



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project number: XX/URT/09/X01

Project Title: **Mini-grids based on small hydropower sources to augment rural electrification in Tanzania**

Starting date: June 2011

Duration: 4 years

Project site: United Republic of Tanzania

Government co-ordinating agencies: [Ministry of Energy and Minerals, Rural Energy Agency and Vice President's Office-Division of Environment](#)

Host country counterparts: Ministry of Energy and Minerals,
Division of Environment – Vice Presidents Office,
Rural Energy Agency,
Tanzania Electric Supply Company Ltd.,
College of Engineering and Technology - University of Dar es Salaam and
Private sector enterprises

Executing Agency: United Nations Industrial Development Organization (UNIDO)

Cooperating Agency: Rural Energy Agency

Project Inputs:	US\$
- UNIDO inputs (In-cash):	80,000
- GEF inputs:	3,350,000
- Support cost on GEF contribution (10%):	335,000
- Counterpart inputs:	
✓ Rural Energy Agency (In-kind and Cash)	7,000,000
✓ Andoya Hydro Electric Power Company (In Cash)	2,500,000
✓ Behindertenhilfe Neckar-Alb (In-cash)	112,500
✓ Ministry of Energy and Minerals (In-kind)	36,000
✓ College of Engineering and Technology (In-kind)	50,000
- Grand Total:	13,463,500

Brief description:

This project will develop micro / mini hydropower based mini-grids in Tanzania to supplement the country effort to increase the access to rural electrification. It will reduce GHG emissions resulting from the use of traditional energy sources in rural Tanzania. Micro / mini hydro power will substitute the GHG intensive diesel generators in areas, where there are no electricity.

Tanzania possesses substantial proven technical potential for generating power using small scale hydro power particularly in highland's headwater catchments. The potential for small scale hydro power accounts for about 300-500 MW, of which, only around 24 MW has been developed so far.

Wide development of micro / mini hydro power has not been realized, despite its potential and available opportunities. This is due to various reasons including lack of proper institutional structure to support the development of small hydropower schemes, lack of technical expertise, high cost and difficulties in sourcing and importing equipment and lack of local manufacturing capabilities/facilities.

This project therefore aims at addressing most of these barriers by establishing a platform for the development of small scale hydro power in the country. The activities will include i) conducting detailed feasibility studies for the demonstration sites, ii) building of capacity for the stakeholders in developing micro / mini hydropower based mini-grids and iii) developing viable business model for micro / mini hydropower based mini-grid and iv) demonstration of micro / mini hydropower plants for a cumulative capacity of at least 3.2 MW. The project is expected to strengthen the policy, regulatory and institutional framework supporting the micro / mini hydropower based mini-grid systems in Tanzania.

The project is expected to build necessary human and institutional capacities at all levels in order to achieve the scientific, engineering and technical skills and also the infrastructure necessary for the design, development, fabrication, installation and maintenance of micro / mini hydropower plants.

The proposed micro / mini hydropower based mini-grids to be setup under the project are expected to bring global benefits by reducing around 335,658 t CO₂e directly and around 2,685,185 t CO₂e indirectly, which otherwise would have resulted from the use of diesel generators, as it is the most common electricity source in Tanzania.

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A. CONTEXT

A.1. Origin of the proposal

This project is a result of discussion between UNIDO and the local stakeholders in Tanzania, particularly the Ministry of Energy and Minerals (MEM), the Rural Energy Agency (REA), Division of Environment - Vice President's Office (DOE-VPO) and the national power utility, Tanzania Electricity Company Limited (TANESCO) among others. This project will assist, MEM through the REA in promoting renewable energy (RE) projects with special focus on Micro / mini hydropower projects in Tanzania.

UNIDO initiated the project design and the preparatory work, which led to the formulation and submission of the Project Identification Form (PIF) for micro / mini hydropower based mini-grids and Project Preparation Grant (PPG) to the GEF under project GF/URT/10/003 and YA/URT/10/002.

During the PIF preparation, there was an indication to get co-financing from bilateral aid agencies. However, the money from the donor agencies is now being channelled through the government agencies. The co-financing sources are the REA, MEM, the private developers, who have secured financing from different sources including local financing institutions and the donors. On approval of the PIF and PPG, the design and formulation of the project proposal has been finalized through PPG resources made available by the GEF and UNIDO.

A.2. The background

Tanzania has a population of around 40 million and only less than 14% of the total population has access to electricity from the national grid. About 70% of total population live in rural areas and in that only less than 2% has access to electricity. Lower levels of electricity access and commercial energy use are the major challenges faced by the Tanzanian energy sector, which in turn holds back the country's economy.

More than 50% of the population, who live in poverty, spend more than 35% of their household income to meet their energy needs (like buying kerosene, charcoal and dry cells) as compared to 14.5% spent by the better-off population¹. This situation burdens the poor people who are devoid of electricity with more financial constraints to satisfy their energy needs.

The Government of Tanzania has placed rural electrification in its agenda. The Government has also established REA with the views to promote rural energy services, to facilitate modern energy projects for rural areas and to provide technical support for the developers. In addition, the Government has also established a Rural Energy Board (REB) and a Rural Energy Fund (REF) aiming at rural electrification. On the regulatory side, Standardized Power Purchase Agreement (SPPA) and Standardized Power Purchase Tariff (SPPT) exist for small power producers (SPPs). SPPT is revised on annual basis by the regulatory agency, Energy and Water Utilities Regulatory Authority (EWURA).

The government is also working on the development of feed-in-tariff (FiT), which will set a fair and stable ground for the renewable energy (RE) technologies in relation to commercial aspects.

¹ Partners for Africa Policy Dialogue Conference, 22nd - 24th June 2005, Tanzania National Energy Policy: Focus on Renewable Energy and Poverty Reduction. J. Uisso, & N. Mwihava, Ministry of Energy and Minerals

On the financing side, a World Bank (WB) credit line is available for providing subsidy to RE investments in Tanzania.

As a part of the policy reforms towards promotion of RE, the Government of Tanzania provides exemption on import duty for RE equipments. But, due to the high inflation rate prevailing in the country, the prices of the imported equipments are becoming high. As a result of this, the project developers import RE equipments very rarely and hence to a larger extent, have failed to reap the benefits of import duty exemption provided by the Government.

As of September 2009, Tanzania had a total installed capacity of 961 MW², out of which, 562 MW is from hydropower. But the estimated hydropower potential of the country stands around 4,700 MW. In some areas like Usambara and Pare mountains as well as in the southern highlands, where many perennial rivers and streams with steep drops are available, there are good possibilities for hydropower generation. In addition to the potential hydro resources, these places are in close proximity to the villages that are without electricity. The proven potential for small hydro power in Tanzania is approximately around 300 to 500 MW, of which only around 24 MW has been tapped due to various constraints.

A.3. The problem

Tanzania is one of the least developed countries (LDCs) in sub-Saharan Africa. Its economy faces a large discrepancy, as the majority of the population lacks sustainable energy. The country's power sector, for long time, has relied only upon the national power utility company, TANESCO, to do the generation and distribution. While the situation has been increasingly changing, necessitating the introduction of private sector in electricity generation, still, TANESCO is dominating the energy generation and distribution.

Economic acceleration depends more upon the level of rural electricity access. The low levels of electricity access and commercial energy use are the major challenges faced by the Tanzanian energy sector, which holds back its national economy.

Due to lack of alternative energy sources in most of the remote/off-grid areas, small diesel generators remain as the primary supplier of small quantity of electricity. In places where the gensets are not available, kerosene is used for lighting and cooking. These energy sources, apart from causing health problems to the local communities, also continue to increase the global warming by emitting GHGs into the atmosphere.

Tanzania has abundant RE resources such as biomass, hydro, solar and wind. The intervention and use of RE in rural electrification is extremely important for the improvement of the prevailing poor electricity access situation. Micro / mini hydro power is especially relevant because of its multipurpose use unlike solar.

The country is emphasizing on RE including micro / mini hydro, by creating conducive environment like establishing the REA for managing the rural energy funds and by introducing credit facility, etc.

² <http://www.tanesco.co.tz>

But the implementation of RE, especially micro / mini hydro power, in Tanzania, is a challenging intervention, particularly because of the high investment needed. There are several barriers to improve the rural energy situation in Tanzania including the following:

(1)Lack of proper rural energy planning and implementation

Most of the energy projects are being implemented by stakeholders in an uncoordinated fashion. This makes the energy implementation in the country inefficient and unsustainable, with less impact. The stakeholders need to be coordinated and educated in the planning methodology and execution skills.

(2)Inadequate technical capacity among human as well as institutions in the area of RE development

Inadequate awareness leads to lack of technical capacity. The capacities of various personnel, such as project developers, engineering companies, construction companies, investors, etc. and institutions, such as The Government, related Ministries, technical and financing institutions, etc., who all will be involved in micro / mini hydropower projects, should be developed. Though the potential for micro / mini hydropower plants is high in Tanzania, this potential is not transformed into realistic projects, as the knowledge level and technical capacity within Tanzania is limited. This is clear from the fact that some of the micro / mini hydropower plants which were installed with the aid of foreign experts are not functioning any more. Due to the lack of human capacity, these plants have run for less than the expected plant life time.

(3)High cost of importation of energy production equipment

Recently, there has been a growing interest among the stakeholders on developing micro / mini hydropower schemes. However, the investors lose their interest due to very high expenditures incurred on the imported equipment. This risk is even more relevant when all the equipments (turbines, control systems, etc.) have to be imported from abroad. This leads to higher investment cost and increased payback period, which are unattractive to most of the private investors. Creation of local equipment fabrication platform will considerably reduce the investment cost of such projects.

(4)Lack of awareness and participation through experience sharing

Despite the country's long experience in implementing hydropower schemes (about a century) the technology is not yet widespread. Although the participation of the private sector in electricity service was formally accepted in Tanzania since 1992, its involvement is still very limited. This argument is supported by the recent rural master plan study results, which show that, there are no qualified third party operators in rural areas to implement small hydropower projects except TANESCO, which has offices in almost all districts of mainland Tanzania.

(5) Policy and regulatory barriers such as lack of FiT

Though there are few policies and regulatory frameworks available to promote the RE based electricity generation, there are no defined and well framed path ways that make the policies successful to bring the desired outputs. At present, there is no FiT scheme for the micro / mini hydropower projects. In the absence of the FiT specifically for RE based power generation, it is

not possible for such plants to compete with large scale hydro and fossil fuel based power generation, where the investment cost and generation cost are comparatively lower.

A.4. Target beneficiaries

It is envisaged that the project will benefit a wide range of sectors. The project will primarily embrace the private sector who are in the RE business, especially, hydropower, policy makers, academic institutions (particularly CoET), equipment manufacturing sector, implementing institutions, practising engineers in the field and the end users of the technology.

A.5. Policies, strategies and plans in place

The energy institutional framework for Tanzania has been undergoing restructuring for the past few years. The aim has been to enhance energy security and electricity access to its population. The National Energy Policy was reviewed in 2003. The policy considers the need to: (i) have affordable and reliable energy supply throughout the country; (ii) reform the market for energy services and establish an adequate institutional framework; (iii) enhance the development and utilization of indigenous RE sources and technologies; (iv) adequately take into account environmental considerations for all energy activities; (v) increase energy efficiency (EE) and conservation in all sectors; and (vi) increase the energy education and build gender-balanced capacity in energy planning, implementation and monitoring.

The policy had the following specific objectives: (a) to develop the abundant hydroelectric potential available in the country; (b) to reduce the deforestation through efficient use of woody biomass; (c) to promote the RE resources; (d) to promote the EE and conservation; and (e) to develop the human resources for facilitating the development of energy technologies.

According to the current National Energy Policy of the United Republic of Tanzania (2003), the goal of the rural electrification is the widespread improvement in standard of living of the rural population, thus attaining balanced socio-economic growth among all Tanzanians. Underpinning the policy objective is the issue of poverty alleviation, social development and environmental conservation objectives. Small scale industries, agricultural-processing industries and other income generating activities are given primary importance in planning rural programs. In order to accelerate social development in rural areas, schools, educational institutions, health facilities, water supply, communication and community centres are targeted in rural electrification projects. In addition, rural electrification has an objective of conserving the environment to minimize the impacts of deforestation, climate change, air pollution (indoor & outdoor) and land degradation on mankind development.

