Ministero dello Sviluppo Economico

ENERGY MINISTERS MEETING 2009

AFRICA ENERGY POVERTY

G8 Energy Ministers Meeting 2009
Rome, May 24-25, 2009

World Bank

Table of Contents

Executive Summary 1

I. Energy, Poverty Reduction and the Millennium Development Goals (MDGs) 7

The Status of Energy Services in Africa 7
Energy Supply Quality and Economic Growth in Africa 9
Energy Services and the Millennium Development Goals in Africa 9
Climate Change, Poverty Reduction and the Energy Sector 11

II. Government Policies 12

III. Africa's Huge Investment Backlog in the Electricity Sector 14

IV. Mobilization of Public and Private Financing for Electricity Access in Africa 15

V. Proposed Actions 16

VI. International Programs for Access in Africa 21

VII. Role of the World Bank in addressing Africa's growing energy needs. 23

References 25
Annex 1. Complementarity of Grid & Off-Grid Services in SWAp 26
Annex 2. Energy Consumption, GDP and HDI 28
Annex 3. Matrix of Energy and the Millennium Development Goals 29
Annex 4. World Bank Group (WBG) Support for Energy Access in Africa. 31

Africa Energy Poverty [1]

Executive Summary

Worldwide, about 1.6 billion people lack access to electricity services. There are also large populations without access in the poorer countries of Asia and Latin America, as well as in the rural and peri-urban areas of middle income countries. However large-scale electrification programs that are currently underway in middle income countries and the poor countries of Asia will increase household electricity access more rapidly than in sub-Saharan Africa.

Africa has the lowest electrification rate of all the regions at 26% of households, meaning that as many as 547 million people are without access to electricity. On current trends less than half of African countries will reach universal access to electricity even by 2050. Without access to electricity services, the poor are deprived of opportunities to improve their living standards and the delivery of health and education services is compromised when electricity is not available in clinics, in schools and in the households of students and teachers.

Generation capacity in Africa at 39 MW per million populations is about one tenth of the levels found in other low income regions and some 30 African countries have been experiencing frequent outages and load shedding High-cost and unreliable energy services in Africa have become a significant drag on economic growth and competitiveness in the region. The economic value of power outages can amount to as much as 2 percent of GDP for countries affected. Over the last decade, deficient power infrastructure shaved an average 0.1 percentage points from Africa's per capita growth rate.

It has been estimated that redressing Africa's power deficit could boost economic growth by 1.9 percentage points. To cope with widespread outages a number of countries have had to contract short term leases for "emergency" generation in the form of containerized mobile diesel units costing as much as U$0.35 per kilowatt-hour, with lease payment absorbing more than 1 percent of GDP in many cases.

Worldwide 3 billion people use wood, dung, coal and other traditional fuels inside their homes to meet their cooking needs. Over half of all people relying on biomass live in India and China, but the proportion is greatest in Africa where over 646 million people depended on biomass in 2002 and the World Health Organization estimates that the resulting indoor air pollution is responsible for 1.5 million deaths per year—mostly of children and womend. Every year, African households and business spend upwards of $17 billion on fuel based lighting that is often of poor quality and hazardous.

[1] Throughout this paper "Africa" refers to the 48 countries of Sub-Saharan Africa

The Investment Gap in the Electricity Sector in Africa

The total financing needs for Africa to resolve the power supply crisis are of the order of approximately US$40 billion per annum or 6.4 percent of region's GDP. This is the cost of expanding generation capacity by 7,000 MW per annum to achieve demand-supply balance, extending cross-border transmission to enable regional trade, and raising electrification rates by 10 percentage points. Currently, the region spends only about $11 billion per annum (or just over a quarter of what is required) leaving a financing gap of about $30 billion.

In response to the power crisis, donors have increased their support to the power sector, though more is needed. From the mid-1990s to the mid-2000s, donor assistance for the African power sector averaged no more than US$500 million per year. Following the Gleneagles Summit of the G8 in 2005, there has been a marked increase. Commitments averaged $1.5 billion a year for 2005/07, reaching a peak of $2.3 billion in 2007. This is an important turnaround in funding, but remains small in relation to the needs.

The private sector will be key to energy access expansion. For example, private sector expertise will be needed to develop the large complex generation and transmission projects (especially cross-border projects) that are necessary and for which a project finance approach will be often the most appropriate. Independent power producers can mobilize capital for generation capacity expansion. Many forms of public private partnerships are possible such as when electricity distribution utilities that remain under public ownership, contract with the private sector for functions such as billing and collection. Increasingly, small and medium size enterprises (SMEs) that are sometimes supported by Output-Based-Aid subsidy mechanisms are proving to be effective service providers in rural areas of Africa.

The current global credit crisis poses additional challenges to mobilizing financing for energy infrastructure and especially for projects with perceived higher risk or higher costs. Nevertheless, governments can still access finance in the private markets for sound investments.

Energy Access and Climate Change in Africa

Africa is most vulnerable from climate change impacts – it is least prepared to deal with it, and will suffer the soonest and the most from it. African countries will need to increase their resilience to and minimize negative climate change impacts while investing in growing their economies and eradicating poverty. The poorest households in African countries, with the least resources and the least capacity to adapt, are the most vulnerable from the impacts of climate change.

The energy sector in Africa contributes little to global greenhouse gas emissions. Moreover, scaling up electricity access would add only a small fraction of projected global emissions – from 1.5 percent of global annual energy-related CO2 emissions today to 2-3 percent of global emissions by 2050 (World Bank, 2009). This is a result of very low energy consumption now and the hydro-dominated power generation capacity mix found in many African countries. Provision of basic modern energy services to the poor would contribute only 1 percent to global CO2 emissions (Socolow, 2006).

However, countries in Africa can and should take advantage of the evolving international global climate policy to lower GHG intensity of their growth, to achieve local environment and development benefits, such as in the case of energy efficiency. In this regard, despite contributing little to global emissions, African countries should stand to gain from opportunities afforded by emerging new financing instruments and cleaner energy technologies.

Modern energy services including those from renewable energy sources will facilitate adaptation against climate change in Africa. For example, intensifying agriculture and improving productivity per unit of land is an important adaptation strategy against climate change impacts whose successful implementation will in part depend on increase in supply and use of modern energy in agriculture (for irrigation for example). Poor households in rural areas can better adapt to anticipated climate change impacts when modern energy services are available (for example by enabling increased supply of clean water through pumping). Further expansion of Africa's hydro potential can play a dual role of developing lower carbon energy and increasing climate resilience through improved water storage.

A Call to International Action based on five national and one regional pillar

The enabling conditions for rapid expansion of grid and off-grid electrification exist in many African countries, providing a basis for prioritizing action. A good number of African countries have over the past decade pursued a reform agenda in the energy sector that has created a conducive policy framework in support of rapid scale-up of electrification. These countries have put in place capable institutions including a regulatory agency and utilities that are reasonably well managed and tariffs have been adjusted to close to cost recovery levels.

The biggest challenge in scaling up energy access will be in mobilizing the necessary financing to close the financing gap of more than $30 billion per annum. The investment needs are so huge and public resources are so limited that there is no alternative to sourcing much of the financing gap from capital markets. Increased volumes of financing from multilateral and bilateral donors will also be necessary to complement and leverage private finance, public resources and customer and community contributions.

The agenda for energy access scale-up – i.e. for faster, more comprehensive access to affordable energy - can build on international commitments to poverty reduction, to a low carbon economy and adaptation to climate change. The existing financial instruments of the international financial institutions and bilateral financing institutions are broadly adequate to meet the energy needs for development and access to the poor. However, the volume of financing through existing instruments is inadequate. Multilateral and bilateral financial institutions need to increase the amount they channel to energy infrastructure investments in Africa to help close the financing gap.

Support for low-carbon energy in Africa will require a range of financing instruments, packaged in a complementary way to maximize synergies within the framework of countries' development strategies. The design of new financing instruments to address climate change needs to take account of the particular circumstances of African countries and special support will be required for capacity building to ensure take-up. The climate fund SREP (Scaling-up Renewable Energy Program for Low Income Countries) under the Strategic

Climate Funds is an example of such an instrument. SREP will address capacity building, technical assistance for planning and pre-investment studies, policy development, regulatory reform, and business development and capacity- building as part of larger scale renewable adoption along with investment operations.

Carbon finance has proven to be an effective incentive mechanism to leverage investment in expanding access to energy through low-carbon energy service solutions. In a context of scarce resources and high electricity generation costs, carbon finance offers a new approach to make energy access more affordable and in the process scale up supply across Africa. For example in Senegal, promoting the use of compact fluorescent light bulbs as part of a rural electrification plan is expected to generate energy savings and emissions reductions that can be sold as offsets through the Clean Development Mechanism, thereby reducing the cost of providing energy access to 365,000 rural households.

With increased volume of financing action to address energy poverty based on five national pillars and one regional pillar is feasible:

Actions in support of regional (pan-African) efforts for development of energy corridors. Regional power trade could save sub-Saharan Africa $2 billion per year, reduce the unit cost of delivered power through economies of scale and reduce carbon emissions since additional hydro-power projects would become bankable. The best way to expand generation capacity at the lowest unit cost is to develop large-scale generation projects (often hydropower or natural gas based) to supply regional power pools through cross-border trade. A regional approach is therefore needed to pool resources so that low cost energy can be developed and traded across borders. Action should be based upon existing pre-feasibility studies for the development of electricity, gas and oil grids and at a minimum should make available the significant funds required for project preparation − including design studies, institutional strengthening and environmental and social assessments.

