



Global Environment Facility

MOHAMED T. EL-ASHRY
CHIEF EXECUTIVE OFFICER
AND CHAIRMAN

February 21, 2001

Dear Council Member:

The UNDP, as the Implementing Agency for the project, *India: Biomass Energy for Rural India*, has submitted the attached proposed project document for CEO endorsement prior to final approval of the project document in accordance with UNDP procedures.

The Secretariat has reviewed the project document. It is consistent with the proposal approved by the Council in December 1999 and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by the UNDP satisfactorily details how Council's comments and those of the STAP reviewer have been addressed. I am, therefore, endorsing the project document.

We have today posted the proposed project document on the GEF website at www.gefweb.org. If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

cc: Alternates, Implementing Agencies, STAP



United Nations Development Programme
GLOBAL ENVIRONMENT FACILITY (GEF)



30 January, 2001

Dear Mr. El-Ashry,

Subject: IND/99/G32/A/1G/99 – India: Biomass Energy for Rural India

I am pleased to enclose the project entitled "India: Biomass Energy for Rural India" approved through the December 1999 GEF Executive Council. Also enclosed is the response to comments provided by Council members.

As per paragraph 29 and 30 of the GEF Project Cycle, we are submitting this project to you for circulation to the Executive Council Members for comments and, subsequently, for your final endorsement.

Thank you in advance for expediting the review and approval of this project.

Yours sincerely,


Rafael Asenjo
Executive Coordinator

Mr. Mohamed El-Ashry
Chief Executive Officer
Global Environment Facility
Room G6005
1776 G Street
Washington, D.C. 20433
PM

Response to Technical Comments submitted by Council Members on Climate change and Ozone Work program Approved in December 1999

GEF Council Comments	Response
<p align="center">Comments from Germany</p> <p>1. The Project concept is very acceptable with respect to rural development goals, but the estimation of the incremental costs seems to be overly optimistic in the long run.</p> <p>2. The project has estimated that the incremental cost is negative with approximately 1,390,000 US\$. Nevertheless, the GEF will support the project with US\$ 4,2 Mio. The expected emission reduction are estimated to be 54000 t CO₂ over a period of 25 years, resulting in cost of 78 US\$ per ton of carbon. Assessments over 25 years for a new technology in Indian villages have a lot of uncertainty.</p> <p>3. But the estimation made for the whole of 86,000 non-electrified Indian villages claiming this may result in 177 million tons of carbon reduced, is much beyond a sound assessment and therefore not acceptable.</p> <p>4. In a certain way, the project seems to have more the character of rural development project – which of course is welcome – but less the character of an effective long-term carbon reduction project. The GEF should be aware of this problem and emphasize the objectives, which are within its own mandate in future projects.</p>	<p>1. The costs on bioenergy technology package, particularly, on hardware are likely to decline with growing market volume, which is likely to develop as a result of the project. Further, the implementation or transaction costs are likely to decline due to replication potential making the package even more attractive, once economies of scale are achieved. Gas-engine development, market volume development and decline in implementation costs will lead to further reduction in GEF scenario costs making it even more attractive in the long-term, due to the proposed project implementation.</p> <p>2. The incremental costs have been estimated using the GEF guidelines. The proposed bioenergy package as an alternative project case scenario is a low cost option and as the prices of fuels and electricity are escalating, the viability of this alternative may be better in the long run. Given the rural scenario however, there could be many uncertainties – the project therefore has not only identified the barriers, which are incremental, but will attempt to reduce them through participatory approaches. Further, different institutional models will be tested for the impacts, mainly for sustaining the end-use/ bioenergy services for sustainable development. The project once implemented will have multiplier effect in other regions of India, leading to large mitigation of carbon. Thus the real long-term cost-effectiveness (\$/tC) will be very low.</p> <p>Since the proposed project adopts innovative approach, there may be associated uncertainties. The PDF phase has attempted to mitigate some of the associated risks and one of the objectives of the full project will be to demonstrate the commercial viability of the concept.</p> <p>3. The estimation of abatement is based on the assessment of likely energy consumption made during the PDF phase, using the standard norms. The projection at this stage is linked to the success of the proposed initiative and continuing Government Programmes. The project proposes to establish intensive monitoring mechanisms for studying the project impacts during and after the implementation of the GEF project.</p> <p>It is difficult to assess the long-term carbon abatement potential at this stage. It is even possible to argue that 86,000 unelectrified villages assumed in the project is a conservative estimate, if the project is successfully demonstrated. The projections show that the electricity supply to rural areas will continue to be characterized by low reliability and shortages. Bioenergy is the only renewable energy technology that is not only feasible just in 86,000 villages but also can potentially cover majority of the 550,000 rural villages in India in the long run.</p> <p>4. The project has been integrated with the national priorities and developed under the GEF OP-6. The proposed technological options conform to the IPCC identified carbon mitigation options.</p> <p>There are a large number of studies at national level in India as well as at the global level to show that the bioenergy technologies have the largest potential to meet rural energy in developing countries in the long-term, in Africa, and remote areas of Asia and Latin America. The few attempts made earlier to promote renewable energy technologies have often failed mainly as the focus was on technology rather than meeting the real priority needs of local communities and economy. One of the unique aspects of this project is to integrate energy generation with end-use systems to sustain the project.</p>

<p>Comments from Switzerland</p> <p>5. This project aims at demonstration and dissemination of small big-energy systems and services in rural areas. It addresses the OP6 Promoting the adoption of renewable energy by removing barriers and reducing implementation costs.</p> <p>The results of such a project are very important, as it is the first of its kind. The concept of the project is very interesting and should be supported. It should open new avenues in decentralized energy systems in rural areas.</p> <p>Main Concerns</p> <p>6. The big-energy technologies, especially biomass gasifiers, even though demonstrated at a laboratory and pilot level, have not yet been proven entirely on a commercial operation level. The project proposal assumes that reliable technical solutions will be found, developed, and tested in a very short time, and then disseminated. The time scale envisaged (5 years) for the development, testing, and dissemination of new technologies seems rather rapid. This project has an embedded R&D component, which should not be underestimated. The danger of pushing non-mature technology in the field could be extremely detrimental.</p> <p>Further Commentaries</p> <p>7. It is not clear who is in charge of the development of specifications for the systems. It would be recommended that manufacturers be involved in the development of biomass gasifier specifications and technology package in their entirety and not only for the engines.</p> <p>Conclusions and Recommendations</p> <p>This project addresses important issues of energy supply and services in remote rural areas. It should be supported by GEF. As it is of international interest, it should be supported with international technical expertise when required and monitored independently at international level.</p>	<p>Comments noted.</p> <p>6. The dual-fuel (85% diesel replacement) small-scale biomass gasifier technology is readily available off-the-shelf. The proposal is based on dual-fuel concept and all the estimation of costs and mitigation potential, made in the project proposal, is based on dual-fuel operation. The project implementation can start from day one using the readily available dual-fuel gasifier designs. The only R&D component is for gas-engines, for 100% diesel replacement. This will require only adaptation of the existing designs. The biomass-gasifier technology and bioenergy technology package is an appropriate option for mitigating the GHGs as 85% of the diesel used will be replaced even under the dual-fuel operation. Further, gasifier is only one of the components of the bioenergy package. Biogas for cooking and baseload electricity and forestry for energy plantation are other components.</p> <p>The gasifier and biogas technologies are commercially proven in India with about 35 MW of installed gasifier based power capacity and 3 million biogas plants (as of December 2000). The solution referred in the project context refers to the end use of energy or energy services. Since, the earlier attempts to disseminate the bioenergy technologies focused primarily on the supply side, it is for the first time that the bioenergy technologies have been integrated into a solution package, namely, lighting, irrigation water, cooking gas and so on. The project would attempt to develop and test standardized bioenergy packages and not test technologies.</p> <p>The R&D in the proposed project context will not imply basic R&D but will focus on cost reduction aspects. This component will facilitate use of gas engines (not a new technology) in addition to the already established dual fuel (gas+diesel) mode IC engines.</p> <p>7. The Center for ASTRA at Indian Institute of Science, which is one of leading Advanced Centers in developing biomass gasifier designs will develop the specifications for the systems in collaboration with the manufacturers. The Combustion and Gasification Laboratory at ASTRA is closely working with the commercial gasifier manufacturers. The existing suppliers will supply the system as per the recommended specifications.</p> <p>The project would establish mechanisms for independent monitoring and evaluation, and will bring in international expertise through consultations, workshops, case study documentation, and field missions.</p>
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**UNITED NATIONS DEVELOPMENT PROGRAMME
GLOBAL ENVIRONMENT FACILITY
PROJECT OF THE GOVERNMENT OF INDIA
Project Document**

Project Number : IND/99/G32/A/1G/99
 Project Title : India: Biomass Energy for Rural India
 Duration : 5 years
 Project Site: : Tumkur District, Karnataka
 ACC/UNDP Sector : 20 Environment / 30 Environment Enhancement & Management
 Government Sector : Environment
 and sub-sector : Climate Change
 Government Counterpart : Department of Economic Affairs, Ministry of Finance
 Executing Agency : Department of Rural Development, Government of Karnataka
 Implementing Agency : Karnataka State Council of Science and Technology (KSCST),
 Bangalore

UNDP/GEF	: US\$ 4,017,000
<i>Co-financing:</i>	
Bilateral- ICEF	: US\$ 2,495,000
Government of Karnataka	: US\$ 1,481,000
Government of India (MNES)	: US\$ 391,000
Others	: US\$ 239,000
Total	: US\$ 8,623,000

Estimated Starting Date : April 2001

Brief Description: This project aims at developing and implementing a bioenergy technology package to reduce GHG emissions and to promote a sustainable and participatory approach in meeting rural energy needs. The project will be implemented mainly in a cluster of about 24 villages of Tumkur district in Karnataka. The project goals will be achieved through (i). Demonstrating the technical feasibility and financial viability of bioenergy technologies on a significant scale, (ii). Building capacity and developing appropriate mechanisms for implementation, management and monitoring of the project; (iii). Developing financial, institutional and market strategies to overcome the identified barriers for large-scale replication of the bioenergy package for decentralized applications; and (iv). Disseminating the bioenergy technology and information package on a large scale.

On behalf of	Signature	Date	Name & Title
The Government of India Department of Economic Affairs	_____	_____	Rita Acharya Deputy Secretary (FB)
Executing Agency Government of Karnataka	_____	_____	M R Sreenivasa Murthy Secretary
UNDP	_____	_____	Brenda Gael McSweeney Resident Representative

Exchange Rate at the time of Project Document Signature: 1 US\$ =

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A. BACKGROUND AND CONTEXT

A.1 Energy Sector Background

India has accorded priority to energy in its development plans by devoting a quarter of the national budget to it. Primary energy use in India is dominated by coal (40% of total primary energy supply and 59% of power generation); followed by fuelwood (34%); and petroleum fuels (15%). The share of fossil fuels is projected to increase from around 60% during 1995-96 to 74% of total energy use by 2010. This growth in fossil fuel consumption will result in enhanced greenhouse gases (GHG) emissions. Increased dependence on fossil fuels and fuelwood (in rural areas) is likely to lead to local and regional environmental problems (such as air and water pollution, and land degradation). Further, increased dependence on oil will lead to adverse balance of payments, as over 60% of oil are currently imported. The Ninth Five-Year Plan (1997-2002) aims to address some of these issues by:

- Accelerating rural electrification with due attention to decentralized energy sources;
- Gradually commercializing renewable energy; and
- Rationalizing tariff structure.

Rural Energy: The rural population in India (about 700 million) consumes only about 40% of the total energy and about one-third of the total power generated. Irrigation (11 million electric pumps, projected to reach 19 million) alone in agricultural sector consumes over 85% of the power supplied to rural areas. Even though over 85% of villages are connected to the electricity grid, less than a-third of rural households are electrified and the rest use kerosene for lighting. Where available, electricity supply is characterized by erratic supply, fluctuating voltage and shortages. Further, the extraction of biomass from forest and village trees, low efficiencies of devices and high human drudgery associated with cooking characterize the rural energy consumption pattern. Thus, meeting cooking and irrigation energy requirements through renewables provide a large potential for sustainable development.

Energy and Environment: The environmental implications of current energy use--such as GHG emissions, deforestation, land degradation, water and air pollution-- have been a cause of great concern. Carbon emission in India (from energy sector) is projected to increase from 508 Mt CO₂ in 1990 to 1646 Mt in 2010 (ALGAS, 1998). The consumption rate of fuelwood in rural areas is a matter of high concern as it has already led to, and will continue to lead to an increased pressure on tree resources such as forests and village trees.

Human Context of Energy: The dependence of the rural population on biomass for cooking and other heating activities impacts negatively on the health of women due to the associated drudgery involved in gathering, processing and use of biomass.

A.2 Renewable Energy Strategy

Renewable Energy: The Indian Government has placed emphasis on renewables in the country's future energy plans. The renewable energy policy being formulated aims at transition from a fossil fuel-based energy economy to a renewable energy economy, leading to improved living conditions in rural areas while promoting equitable and sustainable development. Renewable energy programs are implemented by the Ministry of Non-conventional Energy Sources (MNES) through a network of state level nodal agencies and its supportive and financial arm, the Indian Renewable Energy Development Agency.

India has implemented one of the largest renewable energy programmes in the developing world. Solar, wind and biomass are the dominant renewable energy programmes implemented. Biomass programme includes fuelwood conservation through efficient cookstoves, biogas plants for cooking (and

for village electrification), biomass gasifiers for thermal and electrical applications (rural electrification) and biomass power (multi megawatt system for supply to grid). MNES provides subsidies for biogas plants, improved stoves, and village (rural) electrification programmes based on biomass gasifiers as well as community biogas plants and for biomass power projects. Despite several programmes on biomass energy, the rate spread is very low.

- Less than 5% of rural population is covered under biogas programme for cooking.
- Very few biomass gasifier based rural electrification projects (less than 10 village projects dispersed in different parts of India, out of 0.5 million villages).
- Less than 10% of rural households provided with improved cookstoves (assuming only 1/3 of the nearly 30 million improved stoves built are in use and conserve fuelwood).

Government of India (MNES) has a goal of meeting at least 10% of the national energy from renewables. During 1997-98 less than 2% electricity generated was contributed by renewables. Thus India will have to find alternate strategies to increase the rate of spread of renewables, particularly bioenergy.

A.3 Prior Ongoing Assistance

A number of projects, in the bioenergy sector, funded by multilateral and bilateral agencies are being implemented in India. UNDP-GEF and UNDP has also supported several projects.

- UNDP-GEF project “Biomethanation”
- UNDP “Energy and Environment” sub-programme
- Dutch funded AIJ (Activity Implemented Jointly) project on “Biomass gasification”
- USAID funded sugar mill-cogeneration project.

However, there are no externally funded projects on bioenergy for meeting all the rural energy needs in a sustainable way providing local and global (including CO₂ mitigation) environmental benefits. Dissemination of even the MNES funded programmes on different bioenergy technologies face technological, financial and institutional barriers.

A.4 Institutional Framework for Subsector

In India, dissemination of renewable energy programmes involves multiple agencies at national, state and local levels.

- **National Level:**
 - **MNES:** The Ministry of Non-conventional Energy Sources is the Ministry dedicated to promotion of renewables. MNES has three major sections:
 1. Rural energy
 2. Power generation
 3. Urban waste
 - **IREDA:** India Renewable Energy Development Agency is the financial arm of MNES.
- **State Level:**
 - **State Nodal Agencies:** Each state has a nodal agency to promote renewables in the state, which collaborates with MNES, district agencies, manufacturers, NGOs etc.
- **Local Level:** The actual implementation (dissemination, marketing, maintenance, monitoring, manufacturing, etc.) is carried out by several government and non-governmental agencies, namely, district rural development agencies, NGOs, companies, corporations, small entrepreneurs etc.

B. PROJECT JUSTIFICATION

B.1 Scientific and Technical Basis for Assistance for Bioenergy Package

The proposed project focuses on providing high quality rural energy services that are critical to the promotion of development and quality of life in rural areas. It aims at meeting the energy needs of these services of the rural population viz., heat energy for cooking and electricity for lighting and shaft power, through a bioenergy package. Figure 1 presents the bioenergy package.

Bioenergy Package for Carbon Emission Reduction: The proposed bioenergy package has emerged from the Centre for Application of Science and Technology to Rural Areas (ASTRA), Indian Institute of Science's scientific research, development and small scale demonstrations over the past 10 to 15 years in a few villages in Karnataka. The assessments of the bioenergy potential in India show that a biomass strategy based on “sustainable forestry – biomass gasifiers - biogas systems” can meet all the rural energy needs with significant local and global environmental benefits. Bioenergy Systems in Pura village based on community biogas and in Hosahalli village based on energy forest-wood gasifier system have provided significant lessons to the proposed bioenergy project.

Heat energy for cooking: The alternative renewable energy options for meeting cooking energy requirements are improved cook-stoves and biogas plants. The non-renewable energy options are kerosene and LPG, which are penetrating slowly in rural areas due to high costs (of device and fuel) and limited or non-accessibility. Family size biogas plants, based on cattle dung, have limited potential due to inadequate cattle dung availability and high initial cost. A few isolated field experiments and national level assessments have shown the technical potential of cattle dung and leaf litter-based biogas systems to meet the energy needs of cooking in rural India.