In June 2008, the new Electricity Act was passed by the President. This act provides a pivotal role to attract substantial private sector participation in the development of the power sector by creating legal security to the private sector involved in the development of electricity sector.

The government of Tanzania formed a regulatory body, the Energy and Water Utilities Regulatory Authority (EWURA) which became operational in 2006 with the role for ensuring regulatory oversight to promote private sector investment in the energy sector.

The country by recognizing the importance of supporting the rural energy development, created the Rural Energy Agency (REA) which became operational in 2007 to implement rural electrification programs via the Rural Energy Fund (REF). In the three years of operations,

several efforts have been already taken by the agency to promote private sector investment in rural energy technology development in an affordable manner.

The proposed micro / mini hydropower plants of atleast 3.2 MW cumulative capacity to be implemented under GEF project, is in coherence with the national policies of Tanzania by promoting RE technologies in the country. This will also be in line with the National Energy Policy of the United Republic of Tanzania (2003) by supplying the generated electricity to mini-grids. By generating the renewable electricity and supplying it to the mini-grid, the project will improve the social and environmental objectives of the policy.

The project will also strengthen and improve the policy and regulatory system for RE, including micro / mini hydropower, by providing incremental support to FiT. The project addresses the efforts required to improve the private sector participation in the micro / mini hydropower projects through various trainings, streamlining the available financing mechanisms, etc. Under the GEF project, transfer of technology to the interested micro / mini hydropower equipment fabricators will be done to enable local fabrication. This would ensure that similar projects will be replicated in other potential sites. Therefore, it is clear that this project is in line with all the above mentioned government policies and decisions and also fits well within the national priorities of providing access to rural energy through expanded rural electrification in the country.



B. REASONS FOR UNIDO ASSISTANCE

UNIDO's assistance to the proposed project will add very significant value to Tanzania by providing the necessary resources and technical assistance. The project will assist the Tanzanian Government to keep up the momentum on RE and CO₂ emission reductions. In addition, UNIDO, which is one of the agencies implementing Global Environment Facility (GEF), has a comparative advantage in the development and implementation of micro / mini hydropower based mini-grids through its experiences in different parts of the world. UNIDO has, so far, established SHP regional centres in Africa, China and India to address local challenges in micro / mini hydropower development in the particular regions. UNIDO's intervention will lead to strengthening the capacity in installation, operation, maintenance and management of micro / mini hydropower based mini-grids.

UNIDO in liaison with the MEM has come up with rural electrification project idea that is in line with the country's plans and priorities. UNIDO has a long-standing experience in the development of renewable energy projects for rural electrification and other productive uses for the developing countries. It has been implementing these projects with the understanding of the existing policy and project's implementation framework for the country's socio-economic development. It has a strong understanding of how policy, normative, technical, market and financing variables can affect implementation of micro / mini hydropower based mini-grid projects.

The project will provide assistance and lay a solid foundation for the decentralized energy systems for rural electrification in Tanzania. The project will create an attractive environment for the private stakeholders to engage in the rural electrification business through the most efficient path.

Review of existing barriers, meetings with various stakeholder groups and discussions with government agencies during the project preparation phase, has shown the strong relevance of the GEF UNIDO project.

C. THE PROJECT

C.1. Objective of the project

The main objective of the proposed project is to promote micro / mini hydropower based mini grids in Tanzania to augment rural electrification.

Following are the other major objectives of the project:

- To reduce GHG emissions resulting from carbon intensive energy sources such as diesel gensets and kerosene, which are used by majority of Tanzanians for their energy purposes in rural areas.
- To create better environment for increasing access to modern and environmental energy services in rural Tanzania, in order to improve the rural livelihoods and to create conducive environment for developing the abundantly available mini hydro resources by removing the existing barriers.
- To increase the awareness among the decision makers, consumers and other relevant stakeholders on the potential of micro / mini hydropower based mini-grids and for strengthening their capacities.
- To facilitate local fabrication of micro / mini hydropower equipment and accessories.
- To develop a business model for enhancing the development of micro / mini hydropower based mini-grids in Tanzania.

C.2. The UNIDO approach

The proposed project aims at promoting RE, mainly in the form of micro / mini hydropower based mini-grids as viable option, for augmenting the rural electrification in Tanzania. This will also provide access to modern energy services for the rural public and reduce their dependency on carbon intensive energy options. GEF intervention in the project will lead to the installation of micro / mini hydropower plants of 3.2 MW cumulative capacity. The project will also strengthen the capacity in developing, implementing, operating and maintaining micro / mini hydropower based mini-grids.

The project aims to train atleast 50 relevant stakeholders, including but not limited to, project developers, local engineering companies, government planners, technical institutions, financial institutions, plant operators, interested micro / mini hydropower equipment fabricators, EPC contractors, mini-grid operators, etc.

Advertisements will be done through the newspapers and notices about the training programs to be conducted under this project. The interested participants will be requested to apply for the training. National micro / mini hydropower technical centre along with UNIDO will screen the applications and will select the participants. The participants will be selected based on their impact in developing similar micro / mini hydropower plants in other potential sites of Tanzania.

Tentative number of participants in each category is given in the following table:

Table 1: List of Participants

S. No.	Participant category	No. of participants
1.	Project developers	5
2.	Government planners	10
3.	Micro / mini hydro power plant operators	10
4.	Mini-grid operators	5
5.	Financial institutions	5
6.	EPC contractors	5
7.	Local engineering companies	5
8.	Interested equipment fabricators	5
	Total	50

In addition, the technology will be transferred on local fabrication of micro / mini hydropower equipments and also viable business models will be developed for sustained implementation of micro / mini hydropower projects.

The project will make a good platform for information sharing among the stakeholders, which has been lacking in the country. The project will lead to technology transfer from other international expertises. UNIDO will use its well established expertise from its small hydro centres in China, India and African regions. The lessons learnt during the project implementation period will be used as a tool in strengthening the national capacities of institutions, individual players and the national policy interventions.

Successful implementation of the project will create an enabling and attractive platform for the replication of the technology throughout the country. The project components address most of the issues that are barriers to the development of the mini hydropower projects in Tanzania. Once there are successful demonstration sites, enough expertise and a well established financing environment, then the micro / mini hydropower mini-grids will be developed in a much faster rate, thereby increasing the rural electrification of the country.

During PPG stage, prefeasibility studies were conducted in several of sites and 9 sites have been selected for the proposed project. After GEF intervention, local communities at the selected 9 sites are expected to get electricity from the respective power plants. The project will generate 3.2 MW (cumulative) of electricity from the power plants in these sites.

The criteria for the preference in the sites included:

- Ease in site accessibility to reduce the costs;
- Availability of human settlements/electricity demand close to the sites;

- Potential in productive uses for sustainability;
 - Potential off- grid sites

The following map shows the location of the sites where pre-feasibility studies were carried out to identify potential demonstration sites in Tanzania.



Figure 1: Locations of the demonstration sites in Tanzania (red circles)

As the project will supply 3.2 MW of electricity, the nearby residential houses, health centres, dispensaries, village government offices, schools, industries, agricultural and commercial activities, etc. will be benefitted. Increased availability of electricity is expected to increase the commercial activities, thereby creating opportunities for better employment and revenue generation for the locals. Use of hydro electricity will save significant amount of diesel and kerosene and hence the poor village people who are spending more than 50% of their earning for their energy needs can be reduced considerably.

Already stakeholder consultations have been carried out at the PPG stage to create awareness and sensitize the local community. In addition to the above, since the local communities are the end users of the produced electricity, the project will involve them during power plant and mini-grid construction stages. Various consultations at each site would be conducted to finalise the electricity distribution from the power plant. This would maximise the benefits of generated electricity. As the project proposes indigenous manufacturing of micro / mini hydro units, considerable reduction in the capital cost is expected, which will lead to comparatively easier and cheaper replication of similar projects elsewhere in the country.

The demonstration of technical and financial viability of the 3.2 MW micro / mini hydropower based power generation and mini-grid will enable the Government to further establish appropriate policy and regulatory framework, to strengthen institutions and to build capacity leading to the creation of a conducive market environment for increased private sector investment programmes in RE.

List of micro / mini hydropower sites chosen under GEF demonstration projects are given in the following table:

Table 2: List of micro / mini hydro power demonstration projects

S. No.	Name of the site	Capacity (kW)	Project developers
1.	Tandala	407	REA, Tandala Diaconical Centre, Bruderhaus DIAKONIE Germany
2.	Andoya	1,000	REA, Andoya Hydroelectric Power Company
3.	Chita	400	REA, Chita National Service Camp
4.	Mpando	271	REA, Imilinya village
5.	Chala	130	REA, Chala Parish
6.	Uliwa	407	REA, RC Njombe Diocese
7.	Salala-Ludilu	98	REA, KKKT Makete
8.	Macheke	290	REA, Mlangali village
9.	Mhangazhi	190	REA, Mhangazi Electric Cooperative Association
	Total	3,193	

Entire details of the demonstration projects are given in Annex 2 – Pre-feasibility study report for the sites.

The proposed micro / mini hydropower based mini-grids to be set up under the project are expected to bring about global benefits by reducing 335,648 t CO₂e directly and 2,685,185 t CO₂e indirectly, which otherwise would have resulted from the use of diesel generators, as is the case currently in Tanzania.

These demonstration projects are also expected to bring about considerable socio economic benefit by improving the electricity access situation, industrialization and employment generation. The project will bring new technology, knowhow and skill level to Tanzania. The increased availability of power will spur the growth of other industries nearby the project location. The direct and indirect employment generation will be an added economic benefit.

Due to the increased electricity availability, productive activities will be increased so that the people will be empowered enough to pay the electricity bills. Moreover, the increased availability of electricity will in turn increase the productivity of the industries which will ensure their repayment capacity for electricity bills.

Social and productive uses baseline of this project:

Social and productive uses baseline study conducted in the potential sites, proved the need for the demonstration projects. The social and productive uses are summarised in the following table:



Table 3: Potential users and demand of electricity

S. No.	Potential users	Tandala		Andoya		Chala		Uliwa		Salala-Udilu	
		No.	Demand in kW	No.	Demand in kW	No.	Demand in kW	No.	Demand in kW	No.	Demand in kW
1.	Households	1,457	364.25	759	-	1,824	456.00	600	150.00	256	64.00
2.	Primary schools	4	40.00	75	-	3	15.00	1	5.00	1	5.00
3.	Secondary schools	1	20.00		-	2	10.00	1	5.00	0	0.00
4.	Grain mills	15	180.00		-	1	20.00	2	24.00	3	36.00
5.	Micro- businesses	40	80.00	15	-	12	144.00	10	20.00	5	10.00
6.	Mission centres	3	150.00		-	10	20.00	2	30.00	1	15.00
7.	RC mission centre					1	30.00				
8.	Focal development college					1	20				
9.	Carpentry workshops					10	120				
10.	Welding workshop					1	12				
11.	Sunflower oil extractors					4	48				
12.	Mission vocational training centre									1	20.00
13.	Health centre							1	30.00		
	Total		834.25				895.00		264.00		150.00

From the studies, it was found that, the micro / mini hydropower plants in other sites namely, Chita, Mpando, Macheke and Mhangazi will be benefitting RC Missions, vocational training schools, primary and secondary schools, dispensaries, residential houses, shops, small workshops and garages, communication towers, water pumps, mills, etc. that are located in and around the plant area.

Comparing Table 3 and Table 4 and the above description, it is clear that all the sites have enough off-takers of electricity and the demand in these sites exceeds the proposed power plant capacity at each site. Detailed demand assessment is given in the pre-feasibility given in Annex 2.

The study also found that industries resort to diesel generators in the absence of grid electricity. Households depend upon kerosene for lighting purpose and firewood for cooking purpose. This scenario was common in all the proposed project locations. Based on the above findings, it was expected that the project will improve the social and productive use scenario when compared to the baseline.

In addition, the project has huge replication potential where the available hydro resources will be utilized. If this potential is realized, there will be a considerable reduction in the energy related CO₂ emissions in Tanzania and the energy supply situation in the country will be improved.

The project consists of the following four components:

Project Component 1 (PC1) aims at conducting techno-economic feasibility studies for the identified 9 potential sites for demonstration.

