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Energy access in Africa: Challenges ahead

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ABSTRACT

This paper presents a review of the current situation and projections for energy access in Africa. The paper also presents several sets of ambitious energy access targets as agreed by the regional groupings within the region. The paper argues that achieving between 50% and 100% access to modern energy services by 2030 in Africa will require more effective mobilization and use of both domestic and external funding, and the development and implementation of innovative policy frameworks. The paper suggests that greater emphasis will need to be placed on productive uses of energy and energy for income generation in order to break the vicious circle of low incomes leading to poor access to modern energy services, which in turn puts severe limitations on the ability to generate higher incomes. The paper further suggests that if anything near the ambitious targets set by African organisations are to be achieved then it will be advisable to tap into the full menu of energy resource and technology options, and there will be the need for significant increases in the numbers of various actors involved together with more effective institutions in the energy sector.

1. Introduction

Energy is one of the essential inputs for socio-economic development (Johansson and Goldemberg, 2002; Davidson and Sokona, 2002). This fact plus the strong links between energy and the millennium development goals (MDGs) make it even more important to address the challenges and prospects for energy service provision in sub-Saharan Africa (Karekezi, 2002a; Karekezi and Majoro, 2002; Modi, 2004; Modi et al., 2005; Porcaro and Takada, 2004). That the provision of energy services is a necessary but not sufficient condition for sub-Saharan Africa to pull itself out of poverty is not in doubt. That energy services should be seen as one of the means rather than the end is also not in doubt. What is in doubt is how sub-Saharan Africa can go about meeting the energy needs of all its peoples and whether or not the governments and people of the region will be able to mobilise the resources needed to make this happen.

The New Partnership for Africa's Development set the ball rolling by putting forward a strategic development vision with clear objectives for meeting the energy needs of the region (NEPAD, 2001). The Forum of Energy Ministers of Africa (FEMA) and several sub-regional economic communities, notably the Economic Community of West African States (ECOWAS), the East African Community (EAC) and the Economic Community of Central African States (CEMAC) followed suit to develop energy strategies towards achieving the MDGs and realising the NEPAD objectives. The international development community has also been active in highlighting the energy issues of sub-Saharan Africa and proposing programmes to address the energy for development needs. To mention a few, the Global Network on Energy for Sustainable Development (GNESD) has undertaken major pieces of analytical work on energy access and renewable energy for poverty reduction (GNESD, 2005, 2006) and the World Bank has harnessed insights from a wide range of development partners to put forward an Action Plan for Energy Access in Africa (APEA) based on the Investment Framework for Clean Energy and Development (World Bank, 2006).

The term "energy access" has been used to mean "ability to use energy", namely electricity, LPG, charcoal or some other form of energy. In a similar vein "access to energy services" has meant "the ability to use energy services" and Modi et al. (2005) have described energy services as "the services that energy and energy appliances provide … lighting, heating for cooking and space heating, power for transport, water pumping, grinding, and numerous other services that fuels, electricity, and mechanical power make possible."

IEA (2006) states that there is no single internationally accepted definition for electricity access. Quite often there is a differentiation between household access where one is able to use electricity in the home and access to the grid, sometimes described in terms of the "penetration rate", which simply refers to the proportion of a geographical area covered by the grid, regardless of how many households are connected. Access to electricity also refers to the availability of electricity in areas not reached by the grid. In this case, electricity is provided by a decentralised or stand-alone power source (petrol or diesel generator), or a renewable energy device (solar PV, wind turbine

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or biomass gasifier). The term "modern" is often introduced in the access discourse to make a distinction between traditional forms of energy like firewood or agricultural residues and commercial forms of energy like electricity or LPG. The term "modern" is also used to distinguish between traditional forms of technology like the simple three-stone cooking arrangement and relatively more knowledge-intensive technologies like the improved firewood stove or the mobile phone.

Ranjit and O'Sullivan (2002) argue that "access" refers to a household's ability to obtain a modern energy service, should it decide to do so. In this case, access is a function of availability and affordability, where energy is considered to be available if the household is within the economic connection and supply range of the energy network or supplier, and energy is affordable when the household is able to pay the up-front connection cost (or first cost) and energy usage costs. In this context, a high up-front cost may discourage poor households from making a switch to a modern energy form even though this may be available, denying the household access to the energy form in question. Ranjit and O'Sullivan (2002) argue further that availability and affordability are interrelated, so that if a government decides to maintain energy prices below costs, with a view to making energy more affordable to the poorest households, it may actually reduce its availability, as the provider may find it unprofitable to extend coverage to areas where the poor reside.

This paper focuses on the availability or otherwise of modern energy services in Africa with reference to electricity and cooking fuels. Issues around affordability and the factors that drive both availability and affordability lie at the very heart of the discussion. Also recognised in the discussion, albeit implicitly, are the results from studies which have shown that actual transition is more dynamic than previously considered with many households using a combination of fuels (stacking) and that quite often there is also the emergence of home-based enterprises as household incomes improve (Karekezi and Majoro, 2002; Mekonnen and Köhlin, 2008; Ouedraogo, 2006).

2. Current access levels and projections

The sub-Saharan Africa region compares poorly with others in the developing world in terms of the proportion of the population relying on traditional biomass for cooking (see Fig. 1). At the national level, many countries like Liberia, Burkina Faso and Tanzania have more than 95% of their population relying on traditional biomass for cooking and heating. Access to modern energy systems for cooking is therefore very low in most sub-Saharan countries. In the EAC region, for instance, less than 30% households use LPG or improved cookstoves (EAC, 2006, 2007). In West Africa, Senegal has more than 20% of its population using LPG, while Ghana has less than 10%. Many other land-locked countries like Mali and Niger are worse off (ECOWAS, 2006; GOG, 2006).

The numbers of people relying on traditional biomass for cooking are projected to increase in sub-Saharan Africa over the next 25 years or so. Fig. 2 shows this projection in comparison with those of other regions of the world using data from IEA (2006). The increasing numbers of people relying on traditional biomass for cooking is linked directly to the per-capita incomes, which are not expected to increase high enough for people to switch away from traditional biomass use.

