REVIEW OF TaTEDO

Integrated Sustainable Energy Services for Poverty Reduction and Environmental Conservation Program ISES-PRECP

TAN-2308

NORAD COLLECTED REVIEWS 30/2007

Michael G. Angstreich and Msafiri Jackson

Commissioned by the Royal Norwegian Embassy, Dar es Salaam

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June 2007

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1 BACKGROUND

1.6 Summary of Main Points and Recommendation

Population growth and urban growth in Tanzania press woodfuel demand and deforestation upward to the point where deforestation is far outstripping forest regrowth and afforestation. Charcoal production and firewood harvesting provide important income and employment sources as well as domestic services for the Tanzanian people. The improved technologies and energy sources promoted by TaTEDO can contribute to making charcoal production and use environmentally and socio-economically sustainable. TaTEDO is widely recognized as centrally important to Tanzania's efforts for promoting decentralized renewable energy alternatives. Women's status and economy have particularly benefited from TaTEDO's improved, renewable energy technology. Tanzania's need for scaling-up renewable energy technology requires TaTEDO to strengthen quality control, training and service delivery. Close attention to TaTEDO's commercial activities is also required. TaTEDO's work is directly relevant to national, international and Norwegian policies on sustainable development. It is specifically recommended that Norway finance a share of TaTEDO's 4-year project entitled "*Integrated Modern Energy Services for Sustainable Development and Poverty Reduction"*, for which the European Union and HIVOS have already committed support.

1.7 Acknowledgements

The consultants especially thank the Royal Norwegian Embassy in Dar es Salaam and the Tanzania Traditional Energy Development and Environment Organization (TaTEDO) for the excellent technical and logistical support provided at all stages of this review. Our appreciation goes to Norad and Noragric/UMB for channelling such an interesting and timely task to us. Finally, we are grateful to all who took the time to share their knowledge and viewpoints with us.

1.8 Background for the review

TaTEDO is a sustainable energy development NGO with more than ten years of experience in developing sustainable energy projects and programs for rural and urban Tanzania. The overall objective of TaTEDO is to contribute to poverty reduction and environmental conservation. Specific activities include the promotion of improved wood and charcoal stoves, improved charcoal processing and solar energy solutions affordable for the majority of Tanzanians. TaTEDO aims to improve beneficiaries' lives through reduced energy costs and cleaner, more efficient and sustainable energy sources. The beneficiaries of the programme include households, institutions and small and medium enterprises. TaTEDO has also done some initial work on wind power in Tanzania and is involved in pioneering bio-fuels from the jatropha plant (*Jatropha curcas*).

The Norwegian embassy has been supporting specific activities of TaTEDO since the mid 1990s. In July 2003 the Embassy entered into a contract with TaTEDO for a three-year program entitled *Integrated Sustainable Energy Services for Poverty Reduction and Environmental Conservation Programme (ISES-PRECP*). This contract expired in 2006 and a new funding proposal for further programming was submitted. It was agreed that a review of ISES-PRECP should be conducted to assess among other things the extent to which the program's objectives have been achieved and to assess the sustainability of the

program's impact over time. The outcome of this review will form a basis for potential support of the new proposal.

1.9 Methodology for the review

The Norwegian embassy's terms of reference (ToR) for project number TAN-2308 sent and agreed to in early April 2007, provided the instructions for the review (see Annex X). The evaluation team has focused on the main components of the ToR, namely *Efficiency, Effectiveness, Impact, Relevance and Sustainability* plus we had added sections on *Risk Management* and *Replicability.* Thus, a modified version of Format 6 for project reviews from Norad's *Development Cooperation Manual* was employed as a framework for the review. The methodology for the review included document analysis, open-ended and questionnaire-guided key informant and key group interviews. Project site visits and observations were carried out in mid-April 2007. The review team comprised of Michael G. Angstreich of Bioforsk-Norwegian Institute for Agricultural and Environmental Research and Msafiri Jackson of the University College of Lands and Architectural Studies in Dar es Salaam.

1.10 Problem statement

Tanzania's National Forest Policy document of 1998 shows total forest area at 33.5 million hectares, down from 44 million hectares by earlier estimates. FAO has measured deforestation at 130,000 to 500,000 hectares per year (has/a) with afforestation rates said to be as low as 25,000 has/a. Thus the natural capital represented by trees is being diminished. Fuel wood represents 90-92% of Tanzania's annual energy balance while imported petroleum products represent 8%. This 8% import must, however, be paid for by 30% of Tanzania's export earnings. Tanzanians use 1-1.5 m3 fuel wood per capita per annum and some claim that fuel wood accounts for as much as 99% of deforestation.

Cleaner, more energy efficient and environment-friendly forms of energy do exist (solar, hydro-electricity, and gas) but because of Tanzania's general level of poverty no one we talked to thought it would be possible to replace wood and charcoal to a meaningful degree with other sources of energy in the foreseeable future.

Urban population growth drives the charcoal market and thus deforestation in Tanzania. As population increases so does deforestation. As the demand for charcoal grows so does the need for more efficient and affordable renewable energy. Fuel wood harvesting, charcoal production and their marketing are important income and employment sources for Tanzanians. There is unanimity among Tanzanian policy makers that innovative technologies and alternative energy sources can contribute to socio-economic and ecological sustainability of the wood energy sector.

According to information from the Ministry of Natural Resources and Tourism, Department of Forestry, charcoal and firewood account for 75% of deforestation in the Coastal Zone, with charcoal representing the major portion. (The Coastal Zone is one of TaTEDO's project areas.) Farm clearing accounts for another 10% while logging and construction take the remainder. To illustrate charcoal's importance, in the period 2000-2005, 80% of Forest Department royalties in the Coastal Zone came from charcoal traders. In the Western and Southern Zones, farm clearance accounts for 75% of

deforestation with cleared trees also supplying fuelwood. Maize, cotton, livestock, and tobacco are important products in these zones. Tobacco cultivation is especially demanding of the forest as it requires new land annually because of root nematode symbiosis that leads to quickly diminishing yields. Farmers are reluctant to use chemical treatments due to input costs and therefore they clear new forest and woodland for each year's tobacco crop. Added to this is the consumption of firewood for tobacco curing.

Afforestation not only fails to keep up with deforestation in Tanzania but survival rates for out-planted seedlings are low. A pending national tree planting and harvesting plan will try to tackle this problem as well as require the use of improved stoves and improved charcoal kilns.

In addition to the ecological and socio-economic aspects of wood fuel consumption, respiratory and eye ailments as well as burns were reported as important problems.

2 MAIN ToR COMPONENTS

2.1 ENERGY EFFICIENCY

A word on energy or heat efficiency: the percent figures below refer to how much energy or heat is actually used for its intended purpose. The traditional 3-stone stove has a heat energy efficiency of less than 10% (TIRDO, 2001). This implies that more than 90% of the heat is not useable for the intended purpose (e.g. cooking). Improved wood stoves test at efficiency levels up to 25 % (TIRDO, 2001), still not entirely efficient but 2.5 times greater than the 3-stone stove and translating to 50 to 80 % reductions in firewood consumption according to our interviews and the literature reviewed. Another issue, indoor air pollution varies greatly with the type of improved stove (open or chimney) as well as the type of firewood employed and its moisture content. An efficient stove combusts less firewood as it provides sufficient but not excess amounts of combustible air. Both factors lead to lower emissions of toxic gases such as carbon monoxide (CO) and a reduction in the emissions of greenhouse gases such as CO_2.

Ordinary charcoal stoves have a thermal efficiency ranging from 15 to 18% (TIRDO, 2001), while the tested efficiency of improved charcoal stoves range from 22 to 32%. Reduction of charcoal consumption reported by users of improved charcoal stoves ranges between 50 and 60%.

The efficiency range of traditional earth mound kilns is 10 – 20 % (Norconsult, 2002; TaTEDO profile 1). Adoption of better kilns can increase this to 30%. Charcoal making groups we met in Mindu (Tanga) and Msangani (Coast Region) reported interesting results from their own work: At Mindu large traditional kilns give 15 sacks (105 M^3) of charcoal while the improved kiln, though not as large, produce 25 - 30 sacks (210 M^3) of charcoal or up to a 100 % increase. In Msangani, smaller traditional kilns produce 6 sacks of charcoal, while small improved kilns give 10 sacks (65 % increase in conversion of wood to charcoal). In other words, fewer trees need cutting for a given amount charcoal to be produced.

