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# United Nations Development Programme

Government of India

## Terminal Evaluation of UNDP/GEF Project: India: Removal of Barriers to Biomass Power Generation Part I

(GEF Project ID: 1199; UNDP PIMS ID: 740)

### Terminal Evaluation Report

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## SYNOPSIS

**Title of UNDP supported GEF financed project:** Removal of Barriers to Biomass Power Generation (RBBPG Project)

**UNDP Project ID:** PIMS 740

**GEF Project ID:** 1199

**Evaluation time frame:** September 2006 to June 2017

**CEO endorsement date:** January 13, 2005

**Project implementation start date:** September 22, 2006

**Project end date:** July 31, 2017

**Date of evaluation report:** August 31, 2017

**Region and Countries included in the project:** India

**GEF Focal Area Objective:** OP-6 (for GEF-3): Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs

**Implementing partner and other strategic partners:** Implementing partner: Ministry of New and Renewable Energy (MNRE)

**Evaluation team members:** Mr. Roland Wong, International Consultant  
Mr. Parimal Sadaphal, National Consultant

### **Acknowledgements:**

The Evaluators wish to acknowledge with gratitude the time and effort expended by all project participants and stakeholders during the course of the Terminal Evaluation of the project “Removal of Barriers to Biomass Power Generation”. In particular, we wish to thank the UNDP India, the Ministry of New and Renewable Energy as well as other former Project managers and former Project personnel for making the efforts to recall details of their time while on the project. In particular, we wish to thank all the personnel we met in New Delhi (at the Ministry of New and Renewable Energy, IREDA, Bathinder, (Punjab State), Washim, (Maharashtra State), and Vadodara (Gujarat State) for their time to provide their opinions on the impact of this Project, and for your hospitality and insights. We sincerely hope that this report contributes towards an energy independent and low carbon country.

## EXECUTIVE SUMMARY

This report summarizes the findings of the Terminal Evaluation Mission conducted during the July 12-21, 2017 period for the UNDP-GEF Project entitled: “*Removal of Barriers to Biomass Power Generation Part I*” (hereby referred to as the RBBPG Project or the Project), that received a US\$ 5.65 million grant from the Global Environmental Facility (GEF) in January 2005.

### Project Summary Table

Project Title:	<i>Removal of Barriers to Biomass Power Generation Part I (RBBPG Project)</i>			
GEF Project ID:	3554		<i>at endorsement (Million US\$)</i>	<i>at completion (Million US\$)</i>
UNDP Project ID:	4044	GEF financing:	5.650	5.200
Country:	India	IA/EA own:	0	0.250
Region:	Asia and the Pacific	Government:	21.000	16.830
Focal Area:	Climate Change	Other:	26.200	2.900
FA Objectives, (OP/SP):	OP6 for GEF 3: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs	Total co-financing:	21.000	19.980
Executing Agency:	Ministry of New and Renewable Energy (MNRE)	Total Project Cost:	26.200	25.180
Other Partners involved:		ProDoc Signature (date project began):		January 13, 2005
		(Operational) Closing Date:	Proposed: January 13, 2008	Actual: July 31, 2017

### Project Description

The RBBPG ProDoc was prepared based on the barriers identified in 2001. With the world’s second largest population of more than 1.1 billion people and a sustained GDP growth rate ranging from 3.8% to 10.6% from 2002 to 2016, the Government of India has been seeking the means to reduce its CO<sub>2</sub> emissions from increases in energy consumption, predominantly generated from the use of coal and other fossil fuels in the energy sector, and to mitigate the impacts of climate change. Despite encouraging recommendations from the GoI on increasing biomass power generation prior to the commencement of the RBBPG Project, the deployment of biomass power generation technologies was slow (see Para 13) when compared to the availability and collection of biomass. Common barriers to widespread development of biomass power generation encountered during the preparation of the RBBPG project preparation phase in 2002 included:

- Insufficient capacity of stakeholders and an inadequate institutional and policy framework supportive of biomass power generation at the national, regional and local levels;
- Lack of institutional and regulatory framework in the distribution and sale of electricity from biomass power projects;
- Absence of commercial and service networks to provide security of biomass supplies to power plants;

- Limited access to financing for biomass power project proponents;
- Lack of interest of State Electricity Boards (SEBs) in promoting biomass power generation (with coal being a primary competitive fuel source); and
- Absence of effective information dissemination related to the availability of biomass, suitable technologies for its utilization, and benefits to industries and communities.

By removing these barriers within the design 3-year period Part I of the RBBPG Project, biomass power generation development would be further scaled-up in Part II.

The Project goal was to “improving electricity supply without increasing GHG emissions through widescale application of biomass power generation technologies” and its goal of “accelerating adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas (including captive power use and open access power sale), through demonstration of model investment projects (MIPs) demonstrating development models and establishment of sustainable business/support services network and undertaking enabling activities for removal of the key barriers”.

## Project Results

The Project goal and objective and overall outcomes of the RBBPG Project Part I are summarized on Table A against intended outcomes in the RBBPG’s revised Project Results Framework (PRF) of the latter half of 2013.

**Table A: Comparison of Intended Project Outcomes from revised LFA of 2013 to Actual Outcomes**

Intended outcomes in revised LFA of 2013	Actual Outcomes as of July 2017
<p><b>Project Goal:</b> To improve electricity supply without increasing GHG emissions through wide-scale application of biomass power generation technologies EoP target (2016): additional 15.2 MW cumulative capacity MIPs implemented, Approx over 460,000 tCO<sub>2</sub> during project duration and over 3.7 million tCO<sub>2</sub> over lifetime of all MIPs implemented under project</p>	<p><b>Actual achievement of Project goal:</b> Electricity supplies have not been improved through widescale application of biomass power generation technologies. Only 4.2 MW of cumulative capacity (greenfield MIPs) out of which 3.2 MW are not currently operational. Furthermore, GHG emission reductions achieved during the Project duration was in the order of 172,000 tCO<sub>2</sub>, most of which was achieved through strengthened fuel supply linkages, and not through greenfield projects and new equipment.</p>
<p><b>Project Objective:</b> To accelerate the adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas (including captive power use and open access power sale), through demonstration of model investment projects (MIPs) demonstrating development models and establishment of sustainable business/support services network and undertaking enabling activities for removal of the key barriers.</p>	<p><b>Actual achievement of Project objective:</b> The 7 MIPs implemented on the RBBPG Project Part 1 did not accelerate the adoption of environmentally sustainable biomass power technologies for captive power use or open access power sales. Furthermore, the completion of 4 of these MIPs only successfully demonstrated strengthened fuel supply linkages, and facilitated sustainable biomass supply services networks to improve the power load factors for existing biomass power plants.</p>
<p><b>Outcome 1:</b> Technology package benchmarking &amp; validation for different</p>	<p><b>Actual Outcome 1:</b> Technology package benchmarking was developed for gasification technologies, and technologies used in</p>

Intended outcomes in revised LFA of 2013	Actual Outcomes as of July 2017
<p>biomass power technologies, including feasibility of energy plantation ...Technology packages, performance standards, benchmarks for potential biomass power technologies developed and available for use in public domain. Exploring potential feasibility of biomass-hybrid systems. Assessment undertaken of wasteland potential for energy plantation and viable PPP models developed in selected states.</p>	<p>the various MIPs. In addition, a feasibility study on an energy plantation on wastelands was prepared but did not result in any viable public-private partnership models and investments. Furthermore, no studies have been completed on the potential of biomass hybrid projects, nor were any DPRs finalized on any biomass hybrid projects that were submitted to MNRE.</p>
<p><b>Outcome 2:</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....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 &amp; management) and promotional material and awareness raised significantly in pilot states</p>	<p><b>Actual Outcome 2:</b> The capacities of project promoters, financial institutions, regulators, policy makers, SNAs and other stakeholders has been enhanced, however, not to the extent to catalyze investments in biomass power projects. Notwithstanding generation of knowledge products from the Project (including newsletter related to bioenergy and biopower, good practice documents, documents on regulatory issues, and discussion papers) and Project support for 3<sup>rd</sup> country study tours, these have been insufficient in capacity building to remove all barriers to accelerate development of biomass power in India. Furthermore, the late launching of the Government’s knowledge portal in May 2015 (<a href="http://www.biomasspower.gov.in">www.biomasspower.gov.in</a>) did not facilitate the enhancement capacities and confidence of targeted stakeholders; this webpage has not been updated since March 2016.</p>
<p><b>Outcome 3:</b> Development of business, commercial and support services networks in focused states - Appropriate biomass power business models have been widely disseminated and established in the initial pilot states.</p>	<p><b>Actual Outcome 3:</b> Appropriate biomass power business models for grid-connected plants were not established until 2014, at which time biomass power was becoming less competitive to other renewables such as solar PV. Despite competition from lower solar PV tariffs, the Project made strong efforts to obtain CERC commitment to a national biomass tariff, and to stress the importance of supporting the strengthening of biomass supply chains to biomass power plants.</p>
<p><b>Outcome 5<sup>1</sup>:</b> Model Investment Projects (MIPs) cumulating to 15.2 MW (comprising of 9 MW for gasification/ combustion based power generation including open access sale, 4 MW for non-bagasse based co/tri-generation using captive biomass, 2.2 MW small gasifier systems/packages for greening about 200 telecom towers in cluster mode) contracted and implemented in remaining extended project period till March 2016 (EoP)</p>	<p><b>Actual Outcome 5:</b> The Project supported 3 MIPs totaling of 4.2 MW of greenfield biomass power. Only 1.0 MW (1 out of 3 MIPs) can be considered operational. None of these are the small gasifier systems for greening 200 telecom towers. Instead, the Project supported 4 MIPs totaling 47 MW of brownfield MIPs or existing power plants by supporting strengthened fuel supply linkages to improve PLFs of the plants.</p>

<sup>1</sup> Outcome 4 was dropped with the 2013 revision of the RBBPG LFA.

## Summary of Conclusions, Recommendations and Lessons

The overall rating of the RBBPG Part I Project is *unsatisfactory*. The RBBPG Project Part I did not catalyze investments into biomass power projects and expended less than 60% of the GEF grant of US\$5.65 million over an 11-year period. A primary reason for this outcome was in overambitious design that expected to remove a number of regulatory, fiscal, institutional and capacity barriers that impede the accelerated the development of biomass power generation projects, all within a 3-year period.

Another important reason for this outcome was failure of the Project to adapt to changing market conditions in the renewable energy market and move away from the development of grid-connected biomass power plants which were under threat from less costly solar PV power generation. The Project, instead, should have placed more emphasis on more attractive biomass power generation development models such as captive power generation in agro-industries and biomass power generation for the avoidance of rice stalk burning in the Punjab.

### Corrective actions for the design, implementation, monitoring and evaluation of the project:

*Action 1 (to MNRE and UNDP): To improve design of these projects, especially where the objective is to catalyze of multimillion dollar investments for biomass power generation projects, project preparations should include appropriate capacity building activities such as:*

- Ensuring the setup of a biomass power demonstration plant where lessons of design, implementation and operation can be disseminated;
- Extensive handholding with project proponents and state level regulators to ensure a functional demonstration that will instil confidence in potential investors.

*Action 2 (to MNRE and UNDP): To improve implementation of this project, the PMC needed to drive the project with project personnel making more efforts for face-to-face meetings with stakeholders including prospective investors that would be a part of a process to “know your client” especially if the investors are seeking Project support for their investment, for project implementers to understand their comprehension of biomass project investment risks and mitigative actions, and for state regulators to improve their capacity and knowledge of biomass power plant (BMPP) development and enable them to promote and confidently approve BMPP implementation.*

*Action 3 (to MNRE and UNDP): To improve implementation of this project, the Project could have been implemented under direct execution by UNDP that would have allowed MNRE to test innovative implementation approaches on projects (that were required under this Project for the purposes of catalysing biomass power plant investments) without the intense scrutiny for approval of funds under a GoI budget line.*

### Actions to follow up or reinforce initial benefits from the project:

*Action 4 (to current MIP proponents, MNRE and UNDP). All MIPs or demonstration projects should employ a monitoring officer to compile data and information pertaining to energy generation, plant revenue and GHG emission reductions.*

*Action 5 (to MNRE): The aforementioned information of MIP energy savings and investment rates of return needs to be disseminated to a large forum. This was not done on the RBBPG Project Part I.*



Proposals for future directions underlining main objectives of RBBPG Project:

*Action 6 (to MNRE): MNRE needs to improve its collaboration with appropriate biomass associations to promote captive biomass projects with agro-industrial owners and operators, notably those displacing imported fossil fuels.*

*Action 7 (to MNRE): MNRE should propose NCEF compensation to a Punjab state utility for purchase of more costly biomass power as “credit” for air pollution alleviation.*

Best and worst practices in addressing issues relating to relevance, performance and success:

*Best practice: The Project recognized the importance of biomass supply security by diverting project resources as an adaptive management measure to strengthen biomass applies to existing biomass power plants.*

*Poor practice: Promotion multi-crore rupee investments into biomass power generation cannot be merely done through a top-down approach.*

*Poor practice: Project failed to adapt to changing market conditions, focusing only on promotion of distributed generation instead of the captive power market and projects driven by substantial environmental benefits.*

**Evaluation Ratings<sup>2</sup>**

<b>1. Monitoring and Evaluation</b>	<b>Rating</b>	<b>2. IA &amp; EA Execution</b>	<b>Rating</b>
M&E design at entry	2	Quality of Implementation Agency - UNDP	4
M&E Plan Implementation	2	Quality of Execution - Executing Entity (MNRE)	2
Overall quality of M&E	2	Overall quality of Implementation / Execution	3
<b>3. Assessment of Outcomes</b>	<b>Rating</b>	<b>4. Sustainability<sup>3</sup></b>	<b>Rating</b>
Relevance <sup>4</sup>	2	Financial resources	1
Effectiveness	3	Socio-political	1
Efficiency	2	Institutional framework and governance	1
Overall Project Outcome Rating	2	Environmental	4
		Overall likelihood of sustainability	1

<sup>2</sup> Evaluation rating indices (except sustainability – see Footnote 2, and relevance – see Footnote 3): 6=*Highly Satisfactory (HS)*: The project has no shortcomings in the achievement of its objectives; 5=*Satisfactory (S)*: The project has minor shortcomings in the achievement of its objectives; 4=*Moderately Satisfactory (MS)*: The project has moderate shortcomings in the achievement of its objectives; 3=*Moderately Unsatisfactory (MU)*: The project has significant shortcomings in the achievement of its objectives; 2=*Unsatisfactory (U)* The project has major shortcomings in the achievement of its objectives; 1=*Highly Unsatisfactory (HU)*: The project has severe shortcomings in the achievement of its objectives.

<sup>3</sup> Sustainability Dimension Indices: 4 = *Likely (L)*: negligible risks to sustainability; 3 = *Moderately Likely (ML)*: moderate risks to sustainability; 2 = *Moderately Unlikely (MU)*: significant risks to sustainability; and 1 = *Unlikely (U)*: severe risks to sustainability. Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions.