Support for national policy and institutional development and governance improvement. Successful design and timely implementation of energy access programs will hinge critically on strengthening the planning and oversight functions of governments, private-public partnerships as well as on improved corporate governance and operational performance of utilities. Supporting actions will include capacity building for the planning, oversight and regulatory agencies of government and capacity building and twinning arrangements for national utilities to improve operational efficiency through loss reduction, improved metering, billing and collection and investments in energy system upgrading. .

Support for Sector Wide Approaches (SWAPs). Given the scale of investments needed for access scale-up support for a more systematic approach to planning and financing national electrification roll-out programs is critical. Development partners should better co-ordinate, harmonize and channel resources for access scale-up in a more sustained and cost-effective way that is consistent with the Paris Declaration. The sector wide approach should incorporate spatial analysis in determining least cost options that will result in a mix of technologies being employed including grid extension in more densely populated areas and off-grid supply using renewable energy technologies for more dispersed rural households. A sector wide approach should also target essential public services used by the poor through the electrification of health posts, clinics, schools and other community facilities.

Support for energy efficiency programs. Supply side and demand–side measures for energy efficiency improvement – that could benefit from new and increased sources of carbon finance – can reduce the energy burden for all consumers. Supporting actions include deployment of energy saving appliances and equipment including efficient lighting such as compact flourescent lightbulbs (CFLs) that simultaneously reduces electricity usage and demand and electricity bills of poor households. A comprehensive energy efficiency program should include energy audits of industries and commercial buildings and supporting financing mechanisms for investment in rehabilitation and upgrading of energy using equipment in facilities and buildings.

Support for low-carbon energy. The challenge for international assistance programs that support energy sector development in Africa is meeting the needs of the countries for energy access scale-up while also meeting the global imperative for clean energy that protects the planet and preserves the future. Supporting actions should support rapid increases in access for the poor and wherever possible find ways to make lower carbon alternatives affordable. While it is recognized that in Africa access will drive national energy policies, considering the climate change impacts of the prospective least-cost energy mix will be important too. For example, new sources of financing for low-carbon energy can facilitate development of the large hydropower, wind and solar resources located in Africa. In some cases fossil fuel based generation options will be inevitable given the economics, even when taking into account externalities. Indigenous innovation and entrepreneurship should be supported so that countries can better deploy new financing instruments. Overall a strategy to balance growth with energy security and environmental sustainability is advocated. Meeting these objectives will require, tapping into new sources of finance including carbon funds, the GEF and other specialized funds like the recently approved Climate Investment Fund.

Support for modern biomass and lighting programs. About two thirds of the population in Africa lives in rural areas and many of these live in communities where off-grid electricity technologies are least cost in the medium term and where sustainable biomass supply and use can meet their cooking needs. Supporting actions should include programs aimed at delivering affordable, modern, and efficient lighting products using renewable technologies and improved cookstove programs through public private partnership arrangements with . the private sector and NGOs. Complementary promotion of liquefied petroleum gas (LPG), and sustainable management of natural forests with private and community participation are also needed.

Public Policies for Energy Access Scale-up

In countries that have achieved nearly universal electricity access, political commitment has translated into significant government budget allocation for electrification to complement funding from the private sector, communities and consumers.

The public sector policies that can be most effective in addressing barriers to energy access scale-up include the following:

- *Good governance and transparency at the state and corporate level are the keys to attracting foreign and domestic investors.* Sector sustainability results only when the rule of law prevails, property rights are respected and contract obligations are enforced. Effective pricing

policies can support electricity utilities' internal generation of sufficient cash after meeting all their operational expenses and debt service adequate to meet at least the equity requirements of system expansion projects.

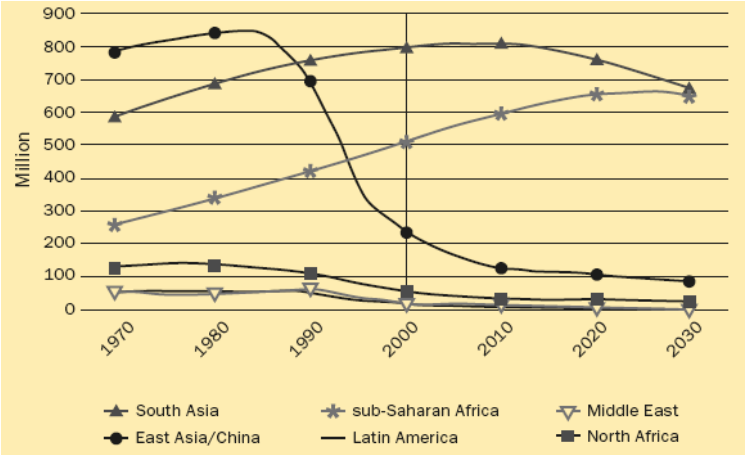
- *Remove obstacles to effective functioning of energy markets*. Effective reforms provide for efficient entry and exit of energy suppliers and users, eliminate restrictions or bottlenecks on the import and distribution of modern fuels and electricity, and remove market distortions that favor one supply source over another.
- *Policies that incentivize, private sector and community participation in rural energy supply*. Policies need to actively encourage local private or cooperative generation and distribution enterprises and need to have supporting capacity building initiatives, and effective regulatory frameworks.
- *Remove barriers to decentralized options for energy supply and more affordable technologies*. Effective regulatory frameworks should include the entire spectrum of primary energy sources, distribution, low carbon and end-use technologies for the delivery of energy services. Inexpensive meters and off-grid solutions using local resources are some of the more affordable solutions needed to expand the spectrum of options.
- *Demand management, optimal generation planning*. Increased support for energy efficiency is essential to meet growing demands in a sustainable manner. Efficiency improvements, demand management, improved planning and operation could moderate the volume of investments needed and thus help bridge the supply-demand gap.
- *Reformulate taxes and subsidies*. High electricity connection costs are a great disincentive to access for poor households. Lowering the first-time connection fee and allowing new customers to pay the fee in installments can incentivize poor households to seek an electricity connection.
- *Policies for sustainable biomass supply*. They include policy measures such as transferring the harvest rights for fuelwood to local communities and a more central role for the forest service in providing technical assistance and capacity development to rural communities involved in harvesting woodfuel and producing charcoal.

I. Energy, Poverty Reduction and the Millennium Development Goals (MDGs)

The Status of Energy Services in Africa

Africa has the lowest electrification rate of all the regions at 26% of households, meaning that as many as 547 million people are without electricity access. Only 51% of the urban population and 8% of the rural population has an electricity connection. On current trends less than half of African countries will reach universal access to electricity even by 2050. Per capita electricity consumption in Africa (excluding South Africa) averages only 124 kilowatt-hours a year, barely 1 percent of the consumption typical in high income countries: hardly enough to power one light bulb per person for 6 hours a day.

Figure 1
Number of people (actual and projected) without electricity 1970-2030, by region under current policies



In the number of people without electricity is either static or increasing because population growth is outstripping the pace at which households are being connected. In other words, the annual rate of new connections in Africa (less than 1%) is not keeping pace with new household formation (1.9%). For example, in both Uganda and Mozambique, the national utilities connect about 10,000 new households per year but population growth, at 2.9% and 2.2% per year, respectively, adds annually 140,000 households in Uganda and 90,000 households in Mozambique.

Only 51% of the urban population and 8% of the rural population has access to electricity. Projections (figure 1) of the International Energy Agency show that the number of people without electricity access will continue to rise in Africa through 2030 unless new policies and programs to increase access are implemented.

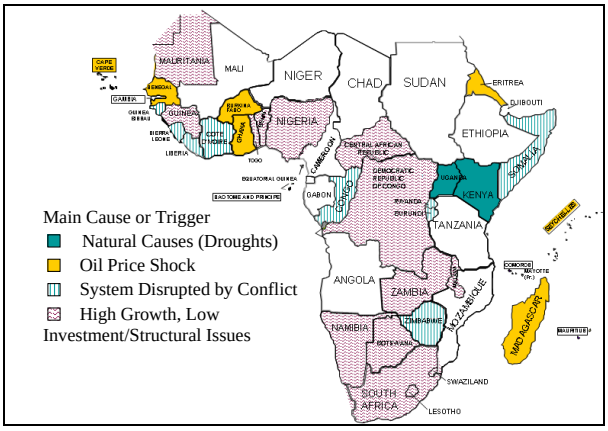
Biomass is a very important fuel in many African countries, sometimes exceeding 70% of the total energy use of a country and, for many of the poor, a vital energy source. In at least 18 countries including Benin, Burkina Faso, Kenya, Malawi and Zambia more than 80% of the

population use solid fuels for cooking. A number of countries have made strong efforts to reduce dependence on solid fuels. For example Senegal dependence on solid fuels has been reduced to 41% of households (WHO, 2006) albeit partly through costly LPG subsidies.

The installed generation capacity in Africa at 68GW is no more than that of Spain; and half of it is in South Africa alone. Generation, transmission and distribution assets have in many cases exceeded their useful life or not been well maintained. Generation capacity at 39 MW per million population is about one tenth of the levels found in other low income regions. Additional electricity generation and transmission capacity will be required to serve newly connected households and other demands in Africa. Large regional hydro and thermal generation plants offer economies of scale that can reduce the current high cost of power supply in many of the countries of SSA.

Some 30 African countries have been experiencing frequent outages and load shedding. A combinations of factors are responsible. Between 2001 and '05 half the countries in Sub-Saharan Africa achieved GDP growth rates in excess of 4.5 percent. Their demand for power grew at a similar pace, yet generation capacity expanded only 1.2 percent annually. The case of South Africa that has had to resort to load shedding during the past few years, clearly illustrates what happens when generation capacity fails to keep up with demand. In some countries, the situation was exacerbated by supply shocks induced by droughts in East Africa, large increases in oil prices,and conflict that destroyed the power infrastructure in some countries and end-of-life breakdown of old, dilapidated power generation systems.