Magadini Primary School has 500 pupils and Florence Moshi has been its Deputy Headteacher since 2004. TaTEDO institutional stove model was installed in 2005 and a solar lighting system in 2006. Both were given to the school by TaTEDO for demonstration purposes. Before the TaTEDO stove there was daily collection of firewood by pupils. Now the pupils bring firewood only once a week from home farms even though the same amounts of food and meals are prepared as before. In addition, the kitchen is now almost smoke-free, something appreciated by the hired cook and the pupils who help prepare the school's daily meals. Nevertheless, there was a 3-stone stove available in case unexpected guests need something over and above the regular meals. The school's solar lighting system enables about 30 primary pupils and 50 secondary students from the neighborhood to study at night, every weekday night from 18:00 to 21:30. This was not possible prior to the installation of the solar lighting system.

Family home of Andrew (accountant) and Helen (housewife and small-scale vendor):
The TaTEDO wood and charcoal stoves have led to a 70% reduction in wood consumption and 50% reduction in charcoal consumption. For quick, early morning tea before he travels by bus to his job in Arusha, Andrew uses a small kerosene burner. Helen sells dried fruits and vegetables from her TaTEDO designed solar drier.

Local community leader Aminiel Mushi recently installed a solar lighting system for Tsh 700.000. Before this he was spending Tsh 20.000/month on kerosene for poor quality lighting. Family has an older version TaTEDO stove for 3 years. It was very effective until the inner chamber expanded after 6 months' use, but it still gives marginal savings. He previously spent Tsh 300.000 per year (on kerosene and batteries for the radio). He therefore expects to recover the costs of solar installation in 2-3 years giving the household 7-8 years of "free" energy since the lifetime of the solar system is 10 years. Fitting of lights around the house, made possible by the solar system, has increased the security significantly. Mr. Mushi complained that he would have saved about 200.000 on the solar system if he had used a more experienced technician. TaTEDO should look into this complaint.

The Magadini SACCOS credit officer complained that late delivery by TaTEDO of ordered equipment encumbered it with greater interest payments to the French NGO, FERT that provides it with loan capital. This led unnecessarily to higher costs for loan beneficiaries (buyers) as the interest is transferred to the consumers. Given the importance of credit for much needed scaling up of renewable energy activity and technology, it behooves TaTEDO to avoid such complaints.

The women who operate the Masaki Restaurant in Sanya Juu reported previously using 2 sacks of charcoal / week at Tshs 20,000 but were now, with the TaTEDO institutional stove, using only 1 trailer of firewood / 2 months (Tshs 20,000) meaning a fuel cost reduction of 87%. No more smoke in the kitchen made it a healthier and more pleasant workplace.

Lushoto District Officer Shelukindo has a TaTEDO stove at home and saves "tremendously" on firewood. He does not doubt its contribution to conserving woodfuel

and the forest. A village woman in her kitchen told him that with the 3-stone stove one head-load of wood lasted for 2 to 3 days while with the improved stove a head-load now lasts 15 days.

At Msangani, Coast Region we were shown an ingenious method for saving more energy. A pot of rice was cooked to a boil on an improved stove, then taken from the stove and placed in a basket insulated with grass and cloth on all sides. The cooking process was completed with the insulated heat. Cooking takes longer but saves fuel.

We inspected the micro-hydropower project at Kinko in Lushoto District. UNIDO was the initiator of this project and a consultant was hired from India. TaTEDO gave this consultant logistical and local contact backup while learning from him how to build local capacity in micro-hydropower. The system was installed in September 2006 but broke down in February 2007. The power plant has a capacity of 9 KW and is designed to serve 100 households with electric power for light and other power requirements such as radios and charging of cellular phones. Fifty two (52) households are so far connected with electric power. Each household is expected to pay Tshs 1500 per month as its contribution for maintaining the system. Since kerosene used to cost Tshs 9000 per month, there will be a saving of Tshs 7500 per month per household. It is also expected that a flour milling machine in the village will be connected to the electric power. Our visit revealed that the plant has not been operating since February with possible reasons for the plant shutdown to include:

1. Sub-standard design, low quality materials and poor construction workmanship
2. Improper operations of the plant
3. Absence of or unimplemented organizational structure
4. Poor management including not collecting monthly dues from power beneficiaries
5. Silt/stones clogging the turbine
6. The sluice wall was damaged by flooding both at its beginning under the dam and at its end above the turbine house
7. Silting behind the dam has almost reached the top of the dam.

It is recommended that, TaTEDO bring together stakeholders (UNIDO, TANESCO, Lushoto District Authority and Village Authority) to address the shortcomings in this rather unique and important project. Despite the above, villagers are not discouraged. They lack however organization for dealing with even ordinary maintenance problems. TaTEDO has written to UNIDO a month ago proposing to discuss and resolve the technical problems. It is presently awaiting UNIDO's response. With Tanzania's potential for micro-hydro power and its need for clean energy, it is recommended that TaTEDO not only do what it can to facilitate technical and community solutions for Kinko power project but also project the lessons from this experience for future work with micro-hydro power elsewhere.

2.2 TaTEDO's ORGANIZATIONAL EFFICIENCY

Here we looked at TaTEDO's structure and financial reporting during the grant period. Currently TaTEDO has a 10-member Board of Directors of which 2 are women.

TaTEDO's staff of 32, includes 9 women. Besides setting policy for TaTEDO, through Meetings, the Board Members do advocacy for renewable energy technology and public relations work including fundraising and linking TaTEDO to other like-minded organizations. TaTEDO's staff is divided into 7 program departments:

1. Clean Development Mechanisms and Decentralized Renewable Energy Systems, Environmental Impact Assessment, Energy Environment Initiatives
2. Biomass-based Decentralized Renewable Energy Systems, Stoves and Ovens
3. Decentralized Renewable Energy Systems, Solar driers and off-grid Electricity
4. Information, Networking, Public Relations and Organizational Marketing
5. Decentralized Renewable Energy Systems Strategic Planning and Development, Monitoring and Evaluation
6. Finance, Administration and Human Resource Development
7. Fundraising and Organizational Development

We got the impression of a functional management structure with fairly horizontal decision-making and responsibility sharing. To an outsider, though, some of the departmental names appear repetitive (e.g. Decentralized Renewable Energy Systems) and TaTEDO might consider streamlining these.

TaTEDO observed a number of constraints in marketing its products. These included lack of knowledge on the part of would-be beneficiaries; absence of information on energy technologies; a lack of suitable financing mechanisms for consumers, producers and distributors of TaTEDO products; limited capacity in terms of business management skills and inadequate technically trained manpower. One way of addressing these constraints, was to establish a subsidiary company, "Sustainable Energy and Environment Company" (SEECO). This is a non profit sharing company, meaning that profits are plowed back into its own development activities, i.e. not paid out to investors. The goal of SEECO is to produce and market improved energy products including charcoal stoves, charcoal ovens, wood stoves, bio-waste stoves, solar cookers, fireless cookers and baking tools in order to reduce TaTEDO's dependence on donor funding. So far, the demand for the company's energy products is greater than the supply. However, the company lacks enough capital to finance production of energy products at a level corresponding to demand. A sufficiently capitalized and properly run SEECO would complement other national TaTEDO fund raising efforts.

On the financial side, below is a summary of the Norwegian grant, 2004-2006:

Year	40% USD in contract	NOK in contract	TZS received in audit	Including TZS from 2003
2004	191,233	1.400.000	221.467.000	15.675.437*
2005	143,142	1.300.000	211.129.010	
2006	128,303	1.300.000	225.851.276	
		4.000.000	658,447,286	

The audits for each year of the Norwegian supported project were reviewed. Each audit contained the auditor's report, a balance sheet, detailed income and expenditure statements, notes, statements on cash flow, fixed assets, cash and bank balances, debtors, provisions and accruals, income and expenditures by program. The audits appear thorough and professional as does TaTEDO's financial management.

Norad's grant to TaTEDO for the year 2004 was TZS 205,791,563 (NOK 1.400.000). However, the amount stated in the audited financial statement for is TZS 221,467,000. The difference of TZS 15,675,437* resulted from carry-overs deferred to 2004 from grants in 2003 and expensed in 2004. Our question is if this carry-over amount should have been made note of in the audit.