Project Component 2 (PC 2) aims at establishing a national micro / mini hydropower technical centre in CoET, which would function as a learning hub for micro / mini hydropower plants. This centre will provide technical support for the replication and adoption of micro / mini hydropower plants in other potential sites across Tanzania.

One of the major issues faced by the interested project investors in developing micro / mini hydropower projects is the very high cost of imported equipments. This situation arises due to the fact that there are no reliable and quality micro / mini hydropower fabricators in Tanzania. This situation poses a significant barrier for the development of micro / mini hydropower plants. To address this barrier, initially, a thorough demand assessment for local hydro-power equipments will be carried out. Also, the interested local fabricators for micro / mini hydropower equipments will be identified, trained and transferred with micro / mini hydropower equipments fabrication technology. This will ensure the availability of high quality micro / mini hydropower equipments within the country itself. Necessary licenses will be arranged for the locally trained fabricators.

PC 2 will also facilitate the capacity building on both human and institutional fronts at various levels in micro / mini hydropower based mini-grids. During the PPG stage, several meetings were conducted with key government stakeholders and during the meetings other stakeholders were also identified. Training and systematic learning programmes will be organized for the identified stakeholders of micro / mini hydropower based mini-grids including but not limited to REA, TANESCO, University of Dar-es-Salaam, River Water Basin Authorities apart from project developers, government planners, micro / mini hydro power plant operators, mini-grid

operators, financial institutions, EPC contractors, local engineering companies, interested equipment fabricators, academic institutions, end-users.

Under PC2, the existing guidelines and standards will be adapted suitably for the development of micro / mini hydropower projects. The prepared guidelines will be published in collaboration with TANESCO and Tanzania Bureau of Standards (TBS).

Another significant barrier for penetration of micro / mini hydropower plants in Tanzania is the lack of FiT for RE projects. Through PC 2, the project aims at improving the policy and regulatory system by providing incremental support for the creation of a FiT for micro / mini hydropower projects.

Project Component 3 (PC 3) aims at developing viable business models for the micro / mini hydropower based mini-grid projects. Moreover, PC 3 aims at increasing the capacity of local entrepreneurs to undertake micro / mini hydropower projects by streamlining the existing financing options.

Capacity of the local entrepreneurs will be improved to undertake micro / mini hydropower mini-grid projects through streamlining existing financing options from REA.

Project Component 4 (PC 4) aims at commissioning micro/mini hydropower based mini-grids of cumulative capacity 3.2 MW, which will replace diesel power generation, thereby contributing to a reduction of 16,782 t CO₂ emission per year. These micro / mini hydropower plants will be monitored and tested for their performances and the results will be widely disseminated. All the stakeholders are expected to gain considerable knowledge and experience and are expected to replicate such projects elsewhere in Tanzania.

All the four components are interdependent facilitating the promotion of market approach for the development of renewable energy in Tanzania.

The development of this project document has been achieved in collaboration with the key stakeholders throughout the entire process. The national steering committee was instrumental in gathering the information across all the interested sectors. The Government institutions have contributed to the policy aspects, financing issues and other relevant aspects and the academic institutions to capacity building. Private sectors were consulted regularly throughout the process for inputs towards initiatives to promote the development of micro / mini hydropower based mini-grids in the country.

Steering committee has met twice in the course of project document development and other stakeholders were also consulted through a seminar on renewable energy promotion initiatives by UNIDO in August 2010, held in Dar es Salaam. Also, during the course of the project development, the potential sites to be included in the project for demonstration plants were visited. The local communities have shown interest and have committed to collaborate towards this endeavour of providing clean energy and improving rural livelihoods. Besides, it should be noted that the stakeholder consultations has yielded significant information on the available potential for the micro / mini hydropower schemes.



Project implementation arrangement

UNIDO will take the responsibility of implementing the project, the delivery of the planned outputs and the achievement of the expected outcomes. The project will be executed by UNIDO in collaboration with the concerned Government Ministries and private sector stakeholders.

UNIDO will administer/manage and allocate the funds of the project on behalf of the GEF Secretariat. UNIDO will provide assistance in the procurement process for any acquired equipment if requested, in the selection of national and international consultants as well as the subcontractors in accordance with the operational rules and regulations.

UNIDO will also provide the assistance on the formal GEF procedures that will apply to the project execution including reporting issues and be the formal channel of correspondence between the project and the GEF secretariat. GEF specialist will provide technical backstopping to the project as deemed necessary.

UNIDO will be responsible for:

- The general management and monitoring of the project;
- Reporting on the project performance to the GEF;
- Procuring the international and national expertise needed for delivering the planned outputs under the four project components;
- Designating the national consultant and the programme officer who will be the focal point of the project;
- Coordinating with the project steering committee to review the project every 2 months during the project implementation period;
- Providing administrative support and financial budgetary follow up required for the execution of the project;
- Annual auditing of the project by following GEF procedures;
- Managing, supervising and monitoring the work of the international teams and for ensuring that the deliverables are technically sound and consistent with the project requirements.

REA will be responsible for:

- Constructing the various demonstration sites
- Establishing the national micro / mini hydro technical centre
- Streamlining financing options for micro / mini hydro projects

CoET will be responsible for:

- Providing staff support for the national micro / mini hydro technical centre
- Preparing the various training materials targeting different stakeholders
- Building human and institutional capacity in micro / mini hydro, by conducting suitable trainings

MEM will be responsible for:

- Providing additional institutional support for the recommendations on FiT for RE projects including micro / mini hydro projects.

TANESCO will be responsible for:

- Publishing the adapted guidelines for micro / mini hydro installation and management.

A Project Management Unit (PMU) will be established and hosted within one of the committee member institution. The PMU will consist of the National Project Manager (NPM) and the Project Administrative Assistant (PAA).

The PMU will be responsible for:

- Coordinating all the project activities carried out by the national experts and other partners by having close association with MEM and CoET.
- Day-to-day management, monitoring and evaluating the project activities as per planned project work.
- Organizing the various seminars and trainings to be conducted under Project Components 2 and 4.

UNIDO will provide the PMU with the necessary management and monitoring support. It will also provide financial support for the project evaluation.

A Project Steering Committee (PSC) will be established. The purpose of this committee will be to review the progress in project implementation, to facilitate the co-ordination among project shareholders and to maintain the transparency in ensuring the ownership and to support the sustainability of the project.

The PSC will be responsible for:

- Guiding the project development strategically in line with the country needs and priorities
- Promoting the partnership among energy stakeholders
- Reviewing the project progress reports

The PSC will have a balanced representation from key stakeholders including MEM, which is responsible for policy formulation and execution of energy related matters in Tanzania, REA, which is responsible for promoting rural energy in the country and TANESCO, which is the national power utility and the major electricity generation and distribution company in the country and VPO-DoE, which is the GEF focal point in the country. UNIDO and the CoET, USDM are responsible for facilitating the capacity building activities.

The committee will be chaired by the GEF Focal point (Operations). The final composition of the PSC will be defined during the project implementation start-up phase. The PSC is envisaged to meet twice a year.

At the beginning of project implementation, a detailed work plan for the entire duration of the project will be developed by UNIDO in collaboration with the PMU, Tanzanian Government and the international teams of experts. The working plan will be used as management and monitoring tool by the PMU and UNIDO and will be reviewed and updated appropriately on biannual basis.

REA will be the core counterpart in executing the proposed project and will be responsible for carrying out and completing it. REA and MEM, as co partners will be responsible for:

- Providing in-kind contribution to the project coordination and administrative issues
- Assisting with office space to accommodate the project coordination personnel and giving him/her necessary technical and administrative support.
- Auditing the project voluntarily by following the national legislation, in case it is deemed necessary.

The figure below presents a summary of the proposed project implementation arrangement:

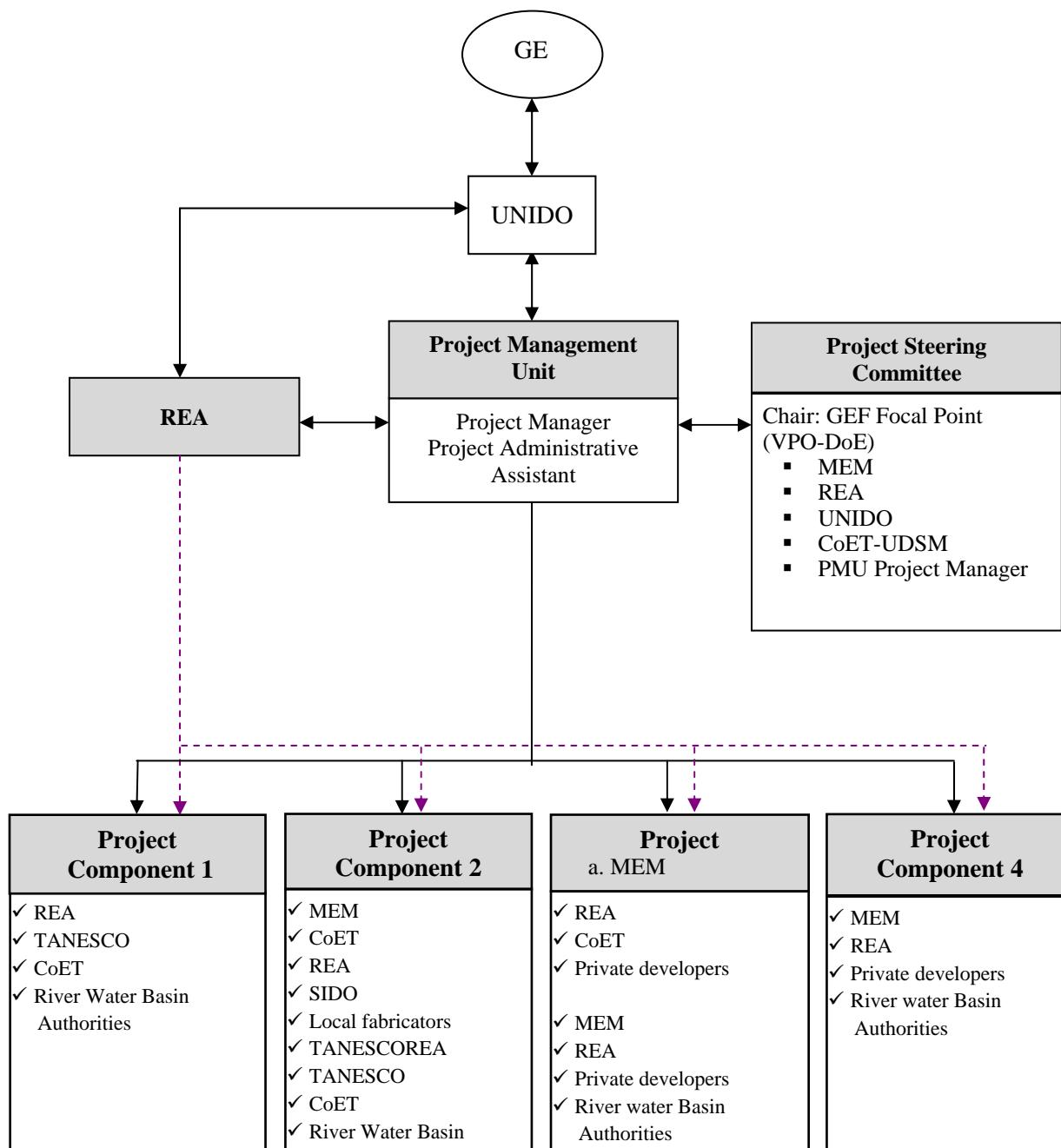


Figure 1: Schematic of project implementation arrangement

UNIDO will closely coordinate with ongoing as well as planned relevant initiatives to ensure maximum synergies and overall impact of Climate Change related technical assistance to Tanzania.

C.3. RBM code and thematic area code

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C.4. Expected outcomes

The expected outcomes of the project are:

- a. Site specific details on potential micro / mini hydropower sites available for further development.
- b. Investment cost of micro / mini hydropower based mini-grids reduced because of the local availability of technical experts and high quality indigenous hydropower equipments.
- c. Interest in developing micro / mini hydropower projects increased among the local entrepreneurs and
- d. Technical and economic viability of micro / mini hydropower technologies demonstrated.

