FULL SIZE PROJECT BRIEF

GEF COUNCIL SUBMISSION

AGENCY'S PROJECT ID: GFL/2328-2721-PMS: GF/4010/5-

GEFSEC PROJECT ID:

COUNTRY: Kenya, Uganda, Tanzania, Malawi, Mozambique, Rwanda, Burundi and Zambia

PROJECT TITLE: Greening the Tea Industry in East Africa

GEF AGENCY: UNEP

OTHER EXECUTING AGENCY (IES): EATTA

DURATION: 4 Years

GEF FOCAL AREA: Climate Change

GEF OPERATIONAL PROGRAM:

- O.P.6: "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs". The central activity is the promotion of small hydropower projects to meet electric power needs of the energy-hungry tea processing factories in eight countries in East Africa.
- O.P. 5 "Removing barriers to energy conservation and energy efficiency"

GEF STRATEGIC PRIORITY:

- SP-2: "Increased Access to Local Resources of Financing for Renewable Energy and Energy Efficiency": The project will mobilize local equity investments from tea factories and financing from local and regional institutions for financing small hydropower and energy efficiency.
- SP-3: "Power Sector Policy Framework Supportive of Renewable Energy and Energy Efficiency": The project will support regulators and utilities to develop light-handed regulations for the development of small hydropower, sale of excess power to the grid and for rural electrification
- SP-4 "Productive uses of renewable energy": The produced power will substantially meet the productive energy needs of the tea sector.

Pipeline Entry Date: 16 March 2005

ESTIMATED STARTING DATE: August 2006

IA FEE: US$ 308,000

FINANCING PLAN (US$)	
GEF PROJECT/COMPONENT	
Project	2,854,000
PDF A	
PDF B	569,400
PDF C	
Sub-Total GEF	3,423,400
Co-financing*	
GEF Agency (UNEP)	n.a
Government	2,680,000
Bilateral (COOPENER/EC: Bilateral donors)	614,000
EATTA	100,000
Tea factories (equity)	7,000,000
Financial Institutions	15,000,000
Construction & Equipment Companies.	220,000
Sub-Total Co-financing:	*25,614,000*
Total Project Financing:	*28,468,000*
FINANCING FOR ASSOCIATED ACTIVITIES IF ANY:	
LEVERAGED RESOURCES IF ANY: *Details provided under the Financial Modality and Cost Effectiveness section	

CONTRIBUTION TO KEY INDICATORS OF THE BUSINESS PLAN: Reduce greenhouse gas emissions directly by approximately 0.76 million tons of CO_2 equivalent over 20 years.

RECORD OF ENDORSEMENT ON BEHALF OF THE GOVERNMENT(S):

(Enter Name, Position, Ministry)	Date*: (Month, day, year)*
R.O.S. Mollel, Senior Permanent Secretary, Vice-President's Office, Tanzania.	June 22, 2005
K. Nkowani, Director and GEF Operational Focal Point, Ministry of Tourism, Environment and Natural Resources, Zambia.	May 10, 2005
Etienne Kayengeyenge, Director General, Management of Environment and Tourism, and GEF Operational Focal Point, Burundi	June 30, 2005
Luciano Andre de Castro, Minister for Coordination of Environmental Affairs, Ministry of Coordination of Environmental Affairs, Mozambique.	July 25, 2005
R.P. Kabwaza, Director of Environmental Affairs and GEF Focal Point in Malawi, Environmental Affairs Department, Malawi.	May 19, 2005
Keith Muhakanizi, Deputy Secretary to the Treasury/GEF Operational Focal Point, Ministry of Finance, Planning and Economic Development, Uganda.	March 13, 2006
A.M. Mwinzi, Ag. Director General, National Environment Management Authority, GEF National Operational Focal Point, Kenya.	March 27, 2006
Patricia Hajabakiga, Minister of Lands, Environment, Forestry, Water and Mines, Rwanda.	April 25, 2006

Approved on behalf of the UNEP. This proposal has been prepared in accordance with GEF policies and procedures and meets the standards of the GEF Project Review Criteria for work program inclusion.

Name & Signature
IA/ExA Coordinator

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Summary

As a result of the proposed Project 'Greening the Tea Industry in East Africa' tea factories in participating countries in Eastern and Southern Africa, under the East Africa Tea Trade Association (EATTA) will have access to clean and reliable electricity from small hydropower for their processing needs. This will substitute for expensive and unreliable electricity from the grid and diesel backup power. An accompanying activity will increase the efficiency of energy use in tea factories. Together these steps will reduce the cost of production and make the tea more competitive on the world market. They will also reduce the GHG emissions in the production of tea, thus greening the tea sector in the EATTA countries. Communities that neighbour tea factories will benefit from access to electricity generated by the small hydropower projects. The project will contribute to rural electrification in countries with among the lowest rural electricity access in the world. Surplus power not used by the tea factories or for rural electrification will be available to the national grid. By substituting for proposed addition of GHG intensive electricity, the project will partially mitigate the increasing trend of fossil-fuel based IPPs, and also make a modest contribution to the greening of the power grids within the EATTA countries.

The proposed Project is private sector-driven enhancing opportunities for public-private partnerships and has only winners: the tea sector benefits from more reliable energy and lower energy costs; rural communities benefit through access to electricity; the grid benefits through access to low cost surplus electricity from the pilot hydropower projects and over time through significantly increased investment in hydropower once the barriers are removed in the course of development of the pilot demonstration projects; and finally the global environment benefits with every kilowatt-hour of hydropower replacing emissions from burning fossil fuels to generate power on the grid or from backup diesel generators.

The Project will achieve the above benefits by removing the major barriers that stand in the way of small hydropower development in the EATTA countries. These are: *lack of confidence in the small hydro sector from investors and financing institutions; limited experience and knowledge in the region about small hydropower technology; unclear government policies to promote small hydropower rural electrification through public private partnership, and ambivalence on the part of utilities to purchase excess energy produced by small renewable energy projects*. The EATTA will, through its Project Management Office set up to execute this project, systematically address all these barriers through a series of well targeted activities.

It is anticipated that within the 4 year Project period at least six small hydropower plants will be constructed to meet the energy needs of the tea sector in the EATTA countries producing a total of around 10 MW of power. The total GHG emissions avoided by the project is anticipated to be around 42,000 tons of CO_2 each year from these pilot projects at the end of the Full Size Project. The cumulative GHG emission reductions from the pilot projects by the end of the Full Scale Project are expected to be 84,000 tons as the projects will come on line in years 3 and 4 of the Project. Over a 20 year life time of these pilot projects some 765,600 tons of CO_2 emissions are expected to be abated as a direct result of the project. Beyond the Project period, it is anticipated that the replication potential of this Project is to produce 82 MW of small hydropower within a twenty year period within the tea sector. In this case, the emissions reductions at the end of the 20 year period comes to 2.92 million tons. This comes to slightly less than US$ 1.00 per ton of CO_2 for the GEF investment into this project. Beyond the tea sector the investment level within the 20 years could be substantially higher once the larger IPP community finds small hydropower an attractive sector to invest in as a result of clear policies to support the sector; business and financing models and the technology become well established in the region.

The PDF-B Project preparation phase has been highly participatory. Key stakeholders in the Project: government officials, financial institutions, tea factories, and the consultancy/ engineering community have been engaged through a series of meetings and a number of workshops, at UNEP and in the EATTA countries themselves. These workshops have generated active interest among stakeholders. A website http://greeningtea.unep.org has been set up by EATTA and UNEP where all relevant documents have been posted throughout the PDF-B project period. It now holds an impressive list of background documents as well as the project documents for this Project. The Website has provided an opportunity for those who are interested in the Project to follow closely its progress and provide inputs. It has been actively used by tea factories, EATTA, consultants, UNEP, banks and construction

and equipment supply companies in the course of the preparation of the FSP Brief. Tea factories and neighboring communities have been extensively consulted in the course of carrying out the Scoping Studies and Pre-feasibility studies in all participating EATTA countries.

The PDF-B consultations with utilities and financial institutions have generated strong interest to participate in the Full Size Project. Letters of support have been received from the ADB, EADB, AfD/ Proparco etc. Commercial banks have also shown strong interest to invest in the small hydropower project pipeline. The Cleaner Energy Fund for Agro-Industry in Africa (CEFA) is being proposed to be setup with the specific objective of financing the pipeline of projects coming out of the FSP. KenGen, the government power generation company in Kenya has recently expressed interest in making up to 50% investment into small hydropower generation projects resulting from the FSP.

Costs and Financing (US$) :

GEF:	-Project	:	$ 2,854,000	
	-PDF A	:	N/A	
	-PDF B	:	$ 569,400	
	Subtotal GEF	:	$ 3,423,400	
Co-financing:				
	-Project (EATTA)	:	$ 100,000 in kind	
	-Other International	:	$ 614,000 cash	
	-Tea Factories	:	$ 7,000,000 cash	
	- Financial Institutions	:	$ 15,000,000 cash	
	- Hydropower industry	:	$ 220,000 in-kind	
	- Governments (in-kind)	:	$ 80,000	
	- Governments (cash)	:	$ 2,600,000	
	- PDF B	:	$ 248,100	
		:	In-kind	
		:	Cash	
	Other International	:	cash/in kind	
	Governments	:	cash/in-kind	
	Subtotal co-financing	:	$ 25,862,100	
	Total Project Cost	**:**	**$ 29,285,500**	**(including PDF-B)**
		;	**$ 28,468,000**	**(without PDF-B)**

Associated Financing (Million US$): N/A

Operational Focal Point Endorsement:

Name:
Date of Endorsement: 27th March 2006
Kenya

Name:
Date of Endorsement: 22nd June 2005
Tanzania

Name:
Date of Endorsement: 13th March 2006
Uganda

Name:
Date of Endorsement: 19th May 2005
Malawi

Name:
Date of Endorsement: 25th April 2006
Rwanda

Name:
Date of Endorsement: 25th July 2005
Mozambique

Name:
Date of Endorsement: 10th May 2005
Zambia

Name:
Date of Endorsement: 30th June 2005
Burundi

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LIST OF ACRONYMS

ADEME	French Agency for Energy and Environment
ADB	African Development Bank
AFREPREN	African Energy Policy Research Network
AREED	African Renewable Energy Enterprise Development
CDCF	Community Development Carbon Fund
CEFA	Cleaner Energy Fund for Agro-industry in Africa
CTC	Cut Tear Curl (process in tea making)
DEG	German Development Bank
EAC	Eastern Arican Community
EADB	East African Development Bank
EATTA	East African Tea Trade Association
EIB	European Investment Bank
ERB	Electricity Regulatory Board
ERT	Energy for Rural Transformation
ESCO	Energy Service Company
EUEI	European Union Energy Initiative for Poverty Reduction and Sustainable Development
ExA	Executing Agency
FSP	Full Size Project
GEF	Global Environment Facility
GEF-KAM	Global Environment Facility – Kenya Association of Manufacturers
GHG	Greenhouse Gas
GW	Giga Watt
GWh	Giga Watt Hour
GTZ	German Agency for Technical Cooperation
IBRD	International Bank for Reconstruction and Development
IA	Implementing Agency
IFC	International Finance Corporation
IPP	Independent Power Producers
ITDG	Intermediate Technology Development Group
KPLC	Kenya Power & Lighting Company
KTDA	Kenya Tea Development Agency
kVA	Kilo Volt Ampere
kW	Kilo Watt
kWh	Kilo Watt Hour
MHP	Micro Hydropower
MOU	Memorandum of Understanding
MW	Mega Watt
MWe	Mega Watt Electrical
MWh	Mega Watt Hour
NEPAD	New Partnership for Africa's Development
NSC	National Steering Committee
O.P.	Operational Programme
PCI	Participating Credit Institution
PDSF	Project Development Support Facility
PMO	Project Management Office
PPA	Power Purchase Agreement
PMO	Project Management Office
PSC	Project Steering Committee
PV	Photovoltaic
REEEP	Renewable Energy and Energy Efficiency Partnership
RERED	Renewable Energy for Rural Economic Development
SADC	Southern African Development Community
SAPP	Southern African Power Pool
SC	Steering Committee
SHP	Small hydropower
STAP	Scientific and Technical Advisory Panel

TANESCO	Tanzania Electrical Service Company
UNDP	United Nations Development Programme
UNEP	United National Environment Programme
UNEP-DGEF	UNEP Division of GEF Co-ordination
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industry Development Organisation
US$	United States dollars (currency)
US¢	United States cents (currency)
ZESCO	Zambia Electric Service Company

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1. BACKGROUND AND RATIONALE

1.1 Small hydropower and Tea in Eastern and Southern Africa

Many Eastern and Southern African countries (Burundi, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe) grow and process tea in bulk for export and local consumption. Tea export is crucial for foreign exchange earnings for these nations. Tea accounts for 20% of total national exports in Kenya and Burundi, 12% in Rwanda and 7% in Malawi. Kenya is the largest exporter of tea in the world as well as the third largest producer[1]. It is dominant in Africa, accounting for around 70% of tea production on the continent. Being labour intensive, the tea sector is a major source of jobs in Eastern and Southern Africa, employing around 1 million and providing the major source of livelihood to some 4 million people.

The East Africa Tea Trade Association (EATTA) is a central organization in the export of tea from Africa. It is a voluntary membership organization including as members: Tea Producers, Buyers (Exporters), Brokers, Packers and Warehouses. EATTA member countries account for some 28% of the total tea exported in the world, most of it through the Mombasa Auction[2]. The Mombasa Auction, established and managed by the EATTA, is a major success story becoming the world's largest auction centre in 2004. The Auction which has grown by a remarkable 300% in the past 20 years, offers teas from all the major African tea producing countries[3]. It is recognized as a World Tea Auction Centre and international blending floor, following the closure of the London Tea Auction in 1998. Mombasa auctions are conducted in US Dollars and assure a steady inflow of hard currency into tea producing countries in Africa.

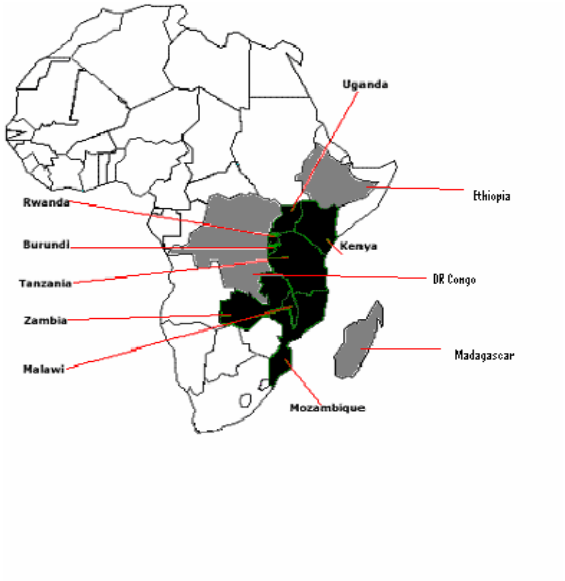

Figure 1: EATTA Member Countries
(Darker shaded EATTA countries participating in the "Greening Tea in East Africa" Project)

[1] Tea is grown in 36 tropical and semi-tropical countries around the world. The six largest tea producing countries - India, China, Kenya, Sri Lanka, Indonesia and Turkey (in that order) - account for 80% of world output. Only around half the tea grown is exported as India and China, in particular, are major consumers as well as producers. Kenya is the largest exporter of tea in the world followed in turn by Sri Lanka, China, India, and Indonesia.

[2] The other auction center in Africa, in Limbe, Malawi, sells teas from Malawi and occasionally from Mozambique, Zimbabwe and Zambia. Due to the seasonal nature of Malawi's tea production, the auction operates weekly for the six months of the season - between December and May - and fortnightly thereafter.

[3] Teas offered at the Mombasa Auction are from Kenya, DRC, Ethiopia, Uganda, Madagascar, Tanzania, Malawi, Rwanda, Zambia, Burundi, and Mozambique.

Tea processing is energy intensive, using as much energy per kg of made tea, as steel processing.[4] Depending on process and equipment efficiencies and types and local cost of fuels used, energy can make up as much as 25% of the total cost of tea production in EATTA countries. Present sources of electricity used for processing of tea are often unreliable, expensive, and greenhouse gas intensive. Small hydropower which is generally available at or near tea estates can provide a clean and reliable source of renewable energy while reducing costs to tea factories at the same time. Since few tea factories in Eastern and Southern Africa have adopted small hydro, a Full Size GEF Project "Greening the Tea Industry in East Africa" is proposed to systematically remove barriers (see discussion on barriers in subsequent section) to hydropower investments by the tea sector. The Project will cover 8 tea producing countries in this region: Burundi, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, and Zambia, all of which are members of EATTA (See Fig 1). The generated power will primarily meet the needs of the tea factories. Where additional power can be generated, it will be used to electrify adjoining communities to the tea factory/estate or fed in to the national grid.

1.2 Importance of Tea in the Economies of the EATTA Countries

Tea generates substantial export revenue for the EATTA countries. The total export earnings from tea in 2004 in Kenya was US$ 450 million, accounting for a substantial 20% of the total export earnings of the country. In Rwanda, tea makes up for 12% of export earnings, in Malawi 7%, in Uganda 4.5%, and in Tanzania at US$ 25 million export revenue, tea accounted for a more modest but important 2% of exports. In 2001, Burundi earned US$ 10.6 million from export of tea. Tea is extremely important for Burundi's national income and typically accounts for over 20% of the country's export earnings. Although export revenue was significantly below the 2001 level in Burundi in 2005, it is likely to increase to similar high levels in the coming years with stability returning to that country.

Among the EATTA countries, Kenya has the highest tea production at 328,497 metric tonnes in 2005 (Table 1). Kenya is followed by Malawi (47,505 metric tonnes), Uganda (32,275 MT), Tanzania (28,205 MT), Mozambique (20,500 MT), Rwanda (14,000 MT). Burundi and Zambia had the lowest production in 2005 among the participating EATTA countries at 1,791 MT and 1,186 MT respectively[5]. See Figure 2.

Table 1: Production and Export of Tea from Eastern and Southern Africa

Country	Production 2005 (tons/year)	Hectares put to Tea	Market Value (US$/kg)	Tea Export Revenue as % of Total (in 2003)	Number of Companies	Number of Tea Factories
Kenya	328,497	122,236	1.54	19	15	91
Malawi	47,505	18,800	0.87	8.1	12	25
Uganda	32,275	20,000	1.04	4.5	12	20
Tanzania	28,205	21,212	1.07	1.3	9	15
Rwanda	14,000	11,800	1.33	12	3	10
Burundi	1,791	8,800	1.09	24	1	5
Mozambique	20,500	2,000	0.71	NA	3	10
Zambia	1,186	500	NA	NA	1	1
Total	**473,959**	**205,000**			**56**	**177**

NA - Data not available
Source: IED

As Table 2 shows, the EATTA countries have high levels of poverty (population earning < US$ 1 per day ranging from 20% to over 60%) and are low on the Human Development Index (rank ranging from 144 to 169) with large dependency on international aid. Where the climate is suitable for it, the tea sector is very attractive to these countries in terms of its contribution to both export earnings and jobs creation to meet the employment needs of fast growing populations. In addition, the industry is a significant contributor to rural development. The industry contributes to the improvement of roads and

[4] Energy intensity ranges from 4.5 – 12 kWh/kg for tea processing compared to 6.3 kWh/kg for steel production (AIT 2002).

[5] For country specific information see Appendix M

other physical infrastructure. It also provides medical facilities, schools, housing, potable water and, in several tea estates, electricity for tea pickers and other employees in the tea growing regions.

The tea sector is very labor intensive with labor accounting for two thirds of production costs ex-factory. Plucking is done by hand by women and men and accounts for 75% of labor costs. The sector contributes substantially to employment generation in the region. In Kenya, the sector is thought to provide employment to 800,000 people with some 3 million, 10% of the country's population, being dependent on their livelihood on the sector (Gesimba et al 2005). The other EATTA participating countries currently have smaller tea sectors, perhaps employing a total of 300,000 people between all of them in the sector and providing livelihood to another million people. This could grow, especially in tea growing countries with lower per capita incomes and correspondingly low wage rates. The high labor costs as a percentage of production will mean that poorer countries in Africa, with a suitable climate for growing tea, with low wage rates will have a comparative advantage in the global market. Wage rates vary substantially within the region as well; with rates in Kericho, Kenya currently twice as high as in Uganda, for example. Kenya's tea production increased steadily from around 50,000 tons in 1975 to over 300,000 tons today. Many of the other countries in the region could replicate the success of Kenya in expanding this economic sector to increase their foreign exchange earnings and employment opportunities, once they have in place the basic infrastructure of roads and power. Power for the new tea factories could come from small hydropower right from the start.

Table 2: Economic Performance of the Participating EATTA Countries

Indicators	Kenya	Malawi	Mozambique	Tanzania	Uganda	Zambia	Burundi	Rwanda
Population (millions) 2003	32.7	12.3	19.1	36.9	26.9	11.3	7.0	8.8
Population Growth Rate (% pa) 2003-2015	2.5	2.2	1.8	1.8	3.7	1.7	3.4	2.1
Human Development Index (HDI) Value	.474	.404	.379	.418	.508	.394	.378	0.450
HDI Rank (2003)	154	165	168	164	144	166	169	159
Population living below US$ 1 a day (%) '03	22.8	41.7	37.9	19.9	-	63.7	58.4	51.7
Population living below US$ 2 a day (%) '03	58.3	76.1	78.4	59.7	-	87.4	89.2	83.7
GDP (US$ billions) 2003	14.4	1.7	4.3	10.3	6.3	4.3	0.6	1.6
GDP Per Capita (US$) 2003	450	156	230	287	249	417	83	195
GDP Per Capita Growth Rate (%/pa) '90-'03	-0.6	0.9	4.6	1.0	3.9	-0.9	-3.5	0.7
Exports of Goods & Services (% of GDP) '03	25	27	23	18	12	21	7	9
Traditional Fuel Consumption (% of total) '02	64.9	85.0	80.3	82.6	93.4	87.3	95.6	90.4
Electricity Consumption Per Capita (kWh) '02	155	80	378	82.6	61	603	25	23
ODA Received Total (US$ millions) 2003	483.5	497.9	1,033	1,669	959.4	560.1	224.2	331.6
Aid Per Capita (US$) 2003	15	45	55	47	38	54	31	39
Net FDI Inflows (% of GDP) 2003	0.6	1.3	7.8	2.4	3.1	2.3	-	0.3

Source: Human Development Report Statistics available at http://hdr.undp.org/statistics/data/countries.cfm and World Development Indicators database available at http://devdata.worldbank.org/data-query/

Globally, most tea is grown on large commercial plantations. In East Africa, particularly in Kenya, small-scale farmers play a key role in the production of tea. Smallholder tea production in Kenya actually accounts for 60% of the total production in the country. Smallholders often grow tea bushes alongside staple crops for their own consumption, with the tea providing cash income. In other EATTA countries smallholder production is more limited; in Malawi and Tanzania, for example, smallholder production accounts for only 7% and 5% respectively. Small-scale producers mostly operate under an umbrella company like the Kenya Tea Development Agency in Kenya (KTDA) or the Smallholder Tea Authority in Malawi. Large estates owned by corporations, including multinational like Unilever and James Finlay, produce the majority of the tea in Malawi, Tanzania and Rwanda and in the region as a whole.

KTDA, which was privatized from a state corporation in June 2000, is currently incorporated as a private company. It is fully owned by small-scale tea farmers through their privately owned Tea Factory Companies. KTDA has a management agreement with the Factory Companies to provide tea extension, sales & marketing, financial services, engineering and other management services. In the KTDA model, farmers receive between 60 and 70% of the final auction price of tea, the remainder 30-40% going to processing and operations costs. KTDA is considered a successful model of

smallholders managing their own businesses and is respected world wide for the high quality tea[6] it produces. Small-holders in Kenya own 54 factories, out of a total of 91 in the country, and 8 more are under construction.

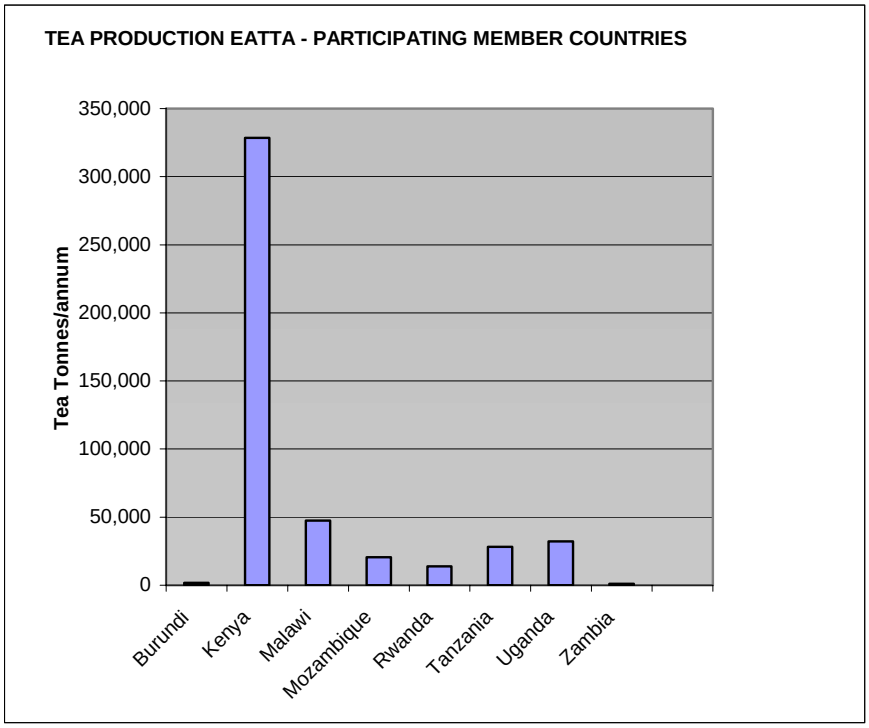

Figure 2: Total Tea Production (in Tons) among participating EATTA countries in 2005

1.3 Prospects for Small Hydropower in Tea and Rural Electrification in Eastern and Southern Africa

1.3.1 Energy Needs in Tea Processing

The processing of green tea leaves, undertaken at the tea factories, requires significant amounts of electrical as well as thermal energy (See Appendix H). Thermal energy is used in withering and drying operations while electrical energy is primarily used for powering large motors for the cutting, tearing, and curling (CTC) process[7], running fans for withering and drying, and motors for vibrating sieves for sorting and grading tea (See Figure 3).