Organizational training is an area that is emphasized by TaTEDO. Training is carried out at three levels:

- Human resource capacity development, through formal and on-the-job training, of TaTEDO staff for implementing programs
- Training of partners in order to enhance their collaboration and implementation skills including knowledge sharing with grassroots organizations.
- Technical, business and community service training for target groups

From board members to the executive director, financial and other program department managers, researchers and drivers, all display professionalism, dedication and updated knowledge. Our enquiries were always met with quick, helpful and knowledgeable responses. Our impression is of a team effort whose aim is to see TaTEDO succeed in its mission.

2.3 EFFECTIVENESS

Here we describe the output of TaTEDO's activities as well as our observations from field visits and a previous evaluation.

Below are selected annual activity results for each of the project years, total for those years and cumulative since 2000:

Activity	2004	2005	2006	Total	Cumulative 00-06
Charcoal stoves	14,205	10,800	181,252	206,257	1,204,307
Wood stoves	---------	1,186	1,891	3,077	116,442
Tree seedlings	194,135	85,411	130,943	410,489	551,767
Solar lanterns	80	7	2	89	94
Solar PVs	8	360	130	498	515
Solar driers	6	20	30	56	80
SMEs/Insts.	776	17	24	817	1.426
Hh savings/a (avg)	?	236,667 Tsh	355,000 Tsh	---------	----------
Afforestation	n.a.	55 has	82 has	137 has	?
Tree has. saved	650 t/h	2,891 t/h	2,556 t/h	6,097 t/h	?
Reduced CO2	25,000 mt	20,629 mt	311,028 mt	356,657 mt	?

In most cases, there was high adoption of the technologies in the first year as compared to the second and third year because most of the areas were covered during that year (2003/2004). On the other hand, in the second year efforts were put on capacity building of the target groups (artisans, technicians, SMEs, personnel, etc). These were then involved in production and dissemination of the technologies and building capacity of others (e.g. stove artisans, etc).
In this regard, it was difficult to get all the data of the installed systems. As for SMEs and institutions, most of those were covered during the first year and hence more efforts were put on building technical capacity of target groups to promote program sustainability.

Adoption of lanterns is low because special campaigns and imported parts are needed. Most people would prefer solar PV systems because, in addition to better lighting, which was also reported to have a positive effect on home security, they provide power for radios, charging cell phones etc. In some cases, the latter has become a business.

In Lukozi, Lushoto we visited a TaTEDO liner-maker who sells 220 stove liners per month to Arusha, Tanga and the local market. Most of his business is in charcoal stove liners but wood stoves are sold locally. He reports a great increase in demand and is looking to set up other distribution points.

Woman stove-maker on a steep hillside at Hamboyo not far from Lukozi reports so much demand that she has no time to go to town! She has sold over 1000 TaTEDO stoves but has recently added a portable GTZ model stove as a way of diversifying her business. This is a cheaper stove for which there is some local demand. She continues to make and sell TaTEDO models, which she says are of better quality.

Agar and Kakinda conclude in their evaluation report of June 2003, done for HIVOS, that TaTEDO, *"*has enabled the widespread adoption of the improved charcoal stove in Dar es Salaam. It has pioneered more efficient charcoal making methods that are beginning to be adopted. It has built a well-respected capacity in Solar PV technology. It has influenced energy and forestry policy for the better. It is close to making its liner production business profitable and has won competitive consulting, research and training contracts as a commercial provider. They finish by saying that, "TaTEDO has the capacity, the networks and the confidence of other stakeholders to deliver a more impactful programme."

2.4 IMPACT/ EXPECTED IMPACT

The government, private sectors and non-governmental organizations, including TaTEDO, all promote the use of renewable energy technologies (RET) in Tanzania. Representatives from all these sectors consider TaTEDO the leader in this field. It should also be mentioned that TaTEDO's influence extends to and is recognized by international actors. Along with its large Tanzanian network, TaTEDO shares information with like-minded contacts in Bolivia, Brazil, Costa Rica, Honduras, Kenya, Uganda and Vietnam. TaTEDO has won an international prize for good development and its executive director, E.N. Sawe, is a recently appointed member of an ad-hoc UN committee on renewable rural energy.

Through the ISES PREC program, TaTEDO has reached a large number of beneficiaries. It is estimated through TaTEDO's own monitoring, internal evaluation surveys and field visits conducted by TaTEDO, Participatory Rapid Appraisal (PRA) methods including group discussions, meetings and transect walks, continuous communications with stakeholders through telephone, internet and use of monitoring tools including monthly forms and reports from beneficiaries, that the average percentage of beneficiaries as part of the general population in the target areas is about 22 percent.

As indicated in the activity table and the Agar and Kakinda conclusion, both under 2.3 EFFECTIVENESS, above, impressive results have already been attained and there is certainly potential for greater impact at many levels. As stated previously, fuel wood harvesting, charcoal production and their marketing are important income and employment sources for Tanzanians. An estimated 1-10 million people are employed, full and part-time, by these activities. There was strong consensus among our respondents that new technologies and alternative energy sources can contribute to the economic and ecological sustainability of these activities and of the nation's forests and woodlands.

Following are some probable impacts of TaTEDO's work with renewable energy:

Improved Kilns: A ban on charcoal making and charcoal marketing in certain areas must be addressed by government to facilitate improving the economy of producer group members and fulfill the potential for environmentally sustainable poverty reduction. As illustrated in the EFFICIENCY section of this report, the new improved kilns promoted by TaTEDO produce more charcoal from fewer trees.

Improved Wood and Charcoal Stoves: Increases in profit margins are already evident and can be expected to continue for restaurants and other businesses using TaTEDO's improved technologies. There are health benefits due to less kitchen smoke and less labor needed to collect fuelwood. A 30 to 70% reduction in the need for wood will free up labor for other opportunities, improve household and institutional economies and impact favorably on the environment. Small industry jobs and skills are created as more people become artisans and entrepreneurs involved in charcoal stove making.

Charcoal Ovens: This activity has already proven popular with and profitable for women's groups and individual female entrepreneurs. Customers, both individual and institutional, are supplied with freshly baked products of good taste and quality. Demand is growing.

Solar PV: Solar photovoltaics have the potential to reduce indoor air pollution and the prevalence of respiratory and eye ailments due to kerosene use, as reported by some respondents. It provides better lighting for reading, homework and home security. Once the initial cost of installation and periodic battery change is overcome, several years of "free" service can be expected thereby improving household economy.

Micro-Hydro Power: This form of electricity generation offers cheap and clean energy that can impact positively on village economy through power to small-enterprises and

improved health benefits through better lighting, reduction in eye and respiratory ailments, reduction in biomass and kerosene use.

Jatropha: Interest in biofuels from the fruits of the *Jatropha curcus* bush is tremendous, not least from European firms. On the positive side, jatropha oil is not edible, so it does not compete as a food crop. It can be used directly as a diesel substitute, can be a cheap and clean burning substitute for kerosene, and can be cultivated perennially on marginal soils. It can be a cash crop for poor farmers in marginal areas. On the negative side, there is great pressure on the Ministry of Energy and Minerals to provide land for large-scale jatropha cultivation and this could compete with food production. One European group has requested 50.000 hectares (500.000 dekar) of Tanzania land by December this year. To create positive impact such requests must be accompanied by assurances of contract farming on individual or community owned land. How to promote jatropha for small farmers? Two % jatropha as cooking fuel and lamp oil will reduce the need for fuelwood and kerosene by the same amount.

Multi-Functional Platform: is an innovation from West Africa that TaTEDO is testing for promotion in Tanzania. It consists of an all-in-one unit comprising of a 10 HP Lister diesel engine with and alternator, a vegetable oil press and a maize milling machine.
The engine can run on jatropha oil and other machine components (e.g. cassava mill or palm kernel cracker) can be substituted. If TaTEDO's pilot project proves that the MFP performs well in Tanzania, it offers many possibilities for local small-scale industry development.

Wind energy: TaTEDO is collecting data from various sites in the country. Previously the cost margin was not attractive compared to oil, but with today's oil prices the economics of wind energy are becoming more favorable.

Health: As reported above, common respiratory and eye aliments can be reduced through the use of improved energy technology. HIV/AIDS victims will enjoy the labor saving aspect of not having to collect as much woodfuel.

