

Cover Note

Project Name: Removal of Barriers to Biomass Power Generation in India, Part I

Date: 02 August 2002

	Work Program Inclusion	Reference/Note
1. Country Ownership		
• Country Eligibility		India ratified the UNFCCC on 1 November 1993
• Country Drivenness	Clear description of project's fit within: - National reports/communications to Conventions - National or sector development plans	The project is consistent with the five-year plans of MNES and other relevant government ministries (section 1). It has been developed to fit within the country's plans for biomass development (Annex E – Central and State Policy Framework for Biomass Power – Salient Features).
• Endorsement	• Endorsement by national operational focal point.	• OFP endorsement letter for this project sent with the brief as Annex D.
2. Program & Policy Conformity		
• Program Designation & Conformity	• Describe how project objectives are consistent with Operational Program objectives or operational criteria.	• Section 3.2 (page 8-9), Annex A.
• Project Design	Describe: - sector issues, root causes, threats, barriers, etc., affecting global environment. - Project logical framework, including a consistent strategy, goals, objectives, outputs, inputs/activities, measurable performance indicators, risks and assumptions. - Detailed description of goals, objectives, outputs, and related assumptions, risks and performance indicators. - Brief description of proposed project activities, including an explanation how the activities would result in project outputs - Global environmental benefits of the project. - Incremental Cost Estimation based on the project logical framework. - Describe project outputs (and related activities and costs) that result in <i>global</i> environmental benefits - Describe project outputs (and related activities and costs) that result in joint <i>global and national</i> environmental benefits. - Describe project outputs (and related activities and costs) that result in <i>national</i> environmental benefits.	- Section 2 (page 6-8) on barriers to accelerated biomass power development. - Annex B. - Section 3 (page 8-9), Section 8.1 on project risks (page 25-26), milestones (page 29), Annex B. - Section 5 (page 12-18). - Annex A. - Annex A. - See expected outputs listed for each activity included in Section 5 (Project Activities and Expected Results) - Annex A and B describes outputs resulting in global and national environmental benefits. - Annex A and B describes outputs resulting in national environmental benefits.

	Work Program Inclusion	Reference/Note
	- Describe the process used to jointly estimate incremental cost with in-country project partner. - Present the incremental cost estimate. If presented as a range, then a brief explanation of challenges and constraints and how these would be addressed by the time of CEO endorsement.	- Incremental Cost addressed in Section 6 and in Annex A (including breakdown of financing by partner). - Incremental Cost addressed in Section 6 and in Annex A (including breakdown of financing by partner and a detailed budget estimate).
Sustainability (including financial sustainability)	Describe proposed approach to address factors influencing sustainability, within and/or outside the project to deal with these factors.	Sustainability addressed in section 8.2, 4.2, and 7.
Replicability	Describe the proposed approach to replication (for e.g., dissemination of lessons, training workshops, information exchange, national and regional forum, etc) (could be within project description).	Replication strategy in section 4.3, activity V in section 5.2, and section 8.2. Training in activity III in section 5.1. Workshops in activity I in section 5.1.
Stakeholder Involvement	- Describe how stakeholders have been involved in project development. - Describe the approach for stakeholder involvement in further project development and implementation.	- Stakeholder participation in Section 7. - Ongoing stakeholder involvement is addressed in Section 5.1.
Monitoring & Evaluation	- Describe how the project design has incorporated lessons from similar projects in the past. - Describe approach for project M&E system, based on the project logical framework, including the following elements: - Specification of indicators for objectives and outputs, including intermediate benchmarks, and means of measurement. - Outline organizational arrangement for implementing M&E. - Indicative total cost of M&E.	- Section 5, activity I; and section 1.2 on biomass development in India. - Monitoring and evaluation is described in Section 10. - Objectively verifiable indicators and means of verification are addressed in Annex B. - M&E implementation in Section 10 - Reflected in total project cost (Section 6).
3. Financing		
Financing Plan	- Estimate total project cost. - Estimate contribution by financing partners. - Propose type of financing instrument.	Total project cost on page 1, and in Section 6. Breakdown detailing the contributions of financing partners is in Table 8.
Implementing Agency Fees	Propose IA fee.	The CO fee under a cost recovery structure.
Cost-effectiveness	- Estimate cost effectiveness, if feasible. - Describe alternate project approaches considered and discarded.	Annex A.

	Work Program Inclusion	Reference/Note
4. Institutional Coordination & Support		
IA Coordination and Support • Core commitments & Linkages	Describe how the proposed project is located within the IA's: • Country/regional/global/sector programs. • GEF activities with potential influence on the proposed project (design and implementation).	
• Consultation, Coordination and Collaboration between IAs, and IAs and EAs, if appropriate.	• Describe how the proposed project relates to activities of other IAs (and 4 RDBs) in the country/region. • Describe planned/agreed coordination, collaboration between IAs in project implementation.	
5. Response to Reviews		
Council	Respond to Council Comments at pipeline entry.	
Convention Secretariat	Respond to comments from Convention Secretariats.	
GEF Secretariat	Respond to comments from GEFSEC on draft project brief.	
Other IAs and 4 RDBs	Respond to comments from other IAs, 4RDBs on draft project brief.	
STAP	Respond to comments by STAP at work program inclusion	
Review by expert from STAP Roster	Respond to review by expert from STAP roster.	Annex C (STAP Roster Technical Review and Response).

PROJECT BRIEF

1. IDENTIFIERS

PROJECT TITLE:	India: Removal of Barriers to Biomass Power Generation, Part I
PROJECT NUMBER:	PMIS #740
REQUESTING COUNTRY:	India
PROJECT TYPE:	Full Project
DURATION:	5 years
GEF IMPLEMENTING AGENCY:	United Nations Development Program (UNDP)
EXECUTING AGENCY:	Ministry of Non-Conventional Energy Sources (MNES)
LOCAL IMPLEMENTING AGENCY:	Maharashtra Industrial and Technical Consultancy Organization (MITCON, Pune)
ELIGIBILITY:	India ratified the UNFCCC on 1 November 1993
GEF FOCAL AREA:	Climate Change
GEF PROGRAMME FRAMEWORK:	OP 6 – Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs

2. SUMMARY: The objective of this two-part project is to remove barriers to the increased use of biomass energy sources for generating electricity for own consumption and export to the grid. This project aims to accelerate the adoption of environmentally sustainable biomass power and cogeneration technologies in India. It will promote combustion, gasification and cogeneration technologies for electricity generation using different types of captive and distributed biomass resources. The project will focus on biomass power projects to be undertaken in three different specific contexts: cooperative sugar mills; agro-processors and biomass producers; and distributed or decentralized biomass. The project strategy is focusing attention in a limited set of States that have plentiful biomass supplies and favorable policy and regulatory environments. It will utilize technical assistance focused on removing the remaining technical, regulatory and institutional barriers to widespread use of biomass power. It will then utilize investment risk mitigation support to promote repeated investments in biomass power generation projects. Part I of the project will provide technical assistance and investment support in a limited number of states. Part II will focus on providing support for risk mitigation to stimulate further replication investments across the targeted sectors and will allow for participation in a wider selection of states, once their policy and regulatory environment become more favorable to biomass power.

3. FINANCING AND LEVERAGE: (US\$million)

GEF financing	Part I	5.65
	Part II	4.23
	Total	9.88
Co-financing		
	MNES	
	Part I	5.24
	Part II	5.13
	Total	10.37
Others (FI's & Promoters)	Part I	28.26
	Part II	16.24
	Total	44.50

Total Project Cost

64.75

4. OPERATIONAL FOCAL POINT ENDORSEMENT:

Name: H. C Bhatia,

Organization: Ministry of Environment & Forests, *Date:* 28 September 2001

5. IA CONTACTS:

Dr. Neera Burra, UNDP, New Delhi; Dr. Richard Hosier, UNDP, New York

LIST OF ACRONYMS/ABBREVIATIONS

ADB	Asian Development Bank
BIG/GT	Biomass Integrated Gasification
BOOT	Build Own Operate Transfer
CERC	Central Electricity Regulatory Commission
cm	Centimeter
DEA	Department of Economic Affairs
DG	Diesel Generation
DPR	Detailed Project Report
FI	Financial Institution
FICCI	Federation of Indian Chambers of Commerce and Industry
GEF	Global Environment Facility
GEP	Greenhouse gas Prevention Project
GHG	Greenhouse Gas
GoI	Government of India
HUDCO	Housing and Urban Development Corporation
IC	International Cooperation
ICICI	Industrial Credit and Investment Corporation of India
IDBI	Industrial Development Bank of India
IFCI	Industrial Financial Corporation of India
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency Ltd
JV	Joint Venture
kg	Kilogram
kW	Kilowatt
LC	Letter of Credit
MIP	Model Investment Project
MITCON	Maharashtra Industrial and Technical Consultancy Organization Ltd.
MNES	Ministry of Non-conventional Energy Sources
MoEF	Ministry of Environment and Forests
MoF	Ministry of Finance
MoP	Ministry of Power
MT	Million Tonnes
MW	Megawatt
NCDC	National Cooperative Development Corporation
NGO	Non Government Organization
NSC	National Steering Committee
NPD	National Project Director
O & M	Operations and Maintenance
PDA	Project Development Agreement
PFC	Power Finance Corporation
PIR	Project Implementation Review
PMC	Project Management Cell
PPA	Power Purchase Agreement
PV	Photovoltaic
R & D	Research and Development
REC	Rural Electrification Corporation
SEB	State Electricity Board
SERC	State Electricity Regulatory Commission
TA	Technical Assistance
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

USAID United States Agency for International Development

1. BACKGROUND AND CONTEXT

1.1 Review of Power Sector

India's power sector is characterized by excess demand, continued dependence on depleting conventional sources of energy; and low pace of energy-efficiency improvement. More than 70% of the current installed generation capacity—about 95,000 MW—is based on fossil fuels, mainly coal. Even with the proposed capacity additions in the various Five Year Plans of the Government of India, shortfalls of power continue at around 20% of peak-power demands.

India has been estimated to have approximately 50,000 MW of renewable energy power potential, mainly from the sources like wind, biomass and mini-hydro. The Ministry of Non-Conventional Energy Sources (MNES)--the nodal Ministry for renewable energy technologies and programs in India--has formulated a number of promotional policies and provides financial and fiscal incentives to tap the estimated renewable energy potential. However, despite substantial efforts by the MNES during the 8th Five Year Plan Period (1992-1997), the installed renewable energy capacity remains at about 1500 MW. For the year 2000, the share of renewable power capacity was less than 2% of the total power generation capacity. Within the category of renewable power, biomass power constitutes only 12-13% of total renewable generation.

1.2 Status of Biomass Power Development in India

Biomass Resources

The availability of biomass for potential power generation in India is estimated at 540 million tonnes per year. The principal agro-residues include rice husks and straw; bagasse; sugarcane tops, leaves and trash; groundnut shells and plants; cotton stalk; coconut residues; mustard stalk; and wastes from a dozen other agricultural products. Between 70 and 75 % of these wastes are used for fodder, for domestic cooking, or for other purposes, leaving behind 120 – 150 million tonnes of usable, agro-residues per year, which could be made available for power generation. Based upon studies carried out by MNES since 1998, the total biomass power potential is estimated at 18000 – 23000 MW, of which, approximately 6000 to 8000 MW of power could be contributed by the industrial sectors like sugar, rice mills, and oil mills. The balance would be derived from distributed biomass resources. In addition to these existing resources, about 70 million hectares of wasteland can be made available for raising energy plantations.

Biomass Conversion Technologies

The national programmes on biomass energy have demonstrated the technical viability of biomass power generation technologies on a limited scale. The major biomass conversion technologies are broadly classified as thermo-chemical and biological. The biological technologies include bio-methanation processes involving methane recovery and biogas production from anaerobic fermentation. The thermo-chemical technologies include: (1) biomass combustion directly in boilers; (2) gasification;

(3) cogeneration; and (4) biomass integrated gasification through combined cycle (BIG/GT). The proposed project focuses on the first three of these thermo-chemical technologies making use of biomass as the energy source in both commercial and near-commercial settings.

Review of Policies, and Linkages to Ongoing Programmes

Although the Government's emphasis on biomass-based power generation has led to increased awareness of the potential for biomass power, the push to exploit these underutilized energy resources is complicated by the complex array of policies and regulations found in the Indian power sector. Although the national Government makes recommendations about power sector structuring and pricing policies, the exact details of the application of these regulations and policies must be implemented at the state level. While some state governments have advanced policies, including buyback, wheeling and banking of electricity generated by the State Electricity Boards, others have not yet adopted them. Additional incentives that have been recommended but not universally adopted include sales tax exemption, reduced customs duty, and accelerated depreciation. This wide variation in policy and regulatory environment requires that the activities undertaken in this project be selectively implemented in those states having the most favorable policies and regulations at the time of project implementation.

As part of the ongoing reforms in the power sector, the State Electricity Boards (SEBs) have been unbundled and broken into generation, transmission, and distribution companies. With a defined mandate to protect the interest of consumers, Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commission (SERC) have been established to establish tariffs and oversee the electricity sector. The regulatory commissions fix tariffs for the purchase of electricity by SEBs from all sources -- including renewables -- based on the guidelines from the Ministry of Power and the MNES, state policies and inputs from public hearings. In the event of disagreements, the conflicts are adjudicated in the High Court.

Some States and SEBs (Maharashtra, Karnataka, Andhra Pradesh, Rajasthan, and Haryana) have adopted conducive policies for purchase of power from biomass power projects as per the MNES guidelines (Rs.2.25/- at 1994-95 base year, with 5% compounding rise) and guidelines from the Ministry of Power (at least 10% power from renewables). In these States, the SERCs have approved MNES guidelines and PPAs have been approved accordingly. While in the other States, perhaps with lesser realization for power shortages, SEBs and consumer forums are advocating for lower tariffs than the prescribed MNES guidelines on tariffs, which is justifiable to cover very high risks of fuel linkage and non-availability of guarantees for payments from SEBs for different possible models/configurations of these projects. Table 1 summarizes the availability of biomass and the status of the power sector reforms with respect to biomass power in a number of potential, participating states.