Currently, in most factories the electrical energy is sourced from, often unreliable, national grids or inefficient and highly polluting and greenhouse gas emitting diesel generators. Most of the countries in the region have inefficient transmission and distribution systems and higher demand than generation capacities resulting in frequent load shedding. Since tea factories are often located in remote areas at the end of the transmission line, voltage on the grid can be low, causing damage to electric motors and preventing the use of some voltage sensitive equipment like fluorescent lights. All tea factories have back up generator sets that are in operation for between 7% and 28% of factory operation time. The factories which face greater grid unreliability have correspondingly higher fuel costs for backup power.

[6] KTDA teas fetched an average of US$ 1.65 per kg at Mombasa auctions in 2005, higher than the average auction rate of US$ 1.52 of other Kenyan teas.

[7] After harvesting, the leaves from the tea bushes can be processed in two ways – CTC (crush, tear and curl) or orthodox. CTC is richer in color than orthodox and is used primarily for tea bags. Up to 97% of Kenya's tea is CTC. Orthodox tea tends to be rich in aroma with less color.

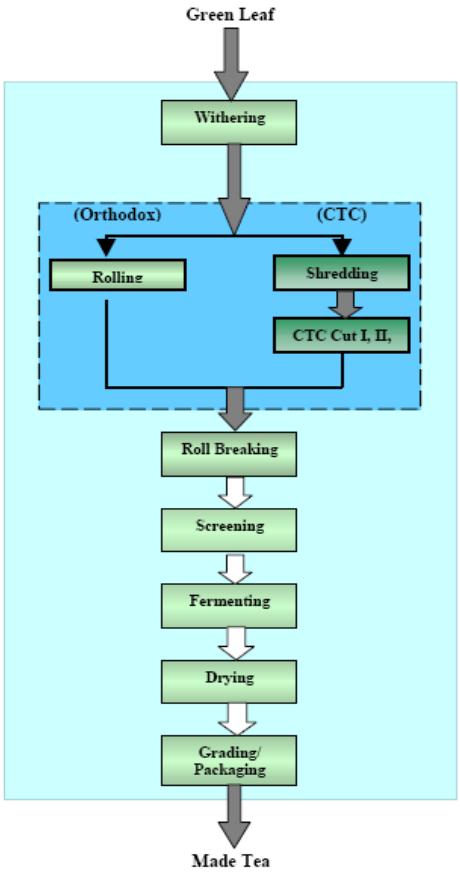

Figure 3: Black Tea Production Processes for Orthodox and CTC Tea[8]

An average of 0.65 kWh of electricity is generally needed to process one kilogram of made tea. Variation in average power consumption occurs due to climatic conditions in each tea growing region. In Rwanda for instance, most tea is processed in the dry season (July through September), when less electricity is required for withering. In Uganda on the other hand, tea production remains steady throughout the year from two rainy seasons but power consumption is higher in the withering process as the ambient air is more humid. There are also significant variations in the efficiencies of the equipment being used in the tea factory. Electricity usage in the EATTA countries was found to range from 0.59 kWh in Kenya to 0.74 kWh per kg of made tea in factories in Uganda.

Although the theoretical thermal energy requirement to remove the moisture from one kilogram of made tea is around 1.9 kWh, system losses result in the actual energy consumption ranging from 4–10 kWh depending on the efficiencies of the processes used and regional climate factors (AIT 2002). Figure 3 above shows the tea production process and Table 3 shows the energy requirements at different stages in the tea production process in a relatively efficient factory. Factories in Kenya and in most other EATTA countries use steam boilers as their main source of thermal energy. Steam is transported through insulated pipes to the dryers and to the withering troughs, the two locations where most of the thermal energy is needed as shown in Table 3. Hot air for drying or withering is generated at the required locations through steam-air heat exchangers.

[8] Source: AIT 2002

Table 3: Energy Requirements in the Processing of Tea

Average Energy Requirements for made tea				
Process	**Electrical Energy %**	**Electrical Energy kWh/kg made tea**	**Thermal Energy %**	**Thermal Energy kWh/kg Made tea**
Withering	15%	0.1	13 %	0.59
CTC	45%	0.29	0 %	0.00
Drying	15%	0.10	87%	3.86
Grading	25%	0.16	0%	0.00
Total	**100 %**	**0.65**	**100 %**	**4.45**

Source: AIT 2002

Fuel wood is the primary source of thermal energy in tea factories in the EATTA countries. Tea estates generally have their own plantations dedicated for fuel wood production. Smallholder owned factories of the KTDA generally do not have fuel wood plantations. They generally buy fuel wood from farmers near the tea factory. In fuel wood deficient areas in Kenya, KTDA factories often have to augment fuel wood supplies with fuel oil to fire boilers. Use of fuel oil can more than triple the cost of thermal energy, so it is used sparingly. Some of the steam boilers in factories are designed, for versatility, to switch between fuel oil to fuel wood. Electricity is almost never used to meet thermal needs of the tea factory because of its substantially higher price compared to both fuel wood and fuel oil.

Table 3 indicates thermal energy requirements are almost 7 times as large as electricity in the processing of tea. This would suggest that the Full Size Project should primarily focus on substituting for thermal energy or reducing its use through energy efficiency measures. However, in terms of expenses electricity costs constitute 60 - 82% of the total energy cost (see Table 5) in a tea factory.[9] Electricity costs are particularly high where the grid power is unreliable or non-existent and tea factories have to resort to running on power from diesel generators. They are also high in countries like Rwanda where a large part of the electricity on the grid is itself generated from diesel generators. This makes it attractive from the tea factories' perspective to develop alternatives to expensive and unreliable electricity supply. The cost of thermal energy (per kWh) from fuel wood ranges from one tenth to one twentieth that of electricity in EATTA countries.[10] It would thus not make economic sense to increase the size of the small hydropower plant to meet the thermal needs of the tea factory with electricity, when heating energy needs could be met using fuel wood from well managed plantations. Fuel wood plantations have the additional benefit of providing local employment. Where the thermal energy needs are met sustainably from plantations within the tea estates, the GHG benefits of substituting for thermal energy with electricity are also modest.

The situation will be somewhat different for those KTDA factories that are using fuel oil to meet a part of their thermal energy needs. Thermal energy (per kWh) costs from fuel oil comes to around one third that of grid electricity in Kenya. However, the cost of electricity from small hydropower could be much lower. In some instances the marginal cost of generating electricity from a small hydropower plant can be lower than fuel oil costs, especially during off-peak hours. In some cases it might even make economic sense to increase the size of the small hydropower plant to substitute for all or part of fuel oil used for firing the boilers with electricity. This will be explored on a case by case basis during detailed hydropower feasibility studies under the Full Size Project. Substituting for fossil fuel can also have substantial GHG reduction benefits which could translate into revenue from the sales of carbon credits, potentially further increasing the attractiveness of this option.

9 The cost of 1 kWh of thermal energy from fuel wood comes to around US¢ 0.80 in Kenya if purchased on the market and can be half of this when the fuel wood is sourced from the tea estate's own plantations. At today's prices, US¢ 27/ liter, the cost of a kWh of thermal energy from fuel oil comes to around US¢ 2.75.

10 The relative ratio of costs could be decreased by 20% to 40% if the likely superior heat transfer efficiency of electrical heating, by placing immersion heaters directly into the boiler, over firewood burning in boilers were to be taken into account. However, this does not change the basic argument.

Energy audits have been completed for tea factories, among other industrial sectors, under the ongoing UNDP/GEF "Industrial Energy Efficiency Project" executed by the Kenya Association of Manufacturers. This GEF-KAM study has shown that a number of attractive investment opportunities for energy efficiency exist at tea factories including improved insulation, better use of hot water and recuperation of waste hot air. On the electrical side reduction of up to 20% of energy consumption was found possible in motors used for drives, fans, and cutters. Each of these investments was projected to have a simple payback period of between 1 and 2.5 years. Improvement of energy efficiency at the tea factory will be an integral part of every detailed feasibility study and project design for hydropower projects built during the Full Size Project. Solar thermal energy is considered to be limited in its ability to meet the needs of tea factories, except to pre-heat water being fed into the boilers. Introduction of higher efficiency boilers and improved insulation in steam carrying pipes will likely be the most cost-effective activities to reduce the use of fuel wood or fuel oil.

Tea is generally grown in wet, hilly areas with an average annual precipitation between 1,200 mm and 2,500 mm. The rainfall and the terrain often make tea growing regions ideal for small hydropower development near the tea processing plant. This resource has not been extensively developed in the past. A survey of the 8 EATTA countries found that only twelve tea factories in the region, of a total of 177, have utilised this potential to date. It is interesting to note that almost no tea factories have invested in small hydropower plants in the last two decades. This is in spite of survey results that show that many more tea factories could be served by small hydropower than are currently.

1.3.2 Energy Supply Situation in Tea Factories in EATTA Countries

A questionnaire survey of 107 tea factories in the EATTA countries by UNEP/EATTA in 2004 found that all tea factories in Tanzania, Kenya, Malawi, Mozambique and Rwanda were supplied by national grids. There were varying degrees of grid unreliability by country. Kenya and Mozambique have relatively higher grid reliability compared to the other countries. Grid supply to tea factories in Uganda, Tanzania and Malawi has relatively lower reliability. Uganda and Tanzania have a number of tea factories that are completely off-grid and depend entirely on diesel genets for their power.

Table 4 below provides a summary of the survey responses by country. A more complete list showing the responses to the questionnaire survey is given in Appendix G.

Table 4: Survey Results Showing Reliability of Power and Energy Use in Tea Factories

Country	Number of respond-ing factories	% Outages on the Grid					Grid Electricity Intensity kWh/kg MT	Diesel used lit/ 100 kg MT		Wood kg/ kg MT	Fuel oil lit/kg MT
		100% (no grid)	<5 %	5-10 %	10-20 %	20-30 %		Supple-mint	100%		
Kenya	65	0	72	20	5	3	0.60	0.42		2.37	0.33
Tanzania	9	11	44	33	11	0	0.64	1.26	40.0	3.80	
Uganda	18	17	6	17	44	17	0.34	3.15	16.6	1.56	
Malawi	11	0	0	100	0	0	0.75	1.35		3.55	
Rwanda	-	0	-	-	-	-	0.53	1.35		4.88	
Mozambique	4	0	75	25			0.64	0.12		4.29	

Based on UNEP/EATTA Survey, 2004
MT = made tea

As can be expected, factories in countries with unreliable electricity supply through the national grid reported higher use of diesel fuel per kg of made tea. This can add significantly to the energy costs of the tea factories, particularly where there is no grid access at all, making their tea significantly less competitive on the market (see economic analysis below). Similarly, those factories using fuel oil to fire their boilers have a substantially larger energy cost than those using firewood. It is only the KTDA factories among all the EATTA members that use fuel oil to fire boilers. The main reason these factories can compete in the market is that they produce premium quality higher priced teas. KTDA

teas routinely fetch higher prices per kg of tea compared to estate factories[11]. Much of the price benefits of their superior teas are spent on the extra cost of fuel. Private estate factories claim that if they switched from firewood to fuel oil their cost of production would exceed current world market prices, averaging US$ 1.52 per kg in 2005 at the Mombasa auctions, for the tea they produce.

During the preparation phase of the Full Size Project, visits were made to tea factories in all the participating EATTA countries to learn first hand how factories were meeting their energy needs. Table 5 summarizes the actual amounts of energy which the factories in the different EATTA countries are using to process tea and the cost of this energy. Interviews carried out with tea factories confirmed that electricity costs used in processing tea vary widely among EATTA countries depending on the electricity tariff and reliability of power. Electricity tariff ranges from US¢ 3.2 per kWh in Mozambique to US¢ 22 per kWh in Rwanda, largely depending on the relative percentages of hydro and diesel-based thermal power on the country's national grid. Diesel generator back up costs at tea factories were found to be as high as US¢ 49 per kWh, in countries where costs of transporting diesel are substantial.

Total electricity costs per ton of made tea range from US$ 48 in Malawi to US$ 307 in Rwanda when both the tariff for grid electricity and expenses for diesel power backup are included (See Table 5). The electricity expenses of tea factories are dependent on the price of grid electricity, reliability of the grid and the cost of backup power. Grid electricity prices are directly dependent on the proportion of electricity generated by diesel. The price of electricity on grids which are highly dependent on diesel and the cost of power backup are both strongly dependent on increasing international oil prices. This has negative implications for the competitiveness of tea from countries like Rwanda with the generation mix on the grid shifting to diesel at the same time remaining unreliable and requiring the tea factory to rely extensively on expensive diesel backup.

Table 5: Cost of Energy in Tea Processing in EATTA Countries

Country	Energy cost (US$/kg made tea)	% of current market price of tea	Grid Electricity cost (US$/kg made tea)	Diesel cost (US$/ton made tea)	Thermal cost (US$/ton made tea)	Electricity Bill as % of total energy bill
Kenya	0.11	6%	0.06	4	43	60%
Malawi	0.07	8%	0.04	8	21	62%
Uganda	0.12	11%	0.06	30	27	82%
Tanzania	0.11	10%	0.05	41	18	80%
Rwanda	0.34	25%	0.22	87	33	80%
Burundi	0.09	7%	0.04	21	28	70%
Mozambique	0.16	12%	0.02	124	13	65%

Source: IED

Tea factories consume a lot of electricity. In Kenya, the tea sector alone consumes over 4 % of the electricity on the national grid. The energy needs of other EATTA countries are more limited at present but could grow to similar levels with increased tea cultivation and processing. Factories are also large users of thermal energy. Here too the percentage of the energy used by the tea factories compared to national use can be quite large. In Sri Lanka, for example, which produces about the same amount of tea as Kenya, it is estimated that the tea industry alone consumes 40% of the firewood used in the country.

[11] One explanation for higher quality teas coming out of KTDA is that small holder farmers who supply KTDA own their own farms and are careful to pick the best leaves when selling to the factory. These farmers also cooperatively own their factory and get a bonus at the end of the year if the factory is able to get a good price for the tea. Larger tea estates use hired labor who have less of an incentive to pick only the best leaves as they are paid by the kg.

Table 6: Electricity and Thermal Energy used in tea factories in EATTA countries

Country	Yearly Tea Production (tons) Made Tea	Electricity used in Tea Industry (GWh)	Total Electricity Consumed in the Country (GWh)	Thermal Energy Used in Tea Industry (GWh)
Kenya	290,000	177	4,202	1,290
Mozambique	1,122	0.68	307	4
Zambia	1,125	0.69	5,300	5
Malawi	42,000	27.5	1,206	200
Burundi	7,500		141.4	
Uganda	33,700	21.4	1,038	156
Tanzania	27,300	15.6	2,193	114
Rwanda	15,484	9.45	121.1	69

Electricity is in short supply in most of the EATTA countries, with the exception of Mozambique. The percentages of the population with electricity are generally below 10% in the countries as a whole. In rural areas they are even lower. Sub-Saharan Africa has among the lowest rural electrification coverage in the world, with typically 2% or less of rural populations served (see Table 7). Where electricity is available in rural areas it is mostly to provide power to tea and sugar factories. Residents in the neighborhood of these estates are often without power. Being at the end of long transmission lines, the factories face frequent interruptions, causing significant losses to the processing of valuable commodities like tea. As utilities struggle to keep up with ever growing demand for power in rapidly growing urban centers, rural areas suffer more frequent brown outs. In addition, most countries, even those with a historical base of hydropower generation, are increasingly adding thermal power to the system to respond quickly to growing demand for power. Responding to calls for expansion of rural electrification will increase the burden to the utilities of importing fuels and will also increase their emission of Greenhouse Gases (GHGs).

Table 7: Rural Electrification in EATTA Countries

Country	Total Electricity Generation (GWh)	Year	% of households electrified in rural areas	Year
Kenya	4,563	2003	1.7	2005
Tanzania	2,748	2003	2	2004
Uganda	1,538	2000	3	2005
Malawi	1,072	2000	0.1	2004
Rwanda	98	2003	<1	2005
Zambia	8,347	2003	2	2002
Mozambique	2,300	1999	0.7	2001
Burundi	117	2001	<1	2005
Total	**20,783**			

***Sources**: IED, 2006c & e; IED, 2005a & b; AFREPREN/FWD, 2004; Mbuthi, 2005; Baanabe 2005; Worldpress.org 2005; CIA, 2005; Nyang, 2005*

An independent, cost-effective, and clean source of power, such as provided by a small hydropower plant close to the tea factory, would have multiple advantages. Firstly it would increase reliability of electricity supply to the factory itself and reduce both the expensive backup power and the costs incurred due to interruptions in processing. When a batch is interrupted, it typically takes half an hour to clean out and restart the shredding machines. During this time, the oxidation process cannot be halted for the leaves that have already gone through the CTC process. Such interruptions produce lower quality tea which has significantly lower price. Tea factories reportedly lose up to 15% of the value of their tea through this lowering of quality.

Secondly, the small hydropower plant would improve the voltage along the grid by adding generation at the end of the transmission line. Additional power generated from this source could also be

supplied to the local communities near the power lines. Also, very importantly, power coming from a clean source like hydropower reduces greenhouse gases from thermal generators supplying the grid and diesel genets used for backup at the factory itself.

1.3.3 Potential Role of SHP in Meeting Tea Estate, RE, and Grid Needs in Eastern and Southern Africa

Most EATTA countries, and particularly their tea growing regions, have substantial small hydro potential. Only very few tea factories in the region are taking advantage of this resource.

Less than 5% of the total small hydropower potential has been developed in the participating EATTA countries as Table 8 shows. The actual potential for small hydropower (SHP) development in EATTA countries including in tea growing regions is likely to be much higher than indicated in Table 8. Potential for small hydro is generally reported based on reports from studied projects, rather than on a comprehensive assessment of resources. In countries where there has been limited hydropower development in the past, the actual potential is usually many times larger than the declared potential. Studied sites are scarce since studies require significant investments. Recent experience in Uganda, supported also by experiences in Nepal and Sri Lanka, is showing that once the incentives are in place and prospective developers start investing in studies, many more potential SHP sites come to light than had been thought to exist.

It is likely that upwards of 100 small hydro projects have been built in the Eastern and Southern Africa region in the past. Projects which have been developed in the past in the EATTA countries generally fall into the following categories.

Missionary stations: A number of off-grid small hydropower plants, mainly in the micro and mini-hydropower range (10-1000 kW); have been developed in most countries in Eastern and Southern Africa at critical service delivery locations like rural hospitals and development centers. These remote centers often run by Christian Missions would typically have been powered by diesel generators before the hydropower was installed. Where diesel supply is the alternative, small hydropower can easily be found to be competitive. Examples of this kind of installation are the 320 kW plant built at the Tenwek Mission Hospital in Kenya in 1987, and some 17 projects in Tanzania ranging in size from 7-700 kW. Examples abound in all the other EATTA countries as well.

Utility built stations: Small hydropower projects have been built by national utilities to supply much needed power to the national grid. Small hydropower projects are making a crucial contribution to the grid in countries like Rwanda and Burundi with modest national grids with around 100 MW of power. The investments for small hydropower on the grid are made by the utilities themselves. Tanzania has the 8 MW Nyumba ya Mungu plant supplying the grid. Utilities will sometimes also operate off-grid small hydropower projects to supply power to a part of the country unlikely to be supplied by the national grid. Malawi has the 4.5 MW Wovwe plant and Tanzania has a 750 kW plant for rural electrification. TANESCO put out a bid in 2003 to refurbish the Kikuletwa (1,160 kW), Tosamaganga (1,200 kW), and Mbalizi (425 kVA) plants. These off-grid plants had been built in the 1940s and 1950s and had fallen to disrepair.

Tea Estates: A number of tea estates have built their own small hydropower plants. Most of the hydro power plants were installed between 1928 and 1940, with a few installed in late 1980's and early 1990's. Many are functioning since the time they were installed and have required very little maintenance. In Kenya, James Finlay has an installed capacity of 2.4 MW and Unilever with a total installed capacity of 2 MW is reportedly making savings of the order of Kshs 44 million (US$ 600,000) on electricity costs per year. In addition a 30 kW system coupled with a reciprocating water pump has been operating at Kimari Tea Factory since 1955. The 2 MW installed are shared between four sites of which three are interconnected to the Unilever internal distribution network. Unilever is looking into the expansion of their hydro power capacity with three more sites having been identified, totalling to 1,680 kW.

Table 8 below shows that around a dozen small hydro plants of total 7 MW capacity have been built to serve tea factories in Kenya, Malawi, Tanzania, Burundi, and Rwanda. Of these 10 continue to work well and power the factories. Two plants in Rwanda and Burundi have fallen to disrepair or were

destroyed during the civil conflict and need rehabilitation. It is interesting to note that only two of the hydropower projects serving the tea sector in the region, both belonging to Unilever Kenya, were built in the last 25 years, all the others were built before the 1980s most in the 1920s and 1930s. Although there has been experience in the small hydro sector in the region, power generation to supply tea factories has not been an active investment area. This is in spite of survey results (see AppendixG) which show that many tea factories suffer from unreliable grids and expensive power and moreover could be served by their own small hydropower projects (see Appendix F).

Table 8: Small Hydropower Developed and Potential in EATTA Countries

Country	Small hydro potential (MW)	Total Small hydro installed (MW)	Small hydro installed in tea estates (kW)	Comments
Kenya	600	14	4,480	James Finlay (2,400 kW); Unilever (4 small hydro projects 420 kW, 800 kW, 740 kW, 90 kW serving 6 factories in Kericho) installed in '20s and '30s, most recently in '80s; Kilmer Tea Factory 30 kW
Tanzania	70	9	250	Dindira Tea Factory (250 kW)
Uganda	46	8	0	Hydropower used in cobalt mining but not in tea
Malawi	?	5.1	1,000	Lujeri and Bloomfield Tea Factories (1000 kW) installed in 1920's
Rwanda	20	3	150	Pfunda (150 kW) Tea Factory operational since 1972; needs rehabilitation
Zambia	4	1.05	0	
Mozambique	?	0.1	0	
Burundi	42	18	430	Leen (430 kW) operating till 1996 when it was attacked and destroyed.

Sources: AFREPREN; Scoping Reports, Innovation Energies Developpement (IED); Presentation Unilever Kenya

A pre-feasibility study of several small hydropower projects carried out by the French firm IED in the Eastern Aberdares tea growing region served by Kenya Tea Development Association (KTDA) factories in late 2004 found that there are indeed substantial hydropower resources that could supply the tea factories in this area. Table 9 shows a list of 7 projects of which six, in the power output range of 1.0 to 2.8 MW, with a total design power output of 11.245 MW are found to be economically attractive.

Table 9: Small Hydropower Sites Identified Close to KTDA Tea Factories

	Site Name	Watershed area	Mean flow	Gross head	Design Flow	Power Out	Energy production	Plant factor	Investment cost	Cost/ kW
		km^2	m^3/s	m	m^3/s	kW	GWh	%	M US$	US$
1	**Gura**	117	5.0	113	4	2,755	17	70	5.78	2,099
2	**North Mathioya NM 1**	105	6.5	101	3.1	2,010	17	94	4.18	2,074
3	**NM 2**	107	6.6	80	3.1	1,540	13	94	3.65	2,369
4	**NM 3**	112	6.9	101	3.1	1,960	16	94	4.08	2,088
5	**South Mathioya**	51	3.1	98	2.5	1,010	8	77	3.54	2,040
6	**Maragua**	31	2.5	153	2	1,970	13	76	3.96	2,014
7	**Thaina**	32	0.3	123	.5	336	1.6	50		

NM - North Mathioya

The pre-feasibility studies show that the sites can generate sufficient power to meet the electricity needs of eight adjoining tea factories and provide rural electrification to neighboring communities.

Table 10 shows different scenarios for the usage of the power produced from the identified hydropower sites. It is seen from the Table that a reasonably attractive return on investment of 14.2% is generated when three of the hydropower sites are developed (North Mathioya I + II + III) with total

power output of 5.51 MW and annual energy production of 45 GWh. It is seen that while the electricity needs of the tea factories can be met with 21 GWh of electricity, 24 GWh can be sold to KPLC in order to generate the expected return on investment.

Table 10: Scenarios for Use of Power from Identified Small Hydropower Projects (KTDA study)

Scenarios	Installed Capacity (kW)	Annual production (GWh)	Self consumption + (Village RE) + KPLC sales (GWh)	Total investment (US$ M)	IRR (%)
Base Case I "Tea Factories Alone"	11,245	84	21 + 63	29.8	11.0
Electricity needs of tea factories (6 SHP) plants)	5,510 (NM 1+ NM 2 + NM 3)	45	21 + 24	14.4	14.2
Tea Factories + Main villages RE	11,245	84	21 + 15 + 48 17,000 hh	35.9	8.3
Tea Factories + Full villages RE	11,245	84	21 + 20 + 43 29,000 hh	37.4	6.6

NM - North Mathioya
hh - Households

It can be seen from Table 10 that the IRR is reasonable for small hydropower projects if they can sell power to the tea factory and sell the surplus to the national grid. The Table also shows that when the cost of expanding the distribution network for rural electrification is added to the cost of the project, the IRR comes down to below commercial levels. We can conclude that small hydropower developed for tea factories can indeed provide power to adjoining communities. However the cost of expanding the network needs to be borne by the government or other donors if the IRR of the small hydro investor is not to suffer.

