



**UNITED NATIONS
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**How to Advance the Implementation of the Energy
Agenda in Africa after CSD-15**

A paper submitted for discussion at the

**Sixth session of the Global Forum for Sustainable Energy (GFSE-6) on
The theme: “Africa is energizing itself”**



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GFSE-6: “Africa is energizing itself”

How to Advance the Implementation of the Energy Agenda in Africa after CSD-15¹

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1. Africa’s Energy resources

Africa is relatively well endowed with energy resources. In 2004, its **proved oil, gas and coal reserves** were 9.4%, 7.9% and 5.54% respectively of the world total, compared to 8.5%, 4% and 2.19% respectively for South and Central America, taken together. **The hydropower potential** of the continent amounts to 13% of the world. In Africa, energy is produced mainly from biomass (47%), oil (24.8%), coal (16.5%), gas (10.4%), and other renewable sources, such as large and small hydro dams, solar, and geothermal sources (1.3%)². However, Africa is a vast continent with 53 countries and energy resources are unevenly regionally located. Most of the hydropower potential lies in central (especially in Congo river basin), eastern and western Africa, oil and gas resources are located in the western and northern parts of the continent, coal reserves are concentrated almost exclusively in Southern Africa, and geothermal is only being developed in eastern Africa. It is apparent from Figures 1 and 2 that 68% of all proved natural gas reserves of the continent is located in two countries (Nigeria and Algeria), while more than 74% of proved oil reserves is found in Nigeria and Libya. These three countries hold the large majority oil and natural gas reserves of the continent. Because of its geographical location across the equator, Africa has abundant solar irradiation ranging from 5 to 7 kWh/m², all year round, and it enjoys a **relatively strong wind** power potential in Northern, Southern and Eastern Africa, where wind regimes ranging from 4 to 10 m/s can be found. Finally, the continent has an estimated **geothermal energy potential of 9000 MW** in the Rift Valley area in East Africa³. Based on these potential and reserves, it could have been possible to achieve a well-balanced energy generation mix on the continent. However, due to numerous barriers this is not currently the case.

¹ This paper is extracted from “Energy for Sustainable Development”, prepared by UNECA on behalf of the joint Africa’s CSD secretariat, submitted to CSD14

² IEA (2002)

³ NASA

Figure 1: Proved Natural Gas Reserves in Africa, in 2004⁴

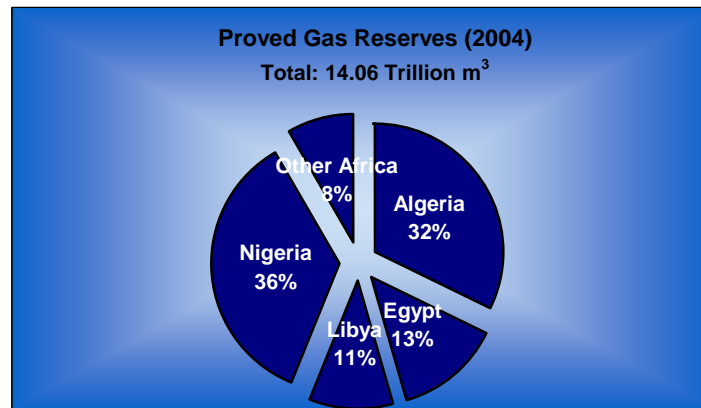
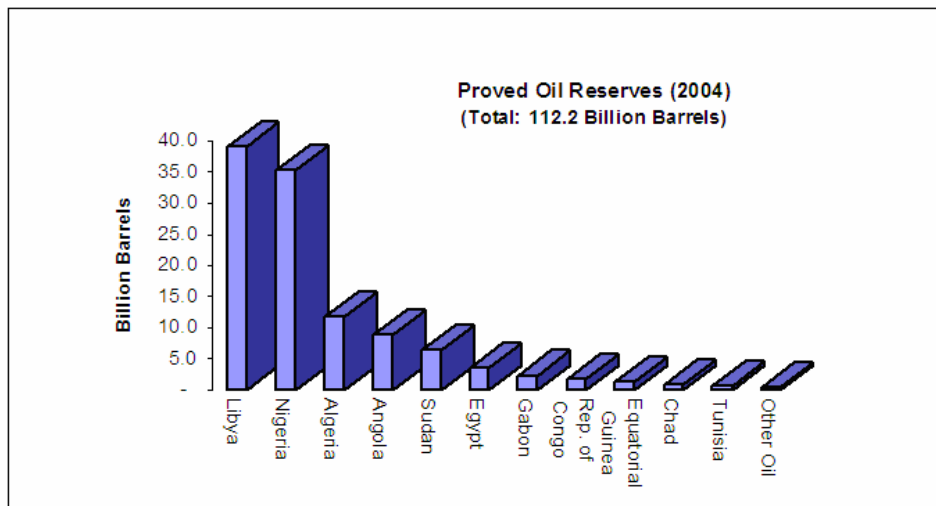