C.5. Output and activities

The outputs and outcomes are based on four technical components of the project as stipulated in Table 1 below:

TABLE 4: PROJECT COMPONENTS

Project components	Expected outputs	Expected outcomes
1. Techno-economic feasibility studies for the identified demonstration sites.	1.1. Detailed feasibility studies prepared for demonstration plants in the identified potential sites.	Site specific details on potential micro / mini hydropower sites available for further development.
2. Capacity building of stakeholders in developing micro / mini hydropower based mini-grids	2.1 National micro / mini hydropower technical centre established at CoET, UDSM to provide technical support for various technical institutions in Tanzania. 2.2 Technology transferred on local fabrication of micro / mini hydropower equipments. 2.3 Existing guidelines and standards adapted to suit installation and management of micro / mini hydropower plant mini-grids in Tanzania 2.4 Feed-in tariff (FiT) for micro / mini	Investment cost of micro / mini hydropower based mini-grids reduced because of the local availability of technical experts and high quality indigenous hydropower equipments.

	hydropower in place	
3. Viable business model for micro / mini hydropower based mini-grid developed.	3.1 Existing financing options of REA streamlined to benefit the local entrepreneurs interested in micro / mini hydropower. .	Interest in developing micro / mini hydropower projects increased among the local entrepreneurs.
4. Demonstration of micro / mini hydropower plants.	4.1 A number of micro / mini hydropower plants with cumulative capacity of at least 3.2 MW implemented in different locations within the country.	Technical and economic viability of micro / mini hydropower technology demonstrated.

Each of the four components is composed of an immediate objective, specific output(s), outcome(s) and number of activities. These are shown in the following tables. By achieving the immediate objectives, the project will contribute towards the achievement of the global and development objectives.

TABLE 5: OUTPUTS AND ACTIVITIES FOR PROJECT COMPONENT 1

PROJECT COMPONENT 1. Techno-economic feasibility studies for the identified demonstration sites	
Detailed feasibility studies will be carried out for the identified demonstration sites.	
Output 1.1. Detailed feasibility studies carried out for the potential sites identified for demonstration.	
Objectives and activities:	
<p>Lack of technical knowhow has been a hindrance in the wider adoption of micro / mini hydropower technology in the country. Moreover the fact that most of the sites lack proper site assessment makes the adoption of this technology more difficult.</p> <p>A thorough due diligence will be conducted by a sub-contractor on the site information including technical, social, economic viability and management modalities for the sustainability of the potential sites. Sub-contracts will be awarded for carrying out detailed feasibility studies for the identified demonstration sites.</p>	
Activities	Responsibility
<ul style="list-style-type: none"> • Carrying out due diligence on site information regarding technical, social and economic viability including management modalities for the sustainability of the sites. 	Sub-contractors and national experts
<ul style="list-style-type: none"> • Preparing feasibility study report on the demonstration sites. 	Sub-contractors and national experts

TABLE 6: OUTPUTS AND ACTIVITIES FOR PROJECT COMPONENT 2

PROJECT COMPONENT 2. Capacity building of stakeholders in developing micro / mini hydropower based mini-grids.

This component aims at building the capacity of the project developers, decision / policy makers, government planners, micro / mini hydro power plant operators, mini-grid operators, financial institutions, EPC contractors, local engineering companies, interested equipment fabricators, academic institutions, end-users, etc, on the potential of the micro / mini hydropower schemes in meeting the energy needs of the rural population for domestic and productive uses at their localities. The capacity development also includes training and technology transfer on local fabrication of micro / mini hydropower equipments. Existing guidelines and standards for micro / mini hydropower will be adapted to suit the Tanzanian conditions and will be disseminated.

Under this component, a FiT for micro / mini hydropower will also be developed.

REA and CoET will be involved under this component and will provide technical personnel support as well as the venue for facilitating the capacity building activities and training workshops.

Output 2.1. National micro / mini hydropower technical centre established to provide technical support for various technical institutions in Tanzania

Objectives and activities:

At present, the expertise of the technical institutions on micro / mini hydropower based mini-grid is very low. In such a situation, it is very difficult to sustain and replicate the micro / mini hydropower based mini-grid projects in the country. Hence, under this component, a national micro / mini hydropower technical centre with trained personnel, necessary equipments and tools will be established CoET at University of Dar es salaam (UDSM), in order to provide technical support for various other technical institutions in Tanzania for facilitating continuous development of micro / mini hydropower based mini-grid projects.

Along with the initial guidance from the international experts on micro / mini hydropower, the trained personnel of CoET will train various stakeholders of micro / mini hydropower systems such as experts, planners, project developers, financial institutions, local engineering companies, mini-grid operators and construction companies in micro / mini hydropower project development and implementation.

International expert along with national expert will develop training materials for all the future trainings to be conducted at CoET.

By this way, the centre will serve as a learning centre for the entire country and will enable further replication of similar projects elsewhere in the country.

International seminars on micro / mini hydropower will be conducted at the centre. This is necessary to build the human and institutional capacity in micro / mini hydropower. The centre will also strengthen the local knowledge / skill in operation and maintenance (O&M) of micro / mini hydropower plants.



Based on the experience gained from the demonstration projects, the micro / mini hydropower based mini-grid project development guide will be prepared and used by CoET for further trainings.

The GEF funding under the output will cover only the training related activities and training materials, while the operational costs of the centre will be met by CoET itself. The national HP technical centre will be within CoET campus. CoET will also be allocating the space for the centre. The staff member from the CoET payroll will be trained and will be working as experts at the technical centre. This will reduce the annual budget requirement for the centre. Moreover, after the closure of the GEF project these staffs will continue to be in the payroll of CoET and also provide services for the clients at a nominal fee. All these activities will ensure the centre's sustainability even after the completion of the project.

Activities	Responsibility
• Assessing the capacity building needs for various technical institutions and CoET.	International and national experts
• Conducting technical trainings for the personnel at the CoET micro / mini hydropower technical centre.	Sub-contractors
• Developing training manuals.	International and national experts
• Establishing the National micro / mini hydropower technical centre.	MEM, REA, CoET, International, national experts and Contractor
• Training the expert planners and institutions on micro / mini hydropower based mini-grid project development and implementation.	CoET, international and national experts
• Preparing micro / mini hydropower based mini-grid project development guide.	International and national experts
Output 2.2. Technology transferred for local fabrication of micro / mini hydropower equipments.	

Objectives and activities:

At present there is no local fabrication of hydro-power equipments in Tanzania and they have to be imported. A thorough demand assessment for local hydro-power equipments will be carried out initially. Also, the existing local capacity in manufacturing micro / mini hydropower equipments will be evaluated and few interested suppliers for micro / mini hydropower equipments will be identified. Based on the evaluation, capacity will be built for the identified interested suppliers, through trainings, experience sharing and by providing fellowships for eligible suppliers in getting long term training in countries with advanced manufacturing technology.

Some of the interested institutions who have shown efforts in equipment fabrications are

CoET at UDSM, Nyumbu, Renewable Energy Development Company (REDCOT), SIDO and Ulaya and Hydro Mill Ltd. Technology will be transferred in all the aspects of manufacturing micro / mini hydropower equipments to the local interested fabricators. These activities will enable high quality local fabrication of micro / mini hydropower turbines and controls, which in turn will sustain the RE activities in the country.

The National micro / mini hydropower technical centre at CoET will be a centre for capacity building on local manufacturing of micro / mini hydropower equipment, especially, the micro-turbines. The training will take place in the Technology Development and Transfer Centre (TDTC) workshop in CoET, where, the technology innovation and research activities take place. The training components include planning and designing aspects of the equipment, actual fabrication of the equipment and marketing strategies. The training will be provided by the international experts from UNIDO-SHP (Small Hydro Power) centres in India and China. National experts will assist and coordinate in these training activities.

It is planned to start the equipment manufacturing activities simultaneously along with the development of demonstration sites. UNIDO will share its experience from a similar technology transfer project carried out, which envisages local manufacturing of cross-flow turbines up to 125 kW in Nigeria. Currently the trainings and other initiatives are being carried out for the transfer of technology to the interested local fabricators.

Under this project, efforts will be taken to use the local fabricated equipments in the replication sites in Tanzania. An experienced and standard turbine manufacturing private company will be subcontracted for the transfer of technology to the local manufacturers. Quality control procedures and standards would be created and recommended to the Tanzanian government for implementation. An international expert well versed in micro / mini hydropower equipment manufacturing will be engaged for this purpose.

Necessary licenses will be arranged for the trained local fabricators to manufacture micro / mini hydropower equipments.

Activities	Responsibility
• Assessing the demand for local hydro-power equipments in the country.	Sub-contractors
• Evaluating the existing local capacity on micro / mini hydropower equipment fabrication and identification of potential / interested fabricators.	Sub-contractors
• Conducting trainings and transferring technology to the identified interested fabricators.	CoET, national experts and sub-contractors
• Licensing the trained fabricators.	MEM, international and national experts
• Foreseeing the manufacturing process and devising the means to sustain the process.	International, national experts and PMU

Output 2.3. Existing guidelines and standards adapted to suit installation and management of micro / mini hydropower plant mini-grids in Tanzania .

Objectives and activities:

At present, no guidelines and standards exist for micro / mini hydropower installation and management. Current focus is on large hydropower plants only. Therefore, under this component, the project will adapt these existing large hydro guidelines and standards to suit the installation and management of micro/ mini hydropower plants in Tanzania. All necessary efforts will be taken to disseminate these adapted guidelines and standards to all stakeholders. These guidelines will also consider the community managed schemes and various successful experiences within and outside the country. The major objective of this output is to make sure that the installation of micro / mini hydropower technology is done in par with the accepted standards. These adapted guidelines and standards will be published in collaboration with TANESCO and TBS. All these activities will be carried out by international experts in assistance with national experts along with TANESCO and TBS.

Activities	Responsibility
<ul style="list-style-type: none"> • Adaptation of existing guidelines for micro / mini hydropower installation and management 	International and national experts
<ul style="list-style-type: none"> • Publishing the standard manual in collaboration with TANESCO and TBS. 	TANESCO, TBS, international and national experts

Output 2.4. FiT for micro / mini hydropower in place.

Objectives and activities:

At present, no market based systems favouring micro / mini hydropower exists in the country. One of the major policy and regulatory issue in Tanzania for the development of micro / mini hydropower is the lack of FiT scheme for RE. At present, Tanzanian government is working on the development of FiT, which will set a fair and stable ground for the RE. Under this output, an incremental support will be provided for arriving at FiT for RE based electricity generation including the micro / mini hydros.. The project will engage international experts to study and recommend appropriate FiT for micro / mini hydropower to the Government. National experts will be engaged to assist the international experts.

Though development of FiT will not directly benefit the project, the FiT scheme for micro / mini hydropower is expected to help development of grid connected projects and thereby support RE capacity additions in the grid. This will lead to increase rural electrification in the future. Hence, this activity will hasten the promotion of micro/mini hydropower replications in the country.

