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**Government of India  
and  
United Nations Development Programme  
Global Environment Facility**

**PROJECT DOCUMENT**

**Removal of Barriers to Biomass Power  
Generation in India, Phase I**

*Biomass Power - 00051271*

**June 2006**

**NEW DELHI**

**UNITED NATIONS DEVELOPMENT PROGRAMME**  
**Global Environment Facility**

**Project Document**

**PIMS No.** 740  
**Project Number:** IND/02/G31/A/1G/99 - 00051271  
**Project Title:** Removal of Barriers to Biomass Power Generation in India, Phase I  
**Project Short Title:** Biomass Power  
**Estimated Start Date:** 1 June 2006  
**Estimated End Date:** 31 May 2009  
**Executing Agency:** Ministry of Non Conventional Energy Sources (MNES), GoI  
**Implementing Agency:** Ministry of Non Conventional Energy Sources (MNES), GoI  
**States Covered:** Haryana, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Madhya Pradesh  
**Project Sites:** Haryana, Maharashtra, Punjab and Rajasthan

**UNDP and Cost Sharing (in US\$)**

**UNDP/GEF**  
 GEF \$ 5,650,000  
**Sub-total UNDP/GEF \$ 5,650,000**

**Co-financing**  
 MNES \$ 5,240,000

**Leveraged Financing**  
 KfW \$ 24,820,000\*

**Financial Institutions & Private Sector** \$ 3,440,000

**Sub-total Cofinancing and Leveraged** \$ 33,500,000

**TOTAL** \$ 39,150,000

\* 19.971 Euro converted at 1 Euro = US \$1,24285

**Brief Description:** The objective of this two-phase 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 to focus attention on 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. Phase I of the project will provide technical assistance and investment support in a limited number of states. Phase 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. The project document relates to activities and financing approved for Phase I of the project only.

On behalf of:	Signature	Date	Name/Title
Executing Agency & Implementing Agency		22/9/06	Ministry of Non Conventional Energy Sources, Government of India
Government of India			Department of Economic Affairs, Ministry of Finance, (GoI)
UNDP		22/9/06	Resident Representative UNDP, India

United Nations official rate of exchange on the date of signature of Project: US\$ 1 = will be as per the prevailing rate of exchange in the month of signature.

## **A. COUNTRY PROGRAMME CONTEXT**

### **I. Background**

The Approach Paper to the Tenth Five-year Plan proposes "a shift in the focus of planning from merely resources to the policy, procedural and institutional changes which are essential for every Indian to realize his or her potential". This resonates with the overarching goals of the work of the United Nations system in India – *to work towards the promotion of sustainable human development and the elimination of human poverty and inequalities* – as well as the UNDP global mandate to establish 'partnerships to fight poverty'. The Government of India (GoI)-UNDP Country Programme for the period 2003 to 2007 is aligned with these priorities, and is a reflection of the recognition that international co-operation can play a significant role in supporting the GoI in addressing these issues.

<sup>1</sup>With an average growth rate in the gross domestic product of 5.8 per cent during the first decade of reforms (1992-2001), India is among the 10 fastest growing economies in the world. India's steady progress over the last decade towards meeting the goals of human development is reflected in the improvement of the country's human development index (HDI) from 0.406 in 1975 to 0.571 in 1999. Yet the challenges for human development remain formidable<sup>1</sup>. Statistics on critical development indicators such as female literacy, life expectancy at birth, child mortality and incomes show that regional and interstate disparities are increasing<sup>2</sup>. There is growing public consensus on the need for proactive measures to tackle the situation of disadvantaged and vulnerable groups. The pressures on environmental and natural resources and the repercussions of their degradation on low-income livelihoods have become a source of increasing concern. In the context of rapid strides in decentralization, there is an urgent need to strengthen the capacity of rural and urban bodies – local governance, as also to make public administration more efficient, open and accountable to the public.

The development cooperation of UNDP is ultimately premised on achievement of the Millennium Development Goals and targets. Goal 7 stipulates ensuring environmental sustainability through integrating the principles of sustainable development into country policies and programmes and reversing the loss of environmental resources.

### **II. The Country Programme (2003-07) and its Thematic Focus**

The new Country Programme (2003-2007) and interventions as reflected in the four inter-linked thematic areas include strengthening national capacities for influencing global debates on environment and mainstreaming global environmental concerns (e.g., biodiversity areas, renewable energy, land degradation, desertification, climate change) into national projects, programmes and policies and; demonstrating technologies and approaches, to address linkages between global environment issues and national developmental challenges.

The United Nations Framework Convention on Climate Change (UNFCCC) to which India is signatory seeks to stabilize atmospheric greenhouse gas (GHG) concentrations at levels that

<sup>1</sup> <http://planningcommission.nic.in/appdraft.pdf>

<sup>2</sup> [http://www.un.org.in/CCA2.htm#The state of human development](http://www.un.org.in/CCA2.htm#The%20state%20of%20human%20development)

would prevent dangerous anthropogenic interference with global climate. Clearly, this stabilization will require greatly increased utilization of renewable energy technologies (RETs). The Operational Strategy of the Global Environment Facility puts initial emphasis, among others, Operational Programs that address long-term program priorities of the Convention to mitigate climate change and the GEF strategic priorities for increased access to local sources of financing for renewable energy and energy efficiency and power sector policy frameworks supportive of renewable energy and energy efficiency. This project falls under the Operational Programme No.6 Promoting Adoption of Renewable Energy by Removing Barriers and reducing Implementation Costs.

## **B. PROJECT BACKGROUND**

### **I. Development Context**

#### **1.1 Review of Power Sector**

The development of the power sector is key to the development of India<sup>3</sup>. The demand for electrical energy has been growing at an average annual growth rate of 7-8%. It is estimated that the future additional power requirements by 2012 will be around 140,000 MW at a cost of Rs. 6000 billion. The total installed capacity has increased from 85,795 MW at the beginning of the Ninth Five-Year Plan to 102,000 MW, that is, at the beginning of the Tenth Five-Year Plan. This addition of 16,205 MW is against the targeted capacity addition of about 40,000 MW during the same period, which means the achievement, has been below 40%. Even with the proposed capacity additions in the various Five-Year Plans of the Government of India, shortfalls of power continue thus posing great challenges.

More than 70% of the installed capacity is based on fossil fuels, mainly coal. The environmental impacts of fossil fuel use both at the local and global levels are enormous. The environmental implications of current energy use—such as GHG emissions, deforestation, land degradation, water and air pollution—have been a cause of great concern. Carbon emissions in India (from the energy sector) are projected to increase from 508 Mt CO<sub>2</sub> in 1990 to 1646 Mt in 2010 (ALGAS, 1998).

In 1996, the Common Minimum National Action Plan for Power (CMNPP) envisaged among 15 actionable points, establishment of Electricity Regulatory Commissions at the National and State Levels, restructure and unbundling of the SEBs to run on commercial basis, and private sector participation in distribution. Despite the reform process having mixed impacts, the overall power scenario is witnessing deterioration, and thus affecting the commercial viability of the power projects. Even at per capita electricity consumption levels among the lowest worldwide, people in a large number of villages have no access to electricity. The end users such as households, farmers, and other commercial and industrial establishments are confronted with poor quality of power supply and associated low quality of life and productivity and socio-economic losses.

<sup>3</sup> Source: Power India Year Book 2001-2002

Thus, the slow pace of implementation of the initiatives, without factoring in the environmental issues, is reflected in India's power sector, characterized by excess demand, continued dependence on depleting conventional sources of energy; and low pace of energy efficiency improvements.

## 1.2 Power Potential and Achievements from Renewable Energy Sources in India - A Review

India has been estimated to have approximately 79,500 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.

Table 1 below gives the Potential and Achievements of Renewable Energy based Power in India. Renewables contributed to approx. 3930 MW, OR 3.6 % of the total installed capacity in the country.

**Table 1. Potential and Achievements of Renewable Energy based Power in India, March 2003<sup>4</sup>**

Sr. No.	Source	Potential (MW)	Achievements (Commissioned Projects)
			MW
1.	Wind power	45000	1870
2.	Small hydro power	15000	1509
3.	Biomass power / Bagasse Cogeneration	19500	537
4	Waste to Energy	1700	12
	<b>Total (1+2+3+4)</b>	<b>79500</b>	<b>3928</b>

The wind power development program of the MNES has been operational since 1985. The key achievements to date include establishment of around 1000 wind monitoring and mapping stations, establishment of demonstration projects in major potential States, establishment of Centre for Wind Energy Technology; establishment of as many as 15 manufacturers for production of wind turbine equipment; development of machine sizes up to 1250 KW; soft loan scheme from IREDA under the World Bank line of credit; development of intelligent power controller for wind electric generators; and organization of number of workshops, business meetings and networking opportunities.

The biomass power/cogeneration program of the MNES has been operational since 1994. The major components include a demonstration project scheme for bagasse based cogeneration projects in the co-operative sector (1994-99); an interest subsidy scheme for commercial bagasse/biomass power projects (1998 to present), program partnership and lead program partnership initiatives for promotion of bagasse based cogeneration and biomass power projects (1998-2001); specific industry oriented R&D initiatives (1998 onwards); national biomass resource assessment program (1997 to present); National Biomass Gasifier

<sup>4</sup> Source – Ministry of Non Conventional Energy Sources, New Delhi

Programme; advanced biomass gasification program; soft loan scheme from IREDA under World Bank and KfW lines of credit; and organization of workshops and meetings throughout the country (1994 to present). Apart from the MNES efforts, USAID – Greenhouse gas Pollution Prevention (GEP) initiative for sugar mill bagasse cogen demonstration projects and bio-energy for sustainable transformation of rural areas (Sutra) were other major initiatives in this sector.

The small hydro program of the MNES was also in operation since 1985. The major efforts in small hydro sector include identification of State-wide number of sites, establishment of demonstration and commercial projects, renovation/modernization/capacity rating program, IREDA soft loan scheme under the World Bank line of credit, development and up-gradation of water mills, UNDP/GEF technical assistance project for optimizing development of small hydro resources in Himalayan and sub-Himalayan regions, research and development initiatives, training and manpower development program, progress monitoring and publicity/awareness creation.

Despite substantial efforts of the MNES through the Five-Year Plans, the installed biomass power / cogeneration capacity remains at about 537 MW as of March 2003. While the installed wind power and small hydro capacities respectively have been 1870 MW and 1509 MW (about 86 %), the biomass power capacity including waste to energy has been only about 549 MW (14 %). For the year 2002-03, the share of renewable power capacity was about 3.6 % of the total power generation capacity.

### **1.3 Lending Environment in India**

Indian Renewable Energy Development Agency Ltd. (IREDA) has been the main financial institution involved in lending for bio-mass power / cogen projects in India, since 1994-95. Almost 75 to 80 % of lending in this sector is from IREDA. Due to MNES initiatives since 1998-99, other national financial institutions including HUDCO, ICICI, PFC, REC, IDFC, NDC, etc. have started looking into this sector seriously and have financed few projects. The interest rates for these projects range from 12 to 15 %, with quarterly / 6 monthly installments of interest and principal with overall repayment period of 10 years. The moratorium offered for repayment of principal amount ranges from 1 to 3 years. Incentives for prompt repayments and for projects in hilly areas or by woman entrepreneurs have been provided by some financial institutions (FIs), up to 1% interest. The quantum of term loan ranges from 60 to 80% of the project capital cost. The nationalised banks and local financing institutions know very little about biomass sector and it has not been mainstreamed into their existing lending mechanism.

The securities required from the promoters for availing long term finances are however strong and exhaustive. Actually, all the financial institutions have been lending these projects on 'Recourse Financing Principles' and not on 'Project Financing Principles'. Over and above the first charge with mortgage on the project facilities, the FIs are insisting on combinations of various other securities including guarantees from respective state governments, bank guarantees from high credit rated FIs, post dated cheques, guarantees from other businesses of the promoters, escrow facility on the promoter account where receivables from power sale are accrued, personal guarantees from promoters and directors, letters of credit and escrow

facility from state electricity boards wherever possible, etc. By and large, the FIs are considering these projects as high risk and are willing to lend only if their funds are secured more than 200 %. In view of precarious market and financial conditions of sugar mills in India, particularly the co-operative sugar mills, non availability of conducive, sustainable and long term policy framework in most of the States and high fuel linkage risks in these projects, FIs treat sugar cogeneration (cogen) and bio-mass sectors as high risk. The technological challenges in this sector further have made adverse impact on financing. Although, major national FIs including IREDA are keen to lend to this sector, the financing mechanisms, which will reduce the lender risks are not in place.

The Sugar Development Fund, although has recently announced quasi equity / loan support for sugar mills implementing cogen power plants up to 35 to 40% of the capital cost at 6 to 8%, the concurrent repayment terms stipulated in the scheme and securities thereof make the main term lending institutions uncomfortable, as well as the project cash flows are affected (this is against repayment of soft loans / quasi equity after repayment of the principal term loan for other schemes of the Sugar Development Fund).

#### **1.4 Review of Key MNES Initiatives**

The demonstration project scheme for bagasse cogen power plants in the co-operative and joint sector sugar mills was announced by MNES way back in the year 1993-94. This provided a capital grant of Rs. 7 million / MW of exportable surplus capacity limited to Rs. 60 million and soft loan at 9% to the tune of Rs. 13 million / MW of exportable surplus capacity. The scheme also necessitated financial involvement from the respective state governments equivalent to Rs. 2.5 million / MW of exportable surplus capacity for eligibility under this scheme. Despite this huge financial incentive, till 1997-98, no co-operative and joint sector sugar mills approached MNES for availing the same. Under the program partnership initiative, MNES promoted this scheme aggressively in the period 1998-00 and about 7 co-operative / joint sector sugar mills were sanctioned the incentives. Unfortunately, due to several financial barriers faced by sugar mills in this sector, only one project could avail the incentives and came on stream as of March 2003. The enormous delay in confirming financial support from the state governments, in-ability of these sugar mills to raise required equity and debt from FIs and achieve the actual financial closure were responsible for this status. The Ministry closed this scheme in March 1999.

The capital grant scheme was also provided by MNES for IPP – co-operative / joint sector sugar mill model between 1999-2001 period with an aim to develop four demo projects in states having major existence of these type of mills. In view of various barriers related to project development agreements between IPP and the host sugar mill, structure of co-operative sugar mill management and the overall financial status of co-operative sugar mills, this initiative also did not help developing a project and subsequent implementation / commissioning.

The interest subsidy scheme for commercial biomass / bagasse based cogen power plants was introduced in the year 1999 and it still continues, although in different form. The interest subsidy scheme works through the lending FIs. Increasing interest subsidy was provided initially for pressure / temperature configuration for 40 kg/cm<sup>2</sup> and above (1%), 60 kg/cm<sup>2</sup>

and above (2%) and 80 kg/cm<sup>2</sup> and above (3%). The scheme was extended to co-operative / joint sector mills after 2001 giving additional 2% reduction for each stage. The floor level of interest after subsidy where at 11 % for commercial projects and 9% for co-operative sugar mill projects. This initiative was mainly responsible for the status of development of these projects to date. Most of the commercial projects commissioned to date have availed MNES interest subsidy. Despite additional incentive for co-operative and joint sector sugar mills, they are unable to avail this incentive as well due to their in-ability to raise required equity and debt from financial institution. The program success has been limited to commercial projects from the private sector sugar mills.

IREDA has led the lending for renewable projects in the country, particularly bio-mass power and bagasse cogen projects. IREDA has been successful in securing World Bank, Asian Development Bank and KfW lines of credit for financing these projects. They finance these projects through their own funds or under the lines of credit available with them at any moment of time and depending on the project / promoter characteristics. IREDA also uses the funds under the lines of credit for development of this sector including assessment studies, capacity building workshops, etc. Although, IREDA receives funds under the lines of credit at low interest rates, IREDA lends to these projects in the range of 11.5 to 13.5 % interest rates. Under the lines of credit, the procurement procedures are defined by each bi-lateral agency and have to be followed for each project. The qualification criteria for projects for lending including appraisal guidelines are defined under these programs or by IREDA, based on their experience.

### **1.5 USAID – GEP initiative**

USAID – GEP initiative for 9 projects in the private sector was primarily useful for demonstration of high pressure technology configurations in these projects up to 67 kg/cm<sup>2</sup>. Under this program, a capital grant of US \$ 1 million was given to select 9 private sector sugar mills implementing these projects. The FIs including IDBI and national / international experts were involved in selecting these sugar mills. The capital grant was helpful in reducing the equity contribution of the promoters, as grant was treated as part of equity. The lending for balance 70% of the capital cost, was primarily done by IREDA and these projects also utilised MNES interest subsidies. The transaction documents are available with USAID, IREDA and the sugar mills. All these 9 projects came on stream and operated minimum 270 days / year on bagasse and other biomass fuels and on pressure / temperature configurations beyond 60 kg/cm<sup>2</sup>. The USAID has documented the experience of this program, but its usefulness for designing financing mechanisms will be limited to private sector sugar mill cogen power plants.

### **1.6 Status of Biomass Power Development in India**

#### ***Biomass Resources (Refer Appendix I for Estimates of Biomass Production in India)***

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 to 75% of these



wastes are used for fodder, domestic cooking, or other purposes, leaving behind 140 to 170 million tonnes of usable, agro-residues per year, which could be made available for power generation. The total biomass power potential is estimated at 18,000 – 23,000 MW, of which approximately 6000 to 7000 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 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). 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 2 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 2.** Current Status of Biomass Availability & Biomass Power Policies by State

State	Biomass Resource Availability from Agro-wastes <sup>5-8</sup>	Biomass Tariff <sup>1</sup> (US cents/kWh) (2002-2003)	Wheeling, Banking Third Party Sale Policies <sup>2,3,4</sup>	Regulatory Framework
Andhra Pradesh	Average (possibly already over-committed)	6.77	Not Favorable	SERC functional, Review by APERC in Progress
Gujarat	Average	6.77	Moderately Favorable	GERC functional
Harayana	High	6.77	Favorable	SERC Functional, Review by State Govt. in progress.
Karnataka	Average	6.77	Moderately Favorable	SERC functional Review by KERC in progress.
Maharashtra	High	6.22	Favorable	SERC functional, tariff order issued by MERC.
Madhya Pradesh	High	4.59	Moderately Favorable	SERC constituted, review by state Govt. in progress.
Punjab	Very High	6.32	Favorable	SERC constituted, review by PSERC in progress.
Rajasthan	High	6.77	Favorable	RERC functional.
Tamil Nadu	High	6.12	Moderately Favorable	SERC constituted, review by TNERC in progress.
Uttar Pradesh	Very High	5.30	Moderately Favorable	SERC functional

**Notes:**

1. Tariff as per MNES Guidelines for 2002-03 6.77 Cents / KWh
2. Favorable = Policy announced, wheeling, banking and third party sale as per MNES guidelines.

3. *Moderately Favorable = Policy announced, wheeling, banking and third party sale allowed with minor deviations as per MNES Guidelines*
4. *Not Favourable = Policy yet to be announced or large deviations in wheeling, banking and third party sale terms compared to MNES Guidelines*
5. *Very High – Estimated Biomass Power potential exceeding 2000 MW*
6. *High – Estimated Biomass Power potential in the range 1000-2000 MW*
7. *Average – Estimated Biomass Power Potential in the range 500-1000 MW*
8. *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 Gas Prevention Project (GEP) has also provided development assistance to this sector over last few years.

### **Status**

As of March 2003, 43 bagasse cogeneration projects, aggregating to 304 MW of exportable surplus and 37 biomass power projects aggregating to 180 MW capacity, totaling to 484 MW projects have been successfully commissioned. Additional 33 bagasse cogen projects aggregating to 323 MW and 39 biomass power projects aggregating 240 MW, totaling to 563 MW are in advance stages of implementation. Out of this, about 1800 biomass power projects based on gasifiers are operational aggregating to 53 MW. High pressure and temperature configuration of 67 kg/cm<sup>2</sup> and 495°C have been established in bagasse cogen and biomass power sectors and extra high pressure configurations are being tried out. Most of the commissioned projects or projects under construction, both in bagasse cogen and biomass power, have been from the private sector, based on captive biomass resources from sugar mills or rice mills. However, a large number of sugar mills in the co-operative and public sector are still unable to implement these projects, despite substantial incentives offered. Also, apart from rice husk, no other major distributed biomass material or combinations thereof have been tried out.

### **Need for Accelerated Development**

The poor results of biomass power development in India, despite strong efforts as well as high potential, are mainly attributable to a complex set of associated barriers related to capacity building, adequate information dissemination, policy and regulatory framework and financing. It is necessary to undertake a critical review of the development so far, identify focus areas and undertake value added efforts for barrier removal. The biomass power development in India is at the spin off stage and specific efforts will accelerate the development, through large scale multiplication. Accelerated development is essential to overcome slow moving status of this sector and achieve maximum potential in the foreseeable future.