Gender: Women appear to be the all-around winners of TaTEDO's improved energy technologies through health benefits from less kitchen air pollution, labor saved in wood collection and cooking, and not least the small enterprise and income generation opportunities open to them as individual and/or group entrepreneurs.

2.5 RELEVANCE

Worldwide "1.6 billion people around the world do not have access to reliable energy sources. The impact of this is measured in poverty and degraded ecosystems. Technologies for providing energy to rural communities are available – solar panels, wood stoves, and micro-hydro are just some examples of technologies which can be mobilized for rural households and villages" IUCN, 2007, **www.iucn.org/energy**

"If renewable energy, energy efficiency and clean conventional technologies are more widely used, with a focus on decentralized systems, benefits can be reaped for economic

and social development as well as for environmental protection." --- "To implement the goal accepted by the international community to halve the proportion of people living on less than one dollar per day by 2015, access to affordable energy services is a prerequisite." WEHAB Working Group, *A Framework for Action on Energy* (World Summit on Sustainable Development, Johannesburg, 2002, pages 7 and 10).

Norway "The poorest are most vulnerable because they lack resources enabling them to adapt to climate changes and because their value creation in large measure is based on nature and its resources. Increased investments in low-carbon technology, increased energy efficiency and increased use of renewable energy are central to meeting these challenges." - - - "Simple and decentralized solutions will be central in this context." (Translation from Thematic priority 4.3 on page 17 of *Regjeringens handlingsplan for miljørettet utviklingssamarbeid* (The Norwegian Government's Action Plan for Environmental Assistance in Development Cooperation), June 2006, Norwegian Ministry of Foreign Affairs, Oslo.

Tanzania "The main reasons for deforestation are clearing for agriculture, overgrazing, wildfires, charcoal burning and over-exploitation of wood resources." --- "Bioenergy is the main source of fuel for the rural population and accounts for 92% of the total energy consumption for the country." Tanzania National Forest Policy, 1998, pages 8-9

"Promote efficient biomass conversion and end-use technologies in order to save resources; reduce rate of deforestation and land degradation; and minimising climate change threats." Tanzania National Energy Policy 2000, Policy Statement 48, page 18.

"Reduction in forest loss for woodfuel, sustainable reliability and security of energy supply. Promotion and dissemination of affordable energy technologies." Tanzania National Forest Programme 2001-2010, Objectives, pages14-15.

"Goal 6: Provision of reliable and affordable energy to consumers." Including "Cluster Strategy 6.2.1, Develop and promote utilization of indigenous energy resources and diversification of energy sources". Tanzania National Strategy for Growth and Reduction of Poverty (NSGRP), 2005, ANNEX, page 13.

Ministry of Energy and Minerals, acting commissioner Mr. Mwihava and energy engineer Mr. Fitwangile "Energy is necessary for Tanzania's development. Use of indigenous sources is crucial including solar, biomass, hydro and wind. A World Bank project from 1988 to 1992 was successful for stoves but not for charcoal kilns. Why not?

1) Forestry ordinance laxness did not provide incentive for efficiency
2) No supervision of kilns
3) Forest officers unmotivated

Deforestation is alarming: 91,270 has/a. Per capita wood consumption is $1m^3$/a x 36 million people = 36 million m^3 wood consumption/year. The mean annual incremental tree growth is 25 million m^3, meaning an 11 million m^3 deficit each year. Protection of

indigenous trees is most important combined with improved charcoal making. TaTEDO was involved in developing Tanzania Energy Policy. Ninety percent (90 %) of Tanzania's energy is from biomass, 8% from imported oil products. The 8% costs 30% of Tanzania's annual export earnings. The most direct method for reducing biomass consumption is through simple, cheap appropriate technologies and TaTEDO is a leader at this. It needs to grow, build capacity, keep abreast of technology development, attract and retain qualified staff. Rural Energy Agency being established *inter alia* to support efforts such as TaTEDO's effort. At present the Ministry only has USD 100.000 in its budget for renewable bioenergy activities."

Edward Shilogile of the Ministry of Natural Resources and Tourism, Dept. of Forestry:
"TaTEDO's improved kilns, especially its sub-surface kiln is definitely saving trees. Great interest of the Ministry is to reduce rate of deforestation through improved charcoal burning. TaTEDO is central to this and is making a substantial contribution. Norwegian supported Natural Resource Program recently ended covering 15% of the country has provided important lessons and best practices for future national coverage. National coverage is now being discussed with Norway. Improved charcoal production (kilns) and consumption (stoves) were and will be important components of a future program and TaTEDO will be involved. Best practices learned from the former project include farmer-owned woodlots for firewood sale and catchment forestry for protecting watersheds."

The East African Community Energy Strategy "Support efforts to develop and adopt the use of improved cook stoves, means to reduce indoor air pollution, and measures to increase sustainable biomass production"

HIVOS: This Dutch NGO has been and continues to be a major supporter of TaTEDO's work. Program Officer Minda Groeneveld-Jusay said that, "Norwegian support has been highly complementary and will continue to be so in the new program that is being partially financed by the EU. It has strengthened TaTEDO's ability to scale-up and allows it to attract engineers and other skilled people for rural, grassroots work. Technology transfer is crucial for rural development, for example micro-hydro power."

2.6 SUSTAINABILITY

Sustainability of TaTEDO's program on improved technology and products depends on compatible national policies and the ability of TaTEDO to satisfy the potential market in Tanzania.

Ninety percent (90 %) of energy consumed in Tanzania is in a form of biomass (mainly wood). Eight percent of energy in Tanzania is imported petroleum products (using 30% of Tanzania foreign revenue). Only 1.3 to 1.5 % is in the form of electricity (hydro or thermal). The deforestation rate in Tanzania is 91,270 hectares per annum. Annual biomass consumption as energy in Tanzania is estimated to be 36 million M^3 (compared with 25 M^3 forest increment). There is thus a net forestry loss of 11 million M^3. Tree cutting for wood fuel and charcoal making are the main culprits for the forestry net loss. Charcoal making from traditional kilns requires 10 – 12 tons of wood to produce 1 ton of charcoal.

To reduce the amount of wood used for biomass fuel, two strategies are considered:

1. Finding alternatives to wood
2. Reduce wood consumption by increasing the efficiencies of charcoal making kilns and cooking stoves

The first option is not attainable in the short and medium terms. Wood biomass will remain a major component of the energy mix in Tanzania for many years to come. Efforts to optimize biomass production and use must continue. Tanzania Energy Policy encourages efficient use of renewable energy including biomass. TaTEDO has done very well and it is ranked number one in this area. It has delivered results in accordance with its planned objectives. These include awareness-raising, training programs, renewable energy technologies, and poverty reduction initiatives. As an example, where as charcoal making from traditional kiln requires 10 – 12 tons of wood to produce 1 ton of charcoal, TaTEDO's improved charcoal kiln requires only 6 to 7 tons of wood to produce 1 ton of charcoal.

Whereas TaTEDO initially focused on biomass only, it has diversified its activities in recent years and is currently also promoting the use of solar energy and min-hydro power. It has also done some initial site screening work on wind power farm in Tanzania and it is also involved in the pioneering work on bio-fuels from the jatropha plant. Technologies promoted by TaTEDO are in-line with Tanzania policies. Based on the discussion held between the evaluators and the Acting Commissioner for Energy in the Ministry of Energy and Minerals as well as other officials, it is obvious that the Tanzania Government values very much TaTEDO's contributions in the areas of affordable energy, environmental protection, and poverty reduction.

As time, geographic and personnel demands for TaTEDO's services increase, organizational capacity becomes an issue, including technical skills, monitoring ability, administration and finance, awareness-raising, outreach, consultancy, etc. TaTEDO is aware of this and plans for an organizational diagnostic to be done later this year by EASUN in Arusha. The exact time is yet to be fixed.

Muheza, Tanga - Edward Lyawere, District Natural Resources Officer: "Charcoal production is very important in Mkinga (New district formed after creating two districts from the former Muheza District). A tree-harvesting plan for each village is now being designed including tree harvesting and planting ledger. Money is lacking for supervision (fuel and transport).Many trees are being planted on farmland but four years of drought have killed many. Awareness raising and training need more emphasis. Land scarcity requires sustainable intensification: agroforestry needed throughout the district, including intercropping with food crops, cashew in Mkinga, rubber in Muheza, improved rice and maize varieties, tomato and onion production can compete with Lushoto area. District has no cash crop after sisal production was laid down."