Figure 2. Africa's power supply crisis has many underlying causes



The cost of producing power in Africa is exceptionally high and rising. Due to the small scale of most national power systems, and the widespread reliance on expensive oil-based generation, the average total historic cost of producing power in Africa is exceptionally high at $0.18 per kilowatt-hour and the average effective tariff is $0.14 per kilowatt-hour.[2] These compare with tariffs of $0.04 per kilowatt-hour in South Asia and $0.07 in East Asia.

Biomass is a very important fuel in many African countries, sometimes exceeding 70% of the total energy use of a country and, for many of the poor, a vital energy source. In at least 18 countries, more than 80% of the population use solid fuels for cooking. The WHO has

[2] Calculated at the level of consumption of 100 kWh/month.

assessed the death toll from various respiratory diseases due to indoor smoke in Africa in 2002 at 396 thousand. Women and children that are most frequently exposed are most at risk. Switching to cleaner fuels and increasing fuel efficiency through better stoves can reduce health risks for all household members. Switching to modern fuels such as kerosene, LPG and biogas, brings about the largest reductions in indoor smoke. However in poor rural communities, where access to these modern fuel alternatives is limited biomass remains the most frequently used fuel. Improved stoves – provided they are adequately designed, installed and maintained – can cut indoor smoke levels considerably and in East Africa have been found to lower pollution by 50% (World Health Organization, 2006).

Energy Supply Quality and Economic Growth in Africa

High-cost and unreliable energy services have become a significant drag on economic growth and competitiveness in the region. The economic value of power outages can amount to as much as 2 percent of GDP for countries affected. Over the last decade, deficient power infrastructure shaved an average 0.1 percentage points from Africa's per capita growth rate during the last decade. It has been estimated that redressing Africa's power deficit could boost economic growth by 1.9 percentage points. To cope with widespread outages a number of countries have had to contract short term leases for "emergency" generation in the form of containerized mobile diesel units costing as much as U$0.35 per kilowatt-hour, with lease payment absorbing more than 1 percent of GDP in many cases.

More than half of firms in more than half the countries surveyed in recent years cite deficient power supply as a major impediment to doing business. Many firms are forced to retain back-up generation at an exorbitant cost of US$0.45 per kilowatt-hour. Frequent power outages mean big losses in forgone sales and damaged equipment—6 percent of turnover on average for formal enterprises, and as much as 16 percent of turnover for informal enterprises.

A startling 97% of firms in Nigeria in a business survey some years ago (before reliability began to improve) identified poor electricity services to be a severe obstacle to business operation and growth. The 2008 Investment Climate Assessment in Kenya found that power supply disruption cost firms 7% of sales revenue and shaved about 2% from national GDP growth.

Energy Services and the Millennium Development Goals in Africa

Lack of power also holds back the achievement of the full range of Millennium Development Goals. Without access to modern and sustainable energy services, the poor in Africa are deprived of opportunities for to improve their living standards. This is because modern energy services are indispensable to increasing productivity, creating enterprises,

employment and incomes, and providing effective public services such as health, education and safe water.

Although energy is not explicitly mentioned in the Millennium Declaration, the MDGs cannot be met without higher quality and larger quantities of energy services than current approaches provide. The contribution of energy services to meeting the MDGs consists of both the direct impact of energy on raising incomes and the indirect impacts on education, health, environment, and gender issues. The linkages between energy services and the MDGs and growth are varied and complex (see Annex 3).

Increasing productivity and incomes of the poor. The productivity of small and medium-scale enterprises that are the main source of jobs for the poor can be improved when reliable energy services are available. Electricity, by providing lighting that extends the workday and powering machines that increase output, raises the productivity of small household businesses and shops.

Contributing to better health. Sterilization of equipment, clean water supply, and refrigeration of essential medicines are impaired in health facilities without adequate electricity. Electricity for water pumping helps ensure a clean water supply, reducing the incidence of waterborne diseases. Electricity enables lighting in health clinics so that they can provide treatment at night.

Supporting education. Access to clean cooking fuels frees time for education—time that would otherwise be spent by women and children collecting traditional fuels or in other menial work. Lack of electricity service is a disincentive for teachers, doctors and nurses to reside in rural areas and prevents children from studying at home.

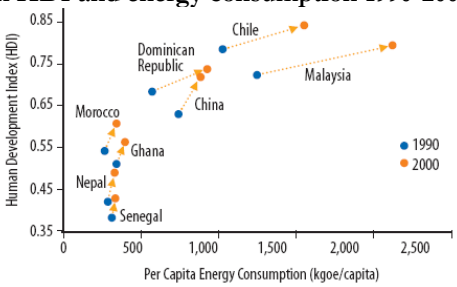
Improving women's quality of life. Increasing access to energy brings benefits for women - in health, education, and productive activities - since it is they who spend more time than men cooking and collecting water and fuel. Modern cooking fuels free women from the burden of collecting and carrying large loads of fuel-wood and from exposure to smoke from primitive cooking stoves.

Reducing environmental harm. Unchecked fuel-wood gathering can lead to land degradation, biomass combustion to indoor air pollution and dirty fuels to outdoor air pollution.. It is the poor who often suffer most from such environmental damage through loss of livelihoods and impaired health. People exposed to indoor smoke from cooking fires are at high risk of respiratory disease. The WHO has assessed the death toll due to indoor smoke in Africa in 2002 at 396 thousand.

Reliance on poor quality fuel-based lighting exacts a heavy burden on the poor. Every year, African households and small businesses spend upwards of $17 billion on lighting, dominated by fuel-based sources such as kerosene, a costly an inefficient alternative. However, despite these huge expenditures – households may spend as much as 30% of their disposable income on fuel-based lighting – consumers receive little value in return. Fuel-based lighting is inefficient, provides limited and poor quality light, and exposes users to significant health and fire hazards.

Energy use and the Human Development Index. The importance of energy services in development is shown by energy consumption's relationship to the Human Development Index (HDI) – a composite index that shows countries' relative performance in social as well as economic terms. Figure 3 shows the relationship between a selected countries' HDI ranking and per capita energy use, with energy consumption used as a proxy for use of energy services. The graph shows the strong linkage over time between energy and human development.

Figure 3
Relationship between HDI and energy consumption 1990-2000, selected countries



Climate Change, Poverty Reduction and the Energy Sector

Africa is most vulnerable from climate change impacts – it is least prepared to deal with it, and will suffer the soonest and the most from it. Climate change is associated with increasing frequency and severity of a variety of natural disasters in Africa including long-term effects of droughts and its impact on subsistence agriculture. African countries will need to increase their resilience to and minimize negative climate change impacts while investing in growing their economies and eradicating poverty.

While adaptation is key priority, Africa should be able and should be helped to gain from new opportunities to obtain clean technology and additional financing from an increasing menu of climate finance instruments, including GEF and Clean Development Mechanism (CDM) Until recently Africa has been relegated to the margins of the carbon market with relatively few projects benefitting from CDM financing. This has begun to change with increased interest from Africa countries and efforts to develop capacity and institutions to use this mechanism and in this regard Africa has been a focus area for the work of the World Bank's Carbon Finance unit. Another opportunity arises from the design of a new program under the Climate Investment Funds established by MDBs and managed by the WB - Scaling-up Renewable Energy Program for Low Income Countries (SREP).

The poorest households in African countries, with the least resources and the least capacity to adapt, are the most vulnerable from the impacts of climate change. Projected changes in the incidence, frequency, intensity, and duration of climate extremes (for example, heat waves, heavy precipitation, and drought), as well as more gradual changes in the average climate, will notably threaten their livelihoods. In countries where yields from dryland, non-irrigated agriculture are already near their maximum temperature tolerance, even small changes in temperature could have a devastating impact on agricultural output, with attendant consequences for food security. With so many of Africa's poor living in rural areas, extreme weather hits the small farmers the worst with failed crops and disrupted water supplies. Climate change may increase the prevalence of some vector-borne diseases (for

example malaria and dengue fever), and vulnerability to water, food, or person-to-person borne diseases (for example cholera and dysentery).

However, the energy sector in Africa contributes little to global greenhouse gas emissions. Moreover, scaling up electricity access would add only a small fraction of projected global emissions. Sub-Saharan Africa (excluding South Africa) contributes 1.5 percent of global annual energy-related CO2 emissions today, and though projected to grow steadily, will still only amount to 2-3 percent of global emissions by 2050. This is a result of very low energy consumption now and the hydro-dominated power generation capacity mix found in many African countries. As a matter of fact, land use and deforestation is the single largest source to greenhouse gas emissions in Africa (except South Africa). Provision of basic modern energy services to the poor in Africa would add little to global carbon footprint, contributing only 1 percent to global CO2 emissions (Socolow, 2006).

Wherever possible, finding ways to adopt advanced technologies for greater sustainability and energy security and to maximize local co-benefits should be pursued. Making lower carbon alternatives – such as renewable energy and energy efficiency - affordable should be pursued in African countries that are striving to increase access to modern energy. Indeed, off-grid renewable energy supply options are complementary to grid supply which can be based on both renewable (e.g. hydro and geothermal) and fossil generation. Yet access will be the driver (i.e. an imperative of national energy policy) and in some cases fossil fuel based generation options will be inevitable given the economics, even when taking into account externalities.

II. Government Policies

The biggest challenge in scaling up energy access will be in mobilizing the necessary financing to close the financing gap of more than $30 billion per annum. The investment needs are so huge and public resources are so limited that there is no alternative to sourcing more of the financing gap from capital markets. In countries that have achieved nearly universal electricity access, political commitment has translated into significant government budget allocation for electrification to complement funding from the private sector, communities and consumers.