<sup>4</sup> Relevance is evaluated as follows: 2 = Relevant (R); 1 = Not relevant (NR)

## ABBREVIATIONS

Acronym	Meaning
APR-PIR	Annual Project Report - Project Implementation Report
BERI	Biomass Energy for Rural India (UNDP-GEF Project)
BMPP	Biomass power plant
BOOT	Build, Own, Operate, Transfer
CDM	Clean Development Mechanism
CERC	Central Electricity Regulatory Authority
CII	Confederation of Indian Industry
CO	UNDP Country Office
CO <sub>2</sub>	Carbon Dioxide
COE	Centre of Excellence
CP	Country Programme
CPAP	Country Programme Action Plan
DPR	Detailed project report
EC	Energy Conservation
ECN	Energy Research Centre
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EOI	Expression of Interest
EOP	End-of-Project
ESCOM	Electricity Service Company
EU	European Union
FICCI	Federation of Indian Chambers of Commerce and Industry
FIT	Feed-in tariff
FY	Fiscal Year
FYP	Five-Year Plan
GBI	Generation-based incentive
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEP	Greenhouse Prevention Project
GoI	Government of India
GHG	Green House gas
HCCI	Haryana Chamber of Commerce and Industries
IBPA	Indian Biomass Power Association
ICICI	Industrial Credit and Investment Corporation of India
IDBI	Industrial Development Bank of India
IEP	Integrated Energy Policy of 2006
IISc	Indian Institute of Science
INR	Indian Rupee
IREDA	Indian Renewable Energy Development Agency
KMS	Knowledge Management and Sharing
KPCL	Karnataka Power Corporation Limited
kWh	kilowatt hour
LFA	Logical Framework Analysis
LFM	Logical Framework Matrix
M&E	Monitoring and evaluation
MIP	Model Investment project
MITCON	Maharashtra Industrial and Technical Consultancy Organization

Acronym	Meaning
MOEF	Ministry of Environment and Forests
MNRE	Ministry of New and Renewable Energy (formerly Ministry of Non-Conventional Sources or MNES)
Mtoe	Million tonnes of oil equivalent
MTR	Midterm Review
MW	Megawatt
NAPCC	National Action Plan on Climate Change
NCEF	National Clean Energy Fund
NEX	National Execution Modality
NGO	Non-governmental organization
NPC	National Project Coordinator
NPD	National Project Director
OP	Operational Programme of GEF
PAC	Project Advisory Committee
PCB	Pollution Control Board
PIMS	UNDP/GEF Project Information Management System
PIR	Project Implementation Report
PLF	Power load factor
PMC	Project Management Cell
PPA	Power purchase agreement
PPP	Public-private partnership
PRF	Project Results Framework
PSC	Project Steering Committee
PV	Photovoltaic
RBBPG	Removal of Barriers to Biomass Power Generation
RBI	Reserve Bank of India
R&D	Research and Development
RPO	Renewable Purchase Obligation
RSIL	Ruchi Soya Industries Ltd.
SEB	State Electricity Board
SERC	State Electricity Regulatory Commission
SEIA	Socio-Economic and Environment Impact Assessments
SMART	Specific, Measurable, Attainable, Relevant and Time-bound
SME	Small-to-medium enterprise
SNA	State Nodal Agency
tCO <sub>2</sub>	Tonne of Carbon Dioxide
TE	Terminal Evaluation
TERI	The Energy Research Institute
ToR	Terms of Reference
TPES	Total primary energy supply
TRAI	Telecom Regulatory Authority
UN	United Nations
UNDAF	UN Development Assistance Framework
UNFCCC	UN Framework Convention on Climate Change
UNDP	UN Development Programme
USAID	United States Agency for International Development
USD	United States dollar (= 66 Indian Rupee)

## 1. INTRODUCTION

1. This report summarizes the findings of the Terminal Evaluation Mission conducted during the July 12-21, and August 8-10, 2017 periods for the UNDP-supported GEF-financed Project entitled: “Removal of Barriers to Biomass Power Generation - Part I” (hereby referred to as the RBBPG Project or the Project), that received a USD 5.65 million grant from the Global Environmental Facility (GEF).
2. The objective of the 2-part RBBPG Project was to “remove barriers to the increased use of biomass energy sources for generating electricity for own consumption and export to the grid”. Part I of the Project was to provide technical assistance and investment support in a limited number of states. Part II was to focus on providing support for risk mitigation to stimulate further replication investments across the targeted sectors and allow for participation in a wider selection of states, once their policy and regulatory environment become more favorable to biomass power.

### 1.1 Purpose of the Evaluation

3. In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP supported GEF-financed projects are required to undergo a Terminal Evaluation (TE) upon completion of implementation of a project to provide a comprehensive and systematic account of the performance of the completed project by evaluating its design, process of implementation and achievements vis-à-vis GEF project objectives and any agreed changes during project implementation. As such, the TE for Part I of the RBBPG Project serves to:
  - promote accountability and transparency, and to assess and disclose levels of accomplishments of the Project in the context of providing technical assistance in the setup of biomass power projects, streamlining regulatory approvals and contracts, impacts resulting from the risk measures taken by the Project, the demonstrative impact of pilot biomass power projects in the selected states with perceived abundance of biomass, and the replication of pilot investments in biomass power projects;
  - synthesize lessons that may help improve the selection, design and implementation of future GEF activities;
  - provide feedback on issues that are recurrent across the renewable energy portfolio that require attention, and on improvements regarding possible follow-up efforts to scale up biomass power plant investments; and
  - contribute to the GEF Evaluation Office databases for aggregation, analysis and reporting on effectiveness of GEF operations in achieving global environmental benefits and on the quality of monitoring and evaluation across the GEF system.
4. This TE was prepared to:
  - be undertaken independent of Project management to ensure independent quality assurance;
  - apply UNDP-GEF norms and standards for evaluations;
  - assess achievements of outputs and outcomes, likelihood of the sustainability of outcomes, and if the Project met the minimum M&E requirements; and
  - report basic data of the evaluation and the Project, as well as provide lessons from the Project on broader applicability. This would include an outlook and guidance in charting future directions by UNDP, the Government of India, on continued support for the increased use of

biomass for power generation and reducing GHG emissions from the power generation sector in India.

## 1.2 Scope and Methodology

5. The scope of the TE for the RBBPG Project Part I was to include all activities funded by GEF and activities from parallel-financing. The Terms of Reference (ToRs) for the TE are contained in Appendix A. Key issues addressed on this TE include:

- Design of the RBBPG Project and its effectiveness in achieving its stated objective of “improving electricity supply without increasing GHG emissions through wide scale application of biomass power generation technologies” and its goal of “accelerating adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas (including captive power use and open access power sale), through demonstration of model investment projects (MIPs) demonstrating development models and establishment of sustainable business/support services network and undertaking enabling activities for removal of the key barriers”;
- Assessment of key financial aspects of the Project, including the extent of co-financing planned and realized;
- The effectiveness of the RBBPG Project in the piloting of biomass power technologies for captive and distributed biomass materials in niche areas;
- Strengths and weaknesses of RBBPG implementation, monitoring and adaptive management and sustainability of Project outcomes including the Project exit strategy;
- Results and impacts of the implemented Project activities including views from RBBPG Project focal points (and other relevant stakeholders) on the impacts of the RBBPG Project activities implemented and their recommendations on the future activities on the scale up of the Project for Part II; and
- Recommendations, lessons learned, best practices from implementing this Project that could be used on other similar GEF projects.

6. The methodology adopted for this evaluation includes:

- Review of project documentation (i.e. APR/PIRs, meeting minutes of Project Steering Committee or multipartite meetings) and pertinent background information;
- Interviews with key project personnel including the current and former Project Managers, technical advisors, and Project developers;
- Interviews with relevant stakeholders including other government agencies and institutes; and
- Field visits to selected Project sites and interviews with beneficiaries.

A detailed itinerary of the TE Mission is provided in Appendix B. A full list of people interviewed and documents reviewed are given in Appendix C and Appendix D respectively. The TE Mission Team for the UNDP-GEF project was comprised of one international expert, and one national expert.

7. The Project was evaluated for overall results in the context of:

- *Relevance* – the extent to which the outcome is suited to local and national development priorities and organizational policies, including changes over time;

- *Effectiveness* – the extent to which an objective was achieved or how likely it is to be achieved;
  - *Efficiency* – the extent to which results were delivered with the least costly resources possible; and
  - *Sustainability* - The likely ability of an intervention to continue to deliver benefits for an extended period of time after completion.
8. All possible efforts have been made to minimize the limitations of this independent evaluation. Notwithstanding that more than 10 days were spent in Punjab, Maharashtra, Gujarat, Karnataka and New Delhi by the evaluation team to collect and triangulate as much information as possible, follow-up interviews and Skype conversations by the evaluation team were also made after the July and August mission. However, information gathering work of the TE team was seriously constrained by the following:
- Unavailability of detailed information on the Project, particularly MIPs, at UNDP as well as at MNRE offices. In fact, no current updates on the status of MIPs were available in both these offices, neither were any officials from the PMU holding charge of this Project available for interaction with the TE team.
  - Lack of proper project documentation especially with reference to reporting of physical progress against appropriate activities, outputs and outcomes as detailed in the ProDoc
  - Inconsistency in use of terms such as outcome and output, which have been used interchangeably in the APR/PIR
  - Use of outputs and outcomes in the APR/PIR that are not mentioned in the ProDoc;
  - Lack of activity-wise financial data.

As such, the TE team took a longer period of time to understand the Project and reconcile it to the logframe matrix (LFM) in the ProDoc, the recommendations of the July 2011 Mid-Term Review (MTR), and the revised version of the LFM in the form of the 2013 Project Results Framework (PRF) against which they were required to evaluate the progress. The TE team has made every effort to understand the Project and present a fair and a well-considered assessment of the project. Any gross misrepresentation of the Project is entirely on account of the aforementioned problems with documentation and data, which was beyond the scope and capacity of the TE team.

### 1.3 Structure of the Evaluation Report

9. This TE report is presented as follows:
- An overview of Project activities from commencement of operations in September 2006 to the 2017 activities;
  - An assessment of Project results based on Project objectives and outcomes through relevance, effectiveness and efficiency criteria;
  - Assessment of sustainability of Project outcomes;
  - Assessment of monitoring and evaluation systems;
  - Assessment of progress that affected Project outcomes and sustainability; and
  - Lessons learned and recommendations.
10. This evaluation report is designed to meet GEF's "Guidelines for GEF Agencies in Conducting Terminal Evaluations, Evaluation Document No. 3" of 2008:

<http://www.thegef.org/gef/sites/thegef.org/files/documents/Policies-TEguidelines7-31.pdf>

11. The Evaluation also meets conditions set by:

- the UNDP Document entitled “UNDP GEF – Terminal Evaluation Guideline”:  
<http://web.undp.org/evaluation/documents/guidance/GEF/UNDP-GEF-TE-Guide.pdf>;
- the UNDP Document entitled “Handbook on Planning, Monitoring and Evaluating for Development Results”, 2009:  
<http://www.undp.org/evaluation/handbook/documents/english/pme-handbook.pdf>; and
- the “Addendum June 2011 Evaluation”:  
<http://www.undp.org/evaluation/documents/HandBook/addendum/Evaluation-Addendum-June-2011.pdf>

## 2. PROJECT DESCRIPTION AND DEVELOPMENT CONTEXT

12. India has relied primarily on the use of fossil fuels to try for its economic growth and development. However, with its improvement in GDP, usage of imported fossil fuels for its power generation, transport, and industrial production has drastically increased creating adverse environmental impacts as well as threats to the energy security of India. In response, the Government of India (GoI) through the Ministry of Non-Conventional Energy Sources (MNES) announced a *National Programme on Biomass Power and Bagasse Cogeneration* in 1993 to include 12 demonstration projects in the cooperative and state sugar mill sector, complete with detailed project reports, biomass assessment studies, and incentives to state nodal agencies and financial institutions. Other promotional efforts made during this programme included guidance to the states for formulating policies for the purchase of power from such projects, particularly in major sugar and biomass producing states, workshops, training programs, awareness programs, and business meets for capacity building. Financial incentives included interest subsidies to encourage development of bagasse cogeneration, biomass power plants, cogeneration in industries and other gasification technologies up to 2001. MNES also encouraged research and development for biomass power generation during this period.
13. This resulted in a total installed capacity of 132 MW of biomass power and 226 MW of bagasse cogeneration with a total of 358 MW installed in 2001. By the end of the 9<sup>th</sup> Five Year Plan Period (1998-2002), more than 600 MW of biomass power generation was installed constituting around 3% of the total biomass power potential of India. These projects had received financial and technical assistance from the Indian Renewable Energy Development Agency, Industrial Development Bank of India (IDBI), and Industrial Credit and Investment Corporation of India (ICICI) as well as the United States Agency for International Development (USAID) under the Greenhouse Prevention Project (GEP).
14. To support development of biomass power generation, MNES commissioned several biomass studies from 1995 to 2004 to estimate the availability of surplus biomass from agricultural residues and agro processing industries. Based on household surveys covering 500 talukas and about 100 districts in 23 states, these studies concluded that 540 million tonnes per year of biomass were available<sup>5</sup>, out of which an average of 15-20% of these residues could be made available for power generation without affecting present uses significantly. These surpluses were found to be much higher in northern states of Punjab, Haryana and Western U.P in the form of paddy straw (which is frequently burnt in fields), and due to multiple annual crop rotations that raise the per capita production of biomass.
15. Under India's 10<sup>th</sup> Five Year Plan (2002-2007), national promotion of biomass energy development was subdivided into biomass power/cogeneration and biomass gasification. To support biomass power generation development during this period, a biomass resource atlas was to be developed along with district-wise resource assessment studies in selected states and other research and development activities. Financial incentives were to be provided in the form of interest subsidies for biomass combustion, bagasse cogeneration, industrial cogeneration, and gasification for megawatt-scale power generation projects.

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<sup>5</sup> Data from the National Botanical Research Institute, Ministry of New and Renewable Energy and Technology Information, Forecasting & Assessment Council, Department of Science & Technology of Government of India.



16. Biomass power plants (BMPPs) received a boost in 2003 with the announcement of feed in tariffs under the Electricity Act<sup>6</sup>. However, few biomass projects were implemented due to the complex regulatory approval process for biomass power projects in India, and investor's lack of confidence in implementing successful and profitable renewable energy projects.
17. At the commencement of the RBBPG Project in 2006:
- cost of biomass for power plants was considered to be negligible resulting in tariffs for electricity from BMPPs in the order of Rs. 3 to 3.5/kWh;
  - plant machinery used in the biomass based power plant or bagasse based cogeneration plant was duty exempt as per Ministry of Finance notification of September 8, 2005;
  - power plants above 5 MW required EIA approval as per Ministry of Environment and Forests notification of September 16, 2006 (at that time, EIA approvals required 1 year, with another 3 months required for permits from the Pollution Control Board (PCB));
  - MNES was renamed the Ministry of New and Renewable Energy (MNRE) who issued the administrative approval<sup>7</sup> for cash incentives and capital subsidies to encourage development of grid connected power plants as a part of the *National Programme on Grid Interactive Biomass Power and Bagasse Cogeneration*. This included interest subsidies, accelerated depreciation, 10-year tax holidays, issuing the certificates for excise duty and custom duty exemptions<sup>8</sup>;
  - With State Nodal Agencies (SNAs) allotting biomass based power projects, no uniform policy existed for all states. Most SNAs were able to allot biomass based power plants up to a 6 MW capacity (with recent increases to 7.5 MW). Some SNAs allot biomass project sites in each district while some consider the distance between the projects, with others allotting on a first come first basis. Regardless, these methods were applied on an ad-hoc basis with no allotment policy being applied on the basis of availability estimates of surplus biomass. IREDA in an effort to mitigate risks in its biomass loan portfolio had fixed the command area of 50 km radius irrespective of the surplus biomass availability while financing the project. This led to less exploitation of biomass for power generation.