Mindu village charcoal group, chairperson Hassan Mkonga: "Kiln sites are temporary and follow the trees. We are very pleased with production results from the TaTEDO kiln.

Regulation limits production to trees at sites being cleared for farming. Marketing made awkward by the need for permits. One member did his own experiment comparing TaTEDO kiln to traditional kiln. We get Tsh 3500 per sack of charcoal while the same sack sells at Ths 7000 to 8000 in Muheza".

Muheza women's group got into bread and cupcake baking with a TaTEDO charcoal oven and training. They sell everything they bake. They need another oven and more bread pans. They buy charcoal in Muheza at Tsh 8000 per sack and use improved wood and charcoal stoves in their home kitchens.

Msangani, Coast Region – Eight women and 6 men came to the meeting and showed us their activities: Charcoal burning, stove-making, tree planting. They are interested in setting up a marketing depot on the main road some 10 kilometers away. This will fetch them a better price for their charcoal but they need guidance and credit.

ProBEC is a SADC financed and GTZ implemented project that has been partnering with TaTEDO since 2004. It restricts its promotion to firewood cooking stoves of various designs and sells 10-20 institutional stoves per month and 5000 household stoves per year. It does training for TaTEDO and vice versa. It just started working with employed farmers working with big companies supplying them with stoves. Companies pay artisans for producing stoves while farmers pay back to the company on credit. ProBEC has seminars on tea estates. ProBEC will be exiting in the near future and is considering turn over to TaTEDO as one alternative in its exit strategy. A study will decide the exit strategy. TaTEDO's Clean Development Mechanism (CDM) ties may provide an answer to the sustainability issue although this is very preliminary. Norway should follow this process.

Norway has been presented with a new 4-year proposal for scaling up and spreading TaTEDO's activities and technologies that includes expansion to Rukwa, among other districts. This is very much in line with the UN-WEHAB admonition to scale up successful projects. The budget for the new proposal totals USD 2.9 million with 10% coming from TaTEDO itself, 13% already approved from the European Union and 77% expected from others including Norway. Components include competence building for entrepreneurship, business and cooperative management and the establishment of decentralized local energy centers. A pilot activity for tying village and district energy teams to the energy centers is envisioned. After the pilot phase it is intended that the district councils will budget for these teams by retaining a small percentage from charcoal and wood sales, stove and oven sales, etc.

2.7 FINANCIAL SUSTAINABILITY

TaTEDO employs a fund raising strategy that has been developed by a special committee comprising of management and board members. The aim is to ensure that TaTEDO will achieve financial sustainability and reduce donor dependence over a phased period of several years. From 2001 to 2005, TaTEDO raised Tsh 609.539 from membership contributions and Tsh 415.750.371 from consultancies. Together these total Tsh 416.359.910 and represent about 16% of total revenues of Tsh 2.527.342.788 (including

donor funding) during the same period. From the information provided there appears to be an upward but erratic non-donor income trend.
On the other hand, SEECO, which was formed to provide commercial income to TaTEDO, shows revenues of Tsh 196.909.425, expenses of Tsh 271.836.295 and losses of Tsh 74.906.870 over the same period. Here, too, a trend is difficult to discern, although it is clear that TaTEDO's overall income situation can be eroded if SEECO's losses continue. SEECO is still a young energy company and efforts are being made to secure SEECO's commercial viability through:

- Low-interest capitalization from institutions specializing in lending to energy projects
- Product diversification, e.g. from traditional charcoal and wood stoves to more solar products
- More mechanization of production processes
- Cost savings through efficient management
- Strengthened leadership, vision and commitment.
- Development of a clear product pricing policy
- Sales strategies and income targets for each product and each service offered

To summarize, TaTEDO's consultancy services are providing good income to the organization while it is taking steps to make SEECO a going commercial concern. Hands-on management and close monitoring of this business venture are advisable.

In its non-commercial development activities, TaTEDO has experienced some problems in recovering start-loans from some groups. This appears to be due to poor entrepreneurship and business management skills and the perception that NGO funds are really grants. As a result TaTEDO focuses on developing entrepreneurs by providing them with business management skills in order to realize profits from their business, to sustain their services and pay back the loans provided to them. More of the actual handling of funds to entrepreneurs is now being undertaken by the local microfinance organizations under collaborative agreements with TaTEDO.

On the efforts of TaTEDO to diversify its income sources and reducing its dependence to donor fund, TaTEDO has a subsidiary company SEECO, a non profit sharing entity whose objective is to commercialize proven modern energy technologies developed by TaTEDO while supporting other entrepreneurs to do the same. On some occasions TaTEDO is subcontracted by different clients to carry out consultancy services. This has become another source of income. Also through working closely with the local authorities, the energy and environment activities are expected to be included in the development plans and be allocated locally mobilized financial resources.

2.8 RISK MANAGEMENT

The programme has encountered a number of risks, and TaTEDO is managing these risks by employing various strategies. Some of the risk and the risk management strategies instituted by TaTEDO are as follows:

Poor recovery of loans from some "entrepreneurs".
TaTEDO is managing what could be considered a "revolving fund" whose intention is to give loans to entrepreneurs. Recovery of such loan is important if more people are to benefit from such funds. In some cases, recover has been very difficulty. An example is that of a charcoal stove making group in Vingunguti, Dar es Salaam who were given a loan for a liner curing kiln and a water tank. To date they are yet to re-pay the loan. TaTEDO is working hard to educate borrowers and all entrepreneurs on proper financial management (which is a problem in the Vingunguti group as well as other groups) and the importance of servicing loans. Repayment of loans does not appear to be a problem with women's groups.

Inadequate support by some village governments and collaborating institutions in the implementation of some activities.
In some activities such as the Kinko micro-hydro power plant, the participation of stakeholders in resolving plant breakdown problems has not been very good. TaTEDO strategies include bringing stakeholders together for discussions on how to address operational problems.

Poor quality products.
Demand is outstripping the supply of wood, charcoal, ovens and stoves; sales of charcoal stoves are undergoing an exponential multiplier effect in Tanzania. This demand has led to spontaneous and uncontrolled fabrication of poor quality stoves by a myriad of producers. These are cheaper and thus price-wise can be more attractive than TaTEDO's high quality stoves. Energy products supported by TaTEDO, its trained artisans and entrepreneurs are closely monitored by TaTEDO, its partners and related stakeholders. Some TaTEDO supported products are labeled with stickers to differentiate them from other products.

TaTEDO does physical inspections of the entrepreneurs it services but it is not here that the problem exists. Because of the uncontrolled production, and because quality control through inspection of all producers is logistically impossible, the strategy being adopted by TaTEDO and partners such as ProBEC is to create broad consumer awareness of the criteria for identifying quality stoves. This way, potential buyers will have the information necessary to choose and purchase high quality products even if it means paying more. Automation of some of the production steps such as that of making standard metal hinges and metal casings can help. Thus, quality control is an issue of broad-based consumer education and awareness as well as entrepreneurial pride and craftsmanship.

TaTEDO will continue to seek collaboration with the Tanzania Bureau of Standards to come up with standards for commercial energy products with which all producers will be required to comply. TBS, we heard, is so far hesitant in involving itself because it considers this the informal sector.

Changing government directive: Ban on tree cutting for charcoal making
The banning of tree cutting affected people who were trained by TaTEDO to use improved charcoal making kilns. In a long run the government intention is to make sure

that for a very tree cut down, several trees are planted. TaTEDO is intensifying its support to tree nursery activities to ensure availability of tree seedlings. TaTEDO is also training charcoal makers on tree planting techniques.

2.9 REPLICABILITY

The project activities are fully replicable and they seem to be doing so spontaneously. In fact, this becomes a problem for quality control as more and more craftsmen and traders beyond TaTEDO's reach and supervision produce and market stoves.