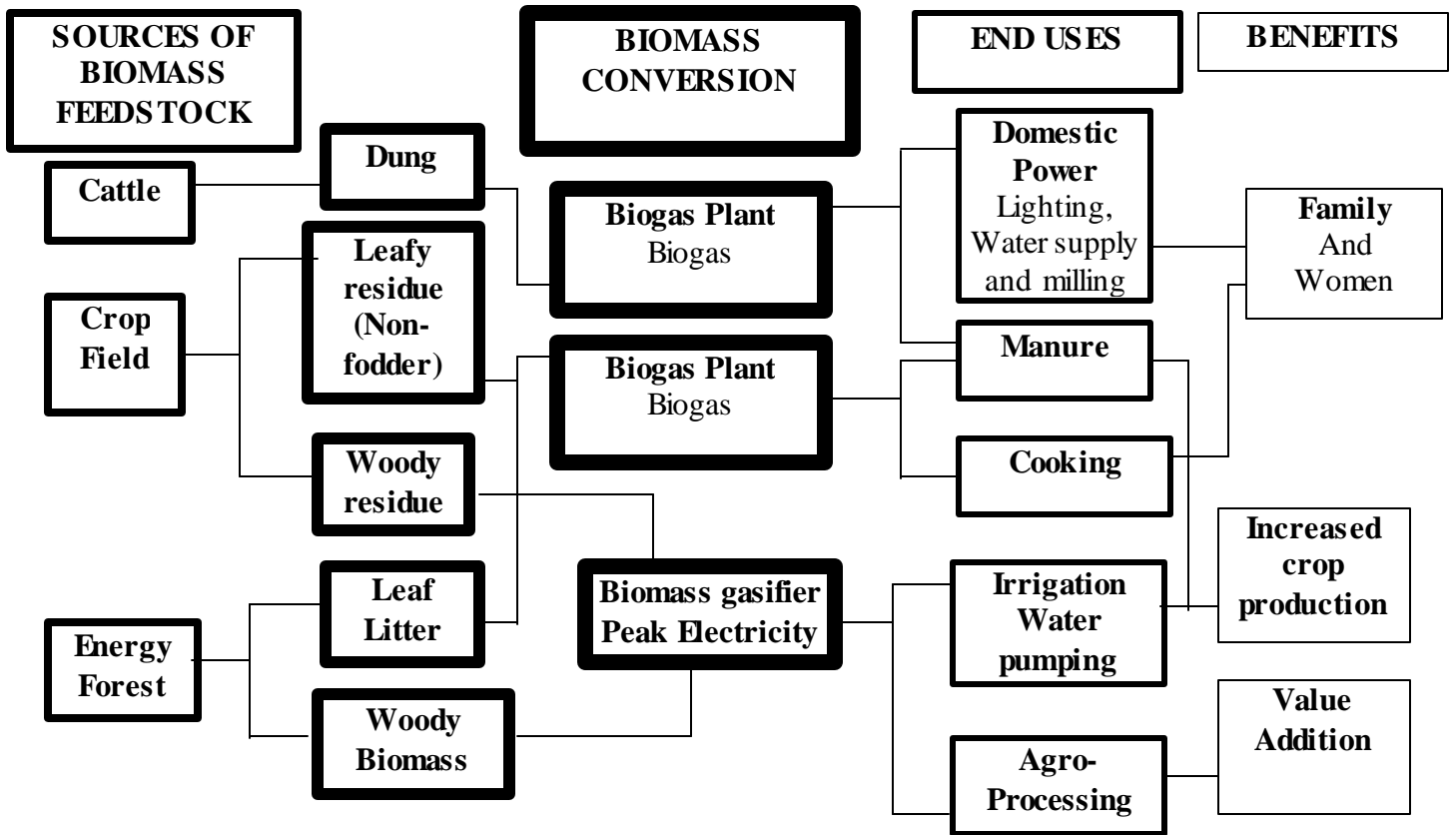
Electricity for lighting and shaft power applications: The features of rural electricity (viz., low and dispersed loads, high T & D costs and losses and seasonality of the load) favors a decentralized approach for meeting the rural electricity needs. Biomass based technologies have the potential to meet the decentralized electricity requirements at different scales (kW to MW) in all locations, where biomass is available or can be produced sustainably. Unlike other decentralized electricity options, biomass based technologies have the potential for supplying electricity on a continuous and year round basis. Woody and leafy biomass feedstock will be available through out the year, including winter and rainy seasons, even in the semi-arid region.

Bioenergy technologies have the following advantages:

- Replacement of fossil fuels and non-sustainable fuelwood with sustainable modern biomass energy leading to GHG emission reductions and carbon sequestration;
- Reclamation of degraded lands and watershed protection;
- Creation of rural jobs and income generation from reliable and quality energy supply;
- Reduction in consumption of kerosene (for lighting) and diesel (for water lifting) used in rural areas, leading to reduction in imports with macro-economic benefits;
- Reduction in overloading of central grid system by de-linking rural grids, leading to improved electricity supply to urban and industrial sectors; and
- Reduction in subsidy outflows from the Government budget allocation to petroleum fuels and grid electricity for rural uses leading to improved financial viability of electricity and petroleum utilities.

FIGURE 1

BIOENERGY TECHNOLOGY PACKAGE



In addition to these benefits, when delivered energy is considered, bioenergy options are financially attractive or competitive for meeting rural energy needs.

B.2 Barriers to Bioenergy Technologies

Despite their technical feasibility and multiple benefits, bioenergy technologies have not spread in India, apart from a few isolated demonstration projects. Bioenergy technologies have so far failed to make an impact on the rural energy scene due to a number of technical, market, information, financial and institutional barriers.

Technical Barriers: As a result of the limited success and scale of previous bioenergy demonstration initiatives, the operational feasibility and financial viability of an integrated bioenergy package has yet to be proven. This is a key barrier resulting in *high-perceived* risks attributed to the technology by the manufacturers, entrepreneurs, and end-users. In addition, the lack of standardization has led to poor reliability of these bioenergy packages. Limited availability of sustainable biomass is yet another barrier to the use of gasifiers.

Institutional Barriers: The insufficient capacity of the village-level institutions for implementation of bioenergy services package in rural areas also serves as a significant barrier. There are also institutional-related financing barriers (e.g., the absence or lack of micro-credit facilities at the target users' level).

Information Barriers: The lack of awareness and information on viable technological configurations act as a barrier to promotion of these technologies.

Financial Barriers: The high perceived technical and institutional risks act as major barriers to investments in bioenergy. Furthermore, the lack of capital for investments and the risk involved has acted as a de-motivating factor for private enterprises.

Market barriers: Bioenergy technologies, in general, have to compete with the conventional sources of energy either with subsidized electricity and fossil fuels (kerosene) options or freely accessible fuelwood and biomass residues. In such a situation, *absence of a level playing field* acts as a key barrier to market penetration.

B.3 Project Rationale

The project aims to reduce CO₂ emissions through the promotion of bioenergy as a viable and sustainable option to meet the rural energy service needs in India. Further, it would provide decentralized bioenergy technology packages for the provision of good quality rural energy services for lighting, drinking water supply, cooking gas, irrigation water supply, and milling; and help in removing key barriers to large-scale adoption and commercialization of bioenergy technology packages.

This project has been prepared to be consistent with the goals and guidelines of the GEF Operational Program 6: “Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs”.

B.4 Linkages to Local, National and Global Development Objectives

The target beneficiaries include rural households (women and farmers), rural entrepreneurs, manufacturers of bioenergy systems, and NGOs. The project proposes to improve the quality of life of women by providing biogas for cooking, electricity for piped water supply and home lighting to all the

households in about 24 villages. About 2000 farmers will benefit from the provision of reliable electricity for lifting water for irrigation; increasing agricultural yields from bio-fertilizer; and increased incomes from farm forestry. All 24 villages will benefit from community participation and village-level institutional development. The project will create opportunities for entrepreneurs through bioenergy systems and service activities such as installation, operation, maintenance, and training. At least fifteen entrepreneurs from each of the four southern states will be selected and trained. The feedback from project monitoring should lead to technological improvements. Initially, one manufacturer from each of the four southern states will be involved in the infrastructural and capacity building programmes. While the Government is likely to gain on policy issues, NGOs will also be involved in the capacity building exercises.

The proposed project supports India's stated national development objectives. The Ninth Five-Year Plan envisages a shift to decentralized and renewable energy in the long-term besides reclamation of degraded land; and rural employment generation. The energy policies aim at reducing dependence on fossil fuels and providing reliable and quality fuels and electricity for all the activities in rural areas, thereby improving the rural quality of life without increasing local and national-level environmental problems. The bioenergy package meets these developmental objectives.

On a global level, this project will facilitate a CO₂ neutral path for sustainable development and serve as a model for other developing countries. It will demonstrate the commercial viability of bioenergy package and enable its widespread adoption in rural India. The anticipated global environmental benefits are:

- Zero or negative net CO₂ emissions through sustainable supply of bioenergy;
- Carbon sequestration in degraded lands through forestry options; and
- CO₂ emission reduction through substituting fossil fuels with bioenergy.

B.5 EXPECTED END OF PROJECT SITUATION

The duration of the project is five years. The project will be implemented in phases. The hardware component (energy generation as well as end use system) commissioning will be completed by the end of third year (at 20% during year-1, 40% during year-2 and year-3). The barrier removal activities will be simultaneously carried out during all the five years of the project. The following would be achieved by the end of the project.

- **Demonstration of Bioenergy End-use Systems**
 - 1.2 MW of total woody biomass gasifier based system with a generating potential of 4800 MWh of bioelectricity annually, mainly for irrigation; these systems will not be operated year round, for example, during peak rainy season;
 - 120 kW community biogas cum bio-fertilizer systems generating 346 MWh for base loads for lighting and drinking water throughout the year; these activities have fixed load and the services are required year-round.
 - 45 community biogas cum bio-fertilizer systems in 24 village settlements with a total capacity of 4000m³/day (range 25 to 100m³/day) for cooking gas and bio-fertilizer production.
 - Establish around 400-500 ha of short rotation forest plantations; 300-400 ha of agro-forestry systems; 200-300 ha of community forestry; 400-500 ha of orchards; and 100-125 ha of high input forestry; and
 - Lessons in different modes of providing the rural energy service package to rural villages, including experience in gaining full cost recovery.

- **Standardization of Technology Packages**
 - Gas engines will be developed based on technology development and adaptation which are made available locally to use the renewable feedstock proposed under the project;
 - Detailed technical specifications will be prepared for the proposed bioenergy packages in selected areas; and
 - Draft standards for bioenergy technologies will be developed for wider replications.
- **Enhanced Institutional and Financial Capacity**
 - Empowerment and participation of women in planning and management of bioenergy packages,
 - Trained entrepreneurs, NGOs and managers operating and managing the project,
 - Trained entrepreneurs, NGOs, managers, manufacturers for replication projects in other parts of Karnataka and India, and
 - Infrastructure established for manufacturing and service support, spare part supply and servicing.
- **Case studies and Policy Documents Prepared and Disseminated through Policy Workshops**
 - Case studies on successful policies prepared (at least 10 case studies),
 - Reports on project experience prepared (on technology performance, institutional development, economic viability etc), and
 - Audio-visual material on project prepared.
- **Information Disseminated for Replication and Policy Impact**
 - “Bioenergy-technology-institutional” package developed,
 - Policy Workshops held for policy makers,
 - “Bioenergy-technology-institutional” package disseminated through workshops, mass media, field visits and soon.
- **Financial Barrier Removed and Investment Risk Fund Created**
 - Venture capital provided for 20 franchisers and franchisees,
 - Revolving fund created and functioning, and
 - Financial viability and willingness to pay among rural households demonstrated.

Thus, the project-end situation would include functional bioenergy-enduse systems, barriers overcome and replication strategies in place for India.

B.6 TARGET BENEFICIARIES

Households: Upto 2500 households benefit from provision of biogas for cooking, electricity for piped water supply and home lighting contributing significantly to the improvement of quality of life of women.

Farmers: Upto 2500 farmers to be provided with reliable electricity for lifting water for irrigation, bio-fertilizer and farm forestry will contribute to increased incomes.

Village communities: Village communities will benefit from community institution development and capacity building among women, common property resources (degraded lands, soil and water) conservation and development diversified employment opportunities.

Women’s Enterprise: Increased agricultural production and reliable energy supply will provide opportunities for women enterprises in agro-processing leading to increased incomes.

Entrepreneurs: At least 60 entrepreneurs will be provided opportunities through bioenergy systems and service activities such as installation, operation, maintenance, servicing, and training. Fifteen entrepreneurs from each of the four southern states will be selected and trained.

Manufacturers: Manufacturers will benefit through the markets and demand for bioenergy systems, created under the project. Further, providing feedback through intensive monitoring of the projects in the field could lead to technological improvements and finally, by removing marketing barriers for generating large scale market demand for bioenergy systems. Initially, one manufacturer from each of the four southern states will be involved in the infrastructural and capacity building programmes.

R & D Institution: Infrastructural development and capacity building for R & D in 3 to 4 institutions.

Government: Facilitate future policy formulations through project implementation experiences and policy studies.

Non Governmental Organizations: Facilitate their involvement in rural energy programs through capacity building. Both local bodies/agencies and NGOs will be involved.

B.7 PROJECT STRATEGY

The UNDP-GEF project aims at overcoming technical, financial and institutional barriers to promotion of biomass energy (bioenergy package). The strategy involves i) technology standardization, demonstration of bioenergy package, ii) capacity building, iii) information generation and dissemination and iv) overcoming financial barriers to promote financial sustainability and replication. The project involves six strategic components.

- **Technology Package Standardization**

This activity will first identify the key problems encountered with small-scale rural bioenergy equipment in India. In order to ensure the availability of low-cost engines, it will particularly focus on the adaptation of gasoline powered engines to biogas and producer gas, thereby making these inexpensive engines suitable for use in rural renewable electrification programmes. It will then develop a draft set of standards in consultation with all potentially interested participants, both technology suppliers and interested system operators. These standards will be tested through the project, and if found to be adequate, will be considered for adoption in other rural areas.

- **Bioenergy System Demonstration and Proof of Concept**

The local enterprises (new or existing) will be identified for installing and operating the proposed bioenergy package. Only systems meeting the draft standards developed in Activity 1 will be utilized. The bioenergy systems will be monitored for technical performance and the feedback from monitoring will be used for revising the technical performance standards for replication in other rural parts of India. The good quality energy services model will be tested and the 'fee-for-service' payment schedule tried and fine-tuned. This activity is the critical focal point for the project as it will utilize the output of Activity 1; will utilize the personnel and skills acquired in Activity 3; it will contribute to the policy dialogue under Activity 4; it will provide lessons for dissemination under Activity 5; and it will be critical to structuring the recovery of costs under Activity 6. Since the capital costs of the systems are expected to be recovered and contributing to the investment risk fund, the budget resources for the capital investment are listed under Activity 6.

- **Capacity Building to Overcome Institutional Barriers**

A profile of 'Bioenergy Services Enterprises' as a rural energy service company (RESCO) for testing the business premises will be developed. Active networking with the existing and new

enterprises through the project implementation arrangements will be undertaken to identify the potential 'Bioenergy Services Enterprises'. Two types of training modules will be designed and developed keeping in view the needs and background of the beneficiaries of the project. The first set of modules will focus primarily on the technical operation of the systems. Its target will be potential future technicians, for operating and maintaining the systems. The second set of modules will be on business skills: marketing, finance, accounting, billing, and project development. These training programs and awareness-raising efforts will help identify a number of enterprises, NGOs, and community-based organizations that may operate the pilot systems under Activity 2. Beyond the project, the experiences from trying this wide range of institutions will help clarify the criteria for selecting future operators in other regions where the systems will be replicated.

- **Enabling Activity to Overcome Market Barriers**

The concept of a rural energy service company is relatively new for India. The activity will first formulate the approach into a policy framework, which makes a solid foundation for *fee-for-services*. Case studies and policy papers to utilize the '*fee-for-service*' rationale to level the playing field for bioenergy in rural energy service provision will be undertaken. In addition, study tours and round tables for exchange of field experience, analysis and impacts within and outside the project activities will be undertaken. A series of papers will be published and disseminated to the policy-makers and other stakeholders.

- **Information Dissemination to Overcome Information Barriers**

The existing information on various aspects of bioenergy systems and services will be compiled, generated, and improved based on the project implementation needs and field experience. This information will be packaged at different stages of project using appropriate techniques to meet the requirements of different categories of stakeholders (users, service providers, manufacturers, etc.). Only when successful installations are in operation will information packages be developed and information dissemination strategies put into operation to ensure the maximum possible replication of the project's experiences.

- **Removal of Financial Barriers**

A funding mechanism will be developed and established in the first year of the project. This mechanism will ensure not only that the costs of the initial systems are recovered, but also that financing is made available for the future dissemination of the bioenergy packages throughout rural India. By the end of the project period, the goal is to ensure that the fee-for-energy service approach will be able to recover all costs of the bioenergy systems. Linkages will be made with micro-credit organizations, NGOs and other village level money lending groups for enabling cost recovery. One of the goals of this activity is to ensure that entrepreneurs, NGOs, and community organizations focusing on the deployment of future systems can be confident that they can recover their costs. The long-term sustainability of the financial mechanisms will be eventually developed and strengthened in the project areas.

- **Financial and Bioenergy System Management (Post-project Period)**

The financial and management system for the post-project period would evolve during the project period. However, two potential options considered are as follows:

- **Commercial bank – Entrepreneur system:** Under this system all the project assets and components will be transferred to a commercial bank. The bank will identify entrepreneurs and provide working capital and the entrepreneurs in-turn will repay the bank from the revenue collected from the beneficiaries. The bank will fix the rates based on the experience in the last two years of the project in collaboration with ASTRA and PMU. The profits or the surplus

income earned by the bank will be converted into a “*Special fund*” to provide start-up capital to entrepreneurs to set-up bioenergy systems in new villages.

- **Panchayat (local government) – Entrepreneurs / NGO;** Under this system all the project assets will be transferred to the Panchayats, in consultation with the Zilla Parishad (District Administration). Zilla Parishad will provide the financial guarantee to the Panchayats, who will take responsibility for the project. The Panchayats will in turn identify NGOs or entrepreneurs and contract out the operation, maintenance and management of the bioenergy system for an agreed technical fee. The assets will be owned by the Panchayats. The identified NGO or entrepreneur will transfer the surplus income to the Panchayats. The surplus income will be converted into a “*Special fund*” to provide start-up Capital for initiating bioenergy project in other villages.

The financial structure and the magnitudes for the transactions will be developed during the project period to enable the commercial banks and Panchayats to fix the rates for payment for the services provided to the beneficiaries, the NGOs and entrepreneurs for operation and management. Other such alternate management options will also be explored during the project period.

B.8 PROJECT IMPLEMENTATION ARRANGEMENT

The institutional framework for the full project implementation is given in Fig 2. The executing agency of the project will be the Dept. of Rural Development and Panchayat Raj of Government of Karnataka (GoK) and the Karnataka State Council for Science and Technology (KSCST) will be the local Implementation Agency. The institutional arrangements for the project are described in this section.

The project implementation involves the participation of Dept. of Rural Development and Panchayat Raj, KSCST, Zilla Parishad, Panchayats (local Govt.) and village community institutions at the state level and MNES and UNDP and ICEF involvement at the National level. A Project Steering Committee (PSC) will be constituted at the State level and the Project Management Unit will be located at KSCST.

Karnataka State Council for Science and Technology (KSCST), the local implementing agency will coordinate all the activities. As shown in Fig 2, KSCST will receive funds from UNDP, ICEF, State government and MNES, will manage and report project finances to the respective funding agencies. KSCST will implement (through technical institutions, consultants, NGOs, Panchayat, entrepreneurs, etc), monitor progress and report the project achievements, problems and lessons to respective funding agencies.