Activities	Responsibility
<ul style="list-style-type: none"> • Preparing and recommending feed-in-tariff. 	UNIDO, TANESCO, international and national



	experts
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TABLE 7: OUTPUTS AND ACTIVITIES FOR PROJECT COMPONENT 3

<p>PROJECT COMPONENT 3. Developing viable business models for micro / mini hydropower based mini-grid.</p> <p>One of the major challenges in the development of micro / mini hydropower schemes is the issue of viable business model. Many schemes in Africa have come to a halt due to lack of sound business models. This project will primarily focus on creating conducive environment for developing projects using viable business models for their sustainability.</p> <p>Under this component, the local entrepreneurs will be encouraged to undertake micro / mini hydropower projects as viable business venture, through streamlining existing financing options from REA.</p> <p>Output 3.1. Existing financing options of REA streamlined to benefit local entrepreneurs interested in micro / mini hydropower.</p> <p>Objectives and activities:</p> <p>Various awareness programmes such as seminars, informal meeting and consultative meetings will be conducted to enable the stakeholders to gain knowledge on the available subsidies and credit lines. National experts will be engaged for this purpose. Various awareness programmes such as seminars, informal meetings and consultative meetings will be conducted along with relevant government agencies in 4 or 5 locations in Tanzania to enable the stakeholders to know the available subsidies and credit lines. During the seminars, representatives from the different funding agencies will also be invited to make presentations and interact with interested project developers. Head-to-head meetings between the private sector and the local financing institutions will be conducted for match making and facilitating the development of RE technologies including micro / mini hydropower.</p> <p>Under this output, international experts will take necessary efforts and liaise with REA for the creation of separate window for micro / mini hydropower projects under the available subsidy / financing schemes. National experts will assist the international experts in the above activities. In addition, national experts will be engaged for the facilitation of securing the finance from these schemes atleast for around 10 projects. On a continuous basis support will be provided for the project developers (advisory supports) to avail the existing grants. All such advisory supports will be provided by the national micro / mini hydro technical centre at CoET. All these will facilitate flow of financing from the available schemes to the new project developers.</p> <p>Micro / mini hydropower installations for demonstration funded by this project will not receive funding from other GEF/WB project. Co-financing from donors, private sector and the Government will be used for this purpose.</p>	
<p>Activities</p> <ul style="list-style-type: none">• Facilitation in obtaining existing financing for 10 projects• .	Responsibility

<ul style="list-style-type: none"> • Raising awareness among the stakeholders on the availability of subsidies and World Bank credit lines through seminars • . 	National experts
<ul style="list-style-type: none"> • Conducting head-to-head meetings between the private sector and local financing institutions • . 	International and national experts
<ul style="list-style-type: none"> • Recommendation on exclusive micro/mini hydropower fund within the existing financing options • . 	International and national experts

TABLE 8: OUTPUTS AND ACTIVITIES FOR PROJECT COMPONENT 4

PROJECT COMPONENT 4. Demonstration of micro / mini hydropower plant based mini-grids.
The immediate objective of this component is to explore, develop, test and adopt viable techno-economic options for disseminating micro / mini hydropower systems in Tanzania. This component will demonstrate the economic viability of micro / mini hydropower based mini-grids by developing demonstration sites which will serve as a model for most of the developers to develop similar projects in other potential sites.
Output 4.1. A number of micro / mini hydropower plants with cumulative capacity of at least 3.2 MW implemented in different locations within the country
<p><u>Objectives and activities:</u></p> <p>The major objective of this output is to demonstrate at least 3.2 MW micro / mini hydropower based mini-grids for rural electrification and productive uses. All the mini-grid demonstration projects will follow the regulations / procedures stipulated by REA.</p> <p>The detailed technical specifications will be prepared and incorporated in the bid documents along with commercial conditions. The bid document will be launched for sourcing micro / mini hydropower equipments. Once the bidders submit their bids, they will be evaluated and shortlisted and the project will be awarded to the most competent and capable bidder based on the scoring mechanism set forth. After the contract is awarded to the bidder, the bidder is expected to implement the project based on the cost and time frame fixed. An international expert will be hired to oversee the site construction activities. All necessary licenses, permits and contracts required for the construction and the operation of the power plant will be arranged prior to the start of the plant construction. Subcontractors will be hired to take care of this activity. Detailed design of mini-grid system, distribution lines, connections, metering, etc. will be carried out. This will also include detailed operational and management arrangements of mini-grids. National experts will co-ordinate with the subcontractors in all these activities. Tender document preparation, launching and tender evaluation will be done for the mini-grid and the mini-grid installation company will be selected. GEF contribution of around 1.7 million USD will be used towards equipment purchase in this project. The construction and commissioning activities of the mini-grid will be supervised by national experts. This procedure will be followed for all the demonstration sites.</p> <p>In the construction site, micro / mini hydropower based mini-grid owners will have a site office to manage the day-to-day activities during the construction and commissioning of the</p>

micro / mini hydropower based mini-grid. This team will work closely with the equipment supplier/EPC contractor in order to facilitate their works in the sites. UNIDO project management team, the international experts and the national experts will closely interact with the site office team and will assist and advice them in the implementation activities.

After the completion of the project, the project performance monitoring will be conducted to study the technical, financial, environmental and socio-economic performance of the project. A monitoring report will be prepared based on the monitoring and analysis. During the performance monitoring, study would be conducted to analyse the situation before and after the implementation of the project. The study would describe the conditions which were prevailing before the project, energy sources, electricity usage, need for the project, etc and the impact of the project. The results of the project would be presented along with the monitoring results.

Full scale project demonstration site visit and seminars will be organized and the project experiences will be disseminated to various interested stake holders for increasing the replication potential of the project. Various dissemination tools such as leaflets, various publishing, website, etc. will be used for effective dissemination.

Various private developers along with REA will act as counterparts under this component. Apart from investing in the project, they will also provide various facilities as and when required for the demonstrations.

It has to be however noted that there is a possibility to marginally increase the capacity of some of the demonstration sites. Hence the total installed capacity is expected to be more than 3.2 MW.

Under this component, UNIDO will facilitate the international bidding and selection of the EPC contractor and will make sure international best practices are followed in these aspects. However, day to day activities of the plant construction and supervision will be done by project owners through co-financing fund. As described earlier, international experts will monitor the implementation of the project to make sure that the plant construction activities are carried out properly by following international standards. For all these activities, UNIDO will act as a facilitator in procuring international experts.

Table 8.a. provides a description of the execution arrangements and the stakeholders of the specific demonstration power plants.

Activities	Responsibility
• Obtaining licenses, permits and contracts for the micro / mini hydropower plants	Subcontractor
• Preparing bidding document for micro / mini hydropower plants	International and national experts
• Launching the bid document, bidding, evaluating and selecting contractor for micro / mini hydropower plants	International and national experts
• Finalization of power plant O&M plan	National expert
• Preparing detailed design of mini-grid system, distribution lines, connections, metering, etc	Sub-contractors
• Preparing bidding documents for mini-grid systems	National experts
• Launching the bid document, bidding, evaluating and selecting the contractor for mini-grids	National expert
• Financial closure	Project investors



• Construction and commissioning of the micro / mini hydropower plants	EPC contractor
• Conducting expert inspection during construction and commissioning	International and national experts
• Construction and commissioning of the mini-grids	Mini-grid contractor
• Supervising the construction and commissioning of mini-grid	National experts
• Monitoring, testing and reporting on plant performance	UNIDO, MEM, REA, International and national experts
• Conducting full scale demonstration site visit and seminar	UNIDO, MEM, REA, international and national experts
• Disseminating the information through leaflets, publications and website	UNIDO, MEM, REA, international and national experts

Table 8.a. Project Execution Arrangement

S.No	Site Name	Capacity (kW)	Mini-grid owner	Partners	Role of partners
1.	Chala	130	Chala parish	REA	Provision of technical services and funds for construction of plant civil works and electromechanical equipment
				Chala parish	Community sensitisation, Mobilisation of civil works and plant management
2.	Andoya	1,000	Andoya Hydroelectric Power Company	Andoya Hydroelectric Power Company	Community sensitisation, Mobilisation of civil works and plant management
				REA	Provision of technical services and funds for construction of plant civil works and electromechanical equipment
3.	Tandala	407	Tandala Diaconical Centre	REA	Provision of technical services and funds for construction of plant civil works and electromechanical

					equipment
				Tandala Diaconical Centre	Community sensitisation, Mobilisation of civil works and plant management
				Behindertenhilfe Neckar-Alb	Support the construction of power transmission lines
4.	Chita	400	Chita National Service Camp	REA	Provision of technical services and funds for construction of plant civil works and electromechanical equipment
				Chita National Service Camp	Community sensitisation, Mobilisation of civil works and plant management
5.	Mpando	271	Imilinya village	REA	Provision of technical services and funds for construction of plant civil works and electromechanical equipment
				Imilinya village	Community sensitisation, Mobilisation of civil works and plant management
6.	Macheke	290	Mlangali village	REA	Provision of technical services and funds for construction of plant civil works and electromechanical equipment
				Mlangali village	Community sensitisation, Mobilisation of civil works and plant management
7.	Uliwa	407	RC Njombe Diocese	REA	Provision of technical services and funds for construction of plant civil works and electromechanical equipment
				RC Njombe Diocese	Community sensitisation, Mobilisation of civil works, plant equipment and plant management
8.	Salala	98	KKKT Makete	REA	Provision of technical

					services and funds for construction of plant civil works and electromechanical equipment
				KKKT Makete	Community sensitisation, Mobilisation of civil works and plant management
9.	Mhangazhi	190	Mhangazi Electric Cooperative Association	REA	Provision of technical services and funds for construction of plant civil works and electromechanical equipment
			Mhangazi Electric Cooperative Association		Provide workforce for the project construction and necessary project land. Responsible for project management
	Total	3,193			



C.6. Timeline of the activities

Activity	Year 1				Year 2				Year 3				Year 4			
	I	II	III	IV												
Project Component 1 – Techno-economic feasibility studies for the identified demonstration sites																
1.1 Detailed feasibility studies carried out for the potential sites identified for demonstration.																
a. Carrying out due diligence on site information regarding technical, social and economic viability including management modalities for the sustainability of the sites.																
b. Preparing feasibility study report on the demonstration sites.																
Project Component 2 – Capacity building of stakeholders in developing micro / mini hydropower based mini-grids																
2.1 National micro / mini hydropower technical centre established at CoET, UDSM to provide technical support for various technical institutions in Tanzania																
a. Assessing the capacity building needs for various technical institutions and CoET.																
b. Conducting technical trainings for the personnel at the CoET micro / mini hydropower technical centre.																
c. Developing training manuals.																
d. Establishing the National micro / mini hydropower technical centre.																



Activity	Year 1				Year 2				Year 3				Year 4			
	I	II	III	IV												
e. Training the expert planners and institutions on micro / mini hydropower based mini-grid project development and implementation.																
f. Preparing micro / mini hydropower based mini-grid project development guide.																
2.2 Technology transferred on local fabrication of micro / mini hydropower equipments.																
a. Assessing the demand for local hydro-power equipments in the country.																
b. Evaluating the existing local capacity on micro / mini hydropower equipment fabrication and identification of potential/interested suppliers.																
c. Conducting trainings and transferring technology to the identified interested suppliers.																
d. Licensing the trained fabricators.																
e. Foreseeing the manufacturing process and devising the means to sustain the process.																
2.3 Existing guidelines and standards adapted to suit installation and management of micro / mini hydropower plant mini-grids in Tanzania																
a. Adaptation of existing guidelines for micro / mini hydropower installation and management.																
b. Publishing the standard manual in collaboration with TANESCO and TBS.																
2.4 Feed-in tariff for micro / mini hydropower in place.																
a. Preparing and recommending feed-in-tariff																
Project Component 3 – Developing viable business models for micro / mini hydropower based mini-grid																



Activity	Year 1				Year 2				Year 3				Year 4			
	I	II	III	IV												
3.1. Capacity of the local entrepreneurs to undertake micro / mini hydropower projects as a viable business venture increased.																
a. Facilitation in obtaining existing financing for 10 projects																
b. Raising awareness among the stakeholders on the availability of subsidies and World Bank credit lines through seminars																
c. Conducting head-to-head meetings between the private sector and local financing institutions																
d. Recommendation on exclusive micro/mini hydropower fund within the existing financing options																
Project Component 4 – Demonstration of micro / mini hydropower plants.																
4.1 A number of micro / mini hydropower plants with cumulative capacity of at least 3.2 MW implemented in different locations within the country																
a. Obtaining licenses, permits and contracts for the micro / mini hydropower plants.																
b. Preparing bidding document for micro / mini hydropower plants.																
c. Launching the bid document, bidding, evaluating and selecting contractor for micro / mini hydropower plants.																
d. Finalization of power plant O & M plan.																



Activity	Year 1				Year 2				Year 3				Year 4			
	I	II	III	IV												
e. Preparing detailed design of mini-grid system, distribution lines, connections, metering, etc.																
f. Preparing bidding documents for mini-grid systems.																
g. Launching the bid document, bidding, evaluating and selecting the contractor for mini-grids.																
h. Financial closure.																
i. Construction and commissioning of the micro / mini hydropower plants																
j. Conducting expert inspection during construction and commissioning.																
k. Construction and commissioning of the mini-grids.																
l. Supervising the construction and commissioning of mini-grid.																
m. Monitoring, testing and reporting on plant performance.																
n. Conducting full scale demonstration site visit and seminar.																
o. Disseminating the information through leaflets, publications and website.																
Project Component 5 - Project Management																
a. Establishing Project Management Unit.																
b. Developing detailed activity plan and schedule.																
c. Establishing Project Steering Committee.																
d. Periodic convening of PSC meeting.																
e. Implementing micro / mini hydropower plants and mini-grids.																
f. Preparing TORs & recruiting of evaluation consultant.																
g. Conducting mid-term evaluation																



Activity	Year 1				Year 2				Year 3				Year 4			
	I	II	III	IV												
h. Conduction of Final Evaluation – 6 months after project completion.																
i. Project Reporting.																
j. Coordinating, managing and monitoring of all the day-to-day project activities.																