The project can claim 410,489 tree seedlings produced and outplanted in the program. This is undoubtedly beneficial but we suggest that there may be quicker, more extensive ways to save forest and woodlands. Even if all 410,489 trees survived the years it would take very long time to attain useful size, a highly doubtful assumption, 50 trees/ha would represent 8,210 hectares protected and in production. Actual survival rates range from close to zero to as much as 95% (the latter through controlled planting and replanting on government land). Grevillea, Acacia and Mringaringa (Cordia africana) were reported as being the best fuel woods, for both firewood and charcoal. The first is an exotic species; the latter two are indigenous. All can be purchased by farmers or landowners for afforestation but the numbers we observed in TaTEDO-subsidized nurseries, while adequate for individual, small-scale private plantings, would not seem to provide the extensiveness required for significant forest regrowth.

In contrast, managing the survival of indigenous seedlings that sprout naturally on farms and in the forest may offer a natural selection process that precludes the need for purchasing and planting seedlings. TaTEDO and its partners may want to consider more forest and kiln-site tree management activities for "covering more ground" and increasing impact. Kiln-sites are moved according to availability of suitable trees. At these sites, the trees are often cut so low to the ground that they lose their ability to regenerate. Leaving more of the trunk to survive would encourage budding and coppicing. Identifying and caring for desirable tree seedlings that regenerate naturally on farmland (agroforestry) and on woodland (forest management) are other methods. In all cases, stewardship is necessary but natural selection better ensures survival at less cost and less labor.

3 CONCLUSIONS and CHALLENGES

The reviewers conclude that TaTEDO is a highly professional and dedicated NGO that is continually searching for ways to improve itself and the renewable energy solutions it offers. TaTEDO already plays a prominent role in Tanzania's environmental and economic development, not least in rural areas but also in the country's growing urban areas. Through scaling up of its activities it has the potential for affecting widespread impact. For TaTEDO and its partners in development the list of challenges is long. Lack of credit is an obstacle to scaling up. This is true for producers as well as consumers of technology. TaTEDO did a needs-assessment that included price considerations. As a consequence, TaTEDO has designed solutions for every price level/ and almost all potential customers. Many more would like to have stoves but it's a matter of finance and low purchasing power. This is especially true for stoves with chimneys, the least indoor

air polluting kind. Awareness-raising and price are crucial. A Dutch bank, Triodos, is talking to Tanzanian banks about increasing credit for expanding production and sales. Even so, from our site visits and interviews with users, producers and distributors demand appears to be outstripping supply.

Other considerations:

- Product quality is an issue of continual importance for consumers and for TaTEDO
- Maintenance of sold products needs to be strengthened by training more technicians and ensuring quick troubleshooting
- Stricter selection of stove lining materials is needed to minimize cracking
- More emphasis is needed on teaching entrepreneurship, marketing and business management skills to entrepreneurs
- Human resource capacity development and staff retention by TaTEDO will become an issue as others attract away TaTEDO employees and as work expands
- Of eight million households in Tanzania, approximately 5 million need TaTEDO-like services. Seventy % of households in Dar es Salaam need improved charcoal stoves.
- Capital is needed to help entrepreneurs get started in other parts of the country, not least the towns. What about a start-capital fund for TaTEDO trainees to initiate businesses?
- Is tree planting the most effective way of increasing forest stock in project areas? What about the selection and care of naturally regenerating tree species?
- Youth need more attention and not least opportunities for positive livelihoods.
- SEECO should be managed and monitored very closely.

Little of the above is new to TaTEDO. The organization is known for keeping itself abreast of developments in its field and constantly improving itself. Nevertheless, attention to these issues will help to retain its leading edge position in decentralized renewable energy development and promotion.

3.1 RECOMMENDATION

TaTEDO is widely recognized as a central force in Tanzania's efforts to promote decentralized renewable energy alternatives. TaTEDO's work is directly relevant to national, international and Norwegian sustainable development and poverty reduction policies. In addition to Norway, it has attracted the support of donors such as the Germany's GTZ and the European Union. Norway should continue to support TaTEDO by financing a share of the new proposal entitled "Integrated Modern Energy Services for Sustainable Development and Poverty Reduction", to which the European Union and HIVOS have already committed themselves.

This proposal's main objective is to scale up access to improved energy technology and services in 19 Tanzanian districts. TaTEDO intends to accomplish this over a 4-year period by:

- Building local capacity at the district and village levels to implement energy related

policies and integrating energy with other sustainable development and poverty reduction initiatives

- Building technical and business capacities to meet increasing demand for energy technologies and services
- Developing 1ocal entrepreneurship and market potential with support from micro-finance institutions
- Promoting liquid and gaseous biomass fuels from multipurpose plants such as jatropha
  and biogas material in order to reduce depletion of woodfuel resources
- Facilitating access to credit in order to increase target groups' access to modern energy technologies and services
- Promoting decentralized energy systems to speed up access of rural households, SMEs and social services to improved energy technologies and services

As such, the new proposal answers the need to broadly scale up energy technology access while incorporating lessons learned from the ISES-PRECP project (TAN-2308) previously supported by Norway.

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5 APPENDICES

5.1 APPENDIX 1 PEOPLE CONSULTED

	NAME	AFFILIATION	POSITION
1	Anandumi Ulomi	TaTEDO Board	Vice-Chairman
2	Rev. Kristofa Mahimbo	TaTEDO Board	Member
3	Mohamedi Mbelwa,	TaTEDO Board	Member
4	Joshua S. Meena	TaTEDO Board	Member
5	Mrs Frida P Temba	TaTEDO Board	Member
6	Mrs Freda Chale	TaTEDO Board	Member
7	James L. Ngeleja	TaTEDO Board	Member
8	Estomih Sawe	TaTEDO Board	Board Secretary/TaTEDO Exec.Officer
9	G. Ngoo	TaTEDO	Coordinator, Energy Environment Initiative
10	G. Samson	TaTEDO	Coordinator, Finance and Adminstration
11	E. Ngoye	TaTEDO	Coordinator, Monitoring and Evaluation
12	L. Pesambili	TaTEDO	Coordinator, Bio-energy
13	B. Kashangaki	TaTEDO	Extension Officer
14	Edward Lyawere	Mheza District Office	District Natural Resources Officer
15	H. B. Shelukindo	Lushoto District Office	District Natural Resources Officer
16	Sofia Shelubaha	West Usambara Women Education (NGO)	Staff
17	Mrs Mbaga	West Usambara Women Education (NGO)	Staff
18	Modey Nyimbile	Amani Conservation Project	Staff
19	Hassan Mkonga	Mindu Charcoal Making Group	Chairperson
20	Ibrahim Ali Manyeko	Mindu Charcoal Making Group	Group Member
21	Kihampa Dorothy	Owner of Tree Nursery and Drier	Entrepreneur:
22	Rukia Chamuzin	Nyota Women Group, Muheza	Entrepreneur:
23	Asnath Hoza	Nyota Women Group, Muheza	Entreprieneur:
24	Bakari Amin	Household with TaTEDO stoves	Stove Users
25	Hamis Nassoro	Sahara Stove Makers Group	Stove Maker/Chaiperson
26	Sima Kashindye	Sahara Stove Makers Group	Stove Maker/Chairperson
27	Julius Mwalongo	Ruvu forest project	Govt. official
28	Ezekiel Shigalu	Msangani SACCOS	Chairperson
29	Mathias Ngamila	Msangani SACCOS	Secretary and Treasurer
30	M. Mayala	Msangani SACCOS	Secretary – Charcoal Sub-Group
31	Tunu Ali	Msangani SACCOS	Chairperson Tree farming
32	Josephine Malongo	Msangani SACCOS	Member - Charcoal making
33	Joyce Ngaza	Msangani SACCOS	Member – Tree nursery
34	Martha James	Msangani SACCOS	Member – Charcoal making
35	Julius Malongo	Msangani SACCOS	Member- Charcoal and Tree farming
36	Rebecca Mayala	Msangani SACCOS	Member- Stove Making and Tree farming
37	Asia Juma	Msangani SACCOS	Member - Tree farming
38	Zamda Ngajuja	Msangani SACCOS	Member- Stove Making and Tree farming
39	Mana Madingu	Msangani SACCOS	Tree nursery
40	Edward Shilogile	Ministry of Nat. Res. and Tourism	Dept. of Forestry, Extension Specialist
41	Amina Lwasye	Norwegian Embassy in Tanzania	Programme Officer

