African Energy Ministers Conference Proceedings, Johannesburg, South Africa September 2011

AFRICAN ENERGY MINISTERS CONFERENCE PROCEEDINGS REPORT

Road To Durban: Promoting Sustainable Energy Access For Africa

Johannesburg, South Africa
September 15th - 16th, 2011

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Africa Renewable Energy
Access Program (AFREA)

energy
Department:
Energy
REPUBLIC OF SOUTH AFRICA

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CONFERENCE CONTEXT

The African Energy Ministers' Conference was held in Johannesburg, South Africa on September 15 and 16, 2011. The conference was organized by the Department of Energy of the Republic of South Africa in collaboration with the Africa Union and the support from the World Bank, the United Nations Industrial Development Organization (UNIDO) and United Nations Energy (UN-Energy).

The two-day conference was an important precursor to the upcoming Conference of Parties (COP17) to the United Nations Framework Convention on Climate Change (UNFCCC) to be held in Durban, South Africa from November 29 to December 9, 2011. The COP17 offers a unique opportunity for African leaders to highlight the impact of climate change on Africa and gain much needed global support for a transformational energy access agenda in the context of climate-resilient development.

More than 48 African ministers and their delegates attended the conference. Many energy specialists and those with experience implementing sustainable energy access programs, including non-African government ministers from several different countries and participants from the private sector, were also in attendance. The conference provided an important platform for high-level policy dialogue to build consensus and catalyze action for sustainable energy access across the African continent. In addition, it highlighted Africa's energy challenges and critical energy investment priorities that need to be addressed.

The conference discussed several key focus areas including the following:

- The scale-up of energy access on the continent through low-carbon strategies;
- The development of regional trade, including strategic actions requiring regional coordination;
- The identification of financing options for Africa's energy investment priorities, thereby enabling the implementation of key projects to build a sustainable energy portfolio

An introductory panel and four technical panels addressing the key focus areas were held on the first day of the conference. The objective of these panel discussions was to understand Africa's energy access issues and challenges, share knowledge and help define Africa's energy development agenda.

A Ministerial Roundtable to encourage dialogue and expand upon the previous day's panel sessions followed on Day 2. The roundtable facilitated the sharing of country perspectives that then contributed to building a roadmap for boosting sustainable energy access in Africa. The ensuing multi-stakeholder panel discussions led to the adoption of the African Energy Ministers' Declaration. The Declaration, referred to as the "Johannesburg Declaration," was the final output resulting from the conference.

Two side events were also held in conjunction with the African Energy Ministers' Conference.

The Green Household Energy Solutions Expo featured off-grid lighting and cooking technologies, integrating household energy into the broader discussions on energy and climate change strategies. The World Bank Group's ongoing "Lighting Africa" program and the soon-to-be-launched "Africa Clean Cooking Initiative," in partnership with the "Global Alliance for Clean Cookstoves," were showcased at the event. Lighting Africa's objective is to

transition the off-grid lighting market from fossil fuels to clean alternatives, such as solar LED lights. As one of the core members of the *Global Alliance for Clean Cookstoves*, the World Bank is preparing to launch the Africa Clean Cooking Initiative (ACCI), a market-transformation program to accelerate scale-up of clean cookstoves in Africa. The Expo attracted a number of the official delegates attending the Africa Energy Ministers' Conference and gave the ministers and other stakeholders an opportunity to familiarize themselves with advances in lighting and cooking technologies, innovations in business and service delivery models, and to learn about successful businesses on the ground from African entrepreneurs.

UNIDO presented a one-day workshop providing a wide range of training tools for sustainable energy development on the Wednesday preceding the conference. For each topic, an expert made a substantive presentation, which was then followed by an interactive discussion with workshop participants. The presentations were formulated as a response to a specific problem or challenge. The training session covered the following topics:

- Overview of renewable energy - benefits and drivers

- Renewable energy technologies and deployment trends
  - Brief review of Technologies for Electricity, Heat and Biofuels
  - Global Deployment trends
  - Costs and cost trends
  - Opportunities for Deployment in Africa
  - Methodology for Prioritisation

- Renewable energy policies
  - Barriers to deployment
  - Policies to encourage deployment (including the IEA Policy Effectiveness Indicator)
  - Importance of calling non-economic barriers
  - Policy Best Practice
  - Integrating Renewables (including an overview of the IEA FAST tool)

Panel Papers

Six background issue papers were prepared to support the technical panels. For the complete text of the background issue papers, including references and case studies, please refer to Annex III. The titles and corresponding page numbers are found below:

EXECUTIVE SUMMARY

Climate Resilience and Energy Access

Energy access and climate change resilience are intrinsically related. Access to electricity is essential to fulfill basic household needs such as lighting, cooling, heating and access to drinking water and sanitation services. It is also critical to improved productivity, competitiveness and employment, which leads to expanded job opportunities and economic growth. Climate change poses a major development challenge for Africa threatening food and energy security through higher temperatures, extreme events, and changes in rainfall. Energy access is vital for Africa's development, its achievement of the MDGs, and its resilience to climate shocks and global economic shocks. Climate resilience approaches to energy access development is important for Africa.

Addressing climate resilience is also an opportunity for Africa to leapfrog towards more sustainable energy technologies. For growth to be sustainable, African countries need to build energy systems that are resilient to climate variations. Climate variability is hardly a new factor in the region's history, but with global warming, Africa's vulnerability is deepening, making it the most exposed region in the world to the impacts of climate change. To increase countries' resilience, adaptation and mitigation strategies have to be simultaneously implemented. Adaptation measures can help to reduce the vulnerability of electricity systems to climate change by building capacity, improving information for decision making and integrating climate risks into management and operation decisions. Setting the continent on a sustainable energy production and consumption path is critical to Africa's development vision while contributing to the global challenge of mitigating GHG emissions. A diversified, greener energy portfolio can boost service reliability and support energy security while lowering the impact on the environment.

INTERNATIONAL COMMUNITY IS KEEN TO GIVE RENEWED ATTENTION TO AFRICA'S CHALLENGES

Global Context

International community is keen to give renewed attention to Africa's challenges. The UN General Assembly has designated 2012 as the International Year of Sustainable Energy Access for All. Energy access will be a major theme in the lead-up to Rio+20. In June, the high-level Ministerial Meeting on Energy and Green Industry adopted the "30-30-30" goals. The goals outline a set of three objectives to achieve by 2030: universal energy access, a 40 percent increase in energy efficiency, and a 30 percent share for renewable energy.

New funds have been pledged to further the green growth and associated development objectives of developing countries. In Cancun in December 2010, the Conference of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) recorded Copenhagen Accord pledges for $30 billion over three years, expecting to fast-start funding for Africa, least-developed countries, and small island developing states. An additional $100 billion a year was also announced for developing countries by 2020. The African Energy Ministers Conference came at a critical juncture in the wake of these COP pledges and in the lead-up to the December 2011 COP17 in Durban, South Africa. Specifically, the Transitional Committee for the design of the Green Climate Fund (GCF) is currently defining the scope, scale, and areas of prioritization for the intended scale-up of long-term financing for developing countries. Initiatives conceived at the Conference could become points of reference for the GCF or for other climate-related financing initiatives in future.

The African Energy Ministers Conference was an important milestone on the road to Durban. The upcoming COP17 to be held in Durban offers a unique opportunity to highlight Africa's energy challenges and gain global support to a transformational agenda that will help secure Africa's energy future in a sustainable manner. The two-day Africa Energy Ministers Conference in Johannesburg facilitated dialogue to reach consensus on the priorities for supporting Africa's energy development agenda in a resilient manner. Africa's leaders were presented with an opportunity to share experiences and discuss low carbon strategies to scale up energy access in the continent; investments and concerted actions required to foster regional trade; and climate finance options for Africa's energy investment priorities.

Africa's Energy Challenges

Energy access rates are unacceptably low in Africa, affecting human and social development. Only 42 percent of Africans have power in their homes. In Sub-Saharan Africa, the electricity access rate declines to 31 percent, the lowest rate in the world and half the rate of the next lowest region, South Asia. In all, 585 million people in Sub-Saharan Africa are excluded from electricity service, accounting for 40 percent of the worldwide un-served population. Scarcity of power and low access affects the delivery of social service and the quality of life. Without electricity, clinics cannot safely store vaccines, food goes wasted at home and in shops, and children cannot study at night. Lack of electricity exacerbates poverty as it precludes home-based productive activities that are a primary source of livelihoods and local economic development in the poorest countries. For other household energy needs, about 80 percent of people rely on traditional use of solid biomass, far more than in any other region of the world. Deforestation can be a serious consequence of concentrated biomass use, especially in the outskirts of urban areas. And indoor air pollution resulting from incomplete combustion of solid fuels in traditional stoves is a leading cause of premature mortality and illnesses.

AFRICA NEEDS TO SCALE UP ENERGY INFRASTRUCTURE TO STRENGTHEN ENERGY SECURITY AND CLIMATE RESILIENCE

Deficient power infrastructure is hindering long-term economic growth in the African continent. The entire installed generation capacity of the continent is 124 gigawatts (GW), of which 94 GW is divided between North African countries and South Africa. The rest of the Sub-Saharan region relies on an installed capacity of only 30 GW, about the same as Norway, a country with less than one percent of Sub-Saharan Africa's population. In addition, as much as one-quarter of it is now unavailable due to age and poor maintenance. The small scale of most national power systems and the widespread reliance on expensive oil-based generation have made the cost of producing power in Sub-Saharan Africa exceptionally high. More than 30 countries have experienced power shortages over the last few years, which mean substantial losses in foregone sales and damaged equipment. The economic costs of power outages, including the costs of running backup generators and of forgone production, typically range between 1 and 4 percent of GDP. Overall, deficient power infrastructure is weakening the competitiveness of Africa's firms, holding back economic growth.

Africa needs to scale up energy infrastructure to strengthen energy security and climate resilience. Using 2005 as a baseline, the World Bank estimated that Sub-Saharan Africa needs to add 7 GW of new generation capacity each year through 2015 to meet suppressed demand, keep pace with projected economic growth, and support the rollout of further electrification. Nearly 31 GW of generation projects have been planned for the next 5–7 years in Sub-Saharan Africa. Although not sufficient to fully bridge the region's energy deficit, this capacity addition is critical progress. Once completed, the additions will double the overall installed capacity of the Sub-Saharan region (excluding South Africa). However, less than 16 GW of additional capacity are currently in pipeline; an additional 15 GW should therefore be prepared, financed and implemented as soon as possible.

A substantial effort in electrification scale-up is needed to reach universal access in the foreseeable future. Expanding access to energy is a social imperative for Africa. Efforts to promote energy access ought to take into consideration rapid urbanization and population growth in Africa. By 2030, nearly half of Africans will be living in urban areas, with the urban population exceeding rural population by 100 million by 2035. At present rates of electrification, only 45 percent of Africans will have electricity in their homes by 2015 and less than 60 percent by 2030. In 2030, 654 million Africans will still lack electricity service, accounting for half of the world's un-served population. Reaching the goal of universal electricity access by 2030, as put forward by the Advisory Group on Energy and Climate Change set up by the United Nations Secretary-General, would require that 150 million people are added to electricity service by 2015 and 512 million by 2030, including 460 million in Sub-Saharan Africa alone. Cleaner energy solutions will help leapfrog African countries to a more climate-resilient future.

RENEWABLE ENERGY CAN HELP BRIDGE AFRICA'S ENERGY DEFICIT AND FURTHER ENHANCE CLIMATE RESILIENCE, RECONCILING SEVERAL DEVELOPMENT IMPERATIVES

Achieving universal electricity access requires diversified approaches. The scale and nature of the electricity access gap and the locations involved mean that electricity will need to be provided through both centralized and decentralized energy technologies and systems, including grid, mini-grid, and off-grid solutions. Grid extension is often the least-cost option in areas with high population densities, while mini-grid and off-grid solutions are more efficient options to bring electricity into sparsely populated peri-urban and rural areas. Renewable energy technologies are ideally suited to mini-grid and off-grid applications and can help significantly scale up electrification in Africa without major harm to the environment and contribute to greater climate resilience.

Facilitating the spread of low-cost and sustainable lighting solutions is critical to meeting basic needs. Until the energy access gap is closed, millions of people can be taken out of the dark through the wide deployment of off-grid lighting solutions. Today, climate-friendly solar and other lighting products offer a valid alternative to the expensive, inefficient, and polluting lighting sources such as candlelight or kerosene lamps on which a large part of Africa's population still relies.

Access to sustainable cooking and heating solutions is paramount to address the health and environmental threats caused by the use of traditional biomass. The transition to modern fuels should be facilitated using tailored approaches that take into account local constraints such as fuel availability, affordability and existence of distribution channels. Where affordability issues prevail, government interventions should focus on promoting more efficient and sustainable supply of biomass. Equally important is to improve the efficiency at which people burn biomass by facilitating the development and commercialization of improved cook stoves and the accompanying sustainable business models to deliver and service them.

Africa's Energy Opportunities

Renewable energy can help bridge Africa's energy deficit and further enhance climate resilience, reconciling several development imperatives. The development of renewable energy sources as part of a diversified portfolio can reduce vulnerability to supply disruptions and market volatility while allowing for a greener energy mix.

Africa's abundant conventional sources will remain a prominent part of the energy mix. Currently, thermal generation based on fossil fuels dominates energy supply in Africa. This is a result of the relative abundance of conventional energy sources. However, natural gas can serve as a bridge to a more sustainable energy supply

and is already playing a critical role in the primary energy portfolios of many developing countries.

Africa's enormous energy potential can be effectively and sustainably unlocked through the development of regional power trade. Regional power trade is key to Africa's energy future, as resources tend to be heavily concentrated and most countries have energy systems that are simply too small to efficiently produce power. Deeping regional power trade will allow for the development of the needed scale and significantly lower power costs, which in turn will spur productivity and competitiveness. Further, trade will put Africa on a less carbon intensive path by allowing the diversification of the energy portfolio at the power pool level. Regional power trade would allow hydropower to provide as much as 48 percent of the continent's energy needs, displacing as much as 20,000 MW of thermal power in the process and saving 70 million metric tons of carbon dioxide emissions annually.

The Way Forward

Successfully meeting the continent's energy access challenge requires a robust scale-up of investments in the energy sector. The overall investments needed to scale up generation capacity and build cross-border transmission networks for full development of power trade have been estimated at $40.6 billion annually. However, existing investment stands at only $11.6 billion per year. It is important to secure the resources needed to finance nearly 31 GW of new generation capacity already planned for roll-out over the next 5-7 years. Just over half of this additional capacity is already in the project pipeline; to maintain momentum, additional resources are needed immediately. The associated funding needs for the entire 31 GW are approximately $27 billion. Of this, a $14 billion financing gap will need to be bridged to prepare the remaining 15 GW of pre-identified generation capacity. A significant portion of this gap can be channeled through climate-friendly funds being designed at this time.

BROAD CONSENSUS ON CLIMATE-RELATED FINANCING REFORM IS REQUIRED TO ENSURE THAT AFRICA'S SPECIFIC ISSUES ARE PRIORITIZED.

Key transformational energy projects can only be advanced by leveraging government, donor and private resources. Large-scale generation projects such as hydropower and geothermal development or natural gas based generation are the backbone of regional power trade and have the potential to change Africa's economic outlook and growth trajectory. But the resources and the skills required are beyond the capacity of just one country. Coordinated government and donor support and increased private sector investment are critical to achieve the needed scale. Public–private partnerships (PPPs) constitute primary critical vehicles to pool and leverage public and private finance and to better facilitate risk-sharing. Resources dedicated to project preparation and additional pre-financing needs can also go a long way in scaling up investment readiness and prepare the ground for project financing. At present, inadequate financing for project preparation – which can account for a considerable part of the overall development cost – is resulting in many projects being indefinitely stalled. Risk mitigation is also paramount to help attract private investments. In this context, international organizations can play a critical role by expanding their traditional concessional financing function to include instruments such as guarantees and other risk sharing mechanisms. Moreover, international organizations can provide important capacity building and technical assistance on many fronts: support the implementation of key policy reforms to improve the investment climate and reduce investment risks; enable project developers to meet industry and international standards in project preparation; and facilitate collaboration among multiple stakeholders.

Broad consensus on climate-related financing reform is required to ensure that Africa's specific issues are prioritized. The emerging green growth funding is an opportunity for Africa to expand energy access and improve

energy efficiency. Climate financing is only one part of the solution but it can strategically complement the scale-up of other forms of financing. To date, some of the internationally agreed climate finance mechanisms meant to catalyze much needed investment have not delivered much for Africa. New climate-related instruments and mechanisms need to specifically address costs, risks, and barriers inherent to Africa's power sectors.

Reform of Clean Development Mechanism (CDM) is needed to incentivize Africa's leapfrogging towards low-carbon development. Africa still only hosts 3 percent of all registered CDM projects worldwide. Carbon-generated revenue flows are performance-based and many project developers lack adequate access to financing for large, up-front investment. Specifically, reforms to the CDM will need to address issues of additionality in order to reduce complexity, expand the mechanism's scale (i.e. for hydro) and increase overall efficiency. Access to CDM funding is particularly difficult for countries that have already made progress on low-carbon development or want to develop micro-scale projects (e.g., energy efficient cook stoves, efficient lighting, solar water heating, etc.). Furthermore, the development of a "fast-track" CDM could prioritize low-income countries and regions. In this context, African governments need to coordinate with their respective ministries to ensure that Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Programs of Action (NAPAs) specifically prioritize low-carbon generation options (e.g. hydro and natural gas) in their plans.

AFRICAN GOVERNMENTS HAVE A KEY ROLE TO PLAY IN TURNING AROUND AFRICA'S ENERGY SITUATION.

Technology transfer is essential to Africa's adoption of greener energy technologies. Capacity-building programs supported by governments, global counterparts, and South–South cooperation should aim to develop expertise on new technologies and applications, in particular those based on cleaner energy generation options. It is also important to support local market development for the production and commercialization of innovative, clean, and affordable lighting and cooking applications and alternate cooking fuels.

African governments have a key role to play in turning around Africa's energy situation. Strong power sectors are built on well-functioning national utilities. The success of large-scale energy programs mainly hinge upon their technical, managerial and commercial capacity. Renewed government efforts to target utility reform and improve corporate governance, oversight and transparency are critical. To build an enabling investment environment that will attract private participation to large-scale transformational projects, utilities need to improve performance to meet 21st century standards (i.e. reducing transmission and distribution losses and strengthening collection rates). Moreover, tariff policies should be carefully designed in order to free-up resources for further investment in lower cost generation and electrification of the poor. Achieving these goals will require efforts to improve the investment climate in African countries, increase the capacity to prepare and manage complex projects, and to attract significant new capital. Collective political support at the highest level will enable African negotiators to reiterate the importance of these priorities in the context of sustainable energy access in the broader climate dialogue.

JOHANNESBURG DECLARATION

AFRICA ENERGY MINISTERS CONFERENCE

JOHANNESBURG DECLARATION

Preamble

We, African Ministers responsible for Energy, convened in Johannesburg, South Africa on September 15 and 16, 2011 at the Africa Energy Ministers Conference on *"Road to Durban: Promoting Sustainable Energy Access in Africa"*, to reach consensus on the priorities for supporting Africa's energy development agenda in a sustainable manner in advance of the 17th Conference of the Parties (COP17/CMP 7) of the United Nations Framework Convention on Climate Change (UNFCCC) and 7th Conference and Meeting of Parties (CMP) to the Kyoto Protocol(KP) to be held in Durban from November 28 to December 9, 2011. Energy issues should also hold a prominent place in the Rio+20 agenda, as it constitutes a key international milestone. The resulting decisions should provide a solid implementation framework for concrete actions on energy.

1. *Recalling* the Maputo Declaration adopted by the African Energy Ministers at their inaugural conference held in Maputo, Mozambique, on November 5th, 2010, and reiterating the commitments that resulted, including the formation of the Conference of Energy Ministers of Africa (CEMA);

2. *Welcoming* the progress achieved in the establishment of Regional Power Pools and the programs, initiatives and partnerships at both regional and sub-regional level geared towards advancing energy sector development and integration in Africa, and appreciating the support of development partners to Africa's energy development agenda.

3. *Welcoming* 2012 as the International Year of Sustainable Energy Access for All, and the sustainable energy goals set forth in the report[1] of the United Nations Secretary-General's Advisory Group on Energy and Climate Change (AGECC);

4. *Welcoming* the continued emphasis placed by the United Nations Secretary-General and the UN system on sustainable energy as central to achieving sustainable development. And specifically on the Action Agenda that is being designed by a new High-Level Group on Energy around three goals: ensuring universal access to modern forms of energy for all by 2030, improving energy efficiency by 40 per cent by 2030, and doubling the global share of renewable energy by 2030;

5. *Acknowledging* that Africa has the lowest rate of access to modern energy amongst all continents, and that

1 Energy for a Sustainable Future, The Secretary-General's Advisory Group on Energy and Climate Change (AGECC), New York, USA, April 28, 2010.

if no significant changes are made it is projected that more people will be without energy services in 2030 than now;

6. *Recognizing* that access to reliable, affordable and sustainable energy service is essential to reduce poverty and promote equitable and sustainable social and economic development, and climate resilience in our continent;

7. *Recognising* that resource efficiency and green growth critically contribute to poverty reduction, job creation, decent work, social development and a better environment;

8. *Emphasizing* that inadequate energy systems jeopardize the achievement of the Millennium Development Goals in Africa and weaken resilience to adverse climate change impacts, as well as hinder opportunities for vulnerable groups especially women and children;

9. *Further emphasizing* the vulnerability of Africa to the negative impacts of climate change, the resultant threats to water supply and energy infrastructure, and hence the need to ensure adaptation to climate change;

10. *Emphasizing* that Africa, Least Developed Countries (LDCs) and Small Island Developing States (SIDS) are prioritised for Green Climate Fund as reflected in the COP 16/CMP 6 Cancun Agreement;

11. Emphasizing the principles of the United Nations Framework Convention on Climate Change, in particular the principle of equity and common but differentiated responsibility and respective capability, and further reinforcing that developing country mitigation and adaptation action is dependent on the provision of finance, technology and capacity building support from developed countries

12. *Highlighting* the fundamental need to build necessary human and institutional capacity developments on a sustainable basis. This is the basis for ensuring we can design and implement bankable projects, effective policies and regulations, and negotiate favourable agreements to ensure the provision of sustainable energy for all.

13. *Recalling* the Monterrey Consensus on Financing for Development that committed to a broad-based development agenda taking into account poverty reduction, environmental sustainability and economic growth which called upon donors to commit to a target of 0.7% of gross national income towards official development assistance;

14. *Recalling also* the COP 15/CMP 5 Copenhagen Accord on Fast Start Financing approaching $30 Billion by 2012 and on long term funding arrangements of up to $100 Billion per year by 2020;

15. *Noting with concern* that only 2% of clean development mechanism (CDM) projects originate in Africa and welcoming the decision of the European Union to focus its demand for carbon credits on supply from the LDCs whilst also encouraging regional and national carbon trading schemes to give priority to the supply from LDCs and others including Africa and SIDS;

16. Despite the fact that Africa as a continent has contributed relatively less to the green house gas emissions we however are taking decisive actions to contribute towards reduction of the global carbon foot print.

We assert that:

17. Climate change is a development challenge that threatens to reverse developmental gains made in recent years. African economies and communities, and the poor among them are most at risk to the adverse effects of climate change , have contributed the least to the problem and will likely be among those impacted the most.

18. Expanding access to modern energy services and building energy security is an utmost priority to accommodate the basic needs of millions of African citizens, facilitate human and social development, assure sustainable economic growth, and contribute to the achievement of the MDGs in Africa and thereby build resilience to the impacts of climate change.

19. Only 42% of African citizens have access to electricity. In sub-Saharan Africa, just one in three people, have access to reliable electricity – the lowest rate in the word. This results in limited educational opportunities for African children and depressed income opportunities especially for African women. Inadequate access to electricity constrains the delivery of social services such as health, water and sanitation.

20. The entire power generation capacity of the continent stands at 124 GW, of which 30 GW is the total of sub-Saharan Africa (excluding South Africa). Unreliable power supply has a significant bearing on economic development in the Sub-Saharan region. It affects over 30 sub-Saharan countries, depressing competitiveness and employment and imposing significant costs especially for rapidly growing urban areas which contribute some 79 percent of total GDP growth in Sub-Saharan Africa.

21. An intermediate goal would be to support and complete the currently planned capacity expansion through key transformational projects, which overall may add an additional 30 GW of capacity within ten years. If only a third of this capacity is utilized for domestic demand, it would accommodate the needs of an additional 150 million served by grid electricity.

22. To make universal access a reality by 2030, an additional 512 million people, 460 million of them in the Sub-Saharan region, should be provided access to electricity. The scale of the challenge requires that all approaches, including grid and off-grid solutions are taken into account and adopted based on an efficiency principle. Rural and urban demands can best be met with a diverse technology mix that takes full advantage of sub-Saharan Africa's exceptional solar, wind, geothermal, biomass, and sustainable hydropower resources.

23. Facilitating the spread of low-cost and sustainable energy solutions is critical to meeting basic needs. Supporting the transition to more sustainable fuels for cooking and heating and the use of more efficient cookstoves is also paramount in reversing the health implications and the environmental degradation imposed by the use of traditional biomass.

24. The use of outdated and highly inefficient production and end-use technologies causes unacceptable energy waste. The rapid deployment of more efficient technologies and improved energy management is a critical priority for African development and will support improvements in energy access and the development of renewable energy.

25. Small Islands States (SIDs) face an unprecedented constraint and challenge in relation to climate change

and unlike countries on the mainland, and cannot in anyway benefit from interconnection for supply. The vulnerability of SIDs become more critical with their dependence on imported fossil fuels.

We identify the following priorities:

26. Dramatically expanding access to modern, clean, high-quality energy services: Electricity access in Africa is still less than 35%, with the exception of South Africa, consumption is around 1% of the level of OECD countries. Approximately 82% of households rely on solid biomass for cooking, which imposes huge health and environmental risks. In addition most countries face regular interruption of services, shortages of supply and rapidly escalating costs.

27. Building energy security by scaling-up regional power supply and transmission: Regional power pools have been established across the continent. The up-scaling and coordination of regional transmission and generation capacity will enable further benefits of scale, security and diversity. In addition it is recognized that large projects in some countries can only be developed on a regional basis.

28. Reducing climate change vulnerability and increasing resilience: African nations are among the most vulnerable to the negative impacts of climate change. As such we need to prioritise the resilience of our communities, infrastructure and economies in the face of these impacts. African nations need to develop country specific and regional adaptation approaches and actions which will enable the identification of priority adaptation actions an integrated part of their sustainable development and poverty eradication policies, measures and strategies whist facilitating development. We further need to develop regional centers that can develop early warning and modeling capability to reduce risk and increase resilience.

29. Prioritising clean energy: Africa is richly endowed with renewable energy resources – many of which may be developed in support of a low-carbon future for the continent. With the support of financing, technology and institutional capacity building from developed countries Africa will be able to greatly enhance its economic, social and environmental development using a diversity of clean energy sources.

30. Improving sector and utility performance: The underperformance by most utilities is a key impediment to sector growth. This is often due to the shortage of management expertise and skilled staff coupled with limited financial and human resources for training. Cooperation in developing skills in this sector across the continent is a priority.

31. The key role of demand-side management and energy efficiency: Experience has shown how demand side management and energy efficiency programmes can reduce costs, improve access and international competitiveness while simultaneously reducing environmental impacts. They are also essential to ensure optimal energy system design, and the integration of renewable energy. There is great potential in learning from the successes of African and other nations in this area.

32. Localising supply chains: Whilst growing our energy economies, we need to ensure that localization of supply chains for not only the supply of equipment and plant, but also the maintenance and operation of our facilities. This will create jobs and grow skills as well as reduce costs.

33. Integrated planning: The energy sector does not operate in isolation. Infrastructure such as power lines, pipelines, water, transport are interdependent. Integrated planning is critical to the sustainability and

further development of our economies and societies. As such we will prioritise integrated planning and the role of the energy sector in developing our economies, promoting investment and localization, as well as improving education, security and health care.

34. Securing financial resources: A key constraint to the effective execution of energy projects across the continent is the lack of resources for project preparation and development – from concept to financial close and execution. In addition most major energy projects require long term finance with repayments linked with project revenue generation. Often the revenue generation is inadequate to support the current high costs of capital and long value chains of comprehensive projects; as such a substantial part of the financing of these projects needs to be in the form of accessible grants and capital at long term concessional rates - especially for interregional transmission and renewable projects. Such projects would also benefit from the more expeditious processing by multilateral and bilateral institutions. In addition we will aim to maximize the flow of green finance and carbon funds as well as the use of market mechanisms such as the CDM.

35. Building technology and innovation capacity: We need to build our technology base through undertaking appropriate research and development (R&D), developing our skills base and facilitating technology transfer to ensure that technologies are needs driven and appropriate for local conditions including undertaking regional resource assessment projects.

36. We need to give special consideration to the needs of SIDs in terms of generation capacity enhancement, promoting the use of renewable sources of energy, and also in terms of capacity building.

We resolve to pursue the following actions:

37. Support for expansion of generation capacity with emphasis on regional projects: The best way to expand generation capacity at the lowest unit cost is to develop large-scale generation projects. A project finance approach in which private sector participation at concessional rates and donor funding are blended will usually be needed to develop these large projects. These projects are invariably complex and will require significant project preparation funds to assess their social and environmental impacts, to undertake upstream regulatory and institutional development and ensure their resilience to climate impacts. Today, the available funding from international agencies to undertake such upstream project preparation work for large regional projects is inadequate. We urge the COP17/CMP 7 to consider placing US$500 million as a corpus of grant funds to develop the next generation of national and regional generation projects, with emphasis on clean energy development. Another impediment to the realization of large hydropower and/or regional projects is their not being eligible for carbon market support such as CDM or climate related funds. We urge the COP17/CMP7 to ensure that both large hydropower and regional (cross-border) projects be declared eligible for “fast-track” finance and green funds, including any new market mechanisms and instruments as well as a call for their access to any new climate-related or green funds.

38. Enhanced funding for policy and institutional development activities: Successful planning, design and timely implementation of scaled-up access programs will hinge critically on the ability of national utilities, other energy sector development and governance institutions to undertake the key technical, planning, management, commercial, and logistical functions. 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: improve transmission and distribution efficiency; adopt a loss reduction strategy; upgrade metering, billing and

collection systems; invest in needed assets and efficient commercial technology for the distribution network; and, improve corporate governance and ensure non-interference in their procurement, financial and commercial operations. We urge the COP17/CMP 7 to consider mobilizing support and resources for accelerated and effective technology transfer and human resource development programs with emphasis on South-South exchanges to boost the capacity of African energy institutions and professionals. We also call for greater international support for a network of regional centers of excellence and innovative funding streams to support the development, dissemination and deployment of appropriate technologies adapted to Africa's needs including home-grown and other solutions that create jobs, foster entrepreneurship and contribute to enhanced export earnings.

