



# SUSTAINABLE ENERGY AND DEVELOPMENT FORUM

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## TaTEDO STRATEGIC PLAN (2008-2012) - A ROAD MAP TO SUSTAINABLE MODERN ENERGY DEVELOPMENT

By Jensen Shuma, TaTEDO

### Introduction

TaTEDO has recently started to implement a five-year strategic plan, Which is a continuation of efforts of more than 17 years, in which (TaTEDO), in collaboration with partners have contributed immensely to promote and increase access to sustainable modern energy technology and services for socio-economic development of communities, poverty alleviation and environmental conservation in Tanzania. This has been done through implementing several projects and programs, geared towards achieving its vision and mission with support from development partners.

The efforts of TaTEDO have significantly contributed toward the development of the energy sector, while ensuring that sufficient attention is paid to environmental, economic and social issues too. The organization acknowledges that, without access to sustainable modern energy services, poor people in Tanzania are deprived of potential income generating opportunities.



Photo 1: Group discussion session during TaTEDO's Strategic Plan formulation

### Overview of the Energy Situation in Tanzania

Although over the past two decades, substantial progress has been made to increase access to modern energy in rural areas of Tanzania, the effort has not kept up with population growth. The situation in Tanzania presently is that approximately 90% of the total energy being consumed in Tanzania is from wood fuels. The remaining 10% is distributed as commercial energy of which oil and gas account for 7.5 %, coal, solar and wind 1%, and the remaining 1.5% is generated from electricity.

At present, only 12% of the Tanzanian population has access to electricity and the percentage of the rural population with access to electricity is less than 2%. There is therefore a big gap between the supply and demand for energy, both for domestic and industrial use in Tanzania. The challenge, in the years to come is to tackle how best to facilitate the availability of an affordable

energy supply for households and commercial activities especially for disadvantaged rural areas. TaTEDO's strategy in contributing to the alleviation of these constraints is to strive to increase access to modern energy services to the different levels of the communities in Tanzania.

The low access to modern energy services has seriously impacted on the overall performance of the country's social and economic indicators and has obviously suppressed economic growth that is manifested in low levels of agricultural productivity due to low mechanization and industrialization. The situation has further perpetuated poverty levels in the country. Experiences and lessons learnt from the field indicate that there is a strong linkage between high dependence on biomass –based solid fuels, human energy, poverty, gender imbalance and environmental degradation.

Adding value to farm products requires modern energy provision to manufacture, process, store and transport. Energy is also needed for empowering small-scale enterprises which contribute to the country's economic growth. Improved access to modern energy services, therefore, is crucial for the overall socio-economic development of the country but certain key challenges need to be overcome.

The current energy production and use systems are not sustainable, in particular because of the negative impacts of burning fossil fuels. There are several types of harmful effects from the process of using fossil fuels as energy. Some of these include air pollution, water pollution, and accumulation of solid waste, not to mention land degradation and negative impacts on human health.

### Rationale of Strategic Plan Formulation

In order to effectively address the energy problems and tackle environmental challenges facing the country, TaTEDO has formulated a strategic implementation plan for the period of 2008-2012. In developing the Strategic Plan, TaTEDO has considered the challenges facing the energy sector in rural and urban areas. The plan reflects TaTEDO's accomplishments over the past years and provides a road map for the organization and her partners to contribute in addressing the energy challenges. The Strategic plan also helps the various work units within the organization to align themselves with its common goals.

### Organizational Diagnosis

The TaTEDO strategic plan was formulated in collaboration with facilitators from EASUN; Arusha in September 2007 through an organizational diagnosis and strategic planning workshop conducted at TaTEDO for the purpose of building its capacity in management and facilitation of organizational development.

The Organizational Diagnosis (OD) enabled TaTEDO and staff members to consciously gain deeper understanding of internal management issues around which TaTEDO needed to change in its organization development. The OD process resulted in the identification of driving forces related to

issues within TaTEDO as well as the political, social, cultural, economic and technological circumstances in the broader environment. Other issues were configuration of relationships with institutions and networking with other organizations.

The organizational diagnosis and strategic plan were definitely part of the ongoing TaTEDO development interventions. The participation in the OD process was designed to enable members understand the questions or issues that shape the performance and future opportunities of sustainable modern energy technology and services. The process enabled a deeper understanding of current driving forces, which are shaping the existence of TaTEDO. The driving forces, functional areas and strategic responses were identified and all plotted on a strategy map.

### TaTEDO's Functional Areas

The most important part of this exercise was a review of vision and mission statements, values and functional areas of TaTEDO. TaTEDO's key functional area was re-emphasized as "Access to sustainable modern energy services". Other identified functional areas are:

- Awareness creation and demonstration of modern energy technologies
- Capacity building for disseminating sustainable modern energy technologies
- Community mobilization for participating in sustainable energy initiatives
- Sustainable modern energy enterprise and business development
- Sustainable energy research and studies
- Sustainable modern energy related consultancies
- Sustainable energy information management
- Networking and partnership development
- Monitoring and evaluation

A practice review workshop was conducted in October 2008. EASUN facilitators, in conjunction with TaTEDO staff and board members conducted the organization diagnosis (OD), with financial support from the HIVOS of the Netherlands. The Strategy was derived from critical

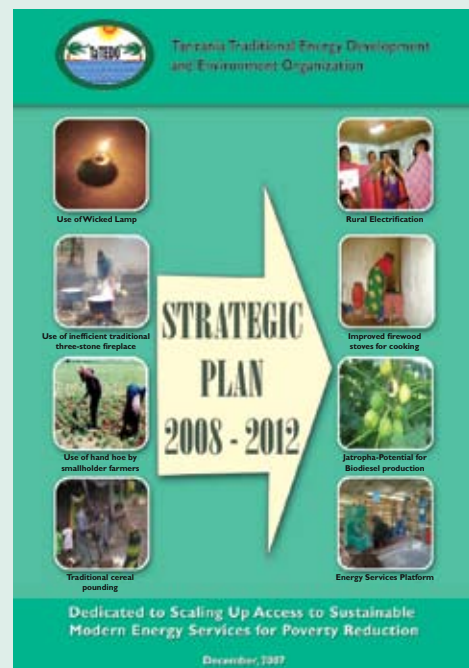


Photo 2: TaTEDO's Strategic Plan Document

issues within the internal environment which need to be prioritized for action based on the objectives of the organization. The organization diagnosis was conducted to assess the internal environment with the intention of assisting the organization to consciously manage the right balance of organizational culture, structure, and systems (which is the actual development process taking place within an organization) and it was therefore a strategic thinking process that helped TaTEDO to plan how best to coordinate its activities and manage its organizational practices in order to remain relevant and effective in reaching its desired targets.

TaTEDO strategic plan gives the direction for developing sustainable modern energy technologies and services towards its mission and vision. Currently, TaTEDO is working in ten rural and urban regions, twenty-seven districts and One hundred and six villages in Tanzania. The regions where TaTEDO is active are Arusha, Dar es Salaam, Manyara, Kilimanjaro, Tanga, Morogoro, Coast, Mwanza, Shinyanga and Rukwa.

The strategic plan is supported by existing systems, approaches and procedures for intervening in communities and target populations in the urban and rural areas.

TaTEDO collaborates with local and external partners. It has close collaboration with local authorities, strong participation of key stakeholders, programmatic and market-oriented approaches as major strategies and approaches for implementing sustainable modern energy development activities within its geographical coverage areas.

### **Strategic Plan Objectives**

Seven (7) strategic objectives identified summarize what TaTEDO plans to accomplish within its five-year framework from 2008 - 2012. The strategic objectives portray what will be done in the next five years in order to contribute in achieving its vision and mission towards facilitating greater access to sustainable energy services.

The strategic objectives stipulated in the plan are:

- To sensitize communities about policies, strategies and cultural issues that influence the adoption and use of sustainable modern energy technologies.
- To mobilize development actors to lobby for conducive sustainable energy and environmental related policies.
- To expand local capacities through research, training and consultancy for improvement of energy technologies and services in Tanzania.
- To enable effective information flow to promote advocacy, policy development and capacity to increase access to sustainable modern energy services.
- To expand the vision, local support and skills related to sustainable modern energy technologies
- To avail resources for skills acquisitions, investment and organizational development for TaTEDO services and sustainability.
- To document and review TaTEDO's experiences in order

to evaluate impacts and improve TaTEDO's service systems.

### **Target Group and Beneficiaries**

The greatest value of strategic planning is the key role it serves for employees and other stakeholders to coordinate complex sets of efforts. The stakeholders who will benefit from this strategic plan include TaTEDO partners such as policy and decision makers at National level and local government staff, farmers, stove artisans, baking groups, ESP technicians, tree nursery owners and charcoal producers at local levels.



*Photo 3: Installation of a mini-grid as a way of increasing access to modern energy services for beneficiaries in rural areas*

The strategic plan also provides TaTEDO with a roadmap for organizing its tasks and resources. It is designed to enable dynamic annual planning of activities and budgets, allowing room for adjustments in accordance with changing circumstances, needs or lessons. However, successful implementation of TaTEDO's strategic plan will require cooperation and commitment of the organization, management, staff and development partners.

### **Future Strategic Prospects**

As the need for addressing energy issues escalates, the demand for TaTEDO services also increases and the need for more resources to implement the activities becomes critical. In order to ensure availability of such resources, TaTEDO will diversify its functional areas through effective use of available resources in undertaking its activities through pragmatic market approach by investing into pro-poor energy market focused schemes and broadening the horizon for more sources and support from all levels (locally, regionally and internationally).

### **Conclusion**

The success of implementing this strategy will indeed require the cooperation and commitment of TaTEDO members, the board, management and above all the generous financial support of development partners. There is a need to pull together and harness human talents, skills and efforts in order to achieve maximum impacts, provide excellent services to our beneficiaries and customers, thus enabling TaTEDO's move towards achieving its vision, mission and goals.

# BIO-FUEL: AN ALTERNATIVE ENERGY-FOOD SECURITY AND ENVIRONMENTAL CONCERN

*Dr. Razack Lokina and Salvatory Macha, University of Dar es Salaam*

## Introduction

Petroleum consumption in Tanzania has reached 1.45 million metric tons. The oil industry is an important sector of the country's economy and on average 55% of the country's foreign exchange earnings are spent to import petroleum products. Tanzania's fuel prices have fluctuated from the highest 2008 country's history. Petrol is now sold between Tshs. 1,400 and Tshs. 1,550 per litre and diesel has a recorded price of between Tshs. 1,350 and Tshs. 1,450. There are several factors influencing the price, such as the Freight on Board (FoB) prices of petroleum, the stability of the national currency (Tanzanian Shilling) as well as several taxes on petroleum products.

The increase in fuel prices is closely linked with the global market forces, which are currently driven by an increasing demand, especially in Asian countries. The increasing prices of petroleum products leads to rising costs in the transport sector, which will have a harmful impact on the whole economy of Tanzania. In order to reduce this burden, the current government policies are directed at exploiting alternative indigenous resources (e.g. national gas resources and potentially the use of bio fuels).

Tanzania is one of the few countries in the world with appropriate conditions for a sustainable expansion of its agriculture and scope for bio fuels production – of course within limits. It is one of the countries in sub-Saharan Africa that depends entirely on imported fossil fuel for local consumption. The government of Tanzania recognizes the importance and need to develop alternative fuels such as liquid bio-fuels that provide support to accelerate investment; enhance rural development, export expectations and contribute to mitigation of climate change. Some studies show that Tanzania's demand and price for petroleum products are growing rapidly at a rate of more than 30 percent a year.

Bio-fuels (especially liquid bio-fuels) have for quite some time been promoted as a substitute for conventional fossil fuels (petroleum and diesel). Two primary bio-fuels today are ethanol (currently produced from sugar cane, sugar beets, corn, wheat, sorghum etc.) and bio-diesel (currently produced from oil seeds such as rape sunflower, Jatropha, soya palm and coconut and animal fats). To a certain extent, ethanol can be blended with petrol while bio-diesel can be blended with petroleum based diesel for use in conventional diesel –fuelled vehicles.

Presently, there is a rapid expansion of the global bio-fuel market as many countries are striving to introduce policies which increase the proportion of bio-fuel in their energy portfolio. If this is to be met, considerable increase in production is rapidly required to satisfy the global demand.

Fortunately, the conditions for agricultural production in Tanzania are among one of the most favourable in the world. The agricultural efficiency has a definite scope to increase at least four times without compromising critical environmental boundaries. Recent studies have demonstrated that Tanzanian productivity in most of its cereals is relatively low when compared to most of Sub-Saharan Africa, suggesting a high potential of increasing productivity, without the need to expand the existing agricultural land if a modest transformation of the country's farming system and processing can be made. It is possible that bio-fuels can be produced in Tanzania in ways which benefit the poor in Tanzania and in a way that is environmentally friendly – it will not be sustainable by itself but there are many promising factors that appear to make it possible.



**Photo 4: Jatropha plant**

This can be done through introducing modern and environmentally friendly tilling techniques that build up carbon contents in the soils and resilience to drought. Cost-effective production and dissemination of improved plant cultivars could go a long way in improving agricultural yields. Increasing the efficient use of ecological fertilisation would also improve yields significantly. Such transformation will not happen by itself – capital, technology transfer, business development and capacity building are needed. Here, we see the interest to bring in these vital ingredients by serious bio-fuel's domestic and international investors, as an opportunity to realize Tanzania's vision of food and fuel security and in meeting poverty reduction targets.

## Why go in for Bio-fuel?

The fuel import has increased from \$400.3 million to \$1.1 billion from 2003 to 2005 as the demand for petrol has increased (GTZ, 2005). To curb this situation, the government needs to have an alternative source of energy. However, for the country to benefit from bio-fuel farming, it is important that there is a policy to guide and regulate these activities. It has to be emphasized that; the bio-fuel production will only be beneficial to a country and the

population at large if processing and producing the fuel will take place domestically. The country should not be turned into a mere raw material producer. Currently, the country has not yet developed any guidance, proposal legislation or sustainable principle for the bio-fuel sector, so it is expected that the forthcoming policy and bio-fuel guidelines should emphasize on ensuring that the country does not remain an exporter of raw materials.