- **Project Steering Committee (PSC):** PSC chaired by the Development Commissioner (or a Senior Officer) of the Government of Karnataka will provide broad guidelines and support, and take major decisions on the project implementation and management. The Project Director will be the Convenor of this Committee. The composition is shown in Figure 2.
 - The main functions of PSC will be:
 - Provide broad Guidelines to Project Management Unit (PMU) and take policy decisions
 - Directive /guidance to PMU on project activities
 - Ensure that the goals of the project are achieved
 - Coordination support to PMU with Govt. Departments and other stakeholders
 - Monitor project physical and financial progress
 - Monitor strategic results to strengthen the impacts of the project

The PSC will meet on twice in a year or as desired by the Chairperson. The Project Director will report on the programmes, plans and progress of the project to the PSC periodically. The PSC could

delegate and authorize a sub-committee (Project Executive Committee) chaired by Project Director, to take all executive decisions such as identification of experts, institutions, recruitment of staff, procurement of equipment. The sites for project implementation in Tumkur district will be approved at the first meeting of the PSC.

- **Project Director (PD):** Secretary to the Department of Rural Development and Panchayat Raj (RDPR) of GoK would be the PD and his/her primary function would be to act as the Government's interface with the PMU and provide broad guidance to project activities. He/she would report the progress to the steering committee. PD would also ensure that the activities of all the government entities are dovetailed and inter-departmental support is fully assured. PD or the nominee of the PD will also chair the Project Executive Committee.
- **Karnataka State Council for Science and Technology – Local Implementation Agency:** KSCST will receive funds from UNDP/GEF, ICEF and MNES and operate through a Project Management Unit located at Tumkur. KSCST will report expenditure to the funding agencies. PMU will function under the operational guidelines of KSCST and the Steering Committee.
- **Technical Support Unit at KSCST:** A Technical Support Unit (TSU) will be formed at KSCST, Indian Institute of Science. It will recruit or hire experts, consultants and institutions for conducting various technical activities. Among others, the tasks of the TSU will be:
 - To prepare technology package, designs and plans,
 - To prepare guidelines for implementation, management and monitoring,
 - To plan and organize capacity building and enabling activities,
 - To prepare policy papers, manuals, guidelines, audio-visual aids, case studies, information and publicity packages etc,
 - To organize workshops, training programmes and awareness campaigns, business meets etc,
 - To organize monitoring and evaluation

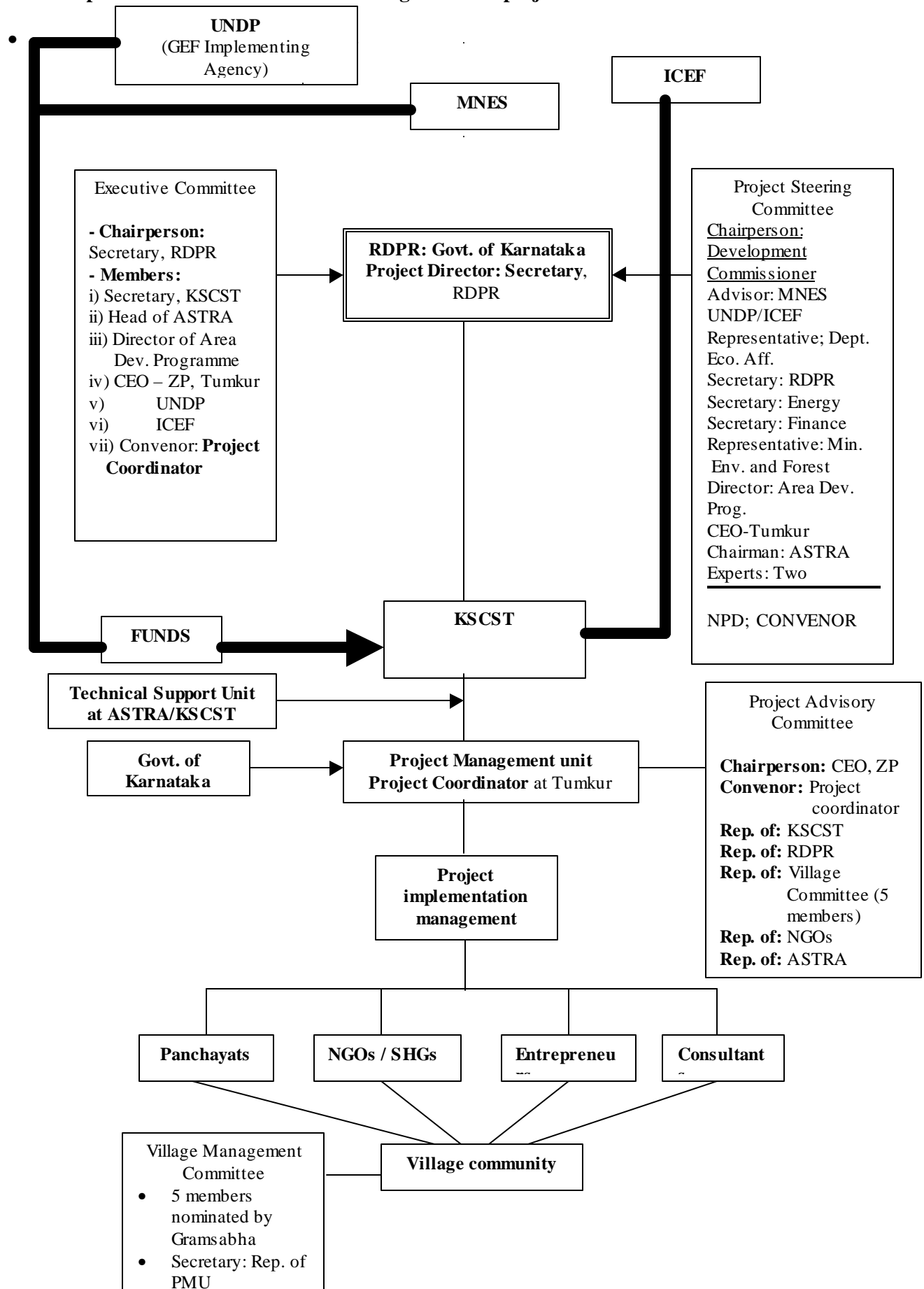
The TSU will function under the overall guidance of Project Director. The TSU will work closely with the project Coordinator.

- **Project Management Unit (PMU):** A dedicated Project Management Unit, headed by a Project Coordinator (PC) will be located in Tumkur, as an extended and exclusive unit of KSCST. PC will be responsible for coordination of day to day project activities. The PMU will function under the overall guidance of the Project Director and will be headed by the Project Coordinator, who will be supported by two Project Officers and two Administration and Finance Support staff. The main functions of PMU will be:
 - Organize and supervise implementation, operation, management, monitoring
 - Procurement of equipment and recruitment of staff in consultation with Project Implementation Committee.
 - Coordinate with district, Panchayat administration, NGOs, manufacturers, entrepreneurs etc.
 - Receive funds from Govt. of Karnataka, MNES, ICEF and UNDP-GEF
 - Funds management and reporting of all funds
 - Selection of Institutions, experts, NGOs, contractors and consultants for different tasks in consultation with Project Executive Committee.
 - Allocation of tasks and coordination
 - Develop Guidelines for implementation and monitoring
 - Periodically report to PD and PEC on programmes and progress
 - Prepare periodic progress reports as required by different agencies

The Executive Committee of KSCST would authorize PMU to adopt measures to speed up the project implementation. PMU will also identify, train and finance entrepreneurs to undertake different tasks such as; turnkey execution of the project components (such as biogas plant construction, installing power generation system), operation of the identified systems (such as gasifiers, flour mill), repair and maintenance (through maintenance contracts), and collection of charges from the beneficiaries under prior agreements, to replicate the concept in other areas. Execution responsibilities for various agencies and institutions will be determined on the basis of comparative advantage (technical capacity, field experience and past performance)

- **Project Executive Committee (PEC):** PEC will be formed to assist the Project Management Unit and the Project Coordinator in taking decisions on a regular basis. This committee will be chaired by the Secretary, RDPR (Project Director) or a person nominated by the PD. The other members will be Chairman, ASTRA; Secretary, KSCST; Director, Area of Development Programme, CEO, Zilla Parishad; ICEF/UNDP. The Project Coordinator will act as the Convenor/Secretary. The Executive Committee of the KSCST and Project Steering Committee will authorize the PEC to take decisions on project implementation such as i) selection of experts and institutions, ii) procurement of major equipment, iii) selection of contractors, entrepreneurs and NGO's, iv) appointment of staff to PMU, v) periodic monitoring of project activities and so on. The PEC will meet once in a month or as required by the project Director and project Coordinator.

FIG 2 Implementation and Fund Flow Arrangement for project



- **Project Coordinator (PC):** PC is the operational and functional head of the PMU, and will organize project planning, implementation and management. The PC will function under the guidance of Project Director. The PD will implement the project with the assistance of the PEC and TSU, which will provide the technical support. The broad functions are
 - Project planning, implementation, management and monitoring
 - Selection and allocation of tasks to different agencies
 - Reporting progress and financial status to PD

The Government of Karnataka will appoint Project Coordinator in consultation with KSCST, UNDP and ICEF. The recruitment of the project staff will be on contractual basis, and through open as well as competitive process.

A Project Advisory Committee (PAC), chaired by the CEO-Zilla Parishad (ZP) will be formed at the district level in Tumkur with the objective of ensuring the stakeholders participation and consultations on project planning and implementation in the district. The membership is given in Fig 2. The CEO of ZP, Tumkur and Project Coordinator will decide on the membership, terms and advisory roles of Project Advisory Committee.

The Village Management Committees (VMC) is a village level representative body to facilitate participation of village community in decision making process and management. It protects the interests of all internal interest groups and village level concerns to make bioenergy services fair, productive and sustainable. The VMC ensures that all end-users will have adequate representation at village level in order to ensure proper functioning of all bioenergy devices /services within its functional boundary. Women will constitute 50% of membership of the VMC. The VMC will further be assisted by "*Bioenergy service user groups*" (modeled on self-help groups, SHGs). These groups undertake specific responsibilities for different activities such as management of biogas plants or biomass gasifiers or irrigation system. They are expected to function best when member strengths do not exceed 30. These groups could facilitate equitable distribution of benefits, enable contribution of beneficiaries towards investment and operation cost. Successful demonstration will simplify lobbying and leveraging bioenergy products in the future.

Role of Centre for ASTRA: The bioenergy concept has emerged from technological developments and field demonstration of bioenergy projects undertaken by Centre for ASTRA, Indian Institute of Science, Bangalore. ASTRA has developed and implemented on an experimental basis, all the technologies incorporated in the bioenergy technology package. ASTRA has been working for nearly 20 years in Tumkur district where the project will be implemented. They have also worked with all the stakeholders in the district; government departments, Panchayats, NGOs, village community and entrepreneurs. Centre for ASTRA prepared the concept note, implemented the PDF - phase of GEF project and has prepared this project document. Thus, Centre for ASTRA as well as the scientists and technologies of ASTRA will be involved in designing the technology package, developing implementation, operation, maintenance and monitoring packages and in capacity building activities of the project. ASTRA will largely provide technical support to the project. Experts from outside ASTRA will also be involved for specific activities. Centre for ASTRA will contribute to the following activities:

- Gas engine development
- Development of draft standard for bioenergy technologies
- Development of bioenergy package
- Development of methodology for monitoring carbon flows
- Documentation and database generation on bioenergy technologies
- Periodic monitoring of physical, financial and institutional aspects

B.9 REASONS FOR ASSISTANCE FROM UNDP

'Biomass energy project' has multiple objectives. The global benefit from the implementation of the project is promotion of a CO₂ neutral energy strategy for rural India, with potential for application in other developing countries in general. The bioenergy package also leads to net CO₂ emission reduction, due to bioenergy substituting fossil fuels used in rural areas. Thus, the project meets the objective of UNDP-GEF programme of promoting technologies and strategies to reduce GHG emissions, justifying UNDP support.

The project aims at capacity building among rural communities, NGOs, entrepreneurs, manufacturers, financing institutions and policy makers to overcome barriers to promotion of renewable energy technologies and bioenergy technologies in particular. One of the main features of the proposed bioenergy package is to integrate energy generation-distribution with end use services such as lighting, pumping water for domestic use and provision of cooking gas. The focus is on providing services. Provision of quality energy for services such as lighting, cooking gas supply, piped water supply and assured irrigation contributes to improvement in quality of life, particularly that of women and children in rural areas. Activities such as raising forests and processing wood for power generation, improved crop production due to irrigation and installation of agro-industries will lead to large rural employment generation and reduction in poverty. Capacity building, creation of rural employment, poverty reduction and improvement in quality of life of rural women are priority goals of UNDP. The project activities contribute to promotion of all these goals of UNDP.

UNDP has been supporting energy-environment project in India and has a large experience of working with governmental and non-governmental agencies. The proposed bioenergy project objectives meet the local and global concerns of UNDP, justifying assistance from UNDP.

C. OBJECTIVES, OUTPUTS AND ACTIVITIES

The development objective of the project is to reduce CO₂ emissions through the promotion of bioenergy as a viable and sustainable option to meet the rural energy service needs in India and thereby leading to sustainable development.

C.1 IMMEDIATE OBJECTIVE 1

The immediate objectives of the project are to develop a decentralized bioenergy technology package for the provision of good quality rural energy services for lighting, drinking water supply, cooking gas, irrigation water supply, and milling.

Outputs 1.1: Gas-engine development.

- Activity 1.1.1. Evaluation of the existing gas-engine designs.
- Activity 1.1.2: Development and adaptation of gas-engines.
- Activity 1.1.3: Field testing of the gas-engines developed.
- Activity 1.1.4: Developing technical specifications for gas-engine manufacture and marketing.

Output 1.2: Development of detailed technical specifications for bioenergy technologies.

- Activity 1.2.1: Identifying representative resource need situations.
- Activity 1.2.2: Developing emissions standards.
- Activity 1.2.3: Defining energy-conversion efficiency thresholds.
- Activity 1.2.4. Develop design and manufacture standards.
- Activity 1.2.5. Define feedstock characteristics.

Activity 1.2.6: Developing computer software packages.

Activity 1.2.7: Develop performance standards.

Output 1.3: Development of draft standards bioenergy package.

Activity 1.3.1: Resource-need assessment.

Activity 1.3.2: Identifying technology options for each of the energy service.

Activity 1.3.3: Development of guidelines for biomass production.

Activity 1.3.4: Optimization of design parameters and designs.

Activity 1.3.5: Guidelines for site selection for bioenergy package implementation.

Activity 1.3.6: Develop methods for estimation of biomass feed stock and land requirement for bioenergy production.

Activity 1.3.7: Develop methods for performance monitoring and maintenance manual preparation.

Activity 1.3.8: Developing bioenergy technology packages for different resource-need situations and socio-economic conditions.

Activity Component 1 - Technology Package Standardization: The key problems encountered with small-scale rural bioenergy equipment in India will be identified and thrust will be given to develop engines to run on 100% gas to avoid diesel consumption. Standardized specifications will be evolved for development and application of bioenergy equipment and rest of the components of the package by wide range of interested participants.

Outputs 2.1. 1.2 MW woody biomass gasifier installation.

Activity 2.1.1: Suitable site selection based on the guidelines developed in Activity 1.3.5.

Activity 2.1.2: Estimating optimum capacity for decentralized generation systems.

Activity 2.1.3: Selection and training of operators for bioenergy systems.

Activity 2.1.4: Install workshops for repairs and maintenance.

Activity 2.1.5: Construction of infrastructure to house the gasifier and power generation system.

Activity 2.1.6: Installation of wood gasifier in suitable village locations.

Activity 2.1.7: Power distribution system to irrigation pump and industrial end-points.

Activity 2.1.8: Laying of irrigation water distributory lines.

Activity 2.1.9: Installation of flourmill.

Activity 2.1.10: Ground water and surface water survey, watershed demarcation.

Output 2.2. 120 kW Community biogas cum biofertilizer systems for domestic electric loads to meet the year-round requirements.

Activity 2.2.1: Suitable site selection based on the guidelines developed in Activity 1.3.5.

Activity 2.2.2: Construction of biogas reactors and infrastructure to house the engine generator systems.

Activity 2.2.3: Construction of sand-bed filters.

Activity 2.2.4: Construction of overhead water tanks and water distribution system.

Activity 2.2.5: Ground water survey and drilling wells and pump installation.

Activity 2.2.6: Power line erection to domestic water supply and home/street lighting.

Output 2.3. 45 Community biogas cum biofertilizers systems to meet the cooking gas requirements.

Activity 2.3.1: Suitable site selection based on the guidelines developed in Activity 1.3.5.

Activity 2.3.2: Construction of biogas reactors and infrastructure.

Activity 2.3.3: Piping system for cooking gas supply.

Activity 2.3.4: Installation of suitable grade cook stoves in households.

Activity 2.3.5: Construction of sand-bed filters.

Output 2.4. Establish short-rotation energy forest plantations, agroforestry systems, community forestry, horticultural orchards and also high input forestry plantations.

Activity 2.4.1. Suitable site selection based on the guidelines developed in Activity 1.3.5.

Activity 2.4.2. Site selection for raising nursery.

Activity 2.4.3. Suitable species selection for various categories of plantations both on private and community land-holdings.

Activity 2.4.4. Procurement of planting materials and other inputs for nursery raising.

Activity 2.4.5. Land preparation, planting and after care.

Output 2.5 Lessons in different modes of providing the rural energy service package to rural villages, including experience in gaining full cost recovery.

Activity 2.5.1 Document the experience through established monitoring system

Activity 2.5.2 Analyze issues related to experience vis-a-vis different modes of providing energy service.

Activity 2.5.3 Identify key lessons learnt and use for designing packages for replication

Activity Component 2 - System demonstration and proof of concept: The technical and economic viability of the biogas, producer-gas and energy plantation systems will be tested by adopting the standardized technology package developed, which will also provide know-how for replication. The end-use systems and services provided by the installation of this package are drinking water supply, irrigation water supply, lighting, cooking gas supply to kitchens and milling using the concept of fee-for-service.

C.2 IMMEDIATE OBJECTIVE 2

To remove barriers to large-scale adoption and commercialization of bioenergy technology packages.

Output 3.1. Bioenergy packages for service enterprises for replication in other parts of rural India

Activity 3.1.1. Identifying entrepreneurs, individuals, institutions (NGOs).

Activity 3.1.2. Develop training manual guidelines.

Activity 3.1.3. Conduct training programmes.

Activity 3.1.4. Provide seed money for establishing bioenergy service centres.

Output 3.2. Approach and methodology for monitoring carbon flows in bioenergy project

Activity 3.2.1. Literature search for methods and manuals for Carbon monitoring.