A total of 56 SHP sites with a potential for just over 70 MW (See Appendix F) were identified by the PDF-B Project team in and around tea factories (within 15-20 km of the tea factory). Of these 56 sites, 6 had already been studied to pre-feasibility level by the tea companies with the support of the French development organization ADEME and 13 were studied during the course of the preparation of the Project Brief. Table 11 shows the combined results of all the 19 Pre-Feasibility Studies which have been completed to date to serve the needs of tea factories. Around 40 tea factories, or 22% in the whole region, are covered by the initial 56 potential hydropower sites. We can anticipate that total capacity of SHP plants that could serve tea factories in the participating EATTA countries is likely to be between 200-300 MW. Further Pre- and Full Feasibility Studies will need to be carried to find out how many of the remainder of the project sites are technically feasible and financially attractive.

Table 11: Summary Findings of Pre-Feasibility Studies

N°	Country	Hydro site or river name	Net head (m)	Investment cost (US$ Million)	Generation potential MWh	Design capacity (kW)	Energy Demand (MWh) at factory
1	Uganda	Nchwera	60	5.549	12,982	2,361	3,377
2	Uganda	Warugo	90	3.580	3,303	693	3,377
3	Kenya	Kipkurere	271	5.000	14,333	2,897	13,635
4	Kenya	Kipchoria	323	3.680	10,239	1,710	4,646
5	Kenya	Kipkurere+Kipchoria	271 & 323	8.690	24,572	4,607	18,281
6	Rwanda	Base 2	32	3.410	4,230	687	1,368
7	Malawi	Lichenya	200	5.663	17,352	4,169	11,960
8	Malawi	Lujeri – upgrading	31	0.939	757	203	1,734
9	Malawi	Ruo – upgrading	116	3.882	8,075	1,705	5,186
10	Malawi	Muluzi	315	2.002	2,264	626	2,169
11	Rwanda	Giciye	97	4.492	7,855	1,225	1,690
12	Kenya	Kimari	34	3.998	5,894	966	7,840
13	Rwanda	Sebeya	76	2.880	7,420	919	1,479
14	Kenya	Gura	100	5.480	17,200	2,775	8,400
15	Kenya	North Mathioya 1	93	4.350	16,600	2,010	9,700
16	Kenya	Yala	116	8.807	32,360	4,691	23,267
17	Kenya	Tagabi	49	0.764	2,312	603	8,181
18	Tanzania	Suma	170	3.334	12,041	1,902	2,505
19	Tanzania	Luhololo	173	3.593	7,114	1,407	2,111
		Total		**80.093**	**206,903**	**36,156**	**130,906**
		Average	**130**	**4.215**	**10,890**	**1,903**	**6,890**

1.3.4 Economic Analysis (energy in the cost of production of tea and financial viability of SHP)

We can draw a number of conclusions from the economic analysis carried out in Appendix I:

1. Energy costs should make up no more than 5 to 15% of the cost of production of tea in EATTA countries, the main variation depending on the ambient climatic conditions, choice of fuels and the reliability of the grid. Use of fuel oil for thermal energy and longer durations of diesel backup increase energy costs. In practice some factories spend up to 25% of their production cost on energy. For the factories with the highest percentage of energy costs in tea production, investment into energy efficiency and substitution by small hydropower would be immediately attractive.

2. While unreliability of the electricity grid supply increases cost of tea production, an equally important and often bigger financial loss to the factory, in the order of 15% where power is most unreliable, is incurred through lowering of quality of the produced tea.

3. Rehabilitation projects are very attractive in terms of high returns on investment, with payback within a year in some cases. Projects in countries like Rwanda, Uganda, Tanzania, and Kenya where the cost of electricity is highest and/or frequently unavailable are most attractive for both rehabilitation and new construction. Projects are least attractive in Mozambique, Zambia, and Malawi, in the present situation where the electricity prices are lowest.

4. Small hydropower investment can benefit tea factories by increasing power reliability and reducing diesel costs. It can also provide rural electrification to neighboring communities and surplus energy can be used to replace fuel oil where it is used. However, the financial attractiveness of the SHP investment depends on the following parameters.
    a. Rural electrification provides local benefits and increases the sustainability of the project. However, adding this component increases capital costs and also lowers the overall load factor of the SHP plant by increasing demand during peak hours and using small amounts of power during the rest of the day. In order to provide a reasonable return on investment, the capital cost of rural electrification needs to be covered by partial or full grants by the government or donors.

    b. The small hydropower investment will improve its financial attractiveness, sometimes dramatically, if it can sell the surplus power to the grid after the needs of the factories and rural electrification are met.

    c. Surplus electricity from SHP plants can also be used to meet thermal energy needs at the tea factory, substituting for fuel oil or firewood. However, the energy used in this way will be priced at the avoided cost of fuel oil or firewood, which comes to around US¢ 2.75 per kWh for fuel oil and US¢ 0.80 per kWh for firewood. Both these prices are lower than what the utility is likely to pay if the power can be sold to the national grid. Using electricity to meet thermal energy needs will thus mean a lower IRR than selling surplus power to the grid, where that option is available.

1.3.5 Successful Global Models of Small Hydropower Development

While development of small hydropower has been extensive in Asia (particularly in China over the last 4 decades but more recently in other countries as well) reaching a capacity of some 33 GW, development in Africa has been minimal at an estimated 0.2 GW (Simon, IT Power). China's small hydropower development was largely driven by long-standing government sponsored rural electrification programs. A number of other Asian countries, for example Nepal, Afghanistan, Philippines, Sri Lanka, have active programs to promote projects in the micro-hydro range (<100 kW) for mini-grid based rural electrification of remote rural communities that are unlikely to be connected to the national grid any time soon. GEF is supporting a number of initiatives to expand energy services through micro and mini hydropower in Africa including through "The First Regional Micro/Mini-hydropower Capacity Development and Investment in Rural Electricity Access in Sub-Saharan Africa" covering nine countries. Experiences from these countries suggest that where resources for them exist, small hydropower (SHP) and micro hydropower can provide renewable energy at prices

competitive with larger generation units on the national grid and at much lower prices than diesel generation (gensets).

The sections below describe the growth of private investments in small hydropower in South Asia: Nepal and Sri Lanka, two countries of similar size, economy, and grid capacity to the EATTA countries are included in this Brief (see Table 12). While China has the most extensive experience in small hydropower development to date of any country, its size and the centrally planned governance structure makes the experience rather unique and not particularly relevant to the situation in Eastern and Southern Africa. The Nepal and Sri Lanka examples demonstrate that the small hydropower projects can be attractive for private investment and local financing institutions in the small developing country context. Their experience is captured in detail in Appendix L. Investors and financiers in these countries were found to respond well when they were provided support to mitigate risks. Building on this earlier experience, once clear policies were put in place, in the form of the national electricity utility agreeing to purchase all power produced by small hydropower producers through a 'standard Power Purchase Agreement (PPA)', the scale of investment was found to increase dramatically in both countries.

Table 12: Small hydropower status in Nepal and Sri Lanka

Country	Population (million)	GDP (US$ billion)	Small hydro installed (MW)	Grid Capacity (MW)	Date of 'standardized PPA'
Nepal	26	5.9	57	614	1998
Sri Lanka	20	18.2	70	2,483	1997

In Nepal in the last 7 years, over 50 feasibility studies have been completed, 20 Power Purchase Agreements (PPAs) signed, 10 projects have reached financial closure, and 7 projects have commenced construction resulting in 5 completed projects. All financing for these hydropower projects has come from local banks. Nepal has seen an investment by local banks of some US$ 47 million in new small hydropower projects since 1998, of which US$ 13 million has gone to smaller projects under the 'standard PPA'.

Small Hydro Origins in Tea in Sri Lanka

The Sri Lanka small hydropower experience is very relevant for the EATTA countries because the development of private investment in hydropower started in the tea estates. Sri Lanka has many similarities with Kenya. The two countries compete neck to neck to be the third largest global tea producer. Colonial planters used micro- and mini-hydro plants on tea and rubber plantations in Sri Lanka in the late 1800's and early 1900's with some 500 plants reported to be functioning at the turn of the century. The electricity grid of the Ceylon Electricity Board (CEB) was extended to the plantations in the 1960s and low prices were offered to factories to increase the load on the grid. This resulted in the closing down of micro-hydro plants on the estates. In the 1980s increase in grid electricity prices as a result of increased fuel prices enhanced interest in reviving some of these plants. Some 60 plants were rehabilitated and began operating in tea estates to reduce electricity bills. These were found to be attractive investments as the costs of rehabilitation were relatively much lower than building a brand new project and returns on investment from the reduced electricity bills were high.

As part of the liberalization in the power sector by the Sri Lankan government, in 1996 the Ceylon Electricity Board (CEB) allowed grid connection of private small hydro (<10 MW) and issued a standard PPA starting in 1997 and revised annually. The rate on the PPA was determined by the avoided cost of fuel at the CEB thermal plants and tied to the international price of petroleum fuel. The tariff offered to developers in 2005 was around US¢ 6 per kWh for the dry season and US¢ 5.3 in the wet season. Returns on investment were found to be attractive with simple payback periods typically around 3-4 years or less. It is likely that continued high petroleum prices will improve returns to investors even more.

The World Bank funded Energy Service Delivery (ESD) Project (1997-2002) played a crucial role in overcoming the financing barrier. ESD provided lines of credit for small hydropower projects through local banks participating in the project: Participating Credit Institutions (PCIs). This encouraged local banks to invest in hydropower. The Renewable Energy for Rural Economic Development (RERED) is a continuation of the ESD project (2003- 2007) and has further expanded the small hydropower sector in Sri Lanka.

Table 13 shows a pipeline of 121 MW of small hydro projects either completed or under construction under the RERED. A more detailed listing of each small hydropower project under the RERED project is listed in Appendix L. Many of the hydropower projects being developed today have their beginnings in tea estates. Today these projects are being developed primarily to sell power to the national grid although most started out meeting the needs of the tea factories.

Table 13: Small Hydropower Projects Commissioned and under Construction under the RERED in Sri Lanka

Commissioned Year	Number of Project	Total kW	Average size of projects (kW)
2002	2	1,560	780
2003	2	4,470	2,235
2004	11	33,090	3,008
2005 and WIP	30	81,687	2,722
Total	**45**	**120,816**	**2,685**

WIP = work in progress
Source: http://www.energyservices.lk/statistics/disbursement.htm

1.3.6 Review of Electricity Industry Structure and Regulatory Framework in EATTA Countries

Over the last 10 years, structural power sector reforms were implemented in the region. As a result reform policy and new electricity acts or amendment of previous ones have taken place in order to liberalize the sector for increased involvement of the private sector (Table 14). Reform policies have also been aimed towards unbundling of generation, transmission and distribution of the power utilities. Sector-specific regulatory bodies have been set up in most of the countries and are planned in others.

Table 14: Status of Power Sector Reform

	Status of Power Sector Reform					
	Reform Policy	New/Amended Electricity Act	Regulation Agency	Licenses Issued	Access to Grid Granted	Private Sector Participation
Kenya	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
Malawi	Implemented	Implemented	Implemented	Pending	Implemented	Pending
Mozambique	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
Tanzania	Implemented	Pending	Implemented	Implemented	Implemented	Implemented
Uganda	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
Zambia	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
Burundi	Implemented	Implemented	Pending	Pending	Pending	Pending
Rwanda	Implemented	Pending	Implemented	Implemented	Implemented	Implemented

Source: AFREPREN

Reform policies have been initiated in all the EATTA countries and accordingly countries have enacted new electricity acts, unbundled their power utilities and set up regulatory bodies. The reform process is moving at different speeds in the different countries as shown in Table 15. The status of the power sector and the status of private sector involvement in the different countries are discussed below[12].

Table 15: Timeline of Power Sector Reform

Country	Reform Initiation	Enactment of Electricity Act	Unbundling/Privatization	Regulatory Body Setup
Kenya	1993	1997	1998	1998
Malawi	1995	1998	2001	2000
Mozambique	1997	1997	2000	1997
Tanzania	1992	Pending	Pending	2001
Uganda	1993	1999	2001	2000
Zambia	1994	1995	1997	1997

[12] See Appendix L for detailed power sector information on each country.

Country	Reform Initiation	Enactment of Electricity Act	Unbundling/Privatization	Regulatory Body Setup
Burundi	1994	2000	Pending	Pending
Rwanda	1999	Pending	Pending	2001

Source: AFREPREN

Table 16 illustrates the status of private sector investment in the power sector in the various countries. Almost all the countries now have regulations in place that allow IPPs to generate power for supply to the grid. IPPs in Kenya, Mozambique, Tanzania, Uganda, Zambia and Rwanda have been licensed for power production. Tanzania has the largest number of IPPs with a total installed capacity of 312 MW. The largest IPP installed project is in Mozambique with a capacity of 2,075 MW of which only 300 MW is allocated for internal consumption and the rest is for export. While private sector participation is encouraged in Malawi, no IPPs exist yet. So far in all the countries except Mozambique, IPPs only account for a small fraction of the total installed capacity of the country. IPPs in all the countries have been found to be inclined towards thermal generation. Three among the ten IPPs of Tanzania have installed thermal power plants with a total capacity of 287 MW, which accounts for the majority of capacity installation by IPPs in Tanzania. Three of the five IPPs in Kenya have thermal installations as well accounting for 173 MW of the total capacity as does the one IPP in Rwanda.

Table 16: Private Sector (IPP) Investment in the Power Sector

Country	Private Sector Participation	Number of IPPs	Total Installed Capacity (MW)	Generation Type
Kenya	IPPs can generate power for supply to grid	5	239	Diesel/Fuel oil 173 MW (74 MW, 56 MW, 43 MW); Geothermal 64 MW; and Cogen 2 MW
Malawi	IPPs can sell power to grid; however no IPPs	0	-	-
Mozambique	IPPs can generate power	1	2,075	Hydro
Tanzania	IPPs licensed and entered into PPAs	10	312	Natural Gas, Diesel, Wood Cogen (2.8 MW), Small hydro (0.8 MW)
Uganda	IPPs licensed to carry out feasibility studies	4	27.5	Diesel and Hydro (3.5 MW)
Zambia	IPPs licensed	1	38	Hydro
Burundi	Market liberalized however IPPs cannot inject power to grid	0	-	-
Rwanda	IPPs licensed	1	10	Diesel
Total		**22**	**2,701.5**	

Source: AFREPREN, Country Experts, Scoping Reports and Country Power Sector Data, Innovation Energie Developpement (IED)

Table 17 shows the existing installed capacity of the grid in each country according to the generation type. It shows that more than half of the system capacity in every EATTA country is based on hydropower. Zambia has entirely hydro-based capacity on its grid. The Uganda and Mozambique grids have 99% and 98% hydro-based generation capacity respectively. Malawi has mostly hydro-based generation as well (93%) and only 7% thermal generation. The highest amount of thermal generation is in Rwanda with 48%, followed by Tanzania with 38% and Kenya with 30%. Kenya is the only country with other renewable sources of generation like geothermal and wind.

Table 17: Status of Power Generation on the Grid

Country	Type of Generation (in MWe)								Total (MWe)
	Hydro	(%)	Thermal	(%)	Geothermal	(%)	Wind	(%)	
Kenya	677.3	(59%)	349.3	(30%)	128	(11%)	0.4	(0.03%)	1,155
Malawi	283.65	(93%)	21.35	(7%)	-	-	-	-	305
Mozamb-ique	2,114	(98%)	43.14	(2%)	-	-	-	-	2,157
Tanzania	561	(62%)	349	(38%)	-	-	-	-	910

Country	Type of Generation (in MWe)								Total (MWe)
	Hydro	(%)	Thermal	(%)	Geothermal	(%)	Wind	(%)	
Uganda	300	(99%)	2.12	(0.7%)	-	-	-	-	303
Zambia	1,620	(100%)	-	-	-	-	-	-	1,620
Burundi	28.7	(84%)	5.5	(16%)	-	-	-	-	34.2
Rwanda	26.74	(52%)	24.37	(48%)	-	-	-	-	51.11

Source: AFREPREN, Country Experts, Scoping Reports and Country Power Sector Data, Innovation Energie Developpement (IED)
Note: '-' indicates the country does not have that type of generation

It seems from the figures above that at present, the grids in most all the countries continue to be dominated by hydropower. However, this can be misleading. A substantial portion of the new generation is based on fossil fuels, the main sources being diesel, fuel oil, some natural gas and coal. Except for geothermal in Kenya and small hydropower in a few countries, there is very little use of other renewable forms of energy for power supply into the grid. This change in the generation mix of countries in the region towards more carbon-intensive electricity is a result of a fast increasing role of IPPs in supplying grid power and these IPPs favouring mostly diesel and fuel oil based generation because of the faster turnaround times of these projects.

The entry of IPPs into the power sector is a recent phenomenon in EATTA countries and has happened mostly as a result of power sector reforms that occurred in most of the countries starting in 1999. Although IPPs at present account for a modest share of the total installed capacity of the grid, their role is expected to grow as national utilities are being unbundled and countries have been welcoming of private sector investment in generation.

Where IPPs have installed both fossil-fuel based and renewable energy plants as in Kenya and Tanzania, the share of fossil fuel based power generation is much larger. This is having an adverse impact in terms of the price of electricity. Power utilities have entered into expensive thermal PPAs in a number of these countries. According to country information from Tanzania and Rwanda electricity purchase tariff offered to IPPs on diesel generation can be as high as US¢ 33.5/kWh. This compares to between US¢ 6 and 8 per kWh that can be expected for small hydropower IPPs. There is clearly an opportunity to substitute for expensive new fossil-fuel based generation with small hydropower in many of the EATTA countries where power shortage is most acute.

Table 18 shows the Power Development Plan for Kenya. It shows that although there is an intention to install 120 MW of hydropower and 271 MW of geothermal energy, the Power Development Plan is clearly dominated by new fossil-fuel based generation to the tune of 1,123 MW in the 2006 -16 timeframe. If this Power Development Plan is executed, the baseline in Kenya is going to be increasingly dominated by fossil-fuel based generation. Any number of small hydropower projects that can come on line within this planning horizon will clearly substitute for fossil-fuel produced electricity.

Table 18: Power Development Plan for Kenya (2006-2016), in MWe

Year	Hydro	Geo	Thermal			Total thermal	Others (import/ line ext.)	TOTAL
			Gas	Coal	Diesel			
2006			43			**43**		**43**
2007					240	**240**		**240**
2008	120.6	69.6						**190.2**
2009		67.2		150		**150**	50	**267.2**
2010								**-**
2011				150		**150**		**150**
2012		67.2					100	**167.2**
2013				150		**150**		**150**
2014				150		**150**		**150**
2015				150		**150**		**150**
2016		67.2	90			**90**		**157.2**
Total	**120.6**	**271.2**	**133**	**750**	**240**	**1,123**	**150**	**1,664.8**

Source: Data from Ministry of Energy, Kenya 2005

Table 19 gives the projected demand and supply of power in Uganda till the year 2025. It is clear from the Table as per the projected new generation capacity that fossil-fuel based generation will expand

rapidly in Uganda, initially in the form of 'Emergency Thermal' but increasingly as long term thermal plants. Any number of small hydropower projects that can be constructed within this time frame will substitute for electricity generated using fossil fuel.

Table 19: Projected Demand and Supply of Power, Uganda (in MWe)

Description	Year										
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2012**	**2015**	**2020**	**2025**
Demand	**230**	**347**	**377**	**409**	**444**	**481**	**497**	**647**	**783**	**1181**	**1910**
Existing capacity (effective)											
Firm Nalubale & Kiira	220	220	265	265	265	220	265	265	265	265	265
Firm Kiira (Unit 14 & 15)		40	40	40	40	40	40	40	40	40	40
Small hydropower	20	20	20	20	20	20	20	20	20	20	20
New generation capacity											
BUJAGALI						150	200	250	250	250	250
KARUMA								100	150	150	150
Small hydro			20	45	60						
Renewables and Geothermal						70	70	90	120	150	150
Emergency thermal		50	50	50	50						
Thermal			75	75	75	75	75	150	200	300	400
(Municipal wastes / gas turbine) (MW)											
AYAGO (N+S)									100	350	550
UHURU											300
KALAGALA											200
Total generation capacity	**240**	**330**	**470**	**495**	**570**	**620**	**670**	**915**	**1145**	**1525**	**2325**

Source: RE Policy for Uganda (Draft), 2005

2. COUNTRY OWNERSHIP

2.1 Country Eligibility

As per GEF requirements all of the participating countries (EATTA members) have to be signatories to the United Nations Framework Convention on Climate Change (UNFCCC). All countries considered have signed and ratified the convention. A summary is provided in Table 20.

Table 20: UNFCCC Ratifications

Country	Date of Signature	Date Of Ratification
Kenya	12 June 1992	30/August 1994
Tanzania	12 June 1992	17 April 1996
Uganda	13 June 1992	08 September 1993
Malawi	10 June 1992	21 April 1994
Rwanda	10 June 1992	18 August 1995
Zambia	11 June 1992	28 May 1993
Mozambique	12 June 1992	25 August 1995
Burundi	11 June 1992	06 January 1997

2.2 Country Driven-ness

National energy regulatory frameworks and National Communications submitted to the United Nations Framework Convention on Climate Change (UNFCCC) were reviewed in all EATTA member states for their stated commitments to the development of small hydro through private sector involvement.

National policies in all of the countries aim to promote private sector involvement in the development of hydropower as well as renewable energy resources in order to curb the dependency on imported fossil fuels. Priority is given to rural electrification in order to increase electricity access of the rural areas of the countries. National Communications of the countries clearly state the need and commitment of the countries to promote hydropower and renewable energy technologies in order to mitigate greenhouse gas emissions and climate change.

2.2.1 National Policies

Regulatory frameworks in the EATTA member states clearly state the need for tapping renewable energy resources of the countries. In order to achieve this objective, private sector involvement has been given priority and governments are committed towards creating an enabling environment for private participation through tax incentives, appropriate regulatory frameworks and financing mechanisms. Rural electrification has been recognized as an important mechanism for increasing electricity access of rural population and to encourage increased economic activities for the socioeconomic growth of rural areas. Table 21 below lists the objectives and strategies of the policies in the different countries. For details on specific policy statements, refer to Appendix R.

Table 21: Policy and Regulatory Framework of EATTA Member States

Country	Regulatory Framework
Kenya	***Draft National Energy Policy, 2004:*** • The government will encourage and promote private sector initiatives in entering the renewable energy market • The government in recognition of the need to lower electricity tariffs will grant income tax holidays for hydroelectric projects depending on their installed capacity • The Electricity Regulatory Board (ERB) will serve as a one stop office for facilitating permits and licenses for electric power producers • In order to encourage private investments in renewable energy sources the government will package and disseminate information (such as hydrological data) for investor and consumer awareness, carry out pre-feasibility and feasibility studies, facilitate rural electrification, allow duty-free import of equipment, tax incentives, as well as encourage financial institutions

Country	Regulatory Framework
Tanzania	***National Energy Policy, 2003:*** • Electricity is to be made available for economic activities in rural areas and rural electrification is thus of national interest as well as a prerequisite for a balanced socioeconomic growth • Introduce appropriate rural energy development, financial, legal, and administrative institutions • Establish norms, codes of practice, guidelines and standards for renewable energy technologies, to facilitate the creation of an enabling environment for sustainable development of renewable energy sources • Ensure inclusion of environmental considerations in all renewable energy planning and implementation and enhance co-generation with other relevant stakeholders • Support research and development of renewable energy technologies and rural energy • Promote entrepreneurship and private initiatives in the production and marketing of products and services for rural and renewable energy • Ensure continued electrification of rural economic centers and make electricity accessible and affordable to low income customers • Facilitate increased availability of energy services including grid and non- grid electrification to rural areas
Uganda	***Energy Policy for Uganda, 2002:*** • Aims to develop the use of renewable energy resources including hydrological resources for both single and large scale applications • Strategies include dissemination of technologies, setting of standards, facilitating financing schemes, etc.
Malawi	***White Paper on Energy Policy for Malawi, 2001:*** • Specific policy goals include: o creation of an enabling environment for investment, private enterprise, competition and operational efficiency and o promotion of wide-spread use of renewable energy among rural and urban populations • Rural electrification will be supported as a means of poverty reduction through intensification of public investments, establishment of a funding mechanism and a regulatory and legal framework • In order to increase access to renewable energy the government will make sure that duties and taxes are not introduced and appropriate financing and credit schemes are available through existing financial institutions
Rwanda	***Enhanced Structural Adjustment Facility Policy Framework:*** • Objective in the energy sector is to expand and diversify energy supplies at competitive costs, promote the efficient utilization of Rwanda's energy resources, and minimize the potential adverse environmental impacts • The immediate priorities in the energy sector are to o rehabilitate key power facilities; o restructure and privatize the part of ELECTROGAZ that supplies and distributes electricity and gas so as to improve its operational efficiency; o build capacity for policy development and investment planning in key sub-sectors such as gas, hydropower, petroleum products, rural electrification • The government is preparing a strategic and regulatory framework to address both urban and rural energy needs and to encourage private sector energy provision and distribution
Zambia	***National Energy Policy, 1999:*** • Mini hydro is identified as a renewable energy resource that is greatly under utilized
Mozambique	***Energy Policy Strategy, 2000:*** • aims to create a proper viable climate in order to attract all stakeholders and key players that could promote the renewable sub-sector • There are proposals to start work in mini and micro hydro but there is a general lack of information on such systems and the related costs
Burundi	

2.2.2 National Communications

In the national communications submitted to the UNFCCC, countries state the promotion of renewable energy, especially hydropower as a clear option for mitigation and reduction of greenhouse gas emissions from the countries. There are plans in all the countries to develop the hydropower potential of the countries and specific projects have been identified. Grid extension, rehabilitation of the existing hydropower stations and network as well as rural electrification through mini/micro hydropower plants are deemed important for meeting each countries commitment under the UNFCCC. Specific policy statements from the national communication documents have been summarized in Table 22 below for each country and Appendix R lists detailed statements from the national communications.