The public sector policies that can be most effective in addressing barriers to energy access scale-up include the following:

- *Good governance and transparency at the state and corporate level are the keys to attracting foreign and domestic investors*. Sector sustainability results only when the rule of law prevails, property rights are respected and contract obligations are enforced. Effective pricing policies can support electricity utility's internal generation of sufficient cash (after meeting all operational expenses and debt service) adequate to meet at least the equity requirements of the system expansion projects. Utilities that achieve a self-financing capability of at least 30 percent generally manage to meet the remaining investment needs through debt, or through the purchase of services from private suppliers. For example, Vietnam managed to meet a rapid 16 percent per annum electricity demand growth rate over 10 years through a combination of public and private participation, enabled by a financially healthy sector. However, increasing

electrification rates often remain a challenge for low-income countries, especially in regard to reaching the poor. If subsidies are needed, they should be transparent, targeted, with a defined time frame for their phasing out and with specific results expected. Ensuring accountability systems are in place to oversee the utilization of resources will also be important.

- *Remove obstacles to effective functioning of energy markets.*_Effective reforms provide for efficient entry and exit of energy suppliers and users, eliminate restrictions or bottlenecks on the important and distribution of modern fuels and electricity, remove market distortions that favor one supply source over another.
- *Policies that incentivize, private sector and community participation in rural energy supply.* Policies need to actively encourage local private or cooperative generation and distribution enterprises and need to have supporting capacity building initiatives and effective regulatory frameworks. There are several policies and instruments that can assist in leveraging funds from different private sector stakeholders. For example, consumer credit mechanisms can motivate rural banks and micro-lenders to include energy-related investments in their portfolio. Performance-based subsidies (such as Output Based Aid – OBA) to complement or replace connection or user fees can go a long way to encourage private sector participation (this approach involves the contracting out of basic service provision to a third party with subsidy payment tied to the delivery of previously specified outputs, such as per network connection). In addition, small and medium enterprise (SME) support programs and public private partnerships fund to provide energy services can help in sharing the risk sharing between the private and the public sectors.
- *Remove barriers to decentralized options for energy supply and more affordable technologies.* Effective regulatory frameworks should facilitate the entire spectrum of possible primary energy sources, distribution, low carbon and end-use technologies for the delivery of energy services. Inexpensive meters and off-grid solutions using local resources are some of the more affordable solutions needed to expand the spectrum of options.
- *Easing first-cost problems.* With first cost-connection to grid electricity ranging up to $1,000 per household and solar home systems ranging from $500 to $1,000 per unit, high costs are an important reason for low connection rates. Financing and credit mechanisms that allow the initial costs to be spread over time are needed to bring these up-front costs within reach of the poor. Lowering costs through design and delivery innovation is also important e.g. through the use of lower cost poles and some degree of local community responsibility for protection, maintenance and repair of systems. It may be also noted that large multi-year electricity network expansion programs of large scope can dramatically lower unit costs of materials (meters, poles, transformers, conductor) used in construction compared to more sporadic or once-off project type approaches.
- *Developing off-grid solutions.* In remote or inaccessible areas where grid supplies are impractical for cost, technical, or institutional reasons, off-grid solutions are proving to be increasingly competitive on cost and service quality criteria. Among recent off-grid electricity programs, some of the successful ones have involved a fund for providing loans and subsidies to rural communities, private entrepreneurs or non-

governmental organizations that develop a viable business plan for providing rural electricity service.

- *Reformulate taxes and subsidies*. Fuels used by the poor (especially kerosene that is used for lighting) should not be burdened with regressive taxes. A high incidence of taxation on gasoline makes for a progressive tax due to patterns of car ownership. Taxation on diesel (and kerosene) is mildly regressive i.e. the total expenditures of poor households rise more in percentage terms than those of the rich when the price of diesel (and kerosene) is increased (World Bank, 2001).
- *Demand management, optimal generation planning.* Increased support for energy efficiency is essential to meet growing demands in a more sustainable manner. Efficiency improvements, demand management, improved planning and operation could moderate the volume of investments needed and thus help bridge the supply-demand gap. This includes energy efficiency actions at the household level; in the building, industrial and agricultural sectors; in power generation and transmission; and in transportation.
- *Policies for sustainable biomass supply*. They include policy measures such as transferring the harvest rights for fuel wood to local communities and transformation of the forest service to a technical assistance and rural capacity development agency.
- *Better integration of energy policy making and clean-energy research and development*. Research and development programs – that are often the recipients of public funding can be better directed to ensuring that energy service delivery solutions are adapted to the particular geographic and social conditions that pertain in specific locales in Africa In additional government can promote North-South partnerships in research and development based on a more equal partnership that emphasizes capacity development rather than simply technology transfer.

III. Africa's Huge Investment Backlog in the Electricity Sector [3]

Addressing Africa's chronic power shortages will require major investments in refurbishment and expansion of power infrastructure. Some 44.3 Gigawatt (GW) out of 70.5 GW installed generation capacity need to be refurbished. An additional 7GW of new generation capacity needs to be built each year to meet suppressed demand, keep pace with projected economic growth, and provide additional capacity to support the rollout of electrification, compared with expansion of less than 1 GW per year during the last decade. The bulk of this new power generation capacity would be needed to meet non-residential demands. In addition, raising electrification rates will require extending distribution networks to reach an additional six million households per year over the next decade.

Spending needs for the power sector amount to US$40.8 billion per year, with a skew towards capital expenditure. The total spending needs for the power sector amount to US$40.8 billion per year or 6.4 percent of the region's GDP.

[3] Analysis in this section is from the *Africa's Infrastructure: A Time for Transformation*, Flagship Report of the Africa Infrastructure Country Diagnostic (AICD) forthcoming

The overall financing gap for the power sector is US$30.9 billion per year. Although most of the financing gap relates to investment, a significant share is also associated with maintenance. The gap represents a substantial 4.8 percent of the region's GDP, but the share is higher for the low income countries.

The global economic crisis could reduce total power spending needs by at least 20 percent, though GDP shares would not be much affected. Economic growth is an important driver of demand for power generation capacity. The power investment needs estimates above are based on growth projections before the onset of the global financial crisis. The IMF's GDP growth projections for Africa were reduced from 5.1 percent a year to 3.5 percent a year due to the global economic crisis. Sensitivity analysis suggests that even lowering the original projected growth rates of 5.1 percent to half of their levels would reduce estimated power sector spending needs by only about 20 percent in absolute terms; lowering required new generation capacity from just over 7 GW to just under 6 GW. Even so, when power spending needs are expressed as a percentage of GDP, the impact of a slower growth scenario is much smaller. Since slower growth reduces GDP as well as power spending needs, the overall economic burden of power sector spending needs is only very slightly lower under a low growth scenario.

Existing spending on the power sector is US$11.6 billion, or just over a quarter of what is actually required. Due to the adoption of high cost generation solutions, existing spending is skewed towards operating expenditure, leaving only US$4.6 billion (more than half sourced from domestic public finance) per year available to fund the long term investments needed to redress the continent's power supply crisis. Existing spending represents 1.8 percent of regional GDP, though in the non-fragile low income countries this share increases to 2.9 percent of GDP. Of the external capital flows, non-OECD finance is the most significant, accounting for $1.1 billion a year, primarily from the China Ex-Im Bank. This is followed by overseas development assistance of $0.7 billion a year and private capital flows of $0.5 billion a year.

Most of the private sector finance to date has been in electricity generation. In recent years, there have been 34 independent power producer (IPP) contracts in Africa involving investments of US$2.4 billion for the construction of a total of 3 GW of new power generation capacity. These projects have provided much needed generation capacity, although remain limited in scale relative to the 7 GW of new capacity that Africa needs each year.

Electricity trade would lead to significant savings from accessing lower-cost (mostly hydropower) power sources. It is possible to calculate the gains from trade as the rate of return on cross-border investments. These have been estimated at 20 percent in Eastern Africa to 167 percent in Southern Africa. While such trade would still only represent about 8 percent of total power demand, in such trading scenarios some smaller countries would depend on imports to meet more than 50 percent of domestic demand (World Bank, 2009, forthcoming).

IV. Mobilization of Public and Private Financing for Electricity Access in Africa

Private sector sponsors and operators and financing from capital markets will be key to the success of access expansion programs. Private sector expertise will be needed to develop the large complex

generation and transmission projects (especially cross-border projects) that are needed for which a project finance approach will be often the most appropriate.

The current ongoing global credit crisis poses additional challenges to countries in obtaining financing for energy infrastructure. Projects with perceived higher risk or higher costs are being passed over. Nevertheless, governments can still access finance in the private markets for sound investments as was demonstrated in February '09 by the response to the infrastructure bond issue by the government of Kenya. The bond of $US 230 equivalent (of which $100 million equivalent is geothermal development and rural electrification) was oversubscribed by more than 40%.

In response to the power crisis, donors are increasing their support to the power sector, though more is needed. From the mid-1990s to the mid-2000s, bilateral and multilateral financing for the African power sector averaged no more than US$500 million per year but following the Gleneagles Summit in 2005, there has been a marked increase. Commitments averaged $1.5 billion a year for 2005/07, reaching a peak of $2.3 billion in 2007. This is an important turnaround in funding, but remains small in relation to the needs. More support will be required if any substantial inroads are to be made to close the financing gap. A joint effort is needed to better make use of international public support as a leveraging instrument for the energy sector. Bilateral and multilateral assistance can be used strategically to improve the terms on which private foreign investments flows by refining and accelerating the use of guarantee and other innovative financial instruments.

In this context, among several innovative ideas, the World Economic Forum Energy Poverty Action Partnership (EPA) pilot program aims to demonstrate how rural access can be accelerated through focusing on the empowerment of local entrepreneurs, small and medium enterprises and community cooperatives. The approach advocated by EPA focuses on developing successful local businesses in energy supply through providing capacity development and technical assistance at community level, access to resources and ongoing assistance with operations.

