

CLIMATE RISK MANAGEMENT FOR THE ENERGY SECTOR IN AFRICA: THE ROLE OF THE AFRICAN DEVELOPMENT BANK

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Abstract. Africa, with its wide spread rural poverty, relatively high dependence on irrigated and rain fed agriculture and chronic energy crises, has of all regions the lowest capacity to adapt to a changing climate. Furthermore, impacts due to increased climatic variability are felt hardest on the continent. Adverse weather events such as droughts, floods, torrential rains and cyclones have significantly increased both in force and frequency over the last 20 years. Thus, the UN Development Programme (UNDP) and the World Bank estimate the cost of adaptation at \$2–7 billion US per annum. Obviously, those costs exceed by far the currently available resources, available in the Global Environment Facility (GEF) adaptation funds. The four Funds amount together to US\$250 million; whereby the envisaged adaptation fund as outcome of COP 14 is estimated to be at US\$700 million. Henceforth, the African Development Bank actively engages the triple challenge of (i) Climate Risk Management both in project due diligent and country initiative level; (ii) Fostering clean Energy Development and; (iii) Increasing universal energy access by 2030. The key guiding strategic documents on both mitigation and adaptation are the Clean Energy Investment Framework as well as the Climate Risk Management and Adaptation Strategy. Furthermore, the Bank is building in both climate change areas staff capacity as well as Regional Member Countries (RMC) strength to develop best practice project designs. For instance, in the Banks energy sector department, holistic approaches, that consider climatological forecasts as well as early warning systems for enhanced dam and reservoir management are already being implemented. Finally, a major obstacle for Climate Risk Management in the African energy sector is its uniqueness in

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terms of under funding and often lack of sound operation and maintenance procedures. Extreme weather events, combined with the mentioned short comings in operations often result in disastrous consequences.

Keywords: Climate risk management; Africa; energy sector

1. Introduction

Climate change has emerged as a serious threat to sustained economic growth, poverty reduction and overall political stability in the world. In the last 2 years, two compelling reports – the 2007 Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC)¹ and the Stern Review² – have shed light on the phenomenon, its most likely driving factors, and the risks and challenges that it presents. IPCC presented consensus empirical evidence of near-certain cause-and-effect linkages between human socio-economic activities and greenhouse gases (GHGs), and between the latter and climate change. The Stern Review, on its part, undertook a comprehensive cost-benefit analysis of international response to climate change. It estimated that climate change could result in economic losses of the order of 5% of GDP world-wide. When a wider range of environmental and social impacts are factored in, potential losses could rise as high as 20% or more of GDP.

In the light of mounting evidence of global climate change, the Heads of State and Government of the G8 States, at their Gleneagles Summit in July 2005, called upon the World Bank and other multilateral development banks (MDBs) to prepare specific proposals on three interrelated challenges: to increase access to quality energy supplies especially for the world's poor; reduce global emission of GHGs, mainly by promoting clean energy development; and adapt to increasing climate variability and extreme weather events. At the subsequent summit meetings at St. Petersburg (in July 2006), Heilingendamm (in June 2007), and Hokkaido Toyako (in July 2008) the G8 Leaders, and their counterparts from major developing countries, reiterated their commitments on these three challenges.

¹ The IPCC's 4th Assessment Report, 2007 in essence states that for the last 600,000 years we are experiencing an unprecedented rate of global warming. Ice core drillings have confirmed that for the last 150 years, the global mean temperature has risen sharply. Furthermore, the report confirmed as well that Africa is the most vulnerable continent to climate change and increased climate variability.

² Stern Review on the Economic of Climate Change, November 2006.

1.1. BACKGROUND

African countries themselves, in recent years, have become more aware of the threats posed by climate change. They have witnessed extreme weather events – historic hot spells, droughts, torrential rains, cyclones, floods, and extreme fluctuations of river flows and lake water levels. Heads of State and Government devoted a segment of the January 2007 AU summit to discussing appropriate responses to climate change, including improved availability of quality information on climate and development, and the harnessing of science and technology. They endorsed an Action Plan for Africa on Climate Information for Development Needs (ClimDevAfrica) elaborated by the Economic Commission for Africa (UNECA), AfDB, and Global Climate Observing System (GCOS), under the leadership of the Commission of the African Union (AUC).