Many see cultivation of cash crops for bio-fuel production as a new opportunity for rural income generation on a large scale. Similarly, the demand of fossil fuel for running generators and a number of cars in Tanzania has increased at a high rate thus contributing to fuel shortage as well as air pollution. Bio-fuels may be as good a potential as transport fuels because they are produced from locally grown oil and sugar/starch plants, thereby saving foreign currency for other imports. Goldenberg et.al (2003) says the use of locally produced ethanol has displaced oil imports thus leading to savings in the Brazilian economy amounting to US\$ 52.1 billion (January 2003 US\$) from 1975 to 2002. Hydrated ethanol is sold for 60 to 70 percent the price of gasohol at the pump. These results show the economic competitiveness of ethanol when compared to gasoline (See Figure 1). Therefore, it is expected that the coming policy and bio-fuel guidelines will appropriately guide through the process of ensuring the country benefits from the bio-fuel undertakings.

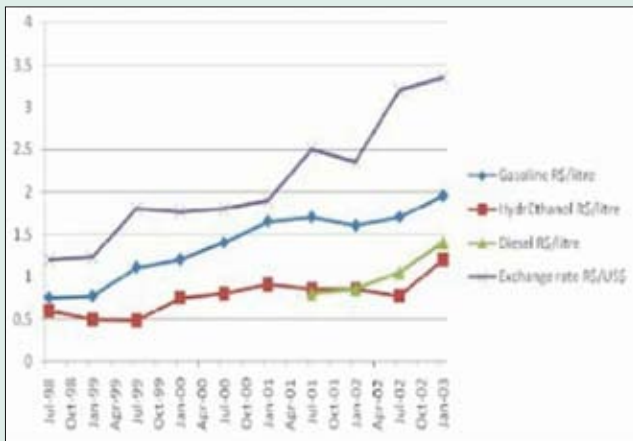


Figure 1: shows a comparison of the main transportation fuels used in Brazil in terms of the price paid in local currency (Real), and the exchange rates against the American dollar  
Source: Mwamila, et al (2009),

Note: R\$ = Brazilian Real, the local currency; and ethanol production is subsidy free.

The figure convincingly demonstrates the long-term competitiveness of ethanol fuel over comparable petroleum products.

Tanzania has the potential to grow large numbers of oil crops of which, only a few are grown on a large scale. Today, the most important crops for oil based bio-fuel production in Tanzania are cashew nuts, palm oil, coconut, sunflower and Jatropha. However, sunflower, cashew nuts, palm oil and coconut have competing consumption patterns, which can minimize their use as feedstock for bio-fuel production. Energy crops can be grown at different levels in the Tanzanian

communities. They can be grown in a decentralized manner by small holder farmers who may sell products to the vendors or nearby companies. Alternatively, energy crops can be cultivated by medium scale farmers as additional income or by large scale plantations and estates as dedicated crops.

### The issue of Food Security concerns

Despite all the potential benefits resulting from cultivation of crops for energy, it may create competition for the land and resources with food crops. This is particularly true when the bio fuel feedstock is also a food crop. Overall increase reliance on bio-fuel is seen by many as a major threat to global food security. World food stocks (particularly cereals) are approaching an historic low levels leading many analysts to conclude that any significant expansion of bio-fuels production will directly impact on global food security (Bell, 2005; Monbiot, 2005). These concerns are based on the premise that bio-fuel production would lead to a competition for land which would otherwise be used for food production, further reducing global food stocks and marginalizing the poor. Bio-energy proponents dispute the logic of coupling global food stocks to bio-energy, pointing out that much of the decline in the stocks is a result of restructuring of the highly inefficient agricultural production subsidies in Europe and USA (Morales, 2005).

Poorly implemented, large scale bio-energy programmes could lead to such displacement and marginalisation of the poor and unwanted environmental impacts, such bio-energy programmes would provide local, value added activities and help to address the root causes of low productivity in subsistence agriculture when carefully implemented. How good the programmes can be, depends very much on the policy and strategies to be formulated and its subsequent implementation. Sometimes, it is also possible to have an independent board which will be tasked to monitor the activities of the investors. This needs to be clearly spelt out in land-use plans and bio-fuel policy and guidelines, which are currently under preparation. The absence of such detailed plans, policy and guidelines presents a risk in allowing too much land for cultivation of energy crops thereby leading to food shortage and crisis.



Photo 5: Jatropha seeds

Where non-food crops can be grown on land that is not capable of supporting food cropping, no competition for food will result except through secondary effects such

as modification of hydrology hence water availability and diversion of investment potential. A potential benefit for the development of perennial non-food energy crops is that they could be used to rehabilitate degraded and abandoned land. An example of this approach was taken by the Indian Bio-diesel Programme which is promoting the growth of *Jatropha* on degraded lands (TERI, 2005). Once rehabilitated, it may be possible to reclaim some of this land for food production. In fact, dedicated bio-energy cropping can result in the use of land which was previously not suitable for cropping which makes existing land use more productive. A study conducted in the country determined that more than 30 million hectares could be used to produce bio-diesel. Similarly, it is claimed that by producing bio-fuel on 300 000 hectares of its 4.6 million hectares under crop, Tanzania could “match current fuel imports.” (Hongo, H, 2005).

### **The Impact of Bio-fuel Expansion on the Poor**

The development of bio-fuel as a source of energy, when grown on a large scale, could represent a paradigm shift in agricultural development. As with all shifts, there will be both winners and losers. Urban and rural landless households, wage-earning households, rural households that are net purchasers of food and urban consumers are all expected to suffer as food prices increase.

The general price increase in most commodities has led to some concerns about its impact on the poor. Usually, as one staple becomes more expensive, people replace it with a cheaper one. But, if the prices of nearly all staples go up, consumers are left with no alternatives. However, to what extent the impact of a rise in food prices is uncertain at the moment. There could be considerable offsetting benefits from development of bio-fuels. From the point of view of poor farmers who have dealt with declining commodity prices for more than 40 years, increasing food prices provide an opportunity for increased benefits and intensified production which could lead to an increase in food crop yield.



*Photo 6: Diesel produced from Jatropha seeds*

Moreover, bio-fuels can also contribute to alleviating poverty through employment creation. Because bio-fuel production is labour intensive, there could be significant employment creation, offsetting the overly negative picture of food security. If mechanisms are introduced to ensure that much of the increase in prices accrues to the farmers, both bio-fuel and increased food prices can stimulate rural economic growth through additional capital inflows, create demand for goods and services that provide employment, reduce rural-urban migration, and create linkages and multipliers. Studies have shown that bio-fuel production in sugarcane-producing regions in Brazil, stimulated rather than competed with the other food crops and the income generated through agro-industrial activities related to sugarcane, helped “capitalize” agriculture and improve conditions for producing other crops (Zarrilli, 2006). Latest estimates suggest that up to 1.1 million jobs can be created in Sub-Saharan Africa (De Keiser and Hongo, 2005).

A key question to ask is what Tanzania as a nation will get out of this type of investment and how to ensure that poor people are not left out. These questions relate to the economic policy of Tanzania and land ownership. Local communities need to become partners in the development of the bio-fuel industry – not merely land lords – unleashing and reaping the benefits of the inflow of technology, infrastructure and capital that can transform the current subsistence agriculture to a modern high yielding farming. Already there are ongoing arrangements on short term lease agreements where local communities, organized through farmers associations become part owners of the investments. These are new creative business models that should be nurtured, brought forward and seriously evaluated.

### **Climate Change and the Environment**

Environmental problems that might arise are those concerned with clearing forests to cultivate bio-fuels. When land is cleared for planting bio-fuel crops, the effect can be harmful on the environment, because expansion of bio-fuel crops can displace other crops or threaten ecosystem integrity from bio diverse ecosystems and farming systems to industrial monoculture. In Brazil, it is feared that future sugarcane expansion might involve fragile areas. In Indonesia and Malaysia, 14 to 15 million hectares of peat lands have been cleared for the development of oil palm plantations. Forests are significantly important because they are a natural carbon sink. When the forest is cleared and the wood consumed as biomass fuel, the carbon is released into the atmosphere as CO<sub>2</sub>, greater than three tons of CO<sub>2</sub> for every ton of carbon burn. The climate impact from replacing healthy forests with a monoculture bio-fuel crop is actually two fold as carbon from the cut forest is replaced, and less atmospheric CO<sub>2</sub> is absorbed by bio-fuel crop than by the healthy forest. One of the best selling, but most debated, points of bio-fuel is its carbon neutrality. This means that, the growing plants absorb carbon and, when harvested, release only the amount of carbon they absorbed. There is little doubt that most bio-fuels emit fewer greenhouse gasses than fossil fuels

when used for energy, thus mitigating the effect on climate change.

The study by WWF (2006) indicates that some feedstock, such as sugar cane, require considerable quantities of water while others such as jatropha require less. In dry areas, the competition between food and fuel crops may become the overriding issue in the fuels vs. food debate and the issue could be addressed by investing in soil management and water saving technologies, some of which are uneconomical under present circumstances with declining commodities' prices. Improvement in crop productivity as well as the shift from high water-use bio-fuel crops (such as sugarcane) to drought-tolerant crops (such as sweet sorghum) is also among options to address the issue of water scarcity.

There are numbers of sustainability questions, connected to the production of bio-fuels. As for the effects on environment, it is important to note that all agricultural activities affect the environment in one way or the other, not least the local biodiversity. The effects may be either positive or negative. High productivity mono-cropping systems, such as sugar cane plantations, will almost certainly have negative effects on local biodiversity. This however, needs to be seen through a broader perspective and a case by case basis. In such an approach, the balance between positive and negative effects of high productivity crop systems are assessed by thorough analysis then discussed and weighed in a process which involves local stakeholders. Local and national capacity of making such balanced interdisciplinary analysis is therefore an essential component of sustainable bio-fuel production systems in Tanzania.



*Photo 7: An inter cropped jatropha plantation*

## **Conclusion**

This review suggests that there are both negative and positive effects in venturing into bio-fuel production. This is not unique to this kind of energy crops, but could as well be found when undertaking large scale mono-cropping systems. What is important is to develop well founded information upon which Tanzania's government and investors can assess, evaluate the advantages and disadvantages of various options and make transparent decisions on the development paths that they decide to take.

To ensure benefits to local communities, it is important that contracts between investors for large-scale crop production and out growers have to be properly formulated so that the latter get the anticipated benefits in terms of increased income and improved food security. Information from the Tanzania Investment Centre (TIC) suggests that most of the bio-fuel investors are planning to grow crops in mono-cultural form, which will inhibit plant biodiversity and provoke pest epidemics. Hence, where possible, intercropping of bio-fuel crops with other crops and rotation cropping should be encouraged so as to maintain soil fertility and minimize pest epidemics.

Large-scale bio-fuel farming entails heavy use of agrochemicals (fertilisers, herbicides, and pesticides) which pollute the soil. Heavy use of N-fertilisers increases soil acidification and high nitrate loadings that lower the quality of discharged water for human and animal use. High doses of P-fertilizers, when washed into water bodies increase eutrophication and algal bloom. Large doses of herbicides are normally used in large-scale plantations to control weed growth. For example, extensive use of paraquat and glyphate in large sugarcane farms is associated with serious human health problems. Moreover, polluting effluents are generated from processing bio-fuel feedstock into liquid bio-fuels, e.g. a lot of attached sediments, soot and chemicals are removed by cane washing before crushing. During bio-ethanol processing from cane juice, if 'vinasse', a by-product of the process, which is a very strong pollutant, is discharged into rivers it will affect various organisms downstream leading to massive death of fish and wildlife using polluted water. Other chemicals used in liquid bio-fuel reprocessing, including strong acids or alkaline solutions also affect living organisms in fresh and marine waters. Thus, the mangrove ecosystems along the Coast Region could be severely affected if the anticipated 422,000 hectares of sugarcane plantations and ethanol manufacture are not carefully managed. It is important that all environmental and social issues are clearly identified and well internalized in the investment decisions. This is possible if a proper EIA is conducted and regular monitoring is conducted.

The issue of land tenure insecurity can be avoided by developing bio-fuel policies that avoid land use competition between food and fuel crops by producing bio-fuels from non-edible crops such as pongamia and jatropha that are suitable for degraded lands or from tropical sugar beet that can grow in alkaline and sodic soils, or by using multi-purpose crops such as sweet sorghum that allow both food and fuel to be harvested from the same crop. There are other options to growing bio-fuel crops (other than food crops) and the issue in many developing countries, especially those that are both net importers of food and fossil fuel is not food versus fuel. Instead, the issue is managing limited water and land resources to promote both food and fuel production.

# CHARCOAL INDUSTRY IN TANZANIA WITH SELECTED TATEDO EXPERIENCE

E.Sawe and S.Sago TaTEDO

## Introduction

Like most sub-Saharan African countries, charcoal in Tanzania is produced mostly from trees harvested in natural forests. Production is mostly through inefficient traditional earth mound kilns, resulting in clear cut equivalent of more than 300 hectares of forests every day. From the current energy situation, wood fuels especially charcoal, will remain a dominant source of energy for the urban households, for the foreseeable future, the demand is also increasing rapidly. For example the demand for charcoal as a source of energy among users of Dar es Salaam region is more than 28,000 bags, (each of 30 kg) per day (Malimbwi, 2008). Countrywide, over one million tons of charcoal are used for cooking annually in urban areas. This amount of charcoal produced and consumed in Tanzania generates about nine million tons of CO<sub>2</sub> per year.

As mentioned above, charcoal consumed in most of the cities is produced in very inefficient methods using traditional earthbound kilns with less than 15% conversion efficiency. Consequently, the current charcoal production practices are unsustainable with negative impact on the environment. The recent banning of charcoal production by the government has largely been unsuccessful in regulating its production and trade. There is an urgent need to look for effective alternatives in addressing the charcoal issue.



*Photo 8: A vehicle pictured carrying bags of charcoal; Tanzania uses about one million tons of charcoal annually.*

## Charcoal Production

Charcoal is produced mostly in rural areas and is the most desired and affordable form of solid biofuels for cooking in all urban / sub-urban centres of Tanzania. Some of the factors influencing the choice of using charcoal instead of firewood in urban areas include:-

- Higher calorific value per unit weight than fire wood.
- Better economic benefits in transporting charcoal over longer distances as compared to firewood.
- Charcoal storage takes less room as compared to firewood.
- Charcoal is not liable to deterioration by insects and fungi which attack firewood.
- Charcoal is almost smokeless and sulphur free as such it is ideal fuel for towns and cities.

