UNITED NATIONS ENVIRONMENT PROGRAMME
GLOBAL ENVIRONMENT FACILITY
PROJECT DOCUMENT

SECTION I - PROJECT IDENTIFICATION

1.1 Sub-Programme Title: Climate Change OP 6: Renewable Energy and cuts across OP5

1.2 Project Title: Cogen for Africa.

1.3 Project Number: GFL / 2328 - 2721 – 4xxx
PMS: GF/ 4010 – 07 - xx

1.4 Geographical Scope: Regional: Ethiopia, Kenya, Malawi, Swaziland, Tanzania, Uganda and Sudan.

1.5 Implementation: Energy, Environment and Development Network for Africa. (AFREPREN/FWD)
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1.6 Duration of the Project: 72 months
Commencing: March 2007
Completion: Feb 2013

1.7 **Cost of the Project: US$**

	PDF-B	**Project**
Cost to the GEF Trust Fund	367,400	5,248,165
Co-financing		
Co-financing for Technical Assistance		
Government		705,600 (in-kind)
ExA: AFREPREN/FWD (related projects & TA)	50,000 (in-kind)	45,422 (cash)
AfDB		336,960 (in-kind)
COOPENER		375,000 (cash)
REEEP		50,000 (cash)
Triodos		60,000 (cash)
Leveraged Financing Private sector/ Utilities		
Private Sector		60,013,368 (cash)
Co-financing Total	**50,000**	**61,586,350**
Total [1]	**417,400**	**66,834,515**

1.8 Project Summary

This regional project aims to promote (mostly biomass-based) cogeneration, generating power out of (mainly agricultural) waste. The key activities of the project will include identification of opportunities, appropriate technologies and suppliers; technical advice to developers, financiers and investors; and, policy guidance (power purchase arrangements/tariffs for captive and excess firm/non firm power, etc). This active support to all stakeholders in Cogen business development in the form of capacity building, technology transfer and pre-feasibility/feasibility/Cogeneration Investment Packages (CIPs), is expected to create a conducive business

[1] The total budget does not change, with the participation of AfDB as a co-implementing agency, since AfDB had already made a pledge prior to council approval.

environment for the scaling-up of cogeneration investments in eastern and southern Africa, which will in turn provide the market demand for a regional cogen centre, with associated satellite national cogen units/focal points.

The project will be jointly co-implemented by UNEP and AfDB. The executing agency is AFREPREN/FWD, based in Nairobi Kenya. AfDB has provided two letters – one which confirms their involvement as co-implementing agency, and another which commits AfDB co-financing. A detailed Cooperation Modalities Memo has been prepared by AfDB, UNEP and the Executing Agency. The Memo confirms that AfDB will be involved in all the key project decisions and will actively participate in the project Steering Committee. AfDB have also reviewed and approved the entire project document, detailed budget, draft Terms of Reference, proposed procurement and hiring processes.

Signatures

For AFREPREN/FWD,

_____
Stephen Karekezi
Director, AFREPREN/FWD

Date: _____

For UNEP

_____
D. Hastie, Chief
Budget and Financial Management
Service, UNON.
Date: _____

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LIST OF ANNEXES

The following Annexes from the Approved Project Brief are NOT included in this project document BUT are available upon request.

Following are the Annexes included in this Project document

LIST OF ACRONYMS

ACP	African, Caribbean and Pacific
ADLI	The Agriculture Development Led Industrialization
AfDB	African Development Bank
AFREPREN/FWD	Energy, Environment and Development Network for Africa
AIT	Asian Institute of Technology
AREED	Africa Rural Energy Enterprise Development
ASEAN	Association of South East Asian Nations
BOO	Build, Operate, Own
CC	Climate Change
CDM	Clean Development Mechanism
CEO	Chief Executive Officer
CfA	Cogen for Africa
CIA	Central Intelligence Agency
CIP	Cogeneration Investment Package
CO2	Carbon Dioxide
Cogen	Cogeneration
DBSA	Development Bank of South Africa
DEG	Deutsche Investitions -und Entwicklungsgesellschaft mbH
DSCR	Debt Service Coverage Ratio
EADB	East African Development Bank
EAPLC	East Africa Power & Lighting Company
EASCF	East Africa Small Hydro and Cogeneration Fund
EC	European Commission
EC-ASEAN	European Commission - Association of South-East Asian Nations
EEPCo	Ethiopia Electricity Power Company
EIB	European Investment Bank
EPC	Engineering, Procurement, and Construction
ERT	Energy for Rural Transformation
ESCO	Energy Service Company
EU	European Union
FMO	Netherlands Development Finance Company
FS	Feasibility Study
FSDPs	Full Scale Demonstration Projects
FSF	Finchaa Sugar Factory
FSPP	Full Scale Promotion Project
FWD	Foundation for Woodstove Dissemination
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GoK	Government of Kenya
GWh	Giga Watt Hour
IBRD	International Bank of Reconstruction and Development
IEA	International Energy Agency
IPCC	Inter Governmental Panel On Climate Change
IPP	Independent Power Producer
IRR	Internal Rate of Return
IRSEAD	Institute of Research in Sustainable Energy and Development
IT	Information Technology
KAM	Kenya Association of Manufacturers
KfW	KfW Entwicklungsbank - KfW development bank
KShs	Kenya Shillings
KPLC	Kenya Power and Lighting Company
KSW	Kinyara Sugar Works
kV	KiloVolts
kW	Kilowatt
kWh	KiloWatt Hour
LCPD	Least Cost Power Development
M&E	Monitoring and Evaluation
MD	Man Day
MEMD	Ministry of Energy and Minerals Development, Uganda
MIP	Management Information Principles

MNES	Ministry of Non-Conventional Energy Sources
MoU	Memorandum of Understanding
MW	Megawatt
MWh	Mega Watt Hour
NEPAD	New Partnership for Africa's Development
NPV	Net Present Value
O&M	Operations and Maintenance
OP	Operational Program
PDF-B	Project Development Facility
PDP	Power Development Plan
PMC	Project Management Council
PPA	Power Purchase Agreement
PPD	Project Design Document
PSC	Project Steering Committee
REEEP	Renewable Energy and Energy Efficiency Partnership
RESCO	Renewable Energy Service Company
RSA	Republic of South Africa
SADC	Southern African Development Community
SBIC	Swaziland Industrial Development Company, Ltd.
SCOUL	The Sugar Corporation of Uganda Ltd
SPC	Special Purpose Company
SSF	Shoa Sugar Factory
STAP	Scientific and Technical Advisory Panel
TANESCO	Tanzania Electric Supply Company
TANWAT	Tanganyika Wattle Company
TC	Tonnes of Cane
TCD	Tons of Cane per Day
TCH	Tonnes of cane per hour
TFA	Techno-Financial Analysis
UEB	Uganda Electricity Board
UETCL	The Uganda Electricity Transmission Company Ltd
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
WADE	World Alliance for Decentralized Energy
WB	World Bank
ZESA	Zimbabwe Electric Supply Authority

SECTION II - BACKGROUND AND PROJECT CONTRIBUTION TO OVERALL SUB-PROGRAMME IMPLEMENTATION

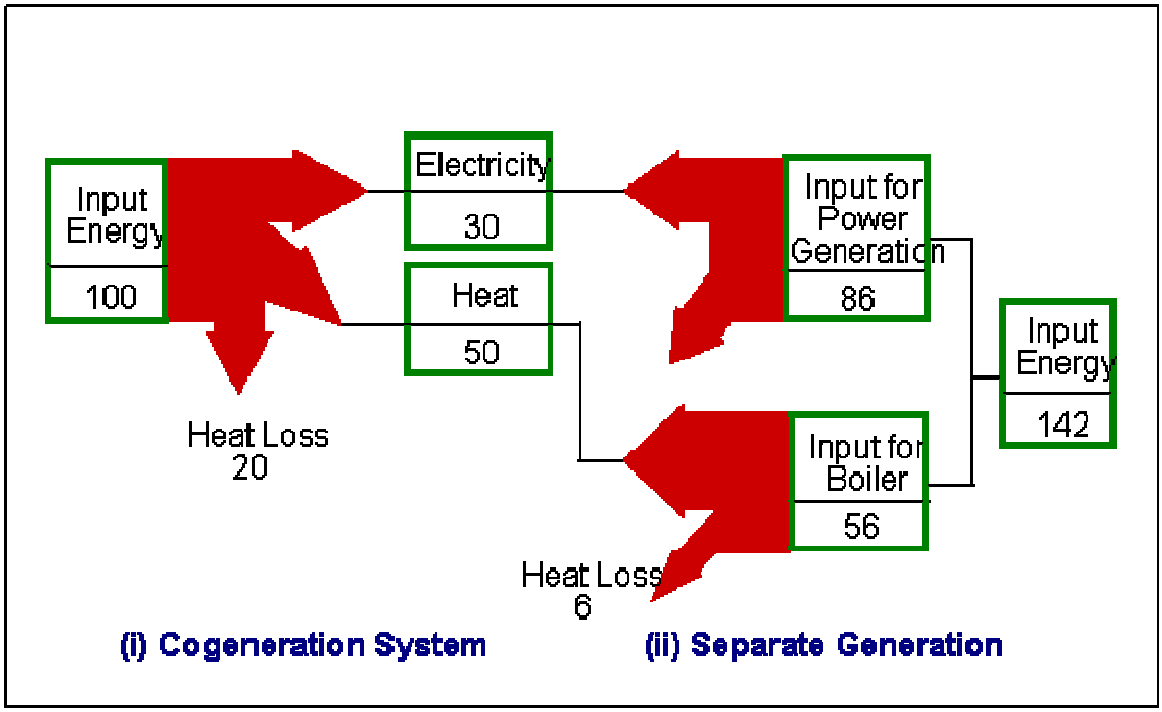
1. BACKGROUND AND RATIONALE

1.1 Why Cogeneration?

In conventional utilities, power production and steam generation are independent of each other and separate fuel sources are used. However, it has been demonstrated that an industry's power and thermal needs can be met using a single energy source. This is called cogeneration.

Cogeneration has the advantage of reducing the primary energy use, while providing a given quantity of two different forms of energy (usually in the forms of heat and power). Conventional energy supply systems require about 40 % more primary energy than a cogeneration system to meet the same energy needs (Figure 1.1). Therefore cogeneration can be both energy efficient and environmentally beneficial. Moreover, when biomass residues from wood and agro-industries are used as fuel for cogeneration, the plant becomes a renewable energy system which, in some instances, could replace the use of fossil fuel.

Figure 1.1: Comparison of energy balances between cogeneration and separate power generation



Source: Mohanty, 2000

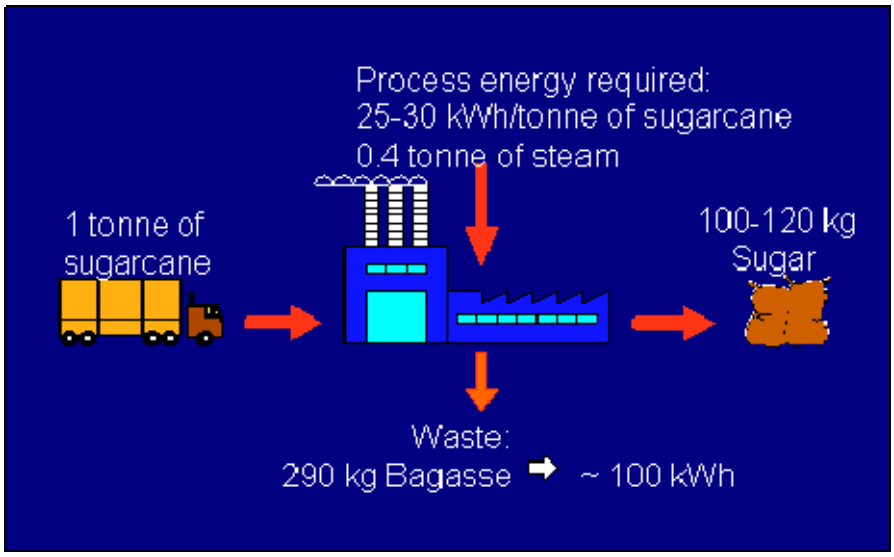
Cogeneration has been widely applied in agro-industries such as sugar and palm oil factories. As the trend in wood industries is a shift towards integrated wood complexes, cogeneration plants are being implemented increasingly in this sector, too. In some cases, rice husks as well as coconut husks and shells, can also be used as a fuel to help meet the energy demands of the plant, while abating the environmental pollution associated with their disposal. If appropriate technologies are implemented, cogeneration can not only render these agro-industries self-sufficient in energy, but can also help them to earn a profit by exporting excess electricity produced to the national grid or to neighbouring industries.

The industries that produce these biomass residues have requirements for energy, usually in the form of electricity and heat. It is therefore customary for these industries to use the residues that are generated in an energy conversion system at least to cover for the internal requirements of the factory itself. Many facilities, however, approach this situation without due regard for energy or environmental merits.

For instance, in sugar factories, after the juice is taken out from the cane, there is about 30-40 % (depending on variety of sugar cane and other agronomical and climatic conditions) of bagasse generated as a waste material in the factory. In the past, because of the limited development of technology and the absence of a regulatory framework that facilitates sales of excess electricity to the grid, the sugar factories' energy systems have been designed to generate just enough electricity and heat for the process while consuming all the bagasse to avoid its accumulation and creation of disposal problems. This approach transforms the energy system into both an energy generating unit and an incineration.

Because of recent developments in the technology which allows the production of high pressure, high temperature steam for the turbine, thus generating more power from the bagasse on one hand, and the potential for the existence of a regulatory framework that allows private generators to sell their excess power to the grid on the other hand, there now exists greater opportunities for generating cleaner power that is not only environmentally benign but an important avenue for generating an additional revenue stream for the sugar industry.
To illustrate, Figure 1.2 shows that for each ton of sugar that comes into the factory for processing, about 100 to 120 kg of sugar is produced. This process of converting sugarcane into sugar needs electricity for its prime movers, motors, pumps, etc. of about 25-30 kWh/ton of sugarcane and heat in the form of low pressure steam amounting to 400 kg/ton of sugarcane. By using the bagasse generated which is around 390 kg in an efficient high pressure Cogen system, up to 110 kWh of electricity could be produced while extracting steam enough for the requirements of the process. The 110 kWh should be able to cover for the electricity requirements of the factory with an excess of around 80 kWh. This excess electricity accounts for more than 2 to 3 times the amount needed internally by the process. This demonstrates the potential of energy that could be harnessed if the conditions are right for implementing efficient Cogen systems in relevant industries in Africa. .

Figure 1.2: Material balance in a sugar factory



With the recent developments in the global sugar market heralding the advent of low sugar prices , African sugar companies are very keen to find ways to reduce costs through efficient operations and additional revenues from complementary activities such as cogeneration. The announcement of the European Union (EU)'s plan to reduce implicit subsidies for sugar exports from African, Caribbean and Pacific (ACP) states, sent fears that the African sugar companies may find it difficult to compete against low prices from other non-African countries[2]. Cogeneration is increasingly perceived by sugar companies as an important opportunity for improving their financial performance by reducing their electricity bills and generating a new stream of revenues. Recent data from Mauritius indicates that half the revenue for sugar factories is from the sale of sugar and the other half from the sale of electricity from cogeneration.

1.2 Applicability of Cogeneration in Africa

Table 1.1 below summarizes the macro-economic figures of the seven African countries that are participating in this project and have expressed keen interest in promoting cogeneration in their industries. It should be observed that for most of them, agriculture alone (and more so if agro-industry is added) account for more than one-third (close to or around 50% for some of them) of the total GDP of the countries. The industries processing these agricultural products normally require energy in the form of electricity to drive their prime movers/machinery and heat for the process. At the same time, they also normally generate residues that could be used as fuel for boilers producing steam for the process and electricity when directed to a turbo-generator. The set up then becomes a cogeneration system.

[2] Daily Nation, December 7, 2005, Kenya

Table 1.1: Economic figures of the seven countries involved

Countries	Gross domestic product (GDP) in Million USD 2003	Real GDP growth %			Per capita GDP in USD 2003	GDP per sector 2004		
		2002	2003	2004		Agriculture %	Industry %	Services %
Ethiopia	6,972	1.9	-3.7	11.6	101.6	47.0	12.4	40.6
Kenya	10,892	1.2	1.8	2.2	341.2	19.3	18.5	62.4
Malawi	1,776	2.7	4.4	4.0	162.0	54.8	19.2	26.0
Sudan	17,800	6.5	6.0	8.6	460	41.2	18.5	40.4
Swaziland	1,487	2.8	2.4	2.5	1,351.8	16.1	43.4	40.5
Tanzania	11,079	7.2	7.1	5.8	308.6	43.2	17.2	39.6
Uganda	6,959	6.8	4.7	5.0	275.3	35.8	20.8	43.6

Source: World Bank, 2005; CIA World Factsheet 2005

In the seven participating countries, the sugar industry that produces bagasse is a major sector given high priority by the governments. On the demand side, the need for additional power capacity is increasing and governments are turning to the private sector to meet the challenge of investing in power generation facilities. For instance, Uganda which is currently facing shortage in power due to the lowering of the water level in Lake Victoria which is the source of the hydro power that supplies most of the country's electricity requirements (see Annex S), as well as Kenya and Tanzania are keen to attract private Independent Power Producers (IPPs) to install additional power generating capacities.
The sections that follow present background information and data on the resources and potential for the application of cogeneration in Africa, and the benefits that could be derived in wider application of cogeneration in the region.

1.2.1 Resource assessment and potential

Based on the information that is currently available, cogeneration has huge potential in relevant sectors such as: sugar, pulp and paper, wood processing, coffee, maize, rice, hotels, hospitals, commercial complexes, etc.
One of the key determining factors that drive the decision of project developers to implement a cogeneration system is the availability of fuel to supply the requirements of the plant at reasonable prices and at a sustained period of time.
Other than coal and natural gas, which are possible fuels for cogeneration, an abundant supply of fuel comes from the residues that are generated by the industries using wood and agricultural crops as raw material. In Annex M the statistics of agricultural produce in each of the participating countries and the availability of biomass residues generated by different industries in the different countries is provided. These agricultural products when processed into their consumable form, produce some residues in the form of biomass wastes. These so-called wastes, being combustible material with significant energy content (calorific value), could be used as fuel in energy conversion systems such as cogeneration plants. Table 1.2 shows the biomass residues produced by the sugar and rice industries in the different countries and their theoretical power generation potential. In these industries, the residues are centralized in the mills/factories where the raw material is processed, which makes it easy for these residues to be gathered and used as fuel.

Table 1.2: Biomass residues by industry by country (2004)

A. Sugarcane

Country	Sugarcane (1000 tons)	Bagasse production (1000 tons)*	Theoretical power generation potential (MWh/year)**
Ethiopia	2,454	859	282,242
Kenya	4,661	1,631	536,014
Malawi	2,100	735	241,500
Sudan	5,500	1,925	632,500
Swaziland	4,500	1,575	517,500
Tanzania	2,000	700	230,000
Uganda	1,600	560	184,000

TOTAL	**22,815**	**7,985**	**2,623,756**

* At an average of 35% bagasse to cane ratio
** At an assumed boiler pressure of 65 bar

B. Rice

Country	**Rice paddy (1000 tons)**	**Rice husk production (1000 tons)*** **	**Theoretical power generation potential (MWh/year)*** **
Ethiopia	15.50	3	1,550
Kenya	49.30	10	4,930
Malawi	49.72	10	4,972
Sudan	15.75	3	1,575
Swaziland	0.17	0.03	17
Tanzania	680.00	136	68,000
Uganda	140.00	28	14,000
TOTAL	**950.44**	**190**	**95,044**

*** At an average of 20% rice husk to paddy ratio
**** At an assumed boiler pressure of 20 bar

It is, however, acknowledged that due to institutional, policy, regulatory and practical constraints the above theoretical potential may not be fully realized.

One issue that concerns the use of biomass residues as fuel for cogeneration is the seasonality of some of the agricultural products. A good example is the sugar industry. There is a concern that if a cogeneration plant is implemented to supply excess power to the grid on a firm basis, the plant may not be able to operate whole year round due to lack of fuel during the off-milling season. However, experiences from Thailand (with milling season of 3 to 4 months) and Mauritius (with milling season of 7 to 8 months) has shown that a whole year round electricity production is possible to achieve either by spreading out the bagasse to cover the operation during the off-milling season (case of Thailand) or using non-bagasse secondary fuel (case of Mauritius). In most countries here in Africa, the sugar factories operate for an average period of 10 to 11 months. With longer milling duration, the sugar industries in the participating countries of Africa, bagasse production is spread throughout the year which facilitates the operation of the cogeneration plant all year round (by storing a portion of bagasse for four to six weeks into the off-milling season) and eliminates the necessity to use secondary fuel such as coal. Moreover, with the advent of the diffuser technology to extract the juice from the sugar cane instead of the conventional milling, such as the one used in Mumias Sugar factory in Kenya, the down time and scheduled maintenance is significantly reduced thus allowing factories to operate for a longer period in a year.

Other than the above solution on seasonality, the limited period of the sugar milling season might not necessarily be a barrier for cogeneration as investments in generation are often dictated by capacity shortages, instead of energy shortages. As part of the initial planning during Project implementation, capacity balance tables could be constructed for each participating country to show demand and reserves against available energy in both capacity and energy terms on a monthly basis. By obtaining the resultant deficit or surplus in capacity or energy, the need for cogeneration by month could be demonstrated. This would reveal the cost-effectiveness of cogeneration technology for meeting capacity requirements. The information will also be useful for assessing the appropriateness of the Power Purchase Agreement (PPA).

One upside in the sugar industry is the fact that sugar cane also contains tops and leaves (cane trash) which is potentially available as fuel and is comparable to bagasse in terms of its potential available energy content per ton of sugar cane. This is traditionally burned and left on the field for soil conditioning. However, a potion of this could be taken and used as additional fuel which is being done in new cogeneration plants in Thailand as well as pilot plants in Brazil.

On the factory level, within the sugar industry alone (which has more accessible and organized data), the potential to harness the existing bagasse for cogeneration is undeniable. Table 1.3 provides an overview of the potential for cogeneration from sugar cane in the participating countries using 2002 data. The estimated potential is conservative as it does not take into account both the growth since 2002 as well as the future growth of the sugar production in all countries. Use of other biomass fuels (such as residues from wood/pulp/paper industries, coconut husks, rice husks, residues from maize, coffee, sisal and palm oil agro-industries) for cogeneration have likewise not been included in this estimate. In addition, alternative fuels to continue powering cogeneration plants beyond harvesting periods and milling season have not been considered. It can be seen from the table that depending on the efficiency of the system adopted (from medium efficiency to high efficiency, state-of-the-art, high pressure cogeneration systems) the additional power cogeneration capacity would vary from 225 MW to 550 MW.

Among the potential projects in the sugar industry of the participating countries, there are those that have undergone initial project development. These projects and the status of their development are provided in Table 1.4.

Table 1.3: Potential for cogeneration from sugarcane in Eastern and Southern Africa[3]

Country/Sugar factory	**Cane crushed (2002)**	**Electricity generation (Note 1)**						**IC (Note 2)**	**Additional power if cogeneration efficiency is improved (Note 3)**			**Status of cogeneration project development**
		44bar - 90kWh/TC		**65bar - 115kWh/TC**		**82bar - 150kWh/TC**						
	Tons	**kWh**	**MW**	**kWh**	**MW**	**kWh**	**MW**	**MW**	**MW**	**MW**	**MW**	
ETHIOPIA												
Finchaa Sugar Factory	617,283	55,555,470	10.1	70,987,545	12.9	92,592,450	17.5	7.0	3.1	5.9	10.5	Pre-feasibility study conducted for 34MW, with factory expansion
Wonji/Shoa	530,000	47,700,000	8.7	60,950,000	11.1	79,500,000	15.0	6.4	2.3	4.7	8.6	Pre-feasibility study conducted for 18MW, with factory expansion
Sub Total	**1,147,283**	**103,255,470**	**18.7**	**131,937,545**	**24.0**	**172,092,450**	**32.4**	**13.4**	**5.3**	**10.6**	**19.1**	
KENYA												
West-Kenya	399,000	35,910,000	6.5	45,885,000	8.3	57,057,000	10.8	2.5	4.0	5.8	8.3	
Muhoroni	413,070	37,176,300	6.7	47,503,050	8.6	59,069,010	11.1	3.0	3.7	5.6	8.1	
Nzoia	568,098	51,128,820	9.3	65,331,270	11.9	81,238,014	15.3	4.5	4.8	7.4	10.8	
Mumias	2,207,120	198,640,800	36.1	253,818,800	46.1	315,618,160	59.5	15.0	21.1	31.1	44.5	Selling 2MW to the grid; Pre-feasibility study conducted for 20MW, Factory now negotiating with an Indian firm to expand its electricity generation capacity to 35MW and sell 25MW to the grid by 2008
Chemilil	602,304	54,207,360	9.8	69,264,960	12.6	86,129,472	16.2	6.0	3.8	6.6	10.2	Pre-feasibility study conducted for 15MW
Sony	580,516	52,246,440	9.5	66,759,340	12.1	83,013,788	15.7	7.0	2.5	5.1	8.7	
Proposed - Busia Sugar Company	*1,134,000*	*102,060,000*	*18.5*	*130,410,000*	*23.7*	*162,162,000*	30.6	*0.0*	*18.5*	*23.7*	30.6	*Feasibility study to implement new sugar factory to include 20MW cogeneration plant*
Sub Total	**5,904,108**	**531,369,720**	**96.5**	**678,972,420**	**123.3**	**885,616,200**	**159.2**	**38.0**	**58.5**	**85.3**	**121.2**	
MALAWI												
Dwangwa Sugar Mill	795,065	71,555,850	13.0	91,432,475	16.6	119,259,750	22.5	7.0	6.0	9.6	15.5	
Ntchalo Sugar Mill	1,300,000	117,000,000	21.2	149,500,000	27.1	195,000,000	36.8	11.5	9.7	15.6	25.3	

[3] Incorporated updated potential based on new data and information received after Council approval.

Sub Total	**2,095,065**	**188,555,850**	**34.2**	**240,932,475**	**43.7**	**314,259,750**	**59.2**	**18.5**	**15.7**	**25.2**	**40.7**	
SWAZILAND												
Simunye	2,352,000	211,680,000	38.4	270,480,000	49.1	352,800,000	66.5	17.0	21.4	32.1	49.5	Pre-feasibility study for 50MW conducted
Mlhume	1,764,000	158,760,000	28.8	202,860,000	36.8	264,600,000	49.9	18.5	10.3	18.3	31.4	Pre-feasibility study for 50MW conducted, with factory expansion
Ubombo	2,745,600	247,104,000	44.9	315,744,000	57.3	411,840,000	77.6	17.5	27.4	39.8	60.1	
Sub Total	**6,861,600**	**617,544,000**	**112.1**	**789,084,000**	**143.3**	**1,029,240,000**	**194.0**	**53.0**	**59.1**	**90.3**	**141.0**	

Country/Sugar factory	**Cane crushed (2002)**	**44bar - 90kWh/TC**		**65bar - 115kWh/TC**		**82bar - 150kWh/TC**		**IC (Note 2)**	**Additional power if cogeneration efficiency is improved (Note 3)**			**Status of cogeneration project development -Feasibility Studies**
	Tons	**kWh**	**MW**	**kWh**	**MW**	**kWh**	**MW**	**MW**	**MW**	**MW**	**MW**	
SUDAN												
Kenana Sugar Co. Ltd.	3,281,000	295,290,000	53.6	377,315,000	68.5	492,150,000	92.8	40.0	13.6	28.5	52.8	The factory has recently expanded its cogeneration capacity to 53MW
Gunied Sugar Factory	825,000	74,250,000	13.5	94,875,000	17.2	123,750,000	23.3	3.0	10.5	14.2	20.3	Feasibility study conducted for 28MW, with factory expansion
New Halfa Sugar Factory	835,000	75,150,000	13.6	96,025,000	17.4	125,250,000	23.6	6.0	7.6	11.4	17.6	Feasibility study conducted for 30MW, with factory expansion
Sennar Sugar Factory	880,000	79,200,000	14.4	101,200,000	18.4	132,000,000	24.9	6.5	7.9	11.9	18.4	Feasibility study conducted for 28MW, with factory expansion
Sub Total	**5,821,000**	**523,890,000**	**95.1**	**669,415,000**	**121.5**	**873,150,000**	**164.6**	**55.5**	**39.6**	**66.0**	**109.1**	
TANZANIA												
Kilombero Sugar Plant K1	403,200	36,288,000	6.6	46,368,000	8.4	60,480,000	11.4	6.0	0.6	2.4	5.4	
Kilombero Sugar Plant K2	504,000	45,360,000	8.2	57,960,000	10.5	75,600,000	14.3	2.8	5.4	7.7	11.5	
Mtibwa Sugar Estate	1,764,000	158,760,000	28.8	202,860,000	36.8	264,600,000	49.9	13.0	15.8	23.8	36.9	There are plans to expand the factory capacity to generate 30MW of which 25MW is targeted for sale to the grid
Kagera Sugar Company	302,400	27,216,000	4.9	34,776,000	6.3	45,360,000	8.6	5.0	-	1.3	3.6	
Tanganyika Planting	655,200	58,968,000	10.7	75,348,000	13.7	98,280,000	18.5	3.0	7.7	10.7	15.5	Pre-feasibility study conducted for

Company												20MW, with factory expansion
Sub Total	**3,628,800**	**326,592,000**	**59.3**	**417,312,000**	**75.8**	**544,320,000**	**102.6**	**29.8**	**29.5**	**46.0**	**72.8**	
UGANDA												
Kakira Sugar Works	710,000	63,900,000	11.6	81,650,000	14.8	106,500,000	20.1	6.0	5.6	8.8	14.1	Agreement to sell 12MW to the grid, interested in expansion if attractive PPA is agreed upon
Kinyara Sugar Company	610,000	54,900,000	10.0	70,150,000	12.7	91,500,000	17.3	2.0	8.0	10.7	15.3	Pre-feasibility study conducted for 5MW, The factory was recently privatized when 51% of its shared were acquired by the Rai Group.
SCOUL	387,000	34,830,000	6.3	44,505,000	8.1	58,050,000	10.9	2.0	4.3	6.1	8.9	
Sub Total	**1,707,000**	**153,630,000**	**27.9**	**196,305,000**	**35.6**	**256,050,000**	**48.3**	**10.0**	**17.9**	**25.6**	**38.3**	
GRAND TOTAL	**27,164,856**	**2,444,837,040**	**443.9**	**1,526,038,640**	**567.2**	**3,884,574,408**	**732.4**	**218.2**	**225.7**	**349.0**	**514.2**	

Note 1: 3 scenarios are used to estimate electricity generation, based on improvements in efficiency and boiler pressure from the Mauritius experience. These are: 44 bar pressure at 90kWh/TC, 65 bar at 115kWh/TC and 82 bar at 150kWh/TC. Assumes 35% bagasse to cane ratio at 50 % moisture content
Note 2: IC = Installed capacity. This is the current installed electrical capacity of the sugar factory.
Note 3: The difference between the current installed capacity and the electricity that can be generated under the 3 scenarios, with varying boiler pressure.
Note 4: Conversion from kWh to MW assumes plant operating duration of 270 days, 24hrs a day and capacity utilization of 85%.

Table 1.4: Cogeneration investments in sugar factories that have been planned during the past 20 years

Country/Sugar factory	**Cogeneration Expansion plans/Pre-Feasibility Studies**	**Planned Investment (US$)**
KENYA		
Mumias	Selling 2MW to the grid; Pre-feasibility study conducted for 21MW	12million
Chemilil	Pre-feasibility study conducted for 15MW	23.7million
Proposed - Busia Sugar Company	*Feasibility study to implement new sugar factory to include 20MW cogeneration plant*	*100million (includes cost of factory setup with cogeneration component)*
SUDAN		
Gunied Sugar Factory	Feasibility study conducted for 28MW, with factory expansion	34-39million
New Halfa Sugar Factory	Feasibility study conducted for 30MW, with factory expansion	31-37million

Sennar Sugar Factory	Feasibility study conducted for 13MW, with factory expansion	19million
TANZANIA		
Tanganyika Planting Company	Pre-feasibility study conducted for 20MW, with factory expansion	To be confirmed
ETHIOPIA		
Finchaa Sugar Factory	Pre-feasibility study conducted for 34MW, with factory expansion	34million
Wonji/Shoa	Pre-feasibility study conducted for 18MW, with factory expansion	195million (includes factory expansion with cogeneration component)
UGANDA		
Kakira Sugar Works	Agreement to sell 12MW to the grid, interested in expansion if attractive PPA is agreed upon	To be confirmed
Kinyara Sugar Company	Pre-feasibility study conducted for 5MW	To be confirmed
SWAZILAND		
Simunye	Pre-feasibility study for 50MW conducted	77.5million
Mlhume	Pre-feasibility study for 50MW conducted, with factory expansion	77.1million

Note: The variation in cost per MW from country to country could be due the use of high pressure systems, which are more sophisticated and therefore more costly. In addition, in some countries, the investment includes a bagasse handling facility, and expansion of the sugar plantation and factory.

1.2.2 Target/expected achievement[4]

The potential for implementing medium to high-pressure cogeneration systems (as compared to the current practice of inefficient low-pressure systems) is huge. However, it should be noted that for the past 40 years[5] or more, the sugar industry in the participating countries has installed only around 200 MW of cogeneration equipment even when the need for additional capacity to reach self-sufficiency exists. Moreover, as far as the current phase of this Project has investigated, only the Kakira Sugar Works in Uganda has a 45-bar boiler, although this is still in the construction stage and is not yet in operation.

Given this scenario, it is the Project's target that through its activities of removing the barriers that exist and assisting in transforming the cogeneration industry into a profitable cogeneration market through capacity building, technical assistance, and institutional support for policy formulation, an additional of 40 MW of modern and efficient cogeneration capacity will be implemented as Full Scale Promotion Projects (FSPPs). It is assumed that about 6 FSPPs are required to meet the 40 MW target during project implementation. These projects will act as showcases in convincing other potential project developers/owners of the technical reliability, economic viability and environmental friendliness of these types of cogeneration systems.

It is also expected that during the Project implementation another 20 MW of projects will have been directly supported through the provision of advice, services and training but are not considered as FSPPs. These projects are expected to be either being implemented or at the advanced stage of project development at the end of the Project. Once the FSPPs are implemented and used as show cases of modern and efficient cogeneration systems, replication of such systems are expected to happen most likely beyond the 6-year duration of the Project for a total of around 200 MW, which includes the 20 MW that have been supported and developed during the Project implementation.

The target of 40 MW direct project and 20 MW direct post-project is ambitious considering the long development stage of cogeneration projects vis-à-vis the Project duration of 6 years. However, taking into account the potential in the participating countries and the design of the Projects which draws lessons and experiences from successful institutional models, this target is realizable. In comparison, the Cogen Programme in Asia realized 30 MW of directly supported projects during the first 10 years and around 150 MW during the third phase and last 3 years of its operations.

It must be emphasized that in order to maximize the benefits of implementing highly efficient cogeneration systems in the sugar factories, the efficiency in the use of process steam and electricity in the sugar processing should also be improved. This will free up more bagasse to generate additional electricity for sales to the grid.

1.2.3 Benefits of cogeneration

The benefits of implementing cogeneration systems encompass the efficiency, economic and environmental aspects which governments, industries, businesses and communities of Africa as well as the global environment could gain if efficient cogeneration is properly exploited. Some of the major benefits of cogeneration are mentioned below and are elaborated in Annex V.

- Energy cost savings

These savings come mainly from not having to purchase power from the grid or from not having to buy conventional fuel for generating power and/or heat, especially if using biomass as fuel. Further savings can be realized due to the lower primary energy consumption of a cogeneration system compared to a conventional separate heat and power generation.

It is known that many sugar factories in Africa, in spite of the huge quantity of bagasse generated though their operation, are not self-sufficient in energy and are still importing power from the grid. Notable examples of this situation are mentioned in the Annex. If appropriate cogeneration systems are implemented in these factories, the amount of money spent for paying the electricity bills would be saved thus reducing production costs.

- Use of indigenous, cheap renewable fuel source instead of imported, finite fossil fuel

Biomass residues suitable for cogeneration can be found in abundant quantities in most sub-Saharan African countries. Using these residues allows agro-industries to generate power and heat from what is considered as indigenous, cheap, environmentally friendly and renewable fuel.

Some of the countries in the region, namely, Kenya, Uganda, Tanzania are experiencing shortage of power from existing hydroelectric generating capacities and have implemented or are planning to implement thermal power plants using diesel/coal as fuel as additional capacities to augment the shortage. If the available biomass resources are

[4] The pre-defined target is the 40MW and it is assumed that about 6 FSPPs are required to meet the 40 MW target during project implementation and 20MW during pipeline,

[5] Most sugar factories were established before independence, and had ambitious cogeneration plans, which to date have not been realized. As per the limited documentation that is available, as well as personal communication with senior and retired sugar factory engineers/experts, these ambitious plans have been updated on an annual basis, with very few actual cogen plants constructed. This demonstrates that the target of 40MW of more efficient cogen investments is very ambitious for the 7 participating East and Southern African countries (in contrast to industrialized countries of Central and Eastern Europe, parts of Latin America and South East Asia/China, where a 40MW target would be perceived as unduly modest).

exploited, these additional capacities could either be delayed or could be partly or wholly replaced by cogeneration systems, while freeing up some hydropower capacities for use at more appropriate times.

- Elimination of disposal problems and associated costs for biomass residues

In Kinyara Sugar Works, Uganda, the management revealed during the stakeholders' discussions that the company spends around 200,000 USD/year to dispose the excess bagasse 2 to 3 kilometers away from the factory. It is estimated that in the sugar factories in Africa, only 60 % of the huge quantities of bagasse produced by the sugar factories is utilized as fuel for inefficient energy systems while the rest is disposed at a cost.
By using these residues, which had been traditionally considered as a waste matter, as fuel for cogeneration systems, the disposal costs and associated hazards of disposing them could be avoided.

- Loss reduction and improvement in quality and reliability of supplies

In many countries in the African region, the reliability of the power supply from the electric utility is not very reliable, prompting the industries to have their own back up system usually using diesel generators. For example, it is estimated that the Kenyan interconnected grid-system experiences over 10,000 recorded power interruptions every month.
By implementing their own cogeneration system using the fuel that comes from their own factories, the reliability of the energy system of the factory is enhanced. In a study conducted by Bothwell Batidzirai[6] on the introduction of a cogeneration plant in the sugar industry in Zimbabwe to sell excess power to the grid, the analysis showed that when embedded generation was introduced into an electricity supply system, the voltage profile on the local network was improved which translate into improved quality of service to local consumers as problems of voltage fluctuations are eliminated. In addition, with properly graded protection system in place, reliability of the local system was improved as the local network can operate in island mode when there is a failure on the main grid. System losses were also reduced significantly, and in the case of Chiredzi network in Zimbabwe, a loss reduction by up to 50 % was possible.

- Additional income

In cases where a cogeneration plant can be installed to produce electricity in excess of what is required by the host facility, extra income could be generated through the sales of excess electricity to the grid. This has been shown to be the case in countries like Thailand, India and Mauritius where sugar factories have implemented cogeneration systems that generate excess electrical capacities for sale to the grid and receive revenues from electricity which account for up to the same amount as the income from the sugar business.

- Opportunity for increasing rural electrification levels

In many biomass-producing industries, a cluster of households develops due to the presence of workers in the industry and the secondary economy that emerges as a result of this settlement. The added capacity from cogeneration could be used to electrify the villages and rural community surrounding the industry hosting the cogeneration system. Mumias Sugar factory, for instance has electrified the houses of its workers from the cogeneration system in the factory. The marginal efforts and investments in doing this is not significantly high compared to the social and economic benefits it provides to the community.

- Reduction of transmission and distribution losses

When a centralized pure power generation is implemented and electricity is distributed to the users in different parts of the country, losses of the power generated are incurred. These losses go as high as 20 % in some of the participating countries in this Project,[7] emphasizing the need for embedded generation such as Cogen.
In Africa, most sugar factories are found at the edge of the country's grid thus requiring an extensive transmission and distribution system. The introduction of embedded cogeneration facilities would significantly improve the power flow in these areas while reducing losses and costs associated with transmission of power from far-away centralized systems.

- Less burden for the national government in electricity generation investment

Because of the need to provide additional capacity for the growing demand for power, and the competing demands for the limited public financial resources, governments in the region have started to turn to the private sector for investments in new power generating capacities. The implementation of new cogeneration plants by the industries both for their own energy requirements and sales of excess power to the national grid, reduces the burden for the national government to invest in capital intensive additional power generating capacities. Moreover, the high costs associated with transmission and distribution networks are avoided.

- Environmental benefits

In general, cogeneration systems with simultaneous production of electricity and thermal energy systems saves fuel energy compared to separate production of electricity and thermal energy. This is caused by the higher overall efficiency, assuming that the cogeneration systems are designed and operated properly and that the thermal energy generation is utilized. The energy consumption is also lower because the losses in the electricity transfer system is minimal for cogeneration plants located close to the demand of electricity compared to electricity production in

[6] Batidzirai, Bothwell, "Cogeneration in Zimbabwe – A Utility Perspective", AFREPREN Occasional Paper No. 19, 2002.
[7] For instance, overall system losses in the following countries are: Malawi: 19%, Tanzania: 22%, Swaziland: 16%.

centralized power systems by utilities and transmitting/distributing via the grid. The reduction in energy consumption in most cases leads to lower emissions of gasses and particulate matters harmful to the environment.

1.3 Potential Role of Cogen in the Region's Electricity Industry

The countries in Africa, and particularly those that are participating in the Cogen for Africa Project have much lower per capita electricity consumption compared to other developing nations in other regions (please see Table 1.5). As these countries grow in economic development and also grow in population, it is expected that high demand (or high suppressed demand) in electricity would need an increase in generating capacity.

Although current sources indicate that hydro power supplies a significant portion of the electricity consumption, this resource could face limitations in the future. Already, because of on-going droughts, the water level of Lake Victoria which is the source of water used by hydro power stations in Uganda, has dropped which caused power production in some hydro plants to fall by nearly half prompting utilities to draw power from more expensive fossil-fuelled Independent Power Producers (IPPs)[8]. In addition, there is a need to meet an increase in demand due to increase electrification and also due to improved quality of life requiring additional electricity generation capacity.

Considering the potential that electricity from cogeneration plants could provide using indigenous and even renewable fuel and using investments coming from the private sector, it is obvious that the financial burden to the governments and environmental burden to the global environment could be reduced.

Table 1.5: Electricity supply and demand scenario in the seven countries involved (20034 figures)[9]

Countries	**Population (mil.)**	**Installed capacity (MW)**	**Electricity production (GWh)**					**Elect. consumption per capita (kWh)**
			Total (GWh)	**By source**				
				Fossil Thermal	**Hydro**	**Geo-thermal**	**Other (renewables)**	
Ethiopia	68.6	726	1812*	17	1790	-	5	20.6*
Kenya	31.9	1,143	4563	1431	2574	480	78+	119
Malawi	11	238	1177	81	1096	-	-	88.2
Sudan	33.5	755	3165	1649	1516	-	-	87.8
Swaziland	1.1	128	395	202	193	-	-	1,066
Tanzania	35.9	881	2770*	144	2573	-	53	55.8*
Uganda	25.3	303	1756	12	1744	-	-	55.4
TOTAL	**207.3**	**4,174**	**15,638**	**3,536**	**11,486**	**480**	**136**	**-**

Source: World Bank, 2005; CIA World Factsheet 2005; AFREPREN, 2005; African Energy 2005.
*2001 data. More recent estimates indicate the Installed Capacity as 1088MW, and the per capita electricity consumption at 84kWh ;
+ Natural gas and wind

In Annex L, a review of the electricity supply industry of the participating countries is conducted with the aim of analyzing the usefulness and applicability of implementing cogeneration systems to supply the additional power requirements in these countries. Below, brief analyses of some countries show the potential role of cogeneration in the countries' electricity industry.

Kenya currently has a total installed capacity of 1155 MW, consisting of hydropower at 677.3 MW (58.6 %), followed by thermal at 349.3 MW (30.2 %), geothermal at 128 MW (11 %) and wind at 0.4 MW (0.03 %).

For a long time, the power sector in Kenya was dominated by a vertically integrated power utility, the Kenya Power and Lighting Company (KPLC), which was the dominant player in the generation, transmission and distribution of power in the country.[10] With the enactment of the Electricity Act of 1997, the generation segment was liberalized allowing the participation of Independent Power Producers (IPPs). These IPPs have installed mainly diesel power plants (284.5 MW out of the total 348.5 MW between 1997 to 2001), resulting in high tariffs at an average of 11.25 Kshs/kWh (0.16 USD/kWh). Table 1.6 presents the summary of the most recent IPP investments.

[8] Daily News, November, 15, 2003; Daily Nation, January 19, 2006, Kenya; The East African News, January 23-29, 2006.
[9] Incorporated updated installed capacity based on new data and information received after Council approval.
[10] Mbuthi, P. and Yuko, D., A Review of Geothermal and Cogeneration Technologies in Kenya, in Sustainable Energy in Africa, AFREPREN/FWD, 2005.

Table 1.6: Summary of IPP investments in Kenya

Company Name	Project Location	Project type	Project capacity (MW)	Investment (US$ million)	Completion Date
IberAfrica	Nairobi	**Diesel** plant	44	N/a	1997
IberAfrica	Nairobi	**Diesel** plant	12	13	October 2000
Westmont Power	Mombasa	**Diesel** plant, barge-mounted	43.5	N/a	1997
Ormat International	Olkaria	Geothermal Plant	64	210	12 MW by Nov. 2000, 52 MW by July 2003
BWSC (in full)	Lanet	**Diesel** Plant	55	65	July 2001
BWSC (in full)	Eldoret	**Diesel** Plant	55	65	July 2001
Tsavo Power Co.	Kipevu	**Diesel** Plant	75	85	July 2001

Source: Marandu, E., and Kayo, D., 2004

The use of thermal fossil power plants will continue to dominate the future capacity additions in the country's electricity supply industry, as evidenced by the Least Cost Power Development Plan (PDP) issued by the Ministry of Energy. As shown in the Table 1.7, it is planned that up to 2016, 1,123 MW of power capacity (consisting of 67.5 % of total capacity additions) will come from thermal power plants mainly fuelled by coal and diesel.

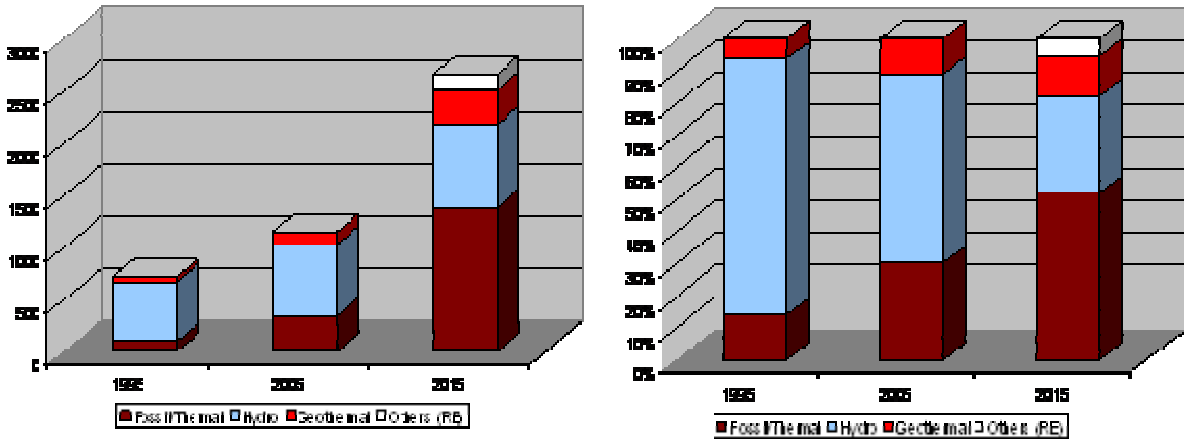
Table 1.7: Power Development Plan for Kenya (2006-2016), in MW

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, 2005

Figure 1.3 shows the trend in power source mix for the years 1995, 2005 and 2015. The 2015 figures were calculated from Least Cost Power Development Plan (PDP) issued by the Ministry of Energy. Considering the current per capita electricity consumption of 121 kWh, and the population's access to electricity at the national level of 15 %, there is significant room for the capacity and demand to increase in the future.

Figure 1.3: Kenya's installed generating capacities in 1995, 2005 and 2015 in MWe (left) and in percentage of mix (right)



Source: Data from PDP of Ministry of Energy, 2005

With the trend of increased fossil fuel power plants in the future, the prices of electricity is set to go higher especially in the backdrop of the insecurity linked to fluctuating world oil prices. On the environmental point of view, this certainly leads to more emissions of harmful Greenhouse Gasses.

If the sugar companies and other developers of cogeneration are given the right incentives to exploit the residues generated by the industries to implement additional capacities in order to sell excess power to the grid, cogeneration plants using bagasse and other biomass could partially replace the planned thermal plants using fossil fuel.

Although it is not reflected in the PDP, the Government of Kenya recognizes the potential role of cogeneration in supplying the growing electricity requirements of the country. In Sessional Paper No.4 of 2004 on Energy and Ministry of Energy's Strategic Plan (2004-2009), the Government undertakes to promote the exploitation and expansion of existing cogeneration capacity in order to improve the diversity of national power supply and save foreign exchange currently used to import fossil fuels for generation of power. This undertaking has further been strengthened by the current trend of escalating fuel prices in the world market hence the government's greater resolve to assist cogenerators and other independent power producers (IPPs) to secure favorable bulk electricity tariffs and supply related terms. In particular the government intends to:[11]

- Undertake appropriate studies on cogeneration
- Assess bagasse-based cogeneration potential and use the Least Cost Power Development (LCPD) criteria to implement identified projects.
- Launch medium term bagasse-based cogeneration investment programme

However, until now, there are insufficient incentives given to project owners/developers to implement efficient and high capacity cogeneration systems. The proposed Cogen for Africa Project is expected to assist in helping the government and the private sector in creating the right stimuli and transforming the market conditions so that the aforementioned plans to promote a major cogeneration industry are realized.

On the industry front, developments indicate that this project's objectives of promoting high pressure cogeneration systems could match well with the activities and plans of the sugar industry. A recent survey and round of discussions with the sugar factories for the preparation of this PDF-B indicated that all the factories have rolled out plans to scale up their sugar crushing capacities as well as incorporate cogeneration, first to ensure power self-sufficiency as well as export to the national grid. For example, SONY Sugar Company has a two-phased programme to increase crushing capacity from 3,000 tons of cane per day to 6,500 and as a result inject 26 MW of electricity to the national grid in the first phase. In the second phase, the company has planned to increase the crushing capacity to 8,000 tons and subsequently be able to export 36 MW to the grid.

In addition to the existing factories that have plans for expansion, Busia Sugar Company which currently owns their own sugar cane plantation and manages around 8,000 farmers (with a plan to increase to 30,000 farmers) is in the advanced stages of establishing a sugar factory with a capacity of 4,200 tons of cane per day. This company plans to incorporate a cogeneration unit with a capacity of 20 MW in the initial phase, if the viability of the project could be ascertained.

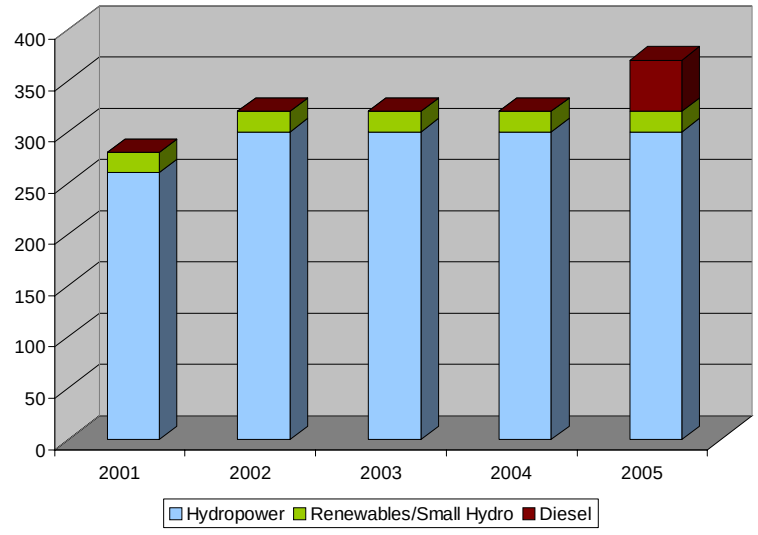
[11] (Government of Kenya, 2004, 2005)

It is known that in Kenya, about six million inhabitants are directly or indirectly dependent in the sugar industry. With the increased competition due to low sugar prices from other countries and the planned rationalization in the Kenyan sugar industries, cogeneration is a potential important contributor to the competitiveness of sugar sector in Kenya.
It should be noted that Kenya has other agro-industrial residues - an estimated amount of 2.7 million tons annually (Ministry of Energy as cited by Yuko, et. al., 2005) - that could be exploited for cogeneration. Details of their locations and achievable potential could be investigated further during the Project implementation.
Other national and social goals that are met by implementing cogeneration from bagasse and other biomass include:

- The power sector will benefit from additional generation of power from an indigenous source with a price regime that is more stable than oil.
- The energy will replace more expensive imported fossil fuel generation.
- The excess electricity sold to the national grid will improve the revenues and profitability of the sugar factories.
- Farmers will benefit from higher payments for their cane. In addition, they may be able to sell the cane trash for power generation, further increasing their revenues.
- It is expected that this chain of activities will result in more income and jobs (cogeneration could stimulate increased cane acreage) for the 6 million Kenyans directly or indirectly dependent on the sugar sector, and a general reduction in poverty levels.

By creating added value to the sugar cane and particularly to the bagasse and other biomass which are traditionally burned inefficiently or disposed in landfills, numerous commercial, economic, environmental and social benefits would be realized that would enhance national, industrial and individual well being.
In Uganda, most of the electricity is generated by hydropower stations. The country is estimated to have a total hydropower potential of about 2,700 MW along the Nile River and a further 50 to 100 MW of mini and micro hydropower elsewhere in the country. Out of these, 320 MW of hydropower has been exploited and installed, with 300 MW coming from large hydro plants of Kiira and Nalubale, as can be seen in Figure 1.4 which shows the trend of the installed generating capacity of the grid in Uganda between 2001 to 2005.
However, prolonged drought for the past years as well as other factors[12] has resulted in a drop in the Lake Victoria by about 2 meters according to several sources which reduced the effective generation capacity of the Kiira and Nalubale hydropower plants to as low as 190 MW. With a current peak demand estimated at about 330 MW, there is still a deficit of about 100 MW of electricity for the country. This has prompted the government to introduce power rationing and daytime load shedding.

Figure 1.4: Installed generating capacity grid mix (in MWe), Uganda



Source: Data from the Ministry of Energy and Minerals Development, Uganda

Recently, an emergency diesel thermal power plant with a capacity of 50 MW was procured to reduce the power shortage. It is therefore expected that Uganda will implement additional emergency fossil-fuelled thermal power plants which could become a baseline power supply (in the short to medium term) especially if the planned two large

[12] The Daily Nation, Kenya, January 19, 2006, reported that according to a Tanzanian hydrologist Dr. Raymond Mgodo, the drop in Lake Victoria's level can be attributed to 3 factors: low rainfall, reduced in-flows from rivers and increased outflow into the Nile River due to increased power generation by Uganda.

hydropower stations (i.e. Bujagali and Karuma) do not materialize. Table 1.8 shows the projected demand and sources of power for Uganda.

Table 1.8: Projected demand and supply of power, Uganda (in MW)

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

It is therefore fitting that the government should look to other options, such as cogeneration, to meet the shortfall which can only be met on a short term by emergency thermal plants owing to the uncertainty and long development and construction time of large hydropower plants.

The sugar industry of Uganda offers potential for generating excess power from the residues produced by the factories that, if tapped, could augment the electricity needs of the country and partially replace the emergency and other thermal power plants that are planned to be built as indicted in Table 1.8 above.

There are currently three sugar factories in Uganda with installed cogeneration facilities using low pressure systems totaling 10 MW. However, if they implement high pressure cogeneration systems the total potential that could be generated from these three factories could range from around 18 to 38 MW depending on the boiler steam pressure used.

These three sugar factories are upbeat on the prospects of the sugar sector and have plans for expansion in their capacities, which in turn further increases the power capacity that could be potentially implemented from this industry. Moreover, an old factory, the Sango Bay Sugar Factory is under rehabilitation and is expected to start production in 2007. Table 1.9 gives the capacities of the factories once the planned expansion/rehabilitation is completed.

Table 1.9: Planned expansion of sugar factories in Uganda

Company	**Planned through put (TCH)**	**Completion date**
Kakira	200	2008
Scoul	130	2008
Kinyara	140	2007
Sango Bay	25	2007

Source: Discussions with factory owners

Uganda is also endowed with other indigenous resources that could be used as fuel for cogeneration. According to the National Biomass Energy Demand and Supply Strategy Study (2001), the total amount of crop residues left after harvesting or processing of crops amount yearly to roughly 11 million tons. These include residues from sugarcane, banana, maize, sorghum, beans, coffee groundnuts, rice and Soya beans. Of course, not all of these residues could be utilized as many of them remain in the field or are scattered throughout the country and need to be gathered and

transported which could make the cogeneration unviable. However, some products such as rice and coffee (other than sugarcane) are centrally processed and therefore present a potential for their residues to be utilized in cogeneration plants. One big industry processing rice in Uganda is the Tilda Uganda Ltd. whish has a production capacity of 250,000 tons per year. The potential of implementing a cogeneration plant using rice husks produced from this factory and those nearby could be investigated during the implementation stage of this Project.

There are some developments in the Ugandan energy sector that are seen to help in making the environment more encouraging to for private sector developers to invest in new cogeneration projects. In 1999, the Government of Uganda enacted the Electricity Act which removed the monopoly of the state utility, the Uganda Electricity Board (UEB) and allowed the introduction of other players into the sector, hence paving the way for independent generation and entry of Independent Power Producers (IPPs). The Act also provides for the establishment of the Electricity Regulatory Authority (ERA) to regulate the sector. The government has issued concessions for generation and distribution and is in the process of providing the same for transmission networks to increase the role of the private sector. A rural electrification fund which could provide subsidies for capital investments of rural electrification projects has also been established.

In 2001, a 10-year Energy for Rural Transformation (ERT) project was implemented by the World Bank and the Government of Uganda. It aims to develop rural energy and information technology so that they make a significant contribution to bringing about rural transformation. Strong emphasis is placed on the promotion of solar/PV systems, although other systems such as small/micro-hydro and cogeneration will also be supported through the renewable energy power generation component.

Through the above frameworks, the sugar industry was encouraged to sell any excess electricity to the grid. Notably, Kakira Sugar Works has used a WB/GEF capital investment subsidy and a loan provided by the East African Development Bank under the ERT Refinance Facility. It will allow the company to sell 12 MW of electricity to the grid for 18 hours a day. The Sugar Corporation of Uganda Ltd. (SCOUL) also hopes to secure similar support for its new generating capacity and sell around 2.0 MW of electricity to the grid.

Although this is a step further than what they have at the moment, it should be noted that Kakira has chosen to implement a 45-bar boiler steam pressure and SCOUL has opted for a 32-bar boiler steam pressure and a back-pressure turbine, which are lower compared to what can be potentially implemented. Kakira and Scoul have mentioned high capital expenditure, lack of local expertise and absence of an attractive tariff to make the high pressure system viable as the main reasons for not going into the more efficient cogeneration system (Please see Box 3.2 for more information on Kakira).