It is important to note that among the developing regions presented in Fig. 2, North Africa has the lowest number of people relying on traditional biomass, less than 10 million out of a total population of over 200 million; this is in sharp contrast to sub-Saharan Africa where the corresponding number rises from around 600 million people today to over 700 million in 2030. It is also important to note that for those developing regions with high economic growth rates the numbers of people relying on traditional biomass are projected to either stabilise as in the case of India, or decrease in the case of China. If these trends do indeed occur and continue beyond 2030 then sub-Saharan Africa could find itself as the developing region with the largest number of people relying on traditional biomass within the next 30–50 years.

Data on access to thermal energy for productive uses like baking, crop drying, metalworking and vegetable oil processing is not available in any systematic manner in or across countries in Africa. Mechanical or motive power for productive uses has gained more currency in the last 5–10 years so that ECOWAS (2006), for example, reports that about 10% of the population in rural areas of West Africa have access to energy services for food processing and other motive power needs. The UNDP-led

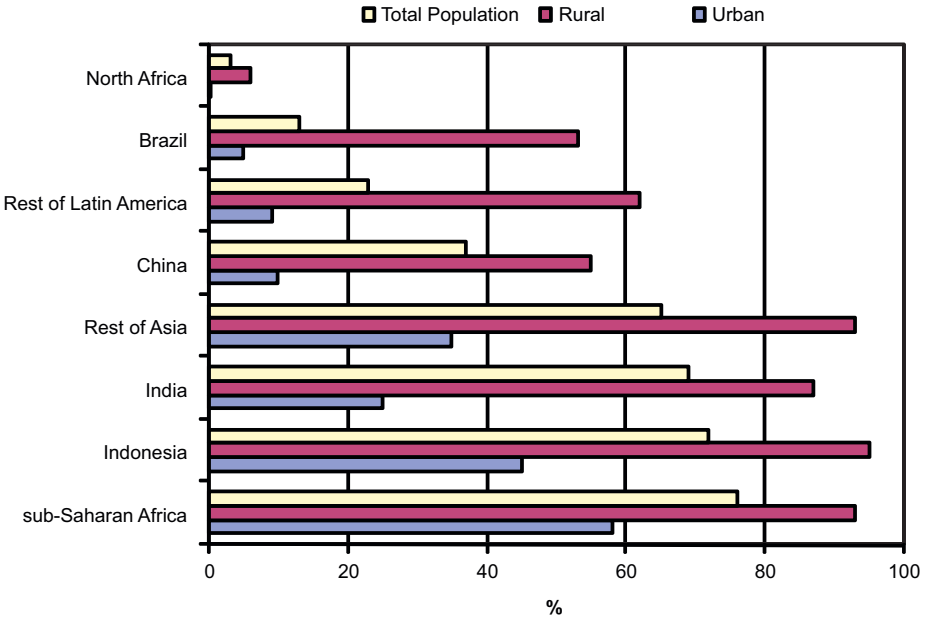

Fig. 1. Proportion of the population relying on traditional biomass for cooking.

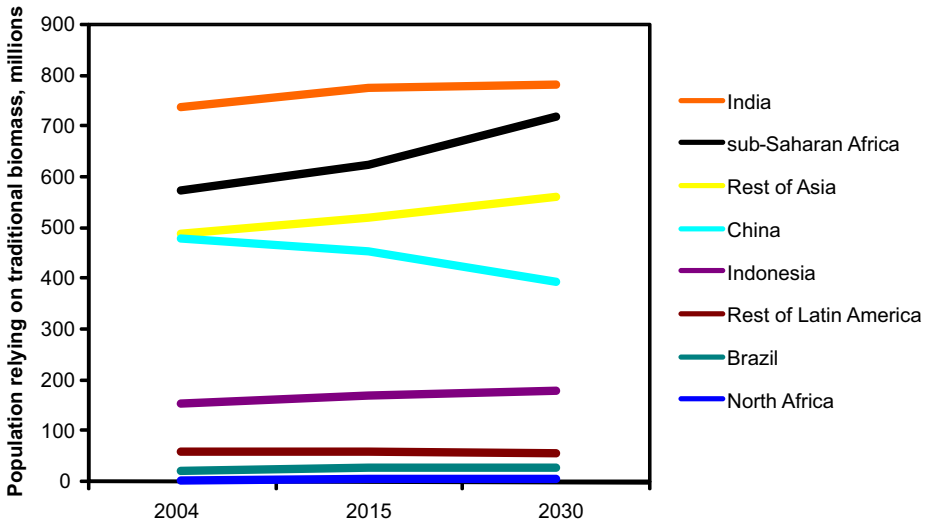

Fig. 2. Projections of people relying on traditional biomass for cooking.
Data Source: IEA (2006).