Activity 3.2.2 Establish methods and develop manuals to measure the carbon flows

Activity 3.2.3 Organize a technical workshop to discuss the methodology

Activity 3.2.4 Organize training programme for training scientists to monitor carbon flows.

Activity 3.2.5 Measure carbon flows based on the above

Output 3.3. Training and involvement of women in planning and management of the bioenergy systems

Activity 3.3.1. Identify NGOs for organizing women institutions.

Activity 3.3.2. Organize village level institutions for women such as SHG cooperative societies.

Activity 3.3.3. Organize training programmes.

Activity 3.3.4. Develop manuals for training programmes.

Output 3.4. Training Center for training entrepreneurs, NGOs and managers on implementation of technology and institutional package

Activity 3.4.1 Identify infrastructural and other resources required for conducting training programmes

Activity 3.4.2 Develop criteria for institutions/agencies for conducting training programmes
Activity 3.4.3 Assess the institutional capacities of different select agencies
Activity 3.4.4 Shortlist potential agencies
Activity 3.4.5 Develop trainers training module and strengthen their capability for conducting training programmes on bioenergy packages

Output 3.5. Training for entrepreneurs, NGOs, technicians and managers in the business skills

Activity 3.5.1. Identify businessmen and entrepreneurs, technicians and NGOs.
Activity 3.5.2. Developing training manuals and packages.
Activity 3.5.3. Conducting training programmes at the training centers.
Activity 3.5.4. Organizing field visits.
Activity 3.5.5. Organizing business meets.

Output 3.6. Infrastructure development for manufacturing, spare parts supply and servicing of bioenergy systems

Activity 3.6.1 Identify the value chain for the bioenergy systems
Activity 3.6.2 Establish centers through bioenergy service enterprise, and NGOs for provision of support services to installed bioenergy systems
Activity 3.6.3. Link R & D activities and provide feedback from the field to manufacturers
Activity 3.6.4 Facilitate establishment of infrastructure by the manufacturers through the above

Activity Component 3 - Capacity building: Personnel will be trained in the technical, financial, marketing and project development skills to be able to operate through institutional mode such as the rural energy service companies either as entrepreneurs, NGOs or businesses. The aim is to sustain the activity beyond the project duration in the given area and to replicate in wide areas.

Output 4.1. 'Fee for service' framework

Activity 4.1.1. Conduct financial analysis of different component of bioenergy systems and services
Activity 4.1.2. Evaluation of pricing of services
Activity 4.1.3. Analyze the experience of collection of fee for energy services
Activity 4.1.1. Design different financing mechanisms for maximizing the recovery of costs
Activity 4.1.4. Provide inputs to the policy makers on the successful financing modalities

Output 4.2 Policy papers to make impact on policy makers.

Activity 4.2.1. Identify institutions for preparing policy papers.
Activity 4.2.2. Organize a scoping workshop for groups working on policy papers.
Activity 4.2.3. Preparation and publication of case studies.

Output 4.3. Case studies on bioenergy technologies and field implementation.

Activity 4.3.1. Identify technologies and locations for case studies.
Activity 4.3.2. Identification and allocation of case studies to different institutions.
Activity 4.3.3. Organize scoping and discussion workshop.
Activity 4.3.4. Commissioning case studies.
Activity 4.3.5. Conduct field studies.
Activity 4.3.6. Workshop to evaluate case studies prepared.

Output 4.4. Workshops to involve stakeholders especially policy makers to exchange the experiences, study tours and policy research activities

Activity 4.4.1 Develop workshop contents, identify stakeholders
Activity 4.4.2 Planning and conducting of workshop

Activity 4.4.1 Organize study tours for exchange of experiences and policy research recommendations

Output 4.5 Documentation of lessons learnt and sharing of experiences

Activity 4.5.1. Publish the policy papers and case studies.

Activity 4.5.2. Organize workshops for policy makers and media people.

Activity 4.5.3. Organize field visits to bioenergy project sites.

Activity 4.5.4. Establish policy research, documentation and data base centre.

Activity 4.5.5. Undertake field visits and monitor all bioenergy projects.

Activity 4.5.6. Developing information flow mechanisms.

Activity 4.5.7. Data base preparation on technologies, policies, field projects, and institutions.

Activity 4.5.8 Preparation of periodic reports of the data base.

Activity Component 4 - Enabling activities: The main objective is to strengthen the new concept of rural energy service company by developing a policy framework to support fee-for-service model that will allow entrepreneurs to charge a fee for services delivered from bioenergy package. The experience will be analyzed through documentation of field monitoring experiences, case studies, policy-analysis, -documents and -workshops for level playing the field for bioenergy service establishment and replication.

Output 5.1. Information package made available for bioenergy technologies manufacturers, suppliers, financial mechanisms, performance guidelines, R & D facilities, technical expertise, etc.

Activity 5.1.1. Development of operation and maintenance manuals for gasifiers, biogas systems, etc.

Activity 5.1.2. Development of a manual for management systems.

Activity 5.1.3. Development of accounting systems for project inputs and outputs, costs and benefits.

Activity 5.1.4. Development of public display information system for different target groups

Activity 5.1.5. Documentation of resource availability containing geographical, socio-economic, agro-climatology and technical database information systems.

Activity 5.1.6. Compilation of specification and performance guidelines for bioenergy components.

Activity 5.1.7. Comprehensive list of technical expertise services and repair facility available for different components of bioenergy package

Output 5.2. Methodology and designs for project formulation, financial analysis, implementation, fee recovery for services and project monitoring guidelines for potential replicability will be evolved.

Activity 5.2.1. Development of brochures on various bioenergy technologies.

Activity 5.2.2. Technical document preparation related to designs, financial analysis, implementation and fee recovery for services.

Activity 5.2.3. Development of project monitoring guidelines.

Output 5.3. Development of promotional modules of bioenergy packages using audio-visual, print and other mass media for training and dissemination.

Activity 5.3.1. Preparation of electronic communication media - website, advertisements, audio cassettes etc.

Activity 5.3.2. Preparation of documentary films and audio-visual cassettes of successful case studies.

Activity 5.3.3. Organizing field visits to successful project locations

Activity 5.3.4. Organizing community fairs and awareness workshops.

Activity 5.3.5. Organizing other effective mass communication dialogues through plays, meetings

Output 5.4. Establishing communication network within the project area to enable proper communication among project sites, PMU, PSU and bioenergy services enterprises
Activity 5.4.1 Designing and obtaining necessary softwares for communication flows
Activity 5.4.2 Identifying equipment and accessories hardware to support the communication network

Activity Component 5 - Information dissemination: The information on successful implementation of bioenergy systems and services will be compiled as an information package, which will include proposed standards, technical designs, costs, benefits, sources of technology, sources of financing and software packages to meet the requirement of different categories of stakeholders. This information package, which will be the rationale for establishment of fee-for-services approach and leveled playing field, will be disseminated through mass media, workshops, techno-economic reports and field visits.

Output 6.1: Financing of enterprises

Activity 6.1.1. Advertisement, selection and identification of enterprises
Activity 6.1.3. Organize training programmes for select enterprises
Activity 6.1.4. Organize field visits.
Activity 6.1.5. Fund and monitor the projects of enterprises.

Output 6.2. Creation of Investment Risk fund or Revolving Fund

Activity 6.2.1. Develop guidelines for operation of revolving fund.
Activity 6.2.2. Finance the capital investments (cost of installation of gasifiers, biogas plants)
Activity 6.2.3. Develop schemes for financing entrepreneurs, banks, producers, bioenergy enterprise companies.
Activity 6.2.4. Monitoring of revolving fund operation.

Output 6.3. Formulation of approach involving bidding for concessions to operate future bioenergy systems in areas targeted for replication

Activity 6.3.1. Identification of potential replicable areas
Activity 6.3.2 Developing approaches for concessions for spreading bioenergy packages in the identified areas based on evaluation of earlier outputs.

Output 6.4. Demonstration of financial viability

Activity 6.4.1. Develop methodology and approach to determine and fix charges to services.
Activity 6.4.2. Prepare costs or charges to be recovered for services.
Activity 6.4.3. Develop guidelines for recovering charges and fund management
Activity 6.4.4. Identify institutions (bioenergy service companies) for fund management.
Activity 6.4.5. Monitor the fund flows; costs, recovery, income and expenditure.

Output 6.5. Demonstration of willingness to pay

Activity 6.5.1. Develop financing schemes through community participation
Activity 6.5.2. Develop institutional strategies for effective payment collection
Activity 6.5.3 Build capacity of the rural households to effectively use the energy services

Activity Component 6 - Removal of financial barriers and creation of investment risk fund: This envisages to remove critical investment risks and ensures to establish a risk mitigation revolving fund which will support to overcome risks from cost recovery for project duration and would be reinvested for promoting leverages in market resources and also make available for future dissemination.

Output 7.1. Periodic monitoring of physical, financial and institutional aspects.

- Activity 7.1.1. Identify parameters to be monitored.
- Activity 7.1.2. Prepare guidelines and manuals for monitoring.
- Activity 7.1.3. Identify institutions and conduct training programs.
- Activity 7.1.4. Organize workshop to assess the guidelines, methods and manuals.
- Activity 7.1.5. Initiate periodic monitoring.
- Activity 7.1.6. Prepare periodic monitoring reports.

Output 7.2. Mid-project period and project-end evaluation.

- Activity 7.2.1. Organize workshop to develop guidelines for project evaluation.
- Activity 7.2.2. Identify experts and institutions for evaluation.
- Activity 7.2.3. Commission external evaluation studies.
- Activity 7.2.4. Publish reports and organize workshop to discuss evaluation reports.

Output 7.3. Monitoring carbon flows.

- Activity 7.3.1. Develop methods, manuals and guidelines for monitoring carbon flows.
- Activity 7.3.2. Organize workshop for evaluating the methods.
- Activity 7.3.3. Organize training program on methods.
- Activity 7.3.4. Initiate monitoring and measurement of carbon parameters.
- Activity 7.3.5. Prepare annual project carbon balance reports.

Output 7.4 Post-project evaluation

- Activity 7.4.1. Develop methods for project performance in the post-project of 5 years.
- Activity 7.4.2. Identify external institution or team for the task.
- Activity 7.4.3. Conduct detailed evaluation.
- Activity 7.4.4. Organize workshop for presenting findings.
- Activity 7.4.5. Prepare report and disseminate the findings.

Activity Component 7 - Monitoring and Evaluation: Goal is to periodically monitor and evaluate different components of the project to learn lesson for improving project performance and for replication.

D. INPUTS

UNDP/GEF inputs: The bioenergy project comes under the GEF-operational program 6: “promoting the adoption of renewable energy by removing barriers and reducing implementation costs”. UNDP/GEF inputs would be provided primarily for barrier removal activities. UNDP/GEF will provide funds for technology package standardization, capacity and institution building, enabling activities, information package generation and dissemination activities, and creation of investment risk fund.

MNES: MNES will provide national support for policy, planning and financial incentives towards investment cost for biomass gasifier power generation system and community biogas electricity system.

Government of Karnataka: The Government of Karnataka (GoK) support will provide overall administrative as well as logistics support to the project. The GoK’s inputs would include capital (equipment) cost of energy end-use systems (such as irrigation, lighting, drinking water supply etc) and partly towards meeting operation and maintenance costs and forestry activities.

ICEF: ICEF inputs will be for the technology package standardization, equipment cost for energy systems, capacity building and enabling activities, information package generation and dissemination and financial barrier removal activities.

User contribution: The beneficiaries contribution will be towards deposits for energy end-use systems (such as electrical wiring for lighting, pipes and taps for pumping drinking water) and labour for forestry plantations.

The project budget along with contribution from various agencies is provided in Annex-1.

E. RISKS

E.1 Risks and Sustainability

The proposed project involves the participation and coordination of various agencies such as village management committee, state or national level committees, entrepreneurs, manufacturers, NGOs, state government departments financing agencies, and R& D institutions at various levels. A project of this nature is likely to face risks, ranging from failure of payment for the energy service to the failure due to policy changes of the government. Thus, there are two categories of risks; firstly, those that are internal to the project and secondly, those that are external to the project. Some of the potential risks and mitigation measures internal to the project are listed in Table 2 below.

External Risks: Some of the risk external to the project includes the following;

- *Oil prices:* Large decline in oil prices may affect relative cost-effectiveness of the project components compared to diesel based baseline systems. However, if the oil prices increase, the project will become more attractive as the baseline scenario costs will increase. The project will be largely insulated from world oil prices, with the adoption of gas engine, replacing diesel use by 100%.
- *Government policies on renewable energy:* The power sector in India is going through liberalization processes. Energy pricing, particularly electricity pricing is being rationalized. The subsidies on kerosene and electricity are on the decline. The national government and the state governments are coming up with attractive policies for promoting renewable and particularly bioenergy. Thus the risk of unfavorable energy policies is minimal or absent.

Table 2. Potential Risks and Mitigation Measures

Risks	Mitigation measures
1. Non-participation of the local communities	<p>Medium</p> <ul style="list-style-type: none"> - Empowerment of village committees and participation of village communities in decision making process at all stages - Awareness creation and transparency of functioning - Assured supply of good quality energy services and resulting improvement of quality of life and increased income lead to creation of stake
2. Poor recovery of costs of good quality energy services provided	<p>Medium</p> <ul style="list-style-type: none"> - Increased income through irrigation and agro-processing increases repayment capacity - Employment to landless - Prior agreement with end-users - Ensures payment of services through information flow. - Establishing institutional mechanisms for recovery
3. Low performance of system and reliability of services	<p>Low</p> <ul style="list-style-type: none"> - Continuous, rigorous technical performance monitoring & reporting - Maintenance contracts will ensure quick rectification of problems - Adequately trained, local operators, maintenance and service staff and entrepreneurs - Continued R & D services from ASTRA and other agencies.
4. Limited Government Commitment	<p>Low</p> <ul style="list-style-type: none"> - Participation of senior government decision makers in National Advisory Committee and Project Steering Committee. - The project components are compatible with the priorities of the state government and MNES
5. Lack of Land availability and low productivity	<p>Medium</p> <ul style="list-style-type: none"> - Diverse biomass sources; crop residue, forest plantations on farm land and common land - Long-term supply contracts between farmers and utility - Provision of woody feedstock by farmers for irrigation - Quality seedlings and improved Silvicultural practices for high yields

The project builds on the past experience of ASTRA in implementing bioenergy projects and a number of surveys conducted for the present project. Both show that rural households are *willing to pay* for quality services. The analysis of operation and maintenance costs for different components in year-5 of the project (when all the systems are fully operational) and the estimated revenue based on household surveys of *willingness to pay* are given in Table 3. The analysis shows the bioenergy package is financially viable once the repayments are stepped up to full cost-recovery level. The addition of the earnings from fertilizer sales, once that market is fully developed, will aid in ensuring that the dung-based biogas system becomes financially sustainable.

This bioenergy project is thus based on the premise that the rural households will pay for the good quality energy services provided under the project because they will receive enhanced farm incomes; increased opportunities for employment; and more frequent cash returns. In other words, the

provision of these good quality energy services will provide a “win-win” situation for all. The provision of good quality energy services is expected to lead to an improved quality of life.

**Table 3. Cost and Revenue for Different Services During Year-5
When All Bioenergy Systems are Operational**

Good Quality Bioenergy Services	O & M cost of service in year – 5		Revenue in year - 5		Surplus (Revenue – O & M)	
	Per acre or per HH (US \$)	Total for villages ('000 US\$)	Per acre or HH (US \$)	Total ('000 US\$)	Per acre or HH (US \$)	Total ('000 US\$)
Lighting (2324 HH)	12.26	28.5	5.6	13.1	- 6.6	- 15.3
Drinking water supply (2324 HH)	6.9	16.1	4.2	9.8	- 2.7	- 6.3
Cooking (2324 HH)	28.8	66.9	56.4	131.2	27.7	64.3
Irrigation (2400 acres)	119.8	287.6	176.5	423.7	56.7	136.1
Fertilizer (Dung) 2324	-		15.2	35.3	15.2	35.3
Fertilizer (biomass) 2324	-		23.3	54.1	23.3	54.1
		399.1		667.3		268.2

With respect to sustainability beyond the GEF funding phase, it is proposed to involve the private sector, entrepreneurs and NGOs in the operation, maintenance and management (O, M & M) of the bioenergy system. By the end of the fourth year of the project period, arrangements will be made to transfer O, M & M to private sector, entrepreneurs, NGOs and village institutions. The appropriate combination of institutions and roles for maintenance and management will emerge during the first three years of the project. The transfer of assets will also be finalized during the first three years of the project. The surplus revenue recovered from the project beneficiaries, over the O & M costs will be retained to meet the replacement and O & M costs beyond the project period. However, in the large-scale dissemination, the private sector is expected to play a key role. The profits generated by the private sector are likely to be reinvested for replicating the package in other areas. This would ensure the project sustainability after the completion of the GEF funding period.

F. PROJECT REVIEW, REPORTING AND EVALUATION

Project review, reporting and evaluation will be an important component of project implementation. The project will be executed as per the NEX procedures and UNDP Programming Manual. The project will be subjected to a tripartite review by the representatives of respective funding, executing and implementing agencies every twelve months from the start of the project implementation.

Monitoring, Evaluation and Dissemination: The project implementation, management and performance will be subjected to multiple levels of monitoring and evaluation. The monitoring and evaluation will involve the following:

- Physical progress of the project components such as the rate of installation of biogas plants, hectares of forest planted, number of irrigation pumpsets connected, and capacity utilization of the power generation system;
- Technical performance indicators for the bioenergy systems;
- Services provided and feedback from beneficiaries;
- Financial accounting; rate of utilization of funds, expenditure and benefit flows and rate of recovery from the beneficiaries;
- Participation of communities - social and gender aspects of flow of benefits (additional income generation) and participation in decision-making processes; and
- GHG flows; extent of fossil fuel electricity and fossil fuel substitution, and carbon sequestration.

The PMC and FIU will monitor the various project implementation aspects on a continued basis and will undertake follow-up actions required. The PMC will prepare quarterly progress reports and PIR reports for submission to GEF, UNDP, ICEF and PSC. In addition, an external agency recommended by the PSC will periodically evaluate the physical, financial, social and environmental aspects of the project. The monitoring agency could be a consulting firm, an international NGO or experts from research institutions in India or outside. Such an agency with a proven ability in monitoring climate mitigation projects will be identified jointly by UNDP-GEF, ICEF and PMC.

In addition to the normal project monitoring procedures described above, the process of project document development will consider the feasibility of setting aside a fee for post-project evaluation. If it is deemed feasible and desirable, provision will be made to allow for such an evaluation to take place several years following project conclusion.