42	Bodil Maal	Norwegian Embassy in Tanzania	First Secretary
43	Minda Groeneveld-Jusay	HIVOS	Programme Officer
44	Marianne van der Pol	HIVOS	Programme Officer
45	Camilla Risvoll	Noragric UMB	Project Officer
46	Arild Skåra	Norad Headquarters	Senior Advisor
47	Jarle Hårstad	Norad Headquarters	Evaluator
48	Tore Laugerud	Norwegian Consulting Group	Consultant
49	Mr. Mwihava	Ministry of Energy and Minerals	Acting Commissioner
50	Mr. I. Fitwangile	Ministry of Energy and Minerals	Energy Engineer
51	Lars Kåre Grimsby	Energy Africa	Consultant
52	Arfakisad Ndilanhu	ProBEC	Director
53	Marie Bergstrøm	Sida	Senior Advisor Energy

5.2 APPENDIX II: SOME STAKEHOLDERS RESPONSES

Table 1: Household and Institutions Stove / Oven / Solar PV Users

Respondent name	Type of facility owned	Year of Installation/ purchase	Previousily used facility	Changes due new technology	Impact to Household and Community	Remarks / Recommendation toTATEDO
Magadini Primary School – Ms. Florence Mushi, Deputy Head Teacher and Ms. P. Kileo, Cooker (Sanya Juu)	Firewood Stoves with Vent Solar PV	2005 2006	3 Stones stove No lighting	Fuel wood consumption reduction 50%, No more smoke in the kitchen, Cookers not burnt by fire, Cooking pots last longer, 80 day scholar students now have 3 extra hours for preparatory study at night.	Forest protection, Reduced health risks to kitchen workers. students expected to perform better	
Mr. Andrew Kimaro, Mrs. Helen Kimaro (Sanya Juu)	Charcoal stove & Oven Firewood Stoves with Vent Solar PV	2004 2006 2005	Charcoal stove 3-stones Kerosene lamp	Cut down charcoal needs by 50% Cut down firewood demand by 70 % Save Tshs 240, 000 per year previously used for kerosene, Security light has improved the security.	Forest protection, Improved household economy	Many want the improved firewood stove with vent and oven, however the prices are still high for those in low income bracket
Mr. Aminiel Mushi (Magadini)	Firewood Stoves with Vent Solar PV	2005 2006	3-stones Kerosene lamp	Reduction in firewood consumption for first 6 months only, current firewood consumption like in 3 stones. Six Artisans trained, 20 stove built. Batteries for radio not needed anymore, Charging cellular phone done at home, Save Tshs 240, 000 per year previously used for kerosene, Security light has improved the security.	No significant impact Improved household economy	Strengthen quality control of products and trouble shooting activities. PV solar acquired through SACCOS loan via TATEDO expensive (at Tshs 700,000) than when acquired through individuals (at Tshs 490,000), More outreach needed, Need more than one TATEDO representative.

Respondent name	Type of facility owned	Year of Installation/ purchase	Previousily used facility	Changes due new technology	Impact to Household and Community	Remarks / Recommendation toTATEDO
Mrs. Ebinezeri Mmari /Ms. Angela Mmari	Firewood Stove with vent Solar PV	2006 2006	3-Stones Kerosene Lamp	50 % reduction in firewood consumption New stove cook fast and no smoke. Batteries for radio not needed anymore, Charging cellular phone done at home, Save Tshs 240, 000 per year previously used for kerosene, Security light has improved the security,	Forest protection, Improved economy Prevalence of Respiratory diseases due to kerosene usage has gone down, Improved economy, Improved security around the building.	Kitchen filled with smoke when it malfunction, 3-stone used for pots of different size
Angaza Women Centre (Partner of TaTEDO) – Ms Edith Rajab (cooker), Mrs. Emma Mmari (Manager)	Charcoal Oven / stove Charcoal Stove (two – round and rectangular top)	2003 (?) 2005	Normal Charcoal stoves Gas stove / Normal Charcoal Stove	Less charcoal used for all stoves and oven, Able to bake sufficient bread for students in a short time, Reduced human resources requirements No smoke except when the charcoal is not good.	Forest protection, Improved economy	Frequent breakage of linings/pot support for rectangular charcoal stove and charcoal oven cum stove Quality assurance and control needed Process / design /materials improvement for linings needed Reduction of response time of artisans in troubleshooting
Mrs. Shahili Mbwana (Hamboya Lushoto)	Firewood Stove without vent (earlier TaTEDO model) – Similar to Mkombozi model	2005	Usambara Stove	80 % reduction in firewood consumption Smoke reduced	Forest protection, Improved economy as more time devoted for economic activities instead of wood collection	

Table 2: Commercial and Entrepreneurial Beneficiaries

Name of Beneficiary	Type of Business	Acquired Equipment, Materials, or Training from TaTEDO	Year the Equipment or Materials were Acquired	Used equipment or materials before TaTEDO intervention	Changes following the Intervention	Impact on the Business and Community	Recommendation by Clients and Remarks
Masaki Shop and Restaurant – Ms. Catharine James (Sanya Juu)	Restaurant	Improved Firewood Stove with Vent	2006	Normal Charcoal Stove	Previously used 2 sacks of charcoal / week (Tshs 20,000) now using 1 trailer of firewood / 2 months (Tshs 20,000). Fuel cost reduction by 87%, No more smoke in kitchen. Have not experienced any breakdown. One other restaurant already use improved stove.	An increase in profit margin.	
Ms. Beatrice Exaud Sawe (Bomang'ombe)	Distributor of Charcoal Ovens and Stoves, Bake and sell breads	Receive Charcoal Ovens from TaTEDO for distribution	2005	Was not in this kind of business	Sell an average of 4 ovens per month at Tshs 270,000 each and 15 improved charcoal stoves at Tshs 4,500 each. The demand is increasing, Several Women Group have purchased oven for bread business, Has not experienced any serious technical problem from clients.	Improved economy Poverty reduction for Women engaged in bread business using TaTEDO Oven	To further expand the market, aggressive market needed including advertisement in news media outlets.

Name of Beneficiary	Type of Business	Acquired Equipment, Materials, or Training from TaTEDO	Year the Equipment or Materials or Training were Given	Used Equipment or materials before TaTEDO intervention	Changes following the Intervention	Impact on the Business Person and Community	Recommendation by Clients and Remarks
Mr. and Mrs. Michael Tarimo	Making and selling bread, Owning a shop for general groceries	Charcoal Oven (one)	2006	Not in bread business	30 breads baked per hour Supply breads to other shops There is one other bread supplier owning the TaTEDO Oven also. The demand is still high	Expansion of business and more profit, Villages supplied with fresh quality breads	The beneficiaries satisfied with the oven performance
Mrs. Mary Hiza – Kibo Garden Tree	Trees Seedlings Nursery	Attended Training organized by TaTEDO on Business Management, Given: Seedlings (50,000), Wheel barrow, Hose pipe, polyethylene tubes (10,000), Sieve, and Watering Can	2003	Was running a small tree seedlings nursery with an average of 80,000 seedlings	150% expansion of average number of seedlings (up to 200,000 seedlings at a time) TaTEDO support enabled the entrepreneur to set the price of most of tree seedlings at Tshs 100 per seedling and fruit tree seedlings at Tshs 500 per seedling	Improved economy of the entrepreneur, Availability of tree seedlings at reasonable price	
Mindu Village Charcoal Making Group (8 members): Mr. Hassan Mkonga – Chairperson	Charcoal Making	Attended training organized by TaTEDO on charcoal making	2005	Charcoal making using traditional method	Cutting fewer trees and producing more charcoal. Big traditional kiln gave 15 sacks (105 M^3) of charcoal while Improved kiln give 30 (210 M^3)sacks of charcoal	Expect improved economy of group members Cutting of fewer trees	TaTEDO support in form of working tools (e.g. saw mills) required. Barn on charcoal making has affected the group negatively.