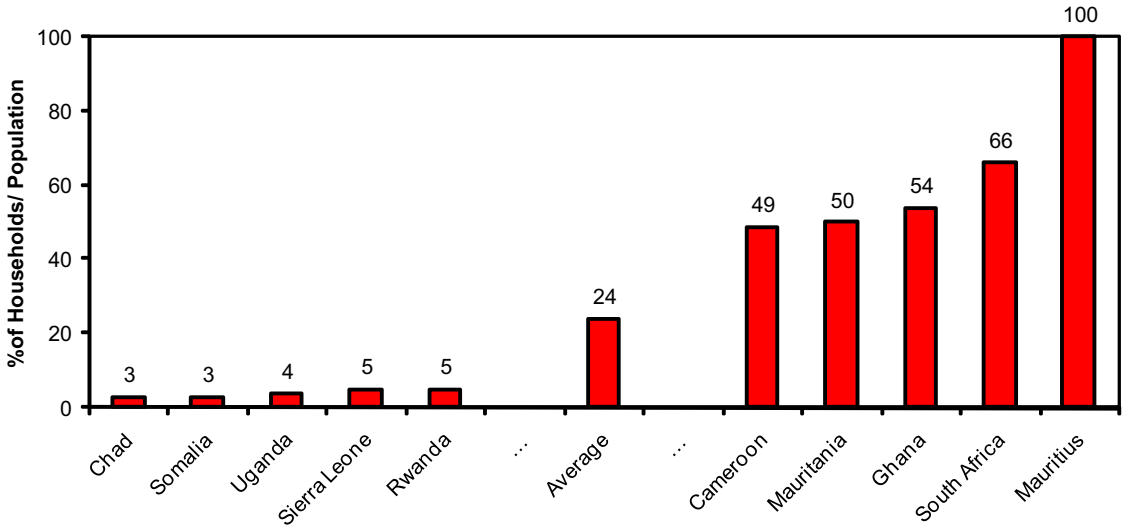

Fig. 3. Access rates for least and most electrified countries in sub-Saharan Africa.

Multi-Functional Platform (MFP) projects in West Africa, particularly the longest running one in Mali, have helped to focus attention on access to mechanical power for food processing (and limited electricity production.) Mali has over 500 village MFPs, of which about 60% were operational as at December 2005; Crole-Rees et al. (2006) give an estimate of 6% for access to the food processing and battery-charging services provided by these MFPs but this is probably over-estimated given the 40% failure rate and the fact that there are more than 11,000 villages in Mali.

Access to electricity, whether defined as electricity in the home or electricity within given geographical areas, averages around 25% for sub-Saharan Africa. At the bottom end of the scale, lie countries like Chad, Somalia, Uganda, Sierra Leone and Rwanda, which have access levels of 5% or below while the top end has countries like Mauritania, Ghana and South Africa having access levels above 50%, as shown in Fig. 3. Mauritius is the only country in sub-Saharan Africa with an electricity access rate of 100%, or 94%, if one uses the IEA data, which compares well with most of the countries in North Africa (99% in Tunisia, 98% in Algeria and Egypt and 97% in Libya).

These rates vary considerably according to the source of data. For Zambia, electricity access of 12% and 19% are reported by World Bank and IEA, respectively. For Kenya, the electricity access rates vary between 8% and 14% in the World Bank and IEA datasets, respectively). These figures point to some quality of data questions, which need to be addressed as a matter of urgency and this is an area where a regional agency like the African Energy Commission (AFREC) may have very important work to do.

Electricity access rates also vary considerably from urban to peri-urban and rural areas. In the EAC region less than 40% urban households and 5% rural households have access to electricity. In particular, rural schools, clinics and hospitals have less than 10% access to electricity (EAC, 2006, 2007). What these datasets do not show is the poor quality of electricity supply even at these low access rates. Blackouts and brownouts are common in many countries. Even countries with relatively higher access rate, like South Africa and Ghana, have serious supply side deficiencies, which have forced them to resort to load shedding (Wamukonya et al., 2007).

The trend for people without electricity in sub-Saharan Africa is similar to that for people relying on traditional biomass for

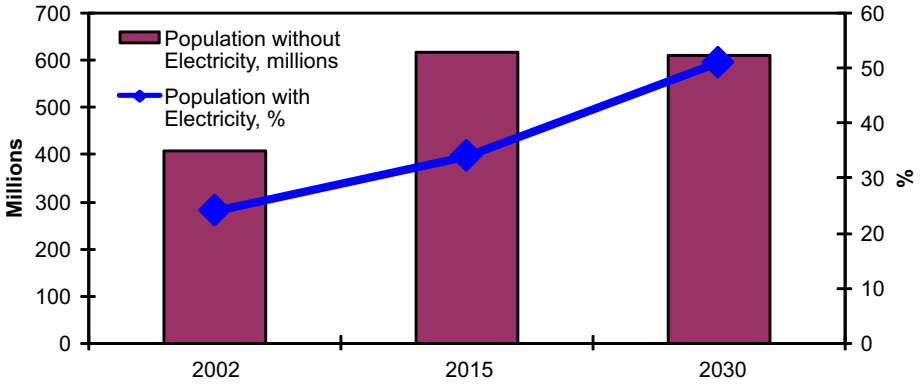

Fig. 4. Projections for population with and without electricity in sub-Saharan Africa.

cooking. In this case, as shown in Fig. 4, the numbers are projected to increase from approximately 400 million to more than 600 million over the 15-year horizon. This is in spite of the projected increases in electrification rates, up to 51% by 2030. Population growth is perceived as the underlying factor, as it tends to outstrip the pace at which households are connected.

3. Energy access targets and financing requirements

The New Partnership for Africa's Development (NEPAD) set the ball rolling in 2001 by putting forward a set of objectives for the energy sector. Among these was the objective "to increase from 10% to 35% or more, access to reliable and affordable commercial energy supply by Africa's population in 20 years". It is important to note that the NEPAD objectives already, at this stage, pointed in the direction of productive activities for economic growth, reversing environmental degradation associated with traditional fuels, regional integration and sectoral reform.

FEMA and several regional economic communities proposed specific targets for increasing access to modern energy services, fashioned along similar lines as those agreed at the UN Millennium Project 2004 Workshop (CEMAC, 2006; EAC, 2005, 2006, 2007; ECOWAS, 2006; FEMA, 2006; Modi et al., 2005). As summarized in Table 1, the targets range between 50% and 100% with the exception of electricity for rural households where the emphasis is on community services and where there are either lower targets or none at all (further details on the specific targets for each the regional/sub-regional organisations are provided in Appendix A). Practically in all cases, the primary objective, in line with the MDGs, is to provide access to modern energy services for at least half of the total population.

There is quite an active debate in both formal and informal circles on the achievability or otherwise of the African energy access targets. The targets are often seen as "part of a vision rather than targets that represent necessary or sufficient prerequisites for meeting the MDGs" (EAC, 2005). The World Bank's APEA takes the view that even the 50% by 2015 may not be achievable; it argues that a more realistic target to aim for, in the case of electricity access, is 35% by 2015 and 48% by 2030. These projections are similar to those made by IEA (2004).

