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Sustainable Energy Solutions in East Africa

Status, experiences and policy recommendations from NGOs in Tanzania, Kenya and Uganda

Report by

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INTRODUCTION

Energy services and appropriate energy technologies are essential inputs to economic, social and environmental dimensions of sustainable human development. Hydropower has historically been the dominant energy source that Norwegian international energy development projects have focused on. This is mainly due to the fact that Norway is a hydropower nation and has knowledge in this field. In addition, many Norwegian companies are working with hydropower. Small-scale, decentralized, renewable energy projects with focus on poverty reduction and energy efficiency have received less attention.

Small-scale energy solutions are often relatively cheap, they can quickly provide necessary energy services to rural communities in a sustainable manner, and they are often the most environmental friendly solutions. A survey made in 2006 by Norges Naturvernforbund (Norwegian Society for the Conservation of Nature) showed that many Norwegian NGOs being involved in developing countries do not have much focus within this field, but still want to increase their knowledge.

With increased climate focus and the need to reduce the use of fossil fuels, the Norwegian government has decided to increase the energy budget in the international development aid. This decision is plausible and a variety of approaches and technologies are necessary to meet the energy needs.

On this background Norges Naturvernforbund wanted to hear from local NGOs in Uganda, Kenya and Tanzania what experience they have with energy development projects and get their advice for future action. This report is the result of that cooperation.

The majority of the rural and peri-urban population in East Africa depends on traditional fuels, mainly firewood, charcoal and cow dung for cooking and heating, and kerosene and dry cell batteries for lighting and radio listening. It is also widely understood and accepted that excessive burning of fossil-based oils, firewood, and charcoal affects the climate, environment and human health, particularly children and women who use these fuels in the household and small-scale enterprises.

The report does not focus on particular projects but rather on the necessary framework for a sustainable energy project to succeed in addressing: energy security, poverty reductions and at the same time be sustainable and environmental friendly.

The NGOs involved in writing this report have been coordinated within the framework of the East African coordination node of the International Network for Sustainable Energy (INFORSE). In addition to Norges Naturvernforbund the organisations are Climate and Development Initiatives (CDI), Uganda and Tanzania Traditional Energy Development and Environment Organisation (TaTEDO), Tanzania, (www.tatedo.org). Norges Naturvernforbund is very grateful to Timothy Byakola, CDI and Oscar Lema, TaTEDO for sharing their experiences and knowledge.

EXPERIENCES

Effects of Decentralized, Clean Energy Technologies

Small-scale renewable energy solutions can play a vital role in poverty alleviation, environmental sustainability and economic development. Such systems can provide energy that is affordable to the poor and can be a source of employment and enterprise creation for both the rural and urban poor. There is a growing evidence to suggest that investment in small and medium-scale renewable energy projects may have strong impacts in improving the energy services for the majority of the population, especially the rural and urban poor. These projects can also play a vital role in minimising fuel imports by providing viable alternatives to thermal-based electricity.

Barriers to Increased Use of Decentralized, Clean Energy Technologies

Although there exists a significant potential for increasing the use of decentralized, modern and clean energy technologies in rural areas, it is being limited by several factors, including:

- National policies and institutional framework are not giving sufficient leverage for entrepreneurs to consolidate or tap into new energy business ventures, neither promoting these technologies.
- Governments and donors' funding has mainly benefited conventional and large size energy projects.
- Potential entrepreneurs face high initial investment costs and associated risks when trying to establish their businesses related to modern energy technologies and services, and the financial return sometimes do not meet their profitability expectations.
- Access to financing is a problem, mainly due to the fact that financial institutions demand to have as close to 100% security as possible for their loans. This conservative lending policy is partly rooted in their lack of experience in pricing risk.
- There is insufficient entrepreneurship knowledge, business support services and seed capital to initiate formal businesses.
- If no business initiatives and good financial possibilities are linked to the energy projects they will not be sustained.
- There is limited knowledge on energy efficient and renewable energy products and their associated investment opportunities.
- Many potential end-users of modern energy technologies and services cannot afford to pay upfront for the products and services offered by the entrepreneurs and end-user financing is not well instituted.
- Participation of different stakeholders in decision-making is limited.
- Cooking is the most energy demanding activity of many rural households. The fact that it is looked upon as a woman's job partly explains that it is not a strong focus on introducing improved technologies.

An Implementation Approach for Energy Projects

Decentralized, sustainable energy technology itself is a package comprised by "hardware and software". The "hardware" includes the energy technology and physical project components. The "software" includes community mobilization, participatory development of the energy technology itself, capacity-building for the use of production technology and scaling-up through market development. Implementation

of these energy technology projects is depending on a bottom-up approach and a big number of individuals, being energy producers and decision makers at the same time.

As an example we present TaTEDO's approach for implementation of energy projects, based on their experiences during more than 15 years:

The field implementation phases include:

- Identification and selection of target areas
- Local level baseline information collection and establishment of indicators, through secondary information and interviews
- Participatory problems identification, needs and opportunities assessment and preparation of local level plans with process and effect indicators and targets through PRA methods
- Demonstration, awareness raising and technology and approach adaptation
- Capacity-building for scaling-up through market development for sustainable energy business development (seedling enterprises), credit installations and maintenance
- Participatory monitoring and evaluation at all levels
- Learning and replication with adaptation

The approach phases are equity oriented, ensuring participation of all members of the community or a wider range of stakeholders, in particular women and poor people.

TaTEDO's approach involves giving training on the technology installation/ production to the local technicians/masons and providing knowledge on the operation and maintenance of the technology to other community members.

The approach requires a careful selection of who will participate and benefit, what the needs and expectations of various stakeholders are, how the project activities will be carried out and when the different activities will take place. All are essential "ingredients" needed for a project to be carefully planned, monitored and evaluated.

RECOMMENDATIONS

Create an Enabling Environment for SMEs to grow

- Establish policies, institutional frameworks and legislative measures that enhance the development of SMEs, and translate them into action
- Address high capital costs and facilitate access to financing (long-term low interest loans, grants and subsidies through joint efforts from government, donors and financial institutions; give in-depth, evidence-based information to financial institutions on costs and benefits of investments in clean energy technologies, to reduce their perception of the rural energy business as being risky)
- Develop functional energy markets (explicit national policies and procedures; financial and fiscal incentives including micro credits, soft loans and tax exemption to stimulate public-private sales outlets and support services; hire purchase schemes, targeted subsidies, consumer credits, incentive packages)

Apply an Appropriate Policy Approach

- Increase participation regarding energy issues, especially of end-users like women and other disadvantaged groups
- Invest more in decentralized energy systems, to reduce vulnerability and costs
- Take account of local variations in energy planning, to adapt the energy solutions to the local needs, opportunities and constraints

Increase the Capacities of Stakeholders

- Increase knowledge and capacity among the stakeholders (give key persons at the local level the technical, economical and socio-cultural skills needed to increase the use of new alternative renewable energies; communicate the benefits of clean energy, the link between energy and development, availability and application of the various technologies, potential business opportunities; more energy-related education in schools and high schools)

- Apply innovative strategies for dissemination of new renewable energy technologies
- Energy projects and programmes to work closely with national governments, financial institutions, NGOs and development organizations to ensure that sustainable regulatory mechanisms, policies, financing, adequate skills and manpower are continuously developed and strengthened
- Strengthen research on relevant energy options, with the aim of improving their efficiency and supply

TANZANIA REPORT

Prepared by Oscar P. Lema, Tanzania Traditional Energy Development and Environment Organisation (TaTEDO)

Energy Situation in Tanzania

Access to better and affordable energy services is scarce in Tanzania, especially in rural areas. Domestic energy demand in Tanzania has grown rapidly due to population growth (2.9% in 2002) and the increase in economic activities during the last ten years. The estimated total energy consumption is more than 22 million tones of oil equivalent (TOE) or 0.7 TOE per capita. Energy consumption in rural areas accounts for about 85%. The energy balance is dominated by biomass-based fuels, particularly fuel wood (charcoal and firewood), which are the main source of energy to both urban and rural areas. Biomass-based fuel accounts for more than 90% of primary energy supply. Commercial energy sources i.e., petroleum and electricity, account for about 8% and 1.2%, respectively, of the primary energy used. Coal, solar and wind account for less than 1% of energy used. Other abundant but so far not fully tapped indigenous energy sources which could be harnessed to meet the growing energy requirements include hydropower, coal, solar, wind, and geothermal energy. Hydropower potential is estimated at 4.7 GW, coal reserves are estimated at about 1,200 million tonnes, of which 304 million tonnes are proven. Natural gas is estimated at 45 billion cubic metres of proven reserves. Government initiatives to explore and use of natural gas is in progress. Of the total energy demand in agriculture, 75% is met from human energy, 15% by animal power and 10% by diesel, electricity and solar power. Drying and processing of agricultural products is by traditional applications of solar energy and fuel wood. Many agricultural activities contribute towards deforestation, through extensive farming and slash-and-burn practices. Commerce accounts for about 6% of the national commercial energy consumption. The commercial sector includes among others wholesale and retail shops, hospitals, hotels, restaurants and recreation centres. Overall, the demand for energy in the sector is mainly met by commercial electricity and petroleum.

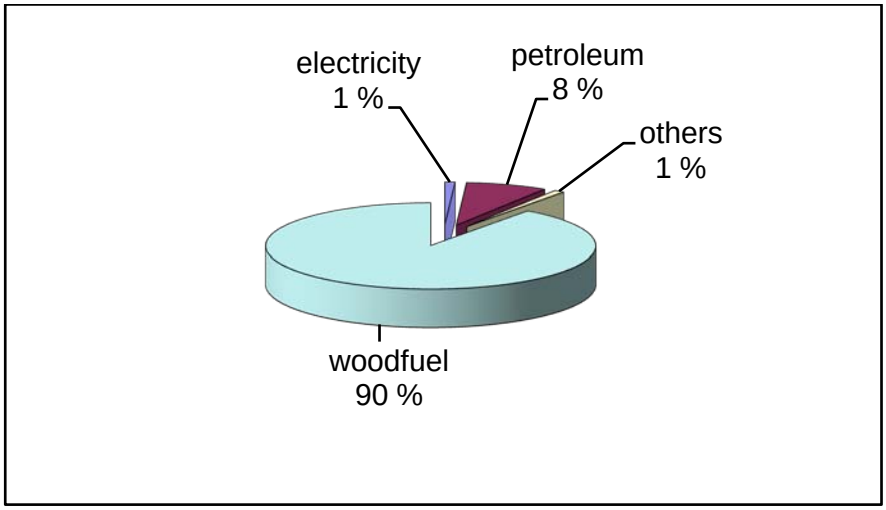

Figure 1: Total energy consumption in Tanzania

Energy Profile

- **Electricity**: Current installed and effective capacity of electricity generation in Tanzania is 863 and 857 MW respectively. It is estimated that only 12% of the Tanzanian population has access to electricity; 10% from the grid and 2% from non-grid. Electrification option in provision of rural energy service is of a priority and can be harnessed from various sources such as, grid extension, isolated micro- and mini- hydro projects, thermal plants, solar PV, wind, etc.
- **Liquid (Petroleum) Fuels**: The country imports all its liquid fuels at an annual order of 1.2 million metric tons costing about 200 million USD. The recently commissioned SONGAS project will partly substitute fuel requirements for generation of electricity at Ubungo thermal power plant.
- **Natural Gas**: Natural gas reserves at Songosongo in Lindi and Mnazi Bay in Mtwara are estimated at 30 and 15 billion cubic meters respectively. Currently the gas principle use is to generate electricity and industrial energy supply at a cement factory in Dar es Salaam. Sectoral breakdown of liquid consumption shows that transport consumes 40% followed by industry at 24% and then household at 21%. Agriculture accounts for 11%.