In most Sub Saharan African countries, charcoal production is a poor man's business. In Tanzania, for instance, charcoal provides up to 80% of the domestic energy needs of the households in urban and sub-urban areas. Landless, uneducated or otherwise disadvantaged people provide a cheap source of labour. The poor are also powerless and cannot defend their vital interests against the more powerful stakeholders of the charcoal supply chain such as traders and transporters. In charcoal business, the profits are usually concentrated in the hands of a few intermediaries, engaged as transport agents or wholesalers

## Selected TaTEDO Experiences in Charcoal Production

TaTEDO has a growing experience, in the area of sustainable charcoal production methods which involve tree planting, harvesting techniques and improved charcoal production capacity building and marketing activities. From the year 2001, TaTEDO has implemented projects and programmes on improved charcoal production methods and tree planting activities. Currently, TaTEDO is implementing a program on Integrated Modern Energy Services for Sustainable Development and Poverty Reduction in Tanzania (2007-2010) in 8 regions of the United Republic of Tanzania, the programme is supported by the Norwegian Government, EU and the HIVOS. Charcoal producers, TOTs and forest extension officers are being trained on sustainable charcoal production methods and enterprise development skills. Charcoal producers are being encouraged to form charcoal producers' associations to strengthen their market position.

## Improved Charcoal Production Kilns

There are two types of improved charcoal production kilns promoted by TaTEDO. These are Improved Basic Earth mound Kilns (IBEK) and Half Orange Kilns (HOK).

## Improved Basic Earth mound Kilns (IBEK)

This is an improved traditional kiln, which is currently being promoted by TaTEDO in Tanzania. It has conversion efficiency of about 20-30 per cent as compared to traditional earth mound kilns which have less than 12 per cent efficiency. IBEK has the benefit of reducing the number of logs which burn to ashes (wood wastage) in the kiln and increase quantity of charcoal produced per kiln as well as reduced carbonization cycle time from 8 days to 4days . IBEK is applicable to small scale/individual charcoal producers.



*Photo 9: Training on charcoal production, using an Improved Basic Earth Mound Kiln (IBEK)*

## Half Orange Kiln (HOK)

This is an improved charcoal production kiln, constructed using burnt bricks; it has efficiency of about 25- 30 per cent. The half orange kiln has the benefit of reducing wood wastage in the kiln and hence increases the quantity and quality of charcoal produced. The half orange kiln is applicable where there is a sustainable large amount of raw materials (wood) for carbonization such as in saw mill industries. TaTEDO has promoted this technology, by conducting training for technicians on construction and operation of HOK in sawmills industries and areas of large scale tree clearing for agriculture.



*Photo 10: Half orange kiln*

## Some of the TaTEDO Achievements

As a result of TaTEDO interventions, the following achievements have been realized.

- More than 650 charcoal producers and 100 TOTs have been trained on sustainable and improved charcoal production methods in 10 regions of Tanzania.
- More than 700,000 tree seedlings have been raised and planted by peri-urban small holder farmers, schools and women groups with TaTEDO support. This is equivalent to an area of 400 hectares of planted trees.
- Training manuals, trainer's guide and hands-on manuals on improved charcoal production methods and tree planting have been prepared, published and distributed to target groups and stakeholders.
- Several private farmers, farmer groups and schools have been trained and assisted to establish commercial nurseries, tree growing and environment conservation.
- More than 10 groups of charcoal producers have been formulated and are being assisted to establish associations for marketing charcoal collectively.

## Conclusions and Recommendations

Charcoal will remain the dominant source of energy for cooking for the urban household sector for the foreseeable future. Currently, the charcoal industry, despite its many shortcomings, delivers charcoal to urban users through an informal system based on unfair market forces. The recent efforts of the World Bank to facilitate a preparation of

charcoal policy note for Tanzania should be commended; the launching of a policy note on charcoal production and utilization will create new possibilities for the modernization of the charcoal industry in Tanzania.

It is therefore recommended that development of a bio energy policy including charcoal production and use policy, strategy, legislation and programmes formulation should address among others, the following.

- The sustainable utilization of the indigenous forest resources for charcoal production depends on better management and planning. Forest Division should work closely with the Energy Department and other stakeholders to enhance sustainable management of natural resources through active and effective participation of relevant key stakeholders from local to national levels.
- Appropriate legal mechanisms should be put in place to enhance the role of the Forest Division and the Department of Energy which should play a greater role in this very important and vital energy source. Forest Division, in collaboration with the Energy Department and other stakeholders should establish a mechanism to monitor on ongoing basis, the activities of the charcoal industry such as price trends at all levels, volumes of production and consumption, legislation enforcement and forest resources for charcoal production. This should be done in conjunction with other relevant stakeholders in charcoal production and distribution.
- The Government should devise an effective method of charcoal revenues collection. The charcoal industry countrywide is currently generating more than 500 billion shillings as revenue. In doing this, it is necessary to take into account, the interests of various players, such as the Forest Division, local communities, dealers, retailers, users and producers etc. The aim should be to establish a mechanism whereby each actor holds a fair stake and revenue collected is ploughed back to develop the industry by ensuring sustainable management of the resources and a well functioning charcoal industry system.
- Electricity, kerosene, LPG, natural gas and carbonized briquettes could meet a greater part of the growing household energy demand that is now predominately met by charcoal. The extent of use of these alternative fuels should be left to market forces with appropriate incentives and regulations in place to determine their economic viability and social acceptability.
- Present traditional charcoal production kilns are very inefficient (8 – 12 per cent). Charcoal producers should be trained on sustainable and improved charcoal production skills. They should also be supported to form charcoal producers and marketing associations which will enable them to fetch higher prices for the charcoal they produce.

# LARGE SCALE HYDROPOWER, RENEWABLE ENERGY ADAPTATION, CLIMATE CHANGE & ENERGY SECURITY IN TANZANIA

By Eng James Ngeleja, National Environment Management Council (NEMC)

## Tanzania's Economy and Climate Change

Tanzania's economic sectors of growth include agriculture, tourism, energy, mining, fishing, livestock, forestry and water. The industrial sector is still young and caters for domestic needs mainly. Apparently, all these sectors are natural resources and climate linked. Therefore climate change has impacts on them and the major challenges lie on mitigation and adaptation.

On the other hand, the water, agriculture and forestry sector are the main source of energy in Tanzania. Forestry based energy in form of firewood and charcoal constitutes the main source of energy. It is estimated that 90% of the total energy supply is in the form of firewood and charcoal, which is also used by the majority of Tanzanians.

The agricultural sector is another source of energy in the form of bio waste derived from post harvests of cotton, maize, millet, rice, etc. Cow dung is also used for cooking in areas with more cattle or livestock in general. The use of bio waste for domestic cooking is significantly increasing in areas where firewood and charcoal supplies are becoming scarce. Bio waste in the form of rice husks and cotton stalks is also being used in rural based small businesses and income generating activities such as brick making, fish smoking and local breweries.

The water sector is a significant source of electric power from hydropower sources. It is estimated that about 47% of the installed power generating facilities in Tanzania are hydro based.

From the foregoing brief introduction, it is therefore evident that climate change impacts have adverse impacts on the energy sector in general and on the electricity sector specifically. Therefore climate change impacts need to be addressed through mitigation and adaptation initiatives.

## Tanzania's Commercial Energy Generation

Tanzania's commercial energy generation is based on hydropower and thermal energy sources. By the end of 2007, Tanzania's installed power generating capacity was 1034 MW including IPPs and imports.

Total hydropower installed capacity was about 54% of the installed generating capacity by 2007. It is therefore obvious that climate change impacts on hydropower and require special studies.

## Climate Change and Energy Security

From a climatologically perspective, the term climate change refers to any irreversible change in the traditional space time

pattern of climate. Climate change is caused by a process called "green house effects". The sun light (also called solar radiation) passes through the atmosphere and heats the earth surface. The heat makes the earth warm. Some of the heat is released back to the atmosphere which is called (infrared radiation). Certain gases called "greenhouse gases (ghgs) form a layer on the earth's upper layer. These gases keep the earth at temperatures that are appropriate for life. The most common of all these gases are carbon dioxide, methane and nitrogen oxides.

## Tanzania's Commercial Energy Generation

Plant (Hydro)	Capacity (MW)	Remarks
Kidatu	204	Regulation dam/
Kihansi	180	base load
Mtera	80	Regulation dam/
Pangani falls	68	peak load
Hale	21	
Nyumba ya Mungu	8	
<b>Sub total</b>	<b>561</b>	
<b>Thermal Plant</b>		
Ubungo gas turbines (GE LM 6000	140	owned by Songas (IPP)
Ubungo ABB IPTL	100	IPP(Songas)
Other diesel based plants	34	IPP
		Owned by TANESCO
<b>Sub total</b>	<b>314</b>	
<b>Total</b>	<b>875</b>	
<b>Rentals (IPPs)</b>		
Aggreko	40	
Dowans	100	
Artumas	12	
imports	1.0	From Zambia for
	5.0	Tunduma
	0.5	From Uganda for
		Kagera
		From Tanwat for
		Njombe
<b>Total</b>	<b>158.5</b>	
<b>Grand total</b>	<b>1033.5</b>	

Figure 2: Tanzania installed power generating capacity by 2007

Source: MEM 2007

For about 150 years, human activities have thickened the gas layers. Consequently, the world is getting warmer. Scientists have confirmed that during the last 100 years the earth has warmed by about 0.74 degrees centigrade. Green house gas concentrations have increased from 270 ppm in the pre-industrial era to about 400ppm. For example since 1940, carbon dioxide emissions were about 2 billion tons per year. Currently, it is in the range of 13 billion per year. The consequences of the climate change include increased frequency and severity of extreme weather events such as storms, floods and drought, increasing sea level rises which

are projected to reach about 59cm by end of 21<sup>st</sup> century, melting glaciers and erratic patterns of rainfall.



**Photo11: A small hydropower in Njombe district in Iringa region, hydropower accounts for 54% of total electricity generated in Tanzania.**

The aforementioned impacts are serious globally, including in Africa and Tanzania specifically. At global level, the international community addresses climate change impacts through the United Nations Framework Convention on Climate Change (UNFCCC) to which Tanzania is a member. UNFCCC was established in 1992 and Tanzania ratified it in 1996.

The main intervention challenges for climate change impacts are adaptation and mitigation. At a global level, the international community is currently working on developing incentive programmes to implement both adaptation and mitigation initiatives. These programmes include carbon funds, emission trading, clean development mechanisms and low carbon economy.

At a national level, both adaptation and mitigation initiatives need to be undertaken at all levels starting from household, community level to the district levels. Furthermore, there is a need to develop programmes at the sector level such as in the energy sector.

### **Energy Security and Climate Change Impacts**

Environmental resources of land, water and air are the main sources of people's livelihood and the backbone of the country's main productive and growth sectors such as the energy sector. The degradation of the environmental resources by climate change leads to threats of the country's energy security. The threats on energy security are translated into reduced electricity generation capacity, increased cost of electricity, reduced economic growth, lower rate of development and other relevant threats.

From 1990 to date, Tanzania has gone through three major dry spells (drought), the longest of which was from 2004 – 2006. During this time the country was more dependent on hydropower. Consequently, the country experienced shortage or reduced electricity generation capacity.

However, there are other factors that contribute to the reduced electricity generation. These factors include the increased number of water users e.g. for agricultural irrigation, livestock and deforestation in the respective water basins. Maintenance and repairs to some of the hydropower plants has also contributed to reduced electricity generation.

### **National Energy Policy – Climate Change Context**

The objective of the national energy policy is to establish an efficient energy production, procurement, transportation, distribution and end use systems in an environmentally sound and sustainable manner. Apparently, the environmental aspects in the energy policy are linked to energy production and use patterns. Accordingly, energy production of all sources has to be done in an environmentally sound way without adverse impacts on the environmental resources of air, water, soil or land.

Likewise, energy use patterns must not have adverse impacts on the environment resources. Energy end use impacts are associated with emissions. The emissions are in gaseous form and include carbon dioxide which is one of the major green house gases that contribute to global warming which is a source of climate change.

The environmental concerns of climate change and their wider impacts are not well covered in the national energy policy. Climate change results such as floods, increased temperatures, drought and unpredictable rainfall patterns are not well addressed in the energy policy.

### **Relevant Adaptation Strategies to Drought Related Electricity Crisis**

#### **Diversification**

Diversification of power generating sources is among the effective adaptation strategies that are being developed by both the ministry and TANESCO. It is however noted that the major driving factor for diversification is more linked to the national economy on issues of power availability, reliability and affordability. The environmental factor is linked to emissions which in the case of Tanzania, are of low levels.

The power sources for diversification that are included in the Power System Master Plan (PSMP) (2007 – 2031) are coal, hydro, natural gas and interconnection. These new diversification power sources are for the national grid. Biomass cogeneration is another potential power source for diversification to the national grid and rural electrification.

#### **Interconnection**

Interconnection between Tanzania, Zambia and Kenya has been, as a main objective, to enhance energy security. Plans are underway whereby; a study for a 330kV transmission line from Zambia to Kenya through Tanzania has been carried out. The whole initiative is for the East African region to be interconnected with the Southern African Power Pool (SAPP).

In another development, an interconnection between Rwanda, Burundi and Tanzania is underway to make use of the Rusumo Waterfalls of the Kagera River, which is shared by the three countries.

### **Energy Efficiency and Fuel Switch**

Energy efficiency initiatives need to be better promoted in the region. Initial steps include raising awareness. Energy efficiency has both economic and environmental benefits.

Energy efficiency initiatives are in the broad areas of waste management and fuel switch where science and technology is highly applied.

In regard to waste management, reducing material use through “recycling” reduces energy use and hence reduction of green house gases.

In regard to fuel switch, different fuels have different combustion and emission characteristics. Fuel switch to renewable sources of energy like solar, wind, biomass, geothermal contribute to reduction of greenhouse gases.

During 2006 – 2007 when petroleum products were high in prices in the global market, many industries switched from petroleum products normally heavy fuel oil to biomass (wood) for thermal energy requirements.

Demand side management (DSM) is another adaptation strategy that needs to be promoted.



*Photo 12: One of TANESCO power generators*

### **Development of Small Hydropower**

The hydropower family is large consisting of small, medium, large, run of rivers, storage operation and pumped storages.