In response to the mandates from its regional and non-regional member states, the AfDB has been developing its response to climate change along multiple parallel tracks:

- A Clean Energy Investment Framework outlining the Bank Group's strategic approach to supporting African countries' efforts to attain energy access for all by 2030 and to increase their contribution to global climate change mitigation efforts was endorsed by the Boards of Directors in March 2008.
- As one of the first Multi-Lateral Development Bank's (MDB) the African Development Bank has developed a stand-alone Climate Risk Management and Adaptation Strategy for Africa – given the significance of adaptation for the African continent, this separation underscores the relevance of the subject at hand.
- The Bank has been working closely with the governments of Central African Countries and the United Kingdom in developing a Congo Basin Forest Initiative aimed at reversing deforestation by strengthening the capacity of local communities to sustainably manage forest resources thereby maintaining benefits, and by assisting them to find alternative environment-friendly livelihoods compatible with improved quality of living.
- The Climate Information for Development "ClimDevAfrica" Plan is under preparation and expected to become operational in September 2009. The program aims to increase climatological data availability on the continent, and hence contribute to build climate resilient societies.

2. The Clean Energy Investment Framework at the Bank

In light of the mounting evidence of the causes and effects of global climate change, the Heads of State and Government of the G8 states, at their Gleneagles Summit in July 2005, called upon the World Bank and other multilateral development banks (MDB's) to prepare specific proposals to address three inter-related challenges: expanding access to reliable energy supplies, particularly for the world's poor; promoting investment in clean energy and low-carbon approaches to economic development; and supporting developing countries undertake concrete measures to adapt to climate change and strengthen their capacities to cope with increasing climate variability and extreme weather events. This report presents a comprehensive framework for dealing with these triple challenges in Africa.

2.1. PILLAR I: EXPANDING ENERGY ACCESS

Africa has considerable energy potential but it consumes the least amount of energy per capita in the world, and is a significant net exporter of energy resources. Endemic low per-capita consumption of energy is both a cause and a consequence of Africa's prolonged poor socio-economic performance since the early 1970s, particularly in oil-importing Sub-Saharan African (SSA) countries. In these countries in general, less than 10% of the rural population has access to modern energy services. An estimated 400,000 deaths yearly – predominantly women and children – are linked to the use of traditional fuels in poorly-ventilated cooking places. There is a steady deterioration in the quality and reliability of electricity supply, due to chronic under-investment in capacity expansion and operations and maintenance.

Access-for-all to safe, reliable and affordable energy supplies is an imperative, in order to improve the quality of life, strengthen the capacity of African economies to compete more effectively in the global economy, and reduce poverty. However, energy development and access to safe and reliable energy and power supplies for the entire population in Africa, particularly in SSA, are hampered by several major constraints. These include: inadequate attention paid to energy development in national development plans and poverty reduction strategies; lack of energy supplies stockpiling, transportation and distribution infrastructure (including the high capital costs of extending national electric power transmission grids to rural areas and building local distribution networks at the village level); low tax revenues and limited capacity to provide public funding to infrastructure capital investment and consumer subsidies to poor households; limited private domestic savings due to high levels of poverty; tremendous pressures on energy infrastructure due to rapidly rising populations, rural-to-urban

migrations and the rising concentration of populations in unplanned peri-urban areas.