With reference to the debate on energy access targets, it is suggested that a Scenario A for electrification in Africa would have a target of 50% by 2015 based on the primary objectives of the Regional Economic Communities (RECs), which can be extrapolated to about 100% by 2030, as shown in Fig. 5. Scenario B, in line with the suggestion by The World Bank, would have a target close to 50% by 2030 and Scenario C would represent a Worst Case Scenario where access levels either remain stagnant or deteriorate over time. Mauritius is already practically at 100% electricity access, whichever way it is defined, and South Africa for all intents and purposes should be able to reach same well before 2030. The difficulty in achieving Scenario A lies in the fact that practically all countries in sub-Saharan Africa would need to do more or less like South Africa and Mauritius. Taken within the context of all the issues around power sector performance and affordability, 100% electrification in every African country by 2030 will be no mean feat.

The World Bank's APEA indicated the levels of investment required to achieve 100% electrification or 48% by 2030. These levels are presented in Table 2 together with the respective investment costs of the three RECs (viz, CEMAC, EAC and ECOWAS), which have developed comprehensive energy access strategies/programmes (more details on the costing by the RECs can be found in Appendix B). In order to reach electricity targets of 100% or 48% by 2030, the World Bank estimates that this will require $11 billion or $4 billion per annum, respectively in sub-Saharan Africa (with a current population of 725 million people).

The investment costs for ECOWAS (250 million people) and EAC (110 million), which is estimated at $5.2 billion and 0.3 billion per annum, respectively cover electricity, cooking fuels and mechanical power.[1] CEMAC also estimates electricity investments of about $0.2 billion for 35 million people. The World Bank's estimate of $11 billion per annum compares quite well with the ECOWAS investment costs estimate of $5.2 billion per annum, if one takes into account the larger population for sub-Saharan Africa and investment costs for only electricity. The World Bank's view on the non-achievability of the 100% by 2030 target is premised on its estimates of the very high levels of investment required. It points out that even the $4 billion per annum estimated for the 48% by 2030 target is already twice the historical levels of investment of the electricity sector in sub-Saharan Africa. Between the two targets and estimated investments required (and adjusting the World Bank estimate upward by about 50% to include cooking and mechanical power), the total amount of required investments should be expected to range between about $6 billion and $15 billion per annum for sub-Saharan Africa.

[1] The amount of investment needed to reach the ECOWAS energy targets is estimated at $17.5 billion over 10 years ($1.75 billion per year) for investment in access equipment, including the costs of studies to support measures, and $34.6 billion over 10 years ($3.45 billion per year) for energy including depreciation of production and transmission costs, including amortisation of production, yielding an overall cost of $52.1 billion over a 10-year period ($5.2 billion per year), which works out to around $16 per inhabitant per year. The EAC Secretariat estimates that about $2.7 Billion in resources will need to be mobilised to accomplish their targets; clarification is being sought on some of the investment figures reported in their strategy document.

Table 1
Sub-regional estimates of energy access investment costs — ECOWAS regional plan of action.

						Investment		Programme development and support			Cost of energy consumption		Total	
Programme	**2005 Status**	**Objective 2015**	**Number of connections added**		**% Total pop served in 2015**	**Cost over 10 yrs (M$)**	**$ per capita per year**	**%**	**Cost over 10 yrs (M$)**	**$ per capita per year**	**Cost over 10 yrs (M$)**	**$ per capita per year**	**Average yearly cost (M$)**	**$ per capita per year**
Improved cooking fuels	~10 (i) tot pop LPG access	100%	29,656	'000 LPG households	100% pop has access (ii)	2850	0.88	30	855	0.26	25,467	7.52	2817	8.65
Mechanical power (vii)	0% (i)	100% villages	46,228	Decentralised and secondary settlements		741	0.23	30	222	0.07	1696	0.52	266	0.82
Electrification	20%	~60%				10,957	3.37		1909	0.59	8458	2.60	2132	6.55
Periurban and urban electrification (iii)	~20% urban pop	100% urban population	15,683	'000 households	54%	5484	1.68	15	823	0.25	3882	1.19	1019	3.13
Productive uses, social and community services (iv) (viii)	~25% (i)	100% secondary towns	24,611	Secondary towns (ix)	idem	3703	1.14	15	555	0.17	−162	−0.05	410	1.26
Household connection in electrified settlements (iv)	–	40% village population	13,429	'000 households	64%	1494	0.46	30	448	0.14	3693	1.13	564	1.73
Decentralised electrification (v) (vi)	Negligible	80%	21,617 1081	Decentralised localities (ix) '000 households	66%	276	0.08	30	83	0.03	1046	0.32	141	0.43
Rural electrification programme						5473	1.68		1086	0.33	4577	1.41	1114	3.42
Total cost						**14,549**	**4.47**		**2986**	**0.92**	**34,621**	**10.64**	**5216**	**16.02**

(i) Estimate
(ii) Access rate: % total population being served
(iii) Business as usual tendency regarding rural population access
(iv) Target settlements: > 2000 inhabitants for category 2 and > 1000 for category 1; investment NET of cost of mechanical power
(v) Target settlements: > 1000 inhabitants < 2000 for category 2 and > 500 and < 1000 for category 1; investment NET of cost of mechanical power — hence only for 50 household connections per settlement
(vi) Energy consumption includes household consumption but not mechanical power, which is in the related programme
(vii) Investment in settlements > 100 inhabitants for category 2 and > 500 for category 1; energy consumptions are @ 12,000 kWh/yr and @ 0.4 cts for secondary towns and decentralised settlements
(viii) Once village is connected to network the consumption exceeds 18,000 kWh @ 0.2 cts, which implies a savings as compared to 12,000 kWh @ 0.4 cts (mechanical power)
(ix) 24,611 secondary towns and 21,617 decentralised settlements total 46,228 settlements under the mechanical power programme
(x) Population access rate