## **II. Issues to be Addressed**

### **2.1 Target Sectors**

It is evident that in captive biomass resources from sugar mills, rice mills, agro-based oil industries and wood based industries, the sugar industry has a potential of the order of 3500 MW from bagasse, which is a renewable fuel. All the development in bagasse based cogeneration so far is limited to private sector, leaving major potential from the co-operative and public sector sugar mills still remaining untapped. The co-operative and public sector sugar mills form about 70% of total numbers of sugar mills in India, with almost equivalent share of the potential. However, almost no development has taken place in this sector to date, due to complex barriers associated with this sub-sector as outlined in section 2.2. It is essential to focus on this particular sub-sector, if large scale multiplication within and in balance private sector sugar mills are to be aimed at.

In other biomass industries, rice husk based biomass power plants are getting commercialized successively. However, different types of captive and distributed biomass materials or combinations thereof, between 1 to 6 MW or above capacity, have not been implemented extensively except Andhra Pradesh. Any focused effort in this regard will be useful to achieve multiplication in this sub-sector. In the distributed biomass power sector, the development of the plant capacities up to 1 MW scale, at different geographical locations, combination of distributed biomass materials and with different types of entrepreneurship models is relatively low.

This is the most challenging sub-sector, given the small scale category of projects, nascent status of gasification technology, need for collection of distributed biomass materials from the field and non-availability of business, commercial and support services at the ground locations, where development of these projects have good potential.

### **2.2 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/letter of credit mechanism impede the growth of biomass power projects, because of uncertainty in power purchase rates and insufficient security mechanisms for financial institutions. The present tariff policies of the government for conventional supply do not consider all the benefits of biomass projects, such as minimal transmission and distribution (T&D) losses, substantial overall environment and social benefits to local people. Likewise, the benefits to SEBs due to additional reactive power 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.

### **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 and difficulties in raising equity* – 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/cm<sup>2</sup>) 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 grid connected 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.

### **Barriers Faced by Private Sector/other Entrepreneurs, including Biomass Processors, > 1 MW scale on Distributed and/or Captive Biomass**

- *High transactions cost* – Private sector/other 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* – Private sector/other 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.
- *Lack of working capital* – Limited access to banks for working capital requirements for storing huge stocks of biomass materials for ensured year round operation.
- *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 in-ability 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.

### **Barriers Facing Small Private/Other Entrepreneurs including Independent Power Producer Model, using Distributed Biomass Resources, < 1 MW Scale**

- *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, lead to high transaction costs.
- *Limited access to financing* - For power projects seeking to use distributed biomass resources, there are no established lenders.
- *Lack of working capital* - Limited access to banks for working capital requirements for storing huge stocks of biomass materials for ensured year round operation.
- *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.

While the proposed project would compliment the ongoing efforts, the project interventions are based on a critical evaluation of the ongoing initiatives for addressing the above identified issues and barriers, specific to targeted sectors.

### **III. Indicators of National Priority**

The proposed project is consistent with the national programs, policies and priorities, as well as with nationally and internationally agreed-upon programs for sustainable development. The Central Government has proposed guidelines for increasing the share of power from renewables in total power generation in the next decade, from the present share of 3%. The draft renewable energy policy has been prepared and is under finalization. The Electricity Bill 2001 has been introduced in the Parliament and also includes provision of accelerated development of renewable energy.

A separate Department of Non Conventional energy Source as part of the Ministry of Power was set up in 1982. This was later converted into full fledged Ministry in 1992 - Ministry of Non-conventional Energy Sources, for promoting renewable energy development in the country in all applicable sub-sectors including wind, small hydro, biomass and solar energy. A separate lending arm of the Ministry has been created in 1987, Indian Renewable Energy Development Agency Ltd., for providing promotional and developmental financial assistance for renewable energy projects. Both the MNES and IREDA have put in substantial efforts in this sector.

During the Tenth Five Year Plan period (2002-2007), the MNES has proposed a target of 775 MW alone from the biomass power sector, including 450 MW from cogeneration and 325 MW from biomass power.

India has ratified the UN Framework Convention on Climate Change (UNFCCC) in 1993 and the Kyoto Protocol in 2002. It is currently preparing the initial national communication to the UNFCCC in accordance with the Convention. The proposed project would establish additional capacity of power generation from biomass materials and thereby displace coal-based power generation, leading to reduction in CO<sub>2</sub> emissions. In view of the continued demand-supply gap in the power sector, the removal of key barriers will lead to reduced transaction costs of these technologies, thereby placing them on a more equal footing with conventional fossil fuel power generation.

The Ministry of Non Conventional Energy Sources, Technical and Political GEF focal points endorsed the project brief of the proposed project prepared in accordance with UNDP/GEF guidelines and approved by the GEF Council in October 2002.

#### **IV. Lessons Learnt from Previous Programs**

The progress of the government (Ministry of Non Conventional Energy Sources) initiated national program "Biomass Power Programme" has not been significant. Despite the most favorable policy guidelines for power generation based on biomass such as wheeling, banking, and third party sales and successful demonstration of a few biomass power projects, only 537 MW has been installed against an estimated potential of 19500 MW. Out of this, the share of the installed capacity of decentralized (local grid) biomass power using distributed biomass in gasifiers is only about 53 MW; cogeneration mainly in private sugar mills is 304 MW; and others based on combustion and cogeneration include 180 MW. This program has successfully demonstrated projects on a commercial basis, however, the feedstock has been limited to rice husks and bagasse and a few other biomass in some States. Since the policies do not differentiate feedstock, demonstration of technology in the case of other distributed 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 of 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 to purchase 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 program 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 program to barriers that continue to exist.



In the case of the sugar sector, which has two sub-sectors, namely, the private sector mills and cooperative sector sugar mills, the approaches adopted to promote cogeneration in the latter met with limited success. Being the most organized sector within the biomass sector, projects were supported by a number of other agencies, including 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. This project supported successfully 9 private sector sugar mills in the States of Uttar Pradesh, Tamil Nadu, Karnataka and Punjab. The interventions through the proposed GEF project would build upon these experiences. Since the co-operative sector had limited success due to the complexities involved within the system and outside the system (e.g. sugar policies of the government), the project aims to demonstrate viable business models in the co-operative 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.

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/G32) 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.

## **V. Reasons for UNDP Cooperation**

UNDP has been supporting energy-environment projects in India and has a large experience of working with governmental and non-governmental agencies. The proposed project contributes towards the environment goal and two sub-goals of UNDP in India: i) environment and energy for livelihoods; and, ii) regional and global instruments that promote environmentally sustainable development of the Strategic Results Framework (SRF) of UNDP. The project design is consistent with the strategic areas of support identified in the SRF: policy framework, and global conventions and funding. The project supports a major intended outcome of global concerns and commitments addressed at the national level through mainstream national development planning machinery. The thematic area of Vulnerability Reduction and Environment Sustainability of the new UNDP Country Programme for India (2003-2007) envisages support to meet the goals of global conventions and mobilize resources from diverse sources, including the Indian private sector, to address national/regional concerns such as the management of globally significant biodiversity areas, renewable energy, land degradation, desertification and climate change; and demonstrating technologies, including traditional technologies and innovative approaches, to address linkages between global environment issues and national developmental challenges.

This project is consistent with UNDP's priorities to support sustainable energy use and build capacity to achieve global environmental and developmental goals. The project proposes to demonstrate best practices and innovative approaches such as the development and testing of contingent grants to enhance access to financing biomass power technologies. As a GEF implementing agency, UNDP facilitates the Government of India's commitment to promote sustainable technological interventions such as those proposed under this project.

Biomass power projects have multiple objectives. Besides the global benefits from the implementation of the project due to bioenergy substituting fossil fuels, the project aims at capacity building of various stakeholders in implementation of biomass power projects. One of the main features of the project is to integrate biomass production and energy generation-distribution. Activities such as setting up of biomass depots, power generation and distribution will lead to rural employment generation, particularly of women, and reduction in poverty. Capacity building, creation of rural employment, poverty reduction and improvement in quality of life through reliable electricity supply would be achieved through the project. The project activities thus contribute to promotion of all these goals of UNDP.

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".

## **C. THE PROJECT**

### **I. 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 through increased access to financing.

### **II. Project Strategy and Implementation Approach**

The project is divided into two phases. Phase I focuses on (a) providing technical assistance for barrier removal activities to various identified stakeholders; and (b) extending contingent support for demonstrating the Model Investment Projects (MIPs), which would act as the "Best Practices" for Phase II. The focus of Phase II will be to use experience of MIPs and TA activities in specific target states of Phase I to replicate in all other targeted states.

#### (a) Technical Assistance for Barriers Removal Activities:

The Technical Assistance (TA) focuses on activities that address the barriers that are generic for the biomass sector. Major components of this assistance will be to support capacity building of different stakeholders, knowledge-experience (performance) sharing for advocacy, and information dissemination. Specific support will be provided to relevant stakeholders for reviewing existing project development and power purchase agreements for their standardization. Biomass investor-friendly approaches and guidelines for investments through streamlined procedures will be evolved, and project appraisal guidelines will be developed. Activities to facilitate consultative processes among policy makers for creating conducive regulatory frameworks for biomass projects will be undertaken. Technical support to investors will be provided for O&M manuals, capacity building and information sharing.

#### (b) Contingent Financing for MIPs

To promote investments through conventional financing channels, a special provision through a flexible framework of contingent financing has been proposed. This framework would address barriers and risks that are incremental in the three identified biomass sectors – cogeneration in cooperative sugar mills, distributed and captive biomass power sectors. Further, this component would facilitate investments in the biomass power sector through mainstreaming financing operations. The conventional subsidies and financial incentives of the MNES would not be applicable in this framework. A comparison of MNES schemes versus proposed contingent mechanism is provided at Appendix 5. Specific activities will be determined for operationalizing the contingent-financing framework involving selection of FIs, designing contingent schemes, and TA for MIPs. Experts and experienced financial structuring agency, and other stakeholders will be consulted and involved at various stages of implementation.

Funds targeted under the project for contingent financing of MIPs total US\$ 6 million and comprise two components (i) investments in MIPs, and (ii) Technical Assistance to MIP. The total budget for investments in MIPs is US\$4 million. The Technical Assistance activities (total US\$2 million) will support the barrier removal activities specific to implementation of the MIPs.

The projects financed through the contingent modality would act as models for future investments through commercial financing in the biomass sector. These projects will 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. In the case of biomass sectors (other than the sugar mill subsector), the MIPs will be categorized into less than 1 MW and greater than 1 MW of installed plant capacities. While MIPs with less than 1 MW will be based on gasifier technology, others may be based on cogeneration or combustion technologies. Thus the MIPs would reflect the specific characteristics of these sub-segments in addressing the barriers and correspond to different approaches adopted for each biomass sector.

Depending upon the risk and barriers profile of the MIPs, there would be three types of financing schemes as outlined below: (Refer to Appendix 5 for details on the contingent financing framework based on consultations with FIs).

(i) Subordinate Debt Financing:

This mode of financing is usually preferred when investments are constrained due to inadequate equity participation such as cooperative sector or potential investors only constrained by access to financial resources. Normally, the subordinate debt component carries relatively lower interest rate and payable after the repayment of principal loan. In some cases, interest payments are also deferred. However, there would be an element of flexibility depending upon the nature of the investors and the type of investments. In the context of this project, this modality would cover institutional risks and barriers. While the extent of support will vary from MIP to MIP, the maximum funds support to a MIP would be 10% of the capital cost of the MIP.

(ii) Guarantees:

Guarantees are being generally used to address the risks of performance and recovery of loans associated with investments mainly in new sectors. Since, the biomass power sector is associated with a number of risks ranging from fuel linkage, technology and financing, it is proposed to develop and implement a guarantee programme for the biomass sector. Different schemes would be designed to broadly cover the technology and financing risks of FIs and promoters particularly in the small and distributed biomass power sector. The guarantee component would be limited to a maximum of 10% of the capital cost of MIP.

(iii) Venture/Seed Capital

New technologies and high-risk investments are usually supported through venture/seed capital by various institutions. This project would seek venture capital in specific investment

categories involving small and distributed biomass energy production and distribution. The venture/seed capital support would be limited up to a maximum of 10% of the capital cost of MIP.

The TA activities for the FIs will support effective implementation of MIPs through provision of additional resources for specific components including:

- Verifying biomass assessment and depot mapping
- Monitoring MIPs
- Risk and barriers assessment specific to MIPs
- Pre-project activities support

The TA funds for MIPs will be one-time grants to the development and successful commissioning of MIPs, which will enable the FIs and the project promoters to learn about the intricacies of financing biomass investments. This is further expected to boost the confidence levels of FIs in the biomass sectors and will help them in Phase II and post project replication phases. FIs are expected to develop new mechanisms for partial or total funding for such investments in the post-project phase or to link them with their existing financing schemes and terms as appropriate.

The above modalities would be customized to meet specific financial structuring model requirements. An experienced investment banking/financial consultant working closely with the selected FIs would design the financing schemes. The key financial institutions, namely, Industrial Credit and Investment Corporation of India (ICICI), Infrastructure Development Finance Company (IDFC), National Bank for Agriculture and Rural Development (NABARD) and SBI Capital Markets Ltd. have already sent letters indicating their willingness to participate in the project and in particular, operationalizing the contingent modalities.

### **Implementation Approach**

**Geographic Focus** - The geographical focus for the activities in Phase I of the 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 second selection criterion deals with biomass resource availability. Project activities will focus initially on states with available biomass resources, which is intended to maximize the replication potential of the project. The third selection criterion is geographical location. To minimize transport costs to the project, the investment activities will be clustered in contiguous States. Based on the above criteria, the MIP's during Phase I of the project will be concentrated in the States of Maharashtra, Haryana, Punjab, and Rajasthan, having relatively favorable policy and regulatory environments for biomass power. The other Phase I TA activities, which are not directly related to the contingent financing, will have a slightly broader geographic focus in order to lay the foundation for broader participation in Phase II of the project. In addition to the four states hosting the MIPs, the TA activities will likely focus on the states of Tamil Nadu, Uttar Pradesh and Madhya Pradesh, in order to help them create favorable conditions for future biomass power development.

**Selection of FIs** - The participating FIs will be chosen based on a competitive selection process, with the criteria for selecting the FIs developed through a transparent multi-stakeholder process. This selection process will be carried out as part of the project's general TA component (see part a above).

While the number of competitively selected participating FIs is ultimately dependent on the requirements of the MIPs in the different target categories, at least two FIs will be selected:

- One FI will focus on the 2 MIPs proposed for the co-operative sugar mill, with IPPs and greater than 1 MW scale biomass power projects
- Another FI will focus on the other 5 MIPs, which are less than 1 MW scale biomass power projects. For this scale of operation, very small entrepreneurs and project promoters will be required and certain financial institution catering to smaller projects and businesses will be more appropriate.

**Agreements with FIs** - Upon identification of the appropriate FIs, the necessary agreements / memorandums of understanding (MOU) between UNDP, MNES and FIs, as well as between FIs and MIPs will be developed and entered into. These agreements/MoUs will stimulate conditions of transfer of funds, management, execution, administration, financial reporting, and recovery conditions on the use of the funds for developing MIPs in the relevant target sub-sectors. The total amount of funds transferred to each FI will depend on the MIPs that they will in turn finance. The select FIs would implement the contingent schemes with an aim to recover the contingent financing support provided to the MIPs and for project replication by mainstreaming this sector into their existing and/or modified schemes. They would be responsible for managing the activities for developing and financing MIPs for successful implementation.

**Recovery of Contingent Funds** - The FIs and investors involved in the MIPs will be demonstrating the performance of the financing models. The models supported through the project will then be used by them during Phase II and / or post project replication phase, as well as for mainstreaming biomass power project financing activity within the select and other FIs. The recovery of contingent funds provided by the project would either flow back to the MNES in the input proportions or allowed to be used by select FI during the replication phase. These terms will be finalized as part of the TA activity, but it is envisioned that the reflows of the contingent funds will be placed in a separate account available to the participating FIs for replication of the pilot structures, thereby creating additional incentives for the FIs to make their programs successful. The treatment of reflows will be a major factor to FIs and will be resolved before the FIs selection through competitive bidding is announced.

## **Phase II: Project Implementation**

Phase II and post-project replication phases will be based on the experience of development and successful commissioning of MIPs proposed in Phase I. 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 in this sector. The first 7 of these will be undertaken on a pilot basis during Phase I of the project. Phase II will use the outputs and experiences of Phase I as a springboard to create financing mechanisms necessary to ensure that the remaining MIP's are implemented. Phase I of this two-part project would be evaluated for the

success of the contingent schemes and its potential for adapting innovative financial mechanisms through focused barriers removal activities. Phase II would thus logically follow after successful evaluation of Phase I through a joint UNDP-GOI mission indicating Operationalization of MIPs and adoption of contingent schemes by Financial Institutions.

### **III Replication Strategy**

The replication strategy is, that by providing TA and some investment funds for MIPs, the strongest FIs in the region will develop skills and relevant experience that would allow them to continue to funds biomass projects. Beyond the project lifetime, funding of biomass projects would be essentially mainstreamed by the FIs into their existing and/or modified business development approaches.

The recovery of contingent funds provided by the project would either flow back to the MNES in the input proportions or allowed to be used by select FI during the replication phase. These terms would be worked out as part of the TA activity, but it is possible that the reflows of the contingent funds will be placed in a separate account available to the participating FIs for replication of the pilot structures, thereby creating additional incentives for the FIs to make their programs work.

Further, the Phase I project will establish the design of a non-FI specific Guarantee Mechanism that will become operational under Phase II. This design will pave the way for the introduction of the true Guarantee Mechanism as contingent finance vehicle for leveraging the Phase II demonstration projects. The lessons under Phase I regarding operationalising the models, and assessments of existing barriers arising out of them, will help to inform the most effective design of the Guarantee Mechanism.

The potential for biomass electricity generation in rural India is substantial; hence, the possibility of replication is enormous. The estimated potential for captive and distributed biomass materials is 6000 - 7000 MW and 13000-17000 MW, respectively, and only about 3% 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 below gives a breakdown of the replication potential, 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
	<b>Total</b>	<b>600</b>	<b>15.5</b>	<b>1000</b>

Therefore, to efficiently tap this potential, the project will establish a commercial framework for biomass electricity generation and, by adopting a phased approach to move along the learning curve and generate increased costs savings, it will create a basis for continued investments by the private sector during Phase 2 and beyond. Moreover, the project is designed to create a favourable environment for initial market penetration into biomass electricity generation, to stimulate investments through targeted and competitive incentive support, incorporating experience and lessons learned before proceeding to the more expanded second phase. MNES is committed, with the support of the FIs, to assist in the capital cost reduction trend of biomass electricity generation and will strive to include in each "sub-project" a mechanism which would provide incentives to project sponsors to perform effectively. These incentives will be created with the specific project type and transaction model employed, as described below, and will seek to enhance the replicability and sustainability of each of the "sub-projects".

In general, replicability will be a Phase 2 activity. However, during project preparation and implementation of Phase 1, project support through the provision of TA and limited upfront investment (contingent) funds for MIPs will enable selected FIs at both the central and state levels to develop skills and relevant experience that would allow them to continue to fund biomass projects. Beyond the project lifetime, it is expected that funding of biomass electricity generation projects would be essentially mainstreamed by the FIs into their regular business development approaches and lending operations.

The recovery of contingent funds provided by the project during Phase 1 would flow back to the selected FIs for use during Phase 2 and beyond. The operational guidelines for use of the contingent funds would be worked out as part of the TA activity, but it is possible that the reflows will be placed in a separate "biomass finance or contingent account" available to the participating FIs for replication of the pilot structures, thereby creating additional incentives for the FIs to make their programs work.

Further, the Phase I project will establish the design of a non-FI specific Guarantee Mechanism that will become operational under Phase II. This design will pave the way for the introduction of the true Guarantee Mechanism as contingent finance vehicle for leveraging the Phase II projects. The lessons under Phase I regarding operationalising the models, and



assessments of existing barriers arising out of them, will help to inform the most effective design of the Guarantee Mechanism.

It is recognized that addressing the policy and regulatory context and removal of other barriers will be crucial to the replicability of biomass electricity generation. Hence, selection of projects for Phase 2 will be made against a carefully chosen set of criteria that would include an assessment of the policy/regulatory provisions that foster and allow IPPs to operate and supply a captive market against an appropriate tariff, set interconnection standards, enable net metering, permit sale of excess energy to the grid through a PPA that ensures the financial viability of biomass power plants. In addition, one of the lessons learned from previous UNDP/GEF biomass projects is that long-term fuel-supply contracts – essential for project financing – is not straightforward, but rather risky business in the biomass field. As soon as the owners of the biomass resource realize that their agricultural waste can be put to productive use, they attach a value to it. Therefore, the issue of ensuring the availability and supply of biomass will, no doubt, assume a prominent role in this project and in the replication initiatives in the future.