2.2. PILLAR II: CLEAN ENERGY DEVELOPMENT

Expanding energy access is a priority for Africa. However, the right balance must be struck between this goal and following a low-carbon path, limiting GHG emissions per unit of GDP. As one of the regions most vulnerable to global warming, Africa has a vested interest in rendering effective support for global mitigation efforts. As a demonstration of the utmost importance that Africa attaches to preventing excessive global warming, African countries may need to provide contributions of their own (albeit voluntary and nonbinding ones) to global emissions reduction. More effective use of flexible mechanisms under the Kyoto Protocol negotiated under the United Nations Framework Convention on Climate Change (UNFCCC), in particular the Clean Development Mechanism (CDM), provides a limited but crucial avenue for Africa to mobilize badly needed financing to buy down the initial cost of low-emission energy generating capacity. Africa is endowed with enormous renewable energy potential that remains largely untapped. African economies can progressively switch to cleaner sources of energy and cleaner development practices if resources are correctly priced taking into account their replacement value and pollution clean-up costs.

African private enterprises, civil society, NGOs, and research institutions also should invest greater effort in understanding the new exigencies, opportunities and challenges of the transition to clean development. Possible innovations include installing and using clean and more efficient stoves; switching to solar power; setting up viable decentralized community-level energy and power utilities to harness local resources such as wind energy, micro and small-scale hydro-power, biogas from communal waste, and sustainable managed community forests; popularizing energy-saving (or passive) housing architecture; licensing energy-efficient appliances; favouring energy-saving bulbs; and undertaking waste recycling. Communities should be provided adequate incentives to preserve local forest and wetland ecosystems, thereby avoiding deforestation and wetland destruction.

2.3. PILLAR III: CLIMATE RISK MANAGEMENT AND ADAPTATION TO CLIMATE CHANGE

As aforementioned, the consensus among experts is that Africa is one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity. Countries' situations are exacerbated by anterior development challenges, particularly the high

incidence of poverty, poor governance and weak institutions, limited access to capital, infrastructure and technologies, environmental degradation, and complex disasters and conflicts. Most countries are not effectively facing up to current climate variability and extreme weather events, such as floods, cyclones and tornadoes, periodic droughts, and water scarcity, let alone being ready to face up to greater variability due to changing climate in the years ahead.

Thus, the Bank develops on a parallel track the climate risk management and adaptation strategy. This process will be guided through two main delivery modalities:

- Climate risk management as part of the due diligence in Bank Group projects and country/sector planning: Climate risks directly affect Bank operations.³ These risks should be addressed in project preparation processes and appraisals similar to other risks: systematic analysis and incorporation into project design and decision-making. Eventually, a large share of the Bank's operations will include systematic climate risk management, as part of due diligence in country programming and project preparation.
- Support for climate risk management by regional member countries The main entry point for regional member country support should be the Bank's own country operations. The Bank should identify high-risk investment cases, where external resources can be found for climate risk management add-ons. These cases can be used as a trigger for broader climate risk improvements in regional member countries.

The aim is for climate issues to be integrated into national, sub-national, local and sectoral development planning and decision-making processes. This includes ensuring complementarity with national frameworks such as Poverty Reduction Strategy Papers (PRSPs), sectoral strategies and plans, as well as national and local strategies for sustainable development. Furthermore, a key issue is integration into economic planning and the budgetary process, within and across all sensitive sectors.

2.3.1. *Climate Risk Management*

Many of the most effective measures to adapt to future climate change coincide with those that can reduce vulnerability to current climate risks.

³ Particular areas of present and increasing vulnerability are existing infrastructure such as roads, bridges, railways, power supply systems, etc. Furthermore, agriculture, water resources, health, ecosystems and biodiversity including forestry and coastal zones, safety of human settlements, are under threat by increased climate variability.

This principle lies behind climate risk management, which integrates management of current climate variability and extremes with adaptation to climate change. Climate risk management offers immediate benefits to economic development in Africa, as well as longer term security in the face of a changing climate.

The systematic integration of climate risk management in development operations is receiving increasing attention in various development agencies and development banks. Examples of the methods and tools that are being developed for this purpose include the World Bank's Climate Risk Screening Tool; methods from the Asian Development Bank's CLIMAP program; and risk screening tools developed by the UK's Department for International Development (DFID). Besides the development of these tools, there is further a growing body of projects implemented by development banks that explicitly include climate risk management. The private sector, in particular insurance and reinsurance companies, are also beginning to take the lead in integrating climate risks into their insurance products.