39. Energy planning and international cooperation: A sector wide approach to scale up energy access has the potential to channel donor resources in a more sustained and cost-effective way that is consistent with the Paris Declaration[2]. Given the scale of investments needed, a systematic and climate-friendly approach to planning and financing new investments is critical. A sector wide approach employs integrated planning resulting in a mix of technologies being appropriately targeted for (a) grid extension in urban and rural areas where population density and distribution enables it to be least cost, (b) mini grid and off-grid systems based on renewable energy technologies for dispersed populations.; and (c) low-cost home-energy systems (e.g. solar, LED, geyser blankets, low flow showerheads etc.) as well as efficient cook stoves, through development of markets for such products. In addition to connecting the households, solar-powered electrification of clinics and schools to serve low-income communities is another way of bringing the benefits of investment in electrification directly to these communities. We urge development partners to honor funding commitments made for energy access and energy poverty and deliver on increased funding assistance for access programs from climate-related funds being mobilized. The African Energy Ministers in turn resolve to lead and champion strong programs for access planning and strengthen the policy and institutional framework for implementation to accelerate the achievement of results.

40. Regional trade and energy resource development: Enhanced support from development partners for scaling up regional energy trade and development of clean and renewable energy resources. The urgency to support regional strategies and complete key regional transformational projects that will secure sustainable, efficient and affordable energy supply based on economies of scales and diversification of the energy mix at the power pool level. We call upon the COP17/CMP 7 to ensure that the operational and eligibility criteria of fast-track and green funds being mobilized to be used as up-front capital in support for development of Africa's developmental priorities, including inter alia, utilization of its vast and largely untapped hydro-power resources. In addition, we call on the COP17/CMP 7 to urgently address the CDM and the carbon market to similarly support development of Africa's rich hydro resources.

41. The UNFCCC process has to date tended to prioritise the mitigation of emissions: We believe that adaptation to the negative impacts of Climate Change deserves balanced treatment. We call upon the COP17/CMP 7 to ensure that there is balanced treatment of both adaptation and mitigation and in particular that adaptation projects be recognized for support in the Green Climate fund. We further suggest that templates be developed to facilitate the development of country and regional adaptation plans for the most vulnerable countries and regions – especially in Africa.

42. In order to ensure the success of these actions, we commit to:

2 Paris Declaration on Aid Effectiveness, Paris, France, March 2, 2005.

a. Full cooperation in the achievement of the above actions
b. Cooperation in developing regional integrated energy plans which will identify priority energy projects across the continent.
c. Cooperation in the sharing of lessons learnt in the energy field through holding workshops and training programmes.
d. Improving the efficiency of our Energy operations to reduce emissions and improve affordability
e. Working in partnership with key stakeholders including business and our Development partners

In conclusion, we call upon all multilateral development institutions, the UN Secretary-General and all the UN Agencies and Programmes to globally support Africa's transformational energy agenda. We commend the Republic of South Africa and the African Union for taking the initiative to organize and host this important conference and acknowledge the support from development partners who have made this Conference possible, particularly, the World Bank, the United Nations Industrial Development Organization, and the United Nations Foundation and UN-Energy.

Johannesburg, South Africa on 16th September, 2011.

CONFERENCE AGENDA – DAY 1

The African Energy Ministers Conference opened with key remarks from several internationally renowned individuals who stressed the importance of significantly improving sustainable energy access for Africa. The five panel sessions were each followed by moderated discussions that facilitated knowledge sharing between panel participants and attendees.

Opening Ceremony

The delegates were welcomed and reminded of the importance of promoting sustainable energy access for Africa as one step on the road to Durban and COP17.

Master of Ceremonies: Dr. Kandeh K. Yumkella, Director-General of UNIDO

Dr. Yumkella began by highlighting the recent increased international interest in achieving universal energy access. Promoting sustainable energy access for Africa was acknowledged as an important milestone on the road to Durban and COP17 and also as the theme of the conference. It was noted that Africa currently has an opportunity to make energy access a top priority at the international level. It was expected that the conference would enable the attendees to contribute to and participate in the development of tangible benchmarks to effectively meet this goal. The expected final output of the conference was a declaration that would include the voices of all the delegates.

Welcome Remarks

H.E. Salvador Namburete, President of CEMA, Minister of Energy, Mozambique

The Honorable Minister of Energy pointed out the opportunity provided by the conference to share views leading up to COP17 as a way to look for sustainable solutions in promoting energy access. The severe levels of energy poverty in Sub-Saharan Africa were highlighted as a key challenge for the continent. The adverse impact of climate change on energy production and biomass in Africa was emphasized. Energy access was identified as crucial for economic development and decreasing energy poverty. Mr. Namburete discussed the importance of using a diverse range of energy resources, technological innovation and energy polices. He stressed the need for close cooperation and political will to drive change.

Dr. Elham Ibrahim, Commissioner for Infrastructure and Energy, African Union

Dr. Ibrahim expressed confidence that a consensus could be reached, even given the large number of attendees from a variety of countries. She encouraged participants to speak with one voice and establish clear guidelines on how best to achieve universal energy access for all. The speaker emphasized the importance of identifying bankable projects across Africa and collaborating with all partners, including the private sector, to promote the goal sustainable energy access.

Message from COP17 Incoming President: H.E. Mr. Ebrahim Ibrahim, Deputy Minister for International Relations and Cooperation, South Africa

The Honorable Deputy Minister asserted that it is a pivotal time in history to make critical decisions on energy access vis-à-vis the international climate change dialogue. In this context, the opportunity presented by COP17 to formulate a global response as the only acceptable solution to address Africa's vulnerability to climate change was emphasized. Key principles were shared with the audience to provide guidance for desirable COP17 outcomes specific to Africa's needs. The importance of a party-driven process, transparency and inclusivity were further underscored.

Keynote Address: H.E. Ms. Dipuo Peters, Minister of Energy, South Africa

The Honorable Minister of Energy welcomed and thanked the delegates for their political leadership in consistently raising the issue of access to energy. The audience was reminded of the practical consequences of extremely low energy access levels in Sub-Saharan Africa that directly correlate to quality of life indicators (i.e., health implications, etc.). The under-developed state of the power sector, the need for better connectivity and lower prices for power were given as examples of areas for improvement. The failure to benefit from the carbon market was also discussed.

The speaker pointed out that Ministers have a role to play as key catalysts for reducing poverty. The need to attract funding to address the risks associated with climate change and lack of access to energy was reiterated. Minister Peters briefly outlined a provisional pathway to clean energy for Africa. In addition, she reminded the Ministers of Energy of their responsibility to engage with colleagues to share good practices, challenges and ideas to conceive projects that can be pragmatically implemented at the local level and also be used as examples for COP17.

Panel Sessions

Several prominent individuals representing many different stakeholders made significant contributions as either chairs or speakers for the five panel sessions that were held on Day 1. In addition to panel participants, key discussion points for the five panel sessions on Day 1 are also outlined below. The discussion points were supported by several background issue papers, outlines for which may be found at the end of this section.

Introductory Panel Session: The Challenge of Achieving Universal Access

The session was chaired by ***H.E. Mr. Isak Katali, Minister of Mines and Energy, Namibia.***

The panel speakers were:

- ***Ms. Maria van der Hoeven, Executive Director, International Energy Agency: Enhancing Energy Access and Sustainability in Africa (via recorded message)***

Ms. Hoevan highlighted that the age of cheap energy has ended and, moving forward, energy efficiency will be an increasingly important issue, particularly on the basis of population growth. The magnitude of the associated monetary costs that will be incurred by governments in order to reach universal energy access was briefly discussed. A pragmatic outline of how universal energy access can be achieved was shared. It emphasized the need for private sector partnerships to harness investment, the importance of achieving goals at reasonable scale and prices and acknowledging the long-term benefits of lower emissions in pursuing energy access. It was suggested that energy policies take low carbon growth into consideration while still maintaining a focus on sound economic development and investment.

- ***Dr. Elham Ibrahim, Commissioner for Infrastructure and Energy, African Union: The Energy Access and Infrastructure Challenge for Africa***

Electricity access rates in Africa were presented to highlight the continent's overall low energy access status. A balanced approach in accelerating scale-up was advocated in improved addressing energy access and environmental challenges. Africa's infrastructure needs for energy access and funding requirements, including the tools available, were outlined. The role of the African Union (AU) and its key initiatives was discussed. Climate change was mentioned as a major development challenge for Africa; specific attention was given to currently under-developed but rich renewable energy sources. A strong recommendation was made that Africa endeavor to speak with "one voice" and make provisions to be able to benefit from the various funding mechanisms.

- ***Mr. Jamal Saghir, Director for Sustainable Development, Africa Region, World Bank: Call for Action – Boosting Energy Access for Africa***

Mr. Saghir emphasized the importance of taking action now to secure Africa's energy future. Targets were identified for achieving 30 GW of planned capacity in Africa within the next decade. Attention was directed to the need for expansion in generation capacity through large-scale energy programs and bankable projects with concerted efforts from all stakeholders. The financial, economic and environmental savings from regional power trade were discussed. In this context, the speaker also pointed out the need to consider energy generation needs as a whole package and emphasized the need to complete cross-border interconnections. Several actions were suggested to secure Africa's energy future, including engaging with the World Bank in the preparation of transformational projects in Africa. In conclusion, Mr. Saghir stressed the need for co-operation between power utilities and governments and the importance of Africa speaking as one voice with regard to reaching energy goals.

This session aimed to:

- Unbundle the concept of energy access;
- Review impediments such as infrastructure, finance and technology to boosting energy access in Africa;
- Explore how global climate change affects the ability of African countries to address energy access issues.

The panel also highlighted opportunities for boosting energy access and discussed priority projects that can be fast-tracked for accelerating energy access on the African continent.

Technical Panel Sessions:

Climate Change Resilience: Bringing Mitigation & Adaptation Together

The session was chaired by ***H.E. Mr. Monyane Moleleke, Minister of Natural Resources, Lesotho.***

The panel participants were:

- ***Ms. Nosipho Ngcaba, Director General of Environmental Affairs, South Africa.***
- ***Dr. Veerle Vandeweerd, Director of Environment and Energy Group, UNDP (Recorded message from Ms. Helen Clark, Administrator, UNDP)***
- ***Mr. Eng. Maher Aziz Bedrous, Counselor for Environmental Management and Studies Sector,***

Egyptian Electricity Holding Company, Energy and Environment Consultant (E&E), National Counselor for CDM, Egypt

- ***Ms. Christina Figueres, Executive Secretary, United Nations Framework Convention on Climate Change (UNFCCC) (via recorded message)***

This panel discussed:

- How climate change impacts Africa and;
- How the energy access agenda in Africa relates to ongoing discussions on mitigation and adaptation to climate change.

The overall objective was to help define the energy access agenda in the context of climate-resilient development, spanning both the mitigation and adaptation debates.

The Dialogue of Ministers was facilitated by ***H.E. Mr. Monyane Moleleki, Minister of Natural Resources, Lesotho.***

The Way Toward Sustainable Universal Energy Access — Building Climate-Resilient Energy Systems

The panel was chaired by ***H.E. Mrs. E.B.A. Vieira Lopes, Minister of Energy and Water, Angola.***

The panel speakers were:

- ***Mr. Edward Njoroge, Managing Director and CEO, Kenya Electricity Generating Company Ltd., Kenya***
- ***Mr. Harry Verhaar, Sr. Director for Energy and Climate Change, Phillips, Netherlands***
- ***Mr. Steve Lennon, Executive Manager, Corporate Affairs, Eskom, South Africa***

This panel reviewed:

- The range of resources, technologies and approaches that can significantly contribute to a scale-up of energy access for Africa's people and businesses and;
- Promote energy security while placing the continent on a low-carbon development pathway.

The session assessed the current situation of Africa's energy sector, discussed energy poverty and defined the scale of the challenges ahead. Options of how to further build on proven, successful experiences and approaches for achieving sustainable energy access in Africa were also discussed.

The Dialogue of Ministers was facilitated by ***H.E. Mr. Wondimu Sigo Tekle, State Minister for Water and En ergy, Ethiopia.***

Building the Wires, Capacity and Harmonization for True Regional Integration

The chairperson for this panel was ***Mr. Jamal Saghir, Director, Sustainable Development Department, Africa Region, World Bank.***

Panelists for this session included:

- ***Mr. Brian Dames, CEO, Eskom***

- ***Mr. Jasper Oduor, Executive Secretary, Eastern Africa Power Pool***
- ***Mr. Pius Gumbi, Chairman, Southern African Power Pool and CEO, Swaziland Electricity Company, Swaziland***

This panel addressed:

- The challenges and opportunities for increasing regional power trade and;
- The role of governments, regional economic communities, donors and financiers in advancing key, transformational cross-border projects.

The session addressed needs in terms of physical interconnections as well as strengthening capacities for regional planning and regulatory frameworks.

The Dialogue of Ministers was facilitated by ***H.E. Dr. Joe Oteng Adjei, Minister of Energy, Ghana.***

Securing the Resources for Green Growth

This panel was chaired by ***Mr. Michael Liebreich, Chief Executive, Bloombery New Energy Finance.***

Speakers for the panel included:

- ***Mr. Jean Michel Debrat, Deputy Director General, Agence Francaise de Developpement (on behalf of Dr. Thomas Duve, Regional Director of KfW)***
- ***Mr. Sim Tshabalala, Deputy Group CEO, Standard Bank, South Africa***
- ***Mr. Varadarajan Atur, Energy Program Coordinator, Africa Region, World Bank***
- ***Mr. Engedasaw Negash, Acting Manager for Eastern and Southern Africa Energy Sector Development, Africa Development Bank***

This panel explored:

- The creation and coordination of readily accessible and dedicated resources for raising capacity for planning (e.g., defining and developing low-emission strategies);
- Project preparation (strengthening safeguards, enabling regional project structures) and;
- Improving the investment climate (e.g., through transaction advisory services and support for public-private partnerships).

The overall objective was to increase support for transformative and replicable investments that will contribute to low-carbon growth.

The Dialogue of Ministers was facilitated by ***H.E. Mr. A. Malima, Deputy Minister of Energy and Mineral Resources, Tanzania.***

CONFERENCE AGENDA – DAY 2

The second day of the African Energy Ministers' Conference focused on defining priorities for Africa's climate-resilient energy development agenda in the context of the COP17 climate change negotiations to be held in Durban later this year. The need for high-level dialogue and greater cooperation between countries and partners to adopt technical and financial solutions for expanded access to lower-carbon sources of energy was emphasized. At the end of Day 2, the "Johannesburg Declaration" was adopted following a Ministerial Roundtable that encouraged discussion and provided substantial input for the final output of the Conference.

Ministerial Roundtable

Keynote address by ***Minister Ebrahim Patel, Minister of Economic Development, South Africa.***

In his address, Minister Patel reinforced the message that by leveraging new global technologies, the local African entrepreneurial spirit and emerging partnerships, it is possible to bring clean and affordable solutions to all Africans, while also creating jobs and development on the ground, particularly in rural areas.

This panel was chaired by ***Daniel Kammen, Chief Technical Specialist for Renewable Energy and Energy Efficiency, World Bank.***

The panel speakers were:

- ***Mr. Robert Aitkin, Managing Director, Restio Energy***
- ***Mr. Ron Bills, Chairman and CEO, Envirofit***
- ***Ms. Joyce De Mucci, Barefoot Power***
- ***Mr. Bill Farmer, The Uganda Carbon Bureau***
- ***Ms. Richenda van Leeuwn, Senior Director of the Energy and Climate team, UN Foundation***
- ***Mr. Suraj Oloburo, CEO, Toyola Energy***

The panel aimed to:

- Provide a platform to share country experiences to better formulate a concrete action plan to dramatically improve sustainable energy access in Africa;
- Help define Africa's energy development agenda for Durban and beyond.

The main objective of the session was to facilitate meaningful knowledge-sharing to feed into the adoption of an African Energy Ministers' Declaration.

The Dialogue of Ministers was facilitated by ***H.E. Eng. Ruhamya Coletha U., Minister of State in charge of Energy and Water and Minister of Infrastructure, Rwanda.***

Multi-stakeholder Panel: The Roadmap Toward 2030

The chairpersons for this session were ***H.E. Mr. Mohammed M. Mohamud, Deputy Minister of Energy, Kenya***

and Dr. Elham Ibrahim, Commissioner for Infrastructure and Energy, African Union.

The panel sought to:

- Set a global agenda to secure Africa's energy future and
- Identify clear targets and key projects.

An open session then followed to allow for comments from Ministers.

Dr. Kandeh K. Yumkella, Director-General, UNIDO gave a short introduction.

The chairperson and moderator for the open session was ***H.E. Professor Ogunlade R. Davidson, Minister of Energy and Water Resources, Sierra Leone.***

The open session specifically focused on the roles that governments, regional economic communities, donors and financiers will have to play to build political momentum, improve planning and technical capacity and mobilize the needed resources.

Communiqué Drafting Session – Minister Dialogue and Adoption of the Declaration

The final declaration was presented by Ms. Nelisiwe Magubane, Director General, Department of Energy, South Africa.

The Declaration is expected to feed into the upcoming COP17 discussions in Durban. The main points put forward in the Declaration were the following:

- Consider placing US$500 million as corpus of grant funds to develop national and regional projects to expand capacity generation with emphasis on clean energy development;
- Reform of the Clean Development Mechanism (CDM) and green financing to ensure that large hydropower and regional (cross-border) projects are eligible for fast-track finance;
- Mobilize funding for policy and institutional development activities (i.e., capacity building and technical assistance);
- A sector-wide approach for energy planning and international cooperation to follow through on funding commitments;
- Mobilize fast-track and green funds as up-front capital to enhance regional trade and;
- Ensure balanced treatment of both adaptation and mitigation with adaptation projects being recognized as eligible for support from the Green Climate Fund.

The Minister Dialogue and adoption of the Declaration moderator was ***H.E. Professor Ogunlade R. Davidson, Minister of Energy and Water Resources, Sierra Leone.***

Closing Remarks

Closing remarks were made by Dr. Elham Ibrahim, Commissioner for Infrastructure and Energy, African Union and by H.E. Ms. Dipuo Peters, Minister of Energy, South Africa.

Dr. Elham Ibrahim, Commissioner for Infrastructure and Energy, African Union

Dr. Ibrahim congratulated the audience for reaching an outcome. The speaker reiterated the African Union (AU) Commission's commitment to work closely with the Energy Ministers and welcomed the outcomes of the conference, which would help provide direction for AU's future action plan. The audience was reminded of the urgency to fast track "energy access" and its role in sustainable development, including reaching the Millennium Development Goals (MDGs). Invitations were extended to development partners to address priority projects and main challenges such as finance and global climate change. In addition, the AU encouraged African countries to develop energy planning and policy harmonization that take a regional approach. Green growth also was suggested as a solution to address financing issues. In conclusion, Dr. Ibrahim expressed her confidence that the conference outcomes would contribute to better well-being for Africa.

H.E. Ms. Dipuo Peters, Minister of Energy, South Africa

Minister Peters thanked everyone who played a part in making the conference a success. In addition, year 2012 was again acknowledged as the "International Year for Sustainable Energy for All." Ms. Peters affirmed that, through the decisions made at the conference, sustainable outcomes could be realized and a difference made to people's lives. A request was made to the countries that use 80% of the world's energy to contribute and help secure energy access for Africa. Women were encouraged to join Africa's energy sector and become entrepreneurs and technology designers. The Clean Energy Education & Empowerment (C3E) initiative was also highlighted in this regard. In conclusion, the important role that Energy Ministers have to play in catalyzing energy access, specifically for Africans living in extreme poverty, was stressed.

ANNEXES

ANNEX I Johannesburg Declaration (French Version)
ANNEX II Summary of Panelist Presentations
ANNEX III Conference Background Materials

JOHANNESBURG DECLARATION (FRENCH VERSION)

CONFÉRENCE DES MINISTRES DE L'ÉNERGIE D'AFRIQUE

DÉCLARATION DE JOHANNESBURG

Avant propos

Nous, Ministres Africains responsable de l'Énergie réunis à Johannesburg, Afrique du Sud les 15 et 16 Septembre 2011 à la Conférence des Ministres de l'Énergie d'Afrique sur "*La route de Durban: Promouvoir l'Accès à l'Énergie Renouvelable en Afrique"*, pour atteindre un consensus sur les priorités afin de soutenir le programme de développement de l'énergie de façon durable en avance de la 17eme Conférence des Parties (COP17/ CMO 7) de la Convention Cadre des Nations Unies sur les Changements Climatiques (UNFCCC) et la 7eme Conférence et réunion des Partis (CMP) sur le Protocole de Kyoto (KP) qui se tiendra à Durban du 28 Novembre au 9 Décembre 2011. Les problèmes de l'énergie devraient aussi tenir une place proéminente dans l'agenda du R10+20 car il constitue un jalon international clé. Les décisions en résultant devraient fournir une structure solide de mise en application pour des actions concrètes sur l'énergie.

1 *Rappelant* la Déclaration de Maputo adoptée par les Ministres Africains de l'Énergie lors de leur conférence inaugurale tenue à Maputo, Mozambique, le 5 novembre 2010, et réitérant l'engagement qui en résulta, y compris la formation de la Conférence des ministres de l'Énergie d'Afrique (CEMA)

2 *Accueillant* les progrès achevés dans l'établissement des Groupements Régionaux pour la Puissance Électrique et les programmes, initiatives et partenariats à la fois au niveau régional et subrégional articulés vers l'avancement du développement du secteur de l'énergie et l'intégration en Afrique, et appréciant le soutien des partenaires du développement à l'agenda de développement de l'énergie de l'Afrique.

3 *Bienvenue à* 2012 comme l'Année Internationale pour l'Accès à l'Énergie Renouvelable pour Tous, et des objectifs d'énergie renouvelable définis dans le rapport[3] du Groupe Consultatif sur l'Énergie et les Changements Climatiques du Secrétaire Général des Nations Unies (AGECC).

4 *Accueillant* l'emphase continue mise par le Secrétaire Général des Nations Unies et le systeme UN sur l'énergie durable comme centrale pour réussir un développement durable. Et particulièrement le Programme d'Action qui est en cours de conception par un nouveau Groupe de Haut niveau sur l'Énergie autour de trois objectifs : assurer un accès universel aux formes modernes d'énergie pour tous pour 2030, améliorer le rendement énergétique de 40 pour cent pour 2030 et doubler la part globale de l'énergie renouvelable pour 2030

5 *Sachant que* l'Afrique possède le taux le plus bas pour l'accès aux énergies modernes parmi tous les

3 Energy for a Sustainable Future, The Secretary-General's Advisory Group on Energy and Climate Change (AGECC), New York, USA, April 28, 2010,

continents et que si aucuns changements significatifs ne sont faits il est prévu que plus de gens en 2030 seront sans les services de l'énergie qu'aujourd'hui.

6 *Reconnaissant* que l'accès à un service fiable, abordable et renouvelable de l'énergie est essentiel pour réduire la pauvreté et promouvoir le développement équitable et durable économique et social, et la résistance au climat sur notre continent;

7 *Reconnaissant* que l'efficacité des ressources et la croissance verte contribuent de manière critique à la réduction de la pauvreté, la création d'emplois, un travail décent, le développement social et un meilleur environnement.

8 *Soulignant* que des systèmes inadéquats d'énergie mettent en péril la réussite des Objectifs de Développement du Millénaire en Afrique et affaiblissent la résistance aux impacts négatifs du changement climatique et entravent aussi les chances des groupes vulnérables et plus spécialement les femmes et les enfants.

9 *Soulignant davantage* la vulnérabilité de l'Afrique face aux impacts négatifs du changement climatique, les menaces qui en résultent sur l'infrastructure et l'alimentation en eau et par suite le besoin d'assurer l'adaptation au changement climatique.

10 *Soulignant* que l'Afrique, les Pays les Moins Développés (LDC) et les Petits États et Territoires Insulaires en Développement (SIDS) sont prioritaires au Fond Vert pour le Climat comme reflété dans les COP 16/ CMP 6 de l'Accord de Cancun.

11 *Soulignant* les principes de la Convention Cadre des Nations Unies sur les Changements Climatiques, en particulier le principe d'équité et de responsabilité commune mais différenciée des capacités respectives, et renforçant plus avant que l'action d'atténuation et d'adaptation des pays en cours de développement dépend du soutien par l'apport de finance, technologie et renforcement des capacités des pays développés.

12 *Soulignant* le besoin fondamental de construire les capacités humaines et institutionnelles de développement nécessaires sur une base durable. Ceci est la base pour nous assurer que nous pouvons concevoir et mettre en œuvre des projets bancables, des politiques et règlements efficaces et négocier des accords favorables pour assurer la provision d'énergie durable pour tous.

13 *Rappelant* le Consensus de Monterrey sur le financement pour le Développement qui engagea à un large programme prenant compte de la réduction de la pauvreté, la durabilité de l'environnement et de la croissance économique qui appelait les donateurs à s'engager sur une cible de 0.7% du produit intérieur brut au profit d'une aide officielle au développement;

14 *Rappelant aussi* L'Accord COP 15/CMP 5 de Copenhague sur le Financement Rapide approchant $30 milliards en 2012 et les arrangements de financement à long terme atteignant $100 milliards par an en 2020;

15 *Notant avec inquiétude* que seulement 2% des projets de ''clean development mechanism'' (CDM) ont leur origine en Afrique et accueillant avec joie la décision de l'Union européenne de concentrer sa demande en crédits carbone sur une fourniture par les LDCs tout en encourageant aussi les négociations

régionales et nationales sur les plans carbone en donnant la priorité à une fourniture par les LDCs et autres y compris l'Afrique et les SIDS.

16 En dépit du fait que l'Afrique en tant que continent a relativement peu contribué aux émissions de serre, nous prenons toutefois des actions décisives pour contribuer à la réduction de l'empreinte globale du carbone

Nous affirmons que:

17 Le changement climatique est un défi au développement qui menace d'inverser les gains en développement obtenus au cours des récentes années. Les économies et communautés Africaines, et les pauvres parmi elles sont les plus exposés au risque des effets négatifs du changement climatique ont contribué le moins à ce problème seront vraisemblablement parmi ceux qui en subiront le plus l'impact.

18 Étendre l'accès aux services d'énergie moderne et construire une sécurité de l'énergie est une priorité absolue pour répondre aux besoins élémentaires de millions de citoyens Africains, faciliter le développement humain et social, assurer la croissance économique durable et contribuer à la réussite des MDGs en Afrique et de ce fait bâtir une résistance aux impacts du changement climatique.

19 Seulement 42% des citoyens Africains ont accès à l'électricité. Dans l'Afrique subsaharienne seulement une personne sur trois a accès à une électricité fiable- le taux le plus bas du monde. Il en résulte des chances limitées pour l'éducation pour les enfants Africains et une chance de revenu amoindrie en particulier pour les femmes Africaines. Un accès insuffisant à l'électricité fait obstacle à la distribution des services sociaux tels que santé, eau et installations sanitaires.

20 La capacité totale de production de puissance du continent se situe a 124 GW des quels 30 GW sont le total de l'Afrique Subsaharienne (l'Afrique du Sud exclue): Une fourniture d'électricité peu fiable pèse de manière significative sur le développement économique de la région Subsaharienne. Elle affecte plus de 30 pays Subsahariens, réduisant la compétitivité et l'emploi et imposant des couts significatifs en particulier pour les zones urbaines en pleine croissance qui contribuent pour quelques 79 pour cent à la croissance du PIB en Afrique Subsaharienne..

21 Un but intermédiaire serait de soutenir et achever l'expansion de capacité actuellement programmée par des projets de transformation clé qui globalement peuvent ajouter une capacité de 30 GW supplémentaires dans les dix ans. Si seulement un tiers de cette capacité est utilisée pour la demande domestique, cela pourrait répondre aux besoins de 150 millions de personnes raccordées au réseau électrique.

22 Pour faire de l'accès universel une réalité pour 2030, 512 millions de personnes supplémetaires, 460 millions d'entre elles dans la région Subsaharienne, bénéficieraient de l'accès à l'électricité. L'échelle de ce défi requiert que toutes les approches, y compris les solutions sur et hors réseau soient prises en compte et adoptées sur la base d'un principe d'efficacité. Les demandes rurales et urbaines peuvent être mieux atteint avec un mélange de technologies diverses qui profite pleinement des ressources exceptionnelles de l'Afrique subsaharienne en solaire, éolien, géothermique, bio masse et puissance hydraulique durable.

23 Faciliter l'expansion des solutions d'énergies à bas prix et renouvelables est critique pour répondre aux besoins de base. Soutenir la transition vers des carburants renouvelables pour la cuisine et le chauffage

et l'emploi d'appareils de cuisson d'un meilleur rendement est également primordial dans le changement complet des implications sur la santé et la dégradation de l'environnement imposées par l'utilisation traditionnelle de la bio masse.

24 L'utilisation de production périmée et hautement insuffisante et de technologies en fin de vie sont la cause d'un gaspillage d'énergie inacceptable. Le déploiement rapide de technologies plus efficaces et une gestion améliorée de d'énergie sont une priorité critique pour le développement Africain et aideront à l'amélioration de l'accès à l'énergie et au développement d'énergie renouvelable.

25 Les Petits États et Territoires Insulaires en Développement (SIDS) ont à faire face à un obstacle sans précédent concernant le changement climatique et à la différence des pays continentaux ne peuvent bénéficier en aucune manière d'interconnexion pour l'alimentation en énergie. La vulnérabilité des SIDs devient encore plus critique du fait de leur dépendance à l'importation de carburants fossiles

Nous identifions les priorités suivantes:

26 Élargir de façon spectaculaire l'accès aux services modernes, propres et de haute qualité de l'énergie: L'accès à l'électricité en Afrique est encore inferieure à 35% à l'exception de l'Afrique du Sud, la consommation est autour de 1% du niveau des pays de l'OCDE . Environ 82% des foyers tributaires de la biomasse pour la cuisine, ce qui impose des risques énormes pour la santé et l'environnement. De plus la plupart des pays ont à faire face à des interruptions régulières du service, pénurie d'alimentation et montée en flèche rapide des prix.

27 Construire la sécurité de l'énergie en augmentant proportionnellement la fourniture régionale en puissance et transmission: Des groupements régionaux de puissance électrique ont été établis à travers le continent. L'augmentation proportionnelle et coordination régionale de la distribution et de la capacité de production permettra d'autres avantages d'importance, sécurité et diversité. De plus il est reconnu que les grands projets dans certains pays ne peuvent être développés que sur une base régionale.

28 Réduire la vulnerabilité au changement climatique et accroitre la résistance: Les nations Africaines sont parmi les plus vulnérables aux impacts négatifs du changement climatique. De ce fait nous devons donner la priorité à la résistance de nos infrastructures communautaires et économiques face à ces impacts. Les nations Africaines ont besoin de développer des approches et actions spécifiques au pays et adaptées aux régions qui permettront l'identification des actions d'adaptation prioritaires, une partie intégrée de leur développement durable et politiques d'éradication de la pauvreté, mesures et stratégies, tout en facilitant le développement. Nous avons de plus besoin de développer des centres régionaux qui peuvent établir des alertes précoces et des capacités de modélisation pour réduire le risque et accroitre la résistance.