Lastly, as a regional technology and market leader, India is well positioned to help effect broader replicability of project experience and cost reductions on biomass electricity generation throughout the region.

#### **IV. Project Results**

##### **3.1 Development Goals**

The project will contribute to mainstreaming environmental benefits into development goals by improving the sustainable energy supply. The project aims to specifically address the key barriers through provision of Technical Assistance, and implementation of MIPs for accelerated adoption of environmentally sustainable biomass power technologies. The technical assistance is 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.

##### **3.2 Technical Assistance (TA) Component**

###### **Outcome I - Technology package bench marking and validation for different biomass power technologies**

(Refer Appendix 3, sections 3.1, 3.2, 3.3 and 3.4 for indicative Terms of References, ToRs, for select agencies / experts / teams to be appointed for various activities to be undertaken for different outputs of Outcome I)

### **Output 1.1. Technology Improvement and Upgrade Needs Identified, Including Objective Assessment of Capabilities of Indian Technology and Equipment Suppliers**

*Activity 1.1.1 Carry out a review of the State of the Art technologies, national and international, for potential biomass power application (including combustion, gasification/pyrolysis, advanced biomass gasification, fuel cells and micro turbine) and develop sustained plan for adoption of biomass power technologies*

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 Technology gaps and improvements will be identified.

*Activity 1.1.2 Develop strategic plan for sustained adoption of biomass power technologies through a consultative process involving all key stakeholders*

A strategic plan based on the identified gaps will be devised for short and long term R&D, technology development/improvement, capacity building and technology absorption, along with budget requirements. The action plan will be recommended for such improvements.

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. A relevant technical team will be constituted for the purpose.

Monitoring indicators: i) finalization of ToRs, ii) selection and appointment of team of national and international experts, iii) issue of contract to the lead agency/institution and preparation of reports on status of technologies and iv) technology mapping (short term & long term) for biomass power technologies. The time frame for completing this activity will be 6 quarters or 18 months from the start date.

### **Output 1.2. Technology Performance and Evaluation of Benchmarks for Model Investment Projects (MIPs) Available**

*Activity 1.2.1 Develop benchmarks for MIPs and their validation through a technical team*

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.

This activity will define the major technology parameters of all the 7 MIPs and expected performance indicators for each, list on the analysis of information available, critically evaluate the design and operating parameters of the commissioned MIPs and validate the benchmarks for MIPs in all categories for future references. The benchmarks for performance and evaluation for each type of technology will also be developed and documented for wider publication through workshops.

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. A relevant technical team will be appointed.

The monitoring indicators for this activity will include i) finalization of ToRs, ii) selection and appointment of team of experts, iii) issue of contract to the lead agency/institution and iv) preparation of reports on development of benchmarks for the proposed 7 MIPs in the focused States and v) performance evaluation report for validation of benchmarks for MIPs. The time frame required for this activity will be 12 quarters or 36 months from the start date.

### ***Output 1.3. Long-term Perspective Plan for Utilization of Wasteland and Biomass Resources for Power Generation***

#### ***Activity 1.3.1 Study of techno-commercial viability of wasteland for biomass production for power generation***

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, through study in the focused States. Field level studies on the assessment of wasteland, evaluation of energy plantation technology – species and methods, 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.

A relevant technical team, including wasteland and energy plantation experts, energy plantation to power experts, State Nodal Agencies (SNAs) of focused States and appointed local agencies for data collection will be commissioned for the purpose.

The monitoring indicators for this activity will include i) finalization of ToRs, ii) selection and appointment of team of experts, iii) issue of contract to the lead agency/institution and iv) preparation of reports on feasibility of energy plantation from wasteland for grid connected

power through different technologies. The time frame required for this activity will be 8 quarters or 24 months from the start date.

## **Outcome II**

Enhanced capacities and confidence of project promoters, financial institutions, regulators, policy makers, State nodal agencies, other stakeholders through effective information development and dissemination programme, along with capacity building initiatives.

(Refer to Appendix 3, sections 3.5 to 3.17 for indicative ToRs, for select agencies / experts / teams to be appointed for various activities to be undertaken for different outputs of Outcome II).

### ***Output 2.1. Increased Information Available with Project Promoters and all Stakeholders in the Focused States and their Enhanced Knowledge Base***

The information development/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 Engineering, Procurement & Construction (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.

#### ***Activity 2.1.1 Create online databases for biomass projects promotion and development in focus States***

**Sub-activity 2.1.1(a) Establish database on potential Biomass Depots.** This activity will develop a database on biomass power depots in the focused States, based on a review of all information/data/documents on biomass assessment. It will identify high potential districts/tehsils, carry out laboratory analysis of different biomass materials and mapping of potential sites for biomass depots. The database would provide information on land and equipment requirements for setting up of biomass depots, investment and operating costs, and a suggested strategy for development of depots through consultative processes involving local entrepreneurs/Non Government Organisations (NGOs) / Self-help Groups (SHGs), villagers, particularly landless village level entrepreneurs and women (Appendix 3, Section 3.5 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and

preparation of reports on mapping of biomass depots in each of the focused States. The time frame required for this activity will be 3 quarters or 9 months from the start date.

**Sub-activity 2.1.1(b) Develop project profiles.** This activity will include preparation of a database on biomass power project profiles in the focused States to help decisions by potential entrepreneurs. The profiles would provide information on biomass depot, technology and plant size, market, equipment, space/manpower required, investment and expected returns, risk analysis, biomass availability, possible grid interface, prevailing policies and steps for project implementation (Appendix 3, Section 3.6 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of database on location specific project profiles. The time frame required for this activity will be 3 quarters or 9 months.

**Sub-activity 2.1.1(c) Develop profiles of Service Providers.** This activity will include preparation of technology specific capability profiles of equipment suppliers, EPC and O& M contractors, consultants and engineering companies, including detailed address and names of contact persons, experience and man power profile, detailed address list of customers and feedback, equipment/infrastructure availability, annual reports/balance sheets/company profiles and specific interest in biomass power sector (Appendix 3, Section 3.7 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of database on capability profiles. The time frame required for this activity will be 3 quarters or 9 months.

**Sub-activity 2.1.1(d) Develop Investment Factors.** This activity will prepare a database on investment factors in the focused States, including policies, procedures and changes thereof. This database will also involve key investment factors for decision making by the entrepreneurs related to them and methodology of ranking them.

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of database on investment factors in each of the focused States. The time frame required for this activity will be 2 quarters or 6 months.

**Sub-activity 2.1.1(e) Develop institutional profiles.** This activity will prepare technology and biomass resource specific institutional profiles of NGOs, SHGs, financial institutions, local banks, financial intermediaries/market intermediaries, service entrepreneurs and agencies in the focused States. This database on these institutions would enable prospective biomass entrepreneurs to approach them for specific purposes (Appendix 3, Section 3.8 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of database on institutional profiles in each of the focused States.

The time frame required for this activity will be 2 quarters or 6 months.

*Activity 2.1.2 Preparation of Good Practice Documents on Various Aspects of Biomass Power Plants*

**Sub-activity 2.1.2(a) Prepare Model Feasibility Reports/Detailed Project Reports.** This activity will evolve templates or best practice manuals on feasibility reports and DPRs based on a review of the feasibility studies undertaken and detailed project reports available for different types and sub sectors of biomass power projects and discussions with select entrepreneurs, FIs, approving agencies, and other stakeholders (Appendix 3, Section 3.11 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of best practice feasibility reports/DPRs. The time frame required for this activity will be 3 quarters or 9 months.

**Sub-activity 2.1.2(b) Develop model Fuel Supply Agreements.** This activity will identify and evaluate key elements of fuel supply transactions in biomass power projects, carry out a study of existing fuel supply agreements, hold discussions with select entrepreneurs, FIs, other stakeholders and develop good practices on fuel supply agreements (Appendix 3, Section 3.10 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of good practice on fuel supply agreements. The time frame required for this activity will be 3 quarters or 9 months.

**Sub-activity 2.1.2(c) Develop Model Energy Purchase/Wheeling/Banking Agreements.** This activity will compile and review existing energy purchase, wheeling and banking agreements of various concerned agencies such as CERC, SERCs, and SEBs. This review will identify and evaluate key elements of concern, which would be deliberated through a consultative process and interactions with existing and potential entrepreneurs, SEBs and consumer forums. Based on these, model agreements for different types of target biomass power sectors will be developed. Feed back will be obtained by soliciting comments from various stakeholders on the drafts before they are finalized (Appendix 3, Section 3.9 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of model energy purchase/wheeling/banking agreements. The time frame required for this activity will be 3 quarters or 9 months.

**Sub-activity 2.1.2(d) Develop Model Project Development Agreements.** This activity will compile and review existing project agreements for different combinations of entrepreneurs and biomass power hosts for target biomass power sectors. It will identify and evaluate key elements of each, and deliberate the issues through a consultative process and interaction with existing and potential entrepreneurs, SEBs, and FIs. Based on this, model project agreements for different types of target biomass power sectors. Typical project agreements between an independent power plant promoters or developers and biomass host in each target sub-sectors may include i) land lease agreements ii) captive electricity and steam supply agreement iii) water supply agreement iv) effluent supply agreement (Appendix 3, Section 3.12 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of best practice project development agreements.

The time frame required for this activity will be 4 quarters or 12 months.

**Sub-activity 2.1.2(e) Develop Project Management & Information Systems.** Most of projects commissioned in the past do not have systems for monitoring key biomass power project performance parameters related to technology, finance, implementation and operation. In the absence of effective systems, the overall project performance cannot be evaluated. This activity would help in designing appropriate MIS based on identification of key data needs, sources, analysis for optimizing performance and providing feedback to the concerned stakeholders (Appendix 3, Section 3.13 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and preparation of best practice project MIS documents. The time frame required for this activity will be 3 quarters or 9 months.

### **Output 2.2 Improved Capacity of Key Stakeholders and Project Promoters in the Targeted States**

In the absence of baselines on individual and institutional capacities of the major stakeholders for biomass power projects, this activity will conduct consultative meetings and workshops for identifying specific capacity building needs and devising time bound capacity building programmes and their implementation. The proposed strategy for capacity building would have components of communication and advocacy, information dissemination and exchange programmes. A board spectrum of the stakeholder would be participating in this activity, 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 and project promoters.

#### **Activity 2.2.1 Communication and Advocacy**

This activity will make efforts to sensitize key policy makers and institutions on biomass power sector issues – regulatory, financing and institutional. Need based policy research studies would be commissioned on the specific issues identified through consultative processes (consultative workshops and round tables) for each target biomass sector. This would be supplemented by preparing articles, both in English and local languages in the focused States and their wider dissemination through different mass media, namely, print, audio/video and multimedia (Appendix 3, Section 3.14 and 3.15 gives relevant ToRs).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and arrange for publication of articles, generation of public debates, participation in public hearings of SERCs, TV/Radio/Multimedia presentations etc. The time frame required for this activity will be 3 quarters or 9 months.

#### *Activity 2.2.2 Improve Access to Information through Website*

This activity will provide comprehensive and up-to-date information required on biomass power projects development. It will support designing a website to meet the information needs of various stakeholders on different aspects of biomass power sector. The web site, which would be interactive, would cover various aspects of biomass power including information on potential, achievements, performance, policy and regulatory framework, institutions, experts, consultants, equipment / technology suppliers, related Central and State government agencies, fiscal incentives, technology status would link to the databases being created on biomass resources, technologies, project profiles in the focus states (Appendix 3, Section 3.16 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and development/operationalisation of the web site. The time frame required for this activity will be 3 quarters or 9 months.

#### *Activity 2.2.3 Develop and Test Capacity Building Modules in the Focused States*

This activity will develop capacity building modules through consultative and orientation meetings with key stakeholders in primary focus states. Regulators, consumer forums, State government departments, State nodal agencies, industry associations, key institutions including NGOs/SHGs/industry associations and project promoters would participate in these meetings. These modules will be tested through organizing and evaluating specific skill up-gradation and training programs at all levels, particularly for grass root level institutions, NGOs/SHGs, village level entrepreneurs and women (Appendix 3, Section 3.17 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and reports on evaluation of consultative meetings/workshops and capacity building modules. The time frame required for this activity will be 3 quarters or 9 months.



#### *Activity 2.2.4 Conduct Information and Knowledge Sharing Programmes through Organized Study Tours/Missions involving Focused States*

This activity will identify specific case studies, institutions and entrepreneurs in focus states and create platforms for the exchange of experiences for facilitating creating of Centres for Excellence in Biomass power Sector in key institutions. A maximum of three international study tours (one per year) would be organized for the select stakeholders. The study tours will be planned, organized and evaluated for their impact using predetermined indicators (such as weightage for cost sharing by private industry or sponsorships) and methods by an independent organization. The plan would be endorsed by the Steering Committee.

The monitoring indicators for this activity will include planning of optimum number of study tours/missions, selection of participants, conduct and documentation of feedback. The time frame required for this activity will be 9 quarters or 27 months.

#### *Activity 2.2.5 Support for Fellowships/Participation in National/International Events*

This activity will include provision of financial support for 5 fellowships per State (total 20 – 12 national and 8 - international) from key institutions/stakeholders/project promoters. The process of selection of programmes and candidates will be undertaken by an independent organization. Presentation of select papers based on the project experience will be supported for a maximum of 3 events.

The monitoring indicators for this activity will include finalization of areas and institutions for fellowships and selection of type of events for support, advertisement and selection of candidates, provision of financial support and administering of fellowships/event participation and documentation of feedback. The time frame required for this activity will be 3 quarters or 9 months.

### **Outcome III Development of business, commercial and support service networks in focused States.**

(Refer to Appendix 3, sections 3.18 to 3.20 for indicative ToRs, for select agencies / experts / teams to be appointed for various activities to be undertaken for different outputs of outcome II)

#### ***Output 3.1. Biomass Activities Mainstreamed into the Existing Institutional Framework – NGOs, Women/SHGs, Micro-lending Institutions and Intermediaries in the Focused States***

The activities involved for this output will include 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.

Since biomass would be produced locally, efforts would be made to involve appropriate institutions (NABARD, Commercial Banks and micro-lending institutions) at all levels through participatory approaches and consultative processes with particular focus on gender issues.

#### *Activity 3.1.1 Study of required institutional mechanisms for biomass power projects development*

This activity will identify required business, commercial and support service mechanism for promoting, executing, operating and sustaining biomass power projects of target sub-sectors, through interaction with experts, associations, financial institutions, entrepreneurs, equipment suppliers etc. The key elements of required institutional mechanism for biomass power sector will be developed and finalized through feedback (Appendix 3, Section 3.18 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and report on required institutional mechanisms. The time frame required for this activity will be 3 quarters or 9 months.

#### *Activity 3.1.2 Evaluate existing commercial and institutional framework in focus States for their suitability to promote biomass power projects*

This activity will identify and evaluate available business, commercial and support service institutional mechanisms in the focused States for promoting, executing, operating and sustaining biomass power projects of target subsectors, and evaluate key institutions therein. The specific gaps in the required and available mechanisms will be identified (Appendix 3, Section 3.19 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and report on available institutional mechanisms in the focused States. The time frame required for this activity will be 3 quarters or 9 months.

#### *Activity 3.1.3 Provide orientation to select institutions on the institutional requirements to participate in biomass power sector development*

This activity will orient specific and evaluated institutions in the focused States through consultative processes and workshops for mainstreaming biomass power activities in their existing/proposed work plans and actions. The prevailing gaps in the required and available

institutional mechanism will also be discussed with these institutions and specific needs for institutional development with gender focus will be identified through this activity. Appendix 3, Section 3.20 gives relevant ToR

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and report on feedback of orientation meetings/workshops and number of women involved. The time frame required for this activity will be 3 quarters or 9 months.

### ***Output 3.2. Preparation of Master Plan for Creation of Dynamic and Sustainable Institutional Framework***

#### ***Activity 3.2.1 Develop master plan for development of Institutional Mechanisms in the Focused States***

This activity will evolve a master plan for development of dynamic and sustainable institutional mechanisms in the focused States, based on the required and available institutions, evaluation of specific institutions and development needs identified in activities of output 3.1 above. Generation of a long-term plan for the purpose and accomplishing defined milestones within the project life will be achieved under the activity through active participation of State Nodal Agencies. The master plan will also include budget, timeframe and activities and the involvement of specific institutions.

A team of persons including experts/consultants engaged in institutional development and experts/consultants engaged in target categories of biomass power projects will be constituted for the purpose.

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and report on master plan. The time frame required for this activity will be 3 quarters or 9 months.

### **Outcome IV Creation of fund for contingent financing**

(Appendix 5 gives contingent financing framework for model investment projects including indicative budget allocations for technical assistance for development of MIPs and contingency financing components for MIPs).

### ***Output 4.1. Innovative Financing Schemes Designed and Feasibility of Viable Institutional Models Established***

The activities for this output will focus on selection of FIs through competitive process, MIPs and operationalising the first seven MIPs. The financing would be made available for these projects through FIs and commercial banks. Depending upon the risks for the investors, financial institutions would structure the mechanism utilizing contingent funds to leverage loans. It has been proposed to use guarantee mode for investors with adequate equity base and subordinate loans for cooperative and small biomass investors. The lessons of operationalising the models and assessment of existing barriers arising out of them will prove to be of 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 for FIs and MIPs 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.

#### *Activity 4.1 Select Financial Institutions for Creation of Contingent Fund for Financing Biomass Power Plants in the Target Sectors*

This activity will identify, evaluate and short list specific financial institutions at the national and focused State levels, which will be willing to participate in the proposed project, have relevant experience and expertise and intention to finance these projects. Detailed interactions with them will be held regarding their existing schemes and capabilities, feedback/comments on the proposed contingent financing framework and their relevant experience of operating the proposed contingent fund in desired innovative ways and means. The selection of specific FIs will be undertaken through a competitive process and MoUs / agreements with them will be signed for their responsibilities regarding operation of the contingent fund during the project phase, as well as post-project replication phase.

Appendix 3, Section 3.21 gives relevant ToR

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the expert agency / institution and signing of MoUs with select financial institutions. The time frame required for this activity will be maximum 2 quarters or maximum 6 months from the start date.

#### *Activity 4.2 Design Financial Structuring Models for MIPs, utilizing Contingent Funds*

This activity will study, evaluate and finalize financial structuring models and contingent fund components to be provided for MIPs. It will carry out risk assessment, determine selection criteria of MIPs, and specific contingent fund components to leverage conventional term loans for achieving financial closure of MIPs. This activity will also develop approaches and strategies for creating and operating contingent fund for MIPs in Phases 1 and 2 as well as postproject replication phase. The entire activity will be undertaken in consultation with FIs and other relevant stakeholders (Appendix 3, Section 3.22 gives relevant ToR).

The monitoring indicators for this activity will include finalization of ToRs, selection and appointment of team of experts, issue of contract to the lead agency/institution and achieving financial closure for MIPs. The time frame required for this activity will be 2 quarters or 6 months from the start date.

#### *Activity 4.3 Design a Non-FI Specific Guarantee Mechanism*

Under Phase I, design work will be undertaken for a non-FI specific Guarantee Mechanism that will become operational under Phase II. This design will pave the way for the introduction of the true Guarantee Mechanism as contingent finance vehicle for leveraging

the Phase II demonstration projects. The lessons under Phase I regarding operationalising the models, and assessments of existing barriers arising out of them, will help to inform the most effective design of the Guarantee Mechanism. The entire activity will be undertaken in consultation with FIs and other relevant stakeholders.

## **Outcome V: Model Investment Projects**

### ***Output 5.1. Commissioning and Stabilization of MIPs***

Based on the criteria established through Activity 1.2.1, 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 generating 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 Phase I of the project and the other will be included in Phase 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 Phase I of the project. The remaining 35 are targeted for support under Phase II. In all, 43 MIPs would be required to demonstrate different model types covering geographical spread of the country.

The potential project configurations for MIPs for the first set of 7 projects are given in *Appendix 4*, in terms of project type, size and number of projects, project details, financing structure, indicative location, major selection criteria, reasons for GEF support etc. A brief summary is provided below:

- I. MIP category: Cooperative Sugar Mills  
Location: Maharashtra  
Number: 1 (16.73 MW)

- II. MIP category: Captive Biomass  
Location: Haryana or Rajasthan or Punjab  
Number: 1 or 2 (5 MW)
- III. MIP category: Distributed Biomass  
Location: Haryana, Rajasthan, Punjab and Maharashtra  
Number: 4 or 5 (5 MW)

#### *Activity 5.1.1 Generate Project Pipeline for selection of MIPs*

This activity will generate project pipeline in the focused States through workshops, advertising and promotion and networking activities with close cooperation and involvement of SNAs, select financial institutions, local banks, experts and consultants, industry associations, equipment suppliers etc. A methodology and selection criteria for MIPs will be developed in consultation with the financial institutions and financial structuring agencies. The evaluation of project pipelines and selection of projects for MIPs will be done through the financial institutions.