- **Coal**: The country is estimated to have 1,200 million tonnes, known sites are Kiwira and Mchuchuma/Katewaka around Lake Nyasa. Mining is on going at Kiwira where the coal is used to generate 6 MW that are fed into the national grid and some is used in cement and textile industries. There have been efforts to promote use of coal briquettes at institutional and household level to substitute charcoal and firewood.

Electricity Generation and Distribution

The Tanzanian Electric Supply Company Limited (TANESCO) is a parastatal and vertically integrated company tasked with supplying electricity to the Tanzania population. The vast majority of the country's energy infrastructure for generation transmission and distribution is currently property of TANESCO. Tanzania's electricity is derived primarily from two major hydroelectric power systems. The first in the North, involves three stations exploiting the Pangani River basin and the second consists of three systems within the Rufiji system (using the Great Ruaha and Kihansi rivers). These systems contain principal reservoirs at Mtera (3,200 million m^3), Kidatu (125 million m^3) and Nyumba ya Mungu (875 million m^3) Total installed hydroelectric power is 561 MW. There are also 55 mini hydroelectric generators, which are not connected to the grid but supplying 23MW of electricity to isolated parts of the country. Future identified and studied hydroelectric generation sites include those at Rumakali (222 Mw), Ruhudji (358 MW) and Mandera (20 MW). A number of thermal plants complete the network, of which nearly all of them are connected to the national grid. The recently converted fuel-jet power plants at Ubungo in Dar es Salaam, have a combined installed a capacity of 120 MW. The Songosongo natural gas pipeline now supplies these Ubungo plants.

The Independent Power Tanzania Limited (IPTL) is a private Malaysian company operating a 100 MW thermal powered plant located in Dar es Salaam. The company has been since 2001 selling electricity to the national grid. Other grid-connected diesel powered generators contribute 89 MW and serves south and western parts of the country. In summary, total installed generation capacity is approximately 900 MW, of which 561 MW is hydroelectric and 339 MW is thermal. Tanzania also imports power from Uganda to serve the Kagera region and from Zambia to serve the South-Western regions (Mbeya and Rukwa). Electricity is transported throughout the country using 220, 132 and 66 kilovolts lines. This includes the underwater marine cables connecting Zanzibar and mainland Tanzania. Distribution operates at 33 kV, 11 kV

and 449/230 V. As of 2004, maximum demand was approximately 476 MW serving around 500,000 consumers.

Energy Use

Tanzania use on average 407 kilos of energy (per oil equivalent) and 62 KWh of electricity per capita. While this energy use is very low by international standards, access to other services like telephones is high and is growing quickly. Based on the current energy situation, approximately 90% of the total energy that is presently being consumed in Tanzania is fuel wood. This dependence on fuel wood contributes to deforestation and the decline of country's pristine natural environment. Simultaneously, the use of fossil fuels for electricity generation costs the GOT treasury valuable foreign reserves and contributes negatively to the worldwide problem of global warming. The remaining 10% is distributed as follows: 8% petroleum products, 1% Coal and Renewable energy; and the remaining 1% is from thermal and hydro electricity. There is therefore a big gap in Tanzania between the supply and demand of energy, both for domestic and industrial applications in Tanzania. Table 1 below summarizes the natural resources in Tanzania and their level of exploitations.

Table 1: Natural resources and their level of exploitation. (Source: "Pricing Structure of Energy Services and Products Study Report", April 2005)

Resources	Potential	Degree of Exploitation as of February 2005	Users
Hydro	4,700MW 234.6 MW small hydropower	560 MW 4MW	General public, as electricity for domestic, commercial and industrial uses

Resources	Potential	Degree of Exploitation as of February 2005	Users
Biomass Biomass Residues	Sustained yield 24.3 mil.m^3 p.a. 15 T.crop & 1.1 m.of forest waste p.a., 14 m. cattle, 11 m. goats & sheep etc	Use ~ 40m.m^3 91,296 ha..p.a deforestation > 1,000 biogas digesters 32.30 MW at Sugar plants 3.525 MW from forest residues	General public, as electricity for domestic, commercial and industrial uses
Solar	187 W/m^2	1.2 MW electricity + water heaters, driers, cookers	General public, as electricity for domestic and commercial uses
Wind	Speed: 0.9 – 4.8 m/s	~ 129 windmills (47 are in operation) + 8.5 kWe	General public, for water pumping and electricity use
Coal	304 x 10^6 tons	< 150,000 T p.a.	General public, as electricity and heat for domestic, commercial and industrial use
Natural Gas	45 billion m^3	Son Gas IPP 145 MW electricity, and Twiga Cement Company	General public, as electricity and heat for domestic, commercial and

			industrial use
Geothermal	Limited assessment estimated > 150 MW	Not exploited	General public, as electricity and heat for domestic, commercial and industrial use
Nuclear	Uranium exists – not assessed	Not exploited	General public, as electricity and heat for domestic, commercial and industrial use
Tidal, Wave and OTEC	Not assessed	Not exploited	General public, as electricity and heat for domestic, commercial and industrial use

Energy Policy

The main objective of the Tanzania National Economic Development Policy is to improve the welfare and raise the standard of living of the population. In line with this, the objective set for the National Energy Policy aims at ensuring the availability of reliable and affordable energy supplies and their use in a rational and sustainable manner to ensure the proper and sustainable use of natural resources and protect the environment. This entails the importance of synchronization and coordination of the energy policy implementation and approaches with policies, plans and strategies of other sectors. Also the revised Poverty Reduction Strategy (PRS-2) has recognized the energy sector as one of the key sectors in fighting against poverty. The main objectives and general policy baselines of the energy policy of 1992 were:

- Liberalization of the energy market.
- Use of fiscal (taxes, duties, levies) and non-fiscal (fees, subsidies, credits, guarantees) interventions to direct market forces and correct market failures.

- Energy conservation and efficiency.
- Sensitivity to gender needs and linkages with the energy sector.
- Stimulation of energy technologies development and transfer.
- Efficient use of energy in industry and transport sector.
- Generation and distribution of electricity at affordable prices.
- Supply of electricity to small townships and industries lying adjacent to and far off the grid system, starting with agro-based industries and using alternative sources.
- Development and dissemination of efficient wood fuel conversion and utilization technologies, coal stoves, kerosene stoves and electric stoves for domestic purposes for rural and urban households.
- Exploitation of hydroelectric potential.
- Development and utilization of natural gas and coal resources.
- Utilization of forest and agricultural residues for energy production

Since 1992, a number of developments within the energy sector have been recorded. The most obvious change was the introduction of contracted management in the national power utility company (TANESCO), which can be regarded as a drastic departure from the 1992 policy. In addition, improved stoves and other modern renewable energy technologies are slowly gaining importance in urban and to a lesser extent in rural Tanzania. Another notable change is the increase use of petroleum-based products. The petroleum network comprised of multi-national petroleum companies and petrol stations are mushrooming all across Tanzania. Although these developments underscore the government's effort to extend energy use to other sources outside traditional fuel, they nonetheless accentuate the country's dependence on foreign companies for energy supplies. A number of the objectives mentioned in the 1992 energy policy document were not met. Woodfuel continues to be the main energy carrier in Tanzania with considerable negative implications on forest reserves. The adoption and use of natural gas has not led to full implementation. The liberalisation of the energy market did not result in the development of private sector initiatives. The stated goals of creating an enabling environment to allow non-conventional energy sources such as solar, wind electricity, the extension of national electricity grid to rural areas and the establishment of decentralized grids have not yielded the desired outcome. The failure of the non-implementation of the 1992 energy policy could be attributed to several factors notably:

- Inadequate involvement of key stakeholders at the various levels of implementation during plan formulation and implementation arrangements.
- Lack of transparency.
- Lack of proper distribution of tasks and responsibilities.
- Inadequate use of effective technology assessment tools and poor guidelines for stakeholders.
- Inadequate monitoring and evaluation of the effectiveness of fiscal, financial policy instruments
- Lack of incentives for innovation and entrepreneurship,
- Lack of dynamic technology transfers and information networks.

Renewable Energy Sources

These include photovoltaic (PV), wind pumps, biofuels, biomass (biogas and briquettes) and improved wood conversion. There are various initiatives towards popularization and deployment of renewable energy sources in the country. Their use has not being given the priority they deserve and as such not put into actions.

Institutional and Policy Reforms

Notwithstanding all of these obstacles, the government has established an appropriate institutional framework for policy implementation, which includes Rural Energy Agency (REA) with Rural Energy Fund (REF). The bills were discussed and accepted by the Parliament and these two bodies are now operational.

The REA have a major function of promoting new investment in modern energy for rural areas throughout Tanzania. It is working with key service sector institutions, ministries responsible for rural services (e.g. water, health, communication, education, local government, etc.) to promote investment in modern energy and to increase access of rural people for improved energy services. REA and REF will ensure that rural energy services are appropriately provided to the population in the area of renewable energy and energy efficiency and energy conservation. The Rural Energy Agency (REA) is the responsible institution for rural energy development. The Ministry of Energy and Minerals is proposing to attract other institutions, which will actively seek to help rural communities and work with NGOs, businesses, entrepreneurs, municipalities or Community Based Organizations (CBOs) through planning, financing and executing rural energy programmes. REF was similarly

established as a fund that will be the repository of financial resources for communities, companies, local governments and others that are able to invest in provision of modern energy services. REA on the other hand, will facilitate development of rural energy projects. The projects will ultimately be owned and implemented by the private sector, NGOs and community based organizations.

The REF is an instrument that REA use to stimulate development of rural energy projects. It will provide capital subsidies to bring down the cost of energy services in order to reduce the risk for project developers. The first key role of REA and REF is to bridge the technical assistance and financing "gaps". REA and REF would be accessible to the rural communities and will link key stakeholders to facilitate development of viable energy projects, bridge finance, technical and capacity gaps in order to stimulate investment.

Likewise, in Tanzania, energy is not explicitly mentioned as a priority issue in any of the socio- economic development policy planning initiatives. This could reveal that energy is not seen as a priority sector for pro-poor policies and the alleviation of poverty. However, in 1992 with the publication of the first National Energy Policy the linkage between energy and poverty was explicitly made. Equally, the importance of renewable energy technologies to respond to environmental degradation and rising energy demand is acknowledged within the same document. Together with the Energy Policy, the government of Tanzania prepared the Energy Master Plan, which was an implementation programme for the Energy Policy. These efforts have not resulted into desired results.

Experiences

Field Implementation Approach

Based on its seventeen years' experience on sustainable rural energy in the country, TaTEDO has developed a systematic approach of implementing programmes and projects. The developed approach recognises that sustainable energy technology itself is a package comprising "hardware and software". The "hardware" includes the energy technology and physical project components. The "software" includes community mobilization, participatory development of the energy technology itself and capacity building for the use of production technology and scaling up through market development. The approach involves giving training on the technology installation/ production to the local technicians/masons and providing knowledge on the operation and maintenance of the technology to other community members. This

approach enhances the quality of the energy technologies and services that the rural energy end-users and entrepreneurs will receive.