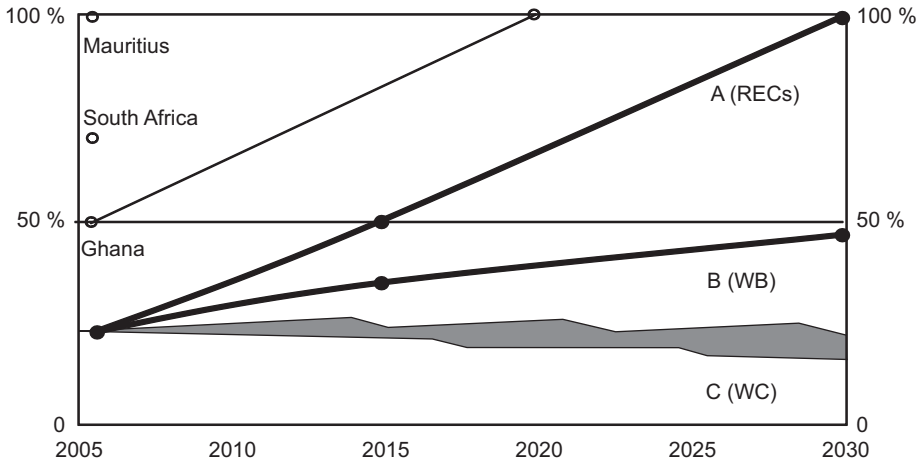

Fig. 5. Various scenarios for future electrification in Africa.

Table 2
EAC scaling up strategy.
Source: EAC (2007).

	Capital expenditure	Programmatic support and loan guarantees	Total soft costs (programmes and loan guarantees) and hard costs (capital expenditure) per individual
Target 1: Modern cooking	To meet the targets for access to modern cooking services, the EAC estimates that it will need to catalyze $262 Million on clean, safe cooking technologies	$20 Million in programmatic funding will be spent on: beneficiary education and awareness, institutional capacity building, and policy standardization $29 Million in loan guarantees is also required	$6 per individual
Target 2: Electricity for urban and peri-urban households	$10 Million over 8 years for programmes: beneficiary education and awareness, institutional capacity building programmes, and policy reforms	$70 Million in concessional loan guarantees to catalyze $1.5 Billion of beneficiary investment in electrification of urban/peri-urban households and informal settlements	$42 per individual
Targets 3 and 4: Electricity for social services and mechanical power in communities	$308 Million subsidy to support capital investment in hardware for social services. This covers 40% of the capital costs of community electrification	$186 Million over 8 years for: beneficiary education and awareness, institutional capacity building, policy reforms, research and development, subsidies for social services $192 Million in concessional loan guarantees to catalyze $919 Million of investment in social service electrification and motive power	$14 per individual

It will be a big challenge to find and invest these amounts between now and 2015. This will call for various approaches involving significant increases in the mobilization of domestic financial resources and more effective use of external funding as well as the development and implementation of innovative policy frameworks. These approaches will be discussed in Section 4.

4. Options and priorities for the future

4.1. Mobilising domestic financial resources and making better use of external inflows

On the domestic funding front, it is important that countries mobilise all the financial resources to make a stronger case for external funding. Experience shows that addressing African energy problems cannot be done without significant doses of local financing. The whole range of public sector resources (national budgets, electrification/energy funds based on levies and surcharges, debt relief, etc.) will need to be mobilised. A wide range of public financing instruments will also need to be employed including specialised funds to provide equity and debt for private sector ventures, and consumer subsidy schemes like lifeline tariffs.

Still on the domestic front, private commercial finance will need to be brought in for (equity, loans, consumer credit, micro-finance, etc.) The evidence is overwhelming that unless consumers as a whole are willing to pay for operating costs, at the very least; energy access programmes are unlikely to be sustainable. Domestic end-users will therefore have to shoulder operating costs and cross-subsidies or other forms of appropriate financing mechanisms/schemes, which will need to be developed to cater for poorer consumers.

On the external front, a wide range of donor sources (the traditional bilateral and multilateral agencies, new funds like Infrastructure Consortium, etc.) and various schemes (grants, concessional loans, further debt relief, etc.) will need to be drawn upon to meet a significant part of the shortfall between current funding levels and anticipated investment requirements. The World Bank's sector syndication approach for electrification projects can make a major contribution, and FEMA member ministers will do well to take them up in this regard. Carbon finance has also tended to by-pass sub-Saharan Africa and current efforts including those led by UNEP and UNDP to assist African

countries to gain better access to the Clean Development Mechanism (CDM), could help to improve this situation (Tsikata et al., 2008). Here too, FEMA might want to articulate its support for these efforts.

4.2. Emphasising productive uses and income generation

There is an emerging consensus, based on the evidence from many energy access interventions around the world, that too narrow a focus on expanding energy delivery without adequate attention to productive uses for income generation yields little by way of socio-economic development (Chambwera and Folmer, 2007; Kirubi et al., forthcoming; Sebitosi and Pillay, 2007). Electricity plays an important role but yields the best results when accompanied with ancillary infrastructural development like roads and telecommunications, and services like SME and consumer finance that spur business and market development.

The role of increasing incomes in promoting the transition to cleaner energy fuels for cooking is well established. It would therefore seem important for energy planners and project developers to design cooking initiatives such that they either include or go hand in hand with productive use of energy and energy for income generation activities.

Planning for mechanical power in rural areas without electricity, as in several sub-regional access programmes, will be important for addressing the productive uses and income generation imperative. Some flexibility will be required here with the promotion of MFPs, taking into account lessons from ongoing projects in West Africa with respect to ownership and management as well as relative capital and energy costs (Brew-Hammond and Crole-Rees, 2004; Crole-Rees et al., 2006; Obeng, 2006).

A broader range of mechanical power (and decentralised electricity generation) options will need to considered including technical and financial support for conventional mill operators to start new operations or expand into remote rural areas. This is an area where FEMA could go beyond the World Bank's APEA and engage the newly emerging global players like China and India to establish a capital subsidisation fund and possibly also, technology transfer schemes given that most of the diesel engines employed come from these countries.