Project reporting: The PMU located at KSCST will undertake the task of reporting the progress to different funding agencies periodically. The schedule for project review will vary for different activities. Project Director shall prepare and submit to each review meeting, a Project Annual Performance Report (APR). Additional APRs may be requested, if necessary. A final project report will be prepared for consideration at the terminal tripartite review meeting.

Post Project Period Monitoring and Evaluation: A post-project period monitoring to assess i) the sustainability of the project activities after the 5 year project period, ii) the impact made by the project on overcoming the barriers, iii) the spread of bioenergy package to other district and states, and iv) the participation of entrepreneurs, industry, NGOs etc. The post-project evaluation will be carried out after 12 months and 30 months of the termination of the project.

G. PRIOR OBLIGATIONS AND PRE-REQUISITES

There are no prior obligations. The pre-requisites include formation of Project Steering Committee and Setting up of PMU at KSCST.

H. FINANCIAL AND ACCOUNTING ARRANGEMENTS

The financial reporting, accounting arrangements and auditing procedures will be as per UNDP Programming Manual and the extant procedures of the Government.

Funds will be advanced on a quarterly basis based on the approved work plan. Request for funds will be made in the financial report format providing information on the available funds, new requirements as well as the expenditure for the past quarter. The financial report will be signed by a competent authority in the executing agency or by any other person so designated.

Auditors to the project will be officially designated. Such auditor, and/or other officially appointed auditors shall undertake annual management and financial audit of the project in accordance with UNDP auditing procedures.

In addition, all accounts maintained by the Government for UNDP resources may be audited by the UNDP internal auditors and/or the United Nations Board of Auditors or by public accountants designated by the United Nations Board of Auditors. The financial reporting, accounting arrangements and auditing procedures will be as per UNDP procedures. The PMU at KSCST, UNDP, ICFE will come to an agreed procedure for auditing at the beginning of the project initiation.

I. LEGAL CONTEXT

The Government executing agent designated on the cover page of this project document has been duly delegated by the Government coordinating authority, the Department of Economic Affairs, Ministry of Finance, to carry out this project and accordingly will follow the accounting, financial reporting and auditing procedures set forth in the following document as may be amended by UNDP/Government of India (GoI) from time to time.

- UNDP Procedures as laid out in the Programming Manual.
- Extant procedures of the Government.
- Standard annex to sub-programme/project documents for use in countries, which are not party to the Standard Basic Assistance Agreement (SBAA).

The above documents are an integral part of this project document although incorporated herein only by reference. They have already been provided to the Government and the said Executing Agent.

The following types of revisions may be made to this project document with the signature of the UNDP Resident Representative only, provided he or she is assured that the other signatories of the project document have no objections to the proposed changes:

- Revision in, or addition of, any of the annexes of the project document (with the exception of the standard legal text for non-SBAA countries which may not be altered and agreement to which is a pre-condition for UNDP assistance (See Annex 6)
- Revisions which do not involve significant changes in the immediate objectives, outputs or activities of a project, but are caused by the rearrangement of inputs agreed to or by cost increases due to inflation; and
- Mandatory annual revisions, which re-phase the delivery of agreed, project inputs or other costs due to inflation or take into account agency expenditure flexibility.

ANNEXURES

- Annex 1A. Project budget total from all agencies
- Annex 1B. Project budget from UNDP/GEF
- Annex 1C. Project budget from State Government
- Annex 1D. Project statement from ICEF
- Annex 1E. Project budget from MNES
- Annex 2. Project Planning Matrix
- Annex 3. Work plan
- Annex 4. Carbon emission avoided and sequestered
- Annex 5. Incremental costs
- Annex 6. Schedule of project reviews, reporting and external evaluation
- Annex 7. Terms of Reference

Annex 1A

		Project Budget Covering UNDP/GEF, State Government, ICEF and Users' Contribution													
Sl.		Total		2001		2002		2003		2004		2005		2006	
No.		W/m	US \$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US
10	Personnel														
11	<i>International consultants</i>														
11.01	International consultants	50	50,000					10	10,000	10	10,000	20	20,000	10	10,000
		Days													
13	<i>Administrative support</i>														
13.01	Accountants	60	30,000	6	3000	12	6000	12	6000	12	6000	12	6000	6	6000
13.02	Administrative assistants	120	30,000	12	3000	24	6000	24	6000	24	6000	24	6000	12	12,000
13.03	Field support unit	60	30,000	6	3000	12	6000	12	6000	12	6000	12	6000	6	6000
15	<i>Monitoring and Evaluation</i>														
15.01	Domestic travel		150,000		5,000		30,000		40,000		30,000		30,000		150,000
15.02	International		60,000						10,000		20,000		10,000		20,000
16	<i>Mission Costs</i>														
16.01	Local mission costs		94,000		4,000		20,000		20,000		20,000		20,000		100,000
17	<i>National Consultants</i>														
17.01	Project Coordinator	60	120,000	6	12,000	12	24,000	12	24,000	12	24,000	12	24,000	6	12,000
17.02	Project Officers	240	240,000	24	24,000	48	48,000	48	48,000	48	48,000	48	48,000	24	24,000
17.03	Experts - Draft std. Local	62	75,000	10	12,000	40	48,000	12	15,000						
17.04	Experts - Proj. imple. Package	42	50,000		20,000		20,000		10,000						
17.05	Experts - Capacity Building	120	144,000	9	10,800	24	28,800	20	24,000	24	28,800	35	42,000	8	9,600
17.06	Experts - M & E	18	18,000			6	6,000	10	10,000	2	2,000				
17.07	Consultants - EA	40	48,000						10,000		20,000		10,000		

17.08	Consultant - financial		30,000		10,000		20,000							
19	Component total													
20	Contracts													
21	<i>Sub-contract A</i>													
21.01	Res. Assessment & installations		185,000		20,000		33,000		66,000		66,000			
22	<i>Sub-contract B</i>													
22.01	Gas Engine Adaptation		100,000				100,000							
23	<i>Sub-contracts C</i>													
23.01	Cap. Building		200,000				25,000		50,000		100,000		25,000	
25	<i>Sub-contracts D</i>													
25.01	Enabling Activities		300,000				25,000		50,000		75,000		100,000	50,000
26	<i>Sub-contracts E</i>													
26.01	Information dissemination		580,000				30,000		50,000		300,000		100,000	100,000
27	<i>Sub-contracts F</i>													
27.01	Financial Mechanisms		40,000		20,000		20,000							
28	<i>Sub-contracts G</i>													
28.01	External monitoring		48,000				10,000		10,000		20,000		5,000	5,000
29	<i>Sub-contract E</i>													
29.01	Std. Tech. Package		100,800						50,400		50,400			
30	Component total													
30	Training													
32	<i>Workshops/ Community mtgs.</i>													
32.01	Technical workshops		30,000				15,000		15,000					
32.02	Cap. Building		140,000				25,000		25,000		40,000		50,000	
32.03	Workshops		50,000								15,000		20,000	15,000
32.04	Information/ Awareness		117,000				20,000		30,000		30,000		20,000	17,000
39	Component total													
40	Equipment													
45.01	Expendable Items		39,200		7,000		7,000		12,000		6,700		6,500	
45.02	Non-Expendable Items*		3,687,000				725,000		1,425,000		1,440,000		97,000	

49	Component Total													
50	Miscellaneous													
52.01	Reporting Costs		20,000		1,000		1,500		2,500		5,000		5000	
53.01	Sundries		40,000		5000		5000		5000		10,000		10000	
54.01	GEF Support Costs													
59	Component Total													
70	Micro-Capital grants													
71.01	Micro-credits		600,000				120000		240000		240,000			
72.01	Others		1,177,000				1177000							
99	PSD/Project Total		8,623,000		159,800		2,601,300		2,269,900		2,618,900		660,500	312

* Refers to cost of the standardized technology packages

Annex 1B

		Project Budget Covering UNDP/GEF Contribution													
Sl. No.		Total		2001		2002		2003		2004		2005		2006	
		W/m	US \$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$
10	Personnel														
11	<i>International consultants</i>														
11.01	International consultants	50	50,000					10	10,000	10	10,000	20	20,000	10	10
		days													
13	<i>Administrative support</i>														
13.01	Accountants	60	30,000	6	3000	12	6000	12	6000	12	6000	12	6000	6	3
13.02	Administrative assistants	120	30,000	12	3000	24	6000	24	6000	24	6000	24	6000	12	3
13.03	Field support unit	30	15,000	3	1500	6	3000	6	3000	6	3000	6	3000	3	1
15	<i>Monitoring and Evaluation</i>														
15.01	Domestic travel		120,000		5,000		30,000		20,000		30,000		20,000		15,
15.02	International		60,000						10,000		20,000		10,000		20,
16	<i>Mission Costs</i>														
16.01	Local mission costs		94,000		4,000		20,000		20,000		20,000		20,000		10,
17	<i>National Consultants</i>														
17.01	Project Coordinator	60	120,000	6	12,000	12	24000	12	24000	12	24000	12	24000	6	12
17.02	Project Officers	240	240,000	24	24,000	48	48,000	48	48,000	48	48,000	48	48,000	24	24,
17.03	Experts - Tech Stds/Package	62	75,000	10	12000	40	48,000	12	15,000						
17.04	Experts - Proj. imple. Package	42	50,000		20,000		20,000		10,000						
17.05	Experts - Capacity Building	120	144,000		10,800		28,800		24,000		28800		42000		9,
17.06	Experts - M & E	18	18,000			6	6000	10	10,000	2	2,000				

17.07	Consultants - EA													
17.08	Consultant - financial		30,000	10,000		20,000								
19	Component total													
20	Contracts													
21	<i>Sub-contract A</i>													
21.01	Res. Assessment & installations		20,000	20,000										
22	<i>Sub-contract B</i>													
22.01	Gas Engine Adaptation		100,000			100,000								
23	<i>Sub-contracts C</i>													
23.01	Cap. Building		120,000			25,000	50,000	45,000						
25	<i>Sub-contracts D</i>													
25.01	Enabling Activities													
26	<i>Sub-contracts E</i>													
26.01	Information dissemination		230,000			30,000	50,000	50,000	50,000	50,000			50,	
27	<i>Sub-contracts F</i>													
27.01	Financial Mechanisms		40,000	20,000		20,000								
28	<i>Sub-contracts G</i>													
28.01	External monitoring		38,000			10,000	10,000	10,000	5,000	3,				
29	Subcontract E													
29.01	Std. Tech. Package		100,800				50,400	50,400						
	Component total													
30	Training													
32	<i>Workshops/ Community mtgs.</i>													
32.01	Technical workshops													
32.02	Cap. Building		130,000			25,000	30,000	75,000						
32.03	Workshops		20,000					10,000	10,000					
32.04	Information/ Awareness		117,000			20,000	30,000	30,000	20,000	17,				
39	Component total													
40	Equipment													
45.01	Expendable Items		29,200	5,000		5,000	10,000	4,700	4,500					

45.02	Non-Expendable Items		1,366,000			274,000		546,000		546,000			
49	Component Total												
50	Miscellaneous												
52.01	Reporting Costs		10,000	500	750	1,250	2,500	2,500	2,500	2,500	2,500	2,500	2
53.01	Sundries		20,000	2000	3000	5000	5,000	5,000	5,000	5,000	5,000	5,000	
54.01	GEF Support Costs												
59	Component Total												
70	Micro-Capital grants												
71.01	Micro-credits		600,000			120000	240000	240,000	240,000	240,000	240,000	240,000	
72.01	Others												
99	PSD/Project Total		4,017,000	152,800		892,550		1,228,650		1,266,400		296,000	180,

Annex 1C

		Project Budget Covering State Government Contribution															
Sl. No.		Total		2001		2002		2003		2004		2005		2006			
		W/m	US \$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$		
10	Personnel																
11	<i>International consultants</i>																
11.01	International consultants																
13	<i>Administrative support</i>																
13.01	Accountants																
13.02	Administrative assistants																
13.03	Field support unit																
15	<i>Monitoring and Evaluation</i>																
15.01	Domestic travel																
15.02	International																
16	<i>Mission Costs</i>																
16.01	Local mission costs																
17	<i>National Consultants</i>																
17.01	Project Coordinator																
17.02	Project Officers																
17.03	Experts - Tech Stds/Package																
17.04	Experts - Proj. imple. Package																
17.05	Experts - Capacity Building																
17.06	Experts - M & E																
17.07	Consultants - EA																

17.08	Consultant - financial														
19	Component total														
20	Contracts														
21	<i>Sub-contract A</i>														
21.01	Res. Assessment & installations	165,000				33,000		66,000		66,000					
22	<i>Sub-contract B</i>														
22.01	Gas Engine Adaptation														
23	<i>Sub-contracts C</i>														
23.01	Cap. Building														
25	<i>Sub-contracts D</i>														
25.01	Enabling Activities														
26	<i>Sub-contracts E</i>														
26.01	Information dissemination														
27	<i>Sub-contracts F</i>														
27.01	Financial Mechanisms														
28	<i>Sub-contracts G</i>														
28.01	External monitoring														
29	Component total														
30	Training														
32	<i>Workshops/ Community mtgs.</i>														
32.01	Technical workshops														
32.02	Cap. Building														
32.03	Workshops														
32.04	Information/ Awareness														
39	Component total														
40	Equipment														
45.01	Expendable Items														
45.02	Non-Expendable Items	845,000				169,000		338,000		338,000					
49	Component Total														

50	Miscellaneous														
52.01	Reporting Costs														
53.01	Sundries														
54.01	GEF Support Costs														
59	Component Total														
70	Micro-Capital grants														
71.01	Micro-credits														
72.01	Others		471,000			471,000									
99	PSD/Project Total		1,481,000		0	673,000		404,000		404,000				0	

Annex 1D

		Project Budget Covering ICEF Contribution													
Sl.		Total		2001		2002		2003		2004		2005		2006	
No.		W/m	US \$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$
10	Personnel														
11	<i>International consultants</i>														
11.01	International consultants														
13	<i>Administrative support</i>														
13.01	Accountants														
13.02	Administrative assistants														
13.03	Field support unit	30	15,000	3	1500	6	3000	6	3000	6	3000	6	3000	3	1
15	<i>Monitoring and Evaluation</i>														
15.01	Domestic travel														
15.02	International														
16	<i>Mission Costs</i>														
16.01	Local mission costs		30,000						20,000				10,000		
17	<i>National Consultants</i>														
17.01	Project Coordinator														
17.02	Project Officers														
17.03	Experts - Tech Stds/Package														
17.04	Experts - Proj. imple. Package														
17.05	Experts - Capacity Building														
17.06	Experts - M & E														
17.07	Consultants - EA		48,000						10,000		20,000		10,000		8
17.08	Consultant - financial														

19	Component total																
20	Contracts																
21	<i>Sub-contract A</i>																
21.01	Res. Assessment & installations																
22	<i>Sub-contract B</i>																
22.01	Gas Engine Adaptation																
23	<i>Sub-contracts C</i>																
23.01	Cap. Building	80,000								55,000		25,000					
25	<i>Sub-contracts D</i>																
25.01	Enabling Activities	300,000				25,000		50,000		75,000		100,000				50,	
26	<i>Sub-contracts E</i>																
26.01	Information dissemination	350,000								250,000		50,000				50,	
27	<i>Sub-contracts F</i>																
27.01	Financial Mechanisms																
28	<i>Sub-contracts G</i>																
28.01	External monitoring	10,000								10,000							
29	Component total																
30	Training																
32	<i>Workshops/ Community mtgs.</i>																
32.01	Technical workshops	30,000				15,000		15,000									
32.02	Cap. Building	150,000				25,000		20,000		5,000		100,000					
32.03	Workshops	30,000						5,000		10,000		15,000					
32.04	Information/ Awareness																
39	Component total																
40	Equipment																
45.01	Expendable Items	10,000				2,000		2,000		2,000		2,000				2,	
45.02	Non-Expendable Items	882,000				176,000		352,000		354,000							
49	Component Total																
50	Miscellaneous																

52.01	Reporting Costs		10,000		500		750		1,250		2,500		2500		2
53.01	Sundries		20,000		2500		2500		2500		5,000		5000		2
54.01	GEF Support Costs														
59	Component Total														
70	Micro-Capital grants														
71.01	Micro-credits														
72.01	Others		530,000				530000								
99	PSD/Project Total		2,495,000		4,500		779,250		480,750		791,500		322,500		116,

Annex 1E

		Project Budget Covering MNES Contribution													
Sl. No.		Total		2001		2002		2003		2004		2005		2006	
		W/m	US \$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$	W/m	US\$
10	Personnel														
11	<i>International consultants</i>														
11.01	International consultants														
13	<i>Administrative support</i>														
13.01	Accountants														
13.02	Administrative assistants														
13.03	Field support unit														
15	<i>Monitoring and Evaluation</i>														
15.01	Domestic travel														
15.02	International														
16	<i>Mission Costs</i>														
16.01	Local mission costs														
17	<i>National Consultants</i>														
17.01	Project Coordinator														
17.02	Project Officers														
17.03	Experts - Tech Stds/Package														
17.04	Experts - Proj. imple. Package														
17.05	Experts - Capacity Building														
17.06	Experts - M & E														
17.07	Consultants - EA														
17.08	Consultant - financial														

19	Component total																		
20	Contracts																		
21	<i>Sub-contract A</i>																		
21.01	Res. Assessment & installations																		
22	<i>Sub-contract B</i>																		
22.01	Gas Engine Adaptation																		
23	<i>Sub-contracts C</i>																		
23.01	Cap. Building																		
25	<i>Sub-contracts D</i>																		
25.01	Enabling Activities																		
26	<i>Sub-contracts E</i>																		
26.01	Information dissemination																		
27	<i>Sub-contracts F</i>																		
27.01	Financial Mechanisms																		
28	<i>Sub-contracts G</i>																		
28.01	External monitoring																		
29	Component total																		
30	Training																		
32	<i>Workshops/ Community mtgs.</i>																		
32.01	Technical workshops																		
32.02	Cap. Building																		
32.03	Workshops																		
32.04	Information/ Awareness																		
39	Component total																		
40	Equipment																		
45.01	Expendable Items																		
45.02	Non-Expendable Items			391,000				78,200		156,400		156,400							
49	Component Total																		
50	Miscellaneous																		

52.01	Reporting Costs													
53.01	Sundries													
54.01	GEF Support Costs													
59	Component Total													
70	Micro-Capital grants													
71.01	Micro-credits													
72.01	Others													
99	PSD/Project Total		391,000		0		78,200		156,400		156,400		0	

**Annex 2:
Project Planning Matrix**

NARRATIVE SUMMARY	OBJECTIVITY- VERIFIABLE INDICATORS	MEANS OF VERIFICATION	CRITICAL ASSUMPTIONS
I. Development Objective (Impacts)			
To reduce CO ₂ emissions through the promotion of bioenergy as a viable and sustainable option to meet the rural energy service needs in India.	Extent of energy needs met by bio-energy Reduction in use of non-renewable energy sources	Adoption of bioenergy packages in other parts of rural India	Globally, bioenergy package will continue to be one of the key climate change-mitigation options and the government is committed towards the reduction in GHG emissions. Provision of good quality bioenergy services will improve the quality of life, and thereby lead to its replication in other parts of rural India. Large scale of use of bioenergy will lead to reduction in GHG emissions.
II. Immediate Objective (Outcomes) / Purposes:			
Immediate Objective I To provide a decentralized bioenergy technology package for the provision of good quality rural energy services for lighting, drinking water supply, cooking gas, irrigation water supply, and milling;	% of households having access to bioenergy services % Functional bioenergy systems meeting the % energy requirements	Per capita bioenergy consumed	The findings of survey undertaken as a part of PDF activities hold good.
Activity 1: Technology Package Standardization			
Output 1: Development; adaptation; and resulting availability of gas engines--which are available locally--to use the renewable feedstock proposed under the project;	No. of systems installed	Evaluation of performance of gas engines	Introduction of gas engines will improve the efficiency and use of 100 % renewable resources and lead to reduction in costs of services.
Output 2: Detailed technical specifications will be drawn for the proposed bioenergy packages in selected areas	Report on recommended specifications	Evaluation report of technical specifications	The technological components are well known and trouble free and could be adopted and modified and put together to suit local conditions without a large effort in R & D. The industry will favour high quality standards and adhere to the standards while producing these equipments.