This approach involves a number of phases, where each phase of field implementation presents an opportunity to fulfil different needs and expectations. Each phase is linked to the next and cumulatively they produce a range of outcomes/ impacts specific to sustainable energy programmes. Therefore the approach requires a careful selection of who will participate and benefit, what the needs and expectations of various stakeholders are, how the project activities will be carried out and when the different activities will take place. All are essential "ingredients" needed for a project to be carefully planned, monitored and evaluated.

The field implementation phases include:

- Identification and selection of target areas (rural villages)
- Local level baseline information collection and establishment of indicators, through secondary information and interviews
- Participatory problems identification, needs and opportunities assessment and preparation of local level plans with process and effect indicators and targets through PRA methods
- Demonstration, awareness raising and technology and approach adaptation
- Capacity building for scaling-up through market development for sustainable energy business development (seedling enterprises), credit installations and maintenance
- Participatory monitoring and evaluation at all levels
- Learning and replication with adaptation

The approach phases are equity oriented, ensuring participation of all members of the community or a wider range of stakeholders, in particular women and poor people.

Development of Market and Businesses

There exists a significant potential for market development of modern energy technologies in rural areas, but it is being limited by several factors, including lack of business skills, access to finance and market awareness. Also insufficient entrepreneurship knowledge, business support services and seed capital to initiate formal businesses have limited the access of modern energy technology and services to most Tanzanians. The initial investment and associated risks in developing the

markets for modern energy technology businesses at the village and district levels are major setbacks to most potential entrepreneurs, either individually or in groups.

Sometimes the financial return would not meet the profitability expectation of potential entrepreneurs, due to the high initial costs required to establish these businesses. The entrepreneurship support services and market development efforts of TaTEDO aim at providing entrepreneurs at local level (village and district), individually or groups, with enterprise and business support services to help them to plan and undertake profitable and successful modern energy businesses.

Although the combination of enterprise development support and seed financing can be effective at expanding energy access, it is often not enough to get entrepreneurs focused on rural markets. Without end-user financing, a significant proportion of potential users who could not afford to pay upfront for the products and services offered by the entrepreneurs could not be reached. This end-user financing gap was one of the main reasons why the majority of clean energy enterprises supported under UNEP's AREED (African Rural Energy Enterprise Development) programme phase I (2000 -2007), tended to gravitate to the more well-off customers in urban and peri-urban markets. This situation underpinned the continued exclusion of the majority of people in rural areas from modern energy services and products. AREED phase II started in January 2008 and intends to service rural modern energy market needs.

The AREED phase I in Tanzania achieved some good results in the course of the last seven years. This is being reflected from the six investments on the ground and more than ten proposals in the pipeline. The programme has succeeded in developing an ingenious plan of loan provision and capacity development in the areas of bankable business plan development, analysis of market conditions and identification of efficient modern energy systems for entrepreneurs who have little prospects of securing capital to invest in viable energy activities.

In spite of these achievements, there are several challenges and barriers facing energy sector businesses were noted. They include:

- Lack of relevant national policies and institutional framework that will give sufficient leverage for entrepreneurs to consolidate or tap into new energy business ventures
- Lack of capacity building in energy system development and commercialisation
- Weak and limited rural energy market

- Limited information and knowledge on energy efficient and renewable energy products and their associated investment opportunities
- Inherently high initial cost of renewables and energy efficient products
- High capital investment and poor access to clean energy sector financing
- Long and arduous administrative processes involved in energy enterprise creation
- Lack of effective communication between relevant government institutions and energy SMEs (small and medium sized enterprises)
- Low public confidence in energy sector business

Commercial Lending for Small Rural Electrification Projects

A major constraint in developing small and medium sized electricity grids and other energy projects in Tanzania stems from the high risk associated with rural project lending, on the one hand, and lending in a new area of investment (i.e. rural electrification), on the other.

This constraint is felt most acutely by rural-based investors, or non-governmental organizations, who have no known track record with city-based financial institutions and/or non-tradable assets with which to secure loans. Successful rural entrepreneurs who have invested in rural enterprises (e.g. grinding mills, hotels, milk processing plants, coffee mills, transport), but whose investment and asset base is entirely or primarily in rural areas, face great hurdles in convincing financiers to provide loans with less than 100% security. Providing back-to-back guarantee from Tanzanian or foreign sources is not an option for most rural entrepreneurs. Likewise, rural-based non-governmental organizations (e.g. hospitals, schools, water NGOs) that seek to move into rural electrification also face the same hurdles.

From the financier's perspective, complete risk cover against non-secured investments in rural Tanzania is logical, and rooted in experience, both in Tanzania and other parts of the world. There is virtually no non-recourse financing (i.e. lending against non-secured assets) in Tanzania. Historical rural lending in Tanzania, indeed project lending in both urban and rural Tanzania, has led financial institutions to adopt this conservative approach.

Moreover, the concept of rural electricity companies is completely new in Tanzania (indeed in most of the world). Lack of a convincing track record, i.e. where there is

not a sufficient number of projects or accumulated experience of success or failure, discourage financiers from moving into this sector. Each project is considered on a case by-case basis, and no aggregation of projects, hence pooling of risk, takes place. Further, the range in potential size and complexity of rural power supply projects, from small hydropower schemes with a hundred or so consumers, to schemes with thousands of consumers, discourage projects aggregation, and does not provide financiers with any good means of assessing and hence pricing risk.

The lack of a credit guarantee scheme as a means of pooling risk further leads financiers either to avoid financing projects entirely, or to obtain as close to 100% security as possible. Each of these factors, unless addressed, seriously impedes rural electrification in Tanzania, regardless of how many grants or subsidies donors and the government provide, so long as the donors expect and rely upon financial institutions to fund part of the investment. There is insufficient risk protection or experience with pricing risk to encourage lending institutions to enter the sector without full guarantee.

Recommendations

Sustainable energy projects of the AREED type have an enormous potential to contribute to the overall national development priorities and in particular the goal of widening access to clean and sustainable energy services for under-served communities. The development of effective SMEs will enhance employment opportunities, growth and poverty reduction. Therefore, there is a need for dynamic policy initiatives and mobilization of capital and human resources to develop and enhance energy SMEs. Given this context, the following policy recommendations are made to address the challenges that need priority attention:

Establish Relevant Policies and Frameworks to Reduce Barriers to Energy Access and SME Development

This recommendation focuses on the need to establish relevant policies and institutional frameworks with the aim of overcoming barriers to the effective performance of energy SMEs in the delivery of sustainable energy services. National

governments and parliaments are responsible for the formulation of policies, institutional framework and legislative measures to support enterprise development and expansion. The objectives, principles and resources required to establish and strengthen energy sector enterprises present a number of challenges. However, the following areas are recommended for attention in the development and enhancement of energy SMEs:

- Translating policies into actions having clear-cut paths for budgetary support and implementation strategies.
- Improving the policy environment of the private sector to foster strong links with public sector decision-makers.
- Conscious political commitment to widen national energy access particularly for peri-urban and rural communities
- Establish sector department in the local government authorities to deal specifically with energy development issues

Sustainable energy delivery to underserved communities in Tanzania can be achieved by putting in place sound principles and policies that can facilitate effective and efficient performance and this demands government action. While the policy and institutional settings seem to be in place, there are still considerable difficulties in translating policies into actions. Moreover, the policies lack clear-cut paths for budgetary support and implementation strategies; actions contained in existing institutional framework are also not properly streamlined to address the peculiar needs of energy SMEs.

There is growing recognition that improving the policy environment of the private sector can foster strong links with public sector decision-makers and this can unlock resources that have the potential to boost the performance of energy access. Clear implementation strategies will help to provide broad paths to reach the goal of providing energy efficient and renewable energy services to the under-served for sustainable development. In this regard, there is the need to define the responsibilities of both private and public sector stakeholders to ensure improved and secured energy services.

Research evidence suggests that the lack of conscious political commitment to widen national energy access is likely to constrain energy sector businesses. Therefore,

there is the need for comprehensive policies and regulations that are underpinned with robust principles, which will survive the test of time. Such requirements are essential to mitigate the short-term effects caused by a change of government or cabinet reshuffles and will provide clear direction for energy sector businesses to meet future energy demands.

Address High Capital Costs and Facilitate Access to Financing

Energy SMEs tend to require a great deal of investment to operate energy service companies. However, most entrepreneurs are constrained by the difficulty in mobilising start-up financial capital. The difficulty in mobilising funds would necessitate making the investment on a hire purchase basis and this requires information and guidance from experts. Again, in an effort to obtain bank loans or credits, transaction costs may overshadow potential gains from high interest loans. Given this background, institutions and companies dealing with energy businesses have to closely work with financial institutions and national governments to complement existing support to local entrepreneurs with grants and long-term low interest loans. Financing energy projects would require long-term low interest loans, and taking on such long term commitments is difficult for small entrepreneurs who are more concerned with day-to-day survival. Low capital cost is crucial for overcoming the constraint of high initial capital and can reduce the burden of high up-front costs of energy service delivery equipment.

Commercial banks tend to be very reluctant to invest in the energy sector since energy projects take a long time to mature and the risks are high. In this regard, public-private sector initiatives in the energy sector will encourage a healthy financial sector competition to bring about a reduction in capital costs. Another option worth considering is the introduction of investment-based subsidies. The availability of such subsidies can increase local investment in energy efficiency and renewable energy, create competition and reduce delivery costs to consumers. In the long run national governments should make conscious efforts to create the enabling supply-side fiscal policy as an incentive to widen energy access for poverty reduction, economic growth and development.

To overcome the credit risk barriers it is necessary to gain more experience in the sector, and more confidence in appraising projects, (i.e. knowing what one is lending

into). This can only be achieved by increasing the number of projects, and disseminating the lessons from those projects. This in turn, can only be achieved when a sufficient number of projects have been financed.

To " ramp up" the volume of projects and experience is the critical challenge. To accomplish this requires some form of risk/ credit guarantee scheme. It is too much to expect the banking sector to develop and finance such a scheme on their own. With few exceptions, banks lack both the liquidity and the asset base/portfolio to cover or finance such a scheme. Donors are willing to provide grants and subsidy elements of rural electrification, but at the same time, want the banking sector to grow and take on more of the risk. Banks also need to develop (and/or to encourage other institutions to develop) the intermediation (e.g. insurance, mortgages, etc.) needed to cover this risk. Government is unwilling to further subsidize finance, as it has the painful experience of picking up much of the tab for insufficient risk assessment/appraisal and protection in the past.

So long as finance institutions, donors and government remain unwilling to cover credit risk in this sector, it is very difficult to see the sector growing. Few investors will be able to raise back-to-back guarantee on local loans, or to find the 100% security /collateral to obtain credit from financial institutions. A few large city-based or international firms will be able to raise both the equity and provide the collateral to obtain local loans, but not enough to give the financial sector sufficient experience or confidence in the sector to venture very far with smaller, rural-based or non-governmental investors.