29 Donner la priorité aux énergies propres: L'Afrique est richement dotée en ressources d'énergie renouvelable – beaucoup d'entre elles pouvant être développées en soutien d'un futur à bas carbone pour le continent. Avec le support du financement, de la technologie et du renforcement des capacités institutionnelles de la part des pays développés l'Afrique sera capable d'améliorer grandement son développement économique social et environnemental en utilisant une diversité de sources d'énergie propre.

30 Améliorer les performances du secteur et des services: La sous performance de la plupart des services et un obstacle clé à la croissance du secteur. Ceci est souvent du à une pénurie de compétence en direction

et de personnel qualifié associé à des ressources financières et humaines limitées pour la formation. La coopération dans le développement des compétences dans ce secteur à travers le continent est une priorité.

31 Le rôle clé de la gestion du coté demande et du rendement de l'énergie: L'expérience a montré que la gestion de la demande et les programmes d'efficacité énergétique peuvent réduire les couts, améliorer l'accès et la compétitivité internationale tout en réduisant simultanément les impacts environnementaux. Ils sont aussi essentiels pour assurer la conception optimale de systèmes d'énergie et l'intégration d'énergies nouvelles. Il existe un énorme potentiel dans les enseignements provenant des réussites Africaines et d'autres nations dans ce domaine.

32 Localiser les chaines logistiques: Tout en faisant croitre nos économies d'énergie, nous devons assurer cette localisation des chaines logistiques non seulement pour la fourniture d'équipements et de matériels, mais aussi l'entretien et le fonctionnement de nos installations - Ceci créera des emplois et accroitra les savoir-faire et réduira aussi les couts.

33 Planification intégrée: Le secteur de l'énergie ne fonctionne pas de manière isolée. Les l'infrastructure telles que les lignes électriques, les pipelines, l'eau, le transport sont interdépendants. Une planification intégrée est critique pour la durabilité et développement supplémentaire de nos économies et sociétés. De ce fait nous donnerons la priorité à la planification intégrée et au rôle du secteur de l'énergie dans le développement de nos économies, promouvant les investissements et la localisation ainsi qu'améliorant l'éduction, la sécurité et les soins de santé.

34 Obtenir les ressources financières: L'une des contraintes clé dans l'exécution effective de projets sur l'énergie à travers le continent est l'absence de ressources pour la préparation et le développement du projet – de la conception à l'accord de financement et l'exécution. De plus la plupart des grands projets sur l'énergie demandent un financement à long terme avec des remboursements liés aux résultats financiers du projet. Bien souvent la production de revenu est inadéquate pour soutenir le cout élevé actuel du capital et les longues chaines de valeur de vastes projets, et en tant que tel une partie substantielle du financement de ces projets doit être sous forme de subventions et capital accessibles à taux réduit à long termes – en particulier pour les projets de transmission interrégionale et renouvelables. De tels projets bénéficieraient aussi de traitements plus rapides par les institutions multi et bilatérales. De plus nous viserons à maximiser le flux de financement verts et fonds du carbone ainsi que l'utilisation des mécanismes du marché tels que le CDM.

35 Renforcement des capacités de technologie et d'innovation: Nous avons besoin de bâtir notre base technologique par l'entreprise de la Recherche et Développement (R&D) appropriés, développer notre base de savoir faire et faciliter le transfert de technologie et d'assurer que les technologies sont motivées par les besoins et appropriées aux conditions locales y compris d'entreprendre des projets d'évaluation des ressources régionales.

36 Nous avons besoin de d'apporter une considération particulière aux besoins des SIDs en termes d'amélioration de la capacité de production – promouvant l'utilisation de sources renouvelables d'énergie et également en termes de renforcement des capacités.

Nous décidons de poursuivre les actions suivantes:

37 Soutien pour l'expansion de la capacité de production avec emphase sur les projets régionaux. La meilleure voie pour accroitre la capacité de production au cout le plus bas et de développer des projets de production à grande échelle. Une approche de financement de projet dans lequel la participation financière du secteur privé à taux préférentiels et celle des donateurs sont mêlées sera habituellement requise pour développer ces grands projets. Ces projets sont invariablement complexes et demanderont des fonds significatifs de préparation de projet pour évaluer leur impact social et environnemental, pour entreprendre en amont le développement réglementaire et institutionnel et s'assurer de leur résistance aux impacts climatiques. Aujourd'hui, le financement disponible auprès des agences internationales pour entreprendre un tel travail de préparation en amont pour de vastes projets régionaux est inadéquat. Nous prions avec insistance la COP17/CMP717/ CMP7 de prendre en considération la mise en place de US$500 millions en tant que capital d'un fond de réserve de financement pour développer la prochaine generation de projets nationaux et régionaux de production, en mettant_l'accent sur le développement d'énergie propre - Un autre obstacle à la réalisation de vastes projets de puissance hydraulique et/ou de projets régionaux réside dans leur inéligibilité au marché du carbone et au soutien tel que les fonds CDM ou relatifs au climat - Nous demandons avec empressement à la COP17/CMP717/ CMP7 que les deux projets de puissance hydraulique à grande échelle et régionaux (transfrontaliers) soient déclarés éligibles pour un financement et fonds verts, y compris tous nouveaux mécanismes et instruments du marché ainsi qu'un appel pour leur accès à tout nouveau fond vert ou lié au climat.

38 Financement accru pour les activités de développement politique et institutionnel**.** Une planification, une conception et la mise en œuvre rapide de programmes d'accès accéléré couronnées de succès articuleront de manière critique l'aptitude des services nationaux, autres développement du secteur de l'énergie et institutions de gouvernance à entreprendre les fonctions clé techniques, de planning, gestion, commerciale et logistiques. Les pays peuvent choisir différentes formes de structures du secteur privé-public pour la mise en œuvre de programmes accélérés mais invariablement le besoin existera pour les services publics nationaux de remplir leur fonctions à des niveaux de compétence et d'efficacité sérieusement améliorés: améliorer l'efficacité du transport et de la distribution; adopter une stratégie sur la réduction des pertes; modernisation des systèmes de comptage, de facturation et de collecte;

Investir dans les biens d'équipement nécessaires et une technologie commercial efficace pour le réseau de distribution; et, améliorer la gouvernance d'entreprise et assurer la non interférence dans leurs activités d'approvisionnement, financières et commerciales. Nous conseillons vivement à la COP17/ CMP 7 17/CMP 7 de considérer la mobilisation d'un soutien et des ressources pour les programmes de développement de transfert accéléré et efficace de technologie et des ressources humaines avec une emphase particulière sur les échanges avec l'Afrique du Sud pour stimuler la capacité des institutions et professionnels Africains de l'énergie. Nous appelons aussi à un soutien international plus grand pour un réseau de centres régionaux d'excellence et de courants de financement innovants pour soutenir le développement, la propagation et le déploiement des technologies adaptées aux besoins de l'Afrique y compris les solutions du pays et autres solutions créatrices d'emploi, favorisent l'entreprenariat et contribuent à améliorer les profits à l'exportation.

39 Planification de l'énergie et coopération internationale. Une *approche large du secteur* pour accroitre l'accès à l'énergie possède le potentiel pour canaliser les ressources des donateurs de manière plus durable et de façon plus rentable cohérente avec la Déclaration de Paris[4]. Étant donnée l'échelle des investissements nécessaires, une approche systématique et climatiquement orientée de la planification et du financement de nouveaux investissements est critique. Une approche large du secteur emploie

4 Paris Declaration on Aid Effectiveness, Paris, France, March 2, 2005,

une planification intégrée résultant en un mélange de technologies, étant opportunément ciblés sur : (a) l'extension du réseau dans les zones urbaines et rurales où la densité de population et la distribution en permettent le moindre cout, (b) mini réseaux et systèmes hors réseau basés sur les technologies des énergies renouvelables pour les populations dispersées.; et (c) Systèmes d'énergie domestique à bas prix (par exemple : solaire, LED, couvertures de chauffe-eau, pommes de douche à faible débit etc.) ainsi que des appareils de cuisson d'un bon rendement, à travers le développement des marchés pour de tels produits. En plus du raccordement des foyers, l'électrification solaire des cliniques et écoles pour servir les communautés à faible revenu est une autre façon d'apporter les bénéfices de l'investissement dans l'électrification, directement à ces communautés. Nous demandons vivement aux partenaires en développement d'honorer leurs engagements de financement sur l'accès à l'énergie et la pauvreté en énergie et de fournir une assistance de financement accrue pour que les programmes d'accès aux fonds liés au climat soient mobilisés. Les Ministres Africains de l'Énergie à leur tour décident de mener et de se faire les champions de programmes solides pour la planification de l'accès et le renforcement de la structure politique et institutionnelle de mise en œuvre pour accélérer l'obtention de résultats.

40 Développement des échanges locaux et ressources en énergie. Soutien renforcé de la part des partenaires en développement pour accroitre le commerce régional de l'énergie et le développement de ressources en énergie propres et renouvelables - Urgence à soutenir les stratégies régionales et achever les projets régionaux clé de transformation qui assureront un approvisionnement durable, efficace et abordable en énergie basé sur des économies d'échelles et diversification du mélange d'énergie au niveau du groupement de puissance. Nous appelons la COP17/CMP 717/CMP 7 à assurer que les critères opérationnels_et d'éligibilité d'identification rapide et mobilisation des fonds verts soient utilisés en capital de départ en soutien des priorités de développement de l'Afrique, y compris inter alia, l'utilisation de sas vastes et largement inexploitées ressources en puissance hydraulique. De plus nous appelons la COP17/CMP 7 à adresser de manière urgente le CDM et le marché du carbone pour soutenir de manière similaire le développement des riches ressources hydrauliques de l'Afrique.

41 Le processus UNFCCC a à ce jour eu tendance à donner la priorité à l'atténuation des émissions. Nous croyions que l'adaptation aux impacts négatifs du Changement Climatique mérite une attention équilibrée. Nous appelons la COP17/CMP 717/CMP 7 à s'assurer qu'il existe un traitement équilibré de l'adaptation et de l'atténuation et en particulier que les projets d'adaptation soient reconnus pour un soutien du fond Climat Vert (Green Climate fund). Nous suggérons de plus que des modèles soient développés pour faciliter le développement des plans d'adaptation de pays et régionaux pour les pays et régions les plus vulnérables – particulièrement en Afrique.

42 Afin d'assurer le succès de ces actions, nous nous engageons à:-

a. Une coopération totale dans la réussite des actions ci-dessus

b. Coopérer au développement régional des plans intégrés d'énergie qui identifieront les projets d'énergie prioritaires à travers le continent. (Une liste des projets prioritaires critiques au développement de l'infrastructure Africaine de puissance électrique est jointe. Nous nous engagerons conjointement avec nos partenaires en Développement à assurer le futur de ces projets. Voir annexe 1)

c. Coopérer dans le partage des leçons apprises dans le domaine de l'énergie par la tenue d'ateliers et de programmes de formation.

d. Améliorer l'efficacité de nos installations d'énergie pour réduire les émissions et rendre l'énergie plus abordable

e. Travailler en partenariat avec les parties prenantes clé y compris les partenaires en affaires et nos

partenaires en Développement

En conclusion, nous faisons appel à toutes les institutions de développement multilatéral et au Secrétaire Général des Nations Unies et à toutes les Agences UN et Programmes pour soutenir globalement l'agenda transformationnel de l'énergie de l'Afrique - Nous faisons l'éloge de la République d'Afrique du Sud pour avoir pris l'initiative d'organiser et d'héberger cette importante conférence et reconnaissons le soutien des partenaires en développement qui ont redu possible cette Conférence, en particulier la Banque Mondiale, l'Organisation des Nations Unies pour le Développement Industriel et la fondation des Nations Unies et UN-Energy.

Johannesburg, Afrique du Sud le 16 Septembre, 2011.

ANNEX II – SUMMARY OF PANELIST PRESENTATIONS

An introductory panel and four technical panel sessions were held on the first day of the conference. The objective of the sessions was to facilitate dialogue and encourage knowledge-sharing that would then feed into the development of a road map for achieving universal energy access for Africa. A Ministerial Round Table and Dialogue followed on the second day. Each session was hosted by a chairperson/moderator. Summaries of the panelists' presentations are provided below.

Green Household Energy Solutions

Energy Access, Household Energy and Development
Mr. Daniel Kammen
Chief Technical Specialist for Renewable Energy and Energy Efficiency, World Bank 52

DAY 1 – INTRODUCTORY PANEL

The Challenge of Achieving Universal Access

Call for Action – Boosting Energy Access for Africa

Mr. Jamal Saghir
Director for Sustainable Development, Africa Region, World Bank

Presentation

Mr. Saghir opened by underscoring the current energy access levels in Africa compared to the rest of the world. Africa's urgent need for energy access was highlighted by a NASA satellite photo ('World at Night') showing most of the developing world in the 'dark;' Africa's lack of electrification was particularly acute. A second image showed Africa with brightly shining lights to demonstrate how differently Africa would look with universal energy access.

Africa will not be able to make sustantianl and sustainable progress without adequate electrification. The way forward ahead may be made less aurduous, depending on what actions are identified and acted upon now. Several challenges face Africa, including: only 31% of the population has access to electricity; 82% of households depend on solid biomass for cooking; regular interruption of services in approximately 30 countries; and 6% turnover in the formal sector (16% in the informal) due to power interruptions.

Large-scale energy programs are needed immediately in Africa. The requirements are beyond any one stakeholder; collective efforts are needed from all stakeholders to address the energy access challenge. The African continent is rich in energy resources but poor in power generation. There is, a need for all stakeholders to pick up the challenges put before them to light up Africa. If business as usual continues, universal energy access would be another 50 years away.

A table outlining Africa's energy future by year 2020 outlined two scenarios based on a business-as-usual path versus implementing concerted actions.

	Today	Africa in 2020: Business as Usual	Africa in 2020: Concerted Action
Installed capacity (GW)	78	81	100
Power consumption (kWh pc pa excl. RSA)	124	164	235
Electrification (% population)	30	34	49
Cost of power (US cents/kWh)	18	18	10
Hydropower (% consumption)	36	36	48
Power traded (% consumption)	16	16	40

Both Africa's energy future and the power sector stand to gain across the board through concerted actions rather than the lackluster business-as-usual path.

Installation capacity over the last decade was discussed. Historically, rates of expansion in generation capacity and electrification in Africa have been extremely low. On average, approximately 1 GW of generation capacity has been added annually. To put this in perspective, the 1 GW of expanded capacity on the African continent every year is equal to what China adds every two weeks. Recent financial commitments show a turning point for generation projects with support from the private sector, non-OECD partners and multilateral donors. Africa's power sector has recent commitments of 3 GW per year of new generation projects, and 6-7 GW per year and some 20,000 Km of regional transmission lines are in progress.

The World Bank believes that an additional 30 GW is possible by 2020, at a lower cost. Africa needs a regional trading block with regional integrations to enable an estimated 6-7 GW to be added every year. This effort would require South-South cooperation with capital flowing into the African power sector from emerging financiers such as China, India and Arab countries.

The next table illustrated the goal in the next ten years to add 30 GW. Capacity generation was broken down by GW, based on 'projects under construction' and 'projects to be prepared, depending on contributions from current financiers. Financiers included the World Bank, other multilaterals, emerging financiers (i.e., China) and the private sector.

The 30 GW target could be achieved in the next ten years, and in line with this, the World Bank has financed 8 GW so far, with China contributing approximately 5 GW. The private sector would have to repay its loans in order to start moving toward the 30 GW target. There is a need to make alternative renewable energies available with bankable projects. Such projects are very expensive, costing approximately $50 million in project preparation, and therefore cannot be achieved with a few million dollars. The World Bank and African countries need to talk together about the preparing projects to be carried out in Africa.

Major Independent Power Projects (IPPs) in some key African countries have the potential to develop additional generation capacity. Currently developed IPP capacities and future generation capacities from untapped IPP potential through specific technologies were discussed, with examples of large investments required to develop bankable projects that were implemented and are currently under preparation.

Financial, economic and environmental savings that can be achieved from regional power trade power pools include cost savings, lower long-run marginal power costs and emission reductions.

DAY 1 – INTRODUCTORY PANEL

The Challenge of Achieving Universal Access

The Energy Access and Infrastructure Challenge for Africa

Dr. Elham Ibrahim
Commissioner for Infrastructure and Energy, African Union

Presentation

Dr. Ibrahim opened by addressing the issue of differing levels of energy access in Africa.

Electricity access rates (2007 data) underscore the overall low energy access status of Africa. The majority of African countries are categorized into four groups according to electricity access rates: 10% or less, 11%-25%, 26%-50% and 50%-100%. It was predicted that less than 40% of African countries will reach universal access to electricity by 2050. Only nine countries currently have energy access greater than 50% and 11 countries have access of less than 10%, emphasizing the scale of the challenge of reaching universal access by 2050.

Africa's electricity consumption, compared to the rest of the world based on population size, total electricity consumption and per capita electricity consumption (2007 data), is the lowest worldwide.

In African households, more than 80% of energy demand is met through the use of inefficient biomass. The potential for biomass is becoming smaller and smaller as less becomes available. The underlying causes of the depletion of biomass resources are: several years of poor forestry practices, bad weather conditions, population growth and extensive agriculture.

There are several energy access constraints in Africa, key among them: inadequate generation capacity for production; exceptionally high costs for power generation; approximately 21 of 48 countries have less than 200 MW, below the minimum efficiency scales and working inefficiently relative to most countries; high costs of transmission and distribution networks, especially for remote populations; and the lack of synergy between energy and land use sectors in the overall management of the biomass sector.

Key areas for efforts toward energy access in the context of environmental challenges objective should focus on a balanced approach in accelerating the scale-up of improved energy access.

Steps should be taken to sustainably manage environmental challenges such as deforestation, desertification and climate change. Energy sector participation in the global climate change debates is one key area where efforts need to be focused to better mitigate tension. There is a need for increased focus on renewable energy sources such as wind, solar, modern biomass, geothermal and hydropower. Efficient production and use of energy at all levels, progressively transferring energy subsidies for fossil fuels to renewable energy technologies, are essential.

To meet the goal of universal energy access, approximately 7 GW of new generation capacity will be needed each year. The costs associated with infrastructure building, maintenance and operating costs needed to achieve

universal access is estimated to be $41 billion per year. This cost can be broken down into two components: a) $27 billion for capital expenditure and b) $14 billion for operation and maintenance. The various tools currently at the energy sector's disposal include, but are not limited to: diversified public-private partnerships; rural decentralized energy programs; efficiency of the power utilities; regional cooperation; innovative financing schemes for renewable energy (i.e., CDM, Green economy); and technical and organizational initiatives intended to support the financing and managing of businesses in the energy sector.

In addition to the above tools, African Union (AU) initiatives include the Program for Infrastructure Development in Africa (PIDA); Africa-EU Energy Partnership; Hydropower 2020; a Solar Study; and the Regional Geothermal Program. The AU has also set up the COEMA to combat institutional issues.

The AU initiatives, their specific objectives and current status updates are outlined below.

Program for Infrastructure Development in Africa (PIDA): Provides funding for infrastructure on the continent, bridging the infrastructure gap and promoting regional integration. The second report on this program has been received. All countries were invited to participate in the workshops for this program.

Hydropower 2020: Promote the development of the hydropower potential of the major river basins in Africa. This initiative has already begun and is in the advanced planning stage.

Africa-EU Energy Partnership: Target is to provide access to modern and sustainable energy services to at least an additional 100 million Africans by 2020.

Solar Study: This study promotes the development of all the African deserts' solar potential.

Regional Geothermal Program: Accelerates the development of the geothermal resources in the East African Rift System (EARS). This program was adopted two years ago with German support to look at geothermal resources. There are pilot projects in Kenya and Ethiopia.

The AU set up the COEMA to combat institutional issues. This body is responsible for governing and leading the energy sector in Africa. COEMA meets every two years to review plans, check targets and achievements.

To conclude, sustainable development and management of renewable energy resources are vital for scaling-up energy access, promoting energy security and placing African countries on a low-carbon development pathway. Africa has large potential for improving energy efficiency but countries need to work together in this area.

Climate change is a major development challenge for Africa. In addition, Africa is well endowed with renewable energy sources that are currently under-developed.

Africa should endeavor to speak with "one voice" and make provisions to be able to benefit from the various funding mechanisms.

DAY 1 – TECHNICAL PANEL

The Way toward Sustainable Universal Energy Access: Building Climate-Resilient Energy Systems

Mr. Edward Njoroge
Managing Director & CEO, Kenya Electricity Generating Company Ltd. (KenGen)

Presentation

Mr. Njoroge put the challenge faced by Africa into perspective by noting the sheer physical size of the continent; comparing the African continent, in terms of size and scale, to other large countries in the world; and Comparing the number of countries within Africa, the population size and estimated growth by 2030, the collective GDP and consumer spending forecasts.

Africa's energy consumption is led by biomass followed by petroleum, electricity, gas and coal. Inadequate power supply is the most severe limitation to new business development in Africa. The majority of the installed capacity within the African continent is found in Northern Africa and South Africa, leaving Sub-Saharan Africa with a very low level of installed capacity. According to a World Bank report, there are revenue losses of US$ 3 million in the power sector due to operating inefficiencies.

Africa's low electrification rates in urban and rural areas, including the entire continent, and estimates of per capita power consumption in comparison to developed countries were discussed. Africa's population percentage in the dark, is low relative to the total global population without access to modern energy access.

Africa has a challenge to scale-up renewables, especially due to very low use of current renewable sources (estimated at around 17%) in its energy generation mix. There is a need to address energy efficiency, including more hydro systems to scale-up renewables. The total cost of bridging Africa's power infrastructure gap over the next decade was estimated at US$41 billion a year.

There are four building blocks for a climate-resilient energy system in Africa: a) scaling-up renewables, b) energy efficiency, c) financing clean energy and d) regional interconnectivity. Some key highlights for each of the four areas are outlined below:

- Scaling-up Renewables

  The current resource potential in Africa to address the scale-up of renewables include: hydropower, geothermal, wind and solar. Currently, however, Africa has not fully exploited its entire renewable energy potential. The enormous hydropower potential within the continent is barely utilized. Geothermal resources are abundantly available but there is still much to be harnessed, especially in the eastern and western rift valley basin. Africa also has large wind power potential throughout the continent. Detailed studies need to be carried out to exploit the true wind power potential, especially in locations such as the municipality of Cape Town and the countries of Kenya, Ethiopia and Madagascar. Most of Africa is exposed to good sunlight, but solar technology is still too expensive to commercialize.

- Energy Efficiency (EE)

  Energy efficiency is essential, as the majority of all power generated in Africa (approximately 35%) is being lost through use of inefficient transmission lines. Improving EE has the potential to reduce investment required for new capacity, including the potential to reduce pollution and increase competitiveness.

- Financing Clean Energy

  The government, development financial institutions (DFIs), commercial banks, private sector, PPPs and capital markets (ABS, Bonds), including Carbon Finance CDM instruments, can all play an important role to finance clean energy projects in Africa.

- Regional Interconnectivity

  Systems need to be integrated throughout the African continent to leverage regional interconnectivity for universal energy access. Economies of scale, increased system reliability, a good energy generation mix and reduced dependency on thermal generation can all play a part in regional interconnectivity.

For example, Kenya started its EE programs in 2001 and has since gained cumulative savings of US$50 million with estimated annual emission reductions of 600,000 tons of CO_2. Currently, the government supports EE programs with annual funding of US$250,000. In addition, the Kenyan government estimates potential annual savings of US$40 million in the region.

Kenya is the first African country to exploit geothermal energy in a significant way, by involving both the private and public sectors in its development. It is estimated that by 2030, Kenya will have installed geothermal capacity of over 17,000 MW. The cost associated with reaching this capacity target requires an estimated geothermal investment in excess of US$17 billion by 2030.

Geothermal Finance can be broken in to three areas starting with Resource Exploration: mainly funded by government with high risk; Resource Assessment: mainly funded by government with high risk; and Power Plant Development: many outside parties willing to finance this stage. It is important to note that the Kenyan Electricity Generating Company (KenGen) took the initiative and did not rely on traditional financing to do the upfront work associated with resource exploration. KenGen, even though initially challenged, was successful in raising US$350 million through a public infrastructure bond followed by additional capital raised through the local Kenyan stock market to help start the initial drilling. Once momentum was achieved, DFIs helped raise another US$900 million. KenGen unlocked its finance through cooperation between the government and the utilities. Moving forward, there may be financial risks, but KenGen is determined to find funding sources to make way for private sector participation with additional capital mobilization.

KenGen's approach to making geothermal power a reality in Kenya is to act now, act together and act differently. What this means is, act now to attract government commitment for investments including seeking increased concessional funding. Act together in terms of regional interconnectivity and to reform existing carbon markets. And, act differently in terms of cost-effective tariffs and regulators being more proactive.

DAY 1 – TECHNICAL PANEL

The Way toward Sustainable Universal Energy Access: Building Climate-Resilient Energy Systems

Mr. Harry Verhaar
Sr. Director for Energy and Climate Change, Philips

Presentation

Energy access gowth in Africa is expected to happen much faster than in Europe. Africa has the opportunity to learn from Europe's mistakes and leapfrog with clean energy solutions and improved health systems.

Energy for all can be viewed from a historical perspective that ranges from basic needs to aspirational needs. The spectrum of these needs can run from energy, lighting, communication and healthcare, to entertainment and sports. These needs can be met through on-grid or off-grid solutions, dependent upon access constraints based on geographic locations such as being in a developing country versus a developed country.

The threat of climate change is real. Therefore, it is in everyone's interests to use limited resources intelligently to secure energy supply solutions. The key drivers for Energy Efficient (EE) lighting solutions can be 1) rising energy prices, 2) climate change, 3) security of energy supply and 4) economic growth. Philips estimates that there could be potential savings of around 40% through the use of EE lighting solutions.

Globally, off-grid lighting uses an estimated equivalent of 500 million barrels of oil per year with an annual cost of approximately US$50 billion. The African continent has high energy costs due to dependence on oil and kerosene to meet its basic energy needs. To compare, if all kerosene users substitute solar panels and LED lighting to meet their off-grid lighting needs, the estimated cost is only US$10-20 billion per year. As a result, the payback will be equivalent to half a year's supply of oil consumption with added cost savings. Benefits in using EE lighting include reduced energy costs, environmental benefits, reliable access to energy and economic growth.

The United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF) launched a new global initiative in 2009 to accelerate the phase-out of inefficient lighting in emerging and developing countries. This program was implemented in collaboration with the private sector by partnering with Philips and OSRAM. It aimed to reduce costs of electricity consumers and simultaneously reduce emissions of greenhouse gases.

Philips is providing a variety of solutions to improve the health and well-being of Africans through off-grid lighting. Some of these include EE lighting solutions in homes, schools, communities, businesses, hospitals, streets and outdoor playgrounds. The benefits of good lighting solutions in Africa allow its population to lengthen their day and improve education and also have better safety at night with street lighting.

Philips in Nairobi, Kenya, also initiated the Philips Solar Football Project during 2009. This EE lighting project contributed significantly to the socio-economic growth of Kenyans.

To conclude, off-grid EE lighting solutions have a higher upfront cost but can prove to be cost-effective in the long run. They can also contribute significantly to the socio-economic development of a 21st century Africa, creating a need to explore sources of financing for off-grid lighting solutions for Africa. The Lighting Africa initiative can serve as a driver for a greener African economy, allowing dialogue during COP17 and Rio +20 discussions. This initiative can be used as a proven model to help garner funds through the Green Fund, Carbon Finance CDM instrument including PPP initiatives focusing on EE lighting projects. Philips is committed to help shape the dialogue and partner with Africa to make this happen.

DAY 1 – TECHNICAL PANEL

The Way toward Sustainable Universal Energy Access: Building Climate-Resilient Energy Systems

Mr. Steve Lennon
Executive Manager, Corporate Affairs, Eskom

Presentation

Electrification levels in South Africa have risen significantly. Four-and-a-half million households have been added to the grid since 1994, with most using pre-paid services. Nevertheless, there is still a significant backlog of 3 million households without access to electricity with an estimated cost of US$5-7 billion needed for electrification.

Electrification at both the national and rural levels in South Africa has significantly grown with estimates of 30%-83% in urban areas and 12%-57% in rural areas. South Africa's electrification strategy, initially funded through tariffs and later by a fiscus, has focused on schools and clinics and also provided protection for the poor through the Free Basic Electricity initiative.

Access to energy fundamentally changes the way a society operates, and improves the resilience of a society as a whole. Examples of such changes include direct and indirect job creation, development of small businesses, improvement of air quality and improvement of education and skills through access to modern communication, to name a few.

The Eskom project aimed at sustainable universal access in South Africa has been successful in providing energy access while building climate-resilience. Success stories of Eskom include job creation, development of Small & Medium Enterprises (SMEs) with potential economic growth, air quality improvement (through replacement of coal and wood), improvement in education and skills including access to modern communications systems. In addition, there have also been safety and health care benefits through lighting, refrigeration and communications initiatives. Energy access improves the resilience of society as a whole. Thus, the overall external benefits achieved through the Eskom project, far exceeds the costs.

Africa is most vulnerable to the negative impacts of climate change. No matter what is done in terms of mitigating carbon emissions, it will be impossible to avoid most effects and impacts of climate change in the future. When Africa increases the robustness of its infrastructure needs, careful consideration should be given to macro issues such as technology choices, what will change in terms of supply and demand, the impact of changing weather conditions, etc.

Eskom has been successful in building a sustainability nexus by linking energy access with mitigation and adaptation strategies to develop climate-resilient energy systems. With this in mind, Eskom has developed robust energy systems with advanced infrastructures that have improved the resilience essential to adaptation. Furthermore, Eskom's adaptation strategy includes: a) increasing the robustness of infrastructure designs and factoring climate change into long-term investments; b) reversing trends that increase vulnerability; and c) improving employee / societal awareness and preparedness for future climate change.

Some examples of Eskom's adaptation strategy include the technology used for the dry cooling power stations in Kendal and Matimba, with 300 MW capacities requiring only one-tenth of the water that conventional wet cooled power stations use.

South Africa needs to be aware of the vulnerability of its transmission infrastructure. For example, 40% of line faults are due to weather conditions. There is a need to find ways to make the new infrastructure more resilient. South Africa has abundant energy resources and needs to find ways to utilize and diversify its energy mix.

The Eskom strategy to build a sustainability nexus has evolved from planning future energy investments through South Africa's Integrated Resource Plan, referred as IRP 2010. This energy investment plan maps out the potential energy future until 2030 based on harnessing cleaner sources of power through a 'super grid' within the Southern African Development Community (SADC). This super grid, consisting of very rich energy resources such as coal, natural gas, hydro, geothermal, wind, solar and nuclear, seems to promise significant avenues for growth to ramp-up regional energy access with approximately 43 GW of new generation capacity.