Large scale hydropower is for national and International

power coverage. Management of the associated infrastructures of large scale hydropower is complex. On the other hand, small hydropower systems up to 10MW have less complex infrastructures. The respective river basins have the potential to improve on the multi-purpose uses of the small hydropower infrastructures. Water uses such as irrigation could be easily managed.

Therefore, development of such small hydropower infrastructures is ideal for rural electrification through clean energy sources, .i.e. without greenhouse gas emissions.

### **Integrated Environment and Water Management**

Interactions among different water users, including power generating and environment demands special training and ideal programmes. Aspects such as optimising water resource, environment impact assessment and river engineering need proper and special training for key stakeholders. The stakeholders include water basin managers, water and environment managers, forest officers, engineers and community leaders.

Networking and information sharing among water basin authorities should be further enhanced.

### **Policy Reforms**

Policy reforms aimed at promoting special climate change adaptation technologies such as biomass cogeneration, small hydropower, and fuel switch need to be developed.

Policy on carbon markets, which are linked to these technology applications as financing options in order to scale up the technologies, needs to be developed.

Climate change is a cross – sector concern and therefore, a development issue that needs to be taken into account in all sector policies including the energy policy.

### **Conclusion**

The Tanzania economic growth sectors, including energy, are linked to climatic conditions. Climate change is a cross-sector concern and therefore affects development.

Hydropower is a renewable resource that satisfies sustainability requirements very competitively and on long term basis. Climate change adaptation technologies such as biomass cogeneration and small hydropower need specific policies for wider application. Major driving factors for the Power System Master Plan Development are more economic than for environmental conservation.

# INNOVATIVE SOLAR LOANS TO INCREASE ACCESS TO SUSTAINABLE ENERGY SERVICES IN SIHA DISTRICT

By Godfrey Sanga - TaTEDO

Creative Solar Loan Initiatives started, as a small pilot project for solar home systems financing in 2006. Today, it is one of the leading solar PV financing schemes in Kilimanjaro and Arusha regions. This is the solar home systems financing scheme operated by Umoja Savings and Credit Cooperative Society, Saccos in Magadini village, Siha District in Kilimanjaro Region. In March 2009, more than 120 solar home systems were installed in Siha, Hai, Manyara, Meru and Arumeru districts from the two regions.



**Photo 13: Staff of Umoja Saccos and some visitors. On the right: Mr Lukumay, Chairman, Umoja Saccos and an agent for solar PV development.**

## Solar Loans

Umoja Saccos offers loans for solar PV just like for any other product. They educate their members, process loans and contract the solar company for supply of equipment and installation. Members can then pay the Saccos in four equal instalments in one year.

Solar loan is a profitable business and is currently contributing to about 30% of the total annual profit of Umoja Saccos.

Mr. Emmanuel Lukumay is the man behind all the success in developing solar electricity business at the Saccos. He has worked tirelessly to educate his fellow members on the benefits of solar electric systems, how they can get loans for the products and raise capital to finance more systems.

Mr. Lukumay is the Chairman of the Umoja Saccos.

## Demonstration of the Technology

TaTEDO introduced solar photovoltaic and other sustainable energy technologies, in 2002 through community mobilization, awareness raising and demonstration projects.

A 28Wp solar PV system was installed at the village government office building. When Umoja Saccos was established in 2005, already there was some awareness and understanding on the form of technology.

In early 2006, TaTEDO installed the second demonstration system at Magadini Primary School.

These demonstration projects were accompanied with the use of a number of educational materials including posters, brochures and t-shirts and conducting educational meetings.

## Pilot Project

In the late 2006, Umoja Saccos and TaTEDO implemented a pilot project which financed the installation of seven solar home systems worth TZS 3.3 million in total. The funds were raised by Umoja Saccos from their own sources and TaTEDO, on the other hand, financed all awareness raising and training activities, developing agreements between solar company and customers and between Umoja Saccos and the solar company. This process took approximately four months. Initially, Umoja Saccos contracted the Battery Charging and Solar Power Centre, a local solar company in Sanya Juu in Siha district for supply and installation of the solar electric systems.

Mr. Lukumay says that the pilot project taught them a lot in the solar business. "We learnt how the technology works, how to negotiate and make agreements with solar companies and ensure that our members are getting the best equipment, installation and maintenance services", he said.

TaTEDO developed the pilot project with Umoja Saccos in a public private partnership arrangement with the Saccos.

In 2007, Umoja Saccos secured subsidy funds from the Programme on Renewable Energy in Tanzania (PRET) which was used as a bonus for every solar system installed. PRET paid 40% of the system cost to a supplier upon receiving pro forma invoices and verification of quoted prices. The rest of the cost (60%) was paid to the supplier by Umoja Saccos. Customers were required to repay full the amount and interests to Saccos. Thirty systems were installed under this arrangement, which created more demand for solar systems.

Ten out of 120 systems were installed to power television sets and this has increased access to information and entertainment for owners and neighbours. In some solar lighted households, pupils gather for evening study groups which have helped to improve their class performance significantly.

Many users of the solar electric systems are satisfied with the benefits especially the reduced expenditures on kerosene

and dry cell batteries. On average, a simple payback period for a small solar energy system is 1 ½ years.

Nevertheless, many end users would like large systems which can power TVs as well. This indicates an acceptance of the technology and usefulness to them.



Photo 14: A solar home system

### Challenges

Despite its success, the financing scheme has faced a number of challenges including limited working capital. In 2006, the Saccos, was new and didn't have sufficient capital to finance more than 7 systems. After the pilot project, it took more than 8 months before they could get the support from PRET.

Other challenges include delays by the solar company to complete installations, inferior quality equipment and workmanship. There are two cases where customers complained and refused to pay due to poor performance of installed systems.

Loan repayments are often affected when there is bad harvest caused by factors such weather. Saccos officials mentioned that, their efforts, to educate and reach more customers, is limited due to insufficient funds for education programmes. Saccos has to educate members regularly on how to use its services and familiarization with new products. Until June 2009, Saccos had 433 members, which meant, increased work in handling customer information and loan processing.

### In- House Technical Capacity Building

After successful business operations in the past three years, Saccos has accumulated sufficient working capital for selling

more loans for solar PV. Demand for solar energy services has grown substantially.

The Saccos has made further steps to build technical capacity in-house. In January 2009, Mr. Lukumay attended a one week training course on solar PV technology and entrepreneurship which was organized by TaTEDO at Angaza Women Centre in Sanya Juu. He says that the training has increased his technical capability and he can design and install solar systems and repair them.

He made contacts with more solar technicians and equipment suppliers. Trained technicians formed a network where they share information on markets and availability of equipment. Umoja Saccos can use technicians in the network in installation and maintenance of solar electric systems much faster. Mr Lukumay has installed 4 systems himself.

The solar loans in Magadini have interested many other organizations to replicate the scheme. Umoja Saccos is involved in educating other Saccos institutions in the network USAWA, on how to set-up solar loans. USAWA,

*Umoja wa Saccos za Wakulima – Union of Farmer's Saccos*, comprises of 11 members in the Kilimanjaro region.

### Future Prospects

Mr Lukumay is happy that his efforts are now paying off. Umoja Saccos is exploring more markets with promotional activities and introduction of solar energy applications which can enable income generation such as phone charging and running barber shops.

Umoja Saccos has aimed to sell 400 solar electric systems by 2013. This means that, almost all members of Saccos will own a solar electric system. However, this ambition requires Saccos to increase education and awareness programmes among members and secure sufficient capital to be able to provide solar loans.

### Conclusion

The success of Umoja Saccos demonstrates that integrating solar loans in a conventional loaning system is possible and that 'where there is a will, there is a way.' However, this requires bringing the technology to Saccos and continuous support to develop working systems and tools.

One of the key aspects in such an initiative is that both Saccos and a development agency have the same motive to improve the welfare of their members. They can benefit from each other's capacities.

## SUSTAINABLE MODERN ENERGY INITIATIVES

### **Scaling-Up Access to Integrated Sustainable Modern Energy Services for Poverty Reduction**

The programme is designed to enhance access to sustainable modern energy services, in order to improve the livelihood and assets of the people in the rural areas. The programme is funded by the European Union through the HIVOs of the Netherlands and is planned to be implemented in one hundred and twenty (120) villages located in six regions in Tanzania. These regions are Arusha, Kilimanjaro, Tanga, Shinyanga, Manyara and Mwanza. It is expected that sustainable modern energy services in these areas will contribute significantly to socio-economic development of the beneficiaries and environment conservation.

The objective of this programme is to contribute to sustainable livelihoods, poverty reduction and sustainable rural development through improved access to sustainable modern energy in rural communities of Tanzania. The programme significantly contributes to access to sustainable modern energy services in rural areas, with the aim of improving living conditions, boost economic activities and provide better social services.



**Photo 15: TaTEDO promotes use of straight vegetable oil from jatropha plant for rural electrification**

The programme is expected to create and strengthen capacity for designing, fabricating, and installing Energy Service Platforms (ESPs) and sustainable Energy Enterprises (SEEC), promote the production and use of straight vegetable oil from Jatropha and also promote local micro-enterprises.

The target groups for the programme include energy entrepreneurs, technicians and artisans, ESP and PUC operators, village energy management committees, existing government agricultural extension staff and jatropha farmers. The final beneficiaries of this programme are rural households, rural micro-enterprises, rural social service centres and potential farmers.

### **Integrated Sustainable Modern Energy Services for Sustainable Development and Poverty Reduction**

TaTEDO is scaling-up access to modern energy technologies and service programmes in both rural and urban areas in nineteen(19) districts and eight regions of Tanzania; namely Arusha, Coast, Dar es Salaam, Kilimanjaro, Mwanza, Rukwa, Shinyanga and Tanga. The technologies earmarked for scaling-up include efficient wood fuel stoves, charcoal and firewood baking ovens, improved charcoal production kilns, solar PV, dryers and multi-chargers, Energy Services Platforms (ESPs), biogas and growing of multipurpose energy trees.

The overall goal of the programme is to contribute to sustainable development and poverty reduction by enhancing access to sustainable modern energy technologies and services for consumptive and productive uses in households, SMEs and social service centres. The main objective of the programme is to facilitate scaling up access to sustainable modern energy technologies and services.

The programme target groups and beneficiaries are in three categories: -

- Users of the technologies which include;
- Households (headed by both men and women) and social services centres (schools and health centres)
- Service providers comprising of; entrepreneurs (stoves/ovens producers/users, solar technicians, seedling enterprises, tree nursery vendors, charcoal producers, etc) and micro-financing institutions (MFIs).
- Collaborating local partners (NGOs, CBOs, private firms, government institutions, local government departments) and policy makers at national, regional and district levels.

Participatory planning and baseline information collection for some villages has been conducted in Mwanza, Shinyanga, Kilimanjaro, Rukwa and Coastal Regions. Awareness, capacity building and market development of sustainable modern energy technologies have been undertaken where participatory planning was conducted. Capacity building has continued with training of staff and partners on technical skills of producing and installing sustainable modern energy technologies in these regions.

### **Integrated Wood fuel Services for Poverty Reduction in Tanzania**

In collaboration with her development partner, the HIVOS with EU financial support, TaTEDO is implementing a four-year programme. The programme is being implemented in the regions of Arusha, Morogoro, Coast, Tanga and Kilimanjaro. The overall objective of the programme is to

contribute to poverty reduction of the beneficiaries and environment conservation. The specific objective of the programme is to increase income of the rural and urban beneficiaries through reduced costs and increased efficiency of wood-fuel utilization and production by adoption of efficient wood-fuel stoves, ovens and charcoal production kilns.

The beneficiaries and target groups in this programme are households (users of wood fuel stoves), social service centres and SMEs (Stove and Charcoal producers, stove dealers, women groups, local brewing industries, food vendors, hotels and bars), financial Institutions and associates, policy and decision-makers.



**Photo 16: Capacity Building Training for Sustainable Charcoal Production in Mwangi District, Kilimanjaro Region**

The programme is expected to contribute to the achievement of the National Strategy for Growth and Reduction of Poverty (NSGRP) and the Millennium Development Goals number one (1) and seven (7). The programme also creates job opportunities for the target groups through production and marketing of wood fuels technologies. This will also contribute to the reduction of the number of people whose income is less than \$ 1 per day and thus reduction of extreme poverty and hunger. It is also estimated that for every 1000 stoves in use, there will be reduced CO<sub>2</sub> emissions by 1,716 tons per year. Smoke reduction through use of improved wood-fuel stoves will reduce respiratory diseases for women and children. Reduced wood-fuel consumption will save forest areas. The use of more energy efficient and alternative wood-fuel technologies will reduce CO<sub>2</sub> emissions and also conserve forest resources.

### **African Rural Energy Enterprises Development (AREED) (Phase II)**

The African Rural Energy Enterprises Development programme (AREED), was launched in 2000 as an initiative of the United Nations Environment Programme (UNEP) with funding support from the United Nations Foundation (UN-Foundation). The programme constitutes an innovative

approach based on the collaboration of a strategic development partner (UNEP) with local NGOs governments and energy enterprises in five African countries. The AREED programme turned out to be an interesting experience that improved access to clean energy services in five African countries through the development and finance of energy enterprises.

After 8 years of the programme, it was learnt that a supply side approach was not enough and that an end user finance component is required to ensure the sustainability of the programme.



**Photo17: One of the businesses promoted by TaTEDO is baking using improved charcoal ovens. The oven can bake up to 27 loaves of bread and 72 cakes within half an hour**

The End Users' Finance (EUF) component of AREED II was considered an important component in the AREED II. EUF was designed to focus on creating innovative rural credit facilities that enhance the ability to purchase energy products and services, especially for productive applications. The expectation is that the incomes generated from such productive applications enable the users to pay for costs of financing improved energy, thereby facilitating the diffusion of modern and clean energy services into rural economies. The AREED II End Users' Finance component contributes to the enhancement of financial mechanisms that make energy facilities available to rural end users. It also helps to remove or significantly lower the 'first-cost barrier' hindering access to clean energy products and services.