Several options could help break this logjam. To put the sector into perspective, the World Bank and other donors have made a major financial commitment to rural electrification, and specifically to finance small and medium grids with grants and subsidies. The Government of Tanzania is also committed to this process and passed the legislation to set up the Rural Energy Fund (REF), overseen by an autonomous Rural Energy Board (REB), and supported by the Ministry of Energy and Minerals and the Rural Energy Agency (REA), with extensive project indication and preparation resources to stimulate the sector. A major programme to promote investment in rural electrification is underway.

Thus, the basis for privately led rural electrification is in place. Several projects are in an early stage of development and finance. These will provide excellent experience for investors and financiers, providing lessons on how to identify and finance such projects. However, a few projects, identified and supported with considered upfront

donor and government assistance, are insufficient either to "ramp up" rural electrification, or to provide sufficient information on appraising risk. The framework is there for such appraisal. With enough projects, the REA will develop a range of tools and templates for appraising projects, i.e. developing demand and market surveys, preparing business and finance plans to improve the success of investments. The REB will develop the experience to appraise projects and to put in place the monitoring and evaluate mechanisms to track progress and ensure compliance on a number of project performance areas. Again, this requires a certain volume of projects and experience to give bankers and other financiers the confidence to move into the sector.

Nevertheless, without the experience the volume cannot be achieved, but without the volume experience and confidence cannot be gained. Something must be done to break these impasses otherwise the subsidy funds will remain unutilised, and small and medium sized grid based rural electrification will never take off.

Develop Functional Market Systems

To develop functional energy markets, particularly in the rural areas, explicit national policies and procedures to guide and stimulate energy equipment and components market are needed. In addition, the small size of the rural market and scarcity of energy equipment result in high prices of goods and services. It is proposed that private sector associations and trade unions should dialogue with relevant government ministries to put in place financial and fiscal incentives including micro credits, soft loans and tax exemption to stimulate public-private sales outlets and support services in rural communities. This can contribute to increase the prospects of access to energy equipment and services. At the same time, local corporate organisations need to partner international organisations (UNEP, UNDP, GEF, European Union Energy Initiative, Regional Development Banks etc.) to establish hire purchase schemes as an instrument to overcome the barrier of high up-front capital costs of energy efficient and renewable energy equipment. Rural banks and community-based organisations are also effective instruments that can be used to provide resources that will mitigate the high initial costs of clean energy technologies.

The nature of the cash economy in rural Africa is such that uptake of energy efficient and renewable energy technologies will remain slow due to the uneven, uncertain and

seasonal nature of incomes. One of the available policy options is that private sector energy entrepreneurs should tailor the supply of energy efficient and renewable energy technologies to meet the seasonality of cash inflows in rural areas. In the energy market, there is the need to level the playing field. This means that favourable financing mechanisms (targeted subsidies, consumer credits) for renewables and other clean energy sources are needed to overcome high up-front costs and persistent defaults in monthly payments by the rural poor.

One of the policy measures that can be adopted to attract donor interest and investment into the clean energy sources market is to establish national steering committees to collaborate with local research institutions on impacts of existing clean energy services projects on poverty reduction and wealth creation. Tax exemption as well as attractive incentive packages to facilitate the up-front purchase of equipment is equally significant. Government agencies, commissions and organisations mandated to manage various electrification funds and other energy-related funds should explore innovative interventions to reduce the costs of energy efficient and renewable energy technologies through increasing investments in product and market development.

Market incentives and regulatory policies can also facilitate the uptake of renewables but these should be done in a way that helps the market to respond, as markets can be forced even in remotest outposts where demand is low. Rural market develops at a snail's pace unless it is forced and this means adopting a technology-neutral approach based on the expressed needs of rural communities. This will necessitate a wider engagement and collaboration with national institutions to lobby national governments and parliaments to formulate policies and legal framework that would stimulate market development.

Build Human and Institutional Capacity in Energy System Management

It appears that there is the political will to create a conducive business environment for the private sector to function as the engine of growth for job and wealth creation. However, more needs to be done. In this regard, it is recommended that national governments in collaboration with development agencies should implement relevant capacity building programmes by way of training and international exposure in energy system application and management.

Create Facilities to Foster Information and Knowledge Exchange

Knowledge deficit is a key factor that is preventing potential entrepreneurs from participating effectively in the clean energy service market. Owing to the limited knowledge of potential entrepreneurs on energy market opportunities, national governments remain the key player. Recent experience suggests that lack of knowledge on clean energy technology options is all-pervasive, ranging from the financial sector to government ministries. Officials in the various government energy ministries have different career profiles with several of them becoming experts through training. In this regard, there is the need for national governments to create incentives and encourage public officials to participate in seminars, workshops and international meetings to update their knowledge on sustainable energy technologies, business, policies and targets linked to national development goals.

There is a lack of understanding of the financial systems and processes that are relevant to the development of the energy sector market. When financial mechanisms are created they are often subject to diverse interpretation. It is recommended to work closely with private sector actors to furnish local banks, particularly the commercial banks with evidence-based data on costs and benefits of investments in clean energy technologies for cooking, heating or small-scale industrial processes. In- depth knowledge and information to local banks, particularly rural banks and financial organisations, will help to raise awareness, increase acceptance and reduce the perception of energy sector businesses as a risk territory. Existing educative media programmes on poverty reduction and sustainable development efforts (income generation, social empowerment of women and environment protection) should be targeted and piggy-backed to deepen knowledge and understanding of energy related issues.

Given the knowledge deficit that is pervasive in the energy sector, there is the need to devote time to the preparation of fact sheets, leaflets and training manuals that would specifically target a wide range of stakeholders to communicate the benefits of clean energy services, particularly renewables to the public so as to increase knowledge on the link between energy and development. Efforts should be made to diversify training materials to include short video clips that would give potential

entrepreneurs and other stakeholders an idea of the range of energy resources, their application and potential business opportunities.

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KENYA REPORT

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Energy Situation in Kenya

Energy for Poverty Eradication

The government has been implementing a number of pro-poor energy incentives by way of subsidies. A case in point is the kerosene, LPG and electricity subsidies. The subsidies are premised on the expectation that the resultant lower prices will benefit the poor. While the energy sector reforms are premised on economic growth and poverty reduction, clarifying the link between each policy strategy with the poverty alleviation objectives has been a challenging task. For example, different strategies for increasing energy supply have been identified, but ways of satisfying the particular needs of the poor are not adequately outlined.

The High and Medium Potential Areas have been identified, which contain the majority of the rural population as most of the poor are concentrated here. Six of the eight provinces in Kenya have more than 55% of their population living in poverty. Three provinces, North Eastern, Nyanza and Coast have at least 70% of the population living in poverty. One of the implications of poverty in Kenya is a low level of modern energy consumption. Only about 5% of rural and 50% of urban households have access to electricity. This gives a national average of 15% access to electricity (SID, 2004).

The Ministry of Energy has developed a short and medium term energy plan. The plan identifies a number of areas for intervention that include increasing electricity access in both urban and rural areas, increasing electricity generation, institutional strengthening, regional power interconnections and reinforcement and expansion of transmission systems. The plan also aims at identifying and developing new sources of energy, an oversight to achieve quality, energy efficiency and conservation and energy projects impact assessment among other things.

Furthermore, even with the unbundling commercialisation and privatisation of the power sector, lower electricity price benefits were expected and better coverage of

access by the poor. It is envisaged that the implementation of institutional and regulatory reforms will increase the chances of improving the supply of electricity to the poor.

Energy Planning at National and Local Levels

The government has put in place mechanisms for participation at all levels of decision making, also at lower levels. Under the Ministry of Energy there is the Renewable Energy Department with the following Divisions: Biofuels, Solar and Wind, Mini/Micro Hydropower and Energy Conservation. The Department runs 10 energy centres located in the major ecological zones. These are Jamhuri (near Nairobi); Wambugu Energy Centre (Nyeri); Kitui; Mtwapa (Kilifi); Uasin Gishu; Kericho, Bukura (Kakamega); Kisii, Busia and Migori. These centres are the Department's frontline technical arm through which renewable energy information is disseminated to, and feedback is received from the public.

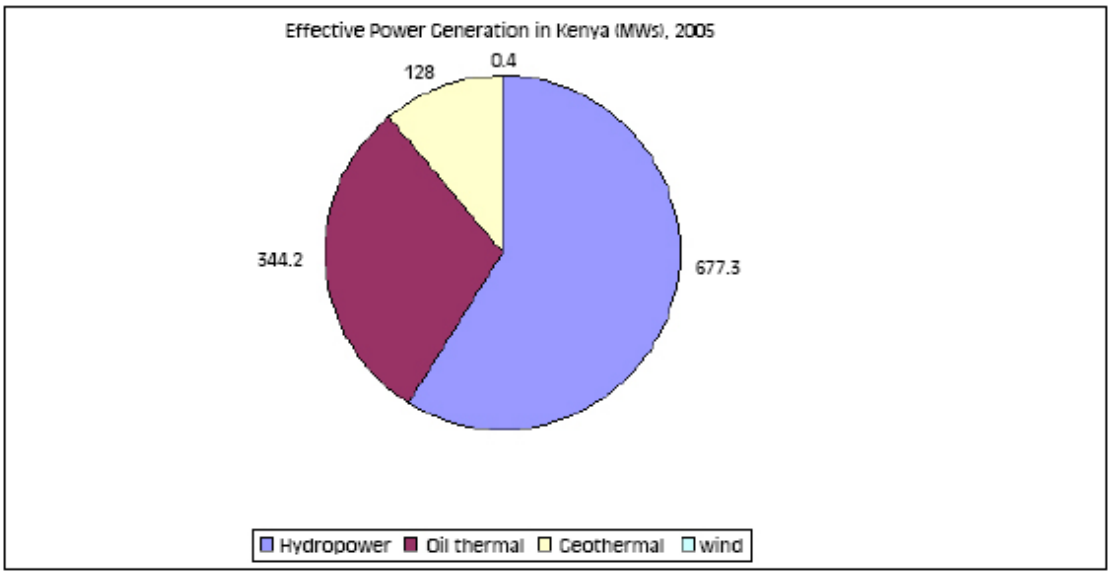
The Energy Sources

A lot of investment has been made towards the development of a number of energy options to able the country meet its growing demand for clean energy services. The energy sector is characterised by various sources and options of energy. However, the sector does not vary so much from the other sister countries in East Africa. The rate of energy production in Kenya has been estimated at about 13.89 million TOE (IEA Statistics 2008). The demand for energy has been growing with the growing economy of the country. The growth in demand is not proportional to the rate at which the country's energy generation has been growing.

Biomass (fuel wood) is the largest single form of energy that is consumed by the largest section of the population of Kenya. It accounts for about 68% of the total energy consumption with an estimated annual wood demand of more than 38 million tonnes. The sustainable biomass supply for Kenya has been estimated at 15 million tonnes. The annual wood demand therefore creates a deficit of more than 60%, making it purely unsustainable for the country. There have been several interventions by government and other interested persons or institutions aimed at minimising the level of biomass consumption. Given the rate of forest conversion in the country there is a need for enhanced intervention if forests are to be conserved.