V. Proposed Actions

This background paper has proposed actions to address energy poverty based on five national and one regional pillar.

A. Support for regional trans-Africa electricity networks

The best way to expand generation capacity at the lowest unit cost is to develop large-scale generation projects to supply regional power pools through cross-border trade. The reason is that 21 of 48 Sub-Saharan countries have total generation capacity of less than 200 megawatts each, well below minimum thresholds in terms of economies of scale. It is therefore not cost-effective for these countries to develop small scale (typically oil-based) power generation. However, the region does have huge energy potential – particularly hydro-power – much of it concentrated in a handful of countries that are far from centers of demand and too poor to undertake its development solely through their own effortds. A regional approach is therefore needed to pool resources so that this low cost energy can be

developed and traded across borders. Regional power trade could save Africa US$2 billion per year in overall energy costs. Moreover, by allowing a larger volume of hydro-power potential to be developed, regional trade would also result in savings of 70 million tons of carbon emissions per year.

The economic rationale for large generation projects is often stronger when they are intended to supply both domestic needs in the country in which they are located and foreign (i.e. export) needs in neighboring countries. Many of the large regional projects in Africa would favor development of low cost supply potential such as hydropower potential in Guinea, Ethiopia and DRC and thermal capacity in Nigeria. Large investments benefit from economies of scale: for a given amount of generation capacity, the total costs (design, engineering, capital items, civil works, safeguards and others) for one large plant are lower than for several smaller plants with the same aggregate capacity.

A project finance approach predicated on regional power off-take, in which private sector participation and donor funding are blended, is needed for these projects. The work of the power pools in rehabilitation and expansion of the cross-border transmission infrastructure to increase the potential for trade, and harmonization of regulations and system operating agreements will be critical.

While the economics of regional large-scale generation projects are compelling this has not been sufficient motivation to galvanize their development. The potential gains from trade are much larger for some countries than for others, and considerations of self-sufficiency sometimes have greater consideration in decision making than access to low-cost power. The role of political leaders and regional organizations will be critical in overcoming these short-sighted views.

The available funding from international and bilateral agencies to undertake upstream project preparation work for large regional projects is inadequate and should be expanded. These projects are invariably complex and will require significant project preparation funds to assess their social and environmental impacts and to undertake upstream regulatory and institutional development.

B. Sector Wide Approach (SWAp) for Expanding Access to Electricity

The enabling conditions for rapid scale-up of grid and off-grid electrification exist in many African countries, providing a basis for prioritizing action. A number of African countries have in over the past decade pursued a reform agenda in the energy sector. These include Botswana, Burkina Faso, Ethiopia, Ghana, Kenya, Mali, Mozambique, Namibia, Nigeria, Rwanda, Senegal, South Africa and Tanzania. There already exists in most of the reforming countries a conducive policy framework to support rapid scale-up of electrification. Its characteristics include a positive macroeconomic environment, a credible financing plan for a multi-year national electrification program, capable institutions including utilities that are reasonably well managed, and a trajectory for tariffs approaching cost recovery.

Given the scale of investments needed, a systematic approach to planning and financing new electricity infrastructure investments is critical. Too often, a project-by-project ad-hoc approach in development partner financing has led to fragmented planning, volatile and uncertain financial flows, and duplication of efforts. An alternative is a sector wide approach i.e. programs of access roll-out as part of a coherent national strategy that channels and programs donor support in a more sustained and cost-effective way that is consistent with the Paris Declaration.

Since a sector-wide approach is necessarily a multi-year program with confirmed funding, it leads to reduced unit costs (of poles, transformers, solar panels, etc) and thus can better ensure that electrification programs reach poorer households in rural areas in a shorter time frame. A sector wide approach will result in a mix of technologies being employed, such as: (a) grid extension in urban areas and in rural areas where population density andsettlement patterns show it to be least cost; (b) off-grid models based on innovative renewable energy technologies for more dispersed populations. A sector wide approach is not only aimed at households. Solar-powered electrification of clinics and schools that provide essential public services to low-income communities is another way of bringing the benefits of investment in electrification directly to these communities.

Investment and policies to improve efficiency of energy service utilization should also be part of a SWAp program. An example of an ongoing program of energy efficiency improvement that is well integrated in an aggressive program to increase electricity access is that of Uganda. When Uganda was faced with an energy crisis it implemented a number of measures to complement the investments it made to increase electricity supply. It launched an aggressive loss reduction program in the power system. In one six month period it reduced losses by 5% to 36%. The medium term program is to lower losses to 20% within 5 years. Uganda has also made 1 million energy saver bulbs (CFLs) available that both reduced demand and reduced electricity bills of poor households and it launched a program of energy audits of industries and commercial buildings. (Ministry of Energy and Mineral Development, Uganda, 2006).

C. Support for policy and institutional development and governance improvement activities.

Successful design and timely implementation of scaled-up access programs will hinge critically on the ability of incumbent national utilities to undertake the key technical, planning, management, commercial, and logistical functions. At present, the operational inefficiencies of Africa's power utilities are costing the region US$2.7 billion per year, and an under-pricing of power is costing a further US$2.2 billion per year. Hence, the urgency of institutional reform, and the establishment of sound policies on cost recovery for the sector. In addressing these issues, countries can choose various forms of private-public sector structures for implementation of scale-up programs but invariably there will be need for national utilities to perform their functions at greatly improved levels of efficiency and effectiveness. For example there will be a need for national utilities to improve transmission efficiency, adopt a loss reduction strategy, upgrade metering, billing and collection systems, and invest in efficient technology for the distribution network.

Financial viability of incumbent utilities—and hence creditworthiness and access to domestic and international private capital—is important for the overall development of the sector. It demands that utility revenues allow at least the recovery of operating costs and ideally some contribution to capital cost of new network expansion. That means that in many cases tariffs need to be gradually adjusted to levels that will allow these goals to be met, while remaining sensitive to the limited capacity to pay of poorer households. Improving cost recovery is prerequisite for sustaining investments in electrification and regional power generation projects. The corollary of tariff adjustments is the need to significantly reduce operating costs to lessen the financial burden on consumers of efforts to recover costs. Effective end-use efficiency improvements can further offset these impacts of tariff rationalization on consumers

Independent power producers (IPPs) can play a significant role in generation expansion. In this regard, the financial condition as off-taker of the distribution utilities (often national utilities) that sell to final consumers has a direct bearing on the extent of IPP participation. The distribution utility's collections from sales needs to be adequate to cover its obligations to IPPs.

The lack of strategic policy and planning for the electricity sector at the central government level is often a critical weakness. A well-developed plan for the sector would make it more resilient to exogenous shocks such as drought or spikes in oil prices and should allow governments to move beyond a "firefighting" stance to a more systematic and long-range planning mode. ,.

In addition to improving their technical performance there is need for better corporate governance in utilities and non-interference in their procurement, financial and commercial operations.

D. Support for low-carbon energy.

The challenge for international assistance programs that support energy sector development in Africa is meeting the needs of the countries for energy access scale-up while also meeting the global imperative for clean energy that protects the planet and preserves the future. For the least developed countries the challenge is to support rapid increases in access for the poor and wherever possible finding ways to make lower carbon alternatives affordable. While it is recognized that in Africa access will drive national energy policies, considering the climate change impacts of the prospective least-cost energy mix will be important too. In some cases fossil fuel based generation options will be inevitable given the economics, even when taking into account externalities. Overall, a strategy to balance growth with energy security and environmental sustainability is advocated.

Support for low-carbon energy in Africa will require a range of financing instruments, packaged in a complementary way to maximize synergies within the framework of countries' development strategies. The design of new financing instruments to address climate change needs to take account of the particular circumstances of African countries and special support will be required for capacity building to ensure take-up. The climate fund SREP (Scaling-up Renewable Energy Program for Low Income Countries) under the Strategic

Climate Funds is an example of such an instrument. SREP will address capacity building, technical assistance for planning and pre-investment studies, policy development, regulatory reform, and business development and capacity- building as part of larger scale renewable adoption along with investment operations.

Carbon finance has proven to be an effective incentive mechanism to leverage investment in expanding access to energy through low-carbon energy service solutions. In a context of scarce resources and high electricity generation costs, carbon finance offers a new approach to make energy access more affordable and in the process scale up supply across Africa. For example in Senegal, promoting the use of compact fluorescent light bulbs as part of a rural electrification plan is expected to generate energy savings and emissions reductions that can be sold as offsets through the Clean Development Mechanism, thereby reducing the cost of providing energy access to 365,000 rural households within five years. In Nigeria carbon finance is supporting a local private power provider to supply electricity to both commercial and residential users using efficient gas-turbine technology. By providing a reliable supply of electricity this project will displace hundreds of inefficient diesel generators and improve local air quality. In South Africa, enhanced gas collection at landfill sites is being used to generate and supply electricity to the municipal grid thereby augmenting local capacity supported by carbon finance.

Scaling up the use of carbon finance across Africa in conjunction with other concessional financing instruments such as the GEF and other specialized funds like the Climate Investment Funds will be critical for supporting projects that deliver on the dual objective of expanding access and reducing emissions. This will ensure that the cost of meeting the global imperative for clean energy is not borne by the African countries themselves.

Furthermore, increased funding for research and development should aim at making low-carbon energy more competitive with fossil based sources. Research and development for off-grid renewable energy in the Africa context needs to pursue a cross-disciplinary approach. To be effective, it must move out of the academic or laboratory setting. Research aimed at improved technical performance needs to be associated with efforts to develop improved business models that aim to deliver products that poor households want at affordable prices. Although R&D funding will be largely in the developed countries, it needs to be matched by increased funding in Africa countries i.e. indigenous innovation should be promoted as renewable energy service delivery will require the active participation African countries through government agencies such as technical institutes, the private sector and community organizations (Jacobson and Kammen).