Table 1 - Biomass Power Policies and Biomass Availability by State

State	Regulatory Reform Status Relative to Biomass	Biomass Resource Availability from Agro-wastes	Wheeling, Banking Third Party Sale Policies: Favorable or Unfavorable to Biomass	Recommended Biomass Tariff (US cents/kWh) (2000-2001)
Maharashtra	SERC functional RE Policy reviewed Tariff order issued for Bagasse Cogeneration	High	Highly Favourable	6.15
Haryana	SERC functional MNES guideline holds	High	Highly Favourable	6.15
Punjab	SERC Constituted MNES guidelines holds	Very High	Moderately Favourable	6.1
Karnataka	SERC functional RE Policy reviewed Tariff order issued	Average	Moderately Favourable	6.15
Andhra Pradesh	SERC functional Tariff orders issued	Average - possibly already over-committed	Moderately Favourable	6.15
Rajasthan	SERC functional	High	Highly Favourable	6.15
Tamil Nadu	SERC Constituted	High	Moderately Favourable	5.84
Uttar Pradesh	SERC functional	Very High	Not Favourable	4.81
Madhya Pradesh	SERC Constituted	High	Not Favourable	4.59
Gujarat	SERC functional	Average	Not Favourable	6.15

Notes:

1. *Highly Favourable* = as per MNES guidelines, wheeling and banking allowed at minimum charges
2. *Moderately Favourable* = as per MNES guidelines, wheeling or/ and banking allowed at higher charges
3. *Not Favourable* = as per MNES guidelines, wheeling or banking or both not allowed
4. *Very High* – Estimated Biomass Power potential exceeding 2000 MW
5. *High* – Estimated Biomass Power potential in the range 1000-2000 MW
6. *Average* – Estimated Biomass Power Potential in the range 500-1000 MW
7. *Low* – Estimated Biomass Power Potential below 500 MW

Although mainstream financial institutions have expressed interest in financing biomass power projects, most projects are still being financed by a handful of financial entities, namely, the Indian Renewable Energy Development Agency, Industrial Development Bank of India (IDBI), and Industrial Credit and Investment Corporation of India (ICICI). The United States Agency for International Development (USAID) under the Greenhouse Prevention Project (GEP) has also provided development assistance to this sector over last few years. These initiatives have resulted in the installation of biomass power projects of 358 MW as of December 2001, with an additional 390 MW equivalent projects in various stages of completion. Plants using captive biomass constitute over 184 MW and the balance of 48 MW is drawn from distributed biomass. Assuming that all these projects are commissioned by the end of 2002 or at the end of 9th plan period, the installed capacity will be over 600 MW, or only 3% of the total biomass power potential. In terms of captive biomass and distributed biomass, these achievements will be only 10% and 0.67% respectively, of the respective potential, in spite of sustained efforts from the government.

2. BARRIERS TO ACCELERATED BIOMASS POWER DEVELOPMENT

In general, the deployment of biomass power generation technologies has been slow. The difficulties facing the implementation of biomass power projects may differ slightly depending upon whether the projects are drawing their biomass resources from a captive (sugar, rice mills, etc.) as opposed to a distributed source (cotton stalks, mustard or rape seed stalks; etc.). The development of biomass power projects involves broadly three categories of sponsors: (1) Sugar Mills and Cooperatives, (2) Private Sector/ Small Entrepreneurs (largely biomass processors) and (3) Independent Power Producers (IPP, power generation companies). Based on the trial and error of past experiences, the following specific barriers to development of biomass power projects and replication of identified models have been recognized:

Absence of Effective Institutional and Financing Mechanisms: The common barriers constitute: i) insufficient capacity of the stakeholders and inadequate institutional and policy framework at the national, regional and local levels; ii) lack of institutional support in dealing biomass power projects such as distribution and sale of electricity, iii) absence of commercial and service networks (e.g. biomass depots for collection, transportation and delivery of biomass fuels) at the national, regional and local levels; and iv) limited access to financing and lack of interest on part of the SEBs in promoting biomass power generation.

Lack of Adequate Policy Framework: Non-uniform policies -- different states have different policies on wheeling, banking, and third party sales -- and inadequacies in the SEB policies related to escrow / LC impede the growth of biomass power projects. The present tariff policies of the government for conventional supply do not consider all the benefits of biomass projects, such as minimal T&D losses, substantial overall environment and social benefits to local people. Likewise, the benefits to SEBs due to deemed generation, improved quality and availability of local power are overlooked. The result is a non-level playing field for renewables. The MNES advised-tariff is based on 'avoided cost' principles, wherein regulators, SEBs and consumers compare cost of generation of biomass projects with pooled cost of generation of depreciated power plants of SEB (which is very low) and with large sized coal based power plants.

Lack of effective regulatory framework: Lack of capacity among the regulators to adequately take into account the various economic, social and environmental costs of conventional energy sources as well as the benefits of renewable generation.

Lack of Technical Capacity: The technologies for biomass power development -- both for combustion and gasification technologies -- have not yet been fully standardized, packaged, documented and validated as they are still in the early stages of commercialization.

Absence of Effective Information Dissemination: The information generally available on viable biomass resources and biomass power technological configurations and project parameters at national and international levels is limited. There is no documentation of earlier experience of projects, such as

information on project performance. Furthermore, the mode of information dissemination largely remains ineffective due to lack of capacity among the stakeholders (farmers, project developers or promoters) in this sector. With these two integral elements not being adequately integrated to the existing information dissemination strategy, the potential is not fully realized.

Limited Successful Commercial Demonstration Model Experience: The commercial viability of the biomass power projects is yet to be demonstrated in India on a visible scale. Viable business models need to be established to improve the confidence levels of investors and regulators. Given the nature of the investors in the cooperative and small entrepreneur sectors, this limited confidence poses high-perceived risk, which leads to larger up-front capital requirements.

In addition to the above, the barriers specific to spreading proposed investment models are identified and described below.

a) Barriers faced by Cooperative Sugar Mills

- *High transaction costs* – On account of non-standardized agreements and delays in signing of the project development agreements (PDAs) and power purchase agreement (PPAs), the costs per transactions are prohibitively high.
- *Limited access to funds* – Financial institutions are reluctant to finance cooperatives and small investors, which expresses itself in unreasonable securitization requirements.
- *Long gestation period* – The experience to date has been that the project development cycle requires several years to complete. The pre-project implementation phase (involving project design, documentation, loan sanctions/approval) has taken more than two years in many projects.
- *Low technological confidence* – The lack of standardization and the introduction of high pressure boilers (greater than 67 kg/cm²) have led to a resistance to switch over to alternative processes and business models.
- *Limited capacity* – Cooperatives have a low capacity to design/develop, operate, and manage power projects.
- *Fuel supply risks* – As these projects are largely considered to make use of captive biomass, the fuel-supply risks revolve mostly around the question of physical availability, which is a function of rainfall, harvesting effectiveness, and productivity.
- *High management risks* – Since the cooperative sector is subject to change in management every five years, and is influenced by political factors, the risks for biomass power projects becomes high.

b) Barriers Faced by Private Sector/ Small Entrepreneurs, Largely Biomass Processors

- *High transactions cost* – Small entrepreneurs have difficulties raising loans on existing financing norms due to perceived high risks by FIs, negotiations on PPA clauses related to escrow / LC, etc.
- *Limited interest in power projects* – Small investors have been unable to put equity / debt on power development due to limited “proof-of-concept” demonstrations, apart from rice-husk power plants.
- *High investment risks* - For the project promoters and financial institutions, there is a perceived high investment risk due to the limited number of visibly successful demonstrations.

- *Fuel supply risks* – For biomass processors, the fuel-supply risks are twofold. The first set are the physical availability, found in the case of all biomass power projects (rainfall, harvesting effectiveness, and productivity). The second are the questions of contracted supply encountered when dealing with distributed biomass supplies. The inability to lock-up sufficient supplies of biomass from various sources will serve as a hindrance to project finance and implementation.
- *Operational risks* – These include the use of high-pressure boilers with multi-fuel based biomass power plants; the lack of experience using distributed biomass materials.

c) Barriers Facing Independent Power Producer Model Using Distributed Biomass Resources

- *High transaction costs* - The absence of fuel depots means that the cost of setting up of depots and difficulty in establishing fuel linkage for year round operation, leads to high transaction costs.
- *Limited access to financing* – For power projects seeking to use distributed biomass resources, there are no established lenders.
- *Lack of infrastructure* – The ability to connect small-scale generators to the grid is limited.
- *Fuel supply risks* – The fuel-supply risks again fall into two categories, with perhaps the second group being the most formidable for this group of producers. The first set are the physical availability, found in the case of all biomass power projects (rainfall, harvesting effectiveness, and productivity). Secondly, the questions of contracted supply are encountered when dealing with distributed biomass supplies. The inability to lock-up sufficient supplies of biomass from various sources will serve as a hindrance to project finance and implementation. Fuel-supply agreements and mechanisms are critical to projects for these actors.
- *Operational risks* – There are operational risks associated with utilizing high pressure boilers with multi fuel based biomass power plants and the limited demonstration ability of different entrepreneurial models to suit the local situation and biomass types.

3. PROJECT OBJECTIVES & RATIONALE

3.1 Project Objectives

The global development objective of the project is to improve the electricity supply using renewable energy sources without increasing the greenhouse gas (GHG) emissions. The immediate objective of this project is to accelerate the adoption of environmentally sustainable biomass power technologies by removing the barriers identified, thereby laying the foundation for the large-scale commercialization of biomass power.

3.2 Rationale

The proposed project is consistent with the national programmes, policies and priorities, as well as with nationally and internationally agreed-upon programmes for sustainable development. The removal of barriers will lead to reduced transaction costs of these technologies, thereby placing them on a more equal footing with conventional fossil fuels power generation. In view of the continued demand-supply gap in the power sector, any additional capacity of power generation from biomass materials displaces coal-based power generation, leading to reduction in CO₂ emissions. Finally, the objectives of the

proposed project are consistent with the objectives of the GEF Operational Programme No. 6 on “Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs”.

4. PROJECT DESIGN

The design of the proposed project, as evolved during the preparatory phase, is based on two broad components: 1) Technical Assistance and 2) Investment Support for Model Investment Projects (MIPs). The geographical focus for the activities in this project is based upon the idea of selectivity in three senses. The first and foremost criterion is the policy and regulatory environment of the selected states. The MIP's undertaken during Part I of the project will be concentrated in those states with the most favorable policy and regulatory environments for biomass power. These are most likely to be Maharashtra, Haryana, and Punjab, but as regulatory decisions are changing rapidly, this selection may be reconsidered at the time of project inception.

The second selection criterion has to do with biomass resource availability. Project activities will focus initially on states with available biomass resources. This is intended to maximize the replication potential of the project. In making selections between states with favorable policies and regulations and those with sufficient biomass resources, the individual cases will be informed by both. For example, Andhra Pradesh has favorable regulatory conditions, but the available biomass resources may be over-committed.

The third selection criterion is geographical location. In order to minimize transport costs to the project, the MIP's will be clustered in contiguous states.

The technical assistance activities undertaken in Part I will have a slightly broader geographic focus in order to lay the foundation for broader participation in Part II of the project. In addition to the three states hosting the MIP's, the TA activities will likely focus on the states of Tamil Nadu, Rajasthan, Uttar Pradesh and Madhya Pradesh, in order to help them create favorable conditions for future biomass power development.

Part I of this two-part project focuses on providing the technical assistance to remove barriers through the models provided by 7 initial MIPs. Part II of the project will focus on creating innovative financial mechanisms to further remove the investment barriers necessary to stimulate further replication of the demonstrated biomass power projects.

4.1 Technical Assistance to Remove Barriers and Reduce Transaction Costs

Some of the barriers identified can be adequately removed through technical assistance (TA) targeted on the specific problems. TA will include developing standardized project development agreements, power purchase agreements, support to conducting feasibility studies, and the identification of selection criteria for replication projects; developing project appraisal guidelines with particular emphasis on the

investment models, Government support agreements, policy dialogue with State Governments / SEBs / MoP / CERCs / SERCs, O&M manuals, capacity building and information dissemination initiatives, for addressing generic barriers related to wide-spread adoption of the proposed investment models. The contingent financing support will be required to demonstrate the business and financing models in an environment conducive to large-scale replication.

Based on the experience of the national programme and the detailed study of the sector, 43 MIPs are considered essential to getting biomass power projects moving. The first 7 of these will be undertaken on a pilot basis during Part I of the project. Part II will use the outputs and experiences of Part I as a springboard to create the financing mechanisms necessary to ensure that the remaining MIP's are implemented. As identified and selected, the MIPs represent a cross-section of the types of technologies, feedstock, and regional diversity considered essential to stimulating the range of biomass options found within India.

4.2 Financing Plan

Given the context of the identified barriers and the need to cover the institutional investment model risks, the GEF financing is targeting both TA needs and financial risk-mitigation needs. The MIP's vary greatly in size, from less than one MW each to nearly 20MW. The estimated investment cost of all 43 MIPs (targeting 47 MW of total installed capacity) is US \$55.0 million. Out of this, it is estimated that contingent funds of US \$ 10.5 million are needed because of the risks associated with the fuel-supply and technology that have not been utilized to date in India. The estimated amount of the risk-guarantee funds is equivalent to 20% of total project cost. (A broad framework for analysis of contingent financing is provided at Appendix 1. Details on the investment risk mitigation and contingent finance will be finalized at the time of final project endorsement.) The overall GEF assistance is being restricted up to 10% of the MIP cost, on a declining scale, to reflect the indicators of sustainability. MNES will match the GEF contribution and the balance (80%) will be mainstreamed with the existing financing schemes of FIs. MIPs will follow the format of the project and be implemented in two phases: Part I will include the initial 7 models and Part II will target the remaining 36. Table 2 summarizes the anticipated financing arrangements.

Table 2: GEF Support to Risk Mitigation for Model Investment Projects (MIP's)

Phase	Details	Total MIP Cost (US \$ million)	GEF Fund Allocation					
			Guarantee Fund		Contingent Grant/Loan Fund		Total	
			Percent	US \$ million	Percent	US \$ million	Percent	US \$ million
I (first 3 years)	7 MIPs (two in captive biomass sector and five in distributed biomass sector)	31.83	2	0.64	8	2.55	10	3.19
II (3 rd - 5 th years)	36 MIPs (one in captive biomass and 35 in distributed biomass sector)	23.17	3	0.7	5	1.13	8	1.83
Total		55.00	2.44	1.34	6.67	3.68	9.13	5.02

4.3 Replication Strategy

Power generation from both captive and distributed biomass materials have wider applications and replication potential. The estimated potential for captive and distributed biomass materials is 6000 - 8000 MW and 15000-17000 MW, respectively, and only 2% of the potential has been realized through MNES programmes. Appendix 2 gives the potential biomass resources and availability for power generation in India. The proposed project activities will enhance the supply side of the biomass power equation, making it clear how such plants can be financed, built, and connected to the grid. The focused efforts in the identified biomass sectors will yield visible growth to ensure large-scale development in future. At the end of the project, the MIPs would have demonstrated the viability of commercial models, which are expected to create an additional exportable capacity of 1000 MW in the next five years through similar projects. Table 3 gives a break-up of replication of project similar to those identified for the MIPs for the period 2006-2010.