Electricity accounts for about 8% of the total national energy demand. Access to electricity has been estimated at 15% of the population on national level and 4% in rural areas. The national per capita consumption of electricity is estimated to be 121 KWh per year. The major sources of electricity in Kenya include large and small hydropower, geothermal, thermal, wind, solar and cogeneration. Although the use of solar energy has increased, its contribution in the country's energy balance is still unknown. In terms of generation capacity, hydro power accounts for 1,917 GWh (44%), thermal oil 653 GWh (15%), independent power producers 1,313 GWh (30%), geothermal 456GWh (11%) and wind energy, 0.1 GWh (0.002%). For a long time, Kenya has been importing electricity from Uganda, accounting for 3.1% of total domestic electricity consumption. This has been affected by the recent decline in water levels in Lake Victoria.

Figure 2: Sources of electricity in Kenya



The national electricity consumption has been steadily growing due to the increase in demand in the small and medium enterprises and in the domestic sector (Bhushan, 2000). It has been observed that the Kenyan electricity sub-sector needs at least 40 MW of additional electricity generation capacity every year (Nicky, 2002) if it is to meet the increasing demand for electricity. Over the years, the level of investment in the energy sector has not been proportional to the growth in demand and therefore

there has not been sufficient energy to accommodate the growing demand (Karekezi S. and Mutiso, 2000).

The least cost power sector expansion plan prepared for the Government of Kenya indicates the need for an additional installed capacity of 1,288 MW by the year 2013 if the projected demand is to be met. This implies that there is a need for additional efforts in the generation capacity of electricity (Nicky, F. 2002). Stagnation in investments in new generation and transmission capacity has resulted into significant mismatch of electricity demand and supply. Out of 328 MW planned for development between 1996 and 2000, only 205 MW was developed. The firm hydropower capacity of 501 MW sharply reduced to about 104 MW due to drought.

Kenya does not have its own petroleum reserves, meaning that the petroleum products in the country have to be imported. The supply of petroleum products is estimated at more than 3.2 million tonnes of crude and refined petroleum products. The demand for petroleum products has been growing year after year and is expected to continue growing for the years to come.

Development of the Energy Sector

As earlier noted, Kenya has invested into the development of a number of energy options to meet the county's growing need for clean energy. Kenya's energy sector is characterised by various sources and options.

Wind energy

Wind energy has been used in Kenya primarily for water lifting since the beginning of the 19th century but its use declined with the advent of oil fired internal combustion engines, which are flexible and more convenient to use. However, with the rising cost of oil, the exploitation of wind energy is becoming increasingly more attractive, particularly in areas remote from the grid and oil supply outlets.

To promote investment in wind energy generation, the Ministry of Energy recently completed preparation of a broad National Wind Atlas. In addition, the government is promoting the development of wind-diesel hybrid systems for electricity generation under rural electrification programme in areas remote from the national grid. In the

meantime, a total of 550 Kilowatts are installed in Ngong and Marsabit, generating about 0.4 GWh of electrical power.

Solar energy

Being located along the equator most parts of the country receive sufficient sunshine required for solar energy harvesting. By the year 2005, the number of installed solar PV systems amounted to 220,000. The performance of Kenya in the dissemination of solar equipment has been far much better among the East African countries, although a lot remains to be done to exploit its enormous potential. There is a number of companies that are involved in the dissemination of solar equipment. NGOs have also greatly contributed to national efforts to disseminate solar energy.

Geothermal energy

Kenya is the first African country to have developed and put to use geothermal energy for electricity generation. Geothermal energy today is the most promising source of energy in Kenya. This is partly because the government has given substantial support to the development of the geothermal resources in the country. There are currently three operational geothermal plants in Kenya that produce a combined electricity output of more than 120 MW. Currently 70MW of power are supplied, representing about 16% of the electricity to the national grid. Plans are underway to add another four plants.

Energy Technologies

Biomass Technologies

Biomass is the largest form of primary energy consumed, accounting for 68 % of the total national primary energy supply. The demand for biomass energy has been estimated to be growing at 2.7 % per year while the supply has been estimated to be growing at only 0.6 % per year.

The principal drivers of biomass energy demand are population growth, lack of access to biomass energy substitutes and the growing incidence of poverty among the Kenyans. The biomass energy supply and demand imbalance is exerting

considerable pressure on the remaining forests and vegetation stocks, thereby accelerating the processes of land degradation. In addition, the production of biomass energy poses a threat to competing land use systems such as agriculture, forestry and human settlements.

a) Firewood

In the year 2000, the average annual firewood consumption in Kenya by the rural and urban areas was estimated to about 3,394 and 2,701 kg per household, respectively. The corresponding per capita consumption was 741 and 691 kg, respectively. The consumption pattern of biomass energy in Kenya has been largely characterized by use of poor energy saving technologies that have greatly contributed to unsustainable biomass consumption in the country. Among the majority of the rural communities, the major cooking technology is the three-stone cooking methods that are wasteful of the energy used. While efforts have been made to introduce energy saving cooking stoves a lot still needs to be done, to improve on their rate of dissemination and acceptability.

b) Use of Charcoal and Improved Stoves

The improved charcoal stove popularly known as KCJ (Kenya Ceramic Jiko) was developed and disseminated in the early 1980s. The improved ceramic wood stove was introduced in the late 1980s. The energy conversion efficiency of both types is 30 – 35 % on the average compared to the traditional three-stone fireplace. The improved stove industry has become a significant source of livelihood for a number of Kenyans. In 2002, the adoption level of KCJ was found to be about 47 % while that of the improved efficient woodstove was 4 % (Kamfor, 2002). The current policy seeks to enhance the penetration of KCJ and improved woodstove to 80 % and 15 % respectively by 2010.

Charcoal is an important energy source more especially for urban dwellers and some rural well-to-do communities. Charcoal production for the growing population has been largely associated with the increasing levels of deforestation. The high levels of poverty coupled with the high charcoal demand among the urban populace, the charcoal business has become a common and all year round business activity nationwide. Effective regulation of the charcoal industry has remained one of the key

challenges that is faced by the government today and is likely to remain so in the medium and long term, as well.

Many people are confronted with a number of problems that eventually translate to negative impacts on the environment. It has been estimated that, on average, the urban charcoal consumption in the year 2000 was 156 and 152 kg per capita for rural and urban dwellers, respectively. It has also been further revealed that, contrary to the widely held and popular view that charcoal is a fuel for the low income urban dwellers in Kenya, in fact about 83 % of high income groups regularly use charcoal as a source of energy, meaning that charcoal is consumed by all categories of urban dwellers. This is so because other than charcoal and other forms of biomass energy, the other energy options are considered to be expensive and unaffordable to different consumers, even to those who have a reasonable income.

There are several negative impacts that are associated with the use of biomass energy in Kenya. Some of these impacts originate from the use of wood and charcoal-burning stoves: heavy labour in finding, cutting and carrying wood, usually by women and girls; degradation of the environment from loss of trees and resulting erosion and habitat destruction; emissions of products of incomplete combustion including carbon monoxide, nitrogen, sulphur oxides and various organic compounds as well as particulate matter; and, the health damage inflicted by particulate matter which contributes to acute respiratory infections, the leading cause of illness in Kenya and other developing countries.

Types of Charcoal Stoves used in Kenya: Center is the traditional non-energy stove saving. (Source; AFREPREN)

Among the energy saving technologies is the Kenya Ceramic Jiko (KCJ), which has been domesticated and promoted among the communities in Kenya. This technology

was developed as a response to a number of energy use and conservation problems. It is a portable improved charcoal burning stove consisting of an hour-glass shaped metal cladding with an interior ceramic liner that is perforated to permit the ash to fall to the collection box at the base. A thin layer of vermiculite or cement is placed between the cladding and the liner. A single pot is placed on the rests at the top of the stove.

If used and maintained properly, the KCJ can reduce fuel use by 30 - 50%, although not surprisingly there is considerable variation based on the extent of training and outreach efforts, stove quality, and cooking practices. There are now more than 200 businesses, artisans, and micro-enterprise or informal sector manufacturers producing over 13,000 stoves each month. It is estimated that over 700,000 KCJ's are already in use in Kenya; the stoves are found in over 50% of all urban homes, and roughly 16% of rural homes. The general features of the KCJ program and the stove design itself have both been utilized in formulating improved biomass stove programs in a number of African nations. The ovens are now in use in more than 30 nations.

c) The Biomass Policy and Demand in Kenya

The government's biomass policy objective is to ensure sufficient biomass supplies to meet demand on a sustainable basis while minimizing the associated environmental impacts. Consistent with this objective, a number of strategies and action plans have been formulated whose implementation is expected to help achieve the stated objective. While the policy has good intentions, it seems not to be realistic and therefore it may not easily be achievable. The rate of deforestation in Kenya today is higher than the rate of afforestation. With the growing rates in the country's population, the rate of forest conversion has also been growing as a result of continued conversion of forestland for agriculture and fuel wood.

Solar Energy Technologies

Kenya receives 4 – 6 KWh per square metre per day. This is equivalent to 250 Mtoe per day. However, only an insignificant amount out of this vast resource is hitherto harnessed. Diverse application of solar energy include solar thermal for heating and drying and solar photovoltaic (PV) for lighting, water pumping, refrigeration and

telecommunications. An estimated 220,000 solar PV units are currently in use in Kenya On the other hand; about 7,000 solar thermal systems are in use for drying and water heating. However, solar energy has remained mainly an important source of energy at household level with no success being gained in the industrial sector.

Locally, a number of solar energy technologies have been developed and are used largely in cooking, water heating and drying of agricultural produce.

The government is currently implementing a solar PV electrification of schools and other institutions in selected districts, which are remote from the national grid as part of a national strategy to enhance the contribution of renewable sources of energy to the overall energy supply mix.

Wind Energy Technologies

Wind energy is viable source of energy in Kenya; more especially in the coastal region where wind speeds are relatively high. Today Kenya has an installed Wind power capacity of 550 KW. Government of Kenya has over the years supported the development of appropriate wind pump technologies. Efforts have also been made to develop wind energy using local materials and technology. The initial wind energy development initiatives were carried out in Thika during 1977-8, and the first proto type was built in 1979. The inception of the local Kijito wind pumps in Kenya can be traced from 1998. Kenya was the first country in Africa to be appointed as a collaborator in the Intermediate Technology Development Group (ITDG), which initiated work on wind pumps.

Small Hydro Energy Technologies (Small, Mini, Micro and Pico)

There is a significant endowment of sites suitable for stand-alone systems, which are essential to rural energy demand patterns. The current known potential for mini and micro hydro is estimated to be more that 300 MW. Small hydro is an important source of energy for communities that far away from the national grid and could be developed as decentralized grids. There are even smaller energy generation systems that have been used to supply energy to a limited number of families and therefore they may not need the development of a grid system.

Currently there are a number of pilot projects in the area of mini and micro hydro that have been implemented to assess the viability of such systems and create the impetus for accelerated exploitation of mini/micro hydro resources. With the liberalization of the energy sector, the private sector is expected to play a vital role in the development of the country's mini/micro hydropower potential. The government, through the Kenya Power and Lighting Company has already built 11 off-grid power stations in areas like Mandera, Tana River Wajir, Lodwar, and Moyale. More stations are being built in parts of Nyanza and north Rift Valley.

Biogas Energy Technologies

Biogas technology has been actively promoted in the country since early 1980s. So far about 1,400 family biogas plants (10m3) have been installed and each producing on average about 1.2 m3 of biogas per day. The gas is used for cooking and to some smaller extent for lighting. Faster adoption of the technology is hampered by the high capital costs of construction and insufficiently low level of awareness. Several biogas plants are expected to have gone out of production. A national biogas survey is envisaged to determine the number of operational and no-operational plants with the view of formulating appropriate interventions to enhance the adoption of the technology.