E. Support for energy efficiency programs

Supply side and demand–side measures for energy efficiency improvement – that could benefit from new and increased sources of carbon finance – can reduce the energy burden for all consumers. Supporting actions include deployment of energy saving appliances and equipment including efficient lighting such as compact flourescent lightbulbs (CFLs) that simultaneously reduces electricity usage and demand and electricity bills of poor households. A comprehensive energy efficiency program should include energy audits of industries and commercial buildings and supporting financing mechanisms for investment in rehabilitation and upgrading of energy using equipment in facilities and buildings.

F. Support for modern biomass and lighting programs.

For households and small businesses that do not have electricity service, provision of a stand-alone modern lighting package can meet their essential lighting needs. Households and businesses that do not have electricity usually rely on fuel-based lighting or flashlights that provide poor quality light and have high operating cost. Programs aimed at delivering affordable, modern and efficient lighting products using renewable energy technologies can address their immediate lighting needs and in the process transform their quality of life. Advances in efficient lighting technologies, such as Compact Fluorescent Lamps (CFLs) - and the latest Light Emitting Diode (LED) based-systems, make it possible to offer lighting solutions that are clean, efficient and reliable, at prices that are comparable to typical monthly expenditures by poor households on kerosene for lighting. One particularly successful initiative now underway is the World Bank Group's "Lighting Africa" project to get the efficient, clean and reliable lighting technologies to 250 million people in Sub-Saharan Africa by 2030, in collaboration with the private sector expertise and capital and through private-public partnerships (PPPs).

Programs such as the PROGEDE project in Senegal includes several initiatives such as the dissemination of improved biomass stoves by the private sector and NGOs; the establishment of urban and peri-urban "energy boutiques" or energy shops; the provision of support for the continuation of interfuel substitution options, such as the execution of specific technical and market feasibility studies to support the promotion of liquefied petroleum gas (LPG), gelfuel and kerosene as substitute cooking fuels.

Responsible energy policies for biomass should induce sustainable management of natural forests through policy measures such as transferring the harvest rights for fuel wood to local communities and transformation of the forest service from one with limited transparency and accountability to a technical assistance and rural capacity development agency, with significantly improved governance.

Modern biofuels produced from maize, jatropha and other feedstocks have their main use as a transport fuel and not as a household fuel for cooking. Thus, use of biofuels to meet the needs of the poor is limited. It may be also noted that production of biofuels in some settings carry social and environmental risks for the poor through their upward pressure on food prices, intensified competition for land and water, and land-use change.

VI. International Programs for Access in Africa

The vast challenges and the wide array of possible responses to the issue of energy services and their role in achieving poverty reduction and the MDGs pose a formidable task for stakeholders in the energy sector. Development financial institutions such as the World Bank Group and regional development banks can support countries' energy access and climate change mitigation and adaptation efforts, including the adoption of low-carbon technologies, through the combination of conventional lending, concessional funding, carbon finance, and guarantees, which in turn can leverage traditional commercial lending from the private

sector. The task ahead is complex, expensive, and requires long-term vision, commitment to policies that will meet the energy needs of the poor, and strengthened international cooperation and financing.

It also requires concerted efforts from a variety of stakeholders. Coordinated efforts by the international community with all stakeholders in the energy sector can play a significant role in expanding sustainable energy services for poverty reduction and achievement of the MDGs in Africa. The main roles of the different stakeholders are:

- *Government*. Governments and public institutions have a continuing and important role to play through its role in policy development and budgetary support that complements funding that can be sourced from capital markets, communities and consumers. The regulatory role of government and technical assistance of public institutions such as rural electrification agencies is important.
- *Private Sector*. The expertise and efficiency of the private sector and private finance will be key to the success of energy access programs. The role of the domestic private sector in national access programs is increasing worldwide, and new public-private models have demonstrated that these can respond in meeting the electrification needs of the rural and urban poor. Increasingly, small and medium size enterprises (SMEs) are proving to be effective service providers.
- *Community Organizations*. Community organizations can drive energy services development. NGOs can support the creation of infrastructure for commercial dissemination of technology; public or private companies may sell electricity; local companies may lease or sell a rural farmer a household photovoltaic (PV) system.
- *Multilateral institutions –AfDB, NEPAD, and the Regional Economic Commissions*. Multi-lateral financial organizations are key stakeholders and have great influence over policies and programs despite their relatively small financial resources compared to the investment needs. As each agency has relatively limited resources, synergies amongst financiers help develop investment programs and leverage government and private sector resources for greater impact. Their combined knowledge and technical assistance capacity is a key service to developing countries.
- *Bilateral Donors*. The energy sector receives only a fraction of official flows, given the competing demands. Increased, stable and longer-term bilateral targeted to energy investments for poverty reduction warrants urgent consideration.
- *Climate Investment Funds*. The Climate Investment Funds (CIF) aim at reducing the cost of climate actions for developing countries and catalyzing transformational technologies and project approaches for climate change mitigation and adaptation. Approved by the WBG board in July 2008 and supported by US$6.1 billion in donor funds, the (CIF) is an interim instrument with specific sunset clauses linked to agreements on the future of the climate change regime. By combining significant concessional financing with international financial institutions, public and private sector flows, and other climate financing (such as carbon finance and GEF), the CIF will demonstrate how multilateral development banks can help some African countries combine poverty reduction and growth objectives with deployment and transfer of low carbon technologies and mainstream climate resilience into core development planning.

- *Global and Local Partnerships.* Various public-private partnerships – both at the global and local levels - have played a special role given the interconnectedness between energy services, poverty reduction and the MDGs. They include the Global Environment Facility, the Global Partnership for Output Based Aid, Global Village Energy Partnership, the Renewable Energy and Energy Efficiency Partnership, the Partnership on Clean Fuels and Vehicles, the LPG Rural Energy Challenge and more recently, Energy Poverty Action, the Strategic Climate Fund Scaling-Up Renewable Energy Program for Low Income Countries (SREP), the Clean Energy Investment Framework Multi-Donor Trust Fund and the Energy for the Poor Initiative. One example of a global partnership with focus on electricity access expansion through clean energy development is the African Rift Geothermal Development Facility (ARGeo) initiated by UNEP and KfW with funding by the GEF and co-funding from KfW and the Italian Government, with the aim of removing barriers to development of geothermal energy in the countries of the East African Rift Valley.

VII. Role of the World Bank Group in addressing Africa's growing energy needs.

The World Bank Group is scaling up its energy investment program in Africa through a variety of instruments including IBRD and IDA loans and credits, guarantees, equity investments of IFC, advisory work, policy dialogue and partnerships. In fiscal year 2008 new lending in projects amounted to $1.2 billion. It investments in energy infrastructure aim to ensure that improved access to energy infrastructure services is affordable to poor communities and that projects increase social value and sharing of benefits by all groups in the community and not simply mitigation of negative impacts and safeguards (World Bank, 2008).

The Bank Groups' investments support an appropriate mix of energy supplies based on local opportunities and needs and a modern and efficient policy and operating environment. In recent years it has increased it support for regional trans-Africa electricity networks (e.g. for west and southern Africa power pool interconnections), for renewable energy development (e.g. geothermal energy development in Kenya and hydropower development in Uganda), for renewable energy-off grid solutions (e.g. Mali, Uganda and other countries) and for sustainable traditional fuel (e.g. Senegal).

Lighting Africa is a World Bank Group initiative which supports the private sector to develop, accelerate, and sustain the market for modern off-grid lighting technologies tailored to the needs of African households especially those that are poor and without access to grid electricity.

The WBG strategy premises that neither the public nor the private sector can alone meet the access, quality, financing, and policy gaps for infrastructure. It recognizes the need for ongoing government support and establishing a market environment to attract private sector participation. Strengthening the enabling environment for public private partnerships is a key focus of its support for energy access in Africa. It will also continue to promote strong governance of energy infrastructure service delivery through close support to clients for achieving stronger governance in the area of public and private provision of services.

The Energy for the Poor is an initiative that the World Bank has developed in consultation with a number of donors following the Energy Conference in Jeddah in June 2008. The initiative seeks to improve energy access and protect the poor from volatility of energy prices through co and parallel financing of projects to enhance energy access, promote energy efficiency and energy diversification including hydropower projects. In this context, at the Coordination Meeting of the Arab and Islamic Funds in Kuwait, a series of pipeline projects were presented by the Bank. The funds expressed interest in a number of projects and made preliminary pledges to these projects for an indicative amount of US$250 million. These resources will be received by the individual countries in parallel to the IDA resources.

The WBG has had a lead role in development of carbon finance mechanisms that have proven to be an effective incentive mechanism to leverage investment in expanding access to energy through low-carbon energy service solutions and it initiated the Prototype Carbon Fund, the first global carbon fund. In a context of scarce resources and high electricity generation costs, carbon finance offers a new approach to make energy access more affordable and in the process scale up supply across Africa.

As noted above, the WBG has taken the lead in formulation of new financing instruments - the Climate Investment Funds (CIF) that are aimed at reducing the cost of climate actions for developing countries and catalyzing transformational technologies and project approaches for climate change mitigation and adaptation.