Table 3: Stove Makers

Name of Stove Maker	Type of Stove	Year of commence ment	Production Capacity	Nature of TaTEDO Support	Changes for artisans and community	Impact to the Artisans and Community, Recommendations and Remarks
Mr. Denis Tarimo and Mr. Joseph Mariki (Mahango, Rombo)	HMTF firewood stove (Liner) Firewood Stove with Vent		200 in two years 16 in two years	Attended a Coarse in Stove Making	HMTF stove have high and constant demand, It emit smoke in the room, It is cheap (Tshs 2000) Demand of Firewood Stove with Vent gradually increasing (Tshs 60,000), It consume less wood compared with 3-Stones	HMTF firewood stove produced by TaTEDO partner, Its price is cheap, TaTEDO encourage its use. Encourage the use of Firewood Stove with Vent for those who can afford as it consume less firewood and smoke emission is minimal compared to HMTF
Mr. Hassan Mangare-Workshop Owner – Lukozi, Lushoto	Stove Linings Charcoal Stove Firewood stove	2005	500 linings per month 100 per month (price range Tshs 3500 – 5000 per stove) Mass prod. Not yet	Given a loan for construction of kiln for lining and workshop building Attended several training Used a trainer at Lushoto District	Selling 220 liners per month in Arusha and Tanga Job creations: Artisans trained by Mangare who are now in Arusha are using linings to make stoves in Arusha (soon to locate another team in Moshi).	Improved economy of the entrepreneur. Job creation for other artisans (multiplier effect) Need further training in oven production

Table 4: Kinko Micro-Hydro Power

(Main funder UNDP – with involvement of TaTEDO in the implementation)

Name of Respondents	Date of Commencement (Power Generation) and Current Status	Capacity	Changes	Impact to Community	Observed Possible Reasons for Problems and Remarks
Mr. Said Ayub and Mr. Kisaka Nyaki	2006 (currently not working)	9 KW, Planned to serve 100 households	52 houses connected with electric power. Electric lighting in these houses. Each household expected to pay Tshs 1500 per month as contribution for electric energy. Since kerosene used to cost Tshs 9000 per month, there will be a saving of Tshs 7500 per month for a household. A flour milling machine to be connected	Improved economy of the villagers is expected Improved health of the Kinko community as a result of emissions from kerosene combustion.	Sub-standard design and construction workmanship Improper operations of the plant Absence or unimplemented appropriate organization structure Poor management including not collecting monthly dues from power beneficiaries It is recommended that, TaTEDO bring together stakeholders (UNIDP, TANESCO. Lushoto District Authority and Village Authority) to address the shortcomings in this rather unique and important project.

Table 4: Ministry of Energy and Minerals

Name and Position of Respondent	Tanzania Policy and Biomass / Renewable Energy	Current wood biomass energy generation / consumption and efficiency	Government Options in reducing wood biomass used for energy and its Strategy	Government Activities which Compliment TaTEDO Initiatives	The Future of TaTEDO and Biomass use it Tanzania
Mr. N. Mwihava (Ag. Commissioner of Energy) and Mr. I. Fitwanginle (Chemical Engineer)	Tanzania Energy Policy encourages the use of Renewable Energy. TaTEDO promote use of Biomass, Solar, and Wind energy. It pays attention to link to energy need and environmental protection. Technologies promoted by TaTEDO are in-line with Tanzania Policies	90 % of energy consumed in Tanzania is in a form of biomass (mainly wood). 8% of energy in Tanzania is imported petroleum products (use 30% of Tanzania foreign revenue to import). Only 1.3 to 1.5 % is in the form of electricity (hydro or thermal). Deforestation rate in Tanzania is 91,270 hectare per annum. Annual biomass consumption as energy in Tanzania is estimated to be 36 million M^3 (compared with 25 M^3 forestry increment). Charcoal making from traditional kiln require 10 – 12 tons of wood to produce 1 ton of charcoal	Wood biomass will remain a major component of the energy mix for many years to come. To reduce the amount of wood used for biomass (forestry protection); two strategies have to be used: Look for alternative to wood, and reduce wood consumption by increasing the efficiencies of charcoal making kilns and cooking stoves. Improved charcoal kiln require 6 to 7 tons of wood to produce 1 ton of charcoal.	The rural energy urgency is being established (expected to be represented at regional and district level). Along with this, rural energy fund will be established to support people in acquiring efficient energy facilities The National Biofuel Task force has been appointed and it focuses on liquid bio-fuels. Expected to review relevant policies, draft pertinent law, and propose strategies	Wood biomass will remain a major component of the energy mix for many years to come. Effort to optimize their production and use has to continue. TaTEDO is ranked number one in this area and other renewable energy technologies. TaTEDO has done very well in this area, and it has delivered according to its set down goals. It has maintained the quality in terms of its awareness training programmes, renewable energies technologies, and poverty reduction initiatives. TaTEDO needs to develop and retain its staff.

5.3 APPENDIX III: TERMS of REFERENCE

ToR FOR - Review of TaTEDO

Project name : **Integrated Sustainable Energy Service for Poverty Reduction and Environment Conservation Programme**

Project number : **TAN-2308**

Agreement name : **Tanzania Traditional Energy Development and Environment Organization**
ENVIRONMENT
TaTEDO

Agreement number : **03/303**

Is the Checklist used when writing this ToR	Yes	No
	X	

1 Background

- *Short description of the programme that will be reviewed, based on the Agreement, Programme Document(s) and appraisal*

TaTEDO is a sustainable energy development NGO, with more than ten years experience actively involving itself in developing sustainable energy developments projects and programmes in rural and urban areas.
The overall objective of the programme is to contribute to reduction of poverty and environmental conservation. The specific activities include promotion of wood fuels stoves, improved charcoal products and solar PV. In so doing the income of the beneficiaries is increased through reduced costs and increased efficiency in utilisation and production of efficient wood fuels stoves, ovens and charcoal production klins.The beneficiaries of the programme include households, institutions and Small and medium enterprises.

- **Why the review is initiated**

The Embassy has been supporting TaTEDO since mid 1990's on specific programmes. In July 2003 the Embassy entered into a contract with TaTEDO for a three years support to a programme known as *Integrated sustainable Energy Services for poverty reduction and Environmental conservation Programme (ISES-PRECP*). The contract expired in 2006 and a new proposal and request for further funding was submitted.
It has been agreed that a review should be conducted to asses among other things the extent to which objectives have been achieved and also to asses the sustainability of the impact over time. The outcome of this review will form a basis for potential support.

- Team composition and leadership. An external consultant will be commissioned by Norad and will be assisted by a local consultant identified by the Embassy.

Team Composition:

1) Michael G. Angstreich, MSc
Senior Advisor for Development Cooperation
Bioforsk - The Norwegian Institute for Agricultural and Environmental Research
Høgskoleveien 7
1432 Ås, Norway

2) Prof. Msafiri Mmamba Jackson
University College of Lands and Architectural Studies (UCLAS)
Dar es Salaam

2 Purpose, context and intended use

Description of the main purpose, context and intended use (stakeholders)
The main purpose of this review is basically to assess the performance of the programme in relation to the overall goals and objectives of the programme and its effectiveness and relevance.
Specific purposes:
-To determine and describe the extent to which intended results were achieved or are likely to be achieved.
-To determine and describe what has been achieved with regard to the new energy technologies and the impact on the communities where the Project was implemented, in terms of increased capacity in environmental protection and increased income.
-To determine whether the support to TaTEDO is consistent with the new Embassy's Environment and Natural Resources Management Programme under preparation.
- To assess and come out with observations and recommendations on the programme management and administrative systems.

The review will help the Embassy in considering potential cooperation based on the proposal submitted.

3 Scope of work

The review will address the general aspects of the programme as follows: (for definition of the review criteria, see Annex III in the manual)

- Efficiency
- Effectiveness
- Impact, including that on poverty, environment, gender and HIV/AIDS issues.
- Relevance
- Sustainability

4 IMPLEMENTATION of the review

- *Sources of information and methodology to be employed*

The review team will define methodologies and techniques to be employed based on their experience and expertise. However they should include review of key documents, interviews and field visits to few selected areas.

- *Division of responsibility between the consultant/team, the Embassy*

  The Embassy will be responsible for the logistical arrangements and payment of an independent local consultant. The Independent consultant from Norway will be the team leader

- *Timetable for preparation, field work and finalisation of report*

  The review team will present an inception report to the Embassy and a work plan for carrying out the assignment.
  The team will begin the task not latter than the 10th April 2007. A draft report will be submitted to the Embassy not latter than the 28th April 2007 and a final report by 15th May 2007.

5 Reporting

The reports should contain the following:

- An executive summary of conclusions and recommendations as well as lessons learned, of maximum two pages

- A full text report with methodology and findings, conclusions and recommendations

- The Reports should be sent in electronic version and paper version and must be in English language.

Approved……. Date……