Co-generation Technology

Co-generation is one the technologies in Kenya that have a promising future. It today carried out using bagasse as a primary fuel in the domestic sugar industry. The sugar industry in the country is comprised of seven sugar companies producing an average of 1.8 million tonnes of bagasse with fibre contents of about 18% by weight annually. Out of this quantity only about 56% is used in the co-generation industry, which has an installed capacity of 25 MW. So far, it is only Mumias Sugar Company that is self-sufficient in electricity production among the seven factories and it has the capacity to export about 2 MW of surplus power to the national grid.

Petroleum Based Energy Technologies

Kenya has a number of generators that are owned by government, private companies, institutions, small businesses and individual households. These generators play an

important role as a source of commercial energy and in the supply of household energy, especially in areas where access to the national grid is still a problem. Petroleum products are also used in industry to provide energy that is vital for running heavy and light machinery. Among the communities whose income is low, kerosene is a critical source of energy for lighting and cooking. Petroleum products are also important as a source of fuel in the country's vibrant transport sector.

A national survey conducted in 2005/06 financial year indicated that 76.4 per cent of the Kenyan population relies on paraffin for lighting and cooking. The consumption of paraffin has however been declining in what economists have attributed to rising prices. This decline is however seen to be pushing the poor, especially in rural areas, to use fuel wood, with serious consequences on the environment. In 2007 kerosene consumption dropped to 329,000 metric tons down from 364,000 tons in 2006 and 389,000 tons in 2005.

The extensive and ever increasing use of fossil fuels in Kenya offers a challenge to the economy of the country in light of the ever increasing global fuel prices. Thermal power generation in the country has also resulted in over release of greenhouse gases into the atmosphere, thereby contributing to global concern over climate change.

Biofuel Energy Technologies

Growing raw material for biofuels is today a rapidly growing business. There is already a big interest on new liquid biofuel sources such as oil palm for industry and jatropha for supporting rural livelihoods. There are oil palm plantations in the rural agricultural districts of Kakamega, Busia and Bungoma in western Kenya. Mumias Sugar Company has an out grower network of some 40,000 smallholder farmers growing palm oil trees. While the commercial viability of palm can be linked to mega investment, in Kenya jatropha is seen to be of a lesser concern and good for rural livelihoods and fragile ecosystems. Jatropha is not seen to compete with food crops, but instead expands the livelihood options in poor rural areas.

Energy Conservation

Energy conservation practices and efficiency in utilisation are vital aspects of demand-side management of energy. The government is today promoting energy

conservation and efficiency improvement at the various consumer levels, including industrial, institutional and domestic levels. A number of energy conservation initiatives are currently being implemented in conjunction with other stakeholders. It must be mentioned however, that the process of energy conservation and efficiency management are not easy to come by as they involve a number of players. It also involves economic empowerment of the communities so as to enable them to adopt energy saving and more efficient technologies.

Financing Energy Access

The least cost power sector expansion plan prepared for the Government of Kenya indicates the need for an additional installed capacity of 1,288 MW by the year 2013 if the projected demand is to be met. This implies doubling the electricity production capacity (Nicky, F. 2002). Stagnation in investments in new generation and transmission capacity has resulted into significant mismatch of electricity demand and supply. Out of 328 MW planned for development between 1996 and 2000, only 205 MW was developed.

The Government of Kenya considers reliable supply of electricity as a critical factor for the growth and development processes of the country, more particularly so to the manufacturing sector. To this end, Kenya has been building on the success of its rural electrification progamme and in the 2007/08 budget; there were plans for government to further expand its rural electrification progamme so as to make power accessible to all Kenyans. In the 2007/8 budget about KSh. 8 million (0.02%) was budgeted for to avert any shortage of power supply that could impact negatively on the manufacturing sector. In the budget however it was noted that the direct fiscal burden of the energy sector was going to be reduced with the participation of the private sector as a result of opening up the sector to private investors to participate in electricity generation.

The 2007/8 budget targets connecting large towns that are far away from the national grid to electric power by May 2008. It was estimated that there would be additional 460 market centres, 110 secondary schools, 38 health centres and 17 water projects, but the budget remained silent on the number of domestic and commercial consumers that would be connected to the grid. In the same budget the government proposed to provide diesel-fired isolated mini grids and to enhance

capacity of power generation and distribution to sustain economic expansion. However, little does the budget say about financing and support for the development of non-conventional energy sources. This oversight is likely to affect access to clean energy among the rural poor whose chances of accessing the national grid is remote.

Experiences

Effects of Small-Scale Renewable Energy Solutions

Small-scale renewable energy solutions can play a vital role in poverty alleviation, environmental sustainability and economic development. Such systems can provide energy that is affordable to the poor and can be a source of employment and enterprise creation for both the rural and urban poor. In Kenya, there is a growing evidence to suggest that investment in small and medium-scale renewable energy projects may have strong impacts in improving the energy services for the majority of the population, especially the rural and urban poor. These projects can also play a vital role in minimising fuel imports by providing viable alternatives to thermal-based electricity.

Access to Energy Services and Technologies

While the efforts made by the government in providing energy services to its people is appreciated, it is worth mentioning that there are a number of communities still facing an inadequate energy supply. Many communities today do not have access to clean energy and where it is available it is not affordable to them. Some energy technologies are very expensive and therefore not affordable to the majority of the population. There have also been a number of problems that relate to lack of appropriate and comprehensive policy guidelines from the side of the government to promote solar, co-generation, improved stoves and many other technologies.

Government and Donor Funding for the Development of Alternative Energy Solutions

The government has not provided adequate funding for the development of other energy options. There are many potential sites for small/micro hydro as well as solar energy technologies and other options that can generate enough energy to

supplement available energy from conventional sources. The inadequate budgeting for non-conventional energy options has negatively impacted on their development and dissemination. Most donors' funding has also mainly benefited conventional energy sources, leaving other potential options poorly financed. The poor budget for non-conventional energy options has also contributed to poor dissemination of information on available energy options, leading to inadequate modern, affordable and environmentally friendly energy technologies. Issues of participation of different stakeholders in decision making are critical in ensuring that all are embracing and accepting policies in the energy sector.

Improved Stoves

The KCJ project gained a number of experiences, including: The view of some researchers and dissemination groups (Kammen, 1995b) that there could be a bias against changing the cooking style at all (food in Kenya is respected and therefore it must be prepared in a socially accepted manner); the need to promote the KCJ stove as fuel saving despite higher initial costs; and the need to conduct training and support services for a seemingly 'simple' household technology. A success and a drawback of the stove programme is the network of often-informal sector manufacturers and vendors. On the one hand, the direct and grassroots commercialization fully integrates the KCJ stove into the local economy. On the other hand, quality and price variations in the stoves produced in such diverse settings can be great, including a number of clearly sub-standard models. The KCJ process focused attention on the trade-offs between development 'project' and commercial sector management of a technology, and highlights the potential to involve the informal sector. At the same time, it has become clear that there is an important role for cooperative projects where the government, NGOs or other organizations provide training, outreach services, publicity, and other logistical support for the local commercial industry.

Solar Energy Technologies

Solar dissemination in the country has had a setback that has resulted from its presumed high initial costs of solar equipment. In recent times, however, there has also been a major problem of counterfeit solar equipment on the Kenyan market. All

these have created problems in the dissemination efforts of the solar energy technologies.

Biogas

Biogas can be an important source of energy for many rural households since they generate more than 90% of organic waste in most rural Kenya. However, biogas remains constrained by the initial costs required for putting in place a plant.

Recommendations

Increased Participation and Awareness

There is a need for increased awareness and participation of a number of stakeholders in decision-making regarding energy issues, especially women and other disadvantaged groups. Therefore, the number of energy centres on district level should be increased and decentralized energy demonstration centres should be established for the communities to know and learn of the available energy saving technologies.

The government and other stakeholders should develop awareness programmes that will address issues relating to energy conservation practices, energy efficiency and available energy technologies.

The government, working together with other stakeholders, should make efforts to ensure that the communities are made aware of the dangers associated with unsustainable practices that are associated with biomass energy consumption.

The communities and the general public should be made aware of the link between their energy consumption patterns and that these patterns affect the climate change threat.

There is a need for disseminating information on the benefits and dangers of biofuel energy at local and national and decision-making levels.

Strengthened Government Policies and Interventions

The government should commit itself towards the development of renewable energy options in the same framework as it is doing with the development of conventional energy options.

There is a need for identifying rural based energy options that need to be developed instead of depending on the costly extension of the central electricity grid.

As a way of reducing the cost of the available technologies on the market, there is a need for the government to wave taxes on importation and sale of these technologies.

The government should develop an appropriate mechanism for introducing a subsidy on the available energy saving technologies, with the view of making them affordable to the poor of the poor.

Solar energy dissemination will require deliberate state interventions with the view of ensuring that the standards of the equipment on the market is good and worthy for use by the local communities. Other than the solar equipment standards, there is a need for ensuring that the cost of solar is within the reach of the local communities and the technology itself is available to the communities, even in the remotest areas where availability of energy is an issue.

The government should develop a national biofuel policy to address issues of biofuel development, policies and legislation.

There is a need for the government to come up with a policy that will help guide energy generation in the sugar industry. Very limited or no effort has been made to encourage the industry to invest in the process energy generation. If the sugar industry is unwilling to generate power from their bagasse, then efforts should be put in place that encourage the private sector outside the sugar industry to be involved in co-generation as a business enterprise.

Efforts should be made to promote initiatives that enhance poverty alleviation among the communities, so as to economically empower them to afford the available energy options.

Strengthened Research

There is a need for further research on the available energy options with the view of improving their efficiency and supply country-wide.

The impacts of biofuel plants on land use, environment and to the people continues to be an issue of debate. It is important to investigate the impacts of land use and land use change that are crucial for developing and implementing actions towards new forms of development, as well as for adaptation to climate change.

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UGANDA REPORT

Prepared by Timothy Byakola, Climate and Development Initiatives (CDI), Uganda

Energy Situation in Uganda

Uganda's population stands at about 25 million people, of which 95% do not have access to electricity. The current annual population growth is about 3% with an electricity demand growth rate of 7-8% per year.

Uganda's per capita energy consumption of 0.3 TOE is among the lowest in the world. Few people have access to modern energy supplies such as electricity and petroleum products. The energy consumption is about 5 million TOE per year, of which approximately 93% is biomass (wood, charcoal and agricultural residue). The grid electricity access rate is 6% for the whole country and about 1% for the rural areas.

Table 2: Country Statistics

	2003	2004	2005	2006
Real GDP growth	4.7	4.0	5.3	5.6
Tax revenue as % of GDP	11.3	12.2	12.8	
Value of exports ($ M)	563.0	629.7	659.7	663.3
Value of imports ($ M)	1255.9	1318.2	1492.5	1620.0
Current account balance ($ M)	-377.4	-361.5	-462.8	- 507.8
Balance of payments	178			

($ M)				
External Debt ($)	3.9	3.8	3.7	3.6
Incidence of absolute poverty %	38	38		
HIV /AIDS prevalence		6.1	5.6	
Life expectancy	42	43	47	

The annual energy consumption is estimated to be 20 million tonnes of wood, 430,000 tonnes of oil products, hydropower installed capacity of 300 MW from two large dams, another 13 MW from small hydro projects and 10 MW produced from cogeneration. The country also generates about 50 MW from thermal to cater for the increased electricity needs of Kampala and another 3 MW for urban towns in Northern region where the national grid has so far not been extended.