The addition of the new 43 GW to the energy access infrastructure allows South Africa to boost its generation capacity to 85 GW in total, relative to the current capacity of 42 GW. This new energy access path not only creates a climate-resilient energy mix but also allows South Africa to diversify its energy sourcing with only 15% of new projects coming from coal. In contrast to the current energy mix, which is highly dependent on coal, this new energy strategy puts South Africa on a low-carbon path with an estimated reduction of 34% in greenhouse gas emissions and an even further reduction of 60% in water usage intensity leading up to the year 2030. The new energy mix for the additional 43 GW of generation capacity will include 23% nuclear, 22% solar, 20% wind, 14% gas, 6% hydro and 15% coal.

In conclusion, increasing the robustness of infrastructure designs and factoring climate change into long-term investments in South Africa, makes energy access a key enabler of sustainable economic growth and development.

DAY 1 – TECHNICAL PANEL

Building the Wires, Capacity and Harmonization for True Regional Integration

Mr. Jasper Oduor
Executive Secretary, Eastern Africa Power Pool (EAPP)

Presentation

Mr. Oduor provided an introduction of the Eastern Africa Power Pool (EAPP) followed by the EAPP's objectives, including its current activities and achievements as outlined below.

The EAPP was established in 2005 and currently has nine members with 12 utilities. Potential future members include Djibouti, Eritrea, Somalia, Southern Sudan and Uganda.

The EAPP has several objectives, including: secure power supply for the region's countries; optimize the use of energy resources; coordinate system planning, development and operation; increase power supply in the region; reduce electricity cost by interconnection and power trade; provide efficient coordination in power production, transmission and trade; create a conducive environment for investment; and facilitate the development of a competitive electricity market.

EAPP's current activities are wide-ranging and include institutional development, harmonization with the regional grid code (powering progress) and coordination and collaboration. Some of the EAPP's main contributions to regional cooperation thus far are as follows: the drafting of a governance structure; the development of market designs and roadmap to 2025; approving a regional master plan and grid code; reviewing market rules; recruiting key RMOC and RRC staff; capacity-building for utilities and staff; the harmonization of technical standards; and establishing excellent relations with partners.

The EAPP region is rich in resources such as hydro, geothermal, gas and oil. In addition, wind and solar resources also exist throughout the entire EAPP region, while biomass is available in most areas.

Thre is good hydropower potential in the central and southern parts of the EAPP region. Countries such as DRC and Ethiopia have solid hydropower potential estimated at 100 GW and 45 GW, respectively. The EAPP region, which is home to the great East African Rift Valley, also has abundant geothermal resources spanning most member countries. Currently, Kenya is the most active, with the highest installed geothermal capacity in the region. Although not fully exploited, studies for geothermal exploration are underway in many EAPP member countries. Uganda and DRC also have oil resources.

The power supply demand in the EAPP region is growing at approximately 7%, which is currently double the GDP growth rate. However, over the last decade, there have been droughts and power shortages, and there is low system reliability with average power losses of approximately 23%.

The three imperatives for regional power integration are wires, generation capacity and harmonization. 'Wires' provide interconnections between countries and facilitate access to cheaper energy. Interconnections with many

countries also help avoid overdependence on a single country or its resources. In addition, for the second stage of the EAPP regional market, interconnections must be in place for trading between any two countries. 'Generation Capacity' with surplus capacity is at the heart of power trade. Surplus capacity improves reliability, affordability and access. 'Harmonization' is the third imperative required for regional power integration and highly necessary for technical compatibility and legality. Harmonization allows legal, institutional, regulatory and policy provisions of countries within the region countries to be assessed. In the context of harmonization, although no member country restricts cross-border trade, explicit provisions are needed in most countries' legal, regulatory and policy frameworks.

In order to achieve regional power integration, the EAPP region has identified feasible interconnection projects. Some ongoing interconnection projects making good progress are between Rwanda-DRC-Burundi; Kenya-Uganda; and Kenya-Tanzania. In addition, there are concrete pledges for the Ethio-Kenya interconnector. EAPP has also identified regional generation projects to fulfill the capacity imperative while encouraging attention to wind and geothermal technologies.

The future of regional power integration in the EAPP region looks positive. As a result, it is expected that thermal production will decrease with an increase in hydropower due to power trade. The 2020 prospects show that Kenya will produce approximately 30,715 GW through geothermal technologies and another estimated 1,134 GW through wind technologies.

DAY 1 – TECHNICAL PANEL

Building the Wires, Capacity and Harmonization for True Regional Integration

Mr. Pius N. Gumbi
Chairperson for the Executive Committee, Southern African Power Pool (SAPP)

Presentation

The Southern African Power Pool (SAPP) currently consists of 12 member countries with approximately 230 million people. The energy generation mix of the SAPP, consisting primarily of coal (74.3%), hydro (20.1%), nuclear (4.0%) and gas/diesel (1.6%), was shared. The main countries within the SAPP that contribute to these major types of energy resources are: South Africa—coal (80.4%), Mozambique—hydro (5.0%), Zimbabwe—nuclear (4.1%), Zambia—gas/diesel (3.6%), DRC—hydro (2.6%) and Other—rest (4.3%).

The SAPP Pool Plan outlines the challenges and opportunities for increasing power trade in the SAPP. Currently, this plan is in the process of being revised through stakeholder engagement and consultation with the objective of outlining the priority projects for funding considerations.

A table outlined the "Demand of Transmission Capacities on Critical Corridors in SAPP." Key opportunities include ZIZABONA interconnector projects, SAPP Central Transmission Corridor and the Mozambique-Malawi interconnector.

SAPP's position on climate change features several initiatives that SAPP member countries are encouraged to implement, including: raise awareness and promote training and capacity-building within their respective organizations at all levels; support the establishment of an inventory of applicable greenhouse gases; and become involved in the climate change projects.

SAPP's Renewable Energy (RE) initiatives would mitigate climate change utilizing the region's significant RE:. biomass, geothermal, solar, wind, hydro and ocean energy. Highlights of these RE resources include:

- Wind

  The energy potential for Southern Africa has been estimated at 16.0 Twh/year. Wind energy projects are being implemented in all SADC countries, though at different magnitudes. Eskom has started development of 100MW wind facility on the West Coast of RSA.

- Solar

  This is the most abundant of all energy resources. Solar potential in Southern Africa is estimated at between 25,000 to 30,000 Twh/year.

- Geothermal

Studies indicate that Malawi, Zambia & Tanzania & Mozambique have a potential of 4,000MW from geothermal.

- Ocean Energy

  South Africa has undetaken studies to assess the energy potential of the ocean; Eskom has completed an ocean energy assessment.

Overall, the SAPP expects to increase RE contributions from the current 20% to 29% by 2030.

In addition to the RE initiatives, SAPP is active in Energy Efficiency (EE) initiatives through the introduction of energy-saving bulbs, commercial lighting, solar water heaters and hot water load control measures. SAPP has currently realized 850 MW through saved power including playing an active role in transmission loss reductions.

The role of governments, regional economic communities, donors and financiers in advancing key transformational cross-border projects was briefly discussed. There is a need to develop financial models customized to cross-border projects including SAPP's efforts to work with donors and financiers to implement least costly solutions to promote cross-border energy trading. The key barriers to investors are tendering procedures, low tariffs and political instability.

SAPP has completed a study to calculate the Grid Emission Factor. This study has enabled SAPP to identify important emission levels within the SAPP region and assess the Carbon Finance impacts. SAPP is currently working to register CDM projects for the region and has identified the need for policy reform to make CDM a success.

The current practice within the SAPP region is to administer an "Earth Hour" by encouraging individuals and businesses to turn-off electricity to conserve energy for an hour, every year. The first "Earth Hour" was held on March 26, 2011, and all SAPP countries recognized its significance. The second "Earth Hour" is scheduled for March 30, 2012.

DAY 1 – TECHNICAL PANEL

Securing the Resources for Green Growth

Mr. Varadarajan Atur
Energy Program Coordinator, Africa Region, World Bank

Presentation

Business-as-usual will not win the war on darkness and only 50% of the Sub-Saharan population will have access to modern energy by 2030. Considering expected population growth in Africa and putting things in perspective, meeting universal energy access by 2030 will require a substantial scale-up and expansion of generation capacity.

More than 7 GW of new generation capacity is needed annually for a decade in order to meet suppressed demand, keep pace with projected economic growth and support the rollout of electrification. Power Pools spanning the continent play a key role in supporting this new generation capacity. The four main power pools identified in order of generation capacity are Southern Africa Power Pool (SAPP) with 33.3 GW, West African Power Pool (WAPP) with 18 GW, Eastern Africa Power Pool (EAPP) with 17.1 GW and Central Africa Power Pool (SAPP) with 4.4 GW. These four power pools allow a total of 72.8 GW of generation capacity for the African continent.

Several actions are needed in the short- to medium-term in order to build a thriving and sustainable energy future for Africa. Paramount among these are five actions: a) scale-up green technologies; b) complete planned capacity expansion of 30 GW; c) focus on large-scale transformational projects; d) exploit the potential of major Independent Power Projects (IPPs); and e) complete interconnections critical to energy access. These actions are detailed below:

- Scale-up green technologies

  The African continent is well endowed with renewable energy sources. Moreover, Africa has nearly one-tenth of the world's total hydropower potential with 45 GW of economically feasible generation capacity, more than 15 GW of geothermal power potential in the Rift Valley Region and approximately 8% of world's proven natural gas reserves in the countries of the Gulf of Guinea. In addition, the continent is rich in wind and solar potential, which needs to be exploited at scale.

- Complete planned capacity expansion of 30 GW

  Africa has nearly 31 GW of planned generation capacity for the next 5-7 years. Just over half (15.6 GW) of this planned capacity is already under construction, with the remaining 15 GW still to be prepared. Once completed, this 31 GW of planned capacity can double Sub-Saharan Africa's (SSA) current capacity, excluding South Africa. To complete this planned capacity, commitments need to be shared equally by multilaterals, emerging financiers and the private sector. The table below outlines specific commitments (shown in GWs) undertaken by the World Bank (4 GW), other multilaterals (4 GW), emerging financiers (4 GW) and private sector (3 GW) to complete the remaining 15 GW of planned capacity.

	Under Construction	To Be Prepared	Total
World Bank	8.0	4.0	12.0
Other multilaterals	1.4	4.0	5.4
Emerging financiers	4.8	4.0	8.8
Private sector	1.4	3.0	4.4
TOTAL (GW)	**15.6**	**15.0**	**30.6**

- Focus on Large-Scale Transformational Projects

  Africa developed only 8.5 MW of hydropower during the last decade. The continent has large-scale hydropower potential in the range of 30 GW through large-scale transformational projects that are capable of changing its economic outlook. As shown in the table below, Ethiopia, Guinea and DRC have tremendous untapped hydro potential to be explored through large-scale transformational projects.

Country	Hydro Developed in last decade (MW)	Hydro Potential in next decade (GW)
Ethiopia	2.8	8.2
Guinea	0.8	4.3
DRC	1.3	4.0
Sudan	1.4	3.7
Mozambique	0	3.2
Cameroon	0.2	2.4
Zambia	0.5	2.0
Uganda	1.1	1.2
Ghana	0.4	1.0
TOTAL	**8.5**	**30.0**

- Exploit Major Independent Power Project (IPPs) Potential

  To date, 2.9 GW of planned capacity is expected to be generated through IPPs within the next five years. Africa can utilize IPPs to exploit an additional 13.6 GW of generation capacity with 4 GW of this realizable within the next four years, mainly through coal, gas, geothermal technologies and some oil. South Africa, Botswana and Mozambique have high potential to exploit IPPs based on coal technologies, while Nigeria and Ghana lead in Natural Gas.

- Complete interconnections critical to energy access

  In order to harness the true potential of the power pools for energy access in Sub-Saharan Africa, strategic transmission links needs to be prioritized. These include: a) links that allow major hydro and thermal hydro producers to export; b) links with small country economies with major impact/fast payback; and c) North-South equator links that may play a key role with climate change.

The total funding need associated with the planned capacity expansion of 30 GW is more than US$27 billion. To maintain momentum, there is an urgent need to act quickly to bridge a US$14 billion financing gap associated with the remaining 15 GW of pre-identified generation capacity. To achieve this US$14 billion funding target, the

World Bank, other multilaterals and emerging financiers including the private sector must play a major financing role. The amount of financing needed by each of these entities is shown in the following table:

US$ billion	Funded as of 1/1/11	In Need of Funding	Total
World Bank	5.5	3.2	8.7
Other multilaterals	1.9	3.2	5.1
Emerging financiers	3.9	3.9	7.8
Private sector	2.2	3.4	5.6
TOTAL	**13.5**	**13.7**	**27.2**

Major challenges exist, in particular for countries and project developers/sponsors, to achieve universal energy access in Sub-Saharan Africa. These range from geo-politically challenging projects that often require multi-country cooperation to extremely high upfront developmental costs with long-term payment risks, including sponsoring institutions lacking the capacity to develop, prepare and finance such projects. A different set of challenges exists for commercial banks, multilateral development banks and international finance institutions. Weak sectors and non-creditworthy public utilities preclude public-private partnerships (PPP) while commercial financing for environmental and social safeguards raises transaction costs.

Africa can overcome these challenges by exploring regional energy opportunities, building credible regulation and improving governance. Strengthening capacity and increasing resources to prepare a pipeline of bankable projects and adopting global standards for project implementation are key to addressing the major challenges.

Project preparation costs for bankable projects can account for up to 10% of overall project costs, and, existing donor project preparation facilities are rarely able to provide grants of more than $1-10 million. Based on Africa's needs, there is a grave need for a dedicated Project Preparation Grant Facility with an estimated US$500 million in initial funding to develop large transformational power projects.

Green-growth financing can be combined as risk allocation and mitigation instruments to de-risk projects and promote private financing. Governments can also contribute to upfront exploration of green projects with added leverage from green finance. Green-growth financing can expand resource mobilization from within the sector by developing major PPP programs and harnessing donor resources to complete key transmission lines. Banks can contribute by buying down technology risks associated with renewable energy projects and engaging the private sector through effective deal structuring.

There are two types of concessional finance mechanisms to assist green growth. The first, traditional concessional finance, consists of government finance, Official Developmental Assistance (ODA) thorough multilateral development banks (MDBs) including bilateral finance and the private sector. The second type of concessional finance is climate-related concessional finance, better known as climate finance. Climate finance encompasses capacity building, special finance to convene global expertise and resources to buy down risk and investment cost of innovative technologies.

Climate finance instruments available for Africa to meet universal energy access include the Global Environment Facility (GEF), the Clean Technology Fund (CTF) and the Scale-up Renewable Energy in Low Income Countries (SREP) structured through the Climate Investment Fund (CIF), Carbon Finance (CF) and the Green Climate Fund currently under development. A host of other concessional finance instruments are available for green growth through the private sector and official developmental assistance initiatives thorough multilateral and

bilateral development institutions.

Some of the key criteria needed to access these climate finance instruments can be outlined as:

- Rapid deployment of low-carbon technologies on a significant scale;
- Transformational impacts and replicability;
- Reduction in greenhouse gas emissions;
- Environmental sustainability;
- Co-benefits including gender impacts; and
- Accredited national institution required for direct access of green finance.

For Africa, there is a need to think differently to facilitate access to climate finance. It is important to design new climate-related instruments tailored to address costs, risks and barriers inherent to Africa's power sector. The CDM should be reformed to incentivize Africa's leapfrogging toward low-carbon development. Technology transfers are essential to the facilitation of Africa's adoption of greener energy technologies. It is important to keep in mind that new technology transfer cannot be achieved without proper capacity building initiatives. In conclusion, the goal for 2020 should be achieving the planned 30 GW of capacity expansion for Africa.

DAY 2 – MINISTERIAL ROUNDTABLE

Green Household Energy Solutions

Energy Access, Household Energy and Development

Mr. Daniel Kammen
Chief Technical Specialist for Renewable Energy and Energy Efficiency, World Bank

Presentation

Heavy reliance on solid fuels for cooking is particularly high in least-developing countries (LDCs). Based on International Energy Agency (IEA) data from 2010, the LDCs and regions showing "percentages of households using solid fuels for cooking" were grouped in four quartiles as 25% and under, 26%-50%, 51%-75% and over 75%. Approximately 2.7 billion people around the world still rely on solid fuels to meet basic energy needs (i.e., cooking & heating) in the 21st century.

The "people without access to electricity (in millions)" within the same LDCs and regions. compared between 2009 populations and predicted 2030 populations based in rural and urban areas showed that today, 1.4 billion people lack access to electricity and, based on current trends, approximately 1.2 billion people will still lack access in 2030. An additional billion people will have intermittent/unreliable access. Sub-Saharan Africa (SSA) is one of the only regions in the world where the absolute number of individuals that lack access to electricity is forecast to grow, based on. a 2011 report written on "Energy Access Scenarios to 2030 for the Power Sector in Sub-Saharan Africa."

Monthly cooking costs from a case study in Tanzania showed five types of different fuels were use: charcoal (unimproved), charcoal (improved), electricity, LPG and kerosene. Comparisons were made on the monthly cooking costs between 1990 and 2004 for each of these fuel types. A baseline for the "lowest cost option" was established at 2000 Tanzanian Shillings per month (Tsh/month). Based on the data, electricity and charcoal (improved) were identified as the lowest cost options in 1990. By contrast, charcoal (improved) was the least-cost option in 2004. The study noted that across all five fuel types, in both 1990 and 2004, electricity was identified to be cheaper than using either LPG or kerosene.

There are several key negative health and environmental impacts from the use of biomass. Exposure to indoor air pollution (IAP) has been identified as a significant public health hazard, resulting in almost two million premature deaths in women and children each year. Unsustainable production of wood fuels is also a serious threat to forest cover in SSA.

Approximately US$8.2 billion is spent annually on inferior lighting fuels. Kerosene and candles are primary inferior light sources, followed by biomass, and are the major contributors to annual spending in off-grid households. Inefficient fuel-cost lighting is a major industry in Africa, with annual costs of approximately US$10 billion dollars.

In contrast, "high quality modern lighting" improves lives and can be effectively brought onto the market. The benefits from access to high quality modern lighting are: better value than fuel based lighting; better safety with less risk to fire hazards in households; better health benefits resulting from reduced exposure to IAP; and

versatile improvements to households and SMEs including the added service to charge cell phone batteries through modern lighting solutions.

Based on IEA data from 2010, two scenarios related to Clean Cooking and Electricity Generation for Universal Energy Access for SSA by 2030 were discussed.

The Clean Cooking scenario started by outlining the population (in millions) that show "reliance on traditional use of biomass" for the years 2009, 2015 and 2030. Costs associated (in billions) with the "Investment requirements for Clean Cooking" ranging over two periods, 2010-15 and 2016-30, project US$4 to 9 billion investments for each respective period.

The Electricity Generation scenario initially outlined the "population lacking electricity access" based on rural and urban comparisons for years 2009 and 2030. This was followed by "Generation requirements in Twh broken down into three categories: on-grid with 195 Twh, mini-grid with 187 Twh" and off-grid with 80 Twh, respectively. The costs associated with the "investment requirements" over the two periods, 2010-15 and 2016-30, ranged from US$80 to 262 billion.

There are several "Green Household Energy Solutions" and World Bank initiatives. The "Clean Cooking" initiatives to help accelerate energy access in African households include new technology developments through the use of improved "cookstoves" that facilitate reductions in a) fuel use, b) time to cook and c) emission reductions were highlighted. Because of the combustion and heat transfer efficiency of these improved cookstoves, users were able to decrease fuel use by 30%-50% and reduce emissions by 50%-90%. The variety of cookstoves available on the market, based on needs and preferences, include health, gender and environment benefits.

The Africa Clean Cooking Initiative (ACCI), sponsored by the World Bank, is "A market-transformation program to facilitate scale-up of private sector investments in clean cooking solutions in Africa." Key elements of the ACCI are: World Bank's strategic partnership with Global lliance for Clean Cookstoves"; strengthen and support the private sector along the value chain; scale-up of sales to build the green job sector, providing a platform for innovation and outlet for African entrepreneurs; and share experiences in household energy, including the Lighting Africa experience addressing market barriers.

New technology developments in LEDs, PV and batteries have helped create a new market niche for lighting. There is a variety of off-grid lighting products catering to the "base of the pyramid" consumers, including their performance and affordability. There are many benefits associated with these new lighting technologies, starting with better lighting that enables cost savings due to the non-use of kerosene and other fuels. Moreover, the significant improvements expected to be made in the near future would result in more efficient and less-costly lighting technologies to the users.

The "Lighting Africa Program," a joint World Bank/IFC initiative, was piloted initially in Kenya and Ghana, and subsequently expanded into East Africa, Nigeria and Francophone West Africa. The five components of the program to address market barriers were discussed, along with the names of several partner organizations for both the Lighting Africa and Clean Cookstoves initiatives.

Data show correlations between high reliance on solid fuels and poverty. In particular, a case study from Kenya has linked observed illness reductions based on average daily exposure levels from combustion of different types of solid fuels.

There is a greenhouse gas marginal abatement curve that demonstrates the monetary ($ saved) and emission reductions (tCO_2 conserved annually) benefits through the use of various Energy Efficiency (EE)/Conservation and Renewable Energy (RE) solutions.

ANNEX III – CONFERENCE BACKGROUND MATERIALS

Six background issue papers were prepared to support the technical panels. Their titles and key messages are briefly summarized below:

CLIMATE RESILIENCE AND ENERGY ACCESS: A TOP PRIORITY FOR AFRICA

Key issues

- Africa contributes less than 4% of global CO_2 emissions, but it is the continent most vulnerable to climate change and least prepared to deal with its effects.
- Climate change will threaten food and energy security through higher temperatures, extreme events, and changes in rainfall.
- 585 million people do not have access to modern energy in Sub-Saharan Africa.
- Energy poverty is hindering development in Sub-Saharan countries and is a barrier to economic growth and the successful achievement of the Millennium Development Goals.
- Energy access could increase climate resilience while addressing the energy access gap.

Climate change may affect Africa's economic growth

Over the last several years, climate change has become a worldwide concern. According to the Intergovernmental Panel on Climate Change (IPCC), global temperatures are expected to increase 1.8–4.0 degrees Celsius by the end of the century (IPCC, 2007a). Tropical cyclones (hurricanes and typhoons) are likely to become more intense, with higher peak wind speeds and heavier precipitation associated with warmer tropical seas. Precipitation is likely to increase at high latitudes while decreasing in most subtropical land regions (e.g., Egypt). Extreme heat, heat waves, and heavy precipitation (floods) are likely to become more frequent.

Africa is not exempt from climate change. The continent has warmed about half a degree over the last century, and the average annual temperature is likely to rise an additional 3–4 degrees by 2099 (IPCC, 2007a). Dry areas will become drier and wet areas wetter, amplifying droughts and floods. And rising sea levels could affect coastal communities and their economies.

Climate change may exacerbate existing malnutrition and food-scarcity problems in Africa. As predicted by models, between 75 and 250 million people in the continent could suffer an increase in water scarcity by 2020 due to climate change. Yields from rain-fed agriculture could decrease by as much as 50 percent in some countries, while rising water temperatures in large lakes may decrease fish stocks, affecting food supplies (IPCC, 2007b).

Desertification in North Africa. In North Africa, longer periods of drought may accelerate desertification and shift the desert's limit further north, shrinking the land area suitable for agriculture. At the same time, the Sirocco, a hot, dry, southerly wind, is likely to be exacerbated by low rainfall and higher temperatures, causing serious damages to crops.

Agricultural losses and malaria in Sub-Saharan Africa. By 2080, Sub-Saharan countries will suffer a 5–8 percent

(60–90 million hectare) increase in areas suffering from severe dry conditions, causing up to 12 percent net losses in cereal production (Fisher et al., 2008). And by 2050 malaria may become a problem in densely populated areas of Zimbabwe as well as the highlands of Ethiopia, Kenya, Rwanda, and Burundi, which are currently largely malaria-free (IPCC, 2007b).

Permanent GDP losses from climate change. Projections suggest that climate change may lead to significant economic losses. Assuming warming of 2–3 degrees, the cost of climate change could be equivalent to a permanent loss of 0–3 percent in global world output. Increasing the warming estimate to 5–6 degrees would cause a 5–10 percent loss in global GDP, with poor countries suffering costs in excess of 10 percent of GDP (Stern, 2007).

According to a study by the World Bank in three Sub-Saharan countries (World Bank, 2010a):

- Ethiopia's GDP by 2050 could be 2–8 percent lower than its no-climate-change baseline growth path if the country does not invest in adaptation options (increases in temperature of up to approximately 2°C and an increase or decrease in precipitation depending on the models and on the region).
- Ghana could see its GDP decline by 2–7 percent by 2050 from the baseline growth path without climate change, with its water and energy sectors expected to decline by 3–6 percent (increases in temperature of up to 2.2–2.4 °C and decrease in rainfall between –9 and –14 percent).
- In Mozambique, climate change could cause GDP to be 4–14 percent below baseline growth in the 2040–50 decade if adaptation strategies are not implemented (increase or decrease in precipitation depending on the models and on the region; temperature increase of 1–2 °C).

Access to energy—defined as access to adequate, reliable and sustainable electricity services for households needs, public services and productive uses, as well as access to modern fuels and technologies for cooking and heating—is critical for poverty alleviation, economic growth, and climate change resilience.

Africa's rate of access to electricity is the lowest in the world—just 42 percent. The situation is even more acute in Sub-Saharan Africa, where just 31 percent of the population has access. Moreover, 25 countries in Sub-Saharan Africa are in a state of power crisis, with continuous blackouts and rationing (World Bank, 2010b).

Access to electricity could increase climate resilience in many sectors

Electricity access produce benefits across many sectors and can make populations and their economies less vulnerable to extreme events, climate change and social and economic shocks (table 1).

Table 1. Effects of climate change and electricity access in Sub-Saharan Africa

Sector	Impact of climate change	Benefits of energy access
Agriculture and fishing:		
• These are key sectors for economic growth and poverty reduction (30 percent of GDP and 70 percent of employment) (World Bank, 2009) • 95 percent of cultivated land is rain-fed (World Bank, 2009)	• Crop productivity losses due to more intense droughts and shifts in rainfall patterns • Significant losses due to crop failure and livestock death • Decrease of fishery resources in large lakes due to rising water temperature	• Higher cropping intensity and more polyculture (e.g., multiple cropping) • More irrigated land • Improved harvesting processes and storage of crops (e.g., silos) • Expanded productivity and competitiveness in the agriculture sector

Sector	Impact of climate change	Benefits of energy access
Water:		
• Water is a vital development component for nearly every sector in Africa	• Changes in average temperature and precipitation leading to water scarcity • Rising sea levels causing salinization of the drinking water system	• Adequate pumping capacity for providing drinking water • Better irrigation systems • Less time spent carrying water leaving more time for income-earning activities (e.g., farming) • Lower risk of water-borne diseases
Health:		
• Africa is already vulnerable to several climate-sensitive diseases, such as Rift Valley fever, cholera, and malaria	• Increase in temperature spreading malaria to higher altitudes (14 percent increase in cases of malaria by 2030) Hay et al., 2006) • Increase in malnutrition and diarrheal diseases owing to droughts and consequent losses in crop productivity	• Ability of hospitals to operate and store vaccines • Reinforced response systems for vector-borne diseases (e.g., malaria)
Education:		
• In 11 countries, 50 percent or more of young adults have fewer than four years of education (UNESCO, 2010) • Sub-Saharan Africa has registered remarkable progress since 1999, reducing its out-of-school population by nearly 28 percent as of 2007 (UNESCO, 2010)	• Higher global food prices pushing more people into extreme poverty, forcing families to cut back on schooling or withdraw their children from school entirely	• Ability of children to study at night • Expanded learning and education opportunities • Access to computers and other sources of information • Access to new knowledge and skills to adapt livelihoods to climate change
Household sector:		
• Only 42 percent of Africans have electricity in their homes, which depresses basic household needs (including access to adequate lighting, cooling, water and sanitation) and the productivity of home-based businesses.	• Damage to residential and commercial infrastructure due to flooding and surface erosion • Inundation and damage to bridges, roads, and other infrastructure due to rising sea levels • Lower food security and higher poverty owing to reductions in crop yields	• Adequate household access to basic lighting and beyond (heating, cooling, powering appliances) • Improved productivity of home-based production and businesses
Industry:		
• Inadequate power supply constraints productivity and competiveness in the economy at large	• Damage to industrial infrastructure due to flooding and surface erosion • Inundation and damage to bridges, roads, and other infrastructure due to rising sea levels	• Expanded productivity and competitiveness in the industrial sectors • Creation of employment opportunities
Conflict:		
• Many countries are struggling for scarce natural resources, exacerbating conflicts among groups and nations	• Higher risk of regional scarcities and mass migration (primarily food and water) • More large-scale organized conflicts	• Wider availability of food and water • Improved revenues and cash flow

Agriculture. Electricity access can directly enhance agricultural productivity. For example, the use of mechanical and electrical electricity could improve land preparation, cultivation, irrigation, harvesting, post-harvest processing, food production, storage, and the transport of agricultural inputs and outputs. Use of good quality and environmentally sustainable fertilizers and other chemical inputs to agriculture is important for increasing food production. However, mineral fertilizers, chemical pesticides, fungicides and herbicides require electricity in their production, and distribution. Increasing productivity and improving harvesting processes and irrigation systems could help farmers to become more resilient to climate change and reduce their dependence on rainfall (FAO, 2000).

Water. Access to electricity is critical to ensure access to drinking water supply and wastewater services. Electricity is needed to extract water from the source (lakes, rivers, and aquifers), purify it (or desalinate it in coastal areas), and transport it to households (USAID, 2001). Clean water reduces the spread of water-borne diseases, making people more resilient to climate change, in particular to post-flooding events.

Health. Electricity access is vital to allow hospitals to operate and store vaccines, as well as to improve the quality of local medical services. Expanding the medical services in remote areas would reduce the need for residents to travel to other towns for medical treatment (USAID, 2003). Improved health services can reduce child and adult mortality and could reinforce response systems for infectious disease outbreaks.

Education. Education is the primary vehicle to help people in achieving economic and social development and in building resilient communities. Lighting provided at home would allow children to study at night. Lighting and educational equipment in schools would enable people to benefit from better and more advanced education and to access sources of information (USAID, 2003). Through better education, individuals and communities can get knowledge and skills to adapt their livelihoods to the changing climate, diversify their sources of income, and make their lifestyles more climate-friendly. Access to reliable information and knowledge improves decision making by providing weather and climate data and forecasts, information on crop options, information about technologies for water storage and flood protection, and so on.