During the reporting year (2008), two major activities were implemented. The first activity focused on practical ways of incorporating AREED II EUF components into the AREED approach. Accordingly, a workshop on Energy End Users Finance was held in Saly, Mbour (Senegal) from 9<sup>th</sup> to 12<sup>th</sup> April 2008 to exchange policy ideas on how to approach the finance of renewable energy for vulnerable populations of the rural and peri-urban areas of the AREED countries. The main issue that was addressed in this workshop was lack of a robust mechanism to finance low-income energy

end users. AREED II will take this issue into account through the integration and implementation of an end user finance component. More specifically, the workshop tried to explore the partnership opportunities which can be created between AREED and MFIs from the target countries (Senegal, Mali, Tanzania, Ghana and Zambia). The workshop registered 27 participants including: strategic development partners (UNEP, REEEP/Econoler), representatives of MFIs from the five countries and energy entrepreneurs, financed through the AREED partner NGOs. TaTEDO invited two MFI's (Pride Tanzania and VICOBA) to this meeting. The partners agreed in the meeting that AREED II End Users' Finance component will include in each AREED country an initial situational assessment in order to gather information needed to develop the pilot financing mechanisms. Partners agreed that, in order to be successful, energy end-users' financing programme requires the existence of:

- a) A ready and growing demand of energy equipment. b) Energy suppliers capable to deliver quality products and after-sale services.
- c) MFIs which are technically able and willing to create or expand loan products to potential customers of clean energy products and services. Based on the AREED II Project document, UNEP has agreed to co-operate with TaTEDO with respect to the AREED II End Users' Finance Component situation assessment.

The second major activity that was implemented during the reporting period was the discussion of the best way of structuring the AREED II Enterprise Grant Facility, details of cost-sharing criteria and application processing mechanism of AREED II. One tele-conference was organized whereby partners expressed concerns/doubts about the rationale, philosophical foundations and operational implication of implementing a grant mechanism in AREED parallel to seed capital loan philosophy of original AREED. Partners reached a consensus and agreed that use of grants is just meant to "soften the ground" for the short term so that the seed loan capital/loan approach can take root in the medium to long term.

### **Enabling Access to Sustainable Energy (EASE)**

EASE Programme is a North-South collaborative initiative, originally involving the ETC of the Netherlands as the northern partner and three partners from developing countries namely Energetica of Bolivia in South America, TaTEDO of Tanzania in Africa, and RCEE of Vietnam in Asia.

The programme in Tanzania intends to alleviate some of the constraints of low access to sustainable modern energy at different levels of intervention by building capacity of

stakeholders. At the end-users level, factors that limit access include low income, lack of financing and entrepreneurial skills. The issue of knowledge management is also required to be addressed especially in the areas of the whole process of capturing lessons and experiences, processing, packaging information for sharing with other stakeholders. EASE is currently addressing these challenges by supporting capacity building for TaTEDO staff and partners in Tanzania. The capacity building activities were launched during EASE partners meeting hosted at Uhuru Hotel, Moshi in Kilimanjaro Region. The aim is to build capacity of TaTEDO staff and her partners in order to provide technical and business support and to collect and disseminate information and lessons learned to energy entrepreneurs and other key stakeholders. The capacity building has continued with the training of vacvina biogas plant construction. Further capacity building efforts will be undertaken in the areas of entrepreneurship development and information management.

The programme will continue to address barriers in access of sustainable modern energy in rural areas by building capacity. The programme on the entrepreneurs/suppliers side will strengthen capacity for accessing capital, technical competencies and entrepreneurial skill provision to the stakeholders and also bridge institutional gaps and entrepreneurial skills weaknesses by training energy entrepreneurs so as to successfully carry out their energy businesses. Besides that, the issue of knowledge management including the whole process of capturing lessons and experiences, processing, packaging and sharing/disseminating require internal arrangements and facilitate sharing of information among entrepreneurs. All these areas require capacity building so as to enhance energy access for the majority of rural households and contribute to poverty reduction.

### **Competence Platform on Energy Crop and Agro-Forestry Systems for Arid and Semi-Arid Ecosystems- Africa (COMPETE)**

The Competence Platform on Energy Crop and Agro-forestry Systems for Arid and Semi-Arid Ecosystems- Africa (COMPETE) conducted an International Conference and Policy Debate on 'Bio-energy Sustainability Schemes and African Perspective' (COMPETE) in June 2008 at the Ngurdoto Mountain Lodge Arusha, Tanzania.

This international conference was organised by Imperial College, United Kingdom and WIP Renewable Energies, Germany in cooperation with TaTEDO, Tanzania. The main aim of this COMPETE conference was to elaborate recommendations addressing the opportunities and challenges of the global bio energy development from an African Perspective.



**Photo 18: International Conference and Policy Debate on 'Bio-energy Sustainability Schemes and African Perspective' (COMPETE) at the Ngurdoto Mountain Lodge, Arusha, Tanzania**

In his opening remarks, TaTEDO's Executive Director, Mr. Estomin Sawe said that bio-fuels could play an important role in improving the lives and livelihoods of people in Africa.

"The bio-fuels powered technologies have huge potential for providing modern energy services that can contribute to great employment, income opportunities and social well being in rural areas. Presently, bio-fuels represent a fast growing industry seeing a more than 17 percent increase in 2006. The challenge for Africa is to come up with effective policies and strategies that will ensure African countries are secure in fuels and food," he said.

"Most African countries have no policy to support bio-fuels development, no fiscal and financial incentives and no blending targets. However, land grabbing and other initiatives, mostly by foreign investors interested in exporting bio-fuels feedstock to meet foreign blending targets are going on without appropriate regulations in place". He noted.

He said that with the growing interest in bio-fuels worldwide, many African countries at the moment are not well prepared to harness the potentials from this fast growing industry nor to benefit from international trade in bio-fuels while at the same time protecting the environment and rural communities from potential destruction of livelihoods, indecent work, exploitation, food insecurity and other disadvantages resulting from large scale cultivation of energy crops for bio-fuels production.

The main objective of COMPETE is to identify pathways

for the provision of bio-energy, which will improve quality of life of rural population. The project also enhances the equitable exchange of knowledge between EU and developing countries in this critical area of activity and aids the preservation of the critical functions of arid and semi-arid regions in Africa as intact ecosystems.

In Tanzania, the focal point of this project is TaTEDO. The Project brings together world-leading scientists, researchers, donors and practitioners. COMPETE enhances the equitable exchange of knowledge between EU and developing countries from different fields and across the world to create a platform for discussion, knowledge exchange, policy and methodology development.

During the second day of the conference, participants had a field trip to Leguruki, a village where TaTEDO has installed bio-energy technologies facilitating rural electrification and efficient energy utilization. The conference was followed by COMPETE internal meeting held on 18 June 2008.

### **'COMPETE' declaration on sustainable bio-energy for Africa**

The main outcome of the COMPETE Conference and Policy Debate on 'Bio-fuels Sustainability Schemes - An African Perspective' was the elaboration of a COMPETE Declaration on Sustainable Bio-energy for Africa along the lines of two Roundtable Discussions engaging high-level decision-makers from Kenya, Mozambique, Tanzania, Uganda, Zambia, as well as the Union Economique et Monétaire Ouest Africaine (UEMOA).

The declaration emphasizes policies and implementation strategies to enhance the bio-energy potential in Africa. The declaration states that bio-energy should be seen as part of the solution of energy needs and greenhouse gases reduction and not as part of the problem. Major opportunities as well as constraints need to be considered within the range of alternatives that bio-energy can provide especially in developing countries. There are five main topics considered within policies and implementation strategies. These topics include visions guiding the implementation of policies for bio-energy development in Africa, markets (local, national, international) for bio-energy development in Africa, development of land use strategies as means to ensure sustainable bio-energy development in Africa, appropriate land tenure systems as pre-requisite to ensure sustainable bio-energy development in Africa and Capacity building and R&D .

### **Voluntary Carbon Offset Market Initiative to Facilitate the Mitigation of Climate Change in Kilimanjaro Region**

Climate change is one of the most pressing problems facing the world's environment today. Across Africa; global warming has affected the climate of the continent and changed its landscape. The snowy cap of Mount Kilimanjaro is melting and the shorelines of lakes Chad, Tanganyika and Victoria are diminishing. The once mighty Lake Chad is half the size it was 35 years ago. These and many other changes have led to unreliable farming seasons and low water supplies – a serious problem for a continent almost entirely dependent on rain for agriculture.

All these effects are partly contributed by the extraction, processing, supply and use of energy. Burning fuel wood contributes to the devastating environmental problems of deforestation and global warming. Furthermore, the uses of inefficient cooking stoves (fire place) bring hazards of indoor air pollution. According to the World Energy Outlook (WEO), about 1.3 million people mostly women and children die prematurely every year because of exposure to indoor air pollution.

There have been significant efforts worldwide to combat global warming, both in developed and developing countries, across a wide range of sectors including energy and agriculture. Energy efficiency is now universally recognized as one of the quickest, most cost effective ways to reduce energy related emissions associated with global warming and climate change. In Tanzania, TaTEDO has recognized the need for an initiative which would help in mitigating these effects associated with the inefficient use of biomass energy resources through provision of adequate and affordable cooking stoves as a result improving the lives of rural majority.

With the support from Hivos of the Netherlands, TaTEDO is implementing a project of household's efficient stone made woodstoves in Rombo and Hai districts in Kilimanjaro Region. The project is implemented under voluntary carbon offset market to mitigate effects of climate change. The objective of this project is to improve thermal performance of the wood fuel stoves in project area. The project activity focuses on replacing the three stone fire places with efficient of 10 to 15% with improved and efficient fire wood stoves of more than 60%. This will result in reduced wood fuel consumption, avoided carbon dioxide emission and indoor air pollution, reduced workload to women and children and conserved energy resources.

Importance of energy efficiency lies in the fact that it ensures provision of same level of energy using fewer amounts of

wood fuel. Owing to the increasing demand and limited availability of wood fuel, the importance of efficient use of energy has been realized all over the world. The measures of energy efficiency are useful in multiple ways. Reduced use of fossil fuels is essential in lowering the emission of greenhouse gases contributing to global warming.



*Photo 19: A woman cooking with an improved wood fuel stove built in Kilimanjaro region.*

Since its inception in 2007, the project has penetrated to several households, Small, Medium and Micro Enterprises (SMMEs) and institutions. More than 700 stoves have been constructed in selected villages of Hai and Rombo districts in Kilimanjaro region. This significant number of stoves which have been built is a result of an incentive scheme drawn by TaTEDO to both stove masons and early adopters of the technology facilitated to increase the adoption rate of the stoves. T-shirts and kangas were designed, printed and distributed to owners of stoves which encouraged and sensitized more people in the communities to switch from three stone fireplaces to Okoa improved firewood stoves. On the other hand, labor costs of the stone masons, for some of the constructed stoves were contributed by the project, while raw materials such as sand, cement, metallic parts costs were covered by owners of the stoves.

The business of stove construction has been a way of generating income to the stove masons. The project has created multiplier effects in terms of income earned in these two districts. This has been through selling raw-materials (sand, cement, lime, and metal bars); Welding and fabrication of metal parts. These have created employment to new stove masons who are undertaking stove construction as their major activity for income generation; and these technicians are gradually developing their business through entrepreneurial procedures

The constructed stoves also reduce frequencies and time used for collecting firewood which enable women to participate

in other economic activities. The amount of money spent for purchasing firewood is regarded as income.

In order to ensure sustainability of the proposed project activities, capacity building through training has been carried out for the collaborating partners. Involvement of local artisans from the beginning has been crucial to the ultimate success of the project. The artisans have been trained on how to manufacture, market, installing and maintain the constructed stoves.



**Photo20: A young girl cleaning new improved firewood stove built at their kitchen. Improved firewood stoves relieve children of time spent fetching fire wood rather than devoting more time on their studies**

TaTEDO has also conducted entrepreneurship and business management training. The trainee entrepreneurs have been working closely with the organization through awareness creation activities, hence the increase in number of customers.

The stoves constructed are Okoa stoves designed by TaTEDO. Built of stone bricks and cement chimney, Okoa stoves present a modern approach on environment conservation and poverty reduction initiatives. The stove has been undergoing various significant adjustments and improvements in order to increase its efficiency in firewood consumption as well as incorporating more features to increase its benefits. This improvement has led to the construction of Okoa II and Okoa III, respectively. The stove designs include both physical and technical requirements in order to achieve efficient wood burning and optimize air flow and drafting hot gases channeling. The combustion chamber is aligned with high temperature resistance bricks which cannot be dented when subjected to high temperatures. Also, the heat loss is reduced by the insulated combustion chamber with high temperature resistance blocks.

The stove maximizes heat transfer to the pots and reduces losses of heat through conduction hence reducing cooking time.

Chimney installation to the constructed wood fuel stove reduces indoor air pollution in the kitchen and hence reduces

health hazards to stove users. Field experiences indicate that metallic chimney is expensive. As a result the majority of the beneficiaries of Okoa stove cannot afford to install stoves due to added costs from metallic chimney regardless of its advantages such as fuel saving.

In order to reduce the cost of installing okoa stoves, TaTEDO has undertaken research on constructing concrete chimneys made from proper proportions of cement, lime, sand and sawdust, which are locally available. Feedbacks from field results reveal that the introduced simple chimney has lowered chimney costs by about fifty percent encouraging people to adopt disseminated technology.

### **TaTEDO Board Members Study Tour to the Sustainable Modern Energy Development Projects in the Northern Part of Tanzania**

At the end of 2008, TaTEDO Board Members conducted a study tour in the Northern Zone to see various activities undertaken by the organization. The Board visited Mwanga, Rombo, Hai, and Siha districts in Kilimanjaro Region.

During their tour, the Board Members had an opportunity to see what was happening in different project areas. Some of the projects in these areas include Solar (PV) technology, Improved Wood Fuel Stoves, Tree Nursery, Multi-functional Platform and Baking Oven projects.

The Board Members managed to visit the District Commissioner's Office in Mwanga district and briefed by the former District Commissioner for Mwanga, Jordan Rugimbana on the good work and success of TaTEDO projects in the districts. The District Commissioner was accompanied by the District Council Acting Executive Director and heads of various departments involved in TaTEDO activities and technologies.

While in Rombo, one of the districts in which a voluntary carbon offset market project of improved stoves is being implemented to mitigate the adverse effects of the indoor air pollution; the board members witnessed the impacts made by TaTEDO through the spreading of the improved wood fuel stoves also called "Okoa" Stove to residents of this district. A school teacher in Shimbi Ward explained how the use of stoves promoted by TaTEDO have helped to reduce massive use of firewood thereby contributing to national efforts of preserving natural forests from deforestation. The board members visited some of the families which have been using the improved wood fuel stoves promoted by TaTEDO.