Figure 2: Proved Oil Reserves in Africa, 2005

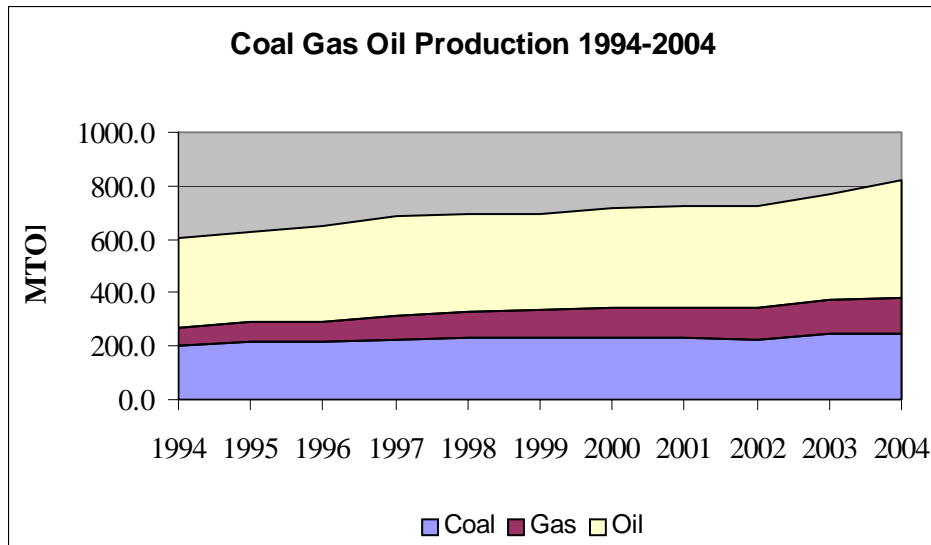


2. Energy consumption and production

Africa exports more of its energy than it consumes. In the last decade, oil, natural gas, and electricity production have increased by 48.1%, 24.3% and 32.8% respectively, while coal production increased much less (**Figure 3**). In absolute terms, oil remains the largest source of modern energy in Africa, with production reaching 441 MTOE in 2004, which represents 11.4% of the world total. In Southern Africa, efforts for improving the energy resource mix through more import of electricity within the Southern African Power Pool, led to a slower increase in coal production.

⁴ Compiled from BP (2005)

Figure 3: Coal, natural gas, and oil production in Africa



Despite its relatively important energy resources, Africa generates only 3.1% of the world electricity, less than any other region of the world (Figure 4). This share has not changed for the last 10 years and most analysts forecast that it will remain the case for the next 15 years, though production of fuels used for electricity will continue to grow steadily. Electricity is generated mainly from coal (46%), gas (23%), hydro (18%), oil (11%) and nuclear (2%, in South Africa only) (Figure 5). Other renewable sources such as solar, geothermal, wind, etc. play an insignificant role so far, despite some noteworthy initiatives such as the development of wind farms in Egypt, Morocco, Algeria, and South Africa. On the continent there are strong disparities among countries: South Africa alone generates close to half of the total African electricity. Many African countries, mostly in SSA with the exception of South Africa, rely heavily on hydropower (70% to 80%) for their electricity generation.