<sup>6</sup> The Parliament enacted "The Electricity Regulatory Commission Act- 1998" No: 14 of 2nd July 1998, an Act for the establishment of a Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs), rationalization of electricity tariff, transparent policies regarding subsidies, promotion of efficient and environmentally benign policies and for matters connected with or incidental to SERCs and the CERC, and declared tariff for renewable energy sources. The base-electrical-energy-purchase price for 1994-95 shall be minimum of Rs. 2.25/kWh. The base-price shall be escalated at a rate of 5% every year for a period of 10 years.

<sup>7</sup> Administrative approval on Scheme for Promotion of Grid Interactive Power Generation Projects based on Renewable Energy Sources for 2006-07, MNRE, 26.12.2006

<sup>8</sup> Currently, these programmes extended the capital subsidy to private sector Independent Power Producers (IPPs) for biomass-based power plants, bagasse based cogeneration plants, and biomass based cogeneration on the:

- National Programme based on Biomass Gasifier consisting of 3 components: (a) Gasifier based programme for off-grid distributed power for rural areas for supporting biomass gasifier based distributed off grid power systems in rural areas limited to 250 kW; (b) Biomass gasifier based captive power generation in rice mills for meeting their captive needs and surplus power fed into the grid and distributed in local areas; and (c) Biomass gasifier based grid-connected power programme;
- National Programme on Biomass Energy and Cogeneration (Non Bagasse) in Industry. The objective of this Programme was to encourage the deployment of biomass cogeneration systems in industry for meeting their captive thermal and electrical energy requirements with supply of surplus power to the grid, to conserve the use of fossil fuels for captive requirements in industry, to bring about reduction in GHG emissions in industry and to create awareness about the potential and benefits of alternative modes of energy generation in industry. Under the programme, financial assistance and support is provided for setting up biomass co-generation (non-bagasse) projects for meeting captive heat and power requirements of industry.

18. The RBBPG Project Part I was designed to create an investment-friendly environment for biomass power projects through the removal of these barriers that would catalyse investment in biomass power generation in India, and help India realize its potential in biomass power generation.

## 2.1 Project Start and Duration

19. The RBBPG project identification form (PIF) was approved on October 15, 2002 and endorsed to the GEF CEO by January 13, 2005. The Government of India (GoI) signed the Project document (ProDoc) on September 22, 2006, marking the official start date of the RBBPG Project Part I. The first RBBPG Project disbursement was on July 3, 2007. The Project duration for Part I originally was planned for 3 years ending in September 22, 2009.
20. However, with poor progress during the 2006 to 2008 period of the Project, a Mid-Term Review (MTR) was conducted in mid-2011 with a recommendation that the Project be extended from October 2012 for another 2 years, 2 months ending in December 2014. In mid-2013, the RBBPG Part I Logical Framework Matrix (LFA) was revised with new targets and timelines including a recommendation for the extension of the Project termination date of December 31, 2016. The latest date requested by MNRE was 30 September 2017.
21. During the period over which the RBBPG Part I Project was implemented, India as well as the world had experienced phenomenal economic growth that has facilitated significant changes and major reforms in the power generation and distribution sector as well as petroleum and the renewable energy sectors. During the RBBPG Project Part I, market conditions for the growth of biomass power generation experienced a number of significant events:
  - As mentioned in Para 17, cost of biomass in 2006 for power plants was considered to be negligible, ranging from Rs. 750 per tonne of biomass resulting in tariffs for electricity from BMPPs in the order of Rs. 3 to 3.5/kWh;
  - In 2008, the Central Electricity Regulatory Authority (CERC) initiated its own efforts to revise all renewable energy tariffs and provide guidelines to all State Electricity Regulatory Authorities (SERCs) in India<sup>9</sup>. This included states of Punjab, Haryana, Rajasthan, Tamil Nadu and Maharashtra who had revised tariffs favourably for the purchase of power from biomass power plants;
  - Simultaneously, India had been experiencing phenomenal economic growth spurring growth in urban areas and widening the demand supply gap for electricity. The initial response of the electricity market was:
    - a curtailment of rural electricity supplies in favour of urban areas which had better ability to pay for energy services; and
    - Energy Service Companies more willing to buy power from any source, even renewable energy sources to address the widening demand supply gap of electricity;
  - MNRE had reported that the installed capacity of biomass power plants and bagasse cogeneration in 2008 was 1,677 MW, which represented 10% of the estimated biomass power

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<sup>9</sup> Evolved from a CERC Discussion Paper on “Promotion of Co-generation and Generation of Electricity from Renewable Sources of Energy”, on 16th May 2008. This paper only covers grid-connected generation mainstreaming the term “renewable” to cover small hydro, wind, biomass and solar plants which were perceived in 2008 as being viable. Co-generation was also included in the paper due to the potential for high energy conversion efficiency and subsequent environmental benefits.

installed capacity potential of 16,000 MW (of which 5,000 MW was bagasse generation). Much of this growth was driven by biomass power projects that were qualified under CDM;

- By 2010 and 2011, biomass prices were rising due to other uses of biomass competing with power generation. Biomass prices, as such, rose from Rs. 750 per tonne to the range of Rs. 2,000 to 2,500 tonne, placing stress on existing operators to operate profitable BMPPs;
- By March 2013, MNRE reported that more than 2,808 MW power was being produced through cogeneration route (about 83% from bagasse based cogeneration and the remaining 17% from non-bagasse based cogeneration), with approximately 1,265 MW being produced through direction combustion Rankine cycle power generation. A Project-financed discussion paper in 2013 reported that more than 25-30% of these plants out of 1,265 MW were not operational due to various reasons such as increasing costs for biomass, low tariffs, and several biomass plants in Chhattisgarh being switched to coal<sup>10</sup>;
- By May 2014 and May 2015, CERC issued revised biomass electricity tariffs rising towards Rs. 7/kWh as guidance to SERCs. Adoption of this new tariff guidance by SERCs has been slow (see Paras 102 to 104);
- With falling global prices of solar PV equipment around 2015 and 2016, electricity prices from solar PV sources were becoming increasingly attractive reducing market demand for electricity from biomass sources. As a result, the market for grid-connected biomass power generation was being reduced justifying the 2013 changes to the RBBPG Part I LFA.

## 2.2 Problems that RBBPG Part I Project Sought to Address

22. The RBBPG ProDoc was prepared based on the barriers identified in 2001. With the world's second largest population of more than 1.1 billion people and a sustained GDP growth rate ranging from 3.8% to 10.6% from 2002 to 2016<sup>11</sup>, the Government of India has been seeking the means to reduce its CO<sub>2</sub> emissions from increases in energy consumption, predominantly generated from the use of coal and other fossil fuels in the energy sector, and to mitigate the impacts of climate change. Despite encouraging recommendations from the Gol on increasing biomass power generation prior to the commencement of the RBBPG Part I Project, the deployment of biomass power generation technologies has been slow as described in Para 13 when compared to the availability and collection of biomass. Common barriers to widespread development of biomass power generation encountered during the preparation of the RBBPG project preparation phase in 2002 included:

- Insufficient capacity of stakeholders and an inadequate institutional and policy framework supportive of biomass power generation at the national, regional and local levels;
- Lack of institutional and regulatory framework in the distribution and sale of electricity from biomass power projects;
- Absence of commercial and service networks to provide security of biomass supplies to power plants;
- Limited access to financing for biomass power project proponents;
- Lack of interest of State Electricity Boards (SEBs) in promoting biomass power generation (with coal being a primary competitive fuel source); and
- Absence of effective information dissemination related to the availability of biomass, suitable technologies for its utilization, and benefits to industries and communities.

<sup>10</sup> "Discussion Paper on Removal of Barriers to Biomass Power Generation in India, Phase-I (UNDP Project ID: 00051271)", May 2013 by P.R. Reddy, Dwarka, New Delhi

<sup>11</sup> <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=IN>

By removing these barriers within the designed 3-year period Part I of the RBBPG Project, biomass power generation development would be further scaled-up in Part II.

23. With the Mid Term Evaluation of the RBBPG Project Part I carried out in middle of 2011, concerns were raised that the Project, even with its remaining resources and its need for a Project extension, would not be able to achieve its GHG emission reduction goals. The MTE further went on to identify new barriers resulting from the changed market and regulatory environment as described in Para 21, and recommending the urgent need to the revisit LFA to reset realistic targets and reorganize work activities with Project extension timelines to March 2016.
24. Details of the LFA revisions are found in Section 2.4. The Project LFA revisions from 2013 are summarized as follows:
  - Dropping of Outcome 4 for the creation of fund for contingent financing;
  - The addition of activities within Output 1.1 to explore the potential of hybridization of biomass with other renewable energy technologies such as solar thermal and biogas;
  - Strengthening of Project linkages with biomass power practitioners at the regional and state levels within Outcome 3, and supporting advocacy of biomass power through the Indian Biomass Power Association (IBPA) within Output 2.2;
  - Resetting the target or additional cumulative installed capacity of greenfield MIPs from 26.73 MW to 15.2 MW. These will consist of:
    - 9 MW for gasification and combustion based power generation including open access sale;
    - 4 MW for non-bagasse based co- and tri-generation using captive biomass; and
    - 2.2 MW for clusters of greening of total 200 about telecom towers (@11kW capacity) including demonstrating innovation in technology/management/fuel linkages.

## 2.3 Goal and Objective of the RBBPG Project Part I

25. The Project goal as taken from the ProDoc and the revised LFA from 2013 was to “improving electricity supply without increasing GHG emissions through widescale application of biomass power generation technologies” and its objective was to “accelerate adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas (including captive power use and open access power sale), through demonstration of model investment projects (MIPs) demonstrating development models and establishment of sustainable business/support services network and undertaking enabling activities for removal of the key barriers”. The revised RBBPG Project Results Framework (PRF) from July 2013 is contained in Appendix F.

## 2.4 Baseline Indicators Established

26. The original 2003 LFA from the RBBPG Part I ProDoc did not contain a full set of targets for the indicators provided. As such, the 2011 MTE also recommended a revision of the Project’s 2003 LFA to revise intended outcomes, outputs and activities that could be reasonably achieved with the remaining funds, the pace of expenditures, and the assumption that there would be 3 years remaining on Part I of the Project (based on the recommendation by the MTE to extend the Project to March 31, 2016). This is further discussed in Section 3.1.1.

27. Goal-level baseline indicator for the revised 2013 PRF of the RBBPG Project Part I is “extent of supply and energy needs met by biomass power projects, reduction of CO<sub>2</sub> emissions. By end of project (EoP), additional MIPs up to 15.2 MW<sub>e</sub> of biomass power generation contracted”. Targets include:
- EoP target (2016): additional 15.2 MW cumulative capacity MIPs implemented;
  - Approximately over 460,000 tCO<sub>2</sub> during project duration and over 3.7 million tCO<sub>2</sub> over lifetime of all MIPs implemented under project.

The baseline value for all these indicators at the start of the RBBPG Project was zero.

28. Objective-level baseline in the 2013 PRF was set as the “rate of commercial adoption of sustainable biomass power technologies in India”. The target for this indicator is the “additional green field MIP’s up to 15.2 MW (comprising of 97 MW for gasification/combustion based power generation including open access sale, 4 MW for non-bagasse based co/tri-generation using captive biomass, 2.2 MW demonstrating small gasifier systems for greening telecom towers contracted and implemented in remaining extended project period till March 2016).

The baseline value for all these indicators at the start of the RBBPG Project was zero.

29. The 2013 revised outcome-level baseline indicators and targets for the RBBPG Project includes:
- Outcome 1: Technology package benchmarking & validation for different biomass power technologies, including feasibility of energy plantation:
    - Output 1.1:
      - Study reports on potential of biomass hybrid (solar thermal, biogas, etc) technology for power generation documented and submitted to PMU (Target: 1);
      - DPRs of potential biomass-hybrid finalized and submitted to MNRE (Target: 1);
    - Output 1.2: Developed benchmark for MIPs and their validation through a technical team (Target: 1);
    - Output 1.3: One study report on feasibility of dedicated energy plantation on wasteland. DPRs with potential PPP models prepared and submitted to PMU (Target: 1);
    - Output 1.4: Study report on findings of socio-economic impact of biomass power plants with regard to employment generation, livelihood improvement and environment, prepared and submitted to PMU (Target: 1);
  - Outcome 2: Enhanced Capacities and confidence of Project Promoters, Financial Institutions, Regulators, Policy Makers, SNAs, other stakeholders through effective information development & dissemination program, along with capacity building initiatives:
    - Output 2.1:
      - Quarterly Newsletters – Bio energy India published and disseminated (Target: 12);
      - Good Practice documents (model DPR and fuel purchase agreement, energy purchase/ wheeling/ banking, and project development agreements) of biomass power plants prepared (Target: 3);
    - Output 2.2:
      - Document on support provided to Indian Biomass Power Association (IBPA) on various tariff, regulatory, and policy related issues (Target: 1);
      - Discussion papers prepared on various issues (Target: 6);
      - Minutes/proceedings of thematic discussion forums, brain-storming meeting (Target: 6);

- User interactive knowledge portal for the Biomass Power Sector launched and regularly updated over project period (Target: 1);
- Consultative meetings with SNAs, SEBs, industry associations and project promoters organized and documented. Capacity building modules developed and implemented in target states and sectors (Target: 4);
- Specific number of study tours organized (Target: 3);
- Outcome 3:
  - National level event organized annually involving participant of various partners, stakeholders, project developers. Various state/regional level events organized involving particular category of stakeholders to brainstorm/discuss key topics/issue by sharing expertise, knowledge (Target: 3);
- Outcome 5<sup>12</sup>:
  - MIPs cumulating to 12MW additional capacity selected, all financial closure effected and MIPs got commissioned and stabilized for its operation in focus states and target sectors. Targets are Cumulating 15.2 MW (in remaining period) covering:
    - 9 MW cumulative open access sale
    - 4 MW cumulative non bagasse based co/tri-generation
    - 2.2 MW small gasifier systems for telecom tower clusters
  - Performance of all MIPs commissioned got monitored, evaluated and documented. The future replication strategy/plan evolved based on major learnings/findings documented from MIPS commissioned (Target for each MIP implemented cluster in case of telecom towers);

The baseline value for all these indicators at the start of the RBBPG Project Part I can be found in Appendix F.

## 2.5 Main Stakeholders

30. The main stakeholders of the RBBPG Project Part I are the Ministry of New and Renewable Energy (MNRE). While there are several other stakeholders that are associated with this Project, Project funds involving these stakeholders were channeled through MNRE. An elaboration of stakeholders who have participated or received support from the RBBPG Project Part I is provided in Section 3.2.2 (Para 65-68).