Table 22: National Communication Commitments of EATTA Member States

Country	National Communication Commitments
Kenya	***Initial National Communication, June 2002:*** • Policy options to ameliorate climate change include promotion of renewable energy and energy efficiency • The government in collaboration with relevant stakeholders will: o Support efforts to expand hydropower generation to different parts of the country taking advantage of the different rainfall regimes o Expand and intensify rural electrification programs in order to reduce reliance on biomass • Promote alternative energy sources to broaden the national energy mix and lessen dependence on imported energy • The government supports continued exploration and development of hydro and geothermal resources • Development of renewable sources of energy (mini/micro hydro among others) to increase the share of clean energy in the overall energy supply and thereby result in GHG emission avoidance • Ongoing and planned activities include: o Feasibility studies on mini/micro hydro technology o Development of renewable energy technology standards o Evaluation of mini-hydroelectricity generation in tea growing areas
Tanzania	***Initial National Communication, March 2003:*** • Interventions for mitigation in the energy sector include development of renewable sources of energy (The most important renewable energy options identified include hydropower generation, mini-hydropower) • Among the principal specific objectives of the national energy policy is to develop indigenous sources of energy like hydropower for substitution of imported petroleum products • Promotion of appropriate and affordable renewable energy technologies and implementation of a national program to promote renewable energy technologies
Uganda	***Initial National Communication, October 2002:*** • The development of hydroelectric resources along the Nile River and rural electrification are identified as mitigation options • Grid extension and development of small hydropower in remote areas • Promote the use of alternative sources of energy and technologies • Promotion of private sector participation in the development of renewable energy resources
Malawi	***Initial National Communication, December 2003:*** • Rural electrification through grid extension and mini/micro hydropower have been emphasized for GHG reduction • Removal of duty and surtax on Renewable Energy Technology RETs (energy pricing) and certification of RETs installers and inspection of installations (regulation and standardization) for wider use and acceptance of RETs • Energy projects include: o Renovation and extension of Matandani Mini-Hydropower Station (120 kW) in Mwanza District to supply power to Neno Trading Centre and Matandani Rural Growth and surrounding rural areas

Country	National Communication Commitments
Rwanda	***Initial National Communication, June 2005:*** • It has been recognized that the share of hydroelectricity in the energy mix of the country is below the hydroelectric potential of the country • In order to increase access to modern energy sources such as hydropower the government will rehabilitate the existing network as well as install new hydropower stations • Strategies to reduce GHG in the energy sector: o Increase the number and capacity of hydropower dams[13] o Increase the number of mini-hydropower stations particularly in rural areas o Maintenance of hydropower predominance in energy supply • Invest more in energy generation infrastructure sector by building other hydropower stations (potentials exist on Nyabarongo river (Bulinga, 28 MW), Rusizi, Akagera and on smaller streams where there are potentials for micro-hydropower stations) • Strategies, programs and planned activities for management of energy resources: o Strategy: Extension of electricity grid Program: Rural electrification by extension of existing grid Activities: Study of rural electrification master plan; Project identification; Feasibility study; Project implementation o Strategy: Isolated electricity grid supplied by micro-hydropower stations Program: Rural electrification by micro-hydropower stations Activities: Project identification; feasibility study; project implementation
Zambia	***Initial National Communication, August 2004:*** • Development of mini-hydro power stations where the potential exists, particularly as a replacement for diesel generators • Policy: Developing the hydro potential to take advantage of the strategic location of the country in the sub-region. Programs: Examples of mini-hydros which are being considered include three in Northwestern province (i.e. West Lunga — 2.5 MW, Kabompo Gorge — 34 MW and Chikata Falls — 3.5 MW)
Mozambique	***National Communication:*** • Mozambique has very few dams, therefore an effort to build these infrastructures for drainage control and production of energy will be necessary • Measures to improve access to energy: o Introduction of services for renewable energies, including training for installation, handling and maintenance of equipments o Implementation of a low cost national program of electrification of districts that have no access to electricity
Burundi	***Initial National Communication, November 2001:*** • Increasing the access rate to modern energy such as hydro electricity and renewable energy is recognized as an option to reduce GHG • The government will rehabilitate and extend the existing electricity network, plan hydropower plants and promote technologies that save wood fuel as well as promote renewable energy • For decentralized electrification of public infrastructure both solar PV and small (“pico”) hydropower plants are envisioned • Construction of Mpanda Irrigation and Hydroelectric Project to increase electricity generation capacity and increase access to clean energy • Rehabilitation and construction of central and small grid-connected hydroelectric schemes; reinforcement and rehabilitation of the grid network

[13] Hydropower dams that supply the grid in the case of Rwanda are not necessarily large dams; they fall mostly under small hydropower.

3. PROGRAM AND POLICY CONFORMITY

3.1 Fit to GEF Operational Program and Strategic Priority

Small hydropower projects in general support the global environmental objective of reduction of GHG emissions by replacing current or planned thermal power generation. In the context of this project they substitute for thermal based generation being supplied to the tea factories and diesel backup power. Surplus hydropower may in some instances replace fuel oil used in tea factories for meeting thermal needs. The projects can also save the current use of fossil fuels for lighting and operation of diesel mills in the case of rural electrification of neighbouring communities. This reduces indoor air pollution from the traditional burning of kerosene lamps.

However, it is inconceivable to assume the current and actual power consumption and thermal energy utilization of a tea factory as a given fact in the dimensioning of a new (renewable) power supply system. The project will start with a proper energy audit determining what potential there is for energy savings (equipment and production processes). It is only after this that a proper power supply design can be made. Therefore there are two Operational Programs which are directly relevant to this project:

- O.P.6: "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs". The central activity is the promotion of small hydropower projects to meet electric power needs of the energy-hungry tea processing factories in eight countries in East Africa.

- O.P.5: "Removing barriers to energy conservation and energy efficiency".

The project will fulfil the following GEF *Strategic Priorities*:

- SP-2: "Increased Access to Local Resources of Financing for Renewable Energy and Energy Efficiency": The project will mobilize local equity investments from tea factories and financing from local and regional institutions for financing small hydropower and energy efficiency.

- SP-3: "Power Sector Policy Framework Supportive of Renewable Energy and Energy Efficiency": The project will support regulators and utilities to develop light-handed regulations for the development of small hydropower, sale of excess power to the grid and for rural electrification.

- SP-4: "Productive uses of renewable energy": The produced power will substantially meet the productive energy needs of the tea sector.

3.2 Project Design

3.2.1 Problem Analysis

Energy Needs of the Tea Industry

Processing of tea leaves requires substantial amounts of both electric power (for cutting, tearing, rolling, fans, transport, sieving, lighting etc.) and thermal energy (for drying and withering). Tea processing is energy intensive requiring roughly the same intensity (kWh/kg) as the extraction of steel. Tea factories in the entire Eastern and Southern African region have persistently faced problems with supply reliability as well as the cost of electric power while the fluctuating cost of diesel for back-up generator sets and fuel oil for boilers/furnaces may spell the difference between a year of profit or loss. For African tea to remain competitive on the world market, cost cutting in production and processing is necessary.

From the perspective of the Global Environment Facility the interest in addressing the concern of the tea sector basically has an environmental dimension. To a large extent power for tea processing is

sourced from imported fossil fuels (diesel, furnace oil) or the grid (typically 40% thermal) despite the fact that in many cases alternative renewable, and therefore less polluting, sources can be found nearby. Small hydropower, in terms of both price and performance, will be competitive with more conventional power supply options. Diesel backup electricity could easily be three to five times the cost of power from small hydro with relatively low capital cost but high fuel cost (including transport). A more rational generation of power with overall lowest cost would be local small hydro production to reinforce the main grid and eliminate the diesel consumption. Using renewable energy sources in meeting the energy requirements of tea plants may be a new and attractive selling point to Western markets giving an entirely new meaning to the word “green” tea.

Hydropower resources exist in most tea growing areas around the world. This is due to both tea and hydropower requiring hilly terrain and good rainfall. Tea generally grows in areas with rainfall between 1200 mm and 2500 mm a year spread out over the year. This is very suitable for hydropower development. Not surprisingly considering the logistics involved, tea factories are always near tea growing areas. It follows that where there are tea factories, there must also be hydro potential. Only twelve private tea plantations/factories, out of a total of 177 in the region have installed any hydro equipment to meet their power needs. However, these are generally old installations (a few are nearly 100 years old) and not a result of recent developments.

The project study has identified 19 sites in the range of 0.3 to 5 MW near tea factories in 6 countries in the region. This is a fraction of the total number of suitable sites available in tea growing regions of EATTA countries. Of these, ten will be selected to carry out full feasibility studies within the Full Size Project period. A number of these potential sites serve more than one tea factory. All these hydropower sites are capable of meeting the power needs of these tea factories in an environmentally friendly way.

The tea factories typically cover areas with 2-5 km radii from the processing plant. Clusters of tea factories with each factory no more than some 5-6 km from the next can be identified in various tea growing areas. In order to increase power supply security, such clusters of small hydro plants could be interconnected. A cluster development of small hydros may have another positive impact: Because of the number of power plants involved, design, mobilization of contractors, electro-mechanic equipment and installation, training, stocks of spare parts, etc may all be at reduced costs, thus making a cluster development even more attractive to technology providers and each individual project cheaper. Should potential hydro electricity exceed the electricity requirements of both tea factory and nearby communities, such excess power could be used to even meet thermal power requirements of drying tea leaves.

Thermal energy

Thermal needs account for 80-85% of the energy needed in the processing of tea, the rest being electricity. Most tea factories in Eastern and Southern Africa use wood fuel (self grown or purchased) for heat applications. Fuel oil is used to augment firewood supplies where there is insufficient wood to meet the needs of the factory. It is roughly estimated that each 4 hectares of tea plantation require approximately 1 hectare of woodlot in order to cover the thermal power requirements of the tea processing plant. Most tea estates appear to have sufficient wood plantations to cover their own needs. On the other hand it appears that KTDA factories, cooperatively owned by smallholder tea farmers purchase fuel wood, and are often forced to meet a significant part of their thermal needs by fuel oil, since they do not have the land to grow the trees. The use of fuel oil to meet energy needs can increase the cost of the energy component of the cost of production by more than 50% and can lower profit margins significantly.

A number of tea factories already have nurseries for seedlings of fast growing tree varieties to be distributed to tea farmers and to be planted on marginal land (e.g. too steep for tea growing). They purchase the trees from the farmers for use in the factories. In a number of cases wood fuel production is not adequate to cover the year round thermal energy needs of a factory and possibly sustainable production woodlots may have to be developed in addition. Fast as well as slow growing tree species should be considered in order to assure bio-diverse plantations. A survey conducted in collaboration with UNEP and EATTA during the time of actual proposal preparation clearly showed that most tea factories do not depend on fossil fuel (fuel oil) to meet their thermal energy requirements.

Most factories appear to have their own wood lots as main source, while some purchase wood fuel from tea farmers and/or other sources. However it was also noted that many plantations were beginning to find that if they grew their trees longer and sold them on the market as timber, they could fetch a much higher price than using them as firewood. This is particularly true in Kenya where the government has recently put restrictions on access to timber from the state forests. In the future, it is likely that the cost of firewood will increase both due to the increasing distance it has to be transported from and also because of the increase in the opportunity cost of trees as a source of timber. Factories in Kenya which purchase firewood have seen firewood prices jump by over 25% in the last year. This increase in price is likely to encourage switching over to more efficient boilers and other energy conservation. The Full Size Project can play an important role in encouraging this transition. Coupled with energy conservation, surplus power from small hydropower plants, where sales to the grid are not possible, may be able to significantly reduce fuel oil needs of some tea factories.

Small hydropower will not be the first choice to provide thermal energy to tea factory as the avoided cost of thermal energy is around US¢ 0.8 to 2.75 per kWh, even considering the superior efficiency of electrical heating over normal boiler efficiency. This is a lower price than what the grid would pay for electricity supplied to it. In cases where the tea factory is not connected to the grid or for any other reason the small hydropower project can not sell its surplus power to it, electricity from the small hydropower can be fed into boilers to generate steam to meet the thermal needs of the factory during times when there is little power demand from the factory or the neighbouring communities. In addition to estimating how much excess electricity there will be available for meeting thermal needs, detailed hydropower feasibility studies during the Full Size Project will explore the technical feasibility and cost of retrofitting the factory boilers to install electrical heaters, where this option could be financially attractive. Solar thermal energy is considered to be limited in its ability to meet the needs of tea factories, except to pre-heat water being fed into the boilers. Higher efficiency boilers will be introduced and insulation improved in steam carrying pipes as the most cost-effective activities to reduce the use of fuel wood or fuel oil.

Rural Electrification

Homes of tea farmers as well as schools, clinics and other public services in the vicinity of tea factories may or may not yet be electrified. While the tea factory will be the dominant productive use, families of tea farmers and other community members could diversify their earnings through other activities if they had access to electricity. In areas with sufficient hydrological resources, it may well be possible to use such small hydro plants to meet residential, social and possibly even commercial demand for electric power in the tea farming area in addition to covering the demand of the tea factory itself. This will make such a small hydro project option not only attractive commercially but also socially and politically. The economic analysis does show, however, that if the costs of extending the grid were added to the cost of the project, its IRR for many sites would come to below 10% making then unattractive for commercial investment. Where the tea factory is cooperatively owned (all the tea factories of the Kenya Tea Development Agency are owned by tea farmers' cooperatives) the primary interest of the individual tea farmer may not be limited to the IRR of the small hydro plant but could also include the possibility of providing the household with a connection.

A number of governments (primarily Uganda but also Kenya and Tanzania) in the region have put in place grants for private companies that expand rural electrification services. The Ugandan government under its Energy for Rural Transformation (ERT) Program will pay the additional cost accrued to the private power developer for providing rural electrification. One example of this is the West Nile Rural Electrification Company, which in April 2003 was awarded the concession of the West Nile region. This Company is investing in a 3.5 MW small hydro project with partial grant support from the ERT. Three other ESCOs in Uganda are investing in new generation capacity on similar terms.

With such an arrangement it will be possible for the small hydropower project to contribute to rural electrification without compromising its financial attractiveness. This provision lends itself to the establishment of public-private partnerships (tea factory/utility/cooperatives), the creation of an Energy Service Company (ESCO), or a tea factory venturing into power generation and sales or even as distribution with a mini-grid to nearby communities. Such initiatives may count on possible external support from new initiatives such as the EUEI (European Union Energy Initiative for Poverty Reduction and Sustainable Development) particularly in countries where government grants for rural electrification are not already in place.

During the preparation of the Full Size Project Brief, the Project has identified 56 small hydropower sites in tea growing regions of the 8 EATTA countries. Besides the collection of field data (for load forecasts, settlement structures of nearby communities, etc), the hydro potential was assessed based on maps and 20 years of river flow data and actual field surveys. Nineteen of these projects have completed pre-feasibility studies. Each of the sites identified and studied can generate from 300 kW to 5,000 kW. The larger sites can supply more than one tea factory and also supply the local communities and sell the excess energy to the national grid in their country. See Appendix F for a short summary of the findings.

Resource Availability

Scoping studies carried out in participating EATTA countries demonstrate that many more technically attractive small hydropower sites exist that can provide power to tea factories than have been developed. Field missions to all 8 countries and the analysis of 1:50,000 topographic maps of the tea growing areas resulted in the identification of over 50 potential hydro sites (see Appendix F). This is by no means a comprehensive list of potential small hydro sites that could potentially supply tea factories in the EATTA countries. The full list of projects is likely to be two to three times as large. The objective of the Scoping Studies was to identify 13 projects to carry out Prefeasibility Studies. The Prefeasibility Studies have been concluded and the most attractive of the projects will subsequently be developed into some 6 pilot projects in the Full Scale Project period.

Despite the availability of large numbers of technically and potentially financially attractive hydropower projects, tea factories have not made investments into their development. The main reasons for this appear to be lack of familiarity with small hydropower technology for most tea factory operators and their financing banks. The small hydropower construction sector is not well established in EATTA countries either. This means that interested tea factory managers would need to hire overseas consultants to design their projects for them. The potential cost and delays at the pre-investment stage have proven to be prohibitive for all but the most motivated tea factories.

What happens if GEF project is not implemented? (Baseline scenario)

In the baseline scenario the tea factories will continue to rely on unreliable grid electricity and backup diesel generators for electrical power. They will not make investments into attractive small hydropower projects in their vicinity. This will have both global and local implications. Combustion of fossil fuels to produce electricity on the grid or in backup diesel generator sets both produce GHGs. In most countries in the region the overall national power generation capacity is lower than demand. Hence continued use of grid electricity in tea factories that could potentially use their own alternative generation sources deprives service provision to the many in rural areas without access. As such it curtails possibilities for unelectrified people to switch from traditional to modern fuels as well as to embark on income generating opportunities. Drought and the lowering of water levels in reservoirs have resulted in an acute shortage of power in a number of countries in the region. The new power plants coming on line to supply the grid, especially those built by IPPs in response to the severe shortage of power, are largely thermal. Delaying the development of a substantial renewable energy resource will lose the opportunity to postpone near-future fossil-based generation expansion.

With the current sharp increase of petroleum prices, which eventually will also lead to higher electricity tariffs, it is only logical to expect that tea industries will gradually be forced to consider alternative options. The prospect of a few individual tea factories venturing into small hydro without proper technical support is therefore real. Improper analysis of flow data, sub-standard design, civil works, equipment and installations leading to rapid disappointment with the technology, effectively preventing any further development is one possibility. At best only a few of the technically and financially strongest factories will develop good quality small hydropower plants, slowing down and limiting the full scope for expansion of this technology.

What would happen if GEF project is implemented successfully? (Alternative scenario)

The proposed Small Hydro Project will support a region-wide shift of tea processing plants away from grid and fossil fuels to small hydro, where it is both economically justifiable and environmentally benign. This could be in the form of single hydro projects supplying one or more individual factories. Cluster development of small hydro plants to supply a number of factories might also be an option to reduce costs. Although, power from hydropower will be used mostly to meet electricity needs of the

factories, excess power might in the case of isolated projects also be used to feed into the boilers and meet the thermal energy needs of the tea factories, reducing the use of unsustainably harvested firewood and in some cases fuel oil. Extensive use of hydropower to meet electricity and thermal needs avoids the emissions of greenhouse gases, harmful to the earth's climate.

The Project will lead to improved energy efficiency of tea factories in EATTA countries. Energy efficiency of current operations will be evaluated first in order to come to optimal designs for small hydropower systems. Converting tea factories to (mainly) operate on hydro will start with a careful analysis of power requirements and actual consumption. There are likely to be many opportunities for implementing energy efficiency measures. In some cases a more staggered production process may reduce (peak) power demand; in other cases the use of more energy efficient electro-motors may substantially reduce daily power consumption. Installation of more efficient boilers and improving insulation will decrease thermal energy needs. An energy audit in every factory will precede any local hydropower initiative and therefore be part of any feasibility study.

Furthermore, the GEF Project will demonstrate electrification of rural areas adjoining the tea factory for commercial/social purposes using renewable energy from small hydropower through a public private investment modality. The Project will promote energy efficiency in tea factories alongside the switch over to renewable energy. In a number of cases, potentially more hydro power can be generated than the tea factory (-ies) will actually need. The primary objective of the tea factory will be to develop sufficient power for its own needs, and at all times. Excess power for rural electrification purposes can be realized by "over-dimensioning" the small hydro plant and taking local commercial, social and residential loads into consideration.

The Project will promote the development of the small hydropower IPP starting with the tea factory hydros. In countries where tariffs for small scale power sales to the national utility are acceptable, excess power will also be injected into nearby transmission lines. Ability to sell surplus power to the grid will quite logically have a positive impact on the economic and financial feasibility of the proposed projects. The GEF Project will work with regulators in participating EATTA countries towards achieving a "standard PPA" to facilitate the large scaling up of small hydropower development in each of the countries. In countries where this can be established it is likely that IPPs will eventually develop small hydropower projects beyond the tea estates to supply a large percentage of the national grid, thereby replacing fossil fuel used to generate power for the grid. This will result in expanding the impact of the project from greening of the tea industry to greening of the overall electricity grid.

Introducing small hydropower plants to meet local energy needs of both tea factory as well as all the power requirements of the local population will directly instil a sense of responsibility of communities for the energy source; the local river and the watershed feeding it. The importance of continuous water flow, even against the backdrop of possibly reduced rainfall due to climate change, will force both industry and population to preserve or even improve water retention in upstream watershed areas and actively protect such areas. Preservation of the watershed will have biodiversity benefits alongside the climate change benefits of small hydropower.

Barriers to the development and implementation of SHP (why are the potential and associated benefits not realized now)

Despite the availability of excellent hydropower resources, the reality is that virtually no investment is currently taking place into small hydropower projects to supply the tea industry in Eastern and Southern Africa. This section will attempt to pinpoint the major obstacles that stand in the way of large-scale introduction of this environmentally friendly option within EATTA countries.

- Investor Confidence: The tea industry is generally not familiar with the small hydropower sector. Most factories are not aware of the opportunities for hydropower development in their vicinity. A few have carried out pre-feasibility studies but have not moved forward to project implementation. The recent surge of world petroleum prices certainly must provide extra motivation to shift away from fossil fuel but concurrently such sudden high prices also weaken the overall performance of every tea factory reducing its ability to make new investments and to take on large new risks. Particularly risky to the investor is the early 'pre-investment' expense to carry out the detailed feasibility study when there is no guarantee that the investment will be fruitful. Except for Uganda, to date no financial incentives are available in other EATTA countries to carry out detailed feasibility studies for small hydropower projects.

- Financing: Financing institutions in Eastern and Southern African countries are generally not familiar with the small hydropower sector. There is almost no experience in financing of small hydropower on commercial terms in any of the countries. The banks do not consider energy as a loan product and currently do not have the due diligence capacity to review hydropower projects. Commercial banks tend to have short repayment schedules for their loans, which makes them unattractive to borrow from for hydropower projects. Development banks can offer better terms for hydropower projects, including a grace period for construction and longer repayment schedules, if they can be convinced of the quality of the project investment. Project financing, where the hydropower project can itself be the collateral, is generally not available in the EATTA countries with commercial or development banks. This will imply that only those tea companies that can put up sufficient collateral or have a strong corporate balance sheet will be able to get loans for small hydropower projects in the immediate term. There is similarly a lack of easily accessible dedicated Clean Energy Investment Funds serving the Eastern and Southern African region that are suitable for financing small hydropower investments.

- Technical Capability: The engineering and construction firms in the EATTA countries have limited experience with carrying out feasibility studies, designing or constructing small hydropower projects. Without high quality site assessments and feasibility studies, investment will not be forthcoming in this sector. Construction firms have experience with drinking water and irrigation projects but limited experience in the construction of hydropower projects. There is a well established metal industry that can manufacture good quality pipes in a number of EATTA countries that can be used as penstock pipes in small hydropower projects. However, there are no firms in EATTA countries that can manufacture the electro-mechanical and controls equipment for small hydropower. All these limitations lead to high costs and delays in the development of hydropower projects in EATTA countries.

- Policy and Regulatory Uncertainty: Government policies in EATTA countries are generally supportive of development of small hydropower and other renewables (see Section 2.2). Despite the generally favourable policies there do not exist targeted regulations and incentives in most EATTA countries to specifically promote independent generation for captive use or for feeding electricity to the grid and public private partnership in rural electrification. For example, while most countries in the region have discussed 'light handed regulations' for small hydropower projects, none have implemented them so far. Most EATTA countries have until recently been content to expand power generation on the national grid through larger public sector power projects to meet the need of urban consumers and some industrial consumers in rural areas. A general decline of public sector financing for larger power projects and the preference of Independent Power Producers to bring on line expensive thermal projects with short gestation periods have finally alerted national governments and electricity regulators to look more seriously at renewable energy options for power supply. In Uganda, where recent changes in regulations have made rural electrification and renewable energy a national priority, one can see over a dozen small hydropower projects and other renewable energy technologies identified and under development over the last few years.

- Market Uncertainty: Lack of clear rules to allow the sale of power produced by a small hydropower project beyond the tea factory, limits the size of the project and reduces the number of financially attractive small hydropower investment opportunities in EATTA countries. In particular, lack of commitment from the utility to purchase excess power produced at an attractive price can often limit the hydropower project to a size which less than optimally utilizes the available resources. Similarly, lack of regulatory encouragement tea factories developing hydropower projects to sell excess power to neighbouring rural communities results in sub-optimally sized project. Most EATTA countries are in principle committed to private sector supply of power to the national grid. However negotiations with the utility to purchase energy from small producers tend to be cumbersome and the tariff offered unattractive to develop small hydropower projects to their full potential. This market uncertainty stands in the way of substantial investment of the small hydropower sector in EATTA countries. In countries with strong investment streams going into small hydropower, market uncertainty has been overcome with a "standard PPA" (see earlier section with reference to South Asia experience). This is a standard offer from the national utility to purchase all energy produced by the IPP at a pre announced price. The absence of such a standard offer inhibits the scaling up of small hydropower investments to its full market potential.

How can the SHP GEF project remove the barriers identified?
The Project Management Office (PMO), which will be set up by the EATTA to execute the Full Size Project, will systematically overcome the identified barriers (Lack of Investor Confidence; Unavailability of Financing; Limited In-country Technical Capability; Policy and Regulatory Uncertainty; and, Market Uncertainty) that stand in the way of attracting investment into small hydropower projects to meet the needs of tea factories in EATTA countries. The PMO will provide technical support to project developers as well as to engineering companies carrying out feasibility studies and project design, component manufacture and on-site construction. The PMO will also help developers access financing from commercial and development banks and from dedicated Clean Energy Funds. Figure 4 shows how the PMO intends to mobilize financing to small hydropower projects. Loans will be accessed at commercial terms for the hydropower development. Grants and concessional loans will be sought from governments and international funds for rural electrification.