Household sector: Access to electricity is essential to fulfill basic household needs such as lighting, cooling, heating and access to drinking water and sanitation services. Also, it can greatly improve livelihoods in the poorest countries and drive local economic development on a sustainable basis by allowing home-based production and business activities. As such, electricity access is a primary vehicle towards poverty reduction and can improve households' resilience to climate change effects.

Industry. Adequate power supply is critical to boost productivity, competitiveness and employment leading to expanded job opportunities and economic growth. Economic growth and income generation from non-farming sectors could help to reduce the vulnerability of populations to climate change in part by allowing them to invest in adaptation strategies, such as climate-resilient construction methods to build urban infrastructure (USAID, 2003).

High reliance on traditional biomass for fuel has both environmental and health impacts

Reliance on traditional biomass for fuel is disproportionally high in Africa. Over 80 percent of the Sub-Saharan population relies on solid biomass for cooking and to a lesser extent for heating—far more than in any other region of the world—and biomass is expected to remain the predominant energy source for the next two decades (IEA, 2010). Massive reliance on biomass combined with use of poorly designed and inefficient cookstoves expose Sub-Saharan countries to severe health, environmental, social and economic threats. Uncontrolled use of wood biomass increases pressures on local natural resources and in several Sub-Saharan countries deforestation is

becoming a pressing concern, especially on the outskirts of major cities. It is estimated that 60 percent of the Sub-Saharan region's greenhouse gas emissions come from land-use change and deforestation (World Bank, 2010b).

Access to sustainable cooking and heating solutions is important to improve health conditions, support progress toward gender equality, reverse the adverse environmental effects and meet household energy demand for cooking.

However, the switching to sustainable cooking and heating fuels (liquefied petroleum gas, biogas, kerosene, etc.) depends on several factors such as availability, applicability, acceptability and affordability. Where those factors constrains switching to modern fuels, governments should focus on promoting more efficient and sustainable supply of biomass as well as improving the efficiency of cookstoves (e.g. cookstoves that increase the thermal efficiency of traditional fuels and improve the ventilation systems reducing impacts on the environment and on the health).

Africa can address its electricity access gap and climate change through mitigation and adaptation

Effective climate policy aimed at reducing the risks of climate change to natural and human systems involves diverse adaptation and mitigation actions. Adaptation and mitigation strategies are more efficient if implemented simultaneously.

- Mitigation actions—such as investments in renewable electricity (hydropower, geothermal, wind, solar)—can help countries meet supply imbalances and grow economically while also addressing the challenges of global climate change.
- Adaptation actions—such as promoting climate-smart agriculture, water management, and climate-resilient infrastructure—can increase countries' resilience, thereby reducing the costs of climate change, while also minimizing climate impact. According to the IPCC, the economic costs of climate change in Africa could be reduced from 2 percent to 1 percent of GDP by 2040 and from 10 percent to 7 percent of GDP by 2100 (IPCC, 2007a).

Portfolio approach. Countries should consider adopting a portfolio approach to their national adaptation and mitigation strategies. As an example, a country with significant hydro and wind resources under development may seek to hedge its climate exposure to increasingly variable rainfall and reduced availability of water for power generation by investing in complementary wind resources that are abundant in the dry season. Also, countries may build requisite capacity by planning for complementary renewable and conventional supply sources. When countries invest in providing more reliable and sustainable energy access they invest in social and economic development; this in turn strengthens the resilience of populations and their economies to climate change shocks.

Planning power projects in a climate change world. Electricity services (electricity supply and demand, electricity endowment, infrastructure and transportation) may be increasingly affected by climate change (Ebinger and Vergara, 2011). Changes in precipitation and runoff could reduce hydropower plant production and increase uncertainty. Reduced solar cell efficiency could reduce the electricity produced by solar power plants. Increases in the frequency of extreme events and higher sea levels could increase the vulnerability of existing assets (transmission, distribution, and transfer). Climate considerations must be included in the design of generation, transmission and distribution investments. Also, Integrated Resources Planning should become an integral part of long-term sector planning, taking into account the full range of alternatives for both supply and end-use of energy.

Adaptation measures. Adaptation measures can reduce the vulnerability of electricity systems to climate change by building capacity, improving information for decision making and integrating climate risks into management

and operation decisions (table 2) (Ebinger and Vergara, 2011). Adaptation measures come in many forms. They include improving weather/climate information; coupling climate and electricity analysis by adapting climate data to electricity-system needs; reducing inefficiencies in the use of available resources; diversifying the electricity sector; and relocating investments (to safer areas). Better design standards offer the potential to increase the resilience of new infrastructure. Altering the operation and maintenance of existing infrastructure—for example, through actions to adapt hydropower operations to changes in river flow patterns—is another form of adaptation (Ebinger and Vergara, 2011).

Leapfrogging. Climate change could be an opportunity for Sub-Saharan Africa to leapfrog towards more sustainable energy technologies. A greener energy mix can boost service reliability and support energy security while lowering the impact on the environment. But leapfrogging requires addressing a variety of technical, regulatory, and financial constraints—which restrain large-scale development of renewable capacity as well as low-carbon advances of conventional capacity. Concerted action at global level is needed to promote technological transfer and mobilize the needed resources via a combination of private sector participation and donor funding. African countries also have a key role to play in building a more conducive investment climate, including expanding public financing, strengthening governance of the sector and utility performance, and putting in place the regulatory and financial frameworks in place that grant incentives to investors.

Major issues for discussion in Durban and beyond

The Durban negotiations are on two tracks: The Framework Convention and the Kyoto Protocol.
The first track, the United Nations Framework Convention on Climate Change, was signed in 1992 in Rio. It encourages industrialized countries to stabilize greenhouse gas (GHG) emissions in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (UNFCCC, 2011).

The Kyoto Protocol is the second track. The Kyoto Protocol was adopted in Kyoto, Japan, in 1997 and entered into force on February 16, 2005. It sets binding targets for reducing GHGs emissions for 37 industrialized countries and the European community. The commitment period of the Kyoto Protocol ends in 2012 (UNFCCC, 2011).

The major distinction between the Framework Convention and the Kyoto Protocol is that the Convention *encourages* industrialized countries to stabilize GHG emissions, whereas the Protocol *commits* them to do so (UNFCCC, 2011).

Expectations for COP17 are high. The parties will seek to advance the implementation of the Convention and the Kyoto Protocol, as well as the Bali Action Plan, agreed at COP-13 in 2007, and the Cancun Agreements, reached at COP-16 last December (UNFCCC, 2011). Moreover, they will try to ensure that a solid agreement is in place in 2012, when the Kyoto Protocol expires. A new international framework needs to be negotiated and ratified in order to deliver the stringent emission reductions recommended by the IPCC. Parties need to emphasize the importance of capacity building and electricity access as a cross-cutting issue and ensure it is given adequate attention.

Table 2. Examples of adaptation measures to reduce losses/risks in electricity systems

	Technological adaptation measures		Behavioral adaptation measures		
Electricity System	**Hard (structural)**	**Soft (technology and design)**	**(Re)location**	**Anticipation**	**Operation and Maintenance**
Mined resources (oil and gas, thermal power, nuclear power)	Improve robustness of installations to withstand storms (offshore), an flooding/ drought (inland)	Replace water cooling systems with air cooling, dry cooling, or recirculating systems Improve design of gas turbines Expand strategic petroleum reserves Consider underground transfers and transport structures	(Re)locate in areas with lower risk of flooding/drought (Re)locate to safer areas, build dikes to contain flooding, reinforce walls and roofs	Emergency Planning	Manage on-site drainage and runoff Changes in coal handling due to increased moisture content Adapt regulations so that a higher discharge temperature is allowed Consider water re-use add integration technologies at refineries
Hydropower	Build de-silting gates Increase dam height Construct small dams in the upper basins Adapt capacity to flow regime (if increased)	Changes in water reserves and reservoir management Regional integration through transmission connections	(Re)locate based on changes in flow regime		Adapt plant operations to changes in river flow patterns Operational complementarities with other sources (for example natural gas)
Wind		Improve design of turbines to withstand higher wind speeds	(Re)locate based on expected changes in wind-speeds, sea level rise and river flooding		
Solar		Improve design of panels to withstand storms	(Re)locate based on expected changes in cloud cover	Repair plans to ensure functioning of distributed solar systems after extreme events	
Biomass	Build dikes Expand/improve irrigation systems Improve drainage and robustness of electricity plants to withstand storms and flooding	Introduce new crops with higher heat and water stress tolerance Substitute fuel sources	(Re)locate based in areas with lower risk of flooding/storms	Early warning systems (temperature and rainfall) Support for emergency harvesting of biomass	Adjust crop management and rotation schemes Adjust planting and harvesting dates Introduce soil moisture conservation practices

	Technological adaptation measures		Behavioral adaptation measures		
Electricity System	**Hard (structural)**	**Soft (technology and design)**	**(Re)location**	**Anticipation**	**Operation and Maintenance**
Demand	Invest in high-efficiency infrastructures and equipment and in decentralization power generation		Efficient use of electricity through good operating practice		
Transmission and distribution	Improve robustness of pipelines and other transmission and distribution infrastructure Burying or cable re-rating of the power grid		Emergency planning	Regular inspection of vulnerable infrastructure such as wooden utility poleS	

Source: Ebinger and Vergara (2011).

Finance is a critical issue for climate change. Governance issues and institutional arrangements should ensure accessibility and equality of voice between developed and developing countries in the governance and administration of climate funds.

Electricity. The private sector is a key player in financing electricity for development. Private investors seek financial incentives, clear policies on tariffs, and more transparent regulatory and policy frameworks governing investments in electricity infrastructure. Political will and government commitment are urgently needed to prioritize investment in electricity.

Ambition. As Mr. Tosi Mpanu-Mpanu stated, “Where we are not able to reach binding deals in the areas that are of immense importance to Africa we hope to establish solid work programmes which set out concrete pathways towards our targets” (Omari, 2011).

References

Ebinger, Jane, and Walter Vergara. 2011. *Climate Impacts on Electricity Systems*. Washington, DC: World Bank.

FAO. 2000. "The electricity and agriculture nexus." Environment and Natural Resources Working Paper 4. Rome.

Fischer, Günther, Mahendra Shah, and Harrij van Velthuizen. 2008. "Climate Change and Agriculture in Africa." International Institute for Applied Systems Analysis. http://www.iiasa.ac.at/Research/LUC/Outreach-Policy-Briefs/opt08sum-LUC.pdf

Hay, Simon I., Andrew J. Tatem, Carlos Guerra, and Robert W. Snow. 2006. "Population at Malaria Risk in Africa: 2005, 2015, and 2030." Department of Trade and Industry Report T8.2, London.

IEA (International Electricity Agency). 2010. *World Electricity Outlook 2010*. Paris: OECD.

IPCC. 2007a. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. S. Solomon, D. Qin, and M. Manning. Cambridge: Cambridge University Press.

———. 2007b. "Summary for Policymakers." In *Climate Change 2007: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, ed. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C.E. Hanson (7–22). Cambridge: Cambridge University Press.

Omari, Kulthoum. 2011. "Cancun—A Floor and Not a Ceiling in Ongoing Climate Negotiations." Interview with Tosi Mpanu-Mpanu, May 20, 2011. Retrieved from http://www.boell.org.za/web/cop17-694.html

Stern, Nicholas. 2007. *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press.

UNESCO. 2010. "EFA Global Monitoring Report. Regional Overview: Sub-Saharan Africa." In "Reaching the marginalized." http://unesdoc.unesco.org/images/0018/001866/186606E.pdf

USAID. 2001. "The Water–Electricity Nexus: Opportunities for Integrated Environmental Management." Global Environment Center. http://www.usaid.gov/our_work/environment/water/enviro.notes/enviro.notes.water-electricity.pdf

———. 2003. "Electricity, Health, and Education." Retrieved from http://www.electricityandsecurity.com/images/6._Health_and_Education.pdf

World Bank. 2009. "Making Development Climate-resilient: A World Bank Strategy for Sub-Saharan Africa." http://siteresources.worldbank.org/INTAFRICA/Resources/ClimateChange-StrategyReport2010-Full_vNoImages.pdf

———. 2010a. "Economics of Adaptation to Climate Change." http://siteresources.worldbank.org/EXTCC/Resources/EACC_FinalSynthesisReport0803_2010.pdf

———. 2010b. "Africa's Development in a Changing Climate." A key policy advice from World Development Report (WDR) and Making Development Climate-resilient: A World Bank Strategy for Sub-Saharan Africa." http://siteresources.worldbank.org/INTWDR2010/Resources/5287678-1252586925350/Africa-WDR-2010-booklet.pdf

TOWARD UNIVERSAL ACCESS TO MODERN HOUSEHOLD ENERGY SERVICES

Energy poverty—the lack of access to energy for basic household needs, public services, and income generation—is a global problem. Though there is no consensus on the definition of energy access, the International Energy Agency (IEA) recognizes three incremental levels of access with corresponding levels of benefits. The most basic level envisages access to electricity for lighting, health, education, communication, and community services, as well as access to modern fuels and technologies for cooking and heating. The second level of access enables improved productivity in the agricultural, commercial, and transport sectors, empowering communities to engage in self-sustaining productive activities. The highest access level fulfills the needs of everyday life in modern societies, providing sufficient electricity to power domestic appliances and meeting increased energy requirements for heating, cooling, and private transportation.

But economically useful energy access must provide for more than basic needs. As the Advisory Group on Energy and Climate Change (AGECC)[1] defines it, universal energy access means that everyone has "access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses" (AGECC, 2010). This stretches beyond the IEA's first level—fulfilling basic human needs—to include adequate energy services for productive uses, which represents the minimum level needed to improve livelihoods in the poorest countries and drive local economic development on a sustainable basis. In Sub-Saharan Africa, a high share of population depends on household-based enterprises, consisting of unpaid family members engaged in non-farm business activities. These enterprises are typically informal, very small in size and not legally separated from the other household activities. Nevertheless, they are the fastest growing employment category in Sub-Saharan Africa (Fox, 2010). Therefore, for the purpose of this paper, adequate energy access will be defined as entailing the first two IEA levels—basic needs plus improved productivity.

Moreover, boosting productivity, competitiveness, and employment across the whole economy requires that adequate energy supply is ensured not only for self-sustained, home-based productive activities, but for all productive uses in the agriculture, industrial, and service sectors as well. Adequate, reliable, and sustainable energy supply is critical to support growth and move countries up the development ladder.

Energy is needed to meet basic needs and fuel economic opportunities

Reaching the level of access defined above is essential for poverty alleviation, economic growth, and achieving the Millennium Development Goals (MDGs) (box 1). Without adequate and reliable access to energy, clinics cannot operate and safely store vaccines, children cannot study at night, food cannot be stored, and access to water and sanitation is constrained by pumping capacity. Lack of electricity exacerbates poverty, as it precludes most industrial activities and the jobs they create. Unreliable power supply constrains business and agriculture activities, affecting competitiveness, employment, and food security, and seriously jeopardizing the ability of communities to actively improve their economic circumstances.

1 The AGECC, a committee set up by UN Secretary-General Ban Ki-moon, is charged with assessing the global energy situation and incorporating it into international climate-change talks.

Box 1. The importance of modern energy in achieving the MDGs

Goal 1: Eradicate extreme poverty and hunger. Access to modern energy facilitates economic development by providing more efficient and healthier means to undertake basic household tasks and productive activities, often more cheaply than by using inefficient substitutes such as candles and batteries. Modern energy can also power water pumps, providing drinking water and increasing agricultural yields through the use of irrigation.

Goal 2: Achieve universal primary education. In impoverished communities children commonly spend significant time gathering fuelwood, fetching water, and cooking. Access to improved cooking fuels and technologies reduces this time drain and facilitates school attendance. Electricity is important for education because it facilitates communication through information technology and provides basic needs such as lighting.

Goal 3: Promote gender equality and empower women. Improved access to electricity and modern fuels reduces the physical burden associated with carrying wood and frees up valuable time for women, widening their employment opportunities. In addition, street-lighting improves the safety of women and girls at night, allowing them to attend night school and participate in community activities.

Goals 4, 5, and 6: Reduce child mortality; improve maternal health; and combat HIV/AIDS, malaria, and other diseases. Reducing household air pollution through improved cooking fuels and stoves decreases the risk of respiratory infections, chronic obstructive lung disease, and lung cancer (when coal is used). Improved access to energy allows households to boil water, thus reducing the incidence of waterborne disease. Improved energy access also advances communication and transport services critical for emergency health care. Electricity and modern energy services support the functioning of health clinics and hospitals.

Goal 7: Ensure environmental sustainability. Modern cooking fuels and more efficient cookstoves can relieve pressures on the environment caused by the unsustainable use of biomass. The promotion of low-carbon renewable energy is congruent with local and global environmental plans, whereas the unsustainable exploitation of fuelwood can cause local deforestation, soil degradation, and erosion. Using cleaner energy also reduces greenhouse-gas emissions and global warming.

Goal 8: Develop a global partnership for development. Electricity is necessary to power information and communications technology applications.

Source: Adapted from UN-Energy, 2005.

Energy poverty is severe in Sub-Saharan Africa

The first and most striking indicator of energy poverty is the millions of people still left without basic energy services across Sub-Saharan Africa. Only 31 percent of the Sub-Saharan population has access to electricity; this is the lowest electrification rate in the world and half the rate of the next lowest region, South Asia (table 1). If South Africa is excluded, Sub-Saharan Africa's rate declines further, to 28 percent. In all, 585 million people in Sub-Saharan Africa are excluded from electricity service, accounting for 40 percent of the worldwide un-served population. Since 1990, East Asia, Latin America, and the Middle East have all added at least 20 percentage points to their electrification rates, while access rates in Sub-Saharan Africa have remained relatively stagnant, as population growth and household formation outstrip new connections.

Table 1. Electrification rate and population without electricity, 2009

	Population without electricity (millions)	Electrification rate (%)	Urban electrification rate (%)	Rural electrification rate (%)
Africa	587	41.9	68.9	25.0
North Africa	2	99.0	99.6	98.4
Sub-Saharan Africa	585	30.5	59.9	14.3
Developing Asia	799	78.1	93.9	68.8
China & East Asia	186	90.8	96.4	86.5
South Asia	612	62.2	89.1	51.2
Latin America	31	93.4	98.8	74.0
Middle East	22	89.5	98.6	72.2
Developing countries	1,438	73.0	90.7	60.2
Transition economies and OECD	3	99.8	100.0	99.5
World	1,441	78.9	93.6	65.1

Source: IEA 2010.

A stark divide emerges between urban and rural electrification rates in Sub-Saharan Africa. Access to electricity in urban areas is close to 60 percent, compared with less than 15 percent in rural areas, where more than 60 percent of the overall population still resides. Residential electricity consumption is also tiny and falling. Excluding South Africa, Sub-Saharan Africa's 800 million people consume in a year about as much electricity as the 19.5 million inhabitants of the State of New York (IEA, 2010).

Energy poverty further demarcates differences between Sub-Saharan and North Africa. Electricity access rates across North African countries are more in line with those of developed countries. The average access rate for the region is close to 100 percent and applies uniformly to urban and rural areas. Overall power consumption across the six North African countries stands close to 200 terawatt-hours per year (EIA, 2008), almost twice that of all Sub-Saharan countries excluding South Africa. Only 2 million North Africans still lack access to electricity services, mainly in remote areas of the Sahara Desert.

Table 2: People using traditional biomass for cooking (in millions)

	2009	2015	2030
Africa	657	745	922
Sub-Saharan Africa	653	741	918
Developing Asia	1,937	1,944	1,769
China	423	393	280
India	855	863	780
Other developing Asian countries	659	688	709
Latin America	85	85	79
Total	2,679	2,774	2,770

Source: IEA, 2010.

High reliance on traditional and unsustainable biomass energy for cooking and heating purposes is another major indicator of energy poverty in Sub-Saharan Africa. Over 80 percent of the Sub-Saharan population relies on solid biomass for cooking and to a lesser extent for heating—far more than in any other region of the world—and

biomass is expected to remain the predominant energy source for the next two decades. The IEA estimates that by 2030 nearly one billion people in Sub-Saharan Africa will still depend on wood-based biomass as a primary energy source, accounting for a third of the world's total (table 2).

Wood is by far the most dominant solid fuel, followed by charcoal, dung, and coal. Current devices for cooking with biomass are mostly three-stone fires, traditional mud stoves, or metal, cement, pottery, or brick stoves, with no operating chimney or hoods. Massive reliance on biomass combined with use of poorly designed and inefficient cookstoves expose Sub-Saharan countries to severe health, environmental, social and economic threats. Exposure to smoke from traditional cookstoves and open fires is associated with a number of diseases, including acute respiratory illnesses and cancer, and is estimated to cause 1.9 million premature deaths annually worldwide (WHO and UNDP 2009)—more than from tuberculosis and malaria—with women and young children the most affected. Open fires and primitive stoves are naturally inefficient at converting energy into heat for cooking; the amount of biomass cooking fuel required each year can reach up to 2 tons per family. Uncontrolled use of biomass increases pressures on local natural resources and in several Sub-Saharan countries deforestation is becoming a pressing concern, especially on the outskirts of major cities. Biomass burning results in considerable emissions of carbon dioxide (CO_2)—1 billion tons for the 730 million tons of biomass burned each year across the developing world (Akbar et al., 2011). High reliance on biomass energy also has social and economic implications, as the large amounts of time spent collecting wood, especially by women and children, can take time from education and other productive activities. And while the wood-based biomass energy sector employs a significant workforce, its contribution to economic development remains mostly marginal due to ineffective governance of the sector.

Access has not kept pace with population growth or urbanization

Efforts to promote energy access ought to take into consideration rapid urbanization and population growth in Africa. From the 1970s through the early 1990s, African cities experienced the fastest urban population growth rates in world history. Sub-Saharan cities in particular grew at a rate close to 5 percent per year over that period. By 2030, nearly half of Africans will be living in urban areas, with the urban population exceed rural population by 100 million by 2035 (UN, 2009). Urbanization and the growing labor force will eventually lead to an expanded middle-class customer base, with higher willingness and ability to pay for modern electricity services. But poverty is also urbanizing and governments are faced with the pressing need to accommodate demand in rapidly growing low-income and informal urban settlements. Two - thirds of the urban population in Sub-Saharan Africa currently live in slums, which will continue to develop uncontrolled in underserviced and often hazardous areas both in and on the outskirts of major cities. The lack of access to electricity is particularly detrimental to economic and social development among the urban poor. Unreliable and insufficient supply constrains the delivery of social services and also prevents the poor from exploiting the economic opportunities of large cities.

Business as usual will not deliver connections fast enough to accommodate the needs of the fast-growing African urban populations. Electricity access has grown at no more than 1 percentage point per year in the last decade. At this rate, only 45 percent of Africans will have electricity in their homes by 2015 and less than 60 percent by 2030 (table 3). In 2030, 654 million Africans will still lack electricity service, accounting for half of the worldwide un-served population. The majority of these will be found in the Sub-Saharan region.

Table 3. Number of people without access to electricity and electrification rates under business as usual

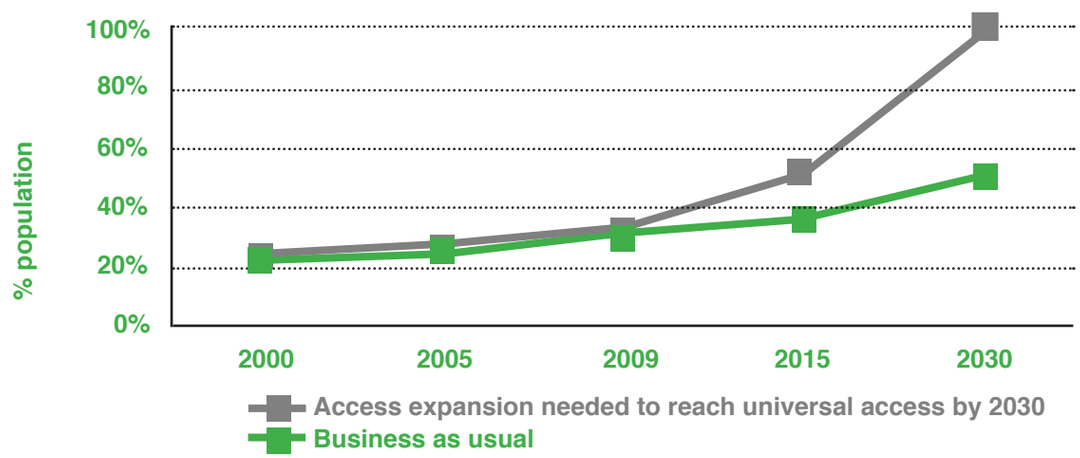
	2015 (millions of people)	2030 (millions of people)	2009 (%)	2015 (%)	2030 (%)
Africa	636	654	42	45	57
Sub-Saharan Africa	635	652	31	35	50
Developing Asia	725	545	78	81	88
China	5	0	99	100	100
India	389	293	66	70	80
Other Asia	331	252	65	72	82
Latin America	25	10	93	95	98
Developing countries	1,404	1,213	73	75	81
World	1,406	1,213	79	81	85

Source: IEA, 2010.

A substantial effort in electrification scale-up is needed to reach universal access in the foreseeable future. Access targets identified by individual countries translate to nearly 50 percent of the overall African population being connected by 2015 (Foster and Briceño-Garmendia, 2010). A more ambitious target of universal access by 2030 has been put forward by the AGECC. In order to reach that target, 150 million people must be added to electricity service by 2015 and 512 million by 2030, including 460 million in Sub-Saharan Africa alone (figure 1).

The challenge of reaching universal access is typically understood as a supply-side problem of rolling out infrastructure networks. However, the relatively low coverage rates of Sub-Saharan Africa even in densely populated urban areas suggest that even where infrastructure is physically present, service coverage is by no means guaranteed. Part of the access deficit is related to demand-side barriers that prevent households from hooking-up to the service, even when they reside in the proximity of networks. Demand-side barriers can take a variety of forms including high connection charges that make hook-ups unaffordable, illegal tenure that disqualifies

Figure 1: Forecasted expansion of access to electricity in Africa



Source: IEA, 2010; authors.

households from connecting, and a variety of other social and economic factors that may deter households from becoming utility clients. Inefficient subsidization compounds the problem. In Sub-Saharan Africa tariff subsidies benefit the relatively affluent minority of households that have power in their homes, while analysis shows that in most countries cost-recovery tariffs would be generally affordable to them (Foster and Briceño-Garmendia, 2010). Therefore, not only do power subsidies fail to reach the vast majority of the poor that have no access to electricity, they also create a large fiscal hemorrhage, estimated at more than $2 billion each year, holding back sector investment and the roll out of access programs.

Diversified approaches are needed to achieve universal access

The scale and nature of the access gap and the locations involved mean that electricity will need to be provided through both centralized and decentralized energy technologies and systems, including grid, mini-grid, and off-grid solutions.

Mini-grid and off-grid solutions are more efficient options to bring electricity into sparsely populated areas, but grid extension is often the least-cost option in areas with high population densities. If pursued at the regional level, especially in Africa, it also offers the opportunity to tap into significant hydropower potential, providing low-cost clean energy. However, rural areas account for the bulk of the additional connections needed to reach universal electricity access by 2030 and in Africa rural populations tend to be dispersed. In Sub-Saharan Africa, only 15 percent of the rural population lives within 10 kilometers of a substation (or within 5 kilometers of a medium-voltage line), while as much as 41 percent lives in areas considered isolated or remote from the grid. Rolling grids to such sparsely populated areas would impose prohibitive costs and supply would be unreliable due to the high technical losses of long-distance transmission systems.

Renewable energy technologies are ideally suited to mini-grid and off-grid applications and can help significantly scale up electrification in Africa without major harm to the environment. High reliance on renewable sources minimizes large-scale electrification programs' impact on energy demand, production, and CO_2 emissions. It is estimated that achieving universal electricity access worldwide by 2030 through grid expansion coupled with massive recourse to off-grid technologies employing small hydro, solar, wind, and various types of bio-energy would increase energy-related CO_2 emissions by just 0.8 percent compared with access expansion under the business-as-usual scenario (IEA, UNDP, and UNIDO, 2010).

Although using renewable energy sources poses challenges, success stories are increasingly emerging. Solar photovoltaic (PV) is an attractive source of electric power to provide basic services such as lighting and pumping of drinking water. For greater load demand, mini-hydro or biomass technologies may offer a better solution. Wind energy can provide significant amounts of power and constitutes a viable cost-competitive resource, with mini-wind prices below those of PV. Overall, renewable energy sources, particularly for household-scale applications, present comparatively low running costs. But their deployment imposes significant upfront costs, advanced technical skills to install and maintain the systems, and appropriate pricing systems. Nevertheless, the economies of scale associated with these technologies result in increased cost-competitiveness and a significant local business-building and job-creation potential from these solutions.

In some parts of Africa, such as in the Maghreb countries, the challenges associated with decentralized systems have been successfully overcome. In Tunisia, where the average electrification rate is 99 percent, several projects under the national Solar Plan are aimed at providing decentralized solar power to various types of users (public buildings, irrigation pumps, farms and villages, gas stations, etc.). In Morocco, a rural electrification program launched in 1996 raised rural electricity access to 96.5 percent by 2009, far above the program's initial objective

of 80 percent. In West Africa, renewable-energy powered mini-grids linking to productive uses in rural areas are being established in eight countries under a Strategic Energy Program funded by the Global Environmental Facility.

Off-grid lighting solutions offer an interim solution until the energy gap is closed

In the interim until the energy access gap can be closed, millions of people can be taken out of the dark through the deployment of lighting solutions that help meet basic household needs.
Clean, off-grid lighting solutions can significantly raise the quality of life for hundreds of millions people. Today, solar and other lighting products offer a valid alternative to the expensive, inefficient, and polluting lighting sources such as candlelight or kerosene lamps on which a large part of Africa's population still relies. They offer better illumination, longer life, and features such as chargers for cell phones or other appliances. Their durability allows extending the working day of small businesses and time for studying. They lower greenhouse gas emissions, and by reducing indoor air pollution they also improve health. These lighting products are becoming increasingly affordable for African low-income households, which spend an estimated $10.5 billion on kerosene for lighting annually.

Market-based approaches are needed to spread clean off-grid lighting solutions, however. The emerging market for off-grid products is hard to penetrate. Manufacturers struggle to find business partners, and financial institutions not familiar with the industry are unable to exploit the market's growth potential. In addition, end users have not yet embraced the new technologies, and low-quality products undermine consumer confidence. Market-based approaches and programs providing policy, technical, and financial support for businesses to develop can make a difference. Programs like *Lighting Africa* can work as a catalyst to make quality off-grid lighting products accessible to energy-poor households in several regions of the continent (box 2).