Uganda is the least electrified country in East Africa, with only 5 % of its population having access to electricity and less than 1 % of the rural population. The country has an electricity consumption per capita of around 55 kWh. Some of the sugar factories in Uganda are near the end of the grid. Kinyara for example is located in the Masindi area, near the North-West border of the country. Being at the edge of the power system, the grid in the area is weak due to long transmission distances. If the factory supplies electricity to the grid, it will make more electricity available to the locality and will help reinforce the low (33kV and 11 kV) voltage lines thus strengthening and stabilizing the national grid.

The investment in cogeneration systems by the private sector to supply power to the grid could also have a benefit in reducing the debt burden of the country in implementing large conventional power stations through foreign loans (see Table 1.10 below). Large scale power projects are normally implemented by the government with debt financing coming from foreign/multi-lateral institutions. By replacing some of the capacities required for conventional power generation with cogeneration projects that are implemented by the private sector which provide the equity and take up the loans for their projects, the country's debt burden could be reduced.

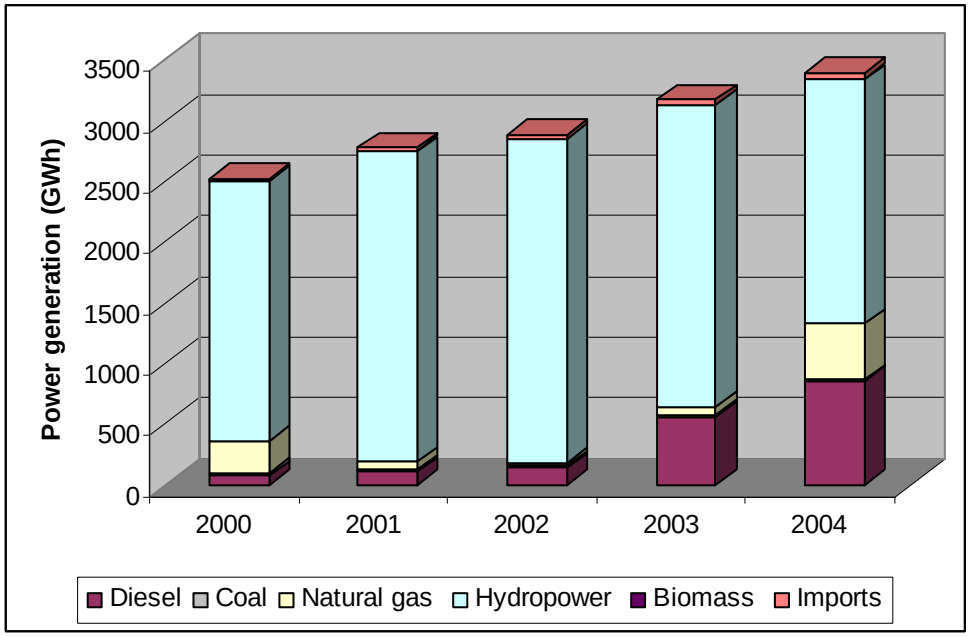
Table 1.10: Projected energy sector loans and total energy sector loans as proportion of total debt burden

Project energy investment	**Project costs (US$)**
Bujagali Hydropower project	580,000,000
Karuma Hydropower project	300,000,000
Rukiga Power extension project	150,000,000
Owen Falls extension project	230,000,000
Power II (Old Owen falls Dam)	28,800,000
Total project investment in conventional energy projects in Uganda	1,288,800,000
Uganda's estimated current debt burden	4,000,000,000
Proportion of conventional energy sector loans	32.22%

Source: Kamese and Engorait, 2005

Tanzania's peak electricity demand is currently about 510 MW with annual energy generation of about 3,000 GWh. The reported demand is suppressed in order to save the national grid from a total collapse, as back up thermal capacity is far less than sufficient to meet peak demand. The trend of energy consumption in Tanzania shows a rapid growth, of about 10% annually, which is attributed to population growth and increase in economic activities. The approach to electricity generation has been to run the hydropower system at near-full generating capacity during rainy season and to reduce hydropower generation during dry season. The hydropower stations supply about 55% of the installed capacity (1018 MW) whereas the remaining quantity is supplied by thermal power plants and imports (8 MW form Republic of Uganda and 5 MW from Republic of Zambia). Furthermore, 182 MW is generated from natural gas and an insignificant amount from coal and biomass. During the recent years, electricity generation from diesel has been increasing as shown in Table 1.9 below.

Figure 1.5: Power generation mix by fuel in Tanzania (2000-2004)



Source: AFREPREN, 2005

Electricity supply in Tanzania consists of both the national interconnected grid and isolated distribution systems. The electricity sub-sector is still dominated by the state-owned utility, Tanzania Electric Supply Company Ltd (TANESCO), which is responsible for about 98% of the electricity supply. TANESCO's distribution network serves about 400,000 customers most of whom are supplied by the national grid. As such, electrification level is still marginal leading to low per capita electricity consumption of about 84 kWh. Extension of the distribution network is hampered by the historical poor financial performance of the utility.

Tanzania's power is undergoing sectoral reforms that aim at accelerating its capacity of meeting the challenges of electrification. The reforms are therefore expected to bring about regulation and control, modernization, and meeting energy conservation and efficiency including the emerging environmental legislations. These reforms are meant to address barriers to electrification and investments in the sector.

Cogeneration in Tanzania exists in sugar-processing factories, in a wattle processing plant, and in a saw mill. Tanganyika Wattle Company (TANWAT) located in Iringa region operates a cogeneration plant which is being fired by wood logs and spent wattle barks. Moreover, Kilombero Sugar Company (KSC) located in Morogoro region, Mtibwa Sugar Estate also located in Morogoro region, Kagera Sugar Company in Kagera region and Tanganyika Planting Company (TPC) of Kilimanjaro are utilizing bagasse in their cogeneration plants. Saohill Saw Mill, located in Iringa region, owns a cogeneration plant using saw mill waste as fuel.

KSC has recently signed a contract with TANESCO to deliver 2 MW of electricity into the national grid during the crushing season. Although Mtibwa Sugar Estate generates a total of 10 GWh of electricity during production season, still imports about 4.0 GWh annually from TANESCO for irrigation and domestic purposes. There are plans to expand the capacity of the factory from the current 90 tonnes of sugar per hour to 250 – 300 tonnes of sugar per hour which could allow the factory to implement up to 30 MW cogeneration capacity and sell excess power to the grid.

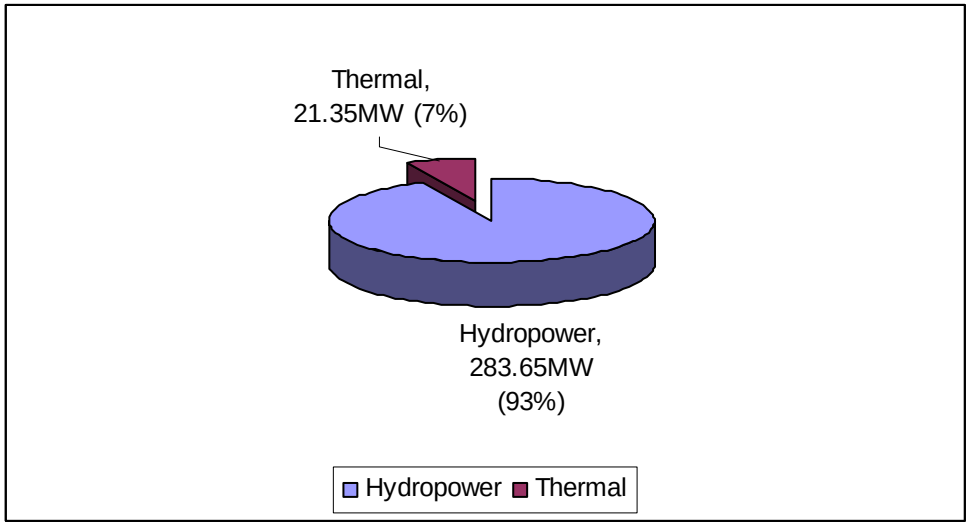
Power generation at TPC is through two back-pressure turbo alternators rated at 3 MW and 2.5 MW respectively. The generated power cannot supply all operations at the estate. The irrigation activities and part of the estate houses are therefore powered by electricity imported from TANESCO. Annual electricity produced by cogeneration amounts to 11.2 GWh, whereas 18.7 GWh is imported electricity. TPC plans to increase the cane-crushing rate of the factory from the existing 130 TCH to 200 TCH, giving the company an opportunity to implement a higher capacity

cogeneration system. Cogeneration at Kagera Sugar Company is done through two steam turbines rated 2.5 MW. There is a potential for the extra power to be used for electrifying nearby villages, as the national electricity grid is yet to reach Kagera region.
Currently, Saohill Saw mill's steam engine generates 1 MW electrical power for internal use. The cogeneration plant in TANWAT has an installed capacity of 2.5 MW, out of which about 35% is exported to the TANESCO isolated grid at Njombe. The sales of power to third parties are at 8.5 to 11 US¢ per kWh. TANWAT has plans to build a second power plant with a capacity of 15 MW. The plan would be implemented if TANESCO accepts to sign a ten-year contract for a feed-in tariff of at least 7.0 to 7.5 US¢ per kWh.
The following observations can be drawn from the experience in Tanzania:

- The cogeneration systems in Tanzania use mainly low-pressure boilers and back-pressure turbines with a few condensing turbines.
- There is a large potential to increase the efficiency of the systems currently installed in Tanzania by adopting advanced high-pressure systems.
- By utilizing the abundantly available raw materials, the electricity to be produced from these biomass cogeneration plants has an opportunity of improving the Tanzania's low level of electrification in a more environmentally friendly manner.
- The cogeneration plant owners have shown the need to expand their biomass cogeneration systems with a possibility of becoming IPPs.
- Regulatory framework need to be put in place for increasing private sector participation in energy generation, transmission and distribution.

Malawi's Electricity Supply Industry (ESI) generates power for the grid mainly by hydro and thermal (largely diesel and gas based) systems (see Figure 1.6). Photovoltaic (PV) systems are used in modular form for telecommunications, lighting and water pumping in rural areas where there is no grid power. Moreover, a significant number of commercial and industrial enterprises have installed their own bagasse, diesel and petrol driven generators.

Figure 1.6: Grid power generation in Malawi (2004)



Source: Mhango, 2005

The commercial electricity supply industry is dominated by a publicly owned and vertically integrated power utility, the Electricity Supply Corporation of Malawi (ESCOM) Ltd., which was established by an Act of Parliament in 1957 (revised 1963, 1998 and 2003). In 2004, ESCOM's total installed capacity was estimated at 305 MW. Of this, approximately 284MW (93%) is generated by hydropower and the remaining 21 MW (7%) is thermal plants. Except for a small mini-hydro plant at Wovwe (4.5 MW) in Karonga, all ESCOM's hydroelectric generation capacity is located along the Shire River, the main natural outlet for Lake Malawi. This makes Malawi's power generation system very vulnerable to the considerable variations in the lake's levels and, hence, flow rates on the Shire.
Access to electricity in Malawi (at 7%) is very low and demand is highly skewed in favor of industrial and large commercial customers who consume approximately 60% of the total electricity production. Domestic users account for around 25%, while the remaining 15% goes to small commercial consumers. Demand has been growing at between 6% and 8% a year.
The ESI in Malawi has, in recent years, failed to provide the quality of service demanded by consumers. Power outages are frequent and impose severe costs on consumers and on the economy. Industrial and other consumers have increasingly been installing their own generators and cogeneration systems. Some of these responses are unlikely to

have been least cost investments from the national point of view. The approved new National Energy Policy for Malawi has addressed these and other issues.

For example, in the short to medium term, the new policy has outlined reforms to the ESI by restructuring the market and promoting private sector participation. Reforms are aimed at changing the market structure by unbundling the vertically integrated industry into generation, transmission and distribution markets niches.

In order to realise these goals, the energy policy has set a number of objectives for the ESI reforms. The most important ones relevant to cogeneration projects are as follows:

- increase the sector's technical and economic efficiency;
- make the sector financially viable and, in the short term, minimise the subsidies required from GoM's budget and, in the longer term, make ESI a net contributor to that budget;
- improve the reliability and quality of electricity supply;
- attract private capital and participation;
- increase capacity to meet growing demand; and
- meet the growing demand for electricity at least cost.

These objectives mean that the Electricity Supply Industry in Malawi intends to create a level playing field which would enable the private sector to participate in the power supply including cogeneration.

Currently there are two sugar factories in the country. These are the Dwangwa and Nchalo sugar factories. Their combined annual production of bagasse is 60,000 tons. Almost all of the bagasse generated goes to cogeneration systems for the factories' own use.

The Sugar plantation in Dwangwa near Nkhotakota District in the Central Region of Malawi is located about 200 kilometers Southeast of the Capital Lilongwe. It has an installed power cogeneration capacity of 7 MW. The plant can sometimes produce only up to 6 MW during the low season of sugar cane crashing. The sugar factory consumes 3.5 MW while the water pumping activity for cane irrigation consumes 1.5 MW. All staff houses use a total of 1.5 MW. The factory imports up to 1 MW from ESCOM.

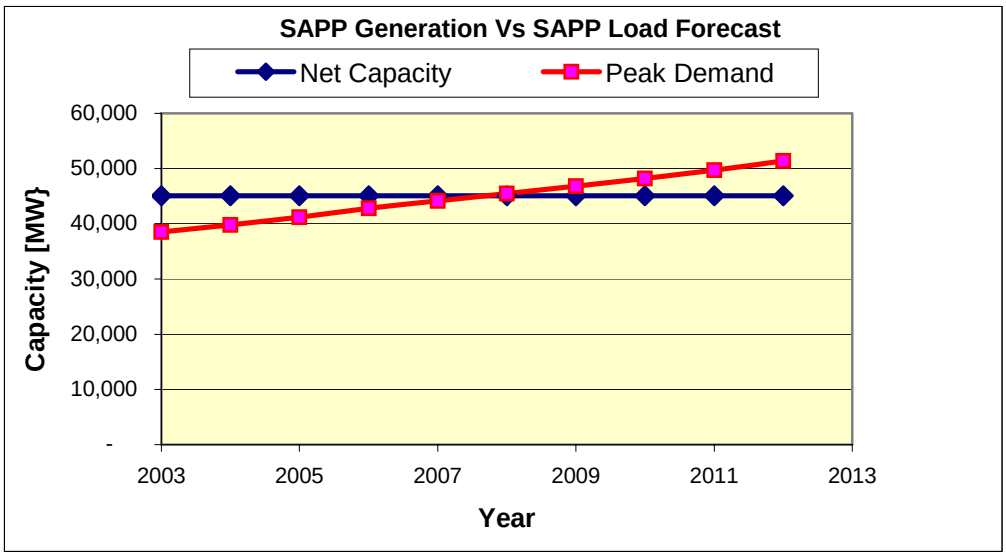
The other sugar plantation is located at Ntchalo about 150 kilometers south of Blantyre, the commercial city of Malawi. Here the installed capacity is 11.5 MW. However because the sugar plant is bigger, the maximum power demand for the whole establishment is 20 MW, which necessitates the sugar company to import up to 9.5 MW from ESCOM.

There are plans to implement highly efficient cogeneration systems in these factories to cover the energy requirements of the factories and sell excess power to the grid.

Currently, Malawi is experiencing a power shortage which has reached a critical stage due to the fact that the Shire River where all the major hydropower generation plants are located, is experiencing environmental degradation. Options that are available to Malawi include increasing the capacity of the existing cogeneration plants and putting up more new ones, coal fired power generation, diesel fired power generation or the more unpredictable hydropower generation.

Others argue that perhaps Malawi should go for the interconnection of its power to its neighboring countries. Unfortunately, while interconnection would likely to be the long run solution to the country's power problems, it should be considered that the whole of the SADC region under the Southern African Power Pool (SAPP) could face shortage of power generation capacity by the year 2007 (see Figure xx). This leaves cogeneration as a very strong contender for the country to increase its power generation capacity without jeopardizing the sustainability of its environment.

Figure 1.7: SAPP generation vs. SAPP load forecast



Source: SADC- SAPP Planning Data

The above trends in the four countries are also happening in other countries in the region. The current electricity sources are being strained and increases thermal power generation using fossil fuel are ongoing or are planned. Implementing cogeneration systems with excess capacity available for sales to the grid would fully or partially replace the installation of the planned thermal plants in these countries.

1.4 Successful Examples and Models

Successful examples of cogeneration systems abound in other countries within the region and other regions of the developing world. In the islands of La Reunion and Mauritius, cogeneration has been successfully introduced and utilized. In Mauritius, cogeneration facilities fuelled primarily by bagasse which is generated extensively by the sugar industry, now covers around 40 % of the total electricity demand of the entire nation A typical sugar factory in Mauritius which has implemented a high pressure cogeneration system and sells electricity to the grid earns revenues equivalent to or more than the revenues it receives from the sales of sugar. A WB-GEF intervention a decade ago was instrumental in bringing about the shift to cogeneration and as such may provide valuable lessons for the introduction of Cogen facilities to other African nations, particularly for those with similar, sizeable sugar industries. Annex R describes the cogeneration developments in Mauritius and prospects for the African continent.
Another example that provides valuable information and cases of successfully implemented and operated Cogen systems is in Southeast Asia. Around fourteen years ago, a Cogen Program funded by the European Commission and based at the Asian Institute of Technology (AIT) in Bangkok was set into motion. The program focused initially on Indonesia, Malaysia, the Philippines and Thailand and later included other additional member states of the Association of South East Asian Nations (ASEAN) namely, Brunei, Cambodia, Laos, Singapore and Vietnam. During the second phase (Cogen 2), the program realized cogeneration projects amounting to around 30 MW_e and 354 MW_{th} of installations. With a financial support from the European Commission amounting to 5.5 M €, private sector investments of around 60 M € in Cogen projects were realized. The third phase of the Program (Cogen 3) which started in January 2002, lasted for three years and ended in December 2004. During this period, the Programme has directly assisted the implementation of a total of close to 150 MW in the form of full-scale demonstration projects, while promotional efforts, policy intervention, and techno-economic and financial advice were provided to other projects that led to the realization and replication of additional cogeneration capacities in the region, bringing the impact of the Programme to around 600 MW. The concept of a Cogen Center and associated Country Offices, the manner in which technical assistance is provided, the way financial incentives are provided through promotional projects are all relevant in the formulation of this Cogen for Africa initiative. Additional information on the EC-ASEAN Cogen Programme and some relevant projects implemented through its support are provided in Annex Q.

2. COUNTRY OWNERSHIP

Cogeneration is relevant for most nations in Africa. However, starting a continent-wide cogeneration program would be very likely too complex and poses tremendous challenge in coordination. For an initial phase, it is proposed that the project concentrate on a selection of interested countries in Eastern and Southern Africa that possess certain features favorable to the implementation of the project namely, anticipated sizable potential for cogeneration, interest in cogeneration project development and private sector participation, national (business) language and prevailing peace and order situation. The countries that have been initially selected are:

- Ethiopia;
- Kenya;
- Malawi;
- Sudan;
- Swaziland;
- Tanzania; and
- Uganda

The island state of Mauritius could be a source of expertise in project development and management, financing and PPA negotiations. The Republic of South Africa (RSA) could provide the technology needed and could also be a source of project funds and technical expertise. For this particular Project, both countries do not feature in terms of directly gaining from GEF funds but are expected to be important sources of technical and financial support.

2.1 Country Eligibility

As a pre-requisite, all of the pre-selected countries are a signatory of the United Nations Framework Convention on Climate Change (UNFCCC). In the Cogen for Africa project all countries that are participating have signed and ratified the convention. The summary below provides an overview of the countries and their eligibility:

Table 2.1: UNFCCC ratifications

Country	Date of signature	Date of ratification
Ethiopia	10 June 1992	05 April 1994
Kenya	12 June 1992	30/August 1994
Malawi	10 June 1992	21 April 1994
Sudan	9 June 1992	19 November 1993
Swaziland	12 June 1992	07 October 1996
Tanzania	12 June 1992	17 April 1996
Uganda	13 June 1992	08 September 1993

2.2 Country Drivenness

A brief inventory of policies and measures supporting Cogen as they exist in individual countries in the region is given for all the seven countries considered. These policies either mention cogeneration or biomass energy explicitly or are indirectly referred to through supporting measures to promote renewables or to promote Independent Power Production (IPP) as a way of increasing national power generation to meet the increasing demand in these countries.

Table 2.2: Inventory of policies supporting cogeneration in the seven participating countries

Country	Reference	Paragraph/article supporting or mentioning cogeneration
Ethiopia	Energy Policy of the Transitional Government of Ethiopia	*The policy indirectly supports cogeneration in agro-industries. "Wherever possible, energy demand in the agricultural sector will be met through locally-produced modern energy resources"*

	Extract from AFREPREN/FWD's Occasional Paper 24	*"The Agriculture Development Led Industrialization (ADLI) strategy makes agricultural development as the corner stone and engine for all programs on sustainable development in Ethiopia. Included in the plan are poverty alleviation and multi-sectoral socio-economic developments in both rural and urban settlements. Although not fully considered and integrated in the original formulation of the strategy, it is now being recognized that energy is a necessary input for all development activities. In this context, therefore, since biomass-based **cogeneration** is the result of agro-industrial development, its optimum and efficient uses should be viewed positively in many respects. In addition, it is important to first appreciate the potential merits and demerits that are likely to be associated with co-generation in Ethiopia."*
	National Communication	*"The policy document stipulates that alternative energy sources and technologies shall be developed to meet increasing demand and encouraged and supports adoption of renewable energy technologies. It also encourages and support rational and use of modern fuels and, introduction of energy conservation and energy saving measures in all sectors. The national energy policy also clearly states that development and use of energy resources shall give due consideration to the protection of the environment"*
Kenya	Energy Bill, Section 4.7[13]	*"**Cogeneration** using bagasse as a primary fuel is a practice in the domestic sugar industry in Kenya. The industry comprising seven sugar companies produces an average of 1.8 million tonnes of bagasse with fiber contents of about 18 % by weight annually. Out of this quantity, 56 % was used in co-generation using an installed capacity of 25 MW and the balance disposed at a cost. Mumias is the only sugar company among the seven that is self-sufficient in electricity production and has the capacity to export its surplus to the national grid. Despite having adequate generating capacity to meet their respective standards and surplus for export, the other six companies are net importers of electricity from the grid. These companies are being restructured with a view to improving their financial performance to enable them, among other things, be self reliant in electricity generation with surplus capacity for export to the grid at competitive prices. In addition and given that Kenya is a net importer of sugar there are plans to expand the existing factories to make the country self-sufficient and produce surplus for export, these new developments will provide opportunities for increased **cogeneration** and reduce reliance on oil fired electricity generation".*
	Section 6.3.2	*"Promote cogeneration….in the sugar industry and other commercial establishments where opportunities exist";* *"Undertake appropriate studies on co-generation"*
	Draft of "Kenya's Climate Change Technology Needs and Needs Assessment Report" (3rd Draft, June 2004)	*The Ministry of Environment and Natural Resources identify **bagasse** as a renewable fuel mentioned under Electrical Power Generation Technologies. Under Technology Needs, cogeneration is mentioned as a key option, i.e.: "There is a need to support factories in the adoption of cogeneration".*
Malawi	National Energy Policy Document of 2003	*Cogeneration (of biomass) is indirectly mentioned under Section 4.3:* *"About 8 % of all energy and 12 % of commercial energy is used by the agricultural and natural resources sector. Nearly 60 % of the solid fuel used in this sector comes from biomass residues (cotton seed husks, **bagasse**, saw dust, rice husks etc.); 25 % is fuelwood and the remaining 15 % is coal. Agro-industrial production of most export crops, such as tobacco and tea, relies almost exclusively on fuelwood. This sector also accounts for just over 20 % of fuelwood usage, second only to households. Agriculture is pursued both commercially and for subsistence".* *In Section 4.3.3 Energy Production through Agriculture is mentioned: "Although the agricultural sector consumes relatively little energy, its contribution to the supply of biomass is crucial. Many agricultural, forestry and agro-forestry products, by-products and residues can serve as raw materials for processing into modern bio-fuels, suitable for the operation of fuel-driven technologies at high efficiencies. Bio-fuels include briquettes, biogas, gel fuel and ethanol. The Dwangwa and Nchalo sugar plantations' production of waste materials in the form of bagasse and molasses is 60,000 and 90,000 tons respectively. Some of the bagasse goes to thermal power generation for the producer's own use. Nearly two-thirds of the molasses are converted into ethanol fuel at the 18 million-liter ethanol plant in Dwangwa. Ethanol can also be produced from starchy materials such as cassava, potatoes, maize, cane sugar etc. Further down the chain, the production of ethanol produces a waste called vinasse, which can be used in biogas production".*

[13] Energy Bill received after Council approval.

	Climate Technology Transfer and Needs Assessment (2003)	*Chapter 4 identifies biomass technology in its list of Technologies in Power Generation as one of its priorities. Furthermore, under Waste Technologies, cogeneration is specially singled out as a priority in the category of Biomass Wastes*
	National Communication	*"Sugar factories are being encouraged to go into cog-generation as a means of reducing production costs by using readily available **bagasse** to generate electricity"*
Swaziland	National Communications for the UNFCC for Swaziland, Page 12, Section 1.5 (Executive Summary/General Description of steps)	*The document mentions electricity generation through **cogeneration** by the use of high-pressure steam turbines burning **bagasse** and wood-pulp residue as input fuel.*
	Swaziland National Energy Policy (2004)	*Chapter 3.3: "The Government is called upon to improve the situation to ensure there are clear guidelines for open access to the national grid" and "The Government is further called upon to investigate and promote efficient and environmentally sound technologies for the utilization of indigenous resources of electricity production".* *Bills that will facilitate these previous statements are currently being prepared for Cabinet consideration before being discussed in the two houses of Parliament. In Chapter 3.3.7, issues concerning Independent Power Producers are addressed:* *"The Government will create an enabling environment to allow the establishment of IPPs as well as support such initiatives".* *Finally in Chapter 5.1.4: "Government wants to diversify supply and increase indigenous power generation".*
Tanzania	National Communications to the UNFCC for Tanzania, Table: 3.1: Some GHG Mitigation Options	*"Energy Efficiency Improvements: Improve efficiency in existing plants through maintenance, improved steam production and management, improvements to motor drive systems, cogeneration and power factor correction."* *"To develop indigenous sources of energy (natural gas, coal, solar, wind, geothermal, hydropower and biomass fuels) to substitute for imported petroleum products."* *"To ensure that the existing and expanded supply of energy is environmentally sustainable."*
	National Energy Policy of 2003	*The energy policy document indirectly supports biomass cogeneration:* *"Generation of electric power shall be fully open to private and public investors as independent power producers. Investment shall be based on economic and financial criteria considering open access to regional network, balanced domestic supply and environmentally impacts"* *"Promote efficient biomass conversion and end-use technologies in order to save resources….and minimising threats on climate change"*
Uganda	Energy Policy for Uganda (2002), Section 1.2.4: New and Renewable Sources of Energy Sub-sector: Biomass	*"Diversify power generation sources to ensure security of supply"* *Priority Policy Action no. 2 (strategic intervention): "Develop selected renewable energy projects e.g. Kakira sugar **cogeneration**…."*
	National Communication	*"To meet some of the objectives, Government shall employ the following strategies:* - *Promote the use of alternative sources of energy and technologies, which are environmentally friendly.* - *Promote efficient utilisation of energy resources* - *Promotion of private sector participation in the development of both conventional and renewable energy resources"*
Sudan	Renewable Energy Masterplan	*"The Rural Energy Masterplan for Sudan highlights a number of renewables that should be fast-tracked for development in Sudan, which includes **biomass cogeneration** for industries.* *To further develop this important option, it is suggested that a project of about US$ 250,000 per year, (primarily for financing of pre-feasibility studies) would be adequate to engineer a major increase in co-generation contribution to Sudan's power sector"*
	National communication	*"This mitigation measure would introduce higher-than-standard efficiency boilers for use in variety of medium to large industries, including sugar factories, edible oil, refineries, etc"*

2.3 Endorsements

Letters of endorsement from the participating countries are provided in Annex G.

3. PROGRAM AND POLICY CONFORMITY

3.1 Fit to GEF Operational Program and Strategic Priority

Cogeneration technologies support the global environmental objective of reduction of GHG emissions by promoting the use of indigenous biomass (waste) material for the generation of both power and heat in a most efficient manner. As such, it addresses the following Operational Programs in the GEF Focal Area of Climate Change:

- GEF Operational Program OP 6: "Promoting the adoption of Renewable Energy by removing barriers and reducing implementation costs". This Operational Program is the most relevant for the proposed project which will focus on the conversion of biomass residues into electric power and heat;
- GEF Operational Program OP 5: "Removal of Barriers to Energy Efficiency and Energy Conservation". This is the second relevant Operational Program. Many existing facilities that provide energy for the needs of the industries are not energy efficient. For instance, some sugar factories which could generate power enough to export twice as much as its own needs do not even generate sufficient power for their own consumption; some need to import power from the grid, as mentioned elsewhere in this document.

As regards the GEF Strategic Priorities, the program will also address each of the following identified strategies:

- CC-2: Power sector policy frameworks supportive of renewable energy and energy efficiency: Addressing legal framework issues regarding sale of excess power and addressing associated tariff concerns will enable power sales to the grid and thus set up a conducive and sustainable business environment for cogeneration.

Other additional strategic objectives include:

- SP-2 "Increased Access to Local Resources of Financing for Renewable Energy and Energy Efficiency": The project will mobilize local equity investments from sugar factories and other agro/forest industries and financing from local and regional financial institutions for investment in cogeneration and energy efficiency.
- SP-4 "Productive uses of renewable energy": The produced power will substantially meet the productive energy needs of the sugar sector and other agro/forest industries and surrounding rural productive enterprises such as maize mills and irrigation pumps.

3.2 Problem Analysis

3.2.1 Current status of cogeneration in Africa

The current use of cogeneration in the East and Southern African region is very limited. Based on available information, discussions with stakeholders and investigations conducted by the Country experts, the use of cogeneration at this time is mostly in the sugar factories. However, these systems are outmoded, inefficient and oftentimes polluting. As explained earlier, these systems have been designed to generate just enough electricity and heat for the process while consuming all the bagasse generated by the factory to avoid its accumulation and creating disposal problems. This approach makes the cogeneration system both an energy generating unit and an incineration system at the same time.

Below are details of the cogeneration status in some countries participating in this Project:

Ethiopia

In Ethiopia, cogeneration is currently utilized only in the sugar industry. The country has four sugar factories, three of which (Metahara, Shoa, Wonji) are owned by the same company. The fourth is Finchaa Sugar Factory (FSF) is located about 335 km away from Addis Ababa. Although most of these sugar factories adequately produce electricity from their cogeneration systems to meet internal power needs, bagasse-based cogeneration that produce excess power for export to the national grid is not yet practiced. In fact, some of the companies use electricity from the national utility, Ethiopian Electric Power Company (EEPCo), for their irrigation and surrounding residential areas. During the crop season, FSF produces electricity not only for internal factory use, but also to power its irrigation systems as well as surrounding towns and villages. Table 3.1 presents the current cogeneration installed capacity in Ethiopia from the four sugar companies.

Table 3.1: Current cogeneration installed capacity in Ethiopia

Factory	**Current Cogeneration Installed Capacity (MWe)**
Finchaa Sugar Factory (FSF)	7.0
Wonji-Shoa-Metahara Sugar Factories	6.4

Total	**13.4**

Source: Wolde-Ghiorgis, 2004

The sugar processing plant which included the cogeneration plant in Wonji was commissioned in 1954. The machinery at Wonji are now about 52 years old and hence are outdated. Shoa Sugar Factory was commissioned in 1962. At 44 years of age, its plants and machinery are also obsolete. Both cogeneration plants have boilers producing low-pressure steam at 16 bar.

Currently, the performance of both factories is unsatisfactory due to age and obsolescence. Maintenance of the plants is becoming difficult, as spare parts for machinery are not available. Hence, modernizing and upgrading the plant and machinery both at the farm and factory is a paramount importance for continued operation of the enterprise.

Kenya

Cogeneration is already practiced in the western part of Kenya where sugar factories use bagasse as a primary fuel. A total of seven companies use cogeneration, although recently, one sugar factory (Miwani) went under receivership and has stopped operations. Currently, the sugar factories in Western Kenya produce an average of 1.8 million tons of bagasse per annum, 60 % of which is used as boiler fuel for steam generation, with electricity being generated from surplus steam. The remaining 40 % of bagasse is simply discarded usually at a cost (Yuko et al, 2003; Rabah, 2000). During the recently-held stakeholders' meetings and discussions, it was observed that huge volumes of bagasse were stored in the backyard of some factories and are becoming a nuisance due to its rapid accumulation and disposal problems (see Annex S). In the case of the Chemelil sugar company, the bagasse has become fire risk – its bagasse dump which is adjacent to the factory recently caught fire and threatened the factory's premises.

Only Mumias Sugar Company among the seven companies is self-sufficient in electricity from its cogeneration system, with a small surplus capacity of 2.5 MW for export to the national grid. Presently, Kenya Power and Lighting Company (KPLC) has allowed Mumias to export electricity to its grid for a maximum of only 2 MW and for a duration of 12 months at a price that barely covers the production cost of electricity. The remaining sugar companies, because of the old equipment used for energy generation, are net importers of electricity (Rabah, 2000; Yuko et al, 2003; Githinji and Maina, 2003). Generally, the boilers in these sugar factories use inefficient, low-pressure systems of 20 to 30 bar pressure. Most sugar factories in Kenya are in dire need of reinvestment to replace their cogeneration equipment which is at or near the end of its useful life. Muhoroni Sugar Factory is, in fact, importing almost 100 % of its power requirements from the grid, with its boilers supplying mainly the steam requirements of the factory. The Institute of Research in Sustainable Energy and Development (IRSEAD, 2004) reports that the current production of bagasse is equivalent to a net capacity of over 300,000 tons of oil annually, a significant amount to replace the potential use of fossil fuel for the expected capacity additions in the next few years, if the shortage of power continues due to prolonged drought in the region.

During the recent seminar on cogeneration in Nairobi[14], the Ministry of Energy reported that it intends to provide a framework and incentives to encourage sugar companies to invest in new cogeneration facilities to generate more power from their bagasse and sell to the grid. Although this step could encourage sugar companies to install larger and more efficient boilers to enable them to fully utilize all the bagasse they produce, it is not immediately seen how the government would operationalize this plan. Some preliminary assessment of cogen potential in selected sugar factories in Kenya are provided in Annex P.

Table 3.2 presents a summary of the status of cogeneration of the western Kenya sugar factories.

Table 3.2: Current cogeneration installed capacity in Kenya

Factory	**Current Cogeneration Installed Capacity (MWe)**
Western	2.5
Muhoroni	3.0
Nzoia	4.5
Mumias	15.0
Chemilil	6.0
Sony	7.0
Total	**38.0**

Source: Yuko et al, 2004; Kagucia, B., 2005; Mbithi, J.M.P., 2005

Malawi

Malawi's experience related to cogeneration came mainly from the bagasse-fired systems that are currently operating in the sugar factories. The country currently has two sugar factories in operation: Nchalo Sugar Mill located 80 km south of Blantyre and Dwanga Sugar Mill located in the central region. Both factories are managed and operated by the Illovo

[14] *Consultative Workshop on Financing for Cogeneration, Nairobi, 8th December 2005.*

Sugar Company which is a company based in South Africa. The two factories, almost 600 km apart have the potential of processing around 2 million tons of cane and recover 260,000 tons of sugar annually.
The installed cogeneration capacities in these two factories are shown in the following table.

Table 3.3: Current cogeneration installed capacity in Malawi

Factory	**Current Cogeneration Installed Capacity (MWe)**
Nchalo Sugar Mill	11.5
Dwanga Sugar Mill	7.0
Total	**18.5**

At present, both factories are not able to meet their electricity requirements for cane processing and are importing power from the national grid. However, based on experience on sugar cane bagasse energy generation elsewhere it is considered that for a sugar factory that adopts energy efficiency and conservation measures in cane processing can meet all its energy requirements from bagasse and can also export a significant amount of excess power to the grid. Preliminary assessments of the cogen potential in the two sugar factories are provided in Annex P.

Sudan

Sudan is one the largest sugar producing countries worldwide. It has four operating sugar factories and an additional two is under construction. Three of the existing factories (i.e. New Halfa, Gunied and Sennar sugar factories) are owned by the state and managed by the Sudan Sugar Company. The fourth is Kenana Sugar Company which is a privately owned factory. The original design of each sugar factory had incorporated a cogeneration plant. The original installed cogeneration capacities in these sugar factories are given in Table 3.4

Table 3.4: Current cogeneration installed capacity in Sudan

Factory	**Current Cogeneration Installed Capacity (MWe)**
Kenana Sugar Factory	40.0
Gunied Sugar Factory	3.0
New Halfa Sugar Factory	6.0
Sennar Sugar Factory	6.5
Total	**55.5**

Source: Hamid, M.A., 2005

Swaziland

Swaziland is a small country (17,000 sq. km) in Southern Africa with around 1.0 million people. Yet, it has a sizable sugar industry producing more than 600,000 tons of sugar in 2005. This production is shared among three sugar factories namely, Simunye Sugar Mill, Mhlume Sugar Mill and Ubombo Sugar Mill, the first two being owned by the Royal Swaziland Sugar Corporation (RSSC). The three factories have a combined capacity of 26,400 TCD and all have cogeneration systems using bagasse and coal as fuel. Coal is used during the milling season to stabilize the combustion in the boilers and during the off-milling season for other activities such as ethanol production and refinery.
Despite the huge amount of bagasse generated by the process, the sugar factories are currently importing electricity from the Swaziland Electricity Board (SEB), the agency responsible for the generation, transmission and distribution of electricity in the country. The electricity from SEB is mostly used for the irrigation of the sugar cane estates owned by the factories. The electricity import costs and the production of electricity using coal, which is imported from South Africa, are a large expense in the operating costs of these sugar factories.
Table 3.5 shows the current cogeneration capacity in Swaziland. Although the combined capacities of the three sugar factories reach 53 MW, this power is generated from low-pressure boilers and none of the electricity generated is sold to the grid.

Table 3.5: Current cogeneration installed capacity in Swaziland

Factory	**Current Cogeneration Installed Capacity (MWe)**
Simunye Sugar Mill	17
Mhlume Sugar Mill	18.5

Ubombo Sugar Mill	17.5
Total	**53**

Source: Kamese, 2004; Isingoma, J.B., 2005

Tanzania

The estimated theoretical cogeneration potential in Tanzania is over 395 MW. Currently, the country has an installed capacity of 33 MW from both sugar and wood-based industries. The following table presents a summary of existing biomass-fuelled cogeneration plants in Tanzania.

Table 3.6: Current cogeneration installed capacity in Tanzania

Factory	**Current Cogeneration Installed Capacity (MWe)**
Kilombero Sugar Plant K1	6.0
Kilombero Sugar Plant K2	2.8
Mtibwa Sugar Estate	13.0
Tanganyika Planting Company	3.0
Kagera Sugar Company	5.0
Sao Hill Saw Mill	1.0
Tanganyika Wattle Company (TANWAT)	2.5
Total	**33.3**

Source: Gwang'ombe, 2004

The current cogeneration facilities in Tanzania are inefficient with low pressure applications resulting in import of power from the grid. Kilombero Sugar Factory has recently signed a contract with the Tanzania Electric Supply Company (TANESCO) to deliver 2 MW of electricity to the national grid during the crushing season. With the exception of this and of Tanganyika Wattle Company (TANWAT), which exports between 1,400 and 2,100 kVA of electricity to TANESCO, the above agro-industries generate electricity primarily for captive power with some limited electrification of the immediate neighborhoods (Ariss, 2003; Ngeleja, 2003; Gwang'ombe, 2004). TANWAT plans to expand its cogeneration plant to 15 MW if TANESCO accepts to sign a 10-year contract at 7 to 7.5 cents USD per kWh.

Uganda

In Uganda, three sugar factories produce an average of 130,000 tons of sugar annually: the Kakira Sugar factory in eastern Uganda (rated capacity of more than 3,500 TCD) has an installed capacity of 6 MW of electricity; the Kinyara Sugar Works (rated capacity of 2,500 TCD) has an installed capacity of 2 MW; and the Sugar Corporation of Uganda (rated capacity of 2,400 TCD) has an installed capacity of 2 MW.

These factories produce electricity from cogeneration to meet most of their internal factory demand using low-pressure systems. With finance from the World Bank and the East African Development Bank, Kakira has recently signed a power supply contract with the Uganda Electricity Board (UEB) to supply 12 MW to the national grid. Table 3.7 presents the current cogeneration installed capacity in Uganda from the three existing sugar factories.

Table 3.7: Current cogeneration installed capacity in Uganda

Factory	**Current Cogeneration Installed Capacity (MWe)**
Kakira Sugar Works (1985) Ltd.	6
Sugar Corporation of Uganda Ltd.	2
Kinyara Sugar Works	2
Total	**10**

Source: Kamese, 2004; Isingoma, J.B., 2005

There is great interest among the sugar factories in Uganda to expand their cogeneration capacity by more than twice the current capacity if a favorable policy framework for selling excess power to the grid will be put in place.

Based on data available, there appears to be a significant potential to further develop cogeneration technology, especially in industries generating biomass waste (sugar, wood, etc.). Comparing with what other countries have

achieved, it appears that there is still much room for increased capacity implementation of cogeneration in the seven participating African countries. See pre-feasibility assessments summarized in Annex K.

3.2.2 Baseline scenario - What happens if Cogen for Africa is not implemented?

Although the potential for cogeneration, particularly in the sugar industry existed for many years, it is shown in the previous sections that only a very small portion (around 3 % of the national capacities) of this potential has been tapped using outmoded low-pressure equipment and inefficient technologies which have been installed many years back. This situation exists because of key barriers to wider use of more efficient high-pressure cogeneration technologies which include (see detailed discussions in Section 3.3):

Technical barriers

- Lack of in-country experience in using high-pressure, high-temperature systems
- Lack of local capability/expertise to support the development, implementation, operation and maintenance of modern and efficient biomass cogeneration systems
- Absence of local manufacturing capability

Financing barriers

- Absence or lack of low-cost, long-term financing
- Lack of assets that could be used as collaterals and guarantees to secure loans
- Lack of developers with the skills to prepare financing packages that responds to the requirements of financial institutions
- Limited expertise in financial institutions to evaluate cogeneration projects
- Lack of experience by financing institutions working in new service areas leading to a higher perception of risk.

Commercial/market barriers

- Lack of successful examples of biomass cogeneration installations in the region
- High capital, development and transaction costs
- Inadequate technical and economic information to make investment decisions
- Lack of framework securing revenues from sales of electricity from cogeneration systems

Regulatory/policy/institutional barriers

- Inadequate policies explicitly promoting cogeneration
- Limited awareness among senior decision makers of the potential benefits of advanced high-pressure cogeneration
- Lack of supporting institutions providing information and services for new and highly efficient cogeneration
- Bureaucratic and non-coordinated procedures to obtain permits
- Lack of regulations related to interconnection to the grid and operation of mini-grids for rural electrification

If the above barriers are not removed, the baseline scenario for the countries within the region which are participating in this project would basically be a continuation of the present situation. Table 3.8 presents the summary of cogeneration in the countries participating in the Cogen for Africa Project.

Table 3.8: Summary of current cogeneration installed capacity in some countries of Africa[15]

Country	**Current Cogeneration Installed Capacity (MWe)**	**Installed National Capacity (MWe)**	**As % of total their National Capacity**
Ethiopia	13.4	726	1.85%
Kenya	38.0	1143	3.32%
Malawi	18.8	238	7.90%
Sudan	55.3	755	7.32%
Swaziland	53	128	41.41%
Tanzania	33.3	881	3.78%
Uganda	10.0	303	3.30%
Mauritius	**242**	**725**	**33.4**

Sources: Gwang'ombe, 2004; Yuko et al, 2004; Kamese, 2004, Engorait, 2004; Wolde-Ghiorgis, 2004; Kagucia, B., 2005; Mbithi, J.M.P., 2005; Isingoma, J.B., 2005

[15] Incorporated updated installed capacity based on new data and information received after Council approval.

This means that in the sugar industry, the factories will continue to maintain their old and inefficient equipment, while the ones that will expand their sugar processing activities will install additional systems mostly for captive power (see following Box) or with a small excess capacity for sales to the grid, whenever the utility allows them to do so. It is very unlikely that the factories will invest in medium to high pressure systems which allow them to generate high excess capacities for sales to the grid. In this scenario, large amounts of biomass residues which can be used as fuel will be dumped most of the time at a cost, while the industry will continue to rely on both grid electricity and, in many cases imported, fossil fuel. Furthermore, as described in Section 1.3, governments – some of which already started to install fossil-fuelled thermal power plants – would find themselves more and more dependent on diesel or coal-fired power plants as evidenced by the Power Development Plans of some countries.

"The Sugar Corporation of Uganda Ltd., because of the deteriorating condition of their cogeneration system and the anticipated expansion of their sugar processing capacity, decided in 2005 to install a 6.0 MW cogeneration system. After studying the feasibility of the different technologies and investigating the viability of selling excess power to the grid, the company has decided to invest in a relatively inefficient technology (32-bar boiler and back-pressure turbine) citing lack of technical expertise to operate the high-pressure cogeneration system, high capital investment costs and low feed-in tariff as the reason for this decision.
Similarly, the Mhlume Sugar Mill in Swaziland bought three years ago a 65-bar boiler for their cogeneration plant. However, because the company cannot justify the purchase of a bigger, highly efficient turbine due to the low viability of the project based on the low feed-in tariff proposed by the utility (Swaziland Energy Board), this boiler has been downgraded to 30-bar steam pressure in line with the steam requirement of the existing turbines. The above two cases illustrate that without appropriate intervention, low-pressure inefficient systems will continue to be implemented in spite of the availability of cheap, renewable fuel and the existence of modern and efficient cogeneration systems in the global market."

It should be mentioned that the current process of power sector reform in many countries has made prospects for power sales to the grid increasingly more interesting. Thus, without a catalytic effect of a devoted Cogen program, cogeneration plants might gradually find more acceptance among relevant agro-industries, but an acceptance that will basically be limited to captive power applications while large amounts of potential biomass fuel will continue to be discarded as waste.
Moreover, if the status of cogeneration in the sugar industries remain in the same level of technology and exploitation, it is unlikely that the concept of cogeneration would spread to other potential sectors such as wood/pulp/paper industries and other agro-industries as well as in other non-renewable fuel applications.
It is also feared that if nothing is done to increase the competitiveness of the sugar industry in the African region through increased productivity, cost effectiveness and increased revenues from other sources, the situation may lead to further deterioration in performance.

3.2.3 Alternative scenario - What would happen if Cogen for Africa is implemented successfully?

Looking back at the experience of the EC-ASEAN COGEN Programme in Asia, when the program started in 1991, biomass residues were considered wastes in the region and the bulk of agro-residues were disposed of either by burning them in the open atmosphere or discarding them into landfills. For the industries that use them as fuel, such as in the sugar and palm oil industries, the residues were used to generate low pressure steam that was sent to back pressure turbines generating heat for the process and electricity just enough for the needs of the factories. In some factories, the power generated was not even enough for the needs of the factory that they had to import power from the grid. This scenario is very much similar to what is now being experienced by agro- industries in many parts of Africa. After the implementation of the 13-year Cogen Programme in Asia which provided technical support, policy interventions and other kinds of services, more than 20 demonstration projects have been implemented and the widespread promotion of cogeneration has resulted in the implementation of around 600 MW of cogeneration capacity in the region. Examples of cogeneration plants that were recently implemented and are relevant to the sugar industries of Africa are shown below.

Box 3.1: Highly efficient cogeneration plants recently implemented in Thailand

Description	**Cogeneration Plant 1**	**Cogeneration Plant 2**
Owner/developer:	*Dan Chang Bio-Energy Co., Ltd.*	*Phu Khieu Bio-Energy Co., Ltd.*
Project type:	*Bagasse-fuelled energy plant*	*Bagasse-fuelled energy plant*
Location:	*Dan Chang, Suphanburi, Thailand*	*Phu Khieu, Chaiyapoom, Thailand*
Description:	*The project is a 53 MW high-pressure (65 bar) cogeneration system. The plant is located adjacent to a sugar factory which supplies bagasse as fuel. The electricity and*	*Dan Chang Bio-Energy is a special purpose company set up to implement a 65 MW cogeneration project consisting of 41 MW new equipment and an existing 24 MW turbine from the sugar factory. The plant is a state-of-the-art high-pressure system*

	steam generated from the project is sold to the sugar factory and the excess power is sold to the Electricity Generating Authority of Thailand (EGAT). The project consists of a new 41 MW system & old equipment transferred from the sugar factory.	*implemented to supply power and steam to the adjacent sugar factory, which in turn will supply bagasse as fuel. The excess power is sold to the grid.*
Power Purchase Agreement:	*"Firm" contract, 21 years*	*"Firm" contract, 21 years*
Tariff:	*1) energy payment, indexed to natural gas price* *2) capacity charge, indexed to Dollar exchange rate*	*1) energy payment, indexed to natural gas price* *2) capacity charge, indexed to Dollar exchange rate*
Incentives:	*BOI privileges, EPPO subsidy*	*BOI privileges*
Commercial operation date:	*May 2004*	*June 2004*

The long-term objective – a realizable one – and in fact, the objective of the Cogen for Africa project is to help transform the cogeneration market and encourage project developers and industries to have profitable cogeneration investments while creating positive impacts on the environment and the socio-economic life of the community.
The potential is there. Based on available data of a few countries in the region, there is evidence that a significant potential exists for further development of the Cogen technology in the region, first of all in industries generating biomass waste. Table 1.3 in Section 1.2.1 shows this huge potential.

Cogeneration in many Eastern and Southern African countries is still in its embryonic stage and largely limited to generation for captive power, above all in the sugar industry. Considering the ever increasing need for power in Africa, the potential for cogeneration projects on the continent, as well as the encouraging results of the Mauritius experience and the Cogen program concept as successfully implemented in Asia, it is expected that a similar activity in Africa and for Africa will yield positive results.
Cogeneration allows generation of both power and heat in a most efficient and environmentally friendly way and adds new capacity to existing rural power grids, delaying the need for additional power plants. This form of "power resource diversification" will certainly help to increase local power supply reliability, a basic ingredient for economic development especially in countries that depend largely on hydropower, as drought appears to be a recurrent phenomenon in the region. With kWh prices assumed to remain between USD 0.06/kWh to USD 0.08/kWh, electricity from cogeneration plants will be competitive and both government and utility will be interested in buying power from agro-industries.
Electricity produced from cogeneration, either as captive power (consumed by the host factory) or sold to the grid is thought to compete in price with most, if not all, of the tariffs charged by national electric power utilities. However, feed-in tariffs offered by utilities to owners of cogeneration plants may not be that promising in many of the participating countries, which is one of the issues that needs to be addressed by the proposed project. Eventually, the economic benefits of cogeneration to both industries and governments should become clear and provide sufficient momentum for further dissemination and regional acceptance of the technology.
Recognizing that cogeneration can yield fuel energy utilization rates of up to 90 % at low or even negative cost per ton of carbon, GEF would be supporting a viable and important mitigation option in the region. Without GEF assistance, cogeneration would not be able to reach its optimum utilization in the region, thereby increasing the need for building new fossil fuel power plants. In a few countries, it is also possible that cogeneration, in the medium to long term, will be able to provide additional power for rural electrification.
The sugar industry in Southern and Eastern Africa should be a first candidate for additional Cogen projects in the area, as the sugar factories already operate cogeneration plants and possess some of the expertise required to expand to more efficient cogeneration applications. Clearly, the core business of a sugar factory is to produce sugar. However, with the price of sugar in the global market being low, electricity generation would allow these companies to diversify their earnings. The program should address regulatory framework and tariff issues in order to avoid situations such as recently occurred in Zimbabwe where the sale of excess power from sugar factory based cogeneration facilities was initially agreed but never realized because no settlement could be reached on the tariff pricing. The production of ethanol is yet another way of income diversification for a sugar factory. This process requires large amounts of heat that is readily available in Cogen systems.
Although the cogeneration approach is considered to be "environmentally friendly" because of the use of (sustainable) biomass (or because of the energy conservation that occurs due to higher efficiency even when using conventional fuels), cogeneration systems could be polluting if not done according to "best practice" and using state-of-the-art technology solutions. The concern for the existing Cogen facilities currently in operation in Africa is that many of them are still using outmoded, low-pressure and inefficient equipment which still necessitates the factories to import electricity from the grid, while burning the residues generated from their factories or discarding and allowing them to rot in open fields.

Even though the environmental objective (i.e. GHG emission reduction) might be clear, the development aspect of cogeneration projects is not negligible. Industries will be better situated to meet their own power needs through captive power waste, while excess power can be sold to the grid giving additional revenue stream to the factories. The benefits derived by the industry could cascade to the farmers who could get higher prices for the sugar cane and to the individuals through more employment opportunities or better employment conditions. Cogen facilities will generally create employment opportunities both directly (in Cogen Plants) and indirectly (both the availability of power and heat may create new industries, new products and new jobs), while avoiding the (improper) discarding of biomass waste. By increasing the profitability of the sugar industry, cogeneration investments could indirectly lead to expanded sugar cane plantations which would generate a large number of jobs. As big percentages of the populace in the sugar-producing countries directly or indirectly rely on the sugar industry, this positive effect could ripple through to millions of individuals. For example, in Kenya, it is estimated that over 6 million people are directly or indirectly dependent on the sugar sector.

On the national level, the plans for additional power generation could be partially or wholly postponed, bringing benefits to the people in general and to the national governments of the participating countries of Africa.

As in the experience of the Cogen Programme in Asia, the above scenarios will not come easy, simply because many barriers exist that hinder the widespread acceptance and implementation of new and highly efficient cogeneration systems.

The next section describes and analyses how key barriers will be addressed by this Project.

3.3 Barriers for the development and implementation of biomass cogeneration in Africa

It has been shown that there is huge potential for using energy efficient cogeneration systems to generate additional cogeneration capacity to supply the energy requirements of industries and selling extra power to the utility for the use of the national grid. This generates additional benefits that could alleviate poverty, enhance the socio-economic condition of the communities and have a positive impact on the environment (detailed description of which have been treated in Section 1.2.2 above). But this is not currently happening and is not foreseen to change significantly in the near future due to a number of barriers that prevent or hinder the potential project developers and other stakeholders from making the necessary decisions to implement these systems.

To investigate the identified barriers, key stakeholders were consulted and interviewed to better understand the situation on the ground. The stakeholders that were consulted consisted of biomass producers and facility owners (i.e. sugar factories), government personnel within the energy sector, experts in the industries and energy sector, and financing institutions (See Annex N).

Based on these consultations and interviews as well as other secondary sources such as authoritative papers, policy papers, books, reports and pre-feasibility studies, the barriers on the widespread acceptance, development, implementation and dissemination of high pressure, efficient and environmentally friendly biomass cogeneration technologies were identified and analyzed. These were then grouped into major categories reflecting similar/related nature so that it will be easy to design measures and activities for their removal. Four major categories of barriers emerged and are ordered according to importance, as perceived by the stakeholders, as follows:

- Technical barriers
- Financing barriers
- Commercial/market barriers
- Regulatory/policy/institutional barriers

Each of these categories is explained in detail hereafter.

Technical barriers

Technical barriers include aspects such as operational performance, reliability of the equipment, extent to which technologies are proven, and the technical capability of support services and personnel relevant for the technology. Key technical barriers that are found in the region include:

- Lack of in-country experience in using high-pressure, high-temperature systems

Although energy generation using bagasse is used traditionally by existing sugar factories, the energy systems that have been installed remain inefficient and do not optimize the use of bagasse as a fuel. As a matter of fact, for many of these factories, the existing energy generation systems cannot generate enough electricity for their own requirements which require them to import electricity from the grid. With the use of modern and efficient cogeneration systems, however, the factory can generate enough heat for the process requirements and electricity which is twice as much as quantity the factory requires.

The inefficiencies in the sugar factories are not only reflected in the energy systems but more importantly, in the core sugar processing systems themselves. Of the five sugar factories visited in Kenya during stakeholders consultations and PDF-B preparations, it was only Mumias Sugar, a publicly listed company (one of the best performing companies in the Nairobi Stock Exchange), which exhibited a highly efficient sugar processing system. West Kenya Sugar, the only other private sugar company in Kenya, is currently building a new plant which is using state-of-the-art equipment. Most of the other sugar factories in Kenya have yet to install modern sugar processing facilities and rely on outmoded and inefficient processing equipment.

- Lack of local capability/expertise to support the development, implementation, operation and maintenance of modern and efficient biomass cogeneration systems

Technical know-how, both among the project developers implementing cogeneration projects and the local institutions providing services, is important for the success of the implementation and operation of cogeneration projects. However, there remains a continuing shortage of personnel in the region who are qualified to provide the required expertise and experience.

One example of expertise which is important in the development and implementation of biomass cogeneration projects is the capability to assess the feasibility of developing a certain potential project. This expertise is lacking, even non-existent, in the participating countries. Other more advanced skills needed during installation and operation of advanced high-pressure cogeneration systems are virtually absent.

"During a visit to Kakira Sugar Works in Uganda, the management revealed that because of the absence of in-house expertise and inability to find it in the country, they had, in the past, hired consultants from India and Hawaii to conduct studies and advice them on their decisions regarding improvement/expansion of their cogeneration systems. "

- Absence of local manufacturing capability

Although cogeneration (with low pressure systems) have been used for many years in some industries in the region, such as the sugar factories, the bulk of the equipment used is manufactured and imported from abroad. For high pressure cogeneration systems, apart from civil works, the majority of the components cannot be manufactured in the participating countries due to lack of manufacturing capability and facilities. It is estimated that only about 5 to 10 % of the total parts for this type of system could be manufactured locally. As a consequence, the capital costs for cogeneration plants are high and the current benefits to the local manufacturing industry are limited.[16] In addition, the situation necessitates that capital costs are paid in foreign currency which is not favorable to the industries and the countries in the region as a significant proportion of revenues accrued by the sugar industry are primarily in the form of local currency earnings.

Financing barriers

Financing is becoming one of the single-most important factors that determine the decision to proceed or not to proceed with a co-generation investment, and the eventual success of its implementation. In spite of its importance, project developers of energy projects tend to postpone facing the financing challenges to a later stage of project development, a move which oftentimes delay the whole implementation process, considering that there are some serious barriers that need to be overcome in order for a cogeneration project to successfully reach financial closure.

These barriers include:

- Absence or lack of low-cost, long-term financing

Studies have shown that the main obstacle to implementing renewable energy projects is often not their technical feasibility, but the absence of low-cost, long-term financing. This problem is complicated by competition among projects for limited funds and is compounded by unfavorable macro-economic conditions of the countries in the region (AFREPREN, 2005). Biomass cogeneration, as a renewable energy solution, is not an exception. This becomes even more pronounced for larger scale cogeneration systems which require higher degree of financing leverage and therefore, a larger amount of debt financing. Discussions with commercial banks in the region revealed that typical commercial loans have interest rates between 15 to 20 % p.a. and tenors of not more than 5 years.

- Lack of assets that could be used as collaterals and guarantees to secure loans

The potential investors in biomass cogeneration projects are either the agro-industries producing the wastes to be used as fuel, or third party developers with or without joint venture partnership with the agro-industry facility owner. These companies generally lack untied assets that could be used as collateral required by banks as security for the provision of loans. Some may also lack the financial muscle to provide or mobilize guarantee instruments in lieu of collaterals in the form of assets. Moreover, a number of sugar industries in Africa have higher debt/equity ratio than what is normally accepted by banks; so, borrowing on their balance sheets would be quite difficult. This is particularly true of state-owned sugar companies whose financial performance is often below par. Sugar companies with significant private sector ownership or which are outrightly owned by the private sector have a much better financial performance track record which provides a good basis for balance sheet financing.