In Machame, the Board Members were thrilled by a large crowd of people who gathered to meet them. People from six villages namely Foo, Wari, Nkuu Ndo, Uduru and Nshana all gathered at Iwasini area ground which different COSEESE usually meet. Also, the board was encouraged by the quorum of women at the meeting. The inhabitants of these villages expressed their desire and need for TaTEDO technologies and

services within their reach. They expressed their willingness to form community sustainable energy enterprises services. They requested TaTEDO to mobilize and organize the establishment of these services in their area.

In Siha districts, the board members visited Magadini village where the village chairman Mr. Emanuel Lukumay gave an explanation on how TaTEDO technologies have been received and lauded by the majority of village residents. In this village the board had a chance to visit tree nurseries and solar technician entrepreneurs.



*Photo 21: TaTEDO board members discussing with one of the several tree nursery owners at Sanya Juu, Siha District, in Kilimanjaro Region*

The board members observed that, there is a need to increase capacity building and training as most entrepreneurs in these districts lack elementary business skills and numerical abilities. Also the organization should design a mechanism of monitoring those who have been trained by TaTEDO in different technologies and skills in order to make sure that the knowledge and skills received are fully utilized for the benefit of the public at large.

### **TaTEDO's Efforts on the Development of Modern Energy Activities in Rukwa Region**

Rukwa Region is located in the remote South-Western extreme part of Tanzania between Lakes Tanganyika and Rukwa. It occupies an area of 75,240sq.km. The region is situated between 5 and 9 degrees latitude south and 30 and 33 degrees longitude east. It is bordered by Zambia to the south-west, the Democratic Republic of Congo to the west, Kigoma Region in the north, and Tabora and Mbeya regions to the north-east and south-east, respectively. Sumbawanga district is one of the four districts of the Rukwa Region, with coverage area of 13,586 m<sup>2</sup>, almost 17% of the total area of the region. The district has 169 villages.

The district has about 69,320 hectares of forest reserve and plantation. A total of 68,973 hectares of land forest reserve which produce, hard timber, charcoal and firewood for the community. About 347 hectares are forest plantations mainly

used for fuel and construction. Firewood and charcoal are the only sources of energy for the poor people in urban and rural areas. Campaigns to create awareness on establishment of private tree nurseries and plantations have been conducted in some villages and schools in order to reduce forest harvesting. Deforestation in Sumbawanga district is still taking place and some efforts (though limited) are in place to train the community on good forest harvesting and management.



*Photo 22: One of the baking training participants practicing to remove cakes from the oven promoted by TaTEDO*

TaTEDO started its activities in Sumbawanga District by conducting participatory rural appraisal in two villages named Laela and Matai. In November 2008, TaTEDO continued with its efforts of implementing modern energy activities in selected rural and urban areas of Sumbawanga district. The sustainable modern energy technologies selected in the first phase for developing modern energy services in the district include improved wood fuel saving stoves and ovens, improved methods of charcoal production, Jatropha (bio-fuels development), solar PV systems, solar phone multi-chargers, solar drying and multi-purpose energy tree crop farming.

TaTEDO, in collaboration with district and municipal councils, NGOs, FBOs, CBOs and interested individuals performed capacity building activities in the villages of Laela, Mtibwa, Matai, Kisumba and others in Sumbawanga municipality. The capacity building activities implemented include training on how to bake using TaTEDO ovens, construction of okoa improved wood fuel stoves, designing and installation of solar photovoltaic, sustainable charcoal production practices using improved charcoal production methods, multipurpose energy tree growing, solar phone multi-charging, etc. The total of 156 target groups (artisans, charcoal producers, solar technicians, baking groups, private tree nurseries, etc) were taught as entrepreneurs and trainers for disseminating the knowledge to other stakeholders. The capacity building activities will continue in other villages through the groups of trainers whom received knowledge and

skills from TaTEDO under the monitoring and supervision of the District Sustainable Energy and Development Clusters (DISEDs) formed by TaTEDO and stakeholders during previous participatory planning meetings.

The TaTEDO initiatives in Rukwa were aired through Sumbawanga radio station to create awareness on sustainable energy technologies and services. The organization will continue with more capacity building activities in Sumbawanga District in the future depending on demand of communities.

### **Tree Nursery planting Provides Income Generating Opportunities to Rural Farmers in Northern Zone**

Thousands of people have streamed to urban areas in recent years in search of employment, including the youth who have abandoned their homes in the rural areas hoping that there is a better life in the urban areas but these dreams always lead to miserable circumstances, as most of them end up living in harsh environments and abject poverty and uncertain of where they are getting their daily bread.

However, there are plenty of opportunities in rural areas created by sustainable energy initiatives. Sustainable energy project benefits include creation and retention of local jobs in a rural economy. Tree nursery, solar drying, charcoal production, and stove making are just a few opportunities which can generate income and therefore reduce poverty and enhance environmental conservation.



*Photo 23: Mrs Jabir Joshua taking care of tree seedling in their family tree nursery*

Hai and Rombo are among the districts which surround Mount Kilimanjaro. The residents in these districts are duty-bound to protect the well being of Mount Kilimanjaro by planting trees in their areas. In order to fulfil this demand, villagers have engaged themselves in tree nursery establishment. A good number of tree nurseries have been established around the area in which tree seedlings are raised for local distribution to farmers so that they can be planted to reverse the effects of deforestation.

One villager who has successfully established a tree nursery in Hai district is Jabir Joshua. Being an old person of more than 60 years, Jabir is still active and participates in income generating activities so as to support his family. Jabir and his wife work daily to make sure that their tree nursery is well managed. Their main activity is to produce seedlings to sell to people around Hai and nearby districts. Between April and June 2009, they produced 5680 seedlings and managed to sell 2200 seedlings. Jabir's family depends solely on agriculture. The tree nursery establishment is one of their major income generating activities. Jabir's nursery is comprised of gravellier, botton brush, bougainvillea, coffee, eucalyptus, oranges and different types of flowers.

Jabiri and his wife are among the Tanzanians who have responded to TaTEDO's initiatives on poverty reduction and environmental conservation. This is a good indication that the natural environment is being rescued from further degradation hence improving the livelihood of the majority in the community.

Nevertheless, Jabiri is not the only person generating income through tree nursery establishment in Wari Village. There are others such as Nassor Mushi, who has a tree nursery which comprises of five different tree species like gravellier, mruka, msese, avocado and guava. Mr Mushi said selling seedlings contributes massively to the family income.

Women are not lagging behind in income generating activities. Ms. Tafiq Mushi is a new tree nursery owner in the district, based at Uduru village. Ms Mushi has a total of 420 tree seedlings of three tree species. There are grevelia 340 seedlings, coffee 50 seedlings and msese 30 seedlings. The tree nursery owner hasn't sold any seedlings but has prospects of expanding her nursery. She needs a water cane, polythene tubes and a wheel barrow to meet her projected goal.

In Rombo district, Ephraim Asenga, a resident of Mamsera Chini village has managed to establish tree nursery comprising of eight tree species which include avocado, gravellier, jatropha, bougainvillea, agrocarpus, and coffee, dovyaris, cafra and lucina.



*Photo 24: Ms Tawfiq Mushi in the routine work of managing their tree nursery at Uduru village.*

Apart from the success they are enjoying, tree nursery entrepreneurs are facing various problems. The main problem is finding reliable markets for their seedlings. This is due to the fact that some farmers don't have enough knowledge about the benefits which can be accrued from tree planting

In addition to job creation, tree planting is a way of providing wood fuel to both rural and urban inhabitants. For the majority of Tanzanians, traditional biomass fuels are an essential source of energy for their daily lives. More than 90 percent of the population depends on charcoal and wood fuel for cooking, baking and heating. Planting trees is a remedial to thousands of trees which are cut down annually to cater for the ever increasing demand for wood fuel and other tree products. Other benefits of tree planting include helping to fight poverty, stopping desertification, fruits and plant medicines, regeneration of the soil, increase of land productivity and improved agricultural practices. Others are off-setting CO<sub>2</sub> levels, counteracting climate change, creating shelter, counteracting deforestation and beautify the environment.

TaTEDO has worked closely with these entrepreneurs in order to ensure their sustainability by providing them with entrepreneurial and business skills that are required in increasingly decentralized tree seed and seedling systems. Knowledge exchange and learning on tree seed handling and management will help increase farm productivity and contribute to natural resource conservation.

### **Solar Drying and Entrepreneurship Training at the Sustainable Energy and Development Centre**

Tanzania has favorable climatic conditions and soil fertility for production of food crops. However the crops particularly fruits and vegetables get spoiled at pre and post harvest periods due to inadequate preservation techniques although there have been more efforts by many food stake-holders to save the losses.

Due to limited knowledge on food preservation, TaTEDO organized and sponsored five days entrepreneurship training on business management and solar drying of fruits and vegetables from 02/03/2009 to 06/03/2009 at Sustainable Energy and Development Centre (SEDC) training Hall, Mbezi Juu, Kinondoni District, Dar es Salaam Region.

The training was a way of developing entrepreneurship knowledge and skills to participants and enabling them to establish and develop their own sustainable business enterprises, consequently contributing to poverty alleviation through employment creation and income generation.

About 19 trainees attended the training with seven men and 12 women who were selected by TaTEDO based on their willingness to learn implementation and management of

the solar drying and business. The training enabled them to get knowledge and skills to improve their day to day work performance. One trainee was from the Coast region, two from Kilimanjaro and the rest were from Dar es Salaam. The training was conducted by Ms Clara Ibihya and Elias Kahabi, who are active facilitators for entrepreneurship development.



*Photo 25: The participants of solar drying training during a practical session put trays of fruits in the solar dryer*

The main objectives of the training were, to impart trainees with basic fruits and vegetable solar drying technology without the use preservatives and to impart business management knowledge and skills required for starting small businesses.

Also to promote individual and institutional networking opportunities for sustainable food processing businesses as well as promoting the effective use of solar driers.

The training had both theory and practical learning sessions. Sharing of knowledge, skills and experience between participants were key methodological steps during training. In the theory session, the participants were taught about Business Management models, drying of fruits and vegetables by using a technology which does not use industrial preservatives in order to safe-guard consumer's health.

The food technology was used according to Tanzania Food and Drugs Authority (TFDA) and Tanzania Bureau of Standards (TBS), which are the two food regulatory institutions in Tanzania. Since the success of any business depends on proper management, elements of good enterprise management were covered. The skills include costing, pricing and supporting enterprises to attain a break-even point, marketing, marketing research, how to generate a profit and expand the business.

Food processing was another part of the theory session through which trainees had the opportunity to learn about food hygiene, food safety, food quality and food assurance. All these topics were to ensure that the quality of food produced is high and safe for consumers.

Major food processing techniques, such as preservation techniques like dehydration, blanching and use of industrial preservatives were taught. Effects of using preservatives to consumers were substantially covered.



**Photo 26: The participants of solar drying training at SEDC, Mbezi Juu, Dar es Salaam**

In food packaging, trainees were taught on issues like types and functions of packaging materials, proper sealing and mandatory information to be disclosed on a food labels as per TFDA requirement.



**Photo 27: Solar dried fruits**

In the practical session, participants were trained on how to dry fruits and vegetables. The decision on the type of food product depended on its marketability, availability of raw materials and processing resources. Facilitators demonstrated how to dry fresh mangoes, pineapples and banana fruits. The participants were also trained on how to dry fresh potatoes, cassava and peas leaves.

Each trainee was given fruits and vegetable recipes which had typical solar drying processes as guidelines for drying vegetables, fruits and other agricultural products. Salt was the only additive used in solar drying of vegetables.

Strict applications of best practices, mainly in good hygiene during the training was the secret behind getting quality and safe processed products. Clean and safe water was used throughout the process. Compliance to good manufacturing practices included blanching, boiling at right temperatures, correct timing and weighing of raw materials and finished goods were subjects taught through this session. There is a need to take on-board correct requirements for achieving maximum solar drying performances and meeting solar drying standards and challenges facing the solar drying business.

During the training sessions, some case studies were given and became very powerful learning points and practical examples for solar drying businesses. For further cementing of what was taught in the class, participants had a field visit to M/s CLAPHIJO Enterprises' fruits and vegetables drying unit at Kibamba CCM for familiarization and practical packaging, including labelling and sealing.

After training, the following were observed as key achievements

- There was a change in mind set of consuming locally processed food. Trainees understood the importance of avoiding imported foods. They also learnt that it is possible to process quality and safe foods at micro levels in the villages.
- Course participants acquired the intended basic fruits and vegetables solar drying and business management knowledge and skills.

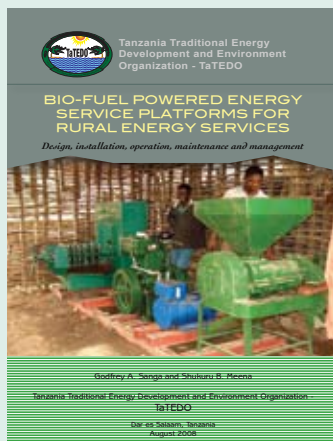
The training initiated cooperation and networking opportunities for TaTEDO, CES and CLAPHIJO. Individuals and Institutional networking opportunities were enhanced among the participants and their organizations. A steering committee was formed as an overseer of the transition period towards having a strong Food Product Driers' Association in Tanzania. The committee was democratically elected by all course participants.

This training was very important to the staff of TaTEDO since an association was established for the development of solar drying business. Participants agreed to prepare a Memorandum of Understanding to guide the association. Participants also promised to share the knowledge and skills with the people in their communities in order to open up opportunities in the country. The training was closed by the Acting Executive Director of TaTEDO Mr. Glory Samson by awarding certificates to trainees. He advised them to produce, consume and sell quality safe food products as a way of building the economy and improving health.

## RELEASE OF NEW PUBLICATIONS

### Resource Guide Book to Bio-fuel Powered Energy Service Platform

TaTEDO has published a guide book for Bio-fuel Powered Energy Services Platform (ESP) for rural energy services. This is a guide for designing, installing, operating, maintaining and managing ESP machines.