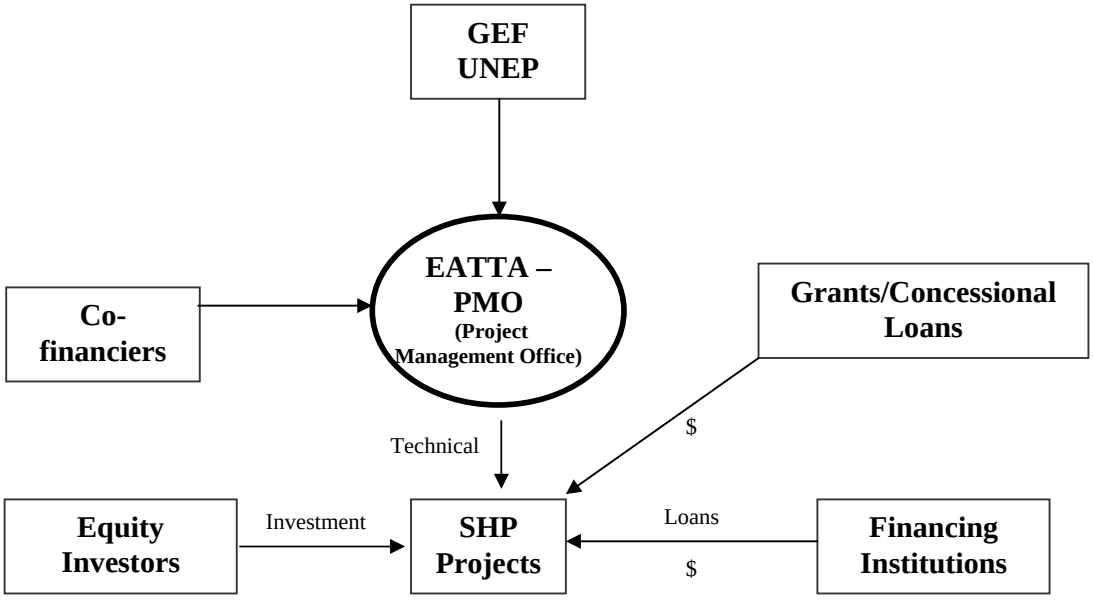

Figure 4: Role of Project Management Office (PMO) in mobilizing Finance for SHP

- Investor Confidence: A tea factory investor not familiar with the technology will see a number of risks in making an investment into a small hydropower project. The PMO will reduce risks and increase the confidence of prospective investors in the small hydropower sector firstly by carrying out 10 high quality detailed project feasibility studies for the demonstration projects and providing technical support to other such studies that developers invest in themselves. Substantial pre-investment costs and poor quality studies are a major barrier to investor interest. The high quality feasibility studies carried out through the PMO, at modest expense to the investors, will provide the confidence to investors to invest in attractive projects. Investor confidence will also be enhanced through trips within the region and overseas to meet with developers who have successfully developed small hydropower projects.

- Financing: The PMO will work aggressively to encourage interest in financing institutions in the region to finance small hydropower projects. High quality feasibility reports with quality control by the PMO will provide a certain amount of confidence to financing institutions to provide loan finance to the proposed projects. Regional and overseas trips for bankers from the EATTA region to meet with banks which are already making loans to small hydropower projects will provide further confidence. It is expected that some US$ 22 million will be invested during the Project

period to build at least 6 pilot projects producing around 10 MW of power. Of this, it is anticipated that 70% (US$ 15 million) will be debt financing. The PMO will carry out a number of activities to assist project developers to access the necessary financing. The main modalities for financing are anticipated to be the following: Balance sheet Financing, Collateral Financing, Project Finance, and eventually Portfolio or Sector Financing for the hydropower sector. See elaboration of these financing modalities in Appendix S. In addition to assisting project developers to access existing financing institutions, the PMO will encourage and support the formation of a Cleaner Energy Fund for Agro-Industry in Africa (CEFA) which will be a dedicated fund to finance the small hydropower project pipeline resulting from two Full Size Projects "Greening the Tea Industry in East Africa" and "Cogeneration for Africa".[14]

- Technical Capability: The PMO will enhance the capability of engineering and construction firms in the EATTA countries to carry out feasibility studies, design, and construct small hydropower projects. Through training construction firms with experience in drinking water and irrigation projects will be provided the tools to apply their experience in the implementation of hydropower projects. The well established regional metal industry that can manufacture good quality pipes in a number of EATTA countries will be encouraged to supply penstock pipes for small hydropower projects. Regional engineering firms will be supported to form Joint Venture partnerships with international firms to supply turbines, generators, and control equipment for small hydropower projects. These companies will also be encouraged to provide technical backup for these components.

- Rural Electrification: The PMO will assist the tea factories that are developing small hydropower projects to sell power to neighboring communities. This might take the form of the power producer selling electricity directly to individual customers. Alternatively, it might take the form of the power producer selling power in bulk to an Energy Service Company (ESCO) through a Power Sales Agreement. The ESCO would then distribute to the local community. ESCOs can be private companies or cooperatives of users. The PMO will assist in the establishment and capacity building of rural electrification cooperatives and also in negotiations between the tea factories and the ESCOs. The PMO will also support the tea factories or ESCOs, depending on each situation, to access government funds which are available for expansion of the distribution lines for rural electrification.

- Policy and Regulatory Uncertainty: The PMO will propose to policy makers and regulators to put in place 'light handed regulations' which are conducive to small hydropower development in EATTA countries. These will include licensing and environmental regulations for small hydropower development and distribution. The PMO will also encourage a simplification and standardization of the subsidy policy for renewable energy and rural electrification in countries like Uganda that do have supportive policies but continue to have cumbersome rules that require a project by project assessment. Similar policies will be promoted in the other EATTA countries.

- Market Uncertainty: Possible markets for the energy produced by small hydropower projects developed by the tea sector are as follows:
    a) Power used within the tea factory
    b) Power supplied for rural electrification where appropriate
    c) Surplus power sold to the national grid.

The market for power within the tea factory is secure for the hydropower project. The PMO will assist tea factories to find markets for excess power from their hydropower development beyond the tea factory. This may be for rural electrification or to sell to the national grid. Except for Burundi, all the

[14] The CEFA concept has been initiated by Kenya-based Integral Advisory Limited ("Integral"). Integral is Eastern Africa Representative for Triodos Renewable Energy for Development Fund (TRED Fund). Integral has proposed TRED Fund as potential sponsor/anchor investor to formulate and capitalize CEFA. TRED Fund, the principal sponsor, is an investment vehicle managed by the Triodos Bank (headquartered in Netherlands). TRED Fund is managed by Triodos International Fund Management BV., a unit of the Triodos Bank, Netherlands. Integral is developing the CEFA concept in consultation with Triodos, UNEP/GEF (Nairobi), AFREPREN (Africa Policy Research Network) and EATTA (East African Tea Trade Association) and their associated energy project development experts.

other EATTA countries have undergone reform in the electricity sector in the last decade. All the countries are in principle receptive to private sector investment in the power sector. As Table 14 shows Kenya, Malawi, Mozambique, Uganda, Rwanda and Zambia all allow access to the national grid for private producers. Except for Malawi, Mozambique and Burundi, all of the other countries have Independent Power Producers (IPPs) supplying power to the national grid. Many of these IPPs have used expensive diesel fuel in the past. The PMO will work with utilities in the EATTA countries to accept in principle that they will purchase surplus hydropower not used by the tea factories.

The PMO will also work with the authorities in the EATTA countries to develop contracting mechanisms for small hydropower developers to sell electricity for rural electrification. The developer will want to be certain that he will be paid for any energy sold to the local communities. This might involve a power sales agreement with a local electricity distribution cooperative or user group. The PMO will assist the developer to develop such an agreement. The Government of Uganda has committed to providing grants for the extra cost incurred by private project developers to provide connections to rural areas. The PMO will encourage other EATTA countries to develop similar policies.

Through workshops, training and support to individual investors, the PMO will inform prospective investors about the potential market for electricity from small hydropower projects in their respective countries. Where excess power can be sold to the national grid, the PMO will assist developers in arriving at a Power Purchase Agreement. A PPA with a credible utility to sell the excess energy is the safest way to overcome market risks for surplus power. For a small producer, the process of negotiating the PPA can be uncertain and time consuming. The PMO will provide technical support to developers so that the costs and time taken to negotiate the PPA are reduced. The PMO will promote a viable ‘standard PPA’ as the most effective way to reduce market risks for future developers of small hydropower projects. This is unlikely to be available at the beginning of the Full Size Project period but could be an important outcome of the project in one or more EATTA countries. To arrive at the ‘standard PPA’ for each country the PMO will first carry out a professional analysis of both the value to the grid of electricity produced by small hydropower plants from the perspective of the utility and also the tariff which the developer will need for an attractive investment based on a cost of construction and investment analysis. This analysis will arrive at a cost per kWh which will be attractive to both utility and developer. This proposed tariff will be proposed as the key parameter of a ‘standard PPA’ through stakeholder consultation. A draft ‘standard PPA’ will be prepared for consideration by all stakeholders. In order to provide real life examples of how the ‘standard PPA’ can be made to work, a mixed group of regulators, utility officials, and prospective hydropower developers will be taken on a tour of countries in South Asia and other African countries where the ‘standard PPA’ is in place.

3.2.2 Objectives and Outcomes

The objective of the proposed GEF project is to increase investment in small hydropower to reduce energy costs in the tea industry in Eastern/Southern Africa, improve reliability of supply, increase power supply for rural electrification, and reduce Greenhouse Gas emissions.

Broader outcomes of the project can be expected to be as follows:

a. Investment confidence established in small hydropower sector among investors, project developers and financing institutions

b. Technical capacity enhanced in EATTA countries to design and construct small hydropower and fabricate associated equipment

c. Models in place for private-public participation in rural electrification through small hydropower

d. Regulatory environment enabled to be conducive to small hydropower IPP investment and rural electrification in EATTA member countries

e. Stage set for establishment of a viable ‘standard PPA’ in EATTA countries for small hydropower.

Considering the varying relevance of the tea sector in every EATTA country, it is obvious that the scope and opportunities for immediate investment and replication will be different in each country.

3.2.3 Target Groups and Stakeholders

Major stakeholders in the project are tea factories and communities living in their vicinity without electricity. Tea factories have been contacted through EATTA. Communities have been consulted in the process of carrying out scoping exercises and pre-feasibility studies. They will be further engaged during the detailed feasibility studies. KTDA which represents smallholder owned tea factories and has consulted extensively with local communities has been strongly involved in the Project preparation. Government officials involved in the regulation of the power sector and formulation of power sector policies are very important stakeholders. These policy makers have participated in the regional workshop during the preparation of the Project and will also be represented on the Project Steering Committee and National Steering Committees in countries which will host pilot small hydropower projects. The engineering, consultancy, contracting and equipment manufacturing community is another key stakeholder. They have been visited during Project preparation and have also participated in the regional workshop. They will be invited to engage strongly during the Project period during the detailed feasibility studies, through training and cpacity building, and during project construction.

The tea factories will be expected to make substantial commercial investments into the 6 pilot small hydropower projects. In order to reduce their risks and increase their confidence in the sector, some 13 pre-feasibility studies were carried out during the PDF-B Full Size Project preparation phase. The increased interest and confidence in the sector was evident from letters received showing significant interest, including financial commitments, from 14 tea factories and associations from 6 EATTA countries. With the Project period itself a total of 10 Detailed Feasibility studies will be carried out. This will ensure that at least six pilot projects can be completed in the Project period, even allowing for up to four projects being slow in reaching financial closure or starting construction late.

3.2.4 Methodology

The GEF Full Size project will apply proven methodologies from Asia and other parts of the world to the development of small hydropower in the tea sector in Eastern and Southern Africa. Experiences are drawn mainly from Nepal and Sri Lanka, two small South Asian countries, with similar size, populations and economic development as the EATTA countries, which have seen a dramatic increase in investment in small hydropower in the last decade. Sri Lanka in particular is a major tea producer and has many lessons for EATTA countries as the early small hydropower development there took place on tea estates.

The Nepal Model

Nepal saw a burst of small hydropower investments after 1998 when a ‘standard PPA’ was announced by the Nepal Electricity Authority offering to purchase all energy produced by small producers below 5 MW at a fixed price of around US¢ 5 per kWh. Technical support was provided to interested developers by a collaborative effort between Winrock International and the GTZ Small Hydro Promotion Project. This team continues to provide technical, legal, managerial support assisting developers to carry out high quality bankable feasibility studies, to negotiate PPA’s with the national utility, to secure financing from local banks, to source equipment, and to construct high quality projects. To date some 55 MW of small hydropower projects have either been constructed or are under construction and have attracted around US$ 60 million from local financing institutions through a Project Finance modality.

The Sri Lankan Model

With technical support from the Intermediate Technology Development Group (ITDG) some 60 mini hydropower projects were rehabilitated on tea estates in the 1980’s and early ‘90s in Sri Lanka. These projects were used to reduce the cost of grid power at the tea factories. At the turn of the century it is estimated that around 500 micro and mini hydropower projects were operational on tea and rubber plantations in Sri Lanka providing them motive and electrical power. Most had fallen to disuse after widespread expansion of the national grid to plantations began to provide electricity at low cost.

The announcement of a ‘standard offer’ by the Ceylon Electricity Board to purchase energy produced by small hydropower projects and a line of credit provided by the World Bank in 1997 provided a

dramatic boost to this sector. Tea estate owners and other IPPs began to build larger projects, up to 10 MW in size to primarily supply the national grid. Small hydropower became an investment sector in its own right. Today, the World Bank supported RERED project has a deal flow of some 45 projects with 120 MW of small hydropower either produced or under construction.

Support to the Tea Sector in EATTA countries (pilot projects selection)

The project proposes to establish a Project Management Office (PMO) within EATTA to overcome the major barriers in a systematic way. The barriers have been identified as:

1. Lack of Investor Confidence
2. Unavailability of Financing
3. Limited In-country Technical Capability
4. Policy and Regulatory Uncertainty
5. Market Uncertainty

A central Project Output and a key responsibility of the Project PMO is the successful construction of six Pilot Small Hydro demonstration projects covering at least three of the EATTA countries. Ten high quality detailed feasibility studies will be carried out with substantial investment by the Full Scale Project and with part financing from the tea factories themselves. At least six pilot demonstration projects are expected to result from these ten studies. The ten projects to be studied will be selected in a manner that is transparent to the key stakeholders. The projects will also be selected to encompass geographical diversity and to increase the potential for replication. This selection process and the earlier processes that have resulted in some 19 projects studied to pre-feasibility level are described below. It is likely that there will be two to three pilot projects in Kenya. This concentration reflects the fact that the largest potential for replication is in Kenya, which has 91 of the 177 tea factories among the participating EATTA countries and excellent hydrological conditions. Sixty percent of the factories in Kenya are owned by smallholders under the umbrella of the Kenya Tea Development Agency (KTDA) with a strong interest in rural electrification from the small hydropower project. However, as their key purpose is market transformation through demonstration, the Project intends to have pilot projects in at least 3 different participating countries, possibly more.

Although there will not be pilot projects in every participating EATTA country, the demonstration effect will be maximized by having EATTA members and policy makers from countries without projects to visit pilots within the region. In addition, technical support, capacity building and limited financial support will be available to carry out pre-feasibility and feasibility studies in any of the countries during the course of the project. Policy makers and EATTA members from all participating countries will also be invited to workshops and overseas visits.

There is a transparent process through which the ten projects for carrying out detailed feasibility studies will be selected. The process first started with Scoping Studies carried out during the PDF-B period in all eight participating EATTA countries. The tea factories to be visited during the Scoping Studies were selected based on consultation with EATTA and interest shown by tea factories which had earlier responded to a questionnaire from UNEP. Based on the results of the Scoping Studies, thirteen pre-feasibility studies were carried out. Six pre-feasibility studies were already available prior to the PDF-B exercise. This has resulted in the total of 19 existing studies shown in Table 25 below.

The thirteen pre-feasibility studies that were carried out within the PDF-B period were selected under the following criteria.

1. Interest and Capability of the Tea Factory:

- Interest voiced by the Tea Company / Tea Factory
- Access to Financing of Tea Companies / Tea Factory
- Replicability in terms of large number of potential tea factories and small hydropower sites.

2. Conducive regulatory environment

- Attractive PPA framework in the country
- Financing access for rural electrification from public RE agencies/ government

3. Attractive site available

- Power demand of the tea factory(ies) and local communities well matched with the available hydropower potential
- Good plant factor likely leading to good IRR

- Potential for hydro rehabilitation (low hanging fruit)
- Attractive hydropower potential (technically and economically)
  - < Priority will be given to sites with the highest head possible
  - < Best average flow rate ($m^3/s/km^2$)
  - < Sites with high flood levels will not be considered
  - < Sites with the lowest transport of solid matter.

4. Logistics and Environment

- Level of assistance that can be tapped from the tea companies or factories
- Distance and accessibility of the tea growing area to the capital and logistical aspect
- Minimal impact on farmers' land, property and environment.

These criteria were drawn up in a transparent manner in close consultation with EATTA and its member tea factories in the participating countries.

The final list of 10 projects for which the Full Size GEF Project will carry out detailed feasibility studies will be compiled using the specific quantified criteria presented in Table 23 and Table24. Table 23 is used to rank projects based on the proven interest of the project promoters, the technical results of the Pre-feasibility studies and the potential for replication. Table 24 is a screen to make sure that the projects that are selected encompass diversity of application and geography to maximize the chances of replication throughout the EATTA countries. The final ranking will be done in an open and transparent manner with full involvement of EATTA members.

Table 23: Criteria for Ranking of Projects to Carry out Feasibility Studies during the FSP

Proven interest for the project	Resolution of the Tea factories' Board of Director	25%	50%
	Proven interest of financing institution	20%	
	Contribution to the pre-FS	5%	
Pre-FS results	Financial attractiveness (IRR, payback period,…)	20%	35%
	Quality of the pre-FS, including reliability of data used	5%	
	Easiness to implement the project, including Site simplicity	10%	
Potential for replication and N° of beneficiary(ies)	N° Tea factories	10%	15%
	N° Tea companies	5%	
	Total	100%	100%

Table 24: Criteria for Selection of Feasibility Studies between the Best Ranked Pre-FS Studies

Regional coverage	N° of countries covered	Min. 3
Potential for replication	Single tea factory project	Min. 2 project
	Multiple tea factories project	Min. 2 project
	PPA	Min. 2 project
	RE component	Min. 1 project
	Rehabilitation or upgrading project	Min. 1 project

The financially attractive projects among those listed in Table 25 are those with the higher IRR. Six projects are seen to have an IRR above 20% even in an isolated mode without a PPA from the utility. With a PPA, this number goes up to 11 projects. The final selection of the ten projects, for which the Project will carry out detailed feasibility studies, will be completed among the first tasks of the PMO as per the criteria outlined in Tables 23 and 24. The results of the pre-feasibility studies alone show a high concentration of the best projects being located in Kenya. However as Table 23 shows, in addition developers must demonstrate that that they are able to acquire licenses and permits for the project, show commitment from the Boards of their companies and also submit letters of support to their project from their bankers before their project will be selected. Application of the criteria in Table 24 will ensure diversity among the final projects selected. This will include broad regional coverage as well as diversity in the types of projects: including projects that serve single of multiple factories, and those that include a rural electrification component or will have a PPA from the utility. It is expected that developers will invest in their own detailed feasility studies for projects which are financially attractive but are not selected by the Full Scale Project. The Project can still provide technical support and quality checks to these studies as per request.

Table 25: Shortlist of Pre-feasibility Completed Projects to Select for Detailed Feasibility Study

N°	Country	Hydro site or river name	Tea company	Investment cost Million US$	Installed capacity (kW)	IRR without PPA	IRR with PPA @ 50% of the actual Power price	Potential RE
1	Uganda	Nchwera	(1)Uganda Tea Development Agency , (2)James Finlay Ltd	5.549	2,361	4.1%	17.5%	Y
2	Uganda	Warugo	(1)Uganda Tea Development Agency , (2)James Finlay Ltd	3.580	693	6.2%	7.7%	Y
3	Kenya	Kipkurere	EPK, Williamson, Nandi Tea Estates, Koisagat	5.00	2,897	35.4%	60.2%	Y
4	Kenya	Kipchoria	EPK	3.68	1,710	13.3%	35.5%	Y
5	Kenya	Kipkurere +Kipchoria	EPK, Williamson, Nandi Tea Estates, Koisagat	8.69	4,607	25.8%	49.6%	Y
6	Rwanda	Base 2	Sorwathe	3.410	687	10.5%	41.0%	Y
7	Malawi	Lichenya	Eastern produce Malawi Ltd, Lujeri Tea Estate, SMA	5.663	4,169	5.1%	9.6%	Y
8	Malawi	Lujeri - upgrading	Lujeri Tea Estate	0.939	203	< 0%	1.7%	N
9	Malawi	Ruo – upgrading	Eastern Produce Malawi Ltd, Lujeri Tea Estate	3.882	1,705	1.2%	4.0%	Y
10	Malawi	Muluzi	Eastern Produce Malawi Ltd	2.002	626	-0.6%	-0.2%	N
11	Rwanda	Giciye	OCIR Thé	4.492	1,225	12.0%	>> 50%	Y
12	Kenya	Kimari	Unilever	3.998	966	18.2%	18.2%	N
13	Rwanda	Sebeya	Pfundi	2.880	919	16.4%	>> 50%	Y
14	Kenya	Gura	KTDA	5.480	2,775	22.0%	55.8%	Y
15	Kenya	North Mathioya 1	KTDA	4.350	2,010	50.8%	>> 50%	Y
16	Kenya	Yala	EPK, Williamson, Nandi Tea Estates, Koisagat, KTDA	8.807	4,691	49.6%	>> 50%	Y
17	Kenya	Tagabi	Unilever	0.764	603	>> 50%	>>50%	N
18	Tanzania	Suma	Wakulima	3.237	1,902	1.4%	22.7%	Y
19	Tanzania	Luhololo	Mufindi	3.219	1,407	< 0%	9.6%	Y

3.2.5 Work Plan

Activities planned for the duration of the project have been outlined in Table 26 below.

Table 26: Activities Planned for the Project Duration (Project Timeline)

	ACTIVITIES	YEARS							
Outcome 1	**INVESTOR CONFIDENCE**	**1**		**2**		**3**		**4**	
1	10 high quality feasibility studies with substantial support	X	X						
2	5 pre feasibility (for training purposes) and 5 detailed feasibility studies with partial support		X	X					
3	4 training on managing risks in small hydropower for developers		X	X					
4	Review pre- feasibility and feasibility studies (5-10) undertaken by developers with own expenses		X	X	X	X	X	X	X
5	Support in negotiating PPA agreements (4) with utility and in negotiating financial closure with banks	X	X	X	X	X	X	X	X
6	Technical backstopping (on demand) for reviewing detailed design, selection of EPC contractors, and equipment purchase (6 projects)	X	X	X	X	X	X	X	X
7	Construction: Review progress and design variations at site (6 projects)	X	X	X	X	X	X	X	X
9	2 training on 'project finance' for bankers and insurance companies			X		X			
10	Study tours to South Asia and within Africa for prospective investors and developers (15 participants)		X						
Outcome 2	TECHNICAL CAPACITY								
1	Develop quality standards for feasibility studies and civil, mechanical, and electrical components of small hydropower established in EATTA countries	X	X						
2	2 training of consulting and construction engineers, system designers, surveyors (20 participants each)		X		X				
3	Facilitation of partnerships between international and Eastern and Southern African firms (2 firms) for joint collaboration and technology transfer	X	X	X	X				

	ACTIVITIES	YEARS							
4	4 training and Q.C. of local equipment and component manufacturers (10 participants each)			X		X			
5	Assessment of local value added in small hydropower development						X	X	
Outcome 3	RURAL ELECTRIFICATION								
1	4 feasibility studies of local distribution network	X	X	X	X				
2	Initiate negotiation of tariff and terms of supply (4 projects)			X	X	X	X	X	X
3	Stimulate formation of user groups among potential beneficiary communities (4 projects)			X	X	X	X	X	X
Outcome 4	POLICY AND REGULATORY FRAMEWORK								
1	Draft light-handed regulations for licensing small hydropower generation by IPPs in EATTA countries (4 countries)	X	X						
2	Consultations with authorities and other stakeholders to arrive at supportive regulations (4 countries)		X	X					
3	Study tours to South Asia and within Africa to visit countries with effective regulations (15 participants to South Asia + 16 participants trip in Africa)		X						
Outcome 5	STANDARD PPA								
1	Studies on a 'viable' standard PPA for small hydropower in EATTA countries (5 countries)				X	X			
2	Consultations with authorities and other stakeholders to arrive at a 'standard PPA' based on study (5 countries)					X	X	X	
3	Study tours to South Asia and within Africa for regulators and utility officials to observe impacts of standard PPA (15 participants)		X						

EPC - Engineering, Procurement and Construction
Q.C - Quality Control

Risks and assumptions

The major risks to the Project can be classified as: Regulatory Risks, Market Risks, Credit Risks, Hydrological Risks, Climate Change Risks, Technical Risks, and Environmental and Social Risks.

Regulatory Risks: In some of the participating EATTA countries, where the project plans to support the development of pilot small hydropower project, it is possible that acquiring permits from the government could take a substantially longer time and additional efforts than anticipated. This could delay the completion of pilot projects beyond the GEF Project time frame. The Project proposes to mitigate this risk by supporting the six pilot projects in those 3-4 countries which already have the most liberal policies towards IPPs and small hydropower development. The Project will work closely with regulators and government officials to facilitate approvals for the six pilot projects and other projects developed during the Project period. It is assumed that regulatory improvements will continue in the EATTA countries and that the governments will remain committed to promotion of independent power projects. It is anticipated that most of the participating countries will take steps towards instituting 'Light-handed Regulations' for renewable energy projects like small hydropower before the end of the Project. The ongoing power crisis (See Appendix V) in most countries in East Africa will further encourage the regulatory bodies in participating countries to expedite permission for small hydropower investments.