Africans need cleaner and more sustainable cooking and heating fuels

Access to sustainable cooking and heating solutions has rarely made the top of governments' agendas, as governments tend to give higher priority to electrification. Also, as income rises, households seek to switch to electricity to meet their lighting needs and power appliances, while the transition from traditional to modern fuels for cooking is less obvious. Nevertheless, access to clean cooking and heating fuels is equally paramount to

Box 2: Lighting Africa

Launched in 2007, this joint World Bank–IFC initiative aims at mobilizing and supporting the private sector to build sustainable markets to provide safe, affordable, and modern off-grid lighting to 2.5 million people in Africa by 2012, facilitating sales of 500,000 off-grid lighting products, and reach 80 million people by 2020. Recent technological developments in light-emitting diode (LED), fluorescent, and solar devices are supported and made accessible to consumers in Sub Saharan Africa. Lighting Africa has five components, each addressing identified barriers that constrain higher penetration of high quality products: (i) quality assurance, (ii) market intelligence, (iii) business development linkages and financing, (iv) consumer awareness, and (v) policy and regulation. In only 2 years, the initiative has contributed to establishing a market of low-cost, off-grid lighting products. In 2010–11, Lighting Africa expanded beyond the pilot countries of Kenya and Ghana and launched activities in Tanzania, Ethiopia, Senegal and Mali. The expansion is continuing in 2011, with a goal of establishing regional programs in East Africa, Francophone and Anglophone West Africa, and post-conflict states.

Source: Authors.

improve health conditions, support progress toward gender equality, and meet household energy demand for cooking. Further, it is important to reverse the adverse environmental effects caused by the unsustainable and polluting energy sources on which the poor are forced to rely to meet their basic needs.

Reaching universal access to sustainable cooking and heating solutions requires an array of fuel and technology options, the local suitability of which depends on factors such as availability, applicability, acceptability and affordability, including access to finance to cover initial investments. Liquefied petroleum gas (LPG) is widely used for cooking and may be the least costly gaseous fuel where proper distribution channels are established. However, the relatively high upfront costs make it affordable only in better-off urban and peri-urban areas. Large-scale LPG programs in Senegal demonstrate that rural distribution challenges can be overcome while at the same time creating local jobs and improving livelihoods. But the subsidies they require are a significant drain on government resources, and may be prohibitive to many less-developed countries. Biogas can provide a clean, renewable fuel in areas where there is cattle farming and other suitable conditions. As the fuel is produced on site, there are few distribution challenges or costs beyond the delivery of the equipment, although the higher initial investment requires that access to finance is provided. Natural gas may be suitable in some urban areas. As an alternative, kerosene is easier to store and distribute, but is still expensive for the poor and can be polluting. For all the modern fuel solutions, substantial awareness—both of the benefits new fuels and technologies provide and of how to use them—is essential to ensure uptake.

Where affordability constrains switching to modern fuels, government interventions should focus on promoting more efficient and sustainable supply of biomass. Regulation of the biomass sector, which remains mostly informal, should aim at establishing an enabling environment for responsible, sustainable, and profitable enterprises to develop from within the sector. A combination of clear rules, transparent enforcement, strong incentives, and targeted capacity building are all critical elements of successful policy reform. The government should provide effective guidance to key stakeholders and the general public by way of information campaigns, training, and demonstration projects (Sander et al., 2011).

Equally important is to improve the efficiency at which people burn biomass. Improved cookstoves, such as those designed more recently and based on higher quality and efficiency standards, represent an essential element of household fuel programs. These stoves offer three benefits: they double or triple the thermal efficiency of traditional fuels, reduce the harmful effects of poor ventilation, and may also provide some co-heating. Improved stoves may last for several years, allowing the accumulated fuel savings to be spent on a range of livelihood-enhancing activities (e.g., medicine, income-producing enterprises for women, and school attendance for children). Additionally, their production and commercialization can be a source of economic opportunity and job creation at the local level. Large-scale market development programs blending technical and financial support from multiple donors and specialized agencies should be deployed to catalyze a private market for development and commercialization of improved cookstoves. A thriving private sector would be able to constantly improve design and performance of stoves while lowering their costs, making them adaptable to local needs and more affordable.

African nations must adopt focused strategies to achieve universal energy access

A roadmap toward universal access includes a number of building blocks with commitments and actions at the national and international level.

Robust national programs: Governments need to prioritize energy access; develop robust, large-scale electrification programs with clear targets, financing plans, and implementation roadmaps. The scale and nature

of the access gap and the locations involved require that electricity is provided through both centralized and decentralized approaches, which calls for an integrated vision of the sector, a rigorous planning process, and regulatory reforms to support the deployment of innovative institutional approaches and technical solutions. This process is typically supported by multilateral organizations, international agencies, and non-profit organizations. In rural areas, new institutional models should be explored, including innovative rural energy finance mechanisms, to engage private sector and local communities.

Scaled-up financing: Given the scale of the effort required, access to various sources of financing is critical, particularly for the initial capital. Donor and government resources, typically including a combination of targeted government subsidies, concessional loans from various sources, grants, cross-subsidization, output-based aid, and end-user tariffs, should be pooled for large-scale, sustained, programmatic effort.

Smart subsidization: Tariff policies need to be carefully designed, striking the right balance between cost recovery—essential for the ongoing sustainability of services—and affordability. Subsidies towards connections fees, which in many countries represent a major barrier preventing poor households from hooking-up to the service, hold considerable social impact. Reducing poorly designed tariff subsidies can improve the financial viability of the utilities, freeing-up resources for further investment in lower cost generation and electrification of the poor.

Increased capacity: Technical assistance from multilateral institutions and international agencies should target local institutions and communities to enhance capacity for service delivery, quality monitoring, financing, and operations and maintenance. Capacity-building programs supported by governments, global counterparts, and South–South cooperation should aim at developing expertise on new technologies and applications, in particular those based on renewable energy sources, as well as supporting local market development for the production and commercialization of innovative, clean, and affordable lighting and cooking applications and alternate cooking fuels.

Improved utility performance: Large-scale and sustained electrification can be deployed only by well-functioning utilities. Renewed government efforts to reform utilities should favor governance over technical fixes and first improve corporate governance, oversight and transparency. Efforts should also focus on reducing technical and commercial losses and improving revenue collection rates, which requires advancements both on technologies used (e.g., smart metering, load management) and on business practices (e.g., prepaid metering, making bills available on cell phones, outsourcing of services).

Providing African citizens with adequate access to clean, reliable, and affordable energy must become a top priority by governments and addressed through coherent national strategies and programmatic approaches. Advocacy must extend from the national to the regional and global level and catalyze commitments and partnerships by international donors and development partners. All stakeholders need to join the campaign and play their role.

References

AGECC (Advisory Group on Energy and Climate Change). 2010. “Energy for a Sustainable Future. Summary Report and Recommendations.” United Nations. New York.

Akbar, S., D. Barnes, A. Eil, and A. Gnezditskaia. 2011. “Household Biomass Cookstoves, Environment, Health, and Climate Change: A New Look at an Old Problem.” Washington, DC: World Bank.

Coady, David. 2010. Petroleum Subsidies: Costly Inequitable and Rising. IMF, Washignton DC

EIA (US Energy Information Administration). “International Energy Statistics.” 2008. http://www.eia.gov/cfapps/ipdbproject

Foster, V., and C. Briceño-Garmendia. 2010. *Africa’s Infrastructure: A Time for Transformation*. Paris and Washington, DC: Agence Française de Développement and World Bank.

Fox, Louise. 2010. “Constraints to productivity improvements for female nano entrepreneurs: Is training the answer?” World Bank, Washington, DC.

IEA (International Energy Agency). 2010. *World Energy Outlook 2010*. Paris: OECD.

IEA (International Energy Agency), UNDP (United Nations Development Programme), and UNIDO (United Nations Industrial Development Organization). 2010. *Energy Poverty: How to Make Modern Energy Access Universal*. Special Excerpt of the World Energy Outlook 2010 for the UN General Assembly for the Millennium Development Goals. Paris: OECD.

IISD (International Institute for Sustainable Development). 2010. *Untold Billions: The Effects of Fossil-Fuel Subsidy Reform*. Geneva.

Sander, K., W. Haider, and B. Hyseni. 2011. “Wood-based Biomass Energy Development for Sub-Saharan Africa.” World Bank, Washington, DC.

UN (United Nations). 2009. “World Urbanization Prospects. The 2009 Revision.” http://esa.un.org/unpd/wup/index.htm

UN-Energy (United Nations-Energy), 2005. “The Energy Challenge for Achieving the Millennium Development Goals.” http://www.un-energy.org/sites/default/files/share/une/un-enrg_paper.pdf

WHO (World Health Organization). 2006. *WHO Air Quality Guidelines: Global Update 2005*. Copenhagen: WHO Regional Office for Europe.

WHO (World Health Organization) and UNDP (United Nations Development Programme). 2009. *The Energy Access Situation in Developing Countries*. New York: United Nations Development Programme.

THE PATH TO REAL ENERGY SECURITY: BUILDING A SUSTAINABLE ENERGY PORTFOLIO

Africa faces severe energy challenges that will continue to constrain economic growth and human development if not addressed. Deficient power infrastructure has a detrimental effect on productivity, which dampens economic growth and weakens competitiveness. In most Sub-Saharan countries, infrastructure problems are estimated to account for 30–60 percent of overall drains on firm productivity, well ahead of red tape, corruption, and other factors (Escribano, Guasch, and Pena, 2008). And in half of the countries analyzed, power issues alone account for 40–80 percent of the infrastructure effect. If the quantity and quality of power infrastructure in all Sub-Saharan countries were improved to that of Mauritius, one of the region's top performers, long-term per capita growth rates would be 2 percentage points higher (Calderon, 2008).

Africa's power generation capacity is inadequate. The entire installed generation capacity of the continent is 124 gigawatts (GW), of which 94 GW is divided between North African countries and South Africa (IEA, 2009). The rest of the Sub-Saharan region relies on an installed capacity of only 30 GW, about the same as Norway, a country of less than one percent of Sub-Saharan Africa's population. Historically, the region's average annual installed capacity increase has been just half that of other developing regions. In 1980, Sub-Saharan Africa matched South Asia in per capita generation capacity, but it has since fallen far behind. Outdated power infrastructure further aggravates the need for new power generation; over half of existing capacity requires refurbishment.

Although North African countries have high electrification rates, electricity demand continues to grow, and a supply–demand gap remains. There is significant potential, however, to conserve energy through various measures of efficiency and pricing.

The high cost of power production is a major challenge for Sub-Saharan Africa. Most national power systems remain small in scale and there is widespread reliance on expensive oil-based generation. The average total historic cost of producing power in Sub-Saharan Africa is as high as $0.18 per kilowatt-hour (kWh), with an average effective tariff of $0.14 per kWh (Foster and Briceño-Garmendia, 2010). By comparison, tariffs in East and South Asia are only $0.07 per kWh and $0.04 per kWh respectively. Rising oil prices, lower availability of hydropower, and greater reliance on emergency leases have put further upward pressure on energy costs and prices in Sub-Saharan Africa.

Power shortages have made Sub-Saharan electricity services unreliable; more than 30 countries have experienced power shortages over the last few years, resulting in frequent interruptions and load shedding. Power outages mean substantial 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 unable to provide their own backup generation (Foster and Steinbuks, 2009). Backup generators now represent a significant proportion of total installed capacity in many Sub-Saharan countries.

The economic costs of power outages, including the costs of running backup generators and of forgone production, typically range between 1 and 4 percent of GDP (Foster and Briceño-Garmendia, 2010). A common response to the immediate crisis is to tender short-term leases for emergency power. Unlike traditional power generation projects, this capacity can be deployed in a few weeks, providing a rapid response to pressing shortages. As

of 2010, a cumulative 990 MW of emergency generation was estimated to be in place in Sub-Saharan Africa, accounting in some countries for large part of their total installed capacity.

Africa needs to scale up energy infrastructure to meet rapidly growing demand

Looking ahead, Africa will not be able to keep pace with growing demand without significant additions to its existing infrastructure. Using 2005 as a baseline, the World Bank estimated that Sub-Saharan Africa needs to add 7 GW of new generation capacity each year through 2015 to meet suppressed demand, keep pace with projected economic growth, and support the rollout of further electrification (Foster and Briceño-Garmendia, 2010).

Economic growth is the most important driver of electricity demand. Sub-Saharan Africa's GDP grew 4.9 percent per year from 2001 through 2008, more than twice its pace during 1980s and 1990s. Growth was still positive during the global financial crisis (at 2 percent in 2009) and has accelerated ever since, reaching 5.9 percent in 2011 (IMF, 2011). In North Africa, countries need to double their power generating capacity during 2010-2020, which would imply an addition of 45GW to the current installed capacity.
T
o accelerate progress, all stakeholders, including governments, private investors, donors, and international institutions need to come together to scale up available finance, raise capacity for project preparation and execution, and improve the investment climate. A broad consensus is necessary if key regional transformational projects and needs are to translate into cohesive regional planning, consistent national plans, and high-quality preparatory work.

African countries must accelerate and expand their supply efforts to meet rapidly growing demand. In Sub-Saharan Africa, generation capacity grew less than 1 GW per year from 1990 to 2005. But recent financial commitments to generation projects by the private sector, non-OECD partners, and donors indicate that a turnaround may be close. The projects have added an average of 3 GW per year, with 6 GW of capacity added in 2010 alone. A surge in South–South cooperation has played an important role. Capital flows into Africa's power sector from emerging financiers such as China, India, and Arab donors have reached unprecedented levels in the last few years, exceeding $1.1 billion annually.

Nearly 31 GW of generation projects have been planned for the next 5–7 years in Sub-Saharan Africa (table 1). Although not sufficient to fully bridge the region's energy deficit, this capacity addition is critical progress. Once completed, the additions will double the overall installed capacity of the Sub-Saharan region (excluding South Africa). However, less than 16 GW of additional capacity are currently in pipeline; an additional 15 GW should therefore be prepared, with commitments equally shared by multilaterals, emerging financiers and private sector.

Table 1. Planned generation projects in Sub-Saharan Africa, by financing source (GW)

	Under construction	In preparation	Total
World Bank	8.0	4.0	12.0
Other multilaterals	1.4	4.0	5.4
Emerging financiers	4.8	4.0	8.8
Private sector	1.4	3.0	4.4
Total	**15.6**	**15.0**	**30.6**

Source: Authors.

In North Africa, according to AUPTDE (Arab Union of Producers, Transporters, Distributors of Electricity) and the U.S. Energy Information Administration, power production grew at an annual rate of 4.8 percent between 1990 and 2008, rising in absolute terms from 90 TWh in 1990 to 250 TWh in 2008. Growth is expected to continue in the future at an average annual rate of about 3.3 percent through 2030.

Uncertainty regarding the future of an international climate change agreement calls into the question the long-term viability of revenue streams for low-carbon projects via carbon markets. However, Africa is an ideal candidate for broader climate financing that can be used to support cleaner generation capacity development at various stages of the project pipeline.

Renewable energy can help bridge Africa's energy deficit

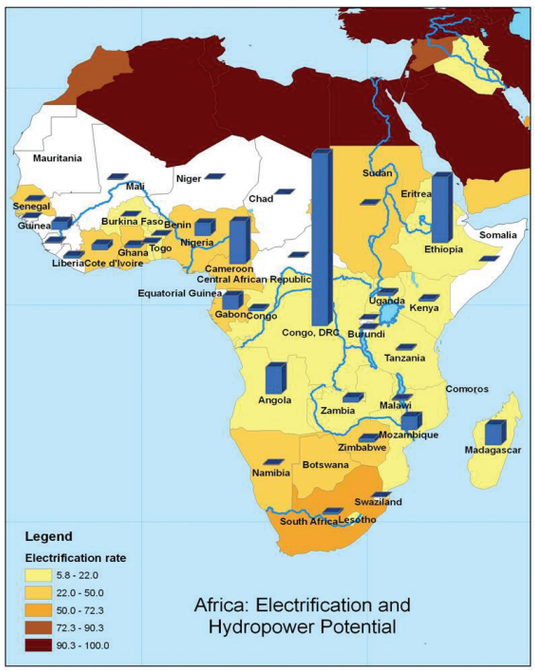
Climate change puts pressure on developed and developing countries alike to reconcile economic growth with environmental concerns. But the challenges ahead are more complex for developing countries, which must allocate scarce resources among pressing and sometimes contrasting development needs. In order to sustain growth and meet the needs of its several hundred million people, Africa needs to make larger strides than other developing regions in expanding access to modern energy services. But it is also the most exposed region in the world to the impacts of climate change. Increased frequency of droughts and floods will make African agriculture—93 percent of which is rain-fed—even more vulnerable. Meanwhile, rising energy prices, especially for carbon-intensive fuels, will further undermine the precarious financial health of Africa's utilities and drain public and private resources from much-needed investment in the power sector. Finding the right energy solutions to set the continent on a sustainable energy-production path is imperative. Renewable energy can greatly contribute toward this objective. Africa is blessed with abundant renewable energy sources, including hydro, geothermal, wind, and solar. Their development at scale as part of a diversified portfolio can reduce vulnerability to supply disruptions and market volatility while allowing for a greener energy mix.

Hydropower in particular can reconcile several development imperatives: energy security, climate change mitigation and adaptation, water security, and regional cooperation. It is important to note that various hydro-meteorological and climate factors such as rainfall, river flow, and drought can affect hydropower generation potential, making this resource susceptible to forces of climate change (Ebinger and Vergara, 2011). However, if Africa were to develop the same share of its hydropower potential as does Canada, the continent would see an eight-fold increase in electricity supply. This would be essentially carbon neutral energy. As a major source of base load capacity, hydropower can complement more variable renewables such as solar and wind, greatly increasing power-supply reliability. While expanding power generation, multipurpose hydropower can strengthen adaptation to increasingly variable hydrology and support irrigation, domestic water supply, navigation, and industrial water supply. Finally, hydropower offers a hedge against rising energy prices and is an important tool for building regional cooperation in both energy and water management.

Sub-Saharan Africa accounts for nearly one tenth of the world's total economically feasible hydropower potential, of which less than 8 percent is currently developed. This potential is concentrated in a few countries (figure 1), with the Democratic Republic of Congo and Ethiopia alone accounting for 60 percent of it. But both are far from the economic centers in southern, western, and northern Africa, and the multi-billion-dollar investments needed to exploit hydro potential are too big for their economies. Regional cooperation leading to full development of power pools and power trade is therefore critical to achieve the scale required to produce hydropower efficiently and spread its benefits to the wider Africa's population.

A review of planned Sub-Saharan hydro projects suggests that considerable hydropower potential of 30 GW can

Figure 1. Africa's hydropower potential



Source: Foster and Briceño-Garmendia, 2010.

be developed within the next decade, mainly concentrated in a handful of countries that are strategically located across the continent (i.e. Ethiopia, Guinea, the Democratic Republic of Congo, Sudan, Mozambique, Cameroon, Zambia, Uganda, and Ghana). These countries altogether have developed less than 10 GW of hydropower in the last decade. But the substantial necessary scale-up requires consideration of several factors, including high capital costs, long lead times, the lack of hydrological data and analysis, the complexity of water allocation across users and jurisdictions, and environmental and social concerns. Capacity building should be deployed at the country level to strengthen energy sector planning and water management, and at the regional level to build long-term river-basin management and support regional planning and coordination to foster regional power markets. Furthermore, while large hydropower projects can expand generation capacity at a lower unit cost, initial capital costs and environmental and social impact assessment costs can be prohibitive. In particular, project preparation costs for large hydro projects can exceed US$100 million as illustrated by the experience of Nam Theun II in Lao PDR. There is a need for more resources to be made available via a combination of private sector participation and donor funding which requires stakeholder coordination. Careful attention should also be paid to the social impacts of large scale hydropower projects and effective stakeholder participation should be promoted to ensure that benefits are equitably shared with affected populations.

Geothermal energy is well suited for providing base load power and is ideal for rural and off-grid applications, given its reliability and low unit costs compared to other renewable technologies. Geothermal has the highest availability factor,[2] at about 95 percent, and provides entirely green energy with practically no adverse effects on the environment.

The East Africa Rift System (EARS) has abundant geothermal potential, able to generate over 15 GW with today's technologies. Exploration and development of geothermal has been carried out at varying degrees by EARS countries. Kenya is at the forefront of the exploration and development of geothermal resources in the region and has a current capacity of 198 MW (box 1). In Ethiopia, a geothermal pilot power plant with an installed capacity of 7.2 MW is currently contributing 4 MW. Djibouti is conducting detailed investigation of geothermal sources, while Eritrea, Rwanda, Tanzania, and Uganda are at a stage of semi-detailed and detailed exploration. Burundi, Comoros, the Democratic Republic of Congo, and Zambia have not yet gone beyond initial reconnaissance and potential inventorying.

One main limiting factor in the development of geothermal resources remains the high upfront cost of necessary exploration and drilling activities, which are needed to confirm resource availability and solicit the interest of the private sector to build and operate power plants. The inadequate technical capacity and the lack of geothermal resource data are other issues that affect development of geothermal plants.

2 Defined as the amount of time a power plant is able to produce electricity over a certain period divided by the amount of time in that period.

Box 1. Geothermal energy development in Kenya

Kenya has an estimated geothermal potential of 7–10 GW spread over 14 prospective sites. Geothermal development is paramount to Kenya's energy diversification strategy. Despite its advantages, the development of geothermal has been slow. Despite its advantages, the development of geothermal has been slow. The current installed geothermal capacity concentrated in the Olkaria Block is 198 MW, of which 48 MW is privately operated. The government has introduced policies and measures to expedite and scale up geothermal development in the country, including opening up the sector to private-sector participation, establishing the Geothermal Development Company (GDC), and setting a feed-in tariff policy. Two additional independent power producers have been licensed to develop Suswa and Longonot geothermal prospects, while an additional 280 MW is under development in the Olkaria Block and is scheduled for commissioning in 2013. Another company is undertaking drilling operations in the Menengai Field, which has an overall potential of 1,600 MW, for initial development of 400 MW. Initial project development activities have also commenced for the development of 800 MW in the Bogoria-Silali Block. This is geared toward meeting the Vision 2030 medium-term target of 1,600 MW by 2016 and 5,000 MW by 2030.

Source: World Bank operational teams.

Wind and solar energy are increasingly becoming key low-carbon options to support technology diversification at both the national and regional levels. Further advancement will require resource mapping at the continental level and extensive cost competitiveness assessments.

Box 2. Developing renewables in North Africa

Algeria is committed to increasing the share of renewable energy sources in its generation mix to 5 percent by 2017 and 20 percent by 2030. The long-term goal is to be met primarily through concentrated solar thermal power (CST) (accounting for 70 percent of the renewable portfolio), which would make Algeria one of the world's most ambitious producers of CST. To this end, New Energy Algeria (NEAL) has been established to implement solar projects. The government has also introduced incentives for renewable generation, including a feed-in tariff.

Egypt is committed to increasing the share of renewables in its generation mix to 20 percent by 2020.This will enable the country to meet growing demand and free up natural gas for higher value export. A new electricity law allocates the proceeds from increased exports of gas to development of renewable capacity. Renewable capacity expansion plans include a 2,500 MW wind scale-up program under implementation and a 150 MW CST program to be implemented by 2017.

Morocco's solar plan aims to increase the share of renewables in the country's generation portfolio to 42 percent by 2020, for a total of 2000 MW of solar-based capacity. The nationally integrated utility is currently implementing an integrated solar combined cycle project with a 20 MW solar field at Ain Beni Mathar.

Tunisia has been a pioneer in the field of renewables among developing countries, having formulated and implemented a policy for rational use of energy and promotion of renewables as early as 1985. Energy intensity began to level off in the 1990s and has since declined to the lowest level in the Middle East and North Africa region. The government has recently announced a "Tunisian Solar Plan" to be rolled out between 2010–16. It includes 40 renewable-energy projects incorporating wind, solar (including three CSP projects totaling about 225 MW), and biomass technologies.

Sources: CTF, 2010; World Bank operational teams.

The North African countries offer a range of useful practices and lessons on renewable energy development, solar and wind (box 2). Given the rising costs of conventional power and the fast growing demand for electricity, these countries have been developing targets for renewable energy and in many cases explicit sub-targets for each technology. Renewable energy development in North Africa has mainly focused on concentrated solar power (CSP), given the abundance of solar radiation and the possibility to access premium markets for solar energy such as the Northern Mediterranean countries. However, exploiting the region's solar energy potential requires significant upfront risk mitigation and substantially expanded concessional financing facilities.

Among Sub-Saharan African countries, South Africa has made considerable strides in advancing renewables. The government has developed an integrated resource plan with a target of nearly 18 GW of additional capacity from renewable sources to be built within 20 years.[3] The national regulator has implemented renewable energy feed-in tariffs (REFIT) for wind, hydropower, landfill gas, concentrated solar thermal power (CST) and photovoltaic solar power (solar PV). The private sector has played a substantial role as well. The national power utility, Eskom, has raised $1.2 billion from various sources, including the Clean Technology Fund (CTF), the World Bank, the African Development Bank, and bilateral and commercial lenders, to develop wind and CST projects.

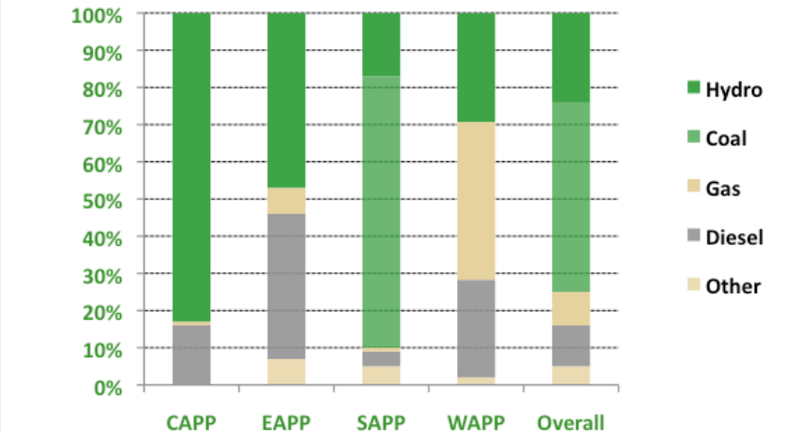
A variety of technical, regulatory, and financial constraints have so far inhibited large-scale development of renewable capacity in Sub-Saharan Africa. Often these also inhibit low-carbon interventions in the non-renewable sector, such as the installation of more efficient generation technology for natural gas and coal installations. From a technical point of view the most obvious impediment is the general lack of accurate data on resource availability. And even if data is available, suitable and up-to-date renewable technology might not be. A further problem is the limited amount and quality of technical skills available locally for installation, operation, and maintenance, let alone manufacturing of renewable-resource technologies. Further, there are often no suitable regulatory and financial frameworks in place that grant incentives for the investments in renewables. In some cases countries have opted for selective regulatory interventions which usually fail to provide a clear long-term perspective to developers and therefore do not trigger substantial investment. Ultimately, a persistent financing gap affects the development of renewables, starting from the lack of dedicated funds to finance feasibility studies and gather accurate data on renewable resources to the lack of private investments due to investor's high risk perception. The problem is compounded by the scarcity of public funds both for financing the infrastructure needed to support deployment of renewable resources—especially transmission and distribution—and to complete project financing in public–private partnerships.

Fossil fuels will remain a prominent part of the energy mix in Sub-Saharan Africa

Currently, thermal generation based on fossil fuels dominates energy supply in Africa. Over half of the generation capacity is coal-based, with hydropower accounting for 25–30 percent (figure 2). The present generation mix is a corollary of the relative abundance of non-renewable energy sources: Botswana, South Africa, and Zimbabwe together hold 5.6 percent of the world's proven reserves of coal, while the countries on the Gulf of Guinea hold 4.9 percent of the world's proven oil reserves and 7.8 percent of its proven natural gas reserves. But as of today, fossil fuel-based power is also the only alternative for several African countries. Coal will remain a critical fuel for meeting rising energy needs in the near term for countries that have abundant reserves of it. Meanwhile, many Sub-Saharan countries must resort to technically inefficient forms of generation powered by expensive imported fuels, such as diesel or heavy oil, due to concentration of resources, the small scale of energy markets in most of the region, and the relative lack of cross-border trade. In East and West Africa, about one-third of installed capacity is diesel-based generators. These countries have few domestic energy resources of their

3 Integrated Resource Plan for Electricity 2010–30, Revision 2, Final report, March 25, 2011, http://www.doe-irp.co.za/content/IRP2010_2030_Final_Report_20110325.pdf

Figure 2. Sub-Saharan Africa's current generation portfolio by subregion



Source: Eberhard and others, 2008.

own, even though there are sufficient hydro and gas resources in neighboring countries to support much lower-cost forms of generation. Moreover, for the time being, wind and solar are not always economically feasible power generation options outside of Northern African, South Africa, and some coastal areas.

Under these constraints, African countries cannot afford to simply overlook fossil fuels, despite environmental concerns. One solution available to many countries is the use of lower-carbon, reliable and affordable natural gas, in addition to renewables. Also, with adequate technological transfer and financial support, countries highly reliant on coal may move toward more efficient coal-based generation. Finally, reducing gas flaring is an imperative both from an efficiency point of view and for environmental preservation.

Natural gas can serve as an affordable bridge to a more sustainable energy supply and is already playing a critical role in the primary energy portfolios of many developing countries. Moving from oil and coal toward gas is a major step forward in reducing CO_2 emissions. CO2 emissions from a natural gas plant are about half those from a coal plant of the same size (Skone, 2010). Overall, it is estimated that replacing coal with natural gas in developing countries would reduce CO_2 emissions by almost 200 million tonnes annually for every one percent market share gain (IEA, 2009)[4]. Power and boiler facilities using natural gas have lower capital costs and require less maintenance than coal or oil. Combined cycle plants provide high efficiencies and can be approved and constructed in much less time than alternatives of similar magnitude. Moreover, gas is an ideal fuel to provide essential base load, swing and back-up capacity to renewable-based power systems (wind, solar and run of river hydro).

Advanced coal technologies for new generation and retrofitting older plants can substantially increase fuel conversion efficiency, thereby limiting greenhouse gas emissions. Technologies like ultra-supercritical pulverized coal, fluidized bed combustion, and integrated gasification combined cycle—while exhibiting different degrees of maturity—offer much higher efficiencies and lower emissions than current subcritical coal technologies. In order to make these technologies available, technology transfer and adequate financial support have to be secured. This is also the case for various other technologies that could significantly improve the environmental characteristics of coal-fired capacity, like carbon capture and storage (CCS), which in the mid- to long-term will allow for the sequestration and storage of large shares of the emissions caused by coal-fired generation, or underground coal gasification (UGC), which eliminates the need for waste disposal and can reduce emissions by around 25 percent. Advanced coal technologies are being deployed at scale in South Africa, helping the country to reconcile the imperatives of energy security and environmental preservation (box 3).