The African Development Bank is planning to integrate climate risk management into its regular operations, and to support enhanced climate risk management by regional member countries. Thus, the institution is currently developing a climate risk management strategy to guide its efforts as well as preparing a number of project interventions, including the CARLA project on climate adaptation for the food security and agriculture sector in Malawi. The strategy will address two key gaps in current Bank work. First, it will help Bank operations integrate the notion that the future climate will be different from the past, which changes investment opportunities and risks. Second, it will address the underinvestment in climate adaptation and in climate risk management, even in light of current climate variability and extremes.

In addition, the AfDB is working with key partners, namely the African Union and the United Nations Economic Commission for Africa, on implementing a UK DfID-sponsored program 'Climate Information for Development Needs' (ClimDevAfrica). The goal of ClimDevAfrica is to improve the availability and use of climate information and services in support of sustainable development and achievement of the MDGs. ClimDevAfrica should result in better food security, improved protection from malaria and other climate-sensitive diseases, enhanced management of water resources, better disaster risk management, more judicious use of energy resources and improved environmental sustainability.

2.3.2. Africa's Special Climatic Situation

Africa faces a number of special challenges that makes the continent more vulnerable to climate change than other parts of the world.

Key economic sectors – specifically agriculture and other natural resource-based sectors – are highly sensitive to climate variability and change.

- Many systems are already close to their tolerance limit for temperature or changes in rainfall.
- Multiple stresses – including endemic poverty, complex governance and institutional dimensions, limited access to capital, ecosystem degradation, disasters and conflicts – combine to exacerbate Africa’s vulnerability to climate variability and change.
- Availability of climate information is limited in most African countries, and the quality is significantly below WMO standard.
- Competing priorities, and short-to medium-term decision-making horizons, often result in lack of attention by politicians and other decision makers to the need for adaptation to climate change. Low priority of adaptation is given due to the fact that it does not have a clear immediate economic output of its own. Hence, it is often considered less important than other development objectives.
- Currently available funding for climate change adaptation in Africa does not come even close to the amount needed.
- The infrastructure to cope with grave disturbances and catastrophic events is weak/underdeveloped.

Climate change does however bring some opportunities for Africa.

- Attention paid to climate risks in the face of climate change can help to reduce the impacts of climate variability and extremes that Africa is already facing today.
- New and improved technologies, and innovations in climate science, are becoming available that could help Africa adapt to climate change.
- Innovative private sector instruments, management practices and business approaches are being developed that can help to cope with climate risks.
- Climate change can act as a catalyst to enhance partnerships between government departments, the private sector, non-governmental organizations, and national as well as international providers of scientific information.
- New adaptation funding provides resources for enhancing the effectiveness of current investments, or developing and implementing innovative practices.
- Incorporating climate risk management into projects results in a re-orientation of project planning and development, and better operation and maintenance, with both immediate and long-term benefits.

3. The Provision of Energy and the Link to the MDG's

Although there is no Millennium Development Goal on energy, sustainable, reliable, and affordable energy services are indispensable to achieve economic growth: to increase the availability and distribution of productive capital, to increase the creation and productivity of enterprises and to increase employment and incomes. The strong correlation between economic growth and poverty reduction is well illustrated by the experience of countries like China, Vietnam and India. They experienced sustained economic growth and a significant poverty reduction.

Goal 1: Eradicate extreme poverty and hunger. Energy services are needed to reduce hunger. Ninety-five percent of the food produced needs to be cooked to be ingested. Without affordable energy for cooking, people cannot eat sufficiently to live healthy and productively. As fuel scarcity increases or when cooking fuel prices increase, families with limited cash incomes will decrease the quantities of food cooked. Women will be the first ones to be affected, as they leave their share to their children and husbands.

Goal 3: Promote gender equality and empower women. The probability that a woman will read is strongly related to the presence or absence of electricity in the home. Educated adults, especially women, further ensure educated children. Research has shown that education for girls is the most effective way of tackling poverty.