Biomass is the predominant renewable energy type used in Uganda, accounting for over 90 % of total energy consumed, and has been growing by approximately 3.6% between 1995 and 2000 (Alternative Energy Resource Development Programme (AERDP). The daily per capita consumption of woody biomass for energy was about 4 kg (NEMA[1] 2001/2002). By 1998, the wood fuel demand was estimated to be about 18.5 million tonnes according to the Forest Department (1996). About 1.2% of wood fuel is used to produce charcoal.

Investment in biomass energy is based on the fact that both the rural and the urban population in Uganda will continue to heavily rely on fuel wood for cooking and heating water. Biomass in form of firewood and charcoal is the main source of energy for rural based industries. Biomass saves foreign exchange and employs up to 20,000 people and generates USh 36 billion (USD 20 million) per year in rural incomes.

Knowledge of large scale biomass energy systems in Uganda is not as widespread as that of small systems. Co-generation, using bagasse, coffee and rice husks remains,

[1] National Environment Management Authority

is done in a few factories. Cogeneration at the Kakira Sugar Works is currently generating 4 MW of electricity from biomass. There are plans of increasing the total capacity to 14 MW, sell 7 MW to the grid and using the remaining 7 MW in the sugar factory. Current cogeneration at other sugar factories is about 6 MW. Cogeneration has not been attempted in the coffee and wood industries, where a lot of biomass waste is produced. It is possible that a growing co-generation industry could lead to increased income for smallholder sugar, coffee and rice farmers. These technologies, however, require large amounts of financial investment to start up.

Wood as a source of energy in Uganda has the following characteristics:

- Wood is the energy in rural and urban areas and among the poor (only 1% of rural population had access to electricity in year 2000).
- Scarcity of fuel wood is affecting the nutritional value of the population as people opt for quick cooking foods, like vegetables instead of beans, peas, etc.
- Commercial woody biomass sector is very important for the national economy and the industrial sector; it employs tens of thousands of people, adds hundreds of millions of USh to local economies (revenues, taxes, and incomes). Local revenue authority collects about USh 2 billion on charcoal movement alone. Forest Department collects between USh 2.3 and 5.3 billion in terms of permits and licenses. This importance is not reflected in Uganda Revenue Authority policy documents, in Ministry of Finance, Planning and Economic Development (MFPED) policies or in Forest Department plans.
- Wood is a renewable source of energy as long as its exploitation and use is done in a sustainable manner; it is vital for food security (used in cooking).
- Wood is widely used in many industrial processes (brick and tile making, lime production, tea drying and tobacco curing, and food processing) and in the majority of institutions (prisons, schools, health centres) and commerce (restaurants, hotels and bakeries).
- Wood saves the country tens of millions of USD in foreign exchange yearly. If all Ugandan industries now using wood converted to petroleum products, Uganda's import bill would increase by over USD 150 million

per year. Wood supplies five times the value of electricity and petroleum utilized by Uganda's industrial sector; wood accounting for USh 10 billion compared with USh 1 billion for electricity and USh 1 billion for petroleum.

- Wood has a limited dependency on foreign currency. Wood fuel will continue to be the dominant source of energy in Uganda for the foreseeable future. Even if the entire hydroelectric potential in Uganda was fully utilized (about 2000 MW), wood would still supply more than 75% of the total energy consumption in year 2015.

Charcoal production consumes 15-20% of the wood supply in Uganda and is mainly consumed in urban areas. When the wood from agricultural expansion is not utilized for charcoal, it is often burned on site. The production of charcoal in Uganda is based on simple technological methods with a very low efficiency (between 8 and 12% recovery).

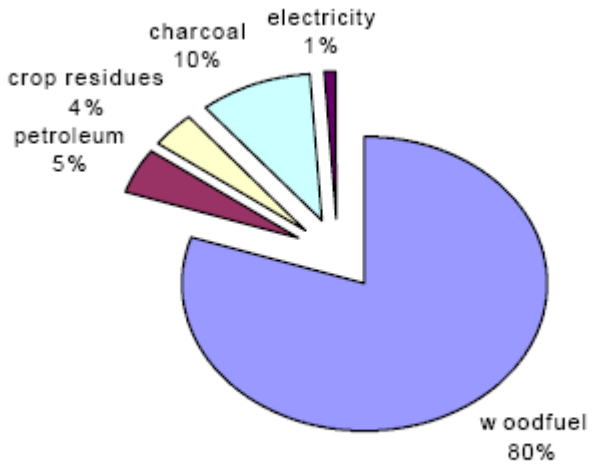

Figure 3: Uganda's Energy Consumption (Source MEMD)

The majority of the communities in urban and rural areas depend largely on firewood and charcoal for their energy. Of the total grid-supplied electricity about 72% of the electricity is consumed by only 12% of the population concentrated in Kampala and nearby towns. The electricity consumption can be categorized as follows: residences (55%), industries (20%), commercial end-users (24%) and street lighting (1%).

The government is studying ways to meet the increasing energy demand from other indigenous energy sources. As part of this effort, the government, with the support of the African Development Bank, has completed a study whose aim is to formulate a long term integrated least-cost alternative energy resource development programme for the country. The energy sources being considered include geothermal, biomass, wind, peat, solar and mini- and micro-hydro.

Experiences

Biomass-based Cogeneration

The low levels of cogeneration can best be explained by the poor pre-liberalization policies of the energy sector. Before liberalization, existing policies restricted the private sector from generating power for sale and limited them to producing power for their industrial consumption. But although the power sector has been liberalized, some obstacles still continue to affect effective cogeneration in the country. Almost all transmission lines in areas that have the potential to utilize electricity are a monopoly of UEDCL. Other power producers in areas where UEDCL enjoys a monopoly remain at the mercy and the ability of UEDCL to secure a market for their electricity. Although co-generation has a high potential of creating employment opportunities it is critical that power producers are assured of a market for the power they produce.

Energy Saving Stoves

Small scale bioenergy technologies appear marginal, but their importance lies in the very large number of end users that these systems serve. Biofueled cookstoves meet the bulk of cooking, heating and lighting needs of most of the homes in Uganda.

Businesses in renewable energy technologies like stoves continue to face market problems and stiff competition from the cheap non-energy saving traditional stoves which are fabricated by non-energy technicians. Efforts have been put in place to disseminate improved stoves to rural communities using cheap local materials. As an example, GTZ has provided support for biofuel stoves, which has helped the dissemination of the stoves. A medium size stove today goes for USh 20,000 compared to the traditional stove which goes for about USh 4,000. Therefore, the

costs are a major obstacle to dissemination of improved stoves. There is also the issue that commercial household stove producers do not carry out awareness programs for customers, and there are no well-organized retail outlets.

There is a need to create awareness about the values and benefits of improved stoves so as to change people's attitudes towards their use and adoption, for better health, savings and for improving the environment. Fuel-wood use also exposes people to indoor pollution, especially the women and the girls.

Biogas

Biogas is a small scale biomass technology that has attracted considerable attention over the last two decades. The raw material is cow dung, which is plentiful in many parts of Uganda, and the technology appears not to be complicated. But there have been constraints that have hindered the large scale use of biogas, particularly for poor farmers who do not keep their cows penned in one place. Secondly, isolated small scale farmers with small herds of cattle are not able to get sufficient feedstock to ensure a steady generation of biogas for lighting and cooking. Thirdly, the investment cost of even the smallest of the biogas units is prohibitive for most poor rural Ugandans. Biogas units at institutions like schools and hospitals have proved more viable than the small scale household bio-digesters. Lack of a financing mechanism, technical and adequate sector policies are the other factors that have affected expansion of biogas technology in Uganda.

Briquettes

Briquette making has remained low and is mainly carried out by women from their domestic wastes. There are some simpler technologies that have been adopted mainly by women's groups, civil society organisations and some housewives to help improve on production. The moulding of the briquettes is manually done or by use of simpler technologies, which produces very small quantities. Commercial briquette production is very limited and it is insignificant on the energy market.

Solar Photovoltaic Technologies

Uganda is endowed with plenty of sunshine, giving solar radiation of about 4-5 kWh/m^2/ day. This level is quite favourable for all solar technology applications. Solar energy applications in Uganda include solar photovoltaics (PV), water heating, cooling and crop drying and are suitable for producing electricity for areas off the grid.

The dramatic drop in production costs over the last two decades is one of the most important driving forces in the recent increase in PV technology use in Uganda.

Estimates on installed solar systems vary greatly. However, information from Uganda Revenue Authority (URA) indicates that between 2000 and 2004, about 36,000 PVs were imported and about 30,000 units before 2000. Imports of water heaters between 2000 and 2004 were about 3,700 units.

PV technology has proven to be very successful in high-tech applications of communication. It has also been used in vaccine refrigeration in remote areas of the country.

The increase in solar dissemination can be attributed to the establishment of the Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE), elimination of taxes on solar equipment and increase in solar SMEs. The increase in SMEs has created competition, raised awareness and controlled prices of solar equipment. However, the waive on taxes on solar equipment in the short run reduced prices of solar panels in the country, although currently prices have gone up almost to pre-tax prices. Solar water heaters, unlike solar electricity, had not been exempt from taxes until 2003.

UPPPRE was started with the goal of developing a sustainable market for solar PV technology. The project addressed various constraints related to marketing and use of PVs; including financing, awareness about the potential of PVs, and technology transfer. Its target areas were areas far away from the national grid and areas where it was not possible to be connected to the grid or any other source of electricity within 5 to 10 years or more.

Rates for solar energy dissemination in Uganda remain relatively low, a fact that is attributed to the high initial investment costs. This technology remains only affordable to government programs, and NGOs that normally would import them with

a tax waiver. Currently a solar unit that can be used for lighting and probably to run a radio set is about USD 550, a price that is unaffordable to many Ugandans, whose annual per capita income is estimated to be less than USD 350. There are also various retailers selling sub-standard PV equipment, which has also compromised the integrity of the PV industry. Maintenance and repair in rural areas is also a problem because of scarcity of local technicians.

The less visible but equally important drawback of PV technology is its high reliance on imported components. Well over 50 percent of the cost of PV technology consists of the panel and solar battery, which are often imported. The high import content of PV technology adds a load to the foreign exchange reserves of the country.

Small Hydropower

Uganda has an installed capacity of 13 MW generated from different small hydro dams across the country. A survey financed by the European Development Fund identified 76 sites with potential ranging from 120 KW to 566 KW in the West Nile region alone.

Even though energy cost per unit of energy may be higher than that from the national grid, mini hydros present a category of energy which could sustainably contribute to poverty reduction in areas off the national grid. There are more than 50 mini hydro sites which have been identified in Uganda with an estimated generation potential of 209 MW. As much as 125 MW of this potential is located in sites where the capacity is over 10 MW.

Geothermal Energy

Uganda's theoretical geothermal potential by 1982 was estimated at about 450 MW. Several prospecting trials in different parts of the country have identified varying potential of the geothermal capacity in Uganda. Over the years, subsequent studies have identified an even higher potential for geothermal energy.