Reducing gas flaring would avoid a significant waste of resources and an extra burden on the environment. Gas flaring is perhaps the most egregious example of Africa failing to tap its energy potential. It is estimated by the end

4 Based on EIA reference case assumptions for 2030 reference case: 2.19 Mt/Mtoe Gas vs 3.81 Mt/Mtoe Coal used for primary fuel

Box 3. Advanced coal technologies in South Africa

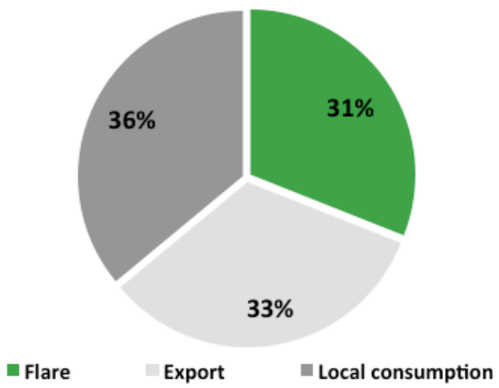
Two new 4800 MW coal-fired power plants in South Africa, Kusile and Medupi, are slated to incorporate super-critical technology. Due to the semi-arid environment and thus the need for dry-cooling, the more mature super-critical technology was preferred to dry-cooled ultra-supercritical. When completed, the two plants will be the largest dry-cooled coal-fired supercritical power plants in the world. Both will be fitted with wet flue gas desulphurization (FGD) equipment, and Kusile will additionally be CCS ready, with work already underway for the first CCS test injection in 2016 and the first operational project in 2021. A pilot UGC project with the objective of ultimately constructing a 2000 MW combined-cycle gas turbine (CCGT) is also underway.

The two coal-fired power plants, along with a new 1300 MW pump storage hydro plant, rehabilitation and re-powering of older power plants, improved energy efficiency, and demand side management, will help the whole southern African sub-region balance its power demand and supply. This will in turn help the sub-region stay on course to achieve MDG and poverty reduction targets in a more sustainable manner.

Source: Authors.

of 2012, only 33 percent of Sub-Saharan Africa produced gas will be consumed in the region; the remaining two-thirds will be exported or flared (figure 3). The amount of gas flared annually could produce 200 TWh of electricity, twice as much the current consumption in Sub-Saharan Africa excluding South Africa. Recent actions by Africa governments and support from development partners have focused on the upstream segment of the natural gas value chain to strengthen government policy and regulation, and to help the mining industry to adopt better business practices. Additional support is needed in the midstream and downstream segments to further reduce flaring and expand gas-fired power generation. Support should span from technological transfer to investments in hard infrastructure and markedly regional gas transportation systems to link gas-rich with energy-poor countries. Attentively devised regulation reforms can also provide effective incentives toward the expansion of gas-fired generation to supplement renewable sources of energy or to increase base load power.

Figure 3. Use of natural gas inSub-Saharan Africa by the end of 2012



Source: GGRF, 2011.

Private sector investments in thermal energy could be scaled up substantially. Africa has substantial potential for gas, geothermal, and other thermal generation that is highly suitable for private sector development by means of Independent Power Projects (IPPs). Historically, private sector investments in these types of projects has been surprisingly low, with a cumulative total capacity of just short of 3 GW, and have heavily concentrated in gas in a handful of countries, mainly in Nigeria and South Africa (table 2).

IPPs could potentially deliver an additional 13.6 GW of capacity in the next 10 years, with 4 GW realizable in the next 5–7 years. About a dozen countries could benefit from IPPs as long as they create the necessary enabling investment climate. Countries where IPPs have been successful have relatively well developed institutions

but remain far from best practice. Credit enhancements are critical to offset perceived investment risks, and multilateral development banks, in cooperation with their public/private windows and guarantee facilities, should contribute to this aim by effectively deploying risk mitigation support.

Table 2. Current and potential IPP generation capacity in Sub-Saharan Africa

Country	To date (GW)	Potential (GW)	Technologies
South Africa	0.6	4.8	Coal
Nigeria	1.3	2	Gas
Botswana	0	1.2	Coal
Kenya	0.2	1	Geothermal, oil
Mozambique	0	0.8	Coal
Ghana	0.01	0.8	Gas
Namibia	0	0.7	Coal, gas
Angola	0.01	0.6	Gas, oil
Tanzania	0.1	0.5	Gas, coal
Côte d'Ivoire	0.3	0.3	Gas
Uganda	0.2	0.3	Gas, oil
S. Sudan	0	0.3	Gas, oil
Others	0.2	0.3	Gas, coal
Total	**2.9**	**13.6**	**Mainly gas**

Source: Authors.

References

AU Commission 2010. “Status, Strategy, Gaps, and Support Programmes in the 11 Countries of the East African Rift System (EARS) for Development of Their Geothermal Energy Resource.” African Union Commission, Infrastructure and Energy Department, Energy Division.

Boden, T.A., G. Marland, and R.J. Andres. 2010. “Global, Regional, and National Fossil-Fuel CO2 Emissions.” Carbon Dioxide Information Analysis Center (doi 10.3334/CDIAC/00001_V2010), Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, TN.

Calderón, César. 2008. “Infrastructure and Growth in Africa.” Working Paper 3, Africa Infrastructure Country Diagnostic, World Bank, Washington, DC.

CTF (Clean Technology Fund). 2010. “Investment Plan for Concentrated Solar Power (CSP) in the Middle East and North Africa Region.” www.climateinvestmentfunds.org.

Eberhard, Anton, Vivien Foster, Cecilia Briceño-Garmendia, Fatimata Ouedraogo, Daniel Camos, and Maria Shkaratan. 2008. “Underpowered: The State of the Power Sector in Sub-Saharan Africa.” Background Paper 6, Africa Infrastructure Country Diagnostic, World Bank, Washington, DC.

Ebinger, Jane, and Walter Vergara. 2011. “Climate Impacts on Energy Systems Key Issues for Energy Sector Adaptation.” World Bank, Washington, DC.

EIA (Energy Information Administration). 2011. *International Energy Annual*. Washington, DC: U.S. Department of Energy. http://www.eia.doe.gov/emeu/international/contents.html.

Escribano, Alvaro, J. Luis Guasch, and Jorge Pena. 2008. “Impact of Infrastructure Constraints on Firm Productivity in Africa.” Working Paper 9, Africa Infrastructure Sector Diagnostic, World Bank, Washington, DC.

Foster, Vivien, and Cecilia Briceño-Garmendia, eds. 2010. *Africa’s Infrastructure: A Time for Transformation.* Paris and Washington, DC: Agence Française de Développement and World Bank.

Foster, Vivien, and Jevgenijs Steinbuks. 2009. “Paying the Price for Unreliable Power Supplies: In-House Generation of Electricity by Firms in Africa.” Policy Research Working Paper 4913, World Bank, Washington, DC.

GGFR (Global Gas Flaring Reduction Public-Private Partnership). 2011. http://www.worldbank.org/ggfr.

IEA (International Energy Agency). 2009. *World Energy Outlook 2009*. Paris.

IMF (International Monetary Fund). 2011. “Regional Economic Outlook: Sub-Saharan Africa.” Washington, DC.

IPCC, 2011: Summary for Policymakers. In *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation,* ed. O. Edenhofer, R. Pichs, Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow. Cambridge: Cambridge University Press.

Skone, T.J., 2010, “Life Cycle Greenhouse Gas Analysis of Natural Gas Extraction and Delivery in the United States.” U.S. National Energy Technology Laboratory

SREP. 2011. “Scaling-Up the Renewable Energy Program: Investment Plan for the Republic of Kenya.” Ministry of Energy, Nairobi, Kenya.

REGIONAL POWER TRADE: CUTTING THE COST OF ENERGY FOR AFRICANS

Power trade can address key energy challenges in Africa, including the continent's chronic struggle for adequate generation capacity and affordable production. Analysis based on data from 2005 suggests that Sub-Saharan Africa will need to add around 7 GW of generation capacity per year for a decade to satisfy existing demand for power and keep pace with the anticipated expansion (Foster and Briceño-Garmendia, 2010). Full development of regional power trade will allow Africa to efficiently tap into its enormous energy potential by realizing economies of scale in a context where resources tend to be concentrated and most countries have energy systems that are simply too small to achieve adequate scale individually. Further, trade will put Africa on a less carbon intensive path by allowing the diversification of the energy portfolio at the power pool level with an incorporation of greener energy into the mix.

Energy resources can be pooled and economies of scale can be leveraged through regional trade arrangements. Under such an arrangement, regional power demand is met by the most cost-effective energy resources available to the region as a whole, and additional cross-border transmission capacity is added wherever required to allow power to flow from production to consumption locations. This arrangement stands in contrast to a situation without trade, where incremental power demand is met solely through expansion of the domestic power sector with no increase in additional cross-border interconnectors. Power trade can be especially attractive to countries that are forced to rely on expensive imported fuels to develop their domestic power sectors and meet their growing demand for power.

Table 1: Extent of regional power trade, 2005–06

	Consumption (TWh)	% of electricity traded
CAPP	8.80	0.1
EAPP	13.41	2.1
SAPP	233.97	9.7
WAPP	28.63	5.7
Total	**284.81**	**8.6**

Source: Derived from Rosnes and Vennemo, 2009.

Power trade has yet to fully take off in Africa. As of 2005–06, cross-border power trade accounted for less than 10 percent of the power in Africa compared to a full potential of 40 percent (table 1). The volumes of electricity traded were relatively small with almost all the trade concentrated in the SAPP. The overall low volumes of trade are indicative of limited availability and capacity of interconnectors to wheel power across borders.

To feed the power pools (box 1), a few countries will need to expand their generation capacity through a set of large-scale, transformative generation projects. Others will need to invest heavily in cross-border transmission capacity (interconnectors) in order to import power.

With new hydropower and cross-border transmission lines, power would flow across Africa

Expanding trade depends critically on massive investments in hydropower by a few countries—Guinea, the Democratic Republic of Congo, Cameroon, Ethiopia, and Sudan. Such projects alone could amount to nearly 75 percent of Sub-Saharan power trade. Inga, in the Democratic Republic of Congo, illustrates the type of transformative investments to be pursued (see box 2, at the end of this report).

Box 1. Power pools in Africa

Regional power trade and the infrastructure needed to facilitate it are best understood in the context of power pools, which span economic communities in Africa. The four main power pools are the Central Africa Power Pool (CAPP), the Eastern Africa Power Pool/Nile Basin Initiative (EAPP/NBI), the Southern Africa Power Pool (SAPP), and the West African Power Pool (WAPP):

The CAPP comprises Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea, and Gabon. It is the main power pool for the CEMAC region.

The EAPP/NBI comprises Burundi, Djibouti, Kenya, Rwanda, Tanzania, Uganda, Ethiopia, Sudan, and Egypt. Owing to the central role of the Nile Basin in determining hydropower potential for the region, it is difficult to think about East Africa's long-term energy prospects without including Ethiopia, Sudan, and Egypt.

The SAPP comprises Angola, Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. It is the main power pool for the SADC.

The WAPP comprises Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. It is the main power pool for ECOWAS.

The island nations of Cape Verde, Madagascar, Mauritius, and Seychelles cannot benefit from interconnections with neighbors. The Democratic Republic of Congo also belongs to the CAPP.

Source: Authors.

Development of power trade will also require significant investments to develop cross-border transmission capacity. Figure 1 portrays the *ideal* vision of power interconnection across Africa countries. As is evident, a significant number of links are missing. Around 116,000 km of links exist, with over 32,000 km still missing.

Rosnes and Vennemo (2009) provide a detailed estimate of the new generation and cross-border transmission capacity that are needed to develop power pools to their fullest potential and maximize trade. Overall, Africa would need almost 82 GW of new generation capacity (or 73 GW without the Nile Basin).[5] Of this 25 GW is hydropower that will be constructed in a situation with full trade. The continent also needs a substantial 65 GW of interconnection capacity. The contributions from each pool needed to make the system effective are detailed in table 2.

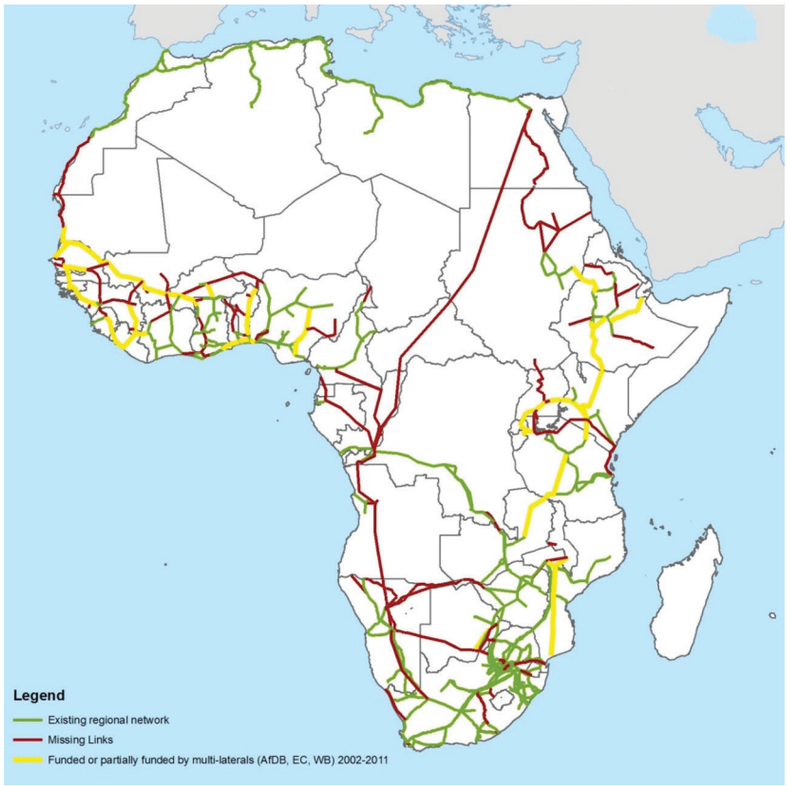
Table 2. Additional capacity requirements for trade (MW)

	Interconnector	Generation (total)	Generation (hydro)
CAPP	1,662	4,395	1,456
EAPP/NBI	27,755	25,637	10,968
SAPP	23,573	33,319	8,633
WAPP	11,250	18,001	3,700

Source: Rosnes and Vennamo, 2009.

5 The aggregates presented here differ from the estimated annual 7 GW of additional capacity previously presented because they include North Africa. Further, the previous estimates were based on the situation in 2005 and did not include progress since that time.

Figure 1. Existing and missing power trade links in Africa



Source: Derived from Foster and Briceño-Garmendia, 2010.

Expanding trade would allow large volumes of power to move across Africa. In the CAPP, Cameroon could capitalize on its rich hydropower potential and export power to all the countries in the power pool except the Central African Republic, which would remain self-sufficient. In the EAPP, Ethiopia and Sudan could fully develop their hydropower potential and become major regional power exporters.

The SAPP has been the most active power pool in Africa since its formation in the 1990s. With trade expansion, the Democratic Republic of Congo could fully develop its hydropower potential and become the region's major power exporter, exporting more than 350 percent of its domestic consumption. Mozambique would also increase its power exports, although on a scale significantly smaller than that of the Democratic Republic of Congo. Angola, Botswana, Namibia, and Zambia—none of which now imports any power—would become significant importers.

In the WAPP, Guinea could leverage its enormous hydropower potential and become the region's exporting powerhouse. Guinea-Bissau, Liberia, and Sierra Leone, which currently do not import any power, could become significant importers. Mali's imports could also expand considerably. Côte d'Ivoire could expect substantially less exports and Ghana could become even more reliant on power imports.

Regional trade promises substantial benefits

Regional trade provides significant opportunities for cost savings and less carbon intensive power generation. Power-exporting countries will produce more power than they can consume, exporting the surplus to their neighbors. Even though they must make substantial investments to expand generation, these countries stand to gain in the long run by selling power in their respective power pools.

Deepening regional power trade would bring substantial economic benefit by reducing the long-run marginal cost of power compared to a situation without trade. Given that power is a key production input to the economy, any reduction in the reference level of power costs spurs productivity and competitiveness. In the CAPP as a whole, trade expansion would reduce the long run marginal costs by $0.02 per kilowatt-hour, or 20 percent; the EAPP, the smallest pool, would see reductions of less than $0.01; SAPP would benefit from a decrease of $0.02, or 5 percent; and WAPP would see a 5 percent reduction in its long-run marginal power costs, from $0.19 to $0.18 per kilowatt-hour.

The magnitude of the cost savings in each country varies significantly. The largest beneficiaries would be

countries that have traditionally relied on very expensive small-scale oil-based generation, assuming that they are able to import hydropower from Cameroon (CAPP), Democratic Republic of Congo (SAPP), Ethiopia and Sudan (EAPP), or Guinea (WAPP). In extreme cases, such as Angola in the SAPP, savings could climb as high as $0.05 per kilowatt-hour. Even in countries where savings appear more modest—on the order of $0.01 per kilowatt-hour—the aggregate value of these savings can be quite significant. While the major power exporters would face an increase in long-run marginal costs due to the need to develop a much larger amount of power, and hence more expensive schemes than those that would be strictly necessary to meet domestic demands alone, these expenses will be more than offset by export income.

Trade integration promises to save each power pool substantial amounts in annual energy costs (table 3) relative to a situation without trade. Even though countries have to invest substantially to expand generation capacity—primarily for capital intensive hydropower—and cross border transmission capacity, these costs are offset by a reduction in variable costs, i.e., the fuel bill associated with reliance on thermal generating plants. For example, in the SAPP, trade expansion reduces the total annual cost of producing and distributing power from $19.5 billion to $18.4 billion, saving the region over $1 billion each year. Countries in the region would have to divert $0.4 billion of their investment budget from generation to regional interconnectors. This would allow the SAPP area to tap into large-scale hydropower, reducing variable costs by over $1 billion annually.

Table 3. Annualized costs of system expansion across power pools (US$ billions)

	Trade expansion	Trade stagnation
CAPP	1,386.0	1,546.0
EAPP	15.0	16.0
SAPP	18.4	19.5
WAPP	12.2	12.7
Island states	0.6	0.6

Source: Derived from Rosnes and Vennemo, 2009.

With increased trade, some countries would produce significantly greater amounts of power than what is domestically consumed. Building the necessary regional power infrastructure would allow Guinea to expand its power production up to 500 percent its domestic consumption, which could then be exported to its neighbors in West Africa. New hydropower generation could allow Cameroon to export power equivalent to 80 percent its domestic needs.

As trade developed, countries without a comparative advantage in power generation would rely on power imports. Some 15 countries would end-up exporting more than half their domestic power needs from neighbors (compared with the situation where trade did not grow). Botswana and Niger would end up importing 100 percent of their consumption from Democratic Republic of Congo and Guinea respectively.

Regional trade also puts Africa on a cleaner development path in terms of carbon dioxide emissions when compared to a scenario without trade. Regional power trade would allow hydropower to provide as much as 48 percent of the continent's energy needs, displacing as much as 20,000 MW of thermal power in the process and saving 70 million metric tons of carbon dioxide emissions annually.

But, a host of technical, financial, and political challenges make this a difficult prospect. Such a vast expansion of existing generation capacity presents a huge technical and financial challenge for the countries. Guinea, for example, would need to invest around $786 million annually for a decade, equivalent to almost a quarter of its

GDP. The Democratic Republic of Congo likewise would need to make an annual investment of $892 million for a decade, equivalent to almost 15 percent of its GDP. Such levels of investment would not be financially tenable for either country without massive capital contributions from the neighbors that would ultimately import the power. Unfortunately, several of the countries with hydropower potential have suffered from political instability and weak governance, which lessens their appeal as destinations for investments of this magnitude. Further, policy makers might be concerned about the large reliance on power imports for their supply of electricity.

In addition to the benefits of trade explained earlier, counter arguments that suggest that trade is a viable long-term alternative can be made. Several African countries rely heavily on expensive fuel exports for domestic power production which significantly increase power production costs. As explained earlier, trade offers a cheaper and viable proposition in the long-run. There is also a precedent for regional trade. Trade in Africa continues to work. Botswana and Niger for example continue to rely on trade for a substantial share of their power supply. Many countries, such as Mozambique, South Africa, Côte d'Ivoire, and Nigeria, have already proved themselves to be reliable power exporters for neighbors over extended periods of time.

Recent progress in promoting regional trade: new plants, new lines, new codes.

Some recent transformational projects have contributed towards enhancing regional integration and lowering energy costs. One example is the West Africa gas pipeline that aims to move 133 million cubic feet of gas per day from Nigeria to Ghana, Benin, and Togo to address those countries' power shortages and high costs of power production.[6] The project has already enabled Ghana to switch from high-cost oil-based generation to cost-effective gas fired generation, saving $0.10 cents per kilowatt-hour produced. Another example is the Southern Africa Regional Gas project, which supports development of gas fields in Mozambique and a 865 km cross-border pipeline to facilitate exports to South Africa to diversity its energy mix.[7]

Power pools have recorded varying levels of progress on regional development, as detailed below.

In the EAPP, a master plan and new transmission lines

The EAPP has completed work on a regional power master plan and a regional grid code to govern the operations of the regional interconnected electricity network. The master plan has endorsed the development of Ethiopia's large hydro resources to facilitate electricity exports to countries that are dependent on thermal generation (e.g., Sudan and Djibouti), currently facing suppressed demand and load shedding (e.g., Uganda, Rwanda, Burundi, and Tanzania), or soon to be energy constrained (e.g., Kenya and Tanzania).

Despite Ethiopia's phenomenal hydro generation potential of 30 GW, however, only 2 GW have been harnessed, and EAPP is still the least developed power pool in Sub-Saharan Africa. Some concrete actions have been recently taken in response to the political willingness and technical need to integrate electric systems. Two transmission lines will be commissioned soon, including interconnections between Ethiopia and Sudan (200 MW) and Ethiopia and Djibouti (180 MW). Those will export hydro energy from Ethiopia, displacing expensive thermal generation in Sudan and Djibouti.[8] And preparation has begun for the Ethiopia–Kenya Interconnector (Eastern Corridor).[9]

The EAPP's 30-year outlook envisages the interconnection of 8 countries in East Africa (figure 2). Based on

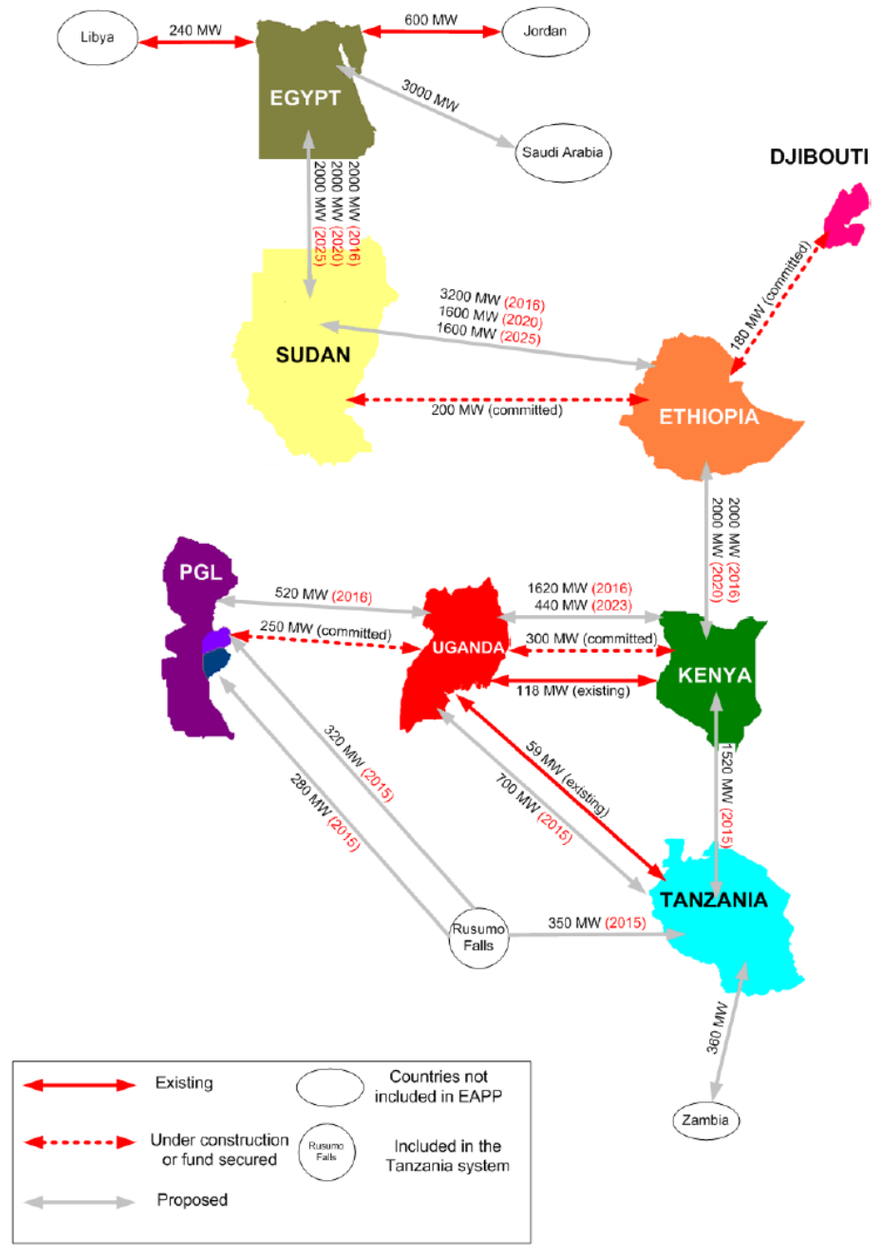
6 This project has received financing from the World Bank and the Multilateral Investment Guarantee Agency (MIGA)
7 This project has received financing from World Bank, the International Finance Corporation, and MIGA.
8 Part of the Ethiopia–Sudan interconnection is being financed by the World Bank's International Development Association.
9 The Ethiopia–Kenya Interconnector (Eastern Corridor) is to be built with support from the World Bank, the African Development Bank, the European Investment Bank, and the French development agency.

two ongoing least-cost expansion plan studies being carried out by the EAPP Secretariat and by the Nile Basin Initiative, transmission investments required over a 30 year period will total $4.7 billion.

In the WAPP, ambitious transmission programs

The WAPP has also made progress. Several transmission programs are in the works, including the Coastal Transmission Backbone Subprogram (Côte d'Ivoire, Ghana, Benin/Togo, Nigeria), the Interzonal Transmission Hub Subprogram (Burkina Faso, OMVS[10] via Mali, Mali via Côte d'Ivoire, LSG via Côte d'Ivoire), the North-core Transmission Subprogram (Nigeria, Niger, Burkina Faso, Benin), the OMVG[11]/OMVS Power System Development Subprogram (The Gambia, Guinea, Guinea Bissau, Mali, Senegal), and the Côte d'Ivoire–Liberia–Sierra Leone–Guinea Power System Redevelopment Subprogram.

Figure 2. Vision of East Africa Power Pool—Major interconnections



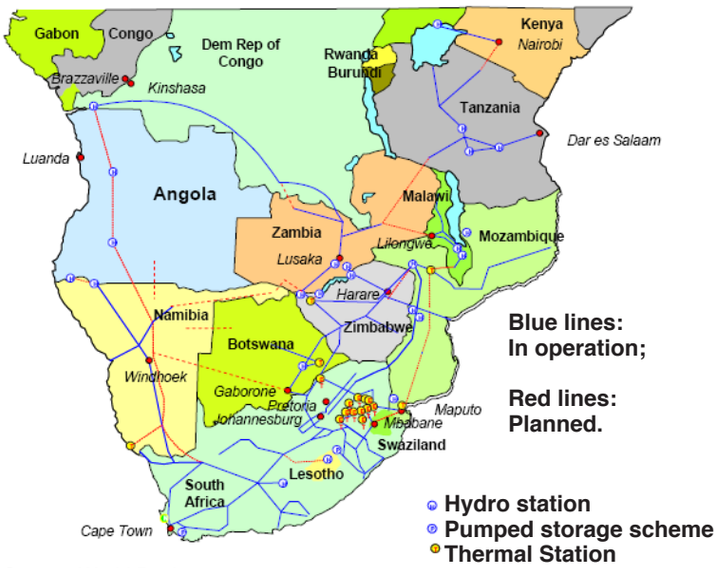
Source: SNC Lavalin International Inc., 2010.

As far as generation is concerned, the 60 MW Felou hydropower facility is under construction and expected to be commissioned in 2013, while in Ghana, construction is underway on the 400 MW Bui hydropower plant, with commissioning envisaged for the end of 2012. To fully address capacity generation shortages, WAPP also seeks to develop regional gas-fired power stations. The power pool launched an international call for prequalification of private partners; applications are expected soon.

In the SAPP, vital interconnectors and hydropower expansion planned

10 Organisation pour la Mise en Valeur du Fleuve Sénégal (Senegal River Basin Development Organization).
11 Organisation pour la Mise en Valeur du Fleuve Gambie (Gambia River Basin Development Organization).

Figure 3. SAPP transmission networks



Source: World Bank, 2011c.

Several projects are ongoing or planned in SAPP member countries. Planned interconnectors will transfer hydropower from the Democratic Republic of Congo to other SAPP members, including the Zimbabwe–Zambia–Botswana–Namibia interconnector the Hwange–Livingstone–Kafue project (figure 3).

But more concrete projects are also in the pipeline, and funding is expected from various entities, including the World Bank Group. Some examples include the rehabilitation of the Inga 1 and Inga 2 hydroelectric facilities; reinforcement of the current backbone from the Democratic Republic of Congo to Zambia; development of the SAPP–Zambia transmission line; development of the Mozambique transmission line; and hydropower development projects in Mozambique, including Cahora Bassa. Mphanda Ncua in Mozambique are also adding around 3,500 MW. Eskom has planned three additional plants—Medupi and Kusile are 4,800 MW coal-fired plants, and Ingula is a 1,300 MW hydro pump storage facility. South Africa has also added 765 kV and 400 kV transmission lines for internal needs and to support future interconnection

Box 2. Transformative investments: The power of Inga

The Inga site in the Democratic Republic of Congo, located on a bend in the Congo River, has possibly the largest hydropower potential in the world, about 40,000 MW. With the SAPP facing large power deficits in the future, the viability of sourcing clean and inexpensive electricity from Inga is being explored by the SADC and the African Union. The full development of Inga could turn the Democratic Republic of Congo into Africa's largest exporter of hydropower, allowing exports into the SAPP to rise from the current 400 GWh (equal to about 6 percent of current production) to more than 50 TWh. Power exports would earn the Democratic Republic of Congo net revenues of more than $500 million per year and guarantee a much more stable stream of income than the exports of physical resources, which are continuously affected by cyclical price movements.

Inga has two existing power plants with installed capacity of 1,800 MW each, but they are currently able to generate only 700 MW as a result of inadequate maintenance; their rehabilitation is supported under the World Bank's ongoing Southern Africa Power Market Program. The Democratic Republic of Congo is reviewing the scope for developing Inga 3 (4,300 MW) and possibly Grand Inga (at least 30,000 MW). Grand Inga could supply electricity to an estimated 500 million of Africa's 900 million people, as well as to the industries of several countries. A pre-feasibility study is being financed by the African Development Bank.