Output 3: Draft standards for bioenergy technologies for use in Activity 2 to test their suitability for wider applications.	Established technical standards	Findings of the proposed monitoring activities	Standards will enhance the reliability and confidence level of the customers
Activity 2: Technology Demonstration and Proof of Concept (response to the technical barriers)			
Output 1: 1.2 MW biomass gasifier (60 units of 20 kW capacity) based power plants with a generating potential of 4800 MWh of bioelectricity annually.	Number of installed bioenergy systems having the recommended specifications/Standards Capacity utilization of installed systems	% increase in area under bioenergy irrigation and corresponding outputs Quantity of fossil fuel substituted	Increase in incomes leads to demand for good quality energy services There will not be any conflicts arising out of sharing of irrigation water.
Output 2: 120 kW (3-10 kW each) Community biogas cum bio-fertilizer systems generating 346 MWh for base loads.	No. of household connected to biogas electricity	% of households having access to lighting services	Rural communities aspire for better quality of life.
Output 3: 24 Biogas cum bio-fertilizer systems in 24 village settlements with a total capacity of 4000m ³ /day (range 25 to 100m ³ /day) for cooking gas and bio-fertilizer production	No. of households connected to biogas	Reduction in fuelwood consumption and fertilizer sales	The targeted beneficiaries of the project will prefer bioenergy services than conventional forms of use of energy.
Output 4: Establish 452 ha of short rotation forest plantations, 371 ha of agro-forestry systems, 271 ha of community forestry 471 ha of orchards and 113 ha of high input forestry.	Area covered under forests	Overall Increase in forest area	There will not be major land tenure issues and the stakeholders' cooperation is guaranteed. The communities will participate in the sustainable forestry activities.
Output 5: Lessons in different modes of providing the rural energy service package to rural villages, including experience in gaining full cost recovery.	Case studies documented	Review of project implementation results	Bioenergy services would not become financially less attractive due to pricing policies of competing energy service utilities. People will actually pay fee for services utilized.

Immediate Objective 2 To remove barriers to large-scale adoption and commercialization of this bioenergy technology package.	Institutional and operational bioenergy services delivery systems in place. No. of local agencies, NGOs, Entrepreneurs, in place providing good quality rural energy services.	Increased demand for bioenergy technologies in other villages	The policies will favour sustainable environment friendly technologies. Barrier removal activities will lead to replication of the bioenergy package in other parts. Common business premises will hold for Bioenergy service business
Activity 3: Capacity Building (response to the institutional barriers)			
Output 1: Bioenergy packages for replication in other parts of rural India;	Evaluation of bioenergy package for wide-scale adoption of technology standards	Installation of bioenergy packages in other rural parts.	Bioenergy packages can be adapted for most parts rural India
Output 2: Approach and methodology for monitoring carbon flows in bioenergy projects;	Database on Carbon flows established	Measuring carbon flows using established practices and methods.	Tools are available to measure the carbon flows accurately.
Output 3: Training and involvement of women in planning and management of the bioenergy systems;	Technical capacity strengthened No. of women participated in the training workshops	Participation of women in planning and management of bioenergy systems	Women will show active interest in the management of bioenergy systems.
Output 4: Training center for training entrepreneurs, NGOs and managers on implementation of technology and institutional package;	Training centres established	Training centres operating or participating in bioenergy package dissemination	The training centres will sustain bioenergy-training activities even after the project duration.
Output 5: Training for entrepreneurs, NGO' s, technicians and managers in the business skills required for making a success of the rural bioenergy development institutions;	Training centres established No. of entrepreneurs, NGOs., technicians etc. trained	Training centres operating or participating in bioenergy package dissemination	
Output 6: Infrastructure development for manufacturing, spare parts supply and servicing of bioenergy systems;	Existence of enterprises providing supply, installation, maintenance, and repairs	Number of institutions and agencies engaged in such activities.	Locally trained manpower will be available to undertake repairs, maintenance, etc. Technical skills built up will remain attractive for rural markets (no migration of technical people from rural areas.
Activity 4: Enabling activities (response to the market barriers)			
Output 1:	Framework for fee for services	Framework for fee for services	Relevant government and private stakeholders'

A solid rationale and framework justifying the fee-for-service approach of rural energy provision;	established	adopted	actively participate in developing appropriate policies.
Output 2: Policy papers to address the issue of <i>level playing field</i> for bioenergy package such as policy analysis for rational pricing of energy	Policy papers published	Changes in relevant policies	Relevant government and private stakeholders' actively participate in developing appropriate policies.
Output 3: Case Studies to highlight successful policy implementation experiences	Case studies documented	Case studies disseminated	The project will be closely monitored and regular feedback will be provided
Output 4: Workshops to involve stakeholders especially policy makers to exchange the experiences, study tours and policy research activities	Extent of participation and recommendations	Extent of recommendations accepted	The recommendations will provide key basis to some of the intended policy changes - such as level playing field for bioenergy services
Output 5: Documentation of lessons learnt and sharing of experiences;	No. of cases documented		
Output 6: Monitoring and evaluation of the proposed project approach and activities.	Quarterly reports Annual reports	Progress made in the implementation of the project	All stakeholders will provide inputs to the monitoring team in addition to their direct feedback to the implementing agency.
Activity 5: Information dissemination (response to the information barriers)			
Output 1: Information system on bioenergy technologies, manufacturers, technology suppliers, financial mechanisms, technical performance, R & D facilities, and technical experts.			Awareness modules will reach the targeted beneficiaries/users
Output 2: Methods for project formulation including financial analysis, implementation, monitoring, etc. for potential replicability;			
Output 3: Promotional modules using audio-visual, print and other media.	Case studies, Video films Software packages developed	Extensive use of promotional modules	

Activity 6: Removal of Financial Barriers and Creation of Investment Risk Fund (response to the financial barriers)

<p>Output 1: Provision of venture capital for franchisers and franchisees as start-up capital; And</p>	<p>Number of entrepreneurs financed</p>	<p>Enterprises/ Rural Energy Service Company (RESICO) operating successfully</p>	<p>There will be sustained demand for good quality bioenergy services.</p>
<p>Output 2: Creation of revolving fund to offset perceived investment risks;</p>	<p>Loan recovery rate Private investments leveraged</p>	<p>Revolving Fund mechanisms in place</p>	
<p>Output 3: Formulation of a approach involving bidding for concessions to operate future bioenergy systems in areas targeted for replication;</p>	<p>Replicable approaches formulated</p>	<p>Replicable approaches adopted</p>	<p>Other areas would be receptive to the recommended approaches</p>
<p>Output 4: Demonstration of economic and financial viability through creation of cost recovery mechanisms.</p>	<p>Private investments by the enterprises</p>	<p>Institutional networks for funding in place</p>	<p>Other financing institutions provide loans for bioenergy technologies and services.</p>
<p>Output 5: Demonstration of willingness and capacity of rural households to pay for good quality energy services;</p>	<p>Loan recovery rate Increase in demand for good quality energy services</p>	<p>Agencies providing credit to households for bioenergy services</p>	<p>Other financing agencies, NGOs, etc., to provide credit for bioenergy technologies and services</p>

Annex 4 Carbon emission avoided and sequestered

This project is important not only in its own right, but also when the global replication potential is considered. Table 5 estimates the mitigation potential for the bioenergy package at the four levels listed below:

- The mitigation potential for the project area is estimated at 54,000 t C, at 2266 t C per village, over a period of 25 years;
- The mitigation potential for 18,000 extremely remote villages in India is estimated to be 40 million t C over a period of 25 years;
- The mitigation potential for all 86,000 unelectrified Indian villages is as high as 194 million t C over 25 years; and
- The total mitigation potential if all 0.557 million villages in India are supplied with the bioenergy package could be as high as 1262 million t C, over 25 years.

The above mitigation potential is significant when compared to the total carbon emissions from energy sector estimated at 138 Million t C for India in 1990. It has to be noted that in India according to some studies, there is a potential to implement the bioenergy package in all the 0.5 million villages, leading to large-scale carbon emission reductions. The mitigation potential of the renewable energy programmes implemented so far in India is estimated to be 1.69 Mt of carbon annually, compared to the 1.63 Mt C if only 18,000 remote villages are considered and 7.8 Mt C if all the 86,000 villages are considered.

Carbon Mitigation Replication Potential of Proposed Bioenergy Package

Activity	Energy use	Annual C emission avoided (tC)	Mitigation potential per village in 25 yrs (tC)	Total mitigation potential in 24 villages in 25 yrs (tC)	Mitigation potential in 18,000 remote villages (MtC) ^a	Mitigation potential in 86,000 unelectrified villages in 25 yrs (MtC) ^b	Mitigation potential assuming 0.557 million villages (MtC) ^c
Cooking ¹	462 t of LPG	397	413	9925	7.43	35.52	230.04
Lighting + drinking H ₂ O supply ²	340 MWh	68	71	1,700	1.27	6.10	39.54
Irrigation ³	4800 MWh	969	1009	24,225	18.16	86.77	562.01

Annex 5

Incremental costs

Broad Development Goals

The broad developmental goal of this project is the provision of good quality energy services to India's rural population. About 87% of the villages in India are officially electrified, but this leaves about 85,000 villages still unelectrified. According to the 1991 census, only 31% of the rural households actually have access to electricity. Given the size of the population in India, the government's objective of 'Electricity to All' would require enormous efforts to make it a reality. This project can thus be viewed as one step ahead to realize this goal.

Baseline

Under the baseline, there are reliable energy service options of extending the grid or using diesel gen-sets for meeting electricity needs and supply LPG for cooking. Even after considering the fact that these may not be economical, the reliability of these services is questionable. Where no grid extension is foreseen, the baseline would represent continued outages leading to only partial supply of required electricity for lighting and pumping and continued fuelwood use for cooking.

As the thrust of the project is to provide services via renewable energy, defining the baseline is somewhat complex. In the case of the three services being provided—domestic water pumping and electric lighting; irrigation water pumping; and gas for cooking—three different systems are used for the baseline costs (see Table A-1). For domestic water pumping and electric lighting, a small diesel gen-set would be used. Over the project's lifetime, this would come to approximately \$579k, not counting additional costs of fertilizer. For pumping irrigation water, a much larger diesel system would be utilized, with costs of about \$7.2m. For cooking fuel, currently people utilize fuelwood. However, this is harvested unsustainably. Over the longer term, LP Gas would provide baseline fuels for cooking. The costs of this option come to about US\$ 2m. Altogether, the baseline costs of providing equivalent good quality energy services come to about US\$ 9.8 million.

Global Environmental Objective

The global environmental objective is the reduction of present and future greenhouse gas emissions through the use of renewable energy for providing energy services for rural populations. The proposed project is beneficial in this context and can be sustained in the long term, once barriers are removed. This program is therefore consistent with GEF Operational Program 6, "Promoting the adoption of renewable energy by removing barriers and reducing implementation costs".

system for base load activities such as lighting and pumping drinking water; and iii) leaf biomass biogas-based gas system for cooking gas supply.

Under the project case, lighting and domestic water pumping will be provided by way of biogas power generation system utilizing cattle-dung as feedstock. The costs of these systems come to approximately US\$ 0.825m. Beyond this, however, there is the additional domestic benefit available from using the biogas effluent as fertilizer. Although the market for this fertilizer is not well developed, this additional benefits makes the proposed system slightly cheaper than the baseline system based upon small-scale diesel gen-sets.

Under the project case, biomass gasifiers utilizing locally grown wood will provide the largest fraction of electric power for irrigation pumping and other agro-industries. The costs of this larger-scale system come to US\$ 6.8m or US\$ 0.4m less than the baseline case. Finally, under the project, biogas operating on leaf-litter will provide the basis for cooking fuel within the village. This system is estimated to cost approximately US\$ 1.775m. Even without accounting for the additional benefits from the fertilizer value of the slurry (US\$ 0.592m), this option is cheaper than the baseline alternative. The biogas plant using leaf litter as feedstock will be used to generate gas for cooking.

The installed capacity of power generation in the baseline as well as the project scenario is identical. The capital cost (refer to Table below) for the baseline scenario (diesel-based system) is \$457,620 whereas it is \$993 880 for alternate scenario (gasifier-based system). Table does not include the cost of pumping motor for water lifting, as it is identical for both the scenarios. The capital cost is given in Table A-1 is only for the power generation system (gasifier +diesel engine + generator). However, the total cost on life cycle cost basis, the alternative project case scenario is a low cost option.

Incremental Cost of Each Intervention (US '000 \$)

<i>Good quality energy services</i>	<i>Baseline Scenario (B)</i>	<i>Alternative Scenario (A)</i>	<i>Incremental benefits* (I)</i>	<i>Incremental cost (A - I) - B</i>
<i>I. Lighting + Drinking Water supply service</i>				
- Capital	42.37	335.68		
- O & M and Fuel	536.96	488.94		
- Fertilizer benefit	-		274.71	
Total	579.33	824.62	274.71	-29.42
<i>II. Irrigation service</i>				
- Capital	457.62	993.88		
- O & M and fuel	6799.44	5823.44		
Total	7257.06	6817.32		- 439.74

Taken as a whole, the bioenergy service packages to be tested and promoted under this project are lower in cost over their life cycle than are the baseline options. However, they are still relatively experimental in nature and have never been promoted as a coherent package, promoted as a solution to the rural energy dilemma. For this bioenergy package to be successfully disseminated across a wide population, a number of barriers must first be removed. GEF is requested to view the costs of removing these barriers as the incremental costs of this project.

The cost of barrier removal activities is provided in the incremental cost matrix. Activity 1, Technology Package Standardization, is unlikely to occur without this project. Therefore, their cost of US\$ 435,000 is considered to be entirely incremental. Activity 2 builds upon the needs for rural villages to obtain good quality energy services. Because the capital costs of the systems to be installed will be recovered and folded into the Risk Guarantee Fund (Activity 6), only the costs of maintenance and woodlot establishment are included in this activity. Therefore, none of the budget for this Activity is considered incremental. The capacity-building (Activity 3) element would be unlikely to occur without the project. As a result, much of it is considered to be incremental—GEF's contribution to this activity is US\$ 722,000 out of the required \$822,000. Much of the policy work or Enabling Activities to be carried out under this project (Activity 4) can only be considered to be related to baseline activities, that is, ensuring that the policy for rural electrification is sound. Only a small fraction of the total— US\$ 100,000— is considered incremental. Given the lack of information about the bioenergy package and its deployment through RESCO's, the information dissemination activity (Activity 5) is largely incremental. GEF is asked to pay US\$ 1.1 million for this activity. Finally, given the large financial barriers to the sustainable financing of the project and the large investor risks being faced, GEF is asked to contribute about US\$ 1.551 m to reduce the risks associated with the further dissemination of the bioenergy package through commercial means. The investment risk fund (Activity 6) is meant to reduce the barrier posed by these larger than normal investment risks associated with testing and disseminating a new technology package.

Costs

The total costs of the project intervention come to approximately US\$ 8.82 million. The baseline costs are estimated at US\$ 4.8m and the incremental costs, that is the costs of removing the barriers necessary to make the bioenergy package sustainable, is US\$ 4.213m, including M&E costs and GEF PDF resources (US\$ 196,600).

Global Environmental Benefits

If the project is successful at providing rural electrification through a RESCO-type bioenergy package, the global benefits are potentially enormous. For the 24 demonstration villages, carbon emission is estimated at approximately 50,000 tonnes of Carbon over 25 years.