- Lack of developers with the skills to prepare financing packages that responds to the requirements of financial institutions

Small to medium-sized project developers lack the in-house expertise to look for funds, prepare the financial plan of the cogeneration project, and negotiate with lenders to obtain the most favorable financing terms. The WB-GEF Energy for Rural Transformation (ERT) program in Uganda has indicated that one of the major problems they face in evaluating the projects applying for ERT financial support is the low quality of proposals received from the project proponents and developers. In addition, existing financing schemes usually require a long application and approval procedure that tend to discourage potential developers from pursuing cogeneration investment.

[16] Kamese, G. and Engorait, S., Status and Prospects of Biomass-based Cogeneration and Geothermal Technologies in Uganda, in Sustainable Energy in Africa, AFREPREN/FWD, 2005.

- Financial institutions lack the expertise to evaluate cogeneration projects

Although financial institutions are normally adept at developing financing plans, their knowledge of cogeneration investments is often limited and, therefore, find it difficult design the right financing scheme that would suit projects involving biomass energy, as well as construct a credit structure that would be acceptable to all parties involved.
Financial institutions do not normally maintain staff members with the skills and expertise to evaluate cogeneration projects. The staff who evaluate projects requesting for financing are, in general, not familiar with these technologies. This leads to reluctance in even starting to consider undertaking due diligence of cogeneration projects.
Whenever financing institutions do not have the in-house expertise to evaluate cogeneration projects, the alternative is to hire an external consultant for this purpose. The cost for this activity is then passed on to the project developer which increases the overall financing costs for the project.

- Lack of experience by financing institutions working in new service areas leads to a higher perception of risk.

Among the financing institutions consulted during the preparation of this document, a few were familiar with the agro-industries in the countries they operate or even of the region. However, there is a general lack of knowledge and familiarity among these financial institutions in cogeneration technologies involving renewable energy such as biomass. This is partly because they are unfamiliar with the technologies used in these projects. This makes them too cautious in lending to these kinds of investments. Although references of projects successfully operating in similar environments are available, such as in Mauritius, very few financiers have visited these projects and have seen them operating successfully.
Commercial/market barriers
The commercial/market barriers refer to impediments that prevent or discourage potential project developers of biomass cogeneration systems from implementing new and modern systems to replace the obsolete and inefficient existing systems.
Without doubt, the barriers related to commercial/market conditions are a major cause the lack of development and implementation of biomass cogeneration technologies in the region. The specific barriers under this category include the following:

- Lack of successful examples of biomass cogeneration installations in the region

In almost any area of new technological introduction, especially in traditional sectors such as the wood and agro-industries, the presence of successful references as concrete examples has an important and crucial impact on the adoption and widespread dissemination of the technologies being introduced. They provide a showcase, a source of lessons to draw from and a basis of confidence that the technology is working and generating the intended benefits. Although modern and efficient biomass cogeneration systems are technically well proven and used widely in some parts of the world, even in nearby Mauritius, there is no example of a high pressure system (i.e. 60 bar and over) implemented in the seven countries participating in this project. This is true in spite of the abundance of biomass wastes produced from industries such as sugar factories that have significant needs for energy in the form of heat and power. This absence of successful examples is one of the major barriers in convincing potential developers to invest in modern biomass cogeneration technologies.

- High capital, development and transaction costs

Highly efficient, high pressure cogeneration projects, using biomass as fuel, are in general more expensive per installed capacity compared to conventional energy technologies. Moreover, with its higher development costs, the overall initial costs of biomass cogeneration tend to be much higher than the low-pressure options even if the amortized costs over the lifetime of the technologies are lower compared to lower pressure equipment. The impact that transaction costs have on energy system prices should also be considered. These affect the viability of the project, a factor which is of prime importance for the participation of the private sector.
For instance, although the two sugar factories in Uganda – the Kakira Sugar Works and Sugar Corporation of Uganda – have implemented larger systems in order to sell excess power to the grid within the existing policy/regulatory framework, and with the financial support of the Energy for Rural Transformation program, the two factories still opted to use low-medium pressure systems (32 bar and 45 bar, respectively). This is because the tariff provided by the utility cannot compensate adequately for the higher costs of the more efficient equipment and the additional costs of hiring foreign consultants/experts needed to commission a more sophisticated high-pressure cogeneration investment. As an indication, a high-pressure system using a 65-bar boiler and an extraction-condensing turbo-generator costs about 50 % more than a low-pressure 30-bar boiler/back-pressure turbo-generator system.

- Inadequate technical and economic information to make investment decisions

Information is a key to making intelligent investment decisions. Because of the lack of reliable and ready information that the developers can customize for their specific projects, potential developers of cogeneration projects tend not to take active steps to initiate investigation on the viability of these projects. For instance, it is acknowledged that in

Mauritius a feasible cogeneration plant for factories should only be considered for plants with cane crushing capacity of 200 tons per hour and above; however, the conditions might be different in Malawi, allowing also smaller capacities to be viable. Thus, if a sugar industry in one of the participating countries decides to seriously consider implementing a biomass cogeneration plant, the management would need to hire a consultant either from Mauritius or outside the region to conduct a thorough feasibility study which would be costly. If in-house or local engineers are trained to conduct such studies and information is available locally to be used for technical and economic inputs to the study, this barrier would be minimized or eliminated.

A case in point is the Busia Sugar Company in Kenya. Busia Sugar currently owns 340 ha. of sugar cane plantation and manages around 8,000 farmers (with plan to increase to 30,000 farmers) and is in the advanced stages of establishing a sugar factory with a capacity of 4,200 tons of cane per day which will incorporate a cogeneration unit. A feasibility study for the sugar factory has already been undertaken, and includes a rough assessment of the cogeneration potential. Although Busia Sugar is confident of their capacity and competence to make an informed decision on the sugar processing aspect, the management is concerned that they do not have the capacity and expertise to evaluate the cogeneration aspect enough to make a good decision. In the letter to UNEP/DGEF, the management of Busia Sugar has expressed that the Cogen for Africa project could assist them in the following areas:

- Undertaking detailed pre-feasibility/feasibility study on the cogeneration component, which builds on the factory-wide feasibility study already undertaken
- Advising on financing models and financing opportunities
- Establishing contact with co-financiers and assisting in financial packaging
- Negotiating a viable power purchase agreement
- Lobbying policy makers for more favorable policy and regulations

Moreover, as there is lack of comprehensive overview available on the (potential) resources of cogeneration in the region outside the sugar industry, [17] it is difficult for a new developer to focus his/her efforts on the sectors and areas with the greatest potential without incurring some expenses in making initial investigations.

Since biomass cogeneration projects are not seen on the same level as conventional energy systems, they are perceived as more risky which contribute to the uncertainty of recouping back the investments made in high-pressure, advanced cogeneration systems.

- Lack of framework securing revenues from sales of electricity from cogeneration systems

A major source of revenues which makes high-pressure cogeneration projects commercially viable is the sales of electricity in excess of what is required by the factory to the national grid. This revenue stream will determine the profitability of the venture. Moreover, the assurance of the off-take of electricity through a secure framework can strengthen the bankability of the project when loan is borrowed on a Project Finance basis which allows the lender to look mainly on the future cash flows of the project for the payment of its principal and corresponding interest.

However, in the participating countries in Africa, a favorable and secure framework for the off-take of excess electricity from cogeneration plants do not exist. A discussion on the Power Purchase Agreement (PPA), which is a major document related to this issue, is described in the next barrier category.

Regulatory/policy/institutional barriers

Promoting biomass cogeneration on a major scale will require substantial private sector investment, which, in turn, requires a supportive policy and regulatory framework that better define the risks and rewards of cogeneration investments.

On one hand, poor or inappropriate government policies can create or raise barriers to the widespread implementation of these technologies; on the other hand, the creation and faithful implementation of appropriate policies and programs could help overcome barriers, create confidence in the market, and stimulate investments in modern and efficient biomass cogeneration projects. Some of the barriers observed within this category include:

- Inadequate policies explicitly promoting cogeneration

Adequate polices to promote cogeneration and encourage potential project developers to implement them should cover provisions such as:

- fiscal incentives such as tax holidays, waiver for import duty, etc.
- adequate feed-in tariffs
- grid access assurance
- targets that are reflected in the Power Development Plans
- cogeneration or renewable energy quotas for utilities
- subsidies, where appropriate

In most cases, the above provisions are at best mentioned as intentions in the general policies and electricity acts of the countries in this region. Specific policies that provide figures and concrete steps are often not available in the countries

[17] During the PDF-B preparation a survey of the potential in the sugar industries was done. AFREPREN has undertaken some limited work in other industries.

participating in this cogeneration initiative. This gives mixed signals to the potential developers who perceive the governments as not being sufficiently committed to the promotion of cogeneration in their countries.

- Limited awareness among senior decision makers of the potential benefits of advanced high-pressure cogeneration

The general concept of cogeneration is well known among senior technocrats in the ministries of energy in the countries of the region. However, high pressure systems that allow industries such as the sugar companies to use all the bagasse produced by the factory to generate three to four times what the factory itself needs and sell excess power to the national grid are not as widely known or understood by many decision makers in the region.. Hence, the government are, often, not fully aware of all the technical, economic, social and environmental benefits this advanced cogeneration investments could deliver at national, sectoral and individual levels.
This is apparent in the fact that when approached by potential sellers of electricity from cogeneration plants owned by sugar factories, ministries of energy and utilities are not willing to provide favorable purchase prices because they argue that bagasse which is used as fuel is a free resource and should not be given tariffs that are comparable to those enjoyed by fossil fuel IPPs.

- Lack of supporting institutions providing information and services for new and highly efficient cogeneration

In both regional and national level in this region, there is a dearth of institutions that provide support, information and assistance to stakeholders involved in cogeneration. Of special importance is assistance in obtaining information on the potential of cogeneration, applicable technologies, suppliers of equipment and experts and consultants with appropriate skills and experience. Some sugar companies intending to implement new cogeneration systems to sell excess power to the grid (for instance, Mumias of Kenya, and Scoul, Kinyara and Kakira of Uganda) had to hire consultants from as far as Hawaii, South Africa and India to conduct assessment and feasibility studies.
There is thus, a great need for a one-stop center, ideally with a regional scope but with focal points to conduct capacity building activities, provide advice and services and provide much-needed information to the stakeholders in the region.

- Bureaucratic and non-coordinated procedures to obtain permits

In many African countries, the procedures to obtain permits for medium-to-small scale energy projects such as cogeneration, renewable energy and energy efficiency are not well defined. In fact, it is not uncommon in some countries to require inputs from many different government agencies.

"In Kenya, cogeneration in the sugar sector is likely to require the involvement of at least three Ministries (Energy, Agriculture and Industry) and at least five other state agencies (national utility in charge of generation – KENGEN; transmission and distribution - KPLC; the national electricity regulator – ERB; the national sugar agency and the national environment agency – NEMA)."

The extra effort required to understand how the system works and go about the approval process from the different agencies greatly increase the transaction costs of developing cogeneration projects, thereby increasing the overall project costs.
One of the barriers mentioned earlier which hinders developers from pursuing cogeneration investment opportunities is the high transaction costs. If governments can structure their procedures so that there is a single agency responsible for the planning, promotion, approval and monitoring of cogeneration (or renewable energy and energy efficiency projects), the efforts and costs involved in developing and implementing projects could be substantially reduced, thereby lowering also the barriers related to affordability of projects. An example often mentioned is the case of India which has a ministry dedicated to renewable sources of energy[18]. This ministry does not only act as a "single window" in the processing of projects such as biomass cogeneration, but it also provides other support such as participation in the financing and offering incentives to encourage project developers and industry owners to implement projects from renewable energy sources.

- Lack of regulations related to interconnection to the grid and operation of mini-grids for rural electrification

Since cogeneration projects are typically smaller than traditional power projects, they need to have a stable and predictable framework laying down the conditions for their interconnection with the electricity grid. The framework should provide standardized criteria aimed at non-discriminatory and transparent regulations on different grid systems and interconnection issues as well as operation of mini-grids for rural electrification. Key issues that need to be clearly defined include:

- Dispatch priority
- Guarantee of transmission and distribution (e.g. mini-grids for rural electrification) of electricity produced by cogeneration units
- Principles concerning who bears the costs relating to grid connection, grid reinforcement, etc.
- Tariffs for use of system (including transport tariffs, tariffs related to sales of surplus electricity to the grid and tariffs for purchase of backup power from the grid).

[18] The Ministry of Non-Conventional Energy Sources (MNES) was established by the Government of India in 1992.

- Tariffs taking into account possible costs and benefits of decentralized embedded generation.
- The possible use of net-metering for future small cogeneration units allowing consumers to offset electricity consumption with on-site production.

At the moment, regulations that are specifically designed for cogeneration in the seven countries participating in this project are, at best unclear, and at worst, non-existent. For example, when Kakira Sugar Works submitted their specifications to the utility in Uganda for the installation of the distribution line from their cogeneration plant to sub-station owned by the national distribution utility (which Kakira Sugar Works had to pay for), it took the utility four months of review and discussions with Kakira before providing the final approval of the specifications. This is simply because certain regulations do not exist and therefore Kakira had to make the proposal for the specifications themselves.

- Absence of a Standard Power Purchase Agreement (PPA)

One of the reasons for the lack of adoption of advanced environmentally sound medium and high-pressure cogeneration systems, among many others, is the absence of a Standard PPA which has a long-term duration and favorable tariff. The off-take of electricity from a reliable buyer is one of the most important arrangements to secure the flow of revenues in a cogeneration plant. The Power Purchase Agreement (PPA) is the common document used in this arrangement and is agreed between the cogeneration plant owner and the buyer of electricity. If the cogeneration plant sells electricity to the grid, the PPA is signed by the utility. Having a well designed PPA that protects the interest of the cogeneration plant, such as "take-or-pay" provisions, could lessen the risk of the developer and raise sufficient comfort for the banks to lend to the project.

In the example cited earlier, the projects successfully implemented in both Asia and Mauritius have long-term PPAs (more than 20 years) with a reliable off-taker which is the utility (and the sugar factory for heat and electricity) at tariffs that were calculated using a standard and transparent formula and adequate to make the project viable.

Unfortunately, a Standard PPA which is transparent and which provides reasonable tariff conditions does not exist in all countries in this region. Out of the seven countries participating in this project, none has an approved Standard PPA that provides long-term contract using standard tariffs that are transparent and publicly known. At best, contracts with utilities have been negotiated on a case-by-case basis resulting in terms that do not provide favorable conditions to the owner of the cogeneration plant. The ones that have received a contract had to go through a lengthy process and series of negotiations and delays. The case examples described in the Box 3.2 aptly illustrate the need for a standard long-term PPA.

Box 3.2: Mumias Sugar Company (Kenya) and Kakira Sugar Works (Uganda): two tales of lengthy Power Purchase Agreement (PPA) negotiations

Mumias Sugar Company, Kenya

Mumias Sugar is the largest and most progressive sugar company in Kenya. As a publicly listed company and one of the best-performing in the country, the management tries to keep the company competitive and profitable by employing state-of-the-art sugar processing facilities in the factory. However, it still uses low-pressure cogeneration equipment. In 1976, with the increase in production to 7,000 tons of cane per day (TCD), Mumias realized that with the tremendous amount of bagasse that the factory produced, it needed to implement a bigger capacity cogeneration system for both captive and electricity export purposes. Hence, the then East Africa Power & Lighting Company (EAPLC) and the Ministry of Energy were approached with a view of formulating an agreement for EAPLC to purchase the excess electricity produced by Mumias. Meanwhile, because the power house switchboard had a long order lead time, Mumias decided to place a firm order for the switchboard and facilities. Unfortunately, when the negotiation for the sales of power to EAPLC was concluded, Mumias found that the price that EAPLC was willing to pay was not enough to make the project viable. They then decided, instead, to buy low pressure boilers and inefficient back-pressure turbines to drive the prime movers of the factory.

In 1990, Mumias embarked on a factory rationalization program to replace the milling technology with a more modern and efficient diffusion technology. Once again, the now Kenya Power and Lighting Company (KPLC) was approached by Mumias to see if KPLC was willing to buy any excess electricity from Mumias but the proposal was declined citing the reason that power from sugar factories are unreliable. Hence, Mumias proceeded with the expansion of its cogeneration facilities without investing in a highly efficient system for electricity export purposes.

In July 2000, when there was an acute power shortage in Kenya due to an extended drought, KPLC approached Mumias soliciting for purchase of excess electricity for a period of 12 months. During this time, Mumias had an installed capacity of 15 MW while needing only 10 MW for its operations. The Ministry of Energy was approached to intervene so that a long-term Power Purchase Agreement (PPA) could be agreed between Mumias and KPLC. However, this did not yield positive result and finally, KPLC contracted Mumias to sell 2 megawatts of electricity to the grid for 12 months, although the sales ran for 18 months when the contract was terminated.

Recently, Mumias has started selling excess power again to KPLC (about 2 MW) but on a short-term contract that does not encourage Mumias company to invest in high-pressure more efficient and larger capacity cogeneration facilities. If Mumias embarks on upgrading its system to the efficiency level of the best systems in Mauritius, it is estimated that around 57 MW could be implemented using the bagasse currently generated from the factory, and with the need of around 10 MW in the factory, it could sell up to 47 MW to the grid.

Kakira Sugar Works, Uganda

Being the largest and most progressive sugar factory in Uganda, Kakira Sugar Works constantly seeks to find opportunities for

improvement and use all its resources optimally. Operating at over 3,500 tcd, the factory produces more than 400,000 tons of bagasse annually. With the current in-house factory requirements of around 4 to 4.5 megawatts, there is a large quantity of surplus bagasse which is disposed through open-field burning.

With its plan for increased sugar production, and having seen an opportunity to sell excess power to the grid by using the bagasse produced by the factory, Kakira submitted a proposal in June 1998 to the Ministry of Energy and Mineral Development (MEMD) for the company to sell 18 MW to the national grid. However, because the government was expecting that the 250 MW Bujagali hydroelectric project would be implemented at that time, it did not make any decision on Kakira's proposal.

When the Energy for Rural Transformation (ERT) program was established in 2001, Kakira submitted a down-sized plan to MEMD with a proposal to sell 7 MW to the national grid on a 24-hr. basis. The government's response was to allow Kakira to sell power only during the peak period for 6 hours per day. With this condition, Kakira had to choose a low efficiency technology (i.e. 20-bar boilers) and had to reduce its agricultural/factory expansion plan from 6,000 tcd to 4,000 tcd.

Still, Kakira decided to submit the first draft of the PPA in February 2002 with a proposal for a tariff of 8 US cents considering that the equipment will have a utilization of only 25 %. In July 2003, after 17 months of negotiations, the PPA was signed between Kakira and the utility at a low tariff of 4.9 US cents/kW, for the sale of 6 MW for 6 hours/day on take-or-pay basis, and with the condition that Kakira build a 14-km 33 kV new distribution line to connect to the grid at Kakira's own costs. It took the utility 4 months to approve the line specifications.

When the developer of the Bujagali hydropower project pulled out in late 2003, Kakira proposed to the government to extend the PPA to 12 MW, for which the government agreed to take for 18 hours a day. To support the project in reaching the required viability, a grant of 3.3 mil. USD and a loan of around 8 mil. USD were approved under the ERT program.

It is worth noting that had the government accepted Kakira's original proposal to sell 18 MW to the grid, the cogeneration plant using a more efficient design would have been completed and already selling power to the grid. This would have reduced the need for emergency diesel thermal power plants or as well as reduced the unpleasant power load shedding that is now being experienced in Uganda.

The above two cases show that without favorable government policies such as a long-term PPA with favorable tariff, agro-industries possessing biomass residues will not be likely to invest in modern, highly efficient cogeneration systems that are designed at maximum capacity to sell excess power to the grid.

Source: From discussions with factory owners

Despite the challenging bureaucratic environment exemplified by the experiences of the two factories mentioned in Box 3.2, the governments in the region have started structural power sector reforms and initiatives to improve the regulatory environment and encourage private participation into the electric power supply of the countries. Currently, in many countries in the region, regulations that officially allow sales of privately generated power by Independent Power Producers to the national grid are in place (see Table 3.9 below for regional details). However, it appears that although the legal framework exists development of standard tariffs through a transparent, long-term Standard Power Purchase Agreement are the final obstacle to be addressed, if the full potential for cogeneration is to be harnessed.

Table 3.9: Status of power sector reform in some African countries[19]

Country	Status of Power Reform Sector					
	Reform Policy	**New/Amended Electricity Act**	**Regulation Agency**	**Licenses Issued**	**Access to Grid Granted**	**Private Sector Participation**
Ethiopia	Implemented	Implemented	Implemented	No	No	Pending
Kenya	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
Malawi	Implemented	Implemented	Implemented	Implemented	Implemented	Pending
Mauritius	Implemented	Implemented	No	Implemented	Implemented	Implemented
Mozambique	Implemented	Implemented	Pending	Pending	Implemented	Pending
Namibia	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
South Africa	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented
Sudan	Implemented	Implemented	No	Pending	Pending	Pending
Swaziland	Implemented	Pending	Pending	Pending	Pending	Pending
Tanzania	Implemented	Pending	Implemented	Implemented	No	Implemented
Uganda	Implemented	Implemented	Implemented	Pending	Pending	Implemented
Zambia	Implemented	Implemented	Implemented	Implemented	Implemented	Implemented

3.4 Removal of Barriers

The success of the Cogen for Africa Project will mainly hinge on how effective it proves to be in removing the above-mentioned barriers. Hence, the activities of the project will be designed and structured to facilitate effective removal of

[19] Status of reforms updated after Council approval

the identified barriers which is expected to transform the cogeneration market in Africa and to lead to expanded and wider use of efficient high pressure cogeneration systems in the region.
In order to design measures that would be acceptable, appropriate and effective according to the realities and conditions of the market and the political climate of the countries involved, at least two local experts from each participating country – one from the energy agency and the other from a biomass producing industry – were commissioned to conduct market assessments and background investigations. The information obtained, together with the observations from discussions and interviews conducted with stakeholders (see Annex N), and the experience gained from the success of the cogeneration initiatives in Mauritius and Southeast Asia, were used to design and formulate activities that are expected to remove the identified barriers. The individual activities are not independent nor are they confined to remove a barrier in one category they are placed under, but will criss-cross through the different barrier categories and their synergy is expected to expedite the barrier removal process.
Below are the measures and activities that will be undertaken by the Cogen for Africa Project to remove the barriers in the different categories.
Removing technical barriers
The overall strategy of the Project in removing the technical barriers is for the Cogen for Africa Project, with its pool of international and regional technical experts, to develop and enhance the capacity of project developers, local technical service providers and local manufacturers in the countries involved.
One area where the potential project developers and project owners of cogeneration projects could be helped is in understanding the sectors where cogeneration is applicable and the magnitude of projects that could be implemented in these sectors. In order to provide a good understanding of the resources available for implementing cogeneration projects, an assessment of the fuel resources, mainly biomass outside the sugar industry (an initial assessment in the sugar industry has been made during the PDF-B stage) , in the seven participating countries will be conducted at the initial stage of the project implementation. This will ensure that potential project developers and participants have a good understanding of the prospects for cogeneration. Once mapped out, the energy potential of all these resources will be calculated, and together with the data and assumptions on the efficiency of the equipment, an estimate of the potential for electricity and heat generation will be made. This information will be made available to the staff of the Cogen Country Offices who will assist in exploiting the potential in their countries and to the potential project developers.

Once these resources are mapped out, the potential capacities that could be implemented by tapping these resources will be determined. On the technology supply side, a survey and assessment of relevant cogeneration technologies available in the global market, suppliers of these technologies and their capabilities, and the applicability of these technologies in the African cogeneration market will be conducted.

To capture the above information, a comprehensive, relational and user-friendly Cogen Database will be designed and developed. The Database, which will also contain information related to financing, policy and other technical matters, will be used to source technologies, conduct matchmaking activities between foreign suppliers and local manufacturers, mobilize funds, disseminate promotional and other relevant information, and for other related activities of the Project.
The capacity building activities on the technical area will be conducted mainly for local engineers and technical personnel in the countries involved. This capacity building activities will be in the form of seminars, workshops and training in subjects covering:

- Fundamentals of cogeneration
- Cogeneration application and technologies
- Biomass as fuel for cogeneration
- Technical and feasibility analysis of cogeneration projects
- Operation and maintenance aspects
- Environmental aspects

The capacity building activities will also aim to develop technical know-how and capability among the relevant local staff of the AFREPREN/FWD Regional Cogen Centre and the National Cogen Offices (the introduction of the Regional Cogen Centre and the National Cogen Offices and their descriptions are detailed in Sections 3.5.3 and 3.5.4).
It is envisaged that a comprehensive training module, which will ideally include a hands-on training within an existing cogeneration plant, will be developed and provided to the staff of the Regional Cogen Centre. The Regional Cogen Centre staff, once trained, will conduct the training of the staff of the National Cogen Offices. This approach is aimed to create a core competence within the personnel directly involved in the implementation of the Project and is expected to help in ensuring the sustainability of the Regional Cogen Centre after the completion of the project.
In addition to the capacity building activities, in order to address the lack of in-house and in-country expertise and experience in implementing biomass cogeneration projects, the Cogen for Africa Project will provide technical assistance and services to project developers and potential owners of cogeneration systems. These services will, among others, include the following aspects:

- Fuel aspects (availability, supply, storage, preparation, etc.)
- Estimation of energy potential from biomass fuel

- Technology selection
- Optimal system configuration
- Major equipment components and scope of supply
- Technical issues and considerations in contractual matters
- Project implementation and management
- Training of operators
- Operation and maintenance aspects

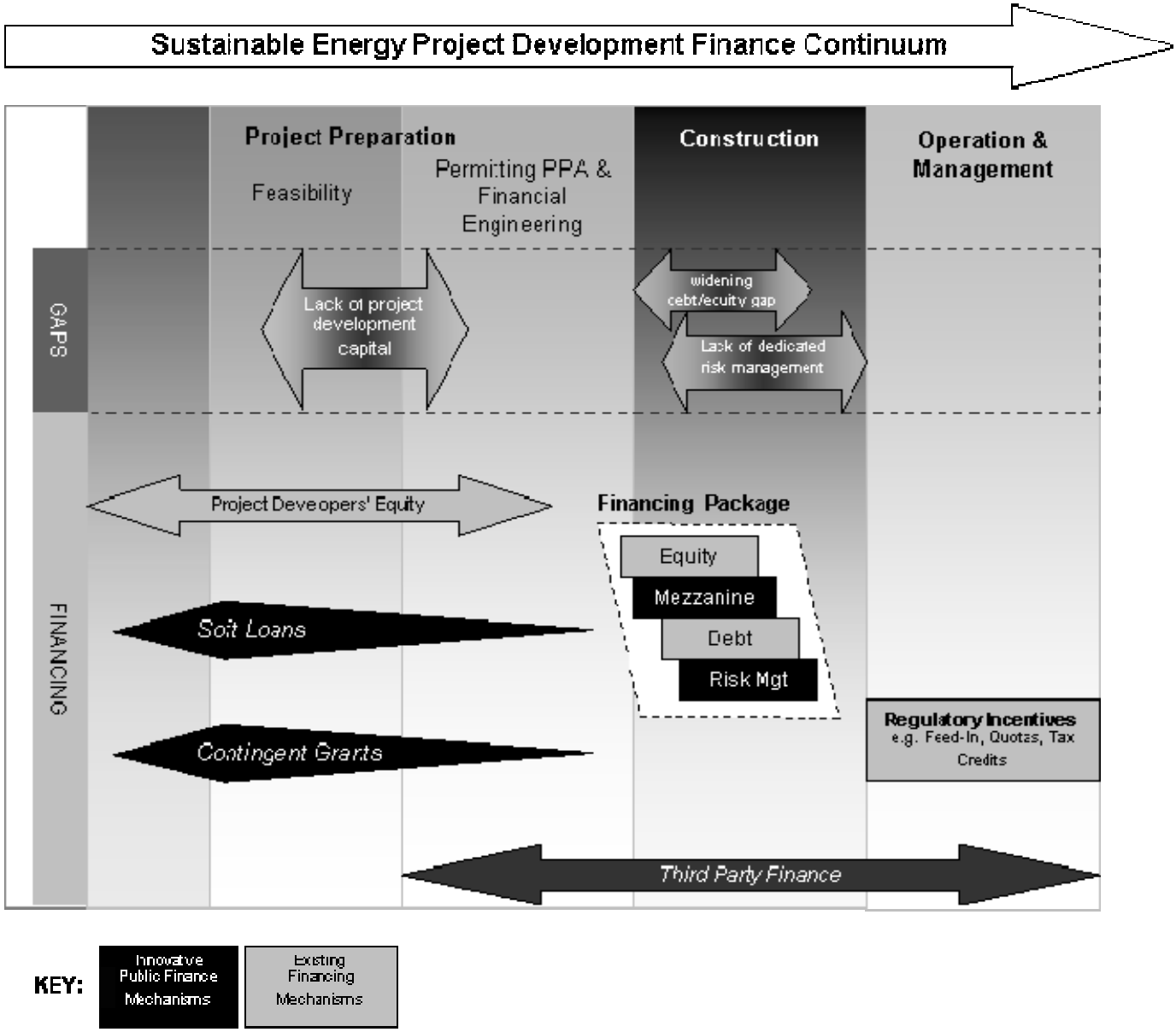
Since there are no existing references of successfully operating high pressure biomass cogeneration systems in the region (with the exception of Mauritius), particularly in the seven participating countries, it is generally useful for potential project developers to see a project which is successfully operating in a similar environment in order to increase their confidence to invest in the technology. Thus, the Project will organize visits by sugar factories from the region to successfully operated references in Mauritius. After one or more reference projects are implemented by this Project in the participating countries, visits to these installations by major stakeholders will be organized on a regular basis.

The lack of local manufacturing capability can be improved by encouraging partnerships between local manufacturing companies which have relevant scope of activities and foreign equipment suppliers. These partnerships could include licensing, joint venture partnerships after-sales service agreement, etc., perhaps starting from the non-critical pressure parts of boiler systems, for instance. A matchmaking strategy and program will be designed aiming at establishing these partnerships and enhancing local manufacturing capability during the project execution.

Removing financing barriers

Non-conventional or sustainable energy projects do not normally have the large scale viability of conventional energy projects, and therefore do not enjoy the financing opportunities and terms that are given to the larger and more financially attractive energy projects. A study launched by UNEP has shown that there is a gap in financing that exists particularly during the project preparation stage, reflected in the lack of development capital to support the efforts of project developers (see Figure 3.1).

Figure 3.1: Sustainable energy project finance continuum



Source: Public Finance Mechanisms to Catalyze Sustainable Energy Sector Growth, UNEP

In order to buy down the risks of investors and lenders in financing the projects, the AFREPREN/FWD Regional Cogen Centre will facilitate and assist projects in obtaining financial support from multi-lateral/bi-lateral agencies and public funds.

"The EC-ASEAN COGEN Programme in Southeast Asia provided grant support of up to 15 % of the equipment cost (with a ceiling of 400,000 Euro) to project developers/owners of biomass cogeneration plants. The support, which lowered the capital investment and mitigated some risks, directly stimulated investments which resulted in the implementation of more than 20 industrial scale demonstration projects with a total of more than 150 MW installed capacity."

The Cogen for Africa project has the possibility to stimulate and bring in support from different sources[20]. The support could come in different forms such as:

- Concessional/soft loans
- Seed capital
- Subsidies
- Provision of credit guarantees

[20] A list of sources for financing support is provided in Section 4.3.

- Other financial incentives

The Project will also provide assistance to both project developers and financing institutions in fulfilling the requirements for the projects to reach financial closure. This could be in the form of:

- Training and capacity building to project developers in matters related to:
  - investment appraisal and decisions
  - financial analysis and financing concepts
- Assistance to project developers in:
  - preparation of information memorandum
  - financial packaging
  - presentation of projects to financing institutions
- Training and capacity building to financing institutions in matters related to:
  - fundamentals of biomass fuels and cogeneration technologies
  - assessment of biomass cogeneration technologies
- Assistance to financing institutions in:
  - conduct of due diligence of projects
  - technical evaluation of projects

Financing of cogeneration projects, especially using biomass as fuel, requires particular attention and structuring in order to ensure its success. The following Box (Box 3.3) gives a checklist which developers should consider for cogeneration projects to be financed successfully. The experts within the Project will train developers and assist them in fulfilling the different aspects required in financing their projects.

Box 3.3: Checklist for successful financing of cogeneration and renewable energy projects

Shareholding and ownership

- *There is a clear shareholding and ownership structure which is reflected in a well structured Shareholders' Agreement.*
- *The owners and sponsors of the project have enough verifiable financial resources to contribute as equity according to the financial institution's minimum requirements.*
- *The owners and sponsors of the project have enough collateral and/or other guarantees to provide whenever required.*

Fuel aspects

- *The ownership of fuel (if biomass) or water rights (if hydro) is ascertained.*
- *The availability of fuel is surveyed and is proven to be available and enough for the use of the energy plant.*
- *An agreement for the supply of fuel (Fuel Supply Agreement) on a long-term basis (at least as long as the duration of the loan) is reached.*

Technology supply, construction and operation

- *Conceptual engineering has been done to ascertain the configuration of the plant and the technology has been selected appropriate for the chosen system.*
- *The main technology supplier(s) have been selected through a transparent and competitive process and their reliability/reputation ascertained.*
- *The complete scope of supply has been established and a turnkey supplier or an integrator (in the case of non-turnkey supply) has been selected.*
- *The equipment supply and construction contract reflects crucial aspects such as fixed costs conditions, performance guarantees and liquidated damages.*
- *An operation & maintenance (O&M) programme has been defined using a competent in-house team, or a reputable external O&M company is contracted.*

Off-take

- *The off-taker of energy (power and/or steam) has been ascertained and a sound, long-term agreement (Power Purchase Agreement) obtained.*
- *If electricity is sold to the grid or to a third party, the regulatory, logistical and technical aspects have been studied and ascertained.*

Financial viability

- *The financial analysis shows that the project is viable using conservative assumptions at different likely scenarios.*

- *The financial modeling shows acceptable cash flow and adequate debt service coverage*

Other development aspects

- *Studies and investigations related to the project development have been conducted such as: Fuel Availability Study, Feasibility Study and Due Diligence.*
- *The Information Memorandum summarizing the major aspects of the project has been prepared for submission to the financing institutions.*
- *Permits, consents and other documentary requirements have been ascertained and completed.*
- *Risks have been thoroughly assessed, adequately mitigated and properly allocated to the relevant and competent parties.*
- *Acceptance of the community and relevant interest groups has been obtained to implement the plant.*

Source: Gonzales, A.D., 2005

Removing commercial/market barriers

Looking at the specific barriers mentioned in the preceding section within this category, the major thread that goes through and links them together is the issue of risk. The risks related to the off-take of electricity because of the lack of a sound and long-term PPA, the perceived technical risk because of the lack of information and concrete examples in the region, and the risk related to viability because of high equipment and transaction costs, all hinder the potential developer to make the crucial move of making an investment in a modern and efficient cogeneration system.

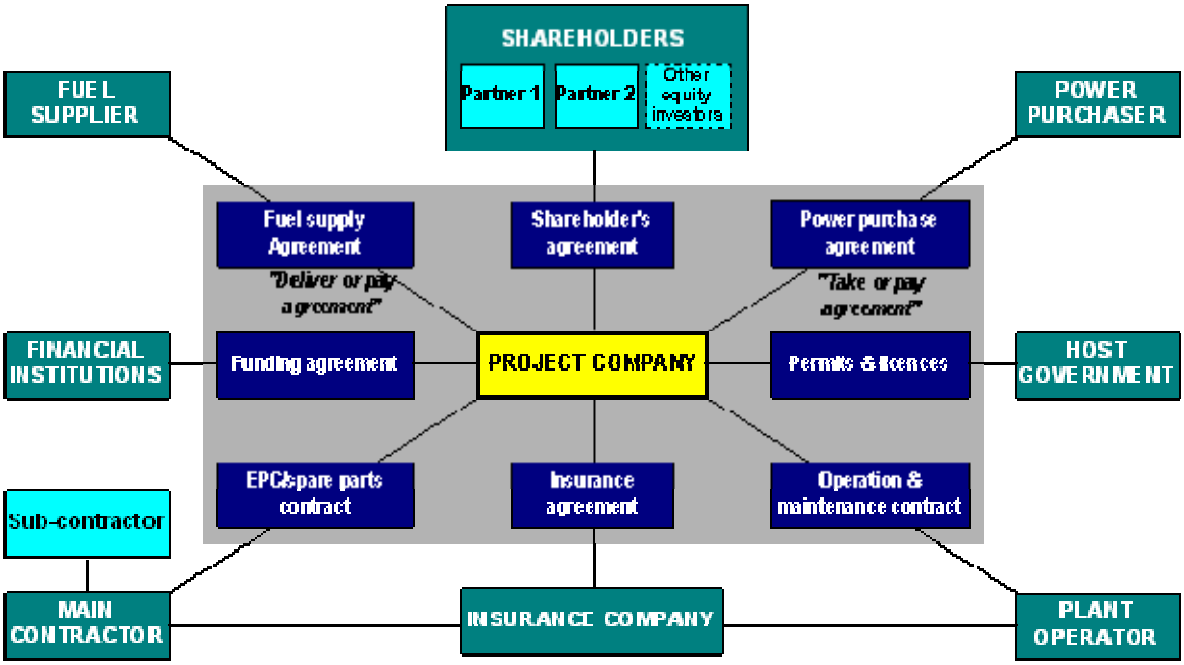
One important feature in the success of the project development process is the concept of risk transference and mitigation. In order to limit the risks to the sponsors of the project, and to the project company itself, there is a need to transfer or to allocate specific risks to external parties who are best able to manage, absorb or mitigate them in the most efficient manner.

A major way to structure the project so that the risks are mitigated and allocated properly is to have credible and fundamentally sound security arrangements consisting of contracts and agreement with the different parties involved. These commercial contracts form the basis of the security structure which creates and ensures the cogeneration project cash flow. The typical principal contracts that should be secured include:

- engineering, procurement, and construction (EPC) agreement
- fuel supply contract
- operations and maintenance agreement
- power purchase agreement
- shareholders agreement

In Figure 3.2, the security arrangements for a typical power project are shown.

Figure 3.2: Security arrangements of a sound cogeneration project



Developing a sound project and organizing all the security arrangements take a lot of efforts and costs. Since most, if not all, of the local developers do not have the in-house expertise to do them and the local/regional capability is limited, they would require services of expensive external service providers for this purpose. The Cogen for Africa Project, as part of its Technical Assistance activities, will assist project developers in structuring their projects and in providing services and advice in making investment decisions and carrying our their project development activities. This is expected to lower the expenses of the projects related to transaction and financing costs which will help in increasing the viability of the projects.

Further to this, it was earlier identified that the absence of successful examples is one of the major barriers in convincing potential developers to invest in modern cogeneration technologies. One of the major activities that the Cogen for Africa will do to demonstrate the technical reliability and economic benefits of modern and efficient biomass cogeneration systems is implement a set of Full Scale Promotion Projects (FSPP) within the seven participating countries. These FSPPs will act as show cases aiming at convincing other potential end-users to implement these technologies.

The initial set of FSPPs will become show cases which similar industries and other stakeholders such as project developers, financing institutions, government agencies, NGOs, civil and community groups, could visit and ascertain the technical feasibility, economic viability/benefits, social impact and environmental performance of the projects. The FSPPs are expected to provide good references not only within the six participating countries but also to the other countries in the African region.

As the first set of FSPPs will not have the benefit of successful examples to follow in the region, and since there is a dearth of information and expertise available to assist in the development and implementation of these projects, supporting mechanisms will be provided to encourage the potential developers to decide and invest in the technology.

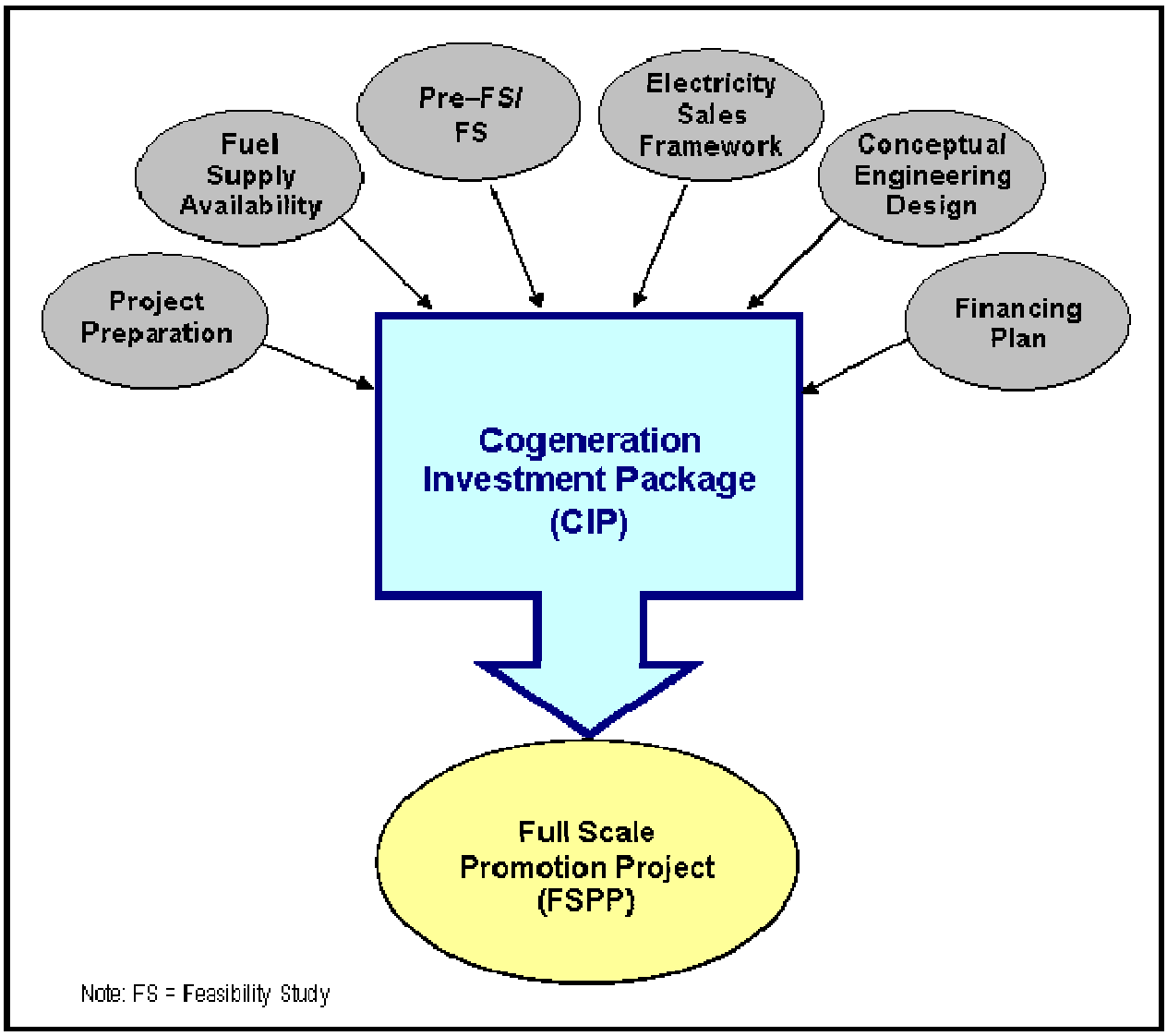
These supporting mechanisms will consist of advice and services provided free-of-charge during the development stage of the project.

More specifically, in order to find ideal candidates for FSPPs, the Project shall identify biomass-producing industries that are willing to be assisted in developing projects that are in the conceptual stage into full-blown commercial and industrial scale projects. For these projects, necessary documentation, studies, and activities will be conducted and the resulting outputs will be documented and packaged into a report to be called the Cogeneration Investment Package (CIP). With the CIP on hand, the potential project developer/owner will have reliable and detailed information which shall be enough to proceed with more advanced development and implementation of a Full Size Promotion Project (FSPP). However not all CIPs are expected to lead to an FSPP. The specific items to be addressed which will be contained in the CIP are listed below and are graphically represented in Figure 3.3.

- Business model and project structuring
- Fuel supply availability
- Pre-feasibility study/Feasibility study
- Electricity sales framework
- Conceptual engineering design
- Financing plan

It should be noted that the preparation of the CIP for the developer/owner of the project should reduce the development and transaction costs of the project which normally costs between 5 to 10 % of the total project cost, and therefore reduce the risk of having to spend on sunk costs that may not result to profitable projects. The reduction in development costs for the investor will also yield in higher returns for both the project and the equity invested by the developer.

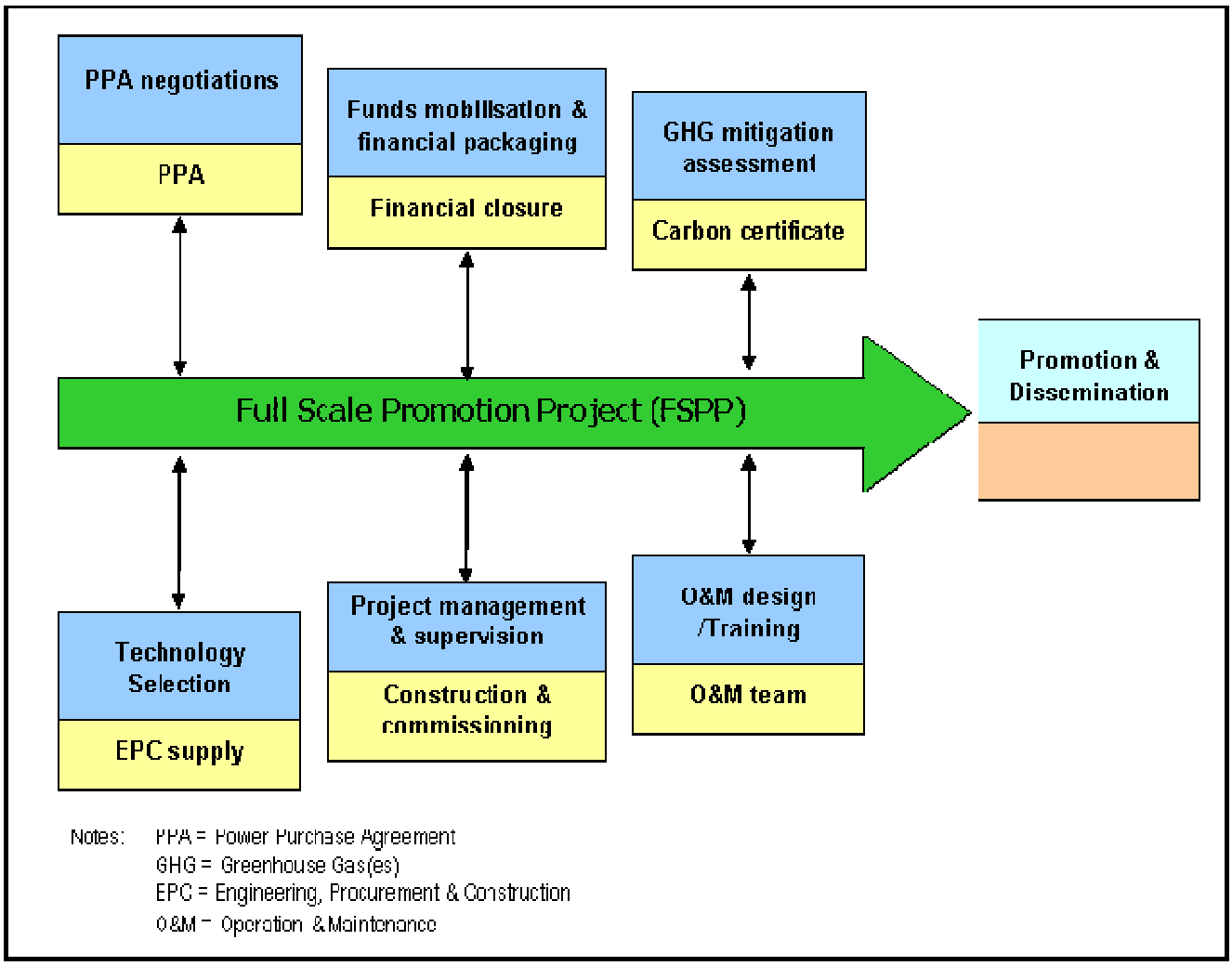
Figure 3.3: The Cogeneration Investment Package



At this stage, further services will be provided to the project developer/owner(s) for the purpose of advancing the projects into implementation stage (Figure 3.4). Additional and more detailed services will be provided consisting mainly of the following aspects:

- Assistance in selection of technology and equipment suppliers
- Advice in project management and supervision during construction and commissioning
- Advice in the design of O&M framework and training of operators
- Assistance in negotiations of PPA
- Assistance in funds mobilization and financial packaging to attain financial closure
- Assistance in accessing environmental and carbon finance support

Figure 3.4: Support services for FSPPs



Further details on the mechanics of the FSPP are described in the Methodology section.
In parallel with the development of FSPPs, potential projects that are in the early conceptual stages will be identified. These will be followed up and, if appropriate, advice will be provided in order to bring them to a level of development where they can be developed into FSPPs. These projects in the pipeline could also be implemented as replications of the FSPPs. The replications are projects that are implemented following the example of an FSPP and without the same comprehensive support provided to an FSPP.
Removing regulatory/policy/institutional barriers
The Cogen for Africa Project will aim to remove the barriers to the widespread implementation of cogeneration in Africa due to regulatory, policy and institutional constraints, but more importantly, it will aim to promote more favorable policies and institutional arrangements that support cogeneration. Below are some of the specific actions that the Project will try to address:

- Increase awareness among senior decision makers of the potential benefits of advanced high-pressure cogeneration
- Lobby for explicitly policies that promote cogeneration
- Encourage the reduction of bureaucratic and non-coordinated procedures to obtain permits
- Formulate and lobby for clear, transparent and explicit regulations related to interconnection to the grid and rural electrification
- Support the establishing of dedicated regional and national institutions providing information and services for new and highly efficient cogeneration

To support the above actions, at the start of the project implementation a review and analysis of the existing policies and regulations in the seven participating countries will be conducted. The aim is to identify gaps in policies and to recommend policy interventions and enhancements supporting cogeneration.
Some of the policies and regulations to be explored and proposed to the governments, where applicable include:

- Feed-in tariffs and regulations
- Other special tariffs
- Guaranteed grid access

- Special grid connection rules
- Reduction in administrative procedures
- Ability to sell electricity to third parties (e.g. mini-grids for rural electrification)
- Tax breaks
- Planning obligations (e.g. obligatory use of cogeneration for steam supply in new industrial estates)
- Planning constraints on new power stations (prioritizing cogeneration installations)
- R&D programs
- Demonstration programs
- Information dissemination programs
- Education and training

An advocacy plan and program will be designed to lobby for and influence policy reforms that promote highly efficient cogeneration and their effective implementation. As far as the governments allow, the Project will also provide policy guidance and assist relevant agencies in formulating policies and regulations to support cogeneration.
One of the major issues which the Project will focus on is the formulation of a Standard Power Purchase Agreement (PPA) that reflect reasonable feed-in tariffs and terms that are transparent and reflect long-term commitments from utilities in all the participating countries.
Because currently, there are no established institutions dedicated at providing information and services to stakeholders involved in cogeneration, a one-stop information centre, hosted by the Project will be created.
Since information and awareness are key to making the policy makers and other stakeholders understand the value and benefits of implementing modern, high-pressure cogeneration systems, a promotional strategy will be developed and implemented to prepare and disseminate relevant information to targeted audience.
Table 3.10 below summarizes the barriers identified according to the four main categories and the specific measures/activities proposed in the Cogen for Africa Project to remove them. The detailed activities to be carried out by the Project and their descriptions are delineated in Section 3.5.6.

Table 3.10: Summary of barriers and measures within the project to remove them

Barriers	Measures to remove barriers	Specific activities of Cogen for Africa Project to remove barriers
I. Technical • Lack of in-country experience in using high-pressure, high-temperature systems • Lack of local capability/ expertise to support the development, implementation, operation and maintenance of modern and efficient cogeneration systems • Absence of local manufacturing capability	• Capacity building activities to develop local expertise • Provision of expert advice and support to potential developers • Partnerships between foreign equipment suppliers and local manufacturers • Visits and study tours to successful installations in a similar environment	• Conduct of seminars, workshops and trainings • Train local engineers within the Cogen Centre • Provide technical advice and services to project developers • Matchmaking for partnerships between foreign suppliers and local manufacturers • Organize visits to successfully operated references in Mauritius and later, within the region
II. Financing • Absence or lack of low-cost, long-term financing • Lack of assets that could be used as collaterals and guarantees to secure loans • Lack of developers with the skills to prepare financing packages that responds to the needs of financial institutions • Financial institutions lack the expertise to evaluate cogeneration projects • Lack of experience by financing institutions working	• Assistance to project developers in obtaining funds at favorable terms to the project • Assistance to financing institutions in the conduct of technical due diligence and project/technology assessments • Capacity building and training of project developers on financing matters • Capacity building and training of financing institutions on understanding biomass energy and assessment of cogeneration technologies	• Assist project developers in mobilization of funds, financial structuring and financial packaging • Provide financing advice and services • Assist financing institutions in the conduct of due diligence and technical evaluation of projects • Conduct training of project developers on investment appraisal and financial analysis • Conduct training for financing institutions on biomass aspects and assessment of cogeneration technologies

in new service areas leads to higher perception of risk.		
III. Commercial/market • Lack of successful examples of biomass cogeneration installations in the region • Inadequate technical and economic information to make investment decisions • High capital, development and transaction costs • Lack of framework securing revenues from sales of electricity from cogeneration systems	• Implementation of demonstration/promotion projects as showcases for replication in the region • Availability of adequate technical and commercial and economic information for investment decisions • Provision of support and advice to project developers in matters related to investment decisions, project structuring and project development • Provision of services to reduce pre-investment expenses	• Organize, support and promote Full Scale Promotion Projects (FSPPs) in the region • Conduct comprehensive assessment of resources and potential for biomass cogeneration • Assist project developers in project structuring and project development activities • Provide pre-investment services to reduce transaction costs • Provide advice related to investment options and decisions
IV. Regulatory/policy/ institutional • Inadequate policies explicitly promoting cogeneration • Limited awareness among senior decision makers of the potential benefits of advanced high-pressure cogeneration • Lack of supporting institutions providing information and services for new and efficient cogeneration • Bureaucratic and non-coordinated procedures to obtain permits • Lack of regulations related to interconnection to the grid and mini-grids for rural electrification • Absence of a Standard Power Purchase Agreement (PPA)	• Policy formulation, reform and enhancements to support cogeneration • Effective implementation of regulations and policies • Establishment of a centralized supporting agency to provide information and services related to cogeneration • Centralization/harmonization of permits and approvals for implementing cogeneration plants • Awareness campaign for relevant stakeholders • Formulation and approval of a framework to sell excess power to the grid (e.g. PPA, etc.), including operation of mini-grids for rural electrification	• Assess the existing regulations and policies, analyze gaps and provide recommendations for policy intervention • Implement advocacy activities to influence policy reforms and implementation to support cogeneration • Provide policy guidance to relevant agencies in formulating policies and regulations to support cogeneration • Act as a one-stop information centre for the provision of information and services related to cogeneration • Conduct awareness campaign through forums and dissemination of relevant information • Assist in the formulation and establishment of frameworks in each participating country for selling of excess power to the grid (Standard PPA), including operation of mini-grids for rural electrification

3.5 Project Design and Methodology

3.5.1 Objectives

The development goal of the Cogen for Africa Project is the creation of a self-sustaining cogeneration industry in Africa thereby contributing to the reduction of CO2 emissions.

The overall objective of the Cogen for Africa project is to help transform the cogeneration industry in Eastern and Southern Africa into a profitable cogeneration market and promote widespread implementation of highly efficient cogeneration systems by removing barriers to their application.

In a continent with an increasing demand for energy, cogeneration should become the common standard wherever appropriate and applicable. The project is expected to result in the following outcomes:

- Outcome 1: Capacity of project developers, technical service providers and local manufacturers of modern and efficient cogeneration systems developed and enhanced
- Outcome 2: Financing for cogeneration projects made available and accessed at terms and conditions that are favorable for investments.
- Outcome 3: Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated in a number of new cogeneration plants and confidence on the certainty of the cogeneration market enhanced.

- Outcome 4: More favorable policies and institutional arrangements that support cogeneration promoted

3.5.2 Overall concept and approach

The concept of the Cogen for Africa Project and the methodologies used in its implementation are based on proven and tested approaches that have been used elsewhere. The strengths of these approaches have been adapted to suit the African context and business environment. These are described below.

The Mauritius model

The tiny island of Mauritius has something to offer to Africa and to the world – in the field of cogeneration. Its sugar industry which had been churning out bagasse as residues from its sugar processing activity, is using these residues as fuel in highly efficient cogeneration systems. Today, the electricity produced by these cogeneration plants in the sugar industry is supplying 40% of the total consumption of the whole country. The revenues coming from this business venture represent more than half of the total revenues of the sugar factories.

The success of the cogeneration industry in Mauritius stems from the investments in, and use of, high pressure boiler systems (up to 82 bar pressure) and highly efficient condensing/extraction-condensing turbo-generators which allow the project owners to implement much higher capacities than what the factories need, thereby giving them opportunity to sell excess power to the grid. The sale to the grid has been facilitated and encouraged by the favorable buyback tariffs and terms reflected in a transparent and long-term Standard Power Purchase Agreements (PPA).

The revenues earned by the sugar factories from the sales of electricity to the grid are shared among the farmers using an agreed sharing mechanism. This effectively increases the earnings of the farmers from the same amount of sugar cane produced because bagasse which had been traditionally considered as wastes is now being paid as fuel. The positive impact of this development to the economic situation of the farmers is not negligible and had engendered widespread support for the cogeneration industry.

Because of these experiences, Mauritius has recently started to provide expertise in developing and implementing cogeneration systems in other countries in the region through consultancy work and management contracts.

A regional approach: The Cogen Asia model

The cogeneration program which has been successfully operated for many years in Southeast Asia and has directly and indirectly promoted the implementation of up to 600 MW of cogeneration projects in the region was implemented as a regional program involving nine countries within the Association of Southeast Asian Nations (ASEAN). The regional nature of the program allowed the resources to be used at an optimum level by setting up a single Executing Agency in the region which hosted the Programme Management Unit where the activities of the program emanate from. Country Coordinators which act as focal points in the participating countries have been selected and provided support to the program. They also provided the link and had been in constant contact with the stakeholders in their respective countries.

This approach created a synergistic effect due to the conduct of regional seminars and training which were attended by participants from different countries, organization of forums and study tours for policy makers in the region, and visits by regional participants to demonstration projects which have been successfully installed and operated in the region. These regional activities provided avenues for the participants to learn from the experiences of other countries, exchange lessons and ideas policy issues, and even conduct joint projects on cogeneration.

3.5.3 UNEP/GEF and African Development Bank (AfDB) - Co-implementation of Cogen for Africa Project

In line with recommendations of the GEF council in August 2006, the Cogen for Africa project will be co-implemented by UNEP/GEF and the African Development Bank (AfDB). A detailed Cooperation Modalities Memo has been prepared by AfDB, UNEP and the Executing Agency. The Memo confirms that AfDB will be involved in all the key project decisions and will actively participate in the project Steering Committee. AfDB have also reviewed and approved the entire project document, detailed budget, draft Terms of Reference, proposed procurement and hiring processes.

The specific modalities for the two co-implementing agencies, AfDB and UNEP/DGEF will be as follows but not limited to:

- Facilitation and coordination of AfDB's assistance in the preparation of investments projects through the participation of the AfDB Task Manager (or his/her representative) in Steering Committee Meetings of both projects which will be organized back-to-back.

- The associated mission expenses of the AfDB Task Manager will be covered through UNEP/DGEF to ensure representation of AfDB at Steering Committee Meetings.