Figure 4: Electricity generation per region

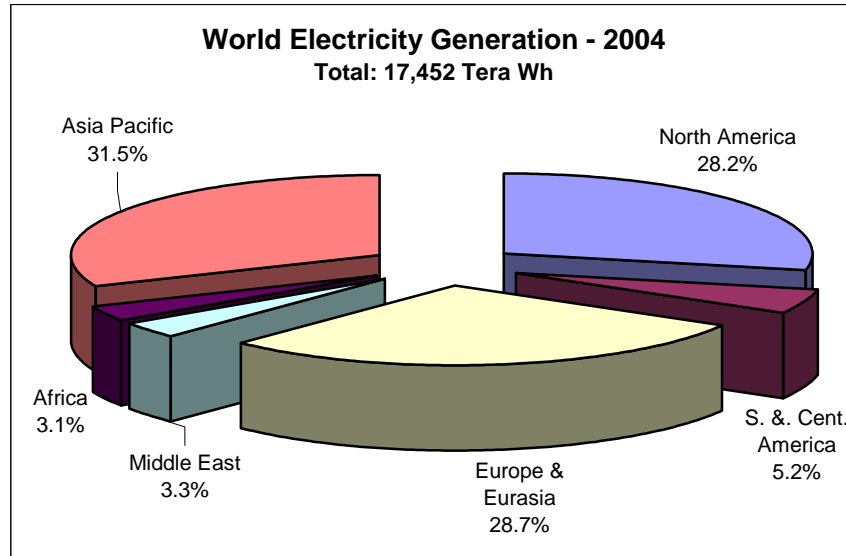
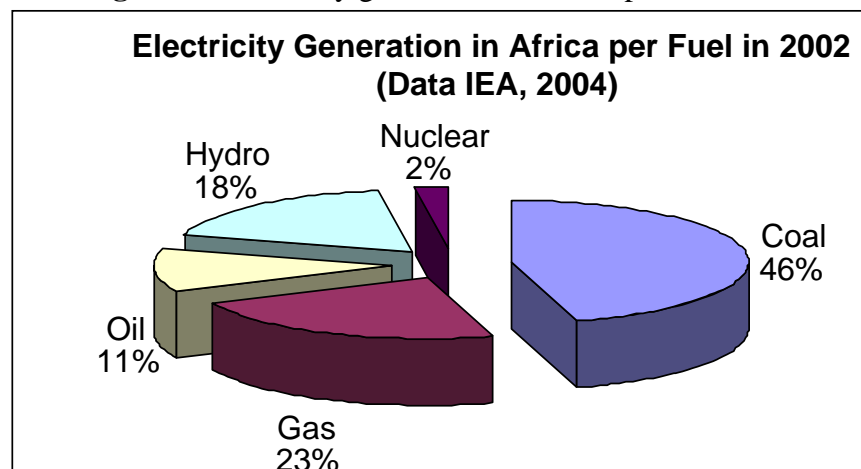


Figure 5: Electricity generation in Africa per fuel, 2002



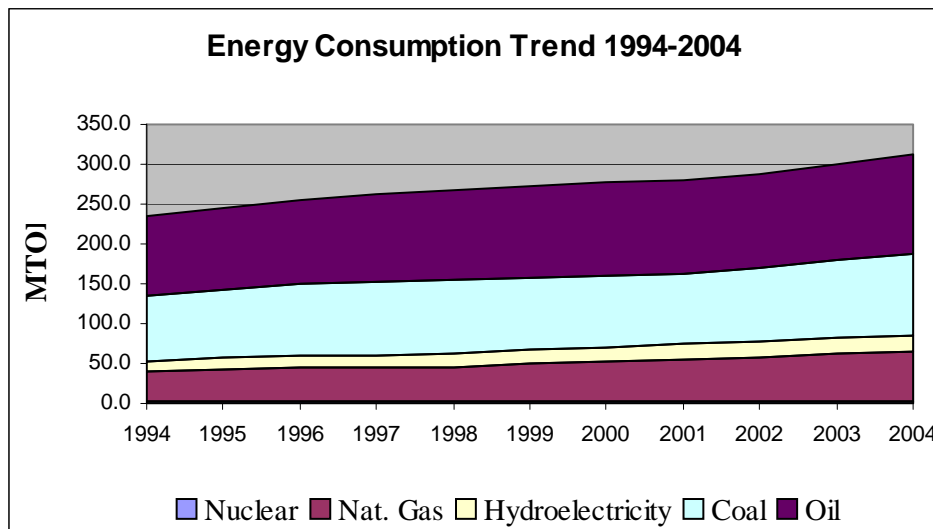
With 13.1% of the world's total population, Africa consumes only 5.5% of the world energy. The per capita energy consumption of 0.5 TOE, far lower than the world average of 1.2 TOE per capita, makes the continent lag behind all the others in energy use.