Table 3: Replication Potential of Projects in the Post-Project Period (2006-2010)

No.	Category	Number of projects	Exportable surplus capacity/project (MW)	Total exportable surplus capacity (MW)
1	Sugar Mill Cogeneration on Cooperative - IPP Model	50	10	500
2	IPP Using Captive Biomass	50	5	250
3	IPP Using Distributed Biomass	500	0.5	250
	Total	600	6.0	1000

5. PROJECT ACTIVITIES AND EXPECTED RESULTS

The project activities that will address the key barriers can be broadly divided into two categories: a) Provision of Technical Assistance, and b) Implementation of MIPs. The technical assistance activities are clustered in three components designed to remove technology barriers; information, policy and regulatory barriers; and institutional barriers to biomass power deployment. The MIP component is intended to provide support to mitigate risks and stimulate enough replications of biomass power projects so that their future implementation is simplified because of the experiences gained. The sub-activities and expected outputs are briefly described below.

5.1 Technical Assistance (TA) Component

ACTIVITY I: *Technology package bench marking and validation, including development of energy plantation on waste land as potential biomass resource (Parts I and II)*

Objectives

- To review the techno-commercial status of grid interfaced biomass power technologies for small-scale power generation from distributed biomass resources;
- To assess the capability of technology and equipment providers, identify the areas of improvement, and strengthen the manufacturing base for biomass power technologies;
- To develop a set of standards or benchmarks for performance and evaluation of biomass technologies for wider applications;
- To assess the viability of use of wasteland for energy plantations; and
- To evaluate the appropriateness of technologies deployed for energy plantation on wastelands.

Brief Description

This activity will primarily focus on the evaluation of the techno-commercial status of each technology in terms of specifications, inputs and outputs, capital and operating costs, minimum viable project sizes and ranges of economic viability indicators. The capabilities of Indian technology and equipment providers will be assessed for ensured long-term performance parameters and efficiencies in comparison with international suppliers and the specific improvements will be identified. The action plan will be recommended for such improvements. The benchmarks for performance and evaluation for each type of technology will also be developed and documented for wider publication through workshops.

The activities related to development of energy plantations on wasteland will also have a long-term impact on increasing biomass resource availability for power generation in India. The tasks covered under this activity within the project life will be primarily to generate a long-term vision for energy plantation on wastelands in India. Studies on the assessment of wasteland, evaluation of energy plantation technology, assessment of the potential of energy plantation for power generation will be commissioned. A review of biomass combustion and gasification technologies using agri-residues feedstock (other than rice husks as biomass power technologies based on rice husk has already been

demonstrated) will be carried out. Further assessments will be made on the required policy, regulatory and institutional framework for the establishment of energy plantation demonstration projects, development of short, mid, and long-term plans for energy plantation on wasteland and their usage for power generation.

As the focus of this activity is technological in nature, it is viewed as a national-level activity and will not focus on any particular state. While this activity will build upon existing materials to the greatest extent possible, this area of technology benchmarking and validation is new to the sector. In the past, the project developers have faced constraints while sizing the project, choosing the boilers and turbines appropriate to various types of feedstock. The emphasis of this activity would be to reduce the technical uncertainties and improve investors' technological confidence level. Since the current practice for the technological assessment is based on the type of fuel used and the exportable surplus, it is important to set technological, performance and other operating standards as well. The activity would enable to set performance standards based on assessment of the ongoing projects and would validate them through the implementation of MIPs. It may be noted that this activity would draw some lessons from the cogeneration activities in the non-cooperative sector, but there is not be enough information on biomass for meaningful benchmarking. Further, the benchmarks would be tuned to suit also the given institutional and business context.

Expected Outputs

- Technology improvement and upgrade needs will be identified;
- Capability of Indian technology and equipment suppliers will be assessed objectively;
- The technology performance and evaluation benchmarks will be made available;
- Establishment of techno-commercial viability of energy plantation to power generation technologies; and
- Establishment of long-term perspective for energy plantation on wasteland, for power generation.

Expected Impact on Barriers

This activity will help to reduce technological uncertainties and transaction costs associated with technology choices for biomass power.

ACTIVITY II: Build stakeholders' capacities and develop effective information dissemination programme with special focus on regulatory bodies (Parts I and II)

Objectives

- To generate an up-to-date national and international database on all aspects of biomass resources, technologies, projects, markets, opportunities, and stakeholders;
- To establish a sustainable system of information dissemination, retrieval, analysis and updates;
- To assess the capability and capacity of the major stakeholders (regulators) of the biomass power sector and identify specific needs for capacity building;
- To generate a time-bound action plan for capacity building of the major stakeholders; and
- To ensure capacity development of the stakeholders and follow-up by close monitoring.

Brief Description

The information dissemination activity will complement the efforts of the Ministry and other agencies, and will be additional to what has been generally part of generic information dissemination on the potential of biomass for power generation. A review of biomass resource mapping exercise of the Ministry will be taken up to generate location and specific investors profile for different capacity and types of biomass based projects for market penetration. Other sub activities will include creation of up-to-date information, database on biomass power project commissioned, under construction in pipeline, technology update, newsletter on biomass power, development of data bank on biomass power technologies, preparation of biomass power directory hand book, preparation of model pre-feasibility, techno-economic feasibility and detailed project reports; model energy purchase agreements, MoUs, project development agreements, fuel supply agreement, package or EPC bid documents. Appraisal guidelines for different types of biomass power projects will also be prepared. Detailed project activities will be clarified during project document finalization.

Capacity building of the major stakeholders including R&D institutions, State Electricity Boards (SEBs), CERCs/SERCs, State & Central Government Agencies, financing institutions and banks, engineers and consultants, NGOs (local / regional / national agencies), service entrepreneurs, technology and equipment suppliers, project developer, sugar mill / rice mill owners, micro entrepreneurs, project promoters and local stakeholders will be undertaken. This activity will focus on identifying specific capacity building needs, devising a time-bound capacity development programme, implementing and executing them, documenting such programmes and lessons learned

Expected outputs

- Improved capability of stakeholders and project promoters;
- Improved confidence level of the major stakeholders; and
- Improved coordination between policy makers and project developers.

Expected Impact on Barriers

These activities will help remove the barriers related to the absence of effective information dissemination and a conducive regulatory framework.

ACTIVITY III: Development of business, commercial and support service networks (Part I)

Objectives

- To strengthen the institutional framework for sustaining biomass power projects using different technologies, materials, locations and development models, on national / regional and local levels;
- To develop draft agreements (PPAs and fuel-supply agreements) envisaged to support biomass power development;
- To prepare model Detailed Project Reports (DPRs), Project Development Agreements (PDAs) and fuel-supply agreements for identified sector and sub-sector groups of MIPs; and,

- To prepare action plan for development of required experts, professionals, groups of experts and professionals, NGOs and training institutions, service institutions, financial intermediaries, market intermediaries.

Brief Description

Activity III will involve the review of existing networks and institutions, and human resource requirements for the biomass sector. This activity will focus on capacity building for managing biomass collection and supply for power generation. The efforts would also include aspects of institutional strengthening and infrastructure improvements for power distribution and sales. Based on the analysis to be undertaken under Activity III, an action plan will be created and the overall institutional framework for sustaining biomass power project will be strengthened through appropriate technologies and materials at local, regional, and national levels.

A number of sub-activities will be required to accomplish the objectives indicated above. A critical review of the kind of business, commercial and support service networks / institutions / professionals required for this sector and assessment of the capability of existing institutional framework will be taken up. This would involve an in-depth study of equipment procurement mechanisms, sourcing different biomass resources, institutional mechanism for delivery of biomass fuels, feasibility of biomass depots, financing of such support services and relevant policy interventions. Draft commercial agreements will be prepared for utilization on a pro forma basis in all projects supported throughout the sector. These will be tailored to the specifics of each MIP and other project being financed. An attempt will be made to develop model DPRs, PDAs and PPAs and any other relevant aspect to facilitate reduced transaction costs. Once the draft is developed and made available, these agreements will be much easier and cheaper to implement. Generation of a long-term plan for the purpose and accomplishing defined milestones within the project life will be attempted under the activity.

Expected Results

- Establishment of long-term institutional framework;
- Development of draft commercial agreements (fuel-supply and off-take agreements) to facilitate simplification of financing and project implementation;
- Preparation of master plan for creation of dynamic and sustainable institutional framework; and
- Achievement of defined milestones within the project life.

Expected Impact on Barriers

This activity will help remove the barriers related to inadequate commercial and institutional framework.

5.2 Implementation of Model Investment Projects (MIPs)

ACTIVITY IV: Creation of fund for contingent financing (Part I and II of project)

Objectives

- To develop financing guidelines for support to MIPs;

- To implement MIP models (independent power producer or joint venture) in all the identified biomass technology resource sub-sectors; and,
- To standardize selection criteria for MIP projects, locations and promoters.

Brief Description

This activity will focus on operationalizing the first seven MIPs. The financing would be made available depending upon the risks for the investors. It has been proposed to use guarantee mode for investors with adequate equity base and contingent grant for cooperative and small biomass investors. The initial focus will be on projects using guarantee mode. The lessons of operationalizing the models and assessment of existing barriers arising out of them will prove to be of a great significance for defining the project models for MIPs in the long term for its replicability. The biomass types, distribution, local environment, and available institutional framework will be used to define project models.

Selection criteria will also be established, and the extent of barriers, biomass resources, technologies and status, and defined project development models, will all be crucial factors in deciding these criteria for MIP projects, their locations and ownership.

Expected Results

- Establishment of seven MIP models and selection criteria for optimum number of MIP models

ACTIVITY V: Model Investment Projects (Part I and II of Project)

Objectives

- To select sponsors and sites satisfying MIP criteria.
- To monitor implementation of MIPs.
- To document results of MIPs and lessons learned.
- To disseminate the information to wide range of stakeholders.

Brief Description

Based on the criteria established through Activity 1 of Part I, the promoters or sponsors and sites for various business models of the full complement of MIPs will be finalized. Stakeholder workshops will be organized and advertisements will be issued for receiving project proposals. The progress of implementation of the finalized projects will be monitored for successful commissioning of these projects. The parameters for performance analysis of commissioned MIPs and lessons learned will be documented for dissemination. An assessment of replication potential will be made to evolve a strategy and plan of action for accelerating the commercialization of biomass power projects.

The co-generation projects (especially, bagasse in sugar mills) have reached pre-commercialization stages. As explained in the project design, this project will demonstrate only one model project, equivalent to 16.73 MW exportable surplus capacity, to demonstrate project developer to host sugar mill BOOT model with combination of extra high pressure and latest technology, year round operation on mill bagasse / procured bagasse and biomass. This MIP will demonstrate the commercial feasibility to a large number of co-operative and joint sector sugar mills.

Two projects on different types and combinations of biomass materials, equivalent to 10 MW, other than rice husk (as rice husk based power plants have already been demonstrated) and at different geographical locations have been proposed. These two MIPs will help demonstrate commercial viability of different types of biomass materials. However, one will be included in Part I of the project and the other will be included in Part II.

A total of 40 MIPs in the distributed biomass material sector with capacity up to 1000 KW configurations have been planned to cover different geographic locations, different types and combinations of biomass materials, different modes of project development and promoters. The first 5 of these projects are included in Part I of the project. The remaining 35 are targeted for support under Part II. In all, 43 MIPs would be required to demonstrate different model types covering geographical spread of the country.

Since 20 MW of proposed biomass power capacity is likely to be in the captive sector, the estimated wasteland required for raising energy plantation through different MIPs under this project is 40,000¹ ha (which will be about 0.5 % of total available wastelands).

Expected Outputs

- Commissioning and stabilization of MIPs.
- Documentation on lessons learned.
- Replication strategy and plan.
- Information dissemination.

Expected Impact on Barriers

The proposed implementation of MIPs will facilitate removal of barriers related to limited successful commercial demonstration model experience.

5.3 Project Management and Monitoring

ACTIVITY VI: Project Management and Monitoring (both Part I and Part II)

Objectives

- To develop implementation mechanism for all MIPs & activities under TA component.
- To develop a comprehensive MIS covering the aspects of monitoring MIPs and the overall project implementation.
- To determine when sufficient progress has been made on Part I to justify proceeding to Part II of the project, assuming that Part II remains necessary.
- To document lessons learnt for all project activities and their objectives vis-à-vis outputs.
- To disseminate information to wide range of stakeholders.

¹ 20 MW * 7000 HRS = 140,000 MWh, which will require 200,000 tonnes; land requirement will be @5 tonnes /ha = 40,000 ha

Brief Description

This activity will develop adequate project management structure and systems to monitor every MIP, as it is the most important element for the success of the proposed project. Further, documenting and post-project evaluation at various stages will be key input for replication for MIP. Formats for project activity, sub-activity, task based monitoring, evaluation and lessons learned will be prepared, discussed and finalized. These will be tested for specific tasks and activities and applied for the entire project during the project period. In addition, the project monitoring team will verify when sufficient progress has been made toward the goals of Part I to proceed to Part II of the project. In addition, management will commission an evaluation of Part I to determine whether or not Part II is justified, or needs to be significantly redesigned, based upon experience in Part I.

Expected Result

- Strong project management structure gets established.
- Transparent evaluations of project activities on short, mid and long term basis become available for project donors, bi-lateral agencies, stakeholders, project promoters, implementing and executing agencies.
- Clear-cut evaluation of progress and recommendations regarding Part II of project.

5.4 Project Configuration, Size & Indicative Geographic Areas

The summary of possible project configurations for MIPs for the first set of 7 projects are given in the following tables, in terms of project type, size and number of projects, project details, financing structure, indicative location, major selection criteria, reasons for GEF support etc. Annex F (optional annex) gives detailed project information sheets for these 7 MIPs.

Table 4 - Summary of First Two Pilot Model Investment Projects (MIP's) Using High Pressure Boilers

MIP No.	Project Type, Size, & Likely Location	Project Details	Financing Structure	Major Selection Criteria & Reasons for GEF Support
1	Sugar mill bagasse / biomass based Co-gen Power Plant Size Avg. 16.73 MW exportable surplus Likely Location: Maharashtra	<u>MIP Type:</u> IPP – Host Sugar Mill BOOT project model; EPC route of project implementation; Boiler / TG configuration 87 kg/cm² & 515°C; minimum 330 days/yr. Operation on mill bagasse / procured bagasse / biomass & 25 MW installed capacity (14 MW surplus in season & 20 MW in off season) <u>Assumptions:</u> 20 years BOOT period, 25 year project life, avg. PLF of 90%, electricity exported / year 106 million (M) kWh, T & D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/tonne (T) <u>Costs:</u> Total Project cost: US \$ 23.3 M Promoter contribution: US \$ 3.50 M GEF risk / contingent fund: US \$ 1.16 M MNES risk / contingent fund: US \$ 1.17 M Term loan from FIs: US \$ 17.50 M Selling price @ 2002-03: 7.39 cents / kWh Total cost 2002-03: 6.0 cents / kWh (incl. fuel / O & M / interest / depreciation, etc.)	IPP equity contribution 15%; risk guarantee / contingent loan fund @ 10%, (5% from GEF) & 75% loan from Fis @ interest rate 14%	Selection Criteria: Biomass availability, capability of IPP, favorable State policy and willingness of host sugar mill Reasons for GEF support: 1) Demonstrate viability with different technical configuration (high pressure boilers) 2) Will offset the initial high upfront capital cost barrier and perceived barriers. 3) To reduced fuel risks 4) To improve the confidence levels in investors with respect to the perceived low rate of return 5) To demonstrate the viability of new investment and financing model for faster replication with reduced transaction costs in cooperative sector.