A team of persons from select financial institutions, experts in financial structuring, and SNAs engaged in target categories of biomass power projects will be constituted by select FIs for each target sub-sector. Select FIs will prepare the ToRs for this activity

The monitoring indicators for this activity will include appointment of teams by select FIs and selection of MIPs. The time frame required for this activity will be 4 quarters or 12 months from the start date.

#### *Activity 5.1.2 Effect financial closure and commission MIPs*

This activity will include strong follow up with the project promoters and select financial institutions for achieving the financial closure, ordering of equipment, construction and commissioning of all 7 MIPs in the focused States.

Teams of persons from select financial institutions, experts in financial structuring, SNAs and experts/consultants engaged in target categories of biomass power projects will be commissioned by select FIs for the purpose for each MIP.

The monitoring indicators for this activity will include appointment of teams by select FIs for each MIP, signing of loan agreements with project promoters and commissioning of each MIP. The time frame required for this activity will be 7 quarters or 21 months.

## **Output 5.2. Documentation on Lessons Learned and Evolution of Replication Strategy/Plan**

### *Activity 5.2.1 Monitor and document performance of MIPs for recommending Replication Strategies*

This activity will monitor the performance of 7 commissioned MIPs in all the focused States compared with the benchmarks set, undertake critical evaluation of performance parameters against benchmarks so as to validate benchmarks. Recommendations will be made for replication in Phase II of the project and beyond, regarding categories of projects and financial structuring models.

A team of persons from select financial institutions, expert in financial structuring, SNAs and experts/consultants engaged in target categories of biomass power projects will be constituted by select FIs for the purpose. Select FIs will prepare ToRs for this activity. As this will be a monitoring and evaluation task required prior to Phase II, UNDP / MNES also will be involved in this activity.

The monitoring indicators for this activity will include appointment of teams by select FIs for each MIP and reports on performance evaluation/replication strategy. The time frame required for this activity will be 3 quarters or 9 months

## **V. 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 – a few, large industrial conglomerates do not dominate the biomass sector. 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 Govt levels.
- Skill upgrades 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.

## **VI. Equity**

The project proposes to augment the electricity supply and thereby improves the reliability and quality of electricity available to the rural population. The involvement of communities especially the landless and poor farmers in the activities of biomass power generation projects, such as biomass processing –collection, drying, baling, pelletization or shredding, transportation and storing improves livelihood. Capacity building workshops will be conducted in rural areas involving women and SHGs for managing biomass resources and technologies. Villagers and farmers at large would benefit through the MIPs as the overall quality of power in the local grid around the decentralized grid connected biomass projects is expected to improve. This would in turn result in the improvement of quality of life – better lighting, reduced incidents of pump sets burning, etc.

## **VII. Risk Analysis**

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 are high. 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, MITCON, which will set up the Project Management Cell and the implementing agency of the proposed project, MNES, has been fully involved in project design. No major shifts in implementing agency are to be expected prior to implementation. 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 4 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 4. Potential Risks and Mitigation Measures**

Risks	Mitigation Measures
1. Low performance and reliability of the technologies	Low <ul style="list-style-type: none"> <li>- Proven technologies proposed</li> <li>- Continuous, rigorous technical performance monitoring &amp; reporting</li> <li>- Maintenance contracts will ensure quick rectification of problems</li> </ul>
2. Reluctance of State Regulators to Uphold Renewable Energy Policy Guidelines	Moderate <ul style="list-style-type: none"> <li>- States with favorable, enforceable policies selected for participation in projects.</li> <li>- TA activities to focus on building enforceable regulatory environment for renewables in additional states</li> </ul>
3. Fuel-Supply Risks	Moderate <ul style="list-style-type: none"> <li>- Project addresses a diverse range of biomass resources</li> <li>- Long-term supply contracts to be established between farmers and power generator to ensure supply of biomass feedstock</li> <li>- Project is focused on areas where recent assessment shows that biomass supplies are sufficient to justify investments</li> </ul>
4. Delay in identifying project promoters & sponsors	Moderate <ul style="list-style-type: none"> <li>- Promoters and sponsors involved at the project design stage</li> <li>- Risk guarantee mechanisms to be put in place to induce investors</li> </ul>
5. Slow implementation progress	Moderate <ul style="list-style-type: none"> <li>- Commitment of the key stakeholders have been obtained</li> <li>- Local implementing agency involved from inception of project preparation activities</li> <li>- Close monitoring of the project proposed</li> </ul>

### VIII. Partnerships and Stakeholder Involvement Plan

The project has been designed as part of the national programme to accelerate the development of biomass power technologies to meet both the needs of rural communities for electricity services for improved quality of life and income-generating activities and of the State Electricity Boards for additional generating capacity utilizing a locally available and environmentally neutral energy resource. Stakeholder participation involving the public and private sectors as well as civil society has played an essential role in the development of the project and will continue to play a significant role during its implementation.

The preparation of the full project brought together all key stakeholders during discussions on the thematic area of Vulnerability Reduction and Environment Sustainability of the UNDP

Country Programme for India (2003-2007). This latest Country Programme envisages support to the Government to meet the objectives of global conventions and mobilize resources from diverse sources, including the Indian private sector, to address national/regional concerns such as the management of globally significant biodiversity areas, renewable energy, land degradation, desertification and climate change; and demonstrate technologies, including traditional technologies and innovative approaches, to address linkages between global environment issues and national developmental challenges.

At the conceptualization stage of the project, the Ministry of Non Conventional Energy Sources, with the support of UNDP, launched a Preparatory Assistance mission in 1998 to carry out extensive consultations with various stakeholders 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 Central and State Government agencies, investors, project developers, industry associations, financial institutions, donors and others. Several meetings were subsequently held and they focused on issues of policy, regulations, financing, tariffs, capacity development, technologies, community participation, etc. The experience and the expectations of the stakeholders were considered during project conceptualization and definition. A State-specific consultation for commitment to the project, particularly with the financial institutions, and State Nodal agencies was held in December 2002, and was followed by intensive consultations with potential financial institutions.

The indicative roles of different stakeholders have been identified to minimize project implementation risks, and thereby ensuring its sustainability. Typical roles of different category of stakeholders are discussed below:

The State Nodal Agencies (SNA) are expected to facilitate project formulation and implementation. In this connection, they will actively liaise with various departments and institutions, including the State Electricity Boards, State Regulatory Commissions, financial institutions, banks and private project developers. While their capacities to effectively network with various partner institutions would be enhanced through the project, the nodal agencies by themselves would not implement projects.

The Financial Institutions would effectively channel their own as well as project and other funds towards financing MIPs and implement the proposed contingent financing modality. Rural banks and micro credit lending institutions would network with insurance agencies for ensured fuel supply through access to micro credits and insurance coverage on the crop and corresponding biomass residues.

Industry Associations would network with existing entrepreneurs and promote biomass power projects resulting in a rolling projects pipeline for financial institutions.

State Governments through the State Electricity Boards, State Nodal Agencies and concerned departments will ensure an enabling environment for project developers and other stakeholders, especially with regard to speedy agreements on energy purchase, wheeling and banking at the tariffs decided by the regulators. They would participate in the capacity development programmes planned under the project.

Regulators would be responsible to allow grid and non-grid power generation and distribution from these projects through speedy regulatory processes including technical validation, public hearings and issuance of fair tariff orders.

Non Governmental Organizations and Community based Organizations would actively participate in the setting up and management of biomass depots, and operation and maintenance services at the local power generation facilities.

Industry comprising of the manufacturers of equipment, technology suppliers and service providers would proactively participate in ensuring quality performance of the projects.

MNES will have direct responsibility for implementation of the project. In this, it will be assisted by a National Project Director and a Project Management Cell (PMC) to be based in New Delhi. The PMC will consist of, among others, a National Project Manager and 2 Project Officers who, in addition to performing their assigned project management functions, will maintain constant dialogue with the above stakeholders and solicit their assistance and support, as required, to undertake key roles in project implementation.

Table-- gives an overall plan for stakeholders' involvement. A report detailing the extent and nature of involvement of stakeholder participation will be prepared and submitted periodically to the Project Steering Committee.

Table: Plan for Stakeholder Participation

Type of Stakeholder	Contributions to Key Outputs	Frequency
Central Ministries/Departments		Periodic (once in six months)
State Government/Departments	Capacity building /and Information related - Provide status paper – policy targets, pricing, etc.  Short/mid/Long term perspective plans for development and utilization of biomass resources for power generation  Active participation in the workshops and other meetings on policy deliberations – energy markets, biomass resource development, investment promotion, and other institutional issues.	Periodic

Regulators	MIP implemented - Participation in consultative meetings/capacity building initiatives on socio-economic and environment benefits; Tariff determination	Periodic
Financial Institutions and Banks	Innovative Financing Schemes; MIPs implemented Appraisals of business plans  Credit lines to operate innovative financial schemes	Continuous
Technical Institutions	Benchmarking and validation -Performance monitoring and evaluation  Good practice on various aspects of biomass power projects  Improved capacity -Act as resource for capacity building/information dissemination	Continuous
Investors	MIP implemented - Act as commercial entities  Avail credit schemes operated through the project  Projects pipeline	Continuous
NGOs/CBOs	Support to project/Ensure that rural consumers benefit from project activities and outputs.	Continuous
Bilateral and other donors	MIPs implemented /Replicated	Periodic

#### IX. Project Geographical Coverage

The project activities would be implemented in 7 States – Haryana, Punjab, Maharashtra, Uttar Pradesh, Tamil Nadu, Madhya Pradesh, and Rajasthan.

## **D. IMPLEMENTATION ARRANGEMENTS & ROLES/ RESPONSIBILITIES OF PROJECT PARTNERS**

### **I. Prior Obligations and Pre-requisites**

The project activities would be initiated immediately after the Constitution of Project Steering Committee (PSC), appointment of NPD and establishment of Project Management Cell (PMC) by MITCON. There are no other prior obligations and pre-requisites necessary.

### **II. Implementation Arrangements – Institutional Mechanisms & Monitoring**

#### **2.1 Executing and Implementing Agency**

The MNES will take overall responsibility for the execution and implementation of the project through a dedicated Project Management Cell set up by MITCON Consultancy Services Ltd. in New Delhi. The MNES will supervise as well as closely monitor the arrangements for the execution of the project. They will be responsible for ensuring:

- Overall project execution, implementation and coordination.
- Coordination with key stakeholders i.e. concerned line Ministries, state governments and other stakeholders.
- Mechanisms for smooth funds flow to the Project Management Cell.

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 work plan.

#### **2.2 Project Steering Committee (PSC)**

A Project Steering Committee (PSC) 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 NPD will be the Member, Secretary of the PSC. The PSC will meet once at least every six months to review the progress of project, and the main functions of the PSC will be:

- Providing guidelines to Project Management Cell (PMC).
- Monitoring Project work plan for ensuring project goals and objectives are achieved in a defined time frame.
- Facilitating inter-Ministerial co-ordination and cooperation with various Government Departments.
- Identifying policy lessons from the project that are replicable to other national initiatives including the need for review of laws, rules and regulations as well as guidelines for major national programs.

- Linking organically broader human development strategy/achievements and innovative approaches in multi-sectoral development programming at the grassroots.
- Reviewing progress of the project through participatory mechanisms and based on lessons from below on key indicators such as ownership, participation, equity and empowerment.

### **2.3 Project Management Cell (PMC) set up by MITCON**

The PMC set up by MITCON Consultancy Services Ltd. (MITCON) will ensure adequate project management structure and systems for facilitating implementation of MIPs and activities under TA component. The project team would be responsible for developing a comprehensive MIS covering the aspects of monitoring MIPs and the overall project implementation. The project team will be headed by a full-time National Project Manager (NPM) and include 2 full time Project Officers (POs), for covering target States of Punjab and Haryana, Rajasthan and Maharashtra and two staff – for Administration and Finance. The PMC will carry out day-to-day working of the project. Experts in the project will closely interact with all project actors and NPM. Select expert will also be involved to facilitate the work of the collaborating institutions in project development and in identifying and coordinating specific inputs, wherever required. The NPM 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.

### **2.4 Project Executive Committee**

A Project Executive Committee (PEC) will be constituted to provide expert advisory inputs to the NPM and PMC. PEC will provide a platform for interaction of the project developers, promoters and other stakeholders. Further, institutional interaction and cooperation will be ensured by the PEC through periodic review of the implementation activities and discussion of issues requiring remedial measures that may arise during the course of project implementation. The PEC will have NPD (MNES) as the Chairman, with members/representatives from MNES, UNDP, Industry Associations and Financial Institutions, Experts and representatives of State government. NPM will be the convenor of the PEC. It is proposed to have quarterly project review meetings with PEC, during the tenure of the project. The PEC would be empowered to carry out the following:

- Facilitating timely decisions on project management issues such as the approval of the FIs, sub-contracts, experts, budget structure, annual work-plans, financial management including advance of funds, implementation issues and audit follow-up.
- Exploring opportunities for flexible management, in tune with the ongoing UNDP initiative will be fully harnessed.
- Implementing the monitoring, evaluation and research strategy. Particularly ensuring that participatory monitoring and evaluation.

## **2.5 Monitoring and Evaluation**

### **Approach**

1. The project integrates a comprehensive monitoring and evaluation programme. The project will be monitored and evaluated according to standard UNDP rules for nationally executed projects. For each of the six components, a detailed monitoring plan will be prepared during project inception. And as part project inception, the Project Logical Framework may be revised; specifically, the detailed indicators will be revisited and adapted as necessary, including measures to track the major external project risks. These indicators will draw upon all sources of information, including those of other donors active in the energy field in India. Appropriate and specific performance benchmarks will be established prior to project implementation to effectively monitor project progress and to make crucial management decisions. An annual reporting cycle will be established that will provide progress reports to be shared among all participants in the project.
2. Following UNDP's emphasis on results-based management, the country office has developed a new format for work plans. This format emphasizes achievements (benchmarks and milestones) as well as cost per output/result. This format will allow for a critical assessment of programme performance as it shows, at a glance, what activities are to be implemented and when, the cost for each activity, the responsible agent for implementation, progress at the end of every quarter, and will facilitate the preparation of the work plans for the subsequent quarters.
3. In addition to normal Government monitoring, UNDP will have the monitoring and reporting obligation for the programme, in accordance GEF Monitoring and Evaluation (M&E) guidelines. In this connection, additional M&E missions will be undertaken by UNDP when this is judged to be required, as for example when there is a need for an intermediate assessment of progress or impact before a decision is made as to the continuation of any given activity. This will be done in collaboration with the Executing Agency (MNES) as well as with the implementing partners/stakeholders.
4. The Executing Agency (MNES) will be responsible for regularly monitoring progress in project implementation. In undertaking this, it will be supported by the National Project Director and the Project Management Cell (PMC). Progress will be measured against targets set out in the Work Plan and Project Logical Framework. PMC will be required to report relevant progress to the National Project Director and UNDP on a quarterly basis. Regular monitoring of the project will occur through this reporting mechanism as well as through site visits, as required. Disbursements of UNDP-GEF funds will be dependent upon the project's ability to establish a well-designed reporting mechanism (e.g. an MIS-based or other system).
5. Annual Tripartite Review meetings (TPRs), with the participation of the Executing Agency, project team, stakeholders and UNDP, will be held to review progress, identify problems, and agree on solutions to maintain timely provision of inputs/achievement of results. The Project Steering Committee will review annual work plans as well as provide strategic advice on the most effective ways and means of implementation. Reporting to GEF will be accomplished through annual Project Implementation Reviews (PIRs).

6. **Phase 1** of the project will be the subject of two independent evaluations: the first one will be half way through implementation, and the other at project completion. The TORs for the second (terminal) evaluation will be expanded to include recommendations, or otherwise, for an expanded Phase 2 project. These independent evaluations will review progress in project implementation and make recommendations, where appropriate, to improve timeliness, relevance and impact of project inputs. They will also assist project stakeholders to draw lessons learned for use in improving the quality of future development interventions with similar activities and could be undertaken in collaboration with other development partners to the project. Such multi-stakeholder and partner evaluations could be a useful learning experience for all parties, where a 360-degree approach could be taken to evaluate all parties' inputs to the project.

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 PEC and PSC levels on yearly basis, based on the six monthly Progress Reports prepared by the PMC, the local implementing agency, as well as from timely feedback from the stakeholders. The monitoring indicators are linked to the Strategic Results Framework of UNDP.

The PMC will be responsible for developing analytical and sampling tools for monitoring progress of the project. The PMC 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.

Every MIP would be monitored through establishing clear baselines and subsequently documenting the experience and conducting post-project evaluation at various stages. This will be a 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 for use in monitoring activities. 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 Phase I to proceed to Phase II of the project. In addition, management will commission an evaluation of Phase I to determine whether or not Phase II is justified, or needs to be significantly redesigned, based upon experience in Phase I. 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.

The M&E plan will consist of three parts: (i) monitoring of the project's physical outputs to assess progress in reaching the biomass power generation targets, including transaction structures, risk sharing, and project types; (ii) evaluation of the project's impacts to assess reduction of policy/institutional/cost barriers; and (iii) to evaluate the lessons learned from the implementation of Phase 1 in order to design and formulate an effective Phase 2 initiative. Table below lists the objectives/activities and the associated mid-term and end-of-project targets that will facilitate monitoring.



## ***Phase -II***

In addition, as this project represents Phase I 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 Phase II of the project to the GEF Council for funding. As currently designed, Phase II 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 phase of the project should be initiated will involve an evaluation certifying that three conditions or events hold true. First, the project activities designed for Phase I of the project have been successfully implemented. Second, the 7 MIP's included in Phase I 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 Phase II as initially designed without major redesign work. If conditions have changed sufficiently due either to the success or failure of the activities included in Phase I of the project, Phase II 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.

## ***UNDP Collaboration***

UNDP will support management of the project and, towards this participate in various project committees and monitoring missions. UNDP will support drawing and up-scaling of development lessons. At the request of the Executing/Implementing Agency, UNDP will also provide support (termed as UNDP Country Office support services) for sub-contracting and for monitoring and evaluation. Country Office support may be provided in other areas also as agreed between UNDP and the Executing Agency/Implementing Agency. Such support activities will be carried out in accordance with UNDP rules and regulations.

## **III. Funds Flow Arrangements and Financial Management**

As per the GOI-NEX Guidelines, the Ministry of Non Conventional Energy Sources, the Executing Agency, shall make suitable provision for their contribution to the project through budgetary provisions. At the request of the Executing Agency, UNDP will release payments directly to the separate Project Account opened by MITCON Consultancy Services Ltd. for technical assistance components and to the selected financial institutions for TA and contingent funds for MIPs. UNDP will advance the funds on a quarterly basis as per the approved work plan at the request of the National Project Director or a designated authority in the appropriate format (i.e., the Financial Report will contain, in addition to the information on funds required, information on annual budget, year-to-year expenditure and available budget).

The PMC and FI partners receiving funds shall maintain a separate bank account in order to receive and disburse UNDP funds. Separate books of accounts on cash basis of accounting shall also be maintained in order to ensure accurate reporting of expenditures and providing

a clear audit trail. In all cases, fund transfers will be on the basis of MoUs/contracts between PMC/FIs and the agencies/experts and project promoters. The terms and conditions of all MoUs/sub-contracts will be discussed and approved by the Empowered PEC.

PMC/FIs will send an annual work plan and budget to the NPD. Upon receiving written authorization from the Executing Agency, UNDP will release funds in advance every three months, based on this annual work-plan. The Project Coordinator will report disbursement to the NPD and UNDP on a quarterly basis, in the Financial Report Format referred to earlier.

The matching contribution from Govt. of India towards technical assistance and contingent funds for MIPs will be received respectively by PMC and FIs, progressively, as per the guidelines from the GoI and duly endorsed by the SC for this project. The modus operandi for GoI contribution will be almost similar to UNDP funds. Separate accounts by Sources (UNDP and MNES) will be maintained for the purpose.

#### **IV. Audit**

As per the GOI NEX Guidelines, the project shall be subject to audit in accordance with UNDP procedures. In order to meet the UNDP requirement of covering 90% of the annual NEX expenditure under audit, an annual audit plan will be drawn up in consultation with DEA. The project shall be informed of the audit requirements by January of the following year. The audit covering annual calendar-year expenditure will focus on the following parameters: (a) financial accounting, documenting and reporting; (b) monitoring, evaluation and reporting; (c) use and control of non-expendable reporting; and (d) UNDP Country Office support.

The auditor shall be appointed in consultation with DEA. In line with the UN Audit Board requirements for submitting the final audit reports by 30th April, the auditors will carry out field visits during February/March. Detailed instructions on audit will be circulated by UNDP separately and cost of audit will be charged to the project budget.