## 2.6 Expected Results

31. To achieve the specific objective of “accelerating the adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas (including captive power use and open access power sale), through demonstration of MIPs demonstrating development models and establishment of sustainable business/support services network and undertaking enabling activities for removal of the key barriers”, the RBBPG Part I Project (as of 2013) was designed for the removal of barriers with the following expected **Project outcomes**:
- Outcome 1: Technology package benchmarking & validation for different biomass power technologies, including feasibility of energy plantation;

<sup>12</sup> The activities of Outcome 4 were dropped as described in Para 32.

- Outcome 2: Enhanced Capacities and confidence of Project Promoters, Financial Institutions, Regulators, Policy Makers, SNAs, other stakeholders through effective information development & dissemination program, along with capacity building initiatives;
  - Outcome 3: Development of business, commercial and support services networks in focused states;
  - Outcome 5: Model Investment Projects (MIPs).
32. Outcome 4 regarding the creation of a contingent financing fund for MIPs was cancelled during the 2013 revisions of the PRF.

### 3. FINDINGS

#### 3.1 Project Design and Formulation

33. Design of the RBBPG Project was conducted during the period of 2002-2005 and, as mentioned in Para 14, included a national estimate of over 540 million tonnes of biomass available for power production per year<sup>13</sup>. Assuming 70 to 75% of biomass waste being used as fodder or domestic cooking, 140 to 170 million tonnes of biomass waste would be available for power production, equivalent to installed capacities of 18,000 to 23,000 MW. Approximately 6,000 to 7,000 MW of installed capacity could be developed by agro-industrial sectors related to sugar, rice and oil mills. In addition to this available biomass waste for power generation, the use of more than 70 million ha of wasteland was viewed as potential for energy plantations. These estimates of the potential of biomass were viewed as sufficiently catalytic for investments into biomass power generation by implementing 3 strategic actions, namely: knowledge development, dissemination and demonstration of MIPs to complement emphasis of the GoI on biomass-based power generation.
34. As mentioned in Para 13, less than 600 MW of biomass power generation was installed constituting less than 3% of the total biomass power potential of India. Implementation of the RBBPG Project Part I was to result in the removal of barriers to biomass power development through improvements in the regulatory framework at both the central and state government levels, improving technical capacity of biomass professionals, and improving information dissemination of biomass power generation. More importantly, the RBBPG Project Part I with its support to develop demonstration biomass power generation projects, would increase confidence of potential investors over a 3-year period. Success of Part I was to have led to a scaled-up investment programme in biomass power generation which was to be supported under Part II of the RBBPG Project.
35. Under the original LFA, the RBBPG Project Part I was to provide resources over a 3-year period to develop grid-connected biomass power projects to be undertaken with cooperative sugar mills, agro-processing industries and biomass power plants using distributed and decentralized biomass resources. The original ProDoc also targeted states with the most favourable biomass power development policies for model investment projects (MIPs). Part I, however, failed to deliver MIPs as designed with one of the chief reasons being that the Project goal and objective were *overly ambitious* tasking the Project to achieve the completion of 7 biomass power projects (totaling 26.73 MW of “greenfield” installed capacity) throughout India, and monitor the performance of the plants for 6 to 12 months, all within a period of 3 years. To achieve this, the Project would have had to overcome the following “baseline” barriers to biomass energy development in India that were prevalent in 2006:
- The lack of available firm and bankable proposals for greenfield biomass power projects. Without any standardization or official documentation of biomass power technologies, the Project team needed to develop 7 bankable MIPs within Year 1 of the Project;
  - Biomass project proponents would have needed to complete planning, engineering design, contracts totaling 26.73 MW of installed capacity by Year 1;
  - Regulatory approvals for these projects or other construction projects were not yet streamlined, with construction regulatory permits taking upwards of 18 to 24 months per project; and

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<sup>13</sup> 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



- Construction and commissioning for these biomass projects would take a minimum of 18 months.

Scheduled as a 3-year project in the ProDoc, Part I of the RBBPG Project had *little to no chance* of achieving its goal and objective of developing of 26.73 MW of installed capacity for biomass power projects as this would have taken a minimum of 56 months<sup>14</sup>. As expected, operation of the first greenfield biomass power plant was not completed until 2013 (the 1.0 MW biomass plant at Sankhera, Gujarat developed by Ankur Technologies in Vadodara, Gujarat), 7 years after the commencement of RBBPG Part I.

36. The MTE of the RBBPG Project Part I was conducted in 2011, citing poor progress in the implementation of MIPs, changing market conditions involving rising biomass prices, and distribution companies offering power purchase agreements (PPAs) involving fixed low tariffs over a long period of time. One of the main recommendations from the MTR was a review of the RBBPG Project Part I LFA to reset realistic targets and to reorganize activities (in consideration of the complexities encountered during the 2008-2011 period in implementing small-scale biomass power projects), all within a new Project time frame that assumed a no-cost Project extension to March 2014.
37. This LFA review was undertaken in 2013 as outlined in Section 2.2. The resulting revisions of this review were:
- factoring in a review of ongoing initiatives that included the greening telecom towers as recommended by the Telecom Regulatory Authority (TRAI) on GoI directives for the telecom sector to become green<sup>15</sup>;
  - revision of targets for cumulative capacity of the MIPs by making them more realistic thereby increasing chances of achieving targets. This would lead to expanded geographical coverage for MIPs and coverage of a wider range of biomass power models including non-bagasse co/tri-gen, biomass hybrids, captive plants, plants selling power in the open access market, and small demonstration pilots with state-of-art gasifier technologies for greening telecom towers; and
  - to drop Outcome 4 in response to a Project-sponsored study<sup>16</sup> that concluded that there was no demand for the “creation of fund for contingent financing” with IREDA (Outcome 4). Resources in Outcome were aimed at capacity building, raising awareness creation and risk mitigation for participating financial institutions.

<sup>14</sup> A rough estimate include preparatory work by the PMC (6 months), advertisement of MIPs (3 months), identification of MIPs (2 months), preparation of Detailed Project Reports (3 months), final selection of MIPs and issuing comfort letters (3 months), promoter procuring nine statutory clearances (18 months), commissioning and implementation of the MIP (18 months) and learning lessons (12 months - one full cycle of year). This totals 65 months (approximately 5.5 years).

<sup>15</sup> In 2013, India had around 400,000 telecom towers with an average power consumption per tower of 3 to 4 kW. Assuming 8 hours of operation by diesel generation sets, an average annual fuel consumption of 8,760 liters of diesel per tower, total carbon emissions from diesel use by telecom towers was estimated to be around 10 million tonnes CO<sub>2</sub>, while annual emission from electricity from the grid by towers was estimated to be in the order of 6 million tonnes CO<sub>2</sub>. The Indian telecom industry represents around 1% percent of the country's total CO<sub>2</sub> emissions. The directive to the telecom sector was to become green with targets of at least 50% of rural and 20% of urban telecom towers by 2015 (which would be enhanced to further to 75% and 33% respectively by 2020) with hybrid (renewable power + grid) and aim to reduce carbon foot print of telecom service providers up to 17% by 2023.

<sup>16</sup> “Identification of Financial Institutions for Operation of Fund for Contingent Financing and Development of Financial Models for MIPs” for MNRE by Ernst & Young, January 2011

### 3.1.1 Analysis of Project Planning Matrix

38. As previously mentioned, there were 2 planning matrices for the RBBPG Part I Project. While this section is devoted to the analysis of the 2013 (and revised) Project Results framework (PRF), the Evaluation Team has the following comments on the original Log frame Matrix (LFM) that was prepared in 2003<sup>17</sup>:

- This LFM contained a narrative of each objective, outcome and output with corresponding “objectivity verifiable indicators” to be monitored with means of verification and corresponding critical assumptions for their success;
- A critical deficiency of the LFM is the lack of clarity of targets which in some cases can be derived from the narrative of the objective, outcome and output as well as the verifiable indicators;
- The LFM also needed to be linked with a timeline for each of the components which is implied on Tables 6, 7 and 8 on Page 23 of the ProDoc (where components are referred to as “activities”) which was to take 3 years to complete Part I and the full dispersal of the US\$5.65 million GEF grant. In hindsight, this was overambitious despite the best intentions in 2005 and 2006 to increase biomass power generation;
- Due to slow implementation of the Project from 2006 to 2008, revision of the LFA was recommended in 2011 to reflect changing market conditions for the production of biomass power, and to refocus Project activities to support biomass power generation projects towards financial viability.

39. The revised Project Results framework (PRF) for the RBBPG Project Part I (as shown in Appendix F) provides 22 indicators (1 goal indicator, 1 objective-level indicator, 4 outcome level indicators and 16 output level indicators) to guide implementation of the Project towards its overall Project goal of “improving electricity supply without increasing GHG emissions through widescale application of biomass power generation technologies”. The wording of *RBBPG Project indicators and targets do not meet SMART criteria*<sup>18</sup> or best practices for the preparation of PRFs. In the opinion of the evaluation team, the absence of SMART indicators and clear targets in this revised PRF only raised the level of difficulty in effectively managing this Project. Specific comments on the quality of the revised PRF follows:

- The description of the various strategies (covering goal, objective, outcomes and outputs), needs to be more concise to articulate a specific outcome or output with an economy of words. For example:
  - the Project objective could simply be “acceleration of the adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials”. The remaining part of the objective as provided in the revised PRF is actually a description of various project outputs which does not need to be placed in the objective description;
  - the Outcome 2 description can be concisely described as “enhanced capacities and confidence of Project promoters, financial institutions, policy makers and other stakeholders”. The remaining description of Outcome 2 in the revised PRF again describes various project activities and outputs which does not need to be placed in the description of Outcome 2;

<sup>17</sup> Annex B, pg 44 of the RBBPG ProDoc

<sup>18</sup> Specific, Measurable, Attainable, Relevant and Time-bound

- Outcomes 3 and 5 should be written as outcomes, not project activities or outputs. Outcome 3 should have been described as “business, commercial and support services networks have been developed in focused states”. Similarly, Outcome 5 should have been described as “MIPs commissioned and implementation started” (which is actually described as the indicator);
  - All indicators listed in the revised PRF, again need to be concise. For example, the Project goal indicators could have been “cumulative installed capacity of MIPs (in MW by EOP)” and “tonnes CO<sub>2</sub> reduced cumulatively by EOP” with the provision of a numerical value in the column of “target”. Similar adjustments to all other output indicator descriptions could have been made more concise by providing how the outputs are achieved in footnotes so as not to clutter the narratives in the PRF. Examples include:
    - an indicator of Activity 2.2.3 could have been simplified to “number of consultative meetings with key stakeholders” with a footnote describing that these consultative meetings should also deliver capacity building modules to attendees;
    - the indicator of Output 3.1 could have been simplified to “number of awareness raising events at state and regional levels conducted by EOP”;
    - the indicator for Output 5.2 is incomprehensible, and could have been simplified to “number of commissioned MIPs that are monitored and evaluated and documented”;
  - There is a low level of ambition of some of the outcomes, notably Outcomes 2 and 3. Knowledge products, study tours and information sharing events were to be delivered. However, the Project could deliver these outputs without needing to conduct any follow-up surveys or discussions to meet the objective of the Project of accelerating biomass power generation projects. Furthermore, the activities of Outcome 3 (being the “development of business, commercial and support services networks in focused states”) do not appear to contribute to this outcome. The outcome label, as such, is misleading;
  - The Evaluation Team believes that outcome level indicators are not necessary since the delivery of the outputs should be designed to achieve a particular outcome. For example, in the revised PRF, the outcome level target is repeated in the output level targets. Elimination of outcome level indicators and targets would avoid such repetition.
40. GHG emission reductions proposed on the RBBPG Project in the ProDoc was only covered on page 43 with an estimation of 0.14 mt CO<sub>2</sub> of GHG emission reductions generated by 43 MIPs. Moreover, this target was not even mentioned on the original LFA in the ProDoc, and no breakdown was available on scheduling of the 7 MIPs to be implemented during Part I of the RBBPG Project.
41. In the absence of detail GHG emission reductions calculations, the MTE of 2011 did provide some calculations of GHG emission reductions generated from 2 MIPs implemented. The midterm evaluators conservatively counted only a certain percentage of the actual GHG emission reductions from these MIPs based on the contributions made by the GEF grant to the operation of these MIPs<sup>19</sup>. GHG emission reductions were not revised when the PRF was revised in 2013.
42. Overall, the quality of the project planning matrices for the RBBPG Project (both the original LFA of 2006 in the ProDoc and the revised PRF in 2013) can be rated as **unsatisfactory**. Indicators and

<sup>19</sup> For the Pandurang SSKL bagasse project, 17.3% of the total GHG emission reductions were attributed to the RBBPG Project contributing 7,604 tCO<sub>2</sub> per year, based on GEF support for the use of cane waste as fuel for the power plant. For the Malwa Power Plant in the Punjab, 25% of the total fuel used was attributed to the RBBPG Project contributing 12,006 tCO<sub>2</sub> per year, based on GEF support for the purchase of tillers that improved access of the power plant to rice straw.

targets for monitoring by the PMU needed to be simplified with timelines to clearly articulate what was to be achieved by the end of Part I of the RBBPG Project.

### 3.1.2 Risks and Assumptions

43. In the RBBPG ProDoc, critical assumptions were provided in the LFM including:

- Bio-mass power remains as the national focus for renewable energy power development;
- The stakeholders and project promoters look for bio-mass power as viable opportunities.

44. Project risks and mitigation measures identified in the RBBPG ProDoc includes:

- low performance and reliability of technologies;
- reluctance of state regulators to uphold renewable energy policy guidelines;
- fuel supply risks;
- delays in identifying project promoters and sponsors;
- slow implementation progress.

All these risks were rated as moderate with corresponding measures to mitigate the risks. Unfortunately, due to slow implementation of the Project during its initial years from 2006 to 2010, the Project encountered changes in market conditions for renewable energy which would change these aforementioned risk ratings from moderate to high, notably that of the reluctance of state regulators to uphold RE policy guidelines.

45. During the 2013 revision of the PRF, critical assumptions were reviewed and updated to suit ongoing market conditions including:

- various biomass hybrid technology sources are available;
- availability of expertise to undertake studies on biomass hybrid systems.

The 2013 revision of the RBBPG Project PRF, however, did not include a revision of the Project risks. The overall process of identification of assumptions and risks for the RBBPG Project appears to be reasonably thorough in light of the actual outcomes of the RBBPG Project in 2017. Again, however, the slow start and implementation progress of the RBBPG Project in 2006 and 2007 was unfortunate, leaving the Project unable to recover to meet its intended targets after 3 years of implementation, and to access funds for Part II.

### 3.1.3 Lessons from Other Relevant Projects Incorporated into RBBPG Project Design

46. The ProDoc of the RBBPG Project does list other relevant projects into its design:

- Government initiated national programme (Ministry of Non-Conventional Energy Sources), namely the “*National Programme on Grid Interactive Biomass Power and Bagasse Cogeneration*” that commenced in 1993 as mentioned in Para 12. Notwithstanding its slow progress, this program successfully demonstrated projects on a commercial basis using rice husk as the main feedstock. Key lessons learned include different investment models required to combine the interests of different stakeholders that have to be considered in making the entire project chain viable. This includes merging the interests of:

- agro-processing industries who do not see their role as power producers (but are dependent on the farmers);
- power producers who do not want to risk their investment without establishing the fuel linkages; and
- state utilities and private customers who do not yet have full confidence in the purchase of electricity from these producers;
- USAID’s Greenhouse Gas Prevention Project (GEP) on advanced bagasse based cogeneration projects in the cooperative sugar mill sector. The successes of this project primarily due to the involvement of the private sector should have been adopted into the RBBPG Project.