Market Risk: The major market for the power produced by the small hydropower projects promoted by this GEF Project is the tea sector. Sudden downturns on the world tea prices could make it difficult for the factories to come up with the equity investment in pilot hydropower plants. The tea sector does see variations in world prices (between US$ 1.52 and US$ 2.11 at the Mombasa Tea Auction between 2000 and 2005), although the fluctuations are less dramatic than for world coffee prices. The tea sector can not influence the world market, which is dependent on production in other parts of the world and global demand for tea. Tea factories can however control their cost of production and the quality of their product. After labor, energy costs are an important variable in the cost of production of tea. Small hydropower provides reliable low cost power, lowering the energy costs in tea production as well as improving the quality of product as a result of fewer interruptions in the tea processing cycle. Higher quality tea fetches higher prices for the producer at the auctions. It was reported by tea factories that diminished quality of tea due to power interruptions resulted in a loss of around 15% in the price of sold tea.

It is anticipated that tea factories in the EATTA countries, which have been operating for close to a century, are likely to invest in small hydropower as a long term investment once the GEF Project succeeds in mitigating some of the regulatory, technical, and financial risks. They are unlikely to be dissuaded by cyclical fluctuations in world prices. Investing in a small hydropower project can on the other hand also hedge against the possible long term decline in tea prices for the factories. There is some evidence that global tea production is increasing faster than demand for tea, as many countries begin to supply the world market. A small hydropower project can generate large profits after its loans are paid off in 8-10 years.

The second market for the produced power is demand for electricity from communities adjoining the tea factory. These communities will comprise of tea growers and workers as well as their other neighbours. Extending distribution lines as a part of the project entail additional capital costs and will lower the IRR of the project. This may not be attractive for the small hydropower investor. Designing the project for both the tea factory and rural electrification can be justified if the government or other external donors are able to pay for extending the distribution lines as a joint private-public enterprise. One risk to this project output being achieved is that the anticipated grant support for extension of the rural electrification network may not be forthcoming. The GEF project proposes to mitigate this risk by working closely with government officials in the rural electrification departments of EATTA countries and private developers to facilitate the desired private-public collaboration. Kenya, Tanzania, and Uganda have all announced provisions for government support for such ventures. Uganda already has established a process for private power developers to apply to the government for support for the incremental costs of carrying out rural electrification.

A second challenge to rural electrification is that the tea factory may not be interested to sell power to individual customers, because of the high transaction costs involved in providing power to rural consumers. The GEF project intends to mitigate this risk by forming user groups or cooperatives which will purchase power in bulk from the small hydropower developer and carry out their own distribution. This is a model that has worked well in Nepal. The developer will sign an agreement (Bulk Power Sales Agreement) with the cooperative outlining the responsibilities of both parties in the

supply of power and payment for it. This agreement will also include rebates if the factory is not able to supply power for more than a maximum downtime specified in the agreement.

The third market for the generated power is the national grid. For power projects which can economically produce more power than can be consumed at the tea factory or in accompanying rural electrification, sales of surplus power to the grid substantially improve the project IRR. There is a risk that the national utility will delay signing a Power Purchase Agreement (PPA) such that the project will either not be able to start on time to be completed with the GEF Project period or will have to be designed as a smaller than optimal sized project to meet local needs only. The Project will work closely with officials of the utilities and regulators so that they feel comfortable in providing a fair PPA to the small hydro developer. Towards the end of the GEF Project it is expected that some of the countries will be prepared to issue Standard PPAs for small-scale renewable energy projects, such as small hydropower.

Credit Risks: The Project anticipates that financing will be available for small hydropower projects from commercial banks active in the region and Development Finance Institutions active in the region. Although the duration of loan terms normally provided by commercial banks is inadequate for small hydropower projects, it is anticipated that with the confidence in the projects which the GEF Project is expected to provide, banks will provide loans for the required period. There is however a risk, particularly for the smaller tea factories that financing will not be forthcoming in time to complete their pilot projects within the GEF Project period. In order to mitigate this risk, the Project will give high priority to projects which have strong support from their credit institutions in the selection of projects to carry out detailed feasibility studies. A second mitigation measure which the Project has explored during the Project preparation period is to encourage and support the formation of the proposed Cleaner Energy Fund for Agro-Industry in Africa (CEFA) with prospective investment by Triodos Bank of the Netherlands (See Appendix T).

Hydrological Risks: Small hydropower projects are susceptible to hydrological risks, particularly if the analysis used for the feasibility study and project design is based on inadequate historical river flow data. Small streams which will be used for small hydropower projects are not generally gauged or their daily flows recorded by the government's Department of Hydrology. Hydrological risks are normally manifested in lower than anticipated river flows available to the power plant during the dry season, resulting in lower than expected power output. The current drought that is severely affecting power production in much of East Africa is an egregious reminder of this risk. There are also risks of underestimating likely flood levels in the design of the intake structures.

Firstly it must be pointed out that since tea production is itself very sensitive to low rainfall, most tea factories were found to have kept daily records of rainfall on their plantations since they started processing tea. Analysis based on such a data base provides confidence regarding the estimated frequency of extreme dry or wet years. Some factories also have records of stream flow going over many years, although this is less common, which provides an excellent basis for developing an accurate Flow Duration Curve for the stream in question. Review of available hydrological records of stream flows in tea growing areas in Kenya suggest that, in earlier drought years, drought affected tea growing regions less than the countries as a whole. This could be partly explained as a result of beneficial micro-climates induced by tea plantations and associated forest plantations.

By way of mitigation of hydrological risks, the pre-feasibility studies that have been carried out in the course of Project preparation have conservatively underestimated dry season flow at 20-30% below what the hydrological analysis shows. This will be standard practice for ungauged streams when the GEF Project carries out the Detailed Feasibility Studies as well. One feature of hydropower supplying tea factories which provides at least partial self-mitigation to hydrological risks is that the production of tea is directly linked to rainfall. During periods of low rainfall, there is a coincidence between low tea production (and hence less power required to process it) and less power produced from the power plant.

Climate Change Risks: Climate change is expected to result in increased frequency of extreme weather events, leading to long periods of drought or sudden heavy rainfall. This risk can not be mitigated completely. However, watersheds with forest cover and tea plantations, as found in tea growing regions are likely to be less affected by climate change than those without good ground cover. Well covered watersheds can be expected to better regulate stream flows in response to excessive rainfall events or to maintain better stream flows despite longer than normal dry spells.

Technical Risks: Poor design of the small hydropower project, sourcing of equipment from an unreliable supplier or manufacturer, or engaging inexperienced contractors can all result in an under-

performing power project. This is a major risk to a first-time developer without experience in the sector. Poor technical choices can result in a project, which showed an attractive IRR in the feasibility study, turning out to be a bad investment. Even a single poorly performing pilot project can give a negative signal to prospective hydropower investors in the country where it is located. The GEF Project proposes to mitigate this risk with strong technical support, and hand holding as needed, to the developer. The Project will carry out high quality Detailed Feasibility Studies of all the pilot projects, through competent consultancy firms. The responsibility of selecting an Engineering, Procurement, and Construction (EPC) contractor and purchasing electromechanical equipment will remain with the developer. However the GEF Project will be prepared to provide technical advice upon demand. The Project will also send out engineers to the hydropower construction site to review progress of the contractor and provide advice to the developer. In addition to the technical support provided to each of the developers of the pilot projects, the GEF Project will also provide training support to engineering, construction, and manufacturing firms in the region so that their capabilities in the technology can be improved and their role in carrying out projects enhanced. This will also contribute to the sustainability of the projects as a responsible local firm can respond quicker if a serious repair or maintenance issue comes up.

Environmental and Social Risks: Even small hydropower projects can have some environmental impacts on the river ecology. This can come in the form of the diversion of stream flow not leaving sufficient water to sustain the aquatic biodiversity in the de-watered sections. International practice for small projects is to leave at least 10% of the river flow at all times to sustain ecological flows. On larger streams, interruption of the run of spawning fish by the water diversion structure (weir) can be a major concern. This can be mitigated through the construction of fish ladders to allow a side path for the fish to surmount the weir. Other possible impacts are from dumping soil into the river during construction. This can be avoided by finding alternative dumping sites. There might also be a need to cut down some trees during construction of structures like the desilting tank, forebay tank, power house, and laying down of the penstock pipe. Standard mitigation is to plant a significantly larger number of replacement trees in the vicinity.

Possible social impacts to the project can arise if there is a conflict in water use between the proposed hydropower project and irrigation, for example.

The GEF Project will encourage the pilot small hydropower projects to carry out Environmental Impact Assessments (EIA) to high environmental standards. The Project will not conduct the EIAs but will offer to review all EIA reports completed by the developers. The EIA reports should include all possible environmental and social impacts of the project and include a clear plan to mitigate the negative impacts and to monitor the impact of the mitigation activities.

On the social side, projects which are able to include a rural electrification component will contribute to the sustainable development of neighbouring communities by reducing their dependence on poor quality and polluting lighting fuels like kerosene, candles, and dry cells. Better quality lighting will improve childrens' education and reduce indoor air pollution. Communities will also be able to use the electric power for alternative income generating activities such as milling, ice making, and furniture making. The small hydropower project will be sustainable if the watershed which supplies it water will be well protected and maintained. Communities that are supplied electricity from the project are likely to be more easily convinced to protect the watershed.

Table 27: Logical framework

Objectives and Outcomes	Verifiable Indicators	Sources of Verification	Important Assumptions/Risks
Development Goal Development of a more sustainable and competitive tea industry through wider use of climate friendly energy options.			
Project objective Increased investment in small hydropower to reduce energy costs in the tea industry in Eastern/Southern Africa, improve reliability of supply, increase power supply for rural electrification, and reduce Greenhouse Gas emissions.	• $'s invested *(in years 1, 2, 3 &4)* • MW produced *(in years 3 & 4)* • MWh utilized *(in years 3 & 4)* • Cost of energy *(years 3 & 4)* • New households electrified *(years 3 & 4)* • GHG reduced *(years 3 & 4)* • Small hydropower investment • attractiveness spilling over to non-tea sector *(years 3 & 4)*	• EATTA/ National tea boards/ associations • Investors • Banks • Tea factories • Rural electrification boards	• World tea prices do not collapse • Regulatory improvements continue
Outcome 1 Investment confidence established in small hydropower sector among investors, project developers and financing institutions (time period: full four years to achieve)	• Ten applications for licenses • Ten Feasibility Studies completed • Growth rates in investment (US$ 22 million) and installation of 10 MW of power. *(time period: licenses and feasibility studies in years 1 and 2; full $'s invested and MW's produced in years2, 3 and 4)*	• Regulators • EATTA/ National tea boards/ associations • Investors • Banks • Tea factories • Rural electrification boards • M&E of project	Overall investment climate positive in the countries in the region
Outcome 2 Technical capacity enhanced in EATTA countries to design and construct small hydropower and fabricate associated equipment	• Five competent local consultant and engineering firms engaged in designing, construction, and successfully commissioning small hydropower. • Increasing local manufacturing content in small hydro installations • Increased local value added in SHP investment *(time period: local technology firms involvement achieved within first 3 years of Project)*	• Directory of small hydro firms • M&E of project	Sufficient interest from local firms.
Outcome 3 Models in place for private-public	• Private sector incentives for investment in rural electrification adopted by govt	• Public announcements/ reports from RE Boards, Regulators	Governments committed to innovative RE

Objectives and Outcomes	Verifiable Indicators	Sources of Verification	Important Assumptions/Risks
participation in rural electrification through small hydropower	• New distribution models developed and adopted by authorities *(time period: government incentives already in place in some countries and will expand; rural electrification through small hydro achieved in last two years of project after generation starts)*	• M&E of project	
Outcome 4 Regulatory environment enabled to be conducive to small hydropower IPP investment and rural electrification in EATTA member countries	• New 'light handed' regulations proposed to relevant authorities outlining a simplified process to acquire water rights and licenses for generation and where appropriate, distribution of power • Simple yet effective environmental regulations proposed for small hydropower *(time period: regulations proposed to all countries within first two years of the Project)*	• Gazettes • Government acts and policies • Public announcements • M&E of project	Reform processes continue momentum.
Outcome 5 Stage set for establishment of a viable 'standard PPA' in EATTA countries for small hydropower	• Three countries with proposed 'standard PPA' for small hydropower *(time period: standard PPA proposed in last two years of project)*	• Utility announcements/ reports • Electricity Regulator announcements • Ministries • M&E of project	Terms of PPA are practical Utility in good financial health
OUTPUTS			
<u>Outputs for Outcome 1</u> 1.1 Full feasibility studies, including detailed design, completed for small hydropower demonstration projects in at least three EATTA countries. 1.2 At least six small hydropower projects developed within Project Period with commercial investment from the tea industry. 1.3 Additional pre feasibility studies with accompanying training completed in remaining EATTA countries.	• Licenses received for ten small hydropower projects • Ten high quality feasibility studies completed • PPAs signed with respective utilities (where appropriate) • Small hydropower financing window established • Financial closure achieved • Contracts signed for construction and equipment supply • Project construction completed • Projects commissioned	• Announcement and reports of financing institutions • M&E of project	Frequency of droughts not exacerbated by climate change Tea industry remains robust Risk: High interest rates make infrastructure investment unattractive.

Objectives and Outcomes	Verifiable Indicators	Sources of Verification	Important Assumptions/Risks
1.4 Financing modalities facilitated for small hydropower	• Five additional feasibility studies financed by developers		
Outputs for Outcome 2 2.1 Eastern/Southern African consultancy/engineering and construction firms engaged in small hydropower development. 2.2 Two Eastern/Southern African manufacturing firms engaged in producing components for small hydropower. 2.3 Increased local value added in small hydropower development. 2.4 Quality standards for small hydropower formulated and proposed to concerned authorities in Bureau of standards, utilities, and Association of Engineers in EATTA countries.	• Five engineering firms receive feasibility study and construction contracts • Manufacturing firms win contracts to supply small hydropower components • Good quality work carried out by Eastern/Southern African firms • Increased content of local value added in small hydropower development as a result of Project. • Quality standards for small hydropower proposed and acknowledgement received from concerned authorities.	• Engineering firms records • M&E	
Outputs for Outcome 3 3.1 Two feasibility studies completed for viable models to demonstrate small hydropower-based RE project electrifying neighbouring communities.	• Feasible studies available to demonstrate the viability of a small hydropower based RE in EATTA countries • Power sales agreement between small hydropower developer and community electrification cooperative (where appropriate).	• M&E	
Outputs for Outcome 4 4.1 Light-handed regulations on licensing of small hydropower generation by IPPs formulated and proposed for EATTA countries 4.2 Light-handed regulations for private sector involvement in small hydro based rural electrification formulated	• Draft regulations available on water rights for small hydropower, licensing, distribution and environmental requirements in EATTA countries. • Acknowledgment from authorities of draft regulations	• Public announcements/reports • Official communications • M&E of project	Continued government support for regulatory reform and independent private power investment

Objectives and Outcomes	Verifiable Indicators	Sources of Verification	Important Assumptions/Risks
and proposed to authorities in EATTA countries.			
Outputs for Outcome 5 5.1 Policy case made for standard PPA's attractive to investors, utilities, and end users for small hydropower made in all EATTA countries. 5.2 Draft standard PPA formulated and proposed to authorities in EATTA countries.	• Policy studies available demonstrating the viability of a standard PPA for all EATTA member countries • Acknowledgment from authorities of draft standard PPA	• M&E of project • Reports • Official Publications • Stakeholder consultations	
ACTIVITIES	MEANS	COST	
Activities for Outputs 1.1-1.5 1.1 Undertake high quality feasibility studies for 10 hydropower sites including demand analysis and energy efficiency. 1.2 Study tours to South Asia and within Africa for prospective investors and developers. 1.3 Support in negotiating PPA agreements with utility and in negotiating financial closure with banks. 1.4 Training on managing risks in small hydropower for developers. 1.5 Develop financing modality for small hydropower investments 1.6 Training on 'project finance' for bankers and insurance companies. 1.7 Technical backstopping (on demand) for system design, selection of contractors, and equipment purchase.	• Project financing expertise • Feasibility study experts • Energy efficiency experts • System design experts • Training workshops	**Total Cost:** US$ 23,642,000 of which GEF contribution is US$ 1,388,000	Ten feasibility studies will result in 6 financial closures and completed projects

Objectives and Outcomes	Verifiable Indicators	Sources of Verification	Important Assumptions/Risks
1.8 Review and conduct quality control of (pre-) feasibility studies undertaken in by prospective developers.			
<u>Activities for Outputs 2.1-2.3</u> 2.1 Develop quality standards for feasibility studies and civil, mechanical, and electrical components of small hydropower established in EATTA countries. 2.2 Training of consulting and construction engineers, system designers, surveyors. 2.3 Training and Q.C. of local equipment and component manufacturers. 2.4 Facilitation of partnerships between international and Eastern and Southern African firms for joint collaboration and technology transfer. 2.5 Assessment of local value added in small hydropower development.	MEANS • Small hydropower design and construction expertise • Small hydro fabrication expertise • Training workshops	COST **Total Cost:** US$ 479,000 of which GEF contribution is US$ 259,000	
<u>Activities for Output 3.1</u> 3.1 Feasibility studies of local distribution network. 3.2 Initiate negotiation of tariff and terms of supply. *3.3* Stimulate formation of user groups among potential beneficiary communities.	MEANS • Feasibility study experts (economists, engineers) • Social mobilization expertise • Distribution tariff expertise • Stakeholder consultation	COST **Total Cost:** US$ 3,348,000 of which GEF contribution is US$ 388,000	

Objectives and Outcomes	Verifiable Indicators	Sources of Verification	Important Assumptions/Risks
Activities for Output 4.1-4.2 4.1 Draft 'light handed' regulations for small hydropower development in EATTA countries 4.2 Consultations with authorities and other stakeholders to arrive at supportive regulations 4.3 Study tours to South Asia and within Africa to visit countries with effective regulations	MEANS • International, regional, & national experts • Regulatory expertise • Facilitators • Workshops and meetings	COST **Total Cost:** US$ 403,000 of which GEF contribution is US$ 323,000	
Activities for Outputs 5.1-5.2 5.1 Studies on a 'viable' standard PPA for small hydropower in EATTA countries. 5.2 Consultations with authorities and other stakeholders to arrive at a 'standard PPA' based on study 5.3 Study tours to South Asia and within Africa for regulators and utility officials to observe impacts of standard PPA.	MEANS • Consultants with PPA expertise • Facilitators • Workshops and meetings	COST **Total Cost:** US$ 237,000 of which GEF contribution is US$ 237,000	

3.2.5 Global Environmental Benefits of the Project

GHG Emission Reduction:
It is anticipated that around 10 MW of power will be generated within the FSP period from 6 pilot small hydropower projects. This power will meet the needs of tea factories and those of nearby communities. Where agreements can be signed with the national utility, power will also be sold to the national grid.

The total energy produced by these projects will be: 10,000 kW x 0.6 (assumed load factor, taking hydrological variations and the fact that some plants will not be able to sell their excess energy to the national grid) x 24 hrs/day x 365 days/annum = 52,560 MWh/annum. Assuming this 10 MW of power will replace diesel powered electricity generation, using IPCC emission factor for diesel of 0.8 ton CO_2 /MWh (as per Appendix B of the Simplified Modalities and Procedures for Small-scale CDM Project Activities) this would result in a mitigation of some 42,048 tons of CO_2 per year at the end of the Full Size Project Period. In some cases the hydro potential might be substantially larger than the demand of the tea factory and the utility may not be prepared to purchase the excess energy produced. Pre feasibility study results for a cluster of tea processing plants in the Eastern Aberdares (Kenya) indicate that there will be sufficient power not only to meet power requirements of tea factory and community but also to use (excess) electricity for thermal purposes (drying of oxidized tea leaves or withering), thus substituting fuel oil or wood fuel. In such a case, the emission factor used would need to be computed for the particular combination of fuels displaced.

Table 28 below gives the emissions expected over the life of the pilot projects using the assumed load factor of 0.6. It shows that roughly 84,000 tons of CO_2 are abated at the end of the Full Size Project period (assuming that on average hydropower plants start abating CO_2 half way through the FSP Project), growing to around 765,0000 tons of CO_2 abated within the 20 year period.

Table 28: Emissions Abated Over 20-year Life of Pilot Projects

End of Years	4	10	20
Cumulative MW installed	10	10	10
Cumulative MWh generated	105,000	439,000	957,000
Total CO_2 tons abated (cumulative)	84,000	351,200	765,600

It is very likely, however, that projects will continue to be constructed in the region to supply tea factories beyond the Full Size Project period. There are all together 177 tea factories in the EATTA region. At a modest growth rate in the hydropower construction industry, we can anticipate that at the end of a 20 year period, 50 tea factories will install small hydropower projects producing a total installed capacity of around 82 MW, at roughly the same average size as those installed during the Project period. At this time, the annual emissions reduction would come to around 345,000 tons of CO_2 per year. The Table below shows how the installed capacity would grow together with the cumulative emissions abated beyond the project period. In this case, the amount of GHG abated comes out to 84,000 tons within the Project period and around 3.7 million tons in a 20 year time period.

Table 29: Emissions Abated Over 20 Years by Small Hydropower Projects

End of Years	4	10	20
Cumulative MW installed	10	32	82
Cumulative MWh generated	105,000	710,000	3,650,000
Total CO_2 tons abated (cumulative)	84,000	568,000	2,920,000

It is anticipated that in reality small hydro projects will be replicated at a faster rate than the above, once the regulatory and policy frameworks are in place in EATTA countries and utilities issue 'standard PPAs'. Once there is a supportive policy framework in place, installation of small hydropower projects are likely to transcend beyond the tea sector to the Independent Power Production sector as has been seen in countries like Sri Lanka and Nepal. The indirect emissions reduction and the global benefits from this are likely to be significantly higher than that shown in Table 29 above.

3.2.6 Incremental Cost

Incremental costs will be incurred in the removal of the main barriers of lack of investor confidence, unavailability of credit and regulatory and market uncertainty. Some investments and activities would be happening in the Baseline scenario without the Project as well. However, with the Project it is expected that these investments would increase dramatically. The summary of the Incremental Cost Matrix below shows for each Project Outcome what the Baseline and Alternative expenditure would be. The Incremental Cost for each Outcome is the difference between these two expenditures.

Table 30: Summary of Incremental Cost Matrix (Full Version in Appendix A)

Project Outcomes	Baseline	Alternative	Increment
Outcome 1: Investment confidence established in small hydropower sector among investors, project developers and financing institutions	Investment in hydropower by tea factories without Project **Baseline cost:** **US$ 500,000**	Investment in hydropower by tea factories + Project investment **Alternative cost:** **US$ 23,642,000**	**Incremental cost:** **US$ 23,142,000** **GEF: US$ 1,388,000** **Private Sector: US$ 21,500,000** **TA Co-finance: US$ 254,000**
Outcome 2: Technical capacity enhanced in EATTA countries to design and construct small hydropower and fabricate associated equipment	Investment by hydro industry without Project **Baseline cost:** **US$ 20,000**	Investment by industry + Project Investment **Alternative cost:** **US$ 479,000**	**Incremental cost: US$ 459,000** **GEF: US$ 259,000** **Co-finance: US$ 200,000**
Outcome 3: Models in place for private-public participation in rural electrification through small hydropower	Investment by government in RE without project **Baseline cost:** **US$ 400,000**	Govt Investment in RE + Project Investment **Alternative cost:** **US$ 3,348,000**	**Incremental cost: US$ 2,948,000** **GEF: US$ 388,000** **TA Co-finance: US$ 360,000** **Governments: US$ 2,200,000**
Outcome 4: Regulatory environment enabled to be conducive to small hydropower IPP investment and rural electrification in EATTA member countries	Investment by govt into regulatory reform for small hydro **Baseline cost:** **US$ 40,000**	Investment by govt + Project Investment **Alternative cost:** **US$ 403,000**	**Incremental cost: US$ 363,000** **GEF: US$ 323,000** **Co-finance: US$ 40,000**
Outcome 5: Stage set for establishment of a viable 'standard PPA' in EATTA countries for small hydropower	No investment by governments into Standard PPA **Baseline cost: nil**	Project Investment into Standard PPA **Alternative cost:** **US$ 237,000**	**Incremental cost: US$ 237,000** **GEF: US$ 237,000**
Project Coordination, including monitoring and evaluation (M&E)	No investment without Project **Baseline cost: nil**	Project Investment + EATTA **Alternative cost:** **US$ 359,000**	**Incremental cost: US$ 359,000** **GEF: US$ 259,000** **Co-finance (EATTA) :** **US$ 100,000**
TOTAL	**Baseline cost:** **US$ 960,000**	**Alternative cost:** **US$ 28,468,000**	**Incremental cost:** **US$ 27,508,000** **GEF: US$ 2,854,000** **Co-finance: US$ 24,654,000**

3.3 Sustainability (including financial sustainability)

Project Level Sustainability

The small hydropower plants will be owned by the respective tea factories or a separate company supplying power to a cluster of tea factories in some instances. The factories will have made the major investment into their power plants. Although support will be provided to such factories through the Project, this would only cover the incremental costs of barrier removal. By investing in these systems the tea factories will reduce their energy costs and the savings accrued will be available for repaying the loan to the bank and for system maintenance. Once the loan is repaid within 8-10 years of project commencement, the electricity will be available for a very low price of US¢ 1-2 per kWh for use by the factory. The 4 small hydropower projects (total of 2,000 kW) owned and operated by Unilever to meet the needs of six tea factories in Kericho in Kenya reportedly save the company around KSh 44 million (around US$ 600,000) in electricity bills every year. It is clear that other factories can achieve similar savings in light of increasing electricity and diesel prices in the region. Clear financial benefits provide a strong incentive for companies to invest in and effectively operate their hydropower projects.