2	Biomass power plant, based on multi fuel procured feed stock Size: 5 MW exportable surplus Likely Location: Haryana or Punjab	<u>MIP Type:</u> 2nd generation entrepreneur / project developer, without captive biomass availability, minimum 300 days operation on procured rice husk, bagasse, ground nut shells from oil mills and jolly flora, package route of implementation, boiler configuration 67 kg/cm² & 485°C or 80 kg/cm² & 510°C <u>Assumptions:</u> 25 year project life, avg. PLF of 80%, electricity exported / year 28.8 M kWh, T & D loss @ 5 %, discount rated @ 15%, fuel price @ US\$ 17.6/T <u>Costs:</u> Total Project cost: US \$ 4.75 M Promoter contribution: US \$ 0.72 M GEF risk / contingent fund: US \$ 0.238 M MNES risk / contingent fund: US \$ 0.238 M Term loan from FIs: US \$ 3.55 M Selling price @ 2002-03: 7.39 cents / kWh Total cost 2002-03: 6.2 cents / kWh (incl. fuel / O & M / interest / depreciation, etc.)	IPP equity contribution 15%; risk guarantee / contingent loan fund @ 10%, (5% from GEF) & 75% loan from FIs @ interest rate 14%	Selection Criteria: Biomass availability & capable 2nd generation entrepreneur, favorable State policy, etc. Reasons for GEF support: 1) To guarantee the project risks arising out of the barriers 2) To improve investor's confidence level 3) To demonstrate viability of a new investment and financing model for faster replicability with reduced transaction cost
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Table 5 - Summary of Five Pilot Model Investment Projects (MIP's) Using Gasifier Engine-Based Biomass Power Plants (<1000kW)

MIP No.	Project Type, Size and Likely Location	Project Details	Financing Structure	Major Selection Criteria
3	Gasifier engine / grid connected biomass power plant Size: 1 MW (10X100 kW systems) Likely Location: Punjab or Haryana	<u>MIP Type</u> Project developer / entrepreneur, rice husk from rice mills and dal husk from dal mills, as feed stock, 200 days operation per year, 1 MW installed capacity, 10 numbers 100 kW biomass gasifiers <u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported / year 3.02 M kWh, T & D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T & selling price <u>Costs</u> Total Project cost: US \$ 0.75 M Promoter contribution: US \$ 0.08 M GEF risk / contingent fund: US \$ 0.07 M MNES risk / contingent fund: US \$ 0.07 M Term loan from FIs: US \$ 0.53 M Selling price @ 2002-03: 7.39 cents / kWh Total cost 2002-03: 6.5 cents / kWh (incl. fuel / O & M / interest / depreciation, etc.)	Entrepreneur equity contribution 10%; risk guarantee / contingent loan fund @ 15%, (7.5% from GEF) & 75% loan from FIs @interest rate 13%	Sustained Biomass availability, capable entrepreneur Reasons for GEF support: 1) to build the capability of the potential investors to implement such projects with minimum risk 2) To demonstrate viability of a new investment and financing model for faster replicability with reduced transaction cost
4	Gasifier engine / grid connected biomass power plant Size: 1 MW (2X500 kW systems) Likely Location: Maharashtra	<u>MIP Type</u> Rural co-op., cotton stalks from cotton fields and other distributed field biomass as feed stock, 200 days operation per year, 1 MW installed capacity, 2 numbers 500 kW biomass gasifiers <u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported / year 3.02 M kWh, T & D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T & selling price <u>Costs</u> Total Project cost: US \$ 0.75 M Promoter contribution: US \$ 0.04 M GEF risk / contingent fund: US \$ 0.08 M MNES risk / contingent fund: US \$ 0.08 M Break even capacity: 70% in 1 st year to 55% in fifth year Selling price @ 2002-03: 7.39 cents / kWh Total cost 2002-03: 6.5 cents / kWh (incl. fuel / O & M / interest / depreciation, etc.)	Equity from rural co-op. 5%; risk guarantee / contingent loan fund @ 20%, (10% from GEF) & 75% loan from FIs @interest rate 13%	Sustained Biomass availability, capable rural co-op. Reasons for GEF support: 1) To establish commercial biomass supply networks 2) To build capability of rural co-op. to assess biomass power project 3) Demonstrate the viability of a new investment and financing model for faster replicability with reduced transaction cost in co-op. sector

MIP No.	Project Type, Size and Likely Location	Project Details	Financing Structure	Major Selection Criteria
5	Gasifier engine / grid connected biomass power plant Size: 1 MW (5X200 kW systems) Likely Location: Punjab or Haryana	<u>MIP Type</u> Project developer / entrepreneur, energy plantation and paddy husk from dal mills as feed stock, 200 days operation per year, 1 MW installed capacity, 5 numbers 200 kW biomass gasifiers <u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported / year 3.02 M kWh, T & D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T <u>Costs</u> Total Project cost: US \$ 0.75 M Promoter contribution: US \$ 0.08 M GEF risk / contingent fund: US \$ 0.07 M MNES risk / contingent fund: US \$ 0.07 M Term loan from FIs: US \$ 0.53 M Selling price @ 2002-03: 7.39 cents / kWh Total cost 2002-03: 6.5 cents / kWh (incl. fuel / O & M / interest / depreciation, etc.)	Entrepreneur equity contribution 10%; risk guarantee / contingent loan fund @ 15%, (7.5% from GEF) & 75% loan from FIs @interest rate 13%	Sustained Biomass availability including contribution from energy plantation, capable entrepreneur Reasons for GEF support: 1) capacity building and minimize risk 2) To demonstrate viability of a new investment and financing model for faster replicability with reduced transaction cost
6	Gasifier engine / grid connected biomass power plant Size: 1 MW (10X100 kW systems) Likely Location: Haryana	<u>MIP Type</u> Rural co-op. society, mustard stalks and energy plantation as feed stock, 200 days operation per year, 1 MW installed capacity, 10 numbers 100 kW biomass gasifiers <u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported / year 3.02 M kWh, T & D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T <u>Costs</u> Total Project cost: US \$ 0.75 M Promoter contribution: US \$ 0.04 M GEF risk / contingent fund: US \$ 0.08 M MNES risk / contingent fund: US \$ 0.08 M Term loan from FIs: US \$ 0.53 M Selling price @ 2002-03: 7.39 cents / kWh Total cost 2002-03: 6.5 cents / kWh	Promoter contribution 5%; risk guarantee / contingent loan fund @ 20%, (10% from GEF) & 75% loan from FIs @interest rate 13%	Sustained Biomass availability and energy plantation, capable rural co-op. Reasons for GEF support: 1) These investments would lead to establishing commercial biomass supply networks 2) The rural co-op. neither has needed capability nor resources to assess biomass power project 3) Demonstrate the viability of a new investment and financing model for faster replicability with reduced transaction cost in co-op. sector

MIP No.	Project Type, Size and Likely Location	Project Details	Financing Structure	Major Selection Criteria
7	Gasifier engine / grid connected biomass power plant Size: 1 MW (2X500 kW systems) Likely Location: Maharashtra	<u>MIP Type</u> Project developer / entrepreneur, coconut shells, coir, , etc. from coconut plantations as feed stock, 200 days operation per year, 1 MW installed capacity, 2 numbers 500 kW biomass gasifiers <u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported / year 3.02 M kWh, T & D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T <u>Costs</u> Total Project cost: US \$ 0.75 M Promoter contribution: US \$ 0.08 M GEF risk / contingent fund: US \$ 0.07 M MNES risk / contingent fund: US \$ 0.07 M Term loan from FIs: US \$ 0.53 M Selling price @ 2002-03: 7.39 cents / kWh Total cost 2002-03: 6.5 cents / kWh	Entrepreneur equity contribution 10%; risk guarantee / contingent loan fund @ 15%, (7.5% from GEF) & 75% loan from FIs @interest rate 13%	Sustained Biomass availability including coconut shells & plantation waste, capable entrepreneur Reasons for GEF support: 1) To build the capability of the investors in assessment of biomass power projects (as it is different to their areas of operation) and implementation of such projects with minimum risk 2) To demonstrate viability of a new investment and financing model for faster replicability with reduced transaction cost

6. INCREMENTAL COSTS AND PROJECT FINANCING

6.1 Incremental Costs

The approach adopted for incremental cost analysis relies on the assumption that the total cost of biomass power technologies will become lower than the systems currently in place once all the barriers are removed.

The up-front capital costs of proposed alternative MIPs is higher than the respective baseline projects, i.e. coal based thermal power plant of equivalent capacity for medium scale captive biomass power projects and DG set of equivalent capacity for small scale distributed biomass power projects. A fund to provide contingent loan / grant or risk guarantee to offset the perceived risks and high upfront costs has been proposed for support through MNES and GEF funds. Agreements with the project developers will be effected for repayment of contingent funds on successful performance of the project, which would be used to provide contingent grants to develop new projects in the same sector.

The baseline cost for 43 MIPs works out to US\$ 44.50 million and the total cost of implementing them based on captive / field biomass materials works out to US \$ 55.00 million. The difference being the incremental cost for implementing the MIPs is estimated at US\$ 10.5 million. Refer Annex A for details. The incremental cost component related to Technical Assistance for removal of general barriers has been estimated at US\$ 9.75 million (refer Annex A for details). Hence, the total project cost for 43 MIPs and costs for all other barrier removal activities, including the project management works out to be US\$ 64.75 million. The total incremental costs work out to be US\$ 20.25 million, out of which the GEF is being asked to provide US\$ 9.88 million (in two tranches or two parts) and the MNES is providing the remainder.

For bilateral/promoters/FIs component, the MNES has already contacted several national and international partner agencies such as ADB, as well as promoters of the proposed MIPs. The letters of intents from ADB and project promoters are being issued to MNES. However, the efforts are being made to mainstream the project with the regular financing schemes of the existing financial institutions.

6.2 Project Financing

As explained in the preceding paragraphs, this proposal seeks financing for the first part of a two-part project. The proposed project budget and financing arrangements for the two parts of the GEF financing and the entire project financing are presented below in Tables 6 to 9.

Table 6 - Budget Covering Total GEF Contribution for Entire Project (US\$ million)

Activity	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Activity 1: Technology benchmarking and validation	1.38	0.15	0.30	0.40	0.50	0.03
Activity 2: Capacity building for effective information dissemination	1.50	0.25	0.25	0.50	0.25	0.25
Activity 3: Development of effective institutional framework	1.50	0.50	0.50	0.50	0	0
Activity 4 & 5: Investment risk mitigation activities for MIP's	5.00	0	2.00	0	2.19	0.81
Activity 6: Project management and monitoring	0.50	0.10	0.10	0.10	0.10	0.10
Total	9.88	1.00	3.15	1.50	3.04	1.19

Table 7 - Budget Covering GEF Contribution for Part I of Project (US\$ million)

Activity	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Activity 1: Technology benchmarking and validation	0.85	0.15	0.30	0.40	0	0
Activity 2: Capacity building for effective information dissemination	1.00	0.25	0.25	0.50	0	0
Activity 3: Development of effective institutional framework	1.50	0.50	0.50	0.50	0	0
Activity 4 & 5: Risk guarantee & contingent loan fund for implementation of 7 MIPs (creation of pilot contingent fund for MIPs in Phase -I)	2.00	0	2.00	0	0	0
Activity 6: Project management and monitoring	0.30	0.10	0.10	0.10	0	0
Total	5.65	1.00	3.15	1.50	0	0

Table 8 - Budget Covering GEF Contribution for Part II of Project (US\$ million)

Activity	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Activity 1: Technology benchmarking and validation	0.53	0	0	0	0.50	0.03
Activity 2: Capacity building for effective information dissemination	0.50	0	0	0	0.25	0.25
Activity 3: Development of effective institutional framework	0	0	0	0	0	0
Activity 4 & 5: Risk guarantee & contingent loan fund for implementation of 36 MIPs	3.00	0	0	0	2.19	0.81
Activity 6: Project management and monitoring	0.20	0	0	0	0.10	0.10
Total	4.23	0	0	0	3.04	1.19

Table 9 - Total budget by sources of funds (US\$ million)

Activity	Total amount	GEF Contribution	MNES Contribution	FI's, Promoters, & Others
Activity 1: Total	2.75	1.38	1.37	0-
Part I		0.85	0.84	
Part II		0.53	0.53	
Activity 2: Total	3.00	1.50	1.50	0-
Part I		1.00	1.00	
Part II		0.50	0.5	
Activity 3: Total	2.00	1.50	0.50	0-
Part I		1.50	0.50	
Part II		0.00	0.00	
Activity 4/5 Total	55.00	5.00	5.50	44.50
Part I		2.00	2.00	28.26
Part II		3.00	3.50	16.24
Activity 6: Total	2.00	0.50	1.50	0-
Part I		0.30	0.90	
Part II		0.20	0.60	
Total	64.75	9.88	10.37	44.50
Total Part I		5.65	5.24	28.26
Total Part II		4.23	5.13	16.24

7. STAKEHOLDER PARTICIPATION

The project has been conceived as part of the national programme to accelerate the deployment of biomass power technologies. The Ministry of Non Conventional Energy Sources with the support of UNDP launched a Preparatory Assistance mission to carry out extensive consultations and evaluate the feasibility of innovative institutional and investment models for biomass power projects. A team was constituted to steer the mission and to develop this project. The first Meeting of the Stakeholders' was held in 1998, and included investors, project developers, industry associations, financial institutions, donors and others. The ongoing consultations with the Ministry of Power, Regulators, State Electricity Boards and the State governments were extended to focus on adoption of the guidelines for preferential fixing of tariffs for biomass power technologies. The experience and the expectations of the stakeholders were considered during project conceptualization and definition. The indicative roles of different stakeholders were identified to minimize the project implementation risks, and thereby ensuring its sustainability. State-specific consultations and commitment to the project have been planned prior to finalization of the project document. The detailed roles of the stakeholders in the implementation process will be elaborated in the project document. As individual MIP's are identified and the locations finalized, local stakeholders will be consulted in the context of project implementation with an eye toward encouraging their support and mitigating any concerns that they may have.