In collaboration with UNEP/DGEFand AFREPREN/FWD, the role and responsibility of the AfDB Task Manager would be to assist in the following (a significant part of which will be undertaken in preparation of participation in Steering Committee Meetings):

- Investment project preparation through the technical assistance of an AfDB Energy Expert
- Review and assessment of TORs/guidelines for full feasibility studies to ensure that they meet international banking and financing standards.
- Review and assessment of draft full feasibility studies prepared by both GEF project to ensure that they meet international banking and financing standards.
- Review and assessment of the TOR, composition and functions of the Steering Committees for both projects.
- Review and assessment of budgets of both projects.
- Review and assessment of TORs and selection of AFREPREN/FWD-Regional Cogen Centre Director, associated local coordination team and national cogen centres
- Review and assessment of TORs and selection of regional and international consultants/experts to be recruited by AFREPREN/FWD
- Participation in twice-a-year face-to-face Project Steering Committee & Management Meetings (PSC/PMC) of the project (additional PSC/PMC Meetings could be undertaken in the form of teleconferences) which also involve representatives of the Executing Agency (AFREPREN/FWD).
- Any other assistance required to bring identified and sound investments to rapid realization.

Key principles that the co-implementers and executing agencies will adhere to and which will assist in ensuring expeditious development of mature and sound investments in both the cogen and small hydro sub-sectors include the following:

- Maximize budget allocations to full feasibility and pre-feasibility studies which are crucial for investment preparation and for convincing potential sponsors and financiers to make the required commitments.

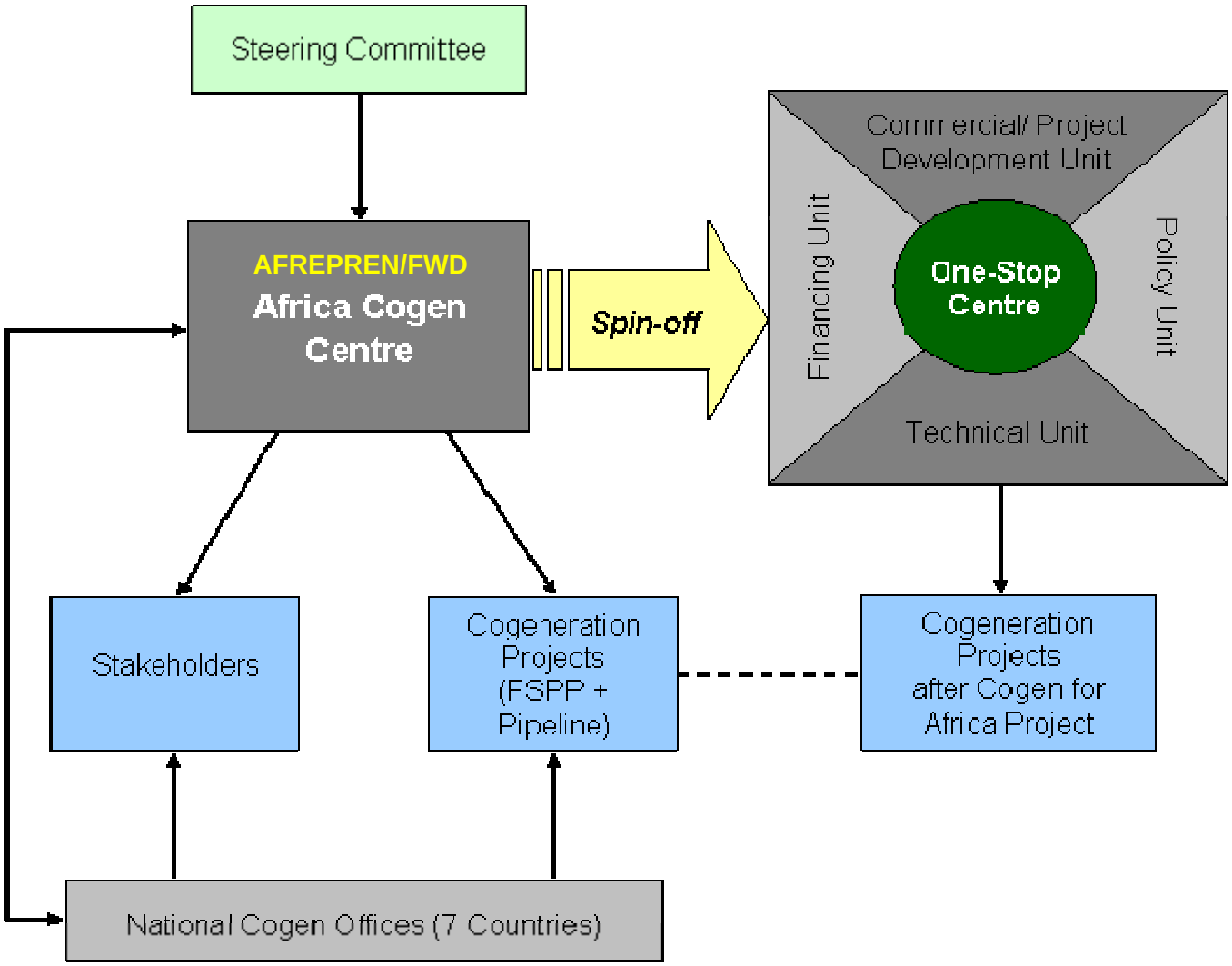
- For local coordination, management and facilitation of project, maximize use of local expertise and skills found in Executing Agency and the countries targeted by the project to ensure cost-effective use of project funding and long-term sustainability.

3.5.4 The AFREPREN/FWD Regional Cogen Centre: a centre of excellence for cogeneration[21]

A major platform for the implementation of the Cogen for Africa Project is the creation of a regional centre of excellence at AFREPREN/FWD to be called the AFREPREN/FWD Regional Cogen Centre which will act as the project management unit of the Project. This center will be modeled on the Cogen Asia Model but taking into account some of the region's specific needs and characteristics, as well as build on the successful Mauritius' experience. It will operate as the center of excellence for cogeneration in the African region. The Regional Cogen Centre will consist of four functional units covering the areas of technical, financing, project development/commercial aspects, and policy matters. These units will be manned by both International and Regional/Local Experts and will act as a one-stop information and service center providing advice, assistance and services to stakeholders of cogeneration investments. Support will be provided by the private sector during years 4 to 6 of the Project implementation.
The AFREPREN/FWD Regional Cogen Centre will report and will be accountable to AFREPREN/FWD and the Project Steering Committee (described in Section 5.3.1) while being supported at the national level by National Cogen Offices which will be set up in each of the countries participating in this Project. The National Cogen Offices will be the first level contact and will liaise with stakeholders in their respective countries.
Upon completion of the project, the one-stop information and service center is expected to spin-off into a self sustaining entity which will continue to provide institutional and practical support to the cogeneration industry in the region.
An overview of this concept is presented in graphical form in Figure 3.5.

[21] Detailed institutional and hosting arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

Figure 3.5: Overview of the Cogen for Africa Project concept



AFREPREN/FWD, the Executing Agency of the Cogen for Africa Project, will host the Regional Cogen Centre which shall manage the activities of the Project (for details on AFREPREN/FWD, please refer to Annex O).

Role and services of the AFREPREN/FWD Regional Cogen Centre

The role and services of the AFREPREN/FWD Regional Cogen Centre are given below. The services have been categorized according to the stakeholder groups served.

Services for (Potential) Project Developers/Owners:

- Support project development process through:
  - the identification of opportunities
  - assistance in preparation business concept and plans
  - identification and selection of technologies and suppliers
  - technical advise to potential investors
  - assistance in pre-investment and feasibility studies
  - assistance in structuring security arrangements (drafting of contracts/agreements and follow up on contractual obligations)

- Support in mobilizing funds and arranging financing through:
  - identification of relevant financing institutions and schemes
  - design of appropriate financing structures for cogeneration projects
  - assistance and facilitation in creation of innovative financing schemes for cogeneration projects
  - assistance in financial structuring and packaging and related activities such as preparation of Financing Plan, Information Memoranda, Term Sheets and other documentation
  - assistance in presentation to, and negotiation with, financing institutions
  - advice in drafting of Financing Agreement

- Support the development of FSPPs through:
    - advice and assistance on application and eligibility
    - financial support, whenever applicable
    - assistance in PPA formulation and seeking approval from authorities
    - advice in project management and supervision during construction and commissioning
    - advice in the design of O&M framework and training of operators

- Conduct training and capacity building activities on, but not limited to, the following aspects:
    - investment appraisal and decisions
    - financial analysis and financing concepts
    - conduct of techno-financial and feasibility studies
    - project development process
    - biomass fuel and combustion characteristics
    - power systems and design concepts
    - fundamentals of cogeneration technology
    - basic and conceptual design of cogeneration systems
    - technology assessment

- Assist in activities leading to environmental and carbon finance participation
- Prepare and disseminate Cogeneration Policy Guidance
- Organize visits and study tours to reference cogeneration installations
- Provide country specific and regional market information

Services for Financiers and External Investors:
- Identify cogeneration opportunities for financing
- Support in the assessment of cogeneration project bankability through:
    - conduct of due diligence of projects
    - technical evaluation of projects
- Conduct training and capacity building to financing institutions in matters related to:
    - fundamentals of biomass fuels and cogeneration technologies
    - assessment of cogeneration technologies
- Organize visits and study tours to reference cogeneration installations
- Provide country specific and regional cogeneration and power market information

For Equipment Suppliers (foreign and local):
- Identify potential projects
- Provide access to Cogen Database on potential partners and their capabilities
- Assist in forging partnerships between foreign equipment suppliers and local manufacturers
- Provide country specific and regional market information

For African Policy Makers:
- Provide cogeneration policy guidance, including matters such as:
    - regulations, consents and permits on sales of electricity to the grid from renewable energy and/or cogeneration
    - utility grid connection for sale of firm/non-firm excess electrical power
    - fiscal and non-fiscal incentives
- Assist in drafting and formulating Standard Power Purchase Agreements
- Arrange dialogues between governments and end users to facilitate understanding of requirements from both ends in order to come up with mutually beneficial policies and regulatory measures
- Organize visits and study tours to reference cogeneration installations

Coordination, Administrative and Secretarial Services:
- Overall coordination and management of the Project
- Set up the premises of the AFREPREN/FWD Regional Cogen Centre within the offices of AFREPREN/FWD and prepare for mobilization
- Identify and recruit national, regional and international experts and staff
- Select, negotiate and contract National Cogen Offices in all participating countries
- Liaise with, train and provide technical assistance to National Cogen Office staff

- Procure office and Project equipment, furniture, supplies, etc.
- Set up IT network and devices
- Prepare Inception Report and Detailed Work Plan
- Manage the financial activities and reporting of the Project
- Procure and adapt Management Information System which will capture, record and report on financial, administrative and management information of the Project
- Organize meetings, and provide administrative support to capacity building activities
- Organize production and printing of reports and promotional materials
- Provide secretarial and administrative services to all the Units and personnel of the Project

Personnel[22]

The proposed personnel of the AFREPREN/FWD Regional Cogen Centre will consist of local as well as regional and international staff. This is elaborated below:

To ensure that the project's initial focus is on investments (and not dissipated in the vagaries and complications associated with assembling a whole new team to run the project), it is recommended that staffing of the Regional Cogen Centre is largely drawn from existing AFREPREN/FWD staff with the right skills, qualification and exposure – about half of the technical staff of the regional cogen centre is expected to be hired from AFREPREN/FWD staff. This will also allow rapid initiation of the project (avoid delays associated with getting the requisite work permits for international experts), and be cost effective as the existing AFREPREN/FWD staff are not as highly paid as international and regional experts/consultants.

To address any skills gap, the staff of the Regional Cogen Centre will be supported by part-time regional and international experts to be contracted as and when needed. Details of the qualifications and responsibilities of the personnel are elaborated in Annex T.

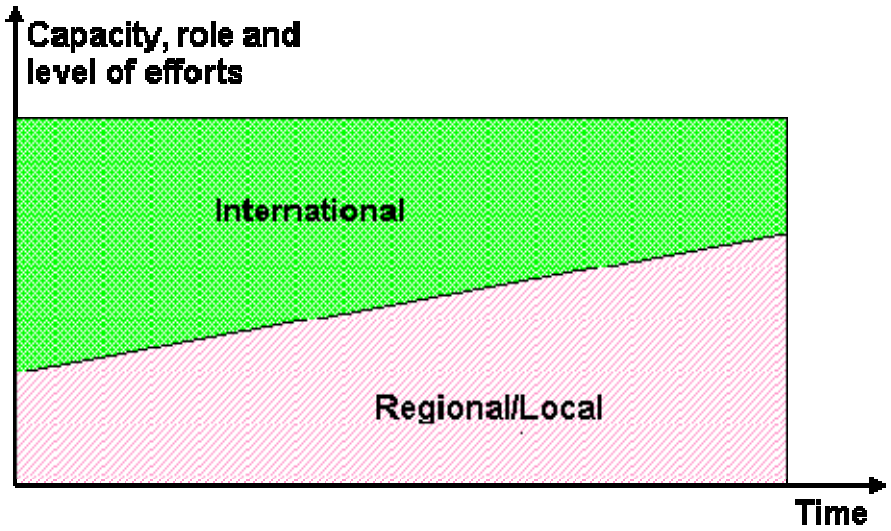
It is expected that the bulk of the international/regional experts/consultants as well as country experts will be contracted to undertake pre-feasibility and feasibility studies (CIPs), as well as other studies that may be required. The involvement and contribution of the International Experts/consultants will ensure:

- high quality technical and financial implementation of the project
- that lessons and experience in other parts of the world are considered and adapted, whenever necessary
- transfer of knowledge and capability to regional/local personnel.

Thus, the person-power requirements and responsibilities of the International Experts/consultants are structured to fulfil the above factors. It is expected that at the beginning of the project, the capacity contribution and level of efforts of the International Experts/consultants will be high, primarily focused on pre-feasibility feasibility studies (CIPs). As time progresses and internal capacity building takes place, the capacity contribution and level of efforts of the International Experts are expected to diminish and the Regional/Local expertise takes a more centre stage in the activities of the project. Figure 3.6 illustrates this idea.

Figure 3.6: Contribution and involvement of International Experts/Consultants vis-à-vis Regional/Local Experts

[22] Detailed institutional arrangements and recruitment process elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.



The personnel will be organized to effectively fulfill the major outcomes of the project on one hand, and to prepare for sustainability on the other hand. These are ensured through the following means:

- The appointment by AFREPREN/FWD of a Regional/Local professional to act as the Director of the AFREPREN/FWD Regional Cogen Centre
- The division of functions and responsibilities into four functional groups according to the four different units described earlier
- The Regional/Local personnel to take leadership, responsibility and "ownership" of the work within the different units through the Unit Heads, while the International Experts provide guidance, advice, training, inputs and act as resource individuals
- The Regional/Local personnel to be employed on a part-time basis for the duration of the Project, and three Regional Experts/consultants working on a short term basis. The capacity, involvement and responsibilities of the Regional/Local personnel to increase in time.
- The International Experts/consultants to consist of, at any one time, a full time (75%) expert, working on a specific pre-feasibility or full feasibility study (CIP), for the duration of the Project with the rest of the experts/consultants working on short term basis according to specific outputs and assignments. The role and involvement of the Short-Term International experts/consultants will decrease in time.

Below are the proposed personnel for the AFREPREN/FWD Regional Cogen Centre within the Cogen for Africa Project, with further elaboration on composition of the expert units and teams:

Regional/Local Personnel

A. Part Time

- AFREPREN/FWD Regional Cogen Centre Director and Associate/Assistant Director
- Project Development, Biomass and Scoping Studies Unit
- Training and Capacity Building, Conference and Event coordination Unit
- Financing and Full Feasibility/CIPs Unit
- Policy advocacy and dissemination Unit
- Technical and pre-feasibility studies Unit (Mechanical /Power/Electrical Engineer)
- Finance/Administrative Staff – Finance officers, Information Systems and Technology coordination; Secretary and Administrator.

B. Short Term

- Regional Cogeneration Expert – To be part of pre-feasibility and full-feasibility/CIPs expert team
- Regional Policy Expert – To be part of pre-feasibility and full-feasibility/CIPs expert team
- Regional Environmental Expert – To be part of pre-feasibility and full-feasibility/CIPs expert team

International Experts

A. Part Time

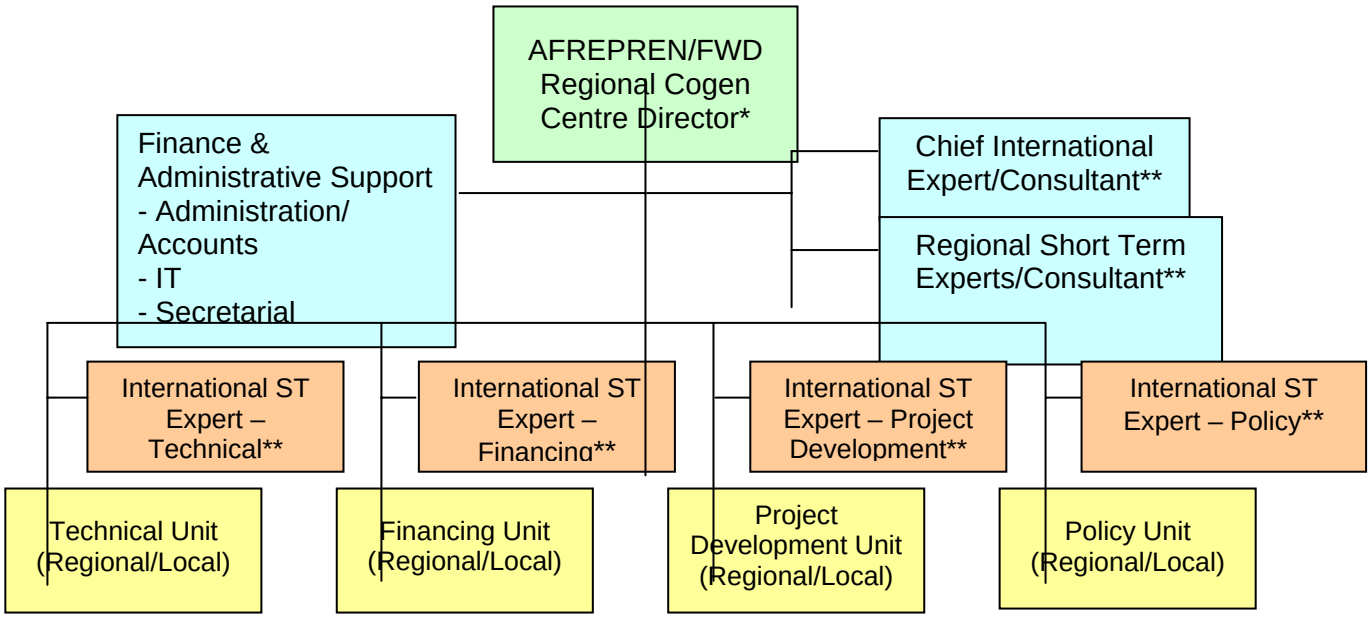
- Principal International Consultant/Expert - To be part of pre-feasibility and full-feasibility/CIPs expert team

B. Short Term

- Business/Project Development Adviser – To be part of pre-feasibility and full-feasibility/CIPs expert team
- Financing Expert To be part of pre-feasibility and full-feasibility/CIPs expert team
- Policy Expert To be part of pre-feasibility and full-feasibility/CIPs expert team
- Cogeneration Expert– To be part of pre-feasibility and full-feasibility/CIPs expert team
- Environmental Expert– To be part of pre-feasibility and full-feasibility/CIPs expert team

The organizational structure of the AFREPREN/FWD Regional Cogen Centre and the distribution of the personnel according to their roles and functions are given in Figure 3.7.

Figure 3.7: Organizational structure of the AFREPREN/FWD Regional Cogen Centre



Notes: * Includes associate/assistant director to assist with project management, as well as take lead in M&E and CIP compilation.
** These experts will be part of the pre-feasibility and full feasibility (CIPs) expert teams
IT = Information Technology
ST = Short-Term

The Full Scale Promotion Project (FSPP) concept

During the early and PDF-B stages of project preparation, as part of the needs assessment among stakeholders, discussions were held with potential developers of cogeneration projects to find out, among others things, the support and services these companies require outside their in-house expertise to develop, implement and operate high pressure cogeneration systems.

The following required support and services which will be provided by the AFREPREN/FWD Regional Cogen Centre have been identified:

A. Project development stage:

- Business model and project structuring
- Fuel supply availability and energy potential calculations
- Pre-feasibility study/Feasibility study
- Electricity sales framework (Standard PPA)
- Conceptual engineering design
- Financing plan

B. Project implementation stage:

- Assistance in selection of technology and equipment suppliers

- Advice in project management and supervision during construction and commissioning
- Advice in the design of O&M framework and training of operators
- Assistance in PPA formulation and seeking approval from authorities
- Assistance in funds mobilization and financial packaging to attain financial closure
- Assistance in accessing environmental and carbon finance support

The requirement for the above support and services by the companies are dependent on the type of company and the level of operational efficiency of the company. To illustrate, Figure 3.8 shows a matrix of the classifications of the sugar factories (which is one of the major industries using cogeneration) in Kenya, according to their ownership and degree of operational efficiency. These four types of companies require different levels of support and services. This spectrum of services vis-à-vis the type of company is captured in Figure 3.9.

Figure 3.8: Matrix showing the types of sugar factories in Kenya according to ownership and degree of operational efficiency

Privately-owned	**State-owned**	
Mumias West Kenya	Chemilil	**High operational efficiency**
Busia	Muhoroni Nzoia Sony	**Low operational efficiency**

Figure 3.9: Matrix showing the level of support required according to ownership and degree of operational efficiency

Privately-owned	**State-owned**	
• Fuel supply availability • Assistance in PPA formulation and seeking approval from authorities • Assistance in funds mobilization and financial packaging to attain financial closure • Assistance in pursuing CDM opportunities	• Business model and project structuring • Fuel supply availability • Pre-feasibility study/Feasibility study • Financing plan • Assistance in PPA formulation and seeking approval from authorities • Assistance in funds mobilization and financial packaging to attain financial closure • Assistance in pursuing CDM opportunities	**High operational efficiency**
• Fuel supply availability • Conceptual engineering design • Assistance in selection of technology and equipment suppliers • Advice in project management and supervision during construction and commissioning • Advice in the design of O&M framework and training of operators • Assistance in PPA formulation and seeking approval from authorities • Assistance in funds mobilization and financial packaging to attain financial closure • Assistance in pursuing CDM	• Business model and project structuring • Fuel supply availability • Pre-feasibility study/Feasibility study • Conceptual engineering design • Financing plan • Assistance in selection of technology and equipment suppliers • Advice in project management and supervision during construction and commissioning • Advice in the design of O&M framework and training of operators • Assistance in PPA formulation and	**Low operational efficiency**

opportunities	seeking approval from authorities • Assistance in funds mobilization and financial packaging to attain financial closure • Assistance in pursuing CDM opportunities

Notes: CDM = Clean Development Mechanism
PPA = Power Purchase Agreement
O&M = Operation & Maintenance

To get these services, a potential project developer or owner of the project would have to contract the services of a competent company/consultant at a fee. And since expertise of this kind is limited in this region, hiring a foreign consultant would be rather expensive. Considering that these expenses would have to be spent without the assurance that the project would be technically feasible or economically viable, potential project developers are normally not willing to spend resources upfront. Moreover, because of the absence of examples of successfully operating modern cogeneration technologies, there is a need to demonstrate the technical reliability and economic benefits of implementing modern and efficient cogeneration systems.
In order to reduce the risks of the potential project developers in spending upfront development costs in a venture that is considered new such as high-pressure cogeneration systems, the Cogen for Africa Project will provide support that limits their development costs, and provides concrete examples of successful projects. One of the major activities that the Project will execute is the implementation of Full Scale Promotion Projects (FSPP) within the seven participating countries. These FSPPs will act as show cases aimed at convincing other potential end-users to implement these technologies by demonstrating the technical reliability, economic viability and environmental friendliness of modern and efficient cogeneration technologies.
The benefits that owners of cogeneration projects will get by applying for an FSPP status for their projects are:

- Assistance in development aspects through the preparation of Cogeneration Investment Packages consisting of services mentioned in (A) Preparatory Stage above
- Assistance in implementation aspects through provision of specialized services mentioned in (B) Project Implementation Stage above

In order to become an FSPP, projects will be evaluated using approved criteria which will be further defined during the initial stage of the Project implementation and reviewed by the Project Steering Committee. These criteria could consist of the following major aspects:

Global criteria	**Detailed criteria**	**Weight**
Proven interest for the project from sugar factor/other agro-industry	• Support for the Pre-Feasibility and Feasibility Studies • Contribution to the pre-feasibility studies • Commitment of equity	30%
Pre-feasibility and Feasibility Study Results	• Financial attractiveness (IRR, NPV payback period) • Solid offer of a viable feed-in tariff • Quality of the pre-feasibility/feasibility study, including reliability of data used • Ease of implementation as indicated by the way the barriers to implementation have been addressed	45%
Project externalities	• Rural electrification • Environmental sustainability	10%
Potential for replication and number of beneficiaries	• Spread across the region • Visibility and accessibility	15%

To attain FSPP status, project developers/owners must agree, by signing an MOU with the AFREPREN/FWD Regional Cogen Centre, to comply with certain obligations. These obligations consist of permission for:

- Visits to the cogeneration installation by other industries/potential project owners
- Monitoring of the performance of the cogeneration project
- Promotion of the cogeneration plant to potential users of cogeneration technologies

3.5.5 National Cogen Offices

A National Cogen Office shall be established in each of the seven participating countries. These offices shall act as focal points in the different participating countries and will liaise with both public and private sector stakeholders on a national basis (industry associations, individual industries, project developers, relevant government agencies, financial sector, community and civil groups, etc.). The National Cogen Offices shall work on a sub-contract basis against a service fee. These offices are to be established in energy sector-related companies in the respective participating countries.

About 2-3 country partners will be selected at the start of the project, to begin with and thereafter increased as the Project Steering Committee sees fit. The two countries selected are Kenya (AFREPREN/FWD, Kenya – as per recommendation of GEFSEC that there should be no additional national centre for Kenya) and Swaziland (Department of Energy, Swaziland), based on the availability of projects with high probability of implementation. The full criteria and procedures for the selection of host agencies in the countries is included in Annex T. Potential institutions are provided in Annex U.

The tasks of each National Cogen Office are, but not limited to, the following:

- Manage the Project on a national level and attend Project Management Council (PMC) meetings (see Section 3.4.3)
- Create/raise awareness of cogeneration as a clean and efficient energy solution among various industrial sectors of the country such as the sugar industry and other agro industries, pulp and paper industries, food, textile, cement, chemical, petroleum and metallurgical industries, and also to (potential) equipment manufacturers, engineering companies, project developers, financiers and banks as well as government agencies in the energy, industrial and environment sector
- Identify potential projects or projects under development and follow up tangible business opportunities with emphasis on projects that may qualify as FSPPs or may become projects in the pipeline
- Maintain and develop contacts with all relevant public and private sector organizations
- Liaise with public sector and relevant government agencies and implement advocacy activities aimed at influencing policy makers to formulate and/or enhance regulations, policies and support measures to encourage the development of cogeneration and sales of power to the grid from cogeneration projects at favorable terms. One option of pursuing this task would be through sub-contracting a national policy advisor, to be a key member of the national cogen centre.[23]
- Facilitate matchmaking between local and international stakeholders such as end-users, engineering companies, equipment suppliers and local manufacturers
- Assist in mobilization of funds by facilitating contacts between the project developers and the AFREPREN/FWD Regional Cogen Centre Experts assisting them on one hand, and the financing institutions based in the country on the other hand
- Implement promotion and dissemination activities at the National level
- Provide existing documentation and developments on policy matters
- Provide initial information/data for the Cogen Database and updates thereafter
- Organize field trips/ study tours/ site visits, seminars/workshops and other meetings in the country
- Regularly collect information on the energy sector, electricity supply industry data, fuel resource assessment, national energy/environmental trends and regulations, trade fairs, exhibitions, conferences and other events, press cuts, etc. The information shall be sent to the Regional Cogen Centre on a regular basis

[23] Detailed institutional arrangements and recruitment process elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

- Submit Quarterly Reports to the Regional Cogen Centre using the standard template to be provided at the initial stage of the project implementation

Annex U provides a list of potential organizations which could host the National Cogen Offices in the seven participating countries.

3.5.6 Stakeholders, their involvement and commitments

Relevant stakeholders have been identified at the early stage of the preparation and their role/involvement both during the Project preparation and Project implementation has been clearly defined. Stakeholders' Meetings in different countries were conducted and face-to-face discussions were held with many of them to assess their needs and ascertain their commitment to the objectives of the Project. Moreover, a website was developed (http://cogen.unep.org/) for the stakeholders to access information, monitor the progress of the document preparation and discuss issues relevant to the Project. As these stakeholders are also beneficiaries of the Project outcomes, their participation and commitment are ensured which adds assurance to the success of the Project. A table showing the different stakeholder groups and their involvement in the Project as well as the benefits they can expect to receive is presented in Table 3.11.

The Steering Committee, which is the highest level of supervision during the Project implementation, will be comprised of representatives from the Funding/Co-funding agencies, Executing Agency (AFREPREN/FWD), senior representatives of the most relevant industries or industry associations of participating countries and senior representatives of relevant government agencies or electric utilities. This will ensure an integrated approach to dealing with the challenges and opportunities that considers the interests of all stakeholders, including cross-cutting concerns/activities that incorporate and support gender and marginal group participation.

The regional AFREPREN/FWD Regional Cogen Centre will be in direct and day-to-day communication with all stakeholders in the cogeneration sector while exposing itself through the active participation in relevant occasions and organizing its own workshops, training seminars, etc.

The envisaged National Cogen Country Offices shall work as an extension of the Regional Cogen Centre on a national level by liaising with government agencies, industry participants and prospective end-users of cogeneration systems.

Table 3.11: Stakeholder groups, their involvement and role in, and benefits from, the Project

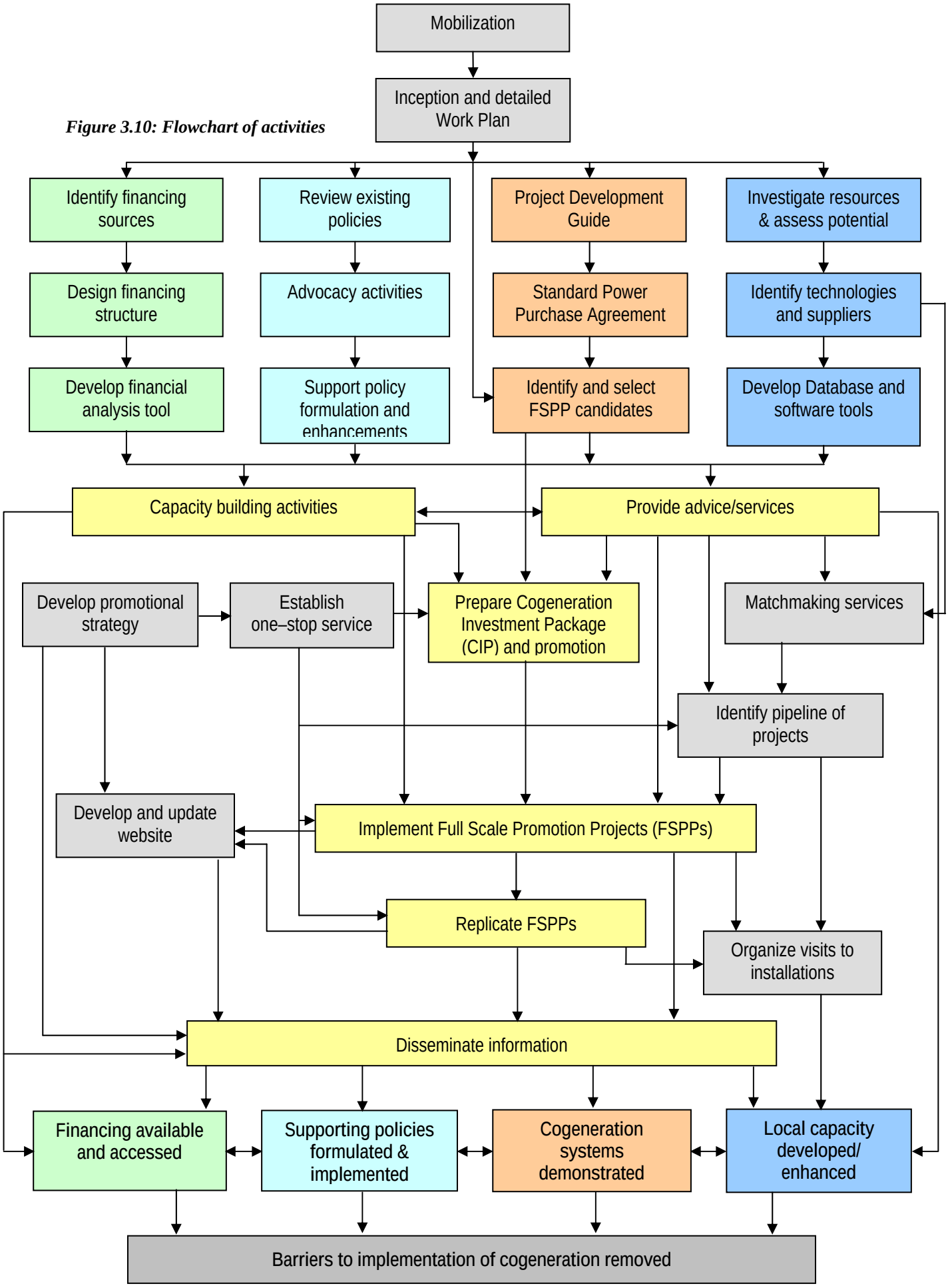
Stakeholder/ beneficiary	Reason for involvement	Role/Nature of involvement		Benefits to stakeholders
		Project preparation	Project implementation	
(Potential) End-users of cogeneration systems	Potential owners and hosts of cogeneration projects	Consultations; discussions on cogeneration potential; provision of information; hosting of visit to factory site	Development and implementation of Full Scale Promotion Projects (FSPPs); equity participation; possible Project Steering Committee (PSC) representative from the industry	Technical, commercial &financing advice; training & capacity building; mobilization of funds for projects; assistance in liaising with government agencies; policy and institutional support; visits to successful cogeneration sites; reliable & readily available information on cogeneration
Project developers	Expertise and funds in developing cogeneration projects; provision of equity	Consultations; discussions on cogeneration potential; provision of information;	Development and implementation of Full Scale Promotion Projects & other cogeneration projects; equity participation; possible PSC representative from the industry	Identification of Cogen business opportunities; technical, commercial &financing advice/services; training & capacity building; mobilization of funds for projects; assistance in liaising with government agencies; policy and institutional support; visits to successful cogeneration sites; reliable & readily available information on cogeneration
Financing institutions	Source of funds (equity, loans, etc.) to the projects	Consultations; discussions on funding potential; provision of information	Funding of projects; possible PSC representative from the industry	Funding opportunities; training & capacity building on assessment & evaluation of cogeneration projects; visits to successful cogeneration sites
Fuel suppliers (biomass residues, etc.)	Source of fuel for cogeneration plants	Consultations; discussions on availability of fuel (mainly bagasse at this stage); provision of information	Supply of (biomass) fuel	Business opportunity; possibly free steam & electricity as trade off
Local manufacturers	Manufacturing & construction of components	Invited to national stakeholders' meetings	Supply & installation of local components; possible Project Steering Committee (PSC) representative from the industry	Partnerships with foreign suppliers of cogeneration equipment; matchmaking service; enhanced manufacturing experience; business opportunity
Equipment suppliers	Source of efficient, high-pressure cogeneration systems	None so far	Supply of cogeneration systems and components; possible equity stakes in projects; assistance in sourcing of bilateral and export credit support	Opportunity for equipment supply; opening up of market; matchmaking opportunity with local manufacturers; delocalization of manufacturing; participation in FSPPs
Policy makers/government agencies	Policy and regulatory support;	Consultations; discussions on policy and	PSC member; policy formulation & enhancements;	Advice and support in policy formulation; workshops & forums on cogeneration; energy security; private sector investment in energy

	enabling environment	regulatory framework; provision of information; assistance in meeting with other stakeholders	Approval of regulations; incentives; subsidies; licensing & permits	services; visits to successful cogeneration installations and FSPPs
Power utilities	Gird connection; purchase of power from cogeneration plants	Consultations; discussions of national electricity demand & future requirements; provision of information	PSC member; purchase of power from cogeneration plants; dialogue through policy papers, workshops, etc.	Additional installed capacity from private sector funding; lesser burden for capital investment in generation capacity and transmission & distribution costs; decentralized source of power & increased stability at end-of-line parts of the grid
Local consultants and service providers	To provide local expertise and services	None so far	Target of capacity building; provision of local expertise	Training and capacity building; increase of expertise & experience in high-pressure cogeneration projects; business opportunities
Communities surrounding the cogeneration installation, including women & marginal groups	Direct & indirect recipients of economic, social & environmental impacts of cogeneration	National stakeholders' meetings	Regular consultations; source of labor market for the employment requirements of projects	Job creation; economic/social benefits of electrification for projects with rural electrification component; cleaner air compared to existence of inefficient systems; information from website

3.5.7 Outcomes, outputs and detailed activities

Figure 3.10 shows the flowchart of the activities of the Cogen for Africa Project. The details and descriptions of these activities together with the outputs for the different outcomes mentioned earlier are also explained in this section.

Figure 3.10: Flowchart of activities



Outcome 1*: Capacity of project developers, technical service providers and local manufacturers of modern and efficient cogeneration systems developed and enhanced*[24]

Outputs:

1.1 Review of fuel resources and assessments of their potential for cogeneration

1.2 Relevant technologies for cogeneration and their suppliers identified and their information inputted in the Database

1.3 A framework for partnerships between foreign equipment suppliers and local manufacturers developed and established

1.4 Local technical personnel trained and assisted on technical and project development aspects of cogeneration.

1.5 Visits organized for relevant stakeholders to successfully operated cogeneration references

Activities:

1.1 Investigate availability of biomass resources and assess their potential for cogeneration

Having reliable data on the availability of biomass resources is an important first step in understanding the potential of using biomass for cogeneration purposes and informing the potential project developers and the relevant stakeholders of this potential. During the PDF-B stage, a survey of the sugar industries has been conducted. However, there are other agro-industries that generate residues and have potential to implement cogeneration systems.

The steps involved in this activity are as follows:

- Identify the sectors that generate biomass wastes
- Map out the biomass waste generation for each relevant sector
- Identify and quantify the current usage of these biomass resources
- Investigate and estimate costs for buying, selling and transporting of biomass wastes
- Assess the industry structure, trends and competitiveness of the industry producing the biomass wastes and their future prospects

From the availability of biomass resources investigated, the next part is to assess and calculate the energy potential of the biomass resources, both in its primary energy form and after conversion to electricity and heat. This should take into consideration the amount of biomass already used for other purposes and are not available for energy conversion. This activity is important to ascertain the realistic potential that could be realized for biomass cogeneration. The specific sub-activities to be conducted include the following:

- Conduct laboratory analyses of some samples to determine the fuel composition and properties
- Analyze the energy consumption patterns and needs of the industries producing biomass wastes
- Establish conversion efficiencies of different technologies for the different biomass fuels
- Estimate primary energy and generation potential of available biomass resources

1.2 Identify applicable technologies for cogeneration, relevant suppliers of equipment and their capabilities

In this activity, a survey to review and assess the technologies applicable for cogeneration will be conducted. Particular emphasis will be given to identifying technologies that have been implemented successfully in similar environments such as in Asia, South America, other parts of Africa like Mauritius, South Africa, etc. An identification of suppliers of cogeneration components from the most active countries globally, an assessment of their capabilities and the applicability of their technologies in the African cogeneration market will be conducted. From this, an inventory of the suppliers, their products and capabilities will be inputted in the Cogen Database which will be developed in the Project (Act. 1.3). These equipment suppliers will be contacted during the tendering process of the projects to be implemented.

In parallel, this activity will also identify local equipment suppliers and manufacturers who currently are or who could become joint venture partners of foreign equipment suppliers.

1.3 Design and develop a database consisting of foreign equipment suppliers and local manufacturers

A Cogen Database will be designed to contain information useful for matchmaking purposes and other activities of the Project. The Cogen Database shall be programmed using a standard database software and shall contain user-friendly features for inputting, editing and reporting, among others. It shall contain information such as:

- Suppliers of cogeneration equipment/components and their capabilities
- Local manufacturers/potential partners and their capabilities
- Project developers
- Relevant industries and industry data
- Financing institutions
- Relevant government agencies
- Utilities
- Electricity sector data
- Relevant documents

[24] Analysis tools elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

- Other useful information and data

The information and data on Cogen Database shall be gathered with the assistance of the Cogen Country Offices and shall be updated regularly.

1.4 Design and implement a matchmaking service between foreign equipment suppliers and local manufacturers

The aim of this activity is increase the local capability and involvement of local manufacturers in the manufacturing and construction of cogeneration systems by creating opportunities for partnerships and encouraging joint ventures and other similar activities between foreign equipment suppliers and local manufacturers. Using the information in the Cogen Database to identify potential partners and concrete projects as the basis to initiate partnerships, the matchmaking service will assist foreign and local companies to initiate contact and work together in manufacturing efficient cogeneration systems.

As the capability of local manufacturers in the participating countries, is not high, the initial partnerships could start with non-pressure parts of the cogeneration system, but this is expected to gradually move on to a higher proportion of local manufacturing and to more important components.

1.5 Develop and/or adapt software tools for technical analysis to be used for analysis of projects and training purposes.

At the initial stage of Project Implementation, an assessment of the software tools that are needed for both training purposes and analysis of projects as well as the availability of software from commercial and non-commercial sources will be assessed. These will vary from simple calculation tools to a more sophisticated engineering and design software. An example of this software is the RETSCREEN which has a biomass version. RETSCREEN CHP module is mainly designed for CHP projects in developed countries with a strong emphasis on space heating and would require extensive adaptation for use in Cogen industries. RETSCREEN is a useful analytical tool at pre-feasibility level. However, without additional customization, RETSCREEN's outputs are neither sufficient nor transparent enough for bankable documents that require more rigorous financial analytical inputs at full scale feasibility level adapted to local conditions and the investment in question. In addition, the preparation of a detailed financing plan and initial due diligence is also needed. The software that will be procured (a customized/upgraded RETSCREEN package or a dedicated CHP software tool) from external providers will be customized and adapted whenever necessary. Some others may need to be developed in-house or their development sub-contracted to relevant service providers.

The areas where software tools that are expected to be used in the Project are:

- Power/cogeneration plant design and engineering
- Energy and mass balance analysis
- Techno-financial analysis
- GHG mitigation calculations
- Cogeneration plant efficiency and monitoring
- MS Project for project planning and task/resource scheduling

1.6 Conduct capacity building activities through seminars, workshops and training

Capacity building activities will be targeted first of all to develop capability and expertise of Regional/local staff of the Project and the staff of the National Cogen Offices in the seven participating countries. As mentioned earlier, this training will consist of different modules covering all aspects of cogeneration development, financing, implementation and operation, and ideally a hands-on training in an operating cogeneration plant using high-pressure systems.

With the trained Regional/local staff and the International Experts as resource persons, seminars, workshops and other forms of training will be conducted with local stakeholders as participants. As these activities require to be done in the different participating countries and in different sectors with varying needs, a comprehensive capacity building program will need to be well designed.

The organization and conduct of the capacity building activities in the technical area will be coordinated with those in other areas so that synergy will be maximized while minimizing the costs incurred.

1.7 Provide technical advice and services to project developers and potential owners of cogeneration systems

As there is lack of in-house and in-country expertise and experience in implementing biomass cogeneration projects, the AFREPREN/FWD Regional Cogen Centre will provide technical assistance and services to project developers and potential owners of cogeneration systems. These services will, among others, include the following aspects:

- Fuel aspects (availability, supply, storage, preparation, etc.)
- Estimation of energy potential from biomass fuel
- Technology selection
- Optimal system configuration
- Major equipment components and scope of supply
- Technical issues and considerations in contractual matters
- Project implementation and management
- Training of operators
- Operation and maintenance aspects

1.8 Organize visits and study tours to successful cogeneration installations

Examples of modern and efficient cogeneration projects that are successfully operating currently exist in neighboring Mauritius. Bringing key individuals from relevant sectors/industries, project developers, financing institutions and other relevant organizations to these installations and letting them see for themselves these technologies, would go a long way in changing their perception regarding the risks involved in these projects. Once the FSPPs are operating in this region, the visits will be organized to FSPP installations.
In these visits, the organization, preparation of materials, local group transportation and other administrative costs will be borne by the project, but transportation, accommodation and incidental costs of the participants shall be borne by the individual participants themselves.
The Project will organize about 3 visits to Mauritius during the first 4 years of the Project Implementation with different participants in each visit.
Once the FSPPs start operating in any of the seven participating countries, visits will also be organized at least once for each operating FSPP.

Outcome 2: *Financing for cogeneration projects made available and accessed at terms and conditions that are favorable for investments*[25]
Outputs:
2.1 A portfolio of relevant financing sources identified and creation/opening up of innovative financing schemes applicable to cogeneration facilitated

2.2 Project developers trained and assisted in financial structuring, financial packaging and accessing of funds

2.3 Financing institutions trained and assisted in evaluation and assessment of cogeneration technologies

Activities:
2.1 Identify and review existing financing sources and mechanisms relevant for the sector and the region
In order for the AFREPREN/FWD Regional Cogen Centre so assist in mobilizing funds for the cogeneration projects, there is a need to identify the financing sources that meet the needs of identified investment projects, the sector and the countries involved. This activity will involve meetings with the most relevant financing institutions in the region, understanding their financing schemes, modalities and requirements, and providing them with appropriate information that will lead them to a better appreciation of the benefits, advantages and realistic risks of biomass cogeneration projects. This will lead to a creation of a portfolio of financiers who should be approached for funding of projects at different stages of development (pre-CIP, CIP and FSPP).
2.2 Design and recommend financing structure appropriate for cogeneration projects
From the information gathered during Activity 2.1, and understanding the nature of cogeneration projects, as well as the industries and developers that sponsor these projects, financing structure models that will be used as a guide for the AFREPREN/FWD Regional Cogen Centre advisers and project developers will be developed. Included in this will be working closely in liaison with the banks to develop bankable proposals and meeting the banks procedures and eligibility criteria and the preparation of typical term sheets that can be proposed by project developers for consideration of, and eventual negotiation with, the financing institutions.
The Regional Cogen Centre, through the guidance of the short-term international specialist on financing, will also facilitate the creation, and/or sourcing, of financing support mechanisms that could stimulate investment decisions for cogeneration or buy down some risks related to high costs of financing. These financing schemes may include new and flexible mechanisms that have not been advanced in this region.
For instance, during consultations with financing institutions, Triodos Bank of the Netherlands has indicated their interest in establishing a Fund to finance cogeneration and small hydro investments in eastern and southern Africa. The Fund could provide equity particularly to holding-type companies which have the strategy to develop a few or several energy generation projects. It could also participate in individual projects, in which case, the financing will be most likely in the form of loans. Similarly, the European Investment Bank (EIB) indicated that they would be willing to establish a credit line facility for cleaner energy projects via an intermediary bank or institution which will on-lend the funds to individual projects.
With the Regional Cogen Centre acting as a catalyst and provider of technical support, different financing mechanisms could be formulated and/or tapped to support the financing of cogeneration projects. These could be in the form of:

- Grants
- Concessional/soft loans
- Seed capital
- Subsidies
- Provision of credit guarantees
- Other financial incentives

2.3 Design and develop financial analysis software tool to be used for project analysis and training

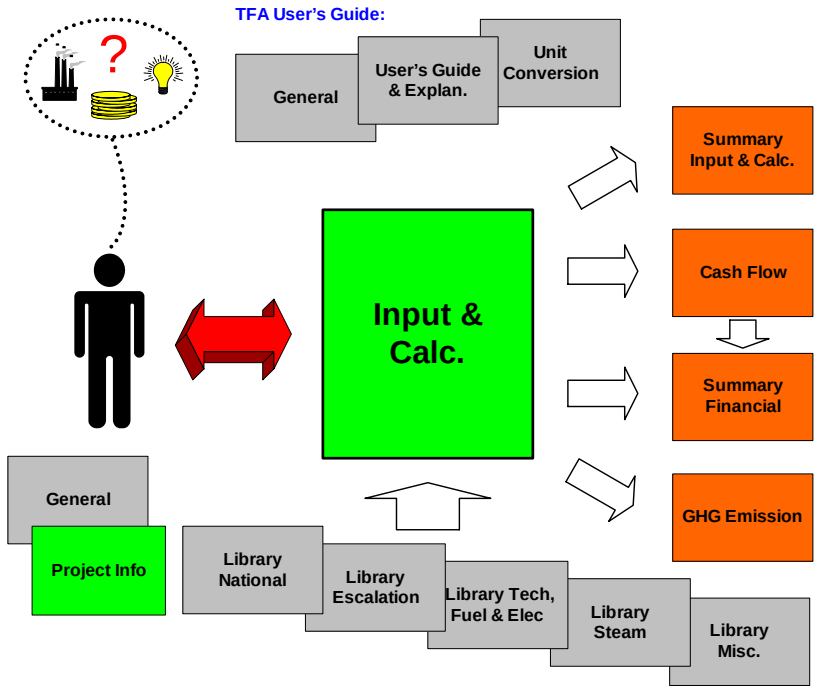
[25] Analysis tools elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

A general financial analysis software (such as a customized/upgraded RETSCREEN package) will be developed and used as a tool in analyzing the profitability of cogeneration projects during the pre-feasibility study and feasibility study stages of project development. Depending on the necessity and complexity of the project, this software may be customized on a case-to case basis. The software will also be used in the training of local personnel identified to be relevant in the development, investment and financing of projects. Furthermore, it is expected that this software will be designed so that it will be appropriate for the financial modeling of bankable projects that will be submitted to the financing institutions for funding.
The financial analysis software should typically contain the following information:

- Inputs and assumptions
- Discounted cashflow analysis
- Income statement
- Balance sheet
- Profitability results: IRR, NPV, payback period
- Financing costs, terms and payment regime
- Ratio analysis: Debt service coverage ratio (DSCR)
- Sensitivity analysis
- Summary of results

The software should be structured in a user-friendly manner so that it could be used by as wide an audience as possible. A possible structure of this model is illustrated in Figure 3.11 below.

Figure 3.11: Possible structure of the financial analysis model



2.4 Conduct training of project developers and financing institutions
Because of the lack of experiences and understanding of advanced high-pressure cogeneration investments by many project developers and financing institutions, it is important to conduct training catered to the needs of these groups of stakeholders.
The building of the capability of the staff of financial institutions involved in the evaluation and approval process of projects would lead to enhanced confidence to consider cogeneration projects that might otherwise be perceived to be too risky, while building of skills for project developers in the financial packaging of projects could improve their chances of getting reasonably favorable terms for loans from financing institutions.
A detailed analysis of the training needs will be conducted during the implementation of the Cogen for Africa project. However, preliminary investigation suggests that the training components could cover, but not be limited to, the following aspects:

- Training and capacity building to project developers in matters related to:
    - investment appraisal and decisions
    - financial analysis and financing concepts
- Training and capacity building to financing institutions in matters related to:

- fundamentals of biomass fuels and cogeneration technologies
- assessment of cogeneration technologies

2.5 Assist project developers and financing institutions in the financing of projects
The AFREPREN/FWD Regional Cogen Centre will also provide assistance to both project developers and financing institutions in fulfilling the requirements for the projects to reach financial closure. Among others, this will entail:

- Assistance to project developers in:
  - preparation of information memorandum
  - financial packaging
  - presentation of projects to financing institutions
- Assistance to financing institutions in:
  - conducting due diligence of projects
  - technical evaluation of projects

Depending on the requirements and the appropriateness of the situation, assistance may only be given to either the project developer or to the financing institution for a particular project.

Outcome 3: *Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated in a number of new cogeneration plants and confidence on the certainty of the cogeneration market enhanced.*
Outputs:
3.1 Project Development Guide completed

3.2 Cogeneration Investment Packages developed and promoted - A total of 12 CIPs/Feasibility Studies will be supported with the funds from GEF.

3.3 Full Scale Promotion Projects (FSPPs) implemented and promoted for replication - The number of FSPPs is not an explicit target. The pre-defined target is the 40MW which could be realized through 6 FSPPs

3.4 Technical assistance provided to pipeline of projects (i.e. non-FSPP projects)

Activities:
3.1 Develop a project development guide for reference and training purposes
One way of enhancing the capability of local project developers and building their confidence in developing projects is to provide them with information on the best practices that have been successfully tested and implemented in a similar environment. To this end, a Cogeneration Project Development Guide that is contextualized to the needs and conditions in the African region will be developed. The Guide will not only be disseminated but will be used as a training material in capacity building activities with the relevant stakeholders in the participating countries.
The Guide should ideally contain the following subjects:
I. Pre-Investment Phase, containing aspects such as:

- Project concept and objectives
- Pre-Feasibility and Feasibility Studies
- Investigation of fuel resources
- Evaluation of energy requirements
- Assessment and selection of technologies
- Assessment of off-takers
- Financial analysis and commercial viability
- Environmental and social impact assessment

II. Investment Phase, containing aspects such as:

- Contractual structuring and risk mitigation
- Tendering of EPC/Equipment supply
- Financing of cogeneration projects
- Financial packaging/Financial closure
- Design, engineering and construction

III. Operating Phase, containing aspects such as:

- Testing and commissioning
- Operation and maintenance

3.2 Identify and select candidate sites for projects, prepare Cogeneration Investment Packages (CIP) for selected sites and promote the CIPs for private sector project development and investment
Among the relevant industries for cogeneration such as biomass wastes producing industries (a sugar factory, for example), the appropriate sites will be identified and most suitable candidates will be selected for further development. A set of criteria for screening and selecting the sites shall be created. At least one site from each participating country

shall be selected. Analysis and available pre-feasibility studies from the PDF phase indicated that two of the most attractive cogen opportunities were in Kenya and Swaziland: namely, Chemelil Sugar Company and Royal Swaziland Sugar Corporation respectively. Both these cogen opportunities satisfy the following key criteria: proven interest for the project from sugar factor, support for the Pre-Feasibility and Feasibility Studies, contribution to the pre-feasibility studies, confirmed interest in committing equity

It is important that for the site to be selected, the potential owner/developer of the project should agree and commit that if the feasibility study reveals the project to be viable and the market package is done, the owner must proceed with the investment of the project as an FSPP.
For the selected sites, the AFREPREN/FWD Regional Cogen Centre will prepare Cogeneration Investment Packages (CIPs) to be offered to the private sector for investment and project implementation. Assuming that each successful FSPP will arise from at least 2 Cogeneration Investment Packages (CIPs)/Feasibility studies, a budgetary allocation for 12 CIPs/Feasibility studies[26] is provided for, from which the 6 FSPPs will be selected. However, it is acknowledged some FSPPs might not arise from a CIP, as there may be near term opportunities that are well developed, and do not require the CIP process (some factories already have pre-feasibility and feasibility studies completed, and therefore do not require to go through all the steps of preparing a CIP).

A CIP, as defined and explained in the preceding section, is a set of documentation resulting from services and activities conducted to develop a project into a stage where a project developer/investor could be in a position to make a decision for investment based on the information provided by the package.
The services and activities involved in the preparation of the CIP are given below:

- Fuel supply availability
- Pre-feasibility study/Feasibility study
- Electricity sales framework
- Conceptual engineering design
- Financing plan

The above services will be done in collaboration with the technical and financial experts who will be providing expertise for components 1 and 2.
A Memorandum of Understanding (MoU) can then be signed between the Cogen Centre and the facility owner agreeing that the above services shall be provided by the Cogen Centre and in return, if the project is found to be viable and the CIP is completed, the owner is expected to proceed further with the investment. It should be noted that only the commercially viable projects, as revealed by the Pre-FS/FS, shall be developed into a full-blown CIP.
Once a CIP is completed, the owner of the host facility where the site of the project will be located, will be presented with the details of the CIP. Normally, it can be expected that because a facility owner has agreed to proceed with the investment once the project is viable and the CIP is completed, the host facility will be ready to implement the project. Alternatively, the facility owner may prefer that a third party will pursue the cogeneration investment and implement the project. In this case, a promotional campaign will be undertaken to identify and encourage third party investors to implement the project. A summary brochure giving the salient features of the CIP shall be prepared for this purpose.
3.3 Select, support and implement FSPPs
The implementation of Full Scale Promotion Projects (FSPPs) is one of the major activities of the Cogen for Africa Project. The FSPPs, once completed and operational, will act as showcases for other biomass-producing facilities in the same or similar industries to implement the same technologies. Because of their technical reliability, economic benefits and positive environmental impact, the FSPPs aim to convince other potential developers to use modern, high-pressure and efficient biomass cogeneration equipment in meeting their energy needs in their facilities. In order for the FSPP to be successfully implemented, supporting activities and services will be provided by the AFREPREN/FWD Regional Cogen Centre during its development and implementation stages. The major services to be provided to the FSPPs are:

- Assistance in selection of technology and equipment suppliers
- Advice in project management and supervision during construction and commissioning
- Advice in the design of O&M framework and training of operators
- Assistance in PPA formulation and seeking approval from authorities
- Assistance in funds mobilization and financial packaging to attain financial closure
- Assistance in accessing environmental and carbon finance support

The concept and mechanics of the FSPP is explained within Section 3.5.3.

The criteria for selection of the FSPPs will include: projects with the highest probability of implementation, financial soundness of the project sponsor, willingness of project sponsor to invest and commitment from financial partners to invest in the project. More detailed criteria for selection are presented in the following table. Both co-implementing agencies (UNEP and AfDB) will participate in the selection of FSPPs.

[26] A total of 12 CIPs/Feasibility Studies will be supported with the funds from GEF. However, additional CIPs/Feasibility studies could be undertaken, with support from other co-financiers. AfDB has indicated willingness to support a number of CIPs/Feasibility studies.

Global criteria	Detailed criteria	Weight
Proven interest for the project from sugar factor/other agro-industry	• Support for the Pre-Feasibility and Feasibility Studies • Contribution to the pre-feasibility studies • Commitment of equity	30%
Pre-feasibility and Feasibility Study Results	• Financial attractiveness (IRR, NPV payback period) • Solid offer of a viable feed-in tariff • Quality of the pre-feasibility/feasibility study, including reliability of data used • Ease of implementation as indicated by the way the barriers to implementation have been addressed	45%
Project externalities	• Rural electrification • Environmental sustainability	10%
Potential for replication and number of beneficiaries	• Spread across the region • Visibility and accessibility	15%

As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

3.4 Identify a pipeline of projects for replication

Some projects may not be mature or advanced enough in their development to become FSPPs. Such projects will be entered into the database and given the required support to advance to CIP and eventually FSPP status.

As it takes time and significant support for such projects to progress to the CIP stage, the Africa Cogen Center, will organize the required follow up meetings with decision makers, invite key stakeholders to training and capacity building workshops, organize site visits for interested investors, and offer project development and technical assistance that is required to move the project to CIP status.

3.5 Provide assistance and services to project developers for projects in the pipeline

Once a project in the pipeline has advanced to a level where the project developer decides to start the development of the project, services identical to the components of the CIP will be offered by the Cogen Centre. Once the CIP is completed, the project could become an FSPP if the developer agrees with the conditions, in which case, the standard FSPP services shall be made available to the project.

All the above components will be conducted through the cogen center. Each component, however, will have distinct personnel who will handle the activities within each component. Experts in component 1 will focus primarily in training, giving advice and services related to technical aspects such as engineering, conceptual design, fuel aspects, power systems, operation & maintenance which are in themselves substantial activities. Activities under component 2 are mainly related to financial aspects of the project. The experts and activities in component 3 will focus on business and commercial aspects, and project development. Experience has shown that structuring a cogeneration project on the commercial and development side requires a lot of attention and sound practices in order for it to be successfully packaged, and developers need a lot of support in this.