Inga 3 is expected to be developed as a private independent power producer at a cost of about $7–8 billion. About 2,000 MW would be purchased by private sector mining or smelting companies in the Democratic Republic of Congo and the rest would be available for domestic consumption and export—a transformative opportunity for the nation and and southern Africa. Strong multilateral and bilateral engagement will be needed to support (a) the technical, institutional, sustainability, and financing feasibility work required; and (b) the financing framework, both for the project investment itself and guarantees for managing regulatory and political risks.

Source: Adapted from World Bank, 2011a.

between with its neighbors. Finally, plans for Grand Inga are also under discussion (box 2).

References

Foster, Vivien, and Cecilia Briceño-Garmendia, eds. 2010. "Africa's Infrastructure: A Time for Transformation." Paris and Washington, DC: Agence Française de Développement and World Bank.

NIGELEC (Societe Nigerienne d'Electricité). 2009. *Analyse des Etats Financiers, Exercice 2009*. Niamey: NIGELEC.

Rosnes, Orvika, and Haakon Vennemo. 2009. "Powering Up: Costing Power Infrastructure Spending Needs in Sub-Saharan Africa." AICD Background Paper 5, Africa Region, World Bank, Washington, DC.

SNC Lavalin International Inc. (in association with Parsons Brinckerhoff). 2010. "EAPP/EAC Regional Power System Master Plan and Grid Code Study. Draft Interim Report."

World Bank. 2011a. Partnering for Africa's regional integration - progress report on the regional integration assistance strategy for Sub-Saharan Africa. Washington, DC.

———. 2011b. First Phase of the Inter-Zonal Transmission Hub (APL 3) Sub-Program of the West Africa Power Pool. Draft version. Washington, DC.

———. 2011c. Southern Africa Power Pool: Briefing for the Spring Meetings 2011. Unpublished report. Washington, DC.

World Bank 2009. "Morupule B Generation and Transmission Project." Project Appraisal Document. October 2009. Washington DC.

SECURING RESOURCES FOR INVESTMENT IN THE ENERGY SECTOR: CLIMATE FINANCE FOR GREEN GROWTH

Africa is rich in clean-energy potential, only a very small portion of which is currently exploited. The region has sizable scope for a transformational scale-up in energy access, with significant economic, development, and climate benefits. As the UNFCCC summit in Durban approaches, participants are discussing the future financing architecture that will support the transition to a greener development path for developing countries. In particular, proposals for the design of the Green Climate Fund will be put forward in Durban. These financial resources for green growth need to be oriented to support a low-carbon transition in Africa.

Targeted energy investment through dedicated climate funding instruments can catalyze much needed investment in Africa's low-carbon energy portfolio. Influential groups such as the G-20 have already demonstrated interest. Governments such as Norway and the United Kingdom have outlined plans to channel billions of dollars into clean and low-carbon energy development in developing countries, and energy investment by multilateral development banks (MDBs) and financiers outside the Organization for Economic Co-operation and Development (OECD) is scaling up. Further underscoring the growing global consensus, the UN General Assembly has designated 2012 as the International Year of Sustainable Energy for All with the idea that the theme will feed directly into Rio+20, to be held next year.

In June, the high-level Ministerial Meeting on Energy and Green Industry adopted the "30-30-30" goals. The goals outline a set of three objectives to achieve by 2030: universal energy access, a 40 percent increase in energy efficiency, and a 30 percent share for renewable energy. The last two goals are particularly relevant for countries and regions such as North Africa and South Africa with comparatively high electrification rates, while the issue of energy access is of the utmost importance for Sub-Saharan Africa. Increased international awareness and willingness to address these issues is a window of opportunity for Africa. The continent can substantially reduce its energy access burden and improve energy efficiency through the strategic use of new green growth funding.

Encouraging substantial investment in low-emission generation options present an opportunity for a technology leap in the energy sector. A cleaner development path represents the best option to check increases in energy-related CO_2 emissions for the continent while also enhancing energy security through portfolio diversification.

Furthermore, significant investment will exert an economic stimulus in the region, contributing to market expansion, job creation, and sustainable economic growth. Of particular note, green employment has the potential to generate both development and climate benefits while contributing to poverty reduction and promoting sustainable livelihoods.

A substantial scale-up in financing is imperative to reducing Africa's energy deficit

Using 2005 as a baseline, the World Bank estimated that Sub-Saharan Africa needs to add 7 GW of new generation capacity each year through 2015 to meet suppressed demand, keep pace with projected economic growth, and support the rollout of further electrification (Foster and Briceño-Garmendia, 2010). This implies investments of

around $40.6 billion are needed annually. However, existing investment stands at only $11.6 billion per year, creating a financing gap equivalent to nearly 4 percent of Sub-Saharan Africa's GDP. This presents a significant challenge for the region's governments. Funding from the public sector and from sources of official development assistance (ODA) is not sufficient to meet the financing gap, resulting in a need to mobilize and increase private sector engagement. Table 1 summarizes the current spending needs, financing flows, and funding gaps in the power sector in Sub-Saharan Africa.

Table 1. Summary of power sector funding in Sub-Saharan Africa: Spending needs, current flows, and funding gap (US$Billion)

	Capital expenditure	Operation and maintenance	Total
Spending needs	26.6	14.0	40.6
Financing flows	4.6	7.0	11.6
Funding gap*	17.6	5.6	23.2

** Totals do not add up because the funding gap can be reduced by (i) improving operating inefficiencies of power utilities ($3.3 billion); (ii) increasing cost recovery ($2.2 billion); and (iii) improving execution of capital budgets ($0.3 billion).*

Source: Adapted from Foster and Briceño-Garmendia, 2010

In the short to medium term, it is important to secure the resources needed to finance nearly 31 GW of new generation capacity already planned in Africa. Just over half of this additional capacity is already in the project pipeline; to maintain momentum, additional resources are needed immediately. The associated funding needs for the entire 31 GW are approximately $27 billion. Of this, a $14 billion financing gap will need to be bridged to prepare the remaining 15 GW of pre-identified generation capacity. Largely out of reach of Sub-Saharan public sector budgets, concrete solutions that can stem the financing shortfall need to be identified and supported.

In the longer term, transformational energy projects such as large hydropower development have the potential to change Africa's economic outlook and growth trajectory. But the required financing, including upfront capital and funding for environmental and social impact assessments, can be prohibitive. Project preparation can account for a significant portion of overall costs (box 1). Also, the energy created needs to be efficiently transmitted to paying consumers in other countries for the investment to be feasible and to have concrete development impacts. Therefore, there is an acute need to catalyze available financing and to harness new funding sources for both a substantial scale-up of generation capacity and for building regional interconnections.

A healthy public sector is essential to attracting investment

The resources and the skills needed to develop transformational projects are beyond the capacity of just one institution. The scale of these projects requires coordinated government support, private sector participation, and the optimization of resource mobilization through the use of risk mitigation tools and concessional loans. Furthermore, these projects often necessitate multi-country cooperation and can therefore be geopolitically challenging, requiring the support of a wide spectrum of stakeholders. Public–private partnerships (PPPs) can be critical vehicles to address these challenges allowing to pool and leverage public and private finance and to better facilitate risk-sharing.

A large share of Africa's energy infrastructure is currently domestically financed. Dedicated public financing can play an important role in developing a strong pipeline of bankable projects, particularly when it comes to

Box 1. New generation projects through public-private development: The hydropower example

Financial resources dedicated to supporting Africa's low-carbon energy development agenda can play a considerable role in developing key projects in a timely manner. Many projects rarely progress beyond the feasibility study stage, remaining undeveloped or indefinitely stalled. This is often the result of insufficient access to financing for project preparation.

Governments are typically not in a position to advance resources or borrow money for project preparation and private sponsors are unwilling to take the significant risks involved in sinking large sums of money up front. Existing donor project preparation facilities are difficult to access, often have different eligibility priorities and are rarely able to provide grants of more than $1–10 million.

The Inga 3 hydroelectric project in the Democratic Republic of Congo is an example of an important transformational project in need of project preparation financing. Projected to bring 4,300 MW of power online, the project only represents a small portion of the Congo River's 40,000 MW of hydropower potential at the site. It is imperative that action be taken now, lest the project become permanently delayed, leaving millions waiting in the dark.

One of the largest bottlenecks for transformational projects such as hydropower is the high upfront capital requirement, including high preparation costs. The following chart provides examples of overall project cost versus preparation costs of several hydropower projects. As demonstrated below, necessary project preparation will cost $100 million for Inga 3

	Overall project costs (US$ M)	Preparation costs (US$ M)	% of total
Implemented			
Bujagali	780	15	2
Nam Theum 2	1,400	124	9
Under preparation			
Inga 3	> 5,000	100	< 2
Cahora Bassa Nth	1,000	60	6

projects based on PPPs. Specifically, the public sector can make certain types of strategic investments—for example, toward the large-scale deployment of greener energy sources, including transmission projects, and improvements in the business environment.

At present significant financial, regulatory, and capacity constraints contribute to a generally unfavorable investment climate and discourage much-needed private sector involvement. The power sector in Africa is particularly prone to high perceived risk and high transaction costs that may arise from a range of issues. Some of these risks include nonperformance of contractual obligations, regulatory risk, procurement problems, and expropriations. As result, investors are not confident of secure, long-term revenue streams. High investment risk may also result in undervalued assets, lowering financial incentives for the investor.

Political leaders and institutions can help mitigate such perceived risks by establishing a more conducive investment climate. This would involve expanding public financing, strengthening sector governance and utility performance, and putting in place regulatory and financial frameworks that will attract investment. A practical combination of targeted funding sources and improvements to the investment climate can leverage limited

resources, substantially increasing the flow of local and international private capital in the energy sector.

Also, donor and public resources dedicated to increasing planning capacity, project preparation, and additional pre-financing needs can go a long way in scaling up investment readiness and better project design.

Risk mitigation instruments can help attract private investments in low-carbon energy

The private sector needs a credible investment partner in the public sector. But the vast majority of Sub-Saharan countries currently do not have sovereign credit ratings. A combination of risk-mitigation instruments can do much to advance the creditworthiness of utilities and thereby attract investors. Credit ratings for power projects in particular are determined by factors such as predictability of project cash flows, project contract and competitiveness, technical and operating risks, and key financial metrics. Key to determining the above criteria are project feasibility studies, capacity assessments, and intense project preparation, all of which require substantial resources to be correctly carried out.

In this context, international organizations can play a critical role by expanding their traditional concessional financing function to include risk mitigation. Financial products—such as partial risk and partial credit guarantees—can significantly lower financing costs and enhance the bankability of projects. Guarantees from multilateral banks such as the World Bank Group have proven successful at leveraging substantial investment for various climate financing projects, including both public sector and private-participant projects. Notable examples include several hydropower projects—China-Ertan II (public project), Laos-Nam Teurn II (private project), and Uganda-Bujagali (private project)—and a transmission project for geothermal power, Philippines-Leite-Luzon (public project). Moreover, international organizations can provide important capacity building and technical assistance on many fronts: support the implementation of key policy reforms to improve the investment climate and reduce investment risks; enable project developers to meet industry and international standards in project preparation; and facilitate collaboration among multiple stakeholders.

Support is strong to mobilize resources for green growth

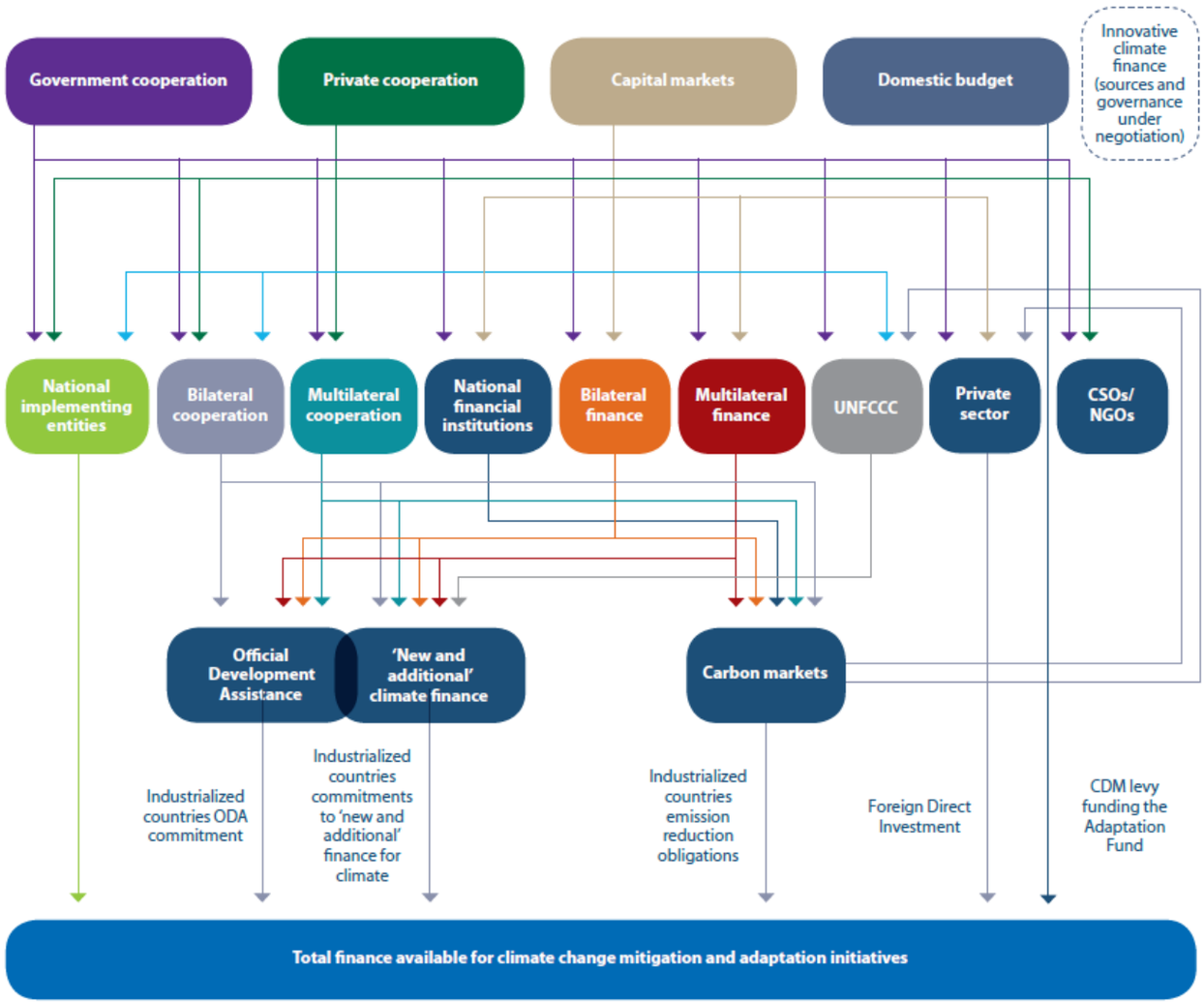
At the Conference of the Parties to the UNFCCC held in Copenhagen in 2009 (COP-15), developed countries pledged to mobilize $30 billion of “Fast-Start Finance” for developing countries between 2010 and 2012, with the goal of reaching $100 billion in annual financing by 2020. The Copenhagen Accord commitments were further reiterated in the Cancun Agreements of 2010. The Green Climate Fund (GCF), also conceived in Cancun, aims to help developing countries scale up climate resilience activities. It is expected that the financing will be mobilized from a wide spectrum of funding sources, including public and private, bilateral and multilateral, and alternative resources (figure 1).

The financing report of the High-level Advisory Group on Climate Change (United Nations 2010) found that strong commitments to domestic mitigation and the introduction of carbon-based instruments in developed countries are key to mobilizing financing for green growth, both public and private.

Climate financing has significant potential to promote greater climate resilience and energy access in Africa. Targeted green financing can fast-start project development and maintain momentum. It can also serve as a catalyst for strategic investment from the private sector by addressing specific aspects of cost and risk, as well as additional barriers encountered along the project cycle. Dedicated climate-related financing is essential to Africa’s adoption of greener energy technologies such as hydro and geothermal on a large scale, because pursuing these greener technologies is often not the least-cost option in the near- to medium-term. Climate financing is only one part of the solution when it comes to increasing energy access in Africa but it can strategically complement the

imperative scale-up of traditional forms of financing.

Figure 1. Climate financing: Sources, agents and channels



Source: Glemarec, 2011.

References

Findley, Michael G., Darren Hawkins, Robert L. Hicks, Daniel L. Nielson, Bradley C. Parks, Ryan M. Powers, J. Timmons Roberts, Michael J. Tierney, and Sven Wilson. 2009. "AidData: Tracking Development Finance," presented at the PLAID Data Vetting Workshop, Washington, DC. September.

Foster, Vivien, and Cecilia Briceño-Garmendia, eds. 2010. "Africa's Infrastructure: A Time for Transformation." Paris and Washington, DC: Agence Française de Développement and World Bank.

Glemarec, Yannick. 2011. *Catalysing Climate Finance: A Guidebook on Policy and Financing Options to Support Green, Low-Emission and Climate-Resilient Development*. New York: United Nations Development Programme.

IEA (International Energy Agency), UNDP (United Nations Development Programme), and UNIDO (United Nations Industrial Development Organization). 2010. "Energy Poverty: How to Make Modern Energy Access Universal? Special Excerpt of the World Energy Outlook 2010 for the UN General Assembly for the Millennium Development Goals." Paris: OECD.

Muzeda, Dambudzo. 2009. "Private Participation in Energy Infrastructure in Africa." OECD-NEPAD Investment Initiative, OECD, Paris.

Paribas. 2009. "Preliminary Financial Feasibility Study – Project Inga 3." Report prepared for the Government of the DRC, PPIAF, and World Bank, December.

United Nations. 2010. *Report of the Secretary General's High-level Advisory Group on Climate Change Financing*. New York. November.

ILLUSTRATIVE CLIMATE-RELATED FINANCIAL INSTRUMENTS FOR LOW-CARBON ENERGY INVESTMENT IN AFRICA

In Cancun in December 2010, the Conference of the Parties (COP) to the UNFCCC recorded Copenhagen Accord pledges for $30 billion in fast-start funding for Africa, least-developed countries, and small island developing states.[12] An additional $100 billion a year is also planned to be made available to developing countries by 2020. The African Energy Ministers Conference comes at a critical juncture in the wake of these COP pledges and in the lead-up to the December 2011 COP17 in Durban, South Africa. Specifically, the Transitional Committee for the design of the Green Climate Fund (GCF) is currently defining the scope, scale, and areas of prioritization for the intended scale-up of long-term financing for developing countries.

Energy access is vital for Africa's development, its achievement of the Millennium Development Goals, and its resilience to climate shocks and global economic shocks. With 2012 designated as the International Year of Sustainable Energy Access for All by the UN General Assembly, energy access will be a major theme in the lead-up to Rio+20. Moreover, the UN has adopted a new initiative on universal energy access, global energy intensity, and renewables: the "30-30-30" goals.[13] The African Energy Ministers Conference presents an opportunity to further enhance and embed sustainable energy access ideas in the broader climate dialogue. Initiatives conceived at the African Energy Ministers Conference could become points of reference for the GCF or for other climate-related financing initiatives in future.

A window of opportunity is opening for energy access in Africa

There are several innovative ways to target, initiate, and mobilize a wide range of funding resources for the development of energy projects. This paper outlines a few examples of climate-friendly products for harnessing financing to enhance energy access. These ideas draw upon existing concepts and submissions for innovative climate-related financing mechanisms. They are potentially relevant for Africa; therefore, they have been included here to enrich the discussion as part of the preparations for the "African" COP meeting in Durban later this year. Ministers may wish to consider calling on the COP in Durban and beyond to further develop these and other relevant initiatives.

With COP17 to be held in Durban, donors and the international community are keen to give renewed attention to Africa's challenges. Chief among these is energy access, which is unacceptably low in Africa, constraining development and increasing vulnerability to external shocks, including climate change. Only 42 percent of Africa's population has access to modern energy, with the rate for Sub-Saharan Africa as low as 31 percent. This contrasts with access rates of nearly 50 percent in South Asia and almost 80 percent in Latin America. The current funding gap for energy investment is around $23 billion per year, although the upfront cost of fully harnessing Africa's energy access potential (i.e. Meeting suppressed demand while keeping pace with economic growth) is likely to be in the range of $40 billion per year (Foster and Briceño-Garmendia, 2010).

12 For a summary of developed country fast-start climate finance pledges: http://pdf.wri.org/climate_finance_pledges_2011-05-09.pdf

13 Introduced at the high-level Ministerial Meeting on Energy and Green Industry held in Vienna in June 2011, the three goals are: (i) achieving universal energy access by 2030; (ii) increasing energy efficiency by 40% by 2030; and (iii) achieving 30% renewable energy by 2030.

Box 1. Key points of the CDM reform

Investment in energy infrastructure projects using carbon finance for CDM projects in Africa has proved more difficult than originally envisioned. Investors have encountered a significant number of financial and capacity barriers, including the high start-up costs of project development, limited funding sources, and high risk perception.

The UNFCCC and stakeholders are currently discussing new ideas of how to better position developing countries and regions to benefit from the CDM. There are several opportunities for reform. Two promising propositions include (i) baseline standardization that would simplify additionality rules for micro-scale projects, and (ii) the potential development of a "fast-track" CDM that prioritizes low-income countries and regions. Examples of micro-scale activities include energy efficient cook stoves, efficient lighting, solar water heating, rural electrification, domestic biodigesters, etc.

To ensure that Africa's specific needs are prioritized, a broad consensus will need to be reached among African stakeholders as represented by their respective designated national authorities (DNAs). However, while CDM reform is important, an international agreement is necessary in order to stimulate and guarantee developed country market demand for Africa's sizable low-carbon potential.

Successfully meeting the continent's energy access challenge will require a robust scale-up of both public and private finance, with a marked shift from traditional energy projects to more sustainable climate-friendly alternatives. So far, some of the internationally agreed climate finance mechanisms meant to catalyze such investment, such as carbon markets, have not delivered much for energy access for Africa. Carbon markets have failed to catalyze the anticipated financing for lower-emission energy projects in developing countries; Africa still only hosts 3 percent of all registered Clean Development Mechanism (CDM) projects worldwide.

Current climate finance mechanisms are not adequate for funding access to clean energy

Several barriers are often identified as impairing the ability of climate finance to promote investments in low-carbon infrastructure projects. The broader issues are inadequate access to capital, limited technical capacity, and an unfavorable investment climate. For carbon finance in particular, the absence of long term price stability and the resulting lack of predictability of future carbon revenue flows weakens its ability to support equity and debt financing. Furthermore, its performance-based nature means that carbon resources are not available for upfront financing needs.

To reach its true potential to mobilize substantial resources for low-carbon projects, climate finance needs a wider set of financial instruments that encourage increased investment by more effectively addressing the costs, risks, and barriers encountered along the project cycle. Perceived investment risk can be mitigated by taking steps to improve investment climates and increase capacity.

Energy projects need to be packaged and bankable in order to demonstrate their financial viability and attract investment. In particular, the public sector faces significant capacity building and technical assistance challenges. Both public and private sector projects require access to significant resources for project preparation. Africa faces an acute project preparation gap that severely constricts its infrastructure investment potential. [14] Projects that require large upfront investment would benefit from easy to access climate-related mechanisms and facilities

14 For more information, please see the following Public-Private Infrastructure Advisory Facility (PPIAF) publications: Leigland and Russell (2009), Leigland and Roberts (2007, and Leigland and Butterfield (2006).

that focus on upstream project preparation.

Innovation in climate-related financing could be an important area for helping energy-related projects in Africa reach financial closure. Several such ideas are presented in this document but are only intended to be illustrative, not all-inclusive.[15]

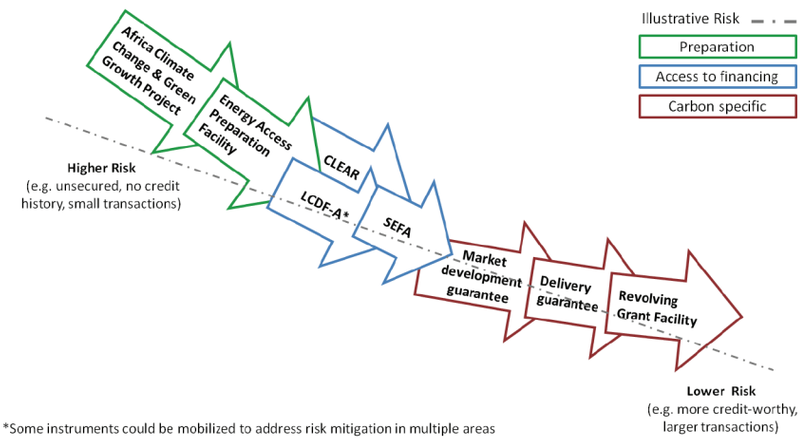
Several new climate-related mechanisms are being developed

Several illustrative initiatives that can address the various identified risks by providing or leveraging investment are outlined here. Intended to be exploratory as opposed to comprehensive, the examples include a range of instruments that address areas such as project preparation (project preparation facilities), financing (facilities to "buy-down" interest rates, development funds) and carbon finance (revolving funds, carbon guarantee instruments). Figure 1 illustrates how instruments in these three areas could help reduce risk. In theory, they can work synergistically to prepare, enhance, and close investment opportunities. Some may even address multiple areas, such as the Low-carbon Development Fund for Africa (LCDF-A), which addresses both project preparation and financing.

Carbon Market Development Guarantee. This product allows pooled carbon credits to be sold by host governments under a forward-sales contract to compliance buyers. It does so by mitigating the risk associated with forward sales of carbon credits, thereby increasing the potential from forward sales and enhancing foreign investments in climate change mitigation in developing countries.

Carbon Revolving Grant Facility. The Revolving Grant Facility would allow front-loading carbon revenues for a given project and shield the project sponsor from the regulatory risk associated with the CDM. It will provide a grant to project entities against a right to a portion of the future emission reductions to be generated by the project. In return for the front-loaded grant, the project owner will retain some of the revenues from the emission reductions as a way to maintain an incentive for good monitoring.

Figure 1. Climate-related instruments could be combined to mitigate risk



African Clean Energy Finance Facility (CLEAR). This proposed facility, which is currently being designed, aims to leverage climate change mitigation for development in Africa. CLEAR intends to mobilize private and public

15 For more information on additional vehicles and investment initiatives for scaled-up climate finance for public, private and public-private partnership (PPP) sources, see www.climatefundsupdate.org.

financing for clean energy projects in Africa by buying down interest rates on loans for these projects in exchange for the project's global greenhouse gas reduction benefits. These benefits would then be designated as African renewable energy certificates based on clean megawatt-hours generated for the grid. The precedent has been set by numerous regions and countries (e.g., American, Australian, Indian, and Dutch renewable energy certificates and British mandatory renewable energy target certificates and renewables obligation certificates). CLEAR supported projects could ultimately generate up to 100 million megawatt-hours, with a value reaching $1 billion if each unit certificate is worth $10. A specific pilot focused on geothermal energy in Kenya is already under consideration following discussions with the Kenyan government.

Low-carbon Development Fund for Africa (LCDF-A). The fund can prioritize Africa while also serving other developing countries for risk diversification. The LCDF-A would be able to fund a large portfolio of low-carbon development projects in Africa and would solve two major issues that investment projects are now facing in African countries: (i) providing access to the large volume of long-term and upfront financing needed, and (ii) offering concessional rates. The purpose of the fund is not necessarily to generate carbon offsets, but to significantly scale up low-carbon development in developing countries.

Africa Climate Change and Green Growth Project. This initiative's objective is to help Africa to build national and regional capacity to effectively manage climate risk. The key indicators of the activity include improved access to climate and related sector information, climate risk decision support, and improved institutional capacity, which will improve countries' readiness to effectively utilize climate finance and develop a pipeline of climate-smart investments. This will be achieved through capacity-building assistance at the African Union level to help selected sub-regional groups with information and institutional and investment activities related to systematically building resilience to climate risks. Countries will be selected on the basis of need, demand, and readiness (i.e. the presence of a National Adaptation program of Action – NAPAs/NAMAs). Such an approach is important when considering longer term climate-sensitive clean energy investments such as hydro-power.

Sustainable Energy Fund for Africa (SEFA). The fund has an initial budget of $57 million and is intended to provide technical capacity building and investment capital support, with a focus on providing sustainable energy to small and medium enterprises. The preliminary tranche of funding will be disbursed over a five-year period but it is envisioned that SEFA will become a multi-donor fund with additional donors coming on board in the near future.

Dedicated Energy Access Preparation Facility. Specifically intended to encourage the development of large-scale clean energy generation projects with strong regional impacts, such a facility could adopt a project finance approach, blending donor funding and private sector participation. The conference may consider calling for the COP17 to consider allocating at least $500 million for the facility. Grant-based resources would concentrate on upstream project preparation such as social and environmental impacts assessments and upstream regulatory and institutional development. To ensure successful implementation, the facility would be easily accessible and professionally managed.

It is important to note that the proposed products are at different stages of conceptualization and for the moment remain only concepts. Financing climate action through low-carbon energy investment will require funds that come from a wide range of sources, including private resources enabled by mitigation instruments. African countries can leverage such resources more effectively if they identify the major risks and needs specific to energy infrastructure investment. This will better enable them to prioritize initiatives and instruments that are easy to access and that expressly address their needs. The conference provides an important opportunity for African governments to seek wider acceptance and endorsement of demand for these and other relevant schemes, helping to raise interest in and resources for their initiatives.

Opportunities for moving forward

Forging a consensus on priorities in the context of the climate change negotiations is imperative. By coordinating to avoid duplication, support can be harnessed to better address Africa's low-carbon energy development and climate resilience priorities. It is important to move quickly to stem the financing shortfall that currently impedes the development of a low-carbon pathway and strong green growth for the continent. Moving forward in a proactive manner can help position Africa at the forefront of climate-related financing.

The African Energy Ministers' Conference in Johannesburg is an important springboard from which to launch ideas and products that can have a meaningful impact on energy access on the continent. The conference is an ideal setting to officially request further elaboration of these and other ideas and products and to present initiatives supporting African energy access to global partners. An announcement to that effect at the COP17 in Durban in December would be a good milestone on the way to Rio+20 in June 2012.

References

Leigland, James, and Henry Russell. 2009. “New Needs for Technical Assistance: Responding to the Effect of the Financial Crisis on Private Participation in Infrastructure.” *Gridlines*, PPIAF, Washington, DC.

Leigland, James, and John Roberts. 2007. “The African Project Preparation Gap: Africans Address a Critical Limiting Factor In Infrastructure Investment.” *Gridlines*, PPIAF, Washington, DC.

Leigland, James, and William Butterfield. 2006. “Reform, Private Capital Needed to Develop Infrastructure in Africa: Problems and Prospects for Private Participation.” *Gridlines*, PPIAF, Washington, DC.

Foster, Vivien, and Cecilia Briceño-Garmendia, eds. 2010. “Africa’s Infrastructure: A Time for Transformation.” Paris and Washington, DC: Agence Française de Développement and World Bank.