8. RISKS AND SUSTAINABILITY

8.1 Project Risks

The success of this project will be dependent upon what happens with a number of risks that are entirely external to the project management. The primary risk to the overall success of this project in stimulating investments in biomass power is the policy and regulatory environment of the electric power sector in India. As has been noted, this is in a constant state of change. In most states, or at least those states where the reform process is advanced, State Electricity Regulatory Commissions have been established and are evaluating proposed power purchase tariffs for renewable energy resources. Once these tariffs are agreed-upon and set, the off-take arrangements for individual power plants can be negotiated and fixed. This will establish the conditions for successful implementation of biomass power projects. Until this stage is reached, the risks loom large. Therefore, the strategy adopted in this proposal is to select states where the regulatory processes are advanced and to selectively concentrate investment-related project activities in these states. Technical assistance activities will focus on a wider selection of states to encourage them to adopt policies more favorable to biomass power investment. In this way, the project seeks to control the risks associated with policy and regulatory uncertainties while creating incentives for future biomass power developments in additional states.

Another important risk in the implementation of this policy is the risk of implementation delays. Several actions have been taken to reduce the importance of implementation delays. First, the project has been developed and the activities described in as great a detail as has been possible. This leaves fewer design activities to be considered prior to implementation. Secondly, the local implementing agency--

MITCON--and the MNES have been fully involved in project design. No major shifts in implementing agency are to be expected prior to implementation. As a result, final project formulation is not expected to be a lengthy, time-consuming process. Finally, the early involvement of and consultation with project stakeholders has also helped to reduce this risk.

The project risks regarding execution, management, co-ordination and close monitoring have been mitigated by formulating a strong, yet flexible, implementation arrangements and choosing the right institutions and persons. Table 10 below gives an overview of five major risks and their mitigation in project design. It includes not only external risks to the overall project, but also risks that are inherent to the design of biomass power projects in general.

Table 10 - Potential Risks and Mitigation Measures

Risks	Mitigation measures
1. Low performance and reliability of the technologies	Low - proven technologies proposed - Continuous, rigorous technical performance monitoring & reporting - Maintenance contracts will ensure quick rectification of problems
2. Reluctance of State Regulators to Uphold Renewable Energy Policy Guidelines	Moderate - States with favorable, enforceable policies selected for participation in projects. - TA activities to focus on building enforceable regulatory environment for renewables in additional states
3. Fuel-Supply Risks	Moderate - Project addresses a diverse range of biomass resources - Long-term supply contracts to be established between farmers and power generator to ensure supply of biomass feedstock - Project is focused on areas where recent assessment shows that biomass supplies are sufficient to justify investments
4. Delay in identifying project promoters & sponsors	Moderate - Promoters and sponsors involved at the project design stage - Risk guarantee mechanisms to be put in place to induce investors
5. Slow implementation progress	Moderate - Commitment of the key stakeholders have been obtained - Local implementing agency involved from inception of project preparation activities - Close monitoring of the project proposed

8.2 Sustainability

The project activities are designed to provide techno-commercial and management mechanisms, suitable and conducive to relevant Indian situations, stakeholders and the select project sites, for long-term sustainability. The major objective of creating sustainable support networks, for all of the focus sectors will be achieved through involvement of key partners in the various project activities, both the TA and the MIP components.

So far, Government programs have focused on biomass technology demonstrations. Unlike other sources of renewable energy -- such as wind and PV -- the biomass sector is not dominated by a few, large industrial conglomerates. This project presents a unique opportunity to build a strong partnership among the government authorities, the private sector, the agricultural sector, NGO's, local communities, entrepreneurs, consultants and experts, equipment and technology providers. The MIPs are designed to ensure that the necessary and sufficient conditions exist to make replication projects successful. Project activities are mainly designed to facilitate institutional mechanisms for long-term sustainability and will lead to reduced transaction costs and provide information to different categories of potential biomass power investors. Specifically, landmark end results of this project to ensure the sustainability are given below:

- On-line data base generation, monitoring, analysis and dissemination of information on power generated and exported from the biomass power projects, already developed or being developed through this project or otherwise, at the apex GoI levels.
- Skill upgradation of the stakeholders including financial institutions, SEB's R&D institutions, entrepreneurs and project developers, experts, consultants and engineers, Central & State Governments and institutions, equipment and technology providers will seek their deeper and long term involvement.
- Establishment of specific agencies for monitoring, testing, certification, pre-investment studies, consultancy services, training, R & D, leasing & financing, insurance, raw material banking, resource mapping, promotion and development, information dissemination, etc will create long term availability of business service support.
- Establishment of commercial demonstration projects, removing thereby key barriers, and providing access and information will ensure large-scale replication of the projects, furthering the sustenance of the project activities.

9. IMPLEMENTATION ARRANGEMENTS

The project implementation involves the participation of UNDP and MNES and a number of organizations such as state nodal agencies, local entrepreneurs or project developers, R&D institutions, financial institutions and banks. See Annex G for a schematic of the implementation arrangements.

The MNES will take overall responsibility for the execution and implementation of the project. A Project Steering Committee comprising of the MNES, Ministry of Power, Rural Development, Planning and Environment, state nodal agencies, DEA, MoEF, and other line ministries. UNDP will oversee the implementation of the project. This Committee will be set up under the chairmanship of the Secretary,

MNES. The Committee will also provide the necessary guidance and oversight to the project implementation and will invite members and experts for specific meetings as needed. The NSC will meet once at least every six months to review the progress of project, and the main functions of the NSC will be:

- Provide guidelines to Project Management Cell (PMC) for policy decisions;
- Provide guidelines to PMC for project activities;
- Monitoring Project work plan;
- Ensuring project goals and objectives are achieved in a defined time frame; and,
- Co-ordination support to PMC with various Government Departments.

A National Project Director (NPD) will be appointed by the MNES to provide overall coordination and supervision to the project. The NPD who will be a senior official of the MNES, will be responsible for the coordination, monitoring and clearance of the detailed workplan. The NPD will be assisted by a full-time Project Manager who will head the Project Management Cell, to be constituted for the project.

The Maharashtra Industrial and Technical consultancy Organization (MITCON) will be the local implementing agency for this project. A Project Management Cell (PMC) will be set up within MITCON to carry out day to day working of the project. The PMC will be headed by a Project Manager, who will maintain close interaction between all project actors. He will also facilitate the work of the collaborating institutions in project development and in identifying and locating expert inputs, wherever required. The Project Manager will also undertake coordination of all the activities under the respective ministries which would include contracting/sub-contracting of activities to various institutions, preparation of TORs for consultants, development of field projects, and organization of training events and workshops. The PMC will also seek specific inputs from various national and state-level agencies, NGOs, collaborating institutions and industry associations.

A Project Advisory Committee (PAC) will be constituted to provide expert advisory inputs to the NPM and PMC. PAC will provide a platform for interaction of the project developers, promoters and other stakeholders. Further, institutional interaction and cooperation will be ensured by the PAC through periodic review of the implementation activities and discussion of issues requiring remedial measures that may arise during the course of project implementation. The PAC will have NPD (MNES) as the Chairman, with members / representatives from MNES, Federation of Indian Chambers of Commerce and Industry (FICCI), Confederation of Indian Industry (CII), Indian Renewable Energy Development Agency Ltd. (IREDA), IDBI, ICICI, Federations, industry experts, and state government officials. The National Project Manager (NPM) will be the convenor of the PAC. It is proposed to have quarterly project review meetings with PAC, during the tenure of the project.

10. MONITORING, EVALUATION AND LESSONS LEARNED

The project integrates a comprehensive monitoring and evaluation programme. Project progress will be evident by timely implementation of project activities, both under the TA and MIP components at the local, regional and national levels. The evaluation will be done at the PAC and NSC levels on yearly basis, based on the six monthly Progress Reports prepared by the PMC/MITCON, the local implementing agency, as well as from timely feedback from the stakeholders.

The PMC / MITCON will be responsible for developing analytical and sampling tools for monitoring progress of the project. The PMC / MITCON will prepare six monthly Progress Reports during the tenure of the project and the NPD shall submit the same to the MNES / the UNDP, the National implementing agencies of GOI and GEF, respectively.

Evaluation

The extent of power generated and exported to the grid / used locally, its cost of generation and the type of biomass resource used are measures of project sustainability. MITCON, the proposed local implementing agency will develop a format for project evaluation at year 2 and every quarter thereafter. In addition, annual participatory evaluation exercises will be undertaken with key stakeholders, local communities, financial institutions and partner organisation. UNDP will report on project performance to the GEF at the annual Project Implementation Review (PIR). The project will document the lessons learned and make it available to the stakeholders over the worldwide web.

Milestones

In addition, as this project represents Part 1 of a two-part programmatic initiative, an independent evaluation will be utilized to determine whether and when satisfactory progress has been made to warrant submission of Part 2 of the project to the GEF Council for funding. As currently designed, Part 2 will require an additional US\$4.23m of GEF funding, and will leverage significant additional investment resources (estimated at US\$16m). The milestones to be used to determine whether or not the second part of the project should be initiated will involve an evaluation certifying three that three conditions or events hold true. First, the project activities designed for Part 1 of the project have been successfully implemented. Second, the 7 MIP's included in Part 1 of the project have been financially closed. Note that this does not require them to have been commissioned, but rather to have been successfully negotiated with sponsors and investors so that a successful model for replication has been established in the targeted business-model areas. Third, the evaluation must demonstrate that the conditions that led to the initial design of the project still hold, and that it is necessary to continue to Part 2 as initially designed without major redesign work. If conditions have changed sufficiently due either to the success or failure of the activities included in Part 1 of the project, Part 2 may have to be significantly redesigned to respond to the rapidly changing reality. The evaluation will specify whether or not change is needed and how that change should be made.

Lessons Learned

The progress of the government (Ministry of Non Conventional Energy Sources) initiated national programme "Biomass Power Programme" has not been significant. Despite the most favorable policies

for power generation based on biomass such as wheeling, banking, and third party sales and successful demonstration of a few biomass power projects, only 146 MW has been installed against an estimated potential of 20000 MW of biomass power. Further, the share of the installed capacity of distributed biomass power is only about 35 MW, though it accounts for more than 15000 MW of the total potential. This programme though has successfully demonstrated projects on a commercial basis, and the feedstock has been mainly rice husks. Since the policies do not differentiate feedstock, demonstration of technology in the case of other dispersed biomass feed stock remains to be taken up. Further, the implementation of all the projects experienced very high transaction costs due to uncertainties related to the project and inordinate delay in obtaining necessary approvals and sanctions before the implementation resulting sometimes in pre-closure of the project or disinterest in new project developers. It was generally found that there is a mismatch of priorities of different stakeholders in the entire formulation of biomass power projects. The agro processing industries do not see their role as power producers (and are dependent on the farmers). The power producers, in turn, do not risk their investment without establishing the fuel linkages. Lastly, the State utilities and the private customers are not convinced for the purchase of electricity from these producers. It has been lately realized that different investment models to combine the interests of different stakeholders have to be considered for making the entire chain viable. The government has now initiated a programme to address the viability of biomass power projects vis-à-vis different private/joint sector models, however, it is unlikely that the pace of the implementation of these projects would be affected by the new programme for the lack of steps to remove the barriers that continue to exist.

In the case of sugar sector, which has two sub-sectors, namely, the private sector mills and cooperative sector sugar mills, there was no distinction made in the approaches adopted by the policies to promote cogeneration. Being the most organized sector within the biomass sector, projects were supported by a number of agencies, mainly the USAID's Greenhouse Gas Prevention Project (GEP). The advanced bagasse based cogeneration projects supported as part of the overall GEP project primarily focused on technology demonstration and related outreach activities. The project was very successful primarily due to the involvement of the private sector. The interventions through the proposed GEF project would build upon these successful experiences. Since cooperative sector has been by and large left out due to the complexities involved within the system and outside the system (sugar policies of the government), the project aims to demonstrate viable business models in the cooperative sugar mill sector.

This project will demonstrate the necessity for integrated management of infrastructure, financing mechanisms, local as well as government machinery for power generation from renewable sources of energy. As conditions in India are unique, successful demonstration of technologies for power generation from biomass will go along way in helping replication of projects. Strong Government commitment is also essential to ensure a conducive policy environment. The lessons learned through the project will be disseminated during and after the project period. Recent experience in India with several conventional and alternative power plants has brought to the forefront the importance of involving and consulting local populations in power-plant siting and construction. This has led to a new conviction on the part of developers, promoters and Government to ensure adequate stakeholder involvement prior to implementation of power generating projects.

UNDP is overseeing the implementation of two GEF-supported projects in India that involve promoting biomass energy. The first is the biomethanation project (Development of High Rate Biomethanation IND/92/G32). This Pilot Phase project promotes the development and implementation of high-rate biogas reactors. However, the technological focus of the project largely overlooked institutional and financial constraints. According to the mid-term evaluation report, there have been considerable delays in the project on account of various institutional constraints such as delays in procurement of equipment, procedural delays in giving financial clearances, reluctance on the part of beneficiaries to contribute 50% of project cost and other institutional constraints. The experience has thus shown that considerable time has been spent on preparation activities and stakeholder consultations. The currently proposed biomass power project seeks to utilize technical assistance and investment risk mitigation support to remove the identified barriers and promote accelerated investments for biomass power generation. Detailed stakeholder consultations have already been undertaken, and sponsors and promoters have been fully consulted during project design. The project clearly focuses on investor's needs and institutional business models and aims to reduce the transaction costs and remove barriers.

The second project (India Biomass Energy for Rural India IND/99/G31) proposes using a number of biomass energy technologies to meet rural energy needs in a village setting through a number of different business models. Its focus is significantly different from that of this project and it is too early in that project's life to incorporate lessons from its implementation.