Goal 4: Reduce child mortality. Women with even a few years of basic education have smaller, healthier families. Each additional year of female education is thought to reduce child mortality by 5–10%.

Goal 6: Combat HIV/AIDS, malaria, and other diseases. Energy services are needed to improve health services: lighting and power is needed to improve safe child delivery and save mothers' lives. Electric lights at night reduce household accidents such as paraffin burns associated with other commonly used fuels. By powering equipment for health clinics, energy enables health clinics to refrigerate vaccines, operate medical equipment, and provide treatment in the evening. By allowing the use of modern tools of mass communication for health education, energy helps fighting of HIV/AIDS and other preventable diseases. Energy services are needed to draw safe water or boil water, and save the debilitation or lives of children subject to diarrhoea.

The energy scenario today is that 1.6 billion people still lack access to modern energy services. 2.6 billion people rely on traditional biomass for cooking. Indoor air pollution (from cooking and heating with biomass over open stoves) is a leading cause of women, infant and child mortality in developing countries ahead of malaria and tuberculosis combined. The

poorest, the one billion who live on less than one dollar a day, spend up to one third of their disposable cash income – US\$10 a month – on poor quality energy services for cooking and lighting.

The aforementioned findings have major policy implications for developing countries to meet their energy needs and achieve the MDGs, in particular the need to integrate energy in all development programs. Further, to diversify primary energy resource portfolios for instance, Africa is rich in natural resources, in particular in hydro-power resources and other renewable energy sources – wind, solar, geothermal, which today are little developed. Africa also has great potential for regional energy trade, in power and hydrocarbons. With a more diverse energy portfolio, Africa can improve its oil intensity and secure its longer term energy needs. Finally, a strong need to focus on energy efficiency, both for energy service suppliers and for energy consumers, is a necessity especially in times of rising oil prices. Improved energy efficiency is the least-cost opportunity to increase the availability of energy resources, as well as reduce energy expenditures. This applies to electricity generation, transport and distribution, as well as to energy use in large and small industries or at the household level.

3.1. SNAPSHOT OF THE AFRICAN ENERGY SECTOR

In North Africa universal access to electricity has nearly been attained thanks to significant public investments by state-owned power utility operators. The challenge is now to make sure that the financial viability of utilities is secured over the long run. Key challenges include reforming existing energy price subsidies, developing adequate incentives to stimulate investments in energy efficiency and implementing frameworks to mobilize public as well as private investment in additional generation, transmission and distribution infrastructure. Strengthening power interconnections among countries and connecting to the European power grid through the Mediterranean Sea, including exporting renewable energy to Europe, are currently under consideration.

Large hydropower sources dominate the energy mix in most African countries, followed by oil and natural gas – particularly in Nigeria, Ivory Coast, Sudan, Senegal, Kenya, Ghana, and Tanzania. Southern Africa, on the other hand, relies heavily on coal as a source of power. As a result of this energy mix, CO₂ emissions from the energy sector in Africa are modest. Land use and deforestation contribute a much larger share of total GHG emissions on account of the heavy reliance on biomass use for cooking and heating. There are three exceptions to this basic premise.

- South Africa, which relies heavily on coal-based energy, contributes to more than 65% of sub-Saharan Africa's total GHG emissions – making it the 14th largest emitter in the world.
- Nigeria – as a result of gas flaring and oil production – is the second largest emitter in sub-Saharan Africa, and
- North Africa has experienced one of the highest global rates of growth in emissions – attributable to oil producers such as Egypt and Algeria and to rapid urban growth.

The potential for hydropower remains very large. Concerns over the environmental and social effects of building large dams have, until recently, slowed investments in hydropower. The remaining hydropower potential in developing countries and, most particularly, in sub-Saharan Africa is very large. Several developing countries are focusing again on this source of electricity, driven by rising demand for electricity. As described in the Water Annex, there is a growing consensus that countries should follow an integrated approach in managing their water resources, planning hydropower development in co-operation with other water-using sectors.