C.7. Risks

Eight categories of risks related to the project and achieving its objectives are considered:

1. Technical
2. Market
3. Financing
4. Policy
5. Governance/political
6. Sustainability
7. Implementation
8. Climate change risk

Component	Risk	Potential impact	Probability	Risk management
Technical risk	Micro / mini hydropower based mini-grids present some technological risks as they are relatively new to the rural areas of Tanzania.	High	Very low	<p>This risk is considered low, as there will be detailed techno-economic feasibility studies carried out on the identified sites and the actual project development will be based only for proven sites.</p> <p>Moreover, hydropower technology requires only minimum maintenance and it poses fewer problems from the point of view of technical aspect.</p> <p>Through the various trainings offered under the project, micro / mini hydropower plants can be operated successfully in rural areas of Tanzania with very low technical risk.</p>
Market risk	No off-takers for the generated electricity.	Medium	Very Low	The electricity generated from micro / mini hydro power plants will be supplied to the local communities and other identified customers in each site. The present demand of electricity outstrips the supply and hence there will not be any risk for electricity off-take.
Financing risk	No investors willing to invest in micro / mini	High	Very low	Letters for financial commitments from all the relevant stakeholders have been

	hydropower based mini-grids.			<p>already obtained. Hence, the project does not have any financing risk.</p> <p>Under PC 2, incremental efforts will be taken to establish a FiT scheme for micro / mini hydropower projects. When such a scheme is implemented, grid connected micro/mini hydropower projects will become very attractive for the project investors.</p> <p>Under PC 3, by streamlining the existing financing options from REA for MHP projects, the capacity of the local entrepreneurs to undertake micro / mini hydropower projects will be increased.</p>
Policy risk	<p>The current policies are too generic, addressing the energy issues in broader aspect.</p> <p>Failure to fix FiT for RE electricity.</p>	Moderate	Moderate	<p>This risk is low, as the government of Tanzania through the MEM is now revising the policy to see the possibility of developing a FiT for promoting RE technologies. The MEM in collaboration with the TANESCO is, with the ultimate aim of having a FiT in the country that will create an attractive environment for most of the private investors.</p> <p>In addition, the proposed project is mini-grid based and will not be affected by FiT. However, the project has been designed with a broader vision of promoting micro/mini hydropower on the whole within the country, which will be accelerated only if FiT is available exclusively for the grid connected micro / mini hydropower projects.</p>
Governance / political risk	New governments change the	High	Very low	As the electricity requirement is a basic demand in Tanzania and is essential for its economic

	existing policies on RE and withdraw support to the GEF project.			growth, even when the government changes, there is less possibility for not continuing this project.
Sustainability risk	Failure to achieve project outcomes and objective after successful delivery of outputs.	Moderate	Very low	Sustainability of the project will be ensured right from the beginning until the completion of the project. Detailed feasibility studies and productive use of electricity by the beneficiary communities will ensure the sustainability of the project.
Implementation risk	Failure to implement the project	Medium	Very Low	UNIDO will mitigate this risk through detailed development of activity plans in close cooperation with in-country project partners, stakeholders and developers. Agreed and transparent modus operandi will be defined before the start of the project implementation.
Climate change risk	Drying of water resources	Moderate	Very low	Enough water storage facility will be provided so as to take care of the water requirement during the dry season. Hence, this risk can be overcome.
	Flooding	Moderate	Very low	Tanzania is vulnerable to moderate flooding only. Proper spillways and diversion channels will be constructed to overcome this risk in the flood prone sites.

D. INPUTS

D.1. Counterpart inputs

The REA will provide cash and in-kind contribution to the project up to USD 7,000,000. In-kind contribution will be in the form of technical personnel to help in undertaking the feasibility studies, capacity buildings, etc. It also includes providing venues for the training workshops and facilitation of business model discussion dialogues. It will also provide office space and permit the use of relevant amenities and facilities to host the Project Management Unit (PMU). The REA has committed to provide the necessary co-financing for the project activities in all components.

The MEM will provide one staff for the entire period of the GEF-UNIDO project for assisting the national PMU. The staff will work on the implementation of project activities, reporting to the ministry on the project progress in line with the agreed activities and national priorities. In addition to it, MEM will provide in-kind contribution towards hydropower assessment in selected regions of Tanzania. The in-kind contribution will be human resources, instruments, equipment and transport to and fro from the site. The total value of contribution of MEM towards the project will be around USD 32,000.

The CoET, University of Dar es salaam will provide in-kind contribution amounting to USD 50,000 for the facilities to establish National micro / mini hydropower technical centre and for executing the capacity building activities. CoET will also avail its facilities and staff to facilitate fabrication of turbines, capacity building activities such as training of technical personnel and policy makers, skilled technicians to undertake maintenance of facilities during and after the project, etc.

Bruderhaus DIAKONIE Germany in association with Behindertenlife Neckar-Alb, Germany will provide in-cash contribution of USD 112,500 for the establishment of transmission lines for the Tandala project.

Andoya Hydro Electric Power Company will contribute USD 2,500,000 for the project in cash and in-kind. The other private counterparts will provide cash and in-kind contribution. Except for Andoya Hydro-Electric Power Company, all other contributions will be routed through REA. They will be responsible for facilitating the installation of pilot plants. The details of the contribution from private counterparts are included in Annex 4 - letters of commitment from different pilot site developers.

In addition, UNIDO will provide USD 80,000 towards project evaluations and UNIDO staff travel.

D.2. UNIDO inputs

1. International staff

International experts on Micro / mini hydropower potential assessment and micro / mini hydropower plant development

These experts will be responsible for the following activities:

- a. Assessing the capacity building needs for various technical institutions
- b. Developing the training manuals for micro / mini hydropower trainings
- c. Establishing the micro / mini hydropower technical centre
- d. Training the expert planners and institutions on micro / mini hydropower project development and implementation
- e. Preparing the micro / mini hydropower projects development guide
- f. Sharing micro / mini hydropower related experiences from other countries
- g. Adaptation of existing guidelines and standards for local micro / mini hydro power plants installation and management
- h. Creating awareness among the stakeholders on the available subsidies and credit lines
- i. Facilitating head-to-head meetings between the private sector and the local financing institutions
- j. Facilitation for streamlining the already existing credit lines for micro-mini hydro power projects.
- k. Full scale demonstration of the project

International expert for Policy and feed-in tariff

This expert will provide technical expertise and will be responsible for:

- a. Providing incremental support to the Tanzanian Government in drafting the FiT scheme for RE projects

International experts on Fabrication of mini/micro hydropower plant equipments

These experts will be responsible for:

- a. Foreseeing the manufacturing process and devising the means of sustaining the process

2. National staff

Project component 2: Capacity building of relevant stakeholders in developing micro / mini hydropower based mini-grids

The short term local experts will be hired when and where required to assist the development and implementation of the micro-mini hydropower based mini-grids. The national expert will provide logistical support during the capacity building activities for the relevant institutions. He/she will work closely with the international expert and the local counterparts. National short-term experts will be recruited to assist and co-ordinate the following activities:

- a. Assessing the capacity building needs for various technical institutions and CoET;
- b. Developing training manuals for micro / mini hydropower trainings;
- c. Establishing the micro / mini hydropower technical centre;
- d. Preparing the micro / mini hydropower projects development guide
- e. Foreseeing the manufacturing process and devising the means to sustain the process
- f. Facilitating the issuance of licenses to the trained fabricators
- g. Publishing the standards and manuals
- h. Incremental support for the establishment of FiT

Project component 3: Developing viable business models for micro / mini hydropower based mini-grid

The recruited national experts will provide local technical expertise and services under the guidance of the international experts and the local counterparts to assist and co-ordinate the following activities:

- a. Creating awareness among the stakeholders on the available subsidies and available credit lines.
- b. Facilitating the streamlining of available subsidies and WB credit lines so as to enable investors to invest in.
- c. Facilitating head-to-head meetings between the private sector and local financing institutions

Project component 4: Demonstration of micro / mini hydropower plant based mini-grids

The national experts will be responsible for all the administrative arrangements for the installation of the micro / mini hydropower plants under the pilot programs. The local experts will assist in the following in PC 4 of the project:

- a. Full scale demonstration of the mini-grids.

3. Sub-contracts

Subcontracts will be given to the services related to the conduct of detailed feasibility studies and designs for the different sites. Also, subcontracts will be issued for the provision of technical expertise for the staffs at CoET technical centre on micro / mini hydropower. Also a sub-contract will be awarded for the transfer of technology for the local fabrication of micro / mini hydro turbines and equipments.

Evaluating the existing local capacity on micro / mini hydropower equipment fabrication and identification of potential/interested suppliers will also be carried out by a sub-contractor. There will also be a sub-contract to obtain the licenses, permits and contracts required for the micro / mini hydropower plants. A separated sub-contact will be awarded for the detailed design of mini-grid system, distribution, lines, connections, metering, etc.

Subcontracts related to services for the establishment of demonstration projects will be managed through UNIDO procurement unit.

4. Training

Following are the training programmes delivered by the project:

1. Training programme for the personnel at the CoET micro / mini hydropower technical centre on technical aspects of micro / mini hydropower based mini-grids.
2. Training programme for the expert planners and institutions on micro / mini hydropower based mini-grid project development and implementation.
3. Training programme for the identified interested fabricators to transfer the technology.



5. Equipment and supplies

Major equipments related to the 3.2 MW micro / mini hydropower demonstration plants are envisaged to be undertaken by the REA and other private investors directly. UNIDO will assist in the procurement process if it is found that the investing partner lacks necessary capacity. Sufficient funds for the purpose will be channelled through UNIDO.

In addition, a part of the budget from GEF-UNIDO funding will be contributed towards the purchase of power plant equipments and machineries required for the establishment demonstration facilities. .

E. BUDGET

Budget summary for the project components

Project Component		Indicative Budget Estimate (US\$)		
No.	Details	GEF Funds	Co-financing	Total
1	Technical assessment and mapping of micro / mini hydropower resources in Tanzania.	200,000	650,000	850,000
2	Capacity building of relevant stakeholders in developing micro / mini hydropower based mini-grids.	700,000	700,000	1,400,000
3	Developing viable business models for micro / mini hydropower based mini-grid.	250,000	350,000	600,000
4	Demonstration of micro / mini hydropower plant based mini-grids.	1,900,000	7,378,500	9,278,500
5	Project management	300,000	700,000	1,000,000
Total		3,350,000	9,778,500	13,128,500

Fund mobilization:

Total project cost is budgeted as USD 13,128,500 and the resource mobilization is envisaged as follows:

GEF contribution in cash through UNIDO	: USD 3,350,000
Co-financing from REA (In-cash & kind)	: USD 7,000,000
Co-financing from Andoya Hydro Electric Company (In-cash & kind)	: USD 2,500,000
Co-financing from Ministry of Energy and Mineral (In-kind)	: USD 36,000
Co-financing from CoET (In-kind)	: USD 50,000
Co-financing from GEF agency UNIDO (In-Cash)	: USD 80,000
Co-financing from Behindertenhilfe Neckar-Alb (In-cash)	: USD 112,500
	:

Based on the above, utilization of UNIDO budget for a total of USD 3,350,000 + USD 80,000 = USD 3,430,000 for 4 years is as follows:

Detailed budget for the GEF support funds

BL	Activity	W/M	Amount, US \$
11-00	International consultants	25	300,000
12-00	National Project Manager	48	240,000
13-00	Project administrative assistant	48	48,000
15-00	Project related travels		205,000
17-00	National short-term consultants	42	168,000
21-00	Subcontracts		560,000
33-00	In-service trainings (within country)		169,000
45-00	Equipments		1,665,000
51-00	Sundries		15,000
81-00	Evaluation (2 times- midterm and final)		60,000
99-99	Total (GEF + UNIDO)		3,430,000
	Support cost @ 10% (of total GEF amount)		335,000
	Grand total		3,765,000

Note:

Project Management cost of USD 300,000 is allocated as follows:

- a) National Project Manager cost: USD 240,000 (48 months x USD 5,000/month)
- b) Project administrative assistant cost: USD 48,000 (48 months x USD 1,000 /month)
- c) Remaining cost of USD 12,000 is allocated to project related travels

UNIDO co-financing of USD 80,000 is allocated as follows:

- a) Project evaluation budget: USD 60,000
- b) Remaining cost of USD 20,000 is allocated to other project evaluation related travels

A detailed job description for the international and national experts involved in the project is given in Annex 5.