References

Africa's Infrastructure: A Time for Transformation, Flagship Report of the Africa Infrastructure Country Diagnostic (AICD), World Bank (forthcoming)

An Investment Framework for Clean Energy and Development, A Progress Report, World Bank, 2006
http://siteresources.worldbank.org/EXTENERGY/Resources/336805-1156971270190/AnInvestmentFrameworkforCleanEnergyandDevelopment.pdf

Energy and Poverty: Myths, Links and Policy Issues, Energy Working Notes, Saghir, May 2005

Financing Technology to Support Low-carbon and Climate Resilient Growth, G8 Background Paper for Environment Ministers Meeting April 22-24, 2009, World Bank, 2009

Energy Week 2006 Keynote Address, Socolow, World Bank
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTENERGY/0,,contentMDK:20849147~pagePK:210058~piPK:210062~theSitePK:336806,00.html

Fuel for Life: Household Energy and Health, World Health Organization, 2006
.

Global Partnership on Output Based Aid
http://www.gpoba.org/index.asp

Infrastructure in Africa (IFC, 2008)
http://www.ifc.org/ifcext/africa.nsf/Content/Infrastructure

Lighting Africa Initiative
http://www.lightingafrica.org/

Paris Declaration on Aid Effectiveness, Paris, France, March 2, 2005,
http://www.oecd.org/document/18/0,2340,en_2649_3236398_35401554_1_1_1_1,00.html

Plan for Meeting Uganda's electricity Supply Needs in the Short, Medium and Long Term, Ministry of Energy and Mineral Development, Uganda, 2006.

Regional Economic Outlook, Sub-Saharan Africa, International Monetary Fund, April 2008, Chapter IV Africa's Power Supply Crisis: Unraveling the Paradoxes

Research That Values the Planet. Jacobson and Kammen. Science and Engineering, The Bridge, Oct 2005
http://rael.berkeley.edu/files/JacobsonKammen_TheBridgeW2005.pdf

Transport Fuel Taxes and Urban Air Quality, Gwilliam, Bacon, Kojima, Lyovsky, Discussion Note, World Bank, 2001
http://www.thepep.org/ClearingHouse/docfiles/transport_fuel%20taxes.pdf

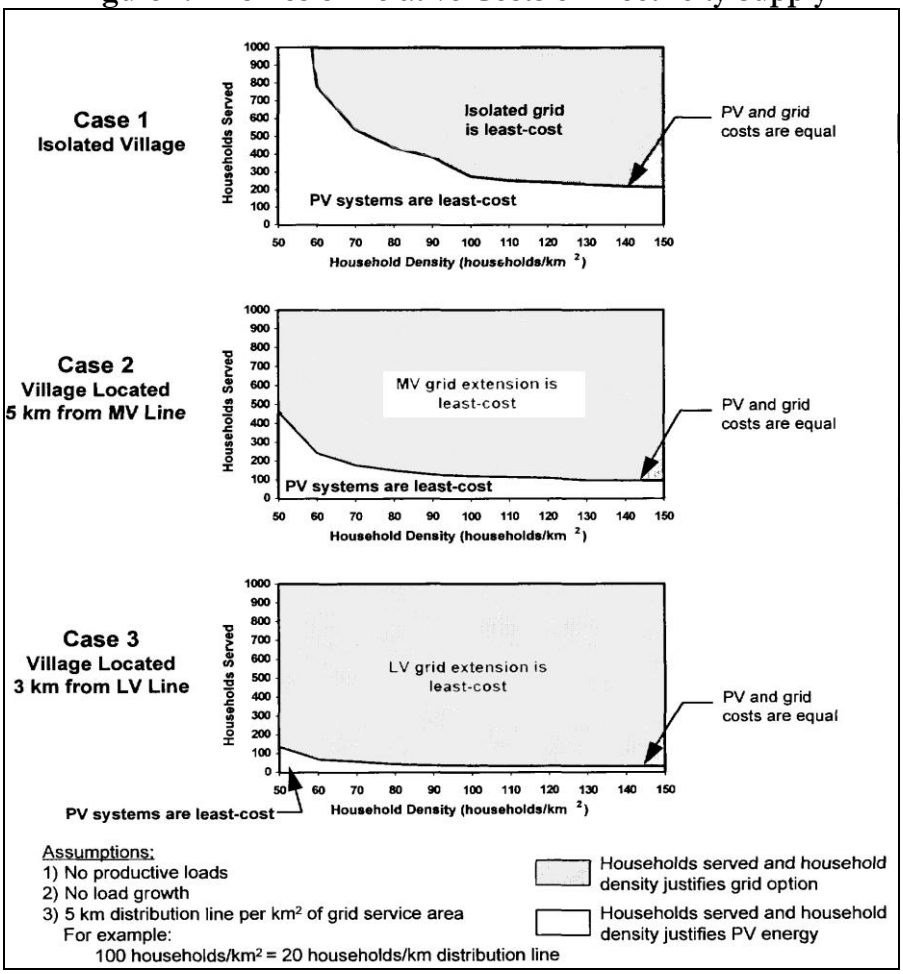
World Energy Outlook, International Energy Agency, 2006.

World Bank Group, Sustainable Infrastructure Action Plan, FY 2009-2011, World Bank, 2008
http://siteresources.worldbank.org/INTSDNETWORK/Resources/SIAPfinal.pdf

Annex 1. Complementarity of Grid & Off-Grid Services in SWAp

Grid and off-grid electricity supply can be simultaneously deployed in a sector wide approach (SWAPs). Approaches to the continued expansion of electricity access vary widely. Successfully tackling the issue means adapting programs to local contexts and country environments. Countries that are adopting a sector wide approach are better able to align both grid and off-grid investments so that they are complementary tracks of a coherent program for scaling-up access. The choice of a technology in a particular location will be based on the costs of supply, the expected electricity demand, and the development impacts of the project (Figure 1 shows how the cost-effectiveness boundary between grid electricity service and off grid solar PV service changes as load density and village distance from the grid changes). Thus the approach to electricity expansion must match the demand characteristics of different types of populations.

Figure 1. Profiles of Relative Costs of Electricity Supply



Main Grid Electrification

The cost of grid electrification including generation, transmission and distribution is often is in the range of US$ 0.10 to US$ 0.20 per kilowatt hour, with rural areas being more expensive that urban areas. However, in many cases the high initial costs of grid electrification can be held down if design standards suitable for areas with less demand are used.

Microgrid Electrification

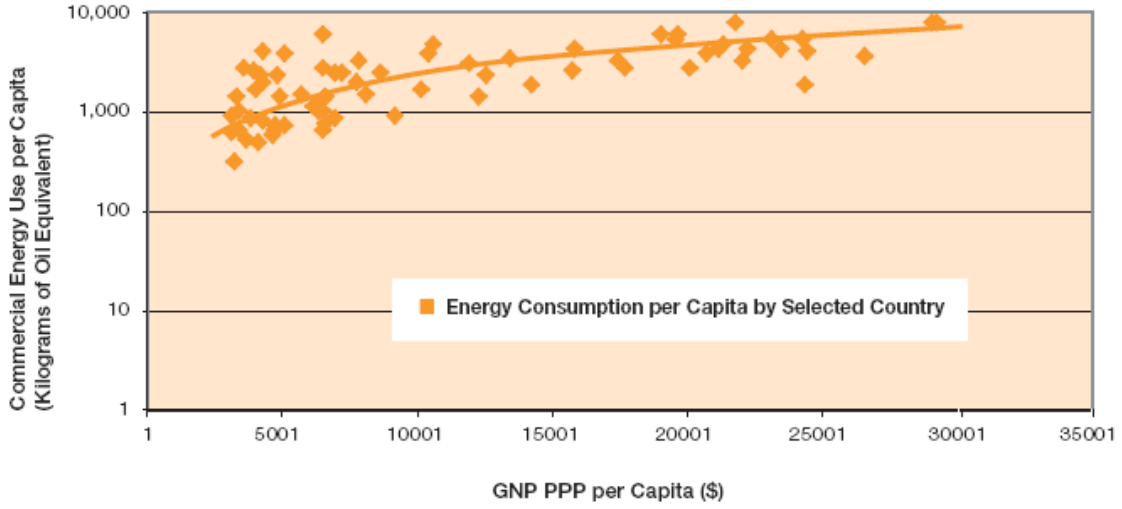
Decentralized isolated distribution systems have been common in remote population centers for many decades. In most developing countries, they predate the establishment of main grid systems. The costs of such systems typically range from between 20 and 60 cents per kilowatt hour. However, diesel generators in remote locations can be hard to maintain and expensive to operate because of the high cost of spare parts and fuel. Microhydro systems involve lower operating costs, but much higher capital cost for the systems and the civil works to channel the water. Successful delivery of service through micro-grids in remote locations often involve specialized government agencies that perform an enabling role in support of private and community based operators.