4.3. Drawing on the full range of resources and technologies

It will be important for sub-Saharan Africa to keep the focus on increasing access to the services that modern energy enables. The enormity of the task at hand, to achieve up to 50% access to modern energy services by 2015, or up to 100% by 2030, dictates an "all hands on deck" approach and hence a broad view will need to be maintained with respect to both the energy resources and the associated technologies, conventional and renewable/non-conventional.

With respect to cooking, a broad range of options exists including improved cookstoves using woodfuel and cleaner fuels (and associated technologies) from biogas to LPG. In the biomass area, developing sustainable supplies at community level is an attractive option, as it yields positive results both at the level of environmental protection and income generation.

Experiences with biogas for cooking in sub-Saharan Africa have not been very encouraging but if new biogas for cooking programmes add on major productive use/income generation components, as suggested earlier, a new brighter picture might emerge. Ethanol gelfuel, as an energy option, is also at an early stage of commercialisation in Southern Africa. Ethanol gelfuel may make better inroads as far as rural applications are concerned, if it is deployed in tandem with income generation projects possibly including the production of bioethanol or bioethanol feedstocks. A similar suggestion could be made regarding the promotion of plant oils for cooking and biodiesel/bio-oil production.

Electricity is probably the area where a broad view may be most difficult to maintain given that there are deep-seated preferences for grid extension over decentralised options, and there are strong advocates for de-emphasizing solar PV – or even banishing it altogether – because of the many failed donor-funded programmes across the region (Karekezi, 2002b, 2002c; Karekezi and Kithyoma, 2002; Wamukonya, 2007). The push for renewable energy systems at all costs has indeed been very strong and for some people "energy for development" equals "alternative energy", regardless of the fact that conventional energy resources and technologies often provide the more financially and technically viable options in many situations. Indeed, oil-producing countries make up about a third of the total number of African countries such that the use of locally produced oil and natural gas constitute a key option in the bid to extend access to modern energy services for all. Energy efficiency also tends to be overlooked even though this usually presents some least cost options on both the supply and demand sides.

An integrated approach to planning for increased access to electricity and modern energy services, in general, will therefore be required. It will be important to create a level playing field so that the truly least cost technologies emerge in the different situations encountered.

4.4. Increasing the actors and developing effective institutions

If sub-Saharan Africa is to achieve anything near the very ambitious targets set for energy access over the next decade or more, then more actors will have to be attracted into the energy access market. Local companies, including micro-enterprises, have played active roles in the marketing of petroleum products for many years. Local entrepreneurs have also provided electricity generation services for some time, though on a more limited scale. More recently, local community based organisations have been mobilised (mostly in the form of women's associations) to provide mechanical power in the MFP programme countries. Larger municipalities, however, have rarely owned and operated electricity generation and distribution systems, South Africa being probably the main exception.

Fig. 6 presents the situation in many developing countries where income distribution is such that 30–40% of the population in urban areas may live below the $1/day poverty line and 70–80% for rural areas. Fig. 6 also shows that energy utilities tend to serve the higher income segments of the urban population (less than 10% in some African countries) and the highest income segments of the rural population (approaching 1% in some countries). The

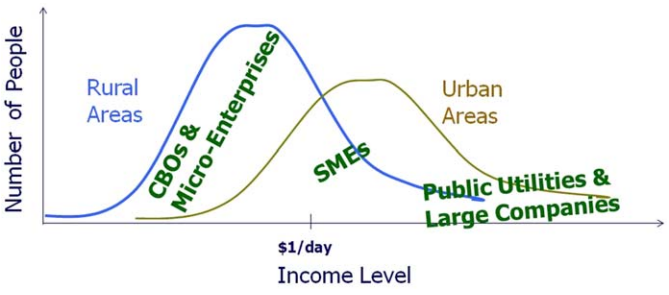

Fig. 6. Energy service enterprise framework for rural and urban areas.

middle and lower income portions of the population – more so in rural than urban areas – are either not served at all or served in very limited ways, depending on the energy form in question.

Meeting the ambitious energy access targets in the 10–25 years timeframe calls for strategies which seek to engage different stakeholders in the rural–urban incomes continuum. A dynamic private sector, for instance, can make a big difference as was the case in Kenya's solar PV industry, which grew to 20,000 installations per annum in 2001 (Sebitosi and Pillay, 2005).

There is also no substitute for engaging consumers – from high as well as low-income brackets – to participate actively in decisions on who should provide their energy services, and which services require the most urgent attention. A case in point is the use Village Electricity Committees, which involve the consumers and recognize the community as an important stakeholder.

At a mezzo level, institutions like Energy/Utilities Regulatory Commissions and Rural Electrification/Energy Agencies are needed not only to ensure a level playing field but also to ensure effective oversight for policy implementation; the Senegalese Rural Electrification Agency (ASER) and the Malian Rural Energy Agency (AMADER) are already charting a positive course which can be emulated by other countries in sub-Saharan Africa. The decision to establish a separate agency for rural (and peri-urban) electrification or one that deals with all rural and peri-urban energy issues will depend on the circumstances in each country. Nevertheless, it is important that the rural and peri-urban energisation/electrification agenda is not taken for granted or left in the hands of officials pre-occupied with urban energy/electricity issues. Whichever institutional model is chosen requires that explicit mechanisms are established to deal with the many challenges of rural and peri-urban energy, including the development of smart subsidy schemes.

At the more macro level, multi-sectoral committees involving Government Ministries from key sectors have been promoted as channels for developing energy for poverty reduction strategies and programmes. These committees could also serve as platforms for coordinating energy interventions with other infrastructural interventions and services and could help to, for instance, integrate rural electrification programmes into other rural development programmes as reported to have been the case in South Africa.

The sub-regional power pools – particularly, SAPP and WAPP – have begun to play important roles in advancing the energy access agenda with respect to power generation and transmission, and also trans-border electrification. The gas pipeline regulatory authority and the proposed energy access agency for ECOWAS are also in the making. These regional institutions will need continuing political support from FEMA members acting through or in cooperation with their respective RECs.