In 2002, the continent electricity consumption was only 514 kWh per capita, lowest of all other world regions. The very limited availability of electricity combined with affordability issues to electricity services in most countries in Africa, have made access to electricity by most Africans very elusive. While electricity access data varies widely depending on the reporting sources, IEA data reports rates ranging from 70% to over 94% in Northern Africa, and an average of 23% in sub-Saharan Africa, in 2002. These numbers do not reflect the large disparities between countries (for instance less than 4%

in Uganda compared to 66% in South Africa or 100% in Mauritius), and between urban and rural areas, where in the latter, rates can be as low as 1%⁵.

Energy consumption in Africa is largely dominated by combustible renewable resources (biomass, animal wastes, municipal and industrial wastes). Energy from biomass accounts for more than 30% of the energy consumed in Africa and more than 80% in some countries such as Burundi (91%), Rwanda and Central Africa Republic (90%), Mozambique (89%), Burkina Faso (87%), Benin (86 %), Madagascar and Niger (85 %) ⁶. Biomass constitutes the main energy resource for the large majority of African households for cooking, drying and space heating. Several million people are involved in the production, distribution and sale of fuelwood and charcoal. From 1994 to 2004, primary energy consumption increased by 24% (Figure 6).

Figure 6: Modern energy consumption trend in Africa

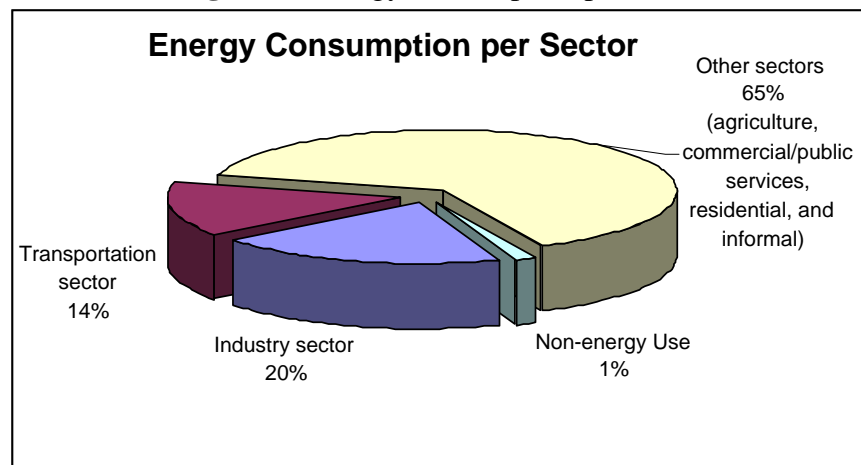


All African countries consume some oil mainly for transportation, electricity generation and industries regardless of whether they have refinery capacities or not (Figure 7). Gas consumption, however, is limited mostly to the few countries that produce it, such as Algeria, Libya, Egypt, Tunisia, Nigeria, Cote d'Ivoire, or those that are located in close proximity with them. This is explained by the lack of transboundary pipeline infrastructure for the transportation of natural gas. South Africa, with its large reserve of coal, is the only country with a significant use of coal.

⁵ WEC, IEA (2002)

⁶ FAO Report (2005)

Figure 7: Energy consumption per sector



3. Brief overview of the main issues for energy development in Africa

Analysis of the low technical, economical and environmental performance of the energy sector in Africa, reveals a bundle of challenges, all urgent, that must be addressed in order for the continent to break the cycle of energy poverty, and make progress towards sustainable development.