Renewable Energy and Household Systems

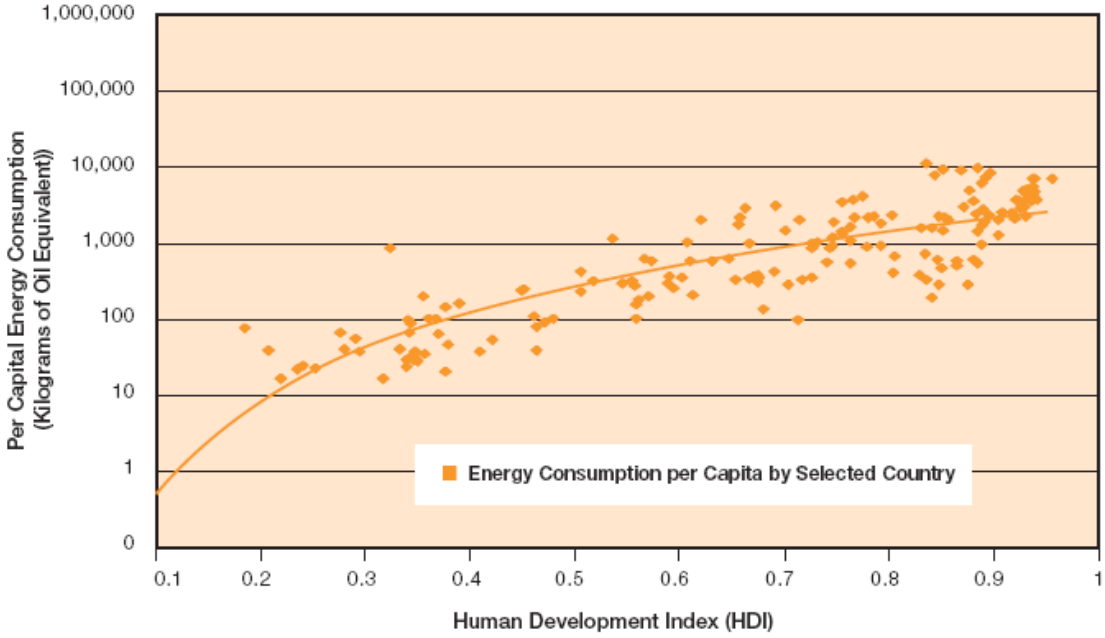
Energy from solar, wind and picohydro systems is an attractive option for regions with these renewable energy resources. The costs of electricity per kilowatt hour generated by such systems can be in the range of US$ 0.50 to US$ 1.00 per kilowatt hour. Offgrid projects in these countries have taken advantage of private-sector institutions, nongovernmental organizations (NGOs), and microfinance institutions (MFIs) that operate in rural areas. These programs can provide electricity to people in remote areas where main grid electrification is prohibitively expensive due to the high capital cost of extending electricity lines. The best offgrid models typically combine private-sector organizations (e.g. private entrepreneurs in Kenya have sold more than 200,000 photovoltaic systems to households that do not have access to grid electricity), donor agencies, local communities, and national utilities that are supported by a strong energy agency whose role to pro mote offgrid electrification.

Annex 2. Energy Consumption, GDP and HDI

GNP and Energy Consumption per Capita



HDI and Energy Consumption per Capita



One way to capture the importance of energy services (not merely energy use or supply as an end in itself) is to show its impact on the human development index (HDI), a composite indicator developed by UNDP to show how countries' relative well being in social as well as economic terms. The figure above displays the correlation between HDI and energy consumption. This figure shows that an HDI of 0.8 or higher currently requires a minimum energy use of about 1 ton of oil-equivalent per year per capita. .

Annex 3. Matrix of Energy and the Millennium Development Goals

Goal	Importance of Energy to Achieving the Goals Direct and indirect contributions
1) Extreme poverty and hunger ➢ To halve, between 1990 and 2015, the proportion of the world's people whose income is less than one dollar per day ➢ To halve, between 1990 and 2015, the proportion of people who suffer from hunger	➢ Access to affordable energy services from gaseous and liquid fuels and electricity enables enterprise development ➢ Lighting permits income generation beyond daylight hours ➢ Machinery increases productivity ➢ Local energy supplies can often be provided by small scale, locally owned business creating employment in local energy service provision and maintenance, fuel crops, etc. ➢ Privatization of energy services can help free up government funds for social welfare investment ➢ Clean, efficient fuels reduce the large share of household income spent on cooking, lighting, and keeping warm (equity issue – poor people pay proportionately more for basic services) ➢ The majority (95%) of staple foods need cooking before they can be eaten and need water for cooking ➢ Post-harvest losses are reduced through better preservation (for example, drying and smoking) and chilling/freezing ➢ Energy for irrigation helps increase food production and access to nutrition
2) Universal primary education ➢ To ensure that, by 2015, children everywhere will be able to complete a full course of primary schooling	➢ Energy can help create a more child friendly environment (access to clean water, sanitation, lighting, and space heating/cooking), thus improving attendance at school and reducing drop out rates ➢ Lighting in schools helps retain teachers, especially if their accommodation has electricity ➢ Electricity enables access to educational media and communications in schools and at home that increase education opportunities and allow distance learning ➢ Access to energy provides the opportunity to use equipment for teaching ➢ Modern energy systems and efficient building design reduces heating/cooling costs and thus school fees, enabling poorer families greater access to education
3) Gender equality and women's empowerment ➢ Ensuring that girls and boys have equal access to primary and secondary education, preferably by 2005, and to all levels of education no later than 2015	➢ Availability of modern energy services frees girls' and young women's time from survival activities (gathering firewood, fetching water, cooking inefficiently, crop processing by hand, manual farming work) ➢ Clean cooking fuels and equipment reduces exposure to indoor air pollution and improves health ➢ Good quality lighting permits home study and allows evening classes ➢ Street lighting improves women's safety ➢ Affordable and reliable energy services offer scope for women's enterprises
4) Child mortality ➢ To reduce by two thirds, between 1990 and 2015, the death rate for children under the age of five years.	➢ Indoor air pollution contributes to respiratory infections that account for up to 20% of the 11 million deaths in children each year ➢ Gathering and preparing traditional fuels exposes young children to health risks and reduces time spent on child care ➢ Provision of nutritious cooked food, space heating, and boiled water contributes towards better health ➢ Electricity enables pumped clean water and purification
Goal	**Importance of Energy to Achieving the Goals** Some direct and indirect contributions
5) Maternal health ➢ To reduce by three quarters,	➢ Energy services are needed to provide access to better medical facilities for maternal care, including medicine refrigeration, equipment sterilization, and operating theaters

between 1990 and 2015, the rate of maternal mortality	➢ Excessive workload and heavy manual labor (carrying heavy loads of fuelwood and water) may affect a pregnant woman's general health and well being
6) HIV/AIDS, malaria, and other major diseases By 2015, to have halted and begun to reverse: ➢ The spread of HIV/AIDS ➢ The scourge of malaria ➢ The scourge of other major diseases that afflict humanity	➢ Electricity in health center enables night availability, helps retain qualified staff, and allows equipment use (for example, sterilization, medicine refrigeration) ➢ Energy for refrigeration allows vaccination and medicine storage for the prevention and treatment of diseases and infections ➢ Safe disposal of used hypodermic syringes by incineration prevents re-use and the potential further spread of HIV/AIDS ➢ Energy is needed to develop, manufacture, and distribute drugs, medicines and vaccinations ➢ Electricity enables access to health education media through information and communications technologies (ICT)
7) Environmental sustainability ➢ To stop the unsustainable exploitation of natural resources; and ➢ To halve, between 1990 and 2015, the proportion of people who are unable to reach or to afford safe drinking water	➢ Increased agricultural productivity is enabled through the use of machinery and irrigation, which in turn reduces the need to expand quantity of land under cultivation, reducing pressure on ecosystem conversion ➢ Traditional fuel use contributes to erosion, reduced soil fertility, and desertification. Fuel substitution, improved efficiency, and energy crops can make exploitation of natural resources more sustainable ➢ Using clean, more efficient fuels will reduce greenhouse gas emissions, which are a major contributor to climate change ➢ Clean energy production can encourage better natural resource management, including improved water quality ➢ Energy can be used to purify water or pump clean ground water locally, reducing time spent collecting it and reducing drudgery

Annex 4. World Bank Group (WBG) Support for Energy Access in Africa.

Economic and financial, environment, and social sustainability – the triple bottom line – in World Bank Group programs for energy access in Africa. Investments in energy infrastructure in Africa that are supported by the World Bank aim to ensure that improved access to energy infrastructure services is affordable to poor communities, including inclusion on gender and disability. The WBG promotes sustainability of energy infrastructure services—to "do good" rather than "do no harm"— by requiring that projects increase social value and sharing of benefits by all groups in the community and not simply mitigation of negative impacts and safeguards (World Bank, 2008).

The World Bank is scaling up its energy investment program in Africa. In fiscal year 2008 new lending in projects amounted to $1.2 billion. The World Bank supports countries in Africa scale up energy access through a variety of instruments including IBRD and IDA loans and credits, guarantees, equity investments of IFC, advisory work, policy dialogue and partnerships. Since the early 1990s, private infrastructure transactions in Africa for nearly $4.8 billion have been arranged by IFC (IFC, 2008). IFC established the InfraVentures fund in 2008 to support the development of infrastructure in Africa and poor countries in other regions. Its first investment was to explore and subsequently develop geothermal resources in Djibouti.

The Bank Groups' investments support an appropriate mix of energy supplies based on local opportunities and needs and a modern and efficient policy and operating environment. In recent years it has increased it support for regional trans-Africa electricity networks (e.g. for west and southern Africa power pool interconnections), for renewable energy development (e.g. geothermal energy development in Kenya and hydropower development in Uganda), for renewable energy-off grid solutions (e.g. Mali, Uganda and other countries) and for sustainable traditional fuel (e.g. Senegal). Lighting Africa is a World Bank Group initiative which supports the private sector to develop, accelerate, and sustain the market for modern off-grid lighting technologies tailored to the needs of African households especially those that are poor and without access to grid electricity.

Public and private partnerships. The World Bank's Sustainable Infrastructure Action Plan (SIAP) recognizes that neither the public nor the private sector can alone meet the access, quality, financing, and policy gaps for infrastructure. The framework of the SIAP recognizes the need for ongoing government support and establishing a market environment to attract private sector participation. Strengthening the enabling environment for public private partnerships is a key focus of its support for energy access in Africa. The World Bank will continue to promote strong governance of energy infrastructure service delivery through close support to clients for achieving stronger governance in the area of public and private provision of services.

The Africa INFRA Program under the recently launched INFRA platform would be needed to finance a package of high priority, high return infrastructure investments. Such investments would be aimed at reducing the impact of the crisis on growth, ensuring maintenance of assets, setting the conditions for renewed growth impetus when the world recovers from this global crisis, and creating employment.