It is expected that the investors will take good care of their investment and provide regular maintenance since a breakdown of machinery would require running backup generators for the factories and inability to sell power to the local communities and utility and result in financial losses. Well equipped factory workshops which are experienced in repair and maintenance of tea making machinery will be able to repair most the minor problems that come up with the small hydro plant. Tea factory workshops are generally equipped with welding sets, milling and lathe machines and have full time mechanics and lathe operators on staff. Furthermore, although there are differences in technical capability to support hydropower development across the countries in the region, tea factories themselves are technically competent in all the EATTA countries. This comes from operating mechanically-complex tea factory equipment and backup diesel generators with demanding operation and maintenance protocols. The substantial technical expertise available in tea factories will be valuable in implementing small hydropower projects and particularly in setting up routine maintenance and operation procedures for them. The experience of Unilever Tea Kenya Limited spanning several decades also demonstrates small hydropower plants for tea factories require minimal maintenance compared to existing back-up power diesel gensets. Should any major problems come up with small hydropower projects they will be referred to the company that supplied the original equipment.

The Project, through the PMO, will support technical training factory engineers on operation and maintenance of hydropower equipment. Factory engineers will also receive extensive hands-on training during the installation of the systems from the engineering companies installing the hydropower equipment. Engineers from local engineering firms will be available to provide technical support to the power plants during and beyond the project lifetime.

Program Level Sustainability

It is not anticipated that the full technical expertise within the PMO will need to be continued beyond the Project lifetime within the EATTA as the hydropower sector should be well on its way to becoming commercially viable. EATTA will maintain and update the Project Website beyond the end of the project to continue to provide information to all stakeholders in member countries interested in the development of small hydropower projects. Information will be available on the Website on existing small hydropower regulations in each country, proposed light-handed regulations and standard PPA, formats for feasibility studies and business plans, existing engineering firms that can carry out feasibility studies or construct projects. It is anticipated that local or regional engineering firms will take on the civil construction contracts for the installation of the power plants and will have worked in partnership with the overseas equipment supply companies. It is these companies which will hold the technical capacity to continue installations beyond the project period and that will provide the necessary major repairs, if needed, to installed equipment. Future demand for small hydropower installations could come from other tea factories or from off-grid communities desiring electricity.

The proposed CEFA (Cleaner Energy Fund for Agro-industry in Africa) will, it is anticipated, initially have a fund of around US$ 24 million to provide equity, debt and mezzanine finance to the small hydropower project pipeline generated by the Full Size Project. CEFA will continue even after the end of the Full Size Project and expand investments into the sector. CEFA proposes to establish a Project Development Support Facility (PDSF) funded to a level of around US$ 2.4 million to carry out

activities to support prospective project developers. PDSF will be a grant facility which project developers and sponsors would be able to access to apply on very specific barrier-removal activities within their projects. The PDSF will thus provide continuity for hydropower development including for powering other agro-industries beyond the tea sector. In addition, PDSF will assist viable projects in their documentation and application for carbon finance under the Clean Development Mechanism (CDM) framework. The PDSF, should it get funded, will be able to carry on many of the investment support activities initially started by the Full Size Project, providing continuity to Project Activities.

Climate change could impact the long term sustainability of small hydropower projects constructed in the region. Change in climate is expected to result in increased frequency of extreme weather events, leading to long periods of drought or sudden heavy rainfall. While this risk can not be mitigated completely, it is expected that watersheds with forest cover and tea plantations, as found in tea growing regions are likely to be less affected by climate change than those without good vegetative cover. The changed hydrology could result in less power production from small hydropower projects in the dry season. This would also coincide with lower tea production on the plantations and so the impact on the tea factory from an energy perspective would be partially mitigated. As the small hydropower projects are expected to be fully paid for within 10 years or less, climate change is unlikely to seriously impact the economic viability of these projects. This 'free energy' from hydropower, once the loans are repaid, may be able to partially shield the tea factories from the potentially more serious impact of climate change on the tea sector itself.

3.4 Replicability

Six small hydropower pilot projects generating some 10 MW of power will be constructed during the Project period. The success of these projects will, it is anticipated, have established the confidence of tea factories in the small hydropower sector providing strong replication effects throughout the tea sector and beyond. The Project will also assist prospective developers to conduct new Pre- and Full Feasibility Studies and provide quality control on them. In addition, the Project will also establish an awareness raising system within the EATTA, which will vigorously and continuously engage with the tea factories and inform them of the financing opportunities as well as the economic and environmental implications of adopting hydro technology. During the preparation of the Full Size Project, UNEP/DGEF has received letters showing significant interest, including financial commitments, from 14 tea factories and associations from 6 EATTA countries. Successful implementation of the pilot projects is expected to further increase this interest from tea factories.

Similarly, financial institutions which invest in the pilot projects will gain first hand experience in making investments into the SHP sector. It is anticipated they will invest in new small hydropower project opportunities beyond the Project life. Other financial institutions are likely to follow their example. UNEP/DGEF has received letters from commercial banks (Standard Chartered and Kenya Commercial Bank) and development banks (African Development Bank and East African Development Bank) during the preparation of the FSP expressing their interest in participating in financing opportunities arising from the Project. The establishment of the proposed CEFA will provide additional resources and higher confidence among the financial community to invest in the sector. The Triodos Renewable Energy for Development Fund is exploring the development of such a fund with other like minded investors. As a regional fund, CEFA will be able to finance new projects within those EATTA countries where a pilot project could not be located during the Project period.

There are 177 tea factories in the EATTA member countries owned and managed by 56 companies. Based on a preliminary survey the majority of factories appear to be aware of nearby hydro potential. Within a 20 year period from the commencement of the Full Size Project, it is anticipated that around 50 small hydropower projects will be in place in the tea sector alone. This is a conservative projection in comparison to the rush of investment that has come into the small hydropower sector, many originating in the tea sector, in Sri Lanka. The strengthening of technical capacity and the confidence of investors and bankers in this sector is very likely to result in SHP investments 'spilling over' into other sectors such as coffee, dairies, mining, and saw milling which are also industries that need reliable and low cost power to make their operations profitable and expand their business.

Replication of small hydropower investment into those EATTA countries that will not have pilot projects during the Full Size Project period will be assisted via visits to pilot projects by tea factory owners, policy makers, and regulators from these remaining countries. Attempts will be made during

the Project period to attract funding from bilateral and multilateral donors to provide support for carrying out additional pre-feasbility and full feasibility studies and to provide technical training to engineering firms in these countries. Additional funds will be sought to extend this technical assistance support to the remaining countries beyond the Project period if this is found to be necessary.

Replication depends on long-term removal of the regulatory barriers in each of the EATTA countries. Developers of small hydropower projects for electricity supply to tea factories do not face any insurmountable regulatory hurdles today in any of the participating EATTA countries. Light-handed regulations for acquiring licences and for getting environmental clearance would further facilitate the process. However, new light-handed regulations will need to be in place before sale of electricity from small hydropower to the grid will be routine in most EATTA countries. In countries where utilities institute a 'standard PPA', it is possible that the spill over from the tea sector can turn into a deluge as the IPP community develops small hydropower to supply the national grid. This has been the experience in Sri Lanka and Nepal as described earlier. Increased private investment into the small hydropower sector in neighboring countries should provide incentives to other countries in Eastern and Southern Africa to remove their own regulatory barriers. The Full Size Project will work closely with regulators in each of the participating EATTA countries to put in place regulations conducive to small hydropower development both for supply to the tea sector and for the grid. Long-term removal of regulatory barriers is currently being undertaken by the World Bank as part of power sector reforms in the respective countries as well as by the African Forum for Utility Regulation (AFUR) and the Regional Electricity Regulators Association of Southern Africa (RERA). The Project will coordinate with all these institutions to minimize regulatory risk standing in the way of replication of the project.

Unmet demand for power exists in all of the EATTA countries. The problem is particularly acute in sub Saharan Africa where less than 2% of the rural population is typically electrified in most countries. Once an effective private public partnership can be demonstrated where the private sector generates power from small hydro; the government will invest in the distribution network; and cooperatives of communities can purchase the produced power for electrification at bulk tariff rates and sell at retail to their members, this can be a powerful driver to attract additional government investment into rural electrification. Governments see the many benefits of electrifying rural communities and the hospitals, schools and small industries in them. This proposed private public partnership would provide governments a very cost-effective way expand services in those parts of the region that have small hydropower potential.

At least one of the six pilots carried out during the Full Size Project will have a rural electrification component through a private public partnership. The Project will assist in building capacity of cooperatives and negotiating a Power Sales Agreement between small hydro developers and cooperatives. Replication of this private-public model for rural electrification will depend to a large extent on the willingness and ability of EATTA country governments to invest in the distribution networks. The Ugandan government already has a public private model in place for rural electrification through the World Bank funded Energy for Rural Transformation (ERT) project. The ERT has made investments into two rural electrification projects to date through this modality, the West Nile Rural Electrification Project involving a 3.5 MW hydro project and the Kisizi Mini-grid Project using the 310 kW mini hydro project. Tanzania and Kenya also have policies to support similar models but have yet to make investments. These countries will likely host the first rural electrification pilot(s) and also host the first replications of small hydro-based rural electrification, to be repeated in the other EATTA countries.

3.5 Stakeholders, their Involvement and Commitments

The EATTA is the principal proponent and stakeholder. The EATTA board members were informed of the project proposal by its Secretary and their opinion was sought with the aim of providing feedback to UNEP-GEF. As a follow up to these consultations, a draft concept note was circulated by the EATTA to its board members and later presented at a board meeting. During the meeting the board members were also individually consulted with the aim of establishing their interest and commitment (see Appendix Q). Detailed information on status of the EATTA, management structure and Small Hydro Program Implementation is attached in Appendix P.

Individual tea companies have also been met and the project discussed further with them. These companies have also presented views and sought clarifications on the project. Not only have the EATTA board members explicitly indicated support and interest in the project, but so also several individual tea companies have shown their interest as potential investors.

Other key stakeholders in the Project are government, financial institutions, small hydropower industry (including consultancy firms, construction and contracting firms, equipment manufactures (steel pipes, gates, turbine components), and rural communities adjoining tea factories that could benefit from rural electrification. A number of workshops have been held to apprise these stakeholder communities about the Project developments at UNEP and in the EATTA countries themselves. These workshops have generated active interest among stakeholders. A website http://greeningtea.unep.org has been set up by EATTA and UNEP where all relevant documents have been posted throughout the PDF-B project period. It now holds an impressive list of background documents as well as the project documents for this Project. The Website has provided an opportunity for those who are interested in the Project to follow closely its progress and provide inputs. It has been actively used by tea factories, EATTA, consultants, UNEP, banks and construction and equipment supply companies in the course of the preparation of the FSP Brief.

3.6 Monitoring and Evaluation

Monitoring Plan

The monitoring plan described in this section will ensure that project outcomes and activities described in the logical framework in Table 27 are being met in a timely fashion. The Monitoring Plan follows UNEP guidelines and UNEP monitoring activities. There are five entities that will have roles to play in the monitoring process.

i. UNEP as the implementing agency will receive quarterly progress and financial reports from the Project Management Office (PMO). UNEP will be represented in the Project Steering Committee (PSC) and will make field visits in order to assess progress and problems as well as appoint independent evaluators for mid-term and final evaluations.

ii. EATTA as the executing agency will play a key role in facilitating direct linkages between all its members in the tea sector. It will liaise with government agencies/ministries as well as utility companies through national tea sector associations. EATTA will chair the Project Steering Committee and appoint its members. EATTA will ensure continued data collection and facilitate workshops.

iii. The Project Steering Committee (PSC) will review all reports and work with the PMO to resolve difficulties that arise during the project to ensure smooth project implementation and monitoring.

iv. The PMO will be hosted by the EATTA and will develop all the reports for submission to UNEP. It will develop a standard reporting framework for all experts working on the project and will ensure that reporting is done in a timely fashion.

v. National Steering Committees (NSCs) will be constituted in member states where pilot projects will be developed and will monitor the progress of these projects and ensure that reporting is done on time.

Project monitoring will occur at two levels:

i. Project Execution Performance
This level of monitoring will track the managerial execution of the proposed project and will monitor the effectiveness of the management structure and supervision of the project. UNEP will carry out this level of monitoring with assistance from the PMO.

ii. Project Outputs and Milestones
Technical execution of the project will be monitored based on the indicators and their verification means outlined in the project logframe. Progress reports prepared by the PMO will assess the outputs that were completed during the time frame against the outputs laid out in

the logframe. Outputs that could not be completed in the specified time frame will be noted and a clear explanation of the delay will be given. This level of monitoring will be carried out by the PSC and the NSCs that track the reports and assess effectiveness of the project and ensure resolution of difficulties.

Stakeholder participation is deemed essential for the success of the project and the involvement of all stakeholders will be ensured. Stakeholder participation in the monitoring process is also essential and tea producers, factories, estates, utility companies and other stakeholders will be involved during the monitoring and evaluation process and the internal monitoring.

The goal and objective of this project and the planned outcomes and activities have formed the basis for this monitoring plan. The project will be evaluated based on managerial execution of the project in terms of effectiveness of project supervision as well as on technical execution of the project in terms of the outputs planned. Details of the Monitoring and Evaluation plan are listed in Appendix U.

4. FINANCIAL MODALITY & COST EFFECTIVENESS

4.1 Financing Plan

Incremental costs to remove the major barriers to attracting small hydro investments in the tea sector will be largely covered by GEF, with anticipated co-financing support from the EATTA, governments, and other donors. Investment into pilot hydropower projects will come from tea factories (equity) and financial institutions (debt). This part of the Project is expected to be financed commercially. Recent interest from KenGen, the government owned power generation company in Kenya, in making up to 50% investment into small hydropower projects resulting from this Full Size Project indicates that equity investment can come from utilities under a private-public joint venture as well. Distribution networks for rural electrification are expected to be financed by governments and donors with the tea factories selling electricity to Energy Service Companies (ESCOs) or Cooperatives as part of a private-public venture.

Actual financing modalities available will be different for each of the six pilot hydropower projects depending on its size, applications for the power produced, and credibility of the promoter. The general categories of financing for pilot small hydro projects during the GEF Project period are listed in Table 31.

Table 31: End-Use and Financing of Mini Hydros

End –Use	Financing
Isolated Small Hydro Tea Factory	Tea Factory, Commercial Banks, Development Finance Institutions, Clean Energy Funds
Tea Factory & Community Electrification	Tea Factory, Utility, Cooperative, Government grants for RE.
Grid connected Mini Hydro Tea Factory	Tea Factory, Commercial Banks, Development Finance Institutions, Clean Energy Funds
Tea Factory & Community Electrification	Tea Factory, Utility, Cooperative, Government grants for RE.

Table 32 shows the Project cost details broken down by Outcomes. Outcomes 1 and 3 include actual investments into small hydropower and rural electrification and the costs for these Outcomes are relatively large. Outcomes 2, 4, and 5 entail capacity building and proposing suitable regulatory reforms and these costs are smaller. The Table also shows where the funds are supposed to come from for the Project. As the Table shows investments will come from the Tea Industry, the Governments in the region, the hydropower construction industry, and other donors in addition to expected GEF support for this project.

Table 32: Summary of Project Costs and Financing

Project Outcomes	Total Cost (US$)	GEF Funding (US$)	TA Co-finance (Coopener/EC; REEEP; bilateral donors) [US$]	EATTA Co-finance (US$)	Government Co-finance (US$)	Capacity Building by Construction & Equipment Cos. (US$)	Tea Factories/ Utilities (equity) [US$]	Banks (debt) [US$]
Outcome 1: Investment confidence established in small hydropower sector among investors, project developers and financing institutions	23,642,000	1,388,000	254,000				7,000,000	15,000,000
Outcome 2: Technical capacity enhanced in EATTA countries to design and construct small hydropower and fabricate associated equipment	479,000	259,000				220,000		
Outcome 3: Models in place for private-public participation in rural electrification through small hydropower	3,348,000	388,000	360,000		2,600,000			
Outcome 4: Regulatory environment enabled to be conducive to small hydropower IPP investment and rural electrification in EATTA member countries	403,000	323,000			80,000			
Outcome 5: Stage set for establishment of a viable 'standard PPA' in EATTA countries for small hydropower	237,000	237,000						
Project Coordination, including monitoring and evaluation (M&E)	359,000	259,000		100,000				
TOTAL	**28,468,000**	**2,854,000**	**614,000**	**100,000**	**2,680,000**	**220,000**	**7,000,000**	**15,000,000**

4.2 Cost Effectiveness

This is a highly cost-effective Project on two counts. Firstly, a modest GEF investment (US$ 2.85 million) is expected to leverage substantially larger private sector and government investments (US$ 25.6 million), during the Full Size Project period, into six pilot small hydropower projects (10 MW total) and at least one rural electrification scheme. This is expected to grow to around US$ 200 million invested, within twenty years of Project commencement, into some 50 small hydropower projects serving tea factories, generating a total of 82 MW of power plus a number of accompanying rural electrification schemes.

Secondly, the GEF investment in the Project will result in substantial carbon benefits. The six pilot projects are expected to directly generate around 765,600 tons of CO_2 credits within 20 years, which comes to around US$ 3.70 per ton of carbon dioxide for the GEF investment. If the full 82 MW are considered, the carbon benefits increase to 2.92 million tons of CO_2 in 20 years, resulting in less than US$ 1.00 per ton of CO_2 abated.

Small hydropower projects, constructed at a cost of US$ 2,000 to US$ 2,500 per kW, the range that is expected for the six pilot projects, typically produce power at between US¢ 6 to 7 per kWh, if they are able to produce and sell 60% or more of their full annual potential. Tea factories in Kenya purchase electricity from KPLC at US¢ 7 per kWh in addition to fixed capacity charges. In comparison, diesel generators, the most common source of backup power at tea factories, produce power at current prices of between US¢ 18 and 37 depending on the local price of diesel in participating EATTA countries. When calculations are carried out over their lifetime, small hydropower projects thus clearly have negative cost incrementality.

4.3 Co-financing

Technical Assistance

Applications have been submitted to Coopener under the “Intelligent Energy Europe” program of the EC and to the Renewable Energy and Energy Efficiency Partnership (REEEP) for additional funds to support the technical assistance activities. If they come through, these funds will increase the technical assistance available to this Project.

The Coopener proposal has the objectives:

- To develop rural electrification packages, including plans, regulatory, financial and organisational arrangement for Rural Electrification from Agro- Industries; and

- To develop local and national expertise from the public institutions, from the private sector (financial institutional, agro-industries), from rural stakeholders for the effective implementation and replication of these packages.

The REEEP proposal intends to “address the financing barriers and risks facing sugar and tea industries in target countries, in investing in REEES (renewable energy and energy efficiency services). It links with 2 ongoing UNEP/GEF projects, on Greening the Tea Industry in East Africa (small hydro), and Cogen for Africa (bagasse cogeneration)”.

Other potential funders being pursued for investment into small hydro and rural electrification feasibility studies and other technical assistance to project developers by the Project are ADEME, USAID, GTZ, and PROINVEST. See list of potential co-financiers in Appendix E. EATTA will make in-kind contributions consisting of rent of office, time of officials, and hosting of events, etc.,

Hydropower Project Investment

The six pilot small hydropower projects which will be constructed within the Full Size Project period will require substantial commercial financing. Tea factories will provide around a third of the project costs as equity finance for these projects. Debt finance will, it is anticipated, come from commercial banks and Development Financial Institutions (DFI) typically provided as:

- Balance sheet financing - loan is provided on the strength of company revenues

- Collateral based financing - assets of the developer are held at collateral

but seldom as:

- Project finance – where the hydro project is itself the collateral.

See Appendix S for a more detailed treatment of these financing modalities.

Small hydropower projects will require longer term finance, typically of 5-8 years after completion of construction and the start of revenue flows, than what most commercial banks can provide. Commercial banks like Standard Chartered and Stanbic typically provide a maximum 5 year loan terms with no grace period for construction. However, in East Africa these same banks have long term and valued relationships with the tea sector based on tea being a major export sector and a reliable earner of foreign exchange for the region. Commercial banks like Stanbic are already providing financing for the construction of tea factories with repayment in 7 years including a 2 year grace period. This can be adequate for the most attractive hydropower projects. Kenya Commercial Bank (KCB), the largest commercial bank in Kenya, provides up to 10 year loan terms for the construction of new tea factories including the two year grace period. This last set of terms is suitable for most small hydropower projects. Different commercial banks are active in other countries with Barclays active in the tea sector in Tanzania, for example.

Financing for small hydropower will in addition be sought at development finance institutions, such as the African Development Bank (ADB), East Africa Development Bank (EADB), European Investment Bank (EIB), and the German Development Bank, DEG. These DFIs will be a crucial source of financing in countries where commercial banks will not be prepared to provide financing to small hydro projects. DFIs can provide loans for up to 15 years; something that will also be attractive for the larger of the small hydropower projects. DFI interest rates also tend to be lower than commercial banks for the proposed environmentally attractive projects. A number of parties have indicated strong interest in participation in financing the small hydropower pipeline generated by the GEF Project during the process of Project preparation consultations. A financing window for Hydropower in tea industries is to be considered through the private sector window of the African Development Bank (ADB) see letter of support. The East African Development Bank (EADB) already provides debt finance to energy infrastructure projects in the three countries: Kenya, Uganda, and Tanzania. EADB has expressed interest in financing projects which originate from the Greening Tea in East Africa project. See aide memoir.

In addition to these existing sources of finance, the Project is encouraging and supporting the establishment of a proposed dedicated Fund: the “Cleaner Energy Fund for Agro-Industry in Africa” (CEFA) under the leadership of the Triodos Bank of Netherlands with other institutional investors. Triodos has stated its intention to invest in the Fund which will through a Fund Manager provide debt, equity, and mezzanine finance for clean energy projects linked with agro-industries in Africa. The proposed CEFA, which is expected to grow to US$ 24 million in the first phase CEFA I, proposes to finance the pipeline of projects coming out of the GEF Project “Greening the Tea Industry in East Africa” as well as another GEF project the “Cogeneration for Africa” Project also being developed under UNEP-GEF. Potential investors in CEFA are JBIC, ADB, EIB, AfD/Proparco. Further details of CEFA are provided in Appendix T.

A letter of support has also been received from Kenya Electricity Generating Company Limited (KenGen), a 100% government-owned company which generates more than 80% of the power in Kenya, stating the company’s interest in financing up to 50% of the investment costs in power generation components of projects that come out of the two Full Scale Projects “Greening the Tea Industry in East Africa” as well as “Cogenaration for Africa”. Although the terms of financing have not been spelled out, this provides yet another option for financing of the hydropower project pipeline, at least for Kenya, coming out of the Project.

Rural Electrification

The GEF Project proposes to carry out rural electrification through a private-public partnership with part of the power generated by some of the small hydropower projects. The tea factory will develop its hydropower project to produce the power for its own use and for rural electrification of adjoining communities. The factory will sell electricity either in bulk to an Energy Service Company (ESCO), a cooperative of users, or to each household, depending on its preference. The public sector,

government or donors, will be approached for investment to construct the distribution lines. Rural electrification (through a possible private/public partnership) is of great interest to the ADB and also to the German GTZ and the EUEI (European Union Energy Initiative for Poverty Alleviation and Sustainable Development). The Coopener fund, another initiative of the European Union, may be another source of funding to develop rural electrification packages linked to small hydropower projects.

Government support will be in the form of investment (grants) into expanding distribution networks for rural electrification through public private investment[15]. The Ugandan government has a public private model in place for rural electrification through the World Bank funded Energy for Rural Transformation (ERT) project. Through this program, funds are made available to private parties to provide rural electrification to cover the non-commercial portion of their investment. The ERT has made investments into two rural electrification projects to date through this modality, the West Nile Rural Electrification Project involving a 3.5 MW hydro project and the Kisizi Mini-grid project using the 310 kW mini hydro project.

The following table (Table 33) provides the current status of co-financing and leveraged financing commitments from the various stakeholders:

Table 33: Status of Co/Leveraged-Financing Commitments

Name of Co/Leveraged-financing (source)	Classification	Type	Amount (US$)	Status
EATTA	Executing Agency	In-kind (rent & office facilities, time of Board members, launch events)	100,000	Confirmed
Participating country governments (Kenya, Tanzania, Uganda, Malawi, Mozambique, Zambia, Rwanda, Burundi)	Government Agencies	In-kind (time of government officials, $80,000)	2,680,000	Confirmed (*see Note 1*)
		Grants for rural electrification through grid extension and development of new power plants ($2.6 million). Outcome 3.		Confirmed (*see Note 2*)
EU/ Coopener/REEEP/AFREPREN-FWD	Multilateral global competitive bids	Grant for rural electrification planning, financial mobilization and capacity building. Outcome 3.	360,000	Partially confirmed (*see Note 3*)
Bilateral donors	Bilateral donors	Grants for supporting pre and full feasibility studies. Outcome 1.	254,000	Confirmed (*see Note 4*)
Private equipment fabrication companies and consulting firms	Private sector	Investment in new manufacturing equipment at metal fabrication workshops and capacity building in engineering and consultancy firms. Outcome 2.	220,000	Confirmed (*see Note 5*)
Tea factories	Equity investors	Investment in studies and equity investment in project finance. Outcome 1.	7,000,000	Confirmed (*see Note 6*)
Commercial banks, development banks, clean energy funds	Finance institutions	Debt investment into project finance. Outcome 1.	15,000,000	Confirmed (*see Note 7*)
Sub-Total Co/Leveraged-financing			**25,614,000**	

[15] Letters of support for this project from Ministries of Energy and Agriculture indicate that in-kind support from Government will also be available in the form of provision of policy oversight for project implementation, personnel from the Ministry of Energy, coordination and ensuring the availability of services from the various Government agencies.

Notes:

Note 1: A number of letters from several Government Ministries of Energy (Tanzania, Uganda, Kenya, Mozambique, Zambia and Malawi) have been submitted to UNEP/DGEF confirming their in-kind support for provision of relevant personnel, policy oversight for implementation of the project and coordination among the various Government agencies to ensure that the project is successfully implemented. In addition, Ministries of Energy will participate in the Project Steering Committee as well as in workshops in which the legal and regulatory framework will be discussed. See pgs 43 - 52 of the compilation of Indicative Letters of Co-financing.