ADDITIONAL INFORMATION

Appendices

Appendix 1 - Draft Analysis for Contingent Financing, and Proposed Mechanisms and Targeted Barriers or Risks

Appendix 2 - Estimates of Biomass Produced in India and Potential for Availability of Biomass

Mandatory Annexes

Annex A. Incremental Cost Annex

Annex B. Logframe Matrix

Annex C. STAP Roster Technical Review

Annex C1. Response to STAP review

Annex D. Letters of Endorsement

Optional Annexes

Annex E. Central and State Policy Framework for Biomass Power – Salient Features

Annex F. Project Information Sheets

Annex G. Implementation Arrangements

Appendix 1

Draft Analysis for Contingent Financing

PROBLEMS	SOLUTIONS		
Barriers/Risks	Technical Assistance (GEF & MNES grant)	Partial Guarantee (GEF & MNES)	Contingent loan/grant (MNES & GEF)
A. COOPERATIVE IPP MODEL IN SUGAR MILLS (1 MIP)			
Absence of Effective Institutional and Financing Mechanisms			
- High transaction costs - Lack of adequate infrastructure for wheeling, distribution and selling power - Limited access to financing; difficulty in securing loans - Long gestation period (delays at various stages of project cycle)	- Fuel supply contracts standardized - Power purchase agreements standardized - workshop to facilitate improvement of infrastructure - Provide preparatory assistance for the identified models (Standardized Project development Agreement - Close monitoring	3 % of the MIP costs to cover the risks of FIs and IPP entering into a contract with Sugar cooperative mill 3% to FIs for relaxation in securitization formalities	Nil
Lack of adequate policy and regulatory framework			
- Non-uniform State Policies	- Workshops for policy dialogues - Standardized contracts/agreements	Nil	Nil
Limited technical capacity			
- Limited capacity to operate high pressure boilers - Low technological confidence	- Capacity building/training - Technology package bench marking and validation	Nil	Nil

Absence of Effective Information dissemination			
- Lack of information on performance (costs, reliability, feasibility, etc.)	- Close monitoring of MIPs and documentation of case studies - Portal on Biomass/ Bagasse Cogeneration power with various user interfaced solutions to meet the investors information needs	Nil	Nil
Limited successful commercial demonstration model experience			
- High investment risks due to management/ financial risks - High investment risks perceived by IPP - Difficulty in raising equity and non-attractive pay back period	1 MIP in sugar cooperative sector	3% of MIP cost to guarantee IPP for the performance of new commercial models (IPP-Cooperative)	10% of MIP costs as contingent loan (approx. 5% from GEF);
B. PRIVATE SECTOR/ SMALL ENTREPRENEUR (BIOMASS PROCESSORS)- IPP (with more or less assured fuel supply)			
Absence of Effective Institutional and Financing Mechanisms			
High transaction costs - Limited financial access; - High costs of project development - difficulty in raising equity (low equity base)	- Power purchase agreements standardized - Provide preparatory assistance for the identified models (IPP/Cooperative)	3 % of the MIP costs to be set aside to guarantee against the securitization requirements	10% of MIP as contingent loan
Lack of adequate policy and regulatory framework			
- Non-uniform State Policies - Absence of level playing field (high subsidized conventional supply of electricity)	- Workshops for Policy dialogues	Nil	Nil

<i>Absence of effective information dissemination</i>			
- Lack of information on performance (costs, reliability, feasibility, etc.)	- Portal on Biomass/ Bagasse Cogeneration power with various user interfaced solutions to meet the investors information needs	Nil	Nil
<i>Lack of technical capacity</i>			
- Operational risks - Limited capacity to manage power business	- Technology package bench marking and validation - Capacity building/Training	2 % of MIP costs to guarantee performance risks	Nil
<i>Lack of successful commercial demonstration model experience</i>			
- Limited interest in power projects - High investment risks perceived by IPP & FIs	- Capacity building/ training	5% of MIP costs to guarantee investment risks	Nil
<i>C. IPP - DISTRIBUTED BIOMASS RESOURCES</i>			
<i>Absence of Effective Institutional and Financing Mechanisms</i>			
- High transaction costs (absence of fuel depots/ fuel linkages) - Limited access to financing - Lack of adequate infrastructure for producing and distributing power	- Preparatory assistance and standardization of procedures for development and commissioning of projects - Review of institutional framework and facilitate establishment of appropriate institutional mechanisms for identified MIPs	- 5% of costs of setting up of fuel depots as a guarantee to FIs for the viability of fuel depots linked to MIPs	10 % of MIP costs as contingent grant (only for Phase I MIPs)

<i>Lack of adequate policy and regulatory framework</i>			
- Non-uniform State Policies - Absence of level playing field (high subsidized conventional supply of electricity)	- Workshops for Policy dialogues	Nil	Nil
<i>Limited technical capacity</i>			
Operational risks	- Capacity building/training of investors/operators	5 % of MIP costs to guarantee performance risks	
<i>Absence of effective information dissemination</i>			
- Lack of information on performance (technology, reliability, financial feasibility, etc.)	- Workshops/ - Documentation of information on performance, costs, etc through intensive monitoring of MIPs and evolving communication strategy - Portal on Biomass power with various user interfaced solutions to meet the investors information needs	Nil	Nil
<i>Lack of successful commercial demonstration model experience</i>			
- Investment risks to FIs/PPs		10% of MIP cost	

Proposed Mechanisms and Targeted Barriers or Risks

Mechanisms	Modus operandi	Targeted barriers/Risks	Resources
Security fund (Two components are associated with this 1) cost of providing the securities 2) difficulty in provision of the securities)	To be established in an FI as a revolving fund and interest on the fund could be used to meet the processing	High transaction costs (delays in loan sanctions) Limited access to financing (securitization norms) FI's investment risks	Not exceeding 5% of MIPs as hypothecation of equipment purchased could be provided easily
Partial guarantee	To be established in FI or the PIA to guarantee the project performance as per the projected financial indicators. The identified IPP's would be monitored by a Monitoring committee comprising all the stakeholders (FI, MNES, IPP, Fuel suppliers)	IPP's investment risks Policy risks – inadequacies related to Escrow/LC Operational risks – lack of demonstrated commercial models	2-5% of MIP costs depending upon the technology TA component Up to 10% depending upon the nature of investors and the MIP Phase
Contingent grant	Seed capital to small investors	Difficulty in raising equity/securing loans (small investors with limited equity) Technical risks (high pressure boilers, multi feedstock) Institutional barriers – biomass fuel depots	Up to 10% on a case to case basis mainly in Phase-I MIP implementation
Technical Assistance grant	PIA will coordinate all the project activities (conduct workshops, training/capacity building, monitor performance, mobilize partners and resources for establishing MIPs, etc.)	Barrier Removal Activities I, II,IV,VI for the barriers identified in section 2 of the project brief.	Up to 20% of MIP costs

Appendix 2

Estimates of Biomass Produced in India

Crop	Production Million Tonnes	Type of Residue	Production to Residue Ratio	Quantity Million Tonnes/ y	Typical Uses
Rice	80	Straw	1.5	120	Used as cattle feed in southern and eastern India and for roof thatching all over the country. Generally burnt in the fields in the North
		Husk	0.3	24	Used mainly as a fuel by small industry
Wheat	65	Straw	1.5	98	Used mainly in cattle feed
Bajra	7	Stalks	2.0	14	Used as domestic fuel
Jowar	11	Stalks	2.0	22	Used as cattle feed, domestic fuel
Maize	10	Cobs	0.3	3	Used as cattle feed
		Stalks	1.5	15	Cattle feed and domestic feed
Millets	35	Straws	1.2	42	Partly as domestic fuel
Sugar-cane	270	Bagasse	0.3	81	Mainly as a captive fuel by sugar plants, partly as raw material for papermaking
		Tops	0.05	14	Used as cattle feed
		Trash	0.10	27	Mostly burnt in the field
Coconut	14 billion units	Shell	0.1 kg/nut	0.2	Partly as domestic fuel
		Fibre	0.2 kg/nut	3.4	Used partly, for making mattresses, carpets, etc.
		Pith	0.2 kg/nut	2.3	
Groundnut	8.8	Shells	0.3	2.6	Used as a fuel by industry
		Haulms	2.0	17.6	Partly as a fuel in households
Cotton	2.5	Stalks	3.0	7.5	Partly as a domestic fuel
		Gin waste	0.1	0.3	Used as a fuel for brick making and small industry
Mustard and Rapeseed	6.4	Stalks	1.8	11.5	Partly as a domestic fuel
Other all seeds	9.0	Straws	2.0	18	Partly as a domestic fuel
Pulses	14	Straws	1.3	18.2	Partly as a domestic fuel
Tobacco/ Jute/ Mestas	2.16	Stalks	5.0	3.8	Used partly as fuel for processing tobacco leaves/domestic fuel
				545.4	

Potential for Availability of Biomass (Other Than Bagasse)

Sources of Biomass	Biomass Generated	Biomass Utilized	Biomass Available
Crop residues	414	280-300	114-134
Agro-industrial Residues (Excluding Bagasse)	50	50	-

Forest Sources	35	-	35
Total (Million MT/Year)	499	280-350	149-169

ANNEX A. INCREMENTAL COST

Broad Development Goals

India's developmental goal is the provision of energy to its population. To this end, its policies support the provision of electric power generation developed in a "least-cost" manner.

Baseline(s)

In the absence of this project, the Indian electricity sector would continue to grow by pursuing largely coal-based power generation. In the past, coal has provided the least-cost alternative. Although most commercial coal plants tend to be large, for the analysis here, indicative numbers have been used for plants of a size that are comparable to those being proposed under the project. The sizes are 10 MW scale for the larger first model projects drawing upon conventional boiler technologies and 500 KW for the smaller gasification projects. The levelised baseline cost per kilowatt hour—as summarized in Table A-1 below—comes to approximately US\$0.052/kWh (Rs. 2.184/kWh) for the larger, boiler-based projects and US\$0.1209/kWh (Rs. 5.078/kWh) for the smaller, gasification-based projects. These figures fall within the range of wholesale purchase prices for India. (Given the wide regional, technological, and financial variations found across India, purchase prices for power range anywhere from a low of US\$0.06/kWh or Rs. 1.5/kWh, to a high of over US\$0.10/kWh or Rs. 4.2/kWh.).

Global Environmental Objectives

The global environmental objective of the proposed project is to reduce GHG emissions associated with electric power generation through the promotion of the expanded use of biomass for on-grid power generation. As the analysis undertaken in the preparation of this project has shown, there are significant barriers to the wide-scale deployment and replication of biomass power in India. This project is designed to remove the identified barriers, thereby accelerating the deployment and improving the sustainability of these projects. Once the identified barriers are removed, it is expected that biomass power projects will be able to be developed and sustained over the long term. The proposed project is consistent with GEF Operational Programme 6, "Promoting the adoption of renewable energy by removing barriers and reducing implementation costs".

Project Case

The GEF project aims at providing energy services required through biomass technologies based on sustainable biomass resources. It thereby leads to fossil fuel substitution and ultimately GHG emission reductions. For the MIPs being supported under this project, the estimated costs are summarized in Table A-1. The estimated costs for the larger, 10MW scale bagasse and biomass-based power systems comes to a levelized US\$0.048 (Rs. 2.02/kWh) or US\$0.051/ kWh (Rs. 2.14/kWh), depending upon whether the biomass is captive (in the case of bagasse at sugar mills) or distributed (and therefore has a higher cost). The estimated costs for the smaller, gasification-based projects range between US\$0.0802 (Rs. 3.444/kWh) and US\$0.10/kWh (Rs. 4.20/kWh). These costs place the biomass power projects targeted under this project within the range of projects being financed that utilize conventional fuel.

However, the analysis undertaken in the preparation of this project has identified certain barriers that need to be removed before the growth of this sector can proceed uninhibited. The bulk of these barriers are of

a technical, informational, and human resource nature. Project activities are targeted to remove these barriers. In addition, in pursuing the feasibility of these projects further, discussions between financial sector stakeholders and project developers indicated that there are additional risks inherent in the application of these technologies that are new to India. In fact, given the newness of the technologies, the financial sector would require larger than normal risk-reserves to be put aside to overcome the fuel-supply and technology risks inherent in the biomass power market. These risk-reserve funds go beyond those that would be required for financial of conventionally-fueled projects. Estimates place the cost of these risk-reserves at nearly 20 percent of the individual project's total capital cost. The GEF is being asked to provide half of this risk fund and the MNES will provide the other half. Altogether, nearly \$10m are needed for risk-mitigation funds for the initial MIPs targeted as part of this project.

Costs

The total costs of the MIPs targeted as part of this project comes to approximately **US \$ M 55.00**. As this amount can be justified on the basis of the production from the identified projects, these do not constitute an incremental cost. However, the cost of the technical assistance activities designed to remove the identified barriers comes to about US\$10.0m. The cost of the risk-mitigation activities proposed to deal with the financial uncertainties brought on by the newness of these technologies and fuel-supplies comes to another US\$10.5m. The incremental costs associated with these barrier removal activities works out to a total **US \$ M 20.50**, to be funded under GEF and the MNES.

Global Environmental Benefits

The implementation of 43 MIPs under the project intervention will yield a total CO₂ emission reduction of approximately 0.14 million tons of CO₂ / year, for about 40 MW cumulative installed capacity of these projects. For Part I alone, a total CO₂ emission reduction of approximately 88,400 tons of CO₂ per year is expected, whereas for Part II the total CO₂ emission reduction will be approximately 55,000 tons of CO₂ per year. The replication and multiplication of all these projects for full potential of about 22,000 MW (5000 MW for captive bio-mass and 17,000 MW for field bio-mass) will give carbon emission reductions of 71.5 million tons of CO₂ per year. For a project life of 15 years, CO₂ emissions reduction for the project intervention and the total potential will be 2.1 million tons and 1073 million tons of CO₂, respectively.

The full incremental cost matrix is contained in Table A-2.

Additional Benefits

The project may have additional domestic benefits in terms of the related business opportunities that are opened up. No additional benefits have been included in the incremental cost calculations.