## **E. MONITORING & EVALUATION, RESEARCH, COMMUNICATIONS & ADVOCACY**

### **I. Monitoring and Evaluation**

In order to ensure effective and results-oriented project implementation, the qualitative monitoring described above will be complemented with evaluation(s) when considered necessary by the PSC. In general, UNDP is trying to practice Outcome Evaluation. This entails assessment of a cluster of projects instead of a single project in order to evaluate relevance, performance and success in the broader context of agreed outcomes. The PSC will be guided by this approach in their decisions regarding the evaluation of the project.

### **II. Research Agenda**

Given the development context, the Project has the potential to contribute significantly to the national and state-level debate and action on energy security and sustainable development. Apart from documentation of best practices by field partners and PMC/FIs, it is crucial to support rigorous study and analysis of the Project that can be shared widely for achieving sustainable development goals. In addition, the Project seeks to strengthen its contribution to policy advocacy at both state and national level as outlined in the project activities.

These research agenda will be developed by PMC in consultation with UNDP and the partners at the beginning of the Project, along with developing the overall plan for communication and advocacy.

### **III. Communication and Advocacy, Lessons Learned, and Upscaling**

The Project will encourage effective communication that covers information gathering and sharing documentation with all Project partners. It will encourage documentation of baseline as well as key milestones during the Project period through use of video and print media; coverage of key events, processes and outputs by journalists and others; training of Project partners in communication tools and skills; success stories with a strong human element and; linkages, wherever possible, with communication staff of the government at district/block levels. It will proactively support design and creation of mechanisms such as workshops to share and review experiences and lessons learnt at different levels within the Project as well as implications for program and policy formulation.

It will also seek to strengthen integration of strategic gender interests into the process of energy policy formulation at State and Central levels so that there is increased visibility of and focus on gender issues in policy dialogue on natural resource management.

The Project will encourage monitoring and evaluation of project processes and outcomes jointly with policy makers, implementing groups and subject specialists. The Project will facilitate the travel of independent journalists to see the work in the field. It will provide funds to local partners to video document the process in the field. UNDP will commission films for international TV, organize annual thematic workshops in collaboration with PMC on issues raised through the research studies.

## F. PROJECT BUDGET

### I. UNDP/GEF Contributions

GEF is contributing through UNDP US\$ 5.65 million for Part-I of the Project. While the detailed budget is enclosed (Annexure A), the component-wise budget (in US \$) is as follows:

Sl.No.	Component	Amount (US\$)
1.	Personnel cost	789,120
2.	Sub-contracts	630,000
3.	Training/workshops	376,957
4.	Equipment cost	135,000
5.	Mission cost	205,000
6.	Travel/local conveyance (incl. Study tours & Fellowships)	
	Domestic	490,722
	International	260,000
7.	Organization fees (MITCON)	247,984
8.	Contingent financing funds for MIPs	2,000,000
9.	Other miscellaneous costs	431,252
10.	PA costs, including Prodoc	83,965
	<b>Total</b>	<b>5650000</b>

UNDP inputs include the following:

- **Personnel:** UNDP will support the salaries of National Project Manager (NPM), support staff and honoraria and travel of all consultants/agencies recruited by the Project, particularly subject specialists. The Project Coordinator and all other members of the Project implementation unit, as well as all consultants recruited for periods exceeding 3 months, will be screened and selected through a transparent process.
- **Travel:** Funds will be provided for travel (local as well as outside the State) for the NPM, other members of the PMC, consultants and agencies. Expenditures will be in accordance with TA/DA rules of the Government of India as applicable. UNDP travel for monitoring purposes will also be charged to the Project.
- **Monitoring and Evaluation:** Funds will be provided for an annual process review using external consultants, as well as for mid-term reviews and final evaluation.
- **Training:** All the grassroots level, district level and national level training and capacity building will be supported by UNDP. These will include costs of resource persons, hiring of space for training program, training materials and travel of participants. PMC will ensure that wherever possible, government buildings will be made available for training free of cost.
- UNDP will also support the travel and expenses for PMC staff, required national and international experts, sub-contractees under the project. Expenses will be as per the rules of the Government of India as applicable.

- **Equipment:** UNDP will provide basic equipment for the Project office and SNAs of the four select states / other institutions involved, wherever required. All purchases will require the prior approval of the PSC or PEC and will be made strictly in accordance with UNDP NEX Guidelines. All equipment procured under the Project will be in the name of 'Resident Representative, UNDP'.
- **Sub-contract:** UNDP will provide support through sub-contract for hiring the services of specialized organizations for specific activities. This may include training in participatory methodologies and sustainable natural resource management, production of films on best practices, documentation of case studies, research studies, preparation of teaching/learning materials and organization of issue-based workshops.
- **Miscellaneous Expenses:** Funds are available for miscellaneous expenses pertaining to the Project for PMC and UNDP such as telephone, fax, rent where necessary, e-mail facility, postage and stationery.

## II. Government Contributions

The Government of India's contribution will be in addition to the in-kind resources, in the form of time given by the National Programme Director and officers of the relevant departments and the Ministries. The Ministry of Non Conventional Energy Sources will contribute US \$ 5.24 million (in equivalent Rupees). The break up is indicated below in US \$:

Sl.No.	Component	Amount (US\$)
1.	Personnel cost	0
2.	Sub-contracts	630000
3.	Training/workshops	332043
4.	Equipment cost	0
5.	Mission cost	0
6.	Travel/local conveyance (incl. Study tours & Fellowships)	
	Domestic	207957
	International	0
7.	Organization fees (MITCON)	0
9.	Contingent financing funds for MIPs	4000000
10.	Other miscellaneous costs	0
11.	PA costs, including Prodoc	70000
	<b>Total</b>	<b>5240000</b>

## III. Other Contributions

The project will receive additional co-financing support from the Financial Institutions and Commercial banks, bi-lateral agencies and project promoters of MIPs, of US \$ 28.26 million. KfW has also indicated interest in setting up a credit line for the project. The promoter contribution is expected to be of US \$ 4.25 million (around 15%) and balance US \$ 24.01 million will be from FIs / bi-lateral agencies.

## IV. Break up of Contingent Funds by Components and Source

The indicative budget summary for the entire contingent fund for MIPs in Phase I, including TA and contingent financing components for target sub-sectors is given in the following table:

**Summary of provision of TA & contingent fund components for MIPs**

Sr. No.	MIP type / category	Indicative budget, US \$		
		TA	Contingent financing	Total
1.	Bagasse cogen in co-operative sugar mills	275000 (17.5%)	1300000 (82.5%)	1575000 (26.25%)
2.	Greater than 1 MW scale projects on distributed / captive biomass	262500 (21 %)	992500 (79%)	1255000 (20.92%)
3.	Less than 1 MW scale projects on distributed biomass	462500 (14.6%)	2707500 (85.4%)	3170000 (52.8%)
	<b>Total</b>	<b>1000000</b>	<b>5000000</b>	<b>6000000</b>

The proposed financial flow for the Phase I project budget is given following table:

Sr. No.	Recipient / Routing Agency	Amount (US \$ million)							
		Generic TA		Contingent financing for MIPs				Total	
				TA		Investments			
		UNDP / GEF	GoI	UNDP / GEF	GoI	UNDP / GEF	GoI	UNDP / GEF	GoI
1.	MNES (Project Account)	3.65	1.24	-	-	-	-	3.65	1.24
2.	Select Fls	-	-	1.00	-	1.00	4.00	2.00	4.00
	<b>Total</b>	<b>3.65</b>	<b>1.24</b>	<b>1.00</b>	<b>-</b>	<b>1.00</b>	<b>4.00</b>	<b>5.65</b>	<b>5.24</b>

## **G. LEGAL CONTEXT**

This project document shall be the instrument envisaged in the Supplemental Provisions to the Project Document attached hereto.

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

- Revisions in, or addition of, any of the Annexes of the project document (with the exception of a Standard Legal Text for non-SBAA countries which may not be altered and agreement to which is a pre-condition for UNDP assistance).
- Revisions, which do not involve significant changes in the immediate objectives, outputs of activities of the Project but are caused by the re-arrangements of inputs already agreed to or by cost increases due to inflation.
- Mandatory annual revisions, which rephrase the delivery of, agreed project inputs or increased experts or other costs due to inflation.
- The Executing Agency and Implementing Agency shall, at all times, ensure compliance with the NEX Guidelines annexed hereto and also comply with the requirements contained in the UNDP Programming Manual to the extent they do not conflict with the said NEX Guidelines or extant rules and provisions of Government of India.

## 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

#### **ADDITIONAL INFORMATION**

##### **Annexes**

Annex A	Project Budget & Financing Plan
Annex B	Work Plan
Annex C	Incremental Cost and Log frame Matrix
Annex D	STAP Roster Technical Review & Response to STAP review
Annex E	Letters of Endorsement

##### **Appendices**

Appendix 1	Estimates of Biomass Potential in India
Appendix 2	Estimates of Biomass Produced in India and Potential for Availability of Biomass
Appendix 3	Draft Terms of References (ToRs) for Sub-contracts
Appendix 4	Summary of Possible Project Configurations for MIPs
Appendix 5	Framework Contingent Financing, and Proposed Mechanisms and Targeted Barriers or Risks

Annex A Project Budget & Financing Plan

Expected Output	Key Activities	Time Frame				Resp Party	Fund	Donor	PLANNED BUDGET Budget Description	Total
		2006	2007	2008	2009					
Accelerated adoption of biomass power technologies	Technology Improvements (1.1.1,1.1.2,1.2.1, 1.3.1)	13594	36228	33914	40783	NEX	62000	10003	71300 Local Consultants	124,520
		4585	12219	11439	13756		62000	10003	International Consultants	42,000
		15557	41459	38812	46672	NEX	62000	10003	72100 Contractual Services	142,500
		21835	58188	54472	65505	NEX	62000	10003	71600 Travel	200,000
		9375	24983	23388	28124	NEX	62000	10003	74500 Miscellaneous	85,869
	Sub-total									
	Increased Information and knowledge level (2.1.1 a-e, 2.1.2 a-e)	13594	36228	33914	40783	NEX	62000	10003	71300 Local Consultants	124,520
		19651	52369	49025	58954	NEX	62000	10003	72100 Contractual Services	180,000
		41154	109671	102669	123463		62000	10003	Workshops	376,957
		21835	58188	54472	65505	NEX	62000	10003	71600 Travel	200,000
		9375	24983	23388	28124	NEX	62000	10003	74500 Miscellaneous	85,869
	Sub-total									
	Capacity building (2.2.1-2.2.5)	13594	36228	33914	40783	NEX	62000	10003	71300 Local Consultants	124,520
		8461	22548	21108	25383	NEX	62000	10003	72100 Contractual Services	77,500
		21835	58188	54472	65505	NEX	62000	10003	71600 Travel	200,000
9375		24983	23388	28124	NEX	62000	10003	74500 Miscellaneous	85,869	
Sub-total										
Business and commercial networks (3.1.1-3.1.3, 3.2.1)	13594	36228	33914	40783	NEX	62000	10003	71300 Local Consultants	124,520	
	8188	21820	20427	24564	NEX	62000	10003	72100 Contractual Services	75,000	
	2808	7484	7006	8425	NEX	62000	10003	71600 Travel	25,722	

	9375	24983	23388	28124	NEX	62000	10003	74500 Miscellaneous	85,869
Sub-total									
Financing/contingent mechanisms (4.1)	13594	36228	33914	40783	NEX	62000	10003	71300 Local Consultants	124,520
	22408							72100 Contractual Services	2,052,500
	2	597151	559022	672245	NEX	62000	10003		
	2729	7273	6809	8188	NEX	62000	10003	71600 Travel	25,000
9375	24983	23388	28124	NEX	62000	10003	74500 Miscellaneous	85,869	
Sub-total						62000			
MIPs(5.1.1-5.1.2, 5.2.1)	13594	36228	33914	40783	NEX	62000	10003	71300 Local Consultants	124,520
	11190							72100 Contractual Services	102,500
	5459	29821	27917	33571	NEX	62000	10003		
		14547	13618	16376	NEX	62000	10003	71600 Travel	50,000
	0							72800 Non-expendable Equipment	
27074	72148	67541	81221	NEX	62000	10003	74500 Miscellaneous	247,984	
Sub-total						62000			
Monitoring and Evaluation	22381	59642	55834	67143	NEX	62000	10003	71300 Local Consultants	205,000
	0							72100 Contractual Services	
		0	0	0	NEX	62000	10003		
	5459	14547	13618	16376	NEX	62000	10003	71600 Travel	50,000
	14739							72800 Non-expendable Equipment	
		39277	36769	44216		62000	10003		135,000
9375	24983	23388	28125	NEX	62000	10003	74500 Miscellaneous	85,870	
Sub-total									
								GRAND-TOTAL	5,650,000

**Project Budget for Government of India Contribution (in US \$)**

	Description	Total	2006-07	2007-08	2008-09
1	Personnel Cost	0	0	0	0
2	Domestic Travel	207957	69319	69319	69319
3	Mission costs	0	0	0	0
4	Sub contracts (50%)	630000	300709	210125	119166
5	Organization fees (MITCON)	0	0	0	0
6	Training/workshops	332043	110681	110681	110681
7	Equipment costs	0	0	0	0
8	Contingent financing fund for MIPs	4000000	0	2400000	1600000
9	Other miscellaneous costs (PA & Prodoc)	70000	70000	0	0
	<b>Total Project Budget</b>	<b>5240000</b>	<b>550709</b>	<b>2790125</b>	<b>1899166</b>

**Annex B Work Plan**

Sr. No.	Output/Activity/ Sub-activity	Period in Quarters													
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
1	Output 1.1														
1.1	Activity 1.1.1														
2	Output 1.2														
2.1	Activity 1.2.1														
3	Output 1.3														
3.1	Activity 1.3.1														
4	Output 2.1														
4.1	Activity 2.1.1														
4.1.1	Sub activity 2.1.1(a)														
4.1.2	Sub activity 2.1.1(b)														
4.1.3	Sub activity 2.1.1 (c)														
4.1.4	Sub activity 2.1.1(d)														
4.1.5	Sub activity 2.1.1(e)														
5	Output 2.1														
5.1	Activity 2.1.2														
5.1.1	Sub activity 2.1.2 (a)														
5.1.2	Sub activity 2.1.2 (b)														
5.1.3	Sub activity 2.1.2 (c)														
5.1.4	Sub activity 2.1.2 (d)														
5.1.5	Sub activity 2.1.2 (e)														
6	Output 2.2														
6.1	Activity 2.2.1														
6.2	Activity 2.2.2														
6.3	Activity 2.2.3														
6.4	Activity 2.2.4														

Sr. No.	Output/Activity/ Sub-activity	Period in Quarters													
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
6.5	Activity 2.2.5														
7	Output 3.1														
7.1	Activity 3.1.1														
7.2	Activity 3.1.2														
7.3	Activity 3.1.3														
8	Output 3.2														
8.1	Activity 3.2.1														
9	Output 4.1														
9.1	Activity 4.1														
9.2	Activity 4.2														
10	Output 5.1														
10.1	Activity 5.1.1														
10.2	Activity 5.1.2														
11	Output 5.2														
11.1	Activity 5.2.1														
12	Project Management														
13.	Monitoring & Evaluation														

## **Annex C Incremental Cost and Log frame Matrix**

### 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 CO<sub>2</sub> emission reduction of approximately 0.14 million tons of CO<sub>2</sub> / year, for about 40 MW cumulative installed capacity of these projects. For Part I alone, a total CO<sub>2</sub> emission reduction of approximately 88,400 tons of CO<sub>2</sub> per year is expected, whereas for Part II the total CO<sub>2</sub> emission reduction will be approximately 55,000 tons of CO<sub>2</sub> 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 CO<sub>2</sub> per year. For a project life of 15 years, CO<sub>2</sub> emissions reduction for the project intervention and the total potential will be 2.1 million tons and 1073 million tons of CO<sub>2</sub>, 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 <sub>2</sub> Emissions	(thousand tons CO <sub>2</sub> /year)	56,414	0	0	(thousand tons CO <sub>2</sub> /year)	850	0	170

**Table A-2. INCREMENTAL COST MATRIX**

Project Activity	Baseline	Alternative	Increment
<p><b>Activity 1:</b> Technology package benchmarking and validation, including development of energy plantation on waste land as potential source of bio-mass power</p>	<p>Poor reliability of bio-mass power technologies, both for captive and distributed bio-mass</p> <p>Energy plantation as potential bio-mass resource for commercial power production is yet to get established</p> <p><b>Cost : nil</b></p>	<p>Develop standards and benchmarks for design &amp; performance parameters, techno-commercial viability, O &amp; M, etc. for co-generation, combustion and gasification technologies and validate the same through proposed MIPs, including documentation.</p> <p>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.</p> <p><b>Cost : US \$ M 2.75</b></p>	<p>Increased reliability &amp; confidence of such projects for promoters, financiers &amp; stakeholders</p> <p>Energy plantation on waste land gets established as a potential source of commercial bio-mass power.</p> <p><b>Cost : US \$ M 2.75</b></p>
<p><b>Activity 2:</b> Capacity Building for Effective Information Dissemination</p>	<p>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 &amp; projects</p> <p><b>Cost : nil</b></p>	<p>Build capacity of major stakeholders including Central &amp; State level policy makers, regulatory agencies, SEBs, project promoters &amp; developers, consultants &amp; engineers, financial sector and intermediaries, etc. on all aspects of bio-mass power projects, in captive as well as distributed bio-mass materials</p> <p>Establish sustainable information dissemination framework for these projects and technologies</p> <p><b>Cost : US \$ M 3.00</b></p>	<p>Major stakeholders have adequate skills and orientation for implementing and sustaining these projects and their confidence level get improved</p> <p>Increased confidence level &amp; capabilities of the major stakeholders and promoters</p> <p><b>Cost : US \$ M 3.00</b></p>

Project Activity	Baseline	Alternative	Increment
<p><b>Activity 3:</b> Development of business, commercial and support service networks for creation of effective institutional framework</p>	<p>No action likely to resolve inadequate institutional framework at national, regional and local levels for biomass power technologies and projects</p> <p><b>Cost: nil</b></p>	<p>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.</p> <p><b>Cost: US\$2.00m</b></p>	<p>Required institutional framework is made available for wider / large scale multiplication of these technologies and projects</p> <p><b>Cost : US \$ 2.00m</b></p>
<p><b>Activity 4:</b> Identification, selection, and implementation of 43 Model Investment Projects (7 during Part 1 and 36 during Part 2)</p>	<p>Models for implementing biomass power projects do not exist either for captive or distributed biomass resources</p> <p>Limited demonstrations exist and no MIPs are liable to be implemented in absence of the project</p> <p><b>Cost:US \$ M 44.50</b></p>	<p>MIPs are assessed and identified for captive bio-mass and field biomass technology demonstration</p> <p>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</p> <p><b>Cost : US \$ M 55.00</b></p>	<p>MIP models get established for demonstration of these technologies</p> <p>Around 43 MIPs get established for captive and field bio-mass technologies and resources, acting as demo projects,</p> <p><b>Cost:US \$ M 10.50</b></p>
<p><b>Activity 5:</b> Project Management, including monitoring and evaluation (M&amp;E) and lessons learned documentation system</p>	<p>No activities will be undertaken in the absence of the project</p> <p><b>Cost : Nil</b></p>	<p>Develop strong project management structure, institutions &amp; persons for close monitoring of the project progress and deliverables, in terms of time / cost / quality / review etc., including their capacity building.</p> <p>Develop M &amp; E and lessons learned documentation and systems, for 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.</p> <p><b>Cost : US \$ M 2.0</b></p>	<p>Adequate project management structure &amp; 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 period.</p> <p>M &amp; E, lessons learned system for the project gets established</p> <p><b>Cost : US \$ M 2.0</b></p>

Project Activity	Baseline	Alternative	Increment
<b>Total Cost</b>	US\$44.25m	US\$ 64.75m	US\$20.50m
<b>Global Benefits</b>	For approximately 40 MW of electric power, the emissions will be approximately 0.14 mt CO <sub>2</sub> per year	For the 43 MIP's, the GHG savings will be approximately 0.14 mt CO <sub>2</sub> per year	<p>For 43 MIP's, the GHG savings will be approximate 0.14 mt CO<sub>2</sub> per year or 2.1m tones of CO<sub>2</sub> avoided over 15 years</p> <p>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<sub>2</sub></p>

### Logframe Matrix

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<p><b>I. Development Objective ( Phase 1 +2)</b></p> <p>To improve the electricity supply without increasing the GHG emissions through wide scale application of bio-mass power technologies</p>	<p>Indicator: Extent of supply and energy needs met by bio-mass power technologies and projects, reduction of usage of fossil fuels and reduction of CO2 emissions</p> <p>Mid Term Target (2007): By the end of phase 1, up to 25 MV of biomass power generation contracted</p> <p>End Of Project Target (2012): By end of phase 2, at least 3% or 3000 MW coming from biomass power supplying regional and national electricity grids</p>	<p>Project documentation on agreements signed for MIP's in phase 1, and data from the Ministry of Power and the MNES.</p>	<p>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</p> <p>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</p> <p>Large scale use of bio-mass power will lead to reduction in GHG emissions and improvement in energy supply</p>