The above activities require synergy and collaborations among the different units of the AFREPREN/FWD Regional Cogen Centre handling the different components. However, it must be noted here that activities under all major components have been (and will be in the implementation stage) streamlined to remove any identified overlaps. Redundancies have been removed to enhance the cost-effectiveness of the Project.

Outcome 4: *More favorable policies and institutional arrangements that support cogeneration promoted*

Outputs:

4.1 Policies and regulations in the different participating countries reviewed and analyzed

4.2 Appropriate regulations, incentives and other measures supporting cogeneration formulated, and submitted to the relevant authorities and decision makers

4.3 Key decision-makers made aware of policy and institutional options for promoting cogeneration investments and encouraging cogeneration-based rural electrification

4.4 One-stop information and service center established and service provided to stakeholders

4.5 Promotion strategy and information dissemination program developed and implemented

4.6 Develop a project website for internal and external audience and update continually

4.7 Standard Power Purchase Agreements (PPAs) with reasonable tariffs and conditions in the participating countries drafted and the stage set for approval

Activities:

4.1 Review and analyze existing policies and regulations, and recommend policy interventions and enhancements to support cogeneration

The seven countries involved have different level of policy development and implementation. At the initial stage of project implementation, a review of the policies and regulations affecting cogeneration as well as the effectiveness of their implementation will be conducted for the seven participating countries. The review will focus on:

- Legislations, programs and incentives promoting cogeneration and decentralized energy systems
- Legislations, programs and incentives promoting biomass and other renewables
- Legislations, programs and incentives regarding independent private generation, sales of excess electricity to the grid, and interconnection issues

After the review, the identified gaps will be analyzed and policy and regulatory options for promoting cogeneration identified. Finally, recommendations related to formulation of new policies, enhancements of existing policies, or improvement of implementation procedures will be provided.

4.2 Design and implement advocacy activities to influence policy reforms and implementation

Advocacy activities have important roles in creating awareness, effecting change and influencing decisions, especially in maters that require government intervention and action. The design of advocacy activities will aim to convince relevant government agencies to adopt and implement policies and support mechanisms favorable for the implementation of biomass cogeneration, through dialogues, fora and appropriate media channels.

4.3 Support policy makers and relevant agencies in policy formulation and enhancements

Once the need for policy formulation and enhancements is established and the policy makers agree to adopt some measures, the policy experts within the Cogen Centre will provide support to the policy makers particularly on the technical soundness of the policies and the experiences of other countries/regions in implementing certain polices.

Moreover, in many countries in the region, the issues related to permitting and consents for the construction and installation of projects such as biomass cogeneration are not clear and straightforward until one actually starts to process these permits. The extra effort invested to understand how the system works and go about the approval process from the different agencies increase transaction costs of developing projects, thereby increasing the overall project costs.

One of the barriers mentioned earlier which hinders developers from pursuing cogeneration investments is the high capital, development and transaction costs. If governments can structure their policies so that there is a centralized agency responsible for the planning, promotion, approval and monitoring of some specific project categories – say, biomass cogeneration, renewable energy and energy efficiency projects – the efforts and costs involved in developing and implementing projects could be substantially reduced, thereby helping in reducing the barriers related to high transaction costs.

4.4 Design and establish a one-stop information and service center within the AFREPREN/FWD Regional Cogen Centre

Currently, whenever a project developer has an intention to start a biomass cogeneration project, there are no institutions that provide complete services to guide and assist the developer in making the right investment decision, selecting the best and most appropriate technology and equipment, understanding and going through the permitting requirements, mobilizing and obtaining funds, and providing expertise during the construction, commissioning, operation and maintenance of the project.

Within the Regional Cogen Centre, a structure which will act as a one-stop information and service provider will be designed and established. Four small units with independent but interrelated functions will be set up. These units correspond to the main categories of the barriers experienced and identified in this sector, namely:

- *Project Development/Commercial Unit* – to take care of providing information, advice/service and capacity building support related to investment decisions, feasibility and viability of projects, project structuring and other project development issues. This unit will prepare the Project Development Guide for project developers of biomass cogeneration systems, prepare the Cogeneration Investment Packages with the support from other Units, and coordinate the selection and implementation of the Full Scale Promotion Projects, with the support and assistance from other Units.
- *Financing Unit* – to take care of providing information, advice/service and capacity building support related to financial analysis, financial structuring, funds mobilization, financial packaging, and evaluation/assessment of projects for financing institutions. The financing unit will design and develop the financial analysis tool to be used for advice and training purposes.
- *Policy Unit* – to take care of providing information and advice/service related to policies, support measures and incentives for cogeneration, and providing support to policy makers in policy formulation and enhancements. The unit will also design and implement the advocacy activities intended to influence policy reforms and execution.

- *Technical Unit* – to take care of providing information, advice/service and capacity building related to technical feasibility of projects, technology and equipment selection, construction, project management, operation and maintenance, and environmental aspects. This unit will develop technical software tools and also design and implement the matchmaking activities between foreign equipment suppliers and local manufacturers.

Further refinements of the scope and responsibilities of the different units should be done during the detailed elaboration of the Work Plan at the inception stage of the project implementation.
The above set-up will become the basis for future sustainability structure at the completion of the project. In order to test and prepare for the financial sustainability of the AFREPREN/FWD Regional Cogen Centre at project completion, at certain point in time during the project implementation, fees for the services to be provided by the different units shall be charged to the clients availing the services.
4.5 Develop a promotional strategy for the whole project, prepare promotional and other relevant materials and disseminate them to relevant stakeholders
A comprehensive promotional strategy will provide guidance and direction to the Regional Cogen Centre and the different constituent units of the one-stop information and service centre on the areas/activities to be promoted, the media channels to be used, the quality and quantity of the materials produced and dissemination methods.
This activity will entail preparation of information materials and, in turn, will support the different units in disseminating information. The preparation, write up and production of the promotional materials shall be prepared with inputs from the different experts and units concerned.
This activity will also design visibility actions to promote the funders and co-funders of the projects.
4.6 Develop a project website for internal and external audience and update continually
A website which will contain information for all parties involved will be developed and continually updated. The website will also contain all reports produced by the Project that are for public consumption. These reports and other supporting material will be made downloadable to interested parties.
The contents and use of website will support the promotional strategy that will be developed and described in Activity 4.5.

4.7 Assist utilities and relevant agencies to draft and set the stage for the approval of a Standard Power Purchase Agreements (PPAs)
Experiences in the region and elsewhere suggest that without a standard PPA that has a long term duration and reflects tariffs that make a biomass cogeneration project viable, there are no interested investors who will be willing to make capital intensive investments in projects such as biomass cogeneration that do not assure a long term off-take of electricity.
This activity will entail working closely with relevant government agencies and the utility to develop standard provisions of a Standard PPA and a consistent, transparent formula for calculating the feed-in tariff for sales of excess electricity from independently generated power using environmentally friendly sources such as biomass cogeneration. The aspect of selling electricity to third parties, through say, mini-grids for rural electrification will also be explored.

UNEP in conjunction with the East Africa Tea Trade Association (EATTA) has also developed the ***"Greening the Tea industry in East Africa - Small Hydro Development"*** project, which has been approved by the GEF Council for funding. The project covers the countries of Burundi, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda and Zambia. It is the intention of the two projects to cooperate in the policy aspects, particularly in promoting sales of power to the grid using standard PPAs and in rural electrification aspects.

Model power purchase agreements (PPAs) developed/available in either of the projects will be shared with the other project where relevant. The two projects will target specific countries where they have comparative advantage, in the discussions on regulatory and tariff issues. For instance, the Tea/Small hydro project is well positioned in Tanzania, and Kenya, and will therefore take a lead in these countries. On the other hand, the Cogen project is better positioned in Malawi and Uganda to take a lead in policy negotiations.

Missions of both projects will be coordinated in order to reduce the cost of mission as well as maximise the benefits to both projects. For example, where the Cogen project is planning a mission to a country that is covered by the Tea/Small hydro project, the Cogen mission will take on board and address policy and regulatory issues that are relevant for the Tea/Small hydro project, and vice versa. Information exchange and sharing between the two projects will also be encouraged, especially on the power sector reforms and tariff negotiations.

In addition, training workshops that cover similar issues for the two projects will be organised jointly, to avoid duplication of efforts and eliminate unnecessary costs. For example, personnel from the Ministries and Regulatory agencies participating in both projects do not have to attend separate training workshops that address similar issues

Assumptions and risks

The success of the Project hinges on certain assumptions that are external to the Project and yet have strong influence on the performance of its operations. Below are the major assumptions considered in the design of this Project:

- Recognition of the participating governments of the importance of reducing GHG emissions and their continuing commitment towards doing it
- Key stakeholders such as government agencies, project developers and financing institutions receptive to the support, training and services to be provided by the AFREPREN/FWD Regional Cogen Centre
- Existence of local manufacturers relevant for cogeneration and interested in establishing partnerships with foreign suppliers
- Availability of external funds for the African region
- Existence of potential cogeneration projects that could become Full Scale Promotion Projects and could fulfill eligibility criteria for accessing funds
- Cogeneration seen by commercial financing institution as a viable lending portfolio
- Operation of the industries where cogeneration is relevant remains viable
- Cost of kWh production below purchase price of utilities
- Off-taker of electricity remains reliable and financially viable
- Government continues to recognize renewable energy and energy efficiency as priority
- Stable political and economic situation
- The case and benefits of Standard PPA accepted by key stakeholders

The Cogen for Africa Project faces risks that are outside the control of the Implementing Agency and the Executing Agency of the Project. Table 3.2 lists the risks that the Project could face during its implementation, the level of these risks and the measures that have been taken during the preparation and design of the Project and/or will be taken during the implementation phase so that the risks will be mitigated.

Table 3.12: Project risks and their mitigation

Risk	Level of risk	Mitigation
Risk that the Governments concerned will not have the political will nor prepared/willing to pay the cost of making renewable energy, energy efficiency and cogeneration a priority	Moderate	• Commitment from governments through endorsement letters • Stakeholders' meetings • Concept of the Cogen for Africa Project is in conformity with the policies and programs of the governments
Risk that key stakeholders are not willing to use the support and services to be provided by the AFREPREN/FWD Regional Cogen Centre	Low	• Commitment letters from stakeholders • Individual discussions with many stakeholders during the project preparations phase • Stakeholders' meetings to discuss needs and requirements of beneficiaries • Well-designed services and activities that cater to the needs of the stakeholders • Dissemination of Project information during preparation phase through the website; access by stakeholders to the website during project preparation
Risk that the Regional Cogen Centre will not have the competence to provide the required support and services to the stakeholders	Low	• Presence of skilled part-time International and Regional Consultants • Involvement of short-term international experts • Capacity building program for local/regional experts
Risk that funds from project developers/owners and financing institutions are not available for	Moderate	• Commitment letters from potential project developers/owners • Commitment letters from relevant financing institutions

investments in cogeneration systems		• Indications of interest and support during discussions and stakeholders' meetings
Risk that the available fuel resources for cogeneration will diminish in the medium to long term	Low	• Availability and adequacy established through statistics and initial survey • Use of residues from sustainable crops such as sugar cane which have existed for a very long time in the participating countries • Industries generating the residues to be used as fuel are relatively stable and progressive
Risk of technological failure with high pressure cogeneration systems	Low	• Use of high pressure cogeneration technologies are proven and are successfully operated in other regions • Availability of suppliers of cogeneration components in the global market well established

The development, financing, construction and operation of cogeneration projects has specific risks that need to be addressed if the project has to be implemented successfully. The key is to identify these risks and apply mechanisms to mitigate them and allocate the remaining risks to the parties most competent to manage them.
Table 3.13 gives the possible risks faced by cogeneration projects and the some ways that could be used in mitigating them and allocating them to the different parties involved.

Table 3.13: Risk allocation and mitigation matrix for cogeneration projects

Risk	Allocation							Mitigation
	Government	Sponsors	Project Company	Third Party Contractor ***	Project Lenders	Insurers	Other guarantee providers	
1. Political/Country								• Political risk insurance from Export Credit Agency (ECA) or multilateral development agencies • Regulatory framework supporting cogeneration and renewable energy projects • Board of Investment (BOI) privileges for green projects
Change in law			✓					
Development/permitting issues	✓	✓	✓					
Adverse govt. action/inaction	✓	✓	✓			✓	✓	
Corporate taxation			✓					
Expropriation			✓			✓	✓	
Political force majeure events	✓					✓	✓	
2. Sponsor								• Sponsors to provide equity and pre-completion guarantee • Experience in supporting renewable energy projects
Competence and reliability		✓						
Equity at risk		✓						
Pre-completion guarantees		✓					✓	
3. Construction								• Fixed-price turnkey (EPC) contract with provision for liquidated damages • Construction time insurance • Choice of reputable contractors
Cost over-runs			✓	✓	✓		✓	
Timeliness and quality			✓	✓				
Contractor default			✓	✓			✓	
Default by project development company			✓	✓				
Work changes and variations				✓	✓			
Increase in financing costs		✓	✓		✓			
Environmental damage	✓		✓			✓		
Force majeure						✓	✓	
4. Technical/technology								• Use of proven technology • Turnkey supplier with good operating references from similar plant configuration • Performance guarantees • Liquidated damages
Reliability of process and equipment		✓		✓			✓	
Technological failure		✓		✓				
Failure to meet performance/specifications		✓		✓			✓	
Accidents during construction						✓	✓	
5. Environmental								• EIA from reputable institution • Implementable operational environmental plan • Awareness campaign
Environmental impact assessment (EIA)		✓	✓					
Operational environmental management			✓	✓				

Risk	Allocation							Mitigation
	Government	Sponsors	Project Company	Third Party Contractor* **	Project Lenders	Insurers	Other guarantee providers	
6. Fuel								• Fuel supply availability study • Long-term fuel supply contract • Storage during lean season • Use of appropriate secondary fuel
Supply availability			✓	✓				
Price and future escalation			✓	✓				
Competing usage			✓	✓				
7. Financial/Legal								• Power Purchase Agreement (PPA) from national grid including provision for foreign exchange and fuel price fluctuation • Equity from sponsors • Fixed rate loans • Hedging mechanisms such as interest swaps • Joint venture/shareholders agreement
Inflation	✓	✓	✓		✓			
Interest rate	✓	✓	✓		✓	✓		
Foreign currency exchange rate	✓	✓	✓	✓	✓	✓		
Ownership of assets			✓					
Security structure			✓		✓			
Insolvency of company		✓	✓		✓			
Breach of financing documents		✓	✓		✓			
Enforceability of security	✓		✓		✓			
8. Operation								• Hiring of competent Operation and Maintenance (O&M) contractor • Sound O&M contract • Insurance during operating life of project
Company default		✓					✓	
Performance of O&M contractor			✓	✓				
Environmental damage			✓			✓		
Force majeure event			✓			✓		
Change in law			✓	✓				
Labor problems and disturbances			✓					
9. Market and Revenue								• Long-term PPA from reliable off-takers • Established scheme for sales of power to the national grid
Insufficient income			✓		✓			
Off-taker default			✓	✓			✓	
Insufficient demand		✓	✓		✓			

Source: Gonzales, A.D., 2001

*** Includes equipment supplier, fuel supplier and O&M contractor

Logical framework

The logical framework is provided in Annex B.

Schedule and milestones

The schedule and milestones for the Project implementation are reflected in the detailed work plan which is attached in Annex I.

3.6 Sustainability (Including Financial Sustainability)[27]

A major aspect of the Project is geared toward the transformation of the cogeneration market into a sustainable and profitable industry. The main actor in this endeavor is the private sector who will develop and own the projects and provide a major portion of the required financing to implement them (See letters of interest from key industry actors in annex H). Thus, the commercial orientation of the cogeneration projects is expected to enhance the sustainability of the Project.

Once it is shown through concrete examples (via the Full Scale Promotion Projects, for instance) that high pressure cogeneration systems are viable alternatives to the existing arrangements of continuing with the use of inefficient systems, and other barriers related to their implementation and adoption are removed, it is expected that the market mechanism will allow more investments to take place.

Discussions with financing institutions in the African region have given an indication that enough funds and liquidity are available for projects that can show evidence of viability and provide the proper security arrangements.

The initiative by Triodos Bank to create the "Clean Energy for Agro-Industries in Africa" (CEFA – see Annex X) specifically to participate in the financing of the potential projects to be developed and implemented within the framework of the Cogen for Africa Project and another project being developed by UNEP/DGEF for small hydropower plants in the tea industry, is expected to ensure the financial sustainability of the cogeneration industry.

As mentioned earlier, the Cogen for Africa project is modeled on the ASEAN Cogen programme, which had an EC grant for cogeneration equipment that acted as an important incentive for project sponsors to invest in cogeneration. The Cogen for Africa project does not have a similar arrangement; therefore it will be difficult to attract project sponsors. However, there are two factors that are likely to ensure project sponsors actively participate in the project. The 1st factor is the involvement of the African Development Bank as a co-implementing agency. The AfDB provides attractive financing for private companies and has extensive expertise in mobilizing and disbursing financing for large energy investment projects. Secondly, a significant portion (32%) of the GEF resources for the project has been allocated to feasibility and pre-feasibility studies. Project sponsors will, therefore, be able to access funding for detailed pre-feasibility and feasibility studies at no cost.

The design of the Cogen for Africa Project also ensures that institutions are established to support the requirements of cogeneration project developers for information, expertise and services even after the completion of the Project. For this, a cogeneration centre of excellence to be called the AFREPREN/FWD Regional Cogen Centre will be established. In the initial years, international experts will be involved in feasibility and pre-feasibility studies in conjunction with local personnel. It is expected that by year 3 of the project, the local AFREPREN/FWD Regional cogen centre staff will have built capacity and will be able to significantly contribute to feasibility and pre-feasibility studies. This will ensure sustainability and retention of skills and expertise within the Regional Cogen Centre.

As explained earlier, the AFREPREN/FWD Regional Cogen Centre will provide services free-of-charge at the initial phase of the Project implementation but will gradually charge its services towards the end of the Project completion, which combined with grant or technical assistance (TA) funds that the cogen centre is able to mobilize, will increase the chances for long term sustainability of the centre. This will be incorporated in the agreement between the Cogen centre and UNEP. This plan and schedule will be respected even in the event of an extension of the Project duration. It is expected that the Regional Cogen Centre will spin-off into a self-sustaining unit within AFREPREN/FWD to provide a one-stop service facility to the stakeholders in the cogeneration industry. This will allow for full cost recovery of the Centre in the first year after the Project completion. The detailed mechanics of the future organizational, business and financial sustainability of the Regional Cogen Centre will be studied and documented comprehensively in a Business Plan that will be conducted during the Project implementation.

[27] Detailed elements of strategy, institutional arrangements, co-financing options and modalities for ensuring sustainability elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

"The concept of transforming a donor-funded project into a self-sustaining entity has been proven to work successfully in the case of the Cogen Programme in Asia. When the EC-ASEAN COGEN Programme ended at the end of 2004, two institutions were spun-off. The AIT Cogen Centre, which carries on the tasks related to the conduct of studies, researches, training and capacity building related to cogeneration, among others; and Full Advantage, a regional network of cogeneration experts, which provides advisory and consultancy services to the cogeneration industry in Asia. (*The Asian Institute of Technology (AIT), based in Bangkok, Thailand was the host and Implementing Agency of the EC-ASEAN COGEN Programme during 1990-2004)"*

To support the AFREPREN/FWD Regional Cogen Centre at the country level are the National Cogen Offices which will directly work with and through the industries and industrial associations in the respective countries. They will also liaise and coordinate with relevant government agencies for the activities of the Project related to policy aspects. As they develop capacity and experience, these institutions are expected to carry on with the provision of support and services to the cogeneration industry in their respective countries. It is expected that the fee-for-service activities of the Centre which starts at year 4 of the Project will also be done by the National Cogen Offices in the relevant country/ies where the service is provided to allow the National Cogen Offices to generate income for their activities.
An agreement between UNEP and the Cogen Centre will be prepared, to ensure that the targets for raising financial sustainability, through fees as well as grant/technical assistance (TA) financing are adhered to.

As the enabling environment through proper and attractive policies that support and encourage investments in efficient cogeneration systems is important in creating a sustainable cogeneration industry, the Project will provide institutional support for policy formulation as one of its activities. The long-term objective is that ultimately, governments of the countries participating in this project would implement policies and regulations that support cogeneration and the sales of excess power from cogeneration systems at favorable conditions. The existence of a Standard Power Purchase Agreement would ensure long-term viability and sustainability of the projects.
The end-result that can be expected from the interventions of the Project will be an outfit that will continue to promote and realize new Cogen facilities in the participating countries beyond the set target of 200 MW and possibly in other nations of the African region, at no further cost to the GEF.

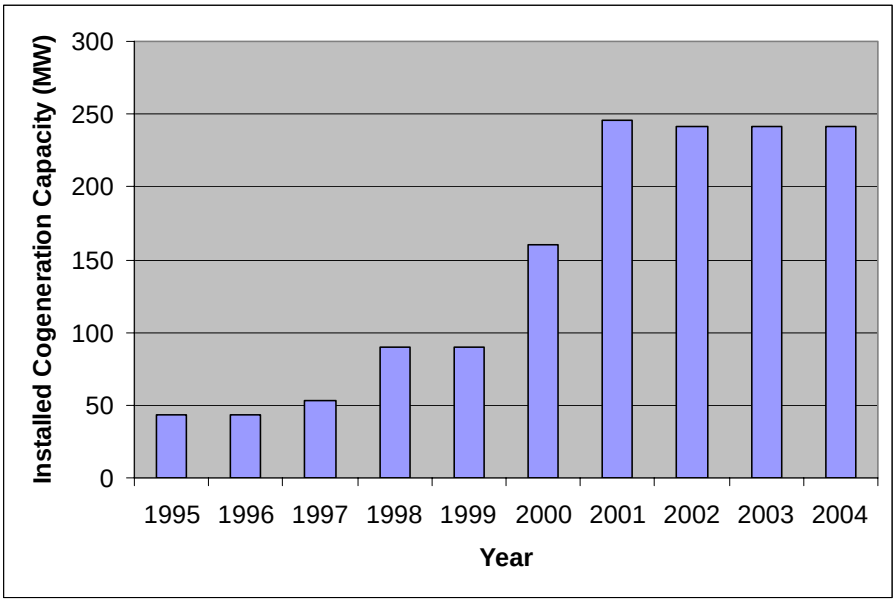
3.7 Replicability

In concept, the proposed Cogen for Africa Project itself is a replication of activities successfully implemented in the Far East. It is anticipated that cogeneration will not only be relevant for the countries that will participate in the proposed Project, but will be relevant for all African nations. The proposed mid-term review could allow additional countries to participate in the second half of the Project, if budget and conditions allow. A francophone replication or Project extension could be initiated for Western Africa as soon as positive signs of Project success become visible. Replication is likely to take place if the right policy environment exists. By including AFREPREN/FWD as the host of the proposed program and Regional Centre, it is envisaged that Cogen experiences and successes will be disseminated to all nations that are part of the AFREPREN/FWD network, thus creating interest and a receptive climate for cogeneration in additional countries. The circulation of AFREPREN/FWD communications through its network plus the physical presence of the network in all energy sector-related activities in the region will warrant an effective dissemination of information and experiences.
The proposed GEF intervention for the Cogen for Africa Project realization is necessary to scale up cogeneration development in Africa, subsequently paving the way for many more Cogen projects to be realized without further Cogen Project intervention. Whereas the proposed Cogen for Africa Project should initially concentrate on industries and fuels with the highest potential in the region such as the sugar industry, the Project will explore other fuels and industries with additional Cogen potential and design and implement appropriate interventions.
The realization of a total installed cogeneration capacity of 40 MW or 6 Full Scale Promotion Projects (FSPPs)[28], together with supporting activities on the capacity building, advisory, financing, institutional and policy aspects are expected to encourage project developers to replicate these FSPPs in other factories, sectors and even countries. Additional 20 MW of direct post-project replication and another 180 MW of indirect replication are expected to be implemented within 5 to 10 years after the project completion. It must be noted that the potential for high-pressure cogeneration in the sugar industry alone in the seven participating countries is over 500 MW of additional capacity. In comparison, the Cogen Programme in Asia has, over a period of 13 years, directly supported more than 150 MW of cogeneration capacity and has stimulated investments in other cogeneration investments for a total of about 600 MW. In Mauritius, the replication of cogeneration

[28] As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

systems in the sugar industry over a period of 20 years has resulted in an additional 200 MW of cogeneration capacity (see graph in Figure 3.12).

Figure 3.12: Growth of cogeneration capacity in Mauritius



3.8 Global environmental benefits of the project

The main fuel that has been identified in the participating countries for the cogeneration systems to be promoted is biomass. It has been acknowledged that for cogeneration plants using biomass as fuel, there is no net CO_2 emission resulting from biomass combustion in the boiler. This is because biomass is considered as CO_2 neutral. When the plant grows, it absorbs CO_2 from the atmosphere. When the biomass is combusted in the boiler, it emits the same amount of CO_2 it absorbed during the plant's growth.

The expected additional cogeneration plants that will be implemented within the Project duration will be hosted by the industries which are generating biomass residues from their processes. Most of these industries have existing systems producing power and steam for their factories using these biomass residues as fuel, although these systems are inefficient and outmoded. Thus, the CO_2 emission reduction will only be calculated on the additional cogeneration capacities that will be implemented over and above the existing plants. The steam generation for process application before and after implementing the new cogeneration system is the same.

The emission mitigation potential of the biomass cogeneration system in this context is the difference in emissions from the cogeneration plant compared to the alternative supply of electricity to be replaced by the cogeneration system, called the baseline.

The following table shows the methodology to be used for calculating the greenhouse gas (GHG), mainly CO_2, mitigation potential.

Table 3.14: Methodology for emission mitigation potential

Cogeneration emission (A)	**Baseline emission (B)**	**Emission mitigation potential**
CO2 emissions from biomass boiler	CO2 emissions from alternative source to be replaced	B - A

Since the CO_2 emission from a biomass boiler used in cogeneration is zero, therefore:

CO_2 emission mitigation potential = emissions from alternative source of electricity replaced

It was shown in the previous sections that based on the existing power supply, current trends and/or Power Development Plans of the participating countries, it can be assumed that the cogeneration plants will replace the thermal power plants

using diesel and coal as fuel. Taking the more conservative figure of the emission factor for diesel (instead of coal) which is 0.8 ton CO_2 /MWh, the direct project, direct post-project and indirect project emission mitigation potential are calculated below. If the actual replacements are made for coal thermal plants, the CO_2 mitigation will be higher.

Direct Project-related emission mitigation potential

The Project has a target to implement an additional cogeneration capacity of 40 MW as Full Scale Promotion Projects (FSPPs)[29] during its 6-year duration. Considering a lifetime of 20 years for the cogeneration equipment, the yearly and accumulated lifetime CO_2 emission for replacement of either diesel thermal power plants are given in Table 3.15.

Table 3.15: CO_2 emission mitigation potential for 40 MW installed capacity (direct project-related)

Description	**Replacing diesel (Emission factor = 0.80 ton CO_2 /MWh**	
	Annual*	**Lifetime (20 years)**
MWh of electricity generated	204,000	4,080,000
Tons CO_2 emission abated	163,200	3,264,000

* Operating at an average of 6,000 hours and load capacity factor of 0.85.

Direct post-project emission mitigation potential

Other than the FSPPs, another 20 MW of projects would have been directly supported by the Project through technical, financial and regulatory advice/services and have reached implementation stage or an advance stage of project development at the end of the Cogen for Africa Project implementation. As these projects may only be completed after the Project duration, their emission mitigation potential are reckoned as direct post-project and are quantified as follows:

Table 3.16: CO_2 emission mitigation potential for the direct post-project installation of 20 MW installed capacity

Description	**Replacing diesel (Emission factor = 0.80 ton CO_2 /MWh**	
	Annual*	**Lifetime (20 years)**
MWh of electricity generated	81,600	1,632,000
Tons CO_2 emission abated	65,280	1,305,600

* Operating at an average of 6,000 hours and load capacity factor of 0.85. A factor of 0.8 is further applied to account for other forces influencing the replication process.

Indirect (project replication) emission mitigation potential

Based on the assessment of the potential reflected in Table 1.4, the implementation of FSPPs and the supporting activities provided by the AFREPREN/FWD Regional Cogen Centre are expected to stimulate further investments in cogeneration projects of up to 200 MW. This includes the 20 MW considered as direct post-project replication and explained in the previous section. A small portion may already start to happen during the Project implementation , but a significant portion of this quantity is expected to be realized beyond the duration of the Project. The potential CO_2 emission reduction of the remaining 180 MW is given in Table 3.17.

[29] As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

Table 3.17: CO_2 emission mitigation potential for 180 MW installed capacity (indirect project-replicated)

Description	Replacing diesel (Emission factor = 0.80 ton CO_2 /MWh	
	Annual*	Lifetime (20 years)
MWh of electricity generated	734,400	14,688,000
Tons CO_2 emission abated	587,520	11,750,400

* Operating at an average of 6,000 hours and load capacity factor of 0.85. A factor of 0.8 is further applied to account for other forces influencing the replication process.

Local environmental benefits

The use of inefficient cogeneration systems using biomass could produce particulates and other harmful substances such as dioxins and furans that could go with the fly ash and affect the local inhabitants near the cogeneration plant. These normally occur due to factors such as: incomplete combustion of biomass, unregulated excess air in the furnace, and the reaction that happens due to the presence of chlorine in the bagasse, presumably from the washing process of the bagasse in brackish water.

The prevention of particulates and harmful substances in cogeneration systems largely depends on the design of the boiler, particularly by good combustion and effective dust collection by Electrostatic Precipitator or Bag Filter. If a bag filter is used, this presents an opportunity to remove the dioxins and furans very effectively with active carbon injection.

To prevent dioxin formation in the furnace, the furnace must have a residence time at a consistent temperature of 850^0C above the last injection of secondary air. If the furnace does not have a consistent temperature profile, insufficient residence time, poor mixing or other combustion deficiencies, then dioxin will be formed in the furnace.

Old bagasse boilers also tend to hold fly-ash in the boiler rear passes in areas such as the bottom drum, or anywhere else that the fly-ash collects. This static fly-ash often coated with carbon compounds may rest in an area of the boiler lower than ~ 300^0C where the Denovo effect operates. This tends to form or reform dioxins and furans if the precursors are present and there is sufficient residence time to effect the reformation. The dioxins tend to stay on the particulate and during soot-blowing will be passed out of the boiler usually attached to the fly-ash.

Modern and efficient cogeneration systems to be promoted in this Project are well designed and are fitted with good air/dust cleaning systems that by implementing these measures, harmful substances present in existing inefficient systems would be avoided.

3.9 Incremental costs

The Projects' overall cost is 66,834,515 USD. Without the implementation of the Project, there would be some baseline activities estimated to cost 10,350,000 USD. The incremental activities will be funded from different sources, of which GEF is requested to finance 5,248,165 USD. The details of the incremental costs and the corresponding sources of financing are presented in the Incremental Cost Matrix in Annex A.

3.10 Monitoring and Evaluation

The Monitoring and Evaluation (M&E – Annex F) will be an important element in the design for the successful operation of the Project. Built into the Project's operations are activities and reporting mechanisms that allow regular and transparent monitoring of the different aspects of the Project implementation.
At the start of the Project, a Project Implementation Manual (PIM) will be prepared. The PIM will detail the administrative, financial and reporting policies of the Project which will guide the actions of every person involved in the execution of the Project.
The Project will also procure or commission the development of a Financial and Management Information System (FMIS), which will act as an integrated tool for financial management and reporting, resource data tracking; monitoring and control of expenditures, etc. The FMIS will ensure up-to-the-minute access to the Project's financial and resource

information by the AFREPREN/FWD Regional Cogen Centre Director and the co-implementing agencies, whenever necessary. It will also ensure a well-designed and transparent financial reporting mechanism to the Implementing Agency.

The following Table shows the M&E plan of the Project.

Table 3.18: Monitoring and evaluation plan

M&E activities	**Frequency /Timing**	**Aspects to be monitored & evaluated/ Description**	**In-charge of activity**	**Approval**
Project implementation Manual	After 3 months	Administrative, financial and reporting policies of the Project	ACCD	PSC
Written Reports				
Inception report	After 3 months	Mobilization; staffing; detailed work plan; detailed budget; Project Implementation Manual	ACCD	PSC; IAs
Quarterly progress report	Quarterly	Quarterly accomplishments; work plan for the next quarter	ACCD	ExA
Annual progress report	Yearly	Annual accomplishments; Expenses for the year completed; next year's work plan and budget	ExA	PSC; IAs
Mid-term progress report	After 3 years	First half-term accomplishments; half-term expenses; update of Project work plan; lessons learned, recommendations and suggestions for re-orientation of activities (if necessary)	ExA	PSC; IAs
Final report	After 6 years	Project accomplishments; Project expenses and financial report; records and evidences of all outputs; lessons learned and recommendations for future actions	ExA	PSC; IAs
NCO progress reports	Quarterly	Country accomplishments; work plan for the next quarter	NCO staff	ExA, PMC
Mission reports	After each mission	Relevant aspects of the mission (according to defined template)	Individual experts	ACCD
FSPP monitoring	After commissioning of the plants	Technical feasibility, economic/financial viability and environmental impact of the Full Scale Promotion Projects (FSPPs)	ExA, CIC; External service providers	PSC
PSC meetings and minutes	Every 6 months	PSC meetings will discuss policy and strategic matters of the Project and provide direction & guidance to the Project. It will also approve selection of Full Scale Promotion Projects, endorse adaptations to the Project components during the Project execution, evaluate the performance and impacts of the Project, and approve Progress, Midterm and Terminal Reports	ACCD	PSC; IAs
PMC meetings and minutes	Every 6 months	The PMC will provide technical and operational guidance to the Programme, select of Full Scale Promotion Projects, monitor and evaluate the progress of the activities and approve quarterly planning of activities	ACCD	PSC
Financial & Management Information System (FMIS)	Throughout the Project; continuous	Accounting transactions; financial management & reporting; monitoring and control of project expenditure; Project resource data tracking;	Finance/ Admin. Manager	ACCD; IAs

		tracking mechanisms for co-financing & expenditure; standard forms & templates		
External audit	Every year & After 6 years (final audit)	Auditing of accounts and financial management; use of international accounting standards	External auditor	IAs, ExA
Mid-term Review	After 3 years	Review of progress on execution & achievement of project outcomes as specified in the Project Document; fine-tuning of work plans for the second half of the project; improving project approaches and optimizing implementation arrangements; recommendation on adaptive measures; extensive and transparent consultation with all key stakeholder groups	ExA	PSC
Terminal Evaluation	After 6 years	Achievements, outcomes & impacts compared to baseline; lessons learned and recommendations for future actions; evaluation according to GEF Project Review Criteria	IAs; Independent evaluators	IAs
Other deliverables				
FSPPs	Project end	40 MW of new and efficient cogeneration projects which could be realized through 6 FSPPs[30]	ExA, ACCD; CIC	PSC
Training and capacity building activities	2 training per year from year 2 to year 6	Capacity building activities (workshops, forums, training) organized for relevant stakeholders on technical, project development and financial aspects of cogeneration	Assigned experts	ACCD
Project Development Guide	Year 2	A guide in developing and implementing cogeneration systems using best practices	Assigned experts	ExA
COGEN Database	Year 1	A database containing foreign and local manufacturers of cogeneration equipment/components	Assigned expert	ExA
Cogen for Africa website	Year 1	Project website containing relevant information on cogeneration and the Project for stakeholders	Assigned expert	ExA
Feasibility studies/Cogeneration Investment Packages	Project end	A total of 12 feasibility studies/Cogeneration Investment Packages (CIPs)[31] and several other pre-feasibility studies for new cogeneration projects	External service providers	ExA, CICs
Fuel resources study	Year 1	Comprehensive study on the available fuel resources and their potential for cogeneration	Assigned experts	ExA, CICs
Study on applicable technologies	Year 1	Review and assessment of technologies applicable for cogeneration that have been implemented successfully in similar environments	External service providers	ExA, CICs
Business Plan	Year 2 & year 4	Business Plan for sustainability of the AFREPREN/FWD Regional Cogen Centre after project completion	External service providers	ACCD, PSC

[30] As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

[31] A total of 12 CIPs/Feasibility Studies will be supported with the funds from GEF. However, additional CIPs/Feasibility studies could be undertaken, with support from other co-financiers. AfDB has indicated willingness to support a number of CIPs/Feasibility studies.

Notes:[32]
ACCD = AFREPREN/FWD Regional Cogen Centre Director
CICs = Chief International Expert/Consultant and other international/regional and national experts
ExA = Executing Agency (AFREPREN/FWD)
IAs= Implementing Agencies
NCO = National Cogen Offices
PMC = Project Management Council
PSC = Project Steering Committee

[32] Detailed institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council.

4. FINANCIAL MODALITY AND COST EFFECTIVENESS

4.1 Financing Plan

4.1.1 Financing mechanisms for cogeneration projects

As the bulk of the financing of the individual cogeneration projects is expected to come from the private sector, it would be best to describe this section by explaining the existing mechanisms used in the financing of these projects.
Typically, a cogeneration energy project can be financed using the following three major financing routes:

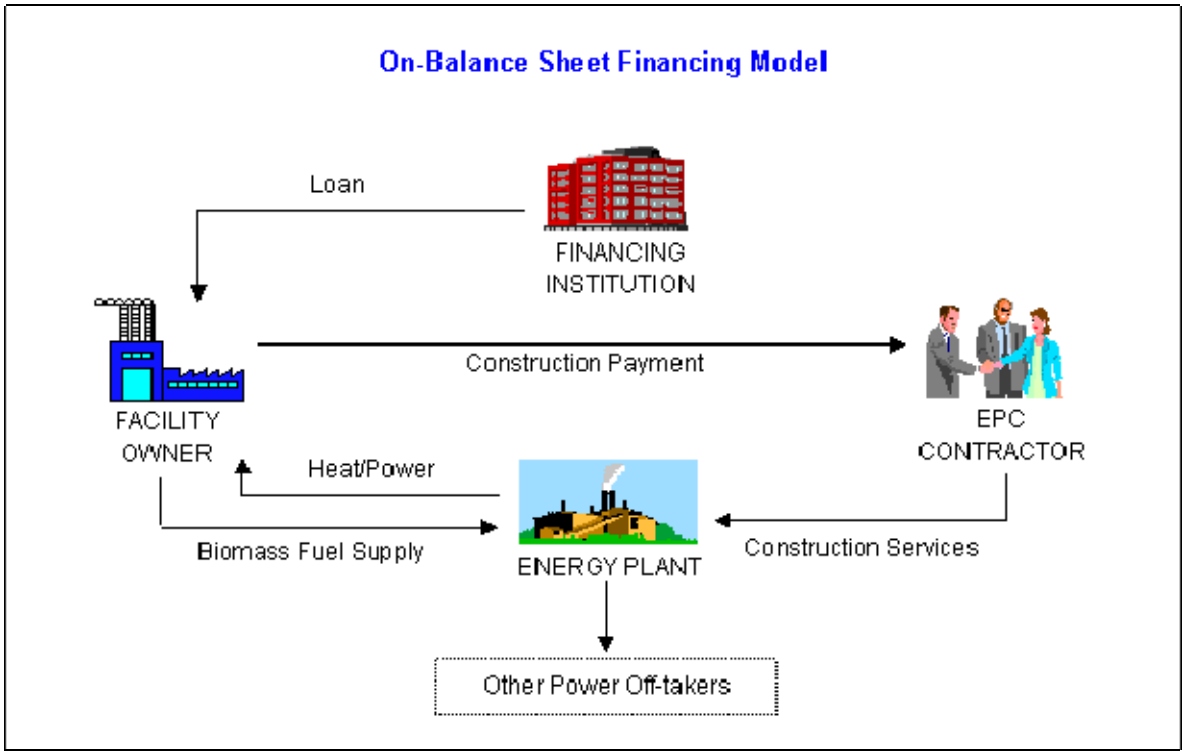
- Self-financing

Self-financing means that the company uses its own internal funds to finance the investment. Usually, this will come from the retained earnings or from existing cash reserves. Where a project is being developed by individuals or a small/new company without reserves, it may be necessary to raise funds from private entities/individuals, either to provide equity or to fund the whole project. For example, because of the high costs of borrowing in Uganda (interest rate of up to 20 % p.a.), the Sugar Corporation of Uganda Limited has recently purchased a 6 MW steam turbo-generator using its own funds.
Normally, however, since the cost of equity is higher than the cost of debt, self-financing is not the most efficient route to finance a project, except for some circumstances where it is not attractive to leverage the project, or when the project is small enough for the company to pay for the whole project cost from its own funds. Usually, the investments in cogeneration projects are too huge for investors to use their own funds alone in building the plant. Moreover, industries like the sugar industry in the African region are experiencing low liquidity because of the low price of sugar in the world market while incurring high production cost.

- On-balance sheet (corporate finance)

On-balance sheet finance is generally the simplest means of raising finance. However, it is likely to be used only by strong corporate sponsors. Although corporate finance can be raised by the issuance of shares or bonds or internal reserves, in most cases it involves raising debt based on the full corporate strength of the borrower at a price that reflects the corporate creditworthiness.
Corporate loans are generally easy to arrange if the borrower is considered creditworthy, but repayment periods are short, normally less than ten years. The structure of the project and the project risk profile would not influence the price of the loan as the corporate borrower accepts all the project risks. The arrangement fees and interest margins over base rate will vary considerably depending on the standing of the borrower.
Figure 4.1 illustrates an on-balance sheet financing model for a small biomass energy project.

Figure 4.1: On-balance sheet financing model: Facility owner-operated and financed



- Project finance basis

Project finance is a means of raising the funds required for a capital investment project wherein the providers of equity rely primarily on the cash flow of the project for the return on their investment, and the providers of debt for the payment of interest and repayment of the principal borrowed by the project.
Projects using the project finance route are developed by borrowing funds based on the creditworthiness of the project alone rather than of the sponsor. All project assets such as the plant hardware and the equity shareholding, would be pledged in support of the loan, as a security in the event of default. As the loan is not borrowed directly by the sponsor of the project, this transaction is not recorded on the balance sheet of the sponsor. Figure 4.2 illustrates the relationships among some project participants and the flow of funds among them.

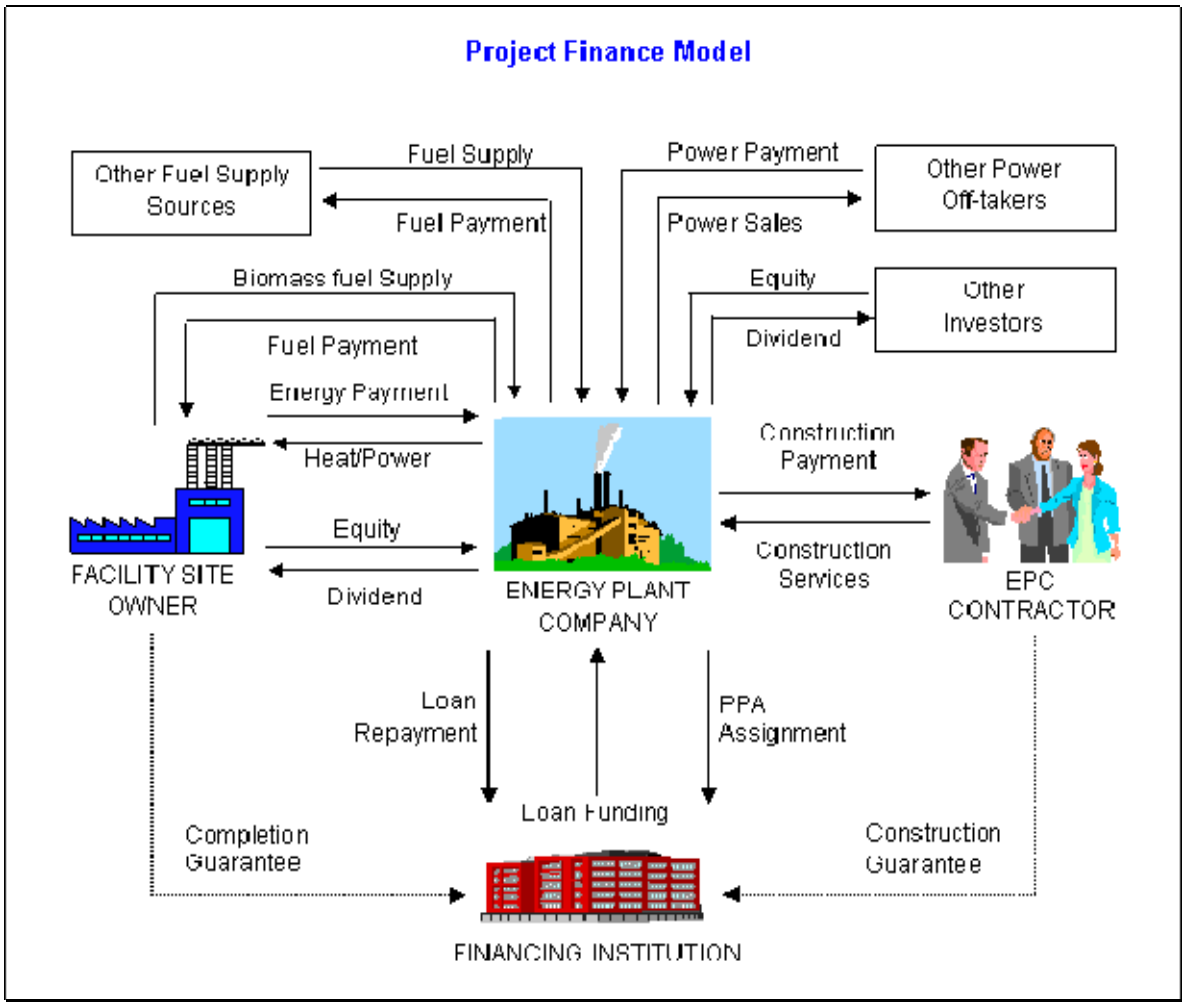
Experience in the implementation of small-scale renewable energy projects in other regions shows that using the project finance route for these types of projects is difficult to arrange.[33] Lenders normally perceive renewable energy projects to have high risks and thus require very stringent security arrangements. This often requires the project sponsors to borrow on their balance sheet, or to provide corporate (sometimes personal) guarantees. However, experiences in other regions have shown that there are two ways where energy efficiency or renewable energy projects can attain off-balance sheet financing:

a) set up a Special Purpose Company (SPC) that would hold the assets related to the cogeneration project but this would require the shareholders put in the SPC a level of equity deemed sufficient by the financial institutions in addition to providing a certain percentage of funding to the project;
b) finance through a third party financing company or an Energy Service Company (ESCO).

The AFREPREN/FWD Regional Cogen Centre, through the services of its international financing expert will assist and guide project developers in applying such structures, whenever applicable, within the context of the targeted countries.

[33] The EC-ASEAN COGEN Programme supported 14 industrial-scale biomass energy projects in South East Asia between 1993-1999. All of the projects have been financed on the balance sheet of the companies. During the Phase III of the Programme (2002-2004), some of the 8 projects implemented have been financed using the Project Finance route.

Figure 4.2: Project finance model: Financing directly to project



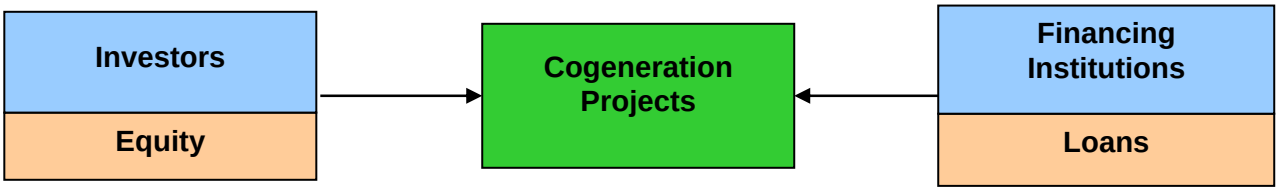
In the current conventional arrangements, the major parties involved in the financing of the projects are:

a) The investors/shareholders of the project who provide the equity in the form of cash, land, and other development expenses. In the African region, this ranges from 35 % to 50 % of the project cost.

b) The financing institutions/lenders who provide for the remaining portion of the project cost typically in the form of a commercial loan. As a security for the loan, collaterals and other forms of guarantees will be required by the financing institutions from the investors.

This conventional financing structure is illustrated in Figure 4.3:

Figure 4.3: Conventional financing participants



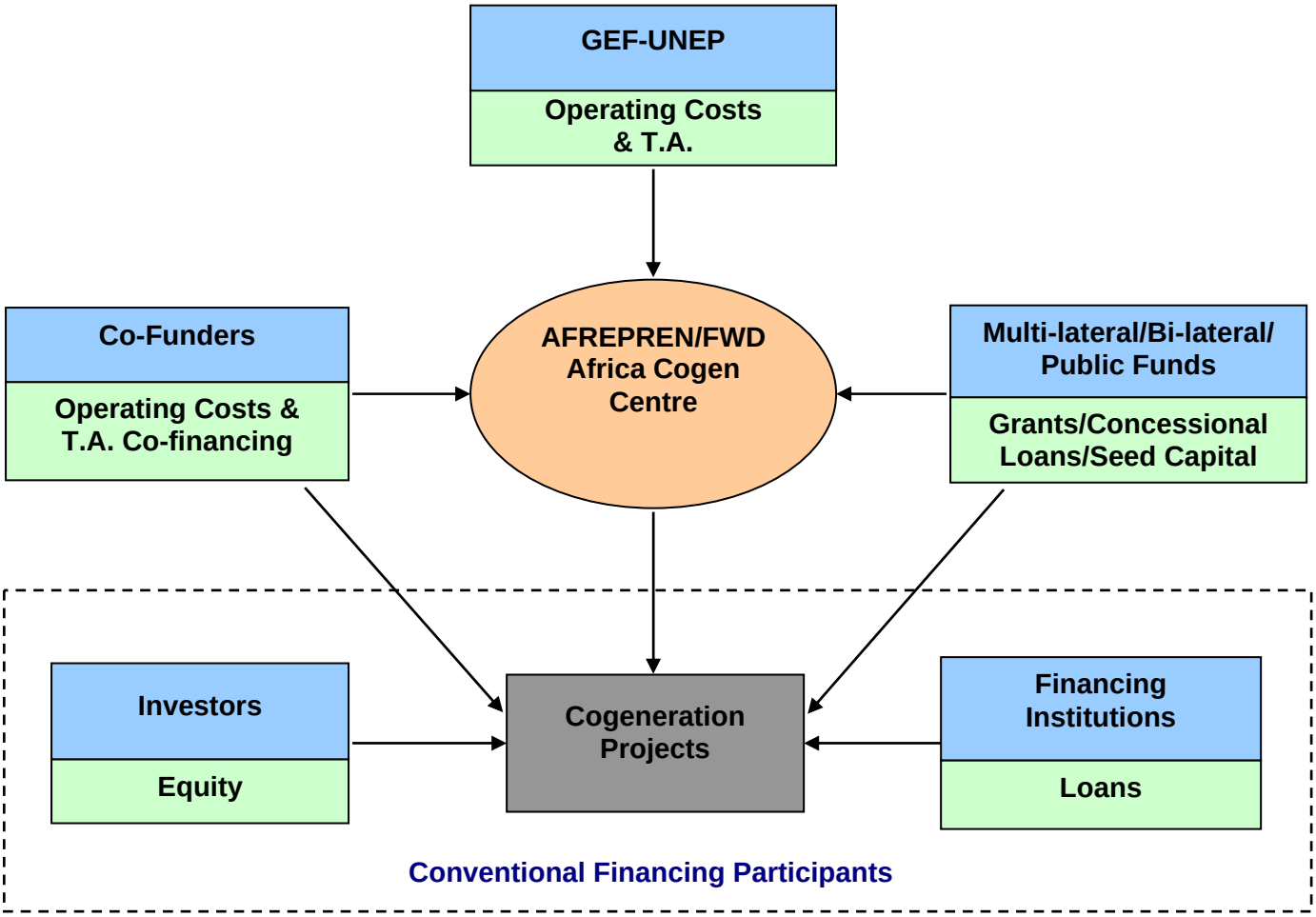
Because of the financing and other barriers mentioned in an earlier section, the growth of biomass cogeneration investments through conventional means is much lower than what could be potentially achieved.

The capital markets in most countries in Africa are still at an early stage of development. Although there are apparent endeavors to promote their efficient growth, such endeavors seem to lag behind other development priorities.

According to recent statements from East African Development Bank (EADB) officials the underlying financial sector lacks depth as it is characterized by dominance of commercial banks that tend to focus on the provision of debt of short term maturities and extremely low savings relative to other low income countries, implying that domestic investments rely extensively on foreign savings, thereby constraining growth potential.[34]

The Cogen for Africa project intends to support the project developers/owners in mobilizing funds at terms that are favorable to the projects to reduce financing constraints by implementing an innovative structure which will stimulate investments through institutional, technical and financial support to investors and financing institutions. This structure is illustrated in the figure below:

Figure 4.4: Innovative structure to stimulate investments in biomass cogeneration



4.1.2 Structure of financing requirements

As illustrated in the figure above, there are two major financing requirements that the Cogen for Africa Project needs in order for it to operate successfully. These are:

A. Funds for the operating costs of the AFREPREN/FWD Regional Cogen Centre and for Technical Assistance;

B. Investment Funds for the FSPP and other cogeneration projects.

Operating costs and Technical Assistance

As mentioned earlier, a regional Cogen Centre to be based in one of the participating countries will be established. This will be staffed by international, regional and local experts who have experience and expertise in providing financial, technical, institutional and policy support to biomass cogeneration and similar projects (details of the management and organization of the Cogen Centre are given in Section 3.5.3). Funds for Technical Assistance will be required to hire these experts who will provide technical assistance activities and services to the different stakeholders in the Project. Furthermore, the Project will need funds to cover for the operating costs such as salaries of supporting staff who will

[34] Daily Monitor, Uganda, 23 January 2006

assist in the day-to-day operations of the Project, remuneration and operating expenses of the Cogen Country Offices, travels and per diem, local transportation, equipment and office supplies, etc. The details of the budgetary requirements are provided in Section 4.1.3.

The sources of these funds are expected to come from:

- Global Environment Facility (to cover for the incremental costs)
- International co-funding agencies
- National governments and public funds of the participating countries in Africa

The details and commitments of the co-financing sources are given in Section 4.3.

Funds for cogeneration projects[35]

As described earlier, the developers of cogeneration projects normally need to put up an equity from its own funds as investment in the project. The equity is normally spent towards the development costs and part of the equipment and construction costs of the project. In this region, for this type and scale of projects, the equity that is usually required is between 35 % to 50 % of the total project costs.

The remaining portion of the total project costs is expected to come wholly or partially from commercial loans to be provided by local and international financing institutions. Initial discussions with several relevant institutions providing this type of financing indicated that viable cogeneration projects with attractive fundamentals and sound security arrangements are high in their list of projects qualified for funding. The Uganda Country Office of the African Development Bank (AfDB), a regional development bank for the African region has indicated that since cogeneration projects are implemented by the private sector, financing these projects are in line with the bank's commitment to expand their support to the private sector, hence, they are within the priority of the AfDB. The bank is also willing to provide specialized credit lines to qualified intermediaries for cogeneration and small hydro projects and to fund up to 1/3 of the project costs.

The East African Development Bank (EADB), a development bank covering the three countries of Kenya, Tanzania and Uganda, has a wide range of financial resources including locally raised funds from Corporate Bonds as well as credit lines from larger financing institutions such as the African Development Bank; DBSA (South Africa); FMO (Netherlands); and, DEG (Germany). According to the EADB representatives, the bank's strong features include flexibility and longer repayment periods of up to 14 years and has expressed interest in the investment opportunities that the Cogen centre will propose. Furthermore, EADB has had an experience in funding a cogeneration project, the Kakira Sugar Works cogeneration system.

The German DEG which is the subsidiary of KfW supporting the private sector, had already been approached by project developers and sugar companies regarding their financing needs for new projects such as cogeneration. DEG could participate as an equity provider or lender, depending on the needs of the clients and the organization's assessment of the project. DEG indicated that it is possible for them to participate on a Project Finance basis.

The South African-based regional banks such as the Amalgamated Bank of South Africa (ABSA), Standard Bank, and the Development Bank of South Africa (DBSA), all have indicated interest in funding the non-equity portion of the qualified cogeneration projects that will be developed with the support of the Cogen for Africa Project. Even banks in Mauritius that have funded Cogen projects and are familiar in evaluating them could be approached for funding.

However, since the capital market in the participating countries is not very well developed, in some circumstances loans from commercial sources could be limited, expensive and require heavy collateral and security arrangements. To reduce the costs of financing from commercial sources and the burden of more rigorous security arrangements, concessional sources of funds and appropriate flexible financing mechanisms will be sought out and arranged for the projects. The AFREPREN/FWD Regional Cogen Centre, as part of its Technical Assistance activities, will work closely with projects developers in liaison with the banks to develop bankable proposals and meeting the banks procedures and eligibility criteria and will provide services to structure and package the projects and bring them into financial closure at terms and conditions that are favorable for, and meet the financial objectives of, the projects.

There are different financing schemes that could be tapped (or created) for cogeneration projects. Table 4.1 provides an indication of the different types of financing mechanisms that could be tapped for cogeneration projects as a function of their sizes.

[35] Detailed elements of strategy, institutional arrangements, co-financing options and modalities for ensuring sustainability elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

Table 4.1: Ranges of cogeneration projects and possible financing mechanisms

System	Scope/Feature	Financing mechanisms/schemes
Small-Scale/ Off-Grid/Captive	▪ Small size cogeneration systems (< 1 MWe) ▪ Developers possibly no/weak track record and no/have difficulty to provide collateral ▪ Possible sectors: small agro-processing industries such as rice, coffee, …	Should develop and/or adopt financial mechanisms to cascade affordable financing to the end-users, and seek assistance for institutional, infrastructure and capacity building. Applicable schemes include: ▪ Self-financing ▪ On-balance sheet ▪ Micro-credit ▪ Grant/subsidy ▪ Specialized/green funds ▪ Seed capital ▪ Renewable Energy Service Company (RESCO) ▪ Leasing ▪ Financial incentives ▪ Supplier's credit ▪ Dealer's credit ▪ Financial bundling ▪ Concessional/soft loans
Medium-Scale/ Isolated-Grid/ Grid-Connected	▪ Cogeneration systems in the range of 1-15 MWe ▪ Facility-owned or third party developer ▪ Developers with some track record and possibly adequate collateral ▪ Possible sectors: sugar, rice, wood processing	Should adopt flexible and less conventional mechanisms, while exploiting the benefits of financing schemes applied to conventional energy. Applicable schemes include: ▪ On-balance sheet ▪ Equity financing (private/public) ▪ Venture capital ▪ Project finance (limited recourse) ▪ Corporate guarantee ▪ Grant/subsidy ▪ Specialized/green funds ▪ Seed capital ▪ RESCO ▪ Leasing ▪ Supplier's credit ▪ Financial bundling ▪ Concessional/soft loans
Large-Scale/ Grid Connected	▪ Cogeneration systems with capacity greater than 15 MWe ▪ Special Purpose Company or facility-owned ▪ Developers with proven track record and known risk ▪ Possible sectors: sugar, pulp & paper and other industries ▪ Fuel: biomass, natural gas, coal	Should operate within the same financing rules applied to conventional energy projects. Applicable schemes include: ▪ Project finance (limited/non-recourse) ▪ Venture capital ▪ Multilateral agency lending ▪ Export Credit Agencies ▪ Political risk guarantee ▪ Bonds issuance ▪ Supplier's credit ▪ Public debt ▪ Concessional/soft loans

Currently, a specialized Fund is being set up by Triodos Bank of the Netherlands with the particular aim of participating in the financing of cogeneration and small hydro projects that will be developed during the implementation phase of the Cogen for Africa Project and another project being proposed for GEF funding, the "Greening of Tea Industry in East

Africa" Project. The Fund, to be called the "Clean Energy for Agro-Industries in Africa" (CEFA – see Annex X) will focus on the pipeline of bankable projects that will be screened and assisted by the two Projects.
The principal sponsor of CEFA is the Triodos Renewable Energy for Development Fund (TRED Fund) which is an investment vehicle managed by the Triodos Bank (headquartered in Netherlands). TRED Fund is funded by the Dutch Ministry of Foreign Affairs, the World Bank and Hivos Foundation, among others.
TRED Fund strategy comprises:

- being a source of finance for new and existing local financial intermediaries that focus on providing financial services to projects and small and medium enterprises in the clean energy sector
- playing an instrumental role in promoting and structuring new initiatives
- actively seeking collaborations with financial intermediaries such as banks, microfinance institutions and leasing companies for clean energy related SME finance and end user finance.

