (T&D). For the first time, required investments in T&D are larger than in power generation: US\$ 5.3 trillion for T&D as compared to power generation's US\$ 4.5 trillion. This is a significant deviation from the past, when power generation accounted for around 60% of required sector investments.

OECD

In the OECD countries 50% of the investments will be focused on the T&D area with the goal of eliminating black-outs and bottlenecks in networks. USA and Canada will need 40% of the total US\$ 4 trillion to modernize their relatively old generation and grid



capacity. Distributed generation will grow and play its part in the overall capacity expansion. To accommodate such expansion, distribution networks need to be upgraded with modern technology, since they are designed to distribute and not collect electricity.

By 2030, a substantial part of the existing and future capacity must be replaced or modernized. For example, the OECD countries will have to retire one third of its power generation capacity during the period. Today, over 120 GW of power generation capacity is well over 30 years old and another 260 GW is over 10 years. All this will have to be retired by 2030.

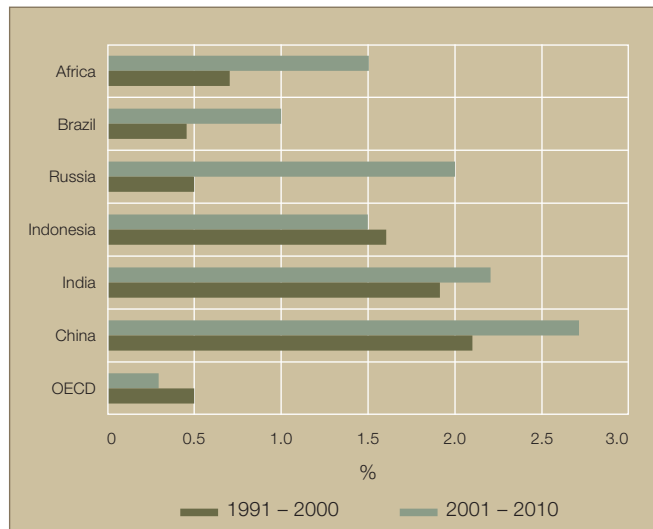
Developing countries

The developing world will need some 52% of the funds and as in the OECD countries, the T&D sector will require about 60% of the projected investments. New transmission grids and distribution networks will have to be built. The reliability of existing ones needs to be improved. China will require US\$ 2 trillion to reach 100% penetration, while an estimated US\$ 0.67 trillion is required to bring the electrification rate in India to just 70%. Coal will remain an important source of energy in these economies. Environmental issues must be resolved before such a coal-based expansion can safely take place.

Transition economies

The transition economies²⁾ will spend close to US\$ 0.7 trillion; with a 50/50 split between generation and T&D. Russia will require half of this capital.

5 Electricity investment as a share of GDP.
(Source: International Energy Agency)



6 Demand for Electricity investments from 2000 to 2030. Constant US\$ 2000.
(Source: International Energy Agency)

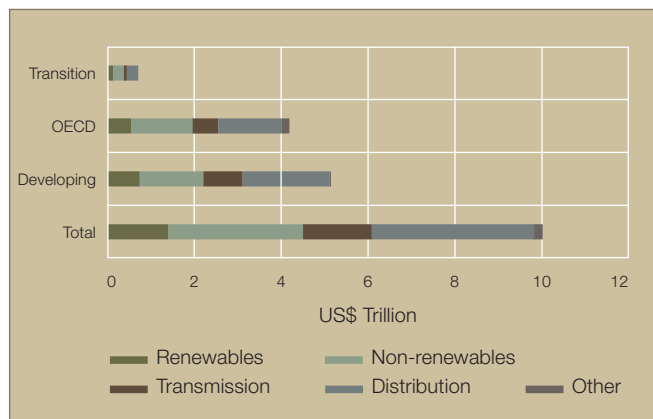




ABB has a role to play

Considering the information presented above combined with the anticipated population growth, the global electricity sector will dominate all energy investments during the next three decades. More than half of the US\$ 10 trillion will be invested in the T&D sector, resulting in a global electricity penetration rate of about 83%. Access for all by 2030 would require an additional 0.07% of world GDP, which ought to be the goal the world aims for.

This huge investment and its effect on CO₂ will demand a response in terms of energy efficiency and technological development. Coal will continue to be

Efficient use of energy in industry could potentially reduce CO₂ by an additional 250 million tonnes per annum.

an important source of energy in many economies but it needs to be matched by increased focus on gas and new advanced forms of renewable energy. Environmental issues must be addressed by an international coherent approach dealing with both the demand and the supply side of the energy issue.

The future energy sector discussed above translates into major business opportunities for ABB in the areas of: power generation, transmission and distribution; and the efficient use of energy in industry, commercial buildings and individual households.

One such opportunity has come with ABB's innovative high-voltage direct current (HVDC) transmission link. In 2004, ABB was awarded the largest power transmission project in the world in recent years. Covering a distance of 1,100 kilometers and 3,000 MW, the

contract was signed while the Chinese Vice Premier, Zeng Peiyan, visited Zürich in June. Another example is modern drives technology in combination with efficient electrical motors with the potential of reducing the energy usage in the industry by 500 TWh corresponding to a potential annual reduction in CO₂ emissions of 250 million tonnes. This is discussed in greater detail in a separate article in this issue of ABB Review.

On a different level, ABB can play a role in progressing the global agenda as formulated in the eight MDGs. In conjunction with UN organizations, governmental and non-governmental bodies, industry partners and customers, ABB has formulated a program called *Access to Electricity*. Its purpose is to develop and implement a business model for the electrification of rural and semi-urban societies, primarily in developing countries.

ABB's know-how, its products, its employees and its desire to participate actively in giving the global population access to electricity are all reflected in this issue of ABB Review.

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Footnotes

²⁾ Transition economies: Russia, Balkan economies and former states of Soviet Union. (Source: IEA - World Energy Outlook 2004)