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<b>II. Project Objective and Outcomes (Phase 1 +2)</b>			
<p>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</p>	<p>Indicator: Rate of commercial adoption of sustainable biomass power technologies in key states in India</p> <p>Mid Term Target (2007): By the end of Phase 1, 7 MIP's contracted covering co generation, gasification and combustion technologies in 3-5 different states in India</p> <p>End Of Project Target (2012): By the end of phase 2, a total of 43 MIP's contracted covering co generation, gasification and combustion technologies covering &gt;5 different states in India</p>	<p>Project documentation on agreements signed for MIP's in phase 1, and data from the Ministry of Power and the MNES.</p>	<p>Conducive policy &amp; regulatory framework for bio-mass power projects gets sustained over the project and follow up periods</p>
<p><b>Outcome I:</b> Technology Package Benchmarking &amp; Validation for different bio-mass power technologies, including feasibility of Energy Plantation (Phase 1 and 2)</p>	<p>Indicator: Status of manufacturing capacities and standards for different biomass power technologies</p> <p>Mid Term Target (2007): By the end of phase 1, the parameters and technical standards for the efficient biomass power technologies targeted by the project have been finalized</p> <p>End of Project Target (2012): By the end of phase 2, access to biomass power technology benchmarks available to project developers and a long term national action plan for bio energy plantations developed</p>	<p>Project documentation and information from the dedicated ministries and institutions</p>	<p>Available information on existing capacities and comparable data/information to establish standards and benchmarks</p>

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<p>Output 1.1: Technology upgrade and improvement needs identified, including assessment of indigenous capabilities &amp; strategic plan for sustained adoption through activities</p> <p>1.1.1 Review of state-of-the-art technologies – international &amp; national for potential biomass power applications (combustion, gasification / pyrolysis, advance biomass gasification, fuel cells &amp; micro turbines) gets established &amp;</p> <p>1.1.2 The strategic plan for sustained adoption of bio-mass power technologies gets developed</p>	<p>Key technology information / data / documents and evaluation of discussion meetings, etc. from select national and international technology suppliers for all these technologies</p> <p>Critical analysis of review report &amp; feedback on Output 1.1 and development of strategic R&amp;D plan and program for technology development / improvement, capacity building and technology absorption</p>	<p>A report on assessment of the status of technologies, its wider circulation and feedback</p> <p>Technology mapping report, short &amp; long term, its wider circulation, networking of institutions and experts and feedback</p>	<p>Bio-mass power technologies internationally are more efficient and local conventional fuel technologies are in-efficient</p> <p>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</p>
<p>Output 1.2 : Technology performance &amp; evaluation of benchmarks for MIPs available</p>	<p>Review of major technology and expected performance parameters as designed and actual for all 7 MIPs, validation and verification</p>	<p>Benchmark evaluation and validation report discussed with major experts and stakeholders and feedback received / documented</p>	<p>Bio-mass power technologies are locally available</p>
<p>Output 1.3 : Long term perspective plan for utilization of waste land and biomass resources for power generation</p>	<p>Studies on assessment of waste land for energy plantation, evaluation of species and methods of energy plantation and assessment of potential of energy plantation for different power generation technologies and preparation of demonstration / development plan</p>	<p>Review of studies and plan through discussions and circulation to experts and stakeholders, documentation of feedback / comments</p>	<p>Bio-mass power remains as the national focus for renewable energy power development</p> <p>The stakeholders and project promoters look for bio-mass power as viable opportunities</p>

Narrative summary	Objectivity verifiable indicator	Mean of verification	Critical assumptions
<p><b>Outcome II:</b> Enhanced Capacities and confidence of Project Promoters, Financial Institutions, regulators, policy makers, SNAs, other stakeholders through Effective Information Development &amp; Dissemination Program, along with capacity building initiatives (Phase 1+2)</p>	<p>Indicator: Enhanced capacities of key stakeholders involved in the facilitation and implementation of selected biomass power technologies</p> <p>Mid Term Target (2007): By the end of phase 1, pilot portfolio of project profiles developed, model formats/agreements established for the targeted biomass technologies (on fuel supply, energy purchase, project development and management) and promotional material and awareness raised significantly in pilot states</p> <p>End of Project Target (2012): By the end of phase 2, wide accessibility to a web based clearing house mechanism on biomass power and inter sector dedicated capacities established</p>	<p>Documentation from practice documents, established data bases and their usage, together with workshops and training tours</p>	<p>Biomass power remains as a major focus for renewable energy power development in the target states and at the national level</p>



Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<p>Output 2.1: Increased information available with project promoters and all stakeholders in targeted states and their enhanced knowledge based through</p> <p>2.1.1 Creation of on line data bases for biomass project promotion and development in target states and</p> <p>2.1.2 Preparation of good practice document on various aspects of biomass power plants</p>	<p>Potential sites identified for bio-mass depots, bio-mass project profiles, capability profiles of equipment suppliers / EPC &amp; O&amp;M contractors / engineering companies / experts, investment factors in terms of policies / procedures / changes for decisions and institutional profiles for focused States of Maharashtra, Punjab, Haryana &amp; Rajasthan States</p> <p>Critical evaluation of current practices in energy purchase / wheeling / banking agreements, fuel supply agreements, feasibility reports and DPRs, project development agreements and project management approaches within focused States or other wise and development of good practice documents on each</p>	<p>Data bases are tested, circulated, discussed, feedback received, etc. from stakeholders and policy makers, project promoters, etc. from focused States</p> <p>Good practice documents get circulated, discussed and feedback received / documented from various stakeholders within the focused States or otherwise</p>	<p>Bio-mass power remains as the focus for renewable energy power development in the target States and at the national level</p> <p>The stakeholders and project promoters look for bio-mass power as viable opportunities</p> <p>Bio-mass power remains as the focus for renewable energy power development in the target States and at the national level</p> <p>The stakeholders and project promoters look for bio-mass power as viable opportunities</p>

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
Output 2.2 : Improved capacity of key stakeholders and project promoters in targeted states through			
2.2.1 Communication and advocacy on biomass power become regular feature	Articles in English and local languages in focused States, policy research studies on regulatory / financing / institutional issues on national & focused State levels and web site on bio-mass power	Response to communication and advocacy on bio-mass power for focused States and national level gets received, critically evaluated and documented & record of no. of articles / news items / studies available	Bio-mass power remains as the focus for renewable energy power development in the target States and at the national level  The stakeholders and project promoters look for bio-mass power as viable opportunities
2.2.2 Improved access to information through web site	Comprehensive web site on biomass power projects launched	Response from users and no. of shots per week or month	Promoters and stakeholders are equipped with internet facilities
2.2.3 Develop and test capacity building modules in the targeted states	Consultative meetings with regulators, consumer forums, State Government Departments / SNAs / SEBs, industry associations and project promoters. Capacity development modules for investors in distributed biomass sector and grass route level institutions in focused States	Increased demands of information / data from major stakeholders for bio-mass power technologies, increased enquiries for project formulation at MNES / FIs / State Government / SNA levels & record of minutes of such meetings	Bio-mass power remains as the focus for renewable energy power development in the target States and at the national level  The stakeholders and project promoters look for bio-mass power as viable opportunities
2.2.4 & 2.2.5 Organised study tours / missions involving target states & support for fellowships / participation in national / international events	Specific no. of study tours / missions conducted and support provided to specific no. of fellowships / participation	Documentation on study tours / missions and participation available for circulation	Meticulous planning for study tours / missions / fellowships / participation & selection of participants through transparent process

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<p><b>Outcome III:</b> Development of Business, Commercial &amp; Support Services Networks in Focused States</p>	<p>Indicator: Definition and implementation of biomass power business dissemination models in the project pilot states</p> <p>Mid Term Target (2007): By the end of phase 1, the appropriate biomass power business models have been widely disseminated and established in the initial pilot states</p> <p>End of Project Target (2012): By the end of phase 2, a menu of viable biomass power models have been successfully demonstrated in &gt;5 states in India</p>	<p>Dissemination program and user feedback from workshops and seminars held on biomass power business, together with Master plans for dissemination and follow up.</p>	<p>Biomass remains a focus within the promotion of RET on the state and national level, and commercial interest increases together with improved support and services network build up.</p>
<p>Output 3.1: Biomass activities mainstreamed into existing institutional framework – NGOs, Women / SHGs, micro lending institutions and intermediaries in the focused states through</p> <p>3.1.1 Study of required institutional mechanisms required for bio-mass power project development</p>	<p>Interaction with key stakeholders / experts of each category of target bio-mass power sectors and development of required institutional mechanism for promotion and development. Bio-mass power business dissemination models for niche areas at local / focused States / national levels get established, along with support service requirements for sustenance</p>	<p>Feedback from project promoters / stakeholders and stakeholder workshop proceedings organised for presenting bio-mass power business dissemination models and institutional mechanisms</p>	<p>Bio-mass power remains as the focus for renewable energy power development in the target States and at the national level</p> <p>The stakeholders and project promoters look for bio-mass power as viable opportunities</p>

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
3.1.2 & 3.1.3 Evaluate existing commercial and institutional framework in target states and provide orientation to select institutions	<p>Dynamic &amp; sustainable institutional networks for bio-mass power projects at local / focused States levels get identified</p> <p>Key institutions at national / regional level get activated &amp; established for R &amp; D, information dissemination, O &amp; M services, financial intermediaries, etc.</p>	<p>Master plan for development of such institutional networks gets prepared and validated by the major stakeholders and project promoters</p> <p>Review of performance of such key institutions over a period of time</p>	<p>Bio-mass power remains as the focus for renewable energy power development in the target States and at the national level</p> <p>The stakeholders and project promoters look for bio-mass power as viable opportunities</p>
Output 3.2 : Master plan for creation of dynamic and sustainable institutional framework is available	Plan for institutional development in focused States along with time frame and budgets	Review of master plan through discussions and circulation to select institutions and stakeholders, including documentation of feedback	<p>Bio-mass power remains as the focus for renewable energy power development in the target States and at the national level</p> <p>The stakeholders and project promoters look for bio-mass power as viable opportunities</p>

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<p><b>Outcome IV: Creation of Fund for Contingent Financing (Phase 1)</b></p>	<p>Indicator: Contingent financing fund with initial deal flows in operation through designated financial institutions</p> <p>Mid Term Target (2007): By the end of phase 1, 7 MIP's successfully facilitated by the contingent financing facilities made available through the selected financial institutions, together with the full design of a non financial institutions specific guarantee mechanism</p> <p>End of Project Target (2012): By the end of phase 2, significantly increased utilization of financial mechanisms for commercial biomass power investments by both cooperative and private sector institutions</p>	<p>Documentation from contingent fund operator and from selected financial institutions on biomass power deals. National level data from MNES and MOP, both at state and national level on biomass power investments and generation permits.</p>	<p>Minimum level of interest and commitment from potential financial institutions.</p>
<p>Output 4.1: Innovative financing schemes design and feasibility of viable institutional models established through</p> <p>4.1.1 Selection of financial institutions for creation of contingent fund for financing biomass power plants in target sectors and</p> <p>4.1.2 Design financial structuring models for MIPs, utilising contingent fund</p> <p>4.1.3 Design a non-FI specific guarantee mechanism</p>	<p>Financial institutions for creation of contingent fund for 7 MIPs are selected</p> <p>Finalization of financial structuring models &amp; contingent fund components to be provided for select MIPs</p> <p>Finalization of a non FE specific guarantee mechanism</p>	<p>MoUs / agreements signed with select FIs</p> <p>Selection &amp; financial closures for 7 MIPs are completed</p>	<p>Select FIs have required experience and capability</p> <p>The project progressively achieves wider acceptance by major FIs &amp; stakeholders involved.</p>

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<p><b>Outcome V: Model Investment Projects (MIP)</b></p>	<p>Indicator: Model investment projects (MIP) commissioned and implementation started</p> <p>Mid Term Target (2007): By the end of phase 1, 7 model investment projects will have been successfully commissioned and have started initial implementation in 3-5 states demonstrating the 3 different biomass power technologies targeted</p> <p>End of Project Target (2012): By the end of phase 2, a total of 43 model investment projects successfully established and in operation in &gt;5 states in India</p>	<p>Project documentation and information from dedicated financial institutions, on the MIP's</p>	<p>Continued political interest and commitment on the state and national level</p>
<p>Output 5.1: Commissioning and stabilization of MIPs, through</p> <p>5.1.1 Generation of project pipeline for selection of MIPs and</p> <p>5.1.2 Effecting financial closures and commissioning of MIPs</p>	<p>Based on the criteria established through Outcome IV, MIPs get selected financially closed and implemented, commissioned and stabilised</p>	<p>Progress reports on MIP selection, implementation, commissioning and stabilisation</p>	<p>The project progressively achieves wider acceptance by major stakeholders and institutions involved.</p>
<p>Output 5.2 : documentation on lessons learned and evolution of replication strategy / plan</p>	<p>Lessons learned documentation gets prepared, validated and tested for MIPs, including replication strategy / plan</p> <p>Perspective plan for multiplication of bio-mass power technologies gets prepared and documented, along with major recommendations</p>	<p>Presentation of case studies &amp; replication strategy / plan to stakeholders and validation, including minutes of such presentation meetings</p> <p>Validation of the perspective plan and recommendations from donor agencies / institutions involved / stakeholders / project promoters</p>	<p>The project progressively achieves wider acceptance by major stakeholders and institutions involved.</p>

Narrative summary	Objectivity verifiable indicators	Mean of verification	Critical assumptions
<b>Project Management &amp; Monitoring</b>			
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 D STAP Roster Technical Review & Response to STAP review**

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 CO<sub>2</sub> per year. Part II is projected to achieve another 55,000 tons of CO<sub>2</sub> 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 CO<sub>2</sub> 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, feed stocks 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.

4. *“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 will not be supported by GEF project.

## Annex E Letters of Endorsement



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

No. 4(2)/30/96-IC-1  
Date: 28<sup>th</sup> 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 18<sup>th</sup> 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.1 dated 28<sup>th</sup> September, 2001.

Yours faithfully,

(H. C Bhatia)  
Section Officer (IC)

## 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

#### **ADDITIONAL INFORMATION**

##### **Annexes**

Annex A	Project Budget & Financing Plan
Annex B	Work Plan
Annex C	Incremental Cost and Log frame Matrix
Annex D	STAP Roster Technical Review & Response to STAP review
Annex E	Letters of Endorsement

##### **Appendices**

Appendix 1	Estimates of Biomass Potential in India
Appendix 2	Estimates of Biomass Produced in India and Potential for Availability of Biomass
Appendix 3	Draft Terms of References (ToRs) for Sub-contracts
Appendix 4	Summary of Possible Project Configurations for MIPs
Appendix 5	Framework Contingent Financing, and Proposed Mechanisms and Targeted Barriers or Risks

## Appendix I

### Estimates of Biomass Potential 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 & 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
<b>TOTAL</b>				<b>545.4</b>	

## Appendix 2

### Estimates of Biomass Produced in India and Potential for Availability of Biomass (Other than Bagasse)

Sources of Biomass	Biomass Generated (Million MT/Year)	Biomass Utilized (Million MT/Year)	Biomass Available (Million MT/Year)
Crop residues	415	280-300	115-135
Agro-industrial Residues (Excluding Bagasse)	50	50	-
Forest Sources	25-35	-	35
<b>Total (Million MT/Year)</b>	<b>500</b>	<b>330-350</b>	<b>140-170</b>

## Appendix 3

### Draft Terms of Reference (ToRs) for Sub-contracts

#### 3.1 State of the Art Technology Review

##### 3.1.1 Objectives

To undertake review of the State of the Art technologies, international & national, for potential biomass power applications (combustion, gasification, pyrolysis, fuel cells and micro turbines).

##### 3.1.2 Broad Scope of Work

- To identify & short-list proven technology suppliers for biomass power for all types of technologies, including combustion, gasification, pyrolysis, fuel cells and micro turbines, nationally and internationally, establish contact through communication and collect all availability technology information/data/documents from them, including detailed address list of their customers, etc.
- To undertake visits to select commissioned projects in each type of technology, hold detailed discussions with the plant personnel, collect required technical information on actual performance and analyze the same to required depth.
- To compare short-listed technology suppliers based on data supplied, generated and feedback from their customers.
- To prepare a review report on State of the Art technologies for biomass power generation, based on above.

##### 3.1.3 Indicative Agencies

Persons from BHEL/Thermax/Alstom, Ankur, IISc, IIT, Bharatidasan University, international experts, etc.

#### 3.2 Strategic Plan for Sustained Adoption of Biomass Power Technologies

##### 3.2.1 Objectives

To develop strategic plan for sustained adoption of biomass power technologies in India.

##### 3.2.2 Broad Scope of Work

- To undertake critical analysis of the Review report on State of the Art Technologies, national & international, and identify major technology gaps in India, in all types of technologies.
- To present the analysis to select industry/R&D experts having relevant experience and undertake detailed discussion meetings for each type of technology.

- To devise short & long term strategic R&D plan and program for technology development/improvement, capacity building and technology absorption, including collaborations within R&D institutions and industry, sharing of experience and expertise, training, in-plant visits and discussions, etc.
- To work out the budget required for the activities and sub-activities for the strategic plan for effective implementation, identify/evaluate/select institutions and experts for undertaking research work, etc.

### **3.2.3 Indicative Agencies**

Persons from BHEL/Thermax-Alstom, Ankur, IISc, IIT, Bharatidasan University, international experts, etc.

## **3.3. Development, Evaluation & Validation of Benchmarks for MIPs**

### **3.3.1 Objectives**

To develop, evaluate and validate benchmarks for 7 Model Investment Projects proposed under the project.

### **3.3.2 Broad Scope of Work**

- To define major technology parameters of all the 7 MIPs and expected performance indicators for each, based on the analysis of information from present technology & equipment suppliers, design & actual values of performance parameters of commissioned projects in each category and review of available information/data on state of the art technologies in each sector.
- To critically evaluate the design and operating performance parameters of the commissioned MIPs and identify reasons for the gaps if any.
- To validate the benchmarks for MIPs in all the categories for future references, including range of design parameters and their impact on actual performance.

### **3.3.3 Indicative Agencies**

Indian Institute of Science, Indian Institute of Technologies, Bharatidasan University, SNAs of focused states, experts and consultants

## **3.4. Assessment of Waste Land for Energy Plantation**

### **3.4.1 Objectives**

To carry out assessment of waste land for energy plantation, including studies of waste land assessment, species & methods of plantation and their potential for different biomass power generation technologies.

### **3.4.2 Broad Scope of Work**

- Assessment of availability of waste land in focused States, review of prevailing laws and regulation for usage and changes required thereof.
- Detailed assessment of potential species and methods of their plantation in the focused States.
- Assessment of potential and constraints if any for different biomass power generation technologies including combustion, gasification, pyrolysis, fuel cells and micro turbines for usage of energy plantation.
- Preparation of demonstration/development plan for energy plantation as biomass power fuel for all types of technologies.

### **3.4.3 Indicative Agencies**

A relevant technical team of persons including waste land and energy plantation experts, energy plantation to power experts, SNAs of focused states and appointed local data collection agencies.

## **3.5. Database on Biomass Depots in Focused States**

### **3.5.1 Objectives**

To develop database on biomass power depots in focused States.

### **3.5.2 Broad Scope of Work**

- To review of all information/data/documents on biomass assessment in all the focused States and identify high potential districts/tehsils in each State.
- To undertake laboratory analysis of different biomass materials in each State through competent laboratories and compare the results with available information.
- To map potential sites for biomass depots in potential districts/tehsils of each State, estimated quantities of biomass materials that can be made available for the depot, depot equipment required and preliminary estimates of investment, equipment/area/manpower required, along with production cost of condensed biomass, etc.
- To provide strategy for development of biomass depots in each State including type of entrepreneurs/NGOs/SHGs, promotion strategy, support required, selection of entrepreneurs, etc.

### **3.5.3 Indicative Agencies**

Select consultants undertaking biomass assessment studies in focused States and SNAs

### **3.6. Database on Biomass Power Project Profiles in Focused States**

#### **3.6.1 Objectives**

To prepare database on biomass power project profiles in focused States.

#### **3.6.2 Broad Scope of Work**

- To review biomass assessment studies/biomass depot mapping exercises in each State and finalize potential sites for biomass power project, along with estimated capacities of projects.
- To prepare location/biomass material specific project profiles for 'Go-No-Go decisions' of the entrepreneurs including brief information on technology, market, equipment, space & manpower required, investment and expected returns, risk analysis, biomass availability, possible grid interface, prevailing policies & steps for project implementation, etc.
- To prepare on-line database, State specific, of the project profiles for diffusion.