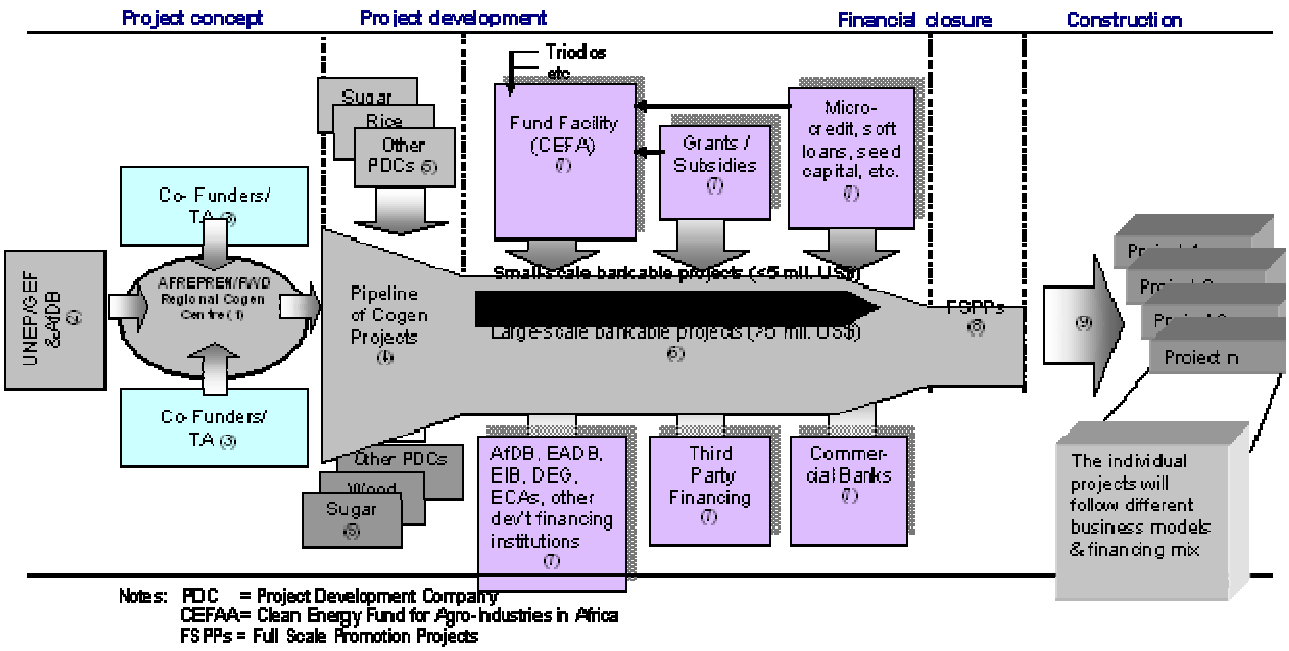
It is within the scope of the above strategy that TRED Fund proposes to sponsor the establishment of CEFA.
Triodos Bank, being the principal promoter for CEFA will provide:

- Seed capitalization of the Fund
- Fund set-up expertise
- Fund-raising leadership

Triodos has confirmed willingness to commit a seed money of about 2 mil. USD and leverage it to bring in other participants to the Fund. The Fund aims to have an initial amount of 20 mil. USD, but could be expanded once the demand is established. The features and modalities of the Fund will be included in the next draft.
The different financing sources and their potential participation in the Cogen for Africa Project and the individual cogeneration projects in relation to the project development continuum are illustrated in Figure 4.5. The numbers in the figure refer to the explanations in the following paragraphs.[36]
The Operating and Technical Assistance costs of the AFREPREN/FWD Regional Cogen Centre (1) are expected to be provided by the GEF (2) and potentially by other co-funders (3).
One of the activities of the Regional Cogen Centre is to identify potential cogeneration projects in the industries that generate their own biomass residues which can be used as fuel. This pipeline of cogeneration projects (4) will be assisted by the experts in the Regional Cogen Centre through the conduct of Pre-Feasibility/Feasibility Studies, project structuring, and other forms of advice and services. The services to be provided by the Regional Cogen Centre for each project will be valued in monetary terms. During the first few years of the Cogen for Africa Project implementation, the services of the Regional Cogen Centre will be provided for free, while the costs incurred outside these services will be covered by the Project Development Companies (5) or by the project owners in the different industrial sectors. Towards the fourth year of project implementation, the Project Development Companies will be required to pay a portion of the value of the services provided by the Regional Cogen Centre. The percentage of the contribution by the Project Development Companies as well as any grants/technical assistance (TA) financing that is mobilized, will gradually increase to 100 % at the completion of the Cogen for Africa Project as part of the plan for the Project's sustainability.
At this stage of project concept formulation and preparation, it is expected that some cogeneration projects will progress to a stage where more advanced project development efforts are required, while others will need further investigations or stimuli before proceeding into the next stage. The projects that proceed to the more advanced stage of project development will be assisted further by the AFREPREN/FWD Regional Cogen Centre in order to bring them to a level where they can be considered bankable projects (6). For the sake of determining the appropriate efforts and support mechanisms to be provide to projects, the pipeline of bankable projects will be categorized according to the size of the projects. Projects that have total project costs of 5.0 million US dollars or less will be categorized as small-scale projects, while projects with total project costs of more than 5.0 million US dollars will be considered large-scale projects. During this stage, the different sources of funds and financing mechanisms (7) will be matched with the requirements of this pipeline of bankable projects. By conducting initial due diligence on the projects and assisting them in preparing bankable proposals/documentation, it is expected that the development and financing costs of the projects will be reduced, the time to reach financial closure will be shortened and the confidence of the financing institutions to lend to the projects will be enhanced. The projects that will reach financial closure will be designated as Full Scale Promotion Projects (8). These Full Scale Promotion Projects are expected to be implemented in the different industries in different countries and will be used as showcases of efficient and modern cogeneration systems in the African region (9).

[36] Detailed institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

Figure 4.5: Financing sources and options for the financing of Cogen for Africa Project and the individual cogeneration projects



4.1.3 Project costs and financing

The total costs of the Cogen for Africa Project amounts to 66,834,515 USD for a Project duration of six (6) years and covering seven (7) Eastern and Southern African countries. Out of this amount, GEF will cover an incremental financing of 5,248,165 USD, while the remaining portion of 61,586,350 USD will come from non-GEF resources. The breakdown of the GEF contribution according to the different outcomes and components of the Project is given in Table 4.2 below.

Table 4.2: Breakdown of GEF incremental financing[37]

Budget Items	GEF incremental financing	Remarks
Outcome 1: Capacity of project developers, technical service providers and local manufacturers of modern and efficient cogeneration systems developed and enhanced	838,498	The GEF financing will be used for the conduct of feasibility studies, provision of technical advice and services to project developers, and training activities of local engineers and other stakeholders. The private sector starting from year 4 onwards will contribute by paying fees for the services gradually increasing up to 100% of the value of the services upon Project completion.
Outcome 2: Financing for cogeneration projects made available and accessed at terms and	998,360	Assistance in mobilizing funds for cogeneration projects and in financial packaging will be provided to project developers and financing institutions. This GEF financing

[37] Detailed elements of strategy and institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.
Notes on Outcome totals: It is expected that the largest effort will be made with respect to the FSPP outcome, followed by Policy outcome, then Financiers outcome and finally Developers outcome. Bulk of expenditures pertaining to administration and logistical support is allocated to project management, and the balance of expenditure which is more closely related to technical and thematic issues allocated to relevant outcomes. Changes in outcome totals reflect the above rationale, which more accurately reflects envisaged activities and differentiated level of effort

conditions that are favorable for investments.		will also be used for capacity building and training on financing aspects of projects.
Outcome 3: Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated in a number of new cogeneration plants and confidence on the certainty of the cogeneration market enhanced.	1,668,409	GEF financing will be used to fund the creation of the Cogeneration Investment Packages and to support the development and implementation of Full Scale Promotion Projects leading to the installation of up to 40 MW of highly efficient cogeneration systems. An additional of 20 MW direct post-project and another 180 MW indirect target is expected. The private sector developers and financing institutions will put up the investments worth 60 mil. USD.
Outcome 4: More favorable policies and institutional arrangements that support cogeneration promoted	1,149,106	Support to policy makers will be provided on policy formulation and enhancements. Advocacy activities will be conducted to influence policy makers to formulate and implement regulations that encourage the implementation of high-pressure cogeneration systems. Contributions in financing will come from the National governments of the participating countries and from Coopener program of the EU.
Project Management (including establishment of AFREPREN/FWD Regional Cogen Centre and coordination of National Cogen Offices	465,976	A regional cogeneration center of excellence to be called the AFREPREN/FWD Regional Cogen Centre will be established. National Cogen Offices in the 7 participating countries will also be set up.
Monitoring and Evaluation	127,816	
GRAND TOTAL	**5,248,165**	

As of end-February 2006, the following co-funders have committed to provide co-financing for the portion of the costs outside GEF financing:

Private sector/utilities:

During the first half of the Project implementation the AFREPREN/FWD Regional Cogen Centre, with its team of international and regional/local experts will provide services to the private sector project developers and cogeneration plant owners. These services will be valued but provided on a free-of-charge basis. At the second half of the Project duration when the viability of the cogeneration projects have been established and the cogeneration market becomes more sustainable, the Regional Cogen Centre will start to charge fees for the services it will provide. Fees will be charged at 25% of the costs at year 4, 50% of the costs at year 5 and 75% of the costs at year 6. The companies in the sugar industry have indicated the need for such services as evidenced by some letters exhibited in Annex H. It is estimated that this contribution (as well as any grants/technical assistance that is mobilized) will reach a total of 395,750 USD.

A major contribution from the private sector will be in the form of investments in Full Scale Promotion Projects (FSPPs) equivalent to 60 million USD for an installed cogeneration capacity of 40 MW (at a total project cost of 1.5 million USD per 1.0 MW of installed capacity). About 35% of the total project costs will be provided as equity by the project developers/owners, while about 65% will come as loans from different commercial/development financial institutions. Other than the sugar companies who have expressed commitments to implement and provide equity for the projects, the Real Energy Developments, Ltd. of ESD Ltd. (UK) and the Kenya Electricity Generating Co., Ltd. (KENGEN), an electric utility in Kenya, have strongly expressed their intention to provide 50% of the investment costs for the cogeneration projects which they could implement through the Cogen for Africa Project (please see Annex H for letters of commitment).

Triodos Bank, as mentioned earlier, is initiating the creation of the "Clean Energy for Agro-Industries in Africa" (CEFA) which is aimed at meeting the specific funding needs of a portfolio of investments and deal flow to be generated by two UNEP/DGEF energy initiatives in Africa: the "Cogen for Africa Project" and the "Greening The Tea Industry in East Africa".

Triodos Bank is a European bank with presence in Netherlands (Head office), Belgium, UK, Spain. It aims to help achieve a more decent, dignified and kinder society and a world that respects people, the environment and different cultures. The Bank is a pioneering force in the world of sustainable banking. It finances companies, institutions and projects that add cultural value, benefit people and benefit the environment.

Triodos Bank, through its fund management unit, "Triodos International Fund Management BV" (TIFM) already manages several funds, among them are three funds that provide finance, both debt and equity, to more than 50 microfinance institutions in approximately 25 developing countries:

- Triodos-Doen Foundation: Total portfolio at the end of 2005: EUR 32.5 million.
- Hivos-Triodos Fund Foundation : Total portfolio at the end of 2005: EUR 24 million.
- Triodos Fair Share Fund: Total portfolio at the end of 2005: EUR 16 million.

National governments:

National Cogen Offices will be established in each country participating in this Project. These offices will act as the representatives of the Project at the country level and will liaise with the national government agencies, project developers and other stakeholders in the country. The rental for the office spaces of these National Cogen Offices and the operating costs such as mailing, communications, utilities, etc. will be contributed as in-kind contribution by the national governments.

Renewable Energy and Energy Efficiency Partnership (REEEP):

The Renewable Energy and Energy Efficiency Partnership (REEEP) aims to accelerate and expand the global market for renewable energy and energy efficiency technologies particularly in the reforming power sector. REEEP has recently approved co-funding for the Cogen for Africa Project in the amount of 50,000 USD. This will be used to fund partially the activities in component 2 which relates to developing the financial aspects of the project.

Coopener/PACEAA:

An application for co-funding has been submitted to a European Commission program for Co-operation with developing countries (COOPENER). COOPENER aims to boost energy efficiency and the use of renewables and concentrates on the creation of favorable market conditions, international transfer of experience and promotion of best practices, institutional capacity building, accelerating learning curves, information dissemination, education and training of market actors. When approved, a fund amounting to 375,000 USD will be used to support the policy aspect of the Cogen for Africa Project particularly related to rural electrification of the surrounding areas of the cogeneration project sites.

Table 4.3 shows the sources of the co-financing according to the different outcomes and components of the Project.

Table 4.3: Project budget summary and corresponding sources of funds (in USD) [38]

Budget Items	Total costs	GEF financing	Co-financing for Technical Assistance							Leveraged Financing Private sector/ Utilities
			National Governments (Note 1)	AfDB (Note 2)	COOPENER (Note 3)	REEEP (Note 4)	Triodos (Note 5)	AFREPREN/ FWD Related Projects and Additional Technical Assistance Finance Raised (Note 6)	Private sector / Utilities; Contribution from Other Co-financiers (Note 7)	Investment
Outcome 1: Capacity of project developers, technical service providers and local manufacturers of modern and efficient cogeneration systems developed and enhanced	1,015,498	838,498	161,000	0	0	6,000	0	10,000	0	0
Outcome 2: Financing for cogeneration projects made available and accessed at terms and conditions that are favorable for investments.	1,335,700	998,360	0	159,840	140,000	37,500		0	0	0
Outcome 3: Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated in a number of new cogeneration plants and confidence on the certainty of the cogeneration market enhanced.	62,045,617	1,668,409	0	159,840	140,000	0	60,000	4,000	13,368	60,000,000
Outcome 4: More favorable policies and institutional arrangements that support cogeneration promoted	1,712,706	1,149, 106	467,600	0	80,000	0	0	16,000	0	0
Project Management (including establishment of AFREPREN/FWD Regional Cogen Centre and coordination of National Cogen Offices	597,178	465,976	77,000	17,280	15,000	6,500	0	15,422	0	*0*
Monitoring and Evaluation	127,816	127,816	0	0	0	0	0	0		
GRAND TOTAL	66,834,515	5,248,165[39]	705,600	336,960	375,000	50,000	60,000	45,422	13,368	60,000,000

[38] Detailed institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.
Notes on Outcome totals: It is expected that the largest effort will be made with respect to the FSPP outcome, followed by Policy outcome, then Financiers outcome and finally Developers outcome. Bulk of expenditures pertaining to administration and logistical support is allocated to project management, and the balance of expenditure which is more closely related to technical and thematic issues allocated to relevant outcomes. Changes in outcome totals reflect the above rationale, which more accurately reflects envisaged activities and differentiated level of effort

[39] The total budget does not change, with the participation of AfDB as a co-implementing agency, since AfDB's had already made a pledge prior to council approval.

Notes:
Note 1: National governments to provide in-kind contribution worth $705,600. Each country expected to contribute $87,800 per country as inkind contribution related to policy, power sector reforms and tariff negotiations; and $11,000 per country as inkind contribution for office facilities, utilities, equipment etc. An allocation of $14,000 related to inkind contribution for field trips by regional cogen centre staff.
Note 2: In-kind contribution from AfDB calculated on the basis of DANIDA international consultant rates of $160 per hour, 9 hours per day.
Note 3: COOPENER/PACEAA project on Rural Electrification for 2 years approved, equivalent to $375,000;
Note 4: Assuming AFREPREN/FWD staff are recruited, REEEP funding for 1 year project awarded to AFREPREN/FWD - Euros 70,000 (equivalent to $84,000); $50,000 allocated to Cogen for Africa and $34,000 to Greening Tea in East Africa. Breakdown of Cogen for Africa allocation - $25,500 for co-financing project personnel and $24,500 for co-financing Training workshops; REEEP project primarily focussed on training, thus explaining large allocation to project development/capacity building line item;
Note 5: Commitment from Triodos Bank to contribute $60,000 to feasibility and pre-feasibility studies secured during PDF-B phase.

Note 6: Assuming AFREPREN/FWD staff are recruited, projected co-financing for AFREPREN/FWD staff from related projects on power sector and renewables, biomass and cogeneration and other relevant development/research projects/studies. Does not take into account additional co-financing provided by AFREPREN/FWD in form of furniture, equipment and facilities provided to the 8 out of the 11 cogen centre staff. Estimate of this contribution to be provided in scheduled regular financial reports after securing the prevailing rental values.
Note 7: Projected co-financing to be raised from fees to be charged by cogen centre as well as in-kind co-financing from any other financiers

4.2 Cost Effectiveness

Cogeneration is a very cost-effective way of reducing primary fuel consumption for the same of amount of energy produced. It is also an extremely cost-effective measure of cutting down on transmission losses and costs as most of these systems are installed at the point of need of energy. Hence, it is a very cost-effective means of reducing greenhouse gasses.

A least cost comparison between bagasse-fired cogeneration plants and diesel power plants which it assumes to replace for 40 MW direct project, 20 MW direct post-project and 180 MW indirect targets, reveals that the discounted levelized cost per kWh of electricity generation is 0.052 USD/kWh for bagasse-fired cogeneration plants compared to 0.207 USD/kWh for diesel power plants. This translates to a negative cost incrementality of 0.155 USD/kWh. On top of this, the steam requirements of the sugar factory has been covered without additional cost to the cogeneration plant. The following table summarizes these figures while Annex W presents the detailed least cost analysis calculations.

Table 4.4: Cost incrementality

Costs (USD)	**Bagasse-fired Cogen**	**Diesel power plant**	**Cost incrementality**
Discounted levelized cost per kWh	0.052	0.207	(0.155)

Actual figures from countries like Tanzania and Kenya have shown that the price of electricity offered to Independent Power Producers (IPPs) particularly those producing electricity using diesel as fuel go as high as 0.335 USD/kWh and 0.16 USD/kWh respectively. There is therefore clear negative cost incrementality in the use of bagasse-fired cogeneration systems.

The Cogen for Africa Project has been designed to optimize the costs and leverage funding from the private sector and other donors for the implementation of clean and highly efficient cogeneration projects. With the GEF incremental cost funding of 5,248,165 USD, another 61,586,350 USD will be brought into the project for a total Project cost of 66,834,515 USD. This translates to a leverage ratio of over 10:1.

In Table 4.5 below, it is shown that the GEF incremental funding decreases from year 4 towards the completion of the Project in year 6. There are two major reasons for this. Firstly, the involvement of the International Experts will gradually reduce from year 4 as the responsibilities and involvement of the Regional/local experts are increased. Secondly, the co-funding from the private sector for the Technical Assistance will start from year 4 as the AFREPREN/FWD Regional Cogen Centre will begin to charge fees for the services it provides to the private sector, as well as raise additional grants and technical assistance financing. Fees will be charged at 25% of the costs at year 4, 50% of the costs at year 5 and 75% of the costs at year 6. This is also in line with the plan for sustainability of the AFREPREN/FWD Regional Cogen Centre in particular, and the sustainability and transformation of the cogeneration industry in general.

Table 4.5: Projected yearly costs and funding (in USD)

Project funding in USD	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Total yearly costs	1,440,023	1,372,980	13,159,305	13,049,234	18,940,874	18,872,099
Co-funding	117,600	117,600	12,117,600	12,217,475	18,244,225	18,286,850
GEF incremental funding	**1,322,423**	**1,255,380**	**1,041,705**	**831,759**	**696,649**	**585,249**

4.3 Co-Financing

The list of other institutions with their indication of funding commitment is given in Table 4.6. A more detailed table is provided in Annex J.

Table 4.6: Sources (and potential sources) of co-financing and status of negotiations

POTENTIAL CO-FINANCIERS (INVESTMENT)

Name of organization/Fund	Type of financing	Geographical coverage	Commitment
1. Triodos Bank	Fund & Portfolio management/ Prefers 2-3 additional partners to set up fund for mini hydro & cogen	Africa-wide	Submitted letter of interest
2. DEG (Deutsche Investitions und Entwicklungsgesellschaft mbH)	Long term financing for start up or expansion projects	Africa-wide	Submitted letter of interest
3. E+Co	Seed and growth capital in the form of debt or equity to SME	Uganda, Ethiopia, Tanzania, Zambia, South Africa, Gambia, Senegal, Mali, Ghana	Submitted letter of interest
4. FINN fund (Finish fund for Industrial Cooperation Ltd)	Co-financing on cogeneration investments projects	Kenya, Uganda, Tanzania, Malawi, Ethiopia, Swaziland, Sudan	Submitted letter of interest
5. EADB (East African Development Bank)	Interested in project financing (east Africa, Kenya Uganda and Tanzania); could support pre-feasibility studies; additional information for further assessment and, if appropriate and possible, provide a Letter of Support for the two initiatives	East Africa (Kenya Uganda, Tanzania)	Submitted letter of interest
6. AfDB (African Development Bank)	Co-finance small hydro projects (now a co-implementing agency)[40]	Africa-wide	Submitted letter of interest
7. KENGEN (Kenya Electricity Generating Company Limited)	Co-financing of electricity generation projects, up to 50% of investment costs	Kenya	Submitted letter of interest for Small Hydro and Cogen
8. Stanbic Bank - Kenya	Financing small hydro projects in the tea sector	Kenya	Submitted letter of interest
9. Standard Chartered Bank Structured Trade Finance Africa	Financing small hydro projects in the tea sector	Africa	Submitted letter of interest for Small Hydro and Cogen
10. Standard Bank Swaziland Limited	Co-financing for cogeneration projects in sugar factories	Swaziland	Submitted letter of interest for Cogen
11. Barclays Mauritius	Project Financing	Africa wide	Submitted letter of interest for Cogen
12. Mauritius Commercial Bank Ltd	Project financing	Africa wide	Submitted letter of interest for Cogen
13. Real Energy Developments Ltd (ESD)	Project Financing – equity contributions of up to 50% of the project costs.	Africa wide	Submitted letter of interest for Cogen
14. Sugar Factories – Kenya Busia Sugar Company West Kenya Sugar company Mumias Sugar company Chemilil Sugar Company	Project Finance and equity	Kenya	Submitted Letter of interest
15. Sugar Factories – Ethiopia Wonji/Shoa Sugar company Metahara sugar company Finchaa Sugar	Project Finance and equity	Ethiopia	Submitted Letter of interest
16. Sugar Factories – Swaziland Royal Swazi Sugar Corporation Simunye Sugar Mlhume Sugar	Project Finance and equity	Swaziland	Submitted Letter of interest
17. Sugar Factories – Sudan Sudan Sugar Company	Project Finance and equity	Sudan	Submitted Letter of interest

[40] As per GEF Council advice, AfDB now a co-implementing agency.

Name of organization/Fund	Type of financing	Geographical coverage	Commitment
18. DFCU Group Uganda	Project financing	Uganda	Awaiting letter of interest
19. AICAD/JICA (African Institute for Capacity Development	Project investment	Africa-wide	Awaiting letter of interest
20. ABSA (Amalgamated Bank of South Africa)	Co-financing of cogeneration projects, must have South African involvement Projects of at least US$10million preferred	South Africa (or projects with South African component) Africa-wide through Barclays Bank	Awaiting letter of interest
21. Swaziland Industrial Development Corporation	Co-financing for cogeneration projects in sugar factories	Swaziland	Awaiting letter of interest
22. ORET/FMO	Project investment	Africa-wide	Awaiting letter of interest
23. International Finance Corporation	Project investment	Africa-wide	Awaiting letter of interest
24. GroFIN	SME financing	East and southern Africa	Awaiting letter of interest
25. DBSA (Development Bank of Southern Africa)	Project investment	Southern Africa	Awaiting letter of interest
26. GTZ (German Technical Cooperation)	Project investment	Africa-wide	Awaiting letter of interest
27. EIB (European Investment Bank)	Credit line via regional/national finance institution e.g. EADB. Approval of credit line with EADB progressing fast	Africa-wide	Awaiting letter of interest

POTENTIAL CO-FINANCIERS (TECHNICAL ASSISTANCE)

Name of organization/Fund	Type of financing	Geographical coverage	Commitment
28. COOPENER	Co-financing for international projects which address non-technological issues and aim to improve access to modern sustainable energy services for poverty alleviation and social economic development in developing countries	Kenya, Uganda, Tanzania, Ethiopia, Rwanda, Burundi, Malawi, Mozambique, Zambia, Swaziland, Sudan	Proposal approved
29. REEEP	TA, specifically targets expansion of sources of finance, improved communications between existing and potential providers of financing and ensuring the establishment of innovative risk mitigation tools that will reinforce these efforts	Kenya, Uganda, Tanzania, Ethiopia, Rwanda, Burundi, Malawi, Mozambique, Zambia, Swaziland, Sudan	Co-funding approved
30. AFREPREN/FWD	Technical Assistance and in-kind contribution	Africa-wide	Submitted Letter of Interest
31. Government Ministries - Ministry of Mines and Energy, Ethiopia - Ministry of energy and Mineral Development, Uganda - Ministry of energy, Kenya - Ministry of Electricity, Sudan - Ministry of Agriculture, Food and Cooperatives, Tanzania - Ministry of Energy and Minerals, Tanzania - Ministry of Energy and Water Development, Zambia - Ministry of Energy, Mozambique Ethiopia Electric Power Company, Ethiopia Kenya Sugar Board, Kenya Electricity Regulator, Malawi	Technical Assistance and in-kind contribution	Africa-wide	Submitted Letter of Interest
32. AICAD/JICA (African Institute for Capacity Development)	Technical Assistance	Africa-wide	Awaiting letter of interest
33. EU office	Technical Assistance	Africa-wide	Awaiting letter of interest
34. International Finance Corporation	Technical Assistance	Africa-wide	Awaiting letter of interest
35. Danida	Mixed credit - Technical Assistance	Africa-wide	Awaiting letter of interest
36. BASE	Technical Assistance	Africa-wide	Awaiting letter of interest
37. GTZ (German Technical Cooperation)	Technical Assistance	Africa-wide	Awaiting letter of interest
38. USAID (U.S Agency for International Development)	Technical Assistance	Africa-wide	Awaiting letter of interest

5. INSTITUTIONAL COORDINATION AND SUPPORT

5.1 Core Commitments and Linkages

The New Partnership for Africa's Development (NEPAD) recognizes that energy plays a critical role in the development process of the region. 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. With its aim of addressing Africa-wide electricity problems, this Cogen initiative clearly falls within the NEPAD agenda.
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.

Specifically, the Short-term Action Plan of NEPAD identifies projects that will be supported by NEPAD. The projects that are highly relevant for the Cogen for Africa Project are the following:

- Training of energy experts
- Cooperation in new and renewable energy
- Cooperation in improving energy efficiency and reliability of supply
- Cooperation in rural energy

In these areas, the Cogen for Africa Project would seek ways to organize mutually beneficial activities that would enhance the effectiveness and meet the desired objectives in a cost effective manner.
Another linkage that has been explored and will continue to be useful for the Project is the Renewable Energy and Energy Efficiency Partnership (REEEP). REEEP aims to accelerate and expand the global market for renewable energy and energy efficiency technologies particularly in the reforming power sector. With the key objectives to identify and remove market barriers to the deployment of renewable energy and energy efficient technologies in the reforming power sector and increase access to financing, REEEP is, by definition, interested in cogeneration. As the Africa Cogen Center is designed to focus on the support of the realization of actual cogeneration plants, synergy with REEEP activities could be achieved. The interest of REEEP is underlined by its confirmed grant offer of $50,000 to the Cogen for Africa project.

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

GEF has activities in related sectors and involving countries which are participating in this Project. UNEP in conjunction with the East Africa Tea Trade Association (EATTA) has also developed the ***"Greening the Tea industry in East Africa - Small Hydro Development"*** project, which has been approved by the GEF Council for funding. The project covers the countries of Burundi, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda and Zambia. It is the intention of the two projects to cooperate in the policy aspects, particularly in promoting sales of power to the grid using standard PPAs and in rural electrification aspects. A major joint regional project approved by EC/COOPENER will enhance synergy between the two projects, as it covers both cogeneration and small hydro as options for rural electrification. In addition, a joint REEEP financed project that involves both projects has been approved for funding and will further strengthen the synergy and collaboration between these two initiatives.

Collaboration between the two projects has been streamlined to cover two aspects:
- Coordination at strategic level: The involvement of AfDB and UNEP in both projects as well as their active participation in the Steering Committees of both projects will ensure that any possible synergies that reduce cost will be exploited. The Steering Committee meetings for the Cogen and Tea/Small hydro are scheduled to be organised on a back-to-back basis, to ensure coordination of activities which would eliminate any potential duplication and maximise sharing of costs.

- Coordination at Activity level: Model power purchase agreements (PPAs) developed/available in either of the projects will be shared with the other project where relevant. The two projects will target specific countries where they have comparative advantage, in the discussions on regulatory and tariff issues. For instance, the Tea/Small hydro project is well positioned in Tanzania, and Kenya, and will therefore take a lead in these countries. On the other hand, the Cogen project is better positioned in Malawi and Uganda to take a lead in policy negotiations.

Missions of both projects will be coordinated in order to reduce the cost of mission as well as maximise the benefits to both projects. For example, where the Cogen project is planning a mission to a country that is covered by the Tea/Small hydro project, the Cogen mission will take on board and address policy and regulatory issues that are relevant for the Tea/Small hydro project, and vice versa. Information exchange and sharing between the two projects will also be encouraged, especially on the power sector reforms and tariff negotiations.

In addition, training workshops that cover similar issues for the two projects will be organised jointly, to avoid duplication of efforts and eliminate unnecessary costs. For example, personnel from the Ministries and Regulatory agencies participating in both projects do not have to attend separate training workshops that address similar issues

The following table provides a succinct illustration of the synergetic links between the two projects that will ensure cost-effective collaboration and cooperation:

GEF Projects	**Strategic Coordination**	**Joint projects**	**Activity-level coordination**
Cogen for Africa Tea/Small Hydro	AfDB and UNEP participating in Steering Committee Meetings	- EC/COOPENER - REEEP	- Sharing of model PPAs - Policy and Regulatory Negotiations - Optimization of missions - Joint Training Courses

With respect to other projects implemented by different Implementing Agencies (IAs), an inventory of current and past GEF activities is listed in Table 5.1, while Table 5.2 presents initiatives in the GEF pipeline. The relevance of these projects in relation to the proposed Cogen for Africa Project and to the individual cogeneration projects are briefly discussed in both tables. Although there is relevance between many of these projects and the Cogen for Africa Project, not all of them have activities in the countries covered by this Project. Furthermore, even for projects in the relevant countries, the scope and activities involved may not offer or allow some collaboration. For the projects GEF that are relevant, a plan for coordination are briefly indicated in the Tables 5.1 and 5.2. At the initial stage of the Project implementation, more detailed discussions on creating synergy and cooperation with these projects will be sought, but in the meantime, a draft coordination plan has already been formulated and is summarized Table 5.1.

Table 5.1: Relevant GEF-related projects in Southern/Eastern Africa (January 2006)

Country	**Project Name**	**Proj. Type**	**Implementing Agency**	**Approval Date**	**Relevance/Comments**	**Coordination Plan**
Mauritius	Sugar Bio-Energy Technology	Full Size	IBRD- The World Bank	May 1, 1991	This project was instrumental in the promotion of cogeneration in Mauritius (T.A. to Bagasse Energy Development Program) making Mauritius the leading African nation in cogeneration. Experiences and expertise to be tapped in formulation of Cogen for Africa Project.	Dr. Deepchand of Mauritius Sugar board participated in Cogen for Africa project formulation and brought Mauritius financiers keen on cogen investment projects on board.
Zambia	Renewable energy-based	Full Size	UNEP	CEO endorsed	a). Cogen development in region may have an impact	Zambia is not one of the target countries for

	electricity generations for Isolated mini-grids			Nov.2005	on future (isolated) power generation in Zambia. b). Regional cogen experience may be of relevance to the project.	the Cogen for Africa project. However, experiences relevant for the cogen project (on isolated grids) will be utilized in implementation of the project.
Kenya	Removal of Barriers to Energy Conservation and Energy Efficiency in Small and Medium Scale Enterprises	Full Size	UNDP	Jul 1, 1998	Within the current execution of this project, cogeneration has been mentioned with great interest but so far no Cogen related activities have been undertaken. The proposed Cogen for Africa would be complementary to GEF-KAM activities.	To end mid 2006. All relevant studies are available for Cogen for Africa to build on.
Ethiopia	Renewable Energy Project	Full Size	IBRD- The World Bank	May 16, 2003	Although the main emphasis is on Solar Home Systems and Hydro mini grids, issues such as policy and institutional support, urban electricity distribution, biomass (stoves) and environmental mitigation are supposed to be addressed. No overlap with Cogen Project.	Will collaborate where cogen using biomass is implemented especially where there is rural electrification component.
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, including (bagasse-based) cogeneration. As such, the project stands to benefit above all from technical expertise provided by the Cogen Project.	Use of APL for cogeneration 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.	Support for biomass as RE will be tapped, if appropriate and still available.
South Africa	Renewable Energy Market Transformation	Full Size	The World Bank	Apr 06, 2005	Cogeneration is included in program for self-generation by sugar and paper industries. In proposed the Cogen Project, RSA is considered as a resource country for expertise and equipment.	RSA is a possible source of expertise and hardware.
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	Where the cogeneration projects in the participating countries are eligible, funding from AREED will be tapped; possible utilization of AREED expertise and services.

					scale approaches.	

Table 5.2 Relevant GEF Pipeline Data (January 2006)

Proj. ID	Country	Agency	Title	Amount (USD)	Relevance/Comments	Coordination Plan
2017	Madagascar	World Bank	Integration of Renewable Energy in Rural Electrification	320,000	Cogeneration could be considered in the "promotion of power generation for renewable energy within emerging rural electrification program including policy support, investment support, guarantees and subsidies, business support and technology transfer". Regional Cogen experience may be of relevance to the Cogen Project	Madagascar is not one of the target countries for the Cogen for Africa project. However, participation in training events on rural electrification could be relevant to this project.
1613	Malawi	World Bank	Energy Access, Expansion and Development Project	285,000	Cogeneration may well fit 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 supporting the policy and institutional process and the development of on-grid biomass IPPs for main or mini grid will be an area of future collaboration.	Co-development and cooperation in providing technical assistance for on-grid biomass IPPs
2119	Regional; Kenya, Ethiopia, Djibouti, Tanzania, Uganda, Eritrea	UNEP	African Rift Geothermal Development Facility	700,000	Cogeneration of Geothermal Power Plants can be only considered for grid connection. Geothermal will, generally speaking, be larger in capacity where as Cogeneration might be more appropriate for rural electrification. Overlap in Kenya, Ethiopia, Tanzania, Uganda. Cogeneration projects will generally require shorter lead time and they can accommodate immediate power shortages.	Participation in joint missions pertaining to PPA/feed-in tariffs and regulatory issues,
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 cogeneration development.	Zambia is not one of the target countries for the Cogen for Africa project. However, experiences relevant for the cogen project (on power sector policies) will be utilized in implementation of the project.
3126	Lesotho, Malawi,	UNDP	Removing Barriers to	25,000	The project to remove market barriers to the adoption of	

	Mozambique Namibia, South Africa, Zimbabwe		Biomass Energy Conservation in small and medium sized enterprises and institutions in Southern Africa Development Community		sustainable biomass energy practices and technologies by institutions and small and medium enterprises by promoting improved, highly efficient biomass-burning stoves. Not relevant to Cogen.	
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, strengthen ICT policy, and grid expansion.	Collaboration in capacity building activities for the biomass aspects; Cogen project developers to access cost-share support where eligible; Cogen projects to access credit & other finance enhancement mechanisms where applicable.
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 lighting sources, thus reducing CO2 emissions, increasing household productivity and fostering economic and social development.	For the countries of Uganda, Tanzania and Kenya, cooperation will be sought for applicable technologies.

During the preparation of this Cogen for Africa Project, stakeholders dealing with cogeneration have been consulted. Furthermore, during the initial phase of the Project implementation, there will be detailed discussions with these stakeholders to deliberate on the practical ways to collaborate on specific activities of the Project. Some of the institutions involved in cogeneration are listed in the following table (Table 5.3).

Table 5.3: Institutions dealing with cogeneration in selected African Countries

Country	**Institution**
Ethiopia	Ethiopian Electric Agency
	Ethiopian Electric Power Corporation
	Finchaa Sugar Company
	Metahara Sugar Company
	Wonji/ Shoa Sugar Company
Kenya	Busia Sugar Company
	Electricity Regulatory Board
	Kenya Association Of Manufacturers
	Kenya Electricity Generating Company
	Kenya Power And Lighting Company
	Kenya Sugar Board
	Muhoroni Sugar Company
	Muhoroni Sugarcane Outgrowers Company Limited
	Mumias Outgrowers Company (1998) Limited

	Nzoia Sugar Company
	South Nyanza Sugar Company (Sony Sugar Company)
Mauritius	Central Electricity Board
	Mauritius Sugar Authority
	Centrale Thermique de Savannah
	Centrale Thermique de Belle Vue
Tanzania	Kagera Sugar Company
	Kilombero Sugar Plant K1
	Mtibwa Sugar Estate
	Sao Hill Saw Mill
	Tanganyika Planting Company
	Tanganyika Wattle Company (TANWAT)
	Tanzania Electricity Supply Company
Uganda	Kinyara Sugar Works
	Kakira Sugar Works Limited
	Uganda Electricity Board
	Sugar Corporation Of Uganda Limited

5.3 Project Implementation Arrangements

5.3.1 Organization and management of Cogen for Africa[41]

In order to guarantee optimal transparency at all levels and all times during program implementation, it is proposed that the management structure of the Cogen for Africa Project is kept relatively simple and straightforward with UNEP and the African Development Bank (AfDB[42]) as co-implementing agencies and AFREPREN/FWD as the executing agency. The project shall report and be accountable to the ***Project Steering Committee (PSC)*** which shall convene every six (6) months. If considered appropriate, telephone conference and email-based meetings could be an alternative. The functions of the PSC are to:

- Provide direction and guidance to the Project
- Monitor and supervise implementation of the Project
- Approve selection of Full Scale Promotion Projects and corresponding support
- Endorse adaptations to the Project components during the Project execution
- Evaluate the performance and impacts of the Project
- Approve Progress, Midterm and Terminal Reports of the Project

The PSC shall be composed of the following full and voting members:

- A representative from UNEP-GEF
- A representative from African Development Bank
- A representative of AFREPREN/FWD
- One representatives from each major Co-Funding agency
- One to three representatives from each participating country, who shall be from the Ministry in-charge of energy or, the National power utility or energy regulator, or the relevant industry such as the sugar industry, or financing institution or local manufacturing. Countries will be represented on the Steering committee in line with

[41] Detailed institutional, hosting and recruitment arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

[42] There are now 2 letters from AfDB: one which confirms their involvement as co-implementing agency, and another which commits AfDB co-financing. In addition, a detailed Cooperation Modalities Memo has been prepared by AfDB, UNEP and the Executing Agency. The Memo confirms that AfDB will be involved in all the key project decisions and will actively participate in the project Steering Committee. AfDB have also reviewed and approved the entire project document, detailed budget, draft Terms of Reference, proposed procurement and hiring processes

availability of mature cogen investment opportunities, initially with representatives from 2-3 countries with near-term cogen opportunities. The PSC will be expanded at a latter stage as the number of cogen investments increases in more countries.

- The AFREPREN/FWD Regional Cogen Centre Director who shall act as the PSC Secretary

The PSC may invite observers to its regular meetings (e.g. Experts involved in the Project implementation, representatives from National Cogen Offices, …) who may be invited to speak or report on certain aspects of the Project. Reporting to the PSC is the ***Project Management Council (PMC)***, the function of which is to:

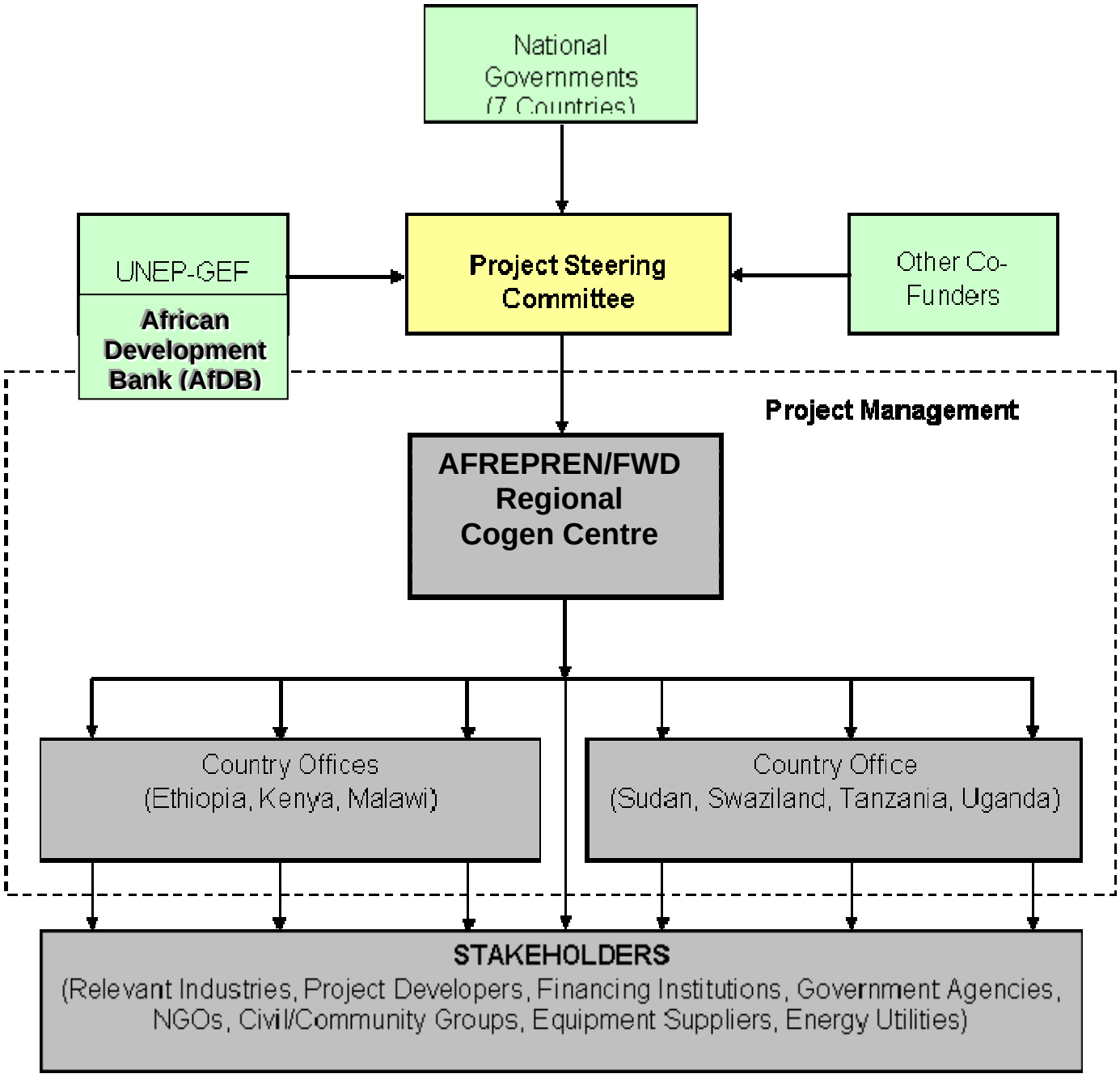
- Provide technical and operational guidance to the Programme
- Select the Full Scale Promotion Projects
- Monitor and evaluate the progress of the activities and approve quarterly planning of activities

The PMC shall convene every six (6) months in the different participating countries on a rotational basis. If considered appropriate, telephone conference and email-based meetings could be an alternative. In order to optimize resources and save time for preparations, the PMC meetings shall be organized in conjunction with PSC meeting. The members of the PMC shall be as follows:

- AFREPREN/FWD Regional Cogen Centre Director
- A representative of AFREPREN/FWD
- Heads of Units of the AFREPREN/FWD Regional Cogen Centre (4)
- Head of Finance and Administrative Support Unit
- One representative from each National Cogen Office

Figure 5.1 elaborates the project management structure of the Cogen for Africa Project. The AFREPREN/FWD Regional Cogen Centre, which manages the day-to-day operations of the Project, reports to the Project Steering Committee. The National Cogen Offices reports to the Regional Cogen Centre and are in direct contact with the stakeholders in their respective countries. The Regional Cogen Centre monitors and supervises the activities of the National Cogen Offices and supports them through training and technical assistance. Under certain circumstances, the Regional Cogen Centre could also have a direct link/contact with the stakeholders through the provision of assistance/advice by the Experts of the Centre.

Figure 5.1: Project management structure of the Cogen for Africa Project



SECTION III - WORKPLAN AND TIMETABLE, BUDGET, FOLLOW-UP

1. Workplan and Timetable

A detailed workplan is provided in Annex I.

2. Budget

A detailed budget in UNEP format is presented in Annex AD. This budget is based upon the GEF approved budget provided in GEF format in Section 2 above.

3. Follow-up

As mentioned earlier, this regional project aims to promote (mostly biomass-based) cogeneration, generating power out of (mainly agricultural) waste. The key activities of the project will include identification of opportunities, appropriate technologies and suppliers; technical advice to developers, financiers and investors; and, policy guidance (power purchase arrangements/tariffs for captive and excess firm/non firm power, etc). This active support to all stakeholders in Cogen business development in the form of capacity building, technology transfer and pre-feasibility/feasibility/Cogeneration Investment Packages (CIPs), is expected to create a conducive business environment for the scaling-up of cogeneration investments in eastern and southern Africa, which will in turn provide the market demand for a regional cogen centre, with associated satellite national cogen units/focal points.

The realization of a total installed cogeneration capacity of 40 MW or 6 Full Scale Promotion Projects (FSPPs)[43], together with supporting activities on capacity building, advisory, financing, institutional and policy aspects are expected to encourage project developers to replicate these FSPPs in other factories, sectors and even countries. An additional 20 MW of direct post-project replication and another 180 MW of indirect replication are expected to be implemented within 5 to 10 years after the project completion.

It is anticipated that cogeneration will not only be relevant for the countries that will participate in the proposed Project, but will be relevant for all African nations. The proposed mid-term review could allow additional countries to participate in the second half of the Project, if budget and conditions allow. A francophone replication or Project extension could be initiated for Western Africa as soon as positive signs of Project success become visible. Replication is likely to take place if the right policy environment exists. Further replication is also possible in other non-renewable fuel sector, as cogeneration is an effective efficiency measure for reducing greenhouse gas emissions as well as promoting broader sustainable practices.

[43] As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

SECTION IV - INSTITUTIONAL FRAMEWORK AND EVALUATION

1. Institutional Framework

AFREPREN/FWD will be responsible for the implementation of the project in accordance with the objectives and activities outlined in Section 2 of this document. UNEP as the GEF Implementing Agencies will be responsible for overall project supervision to ensure consistency with GEF and UNEP policies and procedures, and will provide guidance on linkages with related UNEP and GEF-funded activities. The UNEP DGEF Co-ordination will monitor implementation of the activities undertaken during the execution of the project and will be responsible for clearance and transmission of financial and progress reports to the Global Environment Facility. UNEP retains responsibility for review and approval of the substantive and technical reports produced in accordance with the schedule of work.

Please refer to Annex AF for details on co-implementation modalities between UNEP and AfDB.

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Email: Sandeep.Bhambra@unep.org

2. Evaluation

UNEP will organize evaluations at mid-term and completion of the project to measure the degree to which the objectives of the project have been achieved.

SECTION V - MONITORING AND REPORTING

Management Reports

1 Progress Reports

Within 30 days of the end of reporting period, AFREPREN/FWD will submit to UNEP/DGEF Coordination, using the format given in Annex Y, Half-Yearly Progress Reports as at 30 June and 31 December.

2 Terminal Reports

Within 60 days of the completion of the project, AFREPREN/FWD will submit to UNEP/DGEF Coordination a Terminal Report detailing the activities taken under the project, lessons learned and any recommendations to improve the efficiency of similar activities in the future, using the format provided in Annex AB.

3 Substantive Reports

(i) At the appropriate time, AFREPREN/FWD will submit to UNEP three copies in draft of any substantive project report(s) and, at the same time, inform UNEP of its plans for publication of that text. Within 30 days of receipt, UNEP will give AFREPREN/FWD substantive clearance of the manuscript, indicating any suggestions for change and such wording (recognition, disclaimer, etc.) as it would wish to see figure in the preliminary pages or in the introductory texts.

(ii) It will equally consider the publishing proposal of AFREPREN/FWD and will make comments thereon as advisable.

(iii) It may request AFREPREN/FWD to consider a joint imprint basis. Should AFREPREN/FWD be solely responsible for publishing arrangements, UNEP will nevertheless receive 10 free copies of the published work in each of the agreed languages, for its own purposes.

4 Financial Reports: All financial reporting to UNEP must be in US Dollars.

(i) Details of expenditures will be reported on an activity by activity basis, in line with project budget codes as set out in the project document, as at 31 March, 30 June, 30 September and 31 December using the format given in Annex AA. All expenditure accounts will be dispatched to UNEP within 30 days of the end of the three-month period to which they refer, certified by a duly authorized official of AFREPREN/FWD.

(ii) In addition, the total expenditures incurred during the year ending 31 December, certified by a duly authorized official, should be reported in an opinion by a recognized firm of public accountants, and should be dispatched to UNEP within 180 days, i.e. 30 June. In particular, the auditors should be asked to report whether, in their opinion:

- Proper books of account have been maintained;
- All project expenditures are supported by vouchers and adequate documentation;
- Expenditures have been incurred in accordance with the objectives outlined in the project document.
- The expenditure reports provide a true and fair view of the financial condition and performance of the project

(iii) Within 180 days of the completion of the project, AFREPREN/FWD will supply UNEP with a final statement of account in the format as for the quarterly expenditure statements duly signed by authorized official of AFREPREN/FWD and certified by recognized firm of public accountants

If requested, AFREPREN/FWD shall facilitate an audit by the United Nations Board of Auditors and/or the Audit Service of the accounts of the project.

(iv) Any portion of cash advances remaining unspent or uncommitted by AFREPREN/FWD on completion of the project will be reimbursed to UNEP within one month of the presentation of the final statement of accounts. In the event that there is any delay in such disbursement, AFREPREN/FWD will be financially responsible for any adverse movement in the exchange rates.

(v) Within 30 days of the reporting period, AFREPREN/FWD shall submit to UNEP GEF Coordination Office, a yearly cofinancing report for the project using the format provided in Annex AC showing:

(a) Amount of cofinancing realized compared to the amount of cofinancing committed to at the time of project approval, and

(b) Cofinancing reporting by source and by type:

♦ Sources include the agency's own cofinancing, government cofinance (counterpart commitments), and contributions mobilized for the project from other multilateral agencies, bilateral development cooperation agencies, NGOs, the private sector, and beneficiaries.

♦ Types of cofinance. Cash includes grants, loans, credits and equity investments. In-kind resources are required to be:

- Portion of shared equipment, facilities, personnel and other resources (e.g. library, generator) dedicated uniquely to the GEF project
- valued as the lesser of the cost and the market value of the required inputs they provide for the project, and
- monitored with documentation available for any evaluation or project audit.

Terms and Conditions

5. Non-Expendable Equipment

AFREPREN/FWD will maintain records of non-expendable equipment (items costing US$1500 or more as well as items of attraction such as pocket calculators, cameras, computers, printers, etc.) purchased with UNEP funds (or with Trust Funds or Counter funds administered by UNEP) and will submit, using format in Annex AE, an inventory of such equipment to UNEP, once a year, indicating description, serial no., date of purchase, original cost, present condition, location of each item attached to the progress report submitted on 31 December. Within 60 days of completion of the project, AFREPREN/FWD will submit to UNEP a final inventory of all non-expendable equipment purchased under this project indicating description, serial number, original cost, present condition, location and a proposal for the disposal of the said equipment. Non-expendable equipment purchased with funds administered by UNEP remains the property of UNEP until its disposal is authorized by UNEP, in consultation with AFREPREN/FWD. AFREPREN/FWD shall be responsible for any willful loss or willful damage to equipment purchased with UNEP administered funds. The proceeds from the sale of equipment, (duly authorized by UNEP) shall be credited to the accounts of UNEP, or of the appropriate trust fund or counterpart funds. A duly authorized official of AFREPREN/FWD should physically verify the inventory.

6. Responsibility for Cost Overruns

The GEF approved budget of US$ 5,248,165 cannot be exceeded. Any cost overruns (expenditures in excess of the amount in each budget sub-line) shall be met by the organization responsible for authorizing the expenditures, unless written agreement has been received in advance from UNEP. In cases where UNEP has indicated its agreement to a cost overrun in a budget sub-line to another, a revision to the project document amending the budget will be issued by UNEP.

7. Cash Advance Requirements

Initial cash advance of US$ 474,118 will be made upon signature of the project document by both parties and will cover expenditures expected to be incurred by AFREPREN/FWD during the first six months of the project implementation. Subsequent advances are to be made subject to:

(i) Confirmation by AFREPREN/FWD, at least two weeks before the payment is due, that the expected rate of expenditure and actual cash position necessitate the payment, including a reasonable amount to cover "lead time" for the next remittance; and

(ii) The presentation of

- A satisfactory financial report showing expenditures incurred for the past quarter, under each project activity.
- Timely and satisfactory reports on project implementation

Requests for subsequent cash advances should be made using the standard format provided in Annex Z.

8. Claims by Third Parties against UNEP

AFREPREN/FWD shall be responsible for dealing with any claims which may be brought by third parties against UNEP and its staff, and shall hold UNEP and its staff non-liable in case of any claims or liabilities resulting from operations carried out by AFREPREN/FWD or other project partners under this project document, except where it is agreed by AFREPREN/FWD and UNEP that such claims or liabilities arise from gross negligence or willful misconduct of the staff of UNEP.

9. Amendments

The Parties to this project document shall approve any modification or change to this project document in writing.

LIST OF ANNEXES

The following Annexes from the Approved Project Brief are NOT included in this project document BUT are available upon request.