Incremental Cost Matrix

	Baseline	Alternative	Increment
<p>PROJECT ACTIVITIES</p> <p>1. Technology Package Standardization</p>	<p>Poor reliability of small-scale biomass systems for rural applications, and low consumers' confidence in the technologies.</p> <p>Cost: US\$ 45,000</p>	<p>Develop standards and codes for small-scale biomass energy systems for rural applications. Develop testing capacity and procedures, as well as certification/labeling program for rural biomass energy systems.</p> <p>Cost: US\$ 435,000</p>	<p>Increased reliability of and consumers' confidence in village-level biomass energy technologies.</p> <p>Cost: US\$ 390,000</p>
<p>2. Technology Demonstration</p>	<p>In order to provide the 24 villages with an equivalent package of good quality energy services, each village would have to invest in two diesel-based electricity generation systems and the purchase and utilization of LP Gas (Also see Activity 6 below).</p> <p>Cost: US\$ 1,342,000</p>	<p>Support demonstration of the bioenergy package, made up of three systems: 1) 1.2 MW woody biomass gasifier; 2) 120 kW community biogas generators; and 3) 45 community biogas systems with a capacity of 4000 m³/d. Also establish forest plantations. (see Activity 6 below)</p> <p>Cost: US\$ 1,342,000</p>	<p>To demonstrate the techno-economic viability of village biomass technologies and the cost recovery schemes designed under Activity 6. To demonstrate the project development model for rural biomass applications.</p> <p>Cost: US\$ 0</p>
<p>3. Capacity Building</p>	<p>Managers and operators and private enterprises have little or no knowledge of bioenergy package for rural development. Their skills are not brought to bear on the energy needs of the rural poor.</p>	<p>Provide technical training to the managers and operators of the biomass demonstration systems. Provide technical training to the technicians who will provide technical backstopping for these systems. Provide financial and business management training to the private enterprises in project development skills for bioenergy</p>	<p>Technical assistance will ensure the technical problems encountered in the demonstration systems will be properly handled and ensure the technical viability of these technologies. Institutional arrangement of project development for rural bioenergy applications set up. Private enterprises are interested</p>

		applications. Promote RESCO concept and other models for private sector involvement	and familiar with the project development models for such applications.
	Cost: US\$ 150,000	Cost: US\$ 872,000	Cost: US\$ 722,000
4. Enabling Activity	Under the current subsidized tariff for power, gas, and water in rural areas, the rural bioenergy applications would not be considered. Policies are directed to subsidizing fossil fuel based power, not making development sustainable.	Develop policy framework to support fee-for-service model that would allow the private enterprises to charge a fee for the services delivered from renewable energy. Facilitate policy dialogue between the government, private sector, and consumers.	Increased economic viability of village-level bioenergy technologies. Increased services of rural applications such as power, irrigation, drinking water, and cooking gas for rural consumers. Increased living standard in rural India.
	Cost: US\$ 700,000	Cost: US\$ 800,000	Cost: US\$ 100,000
5. Information Dissemination	Limited information and awareness of rural biomass technologies or RESCO model. Existing information is scattered and incomplete.	Develop information database on bioenergy systems and RESCO's. Disseminate bioenergy information through a public awareness campaign.	Increased public awareness and information on deployment of village-level bioenergy systems. Increased project development techniques
	Cost: US\$ 125,000	Cost: US\$ 1,229,000	Cost: US\$ 1,104,000
6. Financial Barrier Removal and Investment Risk Fund	No investment in village-level bioenergy technologies. Investments only in conventional energy supplies (Activity 2). Financial institutions and private investors regard small-scale biomass technologies as more risky than conventional fossil fuel options.	Ensure cost recovery of technology demonstration and provide a risk guarantee mechanism to ensure future replications ensuring strong linkages to investment institutions.	Increased investment in village-level bioenergy technologies. The financial institutions and private investors have increased confidence and positive experience with rural biomass technologies.
	Cost: \$2,144,000	Cost: US\$ 3,695,000	Cost: US\$ 1,551,000

7. Global Environmental Benefits	Rural biomass applications underdeveloped. The barriers to prevent widespread application of small-scale biomass energy technologies continue to exist. The 24 villages in the project will choose diesel gen-set to meet power demand, and LPG for cooking. The baseline carbon emission = 54,000 tons of carbon over 25 years. The potential 86,000 unelectrified Indian villages are also likely to choose fossil fuels as their power and cooking fuels, the carbon emission would be a total of 194 million tons over 25 years.	Rural biomass energy applications will be widely replicated. The key barriers are removed. It is assumed that biomass fuel can substitute 80% of the diesel by dual-fuel gasifiers, 100% diesel by biogas generators, and 100% LPG for cooking. The alternative carbon emission = 5,000 tons of carbon over 25 years for the 24 villages, and 17 million tons of carbon over 25 years for the 86,000 potential unelectrified Indian villages.	Significant GHG emissions are attained. Direct carbon emission reduction = 50,000 ton C over 25 years for the 24 villages, and 177 million tons of carbon for the potential 86,000 unelectrified Indian villages.
8. Domestic Environmental Benefits	Rural communities do not have access to electricity and commercial fuels for cooking. Local and indoor air pollution as well as adverse health impacts from traditional fuelwood combustion.	Increased supply of power and cooking fuels from indigenous fuels. The local private enterprises will have a growing business in small-scale biomass applications. Reduced local and indoor air pollution.	Improved living standards by increased services of power and cooking fuels in rural India. Increased job opportunities at rural community. Avoided indoor air and improved health impacts from biogas use.
9. Costs	Total: US\$ 4,506,000 MNES: US\$ 391,000 State Government: US\$ 1,481,000 Bilateral: US\$ 2,395,000* Users: US\$ 239,000	US\$ 8,373,000 GEF US \$3,867,000* MNES: US\$ 391,000 State Government: US\$ 1,481,000 Bilateral: US\$ 2,395,000* Users: US\$ 239,000	Total: US\$ 3,867,000 GEF*

* GEF Incremental costs presented here do not include the PDF Costs (US\$ 196,600) or the costs of Monitoring and Evaluation US\$ 150,000. Bilateral costs also do not include US\$ 100,000 for M&E.

Annex 6. Tentative Schedule of project reviews, reporting and external evaluation

Proposed project starting date		April , 2001
REPORTING ACTIVITY DESCRIPTION		
1.	Inception Report	May 2001
2.	1 st Project Steering Committee (PSC) meeting	May 2001
3.	1 st Annual Project Report (APR)	Mar 2002
4.	2 nd Project Steering Committee (PSC) meeting	Nov 2001
5.	2 nd Annual Project Report (APR)	Mar 2003
6.	3 rd Project Steering Committee (PSC) meeting	May 2002
7.	3 rd Annual Project Report (APR)	Mar 2004
8.	4 th Annual Project Report (APR)	Mar 2005
9.	Mid Term Evaluation	Mar 2003
10.	4 th Project Steering Committee (PSC) meeting	Nov 2003
11.	5 th Project Steering Committee (PSC) meeting	May 2004
12.	5 th Annual Project Report (APR)	Mar 2006
13.	6 th Project Steering Committee (PSC) meeting	Nov 2004
14.	7 th Project Steering Committee meeting	May 2005
15.	Terminal Report	Aug 2006
16.	Terminal Evaluation and Project Review	Dec 2006

Annex 7. Terms of Reference (Indicative)

1. Project Coordinator

Position Title: Project Coordinator

Main Responsibility: To coordinate the bioenergy project planning, implementation, management, monitoring and dissemination.

Activities:

- To head the Project Management Unit (PMU) of the bioenergy project.
- To coordinate with different government departments, Zilla Parishad, Panchayats, NGOs, manufacturers etc.
- To work with Technical Support Unit (TSU) and prepare plan for implementation of bioenergy package in Tumkur district.
- To organize and coordinate implementation, operation and management of utilities in the villages of Tumkur districts.
- To work with TSU and outside experts, consultants, NGOs to develop training educational material and organize capacity building activities.
- To organize policy impact activities.
- To coordinate institutional and financial barrier removal activities.
- To coordinate monitoring and evaluation.
- To manage project funds and report funds utilization periodically to respective funding agencies.

Qualification:

- Masters in Science/Engineering/Technology/Economics/Management
- At least 5 years of experience in managerial capacity required.
- Demonstrated ability to plan, implement, manage and monitor rural development or rural energy or environment development programmes.
- Candidates from Administrative Services or Business Management are likely to be preferred.

Accountability: Report to Project Director, Project Executive Committee and Project Advisory Committee.

Duty Station: Tumkur and Bangalore.

2. Project Officers

Main Responsibility: To assist the Project Management Unit, Technical Support Unit and Project Coordinator in planning, implementation, management (administrative and finance) of the bioenergy project.

- Project Officer-1: Project Administration at Project Management Unit (PMU)
- Project Officer-2: Finance Management at Project Management Unit (PMU)
- Project Officer-3: Manager at Technical Support Unit (TSU)
- Project Officer-4: Manager for outreach activities at Technical Support Unit (TSU)

Activities:

The four project officers will have the following responsibilities:

- To manage office and administration (at PMU and TSU)

- To assist project coordinator in planning, implementation and management of project activities.
- To manage project finances (project officer-2)
- To coordinate the activities of different experts, consultants, contractors, NGOs and manufacturers.
- To manage outreach activities; training programmes, workshops, field visits, publications, publicity, press etc.

Qualification:

- Masters in Science/ Engineering/Technology/Economics/accountancy/Management
- Two to three years experience in project management.

Accountability: Project Officers report to Project Coordinator.

Duty Station:

- PMU at Tumkur
- TSU at Bangalore

3. Sub Contract - Resource-need Assessment Survey

Objectives: To conduct field survey and measurement to generate additional data for bioenergy technology package for the identified villages.

Activities:

- Assess and review of the data collected during PDF Block B phase
- Identify additional data required (land, biomass, energy, settlement, socio-economic, institutional etc.) in consultation with experts developing the technology package; Land survey, water source survey, energy survey, biomass survey, settlement maps etc. methods could be employed.
- Conduct field studies / surveys / measurement
- Analyze and provide the report in the format required

Qualification:

- Should have completed socio-economic studies relevant to rural development or rural energy or biomass studies.
- Knowledge of Kannada essential.
- Experience of working in Tumkur district is desirable, though not essential.

Accountability: The sub-contractor is accountable to the head of the technology packaging team and ultimately to the Project Coordinator.

Period: 3 to 6 months (Quarter 1 to 2) during the first year

Duty station: Selected (3 to 4) panchayats in Tumkur district.

4. Gas Engine Adaptation and Development

Position Title: Experts for gas engine development

Main Responsibility: To assess the gas technology designs and modify or adapt to the local needs to replace diesel completely from dual-fuel gasifier and biogas based engines.

Activities:

- To identify and select gas engines operating wholly on producer gas.
- Evaluate the existing designs.
- Modify or adapt the designs for application in India.
- Develop draft standards for manufacturing gas engines.

Qualification:

- Demonstrated technical capacity in working on gas engines.
- Laboratory infrastructure for evaluating and redesigning gas engines.
- Publication of technical reports and journal articles in the relevant field.

Accountability: Work under the guidance of Technical Support Unit.

Period: Quarter 1 to 4 of the project period.

5. Sub Contract - Gas Engine Testing and Evaluation of performance

Objective: To field test and evaluate the gas engine design developed by the experts and market / disseminate the design to the manufactures.

Activities:

- Fabricate the modified gas engine designs.
- Testing in Laboratory for performance.
- Field testing of biogas and producer gas engine.
- Market / disseminate the designs to manufacturers.

Qualification:

- Infrastructure for fabricating and testing gas engines.
- Technical staff for testing and evaluating the performance.
- Experience of working with engine development groups.
- Demonstrated linkages with manufacturers.

Accountability: Work under the guidance of Technical Support Unit.

Period: Quarter 1 to 4 of the project period.

6. Sub Contract - Development of Technical Specification for Bioenergy Technology

Objectives: To develop the bioenergy technology and end-use package for the cluster of villages identified in Tumkur district to meet all the energy needs through bioenergy technology and end-use systems. Provide all design draft standards and field execution parameters.

Activities:

- Assess the 'resource-need' survey data available and requirement
- Develop and provide all design parameters for energy generation and end-use systems
 - Biogas for baseload electricity
 - Biogas for cooking

- Gasifier system for power generation
- Forest and biomass production and processing system
- Electricity and biogas distribution system
- **End-use systems:** Cooking, lighting, irrigation water pumping, flour mill and rural industry systems
- Prepare and provide guidelines for field installation

Accountability: The team is accountable to Chairman, ASTRA for technical aspects and for all other aspects to Project Coordinator, PMU

Period: Quarter 1 to 4

7. Sub Contract - Development of Project Implementation Package

Objectives: To evolve a project implementation package for the sites selected. The package shall be developed based on a detailed interaction with the villagers regarding their requirements, willingness to pay etc.

Duties and deliverables for National Experts:

Irrigation package:

- Necessary documents and agreements for water and resource sharing will be drafted and passed in each village, mandal and zilla panchayats.
- Upon discussion with end-users, sites for each of the bioenergy irrigation utility will be chosen based on road access and proximity to ground water resources identified (borewell sites under 1.1) on a group and settlement basis.

Biogas Illumination and Water supply package:

- Necessary documents and agreements for domestic water supply and illumination as well as dung resource sharing.
- Upon discussion with end users, identify suitable location for REWSU biogas plant.
- Evolve manure /digested slurry redistribution norms.

Biogas cooking:

- Necessary documents and agreements for domestic cooking gas and biomass resource contributions and sharing.
- Upon discussion with end users, identify suitable location for Cooking biogas plant.
- Evolve manure /digested slurry redistribution norms.

Afforestation:

- Necessary documents and agreements for joint management and planting of various classes of afforestation and cost sharing.
- Identify along with people interaction afforestation plan, species mix, biomass demand, cost sharing, etc. on a village wise basis along with cost estimates.

Qualifications (National and International Experts):

Irrigation package:

- 5-8 years experience in Bioenergy projects and their implementation of which 3 years experience should be demonstrable with regards to gasifier based irrigation water pumping

- Demonstrable experience in planning of underground and PVC pipe based water distribution in mini and micro irrigation systems using ground water with allowances for consumptive use and soil characteristics.
- Demonstrable knowledge of dry land and irrigated farming techniques.
- Working knowledge of interpreting and using GIS based systems planning for networking, power distribution, etc. type applications.

Biogas for REWSU:

- 5-8 years of experience in Bioenergy project implementation of which at least 3 years should be demonstrable with regards to planning, designing, installation, operation and management of large biogas plants for water supply and power generation.
- Demonstrable experience in successful implementation of cost reduction techniques and dung based biogas plant design optimization.
- 3 years experience in running community based biogas plants in villages.

Biogas plants for Cooking:

- 5-8 years of experience in bioenergy projects implementation of which at least 3 years should be demonstrable in the use of non-dung biomass feedstocks for biogas production.
- Demonstrable experience in planning and designing non-dung based functional biogas plants (2-3 years or designs).
- Demonstrable experience in successful implementation of cost reduction and gas proofing techniques in non-dung based biogas plant designs for rural applications as well as their design /cost optimization.

Afforestation:

- 5-8 years of experience in bioenergy projects implementation of which at least 3 years should be with regards to the sustainable forest based fuel-wood /multi-use afforestation.
- Demonstrable experience in planning and implementation of afforestation programs for bioenergy and multiple end-use applications.
- 3 years experience in facilitating raising of community owned forestry programs.
- Working knowledge of interpreting GIS and spatial databases, imageries and cadastral maps.

Period: 3 months in Q2

8. Terms of Reference - Technical coordination for development of draft standards bioenergy package

Position title: Coordinator for developing Standardized technology package

Activities:

- To assemble and coordinate a team of experts to develop a standardized bioenergy technology package. Team to include experts on; Biomass gasifier, biogas, forestry, power distribution, irrigation expert, civil engineer
- To ensure the team to participate at all stages from planning to field implementation
- To develop a set of standard biomass resource – energy demand – socio-economic situations for developing the technology packages
- To develop a bioenergy technology packages for large scale dissemination based on project experience
- Organize two workshops inviting technical experts and all other stakeholders

- Prepare Guidelines and computer package on the technology package; going all the details of the package

Qualifications:

- Institution should have experience in developing bioenergy technologies
- Institution should have implemented bioenergy technology demonstration projects
- Institution should have core team of experts in-house and hire if necessary additional experts from other institution, to enable continued participation

Period: Three years

Duty station: Bangalore

9. Terms of Reference - International Technical Expert for Bioenergy Technology Package Review

Position Title: International Technical Expert

Activities:

- To review and assess the bioenergy technology package developed
- To visit field sites where bioenergy technology package has been implemented
- To assess the package for potential replication in different resource and socio-economic situation
- To review the technical soundness of the package.

Qualification:

- Experience in developing, reviewing and monitoring of bioenergy technologies, particularly in developing countries
- Research experience in bioenergy as demonstrated by the publications

Period: Two weeks

Duty station: Bangalore.

10. Sub-contract - System Demonstration and Operation and Maintenance

Objectives: The main goal is to demonstrate the technical and operational feasibility and viability of the bioenergy technology package using the local entrepreneurs.

Activities:

- Identifying entrepreneurs and NGOs
- Provide financial support
- Operation on daily basis: energy generation and end use system
 - **Energy system:**
 - a) Biogas system for cooking,
 - b) Biogas system for electrification,
 - c) Producer gas system for power generation
 - **Input supply system:**
 - a) Wood or biomass feedstock supply

- b) Cattle dung and leaf litter supply
- **End use system:**
 - a) Irrigation water lifting and transmission
 - b) Cooking supply to all houses
 - c) Electricity distribution system for lighting and industry
- Maintenance of energy and end-use systems; daily and periodic
 - Daily field visit to maintain different system
 - Ensure efficient functioning of all equipment

Qualification: Experience in operation and maintenance of gasifiers and technical capacity to undertake the task.

Accountability: The sub-contractor is responsible to the PMU and to the Project Coordinator.

Period: 4 years 6 months (Quarter 3 to 20)

Duty station: 3 to 4 panchayats in Tumkur district. Coordinating office in Tumkur

11. Terms of Reference - Development of Bioenergy Service Enterprises – Experts

Objective: To develop the concept of bio-energy service enterprise and evolving standards for end use services

Activities:

- To conceptualize different types of bio-energy service enterprises
- To evolve end use service standards for each type of service enterprise.
- To prepare Techno-economic feasibility reports (TEFRs) for each type of service enterprise at different scales of operations.
- Preparation of training manuals and training software for training personnel who would operate and manage the bio-energy service enterprises
- Conducting training programmes.

Qualification:

- Technical cum managerial education background,
- 8-10 years experience in rural energy sector,
- Experience in economic analysis
- Experience in preparation of training materials and training software.
- Specific expertise in one of the following fields:
 - Operation of Small power systems,
 - Operation of water supply & irrigation systems,
 - Operation of gas supply systems,
 - Operation of electricity distribution systems,
 - Micro credit operations,
 - Agricultural / Forest and allied resource management,

Period: Quarters 1 to 4

12. Sub Contracts - Development of Bioenergy Service Enterprises

Objective: To promote the establishment of bio-energy service enterprises and ensuring provision of end use services in accordance with performance standards.

Activities:

- To set up different types of bio-energy service enterprises
- To provide end use services of specified standards for each type of service enterprise.

Qualification:

- Should have set up / operated one or a combination of the following:
 - Small power systems,
 - water supply & irrigation systems,
 - gas supply systems,
 - electricity distribution systems,
 - Micro credit operations,
 - Agricultural / Forest and allied resource management,

Period: Quarters 1 to 4

13. Terms of Reference - Carbon-Flow Monitoring Methodology Development

Objective: To develop methodology and guidelines for monitoring carbon stock and flows in forestry and emission reductions due to fossil fuel substitution in the project area.

Activities:

- Review existing and past projects (AIJ), on bioenergy and forestry, for methodologies adopted.
- Assess the resources required for monitoring (staff, technical capacity, instruments)
- Develop methodology for monitoring:
 - Changes in carbon stocks in vegetation and soil
 - Carbon emission reduction due to fossil fuel substitution
 - Carbon emission due to any leakage or positive spill-over
- Develop guidelines and manual for measurement, monitoring and reporting
- Visit to other project sites, where renewable energy (ongoing GEF project) projects are implemented.