#### **3.6.3 Indicative Agencies**

Select consultants undertaking biomass assessment studies in focused States and providing pre-investment consultancy services for biomass power project and SNAs

### **3.7. Technology Specific Capability Profiles**

#### **3.7.1 Objectives**

To prepare focus State-wise/national database on technology specific capability profiles of major equipment suppliers, EPC and O&M contractors, experts & engineers, consultants.

#### **3.7.2 Broad Scope of Work**

To compile, evaluate and prepare database on all above categories of companies/personnel, including following:

- Detailed address & name(s) of contact person(s).
- Experience & manpower profile.
- Detailed address list of customers.
- Customer feedback.
- Equipment/infrastructure profile.
- Bio-data of key personnel.
- Annual reports/balance sheets for last 3 years.
- Company profiles.
- Discussion points on key interest in biomass power sector.

### **3.7.3 Indicative Agencies**

Consultancy companies /industry associations with similar experience, and SNAs

## **3.8. Institutional Profiles in Focused States**

### **3.8.1 Objectives**

To prepare capability profiles of related institutions in each focus State.

### **3.8.2 Broad Scope of Work**

- To identify and short-list specific institutions in finance/banking micro credit, marketing, training, system integration, design & engineering, R&D, HRD, education, etc. in all focused States.
- To collect key information/data on these institutions for potential capacity development for biomass power sector.
- To undertake discussions with top management persons of these institutions to identify/stimulate their interest in biomass power sector.

### **3.8.3 Indicative Agencies**

Institutional development consultants and SNAs of focused states

## **3.9. Good Practice Documents, Energy Purchase/Wheeling/Banking**

### **3.9.1 Objectives**

To develop good practice documents related to Energy Purchase/Wheeling/Banking of grid connected power from biomass power projects

### **3.9.2 Broad Scope of Work**

- To compile and review the available energy purchase, wheeling & banking agreements developed/practiced by various concerned agencies including CERC/SERC SEB's other agencies.
- To interact with existing/potential entrepreneurs of biomass power, SEBs, consumer fora, SERCs, etc. and seek their opinion.
- To develop good practice document for energy purchase, wheeling and banking for biomass power.
- To circulate to select agencies/experts, receive feedback and finalize.



### **3.9.3 Indicative Agencies /Experts**

A team of Shri Harish Bhargava, Dr. Ashok Harane, Dr. Ram Tyagarajan & representatives of Vandana Vidyut and Ankur

### **3.10. Good Practice Document, Fuel Supply Agreement**

#### **3.10.1 Objectives**

To develop good practice fuel supply agreements between sugar mills other captive biomass industries and IPPs, biomass depots and entrepreneurs, village entrepreneurs NGOs SHGs & entrepreneurs.

#### **3.10.2 Broad Scope of Work**

- To identify and evaluate elements of fuel supply transactions in biomass power projects related to quantity, quality, delivery mechanism, period, price formula, legal context, payment terms, etc.
- To study FSAs available for fossil fuel or biomass power projects.
- To discuss with sugar mills, IPPs, village entrepreneurs, existing biomass depot entrepreneurs, biomass traders, legal experts, etc.
- To develop good practice FSAs for all categories.
- To circulate to select agencies experts, receive feedback & finalize

#### **3.10.3 Indicative Agencies**

FSA consultancy company, having legal expertise.

### **3.11. Good Practice Documents, Feasibility Report & DPR**

#### **3.11.1 Objectives**

To prepare good practice Feasibility Report (FR) and Detailed Project Report (DPR) documents for different types/sub-sectors of biomass power projects.

#### **3.11.2 Broad Scope of Work**

- To review available FR DPRs in each category.
- To discuss with select entrepreneurs, FIs, stakeholders, approval agencies, etc.
- To define-develop contents sub-contents of good practice FRs DPRs for each category.
- To circulate to specific agencies experts, get feedback comments and finalize

### **3.11.3 Indicative Agencies / Experts**

Select consultant/any company engaged in preparation of FR/DPRs on various categories of biomass power plants.

### **3.12. Good Practice Documents, Project Development Agreements**

#### **3.12.1 Objectives**

To prepare good practice documents, project development agreements between

- IPP – Co-operative sugar mill.
- IPP/other type of entrepreneur – other captive biomass provider.
- IPP/other type of entrepreneur – biomass depot entrepreneur.
- IPP/other type of entrepreneur – village entrepreneur/NGO/SHG.

#### **3.12.2 Broad Scope of Work**

- To identify elements of transactions between each category of the above, including general, definitions, bagasse/biomass supply, steam supply, electricity supply, water supply, condensate supply, land lease, effluent supply, etc.
- To review existing PDAs prepared by various agencies/consultants.
- To develop good practice project development agreements for each of the above categories.
- To circulate drafts to select entrepreneurs, sugar mills, NGO/SHG, FIs, legal experts, etc. seek their feedback and finalize.

#### **3.12.3 Indicative Agencies**

Select project developer interface service providers.

### **3.13. Good Practice Documents, Project Management Information System**

#### **3.13.1 Objectives**

To develop good practice document, project MIS, for different categories of biomass power plants.

#### **3.13.2 Broad Scope of Work**

- To review existing project MIS available at MNES, various State Nodal Agencies in focus States, commissioned project entrepreneurs of each category, equipment technology support, etc. and undertake detailed discussions with select agencies.
- To develop project MIS for each category of biomass power projects.

- To circulate draft project MIS to select entrepreneurs, FIs and other agencies, seek feedback and finalize.

### 3.13.3 Indicative Agencies

Project engineering consultant/team in all categories of biomass power projects.

## 3.14. Media/Publicity Articles

### 3.14.1 Objectives

To develop media articles on all types of biomass power projects and key issues/barriers involved, the UNDP – GEF – MNES Project, etc. and get the articles printed in national/local main daily newspapers, select business magazines, etc.

### 3.14.2 Broad Scope of Work

- Discussions with select experts in each category of biomass power projects and project co-ordinator
- Prepare draft media/publicity articles/publicity articles in English and Vernaculars and plan for launch.
- Finalize in consultation with experts.
- Undertake press conferences in New Delhi and focus State capital and major cities if required.
- Circulate the articles to major news magazines, get printed and receive feedback.
- Compile all published articles and evaluate feedback.

### 3.14.3 Indicative Agencies/ Experts

Publicity/promotion experts/agencies and SNAs of Focused States.

## 3.15. Policy Research Studies & Public Debates

### 3.15.1 Objectives

To prepare policy research studies on biomass power projects and co-ordinate public debates.

### 3.15.2 Broad Scope of Work

- To discuss with industry experts, consultants, experts and institutions and prepare policy research studies on specific aspects of biomass power projects including policy and regulatory framework, potential, institutional development, capacity building, etc.
- To publish policy research studies in select national/local newspapers, magazines, etc.
- To conduct co-ordinate public debates on these policy research studies.

- To document proceedings/discussions of public debates.

### **3.15.3 Indicative Agencies**

Publicity/promotion agency/expert and SNAs

## **3.16. Web Site Development**

### **3.16.1 Objectives**

To develop comprehensive/interactive web site on biomass power including information on potential, achievements, policy & regulatory framework, frequently asked questions, institutions, experts, equipment/technology suppliers, experts & consultants, related State/Central Govt. agencies, fiscal incentives, technology status, etc.

### **3.16.2 Broad Scope of Work**

- To interact with Project Co-ordinator and experts/associations/institutions.
- To collect, compile, collate, analyze and evaluate information generated within the project, etc.
- To prepare a comprehensive/interactive web site on biomass power.

### **3.16.3 Indicative Agencies**

Web development agency, with relevant experience

## **3.17. Capacity Development Modules for Investors & Institutions**

### **3.17.1 Objectives**

To develop capacity development modules for existing/potential investors and institutions engaged in biomass power sector.

### **3.17.2 Broad Scope of Work**

- To undertake rigorous discussions/consultative meets with existing/potential entrepreneurs and institutions, to identify needs for capacity development.
- To interact with experts/consultants/SNAs/equipment suppliers.
- To develop capacity building modules.
- To circulate, receive feedback and finalize.
- To develop plan for execution of capacity building programs.

### 3.17.3 Indicative Agencies/ Experts

Expert institutional consultants/agencies, having relevant experience and expertise and SNAs

## 3.18. Required Institutional Mechanisms

### 3.18.1 Objectives

To identify required business, commercial and support service mechanisms for promoting/executing/operating/sustaining biomass power projects of different categories.

### 3.18.2 Broad Scope of Work

- To interact with industry experts, associations, equipment suppliers, financial institutions, consultants & experts, entrepreneurs, etc. in each category of target biomass power sectors.
- To develop required institutional mechanism for promotion and development of biomass power projects in target categories.
- To circulate, receive feedback and finalize.

### 3.18.3 Indicative Agencies / Experts

Institutional development experts/agencies, having relevant experience and SNAs

## 3.19. Evaluation of available Institutional Framework in Focused States

### 3.19.1 Objectives

To evaluate available institutional framework in focused States.

### 3.19.2 Broad Scope of Work

- To identify, short-list and interact with various institutions/entrepreneurs experts/financial institutions/R&D institutions/industry associations/SNAs and get all required information/data in all focused States.
- To evaluate information/data and discussions held with select institutions and identify their potential to service institutional requirements of biomass power sector through their capacity building.
- To circulate the report to specific institutions, receive feedback and finalize the evaluation/assessment report.

### 3.19.3 Indicative Agencies / Experts

Institutional development consultancy agencies experts and SNAs

### **3.20. Identification/Evaluation of Specific Institutions in Focused States**

#### **3.20.1 Objectives**

To identify, short-list and evaluate specific institution in focused States for mainstreaming their activities for promotion/development sustenance of biomass power target sub-sectors.

#### **3.20.2 Broad Scope of Work**

- To review report on institutional framework required (18) and available (19).
- To identify specific institutions in focused States including FIs/local banks, NGOs/SHGs/other institution.
- To interact with and undertake detailed evaluation of select institutions for mainstreaming.
- To develop capacity building plans for select institution in focused States.
- To circulate the report, receive feedback and finalize.

#### **3.20.3 Indicative Agency/ Experts**

Institutional development consultancy firm/experts with relevant experience, and SNAs

### **3.21. Selection of FIs for Creation of Contingent Fund**

#### **3.21.1 Objectives**

To select specific financial institutions, at national and focused State levels, for creation of contingent fund.

#### **3.21.2 Broad Scope of Work**

- To identify/short-list specific financial institutions, national & focused State levels, who will be willing to participate in the proposed project and have relevant experience/expertise and intents to finance biomass power projects in all target sub-sectors.
- To undertake detailed interactions with these financial institutions, so as to understand/evaluate their existing schemes and capabilities, to provide finance for this sector, including relevant experience of operating contingent fund proposed under the project in desired innovative ways and means.
- To evaluate and select specific financial institutions for operating contingent fund, provide term loans for MIPs and biomass power projects in the post project replication phase, for ensured replication.
- To develop and sign MoUs with select financial institutions for the purpose.

### **3.21.3 Indicative Agencies / Experts**

SBI Caps Ltd./IFCI/ILFS / international financial structuring expert or agency or any other competent agency engaged in financial structuring/loan syndication having relevant experience and interest in biomass power projects of all target categories.

## **3.22. Designing of Financial Structuring Models including Contingent Fund**

### **3.22.1 Objectives**

To design financial structuring models for MIPs, including innovative mechanisms involved in the contingent fund.

### **3.22.2 Broad Scope of Work**

- To study, evaluate and finalize contingent fund components to be provided for MIPs in target sub-sectors, in consultation with select FIs who have signed MoUs with MNES/UNDP.
- To work with and assist financial institutions in designing appropriate financial structuring models for MIPs, including risk assessment, selection criteria, actual selection of MIPs, contingent fund components, conventional term loan components, etc. and achieve financial closure of select MIPs.
- To assist FIs to develop approaches and strategies for creating and operating contingent fund for MIPs in Part I, II as well as post project replication phase.

### **3.22.3 Indicative Agencies**

SBI Caps Ltd., ILFS, IFCI, international financial structuring expert or agency or any other agency having relevant experience, expertise and interest.

## **3.23 MITCON- A facilitating Agency**

### **3.23.1 Objectives:**

To provide required facilitation to MNES, the Executing Agency for successful execution of this project through setting up a Project Management Cell ( PMC ) at New Delhi and deploying required manpower and providing infrastructure facilities.

### **3.23.2 Broad Scope of Work**

- To assist MNES.
- To set up PMC at New Delhi, including dedicated manpower and infrastructure

### 3.23.3 Other

MNES will enter into a MoU / agreement with MITCON for the deliverables under this project with detailed scope of work , terms and conditions , including the termination clause on approval of prodoc and prior to setting up of PMC or zero date of project.



## Appendix 4

## Summary of Possible Project Configurations for MIPs

## 4.1 First Two Pilot Model Investment Projects (MIPs) 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/cm <sup>2</sup> & 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 @ 11.5-12.5% interest, 10 year repayment & 1 year moratorium Selling price @ 2002-03: 6.38 cents/kWh Total cost 2002-03: 5.6 cents/kWh (incl. fuel/O & M/interest/depreciation, etc.) Break even capacity: 75% in 1 <sup>st</sup> year to 60% in fifth year	To be designed by financial structuring agency and select FI, based on contingent financing framework as per Appendix 5	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.

MIP No.	Project Type, Size, & Likely Location	Project Details	Financing Structure	Major Selection Criteria & Reasons for GEF Support
2	<p>Biomass power plant, based on multi fuel procured feed stock</p> <p>Size: 5 MW exportable surplus</p> <p>Likely Location: Haryana or Punjab</p>	<p><u>MIP Type:</u> 2<sup>nd</sup> 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/cm<sup>2</sup> &amp; 485°C or 80 kg/cm<sup>2</sup> &amp; 510°C</p> <p><u>Assumptions:</u> 25 year project life, avg. PLF of 80%, electricity exported/year 28.8 M kWh, T &amp; D loss @ 5 %, discount rated @ 15%, fuel price @ US\$ 17.6/T</p> <p><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, @ 11.5-12.5% interest, 10 year repayment &amp; 1 year moratorium Selling price @ 2002-03: 6.94 cents/kWh Total cost 2002-03: 6.1 cents/kWh (incl. fuel/O &amp; M/interest/depreciation, etc.) Break even capacity: 75% in 1<sup>st</sup> year to 60% in fifth year</p>	<p>To be designed by financial structuring agency and select FI, based on contingent financing framework as per Appendix 5</p>	<p>Selection Criteria: Biomass availability &amp; capable 2<sup>nd</sup> generation entrepreneur, favorable State policy, etc.</p> <p>Reasons for GEF support:</p> <ol style="list-style-type: none"> <li>1) To guarantee the project risks arising out of the barriers</li> <li>2) To improve investor's confidence level</li> <li>3) To demonstrate viability of a new investment and financing model for faster replicability with reduced transaction cost</li> </ol>

4.2 Summary of Five Pilot Model Investment Projects (MIPs) Using Gasifier Engine-Based Biomass Power Plants (<1000kW)

MIP No.	Project Type, Size and Likely Location	Project Details	Financing Structure	Major Selection Criteria
3	<p>Gasifier engine/grid connected biomass power plant</p> <p>Size: 1 MW (suitable combinations of 100 kWe, 200kWe &amp; 500 kWe systems)</p> <p>Likely Location: Punjab or Haryana</p>	<p><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</p> <p><u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported/year 3.02 M kWh, T &amp; D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T &amp; selling price</p> <p><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, @ 11.5-12.5% interest, 10 year repayment &amp; 2 year moratorium Selling price @ 2002-03: 6.94 cents/kWh Total cost 2002-03: 6.1 cents/kWh (incl. fuel/O &amp; M/interest/depreciation, etc.) Break even capacity: 75% in 1<sup>st</sup> year to 60% in fifth year</p>	<p>To be designed by financial structuring agency and select FI, based on contingent financing framework as per Appendix 5</p>	<p>Sustained Biomass availability, capable entrepreneur</p> <p>Reasons for GEF support:</p> <ol style="list-style-type: none"> <li>1) To build the capability of the potential investors to implement such projects with minimum risk</li> <li>2) To demonstrate viability of a new investment and financing model for faster replicability with reduced transaction cost</li> </ol>

MIP No.	Project Type, Size and Likely Location	Project Details	Financing Structure	Major Selection Criteria
4	<p>Gasifier engine/grid connected biomass power plant</p> <p>Size: 1 MW (suitable combinations of 100 kWe, 200kWe &amp; 500 kWe systems)</p> <p>Likely Location: Maharashtra</p>	<p><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</p> <p><u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported/year 3.02 M kWh, T &amp; D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T &amp; selling price</p> <p><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, @ 11.5-12.5% interest, 10 year repayment &amp; 2 year moratorium Selling price @ 2002-03: 6.38 cents/kWh Total cost 2002-03: 6.1 cents/kWh (incl. fuel/O &amp; M/interest/depreciation, etc.) Break even capacity: 85% in 1<sup>st</sup> year to 70% in fifth year</p>	<p>To be designed by financial structuring agency and select FL based on contingent financing framework as per Appendix 5</p>	<p>Sustained Biomass availability, capable rural co-op.</p> <p>Reasons for GEF support:</p> <ol style="list-style-type: none"> <li>1) To establish commercial biomass supply networks</li> <li>2) To build capability of rural co-operatives to assess biomass power project</li> <li>3) Demonstrate the viability of a new investment and financing model for faster replicability with reduced transaction cost in co-op. sector</li> </ol>

4.3 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
5	<p>Gasifier engine/grid connected biomass power plant</p> <p>Size: 1 MW (suitable combinations of 100 kWe, 200kWe &amp; 500 kWe systems)</p> <p>Likely Location: Punjab or Haryana</p>	<p><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.</p> <p><u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported/year 3.02 M kWh, T &amp; D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T</p> <p><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: 6.93 cents/kWh Total cost 2002-03: 6.1 cents/kWh (incl. fuel/O &amp; M/interest/depreciation, etc.) Break even capacity: 75% in 1<sup>st</sup> year to 60% in fifth year</p>	<p>To be designed by financial structuring agency and select FI, based on contingent financing framework as per Appendix 5</p>	<p>Sustained Biomass availability including contribution from energy plantation, capable entrepreneur</p> <p>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</p>

4.4 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
4)	<p>Gasifier engine/grid connected biomass power plant</p> <p>Size: 1 MW (suitable combinations of 100 kWe, 200kWe &amp; 500 kWe systems)</p> <p>Likely Location: Haryana</p>	<p><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</p> <p><u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported/year 3.02 M kWh, T &amp; D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T</p> <p><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: 6.94 cents/kWh Total cost 2002-03: 6.1 cents/kWh Break even capacity: 75% in 1<sup>st</sup> year to 60% in fifth year</p>	<p>To be designed by financial structuring agency and select FI, based on contingent financing framework as per Appendix 5</p>	<p>Sustained Biomass availability and energy plantation, capable rural co-op.</p> <p>Reasons for GEF support:</p> <ol style="list-style-type: none"> <li>1) These investments would lead to establishing commercial biomass supply networks</li> <li>2) The rural co-op. neither has needed capability nor resources to assess biomass power project</li> <li>3) Demonstrate the viability of a new investment and financing model for faster replicability with reduced transaction cost in co-op. sector</li> </ol>

4.5 Summary of Five Pilot Model Investment Projects (MIP's) Using Gasifier Engine-Based Biomass Power Plants (<1000kW)

MI P No.	Project Type, Size and Likely Location	Project Details	Financing Structure	Major Selection Criteria
7	<p>Gasifier engine/grid connected biomass power plant</p> <p>Size: 1 MW (suitable combinations of 100 kWe, 200kWe &amp; 500 kWe systems)</p> <p>Likely Location: Maharashtra</p>	<p><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</p> <p><u>Assumptions</u> 25 year project life, capacity factor 70%, electricity exported/year 3.02 M kWh, T &amp; D loss @ 5 %, discount rate @ 15%, fuel price @ US\$ 17.6/T</p> <p><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: 6.93 cents/kWh Total cost 2002-03: 6.1 cents/kWh Break even capacity: 75% in 1<sup>st</sup> year to 60% in fifth year</p>	<p>To be designed by financial structuring agency and select FI, based on contingent financing framework as per Appendix 5</p>	<p>Sustained Biomass availability including coconut shells &amp; plantation waste, capable entrepreneur</p> <p>Reasons for GEF support:</p> <ol style="list-style-type: none"> <li>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</li> <li>2) To demonstrate viability of a new investment and financing model for faster replicability with reduced transaction cost</li> </ol>

## Appendix 5

### Contingent Financing Framework for Model Investment Projects

#### 1. Context

The financial incentives and government policies have been primarily driving the financing of biomass power projects for demonstration of technologies. With the continuation of several barriers and risks, which are additional to common on grid renewable energy project risks such as fuel supply and technology risks, the project recognizes that the existing financing mechanisms/facilities are not adequate to address these issues fully to enable large scale replication of biomass power projects. In order to address these incremental risks and barriers associated with the biomass power projects, the project therefore proposes to demonstrate contingent fund mechanisms through the Model Investment Projects (MIPs). This is expected to provide the risk instrument needed to the financial institutions and investors during the implementation of MIPs and help mainstreaming such instruments into the standard menu of financial instrument to facilitate further replication.