#### **3.1.4 Planned Stakeholder Participation**

47. Stakeholders were to be engaged on the RBBPG Project through personnel within the Project Management Cell (PMC) that was to be set up within the Maharashtra Industrial and Technical Consultancy Organization (MITCON). The PMC would engage stakeholders identified for capacity building in Activity II including “R&D institutions, SEBs, state and 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, stakeholder focus would be on the “development of required experts, professionals, groups of experts and professionals, NGOs and training institutions, service institutions, financial intermediaries, market intermediaries”.

#### **3.1.5 Replication Approach**

48. The Project design envisaged a replication approach through successful implementation of the MIPs of Outcome 4 complemented with:
- technical assistance to reduce risks during implementation of MIPs;
  - involvement of financial institutions in the region to develop skills and relevant experience that would allow them to continue to fund biomass projects after the EOP, and when funding of biomass projects becomes institutionalized using existing or revised business development models;
  - the establishment of a guarantee mechanism designed to become operational under Part II, using lessons learned under Part I to improve the success rate of MIPs developed.

#### **3.1.6 UNDP Comparative Advantage**

49. As is usually the case with several other UNDP projects, this Project also had a distinct advantage compared to projects funded by other donor agencies in terms of its focus on policy-based and cross-sectoral approaches as well as creating local capacities through effective collaboration with a wide range of local stakeholders, encompassing public and private sectors in addition to technical experts, civil society and grassroots level organizations. These approaches were strongly applicable to promoting biomass power generation projects on the RBBPG Project. Given UNDP’s long track record on a wide variety of projects within the energy sector, UNDP was appropriately suited as the agency championing this Project.

### 3.1.7 Linkages between RBBPG Project and Other Interventions within the Sector

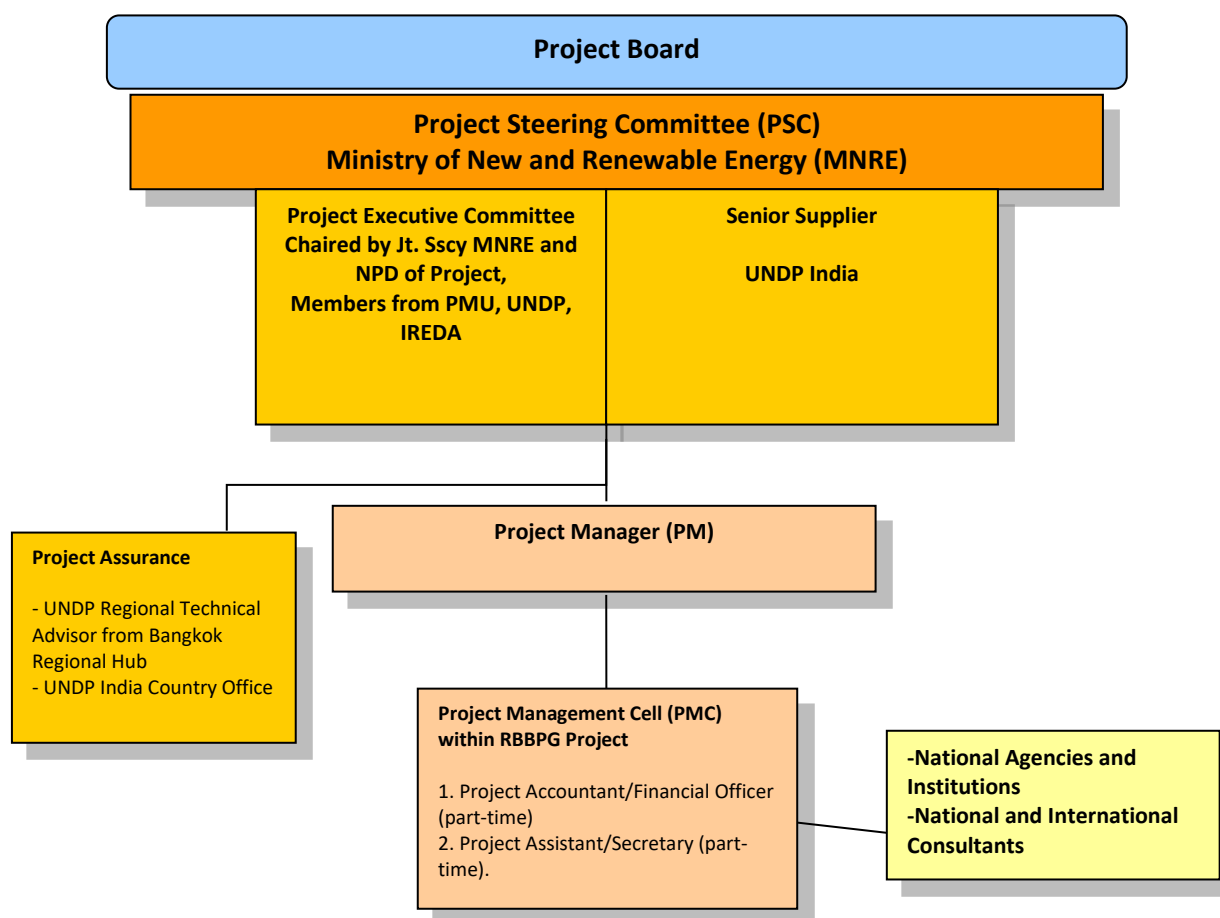
50. UNDP oversaw the implementation of two earlier GEF-supported projects in India that involve promoting biomass energy. The first is the biomethanation project (Development of High Rate Biomethanation IND/92/G32). This project promoted the development and implementation of high-rate biogas reactors. However, the technological focus of the project largely overlooked institutional and financial constraints resulting in equipment procurement delays, procedural delays in financial clearances, and reluctance by project proponents to contribute 50% of the capital costs. The experience on this project also demonstrated considerable time expended on preparation activities and stakeholder consultations. The RBBPG Project sought to utilize the technical assistance and investment risk mitigation support systems of this project to accelerate biomass power generation investments.
51. The second project (India Biomass Energy for Rural India IND/99/G31 or BERI) proposed a number of biomass energy technologies to meet rural energy needs in a village setting through a number of different business models. While the focus of this project is significantly different from the RBBPG Project, lessons from the BERI Project should have been incorporated into the RBBPG Project if deemed appropriate.

### 3.1.8 Management Arrangements

52. The implementing partner of the RBBPG Project was the Ministry of New and Renewable Energy (MNRE) in accordance with UNDP's National Implementation Modality (now referred to as National Execution or NEX modality). NEX modality tasked MNRE with responsibility for certifying work plans and approved budgets, reporting on procurement, coordinating and tracking co-financing, terms of reference for contractors and tender documentation, and chairing the Project Steering Committee (PSC). The Chair of the PSC was to be the National Project Director (NPD) from MNRE. In the approved ProDoc of 2005, the MNRE was named as the Implementing Partner. The name of this Ministry was changed in 2006 to its current name, MNRE. An organogram of the RBBPG Project Part I implementation arrangements is provided on Figure 1.
53. MNRE was to take overall responsibility for the execution and implementation of the Project. The PSC comprising of the MNRE, Ministry of Power, Rural Development, Planning and Environment, state nodal agencies, DEA, MoEF, and other line ministries was constituted. UNDP was to oversee the implementation of the Project. This PSC was to be set up under the chairmanship of the Secretary, MNRE, and was to provide the necessary guidance and oversight to the RBBPG implementation invited experts joining in for specific meetings as and when required.
54. The NPD was to be a senior official appointed by MNRE to provide overall coordination and supervision to the Project. The NPD was to be assisted by a full-time Project Manager who would head the Project Management Cell (PMC). The MITCON was named in ProDoc to be the local implementing agency for the RBBPG Project. The PMC was to be set up within MITCON to carry out day to day working of the project. The PMC would be headed by the aforementioned full-time Project Manager who would undertake a wide range of duties, most importantly and amongst others, maintaining close interaction between all Project actors, and facilitating the work of all collaborating institutions in Project activities and in identifying and locating expert inputs, wherever required.

55. A Project Advisory Committee (PAC) was to be constituted to provide expert advisory inputs to the NPM and PMC. The PAC was designed to provide a platform for the interaction of the biomass power project developers, promoters and other stakeholders. The PAC would also undertake periodic reviews of Project implementation to ensure optimal interactions and cooperation between all participating institutes at both the central and state government levels. The PAC was to have the NPD serve as the Chairman, with representatives from MNRE, Federation of Indian Chambers of Commerce and Industry (FICCI), Confederation of Indian Industry (CII), IREDA, IDBI, ICICI, Federations, industry experts, and state government officials.

**Figure 1: Current Management Arrangements for the UNDP-GEF Project “India: Removal of Barriers to Biomass Power Generation – Part I” (RBBPG) Project**



### 3.2 Project Implementation

56. The following is a compilation of key events and issues of RBBPG Project Part I implementation in chronological order:

- The RBBPG Project was signed by the Government of India on September 22, 2006;
- The period between 2006 and 2008 was marked by almost no achievements and few reports;

- Some progress was made commencing 2008 with 2 out of the 7 MIPs that ultimately emerged being approved and supported by the Project;
- Progress during 2008 and 2009 improved with the commencement of studies reviewing technologies and performances of various biomass power plants, evaluation of institutional frameworks, meetings with private and nationalized banks on commitments to biomass power projects, and ToRs for expressing interest in MIPs. However, a number of outputs were not delivered including knowledge products specified under Outcome 2 (e.g. website, databases and best practice documents); the selection of financial institutions and the design of the fund for contingency financing (Outcome 4); and the generation of an MIP pipeline (Outcome 5). This resulted in the first Project extension recommended to March 31, 2010 from the original closing date of September 21, 2009;
- By mid-2010, 87 applications received for MIPs and 18 expressions of interest received for national level financial institutions for supporting biomass MIPs, necessitating considerable time resources and effort to evaluate. This resulted in a request for a 2<sup>nd</sup> Project extension from March 31, 2010 for another 2 years to March 31, 2012;
- A study was undertaken in January 2011 on “Development of Financial Models for MIPs, Identification of Financial Institutions for Operation of Fund for Contingent Financing” by Ernst & Young revealing the availability of term loans for biomass projects from various financial institutions and the lack of necessity for availing contingent financing from RBBPG Project resources for the purposes of raising awareness and capacity building for financial institutions;
- In mid-2011, the mid-term evaluation of the RBBPG Project Part I was completed concluding that the low rate of disbursement during the 2006-2010 period (only US\$1.663 million or 29.4% of GEF budget) was coincided by a period of very few achievements. The MTE also recommended stock taking of its activities as a prelude to revising the LFM citing the urgency to optimize the use of remaining GEF funds that could be optimally utilized to meet developmental objectives. In addition, the MTE recommended a 3<sup>rd</sup> extension to the Project from March 31, 2012 to March 31, 2014;
- By mid-2012, the Project has proposals for 28 MIPs with a total capacity of 141.2 MW that include the 3 technologies proposed under the Project, namely biomass combustion, cogeneration and biomass gasification. This includes fuel supply linkages with 6 power plants (62.5 MW), 20 power biomass combustion plants that are grid connected (20 MW), 5 gasification based biomass power plants (8.2 MW), and 6 biomass combustion power plants ranging in size from 8 to 10 MW (total of 50.5 MW);
- By mid-2013, a workshop was conducted to revise the project LFM as per recommendations from the MTE to assist the project and focusing on the most efficient means of meeting the developmental objectives of the project. This included the setup of targets for MIPs including those of BMPPs selling power through open access to the market and captive power applications. This review also recommended a 4<sup>th</sup> extension to the Project, from March 31, 2014 to December 31, 2016, considering the complexities involved in the development of small scale projects of 1-2 MW power capacity (grid connection, required permissions and documentation);
- By mid-2017, 37 MW of MIPs were related to fuel linkage support to existing and operational BMPPs. This was done to improve the power load factors (PLFs) of these plants.

### 3.2.1 Adaptive Management

57. Adaptive management is discussed in GEF terminal evaluations to gauge Project performance and the ability of a project to adapt to changing regulatory and environmental conditions, common



occurrences that afflict the majority of GEF projects. Without adaptive management, GEF investments would not be effective in achieving their intended outcomes, outputs and targets.

58. During the critical commencement period from September 2006 to early 2008, the RBBPG Project Part I made almost no progress despite the expenditures of US\$1.14 million up to June 30, 2008. A Project audit conducted for 2007 raised concerns that were discussed between UNDP India's senior management and the Secretary, MNRE. In response to addressing this significant shortcoming, decisions were made in October 2008 to restore Project transparency and put in place the systems and controls for achievement of deliverables and objectives of the Project. Adaptive management measures undertaken included:
- halting all procurement and expenditures related to the Project until the completion of a joint MNRE-UNDP monitoring mission to review the progress against the physical and financial objectives and targets;
  - strictly enforcing all procurement undertaken with Project funds in the future in accordance with normal GoI procurement rules, with a mechanism to be implemented, if requested by MNRE, that UNDP undertake procurement activities on behalf of the Project;
  - replacing all personnel involved with the RBBPG Project Part I personnel up to June 2008, with a newly appointed NPD and NPC from MNRE, in an effort to kick start Project activities, and achieve numerous development outcomes of the Project within a 3-year timeframe. This included engaging a full-time Project Management Consultant on a UNDP service contract.
59. With the loss of 2 critical years from the original Project schedule, MNRE and UNDP continued undertaking adaptive management measures in efforts to catalyse acceleration of biomass power generation development in India. This included Project efforts to influence the Ministry of Environment and Forest to exempt biomass power projects having capacity <15 MW from Environment Impact Assessment (EIA) study. Unfortunately, with full compliance to all procurement rules and the slow transition of new personnel into the PMC to ensure earlier Project concerns were dealt with systematically, the process of selecting potential MIPs for Project support for the critical Outcome 5 was slow, resulting in zero MIPs implemented by the Project's scheduled completion date of September 2009.
60. By mid-2011, the MTE mission was undertaken to provide further recommendations on adaptively managing the RBBPG Project Part I. The MTE reported that while the Project was expected to achieve targets related to technology benchmarking, enhanced capacity, and development of support services, significant shortcomings were anticipated in the achievement of the Project goal and objective consisting of GHG emission reductions generated from operational MIPs. This observation set the stage and justification for the Project to review its LFA and to reset realistic targets prior to the EOP date which was reset at that time from March 31, 2012 to March 31, 2014. It also recommended reorganization of activities with realigned timelines, considering the complex issues involved in implementing small-scale biomass power projects, and the changed market, policy and regulatory environment in the country.
61. By mid-2013, the key recommendation from the MTE on resetting of the LFA was implemented. Details of these changes are provided in Paras 35-37. Major factors considered while revising the PRF included:

- A recommended two-year Project extension from March 31, 2014 to March 31, 2016 to implement the revised activities;
  - Reduced target of cumulative installed capacity of MIPs from 8 states to the entire country;
  - Targeting quickly implementable MIPs, preferably models that have captive biomass supply, and in advanced stages of obtaining statutory approvals;
  - Providing additional incentive in the form of generation based incentives for attracting new MIPs and ensuring operation;
  - Focus on capacity building of key stakeholders at the state level and assistance in overcoming regulatory, tariff, and operational barriers;
  - Generating and sharing knowledge products, which can be helpful for expansion and sustainability of biomass sector.
62. Despite the recommendations of the MTE and the preparation of revised Project activities with the revised PRF in 2013, progress of the RBBPG Project did not improve, in part due to what the TE team observes as insufficient levels of implemented adaptive management:
- The PMC continued to focus efforts into obtaining approval in stakeholder agreement on implementing MIPs in strict compliance with GoI operating rules and procedures. However, these efforts involved obtaining a large number of permits (up to between 8 and 10 approvals at the state level that cannot be obtained concurrently) adding anywhere between 14 and 30 months to the implementation period of a biomass power generation project. The TE team understood that efforts were made by UNDP during this period and up to 2017 to encourage and assist MNRE in developing a “one-stop shop” for potential biomass power plant developers to access services for streamlined approvals of these permits. These efforts, however, did not result in any streamlined regulatory approval process for biomass power developers;
  - While the Project generated a wealth of knowledge and information on issues relevant to promotion of the biomass power, its dissemination was not placed onto a dedicated website until 2014 at which time, UNDP and MNRE websites were used to present the Project’s knowledge products, advertisements, and other biomass promotional materials. By this time, market conditions for BMPPs were changing, MIP proponents for support by the Project were selected, and the impact of a biomass power website was blunted. As such, many of the Project’s activities managed at different locations (such as the biomass resource atlas from IISc, newsletters from the PricewaterhouseCoopers website, etc.) were not available on a “one-stop” information portal, thus not utilizing ideal tools for promoting biomass power generation.
63. During the 2013 to 2017 period, 7 MIPs were implemented (see details as provided on Table 3), all with varying degrees of success with a focus on many of the MIPs on security of biomass fuel supply. An unfortunate consequence of the Project being implemented during this time was the falling price of solar PV electricity generation, making biomass power generation unattractive due to the comparative high and fixed operational costs related to the delivery of biomass to the power plants. As such, the non-captive biomass power generation plants were either marginally profitable or had completely stopped operations due to ongoing disputes with SERCs and state utilities on the honouring of long term PPAs (further details provided in Paras 115, 120-121). A consequence of this development was additional difficulties in generating and implementing more MIPs with available GEF funds (due to the aforementioned reasons). This has resulted in a US\$2.4 million surplus of unused GEF Project funds at the EoP date of July 31, 2017. This could be viewed as a failure to adaptively change Project tactics that market biomass power generation projects towards more

financially viable options such as captive biomass power generation and biomass power generation to mitigate adverse environmental impacts (as mentioned in Paras 125, 132, 141, 147 and 148).

64. In conclusion, UNDP's efforts to adaptively manage this project were **moderately unsatisfactory** in consideration that the Project did not catalyze biomass power generation project investments in India.

### 3.2.2 Partnership Arrangements

65. The primary partnership of the RBBPG Project was with the stakeholders of the MIPs. Assessment of the partnership arrangements of the RBBPG Project, however, was constrained by the lack of documentation of consultative meetings with stakeholders, the awareness raising efforts of the Project (with no list of attendees to the various workshops and events under Component 2), follow-ups on discussions held during these workshops and events (which would allow the evaluation team to assess the impacts of these activities and partnerships formed), and a lack of evidence of extensive discussions with MIP proponents (notably lead up discussions to implementation of the MIPs, and discussions after implementation of the MIPs on operational experiences).
66. Knowledge dissemination efforts by the Project have been rather constrained. Findings of the various studies have not been discussed with a larger set of stakeholders to prioritize areas for further action/research. For example, model documents for PPAs (that can be used between ESCOMs and biomass power producers), fuel supply contracts (between biomass power producers and biomass suppliers) were prepared by MITCON but have not been widely circulated to key stakeholders for their inputs before finalization. Furthermore, the Project had not set up consultation forums to enable communications between stakeholders for the validation, fine tuning and dissemination of Project outputs, and sharing operational experiences (notably on the MIPs).
67. From late 2012 to 2014, the Project undertook a surge of awareness raising workshops and events designed to interest and catalyze investment into biomass power generation projects. This included consultative meetings with groups such as the IBPA, and various renewable energy development agencies in Orissa, and smaller such agencies in the island states of Andaman, Nicobar and Lakshadweep. Moreover, these workshops appear to focus mainly on grid connected biomass power generation projects which as mentioned in Para 63, were becoming less financially attractive. This resulted in what appears to be little or no follow-up on these workshops by the PMC.
68. The urgency for follow-up on these workshops may have been dampened by issues related to the declining demand for biomass power generation due to falling solar PV electricity tariffs (again as mentioned in Para 63). There are still, however, excellent opportunities for the Project to involve stakeholders in the captive market for biomass power generation as well as those projects that address environmental issues (see Paras 125, 132, 141, 147 and 148 for more details). With the late setup of the biomass knowledge portal (mentioned in Para 62), overall efforts by the RBBPG Project Part I to facilitate strengthened partnerships to accelerate the development of biomass power generation projects were **moderately unsatisfactory**.

### 3.2.3 Feedback from M&E Activities Used for Adaptive Management

69. Feedback for M&E activities was provided primarily through *PIRs*. Unfortunately, the Evaluation Team were not provided a full set of *PIRs* during the entire Project implementation period:

- PIR was not available for 2007;
  - The PIR from 2008 was not informative, with development progress reporting not coinciding with the Project's LFM. As such, reading this PIR did not provide any useful information on reasons for the slow progress since 2006;
  - The quality of PIRs from 2009-2015 had improved allowing project monitors to better track progress against the PRF;
  - Despite GHG emission reduction targets in the revised PRF of 2013, post-2013 PIRs did not provide any reporting on progress towards Project GHG emission reduction goal;
  - No PIRs were made available from 2016 and 2017.
70. With the actual outcomes of the RBBPG Project Part I being different from the intended outcomes, the PIRs should have served as a primary sounding board, positive or negative, in providing feedback to the PMC to conduct adaptive management measures. However, despite the moderate quality of the feedback information contained in the PIRs, necessary adaptive management measures to catalyze biomass power generation projects in India were not undertaken by the PMC. As such, feedback from M&E activities for adaptive management are assessed as **moderately unsatisfactory**.

### 3.2.4 Project Finance

71. The RBBPG Part I Project had a GEF budget of US\$ 5.65 million that was to be disbursed over a 3-year duration. After the reorganization of the RBBPG Project in October 2008, GEF resources were advanced by UNDP to the IREDA, the nonbanking financial institution under the administrative control of MNRE. AWP were prepared by the PMC to inform IREDA and UNDP on how GEF funds were to be utilized. Unfortunately, the TE team was not provided with any of audit reports on the effectiveness of funds utilized. In addition, details of when the Project made investments into the MIPs was not available to the TE team. Without this information, the TE team has been unable to assess the cost effectiveness of Project expenditures towards reaching the Project goal of 460,000 tonnes CO<sub>2eq</sub>.
72. Table 1 reveals:
- 2008 PIR reported US\$1.14 million dispersed over a two-year period without any reports of work being initiated for each of the components;
  - A large negative entry in 2010 on Activity 4 and 5, which may have been related to the return of money previously allocated for the setup of the contingent fund under Activity 4;
  - Large expenditures between 2013 and 2017 on Activity 4 and 5, which is likely related to support for the 7 MIPs that were approved after 2013;
73. Project co-financing was estimated to be more than US\$ 7.661 million, more than 60% below the ProDoc estimate of US\$ 21 million. Most of the co-financing was parallel co-financing from BMPP proponents whose investments totalled more than US\$ 6.071 million. The PMC did not monitor or provide complete information on co-financing for the 7 MIPs as well as in-kind contributions by government and private sector personnel (only sanctioning information for 5 out of the 7 MIPs was provided. See Table 2 and 3 for more details). Co-financing details can be found on Table 2.

**Table 1: GEF Project Budget and Expenditures for India RBBPG Part I Project (in USD as of June 30, 2017)**

RBBPG Part I Activities/Components	Budget (from Inception Report)	2007*	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017**	Total disbursed	Total remaining
Activity 1: Technology benchmarking and validation	850,000	45,973	38,111	-5,313	7,038		9,814	46,103	26,280	101,829	81,369	2,970	354,175	
Activity 2: Capacity building for effective information dissemination	1,000,000	58,124	274,593	244,406	126,444	96,164	76,121	96,312	111,957	67,422	41,371	29	1,192,944	
Activity 3: Development of effective institutional framework	1,500,000	488,032	584,662	-281,826	17,834	25,290	6,391	14,778	4,352	3,250	24,355		887,119	
Activity 4 & 5: Risk guarantee & contingent loan fund for implementation of 7 MIPs (creation of pilot contingent fund for MIPs in Phase-I)	2,000,000	4,699	126,745	414,813	-521,217	238,326	16,468	67,851	170,537	911,232	40,752	-883,002	587,206	
Project Management	300,000	-1,959	49,219	-4,514	-2,129	17,924	9,220	25,354	38,804	31,266	5,197		168,382	
<b>Total (Actual)</b>	<b>5,650,000</b>	<b>594,870</b>	<b>1,073,330</b>	<b>367,567</b>	<b>-372,030</b>	<b>377,704</b>					<b>193,044</b>	<b>-880,003</b>	<b>3,189,826</b>	<b>2,460,174</b>
<b>Total (Cumulative Actual)</b>	<b>5,650,000</b>	<b>594,870</b>	<b>1,668,201</b>	<b>2,035,767</b>	<b>1,663,737</b>	<b>2,041,442</b>					<b>2,234,486</b>	<b>1,354,483</b>		
Annual Planned Disbursement (from ProDoc)***		750,000	2,612,500	1,912,500	375,000									
<b>% Expended of Planned Disbursement</b>		<b>79%</b>	<b>41%</b>	<b>19%</b>	<b>-99%</b>									

**Table 2: Co-Financing for India RBBPG Part I Project (as of June 30, 2017)**

Co-financing (type/source)	UNDP own financing (million USD)		Government (million USD)		Partner Agency (million USD)		Private Sector (million USD)		Total (million USD)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants	0.00	0	21.00	1.590 <sup>32</sup>	0.00		0.00	6.071 <sup>33</sup>	21.00	7.661
Loans/Concessions									0.00	0.00
• In-kind support			0.00	0 <sup>34</sup>	0.00			0.00 <sup>35</sup>	0.00	0.00
• Other									0.00	0.00
<b>Totals</b>	<b>0.00</b>	<b>0</b>	<b>21.00</b>	<b>1.590</b>	<b>0.00</b>	<b>0</b>	<b>0.00</b>	<b>0.00</b>	<b>21.00</b>	<b>7.661</b>

<sup>32</sup> GoI contribution through MNRE. However, details of assistance to Malwa and Shree SSK Pandurang BMPPs were not provided to TE team. Details found in Table 3.

<sup>33</sup> Details of private sector contributions to Malwa and Shree SSK Pandurang BMPPs were not provided to TE team. Details found in Table 3.

<sup>34</sup> MNRE in-kind contributions were not made available to TE team.

<sup>35</sup> In-kind contributions by private sector project development teams not made available to TE team.

74. Overall, the cost effectiveness of the RBBPG Project has been **moderately unsatisfactory** in consideration of the low level of MIP investments, and the late start-up of these projects (5 to 6 years after the commencement of Part I in September 2006).

### 3.2.5 M&E Design at Entry and Implementation

75. The ProDoc, MTR nor the review of the LFA in 2013 provided an M&E design. There is no mention of any detailed M&E activities such as the inception workshop and report, PIRs, periodic progress reports, midterm review, and audit reports. As such, *the M&E design is rated as **highly unsatisfactory**.*
76. Despite the absence of an M&E plan, M&E activities were implemented, the quality of which was adversely affected by the quality of the LFA (as mentioned in Paras 38-42). Without clear targets, progress was generally reported on what had transpired during the reporting year without commentary on how the Project activity would be terminated. Furthermore, reporting of the more important indicators such as the Project GHG emission reduction goal of 460,000 tCO<sub>2eq</sub> during the duration of Part I of the RBBPG Project, was poorly documented or not reported at all in the post-2013 PIRs. This is an indication that the PMC did not make any efforts to monitoring GHG emission reductions and energy savings from biomass power projects supported by the Project. As can be seen towards the EOP, the RBBPG Project Part I did not develop an appropriate exit strategy. As such, *M&E plan implementation is rated as **unsatisfactory**.* Ratings according to the GEF Monitoring and Evaluation system<sup>36</sup> are as follows:

- *M&E design at entry - 1;*
- *M&E plan implementation - 2;*
- *Overall quality of M&E - 2.*

### 3.2.6 Performance of Implementing and Executing Entities

77. The performance of the implementing partner of the RBBPG Part I Project, MNRE, can be characterized as follows:
- The early stages of the Project between 2006 to 2008 was marked by little to no delivery of any of the intended outputs, but expenditures of close to 25% of the RBBPG Part I budget;
  - Following the Project re-organization in September 2008, MNRE proceeded with a cautious approach to delivery of Project activities, in compliance with GoI regulations and procedures. However, delivery of Part I would take activities beyond the original 3-year Project period due to a combination of the over ambitious design (as mentioned in Para 35), and the slower pace of delivery by MNRE in strict compliance with GoI procurement rules;

<sup>36</sup> 6 = HS or Highly Satisfactory: There were no shortcomings;

5 = S or Satisfactory: There were minor shortcomings,

4 = MS or Moderately Satisfactory: There were moderate shortcomings;

3 = MU or Moderately Unsatisfactory: There were significant shortcomings;

2 = U or Unsatisfactory: There were major shortcomings;

1 = HU or Highly Unsatisfactory

U/A = Unable to assess

N/A = Not applicable.