F. MONITORING & EVALUATION

Project monitoring and evaluation will be conducted in accordance with the established UNIDO and GEF procedures.

Project results and resources framework matrix will provide performance and impact indicators for project implementation. This will form the basis on which the project's monitoring and evaluation system will be built.

The overall objective of the monitoring and evaluation process is to ensure successful and quality implementation of the project by: i) tracking and reviewing the execution of project activities; ii) taking early corrective action if performance deviates significantly from the original plans and iii) adjusting and updating project strategy and implementation plan to reflect possible changes on the ground results achieved and the corrective actions taken.

a. Monitoring

A detailed monitoring plan for tracking and reporting on project time-bound milestones and accomplishments will be prepared by UNIDO in collaboration with the PMU and project partners at the beginning of project implementation and then will be updated periodically. Monitoring activities will be carried out on the basis of the periodic reports developed by the PMU with the frequency aligning with the quarterly reports.

By making reference to the impact and performance indicators defined in the Project Results Framework, the monitoring plan will track, report and review the project activities and accomplishments in relation to:

- a. Implementation of a micro / mini hydropower based mini-grid projects
- b. Replication potential of such micro / mini hydropower based mini-grid projects elsewhere in Tanzania
- c. Operation and effectiveness of national micro / mini hydropower technical centre
- d. CO₂ emission reduction resulting from the implemented projects
- e. CO₂ emission reduction potential from other replication projects Conduct of various capacity building trainings and their usefulness
- f. Level of awareness and technical capacity within relevant institutions in the market and within enterprises
- g. Improvement in Government policy measures to support micro / mini hydropower based mini-grids
- h. Effectiveness and usefulness of the dissemination activities such as trainings, seminars, site visits, mini-grid performance reports, project website, leaflets, etc.

b. Evaluation

The project will be subjected to a mid-term and final evaluation. The internal mid-term evaluation will be conducted at the end of the 2nd year of the GEF project. The evaluation will focus on various activities such as the construction of the power plant, assess the effectiveness of the trainings, micro / mini hydropower technical centre, transfer of technology on local fabrication of hydropower equipments, etc. carried out until the 2nd year of the project.

An independent final evaluation will take place three months prior to the terminal review meeting and will focus on the technical performance of the power plant and assess the impact of the project as a whole. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefit goals. The final evaluation will also provide recommendations for follow-up activities.

The following table provides the tentative budget for the total evaluation, which has been included in Project Component 5.

Table : Total evaluation budget

Activity	USD
Mid-term evaluation	12,000
Mid-term evaluation travel	6,000
Final evaluation	48,000
Travel	14,000
Total	80,000

c. Reporting

The Project Management Unit (PMU) will present a report to UNIDO every three months with detailed information on the progress of the project as per the annual business plan and activities that have been carried out during the period of each report. An annual report shall be submitted by PMU at the end of each project cycle year with summary of activities carried out over the year. The annual report will also cover the benefits and impacts achieved from the implementation of the project. In addition, the report will include the evidence to demonstrate the progress made in the achievement of the indicators highlighted in the Logical Framework.



G. PRIOR OBLIGATIONS AND PREREQUISITES

No prior obligations and prerequisites apply to the project.

H. LEGAL CONTEXT

The Government of United Republic of Tanzania agrees to apply to the present project, mutatis mutandis, the provisions of Standard Basic Assistance Agreement between the United National Development Programme and the Government, signed and entered into force on 30 May 1978.

I. ANNEXES



Annex 1: Logical Framework

Project Strategy		Objectives verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and assumptions
Goal	To reduce GHG emissions related to the use of carbon intensive energy sources in rural areas in Tanzania.	1. Percentage increment in use of micro / mini hydropower based electricity by rural population. 2. Percentage Increment in CO ₂ e emission reductions (t CO ₂ e).	1. Only 2% of rural population has access to grid electricity. 2. CO ₂ emission due to diesel based local power generation.	A cumulative of 3.2 MW micro / mini hydropower based mini-grids installed during the project duration (2011-2015).	1. Physical verification of the projects in operation. 2. End of project M&E report.	1. Continuous support of relevant government departments and private investors are in place. 2. Policies are in place.
Objective of the project	To promote micro / mini hydropower based mini grids in Tanzania to augment rural electrification.	1. Number of MWs of micro / mini hydropower based mini-grids in operational. 2. Number of locally fabricated micro / mini hydropower equipments and accessories. 3. Number of	1. Only 2% of rural population has access to grid electricity. 2. No local fabricators available for micro / mini hydropower equipments.	1. 3.2 MW (cumulative capacity) of micro / mini hydropower plants with mini-grids established. 2. At least 5 institutions and 5 entrepreneurs available for	1. Physical verification of the implemented projects. 2. Physical verification of the fabrication units. 3. Published FiT rates for micro /	1. Sustained support of the Government (through different policies), REA, all project participants and project investors. 2. Interested local fabricators



Project Strategy		Objectives verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and assumptions
		institutions and entrepreneurs available for developing micro / mini hydropower plants. 4. FiT for RE including small/micro / mini hydropower plants in place.	3. Lack of technical capacity (human and institutional). 4. Weak policy and regulatory regime.	developing micro / mini hydropower plants. 3. FiT for RE including small/micro / mini hydropower plants established.	mini hydropower mini-grids.	available.
Outcome 1	Site specific details on potential micro / mini hydropower sites available for further development.	1. Detailed techno-economic feasibility studies for the identified 9 demonstration sites.	1. Lack of detailed studies for the demonstration sites.	1. Feasibility studies of identified demonstration sites developed.	1. Feasibility study reports.	Continuous support of Government agencies, national utility and the private sector.
Project Component 1: Techno-economic feasibility studies for the identified demonstration sites						
Output 1.1	Detailed feasibility studies and plant designs prepared for the demonstrations in the identified potential sites.	Number of feasibility reports of the demonstration sites (cumulative 3.2 MW).	No feasibility studies exist for the micro / mini hydropower plants development.	To undertake feasibility studies of demonstration sites.	9 feasibility study reports including plant designs for the demonstration sites.	Sustained private and Government support upon agreed project activities.



Project Strategy		Objectives verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and assumptions
Outcome 2	Investment cost of micro / mini hydropower based mini-grids reduced because of the local availability of technical experts and high quality indigenous hydropower equipments.	<ol style="list-style-type: none">Number of trained local planners and experts on micro / mini hydropower based mini-grids.Number of institutions capable of guiding and supporting micro / mini hydropower plant development in future.Number of micro / mini hydropower turbines and controls systems manufacturing facilities operating in the country.	<ol style="list-style-type: none">No sufficient local knowledge exists on developing, implementing and managing the micro / mini hydropower projects.Inadequate institutional capacity exists in the country.Micro / mini hydropower turbines and control systems are imported.	<ol style="list-style-type: none">To strengthen the capacity of atleast 100 persons from CoET, experts, planners and other relevant stakeholders to support micro / mini hydropower mini-grids development in the country.To build capacity of TANESCO and River Basin Authorities in developing and managing micro / mini hydropower systems.To transfer technology for facilitating local fabrication of micro / mini	<ol style="list-style-type: none">Number of trained persons.Number of institutions capable of guiding and supporting micro / mini hydropower plant.Physical verification of operating personnel in the power plant.Training materials.Training evaluation report.Number of trained fabricators.Physical	<ol style="list-style-type: none">Sustained private, institution and Government support upon agreed project activities.Interest of local fabricators.



Project Strategy		Objectives verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and assumptions
				hydropower plant equipments to at least 5 interested suppliers.	verification of the manufacturing facilities.	

Project Component 2: Capacity building of stakeholders in developing micro / mini hydropower based mini-grids

Output 2.1	National micro / mini hydropower technical centre established at CoET, UDSM to provide technical support for various technical institutions in Tanzania.	Approval received and Centre operating.	Insufficient technical capacity exists in various institutions on micro / mini hydropower systems.	To establish the centre, strengthen it with trained personnel and equip with necessary tools and systems for micro / mini hydropower plant development.	1. Physical verification. 2. Government reports. 3. End of project M&E report.	Continuous support of the participating technical institutions, private sector and Government of Tanzania.
Output 2.2	Technology transferred for local fabrication of micro / mini hydropower equipments.	1. Number of local fabricators trained and licensed in manufacturing of micro / mini hydropower equipments. 2. Number of locally fabricated turbines	All hydropower equipments imported.	1. To transfer and adapt micro / mini hydro turbine technology to Tanzania. 2. To train at least 5 interested suppliers.	1. No. of trained fabricators 2. License certificates 3. Training evaluation report 4. No. of trained	Interest of local fabricators and investors.



Project Strategy		Objectives verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and assumptions
		used in at least 2 installations of the project.			persons 5. Physical verification	
Output 2.3	Existing guidelines and standards adapted to suit installation and management of micro / mini hydropower plant mini-grids in Tanzania.	Existing guidelines and standards adapted to suit the micro / mini hydropower development, installation and commissioning in Tanzania	No guidelines and standards exist for micro / mini hydropower installation and management. Current focus is on large hydropower plants only.	To prepare and disseminate guidelines and standards on installation and management of micro / mini hydropower mini-grid projects.	1. Guidelines on project development, installation and commissioning. 2. Government reports.	Continuous support of Government, close collaboration of TANESCO and TBS.
Output 2.4	Feed-in tariff for micro / mini hydropower in place.	Feed-in-tariff system favouring RE including micro / mini hydropower market available.	No market based systems favouring RE including micro / mini hydropower exists in the country.	To facilitate introduction of feed-in-tariff for micro / mini hydropower systems	Communiqué of regulatory authority.	Sustained collaboration among Government, micro / mini hydropower training centre, relevant institutions and private stakeholders.
Outcome 3	Interest in	1. Number of micro /	1. Low interest	1. To create interest	1. Number of	Interest of local



Project Strategy		Objectives verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and assumptions
	developing micro / mini hydropower projects increased among the local entrepreneurs.	mini hydropower plants developed and invested by local entrepreneurs.	from private entrepreneurs to engage in micro / mini hydropower development.	among investors and entrepreneurs in micro / mini hydropower projects of at least 24 MW capacity	investors. 2. Business models developed. 3. Physical verification of the operating power plants	entrepreneurs.

Project Component 3: Developing viable business models for micro / mini hydropower based mini-grid

Output 3.1	Existing financing options of REA streamlined to benefit local entrepreneurs interested in micro / mini hydropower.	Percentage increase in engagement of local entrepreneurs to develop micro / mini hydropower projects.	Low interest from private entrepreneurs to engage in micro / mini hydropower project development.	At least 10 private sector initiatives facilitated for micro / mini hydropower based mini-grids.	1. Project progress reports. 2. End of Project survey.	Sustained support of Government and the private stakeholders.
Outcome 4	Technical and economic viability of micro / mini hydropower technologies demonstrated.	1. Number of rural households with access to electricity. 2. Number of micro / mini hydropower	Only around 2% of the rural population has access to grid electricity.	To establish at least 3.2 MW (cumulative) capacity of micro / mini hydropower based mini-grids in	1. Physical verification. 2. Report of commissioning.	Sustained support of Government and private stakeholders.