ANNEX C:	RESPONSE TO PROJECT REVIEWERS
ANNEX E:	STAKEHOLDER GROUPS, THEIR INVOLVEMENT AND ROLE IN, AND BENEFITS FROM, THE PROJECT
ANNEX G:	OFFICIAL ENDORSEMENTS FROM THE 7 PARTICIPATING COUNTRIES
ANNEX H:	LETTERS OF ENDORSEMENT AND COMMITMENT FROM STAKEHOLDERS AND CO-FINANCIERS
ANNEX J:	SUMMARY OF CO-FINANCIERS
ANNEX K:	PRE-FEASIBILITY ASSESSMENT OF COGENERATION IN SELECTED SUGAR FACTORIES
ANNEX L:	SUMMARY OF THE POWER SECTOR IN PROJECT COUNTRIES
ANNEX M:	SUMMARY OF AGRICULTURAL PRODUCTION IN PROJECT COUNTRIES
ANNEX N:	LIST OF INSTITUTIONS AND PERSONS CONTACTED DURING PDF-B
ANNEX O:	BRIEF ON AFREPREN/FWD
ANNEX P:	PRELIMINARY ASSESSMENT OF COGENERATION POTENTIAL IN SELECTED SUGAR FACTORIES
ANNEX Q:	COGEN PROGRAM IN ASEAN
ANNEX R:	COGENERATION IN MAURITIUS
ANNEX S:	NEWSPAPER ARTICLES RELEVANT TO THE PROJECT
ANNEX U:	POSSIBLE COGEN COUNTRY OFFICES
ANNEX V:	BENEFITS OF COGENERATION
ANNEX W:	LEAST COST ANALYSIS
ANNEX X:	CLEANER ENERGY FUND FOR AGRO-INDUSTRY IN AFRICA (CEFA)

Following are the Annexes included in this Project document

ANNEX A:	INCREMENTAL COST ANALYSIS
ANNEX B:	LOGICAL FRAMEWORK
ANNEX D:	THE DESIGN OF THE AFREPREN/FWD REGIONAL COGEN CENTRE
ANNEX F:	MONITORING AND EVALUATION PLAN
ANNEX I:	WORK PLAN, SCHEDULE AND MILESTONES
ANNEX T:	QUALIFICATIONS AND RESPONSIBILITIES OF AFREPREN/FWD REGIONAL COGEN CENTER PERSONNEL
ANNEX Y:	HALF-YEARLY PROGRESS REPORT FORMAT
ANNEX Z:	FORMAT FOR CASH ADVANCE REQUEST
ANNEX AA:	FORMAT FOR QUARTERLY EXPENDITURE STATEMENT
ANNEX AB:	FORMAT FOR TERMINAL REPORT
ANNEX AC:	FORMAT FOR REPORT ON CO-FINANCING
ANNEX AD:	BUDGET IN UNEP FORMAT (in a separate excel worksheet)
ANNEX AE:	FORMAT FOR INVENTORY OF NON-EXPENDABLE EQUIPMENT
ANNEX AF:	AfDB-UNEP/GEF CO-IMPLEMENTATION OF COGEN AND SMALL HYDRO/TEA PROJECTS
ANNEX AG:	BRIEF ON PROPOSED APPROACH TO “COGEN FOR AFRICA” PROJECT

ANNEX A: INCREMENTAL COST ANALYSIS

Project Outcomes	Baseline	Alternative	Increment
Outcome 1: Capacity of cogeneration project developers, technical service providers and local manufacturers developed and enhanced	• Inefficient and low-pressure cogeneration systems mainly for captive energy generation will continue to be implemented in industries, thus, limiting the experience and expertise of project developers, technical service providers and local manufacturers to the existing (baseline) technologies • Pre-feasibility studies conducted in-house with limited expertise from outside by a few forward looking companies • Local manufacturing capability will remain low and experience limited to inefficient and low-pressure systems	• Comprehensive study conducted on the fuel resources available, their potential for cogeneration and the applicable technologies to implement them • Initiatives made for local equipment manufacturers to develop partnerships with global equipment suppliers of efficient cogeneration systems thereby enhancing their manufacturing capability • Capacity building activities in the form of seminars, workshops and training provided to local engineers and relevant stakeholders • Technical advice and services provided to project developers and potential owners of cogeneration systems • Examples of successfully operated cogeneration installations shown to relevant potential developers/owners through visits and study tours to appropriate sites	• Detailed assessments on the availability of biomass resources potential for cogeneration conducted and made available for project developers and other stakeholders • Participation of local manufacturers in the installation of new cogeneration projects and their capability enhanced through partnerships with foreign suppliers • Skills and capability of local technical personnel on technical and project development aspects of cogeneration developed through training and capacity building activities • Software tools for technical analysis of projects developed and/or adapted and used to provide advice and training of technical personnel
	Baseline cost: 250,000 USD	**Alternative cost: 1,265,498 USD**	**GEF: 838,498 USD** **Other: 177,000 USD** **Total incremental investment:** **1,015,498 USD**
Outcome 2: Financing for cogeneration projects made available and accessed at terms and conditions that are favorable for investments	• Currently, financing of cogeneration systems are made through the company's balance sheet and guaranteed by collaterals. Very few companies have the means and are able to do this. Without supporting mechanisms from specialized institutions such as the Africa Cogen Centre to assist project owners in mobilizing low-cost funds, this situation is not foreseen to change • The existing capability of the financing institutions in evaluating cogeneration projects is limited which leads to a	• Existing financing sources and mechanisms both local and regional/international that are relevant for the sector are identified • To provide flexible mechanisms appropriate for cogeneration projects innovative financing structures will be designed • Training of project developers and financing institutions are conducted aimed at enhancing the success of accessing funds for cogeneration projects • Assistance provided to project developers and	• Existence of financing institutions, funds and innovative schemes that have been tapped/accessed for new investments in cogeneration projects • Through workshops, forums and training organized by the Africa Cogen Centre, the capacity of project developers to package projects for financing are enhanced; relevant financing institutions increased their understanding in capability in assessing cogeneration systems • Project developers received assistance in

	perception of high risks for cogeneration projects	financing institutions in the financing of projects	mobilizing funds for cogeneration projects
	Baseline cost: nil	**Alternative cost:** **1,335,700 USD**	**GEF: 998,360 USD** **Other – 337,340 USD** **Total incremental investment:** **1,335,700 USD**
Outcome 3: Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated in a number of new cogeneration plants and confidence on the certainty of the cogeneration market enhanced	• Some cogeneration plants may be rehabilitated or fine tuned to be self sufficient and covering the factories' energy requirements, while a few may able to sell small amounts of electricity to the grid, but with the absence of successful examples of highly efficient cogeneration plants that profitably sell excess power in high quantities to the grid, the potential of the market will not be maximized • The lack of available information required to make investment decisions and lack of support for project development does not encourage investments on cogeneration systems to happen	• Project development guide reflecting best practices in both project development and implementation of cogeneration systems developed for reference and training purposes • To assist project developers in the development process, Feasibility studies/Cogeneration Investment Packages (CIP) will be prepared for selected sites and promote the CIPs for private sector project development and investment • Support to, and implementation of, Full Scale Promotion Projects (FSPPs), while pipeline of projects will be supported and advanced to a level where a replication can happen • Assistance and services provided to project developers for projects in the pipeline	• Existence of the Project Development Guide which is made accessible to project developers and other stakeholders • A total of 12 Feasibility Studies/CIPs developed and promoted to the private sector for investments • About 40MW of new cogeneration systems which could be realized through 6 FSPPs implemented or being constructed and have received support from the Africa Cogen Centre for their development, implementation and promotion
	Baseline cost: 10,000,000 USD	**Alternative cost:** **72,045,617 USD**	**GEF: 1,668,409 USD** **Private sector: 60,000,000 USD** **Other (Triodos): 377,208 USD** **Total incremental investment:** **62,045,617 USD**
Outcome 4: More favorable policies and institutional arrangements that support cogeneration promoted	• General policies that do not contain more favorable provisions and incentives to cogeneration • Absence of clear regulations for sales of power from cogeneration to the grid at favorable terms • Cogeneration not sufficiently incorporated in power master plans of target countries	• Policies that contain more favorable provisions and incentives to cogeneration compared to those prior to project implementation submitted for approval • Existence of clear draft regulations allowing sales of power from cogeneration to the grid at favorable terms • Cogeneration plans submitted to concerned authorities for incorporation in the power	• Support provided to policy makers and relevant agencies in formulating policies and regulations supporting cogeneration • Policies, regulations and incentives that are more clear and more attractive to investments in cogeneration submitted to relevant authorities for approval • A one-stop information and service center established and services to stakeholders who

		master plans of target countries • Existence of an institutionalized one-stop center providing information and competent services on cogeneration • Advocacy activities carried our to influence policy reforms and implementation. Support is also provided to policy makers and relevant agencies in policy formulation and enhancements • A one-stop information and service center within the Africa Cogen Centre establishment to provide central venue for source of information and services for cogeneration • Promotional strategy formulated for the whole project and promotional materials prepared and disseminated to relevant stakeholders • Project website for internal and external audience developed and updated continually of the website • Support provided to utilities and relevant agencies in drafting and setting the stage for the approval of Standard Power Purchase Agreements (PPAs)	need them effectively provided • Overall strategy on promoting cogeneration developed, promotional materials produced and disseminated to relevant stakeholders • Existence of Project website containing relevant information for stakeholders • A Standard Power Purchase Agreement appropriate for cogeneration drafted and presented to the approving authorities
	Baseline cost: 100,000 USD	**Alternative cost:** **1,812,706 USD**	**GEF: 1,149,106 USD** **Other - 563,600 USD** **Total incremental investment:** **1,712,706 USD**
Project Coordination, including monitoring and evaluation (M&E)	• No project management or coordination activities will occur in the baseline • Collaboration and linkages among stakeholders non-existent or limited	• Establishment of Africa Cogen Centre as a center of excellence for cogeneration in the African region • Application of M&E activities to monitor performance and outputs and document lessons learned for replicability and sustainability • Collaboration and linkages made with stakeholders, relevant programs and other GEF-funded projects	• Existence of the Africa Cogen Centre having international and regional/local experts providing support and expertise to the cogeneration industry in the 7 participating countries of Africa; organizational structure of the Centre well established such as the Project Management Council which provides technical and operational guidance & the Project Steering Committee which provides direction and strategic guidance to the Centre • M&E lessons applied for the effectiveness of the project

			• Sustainability of the Project charted through a sound Business Plan and integrated in the design of the activities of the Project
	Baseline cost: nil	**Alternative cost:** **Total alternative cost:** **597,178 USD**	**GEF: 465,976 USD** **Other: 131,202 USD** **Total incremental investment:** **597,178 USD**
TOTAL	**Baseline cost: 10,350,000 USD**	**Alternative cost:** **77,184,515 USD**	**GEF: 5,248,165 USD** **Private sector: 60,000,000 USD** **National governments: 705,600 USD** **Other: 880,750 USD** **Total Incremental cost:** **66,834,515 USD**

ANNEX B: LOGICAL FRAMEWORK

Project Planning Matrix (PPM)	**Project title: Cogen for Africa**		
Objectives and Outcomes	**Objectively Verifiable Indicators**	**Sources of Verification**	**Important Assumptions/Risks**
Development Goal: Creation of a self-sustaining cogeneration industry in Africa thereby contributing to the reduction of CO2 emissions.	• Cogeneration capacities in the participating countries have reached an average of more than 5% of the installed national capacities by Project end •	• GHG emissions mitigation calculations • Government/Utility records • Statistics • Reports	• Recognition of the participating governments of the importance of reducing GHG emissions and their continuing commitment towards doing it • Cogeneration technologies installed are replacing existing or future more polluting technologies
Project objectives: The overall objective of the Cogen for Africa project is to help transform the cogeneration industry in Eastern and Southern Africa into a profitable cogeneration market and promote widespread implementation of highly efficient cogeneration systems by removing barriers to their application.	• A total of 40 MW installed of efficient cogeneration capacity (or 6 FSPPs[44]) by end of project • Up to a total of 60 million USD investments in new cogeneration systems by Project end • 163,200 tons of CO2 equivalent emissions mitigated annually by end of Project • 204,000 MWh of electricity generated annually by Project end	• Records of implemented projects • Statistics • Reports	• Key stakeholders such as government agencies, project developers and financing institutions receptive to the support and measures to be provided by the Cogen Centre • Stable political and economic situation
OUTCOMES			
Outcome 1: Capacity of project developers, technical service providers and local manufacturers of modern and efficient cogeneration systems developed and enhanced	• Comprehensive study conducted on the fuel resources available, their potential for cogeneration and the applicable technologies to implement them • Existence of a minimum of 10 project developers with capacity to develop and implement high pressure cogeneration systems in the 7 participating countries by end of Project • A total of at least 100 local personnel representing different stakeholder groups have been trained in 7 participating countries by end of Project	• List of participants to capacity building activities • Evaluation forms on capacity building activities • Training materials and seminar/workshop proceedings • Composition of regional/local experts vis-à-vis international experts in the Africa Cogen Centre • Report on partnerships created/assisted • List of participants to visits/study tours • Evaluation forms on visits/study	• Level of interest from relevant stakeholders to receive training • Existence of local manufacturers possessing certain level of capability to start with • Permission from reference installations to allow visits

[44] As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

	• Responsibilities/roles of regional/local experts increased towards the end of Project completion vis-à-vis international experts • Capability of local manufacturers to produce parts of cogeneration systems enhanced by end of the project • 1 visit and study tour per year for the first 3 years by relevant stakeholders to successfully operating cogeneration plants in Mauritius • At least 1 visit by relevant stakeholders to each operating FSPP by end of Project	tours • Progress reports • M&E documents • Midterm evaluation • Terminal report	
Outcome 2: Financing for cogeneration projects made available and accessed at terms and conditions that are favorable for investments	• Existence of financing institutions and financing schemes that are actively providing funds to cogeneration projects by end of the project • Minimum of 20 project developers in 7 participating countries trained and received advice/services by Project end • Funds from financing institutions tapped by new investments in cogeneration projects by end of the project • A total of 40MW of new cogeneration systems have accessed funds to implement projects by end of Project • Up to a total of 60 million USD of funds accessed by new cogeneration projects by end of Project	• Cogen Centre activity report • Financial packaging documents • Annual reports of banks/developers • Progress reports • M&E documents • Midterm evaluation • Terminal report	• Availability of external funds for the African region • Projects proposed eligible for the funds • Political and economic stability
Outcome 3: Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated in a number of new cogeneration plants and confidence on the certainty of the cogeneration market enhanced	• A total of 40 MW of new cogeneration systems implemented and seen as showcases for their technical reliability, economic viability and environmental impact by Project end • A total of 12 Cogeneration Investment Packages (CIPs[45]) developed and promoted to the private sector for investments at end of Project • Advice/services provided to new cogeneration	• Record of new cogeneration systems from owners • Government gazettes • Promotional materials • Progress reports • M&E documents • Midterm evaluation • Terminal report	• The case and benefits of Standard PPA accepted by key stakeholders • Operation of the industries where cogeneration is relevant remains viable • Political and economic stability • Cost of kWh production below buyback tariff • Off-taker of electricity remains reliable and financially viable

[45] A total of 12 CIPs/Feasibility Studies will be supported with the funds from GEF. However, additional CIPs/Feasibility studies could be undertaken, with support from other co-financiers. AfDB has indicated willingness to support a number of CIPs/Feasibility studies.

	investments from year 2 to end of the project		
Outcome 4: More favourable policies and institutional arrangements that support cogeneration promoted	• Policies that contain more favourable provisions and incentives to cogeneration compared to those prior to project implementation submitted for approval by end of Project • Cogeneration plan submitted to authorities for incorporation in the power master plans of target countries by end of Project • Existence of an institutionalized one-stop center providing information and competent services on cogeneration after one year of start of Project • Standard Power Purchase Agreements (PPA) proposed to approving authorities by Project end	• New Bills, Acts and other regulatory documents • Power master plans • Government gazettes • Utility announcements/reports • Standard Power Purchase Agreement documents • Progress reports • M&E documents • Midterm evaluation • Terminal report	• Government continues to recognize renewable energy and energy efficiency as priority • Willingness of the government agencies to receive support/assistance on policy formulation and enhancements
OUTPUTS			
Outputs or Outcome 1: Capacity of project developers, technical service providers and local manufacturers of modern and efficient cogeneration systems developed and enhanced			
1.1. Review of fuel resources and assessments of their potential for cogeneration 1.2. Relevant technologies for cogeneration and their suppliers identified and their information inputted in the Database 1.3. A framework for partnerships between foreign equipment suppliers and local manufacturers developed and established 1.4. Local technical personnel trained and assisted on technical and project development aspects of cogeneration	• Comprehensive study on the fuel resources available, their potential for cogeneration and the applicable technologies conducted and reported within year 1 of project implementation • A database containing foreign and local manufacturers of cogeneration equipment/components designed and implemented within year 1and continually updated throughout the Project duration • Participation of local manufacturers in the installation of new cogeneration projects and their capability enhanced through partnerships with foreign suppliers by end of the project • Minimum of 3 partnerships forged between foreign suppliers and local manufacturers by end of Project • A minimum of 2 training courses per year from year 2 conducted for local technical personnel of project developers and other stakeholders on technical and project	• Fuel resources and potential assessment study report • Technology assessment study report • Database outputs and records • Cogen Centre activity report on matchmaking activities • List of participants to training activities • Evaluation forms on training activities • Training materials and seminar/workshop proceedings • List of participants to visits/study tours • Evaluation forms on visits/study tours • Progress reports • M&E documents • Midterm evaluation • Terminal report	• Availability of data/statistics on resources • Level of interest from relevant stakeholders to receive training • Existence of local manufacturers possessing certain level of capability to start with • Permission from reference installations to allow visits

1.5. Visits organized for relevant stakeholders to successfully operated cogeneration references	development aspects of cogeneration • A total of at least 10 local technical personnel trained per year from year 2 • At least 20 projects assisted/provided advice on technical and project development matters by end of Project • Software tools for technical analysis of projects developed and/or adapted and used to provide advice and training of technical personnel from year 2 to end of the project • Visits (3 times during the first 3 years by different participants) to reference cogeneration plants in Mauritius organized for project developers, policy makers and other relevant stakeholders aiming to convince them of the technical reliability, economic viability and environmental friendliness of the systems; At least 1 visit for each FSPP site organized (around year 4 onwards) aiming at further replication of cogeneration projects in other industries and sectors		
Outputs for Outcome 2: Financing for cogeneration projects made available and accessed at terms and conditions that are favorable for investments			
2.1 A portfolio of relevant financing sources identified and creation/opening up of innovative financing schemes applicable to cogeneration facilitated 2.2 Project developers trained and assisted in financial structuring, financial packaging and accessing of funds	• Existence of financing institutions, funds and innovative schemes that have been tapped/accessed for new investments in cogeneration projects by end of the project • Innovative financing structures appropriate for cogeneration designed by year 2 • A total of 40 MW installed of efficient cogeneration capacity (or 6 FSPPs[46]) that has accessed funds by Project end • Up to a total of 60 million USD of financing provided to new cogeneration projects by Project end • About 2 capacity building activities (workshops, forums, training) organized per	• Cogen Centre activity report on financing activities • List of participants to capacity building activities • Evaluation forms on capacity building activities • Training materials and seminar/workshop proceedings • Financial packaging documents • Annual reports of relevant companies/financing institutions • Progress reports • M&E documents • Midterm evaluation • Terminal report	• Cogeneration seen by commercial financing institution as a viable lending portfolio • Decision of project developers/owners to invest in cogeneration projects

[46] As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

2.3 Financing institutions trained and assisted in evaluation and assessment of cogeneration technologies	year from year 2 for project developers and relevant stakeholders • A minimum of 20 project developers in 7 participating countries trained on financing and other aspects by end of Project • Assistance provided to project developers in mobilizing funds for cogeneration projects from year 2 to end of the project • A minimum of 10 financing institutions trained and assisted in evaluation and assessment of cogeneration technologies by end of the project		
Outputs for Outcome 3: Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated in a number of new cogeneration plants and confidence on the certainty of the cogeneration market enhanced			
3.1 Project Development Guide completed 3.2 Cogeneration Investment Packages developed and promoted 3.3 Full Scale Promotion Projects (FSPPs) implemented and promoted for replication 3.4 Technical assistance provided to pipeline of projects (i.e. non-FSPP projects)	• Existence of the Project Development Guide which is made accessible to project developers and other stakeholders at beginning of year 2 • A total of 12 Feasibility Studies/Cogeneration Investment Packages (CIPs[47]) developed and promoted to the private sector for investments at end of Project • A total of 40MW of new cogeneration systems implemented or being constructed and have received support from the Africa Cogen Centre for their development, implementation and promotion at end of Project • A total of 12 CIPs/feasibility studies and several other pre-feasibility studies conducted for new cogeneration projects by end of Project • A minimum of 5 new cogeneration projects in the pipeline identified every year from year 2; about half of them received assistance and services from the Africa Cogen Centre	• Published version of the Project Development Guide • Statistics on recipient of the Guide • Copies of CIPs • Promotional materials on FSPPs (e.g. leaflets) • Progress reports • M&E documents • Midterm evaluation • Terminal report	• Willingness of potential owners to use the services within the project • Existence of projects appropriate and eligible for FSPPs • Willingness of project owners to comply with obligations required from FSPPs
Outputs for Outcome 4: More favourable policies and institutional arrangements that support cogeneration promoted			

[47] A total of 12 CIPs/Feasibility Studies will be supported with the funds from GEF. However, additional CIPs/Feasibility studies could be undertaken, with support from other co-financiers. AfDB has indicated willingness to support a number of CIPs/Feasibility studies.

4.1 Policies and regulations in the different participating countries reviewed and analyzed 4.2 Appropriate regulations, incentives and other measures supporting cogeneration formulated, and submitted to the relevant authorities and decision makers 4.3 Key decision-makers made aware of policy and institutional options for promoting cogeneration investments and encouraging cogeneration-based rural electrification 4.4 One-stop information and service center established and service provided to stakeholders 4.5 Promotion strategy and information dissemination program developed and implemented 4.6 Standard Power Purchase Agreements (PPAs) with reasonable tariffs and conditions in the participating countries drafted and the stage set for approval	• Review and analysis of policies and regulations conducted during year 1 and recommendations on policy interventions/enhancements provided • Support provided to policy makers and relevant agencies in formulating policies and regulations supporting cogeneration from year 2 to end of the project • Policies, regulations and incentives that are more clear and more attractive to investments in cogeneration proposed and submitted to relevant authorities for approval by end of project • A one-stop information and service center with four units (i.e. Commercial/project development, financing, policy, technical) established in year 1 and services to stakeholders who need them effectively provided; a Business Plan prepared for sustainability after project completion conducted in year 2 and updated in year 4 • Overall strategy on promoting cogeneration developed in year 1; promotional materials regularly produced and disseminated to relevant stakeholders from year 2 to end of the project • Project website designed, implemented and contains relevant information for stakeholders in year 1; website continually updated and effectively accessed by stakeholders • A Standard Power Purchase Agreement containing a transparent tariff calculation formula and long term contract duration drafted and presented to the approving authorities in 7 countries by end of Project	• Policy review and recommendation report • Activity reports on advocacy activities • Activity reports on support/assistance to policy makers • New Bills, Acts and other regulatory documents • Government gazettes • Strategy document on the one-stop information and service center • List of services provided by one-stop information and service center • Business Plan for the sustainability of the one-stop information and service center • Promotional strategy document • Promotional materials • Website • Statistics on website activities (no. of visits, frequency, downloads, trends, etc.) • Drafts of Standard Power Purchase Agreements • Government announcements and gazettes • Progress reports • M&E documents • Midterm evaluation • Terminal report	• Government continues to recognize renewable energy and energy efficiency as priority • Willingness of the government agencies to receive support/assistance on policy formulation and enhancements • The case and benefits of Standard PPA accepted by authorities and key stakeholders
ACTIVITIES	**Means**		
Activities for Outcome 1: 1.1 Investigate availability of biomass resources and assess their potential for cogeneration	• Manpower: International and local/regional experts • Laboratory analysis of fuel samples • Company brochures of suppliers • Resource persons/trainors	**Sources of information to monitor progress:** • Cogen Centre activity reports • Progress reports • M&E documents • Midterm evaluation	• Risk that the available fuel resources will diminish in the medium to long term • Risk that key stakeholders are not willing to use the services to be provided by the Africa

1.2 Identify applicable technologies for cogeneration, relevant suppliers of equipment and their capabilities 1.3 Design and develop a database consisting of foreign equipment suppliers and local manufacturers 1.4 Design and implement a matchmaking service between foreign equipment suppliers and local manufacturers 1.5 Develop and/or adapt software tools for technical analysis to be used for analysis of projects and training purposes 1.6 Conduct capacity building activities through seminars, workshops and training 1.7 Provide technical advice and services to project developers and potential owners of cogeneration systems 1.8 Organize visits and study tours to successful cogeneration installations	• Office facilities and supplies • Office equipment and computer facilities • Training facilities and supplies (venue, computers,…) • Database software programme (e.g. FoxPro) • Data from suppliers, manufacturers and other relevant companies for the Database • Existing software to be adapted • Reference cogeneration projects to visit	**Costs**: 1,015,498 USD, out of which GEF incremental financing will be 838,498 USD	Cogen Centre • Risk that the Africa Cogen Centre will not have the competence to provide the required support and services to the stakeholders
<u>Activities for Outcome 2:</u> 2.1 Identify and review existing financing sources and mechanisms relevant for the sector and the region 2.2 Design and recommend financing structure appropriate for cogeneration projects 2.3 Design and develop financial analysis software tool to be used for project analysis and training 2.4 Conduct training of project developers and financing institutions 2.5 Assist project developers and financing institutions in the financing of projects	• Manpower: International and local/regional experts • Office facilities and supplies • Office equipment and computer facilities • Resource persons/trainors • Training facilities and supplies (venue, computers,…) • Inputs to financial packaging activities (e.g. Business Plan, Fuel Supply Availability Study, Fuel Supply Agreement, Feasibility Studies, Shareholders' Agreement, EPC Proposal/Contract, O&M Plan/Contract, etc.) • Software tools • Financial analysis model	**Sources of information to monitor progress:** • Cogen Centre activity reports • Progress reports • M&E documents • Midterm evaluation • **Costs:** 1,335,700 USD, out of which GEF financing will be 998,360 USD	• Risk that funds from financing institutions are not available for investments in cogeneration systems
<u>Activities for Outcome 3:</u> 3.1 Develop a project development guide for	• Manpower: International and local/regional	**Sources of information to monitor progress:**	• Risk that funds from project developers/owners are not

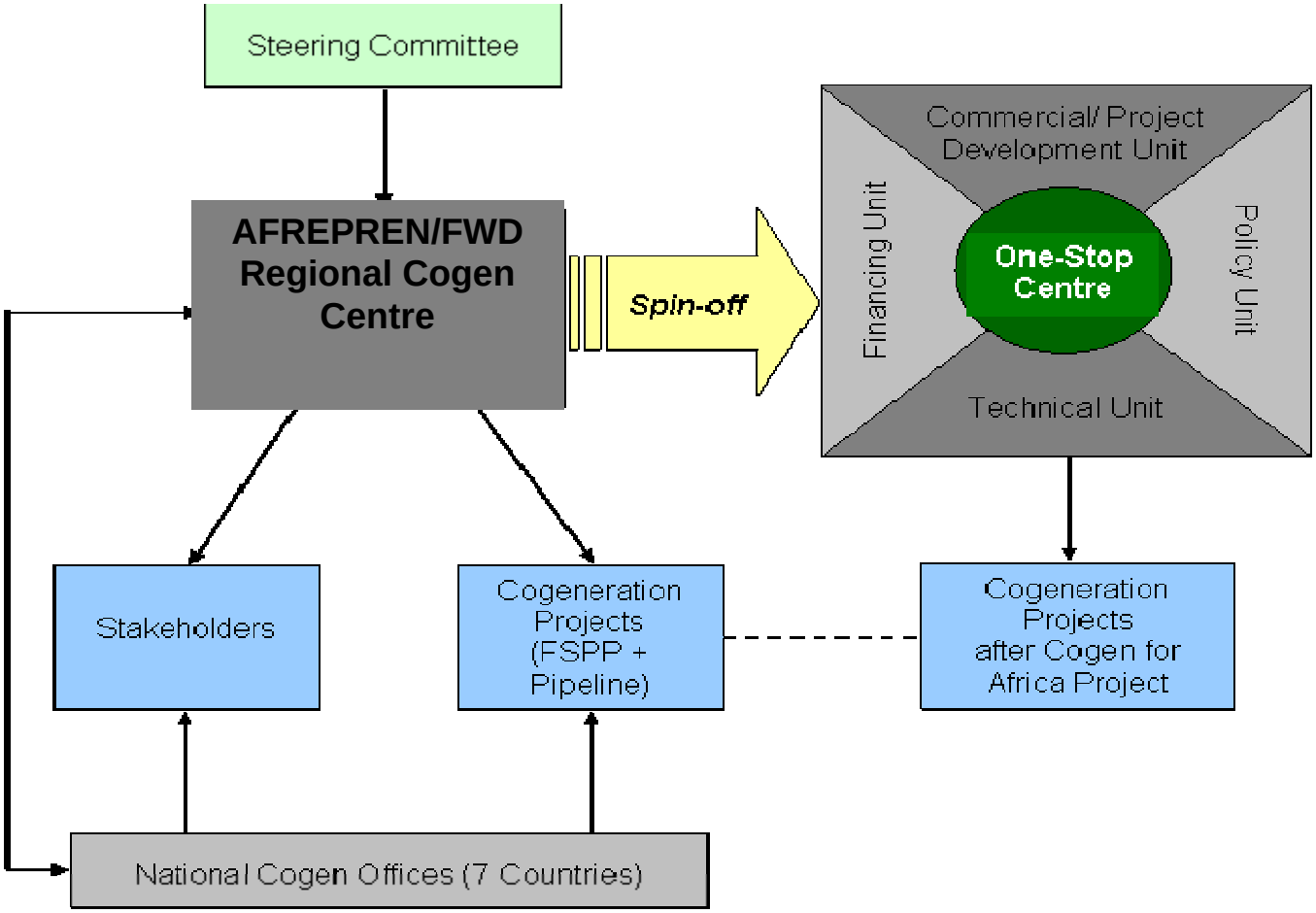
reference and training purposes 3.2 Identify and select candidate sites for projects, prepare Cogeneration Investment Packages (CIP) for selected sites and promote the CIPs for private sector project development and investment 3.3 Select, support and implement FSPPs 3.4 Identify a pipeline of projects for replication 3.5 Provide assistance and services to project developers for projects in the pipeline	experts • Relevant data & experience to be inputted into the Project Development Guide • Resource persons/trainors • Office facilities and supplies • Office equipment and computer facilities • Statistics from relevant agencies • Studies on tariff setting from other countries • Software tools • Financial analysis model	• Cogen Centre activity reports • Progress reports • M&E documents • Midterm evaluation **Costs:** 62, 045,617 USD, out of which GEF financing will be 1,668,409 USD	available for investments in cogeneration systems • Risk of technological failure with high pressure cogeneration systems
<u>Activities for Outcome 4:</u> 4.1 Review and analyze existing policies and regulations, and recommend policy interventions and enhancements to support cogeneration 4.2 Design and implement advocacy activities to influence policy reforms and implementation 4.3 Support policy makers and relevant agencies in policy formulation and enhancements 4.4 Design and establish a one-stop information and service center within the Africa Cogen Centre 4.5 Develop a promotional strategy for the whole project, prepare promotional and other relevant materials and disseminate them to relevant stakeholders 4.6 Develop a project website for internal and external audience and update continually 4.7 Assist utilities and relevant agencies to draft and set the stage for the approval of	• Manpower: International and local/regional experts • Office facilities and supplies • Office equipment and computer facilities • Documents on existing policies and regulations • Documents on policy interventions in other countries • Facilities to conduct dialogues/forums with policy makers • Professional printing service (outsource) • Website host • Documents and materials for website	**Sources of information to monitor progress:** • Cogen Centre activity reports • Progress reports • M&E documents • Midterm evaluation • **Costs:** 1,712,706 USD, out of which GEF financing will be 1,149,106 USD	• Risk that the Governments concerned will not have the political will nor prepared/ willing to pay the cost of making renewable energy, energy efficiency and cogeneration a priority

Standard Power Purchase Agreements (PPAs)			

ANNEX D: THE DESIGN OF THE AFREPREN/FWD REGIONAL COGEN CENTRE[48]

A major output of the Cogen for Africa Project will eventually be the creation of a regional Centre of excellence to be called the AFREPREN/FWD Regional Cogen Centre. This Centre will be modeled on the Cogen Asia Model but taking into account some of the region's specific needs and characteristics, as well as on the successful Mauritius' experience. It will operate as the Centre of excellence for cogeneration in the African region. The Regional Cogen Centre will be set up to consist of four functional units covering the areas of technical, financing, project development/commercial aspects, and policy matters. These units will be manned by both International and Regional/Local Experts and will act as a one-stop information and service Centre providing advice, assistance and services to stakeholders of cogeneration investments.
The Regional Cogen Centre will report and will be accountable to the Project Steering Committee while being supported on the national level by National Cogen Offices which will be set up in each of the countries participating in this Project. The National Cogen Offices will be the first level contact and will liaise with stakeholders in their respective countries.
Upon completion of the project, the one-stop information and service Centre is expected to spin-off into a self sustaining entity which will continue to provide institutional and practical support to the cogeneration industry in the region.
An overview of this concept is presented in graphical form in the following figure.

Overview of the Cogen for Africa Project concept



[48] Detailed elements of strategy, hosting, recruitment and institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

AFREPREN/FWD, the Executing Agency of the Cogen for Africa Project, will host the Regional Cogen Centre which shall manage the activities of the Project (for details on AFREPREN/FWD, please refer to Annex O.

Role and services of the AFREPREN/FWD Regional Cogen Centre

The role and services of the AFREPREN/FWD Regional Cogen Centre are given below. The services have been categorized according to the stakeholder groups served.

Services for (Potential) Project Developers/Owners:

- Support project development process through:
    - the identification of opportunities
    - assistance in preparation business concept and plans
    - identification and selection of technologies and suppliers
    - technical advise to potential investors
    - assistance in pre-investment and feasibility studies
    - assistance in structuring security arrangements (drafting of contracts/agreements and follow up on contractual obligations)

- Support in mobilizing funds and arranging financing through:
    - identification of relevant financing institutions and schemes
    - design of appropriate financing structures for cogeneration projects
    - assistance and facilitation in creation of innovative financing schemes for cogeneration projects
    - assistance in financial structuring and packaging and related activities such as preparation of Financing Plan, Information Memoranda, Term Sheets and other documentation
    - assistance in presentation to, and negotiation with, financing institutions
    - advice in drafting of Financing Agreement

- Support the development of FSPPs through:
    - advice and assistance on application and eligibility
    - financial support, whenever applicable
    - assistance in PPA formulation and seeking approval from authorities
    - advice in project management and supervision during construction and commissioning
    - advice in the design of O&M framework and training of operators

- Conduct training and capacity building activities on, but not limited to, the following aspects:
    - investment appraisal and decisions
    - financial analysis and financing concepts
    - conduct of techno-financial and feasibility studies
    - project development process
    - biomass fuel and combustion characteristics
    - power systems and design concepts
    - fundamentals of cogeneration technology
    - basic and conceptual design of cogeneration systems
    - technology assessment

- Assist in activities leading to environmental and carbon finance participation
- Prepare and disseminate Cogeneration Policy Guidance
- Organize visits and study tours to reference cogeneration installations
- Provide country specific and regional market information

Services for Financiers and External Investors:

- Identify opportunities for financing
- Support in the assessment of project bankability through:
    - conduct of due diligence of projects
    - technical evaluation of projects
- Conduct training and capacity building to financing institutions in matters related to:

    - fundamentals of biomass fuels and cogeneration technologies
    - assessment of cogeneration technologies
- Organize visits and study tours to reference cogeneration installations
- Provide country specific and regional market information

For Equipment Suppliers (foreign and local):

- Identify potential projects
- Provide access to Cogen Database on potential partners and their capabilities
- Assist in forging partnerships between foreign equipment suppliers and local manufacturers
- Provide country specific and regional market information

For African Policy Makers:

- Provide cogeneration policy guidance, including matters such as:
    - regulations, consents and permits on sales of electricity to the grid from renewable energy and/or cogeneration
    - utility grid connection for sale of firm/non-firm excess electrical power
    - fiscal and non-fiscal incentives
- Assist in drafting and formulating Standard Power Purchase Agreements
- Arrange dialogues between governments and end users to facilitate understanding of requirements from both ends in order to come up with mutually beneficial policies and regulatory measures
- Organize visits and study tours to reference cogeneration installations

Coordination, Administrative and Secretarial Services:

- Overall coordination and management of the Project
- Set up the premises of the AFREPREN/FWD Regional Cogen Centre within the offices of AFREPREN/FWD and prepare for mobilization
- Identify and recruit national, regional and international experts and staff
- Select, negotiate and contract National Cogen Offices in all participating countries
- Liaise with, train and provide technical assistance to National Cogen Office staff
- Procure office and Project equipment, furniture, supplies, etc.
- Set up IT network and devices
- Prepare Inception Report and Detailed Work Plan
- Manage the financial activities and reporting of the Project
- Procure and adapt Management Information System which will capture, record and report on financial, administrative and management information of the Project
- Organize meetings, and provide administrative support to capacity building activities
- Organize production and printing of reports and promotional materials
- Provide secretarial and administrative services to all the Units and personnel of the Project

Personnel

The proposed personnel of the AFREPREN/FWD Regional Cogen Centre will consist of local as well as regional and international staff. This is elaborated below:

To ensure that the project's initial focus is on investments (and not dissipated in the vagaries and complications associated with assembling a whole new team to run the project), it is recommended that staffing of the AFREPREN/FWD Regional Cogen Centre is largely drawn from existing AFREPREN/FWD staff with the right skills, qualification and exposure – about half of the technical staff of the regional cogen centre is expected to be hired from AFREPREN/FWD staff. This will also allow rapid initiation of the project (avoid delays associated with getting the requisite work permits for international experts), and be cost effective as the existing AFREPREN/FWD staff are not as highly paid as international and regional experts/consultants.

To address any skills gap, the staff of the AFREPREN/FWD Regional Cogen Centre will be supported by part-time regional and international experts to be contracted as and when needed. Details of the qualifications and responsibilities of the personnel are elaborated in Annex T.

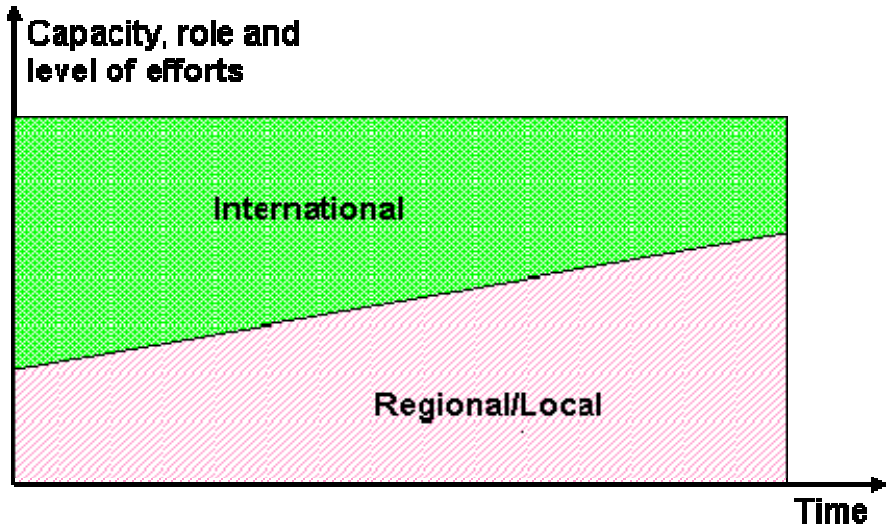
It is expected that the bulk of the international/regional experts/consultants as well as country experts will be contracted to undertake pre-feasibility and feasibility studies (CIPs), as well as other studies that may be required. The involvement and contribution of the International Experts/consultants will ensure:

- high quality technical and financial implementation of the project

- that lessons and experience in other parts of the world are considered and adapted, whenever necessary
- transfer of knowledge and capability to regional/local personnel.

Thus, the person-power requirements and responsibilities of the International Experts/consultants are structured to fulfill the above factors. It is expected that at the beginning of the project, the capacity contribution and level of efforts of the International Experts/consultants will be high, primarily focused on pre-feasibility feasibility studies (CIPs). As time progresses and internal capacity building takes place, the capacity contribution and level of efforts of the International Experts are expected to diminish and the Regional/Local expertise takes a more centre stage in the activities of the project. Figure 3.6 illustrates this idea.

Figure 3.6: Contribution and involvement of International Experts/Consultants vis-à-vis Regional/Local Experts

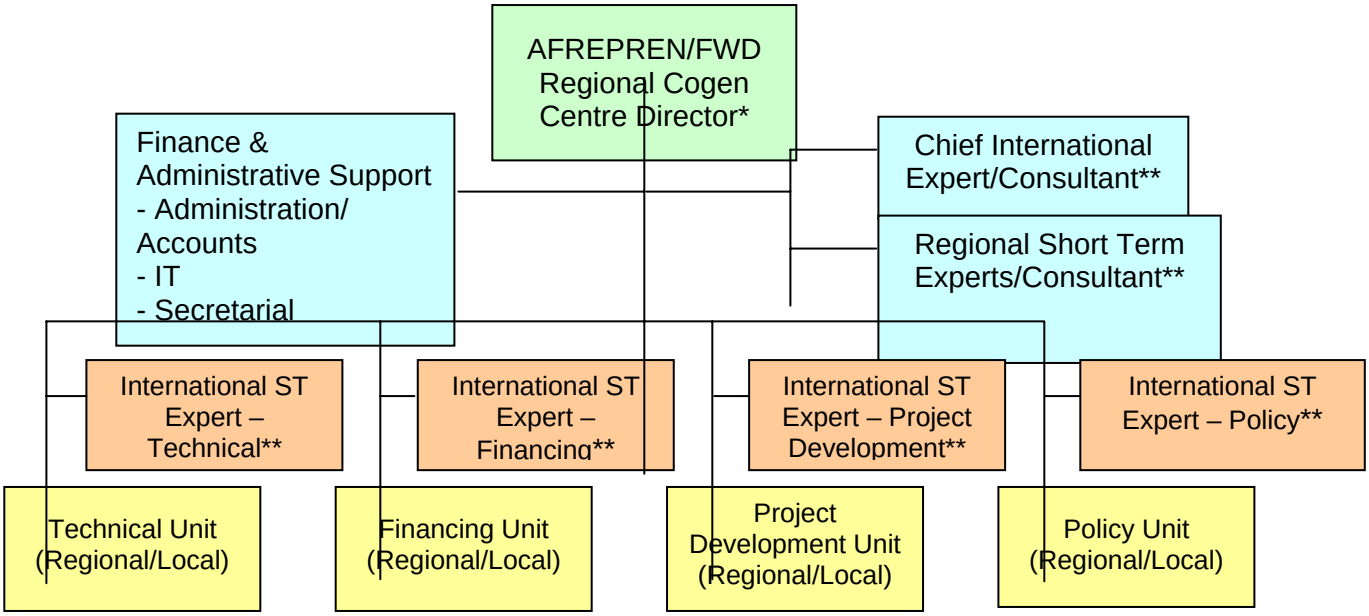


The personnel will be organized to effectively fulfill the major outcomes of the project on one hand, and to prepare for sustainability on the other hand. These are ensured through the following means:

- The appointment by AFREPREN/FWD of a Regional/Local professional to act as the Director of the AFREPREN/FWD Regional Cogen Centre
- The division of functions and responsibilities into four functional groups according to the four different units described earlier
- The Regional/Local personnel to take leadership, responsibility and "ownership" of the work within the different units through the Unit Heads, while the International Experts provide guidance, advice, training, inputs and act as resource individuals
- The Regional/Local personnel to be employed on a part-time basis for the duration of the Project, and three Regional Experts/consultants working on a short term basis. The capacity, involvement and responsibilities of the Regional/Local personnel to increase in time.
- The International Experts/consultants to consist of, at any one time, a full time (75%) expert, working on a specific pre-feasibility or full feasibility study (CIP), for the duration of the Project with the rest of the experts/consultants working on short term basis according to specific outputs and assignments. The role and involvement of the Short-Term International experts/consultants will decrease in time.

The organizational structure of the AFREPREN/FWD Regional Cogen Centre and the distribution of the personnel according to their roles and functions are given in Figure 3.7.

Figure 3.7: Organizational structure of the AFREPREN/FWD Regional Cogen Centre



Notes: * Includes associate/assistant director to assist with project management, as well as take lead in M&E and CIP compilation.

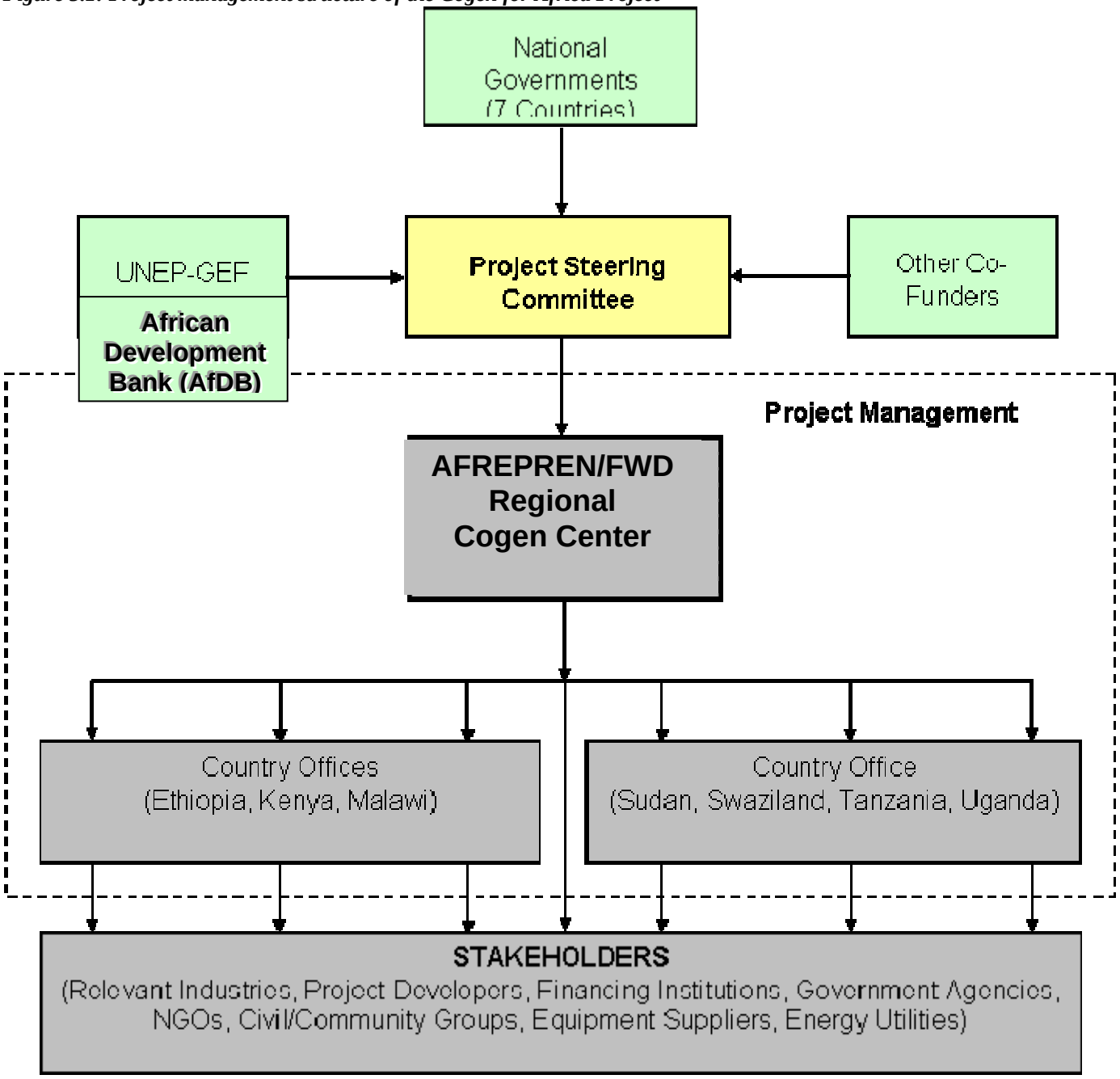
** These experts will be part of the pre-feasibility and full feasibility (CIPs) expert teams

IT = Information Technology

ST = Short-Term

The following figure elaborates the project management structure of the Cogen for Africa Project. The AFREPREN/FWD Regional Cogen Centre, which manages the day-to-day operations of the Project, reports to the Project Steering Committee. The National Cogen Offices reports to the Regional Cogen Centre and are in direct contact with the stakeholders in their respective countries. The Regional Cogen Centre monitors and supervises the activities of the National Cogen Offices and supports them through training and technical assistance. Under certain circumstances, the Regional Cogen Centre could also have a direct link/contact with the stakeholders through the provision of assistance/advice by the Experts of the Centre.

Figure 5.1: Project management structure of the Cogen for Africa Project



ANNEX F: MONITORING AND EVALUATION PLAN

M&E activities	Frequency /Timing	Aspects to be monitored & evaluated/ Description	In-charge of activity	Approval
Project implementation Manual	After 3 months	Administrative, financial and reporting policies of the Project	ACCD	PSC
Written Reports				
Inception report	After 3 months	Mobilization; staffing; detailed work plan; detailed budget; Project Implementation Manual	ACCD	PSC; IAs
Quarterly progress report	Quarterly	Quarterly accomplishments; work plan for the next quarter	ACCD	ExA
Annual progress report	Yearly	Annual accomplishments; Expenses for the year completed; next year's work plan and budget	ExA	PSC; IAs
Mid-term progress report	After 3 years	First half-term accomplishments; half-term expenses; update of Project work plan; lessons learned, recommendations and suggestions for re-orientation of activities (if necessary)	ExA	PSC; IAs
Final report	After 6 years	Project accomplishments; Project expenses and financial report; records and evidences of all outputs; lessons learned and recommendations for future actions	ExA	PSC; IAs
NCO progress reports	Quarterly	Country accomplishments; work plan for the next quarter	NCO staff	ExA, PMC
Mission reports	After each mission	Relevant aspects of the mission (according to defined template)	Individual experts	ACCD
FSPP monitoring	After commissioning of the plants	Technical feasibility, economic/financial viability and environmental impact of the Full Scale Promotion Projects (FSPPs)	ExA, CIC; External service providers	PSC
PSC meetings and minutes	Every 6 months	PSC meetings will discuss policy and strategic matters of the Project and provide direction & guidance to the Project. It will also approve selection of Full Scale Promotion Projects, endorse adaptations to the Project components during the Project execution, evaluate the performance and impacts of the Project, and approve Progress, Midterm and Terminal Reports	ACCD	PSC; IAs
PMC meetings and minutes	Every 6 months	The PMC will provide technical and operational guidance to the Programme, select of Full Scale Promotion Projects, monitor and evaluate the progress of the activities and approve quarterly planning of activities	ACCD	PSC
Financial & Management Information System (FMIS)	Throughout the Project; continuous	Accounting transactions; financial management & reporting; monitoring and control of project expenditure; Project resource data tracking; tracking mechanisms for co-financing & expenditure; standard forms & templates	Finance/ Admin. Manager	ACCD; IAs
External audit	Every year & After 6 years (final audit)	Auditing of accounts and financial management; use of international accounting standards	External auditor	IAs, ExA

Mid-term Review	After 3 years	Review of progress on execution & achievement of project outcomes as specified in the Project Document; fine-tuning of work plans for the second half of the project; improving project approaches and optimizing implementation arrangements; recommendation on adaptive measures; extensive and transparent consultation with all key stakeholder groups	ExA	PSC
Terminal Evaluation	After 6 years	Achievements, outcomes & impacts compared to baseline; lessons learned and recommendations for future actions; evaluation according to GEF Project Review Criteria	IAs; Independent evaluators	IAs
Other deliverables				
FSPPs	Project end	40 MW of new and efficient cogeneration projects which could be realized through 6 FSPPs[49]	ExA, ACCD; CIC	PSC
Training and capacity building activities	2 training per year from year 2 to year 6	Capacity building activities (workshops, forums, training) organized for relevant stakeholders on technical, project development and financial aspects of cogeneration	Assigned experts	ACCD
Project Development Guide	Year 2	A guide in developing and implementing cogeneration systems using best practices	Assigned experts	ExA
COGEN Database	Year 1	A database containing foreign and local manufacturers of cogeneration equipment/components	Assigned expert	ExA
Cogen for Africa website	Year 1	Project website containing relevant information on cogeneration and the Project for stakeholders	Assigned expert	ExA
Feasibility studies/Cogeneration Investment Packages	Project end	A total of 12 feasibility studies/Cogeneration Investment Packages (CIPs)[50] and several other pre-feasibility studies for new cogeneration projects	External service providers	ExA, CICs
Fuel resources study	Year 1	Comprehensive study on the available fuel resources and their potential for cogeneration	Assigned experts	ExA, CICs
Study on applicable technologies	Year 1	Review and assessment of technologies applicable for cogeneration that have been implemented successfully in similar environments	External service providers	ExA, CICs
Business Plan	Year 2 & year 4	Business Plan for sustainability of the AFREPREN/FWD Regional Cogen Centre after project completion	External service providers	ACCD, PSC

Notes:
ACCD = AFREPREN/FWD Regional Cogen Centre Director
CICs = Chief International Expert/Consultant and other international/regional and national experts
ExA = Executing Agency (AFREPREN/FWD)

[49] As mentioned earlier, although the number of FSPPs is not an explicit target, it is envisaged that 6 FSPPs will be funded by this project and will lead to the realization of the pre-defined target of 40MW. Although it could be possible that the 40MW is realized with fewer FSPPs, as a precaution, 6 FSPPs are provided for in the budget.

[50] A total of 12 CIPs/Feasibility Studies will be supported with the funds from GEF. However, additional CIPs/Feasibility studies could be undertaken, with support from other co-financiers. AfDB has indicated willingness to support a number of CIPs/Feasibility studies.

IAs= Implementing Agencies
NCO = National Cogen Offices
PMC = Project Management Council
PSC = Project Steering Committee

ANNEX I: WORK PLAN, SCHEDULE AND MILESTONES[51]

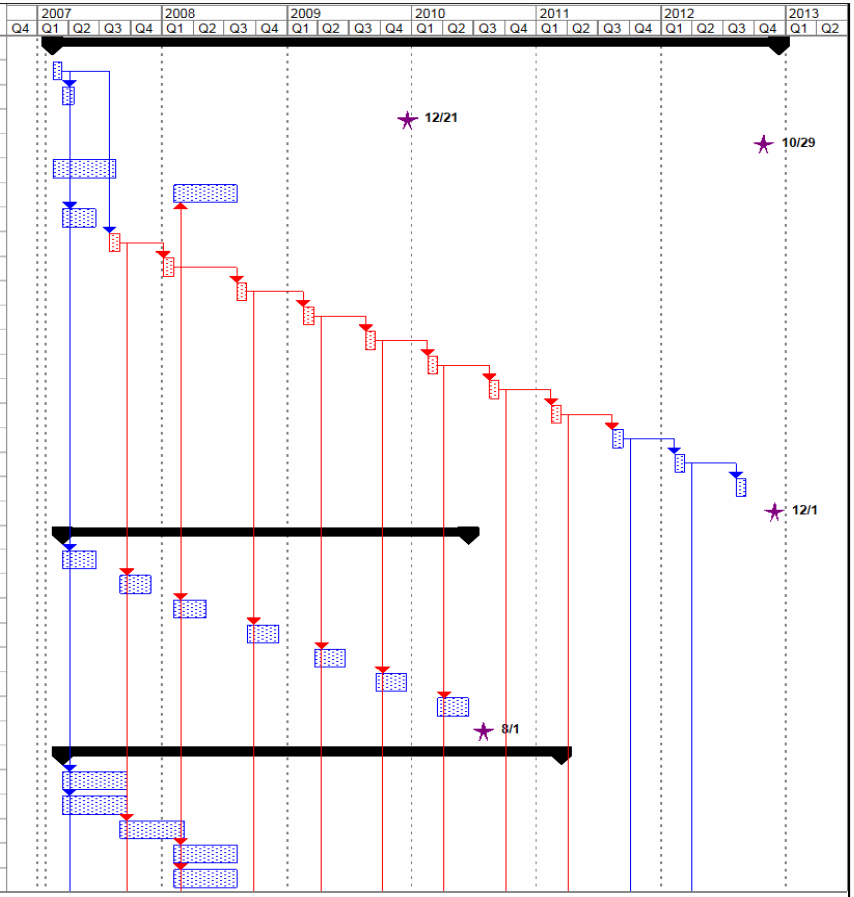
Outcome/Activity		Year 1				Year 2				Year 3				Year 4				Year 5				Year 6			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1 *Capacity of project developers, technical service providers and local manufacturers of modern and efficient cogeneration systems developed and enhanced*	**Activity 1.1: Investigate availability of biomass resources and assess their potential for cogeneration**																								
	Activity 1.2: Identify applicable technologies for cogeneration, relevant suppliers of equipment and their capabilities																								
	Activity 1.3: Design and develop a database consisting of foreign equipment suppliers and local manufacturers																								
	Activity 1.4: Design and implement a matchmaking service between foreign equipment suppliers and local manufacturers																								
	Activity 1.5: Develop and/or adapt software tools for technical analysis to be used for analysis of projects and training purposes																								
	Activity 1.6: Conduct capacity building activities through seminars, workshops and training																								
	Activity 1.7: Provide technical advice and services to project developers and potential owners of cogeneration systems																								
	Activity 1.8: Organize visits and study tours to successful cogeneration installations																								
Outcome 2 *Financing for cogeneration projects made available and accessed at terms and conditions that are favorable for investments.*	**Activity 2.1: Identify and review existing financing sources and mechanisms relevant for the sector and the region**																								
	Activity 2.2: Design and recommend financing structure appropriate for cogeneration projects																								
	Activity 2.3: Design and develop financial analysis software tool to be used for project analysis and training																								
	Activity 2.4: Conduct training of project developers and financing institutions																								
	Activity 2.5: Assist project developers and financing institutions in the financing of projects																								

[51] The project workplan is elaborated using Microsoft Project (see following section) and provides a more detailed description of the linkages between various activities. This tool will be used to track progress of the project and will be included as part of the project monitoring and evaluation plan**.**

Outcome 3 *Commercial, technical, economic and environmental benefits of modern and efficient cogeneration systems demonstrated…*	**Activity 3.1: Develop a project development guide for reference and training purposes**																									
	Activity 3.2: Identify and select candidate sites for projects, prepare Cogeneration Investment Packages (CIP) for selected sites and promote the CIPs for private sector …																									
	Activity 3.3: Select, support and implement Full Scale Promotion Projects (FSPPs)																									
	Activity 3.4: Identify a pipeline of projects for replication																									
	Activity 3.5: Provide assistance and services to project developers for projects in the pipeline																									
Outcome 4 *More favorable policies and institutional arrangements that support cogeneration promoted*	**Activity 4.1: Review and analyze existing policies and regulations, and recommend policy interventions and enhancements to support cogeneration**																									
	Activity 4.2: Design and implement advocacy activities to influence policy reforms and implementation																									
	Activity 4.3: Support policy makers and relevant agencies in policy formulation and enhancements																									
	Activity 4.4: Design and establish a one-stop information and service center within the Africa Cogen Centre																									
	Activity 4.5: Develop a promotional strategy for the whole project, prepare promotional and other relevant materials and disseminate them to relevant stakeholders																									
	Activity 4.6: Develop a project website for internal and external audience and update continually																									
	Activity 4.7: Assist utilities and relevant agencies to draft and set the stage for the approval of a Standard Power Purchase Agreements (PPAs)																									
Project management, coordination, common activities and reporting	**Overall coordination**																									
	Mobilization																									
	Project Kick-off meeting	**o**																								
	Project Steering Committee meetings		**o**		**o**		**o**		**o**		**o**		**o**		**o**		**o**		**o**		**o**		**o**		**o**		**o**
	Project Management Council meetings		**o**				**o**				**o**				**o**				**o**				**o**			
	Launching seminars			**o**																						
	Cogeneration weeks					**o**				**o**				**o**				**o**				**o**				
	Inception report	**o**																								
	Quarterly progress reports	**o**	**o**	**o**		**o**	**o**	**o**		**o**	**o**	**o**		**o**	**o**	**o**		**o**	**o**	**o**		**o**	**o**	**o**		

	Annual progress reports				**o**				**o**								**o**					**o**				
	Mid-term progress report												**o**													
	Final report																									**o**

ID	Task Name
1	**Project Management, Coordination & Sustainability of Cogen Centre**
2	Inception meeting
3	Establish M&E system
4	***Mid-term Evaluation***
5	***Final Evaluation***
6	Procurement of Equipment & Hiring of Consultants
7	Overall Strategy/Business plan
8	Project website design and development
9	PSC/PMC Meetings 1st
10	PSC/PMC Meetings 2nd
11	PSC/PMC Meetings 3rd
12	PSC/PMC Meetings 4th
13	PSC/PMC Meetings 5th
14	PSC/PMC Meetings 6th
15	PSC/PMC Meetings 7th
16	PSC/PMC Meetings 8th
17	PSC/PMC Meetings 9th
18	PSC/PMC Meetings 10th
19	PSC/PMC Meetings 11th
20	***Terminal Report***
21	**Outcome 1: Technical assessment of cogeneration resources**
22	Scoping studies - Tanzania (National Cogen Centre/National Focal Point/National experts)
23	Scoping studies - Uganda (National Cogen Centre/National Focal Point/National Experts)
24	Scoping studies - Kenya (National Cogen Centre/National Focal Point/National Experts)
25	Scoping studies - Ethiopia (National Cogen Centre/National Focal Point/National Experts)
26	Scoping studies - Sudan (National Cogen Centre/National Focal Point/National Experts)
27	Scoping studies - Malawi (National Cogen Centre/National Focal Point/National Experts)
28	Scoping studies - Swaziland (National Cogen Centre/National Focal Point/National Experts)
29	***Comprehensive review of cogeneration fuel resources and applicable technologies***
30	**Outcome 2: Financing for Cogen Investments**
31	Pre-feasibility studies - Uganda
32	Pre-feasibility studies - Kenya 1
33	Pre-feasibility studies - Swaziland 1
34	Pre-feasibility studies - Tanzania 1
35	Pre-feasibility studies - Kenya 2

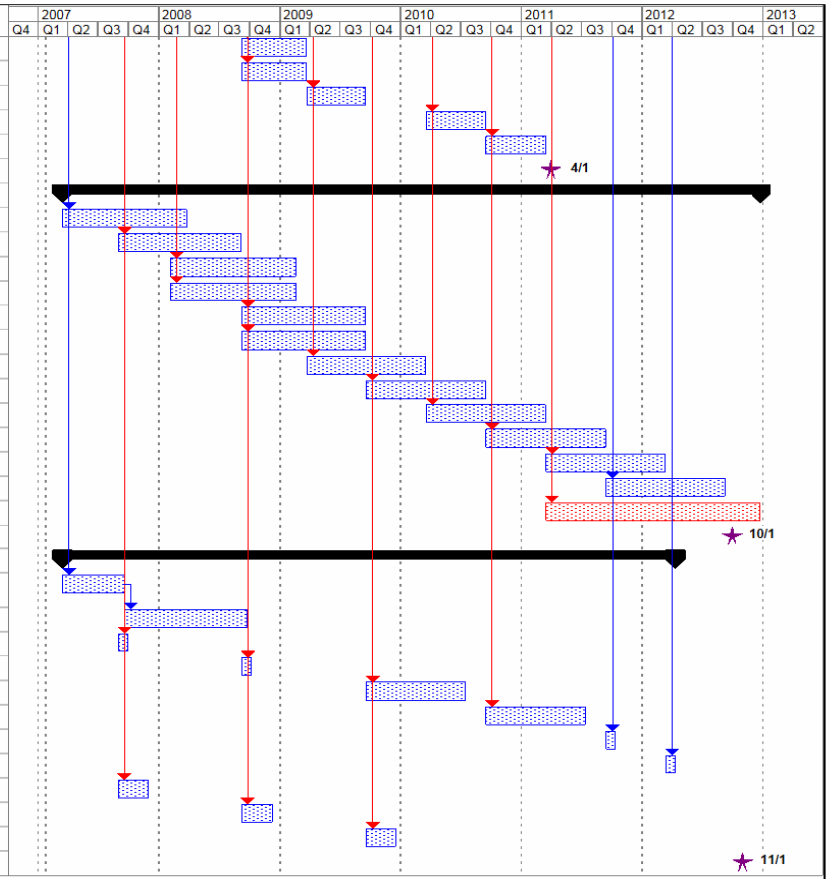


Project: FSP_Cogen for Africa steering
Date: Wed 1/24/07

Task		Milestone		Rolled Up Milestone		Project Summary	
Task Progress		Summary		Rolled Up Progress		Group By Summary	
Critical Task		Rolled Up Task		Split		Deadline	
Critical Task Progress		Rolled Up Critical Task		External Tasks			

Page 1

ID	Task Name
36	Pre-feasibility studies - Sudan
37	Pre-feasibility studies - Malawi
38	Pre-feasibility studies - Ethiopia
39	Pre-feasibility studies - Tanzania 2
40	Pre-feasibility studies - Swaziland 2
41	***Funding for new cogeneration investments accessed***
42	**Outcome 3: Full Size Promotion Projects**
43	Feasibility Studies/Cogen Investment Packages (CIPs) - Kenya 1
44	Feasibility Studies/Cogen Investment Packages (CIPs) - Swaziland 1
45	Feasibility Studies/Cogen Investment Packages (CIPs) - Tanzania 1
46	Feasibility Studies/Cogen Investment Packages (CIPs) - Uganda 1
47	Feasibility Studies/Cogen Investment Packages (CIPs) - Sudan
48	Feasibility Studies/Cogen Investment Packages (CIPs) - Malawi 1
49	Feasibility Studies/Cogen Investment Packages (CIPs) - Kenya 2
50	Feasibility Studies/Cogen Investment Packages (CIPs) - Swaziland 2
51	Feasibility Studies/Cogen Investment Packages (CIPs) - Uganda 2
52	Feasibility Studies/Cogen Investment Packages (CIPs) - Ethiopia
53	Feasibility Studies/Cogen Investment Packages (CIPs) - Tanzania 2
54	Feasibility Studies/Cogen Investment Packages (CIPs) - Malawi 2
55	Pipeline of Projects
56	***6 FSPPs or 40MW of high pressure cogeneration systems***
57	**Outcome 4: Favorable policies and Institutional arrangements**
58	Review and analyze existing policies and regulations, and recommend policy interventions and enhancements to support cogeneration
59	Design and implement advocacy activities to influence policy reforms and implementation
60	Training Workshops/Seminars 1
61	Training Workshops/Seminars 2
62	Training Workshops/Seminars 3
63	Training Workshops/Seminars 4
64	Training Workshops/Seminars 5
65	Training Workshops/Seminars 6
66	Study Tours and Site visits 1
67	Study Tours and Site visits 2
68	Study Tours and Site visits 3
69	***At least 100 personnel trained***



Project: FSP_Cogen for Africa steering
Date: Wed 1/24/07

Task		Milestone		Rolled Up Milestone		Project Summary	
Task Progress		Summary		Rolled Up Progress		Group By Summary	
Critical Task		Rolled Up Task		Split		Deadline	
Critical Task Progress		Rolled Up Critical Task		External Tasks			

ANNEX T: TORs for AFREPREN/FWD Regional Cogen Centre Staff/Experts and Key Activities[52]

In line with the FSP Brief approved by the GEF Council, the TOR for various experts has been elaborated in the following section, and linked to specific project outcomes.