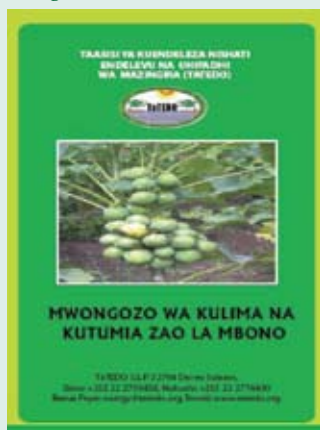


**Photo 29: A cover of the resource manual on cultivation and utilization of Jatropha plant**

The ESP is made up of simple technology and can easily be adapted to meet different energy needs in rural areas. The resource guide book will help people involved in different activities of energy services platform to manage their operations and provide required energy services to the community.

### Resource Manual for Cultivation and Utilization of Jatropha Plant

The production of bio-fuel as an alternative source of energy has gained increased attention in almost ten years. Not only does it provide an effective option for the provision of alternative energy services from the technical point of view, it is based on resources that can be utilized on a sustainable basis all around the globe too.



**Photo 28: A sample guide book for Bio-fuel Powered Energy Services Platform**

The manual provides a thorough guide on crop husbandry and its benefits to the economic and social wellbeing of the country. Key topics covered include jatropha plant and its classes. Planting, cultivation and harvesting of jatropha as well as utilization of jatropha

The manual will be an important publication for energy consultants, agronomists, foresters, project developers, natural and social scientists.

The energy services platforms (ESP) also known as Multifunctional Platforms are simple machines consisting of diesel engines for powering various equipments depending on the need of the people in the community. These equipments (accessories) can be oil press, alternator, milling machines, battery chargers, welding machines, carpentry equipment, etc

## KNOW THE ENERGY UNITS AND OTHER BASICS

### ABBREVIATIONS

Bbl	Barrel (of oil), 159 litres
Bcm	Billion cubic meters (10 <sup>9</sup> m <sup>3</sup> )
Btu	British thermal unit (1 Btu = 1055.06 J)
CNG	Compressed Natural Gas
GJ	Giga joule
GtC	Gigatonnes (elemented) carbon (10 <sup>9</sup> tonnes C)
Gtoe	Gigatonnes oil equivalent (10 <sup>9</sup> tonnes oil equivalent)
GW	Gigawatt (10 <sup>9</sup> watts)
KW	Kilowatt (1000 watts)
LPG	Liquefied Petroleum Gas
Mtoe	Million tonnes oil equivalent
MWh	Megawatt hour
Toe	Tonnes oil equivalent
TWh	Tera watt hours (10 <sup>12</sup> watt hours)
Wp	Peak watt
Sqm	Square metre

### CONVERSIONS

Electrical power is measured in watts	
1,000 watts (W)	= 1 kilowatt (KW)
1,000 kilowatts	= 1 megawatt (MW)
1,000 megawatts	= 1 gigawatt (GW)
1,000 gigawatts	= 1 terawatts (TW)
The kilowatt-hour (kWh) measures the amount of electrical energy supplied or consumed.	
1,000 kWh	= 1 megawatt hour (mWh)
1,000 mWh	= 1 gigawatt hour (GWh)
1,000 GWh	= 1 terawatt hour (TWh)
1 calorie (cal)	= 4.196 Joule (J)

### ENERGY EQUIVALENT

1 million metric tones of oil is equivalent (toe) to:	
1.5 million tons of coal	
1.2 billion Cubic meters of natural gas	
2.5 million tons of fuel wood	
4 terawatt hours of electricity	
2 metric tons of uranium (fast reactors)	
1 barrel of oil = 159 litres	
= 42 gallons (US)	
= 35 gallons (UK)	
1 quad (quadrillion Btu)	
1.05x10 <sup>18</sup> Joules (J)	
1.05 exajoules (EJ)	
3.60x10 <sup>5</sup> metric tons, coal	
1.72x10 <sup>6</sup> barrels, oil	
2.36x10 <sup>5</sup> metric tons, oil	
2.83x10 <sup>10</sup> cubic meters, gas	
1.72x10 <sup>12</sup> cubic feet, gas	
2.93x10 <sup>2</sup> terawatt hours	
1 kilowatt-hour = 3.41x10 <sup>3</sup> British thermal units (Btu)	
= 3.6x10 <sup>6</sup> Joules (J)	
Joule = 9.48x10 <sup>-4</sup> British thermal units (Btu)	
2.78x10 <sup>-7</sup> kilowatt-hours (kWh)	
0.239 Calorie (cal)	
(Generally thought of as the energy content of a match tip)	
1 British thermal unit (Btu) = 2.93x10 <sup>-4</sup> kilowatt-hours (kWh)	
= 1.05x10 <sup>3</sup> Joules (J)	
1 barrel of oil = Approx. 0.136 tones.	

## TARGET GROUPS

### **Sahara (A) Group: A Leading Supplier of Improved Charcoal Saving Stoves in Tanzania**

*By Fredrick Tunutu-TaTEDO*

Just a few kilometres from Dar es Salaam City Centre, on the way to the Julius Nyerere International Airport, one comes across a suburb called Vingunguti. Unlike other suburbs of the City, where most of the inhabitants rush to the City Centre to earn their daily bread, the residents of Vingunguti have managed to create employment in their neighbourhood through charcoal stove manufacturing. Hundreds of cooking stoves are manufactured daily and distributed throughout the country. It is the sort of entrepreneurial initiative, the government will dearly love to encourage across the country.

All these stoves are manufactured by a group of artisans called Sahara (A) group and its associate offspring groups scattered around the area.

The importance of stove artisans to the economic, environmental and social well being of Tanzanians has not been fully recognized. For a long time, artisans have remained the unsung heroes of the country despite contributing significantly and immensely to the health, environmental, economic and social lives of many Tanzanians.

Although most artisans are part of the informal sector in Tanzania, they still work with limited resources and under harsh conditions. Many of them work with no overhead shelter to protect them from the rain and sun and they usually depend on the production of stoves as their sole means of earning a marginal and irregular living.



**Photo 30: An artisan finalizing an improved charcoal stove at Sahara A. Group Workshop in Vingunguti, Dar es Salaam**

Apart from jobs associated with stove making, improved cooking stoves provide a number of benefits. Improved stove efficiency can boost household economies and empower women to reduce the time and expenses involved in obtaining and preparing fuel. The time saved can go towards childcare and other social and economic activities. The use of more efficient and improved cooking stoves is one of the measures that can reduce demand for wood and charcoal fuel. It can also help lower the massive deforestation in many developing countries.

Sahara (A) Group is one of the most successful artisans' groups around the area. Formed in 1994 by 18 artisans, the group has produced thousands of stoves as well as imparted the knowledge to hundreds of artisans scattered around the country.

The charcoal stove manufactured by the group is a portable improved charcoal burning stove consisting of an-hour glass shaped metal cladding with an interior ceramic liner that is perforated to let the ash fall to the collection box at the base. A thin layer of cement is placed between the cladding and the liner.

The chairman of the Group, Mr. Hamisi Nasoro, said that they have been using the profit generated from the business to improve their standard of living.

Before they embarked on stove making, most of the artisans were casual workers earning a minimal income that was insufficient to feed their families. One artisan still remembers how hard it was to start construction work, as they had no required resources in terms of capital and technology. They were not capable of making liners and claddings on their own. They had to buy from Dar es Salaam Small Industries Cooperative (DASICO) and then assemble them in their small workshop; in addition, DASICO members were reluctant to train them on how to make claddings.



**Photo 31: Sahara (A) group chairman Hamisi Nasoro, shaping a metal cladding using pottery heel machine**

However, with determination and high drive they decided to find the alternative way of getting this knowledge. After realizing that DASICO was not willing to train them they had to volunteer their help to other artisans while waiting for their orders of cladding to be produced. By doing so they slowly gained the knowledge and later started to make claddings and liners in their workshop, relieving themselves of the cost of buying claddings from DASICO.

After years of hard work, Sahara has developed and become one of the country's huge stove producers. The success of the group is remarkable. It is the leading supplier of improved charcoal stoves in Tanzania "We worked really hard to achieve our goals and targets, we started with nothing, but you can look around and see for yourself how we have developed this place" said Mashaka Abdala Mashaka, one of the founders of the group. He was proud of the infrastructure they have developed on the ground.

The group, with support from different organizations and local authorities, has managed to construct sheds, kilns for firing clay liners, water wells and a water storage tank.

TaTEDO supported the group by providing them with a water tank, constructed liner firing kilns and a pottery wheel machine. More assistance came from the City Council, which built a manufacturing shed, as well as from the American Embassy, which built water wells.

Additionally, TaTEDO has built the capacity of the group in terms of technical, entrepreneurial and business managerial skills.

Currently, the group has 45 members among whom 11 are women. All of them specialized in different stove making undertakings regardless of gender status. There are artisans who specialize in manufacturing the discrete component of the stove cladding, while others specialize in production and processing of clay liners. Other artisans specialize in assembling the complete stove. In addition there are artisans whose sole occupation is to procure the required raw materials and sell the stove to the customers in retail and wholesale.

The group started with the production of 3,000 stoves per month but the production has increased to 20,000 stoves and 100,000 liners per month yet this does not meet the demand of cooking stoves in the market.

The price of the stoves purchased on wholesale terms ranges from Tshs 2,000 to Tshs 2,500 depending on the size. The cost of building one stove is about Tshs 1,500, making an average profit margin of Tshs 500. But when it gets to the market outside Dar es Salaam, one stove is sold at Tshs 5,000. This shows that the middlemen are earning more than the artisans. This is attributed to lack of economies of scale, poor market competition and production constraints amongst artisans.

The competition has led to several problems, the major one being lack of quality control. With so many liner producers and even more cladding producers, the quality of liner and stoves has deteriorated. This has resulted in producing stoves with low quality. Some liners have cracks and are not durable and some show cracks after only one use. The profit margin has been eroded continuously and the profit motive has driven some liner producers to use sub standard materials. The artisans have therefore resorted to thinner metal sheets for making claddings. The result is the stoves get damaged

after being used for only a short period of time.



**Photo 32: Mr Japo Nasoro making liner at the Sahara (A) workshop**

Despite their achievements in the market, the group still faces difficult tasks before attaining sustainable development. One of the most significant hurdles that Sahara Group is facing is their inability to obtain approved production sites for stove production. The owner of the place granted them permission to use it while looking for their permanent place, but time is running out and he has already given them notice to leave the place.

Mr. Nasoro is urging the government to help them in order to remain in business. He said, former President Benjamin Mkapa ordered the City Authority to allocate a place for these artisans to conduct their business when he visited the group in 1999 but they have not yet received the 'Promised Land' to date. This hinders the group development and has an adverse effect on the wellbeing of the people who depend on the stove production business.

A further problem facing the group and most of the entrepreneurs in the country is the credit availability. In order to grow and prosper, Sahara (A) group and other small enterprises in the stove industry need access to financial services. Adequate credit is essential to establish sufficient production, for it enables them to purchase raw materials in bulk hence cuts down the cost of production.

In order to overcome these obstacles, the group is planning to register itself with the Ministry of Home Affairs. The group also intends to add some more product lines to their business in order to have more strength in the market. In order to do so, they have requested TaTEDO to come up with capacity building training on how to make oven and other new stove technologies.

They believe that TaTEDO has a leading role to play to promote sustainable energy technologies as well as reducing income poverty among the marginalized majority in the country. TaTEDO discourages the use of massive wood fuels, which is detrimental to the growth and regeneration of natural forests and Related effects of deforestation such as carbon sequestration, distributed ecology, climate change and soil erosion.

## Indoor Air Pollution: The Silent Killer of More Than 1.6 Million People Annually

### Scope of the Problem

More than half of the world's population relies on dung, wood, crop waste or coal to meet their most basic energy needs. Cooking and heating with such solid fuels on open fires or stoves without chimneys, leads to indoor air pollution. This indoor smoke contains a range of health-damaging pollutants including soot or dust particles that are able to penetrate deep into the lungs. In poorly ventilated dwellings, indoor smoke can exceed acceptable levels. Exposure is particularly high among women and children, who spend most of their time near the domestic hearth. According to World Health Organization (WHO), indoor air pollution is responsible for the death of 1.6 million people every year - that's one death every 20 seconds.

The use of polluting fuels thus poses a major burden on the health of poor families in developing countries. The dependence on such fuels is both a cause and a result of poverty as poor households often do not have the resources to obtain cleaner, more efficient fuels and appliances. Reliance on simple household fuels and appliances can compromise health and thus hold back economic development, creating a vicious cycle of poverty.



*Photo 33: Cooking with a three stone fireplace means women are subjected to serious health risks.*

According to the 2004 assessment of the International Energy Agency, the number of people relying on biomass fuels such as wood, dung and agricultural residues, for cooking and heating will continue to rise. In sub-Saharan Africa, the reliance on biomass fuels appears to be growing as a result of population growth and the unavailability of, or increase in the price of alternatives such as kerosene and liquid petroleum gas. Despite the magnitude of this growing problem, the health impacts of exposure to indoor air pollution have yet to become a central focus of research, development aid and policy-making.

### The Health Impact: A Major Killer

The World Health Organization (WHO) has assessed the contribution of a range of risk factors regarding the burden of

diseases and revealed that indoor air pollution is the 8th most important risk factor responsible for 2.7% of the global burden of disease. Globally, indoor air pollution from solid fuel use is responsible for 1.6 million deaths due to pneumonia, chronic respiratory disease and lung cancer, with the overall disease burden (in Disability-Adjusted Life Years or DALYs, a measure combining years of life lost due to disability and death) exceeding the burden from outdoor air pollution fivefold. In high-mortality developing countries, indoor smoke is responsible for an estimated 3.7% of the overall disease burden, making it the most lethal killer after malnutrition, unsafe sex and lack of safe water and sanitation.

Indoor air pollution has been associated with a wide range of health outcomes, and the evidence for these associations has been classified as strong, moderate or tentative in a recent systematic review. Included in the above assessment were only those health outcomes for which the evidence for indoor air pollution as a cause was classified as strong. There is consistent evidence that exposure to indoor air pollution increases the risk of pneumonia among children under five years, and chronic respiratory disease and lung cancer (in relation to coal use) among adults over 30 years old. The evidence for a link with lung cancer from exposure to biomass smoke, and for a link with asthma, cataracts and tuberculosis was considered moderate. On the basis of the limited available studies, there is tentative evidence for an association between indoor air pollution and adverse pregnancy outcomes, in particular low birth weight, or ischemic heart disease and nasopharyngeal and laryngeal cancers.