Table A-1. Baseline, Project and Incremental Cost Estimation for MIPs

Parameter	Units	Baseline Technology	GHG mitigation technologies		Units	Baseline Technology	GHG mitigation technologies	
		10 MW Coal Power Plant	10 MW bagasse co-gen plant	10 MW biomass power plant		500 kW DG Set	500 kW gasifier engine system (no diesel)	500 kW gasifier engine system (diesel)
Electricity generated	kWh/MW/year	6,132,000	6,570,000	6,570,000	kWh/MW/year	5,000	5,000	5,000
T & D loss	%	20%	5%	5%	%	5	5	5
Fuel price	US\$/MT	56.16	15.35	23.02	US\$/litre; US\$/MT	0.29	25.58	25.58
Capital cost	US\$ million/MW	1.1163	1.1395	1.16300	US\$/kW	377	640	581
Fuel cost	Cents/kWh	1.78	1.16	1.89	Cents/kWh	9.44	3.58	3.07
O & M Cost	Cents/kWh	0.27	0.35	0.57	Cents/kWh	0.93	2.33	2.51
Admin Cost	Cents/kWh	0.53	0.58	0.76	US\$/kW/yr	6.79	13.58	13.58
Misc. exp.	Cents/kWh	0.18	0.23	0.28	Cents/ kWh	0.58	0.58	0.58
Present Value	US\$ million	3	3	3	US\$	8,741	4,288	5,332
Annualized cost / unit of delivered power	Cents/kWh	5.21	4.79	5.07	Cents/kWh	12.09	8.02	10
CO ₂ Emissions	(thousand tons CO ₂ /year)	56,414	0	0	(thousand tons CO ₂ /year)	850	0	170

Table A-2. INCREMENTAL COST MATRIX

Project Activity	Baseline	Alternative	Increment
Activity 1: Technology package benchmarking and validation, including development of energy plantation on waste land as potential source of bio-mass power	Poor reliability of bio-mass power technologies, both for captive and distributed bio-mass Energy plantation as potential bio-mass resource for commercial power production is yet to get established Cost : nil	Develop standards and benchmarks for design & performance parameters, techno-commercial viability, O & M, etc. for co-generation, combustion and gasification technologies and validate the same through proposed MIPs, including documentation. Assessment undertaken of wasteland potential for energy plantations, energy plantation technologies for power generation, and establishment of energy plantation bio-mass resource information network on a commercial basis. Cost : US \$ M 2.75	Increased reliability & confidence of such projects for promoters, financiers & stakeholders Energy plantation on waste land gets established as a potential source of commercial bio-mass power. Cost : US \$ M 2.75
Activity 2: Capacity Building for Effective Information Dissemination	Little action will be undertaken to resolve inadequate information available to the major stakeholders about resources, regulations, related institutions, financing mechanisms, approvals, etc. associated with bio-mass power technologies & projects Cost : nil	Build capacity of major stakeholders including Central & State level policy makers, regulatory agencies, SEBs, project promoters & developers, consultants & engineers, financial sector and intermediaries, etc. on all aspects of bio-mass power projects, in captive as well as distributed bio-mass materials Establish sustainable information dissemination framework for these projects and technologies	Major stakeholders have adequate skills and orientation for implementing and sustaining these projects and their confidence level get improved Increased confidence level & capabilities of the major stakeholders and promoters

Project Activity	Baseline	Alternative	Increment
		Cost : US \$ M 3.00	Cost : US \$ M 3.00
Activity 3: Development of business, commercial and support service networks for creation of effective institutional framework	No action likely to resolve inadequate institutional framework at national, regional and local levels for biomass power technologies and projects Cost: nil	Project will establish and strengthen the required institutional frameworks. Apart from strengthening the existing stakeholder institutions, a host of service institutions will also be established and/or strengthened. Cost: US\$2.00m	Required institutional framework is made available for wider / large scale multiplication of these technologies and projects Cost : US \$ 2.00m
Activity 4: Identification, selection, and implementation of 43 Model Investment Projects (7 during Part 1 and 36 during Part 2)	Models for implementing biomass power projects do not exist either for captive or distributed biomass resources Limited demonstrations exist and no MIPs are liable to be implemented in absence of the project Cost:US \$ M 44.50	MIPs are assessed and identified for captive bio-mass and field biomass technology demonstration MIPs are implemented for captive and field (distributive) bio-mass spread over different parts of the country and operating on different development models, for large scale multiplication Cost : US \$ M 55.00	MIP models get established for demonstration of these technologies Around 43 MIPs get established for captive and field bio-mass technologies and resources, acting as demo projects, Cost:US \$ M 10.50
Activity 5: Project Management, including monitoring and evaluation (M&E) and lessons learned documentation system	No activities will be undertaken in the absence of the project	Develop strong project management structure, institutions & persons for close monitoring of the project progress and deliverables, in terms of time / cost / quality / review etc., including their capacity building. Develop M & E and lessons learned documentation and systems, for	Adequate project management structure & system including National Steering Committee, Project Advisory Committee, National Project Director, local implementing agency with national project managers and adequate project team, etc. is available, along with itemized and activity-wise / institution-wise budget allocations during the

Project Activity	Baseline	Alternative	Increment
	Cost : Nil	application to the proposed MIPs as well as such projects under implementation or already commissioned. Development of software package for bio-mass power project monitoring, evaluation and lessons learned. Cost : US \$ M 2.0	project period. M & E, lessons learned system for the project gets established Cost : US \$ M 2.0
Total Cost	US\$44.25m	US\$ 64.75m	US\$20.50m
Global Benefits	For approximately 40 MW of electric power, the emissions will be approximately 0.14 mt CO ₂ per year	For the 43 MIP's, the GHG savings will be approximately 0.14 mt CO ₂ per year	For 43 MIP's, the GHG savings will be approximate 0.14 mt CO ₂ per year or 2.1m tones of CO ₂ avoided over 15 years If all biomass were utilized and the entire 22,000MW were utilized, the results over 15 years would be the avoidance of 1073 million tones of CO ₂

ANNEX B. LOGFRAME MATRIX

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
I. Development Objective (Impact)			
To improve the electricity supply without increasing the GHG emissions through wide scale application of bio-mass power technologies	Extent of energy needs met by bio-mass power technologies and projects, reduction of usage of fossil fuels and reduction of CO2 emissions	Adoption of bio-mass power technologies, in captive and field bio-mass sectors and their large scale multiplication	Globally, bio-mass power will continue to be one of the key climate change mitigation options and the Government of India is committed towards reduction in GHG emissions Installation of bio-mass power projects will improve quality of life for the local populace thereby leading to its replication in rural parts of India Large scale use of bio-mass power will lead to reduction in GHG emissions and improvement in energy supply
II. Project Objectives (Outcomes) / Purposes			
To accelerate the adoption of environmentally sustainable bio-mass power technologies for captive and distributed bio-mass materials in niche areas, through demonstration of project development models and establishment of sustainable business / support services network and undertaking enabling activities for removal of the key barriers	Increase in percentage of energy usage from bio-mass power projects, from 0.2 % to 1 %, during 4 years of project duration and 2 years of follow up	Total electricity generation from all types of power plants and total electricity generation from all bio-mass power plants	Conducive policy & regulatory framework for bio-mass power projects gets sustained over the project and follow up periods
Activity I : Technology Package Benchmarking & Validation, including Energy Plantation (Parts I and II)			

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
Output 1 : the techno-commercial viability of each type of technology gets established	Bio-mass fuel to power conversion efficiency, utilisation levels and PLF, consumption of utilities, manpower cost, O & M costs, project payback, internal rate of return, break even and sensitivity analysis, etc.	Technical and economic viability indicators for each type of technology / project are within the current project viability norms	Bio-mass materials required for plant operations are available, fuel linkage. Equity and debt are available. Policy and regulatory framework is sustained and is conducive
Output 2 : technology improvement and up-gradation needs get identified	Bio-mass fuel to power conversion efficiency, requirements of manpower / utility / O & M / overhead, etc.	Comparison with conventional fuel technologies available locally and bio-mass fuel technologies available internationally	Bio-mass power technologies internationally are more efficient and local conventional fuel technologies are in-efficient
Output 3 : capability of Indian technology and equipment suppliers gets assessed objectively	Technology package and outputs, turnover and profitability, specifications of equipment, experience, manpower and facilities, after sales services network, etc.	Assessment of information supplied by them, spot checks and discussions at the manufacturing facilities and feedback from the customers	Indian technology and equipment suppliers are capable of supplying power plant equipment, with little experience in bio-mass power plant equipment
Output 4 : design, performance and evaluation benchmarks for each technology are available	Design, performance and evaluation benchmarks for all bio-mass power technologies are finalised and verified	Design, performance and evaluation benchmark document for all bio-mass power technologies is prepared	Bio-mass power technologies are locally available
Output 5 : establishment of techno-commercial viability of energy plantation to power generation technologies	Identification of technologies, types of materials, input – output ratios and efficiencies, project viability indicators like capital cost, payback, IRR, break even, etc. get documented	Performance review of MIPs for usage of energy plantation on waste lands as bio-mass resources for power generation and comparison with conventional bio-mass power technologies	Bio-mass power remains as the national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Output 6 : establishment of long term	Potential for energy plantation on	Accepted by major stakeholders	Bio-mass power remains as the

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
perspective for energy plantation on waste land for power generation	waste land as bio-mass power resource material gets documented along with required policy – regulatory – institutional framework	and project promoters and increased enquiries for formulation of such projects	national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Activity II : Capacity Building for Effective Information Dissemination (Parts I and II)			
Output 1 : improved confidence level of the major stakeholders	Awareness / training / skill up-gradation workshops, seminars and programmes, interaction & business meets etc. with major stakeholders on regional / national levels	Increased demands of information / data from major stakeholders for bio-mass power technologies	Bio-mass power remains as the national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Output 2 : improvement in the mind sets of the stakeholders	Initiatives from stakeholder institutions for promotion / development of bio-mass power projects	Local / regional programmes, initiatives, actions taken in favour of bio-mass power projects	Bio-mass power remains as the national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Output 3 : improved confidence level and capability of the stakeholders and the project promoters	Easy availability of all required information to the project promoters & major stakeholders	Increased enquiries for project formulation at MNES / FIs / State Govt. / SNAs levels	Bio-mass power remains as the national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Activity III : Development of Business, Commercial & Support Services Network (Part I)			
Output 1 : establishment of long term	Bio-mass power business	Feedback from project	Bio-mass power remains as the

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
institutional framework requirements	dissemination models for niche areas at local / regional/ national levels get established, along with support service requirements for sustenance	promoters / stakeholders and stakeholder workshop proceedings organised for presenting bio-mass power business dissemination models	national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Output 2 : preparation of master plan for creation of dynamic and sustainable institutional framework	Dynamic & sustainable institutional networks for bio-mass power projects at local / regional / national levels get identified	Master plan for development of such institutional networks gets prepared and validated by the major stakeholders and project promoters	Bio-mass power remains as the national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Output 3 : achievement of defined milestones within the project life	Key institutions at national / regional level get activated & established for R & D, information dissemination, O & M services, financial intermediaries, etc.	Review of performance of such key institutions over a period of time	Bio-mass power remains as the national focus for renewable energy power development The stakeholders and project promoters look for bio-mass power as viable opportunities
Activity IV : Identification & Selection of MIP models (Part I)			
Output 1 : establishment of MIP models and selection criteria	Review report of existing models, niche areas and development of optimum no. of models for MIPs, along with critical selection criteria for each get prepared & documented	Accepted by major stakeholders / institutions involved	The project progressively achieves wider acceptance by major stakeholders and institutions involved.
Activity V : Model Investment Projects (Part II)			
Output 1 : MIPs get commissioned and stabilized	Based on the criteria established through Activity 1 of Part I, MIPs get selected financially closed and	Progress reports on MIP selection, implementation, commissioning and stabilisation	The project progressively achieves wider acceptance by major stakeholders and

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
	implemented, commissioned and stabilised		institutions involved.
Output 2 : documentation on lessons learned from MIPs gets completed	Lessons learned documentation gets prepared, validated and tested for MIPs	Presentation of case studies to stakeholders and validation	The project progressively achieves wider acceptance by major stakeholders and institutions involved.
Output 3 : multiplication strategy & plan gets recommended	Perspective plan for multiplication of bio-mass power technologies gets prepared and documented, along with major recommendations	Validation of the perspective plan and recommendations from donor agencies / institutions involved / stakeholders / project promoters	The project progressively achieves wider acceptance by major stakeholders and institutions involved.
Activity VI : Project Management & Monitoring (Parts I and II)			
Output 1 : transparent evaluation of project activities on short, mid and long term basis becomes available for project donors, bi-lateral agencies, stakeholders, project promoters, implementing and executing agencies	Master plan for project activities gets finalised and documented, along with monthly / quarterly / annual performance review formats and adoption of them by all project management institutions	Review / evaluation reports from donor agencies / bi-laterals / project promoters of the project progress	The project progressively achieves wider acceptance by major stakeholders and institutions involved.

ANNEX C – STAP ROSTER TECHNICAL REVIEW AND RESPONSE

Note: The Project Brief was initially reviewed by a STAP Reviewer in September 2001. Subsequent updates to the project warranted a second STAP review conducted in August 2002. Both STAP reviews are included in this Annex.

STAP Review of Project Brief

Removal of Barriers to Biomass Power Generation in India, Part I

Dr. Pat DeLaquil

August 1, 2002

Introduction

The review of this updated project brief, which was previously reviewed in September 28, 2001, focuses primarily on the changes to the project brief. The reviewer agrees with the basic premises of the brief. Namely that India has a significant agricultural economy and unused biomass resources that have the potential to power 18,000 to 23,000 MW of new electricity generation. Much of this power could be utilized by the rural, agricultural communities that produce the biomass. To date, the development of biomass power generation in India has been slow because of significant barriers created by the fuel supply risks associated with the use of many distributed feedstocks, the absence of effective financing and institutional mechanisms, low levels of technical capacity and information dissemination, and non-uniform policy and regulatory frameworks at the state level.

Relative to the Key Issues, the proposed project continues to meet them, as identified in the initial review. The project remains consistent with the designated roles for GEF involvement. The global climate change impact for the project is positive. The proposed project maintains its focus on removal of market barriers, and is appropriately focused on relatively well proven technologies of biomass combustion, small-scale gasification. In addition, the project has identified clear criteria for project selection, diversity of feedstocks, and tailored investment models.

The project brief makes a good case regarding the expected outcomes of its technical assistance activities, and it lists specific end results intended to achieve sustainability. However, the project brief provides little definition on how it will accomplish the desired end results. Therefore, the effectiveness of these activities will depend on their sound implementation through a well-designed Project Document.

Updates to the Project Brief

The project brief is significantly improved since the previous review. The revised project brief has better focused its activities to remove market barriers and promote investments in biomass power generation technologies in India by using technical assistance and investment risk mitigation support. The three major biomass power sectors are also more clearly defined: cooperative sugar mills; agro-processors and biomass producers; and distributed biomass applications. Furthermore, the revised project brief reflects the latest reform developments within the Indian power sector, and it uses this information to focus its activities on those states with a supportive environment and significant biomass resources.

The project strategy to: 1) provide specific forms of technical assistance to remove market barriers, and 2) provide contingent grants to stimulate the financing of model investment projects (MIPs) in those applications with the greatest potential for future replication is basically unchanged, but the revised project brief has a better development of the major market barriers and more specific development of the project

activities. Both of these improvements will support the development of a stronger project document, which is critical to the success of the proposed project.

The one area identified by this reviewer as needing improvement involves an apparent overlap between parts of Activity III and Activity IV. Activity III: Development of business, commercial and support service networks, focuses on strengthening the institutional framework for sustaining biomass power projects within the business, technical, biomass supply and financing communities. It currently includes developing a partial set of pro forma documents for power purchase and biomass supply. In this reviewer's opinion, a full set of pro forma agreements and/or document guidelines (including Detailed Project Reports and Project Development Agreements) should be developed in Activity III through cooperative activities between the major stakeholders. In turn, Activity IV: Creation of fund for contingent financing should then focus on operationalizing these guidelines and agreements through the MIPs. That experience would then allow these agreements and guidelines to be promoting as proven tools/models for project replication.