- Management of the Project basically flowed through the NPD to ensure that poor management practices of the Project from 2006 to 2008 were not repeated. This tact, however, also had the impact of slowing the pace of progress of the RBBPG Project Part I. Moreover, the NPD also served in similar roles for several other donor projects, which only exacerbated the slow pace of the Project;
  - MNRE outreach to potential investors, financing agencies and other stakeholders with vested interests in biomass power generation in India was not dynamic. Moreover, MNRE did not provide the strategic support to move the Project away from less financially viable opportunities developing projects with open access sale of electricity to the grid to more attractive options such as financially viable captive power projects for agro-industries and biomass power projects that facilitate avoidance of rice stalk burning. In the humble opinions of the TE team, these are still highly relevant opportunities in the biomass power generation market;
  - Overall performance of MNRE on the RBBPG Project Part I is assessed as being **unsatisfactory**.
78. The performance of UNDP (the Implementing Agency) can be characterized as follows:
- UNDP experienced difficulties in effective communication with implementing partner, MNRE during the early stages of the Project between 2006 and 2008;
  - UNDP initiated a management review of the Project in 2008 in close consultation with MNRE in light of poor delivery of outputs and close to 25% of the budget expended. This resulted the replacement of all previous Project personnel, improved oversight into Project expenditures to ensure compliance with GoI rules and regulations, and agreement that the UNDP procurement process will be utilized if requested by GoI;
  - UNDP India as well as personnel from the Regional Center in Bangkok were involved with troubleshooting, and increasing the pace of progress notably in state tariffs for biomass power, notably after 2013;
  - Overall performance of UNDP on the RBBPG Project Part I can be assessed as being **moderately satisfactory**.
79. A summary of ratings of the implementing and executing entities of the RBBPG Project Part I are as follows:
- *Implementing Partner (MNRE) – 2;*
  - *Implementing Entity (UNDP) – 4;*
  - *Overall quality of implementation/execution (UNDP/MNRE) – 3.*

### 3.3 Project Results

80. This section provides an overview of the overall project results and assessment of the relevance, effectiveness and efficiency, country ownership, mainstreaming, sustainability, and impact of the RBBPG Part I Project. In addition, evaluation ratings for overall results, effectiveness, efficiency and sustainability are also provided against the revised July 2013 Project PRF (as provided in Appendix F)<sup>37</sup>. For Tables 4 to 8, the “status of target achieved” is color-coded according to the following scheme:

Green: Completed, indicator shows successful achievements	Yellow: Indicator shows expected completion by the EOP	Red: Indicator shows poor achievement – unlikely to be completed by project closure
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<sup>37</sup> Evaluation ratings are on a scale of 1 to 6 as defined in Footnote 36.

### 3.3.1 Overall Results

81. With regards to the target of 15.2 MW of additional cumulative biomass power generation capacity by the EOP, the Project has achieved 39.7 MW within 7 MIPs. While this target has been met, there are several issues that accompany the achievement of this target including:
- Selection of MIPs did not commence until early 2010 through submissions in response to an EOI. Over 87 applications were received requiring considerable resources and time to screen and select appropriate applicants. The commencement of this process was also started after the original terminal date of the RBBPG Project Part I of September 22, 2009;
  - The 2011 PIR stated that first instalments for the 7 MIPs that qualified for Project support had been dispersed by mid-2011. The 7 MIPs selected totaled 41.2 MW of installed biomass power generation, and representing biomass combustion, cogeneration and gasification processes:
    - Biomass combustion projects included Malwa Power Limited (7.5 MW) and Universal Biomass Energy Pvt. Ltd. (14.5 MW), both in Muktsar, Punjab; Dee Vee Power (2 MW) in Bellary, Karnataka; and SLS Power Ltd in Nellore, Andhra Pradesh (6.0 MW);
    - Cogeneration project at Panduranga Sugar in Solapur, Maharashtra, 9 MW; and
    - Gasification projects at Sankheda, Gujarat with Ankur Scientific Energy Technology Pvt. Ltd (1.2 MW), and at Washim, Maharashtra at Ruchi Soya Industries Ltd. (RSIL) (1 MW);
  - Due to poor quality of PIRs and other monitoring documentation of the RBBPG Project, the evaluation team had issues in establishing the dates when project interventions were conducted;
  - Despite the completion of most of these projects by 2013, all of these MIPs have not been operating continuously and consistently, PLFs have been low. This was reconfirmed by the TE team during field visits to each of the 7 MIPs.

Details of the MIPs are provided on Table 4.

82. As mentioned in Paras 69 and 76, very little attention was paid to monitoring CO<sub>2</sub> reductions. As such, without operational records of each of the MIPs and details of the nature and timing of the Project investment into these MIPs, the TE team is unable to reliably estimate the CO<sub>2</sub> emission reductions generated by this Project. Moreover, the lifetime CO<sub>2</sub> reductions over the MIPs cannot be reliably estimated due to the discontinuous operations of most MIPs. GHG emission reductions achieved during the Project duration was in the order of 200,000 tCO<sub>2</sub> (over 10 years), mainly achieved through strengthened fuel supply linkages, and not greenfield projects. Further details of GHG emission reduction estimates are provided on Table 4 as well as results under Outcome 5.
83. With regards to the indicator and target of additional greenfield MIPs after 2013 up to 15.2 MW, the Project oversaw a general lack of interest on biomass power generation. This was primarily due to the lack of interest in electricity sales from biomass power plants caused by falling solar PV electricity tariffs, and the higher and fixed operational costs of biomass power generation projects. As of 2015, only 7 MW of biomass power generation projects were under consideration (one 1 MW gasifier project in Tamil Nadu by M/s Cummins Cogeneration Pvt Ltd., 3 biomass power plants (2MW + 2MW + 1MW) on 3 islands in Lakshadweep, and one 1 MW biomass power plant in Andaman & Nicobar islands. However, the TE team have not received any reports of completion on the aforementioned projects. In addition, one of the Project measures for contacting to potential biomass project investors was through expressions of interest, which resulted in responses from a number of entities, many of whom could not comply with minimum requirements for Project support. A summary of the achievements of RBBPG Project Part I at the Objective level with evaluation ratings are provided on Table 5.



**Table 4: List of Model Investments Projects in Biomass Power Generation**

Name of MIP	Installed Capacity (MW)	Feedstock and Use of Energy	Status	Comments
<b>Malwa Power (Pvt) Ltd., Gulabewela Village (north of Muktsar), Punjab</b>	7.5	200 tpd of paddy straw for production of steam by biomass combustion, fed into a steam turbine, and sale of electricity to the grid	<ul style="list-style-type: none"> <li>• Operational since 2002, recently at an average load of 90%;</li> <li>• 88% of power sold to the grid with the remaining power used internally;</li> <li>• Company has high capacity production due to its development and sustaining of an efficient biomass collection network deploying several biomass suppliers, more than 100 baling machines (purchased and owned by several biomass suppliers), thereby creating substantial and sustainable employment;</li> <li>• Company has successfully lobbied with Punjab Government for subsidizing baler machines purchased by the biomass suppliers;</li> <li>• Project has reportedly provided assistance to strengthen fuel supply linkages for rice stalk to the BMPP. The PMC, however, has not provided any documentation or details of this assistance including cost of the assistance and the GEF grant provided.</li> </ul>	<p>Tariff required for producing biomass power from this plant is in the order of US\$0.11 per kWh, higher than power purchased from solar PV sources.</p> <p>Environmental benefits includes the avoidance of field burning of rice stalk for over 1,100 ha.</p> <p>Company has taken up a leadership role biomass collection activity and have developed close personal rapport with suppliers as well as the farmers.</p> <p>MTE calculates that 12,000 tonnes CO<sub>2eq</sub>/year has been reduced through fuel supply linkage assistance by the Project<sup>38</sup>. Over the duration of RBBPG, this will be 120,000 tonnes CO<sub>2eq</sub>.</p>
<b>Universal Biomass, Malout, Muktsar, Punjab</b>	14.5	450 to 500 tpd of paddy straw for production of steam by biomass combustion, fed into a steam turbine, and sale of electricity to the grid	<ul style="list-style-type: none"> <li>• Operational since 2010 at an average load of 60%;</li> <li>• Entrepreneur has undertaken substantial efforts to secure paddy straw during a 2-week period in November when farmers want paddy straw removed for plantation of wheat;</li> <li>• RBBPG Project assistance was utilized to provide:</li> </ul>	<p>Tariff required for producing biomass power from this plant is in the order of US\$0.11 per kilowatt hour, higher than power purchased from solar PV sources.</p> <p>RBBPG Project reports have indicated that these facilities helped reducing biomass losses by 5-10%, creation of local employment, increased income</p>

<sup>38</sup> Pg 68 of the RBBPG Phase I MTE report (Ocampo and Rajshekar) of July 2011

Name of MIP	Installed Capacity (MW)	Feedstock and Use of Energy	Status	Comments
			<ul style="list-style-type: none"> <li>○ mechanized balers in 2013 to accelerate the collection of straw during the 2-week period;</li> <li>○ set up of additional 18 decentralized biomass depots<sup>39</sup> in a 100 km radius to collect biomass resulting in reduced landed fuel cost by US\$ 4.2 to 4.5 per ton;</li> <li>○ boiler modifications to handle paddy straw bales, avoiding chipping of paddy straw;</li> <li>● Project assistance was provided in 2011 through grants of Rs. 50 lakh (~US\$111,000 from the Project), Rs. 150 lakh (US\$333,000 from MNRE). US\$563,000 was cost to Universal Biomass;</li> <li>● Entrepreneur following the lead of Malwa Power in their methods of securing straw supplies from local farmers. Plant has generated employment opportunities for 1,000 local people in biomass supply and processing.</li> </ul>	<p>to farmers, an increase in plant PLF by 2 to 3%, and substantial reduced landed cost of biomass to plant fuel by US\$ 2.5 to 3 per ton. Based on this experience, Government of Punjab setup a subsidy scheme for farmers and entrepreneurs in 2006 to purchase of tilling and baling machinery for efficient collection of rice stalk.</p> <p>There have been GHG emission reductions from this plant. However, the PMC nor Universal have provided any information on the plant's operations and PLF since 2011. As a result, the TE was unable to include estimates for GHG emission reductions for this plant.</p>
<b>Shree SSK Pandurang Pvt. Ltd, Solapur, Maharashtra</b>	19.0	1,320 tonnes of bagasse and sugarcane trash combusted to produce equivalent of 19 MW of steam primarily for captive use in sugar production and distillery. Excess steam is used by steam turbine to generate electricity that is sold to the grid at Rs. 6.53 per kWh	<ul style="list-style-type: none"> <li>● This cogeneration-based power plant has been in operation since 2006 plant with seasonal variations of operation;</li> <li>● Project provided financial assistance for purchase of baling machines to increase the efficiency of biomass collection and reduce plant operating cost. However, details of this assistance in the sanctioning of this project were not provided to the evaluation team;</li> <li>● Total cost of Project reportedly Rs. 700 lakh (US\$1.5 million) out of which Rs. 400 lakh (US\$444,000) was Project assistance. Sanctioning letter for this Project from MNRE</li> </ul>	<p>MTR estimates that GHG impact of Project is 7,600 tonnes CO<sub>2eq</sub>/year (since 2006) due to addition of sugarcane trash for captive energy use<sup>40</sup>. Over the duration of RBBPG, this will be 76,000 tonnes CO<sub>2eq</sub>.</p> <p>Maharashtra government is no longer signing PPAs for biomass power due to the high production cost.</p>

<sup>39</sup> These consist of a storage shed, harvesting cum chipping device, material handling equipment, cargo centers for transporting biomass from fields through weigh bridges to collection centers

<sup>40</sup> Pg 67 of the RBBPG Phase I MTE report (Ocampo and Rajshekar) of July 2011.

Name of MIP	Installed Capacity (MW)	Feedstock and Use of Energy	Status	Comments
			was not made available to the evaluation team.	
<b>SLS Power Ltd., Nellore, Andhra Pradesh</b>	6.0	185 tonnes/day of rice husk and palm tree leaves combusted to heat, converted to steam and fed into a steam turbine for generation of electricity for sale to the grid.	<ul style="list-style-type: none"> <li>Plant has been operational since 2001 with shutdowns in 2007-8 (boiler burst) and 2011-13 (dispute over tariff which was settled at Rs.5.93/kWh);</li> <li>RBBPG Project assistance was utilized to setup a fuel yard<sup>41</sup>;</li> <li>Project assistance was provided in 2011 through grants of Rs. 37.5 lakh (~US\$83,600 from the Project), Rs. 112.5 lakh (US\$251,000 from MNRE). US\$401,000 was cost to SLS Power;</li> <li>Plant has been shut down since June 2017 due to SERC ruling with no reasons given but assumed to be related to the high cost of biomass electricity.</li> </ul>	<p>Project had setup a supply chain for fuel linkages with active involvement of the local farmers and youths. The local farmers also used power plant bio-char residues as fertilizer in their fields.</p> <p>There have been GHG emission reductions from this plant. However, the PMC nor SLS Power have provided detailed information on the plant's power generation and PLF since 2011. As a result, the TE was unable to include estimates for GHG emission reductions for this plant.</p> <p>Frequent and arbitrary changes in electricity tariffs and lack of honoring PPA does not provide for an investor-friendly environment.</p>
<b>Ankur Scientific Energy Technologies, Sankheda, Gujarat</b>	1.2	Agricultural waste for production of steam by gasification, fed into a steam turbine, and sale of electricity to the grid	<ul style="list-style-type: none"> <li>Operational between July 2012 and December 2013 based on tariff of Rs. 5.25/kWh<sup>42</sup> and RECs;</li> <li>RBBPG Project financial assistance was approved in 2011 for procurement of plant machinery and equipment, its installation and commissioning, and civil works;</li> </ul>	A total of 3,900 tonnes CO <sub>2eq</sub> has been generated from this plant during RBBPG <sup>43</sup> from August 2011 to June 2013. Plant was shut down in January 2014; however, no records of power generated between June 2013 and January 2014 were provided. Plant shutdown exposed a serious issue of

<sup>41</sup> 4 biomass depots were set up within a radius of 50 km to collect various residues, namely cotton stalk, paddy straw, sugar cane trash, to replace rice husks, currently used as main fuel. These depots have helped reduce plant's fuel cost by substantially, generating employment for more than 900 people in biomass supply and processing.

<sup>42</sup> This was the first tariff for a small scale "open access" (i.e. power produced is sold to a third party by wheeling the power through state grid). Ankur sold power to Aditya Birla Insulators in Gujarat.

<sup>43</sup> Pg 23 of UNDP-GEF Report on "Evaluation Report of Biomass MIP Implemented under RBBPG: 1.2 MW Biomass Gasifier Based Power Plant Installed at Sankheda, Gujarat, by Dr. Sanjay Mande, 2013.