- *Low energy production*

Though overall the continent contains abundant and a large variety of energy resources from non-renewable to renewable fossils, modern energy production is far below the needs of the population and the production facilities. This is due to the fact that the energy potential of the continent is largely untapped. The WEC estimates that only 7% of the hydropower potential is used, while wind, geothermal, solar and other renewables sources are barely exploited. This is mostly due to unavailable investment capital from public and private sources, low technology capacities of countries, and generally inadequate science and knowledge facilities, for example for resources assessment and feasibility studies.

- *Uneven regional distribution of energy resources*

Of the 53 countries in Africa, the largest energy potential is found only in a limited number of them. Hydropower potential is the most evenly spread, but the biggest concentration is on the Congo River with a potential of more than 40,000 MW. Oil and gas are mostly concentrated in Algeria, Nigeria and Libya, while coal is mostly found in Southern Africa, and geothermal potential in Eastern Africa. Based on IEA statistics (2002), the Maghreb countries together with the Republic of South Africa account for more than 82% of the African electricity generating capacity. Therefore, many African countries suffer from scarce energy resources, and must pay high prices to import energy. This poses the challenge of developing, at a faster rate, regional energy transport

networks such as Oil and Gas pipelines and cross border and sub-regional electricity networks in order to boost intra Africa energy trade.

- ***Weak share of renewable energy in the energy mix***

A review of the proved energy potential in African presents a striking diversity of resources, which offers a unique opportunity for an optimal energy resource mix for power generation. Though oil, gas and coal are the dominant source of electricity generation (accounting for almost 80%)⁷, African has an almost untapped hydropower, geothermal, photovoltaic, and wind potential. Combustible renewables such as biomass that constitute the dominant energy source for African households are mostly traditionally used in an unsustainable manner that poses much threat to human health and the environment. Improving the electricity generation resource mix is a predominant challenge for sustainable development. Lack of investments, inadequate policy framework and low technical capacity are, among numerous other causes, responsible for the low level of development of RE in Africa.

- ***Low oil refinery capacity***

The refinery capacity of Africa represented in 2004, 3.9% of world total (Table 3), the lowest of all world regions⁸. Further, the production of refineries has been dropping steadily since 1998 due mainly to aging equipment and deficient maintenance. Even in a major oil producer country such as Nigeria, problems with refineries have led to frequent fuel shortages, and forced the Nigerian National Petroleum Corporation (NNPC) to import petroleum products⁹. Even though all African countries consume some oil and petroleum products, half of them do not have any refinery facility. Many of them import refined products from the nearest source. African refinery capacity is mostly concentrated in North, South and West Africa, but half of the continent distillation capacity is in North Africa. Without sufficient financial and technical resources to maintain and invest in more refinery capacities, African countries are even more compelled to export their oil production, and deprive the local population and industries of the necessary fuel for development and daily energy uses, like transportation.

- ***Transport, transmission and distribution challenges***

Historically, even after power sector reforms were undertaken by many countries, the transmission sector has remained under the control and management of governments. It is viewed as a strategic sector generally clustered under national infrastructure. However, the high cost of energy transport and transmission infrastructure such as high voltage power lines, oil and gas pipelines is responsible for the low progress in expanding national distribution electricity grids, and the low level of regional and sub-regional electricity, gas and oil trade among African Nations. It is established that the larger share of most rural electrification projects is the cost of medium voltage transmission lines to

⁷ see figure 5

⁸ BP (2005)

⁹ USDOE (1999)

the village sites. Furthermore, the electricity transmission sector is often plagued with serious technical problems, leading to heavy electricity line losses while demand is still unmet¹⁰.

○ *Low investment and private sector participation in the energy sector*

African governments have not been able to finance the expansion or refurbishment in the power sector or attract private sector investment. The International Finance Corporation (IFC) estimated that, between 1990 and 1998, FDI in the power sector in SSA was only 6% of all infrastructure FDI inflows into the region. In comparison, telecommunications accounted for 89% of all FDI inflows in this period. Far more popular destinations for the electric sector are East Asia and the Pacific, Latin America, and the Caribbean.