The proposed contingent framework has been prepared based on several participatory and consultative processes. A stakeholders' meeting was organized on December 4, in 2003 to seek inputs from the representatives from SEBs and regulators, state nodal agencies, and financial institutions of the project focus States of Punjab, Haryana, Rajasthan and Maharashtra. It was noted that the state nodal agency would play an important role in facilitating investments in the sector, while FIs will actively promote financing of biomass power projects. One-to-one meeting followed this up with potential investors and interested financial institutions and Banks to discuss potential mechanisms for operationalizing contingent support envisaged through this project to cover risks and barriers at large.

Detailed discussions were held with MNES, biomass power / bagasse cogen experts, project promoters and financial institutions including IREDA, IDFC, ICICI, ILFS, NABARD, SBI Caps, etc. to understand the risk profile of target biomass power segments. The incremental risk analysis was evolved for each of the target category including bio-mass resource based, technology based and end use application based. Table 1 below summarises the risk profile emerged out of these discussions. Based on the risk components and target segments, indicating TA components for each were identified, evaluated and ranked. Similarly, components of contingent financing were defined. A lot of interaction, thinking and inputs have been considered in developing the contingent financing framework detailed hereby. The details are still indicative and they will be again refined, fine tuned and defined through a separate generic TA activity with help of experts and select FIs, prior to actual implementing of the MIPs.

#### 2. Risk Profile of Biomass Projects

Based on the discussions with leading financial institutions, investment banks and rural banks incremental risk profile of biomass power projects for target sub sectors was evaluated. Table- 1 gives the summary of the risks perceived by the FIs and others in three broad biomass segments in three areas, namely, resources, technology and applications.



**Table 1. Risk Profile of Biomass Power Projects**

Biomass Market Segment	Incremental Risk Analysis		
	Biomass Resources	Technology	End Use Applications
Bagasse Cogen in cooperative sugar mills	Fuel availability	Not specified	<ul style="list-style-type: none"> <li>• Change in management of the cooperatives</li> <li>• Difficulty in raising equity</li> </ul>
	Low (season) High (Off Season)	Low	High
>1 MW scale project on other types of distributed/captive biomass on combustion route	<ul style="list-style-type: none"> <li>• Increase in fuel prices</li> <li>• Seasonality of availability</li> <li>• Absence of benchmarks/standards</li> <li>• Investment in biomass depots</li> </ul>	Lack of information on new biomass materials, suitability, operating parameters, optimum capacity, costs, etc.	<ul style="list-style-type: none"> <li>• Policy risks</li> <li>• Investment in transmission and distribution</li> </ul>
	High	High	Low
<1 MW scale projects on different distributed biomass materials (pyrolysis/gasification route)	<ul style="list-style-type: none"> <li>• Increase in fuel prices</li> <li>• Seasonal available</li> <li>• Investment in biomass depots</li> <li>• Absence of benchmarks/standards</li> </ul>	<ul style="list-style-type: none"> <li>• Limited industrial base</li> <li>• Lack of standardization</li> <li>• Lack of information on efficiency levels of different biomass types, operating parameters, costs etc.</li> </ul>	Investment in transmission and distribution
	High	High	High

### 3. Contingent Fund Components

The implementation of the contingent fund would be facilitated through targeted technical assistance for the identified barrier induced risks and dedicated investment support for covering investment risks would be implemented. The project envisages the creation of a contingent fund equivalent to US\$ 5 million, in addition to a US\$ 1 million for technical assistance support. This fund is primarily aimed at assisting the select FIs for removing MIP specific barriers for their development, creating contingent fund to be used by select FIs during post project replication phase, as well as for mainstreaming biomass power project financing activity within the select

and other FIs. The entire contingent fund will be specifically used for developing and commissioning 7 MIPs proposed in Part I of the project.

### 3.1 Technical Assistance for the Identified Barrier Induced Risks

The technical assistance component would mainly address barriers that pertain to specific MIPs in the identified investment sectors, and support development of MIP projects. TA will support activities such as benchmarking, defining baseline to monitor the performance against the set benchmarks, and risks identified during the technical appraisal of the MIP. The technical assistance support will be in the nature of one-time grant component and is expected to facilitate replication of MIPs by the select FIs in the post project period.

The indicative technical assistance component for development of MIPs and removal of specific barriers for different categories have been given in Table 2 along with indicative budgets. However the selection of them or additional components for actual application will be decided by the financial institutions, depending on the actual requirement of the specific MIP and project promoter for its ensured success. The distribution of TA for development of MIPs in target categories as shown in Table 2 below are indicative and will be fine tuned as a separate generic TA activity 4.2 mentioned earlier.

**Table 2. Technical Assistance for Development of MIPs**

Sr. No.	Risk/MIP Type	Indicative TA Component(s)	Indicative Budget (US \$)
1	Biomass Resources		
1.1	Bagasse Cogen in Co-op Mills	<ul style="list-style-type: none"> <li>Develop guidelines for biomass assessment and depot mapping and undertake actual studies</li> <li>Testing of available biomass materials</li> <li>Developing and executing fuel supply agreements</li> </ul>	<p>10000</p> <p>2500</p> <p>12500</p>
		Subtotal 1.1	25000
1.2	> 1 MW scale project on distributed/captive sources	<ul style="list-style-type: none"> <li>Develop guidelines for biomass assessment and depot mapping &amp; undertake actual field studies</li> <li>Testing of available biomass materials</li> <li>Developing &amp; executing fuel supply agreements with depot entrepreneurs</li> <li>Selection and training of village entrepreneurs/NGOs/SHGs for depot management</li> </ul>	<p>10000</p> <p>2500</p> <p>12500</p> <p>12500</p>
		Subtotal 1.2	37500
1.3	< 1 MW projects on distributed biomass sources	<ul style="list-style-type: none"> <li>Develop guidelines for biomass assessment &amp; depot mapping &amp; undertake actual field studies</li> </ul>	25000

Sr. No.	Risk/MIP Type	Indicative TA Component(s)	Indicative Budget (US \$)
		<ul style="list-style-type: none"> <li>• Testing of available biomass materials</li> </ul>	10000
		<ul style="list-style-type: none"> <li>• Developing &amp; executing fuel supply agreement with depot entrepreneurs</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Selection and training of village entrepreneurs/NGOs/SHGs for depot management</li> </ul>	40000
		Subtotal 1.3	100000
2.1	Bagasse cogen in co-op sugar mill	<ul style="list-style-type: none"> <li>• Develop guidelines and execute project development agreements</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Evaluation of operating HP boilers/cogen plants</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Develop guidelines for specifications</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Develop guidelines and appraisal of project proposals and selection</li> </ul>	50000
		<ul style="list-style-type: none"> <li>• Appraisal of project promoter</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Financial structuring and closure</li> </ul>	50000
		<ul style="list-style-type: none"> <li>• Develop guidelines negotiate &amp; sign PPA</li> </ul>	25000
		Subtotal 2.1	225000
2.2	>1 MW scale project on distributed biomass materials	<ul style="list-style-type: none"> <li>• Evaluation of operating HP boilers and biomass power plants</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Performance trials with new biomass materials/combinations</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Develop guidelines for specifications</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Financial structuring &amp; closure</li> </ul>	50000
		<ul style="list-style-type: none"> <li>• Develop guidelines for O &amp; M &amp; MIS</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Capacity building of key operating staff</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Appraisal of project/promoter</li> </ul>	25000
		Subtotal 2.2	200000
2.3	<1 MW scale projects on distributed biomass materials	<ul style="list-style-type: none"> <li>• Evaluation study of select biomass gasifiers &amp; grid connected plants &amp; models</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Performance trials on different materials</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Feasibility study on institutional models</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Develop guidelines &amp; undertake appraisals of project proposals/selection &amp; appraisal of project promoters</li> </ul>	100000
		<ul style="list-style-type: none"> <li>• Develop guidelines &amp; execute financial structuring &amp; closures</li> </ul>	100000
		<ul style="list-style-type: none"> <li>• Develop guidelines for specifications, O &amp; M &amp; MIS</li> </ul>	25000
		<ul style="list-style-type: none"> <li>• Capacity building of select</li> </ul>	37500

Sr. No.	Risk/MIP Type	Indicative TA Component(s)	Indicative Budget (US \$)
		entrepreneurs	
		Subtotal 2.3	337500
3.1	Bagasse cogen in co-op sector	<ul style="list-style-type: none"> <li>Develop wheeling/banking agreement</li> <li>Develop model energy purchase agreement</li> </ul>	12500
		Subtotal 3.1	25000
3.2	>1 MW project on distributed/captive materials	<ul style="list-style-type: none"> <li>Develop wheeling/banking agreement</li> <li>Develop model energy purchase agreement</li> </ul>	12500
		Subtotal 3.2	25000
3.3	<1 MW projects on distributed biomass materials	<ul style="list-style-type: none"> <li>Feasibility study for creating distribution networks</li> <li>Develop energy supply agreements with individual consumers of distributed network.</li> </ul>	12500
		Subtotal 3.3	25000
	<b>Total</b>		<b>1000000</b>

### 3.2 Contingent Finance or Investment Support for Covering Investment Risks

The contingent financing support would be used to support investment risks associated in the target sub-sectors. The performance of the fund would be demonstrated by select FIs and investors of the MIPs. The contingent financing support will however be in the form of both contingent grant and loan components, depending upon the type of investment risk that would be mitigated as per specific requirement of the MIPs. In the interest of large-scale commercialization and successful demonstration of contingent fund, both the contingent grant and loan component are expected to revolve.

The indicative contingent financing support components for different MIP categories for removal of specific risks have been provided in table 3 along with indicative budget. The financial institutions will use their wisdom in consultation with the expert investment/financial structuring agency, in designing the type of support (contingent loan and/or grant) and extent required depending on their appraisal of the project/promoter risks and expertise, for ensured success of the support structures, through successful operation and repayment by the promoter. The distribution of contingent fund as shown in Table 3 below is indicative and will be changed suitably within the overall budget by the select FIs, depending on the actual requirements. This will also be done through a separate generic TA activity no. 4.2 as mentioned earlier.

**Table 3. Contingent Financing Support Components for Different MIP Categories**

S. No.	Risk/MIP Type	Indicative Contingency financing component	Indicative Budget (US \$)
1	Biomass Resource		
1.1	Bagasse Cogen in co op mills	Subordinate debt for equity risks for Biomass Depots	100000
1.2	>1 MW project on distributed/captive biomass materials	Subordinate debt for equity risks for depots(up to 15%)	117500
1.3	<1 MW project on distributed biomass materials	Subordinate debts for equity risk for depots(up to 20%)	295000
		<b>Subtotal (1)</b>	<b>512500</b>
2	Technology		
2.1	Bagasse cogen in Co-op sugar mills	<ul style="list-style-type: none"> <li>• Subordinate debt for equity risk (upto 5%)</li> <li>• Performance Guarantee funds</li> </ul>	<ul style="list-style-type: none"> <li>1000000</li> <li>175000</li> </ul>
2.2	>1 MW project on distributed/captive biomass	<ul style="list-style-type: none"> <li>• Subordinate debt for equity risk(upto 10%)</li> <li>• Performance guarantee fund</li> </ul>	<ul style="list-style-type: none"> <li>600000</li> <li>250000</li> </ul>
2.3	<1 MW project on distributed biomass	<ul style="list-style-type: none"> <li>• Subordinate debt for equity risk(upto 10%)</li> <li>• Venture/risk capital(upto 10%)</li> <li>• Performance guarantee fund</li> </ul>	<ul style="list-style-type: none"> <li>650000</li> <li>650000</li> <li>312500</li> </ul>
		<b>Subtotal (2)</b>	<b>3637500</b>
3	End Use Application		
3.1	Bagasse cogen in co-op mills	-	-
3.2	>1 MW project on distributed/captive biomass	-	-
3.3	<1 MW project on distributed/captive biomass	<ul style="list-style-type: none"> <li>• Subordinate debt for equity risk for distribution network</li> <li>• Venture/risk capital for distribution network</li> </ul>	<ul style="list-style-type: none"> <li>550000</li> <li>300000</li> </ul>
		<b>Subtotal (3)</b>	<b>850000</b>
		<b>Grand Total (1+2+3)</b>	<b>5000000</b>

The entire contingent fund, including the technical assistance linked to it and contingent financing of MIPs, will be routed through the financial institutions. As a part of the project activity, this fund will be created at select financial institution(s). MIPs' specific financial structuring models will be designed by experienced investment banking financial consultant working closely with the select FIs. The specific financial institutions will be very carefully

selected through a separate generic TA activity number 4.1. Depending on the requirement of MIPs in different target categories, a single or additional financial institutions will be selected. e.g. for 2 MIPs proposed in co-operative sugar mill - IPP and greater than 1 MW scale biomass power project, one financial institution may be selected. For balance 5 MIPs, less than 1 MW scale biomass power projects another FI may be selected. For this scale of operation, very small entrepreneurs and project promoters will be required and certain financial institution catering to large projects may not have the experience and intentions which other FIs may have. The select FIs would implement the contingent schemes with an aim to ensure revolving of the contingent financing support provided to the MIPs and for project replication by mainstreaming this sector into their existing and/or modified schemes. It will be ensured that the select FIs will certainly have wherewithal for managing the activities for developing and financing MIPs for successful implementation. A separate generic TA activity no. 4.2 deals with designing of financial structuring models for MIPs and utilising TA / contingent fund for MIPs by the select FIs. This activity will be undertaken with help of an expert and experienced financial structuring agency, which will work with the select FIs and other stakeholders throughout the process of development, financing and commissioning of the MIPs.

The necessary agreements will be developed and entered into with the select FIs for transfer, management, execution and administration of both the TA and contingent financing fund totaling to US \$ 6 M, for developing MIPs in the above target sectors. The experience of development and successful commissioning of MIPs proposed in Part I will be the guide in Part II and post project replication phases. Appropriate development of MIPs and financing mechanisms for them, hence itself requires lot of work and the select FIs will have the necessary capacity and expertise. Required additional legal support for developing agreements with the select FIs will be from National and / or International experts.

It is proposed under the project budget and financing plan that UNDP / GEF will contribute the entire TA fund for developing MIPs of US \$ 1 M and MNES will contribute 80% of the contingent fund for MIPs of US \$ 5 M (US\$ 4 M), with balance 20 % (US\$ 1 M) from UNDP/ GEF.

The TA fund for developing MIPs will be spent for the specific components involved therein. These funds normally will not come back from the project promoters of MIPs to the select FIs and hence, they will be one time grant. However, development and successful commissioning of MIPs will help the FIs and the project promoters to learn about these components and it will further help them in Part II and post project replication phases. FIs can develop mechanisms for partial or total funding for such components in the post project phase as grant or loan basis or link them with their financing schemes and terms. The level of interest will be decided by the select FIs and generally will be in the range of 5 to 8 %. The total contingent fund available with FIs including interest and repayments are expected to cover grant components like venture risk capital as well as the TA component grants.

A summary of provision of TA and contingent fund components for target categories is given in Table 4 below:

Table 4: Summary of provision of TA & contingent fund components for MIPs

Sr. No.	MIP type / category	Indicative budget, US \$		
		TA	Contingent financing	Total
1.	Bagasse cogen in co-operative sugar mills	275000 (17.5%)	1300000 (82.5%)	1575000 (26.25%)
2.	Greater than 1 MW scale projects on distributed / captive biomass	262500 (21%)	992500 (79%)	1255000 (20.92%)
3.	Less than 1 MW scale projects on distributed biomass	462500 (14.6%)	2707500 (85.4%)	3170000 (52.8%)
	<b>Total</b>	<b>1000000</b>	<b>5000000</b>	<b>6000000</b>

#### 4. Terms of Contingent Fund

The following criteria may apply for assistance through contingent funds:

- All components of contingent financing put together would not exceed 20% of investment in MIPs.
- Any risk identified would be incremental to the conventional project risks.
- Equity participation would be limited to 5 – 10% depending upon the feasibility, sustainability and replicability potential identified, as per industry standards and judgment by the financial institutions.
- Projects in advanced stages of financial closure or almost financially closed already will not be eligible.

#### 5. Management Arrangements

The funds would be channeled through the select Financial Institutions under an MOU with the MNES. The terms and conditions of MOU would be circulated to the FIs for their concurrence. The PMC to be established by MITCON will coordinate the technical support request of the Financial Institutions. Project Steering Committee, Project Ex. Committee and Project Management Cell will monitor the administration and management of both TA and contingent fund components for MIPs to be routed through the select FIs, during the project period.

## A Comparative Analysis of MNES Schemes Vs. Proposed Contingent Framework

Biomass Market Segment	MNES Schemes	Brief Review	Proposed Contingent Framework
I. Bagasse Cogen in cooperative sugar mills	<ul style="list-style-type: none"> <li>• Capital grant / soft loan scheme for 12 demo projects, 1994-99, with 23% grant in aid, 43% soft loan @ 9% &amp; 8% state share capital</li> <li>• Interest subsidy scheme, 1999-2003, equivalent to 2-4% based on pressure configuration, with ceiling of 11% for interest</li> <li>• Capital grant / soft loan scheme for IPP – co-op. / joint sector model for 4 projects in focused states</li> <li>• Prevailing interest subsidy scheme, 4-6% based on pressure configuration, 6% ceiling for interest and US \$ 0.85 M upper limit</li> </ul>	<ul style="list-style-type: none"> <li>• 7 projects sanctioned, only one commissioned due to barriers</li> <li>• Very few co-ops. were able to avail this scheme, against large beneficiaries in the private sector, due to financial barriers</li> <li>• No concrete proposals were submitted due to non-availability of standard PDAs and financial, policy &amp; regulatory &amp; structural barriers</li> <li>• Financing barriers still continue, hence the success will be limited</li> </ul> <p>No high efficiency cogen plant has been installed in co-op. / joint sectors till date, either on own investment or IPP model, despite large potential</p>	<p>While the technical assistance component includes biomass assessment &amp; linkage, guidelines for project development agreements, appraisal of IPPs, development of model PPAs, etc., the contingent support mainly includes subordinate debt for equity risks and performance guarantee, the main identified risks in this sector, up to 10% of project cost, on repayment basis. Long term involvement of FIs including project selection, commitment for replication &amp; usage of different financial instruments ensured.</p>
II. >1MW scale project on other types of distributed	<ul style="list-style-type: none"> <li>• Interest subsidy in line with scheme for sugar mill cogen from 1999-2003</li> <li>• Prevailing interest subsidy scheme includes 2-3% subsidy beyond 60 kg/cm<sup>2</sup> configuration, 8% interest</li> </ul>	<p>Fairly successful with 37 projects aggregating to 180 MW capacity in place, mainly on rice husk, other biomass materials or combinations not demonstrated so far.</p>	<p>TA components for identified barriers includes biomass assessment and linkage, capacity building, equipment evaluation, performance trials for new materials combinations, guidelines for</p>



<p>captive biomass on combustion route</p>	<p>ceiling and US \$ 0.43 M</p>		<p>specifications, O&amp;M, model wheeling / banking / purchase agreements. The contingent finance support for identified risks includes subordinate debts for equity risks &amp; performance guarantees up to 15% of project cost. Long term involvement of FIs including project selection, commitment for replication &amp; usage of different financial instruments ensured.</p>
<p>III. &lt;1 MW scale projects on different distributed biomass materials (pyrolysis/gasification route)</p>	<p>Capital grant of varying proportions to different types including thermal / electrical applications, gasifier based village electrification, demo projects for biomass gasifiers coupled with producer gas engines, biomass gasifier based power stations in special states / islands and MW scale advance biomass gasification</p>	<p>1800 biomass gasifier based power projects with 53 MW installed capacity demonstrated in different parts of the country, performance evaluation and technology improvements undertaken, commercialisation for different types of biomass materials still not achieved</p>	<p>Technical assistance component for identified barriers includes biomass assessment and fuel linkage, capacity building, evaluation of select grid power plants, performance trials for different materials, feasibility on institutional models, appraisal guidelines, feasibility for distribution networks, model energy supply agreements. The contingent finance components for identified risks include subordinate debts for equity risks, venture capital, performance guarantee, etc. up to 20%. Long term involvement of FIs including project selection, commitment for replication &amp; usage of different financial instruments ensured.</p>