4.5. Developing innovative policies

There are a number of broad policy considerations, which should guide the development and implementation of specific energy policy instruments in each country. First is the fundamental questions around equity, including gender, and how committed a Government is to ensuring that all segments of the population have access to modern energy services. Second is the acknowledgement that there are no one-size-fits-all solutions even in one country. Addressing policy concerns depends on how much effort government officials are prepared to put into identifying and fine-tuning appropriate policy instruments for specific situations.

Examples of specific policy instruments, which have been implemented successfully to increase access to electricity as follows:

- Electricity laws/bills that support distributed generation using both renewable and non-renewable energy sources through de-licensing, technical standards and ball-park tariff recommendations;
- Licensing regulations that differentiate between small and large-scale distributed generation, and grid connected schemes;
- Removal of licensing barriers to encourage owners of small generators/IPPs to invest in distributed generations systems in rural areas;
- The distribution of energy-efficient lighting as a demand side management measure especially in urban and peri-urban areas;
- Smart subsidies drawn from rural electrification or other funds (e.g. constituency/community development funds) to reduce upfront costs of small/medium-sized diesel engines to support productive uses in rural areas;
- Lifeline tariffs whereby the first 50 kWh of electricity (or a similar small amount of energy) is provided at a subsidised rate to benefit the poor; and
- Embedded generation tariffs that reward small IPPs for system reinforcement and technical loss reduction.

An emerging policy tool which can be used to complement the sector syndication approach proposed by the World Bank, is the Energy for Poverty Reduction Action Plan promoted by a couple of the global initiatives under the World Summit on Sustainable Development (WSSD). Two such action plans have been developed for Cameroon and Ghana in relation even though the Ghana process took several years to complete, which does not augur well for meeting time bound national and regional targets in the short term, and the methodology could do with some systematization. National adaptation plans of action to tackle climate change, which are under consideration in many countries, could also serve as a policy tool to confront energy access issues in relation to the environment and sub-Saharan Africa's ability to adapt to climate change at the global level.

FEMA could consider adopting for immediate action by its members the Energy for Poverty Reduction Action Plan (EPRAP) instrument and possibly, also the national adaptation plans of action, in addition to the sector syndication prospectus recommended by the World Bank. It is important that EPRAPs are linked directly to national poverty reduction strategies, and included in national budget allocations, to provide strong financial basis for successful implementation. It is also important that EPRAPs emphasize productive uses and energy for income generation in order to address the key driver for transitioning to cleaner fuels and escaping the poverty trap.

4.6. Driving implementation with monitoring and evaluation

Achieving any of the targets discussed in this paper would require the implementation of energy access programmes emphasizing productive uses and income generation, within policy and institutional frameworks that enhance mobilization of the necessary investment finance as well as a wide range of actors. The progress made in this regard should be monitored closely and evaluated frequently to ensure that the implementation programmes stay on track.

FEMA, in line with its constitution as a platform for the exchange of experiences about successful approaches, could serve

as the forum for regular reporting on progress at the national and sub-regional levels. FEMA monitoring and evaluation sessions could therefore be held once a year to which all Chief/Technical Directors of Energy Ministries and Heads of Energy Divisions/Departments in sub-Saharan Africa are invited to present annual progress reports. Funding partners and selected African and international experts could also be invited to these sessions in order to deepen the quality of the evaluation and also facilitate the learning of lessons from other regions.

5. Conclusions

Sub-Saharan Africa compares poorly with other regions of the developing world in terms of the proportion of the population relying on traditional biomass for cooking, with serious environmental and health implications for the people. Access to electricity averages around 25% in sub-Saharan Africa today, which also compares poorly with other developing regions, and there is very low access to thermal energy and mechanical power for productive uses/income generation.

FEMA and several RECs have put forward targets for increasing access to modern energy services that range between 50% and 100% by 2015. The World Bank's APEA in Africa takes the position that even 50% by 2015 is not achievable and that the more realistic set of targets to aim for in the case of electricity access are 35% by 2015 and 48% by 2030. The big challenge is expected to be the $6–15 billion per annum required to meet any target between 35% and 50% by 2015.

This paper argues that meeting the investment challenge will require increases and more effective use of both domestic and external funding, and the development and implementation of innovative policy frameworks. The paper suggests that greater emphasis will need to be placed on productive uses of energy and energy for income generation in order to break the vicious circle of low incomes leading to poor access to modern energy services, which in turn puts severe limitations on the ability to generate higher incomes. The paper further suggests that if anything near the ambitious targets set by African RECs are to be achieved then it will be advisable to tap into the full menu of energy resource and technology options, and there will also be the need for significant increases in the numbers of various actors involved together with more effective institutions in the energy sector.

Appendix A. Energy Targets set by African Organisations

NEPAD

The following energy sector development objectives were put forward by NEPAD:

- To increase from 10% to 35% or more, access to reliable and affordable commercial energy supply by Africa's population in 20 years;
- To improve the reliability as well as lower the cost of energy supply to productive activities in order to enable economic growth of 6% per annum;
- To reverse environmental degradation that are associated with the use of traditional fuels in rural areas;
- To exploit and develop the hydropower potential of river basins of Africa;
- To integrate transmission grids and gas pipelines so as to facilitate cross-border energy flows;
- To reform and harmonise petroleum regulations and legislation in the continent.

FEMA

The following specific targets suggested in FEMA (2006) were a bit less ambitious:

- Doubling of the consumption of modern fuels including increased energy access for productive uses. The use of modern biomass for industrial purposes should be explored.
- 50% of inhabitants in rural areas should use modern energy for cooking. Options should include improved cooking stoves, which will result in both reduced air pollution and energy savings. Use of pressurised kerosene stoves and LPG stoves where the necessary support infrastructure is available especially in rural areas.
- 75% of the poor in urban and peri-urban areas should have access to modern energy services for basic needs.
- 75% of schools, clinics and community centres should have access to electricity, as this would enhance their international competitiveness.
- Motive power for productive uses should be made available in all rural areas. The use of biofuels should be explored as reliability on oil is reducing due to current price hikes.