Between 1990 and 1999, private investment in electricity in SSA was \$2.9 billion, representing less than 2% of all private electricity projects in developing countries¹¹. The bulk of private investment in electricity was in Latin America and the Caribbean, with almost 40% of the total. More private investment is essential to mobilize resources for the development of the sector and, more importantly, alleviate the budgetary burden on African state-owned power utilities¹².

This low private sector's investment level has been affecting progress in the NEPAD energy programme.

○ *Challenge of energy accessibility and consumption in rural energy area*

In the framework of the modern energy access challenge, the issue of providing sustainable energy in the rural areas must be highlighted. Sixty (60%) to seventy (70%) percent of Africa's population live in rural areas and rely heavily on traditional and unprocessed biomass (wood, animal dung, agricultural waste, etc.) for their daily domestic energy needs, with limited choice and options of fuels for their productive activities. The rate of access to modern energy in these areas has dropped to as low as 1%, in some countries.

Acknowledging the fact that traditional African government policies based on the extension of electricity power grid have achieved a limited success in increasing access to modern energy in the rural areas, new approaches in promoting diversification of energy resources, which include modernization of the traditional wood sector, decentralized energy generation systems and innovative financial and energy delivery mechanisms based on a bottom-up approach are recommended.

¹⁰ Bahgavan (1999)

¹¹ World Bank Data

¹² ECA (2004)

ECA, in partnership with some agencies active in UN-Energy/Africa, is currently conducting the design of a Rural Energy Access Scale-Up Mechanism for Africa (REASUMA). A study is to be released in 2007, followed by a regional workshop on rural energy, which may lead to the design and implementation of a Rural Energy Development Facility for Africa.

- *Non-efficient utilization of energy (in buildings, and industries)*

Due to the inefficient use of energy, Africa uses by far more energy to create \$1 of wealth (as reflected by “units of energy consumed per \$ GDP”) compared to other developing countries.

Pilot studies conducted through a UNDP/GEF regional project in West Africa (Senegal, Côte d’Ivoire) revealed a potential of energy savings of close to 30% in buildings, through appropriate awareness campaigns, regulatory and fiscal measures¹³. This kind of savings can be achieved in other sectors such as transport, industry, and thermal power production.

On the production side, two-thirds of energy is wasted, in the form of heat, during the process of transforming¹⁴ primary energy into its useful form. Much saving potential exist in the mostly old and inefficient thermal power plants used on the continent. Also, loose regulations on quality control of the power transmitted and used led to losses in transmission lines. It is safe to say that at least 30% to 40% more electricity can be made available to Africans through a variety of energy efficiency measures. Though the investments required are cost- effective, the environment also benefits from a reduction in the emission of Green House Gases (GHG).

- *Inadequate policy, regulatory and institutional framework*

Most stakeholders’ reports compiled in this regional review underlined the problem of inadequate institutional framework including policy and regulatory frameworks. Solving the chronic lack of public funding requires bilateral, multilateral and private partners. They would not only bring the required finance for investments in expansion and maintenance of infrastructure and equipment, but also enrich the sector with new managerial and technical skills as well as knowledge and innovative technologies. Unattractive policies, laws and non-transparent regulatory measures and bodies, and unstable institutional frameworks hinder bilateral, multilateral and private sector participation in any development sector.

The challenges and constraints compiled in this section are certainly daunting, but not insurmountable. Progress can be made. In the next and final section, specific recommendations are made to address the challenges identified.

¹³ UNDP/GEF (1997)

¹⁴ WEA (2000)

4. Strategic Way Forward

i. Prioritize efficient institutional, regulatory and policy frameworks

In order to address issues such as the lack of funding, low private sector participation and overall low performance of the energy sector, **African policy-makers** should pay special consideration to policy measures that clarify the role of various stakeholders (public and private); improve investments climate in general through more favorable legal and regulatory reforms; strengthen the role of independent energy regulatory bodies; and lift barriers to the realization of regional integration projects in energy.