Note 2: As part of the aforementioned Governments' commitment, its Agencies charged with the responsibilities of Rural Electrification and installation of new power plants will be involved. In Uganda, for instance, during a meeting with Government representatives from the Ministry of Energy and Minerals as well as from the World Bank-supported Energy for Rural Transformation Project confirmed strong interest in providing grant support for this project. In addition to the letters of support mentioned above from Ministries of Energy, at least one utility KenGen - the national electricity generation utility in Kenya - has provided UNEP/DGEF with a letter of commitment confirming financing of up to 50% of the capital costs of viable small-hydro power plants in Kenya implemented under this project. See pgs 51 and 52 of the compilation of Indicative Letters of Co-financing.

Note 3: Proposals requesting for support to this project have been submitted to EU/Coopener and REEEP. To date, the REEEP proposal has been approved providing US$ 34,000 to this project through AFREPREN-FWD (See pg 16 of the compilation of Indicative Letters of Co-financing Interest). The proposal to EU/Coopener was submitted in February 2006 and the results are expected in June 2006.

Note 4: Letters from bilateral donors confirming interest in providing financial support to the project have been sent to UNEP/DGEF by the African Development Bank and the FINNFUND. See pgs 3 - 4 and 14 - 15, respectively, of the compilation of Indicative Letters of Co-financing.

Note 5: At least one letter of interest has been submitted to UNEP/DGEF by the International Network for Small Hydro Power based in China - one of the world's leading small hydro developers. See pgs 18 and 19 of the compilation of Indicative Letters of Co-financing.

Note 6: UNEP/DGEF has already received letters confirming interest from 14 tea factories and tea associations (largely private entities) from 6 of the project countries. The tea factories have indicated willingness to provide capital finance. See pgs 20 - 42 of the compilation of Indicative Letters of Co-financing.

Note 7: Several commercial banks (Standard Chartered, Kenya Commercial Bank); development banks (Proparco, Actis, DEG-KfW); and, clean energy funds (Triodos Renewable Energy Development Fund) have sent UNEP/DGEF confirming interest in providing financial support to the project (See pgs 5 - 13 of the compilation of Indicative Letters of Co-financing Interest). Triodos Renewable Energy Development Fund's commitment includes US$ 60,000 for technical assistance (See pgs 7 and 8 of the compilation of Indicative Letters of Co-financing).

5. INSTITUTIONAL COORDINATION & SUPPORT

5.1 Core Commitments and Linkages

The Project is working in a region in which countries have made varying progress on the regulatory reform and policy front in the power sector. The Full Size Project intends to use the implementation of the six pilot projects to inform policy makers in the region about the benefits of private sector investment in small hydropower. The pilot projects will likely be implemented in countries which are most advanced in the reform process. Their successful implementation will provide an important instrument to increase awareness among other countries, with less liberal policies towards independent power production. The Full Size Project will actively coordinate with regional bodies involved in the power sector to inform them about progress in the project and to get their feedback on the 'light-handed legislation' that will be proposed for small hydropower as well as the 'standard PPA' that will be proposed.

The Executing Agency, EATTA, has excellent networking links with Government agencies in member countries.The letters of support to EATTA coming from the relevant policy making institutions especially Ministries of Energy, Ministry of Agriculture and electricity utilities attest to the extensive links the executing agency has to influence the policy changes necessary for continued investment activities.

The Project will include coordination with NEPAD, SADC, Southern African Power Pool (SAPP), the Eastern African Community (EAC) and the Nile Basin Initiative, all of which are regional agencies involved in the power sector of participating EATTA countries. Another important agency to coordinate with will be the Regional Electricity Regulators Association of Southern Africa www.rerasadc.com and the African Forum of Utility Regulation www.afurnet.org particularly on the issue of a standard PPA.

NEPAD

NEPAD recognizes that energy plays a critical role in the development process, first as a domestic necessity but also as a factor of production whose cost directly affects prices of goods and other services, and the competitiveness of enterprises. In view of the fact that small market sizes and low purchasing power have been the main barriers to universal access to modern energy for development, NEPAD recognizes that the "business as usual" approach will not meet Africa's energy demand, and adopted a partnership strategy to promote development of the African energy infrastructure. "Greening the Tea Industry in East Africa" initiative clearly falls within the NEPAD's agenda of addressing Africa-wide electricity problems.

The objectives for the Energy Sector under NEPAD, as stated in the NEPAD document are:

- To increase Africans' access to reliable and affordable commercial energy supply from 10 to 35 per cent or more within 20 years;
- To improve the reliability and lower cost of energy supply to productive activities in order to enable economic growth of 6 per cent per annum;
- To rationalize the territorial distribution of existing and unevenly allocated energy resources;
- To strive to develop the abundant solar resources;
- To reverse environmental degradation that is associated with the use of traditional fuels in rural areas;
- To exploit and develop the hydropower potential of the river basins of Africa;
- To integrate and transmission grids and gas pipelines so as to facilitate cross-border energy flows;
- To reform and harmonize petroleum regulations and legislation on the continent.

The NEPAD document identifies actions that need to be taken to address these objectives: the establishment of an African Forum for Utility Regulation and regional regulatory associations; the

establishment of a task force to recommend priorities and implementation strategies for regional projects, including hydropower generation, transmission grids and gas pipelines; the establishment of a task team to accelerate the development of energy supply to low-income housing; and broadening the scope of the program for biomass energy conservation from the Southern African Development Community (SADC) to the rest of the continent.

NEPAD has drawn up a short-term Action Plan, which identifies its priorities in the Energy Sector. The Summary Action Plan (STAP) provides a wide range of activities, some in more detail, than others. It comprises of 23 energy projects; 7 power systems projects, 3 gas/oil projects, 4 studies, 3 capacity building projects, and 6 facilitation projects. This STAP is being revised and a medium term action plan is being developed. The proposed "Greening the Tea Industry in East Africa" initiative fits within the overall theme of facilitation projects.

5.2 Consultation, Coordination and Collaboration between IAs, and IAs & ExAs

GEF Activities in related Sectors:
Table 34 provides an overview of other ongoing GEF activities that will touch on the proposed "Greening of the Tea Industry in Eastern Africa". This proposed concept is basically to be considered a private sector development with a rural electrification component attached to it wherever relevant and feasible. In addition, excess electricity might be absorbed by national electric power utilities. As such, all private sector reform aspects that deal with the regulatory framework of IPP licensing of power generation and distribution as well as firm/ non-firm power tariff setting are of direct relevance to this project. Technology-wise, as well as implementation-wise, there appears to be limited overlap with other existing projects/programs.

The one exception is the ongoing Full Size Project "Removal of Barriers to Energy Conservation and Energy Efficiency in Small and Medium Scale Enterprises" in Kenya, which is also where the most investment in hydropower in the tea sector is likely to take place. This GEF Project being implemented by UNDP and executed by the Kenya Association of Manufacturers (GEF-KAM) has carried out energy audits in six tea factories and has concluded that around 20% of energy savings are possible. The findings of this study will be built upon to encourage energy efficiency alongside the six pilot hydropower investment projects promoted by the 'Greening Tea' FSP.

Another GEF project "Cogeneration for Africa" is being developed by UNEP alongside the proposed project. Cogen for Africa aims to increase power generation from agricultural residues in the sugar and other agricultural industries. Four countries: Kenya, Uganda, Tanzania, Malawi are included in both projects. These projects will have many areas of overlap particularly on the regulatory reforms, Power Purchase Agreements with utilities, and financing of projects from local banks, Development Finance Institutions, and any Clean Energy Funds. The accomplishments of each project can be very useful for the other. As the IA for both Projects, UNEP-DGEF will provide coordination between these projects.

Table 34: Relevant GEF Related Projects in Southern/Eastern Africa (Jan 2006)

Country	Project Name	**Project Type**	**Implementing Agency**	**Approval Date**	**Relevance/Comments**	**Coordination Plan**
Mozambique	Energy Reform and Access Project	Full Size	IBRD- The World Bank	Dec 07, 2001	Encourages Renewable Energy Investments in solar, wind, micro hydro and possibly biomass gasification. Phase I to remove barriers. Actually tea hydro projects will fit the objectives.	Collaboration on increasing investments into small hydro
Zambia	Renewable energy-based electricity generations for Isolated mini-grids	Full Size	UNEP	CEO endorsed Nov. 2005	This project is to focus on community based hydro-developments.	Collaboration on regulatory barrier removal for hydro based mini-grids
Ethiopia	Renewable Energy Project	Full Size	IBRD- The World Bank	May 16, 2003	Aims to promote private sector led off grid rural electrification through SHS and small hydro. Tea factory owned hydro power should fit in this programme. Ethiopia is not participating in this Project.	
Uganda	Rural Energy for Development	Full Size	IBRD- The World Bank	May 1, 2000	Capacity building and technical assistance cover a wide range of energy technologies. As such, the Project stands to benefit from expertise in decentralized power generation and distribution. Small hydro for rural electrification may avail of subsidies for renewable and rural electrification	Use of APL for small hydro projects in Uganda; Synergy/collaboration in conduct of capacity building activities & technical assistance
Malawi	Barrier Removal to Malawi Renewable Energy Program.	Full Size	UNDP	May 7, 1999	The project appears to essentially focus on Solar PV. However, the project might support also the introduction of other renewable energy options in addressing institutional, information and investment barriers.	Small hydro FS Project will build on barrier removal affected by this project.
Zambia, Tanzania	Africa Rural Energy Enterprise Development (AREED)	Full Size	UNEP/UN Foundation	PDF-B for global expansion June, 2003	Currently AREED is implemented in five African Countries and provide early stage funding and expertise development services supplying clean energy technologies. Budgets in AREED are more appropriate for small-scale approaches.	Where the small hydro projects in the participating countries are eligible, funding will be tapped from AREED; possible utilization of AREED expertise and services.
Tanzania	Transformation of Rural Photovoltaics Market	Full Size	UNDP	May 16, 2003	Concentrates on solar home systems and PV for schools and hospitals with some limited productive uses. Mini hydro needs larger power requirements.	
Kenya	Ormat Olkaria III Geothermal power development	Full Size	IBRD/IFC	Dec. 07, 2001	Geothermal power generation is basically large scale and national grid connected.	
Kenya	Industrial Energy Efficiency Project	Full Size	UNDP	May 10, 2000	Energy Audits are being completed for tea factories. Preliminary results indicate reduction of energy consumption for drives, fans, cutters up to 20 % is possible. Motors often over designed. Immediate relevance to sizing of hydro plants.	Project will build on opportunities for efficiency investments identified in tea factories

In addition to projects under implementation, also GEF pipeline entries have been scanned for their relevance to the proposed regional hydro-tea proposal (Table 35).

Table 35: GEF Pipeline Entry (January 2006)

Project ID	**Country**	**Agency**	**Title**	**Amount (US$)**	**Relevance/Comments**	
1191	Zimbabwe	UNDP	Removal of Barriers to E.E and associated GHG reduction in Zimbabwe Industry.	160,000	Tea factories should preferably be energy efficient before designing mini-hydro. Zimbabwe is not member of East African Tea Trade Association	
1613	Malawi	World Bank	Energy Access, Expansion and Development Project	285,000	Mini-hydro fits well into a program that "enhances access to modern energy, especially for the rural population with the expansion of electricity access (in a commercially viable manner), while helping to reduce environmental damage". For Malawi	Co-development and cooperation in providing technical assistance for both hydro based rural electrification and on-grid hydro IPPs

Project ID	Country	Agency	Title	Amount (US$)	Relevance/Comments	
					supporting the policy and institutional process and the development of hydro-based IPPs for main or mini grid will be an area of future collaboration.	
2119	Regional; Kenya, Ethiopia, Djibouti, Tanzania, Uganda, Eritrea	UNEP	African Rift Geothermal Development Facility	700,000	Geothermal Power Plants can be only considered for grid connection. Geothermal will, generally speaking, be larger in capacity where as mini-hydro might be more appropriate for rural electrification. Overlap in Kenya, Ethiopia, Tanzania, Uganda.	
2385	Benin, Burundi, Cameroon, Congo-Brazzaville, Gabon, Equitorial Guinea, Mali, Central African Republic, Democratic Republic of Congo, Rwanda, Togo	UNDP	First African Regional Mini/ Micro Hydro Power Capacity Development Project And Investment in Rural Electricity	325,000	13 Micro hydro demo projects identified for Burundi, 10 demo projects identified for Rwanda UNDP project. As tea enterprises of Rwanda and Burundi are members of EATTA such companies will have access to all training aspects financing offered through proposed tea project.	
2918	Rwanda	World Bank	Sustainable Energy Development Project (SEDP)		Modest TA and investment support to help initiate an off-grid mini-hydro program in Rwanda	
1607	Zambia	World Bank	Power Sector Reform for Increased Access to Electricity	240,000	Cogeneration might be considered in addition to small hydropower. Proposal only singles out Small Hydro and Solar PV. Developing enabling policies, institutional environment, private sector participation for economic growth and poverty reduction are all relevant for hydropower development.	Collaboration on barrier removal and mobilizing of financing for small hydro
3126	Lesotho, Malawi, Mozambique, Namibia, South Africa, Zimbabwe	UNDP	Removing Barriers to Biomass Energy Conservation in small and medium sized enterprises and institutions in Southern Africa Development Community	25,000 (PDF A)	The project to remove market barriers to the adoption of sustainable biomass energy practices and technologies by institutions and small and medium enterprises by promoting improved, highly efficient biomass-burning stoves. Not focused on electric power	
pipeline	Kenya, Tanzania	UNEP	Micro Hydro power for productive use for East Africa	MSP	8 low-cost pilot micro hydro power plants provide productive energy mainly for agro processing and possibly for social loads, or even ICT	
2114	Zambia, Malawi	UNEP	Renewable Energy Promotion through Information and Communication Technology Introduction in Off-Grid Rural Communities	400,000	Hydro development for different target groups. Tea sector is specific industry-based targeted group with easier access to finance.	
2903	Tanzania	World Bank	Energizing Rural Transformation	8.0 Mil. USD	The ERT project will finance capacity building in the new rural electrification and ICT institution, will cost share support for business and market development, support credit and other financial mechanisms to facilitate long-term local commercial finance for RE and ICT businesses, strenghten ICT policy, and grid expansion.	Collaboration on both capacity building for rural electrification through small hydro and in developing financing mechanisms for hydropower investment.
2950	Uganda, Tanzania, Kenya, Ghana, South Africa	IBRD/IFC	Lighting the "Bottom of the Pyramid"	6.0 Mil. USD	The core objective of the Project is to move - under a commercial and sustainable solution - a significant part of the population with no or unreliable access to electricity away from the polluting fuel-based lighting to the less polluting and higher quality modern	Collaboration for Uganda, Tanzania and Kenya in promoting public private modalities for rural electrification

Project ID	Country	Agency	Title	Amount (US$)	Relevance/Comments	
					lighting sources, thus reducing CO2 emissions, increasing household productivity and fostering economic and social development.	

A number of other pipeline entries for the renewable energy sector in the region covered by the EATTA could be quite relevant to the proposed Full Size Project. The World Bank/GEF projects being carried out in Uganda (Rural Energy for Development and Energy for Rural Transformation), Zambia (Renewable Energy-based Electricity Generation for Isolated Mini-grids and Power Sector Reforms for Increased Access to Electricity), Mozambique (Energy Reform and Access Project), Tanzania (Energizing Rural Transformation Project), Rwanda (Sustainable Energy Development Project), Malawi (Energy Access Expansion and Development Project) and a regional project (Lighing the "Bottom of the Pyramid") could all provide opportunities for collaboration particularly for rural electrification. All of these projects share the objectives of increasing access to electricity and other modern energy in rural areas. The public private model of rural electrification which this Full Scale Project aims to promote will receive regulatory support from all these projects and in some cases, particularly the ERT projects in Uganda and Tanzania, could also receive co-financing for expansion of distribution networks. The WB/GEF projects in Mozambique, Malawi, and Zambia that focus on power sector reform will provide regulatory support for private sector participation in the power sector, making common cause with this Full Size Project. Projects and programs that address the electricity sector relevant to the regulatory framework aspects in any of the participating countries are to be considered "natural alliances".

Ongoing grid connection and rural electrification projects need to be informed and consulted about Project (rural) electrification plans as well as the initiatives that may arise from such hydro power generation and distribution potential within the tea sector.

5.3 Project Implementation Arrangements

The proposed project set up is rather straightforward with UNEP as the proposed Implementing Agency and the EATTA as the Executing Agency (see Figure 5 on Management Structure). The EATTA provides the direct linkages with all its members in the tea processing sector, while it liaises with government agencies/ministries as well as utility companies either directly or through the national tea sector associations, where available. The UNEP as an Implementing Agency will join the Project Steering Committee through which it will be able to execute its project monitoring activities. In addition, UNEP will liaise between the Project Management Office (in the EATTA) and the GEFSEC, if necessary.

EATTA's roles and responsibilities during the Full Size Project Implementation are provided below:

a) Chair the Project Steering Committee, appoint SC members;
b) Liaise with members on project issues;
c) Host the Project Management Offices (in Mombasa and Nairobi);
d) Work closely with the regulatory authorities, national utilities, and policy makers in government to arrive at a regulatory framework conducive to achieving the objectives of the project.
e) Facilitate national workshops in collaboration with EATTA members /tea associations etc.;
f) Participate in and facilitate continued data collection.

Program Management Structure

The East Africa Tea Trade Association is based in the port of Mombasa, Kenya. The EATTA operates the Tea Auction of Mombasa for most Eastern and Southern African tea. It is engaged in Tea Warehousing and Brokerage. These are its core activities. For a complete overview please refer to Appendix P. Members of the EATTA members are either engaged in the production or trading of tea. Members of the EATTA are located in all countries that produce tea in the region: Burundi, DR of Congo, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Tanzania, Uganda, and Zambia. In some cases individual tea manufacturers are the EATTA members, in other cases entire

groups or associations are registered as single members. Example: In Kenya, the KTDA – Kenya Tea Development Agency – with 56 tea factories is classified as one single member. The EATTA liaises with various National Authorities on behalf of its members. To date the EATTA has not been engaged in any projects that bears any similarity with the proposed "Greening the Tea Industry in East Africa". UNEP (as Implementing Agency) is collaborating with the EATTA (as Executing Agency) in the realization of the proposed tea factory based small hydro project investments. The Steering Committee shall consist of tea producers, as represented in the EATTA – Board, representatives of the government and regulatory bodies, UNEP as the Impmenting Agency and perhaps a representative from a financial institution. Representatives of tea factories which are participating in the pilot projects will also have representation on the Project Steering Committee.

EATTA shall host a Project Management Office (PMO), in which international and regional experts shall work on all the tasks defined, creating an enabling environment for mini-hydro development in tea factories, rural electrification, hydro pre-feasibility and feasibility studies including detailed design, training of technical staff in Civil Engineering and Electrical Engineering sector as well as tea factory technical staff and liaise with Ministry of Energy /Industry etc. and national utilities. The PMO will support a number of tea factories to implement pilot small hydropower plants on a commercial basis. This will start with carrying out detailed feasibility studies, negotiating a market for the energy produced, mobilizing investment and financing, and finally actual execution of the pilot projects. During this implementation phase there will be direct linkages between the EATTA Project Management Office and the individual tea factories. Hands-on training sessions shall be provided to the entire national tea sector as well as to the civil engineering/electrical engineering sectors (industry associations, consulting/engineering firms etc).

In those EATTA member states where actual pilot projects will be developed, a National Steering Committee shall be formed consisting of the tea processing sectors (e.g. Tea Board / Association) and the Government (e.g. Ministry of agriculture). An overall Project Steering Committee shall be appointed and consist of EATTA representatives (Board Members), Senior Government Officials (Ministries of Energy) and a representative of the Implementing Agency (UNEP).

Figure 5 shows the organizational set up for the "Greening the Tea Sector" GEF Full Size Project. The Project Management Office of the EATTA will work with policy makers and regulators, with the tea factories, financing institutions, and the engineering community in the EATTA countries to increase investments into small hydropower projects to supply the tea sector. The PMO will report to the Steering Committee which will have representation from the major stakeholders.

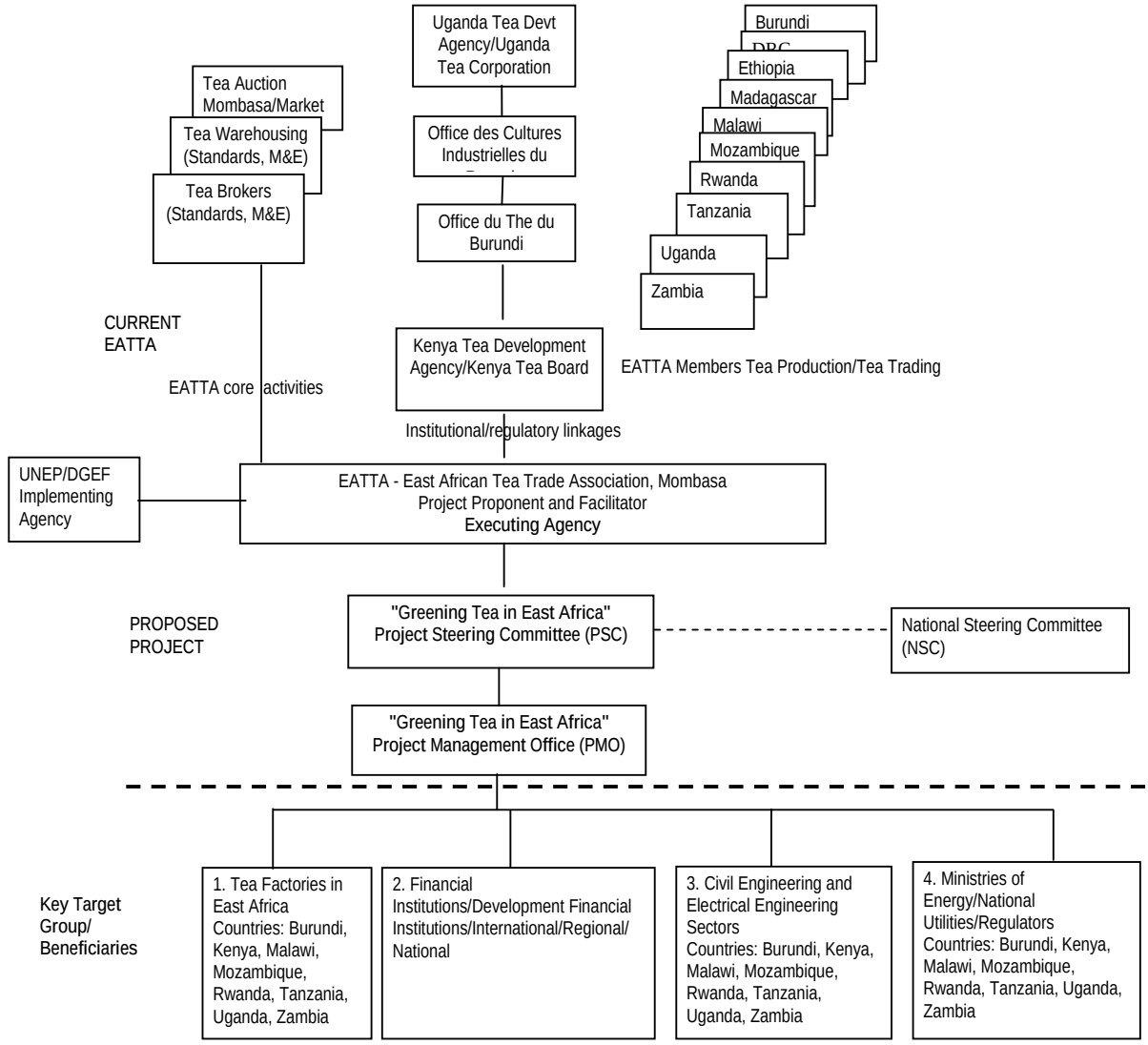

Figure 5: Greening Tea Industry of East Africa - Organizational Setup

5.3.1 Steering Committee

The Project Steering Committee (PSC) will provide the primary governance structure for the Project. EATTA will convene the "Greening Tea in East Africa" Steering Committee. EATTA will chair the Project Steering Committee and appoint its members. Members will include UNEP as the Implementing Agency for this Project. The Project Steering Committee (PSC) will review all reports and work with the PMO to resolve difficulties that arise during the Project to ensure smooth project implementation and monitoring. National Steering Committees (NTSC's) will be constituted in member states where pilot projects will be developed and will monitor the progress of these projects and ensure that reporting is done on time.

EATTA as the executing agency will play a key role in facilitating direct linkages between all its members in the tea sector. It will liaise with government agencies/ministries as well as utility companies through national tea sector associations. EATTA will ensure continued data collection and facilitate workshops.

5.3.2 Project Management Office

The Project Management Office (PMO) will be hosted by the EATTA and will develop all the reports for submission to UNEP. The PMO will be responsible for the operations of the Project i.e. executing the Work Plan and achieving Project Outputs and Outcomes within the Project period. A primary responsibility will be getting the 6 pilot projects constructed within the Project time frame. Through these pilot projects the PMO will achieve the broader goals of the Project of dramatically improving the investment climate for small hydropower in the tea sector and demonstrating rural electrification through private-public partnership. The PMO will also be responsible for executing the Monitoring Plan for the project. It will report to the Project Steering Committee.

The PMO is expected to have the following personnel:

Full time

1. PMO Director	recruited regionally
2. Technical Officer	recruited regionally
3. Administrator/ Accountant	recruited regionally
4. Administrative Assistant	recruited regionally

Part time

5. Regional Finance Expert	
6. Regional Training Expert	
7. Regional Hydropower Expert	
8. Chief International Advisor	recruited internationally
9. Hydropower Expert	recruited internationally

The PMO will be a small team led by a Director and with three other full time personnel. All other experts to the PMO will be part time including the Chief International Advisor and International Hydropower Expert. The PMO will carry out the tasks of training and technical backstopping of hydropower projects with its core personnel and experts listed above. Specific tasks like carrying out of detailed feasibility studies for hydropower projects will be given to competent external consultants. The PMO will develop a standard reporting framework for all experts working on the project and will ensure that reporting is done in a timely fashion.