EAC

The goal of EAC's Energy Access Scaling Up Strategy is to ensure at least half the EAC population have access to modern energy services by 2015 to reduce poverty and meet the MDGs.

The four energy targets endorsed by the Ministers of Energy of the East African Community (EAC) in August 2005 are (UNDP and GTZ, 2005):

- 50% access to modern fuels for those who at present use traditional biomass for cooking, plus support for improved cookstoves, reducing indoor air pollution and sustainable biomass production);
- 100% access to reliable modern energy services for the urban and peri-urban poor;
- 100% access to electricity for services such as lighting, refrigeration, information and communication technology, and water treatment and supply for schools, clinics, hospitals and community centres; and
- 100% access to mechanical power within the communities for productive uses.

ECOWAS

In the ECOWAS/UEMOA White Paper on energy access the ECOWAS/UEMOA Member States commit themselves to provide access to modern energy services by 2015 to at least half the populations in rural and peri-urban communities. The White Paper puts forward a number of very ambitious energy access targets, namely,

- 100% of the total population will have access to improved domestic cooking services by 2015 i.e. 325 million people or 54 million households. 30 million of these could be provided for through LPG;
- At least 60% of people living in rural areas will reside in localities with access to motive power to boost the productivity of economic activities and access to modern community services;
- 66% of the population in rural and urban areas, i.e. some 214 million people, will have access to individual electricity supplies, or

- 100% of urban and peri-urban areas; in rough terms, this means doubling the current access rate;
- 36% of rural populations – where the rate in the least densely populated countries is just 1%, and for the more advanced countries is 10%;

- Moreover, 60% of the rural population will live in a locality equipped with modern basic social services – health, education, drinking water, communication and lighting. This will be achieved through either decentralised electrical facilities or grid extensions. The objective entails increasing current levels threefold.

CEMAC

A travers une simulation d'électrification de chaque catégorie de localité, combinant les méthodes centralisées et décentralisées,

- l'objectif d'accès au service électrique à hauteur de 50% a été obtenu de façon pragmatique:
  - En desservant par réseau 50% de la population péri-urbaine; En apportant un service électrique individuel (réseau ou kits solaires) à 35% des ménages ruraux;
  - En équipant les infrastructures des villages non électrifiés, de telle façon que 56% des ruraux aient accès à des infrastructures électrifiées.
- une forte pénétration du GPL en milieu péri-urbain (70%), une pénétration encore importante dans les centres secondaires (50%) et ensuite dégressive de 35 à 10% suivant la taille des localités;
- l'utilisation, par les autres ménages, de foyers améliorés avec conduit de cheminée (ménages dont la proportion croît en allant de l'urbain vers le rural).

Ces deux {les deux derniers} axes d'investissement concourent à l'atteinte de l'objectif 80% de maîtrise: le gaz à raison de 44%, et les foyers améliorés à raison de 36%.

Appendix B. Sub-regional estimates of energy access investment costs

CEMAC

Le budget sur 5 ans (d'Octobre 2006 à Décembre 2011) présenté à la page suivante, s'élève à 155 milliards de FCFA équivalent à 236 millions d' Euros. Il reflète strictement les lignes de force du PAEC, à savoir:

- Rôle stratégique de la concrétisation d'ouvrages hydroélectriques, sans préjuger de leur localisation ni de leur taille qui devront ressortir – dans de brefs délais – d'études de clarification du potentiel à l'échelle de la CEMAC et de planification des infrastructures d'électrification rurale. La contribution de la CEMAC aux investissements – en tant qu'effet de levier – correspond à l'équivalent de 5 MW par Etat membre qui vont se traduire soit en ''ouvrages spécifiquement communautaire'', soit en ''ouvrages nationaux d'intérêt communautaire'' (total de 63,6 milliards de FCFA soit 41% du budget).
- Les zones de promotion correspondent aux projets pilote recommandés par la reunion des Ministres à Brazzaville. L'investissement s'élève à 25.9 milliards de FCFA (16.7% du budget) pour concrétiser à l'échelle de 600,000 habitants: l'accès à l'électricité privilégiant les ENR et la maîtrise des combustibles domestiques dans une approche environnementale. Les lignes MT associées au développement hydroélectrique (pas forcément liées à des CHE cofinancées par le PAEC) sont incluses dans les investissements qui vont se dérouler dans la zone de promotion prévue dans chaque Etat membre.
- En électrification systématique de populations pauvres avec des taux de pénétration de 75%, le plus fort impact est attendu des électrifications péri-urbaines: montant de 31.4 milliards de FCFA (20.3% du budget) pour électrifier 750,000 habitants.
- L'énergie solaire est fortement promue d'une façon ordonnée et complémentaire à l'hydroélectricité: en tout 15.7 milliards de FCFA (10.1% du budget), plus une partie du budget des zones de promotion qui inclut des installations photovoltaïques.
- Les développements liés à l'exploitation durable de la biomasse sont très significativement pris en compte à travers un budget promotionnel de 3.5 milliards de FCFA pour les applications industrielles comportant des retombées dans la lutte contre la pauvreté, à travers le projet ''combustibles domestiques'' (participation de 500 millions de FCFA aux volets nationaux) et à travers le projet ''zones de promotion'' (part de 24 milliards de FCFA, à définir dans la faisabilité).
- Le développement du marché du GPL et une amélioration de l'ensemble du dispositif pétrolier dans la zone, sont soutenus à hauteur de 5.5 milliards de FCFA.
- Conformément au signal des experts réunis à Douala, des moyens significatifs (5 milliards de FCFA) sont dégagés pour animer une stratégie de transfert de technologies.
- L'ensemble des tâches d'intelligence et d'organisation, incluse la Cellule de pilotage, représente seulement 8.4% du budget total.

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