While the precise mechanism of how exposure causes disease is still unclear, it is known that small particles and several of the other pollutants contained in indoor smoke cause inflammation of the airways and lungs and impair the immune response. Carbon monoxide also results in systemic effects by reducing the oxygen-carrying capacity of the blood.

### Pneumonia and Other Acute Lower Respiratory Infections

Globally, pneumonia and other acute lower respiratory infections represent the single most important cause of death in children less than five years. Exposure to indoor air pollution more than doubles the risk of pneumonia and is thus responsible for more than 900 000 of the 2 million annual deaths from pneumonia.

### Chronic Obstructive Pulmonary Disease

Women exposed to indoor smoke are three times as likely to suffer from chronic obstructive pulmonary disease (COPD), such as chronic bronchitis, than women who cook and heat with electricity, gas and other cleaner fuels. Among men, exposure to this neglected risk factor nearly doubles the risk of chronic respiratory disease. Consequently, indoor air pollution is responsible for approximately 700 000 out of the 2.7 million global deaths due to COPD.

## Lung Cancer

Coal use is widespread in China and cooking on open fires or simple stoves can cause lung cancer in women. Exposure to smoke from coal fires doubles the risk of lung cancer, in particular among women who tend to smoke less than men in most developing countries. Every year, more than one million people die from lung cancer globally, and indoor air pollution is responsible for approximately 1.5% of these deaths.

## Disproportionate Impacts on Children and Women

Household energy practices vary widely around the world, as does the resultant death toll, due to indoor air pollution. While more than two-thirds of indoor smoke deaths from acute lower respiratory infections in children occur in African and South East Asian Regions, over 50% of the COPD deaths due to indoor air pollution occur in the Western Pacific region, according to WHO reports.



*Photo 34: Emiline from SEDC cooking and baking with a Multifunctional Improved Firewood Stove (Okoka III) at SEDC, Mbezi Juu, Dar es Salaam. An improved firewood stove like this reduces hazards of indoor air pollution related diseases*

In most societies, women are in charge of cooking and - depending on the demands of the local cuisine - they spend between three to seven hours per day near the stove, preparing food. About 59% of all indoor air pollution-attributable deaths thus fall on females. Young children are often carried on their mother's back or kept close to the warm hearth. Consequently, infants spend many hours breathing indoor smoke during their first year of life when their developing airways make them particularly vulnerable to hazardous pollutants. As a result, 56% of all indoor air pollution-attributable deaths occur in children under five years of age.

In addition to the health burden, fuel collection can impose a serious time burden on women and children. Alleviating this work will free women's time to for productive endeavors, child care, as well as boost children's school attendance and time for homework.

## Millennium Development Goals Guiding International Action

Tackling indoor air pollution in the context of household energy is linked to achieving the Millennium Development Goals, in particular to reducing child mortality (Goal 4), to

promoting gender equality and empowering women (Goal 3), to opening up opportunities for income generation and eradicating extreme poverty (Goal 1), and to ensuring environmental sustainability (Goal 7). WHO, reports the "proportion of the population using solid fuels for cooking" as an indicator, for assessing progress towards the integration of the principles of sustainable development into a country's policies and programs. Yet, the central role of household energy is not currently reflected in the political responses to achieve the Millennium Development Goals.

Measures to reduce indoor air pollution and associated health effects range from switching to cleaner alternatives, such as gas, electricity or solar energy, to improved stoves or hoods that vent health-damaging pollutants to the outside, to behavioral change. There is an urgent need to investigate which interventions can work and how they can be implemented in a successful, sustainable and financially viable way.

## The Role of World Health Organisation

WHO, as a global public health agency, is advocating for the integration of health in international and national energy policies and programs. WHO collects and evaluates the evidence for the impact of household energy on health and for the effectiveness of interventions in reducing the health burden on children, women and other vulnerable groups. The WHO program, on household energy and health rests on four pillars:

- **Documenting the health burden of indoor air pollution and household energy:** WHO, will provide a regular update of the links between household energy and health and, where feasible, offer support to key research undertakings.
- **Evaluating the effectiveness of technical solutions and their implementation:** Developing simple tools for monitoring the effectiveness of interventions in improving health and building the capacity to conduct such evaluations will help generate much needed information from ongoing small- and large-scale projects. This information will provide the basis for the development of a catalogue of options that review both the effectiveness of interventions and lessons learnt in relation to their implementation.
- **Acting as the global advocate for health as a central component of international and national energy policies:** Ultimately, policy-makers will want to know whether it pays off to invest in large-scale operations to reduce indoor air pollution. In terms of health, a recent cost-effectiveness analysis of different interventions suggests that improved stoves and switching to kerosene and gas represent cost-effective solutions. In addition, WHO is working on a cost-benefit analysis of interventions that - beyond health - will take into account all the benefits associated with improved household energy practices.
- **Monitoring changes in household energy habits over time:** Information about the energy habits of poor, mostly rural households is scarce and WHO has the responsibility to work towards progress in this area and to report, on a yearly basis, the Millennium Development Goal Indicator 29 "percentage of population using solid fuels".

## CONFERENCE AND WORKSHOPS

### **International Conference 'Bio-energy Policy Implementation in Africa'**

International COMPETE Conference 'Bio-energy Policy Implementation in Africa' Fringilla Lodge, Chisamba, Kabwe District, Zambia; 26<sup>th</sup> -28<sup>th</sup> May, 2009

The Competence Platform on Energy Crop and Agro forestry Systems for Arid and Semi-arid Ecosystems – Africa (COMPETE) held a conference on Bio-energy Policy Implementation in Africa in Fringilla, Kabwe, Zambia from 26<sup>th</sup> to 28<sup>th</sup> May 2009.

The international conference was organized by the Centre for Energy, Environment and Engineering Zambia (CEEZ) and WIP Renewable Energies, Germany, in cooperation with the Food Agriculture and Natural Resources Policy Analysis Network (FANRPAN), South Africa, in the framework of the project COMPETE, funded by the European Commission, DG Research.



**Photo35: Participants of the international conference on bio-energy policy implementation Fringilla, Kabwe, Zambia.**

Participants of this COMPETE conference were decision makers from several African countries, representatives from the private sector, NGOs, the donor community, FAO, UNEP, international initiatives as well as national and international energy experts and stakeholders.

The main objective of this conference was to contribute to a sound and successful bio energy policy implementation in Africa. For this, global experiences on bio energy policy implementation will be reported and discussed with high-level decision-makers from Africa. Furthermore, partners from the COMPETE project will present lessons learnt on ensuring value creation and sustainability of

bio energy development in Africa in order to:

- Exploit the benefits of innovative bio energy solutions with respect to sustainable rural development and improved livelihoods, increased energy access and income generation, alternative markets for agricultural products, security of energy supply, and diversification of energy sources.
- Avoid the dangers of negative social and environmental implications, with regards to land competition, land ownership, insufficient value creation for local farmers, and the 'fuel versus food' debate.

### **Workshop: COMPETE and RE Impact 'Bio-energy for Rural Development in Africa and Asia'**

This workshop on "Bio-energy for Rural Development in Africa and Asia" was held in Hamburg Germany on 30<sup>th</sup> June 2009. The workshop was jointly organized by the EU co-funded projects "Competence Platform on Energy Crop and Agro forestry Systems for Arid and Semi-arid Ecosystems-Africa (COMPETE)" and "Rural Energy Production from Bio energy Projects: Providing regulatory and impact assessment frameworks, furthering sustainable biomass production policies and reducing associated risks (RE-Impact)".

Bio energy is a sector that offers significant opportunities for rural development in Africa and Asia. The use of biomass for energy generation can contribute to the provision of affordable and accessible electricity services, and in schemes for the production of bio-fuels for transport such as biodiesel. Rising fossil fuel prices, energy security, global warming and rural poverty are all key drivers behind the renewed interest in small and large scale biomass based electricity production schemes. These schemes span both age-old and modern energy conversion technologies, they are the main energy sources for about one-third of the world's population, and will be critical to the achievement of sustainable development across the developing world.

The aim of this workshop was to present local experiences and results from both projects. Dedicated presentations on specific issues such as rural development and improved livelihoods, land use and land use conflict, biodiversity, and appropriate small and large scale bio energy technologies for waste management, electricity and fuel production, will be done by African and Asian partners of COMPETE and RE-Impact.

## United Nations to Stage a Climate Change Conference in Copenhagen

World government leaders will gather in Copenhagen in December, for the annual UN climate change conference. They are expected to agree on a greenhouse gas reduction treaty with legally binding targets to pick up when the Kyoto Protocol expires at the end of 2012.

In 2012, the Kyoto Protocol to prevent climate changes and global warming runs out. To keep the process on the line, there is an urgent need for a new climate protocol. The United Nations Climate Change Conference will take place at the Bella Centre in Copenhagen, Denmark, between December 7 and December 18, 2009. The conference includes the 15th Conference of the Parties (COP 15) to the United Nations Framework Convention on Climate Change and the 5th Meeting of the Parties (COP/MOP 5) to the Kyoto Protocol. According to the Bali roadmap, a framework for climate change mitigation beyond 2012 is to be agreed on.

At the conference in Copenhagen 2009, the parties of the UNFCCC will meet for the last time on government level before the climate agreement is renewed.

Therefore the Climate Conference in Copenhagen is essential for the world's climate and the Danish government and UNFCCC is putting an effort in making the meeting in Copenhagen a success, ending up with a Copenhagen Protocol to prevent global warming and climate change.

The Climate Conference will take place in the Bella Centre. The conference centre is placed not far from Copenhagen and near the Copenhagen Airport, Kastrup.

Government representatives from 170 countries are expected to be in Copenhagen during the conference accompanied by other government representatives, NGO's, journalists and others. In total, 8000 people are expected in Copenhagen during the climate meeting.

The host of the Copenhagen meeting is the government of Denmark, represented by Connie Hedegaard, the Danish minister of Climate and Energy and Prime Minister Lars Løkke Rasmussen. The official secretariat is placed in connection to The Prime Minister's Office in Copenhagen. Originally, the hosting of the Climate Conference was initiated by the former Prime Minister Anders Fogh Rasmussen.

The Danish Government has decided that not only the subject of the conference be focused on climate but the conference itself also. Among other initiatives, the organizers work on the mounting of a windmill near the Bella Center to produce climate friendly electricity for the conference.

The conference in Copenhagen is the 15th conference of parties (COP15) in the Framework Convention on Climate Change. The recent meeting in United Nations Climate

Change Conferences was held in December 2007 in Bali.

The secretary for the climate conferences is the United Nations Framework Convention on Climate Change UNFCCC-based in the German city Bonn.

An important part of the scientific background for the political decisions taken on the conferences is made by the Intergovernmental Panel on Climate Change (IPCC), based in Geneva, Switzerland. The IPCC is established to provide the decision-makers and others interested in climate change with an objective source of information about climate change. IPCC is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Program (UNEP). In 2007, the IPCC received the Nobel Peace Prize. The Climate Conference in Copenhagen is organized in cooperation with the Ministry of Climate and Energy, Ministry of Foreign Affairs, Ministry of Science, Technology and Innovation, Ministry of Finance and the Prime Minister's Office.

### UNITS OF MEASURING CLIMATE CHANGE

#### Global Warming Potential (GWP)

Not all GHGs have the same effect on climate warming. The GWP is the unit of measure of the effect of a given mass of GHG on climatic warming in relation to CO<sub>2</sub> (GWP of CO<sub>2</sub> = 1) over a period of 100 years. The following table shows the GWP value of Kyoto Protocol GHGs

Greenhouse gas (GHG)	GWP
Water vapour: H <sub>2</sub> O	11
Carbon dioxide: CO <sub>2</sub>	1
Methane: CH <sub>4</sub>	23
Nitrous oxide: N <sub>2</sub> O	296
Perfluorocarbons ( PFCs): CF <sub>4</sub> , C <sub>2</sub> F <sub>6</sub>	5,700; 11900
Sulphur hexafluoride: SF <sub>6</sub>	22,200
Hydrofluorocarbons (HFCs): CHF <sub>3</sub> , CH <sub>3</sub> CHF <sub>2</sub> , etc	120 to 12,000

#### Tonne of CO<sub>2</sub> equivalent (t CO<sub>2</sub> equivalent)

To carry on trade in GHG emissions reduction credits, it was necessary to establish a unit common to all GHGs: the tonne of CO<sub>2</sub> equivalent.

The GWP of a GHG is multiplied by the quantity of the GHG emitted in order to determine its emission in tonnes of CO<sub>2</sub> equivalent.

#### CO<sub>2</sub> equivalent tone of a gas x GWP of the gas

For example, methane has a GWP value of 23, which means that it has a warming potential 23 times greater than CO<sub>2</sub>. So when a company emits 1 tonne of methane, this is reckoned as an emission of 23 tonnes of CO<sub>2</sub>

#### Tone of equivalent carbon

GHG emissions may also be counted as tones of equivalent carbon.

Given that one kilogram of CO<sub>2</sub> contains 0.2727 kg of carbon; the emission of one kilogram of CO<sub>2</sub> is therefore the same as 0.2727 kg of equivalent carbon.

$$\text{Equivalent carbon} = \text{equivalent CO}_2 \times 0.2727$$

## TATEDO IN BRIEF

TaTEDO is a sustainable modern energy development NGO based in Dar es Salaam, Tanzania with activities in several districts with more than 17 years experience. TaTEDO is actively involved in sustainable energy development projects and programs in rural areas. The organization is not for profit and is spearheading the development of sustainable modern energy technologies and services, while conserving the environment.

### Vision

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

### Mission

To advance 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 services, poverty reduction, environmental conservation and self-reliance.

### Goals are to:

- 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 sources.



*Photo 38: TaTEDO board members and staff at TaTEDO offices, Dar es Salaam, Tanzania*

### Activities

Through community based integrated and entrepreneurial approach:

- Promote access to sustainable modern energy services for productive use in SMEs including agro-processing industries, consumptive use in households and social service centers (education, health and water),
- Undertake field implementation of sustainable energy programs and projects.
- Provide energy related consultancy services.
- Mitigate environmental adverse effects associated with energy production and use.
- Develop networks and partnerships with local, national and international organizations,
- 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, conduct energy related applied researches
- Capacity building of sustainable energy (contractors and service providers).

### FEEDBACK

Thank you for reading this newsletter. We welcome any relevant articles/ news/events/adverts to share with other stakeholders.

For further inquires/suggestions please contact:  
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