Recommendations

Invest More in Decentralized Energy Systems

Until recently, electricity industry in Uganda was characterized by a monopoly structure with the main supply point being in Jinja at the Owen Falls Dam. This system depended on a highly centralized supply structure that required huge infrastructure for the distribution of the power across the country. This system is highly vulnerable to disruptions and entails high costs for distributing the power across the entire country. This probably explains the low rates of electricity access, especially in the rural areas, where access is just about 3%.

Energy Planning Needs to Take Account of Local Variations

Current energy policy does not seem to recognize that different parts of the country have differing energy needs. The decentralization policy in Uganda offers a good opportunity to implement decentralized energy planning which caters for regional disparities and constraints. Districts should therefore get actively more involved in energy planning.

Policies to Accelerate Rural Energy Initiatives Should Be Directed at Economically Productive Activities and Small-Scale Enterprise Development

The core goal and concept for promoting improved rural energy initiatives should basically be to provide energy to make it possible for rural small and large scale enterprises to do business. What is important is that the tariffs have to be affordable and the energy investor has to meet costs of production. These businesses may include PV use by traditional birth attendants in rural clinics, lighting for rural schools, small scale fruit industries, fish smoking etc. Duties and taxes need to be reduced for service providers operating in rural areas, as opposed to the current uniform taxation systems. Regulations and tariffs set for urban operators have failed to meet the needs of rural energy providers.

Increase Training and Capacity-Building Initiatives

There is still a great need for long term renewable energy training programmes designed to develop a critical mass of locally trained manpower with the requisite technical, economical and socio-cultural skills needed to increase use of new alternative renewable energies.

The Government Should Work With Financial Institutions to Develop New and Innovative Financing Models for Energy

Access to affordable finance is one of the major obstacles to promoting renewable energy technologies in Uganda. The majority of householders and small scale enterprise owners in rural areas cannot access bank credit because they do not have the collateral needed to qualify for the loans.

Finance from micro-credit organizations is insufficient for purchasing energy equipment. Current government funding for rural energy initiatives is itself insufficient and biased towards assistance to centralized energy systems.

An issue that is worth considering is to develop financing mechanisms based on local resource mobilization that will make the rural energy programme more self-sustaining without donor support.

Limited policy support for renewables is further demonstrated by the low budgetary allocations to renewables in Uganda. Most emphasis is placed on the petroleum and power sectors, which supply a small portion of the population, than on renewables (especially biomass), which supply a large portion of the population. As an example, the 2007/8 budget allocation to the energy sector was developed with the need to mitigate impact of power deficit including making regular reviews on compensatory measures (e.g the Diesel waiver) and development of large dams at Karuma and Bujagali[2]. Very little expenditure is allocated to small and medium scale renewable energy technologies as compared to the conventional energy sector.

[2] Integrating Competitive Priorities into the budget by Angela Katama, Private Sector Expert, CIS Secretariat

Innovative Dissemination Strategies Should Be Applied

Support should be channelled towards wider application of the new renewable technology dissemination strategies that have demonstrated encouraging signs of success. Many of these strategies largely revolve around the idea of participation, income generation and small-scale enterprise development. The rationale is that if producers and distributors can make an attractive income from the manufacture and marketing of renewable energy equipment and users are fully involved in the dissemination process, then the issue of sustainability is resolved in a much more cost-effective fashion.

Development and dissemination of appropriate biomass energy technologies for small and medium scale rural industries could yield significant benefits to both the rural and urban poor in Uganda. Examples include brick making, lime production, fish smoking, tobacco curing, beer brewing, coffee and tea drying. Many of these industries provide employment to both the urban and rural poor sectors.

Another important innovation is the idea of using existing systems of production, marketing and information dissemination. By using an existing production system, the cost of disseminating renewable energy technologies is dramatically reduced. This principle is particularly effective in rural areas where the cost of establishing new marketing and distribution networks is costly. Renewable energy dissemination initiatives can be a component of an existing integrated income-generating project or environment programme or health extension programme. As an example, the rural stove component of the Kenya stove programme successfully utilized this strategy and managed to disseminate over 90,000 improved woodstoves using the existing nation-wide network of home science extension workers.

ANNEXES

Presentation of TaTEDO

TaTEDO is a national NGO based in Dar es Salaam, Tanzania with activities in several districts and more than 15 years of experience, actively involved in sustainable energy development projects and programmes in rural areas. The organisation is non-profit sharing for spearheading development of sustainable modern energy technologies and services while conserving the environment. See also www.tatedo.org.

Vision

Poverty free and self-reliant communities in Tanzania accessing sustainable modern energy services.

Mission

Advancing popular access to sustainable modern energy technologies in marginalized communities in Tanzania, through technological adaptations, capacity building, community mobilization and advocacy for increased access to sustainable energy

Goals

- Improve quality of life of Tanzanians by contributing to availability of improved and sustainable modern energy services, employment and income generating opportunities, which are essential for poverty reduction,
- Reduce environmental degradation resulting from increased use of wood and fossil fuels,
- Assist the country to reduce dependence on imported energy.

Activities

Through community based integrated and entrepreneurial approach:

- Promote access to sustainable modern energy services for productive uses in SMEs including agro-processing industries, consumptive uses in households and social services centres (education, health, water),

- Undertake field implementation of sustainable energy programmes and projects.
- Provide energy related consultancy services,
- Mitigate environmental adverse effects associated with energy production and use
- Develop networking and partnership with local, national and international organisations,
- Manage and disseminate energy information to primary, secondary and other stakeholders,
- Lobby and advocate in order to influence energy and environment related policies, strategies and legislations,
- Provide sustainable energy enterprises development services, and
- Conduct energy related applied researches.

TaTEDO Current Interventions

List of current programmes/projects that TaTEDO is implementing:

PROGRAMMES	DONORS
Up- scaling Access to Integrated Modern Energy Services for Poverty Reduction	EU & HIVOS
Integrated Modern Energy Services for Sustainable Development and Poverty Reduction (Phase II)	NORWEGIAN EMBASSY
Integrated Sustainable Energy Services for Poverty Reduction and Environmental Conservation Programme (ISES-PRECP Phase II).	EU & HIVOS
Households Efficient Stone or Brick Made Woodstoves in Rombo and Hai Districts	HIVOS
African Rural Energy Enterprise Development. (AREED) Programme II	SIDA and UNEP

PROJECTS	
Fredskorpset Exchange Project	FREDSKORPSET
Enabling Access to Sustainable Energy (EASE)	ETC and DGIS
South-South North Climate Change Mitigation Project	DGIS
Competence Platform on Energy Crops and Agro-forestry Systems for Arid and Semi-Arid Ecosystems-Africa (COMPETE)	EU
Sustainable Costal Communities and Ecosystem Project.	TCMP (USAID)

TaTEDO uses programme/project approach in her efforts to promoting sustainable energy technologies and services in Tanzania. From inception, TaTEDO has developed capacity to promote modern energy technologies (METs) and also has strengthened her partnership and networking with different sector stakeholders as well as in energy enterprises development skills. TaTEDO through above programme/projects has developed experiences of working at local levels (districts to the village levels an area with no conventional departments responsible for energy development issues) to increase uptake of modern energy technologies and services to the people in the community. The participatory approaches, partnership and good working relation with other partners (involved in the energy activities) have been some of methodologies used to disseminate skills, knowledge and resources to our target groups. This experience has profoundly assisted TaTEDO to successful implementing her programmes.

Presentation of CDI

Climate and Development Initiatives* (CDI) is an NGO established in Uganda to lobby and advocate for relevant policy changes on climate change and sustainable energy issues in Africa. As one of the lead civil society organizations working on climate change in Uganda, CDI has been involved in many national and regional capacity building projects on implementing mechanisms of the United Nations Framework Convention on Climate Change (UNFCCC). Current focus is on building adaptive capacity to climate change impacts in Africa. CDI coordinates the Climate-Change and Energy Thematic Group of the Uganda Rio+ 10 Coalition. The coalition is a

partner in the Global Sustainability Watch Project, mainly a DANIDA funded project supporting Southern CSOs in following-up implementation of WSSD outcomes in over 27 Countries in Africa, Latin America and Asia.

CDI is regional coordinator for INFORSE – East-Africa. CDI also coordinates Climate Action Network – Uganda (CAN-Uganda).

Presentation of Norges Naturvernforbund

Norges Naturvernforbund was founded in 1914 and is Norway's largest environmental conservation organization with a total of about 28,000 members, with branches in all counties and about 150 local groups. Norges Naturvernforbund believes that public participation is necessary to save our environment. Consequently information work is high on the organization's agenda. This work is aimed at strengthening public environmental awareness, concern and practice. Norges Naturvernforbund works with the whole range of important environmental issues.

Vision

Norges Naturvernforbund will strive to protect nature and the environment in such a way that human activity does not exceed the carrying capacity of nature. Norges Naturvernforbund will work for a society where the people live in harmony with nature. This is a society where the basis and diversity of life is secured for future generations, and where nature's own values are the foundation of the work to increase man's respect for and love of life and landscape.

International work

Norges Naturvernforbund has been engaged in international development projects since the early 1990's and is cooperating with environmental NGOs and support civil society development in a number of countries in the former Soviet Union, Eastern Europe and Africa. The main objective of NNV's international project activities is to ensure capacity building of local partners regarding organization development, competence building on energy, environment and development issues, and policy campaigning on local and national level. We regard capacity building of local NGOs, and through them of local communities, as an important component of development

towards democratization. Environmental education, sustainable energy solutions and climate change are key issues for the cooperation.

Norges Naturvernforbund (Norwegian Society for the Conservation of Nature) is Norway's largest and oldest environmental organization. The organization was established in 1914 and is a non-governmental, nationwide, democratic member organization with around 20 000 individual members, 100 local groups, and regional branches in all counties. After more than 90 years with voluntary work for our common environment, for conservation of the extraordinary nature and wildlife we have in Norway, the organization is well known and respected. Although the organization has a national agenda, many environmental questions have proved to have an international or even global character. Development issues, resource allocations and international cooperation are very much parts of our everyday activities.

Norges Naturvernforbund works actively on international questions on environment, energy, climate and development towards decision makers, the general public and in our own organisation. The International Project Department frequently contributes with inputs on development issues for use in our internal and external information activities. Frequent seminars and workshops are being organized and the department is a regular participant in external forums.

Norges Naturvernforbund cooperates with environmental NGOs and support civil society development in a number of countries in East and South. The objectives are to strengthen our local partners' capacity and influence in their struggle for a better environment. Environmental Education, Sustainable Energy Solutions and Climate Change are key issues for the cooperation. At the present Norges Naturvernforbund initiate, implement and maintain projects regarding capacity building, energy saving, renewable energy, climate and education in 20 countries in former Soviet Union, Eastern-Europe and Africa.

SPARE (School Project for Application of Energy and Recourses) is the largest international school project on energy, climate and environment. 4500 schools and 175.000 pupils in so far 16 countries participate annually in the SPARE educational program. The SPARE program was created in 1996, by Norges Naturvernforbund and is today managed by the International Project Department.

Norges Naturvernforbund is a part of Friends of the Earth International.

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NORGES NATURVERNFORBUND
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