Response to August 2002 STAP Review

The overlap between Activity III and Activity IV, as identified by the STAP reviewer, has been addressed. As suggested, Activity III "Development of business, commercial and support service networks" focuses on producing agreements and/or document guidelines through cooperative activities between the major stakeholders, including MIP specific documentation. Activity IV "Creation of fund for contingent financing" focuses on operationalization of these guidelines and agreements through the MIPs.

STAP Review of India Biomass Project Brief

September 28, 2001 Dr. Pat DeLaquil

Introduction

This project aims at accelerating the adoption of environmentally sustainable biomass power and cogeneration technologies in India by using technical assistance and investment risk mitigation support to remove market barriers and promote investments in biomass power generation. The project focuses on three major biomass power sectors: cooperative sugar mills; small agro-processors; and promoters of distributed biomass resources. The project strategy is to 1) provide various forms of technical assistance to remove market barriers and 2) to provide contingent grants to stimulate the financing of model investment projects (MIPs) in those applications with the greatest potential for future replication. Part 1 of the project will fund seven MIPs, and Part 2 would fund an additional 36 MIPs. The objectives of this proposed project are consistent with the objectives of the GEF Operational Programme No. 6 on “Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs”.

Key Issues

India has a significant agricultural economy, and about 70% of the population live in rural areas and are engaged in agriculture or agricultural-related activities. Recent studies estimate that between 120 and 150 million tons per year of usable, agro-residues are available for power generation. This biomass resource has the potential to power 18,000 to 23,000 MW of new electricity generation, and much of this power would be utilized by the rural, agricultural communities that produce the biomass. In addition to these existing resources, about 70 million hectares of wasteland could be utilized for raising energy plantations, with both land use and power generation benefits.

The project brief states that the development of biomass power generation in India has been slow. From this reviewer’s perspective, the accomplishments over the past decade have been significant, with over 232 MW of biomass power generation installed and a pipeline of another 375 MW in various stages of implementation. However, the project brief correctly states that this is a very small fraction of the biomass potential, and that the hoped- for acceleration of commercial activity in this field has not yet materialized. The brief also correctly notes that the accomplishments to date have largely been achieved in the privately-owned sugar sector and for specific feedstocks, such as rice husk. The cooperatively-owned sugar sector faces significant barriers in the areas of financing and technical capacity, and the technical risks involved with use of many distributed feedstocks, such as nut shells and various crop stalks, need to be further reduced.

The project brief states that emphasis will be placed on demonstration of different project development models, and on the facilitation of project replication through the establishment of sustainable businesses; support service networks; and other key barrier removal activities. This reviewer agrees that such capacity building activities are essential to accelerating the growth of the biomass power generation market in India. However, when the brief states that “The removal of barriers will lead to reduced transaction costs of these technologies and will make them cost effective compared to conventional fossil fuels power generation.” this reviewer must disagree. Many of these technologies are currently cost-competitive, as Table A-1 in the brief clearly shows. Yet, many cost-effective projects never get developed because of perceived technical risks, long and costly project development cycles, and a variety of financial and institutional risks that the brief discusses at length.

Fit to GEF Strategy

The proposed project is consistent with the designated roles for GEF involvement. The funds requested are less than the incremental cost of the project. Key government and private sector institutions will collaborate in the implementation of the project, and the project plans to share knowledge and experience with a wide variety of stakeholders and participants in the biomass power generation market in India.

Global Benefits

The climate change impact for this project is positive, with Part I alone projected to achieve a carbon reduction of 88,400 tons of CO₂ per year. Part II is projected to achieve another 55,000 tons of CO₂ per year, and if the full potential of about 22,000 MW of biomass power generation is eventually implemented, it would result in a carbon reduction of about 71.5 million tons of CO₂ per year.

Technical Soundness and Replicability

Given the proposed project's focus on removal of market barriers, it has chosen (appropriately) to focus on relatively well proven technologies of biomass combustion, cogeneration and small-scale gasification. In addition, the project has identified criteria for project selection that stress geographical diversity, feedstocks other than rice husk, and tailored investment models. For example, a BOOT (Build Own Operate Transfer) model will be used in the cooperative sugar sector to overcome the technical capacity and financing limitations inherent to cooperative sugar mills. For distributed biomass power projects, IPP and rural cooperative approaches will be used. The incorporation of these geographical, feedstock and investment features into the MIPs is intended to increase their effectiveness in stimulating a wide variety of follow-on projects.

Sustainability

The project intends to use a variety of technical assistance activities to remove barriers rather than surmount them. The project brief makes a good case regarding the expected outcomes of its technical assistance activities, and it lists specific end results intended to achieve sustainability. However, the project brief provides little definition on how it will accomplish the desired end results. Therefore, the effectiveness of these activities will depend on their sound implementation through a well-designed Project Document.

Secondary Issues

Environmental Benefits

The proposed project contains activities to support the development of energy plantations on existing wastelands, and several of the MIPs will employ energy plantations as a means of ensuring biomass supply. The amount of land identified for conversion from wasteland to energy plantation under both parts of this proposed project is 40,000 hectare, which is only 0.5% of the available wasteland. Important long-term environmental benefits would be gained if this project stimulates more conversion of wasteland to productive use.

Adequacy of the Project Brief

The project brief is generally well written, but several of the technical assistance activities need clarification and further development.

1. Activity I: Technology benchmarking and validation. To the best understanding of this reviewer, some of what is proposed in this task has been done by MNES. Under a previous grant program, biomass technology suppliers had to be certified by MNES in order to have their projects qualify for the grants. Standards and benchmarks for initial performance exist. However, the long-term performance of the

technologies, their reliability and their O&M requirements are not well documented. In addition, various wasteland utilization studies have been performed. Thus, this activity needs to state that it will build upon existing material and identify the new areas it will explore.

2. Activity II: Build stakeholders' capacities and information dissemination. This activity also proposes several sub-activities that have already been completed to some degree (project data bank, model agreements, and appraisal guidelines). The reviewer assumes that the project will build from the existing materials, but the project brief should state this and define what additional work is needed.
3. Activity III: Develop business, commercial and service support networks. It is not clear to the reviewer how this activity differs from the capacity building aspects of Activity II. The major stakeholders identified for capacity building in Activity II are "R & D institutions, State Electricity Boards (SEBs), State & Central Government Agencies, financing institutions and banks, engineers and consultants, NGOs (local / regional / national agencies), service entrepreneurs, technology and equipment suppliers, project developer, sugar mill / rice mill owners, micro entrepreneurs and project promoters." In Activity III, the focus is on the "development of required experts, professionals, groups of experts and professionals, NGOs and training institutions, service institutions, financial intermediaries, market intermediaries." There is a clear overlap between these two sets, and there is a clear overlap between the general "capacity building" identified in Activity II, and the institutional strengthening and preparation of action plans identified in Activity III. Better definition of both these activities is required.
4. Activities IV and V: Support for Model Investment Projects. These activities appear well designed and the selection of MIPs for Part I meets the proposed criteria for differing investment models, feedstocks and regional diversity.
5. Activity VI: Project Management and Monitoring. The proposed creation of a Project Advisory Committee (PAC) is an excellent approach to gaining input (and hopefully buy-in) from major stakeholder groups. Annual evaluations by the PAC will provide an independent assessment of the effectiveness of the project activities.
6. The project brief mentions (p. 27) that a "new institution, the National Biomass Power Association, will bridge the information gaps amongst the stakeholders, and ensure a conducive environment over the long term." There is no other mention of this organization, and it is not clear whether this organization already exists, or will be formed under this project. Therefore, the reviewer cannot see how it will achieve the stated objective.

Response to September 2001 STAP review

The STAP reviewer has determined that this project is consistent with GEF strategy, has significant carbon reduction benefits, and is technically sound in its focus on technologies of biomass combustion, cogeneration and small-scale gasification. The reviewer has indicated that the project brief is generally well written, and has raised some important points for clarification and elaboration. These points, responses to these points, and the changes made accordingly to the project brief are outlined below.

"The project brief states that emphasis will be placed on demonstration of different project development models, and on the facilitation of project replication through the establishment of sustainable businesses; support service networks; and other key barrier removal activities. This reviewer agrees that such capacity building activities are essential to accelerating the growth of

the biomass power generation market in India. However, when the brief states that “The removal of barriers will lead to reduced transaction costs of these technologies and will make them cost effective compared to conventional fossil fuels power generation.” this reviewer must disagree. Many of these technologies are currently cost-competitive, as Table A-1 in the brief clearly shows. Yet, many cost-effective projects never get developed because of perceived technical risks, long and costly project development cycles, and a variety of financial and institutional risks that the brief discusses at length.”

The project brief has been amended to correctly refer to the significant barriers of perceived risks, development cycles, and additional financial and institutional risks that prevent otherwise cost-effective projects from being developed. This has been reflected in section 3.2.

Adequacy of the Project Brief

1. “Activity I: Technology benchmarking and validation. To the best understanding of this reviewer, some of what is proposed in this task has been done by MNES. Under a previous grant program, biomass technology suppliers had to be certified by MNES in order to have their projects qualify for the grants. Standards and benchmarks for initial performance exist. However, the long-term performance of the technologies, their reliability and their O&M requirements are not well documented. In addition, various wasteland utilization studies have been performed. Thus, this activity needs to state that it will build upon existing material and identify the new areas it will explore.”

As noted by the reviewer, the proposed activity would set standards and benchmarks for long-term performance of the technologies, their reliability and O&M requirements. While this and all other activities would build upon existing materials, this area of technology benchmarking and validation is new to the sector. In the past, the project developers have faced constraints while sizing the project, choosing the boilers and turbines, type of feedstock and its processing and so on. The emphasis of this activity would be to reduce the technical barriers and improve investor’s technological confidence level. Since the current practice for the technological assessment is based on the type of fuel used, and the exportable surplus, it is important to set technological, performance and other operating standards as well. The activity would enable to set performance standards based on assessment of the ongoing projects and would validate them through the implementation of MIPs. It may be noted that this activity would draw some lessons from the cogeneration activities in the non-cooperative sector, but there is not be enough information on biomass (other than rice husks based technologies) for benchmarking. Further, the benchmarks would be tuned to suit also the given institutional and business context.

Regarding the assessment of biomass there is an ongoing effort at a macro level, however, at the field level the lack of information on biomass resource to the project developers still remains a key barrier. Also, efforts are required to define productivity of the wasteland vis-à-vis species or species vis-à-vis efficiency of the biomass plants.

The activity during Part I would formulate benchmarks based on the related experience of developing and commissioning of biomass power projects and in Part II, benchmarks will be established after validation of these on the seven MIPs.

The above has been reflected in Section 5.1, under Activity I.

2. “Activity II: Build stakeholders’ capacities and information dissemination. This activity also

proposes several sub-activities that have already been completed to some degree (project data bank, model agreements, and appraisal guidelines). The reviewer assumes that the project will build from the existing materials, but the project brief should state this and define what additional work is needed.”

This activity is additional to what has been generally part of generic information dissemination on the potential of biomass for power generation. The proposed activity component would emphasize developing a project data bank based on the benchmarks and MIPs established, develop model agreements, and appraisal guidelines to ease investors' risk. This activity would strengthen the capacities of different stakeholders for reducing the time taken from the concept to commissioning of biomass projects. Detailed project activities will be clarified during project document finalization.

The above has been reflected in Section 5.1, under Activity II.

3. *“Activity III: Develop business, commercial and service support networks. It is not clear to the reviewer how this activity differs from the capacity building aspects of Activity II. The major stakeholders identified for capacity building in Activity II are “R & D institutions, State Electricity Boards (SEBs), State & Central Government Agencies, financing institutions and banks, engineers and consultants, NGOs (local / regional / national agencies), service entrepreneurs, technology and equipment suppliers, project developer, sugar mill / rice mill owners, micro entrepreneurs and project promoters.” In Activity III, the focus is on the “development of required experts, professionals, groups of experts and professionals, NGOs and training institutions, service institutions, financial intermediaries, market intermediaries.” There is a clear overlap between these two sets, and there is a clear overlap between the general “capacity building” identified in Activity II, and the institutional strengthening and preparation of action plans identified in Activity III. Better definition of both these activities is required.”*

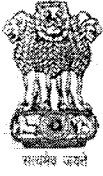
The major stakeholders involved in Activities II and III are the same, however the goals and activities involved in each of these activities are quite different. Activity II focuses solely on building capacity through information gathering and dissemination, including creation of databases, newsletters, handbooks, reports, and model agreements. Activity III, in contrast, involves the review of existing networks and institutions, and human resource requirements for the biomass sector. This activity would focus on capacity building for managing biomass collection and supply for power generation. The efforts would also include aspects of institutional strengthening and infrastructure improvements for power distribution and sales. Based on the analysis to be undertaken under Activity III, an action plan will be created and the overall institutional framework for sustaining biomass power project will be strengthened through appropriate technologies and materials at local, regional, and national levels. All activities will be defined in detail in the project document, and the above has been clarified in Section 5.1 of the text.

6. *“The project brief mentions (p. 27) that a “new institution, the National Biomass Power Association, will bridge the information gaps amongst the stakeholders, and ensure a conducive environment over the long term.” There is no other mention of this organization, and it is not clear whether this organization already exists, or will be formed under this project. Therefore, the reviewer cannot see how it will achieve the stated objective.”*

Unlike some other sectors in renewable energy, such as wind and PV, biomass sector is largely unorganized. Therefore, while formulating this project, an effort to organize this sector was made and, in 1998, a National Biomass Energy Developers Association was formed with biomass project developers as its members. However, the Association's operations will not be supported by GEF project so as not to

undermine its sustainability (it is currently self-supporting). Nevertheless, it will be considered for technical assistance as part of the project.

ANNEX D. LETTERS OF ENDORSEMENT



भारत सरकार
पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT & FORESTS

No. 4(2)/30/96-IC-1
Date: 28th September, 2001

To

Dr. P. Venkat Ramana,
Assistant Resident Representative,
UNDP, 55, Lodi Estate
New Delhi- 110003.
Fax: 462 7984.

Subject: Project proposal on "Removal of Barriers to Biomass Power Generation in India"- regarding endorsement.

Sir,

I am directed to refer to your letter of 18th September, 2001 on the above subject and to say that the Ministry of Environment and Forests has conveyed its 'in-principle' endorsement to the Department of Economic Affairs to the above proposal vide our letter no. 4(2)/30/96-IC.I dated 28th September, 2001.

Yours faithfully,

(H. C Bhatia)
Section Officer (IC)

Ramon Prudencio C. de Mesa

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