3.2. IMPACTS OF CLIMATE CHANGE ON THE ENERGY SECTOR

As aforementioned, climate change presents additional challenges to Africa, which has already been hit hard by high oil prices. As a result of more erratic rainfall patterns, climate change has severely affected power generation capacity of hydro-power dams in Ethiopia as well as in both Eastern Tanzania, Uganda and Western Ghana. Thus, these countries are being forced to spend their limited resources to add emergency generation capacity, most of which relies on diesel fuel-based systems⁴ – thus aggravating greenhouse gas emissions. The impact of climate change on large hydropower projects will mean that future investments in this area will need to be designed with more attention given to hydrological variability.

Consequently, Africa is faced with the dual challenge of increasing energy access while simultaneously making maximum use of clean energy options. Africa has a number of options for clean energy development in view of its enormous untapped renewable energy potential – especially hydro-power, geothermal energy, solar and wind power – as well as more efficient use of biomass and improved energy efficiency. Regional co-operation in energy

⁴ In Uganda 300 MW of Diesel generators had to be installed in 2008, as the delays in the Budjagali hydro power station forced the country into this more expensive and polluting energy source.

development – in particular in the context of river basin water resources management (refer to Water Annex) – will be required and ancillary challenges must be overcome. The combination of (i) greater access to carbon finance and (ii) necessary adaptation to climate change in the water sector can provide Africa with the opportunity and incentives to develop cost-effective options to developing clean energy, in particular hydropower. Thus much greater access to energy (and to water) could help propel Africa to a higher, more diversified economic growth path.

However, past experiences in operation of e.g. hydro power stations in Africa have revealed that an integrated approach to climate risk management is absolutely critical. In particular the adequate training of operating staff is vital to insure proper reservoir management and maintenance of the generating equipment. For instance at the Manzenian 2 MW mini-hydro power station in Lesotho, the flood in 2006 severely damaged the power house. Although the flood was well within the design parameters, poor operations and maintenance have resulted in this disaster.⁵ Furthermore, in order to fulfil the prerequisite given by the World Commission on Dams (WCD) of multi-purpose utilization (irrigation, hydro power, flood prevention etc.), two vital aspects need to be considered:

1. On one hand regional communication and integration, as e.g. the flood prevention in Mozambique starts already as far upstream as Zambia. Hence, in order to prevent adverse impacts downstream, early regional warning systems need to be run.
2. On the other hand, Integrated Water Resource Management (IWRM) needs to be considered on a national level. This also involves the close collaboration with local meteorological services and, on long term bases, the integration of climatological data. In essence, the goal is to inter-link dams operations with short term predictions in order to insure (a) the continuous and reliable supply of cheap hydro power on one hand, and (b) on the other hand, to prevent floods down stream.⁶

⁵ Given That Lesotho is short of 5 MW generating capacity, the involuntary shut down of the plant had significant ramifications for the economy in Lesotho. Furthermore, as the whole region suffered from load shedding, the almost 2 year non operationality of the plant is hard to comprehend. Hence, this case is evidence for the need to strengthen utilities technical capacities.

⁶ The aspect of reservoir management is critical, as operators often run the reservoirs at very high levels for continuous hydro power generation. However, in case of torrential rains, the flood prevention purpose is defeated, as flush gates have to be opened in an emergency in order to avoid damages on the dam. This results in downstream flooding, often without any warning for the population.

Furthermore, diversification of generation sources are yet another option of mitigating the risks ahead. For instance, if the climatological data for a region points to increased variability in rainfall patterns, the standard approach to hydro power adaptation would be the increase of reservoir capacity by either modifying the existing dam, or by constructing a second dam upstream. However, Climate Risk Management in the energy sector at this point needs to consider strongly alternative sources such as Concentrated Solar Power, co-generation or even generators to reach the goal of provision of affordable energy. Hence, this presents an opportunity for clean energy development.