Regional/Local Personnel

1. AFREPREN/FWD Regional Cogen Centre Coordination and Director

Qualifications:

- Minimum of University degree in Engineering and post-graduate Masters Degree in Management or a Masters in Business Administration
- Minimum 15 years experience in the energy sector and minimum 10 years in managing a regional energy-related organization/agency or program
- Extensive knowledge of power sector, regulation and reform, agro-sector, energy policy and cogeneration issues in Africa
- Evidence of published books and journal articles on power sector, regulation and reform, energy policy and cogeneration issues in Africa
- Knowledge of UNEP/GEF facility as well as associated GEF Climate Program priorities, project preparation and implementation mechanisms
- Knowledge and experience with African Development Bank (AfDB), Renewable Energy and Energy Efficiency Partnership (REEEP) and EC/COOPENER will be an added advantage
- Certified knowledge of Microsoft Project management Tool (Version 2000 and above)
- Working knowledge of RETSCREEN cogeneration investment program (Combined Heat & Power).
- Widely traveled in the region (to at least 6 of the target countries for the project as well as Mauritius and South Africa which are possible sources of technical expertise and finance for project) , with good contacts in key institutions including power utilities, regulatory bodies, sugar factories, agro-industries, private energy companies, government ministries etc.
- Demonstrated ability in managing a multi-disciplinary, multi-cultural team and regional organization/network
- Experience in regional cooperation and networking/cooperation with government officials, financiers, NGOs representatives and private sector executives in Africa
- Excellent oral and written communication skills in English – knowledge of a local language e.g. Kiswahili or Arabic would be an added advantage.
- Ability and willingness to travel at short notice

Responsibilities:

- Overall coordination, management, oversight as well as review of applications from, appointments (in conjunction with Steering Committee) and monitoring of key project experts, staffers and sub-contractors.
- In charge of coordination the compilation and updating of Vision, Roll-out Strategy and Sustainability Business Plan.
- Review of key outputs of the project, including scoping studies, pre-feasibility studies and feasibility studies (CIPs)
- Responsible for reporting to Co-implementing Agencies (UNEP/GEF and AfDB), AFREPREN/FWD as well as to PSC and PMC.
- Participate in project Steering Committee
- Provides direction and overall leadership to the Africa Cogen Centre, its staff and the Country Offices

[52] Detailed elements of strategy, hosting, recruitment and institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

- Take overall responsibility for the organization and execution of the project
- Ensure that the activities are carried out according to the project design and the outcomes and outputs/deliverables are achieved within the approved timeframe and budget
- Participate in the Steering Committee as well as provide regular reports to the Steering Committee on the progress and plans of the project

2. Assistant/Associate Director, CIP and M&E Coordinator

Qualifications:

- Minimum of University degree in Commerce/Finance and a post-graduate degree in Finance/Banking
- Should have energy project corporate financing expertise with demonstrated "deal closure" ability.
- Minimum 10 years experience in corporate financing of investments in the power sector or agro/forest industry sector. Knowledge of power sector reforms, regulation and reform, energy policy and cogeneration issues in Africa will be an added advantage.
- Working knowledge of Microsoft Project management Tool (Version 2000 and above)
- Widely traveled in the region with good contacts in key institutions including power utilities, regulatory bodies, sugar factories, agro-industries, private energy companies, government ministries etc (experience in the target countries for the project as well as Mauritius and South Africa and/or India/Thailand will be an added advantage).
- Demonstrated ability in managing a multi-disciplinary, multi-cultural team and regional organization/network
- Experience in regional cooperation and networking/cooperation with government officials, financiers, NGOs representatives and private sector executives in Africa
- Excellent oral and written communication skills in English – knowledge of a local language e.g. Kiswahili or Arabic would be an added advantage.
- Ability and willingness to travel at short notice

Responsibilities:

- Under the guidance of the AFREPREN/FWD Regional Cogen Centre Director, assist in overall coordination, management, oversight of the project
- Review of key outputs of the project, including scoping studies, pre-feasibility studies and feasibility studies
- Compilation of Cogeneration Investment Packages (CIPs)
- Liaising with potential financiers
- Design an M&E plan for the project
- Implementing, monitoring and tracking the M&E activities of the Africa Cogen Centre
- Preparation of progress reports on M&E
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director

3. Training & Capacity Building, Conference/Event Coordinator

Qualifications:

- Minimum University degree in a relevant field (Engineering or Agriculture)
- Combined minimum 10 years experience in project development and management, energy training and capacity building activities
- Extensive knowledge of power sector, regulation and reform, agro-sector, energy policy and cogeneration issues in Africa and evidence of published books and/or journal articles on these subjects
- Experience in organizing regional energy training and capacity building events (workshops, seminars and study tours)

- Knowledge of UNEP/GEF facility as well as associated GEF Climate Program priorities, project preparation and implementation mechanisms
- Knowledge and experience with African Development Bank (AfDB), Renewable Energy and Energy Efficiency Partnership (REEEP) and EC/COOPENER will be an added advantage
- Working knowledge of RETSCREEN cogeneration investment program (Combined Heat & Power).
- Certified knowledge of Microsoft Project management Tool (Version 2000 and above)
- Widely traveled in the region (at least 3 of the target countries for the project as well as Mauritius or South Africa – countries that are likely to be sources of technical expertise and finance for the project)
- Excellent command of spoken and written English, ability to write reports and good presentation skills – knowledge of a local language e.g. Kiswahili or Arabic would be an added advantage.

Responsibilities:

- Development of MS project based-implementation manual
- Implementation, tracking and updating of MS project-based management and implementation system
- Responsible for training and capacity building activities for projects developers/owners
- Coordinating the visits and study tours to successful cogeneration installations
- Coordinating and organizing meetings, seminars/workshops and conferences
- Support national cogen offices/focal points/experts in organizing events
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director

4. Financing and Full Feasibility Study Coordinator

Qualifications:

- Minimum university degree in Finance or Corporate Banking.
- Combined minimum of 10 years relevant experience, particularly in the areas of financial analysis and project corporate financing, funds mobilization and financial packaging.
- Minimum 10 years experience in corporate financing of investments in the power sector or agro/forest industry sector. Knowledge of power sector reforms, regulation and reform, energy policy and cogeneration issues in Africa will be an added advantage.
- Demonstrated managerial experience and ability
- Working knowledge of RETSCREEN cogeneration investment program (Combined Heat & Power) would be an added advantage.
- Working knowledge of Microsoft Project management Tool (Version 2000 and above) would be an added advantage.
- Widely traveled in the region (experience in at least 3 of the target countries for the project as well as Mauritius and/or South Africa will be an added advantage)
- Excellent oral and written communication skills in English – knowledge of a local language e.g. Kiswahili or Arabic would be an added advantage.

Responsibilities:

- Design of feasibility assessment tool, its implementation and updating
- Coordination of Full Feasibility experts
- Liaising with potential financiers
- Responsible for providing financial advice and services to project developers on funds mobilization and financial packaging

- Review of feasibility studies (Cogeneration Investment Packages) prepared by feasibility experts
- Demonstrated managerial experience and ability.
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director.

5. Policy, Advocacy and Dissemination Coordinator

Qualifications:

- Minimum university degree in a relevant field (Economics or Engineering)
- Combined minimum 10 years relevant experience, in power sector policy, regulation and reform legal and contractual arrangements and promotional/communication activities desired
- Extensive knowledge of energy, power sector, reforms and cogeneration issues in Africa and evidence of published books and/or journal articles on energy, power sector, reforms and cogeneration
- Knowledge of the process of formulating Power Purchase Agreements (PPA)
- Knowledge of UNEP/GEF facility as well as associated GEF Climate Program priorities, project preparation and implementation mechanisms
- Knowledge and experience with African Development Bank (AfDB), Renewable Energy and Energy Efficiency Partnership (REEEP) and EC/COOPENER will be an added advantage
- Demonstrated managerial experience and ability
- Excellent command of the spoken and written English, ability to write reports and good presentation skills – Knowledge of a local language e.g. Kiswahili or Arabic would be an added advantage
- Widely traveled in the region (at least 3 of the target countries for the project as well as Mauritius and/or South Africa – countries that are likely to be major sources of finance or expertise for the project)
- Working knowledge of RETSCREEN cogeneration investment program (Combined Heat & Power).
- Certified knowledge of Microsoft Project management Tool (Version 2000 and above)
- Contacts and networks in key institutions e.g. power utilities, Ministries of Energy etc.

Responsibilities:

- Organizing and participating in PPA negotiations
- Promoting supportive policy and regulatory measures for cogeneration (e.g. Standard PPA)
- Tracking policy reforms and associated opportunity windows
- Designing and distributing project dissemination material
- Coordinating the preparation of the promotional and dissemination strategy and its execution
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director

6. Technical Unit and Pre-Feasibility Studies Coordinator

Qualifications:

- Minimum university degree in Mechanical Engineering or Power/Electrical Engineering
- Minimum 10 years relevant experience, particularly in the energy sector, power sub-sector, renewables sub-sector, power plant and/or cogeneration systems

- Extensive knowledge of energy and cogeneration issues in Africa. Published books and/or journal articles/reports on energy and cogeneration would be an added advantage.
- Should have undertaken pre-feasibility and/or feasibility studies preferably in cogeneration related projects.
- Working knowledge of RETSCREEN cogeneration investment program (Combined Heat & Power) would be an added advantage.
- Working knowledge of Microsoft Project management Tool (Version 2000 and above)
- Widely traveled in the region (experience in at least 3 of the target countries for the project as well as Mauritius and/or South Africa will be an added advantage)
- Demonstrated managerial experience and ability.
- Excellent command of spoken and written English, ability to write reports and good presentation skills
- Knowledge of a relevant local language (e.g. Kiswahili or Arabic) would be an added advantage.

Responsibilities:

- Designing, updating pre-feasibility and feasibility tools (RETSCREEN)
- Providing technical advice and services to project developers
- Coordinating pre-feasibility/pre-investment Studies
- Undertake/coordinate survey and assessment of relevant cogen technologies available in the global market and associated suppliers' capability and details.
- Designing and coordinating a matchmaking service between foreign equipment suppliers and local project developers
- Assisting in designing, implementing and updating a Cogen database
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director

7. Project Development, Biomass Energy and Scoping Study Coordinator

Qualifications:

- Minimum relevant university degree in relevant field (Economics or Engineering or Agriculture)
- Combined minimum 10 years experience in undertaking biomass energy assessments and studies
- Extensive knowledge of energy sector, renewables, biomass energy, power sector, reforms and cogeneration issues in Africa and evidence of published books and/or journal articles on energy, renewables, biomass energy and cogeneration.
- Knowledge of UNEP/GEF facility as well as associated GEF Climate Program priorities, project preparation and implementation mechanisms
- Knowledge and experience with African Development Bank (AfDB), Renewable Energy and Energy Efficiency Partnership (REEEP) and EC/COOPENER will be an added advantage
- Working knowledge of RETSCREEN cogeneration investment program (Combined Heat & Power).
- Certified knowledge of Microsoft Project management Tool (Version 2000 and above)
- Widely traveled in the region (at least 3 of the target countries for the project as well as Mauritius and/or South Africa – countries that are likely to be source of technical expertise and financing)
- Demonstrated managerial experience and ability
- Excellent command of the spoken and written English, ability to write reports and good presentation skills

- Knowledge of a local language e.g. Kiswahili would be an added advantage.

Responsibilities:

- Scanning biomass/agro sectors in the region to identify cogen opportunities and coordinate associated scoping studies
- Coordinating scoping studies on cogeneration in agro-industries
- Coordination of national cogen centers/focal points/experts
- Identify and recommendation opportunities for undertaking pre-feasibility and feasibility studies in other agro sectors
- Any other tasks assigned by the AFREPREN/FWD a Cogen Centre Director

8. Finance/Project Accounts Team

Qualifications:

- Minimum university degree in administration, management, finance, commerce accounting or equivalent
- Combined minimum 5 years relevant experience in financial management, or accounting
- At least 2 year experience of UNEP financial reporting systems and requirements
- Working knowledge of accounting software is required
- Extensive expertise in managing financial aspects of large regional projects
- Certified knowledge of Microsoft Project management Tool (Version 2000 and above)
- Working knowledge of Quick Books/SAGE accounting software
- Good knowledge of biomass energy, power sector, reforms and cogeneration issues in Africa
- Demonstrated managerial experience and ability
- Excellent oral and written communication skills in English

Responsibilities:

- Design, implementation and updating of project accounting system
- Preparing regular financial reports
- Reviewing and processing project payments and ensuring overall effective management of project accounts
- Support national cogen offices/focal points/experts in financial reporting
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director

9. Information Systems & Technology Coordinator

Qualifications:

- Minimum university degree in computer science, information technology or equivalent
- Minimum 3 years in computer network administration, database design and management, web design and development and computer hardware and software troubleshooting
- Knowledge of energy sector, renewables, biomass energy, power sector, reforms and cogeneration issues in Africa
- Familiarity and experience with various computer software and operating systems
- Certified knowledge of Microsoft Project management Tool (Version 2000 and above)

- Familiarity and experience with various Database Management Systems
- Good understanding of the spoken and written English

Responsibilities:

- Design, develop and manage a dynamic project website (internet and intranet) for the AFREPREN/FWD Regional Cogen Centre and continually update it
- Provide regular updates on current developments on power sector, cogeneration and energy sector relevant to the project on the project website
- Design, install and maintain the LAN system of the Africa Cogen Centre
- Acquisition and procurement of IT software and hardware, and providing user support
- Provide IT support to national cogen offices/focal points/experts
- Working knowledge of RETSCREEN cogeneration investment program (Combined Heat & Power).
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director

10. Secretary and Admin Support

Qualifications:

- Minimum university degree in social sciences or equivalent
- Expertise in administration of regional energy programme/project
- Knowledge of energy sector, renewables, biomass energy, power sector, reforms and cogeneration issues in Africa
- Certified knowledge of Microsoft Project management Tool (Version 2000 and above)
- Demonstrated managerial experience and ability
- Excellent command of the spoken and written English and ability to write reports and ability to draft correspondence

Responsibilities:

- Provides administrative support to the personnel of the AFREPREN/FWD Regional Cogen Centre
- Assists in administrative matters such as organization of meetings, travel arrangements, processing of purchases, reimbursements, production of reports, etc.
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director

National Cogen Offices/Focal Points/Experts

A National Cogen Office shall be established in each of the seven participating countries. These offices shall act as focal points in the different participating countries and will liaise with both public and private sector stakeholders on a national basis (industry associations, individual industries, project developers, relevant government agencies, financial sector, community and civil groups, etc.). National cogen offices should have the following characteristics:

- Public or private organizations that have expertise in energy and cogeneration issues at national level
- Demonstrated ability to initiate and conduct tariff negotiations
- Demonstrated good links to government ministries, national utilities, regulatory agencies
- Excellent links to national institutions and stakeholders involved in cogeneration
- Ability to dedicate personnel to coordination of Cogen for Africa activities
- Ability to co-finance Cogen for Africa activities through in-kind contributions for office space, equipment and person hours

- Experience in implementation of GEF or similar energy projects.

Responsibilities:
The tasks of each National Cogen Office are, but not limited to, the following:

- Host national cogen office and provide personnel and basic equipment as in-kind contribution to the project
- Coordination of project activities at national level and attend Project Management Council (PMC) meetings. Coordination responsibility to also encompass providing liaison services between the Cogen for Africa project and the Tea/Small Hydro project as well as with other GEF related projects.
- Undertake and/or subcontract experts to undertake scoping studies on cogeneration in sugar and other agro industries, to identify potential projects or projects under development and follow up on business opportunities with emphasis on projects that may qualify as FSPPs or may become projects in the pipeline. TOR of scoping studies to include fuel resource assessments (fuel aspects - availability, supply, storage, preparation, etc and estimation of energy potential from biomass fuel)
- In conjunction with AFREPREN/FWD Regional Cogen Centre, Steering Committee, project sponsors, potential financiers assist/participate in selection of pre-feasibility study experts as well as provide requisite coordination support.
- Maintain and develop contacts with all relevant public and private sector organizations
- Liaise with Policy, Advocacy and Dissemination coordinator and relevant government agencies and coordinate advocacy activities aimed at influencing policy makers to formulate and/or enhance regulations, policies and support measures including favorable tariffs to encourage the development of cogeneration and sales of power to the grid from cogeneration projects at favorable terms
- Implement promotion and dissemination activities at the National level
- Provide existing documentation and developments on policy matters
- Provide initial information/data for the Cogen Database and updates thereafter
- Organize field trips/ study tours/ site visits, seminars/workshops and other meetings in the country
- Regularly collect information on the energy sector, electricity supply industry data, fuel resource assessment, national energy/environmental trends and regulations, trade fairs, exhibitions, conferences and other events, press cuts, etc. The information shall be sent to the AFREPREN/FWD Regional Cogen Centre on a regular basis
- Submit reports to the AFREPREN/FWD Africa Cogen Centre, including co-financing reports, in line with project reporting guidelines

International Experts
1. Principal International Consultant

Qualifications:

- Minimum of university degree in Engineering or equivalent
- Minimum 15 years experience in the cogeneration sub-sector
- Professional experience in the field of cogeneration/power generation
- Experience in regional cooperation programs and networking as well as experience in advanced cogeneration systems in the region or outside the region.
- Demonstrated ability in managing a multi-disciplinary, multi-cultural team

Responsibilities:

- To provide expert assistance and support as and when needed and in response to requests from sponsors and Regional Cogen Centre team.

- Review and provide advice on Feasibility studies, pre-feasibility studies and scoping studies as well as validate the studies in response to requests from AFREPREN/FWD Cogen centre
- Provide training to, and develops capacity of, the regional/local personnel of the regional Cogen Centre on financial analysis and evaluation aspects of cogeneration projects
- Act as a Resource Person on the external training and capacity building activities of the Regional Cogen Centre
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director , UNEP/DGEF and AfDB

2. Financing Expert

Qualifications:
- Minimum university degree in finance/banking
- Minimum 15 years relevant experience, particularly in the areas of corporate banking, financial analysis and evaluation, financial modeling, and financial structuring
- Previous experience in a similar cooperation or regional program on cogeneration preferred
- Excellent command of the spoken and written English, ability to write reports and good presentation skills

Responsibilities:
- To provide expert assistance and support on financing and feasibility assessment issues as and when needed and in response to requests from sponsors and Cogen team.
- Provide expert advice/inputs to the AFREPREN/FWD Regional Cogen Centre and to other stakeholders on matters related to analysis of financial viability, financial structuring, and identification of application financing schemes and sources, as well as validation of pre-feasibility and feasibility studies.
- Provide training to, and develops capacity of, the regional/local personnel of the Africa Cogen Centre on financial analysis and evaluation aspects of cogeneration projects
- Acts as a Resource Person on the external training and capacity building activities of the AFREPREN/FWD Africa Cogen Centre
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre Director, UNEP/DGEF and AfDB

3. Policy Expert

Qualifications:
- Minimum university degree in a relevant field
- Minimum 15 years relevant experience, particularly in the areas of energy policy, power sector reform and tariff negotiations
- Previous experience in formulation, drafting and/or negotiation of Power Purchase Agreements (PPA)
- Previous experience in a similar cooperation or regional program on cogeneration preferred
- Excellent command of the spoken and written English, ability to write reports and good presentation skills

Responsibilities:
- To provide expert assistance and support on regulatory, PPA, IPP and tariff issues as and when needed and in response to requests from sponsors and Cogen team.
- Supports and provides expert advice/inputs to the Africa Cogen Centre and to other stakeholders on matters related to policy formulation, enhancement and reform
- Provides training to, and develops capacity of, the regional/local personnel of the AFREPREN/FWD Regional Cogen Centre on policy matters

- Provides support to the policy makers and other relevant agencies on formulation/enhancements of policies and regulations that will encourage the widespread implementation of cogeneration
- Acts as a Resource Person on the external training and capacity building activities of the AFREPREN/FWD Africa Cogen Centre
- Any other tasks assigned by the AFREPREN/FWD Regional Cogen Centre , UNEP/DGEF and AfDB

4. Full Feasibility Studies/Cogeneration Investment Packages (CIP) Experts/Consultants

Qualifications:

- Minimum 10 years relevant experience in undertaking full feasibility studies and Investment packages
- Extensive expertise in cogeneration project development, preferably in developing regions (expertise in Eastern, Horn and Southern Africa will be an added advantage)
- Excellent command of spoken and written English, ability to write reports and good presentation skills

TOR:

- Subject to available information and existing pre-feasibility studies, TOR of full feasibility studies/Cogeneration Investment Packages (CIPs) expected to include the following elements:

Shareholding and ownership
- Elaboration of a clear shareholding and ownership structure which is reflected in a well structured Shareholders' Agreement.
- Confirmation that owners and sponsors of the project have enough verifiable financial resources to contribute as equity according to the financial institution's minimum requirements.
- Confirmation that owners and sponsors of the project have enough collateral and/or other guarantees to provide whenever required.

Fuel aspects
- Ascertain ownership of biomass fuel
- Survey the availability of fuel to unequivocally prove that it is enough for the lifetime duration of the energy plant.
- Design and secure an agreement for the supply of fuel (Fuel Supply Agreement) on a long-term basis (at least as long as the duration of the loan)

Technology supply, construction and operation
- Undertake conceptual engineering design that provides configuration of the plant and the selected systems/technology.
- Identify and select the main technology supplier(s) through a transparent and competitive process that confirms their reliability/reputation.
- Identify and select an appropriate turnkey supplier or an integrator (in the case of non-turnkey supply)
- Design and secure agreement for an engineering, procurement and construction (EPC) contract that reflects crucial aspects such as fixed costs conditions, performance guarantees and liquidated damages.
- Design and formulate a sound operation & maintenance (O&M) programme using a competent in-house team, or a reputable externally contracted O&M company.

Off-take
- Design, elaborate and secure agreement of a comprehensive electricity sales framework
- Ascertain that the off-taker of energy (power and/or steam) has a sound, long-term agreement (Power Purchase Agreement).
- If electricity is sold to the grid or to a third party, confirm the regulatory, logistical and technical aspects have been adequately assessed and any identified barriers have been addressed.

Financial viability
- Undertake required Pre-feasibility and/or Full Feasibility studies

- Provide detailed financial analysis that shows that the project is viable using conservative assumptions at different likely scenarios.
- Design and elaborate a robust financial model, which confirms an acceptable cash flow and adequate debt service coverage
- Develop a financing plan and secure the requisite agreement from potential financiers

Other development aspects

- Undertake additional studies and investigations that may be required such as Due Diligence.
- Prepare the Information Memorandum summarizing the major aspects of the project and submit to the financing institutions.
- Ensure permits, consents and other documentary requirements have been ascertained and completed.
- Assess risks and provide adequate mitigation measures that are commensurate with the level of risk and properly allocate different risks to the relevant and competent parties.
- Secure acceptance of the community and relevant interest groups to implement the plant.

The CIPs should lead to actual investments in projects that will become FSPPs. At this stage, further services will be provided to the project developer/owner(s) for the purpose of advancing the projects into implementation stage. Additional and more detailed services will be provided consisting mainly of the following aspects:

- Assistance in selection of technology and equipment suppliers
- Advice in project management and supervision during construction and commissioning
- Advice in the design of O&M framework and training of operators
- Assistance in PPA formulation and seeking approval from authorities
- Assistance in funds mobilization and financial packaging to attain financial closure
- Assistance in the preparation of Project Design Document (PDD) and other procedures necessary for CDM registration

5. Pre-Feasibility Studies Experts/Consultants

Qualifications:

- Minimum 10 years relevant experience in undertaking Pre-feasibility studies, Site prospecting to construction and commissioning
- Extensive expertise in cogeneration project development, preferably in developing regions (expertise in Eastern, Horn and Southern Africa will be an added advantage)
- Excellent command of spoken and written English, ability to write reports and good presentation skills

TOR

Subject to available information, the coverage of the pre-feasibility study to include (but not limited to):

- Introduction
    - Overview and objectives of the study
    - Study area
    - Brief on sugar/other agro-industry production and process
    - Regulatory framework (Licensing requirements for power generation and distribution; PPA)
    - Access to finance by sugar/agro-industries

- Cogeneration Technical pre-feasibility
    - Fuel resource assessment
    - Cogeneration technology assessment
    - Power/cogeneration plant design and engineering

- Demand analysis and Load Forecast
    - Current sugar factory/ agro-industries practices (Electrical and Thermal power)
    - Load Forecast assessment

- Economic Analysis
    - Cash Flows
    - IRR and NPV assessment

- Sensitivity Assessment
    - Preliminary identification of risks to achieving objectives and factors affecting sustainability.
    - Preparation of preliminary risk management
    - Sustainability strategies

- Initial environmental assessment of the activity
- Preparation of detailed TOR for a feasibility design study

6. Scoping Studies Experts/Consultants

Qualifications:

- Minimum 10 years relevant experience in undertaking scoping studies
- Extensive expertise in cogeneration assessments, preferably in developing regions (expertise in Eastern, Horn and Southern Africa will be an added advantage)
- Excellent command of spoken and written English, ability to write reports and good presentation skills

TOR:

Subject to available information, the scoping studies will cover (but will not be limited to) the following elements:

Introduction to the Scoping Study

- Sugar/Agro-industry Production
- Historical context of sugar/agro-industry sector
- Introduction to the Power sector
- Demography

Existing energy sources for Sugar/Agro-Industries

- Electric power
- Thermal Power

Local resources for Cogeneration power development

- Cogeneration fuel resource assessment
- Estimated cogeneration potential
- National know-how / capability for cogeneration
- Interest of the Sugar/other agro-industries in cogeneration development

General description of demand

- Sugar/other agro-industries
    - Electric power requirements
    - Thermal power requirements
- Review of demand in surrounding area
    - Households

- Other economic or industrial activities in the area

Regulatory framework assessment

- Key institutions and actors
- Current relevant activities in the power sector
- Policies and practices of PPAs between utilities and IPPs in the power sector
- Licenses and authorizations for independent cogeneration development and distribution
- Customs, taxes, levies and royalties for cogeneration development

Strategy for cogeneration development

- SWOT analysis and identification of priority cogeneration investment opportunities
- Business model recommendations
- Making financing available for cogeneration power investment
- Improving technical capacity in-country for cogeneration development
- Subsidies and support available for private sector rural electrification

TOR for Training courses

Subject to sponsors/stakeholders needs, envisaged training courses could cover the following areas:

- Fundamentals of cogeneration
- Cogeneration application and technologies
- Biomass as fuel for cogeneration
- Technical and feasibility analysis of cogeneration projects
- Operation and maintenance aspects
- Environmental aspects
- Finance,
- Power sector reform/tariffs
- Cogeneration in other non sugar agro-sector/forest industries

- **ANNEX Y: FORMAT FOR HALF YEARLY PROGRESS REPORT**
  as at 30 June and 31 December
  (Please attach a current inventory of outputs/Services when submitting this report)

1. <u>Background Information</u>

1.1 Project Number:

1.2 Project Title:

1.3 Division/Unit:

1.4 Coordinating Agency or Supporting Organization (if relevant):

1.5 Reporting Period (the six months covered by this report):

1.6 Relevant UNEP Programme of Work (2002-2003) Subprogramme No:

1.7 Staffing Details of Cooperating Agency/ Supporting Organization (Applies to personnel / experts/ consultants paid by the project budget):

Functional Title	**Nationality**	**Object of Expenditure** (1101, 1102, 1201, 1301 etc..)

1.8 Sub-Contracts (if relevant):

Name and Address of the Sub-Contractee	**Object of expenditure** (2101, 2201, 2301 etc..)

2. <u>Project Status</u>

2.1 Information on the delivery of outputs/services

	Output/Service (as listed in the approved project document)	**Status (Complete/ Ongoing)**	**Description of work undertaken during the reporting period**	**Description of problems encountered; Issues that need to be addressed; Decisions/Actions to be taken**
1.				

2.2 If the project is not on track, provide reasons and details of remedial action to be taken:

3. Discussion acknowledgment (To be completed by UNEP)

Project Coordinator's General Comments/Observations	**First Supervising Officer's General Comments**
Name: _____ **Date:** _____ **Signature:** _____	**Name:** _____ **Date:** _____ **Signature:** _____

Attachment to Half-Yearly Progress Report: Format for Inventory of Outputs/Services

a) Meetings (UNEP-convened meetings only)

No	Meeting Type (note 4)	Title	Venue	Dates	Convened by	Organized by	# of Participants	List attached Yes/No	Report issued as doc no	Language	Dated
1.											

List of Meeting Participants

No.	Name of the Participant	Nationality

b) Printed Materials

No	Type (note 5)	Title	Author(s)/Editor(s)	Publisher	Symbol	Publication Date	Distribution List Attached Yes/No
1.							

c) Technical Information / Public Information

No	Description	Date
1.		

d) Technical Cooperation

No	Type (note 6)	Purpose	Venue	Duration	For Grants and Fellowships		
					Beneficiaries	Countries/Nationalities	Cost (in US$)
1.							

e) Other Outputs/Services (e.g. Networking, Query-response, Participation in meetings etc.)

No	Description	Date
1.		

Note 4
Meeting types (Inter-governmental Meeting, Expert Group Meeting, Training Workshop/Seminar, Other)
Note 5
Material types (Report to Inter-governmental Meeting, Technical Publication, Technical Report, Other)
Note 6
Technical Cooperation Type (Grants and Fellowships, Advisory Services, Staff Mission, Others)

ANNEX Z: CASH ADVANCE REQUEST

Statement of cash advance as at .....
And cash requirements for the quarter of .....

Name of cooperating agency/ Supporting organization _____
Project No. _____
Project title _____

I. **Cash statement**

1. Opening cash balance as at ..... US$ _____
2. Add: cash advances received:

Date	**Amount**
.....	.....
.....	.....
.....	.....
.....	.....

3. Total cash advanced to date US$ _____
4. Less: total cumulative expenditures incurred US$ (_____)
5. Closing cash balance as at ..... US$ _____

II. **Cash requirements forecast**

6.Estimated disbursements for quarter ending .....US$ _____
7. Less: closing cash balance (see item 5, above) US$ (_____)
8.Total cash requirements for the quarter ..... US$ _____

Prepared by_____ Request approved by_____
Duly authorized official of cooperating agency/ supporting organization

NB: A cash request should be supported by a detailed itemized breakdown of estimated expenditures using the same budget lines as per the approved budget in UNEP format, Annex AD.

ANNEX AA: FORMAT OF QUARTERLY PROJECT EXPENDITURE ACCOUNTS FOR SUPPORTING ORGANIZATIONS

Quarterly project statement of allocation (budget), expenditure and balance (Expressed in US$) covering the period

..... to .....

Project No. ..... Supporting Organization .....

Project title: .....

Project commencing: ..... Project ending: .....

(date) (date)

Object of expenditure by UNEP budget code	**Project budget allocation for year.....**		**Expenditure incurred**				**Unspent balance of budget allocation for year .....**	
			for the quarter		**Cumulative expenditures this year**			
	m/m (1)	**Amount (2)**	**m/m (3)**	**Amount (4)**	**m/m (5)**	**Amount (6)**	**m/m (7)**	**Amount (2)-(6)**
1101 AFREPREN/FWD Regional Cogen Centre Coordinator and Director								
1102 Training & Capacity Building, Conference/Event Coordinator								
1103 Assistant/Associate Director, CIP and M&E Coordinator								
1104 Policy, Advocacy and Dissemination Coordinator								
1105 Technical Unit and Pre-Feasibility Coordinator								
1106 Project Development, Biomass Energy and Scoping Study Coordinator								
1107 Financing, Full Feasibility Study Coordinator								
1151 Finance/Project Accounts Team								
1152 Information Systems & Technology Coordinator								
1153 Secretary and Admin Support								
1201 Principal International Consultant								
1202 Business/Project Development Adviser								
1203 Financing Expert								
1204 Policy Expert								
1205 Feasibility Studies/Cogen Investment Packages (CIPs) - to be determined - Tanzania								
1206 Feasibility Studies/Cogen Investment Packages (CIPs) - to be determined - Uganda								
1207 Feasibility Studies/Cogen Investment Packages (CIPs) - to be determined - Kenya								
1208 Feasibility Studies/Cogen Investment Packages (CIPs) - to be determined - Ethiopia								
1209 Feasibility Studies/Cogen Investment Packages (CIPs) - to be determined - Sudan								
1210 Feasibility Studies/Cogen Investment Packages (CIPs) - to be determined - Malawi & Swaziland								
1211 Cogeneration Expert								

1212 Environmental Expert								
1213 National Cogen Experts - Tanzania								
1214 National Cogen Experts - Uganda								
1215 National Cogen Experts - Kenya								
1216 National Cogen Experts - Ethiopia								
1217 National Cogen Experts - Sudan								
1218 National Cogen Experts - Malawi								
1219 National Cogen Experts - Swaziland								
1220 Scoping studies - Tanzania (National Cogen Centre/National Focal Point/National experts)								
1221 Scoping studies - Uganda (National Cogen Centre/National Focal Point/National Experts)								
1222 Scoping studies - Kenya (National Cogen Centre/National Focal Point/National Experts)								
1223 Scoping studies - Ethiopia (National Cogen Centre/National Focal Point/National Experts)								
1224 Scoping studies - Sudan (National Cogen Centre/National Focal Point/National Experts)								
1225 Scoping studies - Malawi (National Cogen Centre/National Focal Point/National Experts)								
1226 Scoping studies - Swaziland (National Cogen Centre/National Focal Point/National Experts)								
1227 Pre-feasibility studies - Tanzania (could be sub-contract)								
1228 Pre-feasibility studies - Uganda (could be sub-contract)								
1229 Pre-feasibility studies - Kenya (could be sub-contract)								
1230 Pre-feasibility studies - Ethiopia (could be sub-contract)								
1231 Pre-feasibility studies - Sudan (could be sub-contract)								
1232 Pre-feasibility studies - Malawi (could be sub-contract)								
1233 Pre-feasibility studies - Swaziland (could be sub-contract)								
1234 Business plan for Africa Cogen Centre sustainability (could also be sub-contract)								
1235 Regional Cogeneration Expert								
1236 Regional Policy Expert								
1237 Regional Environmental Expert								
1238 Consultancy fee for Tanzania Cogen Office								
1239 Consultancy fee for Uganda Cogen Office								
1240 Consultancy fee for Kenya Cogen Office								
1241 Consultancy fee for Ethiopia Cogen Office								
1242 Consultancy fee for Sudan Cogen Office								
1243 Consultancy fee for Swaziland Cogen Office								
1244 Consultancy fee for Malawi Cogen Office								
1245 AfDB Task Manager Travel & DSA Costs								
1246 AfDB Contribution (AfDB Task Manager's time and Technical Assistance)								
1247 Activity related travel and DSA of international experts & resource persons								
1248 PSC and PMC seminars related travel								
1249 Other conferences, training workshops and consultative meetings - travel for international/regional experts & resource persons								
1250 Site visit/study tour/training - travel for international/regional experts & resource persons								
1251 Launching/Training/fundraising seminars travel for international/regional experts & resource persons								

1252 Cogeneration/training weeks travel for international/regional experts & resource persons 1253 Travel to Africa of International and Regional Experts and Resource Persons 1254 Per diem and accommodation for International and Regional Experts and Resource persons 1255 Domestic missions - Tanzania Cogen Office/Focal point/Expert 1256 Domestic missions - Uganda Cogen Office/Focal point/Expert 1257 Domestic missions - Kenya Cogen Office/Focal point/Expert 1258 Domestic missions - Ethiopia Cogen Office/Focal point/Expert 1259 Domestic missions - Sudan Cogen Office/Focal point/Expert 1260 Domestic missions - Malawi Cogen Office/Focal point/Expert 1261 Domestic missions - Swaziland Cogen Office/Focal point/Expert 1601 To accompany visiting experts and AfDB/UNEP Task Managers; PSC and PMC seminars related travel/DSA; Conferences, workshops and consultative meetings Travel/DSA; Activity related trips of project staff under Outcomes Travel/DSA; Site visit/study tour/training Travel/DSA; Launching/Training/fundraising seminars travel/DSA; Cogeneration/training weeks travel/DSA 1602 EA staff participation in Training courses, site visits and study tours, etc to Mauritius/Reunion/South Africa 3101 Internship stipend (accommodation, meals, local travel etc) 3201 Arrangements for conferences, training workshops & seminars in the main land region 3202 Capacity building/training activities 3203 Site visit/study tour/training arrangements 3204 Site visits/study tours/training travel/DSA to Mauritius/Reunion/South Africa 3205 Launching/Training/fundraising seminars arrangements 3206 Travel for participants for conferences, training workshops & seminars in the main land region; Per diem for all group training; Visibility/advocacy/training actions - Travel 3209 Visibility/advocacy/training actions - arrangements 3210 Management Training for EA staff 3301 Project Kick-off meeting arrangements 3302 Project kick-off meeting - travel 3303 PSC and PMC seminars -arrangements 3304 PSC and PMC meetings related travel/DSA 3305 Per diem for all meetings/conferences 4101 Consumables - office supplies Cogen Centre 4109 Other expendable equipment 4110 Laboratory costs 4111 Software tools (e.g. MS Project, other relevant software and any required upgrades) 4201 Rent of vehicles for field missions (Tanzania) and Cogen Centre 4202 Rent of vehicles for field missions (Uganda) and Cogen Centre 4203 Rent of vehicles for field missions (Kenya) and Cogen Centre								

4204 Rent of vehicles for field missions (Ethiopia) and Cogen Centre								
4205 Rent of vehicles for field missions (Sudan) and Cogen Centre								
4206 Rent of vehicles for field missions (Malawi) and Cogen Centre								
4207 Rent of vehicles for field missions (Swaziland) and Cogen Centre								
4208 Rent of Vehicle for Regional Cogen Centre								
4209 Purchase of Vehicles - Kenya								
4210 Purchase of Vehicles - Uganda								
4211 Purchase of Vehicles - Tanzania								
4212 Purchase of Vehicles - Ethiopia								
4213 Purchase of Vehicles - Swaziland								
4214 Purchase of Vehicles - Malawi								
4215 Purchase of Vehicles - Sudan								
4216 Purchase of Computer&Printer - Kenya								
4217 Purchase of Computer&Printer - Uganda								
4218 Purchase of Computer&Printer - Tanzania								
4219 Purchase of Computer&Printer - Ethiopia								
4220 Purchase of Computer&Printer - Swaziland								
4221 Purchase of Computer&Printer - Malawi								
4222 Purchase of Computer&Printer - Sudan								
4223 Furniture (Office desks, chairs, shelves) - Cogen Centre								
4224 Equipment (fax, photocopier, backup generator) - Cogen Centre (tbd)								
4225 Computers, LCD projectors, printers, scanners & accessories (tbd)								
4226 Cogeneration Equipment								
4301 Spare parts/equipment for machines, tools, office equipment and premises repairs/paints - Cogen Centre								
4302 Insurance for equipment								
4303 Office rent - Cogen Centre								
5101 Utilities and other services - Cogen Centre (electricity/water/sanitation/security/mechanical/heating/airconditioning/backup generator, spare parts and maintenance, etc)								
5102 Utilities and other services - National cogen office Tanzania								
5103 Utilities and other services - National cogen office Uganda								
5104 Utilities and other services - National cogen office Kenya								
5105 Utilities and other services - National cogen office Ethiopia								
5106 Utilities and other services - National cogen office Sudan								
5107 Utilities and other services - National cogen office Malawi								
5108 Utilities and other services - National cogen office Swaziland								
5109 Vehicle operating and maintenance costs - Cogen centre								
5110 Vehicle operating and maintenance costs Tanzania								
5111 Vehicle operating and maintenance costs Uganda								
5112 Vehicle operating and maintenance costs Kenya								
5113 Vehicle operating and maintenance costs Ethiopia								
5114 Vehicle operating and maintenance costs Sudan								
5115 Vehicle operating and maintenance costs Malawi								
5116 Vehicle operating and maintenance costs Swaziland								
5201 Publications/promotional materials/Subscriptions								
5202 Auditing, Tax Consultancy and Legal adviser								
5301 Communications (internet, webhosting, weblink crosschecking, online tools maintenance/upgrading and other related								

internet web expenses)and mailing expenses - Cogen Centre 5302 Communication and mailing expenses - National Cogen Office Tanzania 5303 Communication and mailing expenses - National Cogen Office Uganda 5304 Communication and mailing expenses - National Cogen Office Kenya 5305 Communication and mailing expenses - National Cogen Office Ethiopia 5306 Communication and mailing expenses - National Cogen Office Sudan 5307 Communication and mailing expenses - National Cogen Office Malawi 5308 Communication and mailing expenses - National Cogen Office Swaziland 5309 Telephone/Fax 5310 Bank charges , transaction and fund transfer costs								
5581 Monitoring and evaluation costs (2%)								
99 GRAND TOTAL								

Signed: _____

Duly authorized official of supporting organization

NB: The expenditure should be reported in line with the specific object of expenditures as per project budget

ANNEX AB: TERMINAL REPORT

1. Background Information

1.1 Project Number

1.2 Project Title

1.3 UNEP Division/Unit

1.4 Implementing Organization

2. Project Implementation Details

2.2 Project Activities (*Describe the activities actually undertaken under the project, giving reasons why some activities were not undertaken, if any)*

2.3 Project Outputs (*Compare the outputs generated with the ones listed in the project document*)

2.4 Use of Outputs (*State the use made of the outputs)*

2.5 Degree of achievement of the objectives/results (*On the basis of facts obtained during the follow-up phase, describe how the project document outputs and their use were or were not instrumental in realizing the objectives / results of the project)*

2.6 Determine the degree to which project contributes to the advancement of women in Environmental Management and describe gender sensitive activities carried out by the project.

2.7 Describe how the project has assisted the partner in sustained activities after project completion.

3. Conclusions

3.1 Lessons Learned (*Enumerate the lessons learned during the project's execution. Concentrate on the management of the project, including the principal factors which determined success or failure in meeting the objectives set down in the project document*)

3.2 Recommendations (*Make recommendations to (a) Improve the effect and impact of similar projects in the future and (b) Indicate what further action might be needed to meet the project objectives / results*)

4. Attachments

4.1 Attach an inventory of all non-expendable equipment (value over US$ 1,500) purchased under this project indicating Date of Purchase, Description, Serial Number, Quantity, Cost, Location and Present Condition, together with your proposal for the disposal of the said equipment
4.2 Attach a final Inventory of all Outputs/Services produced through this project

Attachment to Terminal Report: Format for Inventory of Outputs/Services

a) Meetings

No	Meeting Type (note 4)	Title	Venue	Dates	Convened by	Organized by	# of Participants	List attached Yes/No	Report issued as doc no	Language	Dated
1.											

List of Meeting Participants

No.	Name of the Participant	Nationality

b) Printed Materials

No	Type (note 5)	Title	Author(s)/Editor(s)	Publisher	Symbol	Publication Date	Distribution List Attached Yes/No
1.							

c) Technical Information / Public Information

No	Description	Date
1.		

d) Technical Cooperation

No	Type (note 6)	Purpose	Venue	Duration	For Grants and Fellowships		
					Beneficiaries	Countries/Nationalities	Cost (in US$)
1.							

e) Other Outputs/Services (e.g. Networking, Query-response, Participation in meetings etc.)

No	Description	Date
1.		

Note 4
Meeting types (Inter-governmental Meeting, Expert Group Meeting, Training Workshop/Seminar, Other)
Note 5
Material types (Report to Inter-governmental Meeting, Technical Publication, Technical Report, Other)
Note 6
Technical Cooperation Type (Grants and Fellowships, Advisory Services, Staff Mission, Others)

ANNEX AC: FORMAT FOR REPORT ON CO-FINANCING

Title of Project:							
Project Number:							
Name of Executing Agency:							
Project Duration:	**From:**		**To:**				
Reporting Period *(to be done annually)***:**							
Source of Cofinance	**Cash Contributions**			**In-kind Contributions**			**Comments**
	Budget original (at time of approval by GEF)	Budget latest revision	Received to date	Budget original (at time of approval by GEF)	Budget latest revision	Received to date	
Total							

All amounts in US dollars

Name: ……..

Position:……

Date:…….

ANNEX AE: INVENTORY OF NON-EXPANDABLE EQUIPMENT PURCHASED AGAINST UNEP PROJECTS

UNIT VALUE US$1,500 AND ABOVE AND ITEMS OF ATTRACTION
As at _____

Project No._____

Project Title _____

Executing Agency: _____

Internal/SO/CA (UNEP use only)_____

FPMO (UNEP) use only)_____

Description	**Serial No.**	**Date of Purchase**	**Original Price (US$)**	**Purchased / Imported from (Name of Country)**	**Present Condition**	**Location**	**Remarks/recommendation for disposal**

The physical verification of the items was done by:

Name:_____ Signature:_____

Title: _____ Date: _____

ANNEX AF: AfDB-UNEP/GEF CO-IMPLEMENTATION OF COGEN AND SMALL HYDRO/TEA PROJECTS [53]

Cooperation Modalities: AfDB, UNEP/GEF, AFREPREN/FWD and EATTA

Preparation, Execution and Implementation of the "Cogen for Africa" and Small Hydro "Greening Tea Industry" GEF Projects

Introduction

The Small Hydro "Greening Tea" and the Cogeneration in Africa projects are joint initiatives of the ADB and the UNEP/GEF to develop and implement clean energy investment projects within agro-industries in Africa. The initial phase of these two projects will involve the following countries:

"Cogeneration in Africa" Project	**"Greening the Tea Industry" Small Hydro Project**
Total approved amount from GEF **5,248 Million US$**	Total approved amount from GEF **2,854 Million US$**
- Ethiopia - Malawi - Tanzania - Kenya - Uganda - Swaziland - Sudan	- Kenya - Tanzania - Uganda - Zambia - Mozambique - Malawi - Rwanda - Burundi

For both initiatives, a list of investment opportunities with associated pre-feasibility studies has been compiled. In order to speed up the maturity of the potential investments to bankable level, funds are required for the preparation of full feasibility studies, environment, social impact assessment, capacity building, etc. Therefore, request for funds was sent to the Global Environment Facility (GEF) and approval in principle has already been received from the GEF Council waiting for a final letter of support from the co-implementing agency, ADB.

The project partners are:
- UNEP/DGEF : Co-implementing agency
- ADB : Co-implementing agency
- AFREPREN/FWD : Executing Agency
- EATTA (East African Tea Trade Association) : Executing Agency

Collaborative Arrangements

Collaborative arrangements and the role of each of the projects' partners is elaborated in the request (full-size project brief) sent to the GEF. The specific modalities for the two co-implementing agencies, ADB and UNEP/DGEF will be as follows but not limited to:

- Facilitation and coordination of ADB's assistance in the preparation of investments projects through the participation of the ADB Task Manager (or his/her representative) in Steering Committee Meetings of both projects which will be organized back-to-back.

- The associated mission expenses of the ADB Task Manager will be covered through UNEP/DGEF to ensure representation of ADB at Steering Committee Meetings.

[53] Detailed elements of strategy, hosting, recruitment and institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

In collaboration with UNEP/DGEF, AFREPREN/FWD and EATTA, the role and responsibility of the ADB Task Manager would be to assist in the following (a significant part of which will be undertaken in preparation of participation in Steering Committee Meetings):

- Investment project preparation through the technical assistance of an ADB "Energy Expert"
- Review and assessment of TORs/guidelines for full feasibility studies to ensure that they meet international banking and financing standards.
- Review and assessment of draft full feasibility studies prepared by both GEF projects to ensure that they meet international banking and financing standards.
- Review and assessment of the TOR, composition and functions of the Steering Committees for both projects.
- Review and assessment of budgets of both projects.
- Review and assessment of TORs and selection of AFREPREN/FWD-Regional Cogen Centre Director, associated local coordination team and national cogen centres plus EATTA-PMO Director and staffers.
- Review and assessment of TORs and selection of regional and international consultants/experts to be recruited by AFREPREN/FWD and EATTA.
- Participation in twice-a-year face-to-face Project Steering Committee & Management Meetings (PSC/PMC) of both GEF projects (additional PSC/PMC Meetings could be undertaken in the form of teleconferences) which also involve representatives of respective Executing Agencies (AFREPREN/FWD & EATTA).
- Any other assistance required to bring identified and sound investments to rapid realization.

Key principles that the co-implementers and executing agencies will adhere to and which will assist in ensuring expeditious development of mature and sound investments in both the cogen and small hydro sub-sectors include the following:

- Maximize budget allocations to full feasibility and pre-feasibility studies which are crucial for investment preparation and for convincing potential sponsors and financiers to make the required commitments.

- For local coordination, management and facilitation of project, maximize use of local expertise and skills found in Executing Agencies and the countries targeted by the project to ensure cost-effective use of project funding and long-term sustainability..

ANNEX AG: BRIEF ON PROPOSED APPROACH TO "COGEN FOR AFRICA" PROJECT[54]

Recommended that the proposed approach is build around 5 key strands:

1. Focusing resources and attention to central issue – investment
2. Leveraging AFREPREN/FWD network
3. Leveraging existing skills and staffing of AFREPREN/FWD
4. Maximizing utility of international and regional experts/consultants
5. Initially keeping governance structure light

1. Focusing resources and attention to central issue – investment

Interaction with industry representatives (Sithebe of RSSC, Swaziland), financial institutions (AfDB, Stanbic, East African Development Bank, Standard Chartered, Triodos, E&Co, Development Bank of South Africa, European Investment Bank, etc) confirmed key gap as:

> ***"High quality Pre-Feasibility and Feasibility studies that have active participation and endorsement of both project sponsors & potential financiers as well as reflecting the current reality/situation"***

The original Full Size Project (FSP) budget had or very modest allocation for Pre-feasibility and Feasibility studies (11% or $600,000 for 20 studies)

This could lead to situation of having a large long-term team of international, regional and national experts plus large Project Steering/Project Management Committees and no cogen investments on the ground – would question credibility of cogen project & cement the project into a rigid and stifling institutional grid-lock

A better strategy is to grow team as number of cogen investments opportunities and feasibility studies increase – similar strategy to what the Small Hydro/Tea project is pursuing.

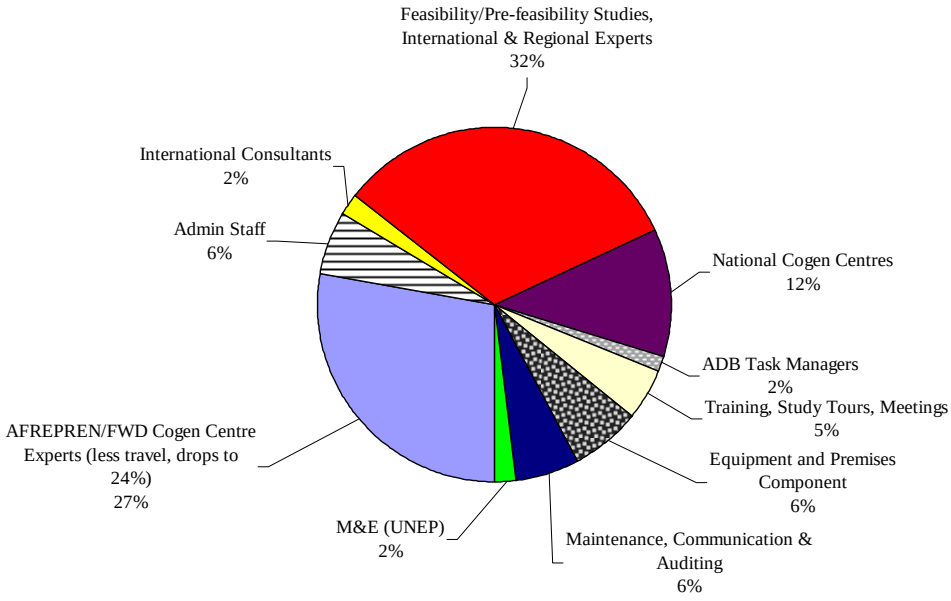
It is, therefore, recommended that substantial funds are set aside (33% see next graph) for Pre-Feasibility studies, Full Feasibility studies, Scoping Studies and preparation of Cogeneration Investment Packages (CIPs) to be commission as and when needed (see attached proposed detailed budget).

It is recommended that studies are spread out over 6years with the bulk of studies undertaken in first 2 years - initially prepared by international/regional consultants/experts or consulting firms, and subsequently to include significant contribution from AFREPREN/FWD Cogen Centre staff in later years as in-house expertise and experience is strengthened and strong rapport is developed with potential financiers and project sponsors.

Funds for feasibility studies to be sourced from reduced allocations to international and regional consultants who are expected to be involved in providing short-term support that might be required (e.g. validating pre-feasibility and full feasibility studies) and, in later years, assist in Training, Capacity Building and raising additional co-financing. Awareness creation and training workshops/events/study tours to be toned down in early years to allow for focused attention on moving investment opportunities forward.

[54] Detailed elements of strategy, hosting, recruitment and institutional arrangements elaborated based on principles spelt out in the original project brief approved by Council and indepth discussions between co-implementing agencies (UNEP & AfDB) and executing agency (AFREPREN/FWD) which took place after Council approval.

UNEP/GEF Contribution



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2. Leveraging AFREPREN/FWD Network

To better leverage AFREPREN/FWD regional network and expertise:

- Resources (including a vehicle plus computer/printer for each country) have been set aside for establishing national cogen offices/focal points to coordinate local activities, provide contacts, ensure regular follow-up on identified investment opportunities and build capacity

- Modest resources have been set aside for national cogen offices/focal points/experts to undertake scoping studies in other agro and forest sub-sectors (tea, wood, coffee, sisal, palm-oil, rice, etc) and identify and build pipeline of cogen investment opportunities.

3. Leveraging Existing Skills and Staffing of AFREPREN/FWD

To ensure that the project's initial focus is on investments (and is not dissipated in the vagaries and complications associated with assembling a whole new team), it is recommended that staffing of the AFREPREN/FWD Africa Regional Cogen Centre is drawn from existing AFREPREN/FWD staff with the right skills, qualification and exposure. This will also allow rapid initiation of the project (avoid delays associated in getting the requisite work permits for international experts), and be cost effective as existing AFREPREN/FWD staff are not as highly paid as international and regional experts.

To address any skills gap, the staff of the AFREPREN/FWD Africa Regional Cogen Centre will be supported by part-time regional and International Experts to be contracted as and when needed.

4. Maximizing Utility of International and Regional Experts/Consultants

It is expected that the bulk of the international/regional experts as well as country experts will be contracted to undertake pre-feasibility and feasibility studies (Cogeneration Investment Packages - CIPs), as well as other studies and training activities that may be required. The involvement and contribution of the International/Regional Experts will ensure:

- High quality technical and financial implementation of the project

- That lessons and experience in other parts of the world are considered and adapted, whenever necessary
- Transfer of knowledge and capability to regional/local personnel.

Thus, the person-power requirements and responsibilities of the International Experts are structured to fulfill the above factors. It is expected that at the beginning of the project, the capacity contribution and level of efforts of the International Experts will be high, primarily focused on pre-feasibility and feasibility studies (CIPs). As time progresses and internal capacity building takes place, the capacity contribution and level of efforts of the International Experts are expected to diminish and the Regional/Local expertise takes a more centre stage in the activities of the project.

It is difficult to determine exact use of external experts as it would differ from investment to investments. It could be a question of reliable biomass fuel supply or PPA or tariff or grid access or establishment of separate IPP or financial structure.

As exact needs cannot be determined at this stage, modest resources have set aside for national, regional and international experts in power sector, regulation, biomass energy, institutional/legal issues, energy sector and cogeneration to be available at short notice for key assignments, travel and providing advice to ensure that investment opportunities move forward.

Experts to be assisted by back-up local technical/financed/administrative staff and local/regional expert consultants at AFREPREN/FWD Regional Cogen Centre to ensure continuity, expeditious follow-up of investments opportunities and support.

5. Initially Keeping Governance Structure Light

To ensure rapid initiation of project, avoid build-up of a bureaucracy in early stages of project development, it is recommended that the initial composition of both Project Steering Committee (PSC) and Project Management Committee (PMC) kept modest and expanded as cogen opportunities are exploited and more countries have active cogen investments

It is, therefore, suggested that initial PSC is composed of UNEP/GEF, AfDB, AFREPREN/FWD and representatives from 1-2 countries with near-term cogen opportunities. The PSC to be expanded at a latter stage as number of cogen investments increases in more countries. The PMC can be slightly larger to accommodate more countries that have medium-term cogen investment opportunities.

Recommended Approach Summarized

The next graph succinctly summarizes the proposed approach to the "Cogen for Africa" project which is likely to lead to near-term results and rapidly credibility of this cogen
initiative.