Specific activities may include:

- Capacity strengthening/building of policy-makers, and energy planners on integrated energy resource planning, energy forecasting, and international negotiation for investment in the energy sector;
- Capacity strengthening of energy regulators;
- Capacity strengthening for energy sector managers;
- Improvement of policy coherence among key energy sectors such as power, wood, water, industries, transport and habitat;
- Update power sector reforms to account more for sustainability issues.

ii. Increase financial flows towards the African energy sector

International development partners, including UN organizations, should enhance their support to African countries to undertake the necessary reforms for a coherent, transparent and attractive investment framework. They should increase advocacy and funding to significantly increase the financial flow towards investment in energy projects in Africa.

Specific activities may include:

- Stronger support, through advocacy, funding, and technical services, to NEPAD energy initiatives.
- Provide more funds towards other energy regional integration projects, such cross-border electricity networks, oil and gas pipelines;
- Funding of major power generation projects at national levels.

iii. Promote energy regional integration as a catalyst for development

All African RECs seek to increase trade among their member countries and then expand their market to other trade zones. Energy trade must be pursued with dedication by the RECs with the support of international partners as an efficient means to reduce the uneven distribution of energy resources in Africa, reduce import cost burdens of energy

resources on most national economies, and increase the supply of secure and environmentally-sustainable energy.

Specific activities may include:

- Support for the operationalization of the African Energy Commission (AFREC), and the implementation of its work programme;
- Support for the strengthening human and institutional capacities related to energy development and the implementation of regional energy projects in the RECs;

iv. Improve the share of RE in the African energy mix

To achieve significant progress in the development of renewable energy on the continent, governments should put in place coherent regulatory and policy frameworks that support the development of thriving markets for renewable energy technologies and recognize the important role of the private sector. These include removing barriers, enhancing fair competition in energy markets and internalizing external costs for all energy sources. Such frameworks are essential to realizing the potentials for renewable energy technologies creating favourable conditions for public and private investments, and to extending modern energy services to populations currently without access¹⁵.

Specific activities may include:

- Accelerate the development and funding of environmentally and socially balanced large hydropower projects on the continent (e.g. hydro projects in Congo, Ethiopia, Uganda, West Africa, etc.);
- Increase capacities and funding to mini/micro hydropower projects in many countries;
- Develop wind projects in northern, southern, and eastern regions;
- Develop and fund geothermal projects in eastern Africa;
- Accelerate technology transfer and indigenisation of technologies for biofuel and co-generation systems development in many countries;

v. Dedicate special attention to rural energy development programmes

African governments, international development partners, regional, sub-regional decision-makers should pay particular attention to problem of access to modern energy in rural areas, and view it as inseparable from poverty reduction efforts and economic growth strategies. They should therefore be willing to drastically increase their financial participation in the sector and assist in the development of key infrastructure that can sustain the minimum economic growth required to break the cycle of poverty and achieve the MDG.

Specific activities may include:

¹⁵ Declaration at the World Conference on Renewable Energy, Bonn, Germany, 2004

- Strengthening the capacities of countries' institutions to deal with the issues of rural energy poverty;
- The design and implementation a Rural Energy Development Facility (AREDF) for Africa at sub-regional or regional levels, based on a rural energy access scale-up mechanism (REASUMA). A study is currently undertaken by ECA in collaboration with other UN-Energy/Africa members.

vi. *Modernize the traditional biomass energy sector*

African governments, with the support of the international community, should design and implement urgent appropriate measures including affordable technologies, to modernize and ensure the efficiency of the traditional biomass energy sector in order to reduce the negative impacts of its heavy usage on human health, the environment, particularly in rural areas.

Specific activities may include:

- Accelerate the dissemination of clean and high efficiency stoves for cooking;
- Accelerate the penetration and reduce cost of LPG sources and equipment in rural areas;
- Modernise the charcoal industry.

vii. *Promote coordination and coherence among all international partners*

Given the number and diversity of international development partners intervening in the energy sector, more efforts must be made to create coherence, complementarities and effectiveness among all international actors working in Africa.

Specific Activities:

- Increase collaboration and joint programming through a collaborative mechanism such as UN-Energy/Africa, among UN agencies, key non-UN actors, and regional organizations such as the AU and NEPAD.
- Support the establishment of and strengthen a high level holistic energy political body, such as a Conference of African Ministers of Energy, dealing with all aspects of energy.

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