Qualification:

- Experience of over 5 years working on bioenergy and forestry projects.
- Experience of working on climate change mitigation projects.
- Minimum Masters in Agriculture or Forestry and a PhD desirable.

Accountability: The expert is accountable to the head of Technical Support Unit.

Period: 6 months (Quarter 3 to 6)

Duty Station: Bangalore

14. Terms of Reference - Training Women – Experts

Objective: To develop training material and training software for training women.

Activities: Assessment of issues on which awareness has to be created among women who will be affected by the project,

- Assessment of training needs,
- Working out organizational structures through which women could be organized and empowered,
- Training of organizations and personnel who will finally be taking up the task of training women.

Qualifications:

- Sociological educational background
- 8 to 10 years experience in training and organizing women and women empowerment in rural sector
- Exposure to rural development issues
- Exposure to rural energy related issues

Period: Suitable contracts to be awarded during Quarters 2 to 12

15. Sub Contract - Training Women

Objective: To conduct training programmes for women to create awareness, to assist in formation of women's organizations and their empowerment.

Activities:

- Conducting training programmes with different objectives viz.
 - Creating awareness about the project and its implications on their livelihoods
 - Developing skills relevant to use of bio-energy services
 - Developing skills related to better production, collection, supply and management of bioenergy resources at household / village levels.
- Assisting women to organize themselves into SHGs to complement the functioning of bioenergy service enterprises.
- Enable women participate in decision making processes related to bioenergy service activities such as prices of bioenergy resources, pricing of services provided by bioenergy services enterprises etc.,
- Enable women to evaluate and provide feedback on quality of service provided by bioenergy service enterprises and voice their demand better services in case of deficiencies.

Qualifications:

- Local presence,
- Sociological educational background of key individuals of the organization
- Prior experience in training and organizing women and women empowerment in rural sector

Period: Suitable contracts to be awarded during Quarters 2 to 12

16. Terms of Reference - Capacity Building – Experts

Objectives: To develop training software related to capacity building needs to project for each category of stakeholders viz.

- Women to create awareness, organize, empowerment etc.
- Development of concept of bioenergy service enterprise and evolving standards for enduse services.
- Entrepreneurs to execute works, market services, mobilize funds, resources and materials etc.
- Operators for o & m
- Village development institutions for protecting community interests, managing assets, monitoring project works, etc.
- NGOs for capacity building of communities.
- Contractors
- Consultants and other service providers
- Gram Panchayats to create awareness and capacity building to enable proper management and protection of community assets and resources.

Activities:

- Assess training needs of each category of stakeholder
- Develop training manuals and other software related to training
- Training of trainees wherever necessary
- Modify training manuals/software based on feedback.

Qualifications:

- 8-10 years in developing training materials
- Expertise in specific field in which training material is to be developed.

Period: Short contracts of 3-6 months whenever required

17. Terms of Reference for National Consultants - Training for Entrepreneurs, NGOs, Managers in Business skills

Position Title: Experts for preparing information and act as resource persons for business skills.

Activities:

- Assess information needs for marketing of bioenergy technologies and management of bioenergy utilities.
- Conduct field studies on the project sites in Tumkur district.
- Conduct field studies on other bioenergy projects in India.
- Develop course material and training package.

Qualification:

- Masters in commerce / Business Management / Engineering/Technology
- Experience in management of rural energy projects or renewable energy utilities.
- Experience in training managers or NGOs or entrepreneurs.

Accountability: Accountable to project coordinator.

Period: Quarter 2 to 8 of the project period.

Duty station: Bangalore and Field sites.

18. Sub Contract - Training programmes for Managers, Entrepreneurs and NGOs on Business skills

Objective: To organize and manage training programmes for entrepreneurs, managers and NGOs in business skills.

Activities:

- Identify entrepreneurs, managers, NGOs etc for the training programme.
- Package information and training material developed by experts.
- Organize training programme.
- Organize field visits.
- Evaluate and follow up on training programme.

Qualification:

- Experience in business skill development.
- Experience in organizing business skill related training programmes.

Accountability: Accountable to Project Coordinator.

Period: Quarter 2 to 15 of the project period.

19. Sub Contract - Policy Papers for Enabling Activities

Objective: To prepare policy papers on the identified issues, as a part of enabling activity, to influence policies, to promote bioenergy technology package.

Policy Papers:

- Financial and institutional package on “*Fee for Service*” concept for rural energy services.
- Level playing field for bioenergy in national and state level energy policies/strategies.
- Energy pricing and regulations in power and fossil fuel sector
- Bioenergy for mitigation of climate change in rural energy strategies.
- Sustainable biomass production for energy in India

Activities: Preparation of policy papers would involve series of activities such as field survey, site visits, evaluation of projects, expert consultations, workshops and review process. The activities may vary from activity to activity but would be largely be along the following lines:

- Literature survey and review
- Survey of power, agriculture, energy etc., sector policies.
- Field studies of selected projects.
- Interview with policy makers, managers in industry, banking experts etc.
- Expert consultation and review through workshops.

Qualification:

- Masters in Science/Engineering/Technology/Economics/Business Administration. Ph.D. is desirable.
- Experience of a minimum of 5 years in research in the relevant area on which policy analysis is needed.

- Demonstrated ability through publications in the relevant field.
- Work experience in policy analysis

Period: Quarter 5 to 12

20. Terms of Reference - Bioenergy Case Studies

Position Title: Bioenergy case studies experts

Objective: To prepare case studies on bioenergy technologies from the project site, from other parts of India and other developing countries.

Case studies: Technologies and locations for case studies would be selected during the course of the project based on the success stories at that time. Some case studies will be from the project site in Tumkur district. Potential examples are as follows:

- Bioenergy technology package performance in one panchayat.
- Financial arrangements for successful bioenergy projects.
- Institutional packages for successful bioenergy projects.
- Participation of women in bioenergy projects.
- Options for sustainable biomass production for rural electrification through small gasifier based systems.
- Biomass gasifier based rural electrification studies.
- Community biogas based rural electrification studies.
- Studies community biogas for cooking.
- NGOs role in capacity building for successful bioenergy projects.
- Entrepreneurship for bioenergy projects.

Activities:

- Identification of case studies through field visits and literature.
- Developing methodology for field studies.
- Field visits and survey.
- Monitoring of performance, flows of costs and benefits.
- Preparation of case study.

Qualification:

- Masters in Science/Engineering/Technology/Economics/Management/Sociology.
- Experience relevant to each case study.
- Exposure to field projects.
- Demonstrated ability through publication in the relevant field.

Accountability: Technical Support Unit.

Duty station: Project site and Bangalore.

21. Terms of Reference - Information Package Generation

Position Title: Information technology generation experts.

Main responsibility: Development of information packages on bioenergy technologies on manufacturers, suppliers, financial mechanisms, technology, performance cost etc.

Activities:

- Development of operation and maintenance manuals for gasifiers, biogas systems, etc.
- Development of a manual for management systems.
- Development of accounting systems for project inputs and outputs, costs and benefits.
- Documentation of resource availability containing geographical, socio-economic, agro-climatology and technical database information systems.
- Comprehensive list of technical expertise, services and repair facility available for different components of bioenergy package

Qualification:

- Knowledge of renewable energy, particularly bioenergy technologies.
- Experience of working in bioenergy projects to know the information needs.
- Publications on bioenergy technologies, institutions.

Accountability: Accountable to Project Coordinators.

Period: Quarter 6 to 10 of the project period.

Duty station: Bangalore

22. Sub Contract - Creating Information Access Systems

Objective: To make information on bioenergy technology and institutional package developed by experts available and accessible to different users.

Activities:

- Development of public display information system for different target groups
- Compilation of specification and performance guidelines for bioenergy components

Qualification:

- Experience in managing information on renewable energy technologies.
- Working experience in data generation and dissemination of institutions.
- Knowledge of renewable energy technologies.

Accountability: Accountable to Project Coordinator.

Period: Quarter 6 to 14 of the project period.

Duty station: Bangalore.

23. Terms of Reference - Guidelines and Package for Project Formulation

Position Title: Expert for preparing guidelines and package for bioenergy project formation.

Main Responsibility: Preparing bioenergy project formulation, guidelines and package to assist individuals and institutions seeking project funding.

Activities:

- Development of brochures on various bioenergy technologies.
- Technical document preparation related to designs, financial analysis, implementation and fee recovery for services.
- Development of project monitoring guidelines

Qualification:

- Experience of having formulated project proposals on renewable energy technologies.
- Experience of working with national or bilateral or multilateral agencies funding renewable energy projects.

Accountability: Accountable to Project Coordinator

Period: Quarter 9 to 12 of the project period.

Duty station: Bangalore

24. Sub Contract - Development of Promotional and Communication Material

Objective: Development of promotional and communication modules on bioenergy technology and institutional packages for large-scale dissemination among rural communities, NGOs and small entrepreneurs.

Activities:

- Preparation of electronic communication media - website, advertisements, audiocassettes etc.
- Preparation of documentary films and audio-visual cassettes of successful case studies.

Qualification:

- Experience in awareness generating activities in rural areas.
- Demonstrated capacity for preparing educational and communication module.
- Experience in developing interactive CDs and websites for disseminating information.

Accountability: Accountable to Project Coordinator.

Period: Quarter 4 to 16 of the project period.

25. Sub Contract - Establishing Communication and Dissemination Network

Objective: To develop and establish communication and dissemination network in the project area and outside and undertake information dissemination on a large-scale

Activities:

- Organizing field visits to successful project locations
- Organizing community fares and awareness workshops.
- Organizing other effective mass communication dialogues through plays, meetings etc.

Qualification:

- Experience in working with rural communities, NGOs and educational institutions on education and awareness programmes.
- Demonstrated experience in networking institutions.

- Experience in conducting or organizing dissemination and awareness activities in rural areas.

Accountability: Accountable to Project Coordinator.

Period: Quarter 13 to 20 of the project period.

26. Terms of Reference - National Consultants

Position Title: Documentation policy research and database development experts.

Main responsibility: To document all aspects of bioenergy in India and prepare database and make it freely accessible to all in India. The aspects to be covered includes:

- Policies and policy changes at national and state level.
- Bioenergy technologies.
- Bioenergy experts, manufacturers, utilities.
- Performance data; engineering and economic.
- Cost of systems, services.
- Bioenergy programmes.

Activities:

- Conduct field studies on technologies
- Conduct survey of manufacturers, entrepreneurs, financing institutions, NGOs etc.
- Periodic monitoring of different aspects such as policies, prices, institutions.
- Develop database.
- Prepare information on CDs, websites.

Qualification:

- Expertise in technologies, institutions and policies in the following areas:
 - Biogas, producer gas expert
 - Forestry and biomass production expert.
 - Economic analyst.
 - Institutional expert.
 - Communication and outreach expert.
 - Greenhouse gas monitoring expert.
 - Monitor projects in Tumkur and prepare information for database system.

Accountability: Report to Technical Support Unit.

27. Sub Contract - Documentation and Database Management

Objective: To maintain database on all aspects of bioenergy, disseminate information and respond to requests for information.

Activities:

- Using information developed by experts, prepare computerized database as on all aspects of bioenergy.
- Prepare database on CDs and make it accessible.
- Prepare an interactive website and load information.
- Prepare and publish bioenergy database bulletin or newsletter.
- Respond to requests for information on bioenergy.

- Hold workshops to disseminate the database

Qualification:

- Knowledge on bioenergy technologies and institutions.
- Experience in networking and database management.

Accountability: Accountable to Project Coordinator.

Period: Quarter 3 to 20 of the project period.

28. Sub Contract

Objective: Organize policy workshops to disseminate information on bioenergy and influence policy making.

Activities:

- Identify issues, select policy papers, and identify the target groups for policy workshops.
- Working with policy and case study experts, prepare workshop materials (reports etc).
- Organize periodic workshops to policy makers.
- Monitoring and post-workshop follow up.

Qualification:

- Experience in organizing workshops or management development workshops.
- Knowledge of energy, environment and development issues.

Accountability: Work under the guidance of Project Coordinator.

Period: Quarter 13 to 20 of the project period.

29. Terms of Reference - Policy Paper on Bioenergy

Position Title: International expert on bioenergy policies.

Main Responsibility: To prepare bioenergy policy paper from experience in other developing and developed countries particularly on policy and financial incentives to promote bioenergy.

Activities:

- To identify key developing and developed countries with significant bioenergy programme
- Monitor and assess bioenergy policies in relevant countries.
- Identify policy and financial barriers and policy instruments adopted in the selected countries.
- Prepare policy papers.

Qualification:

- Experience and exposure to bioenergy institutions and policies in developing countries.
- Experience of working with multilateral and bilateral institutions.
- Publications on bioenergy or renewable energy policies.

Accountability: Work under the guidance of Project Coordinators.

Period: Quarter 11 to 16 of project period.

Duty station: Respective country and Bangalore.

30. Terms of Reference - International expert on bioenergy technologies

Main Responsibility: Develop case studies on relevant bioenergy technologies from other developing countries to complement the case studies from project site in Tumkur and from other parts of India.

Activities:

- Identify relevant country, technology and case study in consultation with project coordinators.
- Undertake field unit.
- Assess and evaluate the technology, utility, institutions and finances.
- Prepare case studies on the issue.

Qualification:

- Bachelors in Engineering /Engineering/Technology/Economics / Management
- Experience of working on bioenergy technologies, policies and institutions in developing countries.
- Publications on bioenergy.

Accountability: Work under the guidance of Project Coordinators.

Period: Quarter 9 to 16 of project period.

31. Terms of Reference - Methods and Guidelines for Project Monitoring

Position Title: Monitoring methodology experts.

Main Responsibility: Developing methodology and guidelines for monitoring bioenergy project in the field in Tumkur and assist in monitoring.

Activities:

- Identify parameters for monitoring; physical, financial, institutional, forestry etc. aspects.
- Develop methodologies for periodic monitoring.
- Develop guidelines and manuals for monitoring.
- Prepare methodology for observation, measurement, recording and analysis.
- Assist the project in monitoring.

Qualification:

- 5 years experience in monitoring of bioenergy or renewable energy projects.
- Publication of reports and papers on monitoring.
- Experience for different experts
 - Biogas
 - Producer gas
 - Forestry and biomass
 - Village institutions
 - Financial flows

Accountability: Report to Project Coordinator.

Period: Quarter 1 to 20 of project period.

32. Sub Contract - Monitoring of Bioenergy Project

Objective: To periodically monitor the bioenergy project in Tumkur villages and prepare status, progress and performance reports.

Activities:

- Identify persons for monitoring.
- Prepare monitoring schedules and recording books.
- Monitor different parameters; daily, weekly, seasonally.
- Prepare daily, weekly and monthly reports.
- Present findings at monthly meetings at PMU.

Qualification:

- Experience of implementing or managing or monitoring bioenergy projects in the field.

Accountability: Report to Project Coordinator.

Period: Quarter 1 to 20 of the project period.

33. Terms of Reference - Project Evaluation-National Experts

Position Title: Experts for project evaluation.

Main Responsibility: To conduct project evaluation with respect to project objectives and outputs

- mid-project evaluation
- project-end evaluation
- post-project evaluation

Activities:

- Identify project activities, performance parameters and project outputs for evaluation.
- Develop methodology for evaluation.
- Conduct field studies, interviews, and discussions with different stakeholders.
- Study and assess performance, monitoring reports, and database.

Qualification:

- Masters in Science/Engineering/Technology/Economics/Management
- Experience of working on bioenergy projects in India for at least 5 years.
- Experience in project evaluation
- Publication of reports / books / papers on bioenergy.

Accountability: Report to Project Coordinator.

Period:

- Quarter 10
- Quarter 20

- 2 years after project end

34. Terms of Reference - Project Evaluation

Position Title: International expert-project evaluation.

Main Responsibility: To conduct project evaluation with respect to project objectives and outputs

- mid-project evaluation
- project-end evaluation
- post-project evaluation

Activities:

- Identify project activities, performance parameters and project outputs for evaluation.
- Develop methodology for evaluation.
- Conduct field studies, interviews, and discussions with different stakeholders.
- Study and assess performance, monitoring reports, and database.

Qualification:

- Experience of learning bioenergy projects or evaluation of bioenergy projects in developing countries.
- Masters in Engineering/Technology/Economics Management
- Experience of working in bilateral and multilateral agencies.

Accountability: Work under guidance of Project Coordinator.

Period:

- Quarter 1
- Quarter 20
- Quarter 25 after project initiation

35. Terms of Reference - Monitoring Carbon Flows

Position Title: Expert for monitoring carbon flows.

Main Responsibility: To monitor carbon flows in the project site and report the extent of carbon mitigation achieved.

Activities:

- Measure or survey and estimate the baseline carbon stock and flows.
- Monitor annual changes in stocks and flows of carbon.
- Using data from other project monitoring activities estimate fossil fuel substitution and carbon emission avoided.
- Prepare annual reports of carbon mitigation.

Qualification:

- Experience of working carbon abatement methodology of projects.
- Publications of carbon stock and flows in energy forestry projects.
- Masters in Science/Engineering/Technology

Accountability: Report to Project Coordinator.

Period: Quarter 1, 4, 8, 12, 16 and 20 of the project.

36. Terms of Reference - Financing Enterprise

Position Title: Expert for preparing Guidelines for Financing Enterprises.

Main Responsibility: Develop guidelines for financing Bioenergy enterprises and identify enterprises for financing.

Activities:

- Assess renewable energy enterprise financing mechanisms in India.
- Select appropriate mechanism for bioenergy package.
- Develop guidelines for financing enterprises.

Qualification:

- Masters in Economics/Business management.
- Ph.D. or MBA desirable.
- Experience on financing mechanisms, arrangements, and institutions.

Accountability: Work under guidance of project coordinator.

Period: Quarter 13 to 20 of the project period.

Duty Station: Bangalore.

37. Sub-Contracts - Creation of Investment Risk Fund or Revolving Fund

Objectives: To create investment risk fund to support bioenergy projects and develop mechanisms for recovery of 'fee-for-service' from beneficiaries.

Activities:

- To assess different fee collection arrangements in renewable energy projects in India.
- To develop recovery mechanism for collecting funds
- To develop fund management or cash flow management.
- Evaluate investment risk fund or revolving fund management institutions
- Develop investment risk fund management institution.

Qualification: Experience in managing funds in renewable energy projects or rural credit programmes.

Accountability: Accountable to project coordinator.

Period: Quarter 2 to 4.