As elaborated in Section 2, the Clean Energy Investment Framework, the African Development Bank and the World Bank are promoting a multi-track approach covering:

- Accelerating access to electricity in urban areas and rural electrification
- Extending, upgrading, and interconnecting national power transmission grids
- Integrating national electricity power supplies and helping to develop efficient power trade arrangements
- Promoting off-grid renewable power supply systems; and
- Promoting sustainable household fuels

3.3. RECOMMENDATIONS ON THE WAY FORWARD FOR AFRICA

- Assisting African governments in mobilizing additional financial resources and develop their capacity: Adaptation to Climate Change is an extra financial burden on developing countries. Mechanisms need to insure that the adaptation assistance is distinct from ODA. Furthermore, setting a growth path of a low-carbon economy requires the financing of incremental costs in new technologies, some of which are still in the early stages of commercial application. The combination of large capital cost, higher risk and increased demands on technological capabilities represents an obstacle to early deployment.
- Promoting technology transfer: The massive new investments required in developing countries' energy sectors over the next 30 years provide a window of opportunity for technological transformation, involving technological transfer accompanied by the development of knowledge, capabilities in areas such as maintenance, and the development of national capacities to climb the technology-ladder. This is an area in which international cooperation – including South–South cooperation – has an important role to play in particular in adaptation to climate

change, as diversifying the energy generation sources is by default a means of CRM.

- Continued Assistance and coordination on the negotiations for the post-2012 Kyoto Protocol framework: The Bank already collaborates with the African Ministers Council on Environment (AMCEN) to streamline the African position. This provides an opportunity to establish an architecture for international cooperation that links climate change mitigation to sustainable energy financing.
- Consider biofuels options, keeping in perspective the importance of balancing the food-biofuels competition for arable lands: Faced with mounting energy crises, many African nations are experimenting or have already invested in projects to produce biofuels. These include South Africa, Nigeria, the Democratic Republic of Congo (DRC), Ethiopia; Mozambique and other southern African countries (including Swaziland, Zambia and Zimbabwe). For example, in recent years, the utilization of agricultural and forestry residues for co-generation, as well as biogas from landfills and sewage plants, has shown promise as feed-stock for biofuels production. However, more assessment of feasibilities of domestic production is necessary.
- Further promotion of clean household biomass fuels: Traditional biomass is the predominant fuel source for cooking and heating in SSA, which results in serious indoor air pollution and deforestation (in SSA over 400,000 deaths of mainly women and children per anno are attributed to indoor pollution). To date, three types of solutions have been attempted to address this issue: I. improved stoves; II. fuel substitution with liquid and gas fuel alternatives such as LPG, kerosene, and natural gas; and III. sustainable forestry management. These measures can not only reduce GHG emissions, but also preserve forests. However, the results have been mixed. The higher costs of improved stoves and alternative fuels, as well as efforts to manage the complicated multi-sector institutional arrangements involved, are among the major challenges.
- Promote energy efficiency: Improving energy efficiency is a “win-win” solution to mitigate climate change and address power shortages. Improving energy efficiency and encouraging energy conservation are fundamental pillars of strategies such as the Bank’s CEIF to switch to low-carbon development and poverty reduction paths with minimal capital investment by Africa’s power utilities. Supply-side initiatives, such as reduction of transmission and distribution losses or generation plant refurbishments to increase technical efficiency, could boost electricity supply by 20% or more in a fraction of the time required to build and commission an equivalent power plant. On the demand side,

governments need to encourage and reinforce a culture of energy saving in homes, enterprises, and public institutions. Significant power savings can be realized by encouraging a switch to energy-saving lights. In Uganda, distribution of 600,000 CFLs with less than \$1 million investment cut peak demand by 30 MW. Eskom in South Africa is planning to disseminate 35 million CFLs, which can cut peak demand by 1,750 MW. In essence, reducing the stress on Africa's electricity supply will result in fewer brown- and black-outs and hence contribute also to addressing climate related risks indirectly. The system will absorb an isolated disaster that results in the shut down of a plant or line much easier, when some leeway is budgeted.