Project Strategy		Objectives verifiable indicators				
		Indicator (quantified and time-bound)	Baseline	Target	Source of verification	Risks and assumptions
		plants in operation.		rural areas.		
Project Component 4: Demonstration of micro / mini hydropower plant based mini-grids						
Output 4.1	3.2 MW implemented in different locations within the country.	Micro / mini hydropower power plants established and running in different sites of Tanzania.	Currently only 5 MW of the potential 250 MW micro / mini hydropower exist.	To develop micro / mini hydropower plants within the capacity ranging from 98 kW – 1MW in selected sites.	<ol style="list-style-type: none">1. Physical verification of the implemented projects.2. Performance monitoring report3. Site visit / seminar.4. Seminar material, leaflets, various publications and website.	<ol style="list-style-type: none">1. Sustained support of the Government.2. Sustained investor support to visit the project while in operation and data collection.



**Annex 2: Pre-feasibility study report for the potential micro / mini hydropower sites
(separate files)**

Annex 3: Estimate of GHG emission reductions

The project activity is the installation of 3.2 MW micro / mini hydropower plants. The project involves direct and indirect emission reductions. The activity contributing to direct emission reduction is due to the installation of 3.2 MW micro / mini hydropower based mini grids and that of indirect emission reduction is replication of similar type of power plants within 10 years in other potential sites.

Direct emission reduction:

3.2 MW micro / mini hydropower plants directly results in emission reduction through electricity generation that replaces diesel usage. The direct emission reduction is calculated using fuel savings attributable to the investment.

Power capacity	: 3,193 kW
Capacity factor	: 75%
Annual electricity generation	: 3,193 kW x 8,760 hours x 0.75
	: 20,978,000 kWh
	: 20,978 MWh

Water resource availability in each site, varies on a monthly basis. Due to budget constraints extensive data collection process could not be conducted as the number of projects involved for demonstration are high. Infact more sites were studied and 9 sites were shortlisted. Hence detailed data collection during PPG stage was not possible. Already a study was conducted on Tanzanian hydro power sites by University of Twente, The Netherlands and there average data of 75% is used for the time being. During the project stage, detailed study on capacity factor for each site will be conducted.

The power plant has a useful lifetime of 20 years. Over its lifetime, micro / mini hydropower based electricity will replace existing diesel based electricity generation. The emission factor for the technology used in baseline scenario is 0.8 t CO₂/MWh.

Amount of electricity generated	(A)	: 20,978 MWh
Emission factor for diesel	(B)	: 0.8 t CO ₂ /MWh
Average useful investment lifetime	(C)	: 20 years
Direct emission reduction	=	A x B x C
	=	20,978 MWh x 0.8 t CO ₂ /MWh x 20 years
	=	335,648 t CO ₂ e

The direct emission reduction from the generated electricity, which replaces diesel usage in the baseline scenario, is 335,648 t CO₂e.

Indirect Emission Reduction (Bottom-up Approach):

The installation of micro / mini hydropower plants also contributes in emission reduction after the project completion, which is accounted as indirect emission reductions. The approach used in this project to calculate indirect emission reduction is bottom-up approach, which considers only the number of times that the project might be replicated after the project completion.



The project activity has long term emission reduction after the project that is achieved through the installation of similar type of power plants in the project area. The number of similar projects in a period of 10 years represents the replication factor. Based on the available estimates for micro / mini hydropower potential, it is conservatively assumed that around 26 MW of micro / mini hydropower plants would be replicated in other potential sites.

Direct emission reduction (A) : 335,648 t CO₂e
Replication factor (B) : 8

Indirect emission reduction
= A x B
= 335,648 t CO₂e x 8
= 2,685,185 t CO₂e

Results

Emission reductions	t CO ₂ e
Direct emissions reductions	335,648
Direct post project emissions reductions	-
Indirect emissions reductions	2,685,185



Annex 4: Commitment letters of co-financing

THE UNITED REPUBLIC OF TANZANIA RURAL ENERGY AGENCY

Telephone: +255 (22) 241200/1/2/3
+255 (22) 2412005/6
Facsimile: +255 22 2412007
E-mail: info@rea.go.tz



Mawasiliano Towers,
Sam Nujoma Road,
P.O. Box 7990,
DAR ES SALAAM.

Ref. No: BC 72/157/08/3

08th March, 2011

The Chief Executive Officer
Global Environmental Facility (GEF)
1818 H Street, NW
Washington DC 20433
USA.

RE: COMMITMENT FROM THE RURAL ENERGY AGENCY ON SUPPORTING THE PROJECT OF MINI - GRIDS BASED ON MINI/MICRO-HYDROPOWER SOURCES TO AUGMENT RURAL ELECTRIFICATION IN TANZANIA

This is to express that the Rural Energy Agency (REA) is highly supportive of the UNIDO- GEF initiated project titled “**Mini Grids Based on Mini/Micro Hydropower Sources to Augment Rural Electrification in Tanzania**”. To ensure the full and successful implementation of this Project, the REA will provide counterpart funding of up to Seven Million US Dollars (\$7mill) in cash and kind to complement the resources already approved by the GEF and other partners.

The Government believes that the project will complement previous and on-going efforts of the Government of Tanzania for the provision of mini grids on mini-hydro sources to augment rural electrification. The Government is aware of the current generation capacity which is far below what is required for rural dwellers and for alternative sources for isolated rural communities.

The duration of the co-financing of the above total will be made available over the next four years (2011-2015).

At this point REA would like to express its acknowledgement to the consideration and looking forward to seeking the cooperation in the implementation of this important project.

Sincerely,

Lutengano U. A. Mwakahesya
DIRECTOR GENERAL

Copy: Mr. Dmitri Piskounov,
Managing Director,
PTC, UNIDO

“ Mr. Jossy M. Thomas,
Industrial Development Officer,
Renewable & Rural Energy Unit,
UNIDO



THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF ENERGY AND MINERALS

Telegrams "ENERGY"
Telephone: 255-22-2117156-9/2119158
Fax No.: 255-22-2116719/2120799



754/33 SAMORA AVENUE
P. O. BOX 2000,
DAR ES SALAAM

Ref. No. CAB 88/321/01

14/02/2011

Managing Director,
UNIDO GEF Focal Point,
P. O. Box 9182,
DAR ES SALAAM.

**RE: COMFORT LETTER FOR THE CO-FINANCING FROM GOVERNMENT
OF TANZANIA TO SUPPORT THE IMPLEMENTATIONS OF GEF-4
PROJECT IN TANZANIA**

Reference is made to your letter dated 18th January 2011 regarding the captioned subject.

The Ministry of Energy and Minerals (MEM) in collaboration with TANESCO have carried out identification and assessment of Small Hydro Power Projects in Rukwa, Mbeya, Iringa, Ruvuma and Kagera regions. So far the identified potential in SHP is approximated to be 475MW of which 8MW has been developed.

Meanwhile, the arrangement to carry out assessment in Morogoro and Kigoma regions is in progress. The schedule for this task will take place effectively from May to October 2011. MEM and TANESCO are also planning to carry out an additional assessment in Iringa region during October and November 2011 to cover the remaining areas not covered during the previous assessment. The estimated total cost for this task is **US\$36,000** taking into consideration that, assessment for SHP in one region is estimated to cost **US\$12,000** for two months.

Based on the aforesaid, the Ministry of Energy and Minerals has capacity to co-finance the project in the form of in-kind contribution. This support is in form of human resources, instruments, equipment and transport to and from the site.

Your cooperation is appreciated.

B.M
Eng. B. J. Mrindoko
FOR: **PERMANENT SECRETARY**



Andoya Hydro Electric Power Co. Ltd

Stand Street Plot No. 199 Block A, P.O. Box 45 Mbinga Tanzania
Tel/Fax: +255 25 2040075, Mob: 0704-002042, 0700-002042, 0704-003020,
Email: andoyahupo@yahoo.com



AHEPO/02/2011

10th March 2011

Dmitri Piscounov
Managing Director
Programme Development and Technical Cooperation Division
P.O. Box 300, 1400 Vienna, Austria.

Dear sir,

**RE: CO-FINANCING COMMITMENT TO FOR DEVELOPMENT OF 1MW PLANT
AS PART OF UNIDO GEF-4 PROJECT ON PROMOTION OF 'MINI GRIDS
BASED MINI/MICRO HYDRO POWER FOR THE ARRANGEMENT RURAL
ELECTRIFICATION IN TANZANIA"**

We would like to thank UNIDO for showing interest in promoting mini hydro plants in Tanzania, Andoya Hydroelectric Power Co. Ltd is committed to develop such projects in Tanzania as part of efforts to increase the national electrification share.

Andoya Hydrulectric Power Company Limited (AHEPO) is a Company established for the purpose of developing and running mini hydro plants for power generation for the rural Tanzania. To start with, the Company will develop 1MW Mini Hydro Plant under the UNIDO GEF 4 project cycle.

The company will mobilise cash amounting to US\$ 2,500,000 in relation to project development through Own equity, bank loans and beneficiary contributions. The company will also be responsible in plant installation and operation work throughout the project lifetime.

We would like to sincerely thank UNIDO for its interest in supporting our project and hope to continue with such cooperation.

Yours Sincerely,



.....
Menas Andoya
Managing Director
AHEPO CO. LTD



**UNIVERSITY OF DAR ES SALAAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
OFFICE OF THE PRINCIPAL**

P.O. BOX 35131 - DAR ES SALAAM - TANZANIA

Tel.: +255 22 2410753 (Direct) or 4210501-9/Ext.2800
Fax: +255 22 2410114 or 2410411 or 2410029

E-mail: principalcoet@udsm.ac.tz
Website: www.CoET.ac.tz

Our Ref.: CoET/001/JHYK/

Date: 08th January 2011

UNIDO-GEF Project

**Project title: Mini-Grids Based on Micro Hydropower Sources to Augment
Rural Electrification in Tanzania**

Re: CoET in-kind Co-financing Commitment

The College of Engineering is committed to implement the project and therefore it will provide in kind support worth USD 50,000. In this regard CoET will avail its facilities and staff to facilitate fabrication of turbines, capacity building activities such as training of technical personnel and policy makers, skilled technicians to undertake maintenance of facilities during and after the project. Specifically our contribution can be categorized as follows:

- i) Availing TDTC workshop (space, some machinery and personnel) for turbine manufacturing training place;
- ii) Availing TDTC workshop (space, some machinery and personnel) as local turbine manufacturing centre and training centre for local entrepreneurs in turbine manufacturing;
- iii) Venues for technical training, seminars and workshops;
- iv) Office space and/or secretary for project training coordination;
- v) 20 academic staff to be trained as trainers;
- vi) 1 academic staff as member of national steering committee of the proposed project;
- vii) 5 Staff to serve as Project Committee at the College of Engineering and Technology to oversee the components that CoET will be coordinating.

Prof. JHY Katima
Principal

Teil haben. Teil sein.

Behindertenhilfe

Behindertenhilfe
Neckar-Alb
Federneestr. 3
72764 Reutlingen

Friedemann Salzer
Leitung
00497121/9300611
00491752632343
friedemann.salzer@bruderhausdiakonie.de

bruderhausDIAKONIE
Stiftung Gustav Werner und Haus am Berg



Evangelische Kirchengemeinde Eilsleben
in Zusammenarbeit mit dem
Kirchenkreis Egeln
(Evangelische Kirche Mitteldeutschland)

Christoph Timme
A2 Eilsleben
Ostend 2
004939409502
timme.eilsleben@t-online.de

Micro-hydropower Project Tanzania Ijangala-Tandala (Downstream)

We, the Protestant (Lutheran) Church in Eilsleben in cooperation with the
church district Egeln(Protestant (Lutheran) Church of Middle Germany)

and

the Behindertenhilfe Neckar-Alb (Organisation helping special aid people in the
area of Reutlingen, Germany)

commit ourselves to contribute to finance the Micro-hydropower Project
Tanzania Ijangala-Tandala. We are ready to take over the cost of the
transmission line for the amount of 112,500 US Dollars.



The (main) purpose of our cofinancing this project is the support of the
Dianconical Centre of Tandala. The need of electricity of this centre is 50 - 100
kW and shall become reality through our contribution.

12.1.2011

Friedemann Salzer
Director of **bruderhausDIAKONIE**
Behindertenhilfe Neckar-Alb
Stiftung Gustav Werner und Haus am Berg
Behindertenhilfe Neckar-Alb
Federseestraße 3
72764 Reutlingen

Christoph Timme
for
Evangelische Kirchengemeinde
Eilsleben



Annex 5: Job Description of international and national experts (separate file)