Name of MIP	Installed Capacity (MW)	Feedstock and Use of Energy	Status	Comments
			<ul style="list-style-type: none"> <li>Project assistance was provided in 2011 through grants of Rs. 55.97 lakh (~US\$125,000 from the Project), Rs. 167.91 lakh (US\$373,000 from MNRE). US\$947,000 was cost to Ankur Scientific;</li> <li>Plant has been idle and shut down since January 2014 due to price crash of RECs, and the reluctance of Gujarat SERC to sustain the tariff at US\$0.11 per kWh, the minimum required for sustained operations of the plant</li> </ul>	SERCs honoring PPAs over their entire term.
<b>Ruchi Soya Industries Ltd., Washim, Maharashtra</b>	1.0	Soya waste from local area for production of steam by fluidized bed gasification, which is fed into a direct fired engine, into electricity (to offset ~50% of the grid electricity) and excess heat used for steam production in plant to offset use of coal.	<ul style="list-style-type: none"> <li>Plant was completed in 2014 and consists of a 1 MW fluidized bed biomass gasification plant using technology from the Energy Research Centre (ECN) and Dahlman of Netherlands. The electricity generated will be partially used for processing soya and excess electricity sold to the grid;</li> <li>Plant excess heat designed to be used to generate 4 Bar of steam displacing the use of coal;</li> <li>RBBPG Project financial assistance was approved in 2011 for procurement of plant machinery and equipment, its installation and commissioning, and civil works;</li> <li>Project assistance was provided in 2011 through grants of Rs. 45 lakh (~US\$100,000 from the Project), Rs. 135 lakh (US\$300,000 from MNRE). US\$2.6 million was cost to both Ruchi Soya and Thermax Ltd.;</li> <li>Plant as well as the company's soybean processing and oil production unit was shut down during 2015 and 2016 due to regional drought and the lack of availability of soya biomass;</li> <li>With good monsoon rains in 2017, plant is expected to be reopened in November 2017. In anticipation, Thermax commenced pilot</li> </ul>	<p>Executed by Thermax Ltd based in India.</p> <p>Plant operational challenges include seasonal availability of biomass, and working capital for the manual collection of biomass. Overcoming this challenge may involve diversification of biomass sources from other crops such as cotton.</p> <p>No GHG emission reductions from this plant during RBBPG.</p>

Name of MIP	Installed Capacity (MW)	Feedstock and Use of Energy	Status	Comments
			operations of the plant in July 2017 to further optimize their technology with a target of 66% combined heat and power efficiencies.	
<b>Dee Vee Power, Kushal Nagar, Karnataka</b>	2.0	Combustion of 50 tonnes/day of coffee husk with electricity to be sold to nearby coffee industries and to the Karnataka Power Corporation	<ul style="list-style-type: none"> <li>• RBBPG Project financial assistance was approved in 2011 for procurement of plant machinery and equipment, its installation and commissioning, and civil works;</li> <li>• Project assistance was approved in 2011 through grants of Rs. 100 lakh (~US\$222,000 from the Project), Rs. 300 lakh (US\$667,000 from MNRE). Rs. 702 lakh (US\$1.56 million) was cost to Dee Vee Power Ltd.;</li> <li>• Construction of plant incomplete due to lack of funds;</li> <li>• Disbursement of MNRE (and Project) funds of Rs. 2 crore was advanced to entrepreneur by 2015;</li> <li>• However, plant was not completed due to conditions of grant disbursement that the plant requires successful operations of the plant for a minimum of 3 months. Entrepreneur is unable to comply with this condition and as such, the plant remains incomplete;</li> <li>• Coffee waste in high demand due to high calorific value.</li> </ul>	<p>The electricity generated was to be sold to local industries at Kushalnagar Industrial Estate and the remaining power to Karnataka Power Corporation Limited through 11 kV line.</p> <p>Since the Project support was to demonstrate this model of biomass project implementation, the lack of support by the Project as of 2017 does not make sense considering the sunk costs incurred by the entrepreneur to building of a partial plant. Project should also have had some flexibility to source other financing for entrepreneur.</p> <p>No GHG emission reductions from this plant during RBBPG.</p>

**Table 5: Project-level achievements against RBBPG Project Part I targets**

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>44</sup>
<b>Project Goal:</b> <i>To improve electricity supply without increasing GHG emissions through wide-scale application of biomass power generation technologies</i>	Extent of supply and energy needs met by biomass power projects, reduction of CO <sub>2</sub> emissions. By end of project, additional MIPs up to 15.2 MWe of biomass power generation contracted.	0	End of Project (EoP) target (2016): additional 15.2 MW cumulative capacity MIPs implemented	41.2 MW. <i>The quality of these MIPs, however, is questionable in consideration of their PLF, current operational status and generation of energy</i>	See Table 4 and Para 81	4
		0	Approx over 460,000 tCO <sub>2</sub> during project duration and over 3.7 million tCO <sub>2</sub> over lifetime of all MIPs implemented under project	<i>Estimates are in the order of 200,000 tCO<sub>2</sub> during 11-year project duration that was only designed for 3 years. These are not reliable estimates of the CO<sub>2</sub> reductions generated by this project.</i>	See Para 82 and Table 4	2
<b>Project Objective:</b> <i>To accelerate the adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas (including captive power use and open access power sale), through demonstration of model investment projects (MIPs) demonstrating development models and establishment of sustainable business/support services network and undertaking enabling activities for removal of the key barriers.</i>	Rate of commercial adoption of sustainable biomass power technologies in India	No Model Investment Projects exist.	Additional green field MIPs up to 15.2 MW <sup>45</sup> (comprising of 9 MW for gasification/ combustion-based power generation including open access sale, 4 MW for non-bagasse based co/tri-generation using captive biomass, 2.2 MW demonstrating small gasifier systems for greening telecom towers contracted and implemented in remaining extended project period till March 2016.	<i>No additional green field MIPs were mobilized after 2013.</i>	See Para 83	2
<b>Overall Rating – Project-Level Targets</b>						<b>3</b>

<sup>44</sup> Ibid 36<sup>45</sup> This is in addition to already implement MIPs (both green field and biomass fuel linkage based). Support for Fuel linkages: (Universal Biomass Energy Pvt. Ltd, Muksar, Punjab, 14.5 MW; SLS Power Ltd., Nellore, Andhra Pradesh, 6 MW; Completed MIPs (MPPL - Muksar – Biomass Combustion, 7.5 MW; Panduranga Sugar - Solapur - Cogeneration, 9 MW; Ankur, Sankheda, Gujarat – 1.2 MW gasifier based power plant, Ruchi Soya (RSIL), 1 MW – fluidized bed biomass gasification plant planned to be set up at Washim, Maharashtra; will be executed by M/s Thermax Ltd).

84. Based on the performance of the MIPs in generation of electricity and the lack of record keeping of MIP operations, the RBBPG Project-Level targets are rated as **unsatisfactory**.

### 3.3.2 Outcome 1: Technology package benchmarking & validation for different biomass power technologies

85. Activities under Outcome 1 were intended to result in “technology package benchmarking and validation for different biomass power technologies including the feasibility of energy plantations”. Project resources were to be used to generate outputs including:

- potential of biomass hybrid technology for power generation in India explored, documented and shared with MNRE;
- technology performance and evaluation of benchmarks for MIPs available;
- long term perspective plan for utilization of wasteland and biomass resources for power generation; and
- socioeconomic study for assessment of impact of biomass power plant on employment generation, livelihood improvement and environment.

A summary of the actual achievements of the activities of Outcome 1 with evaluation ratings are provided on Table 6.

86. With regards to the Project exploring biomass hybrid technologies for power generation after 2013, the Project undertook the following activities including:

- A review of biomass technologies and performance evaluations of various biomass power plants in 2009 by MITCON;
- Several other studies on the feasibility of various biomass technologies and implementation models were posted on various websites<sup>46</sup>;
- In 2014, a consultancy for exploring the potential feasibility of solar thermal integration with existing biomass combustion power plants was awarded to Steag Energy Services (India) Pvt Ltd. The consultancy was to explore plant design, performance, land availability and financial feasibility. A final draft of this report was provided in November 2014.

However, despite these studies, the Project did not deliver its intended output of a study report on the potential of biomass hybrid technologies.

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<sup>46</sup> “Proceedings of workshop on promoting adoption of biomass power technologies and identification of pipeline projects” available on: [http://www.in.undp.org/content/india/en/home/library/environment\\_energy/proceedings-of-workshop-on-promoting-adoption-of-biomass-power/](http://www.in.undp.org/content/india/en/home/library/environment_energy/proceedings-of-workshop-on-promoting-adoption-of-biomass-power/);

“Study of available business models of biomass gasification power projects in India” by Indian Institute of Science, Bangalore, available on: [http://www.in.undp.org/content/india/en/home/library/environment\\_energy/study-of-available-business-models-of-biomass-gasification-power/](http://www.in.undp.org/content/india/en/home/library/environment_energy/study-of-available-business-models-of-biomass-gasification-power/); and

“Sensitisation workshop manual on sub-megawatt scale biomass power generation” for potential investors, available on: [http://www.in.undp.org/content/india/en/home/library/environment\\_energy/sensitization-workshop-manual-on-sub-megawatt-scale-biomasspower/](http://www.in.undp.org/content/india/en/home/library/environment_energy/sensitization-workshop-manual-on-sub-megawatt-scale-biomasspower/)

Table 6: Outcome 1 achievements against targets

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>47</sup>
<b>Outcome 1:</b> Technology package benchmarking & validation for different biomass power technologies including feasibility of energy plantation	Status of manufacturing capacities and standards for different biomass power technologies	Poor reliability of biomass power technologies, both captive and distributed biomass.  Energy plantation as potential biomass resource for commercial power is yet to get established.	Technology packages, performance standards, benchmarks for potential biomass power technologies developed and available for use in public domain. Exploring potential feasibility of biomass-hybrid systems.  Assessment undertaken of wasteland potential for energy plantation and viable PPP models developed in selected states.	<i>By 2008, software tools with query capabilities had already been developed for biomass digital maps with information on biomass availability using remote sensing data involving land uses for agriculture, waste lands, and forests. However, the Project did not explore the feasibility of biomass hybrid systems.</i>	See Paras 85 to 92	3
Output 1.1: Potential of biomass hybrid (solar thermal, biogas, etc) technology for power generation in India explored, documented and shared with MNRE	Study report on potential of biomass hybrid (solar thermal, biogas, etc) technology for power generation documented and submitted to PMU.	0	1	<i>One. A final draft of this report was provided in November 2014. However, there has been no finalization or follow-up on this report.</i>	See Para 86	4
	DPRs of potential biomass-hybrid finalized and submitted to MNRE.	0	1	<i>Zero DPRs received.</i>	See Para 87	3
Output 1.2: Technology performance and evaluation of benchmarks for MIPs available	Developed benchmarks for MIPs and their validation through a technical team.	0	1	<i>In 2010, performance benchmarks were developed for gasification technologies to ring fence qualified gasification suppliers in India.  Benchmarks for technologies in the various MIPs were developed between 2010 and 2014 through various technical consulting teams.</i>	See Para 88	5

<sup>47</sup> Ibid 36



Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>47</sup>
Output 1.3: Long term perspective plan for utilization of wasteland and biomass resources for power generation	Study report on feasibility of dedicated energy plantation on wasteland.  DPRs with potential PPP models prepared and submitted to PMU.	0	1	<i>One study report on the feasibility of an energy plantation on wastelands was prepared in 2014 by DESL.  DPR's were prepared for energy plantations on wastelands.</i>	<i>See Para 89 to 91</i>	5
Output 1.4: Socio-economic study for assessment of impact of biomass power plant on employment generation, livelihood improvement and environment	Study report on findings of socio-economic impact of biomass power plants with regard to employment generation, livelihood improvement and environment, prepared and submitted to PMU.	0	1	<i>Socio-Economic and Environment Impact Assessments (SEIA) of Biomass power plants were completed in 2012 focusing on impacts on the local rural economy.</i>	-	5
<b>Overall Rating – Outcome 1</b>						<b>4</b>

87. With regards to the DPRs in response to the floating of an EOI by the Project, and information generated by the Project on the feasibility of biomass hybrid projects, a total of 16 responses were received in early 2015. However, these potential developers were noncommittal building biomass hybrid projects due to the stated reluctance of Indian financial institutions on funding biomass related projects. A second EOI was issued in early 2015 inviting proposals for biomass solar thermal projects that resulted in no response. As a result, no DPRs on biomass hybrid projects have been received by the Project for review by MNRE.
88. With regards to benchmarking of MIP technologies, a number of important studies were completed by the Project. By 2010, some of the important studies completed included:
- Review of performance of the grid connected biomass power plants installed in India;
  - Review report on the state-of-the-art technologies commercially available worldwide on fuel stock processing and combustion of biomass in multi fuel boilers;
  - Bagasse cogeneration in smaller sugar mills.

The studies were crucial in the preparation of guides for the development of biomass power generation projects in India. These guides included Identification of barriers, resource assessment, evaluation of performance of the existing biomass power plants, review of policy and regulatory framework, development of model documents, and identification of socio-economic and environmental impacts of biomass power projects. By 2012, the Project was able to support development of the Biomass Power Road Map 2012-2017 with MNRE that contributed to the Government setting a set target of 15,000 MW biomass power by 2022. A workshop to discuss biomass policies and regulations to be implemented at the state level was organized in May 2012 at Shimla, which was attended by various SERC chairmen, CERC, CEOs of SNAs, UNDP staff, and MNRE officials. The workshop provided recommendations for policy and regulatory modifications within the existing CERC framework to be implemented by a “Forum of Regulators”, SERCs and relevant approval authorities of for BPPs.

89. With regards to Project efforts to develop long-term strategic planning for the use of wastelands and biomass power projects, there had been a number of other studies completed by 2010 to study the utilization of various biomass types for power generation including:
- Utilization of rice husk for providing electricity in rural areas;
  - Feasibility of briquetting of agro-residues;
  - Management of field distributed crop residues.
90. By late 2014, a consultancy was awarded to review and update the biomass atlas from 2010 with the availability of biomass in wastelands into its database, and to make this information available on the MNRE website. This also led to reports by the state governments of Bihar, Odisha and Rajasthan on identification of proposed wastelands, and a review of existing policy and regulatory frameworks which were shared with relevant state nodal agencies.
91. By early 2015, a number of DPRs were prepared on energy plantations on wastelands including:
- Rajasthan in partnership with the State Farm Corporation on India in Sriganaganagar district;

- Maharashtra in partnership with Tata Power in Satara district;
- Odisha in partnership with Odisha Renewable Energy development Agency in Navagarh District;
- Dedicated energy plantation on wind farms at Tehsil Patan, District Satara, Maharashtra;
- Plantation of beema bamboo for 2.0 and 8.0 MW BMPPs in District Nayagarh, Khordha and Kandhamal, Odisha;
- Plantation of Prosopis Juliflora at Jetsar Farm in District Sri Ganganagar, Rajasthan; and
- Plantation in Mizoram with Global Energy Ltd.

Unfortunately, efforts to catalyze investments into energy plantations on wastelands were abandoned in early 2015. The primary reason was due to the lack of response from Project developers to convert their DPRs into bankable documents for financing. In the case of the plantation in Mizoram, the Project Developer was unable to identify land in due to political unrest in the regions.

92. In conclusion, the results of Component 1 can be rated as **moderately satisfactory** based on the RBBPG Project Part I to deliver some of the intended outputs, but failing to deliver any useful information on biomass hybrid projects after 2013. Without the preparation of such studies, it is difficult to know whether or not biomass hybrid projects would have improved the financial viability of biomass power generation for potential investors.

### 3.3.3 Outcome 2: Enhanced capacities and confidence of stakeholders

93. With regards to the enhancement of stakeholder capacities, activities under Outcome 2 were intended to “enhance capacities and confidence of project promoters, financial institutions, regulators, policymakers, SNAs, other stakeholders through effective information development and dissemination program, along with capacity building initiative”. Project resources were to be utilized to generate outputs including:

- Increased availability of information for project promoters and all stakeholders in focused states and their enhanced knowledge base;
- Improved capacity of key stakeholders and project promoters in targeted states that includes:
  - Communication and advocacy on biomass power become regular feature;
  - Improved access to information through website;
  - Capacity building modules developed and tested in target states/sectors; and
  - Study tours organized for missions in national events.

A summary of the actual achievements of the activities of Outcome 2 with evaluation ratings are provided on Table 7.

94. With regards to “increased availability of information available for project promoters and all stakeholders in focused states”, issues of the “Bioenergy Magazine” between September 2009 and July 2011 have been uploaded onto both MNRE and UNDP Project websites with a focus on biomass power technologies, policy and regulatory issues, and best practices. The name of the publication changed to “Biopower Magazine” with quarterly issues commencing in January-March 2014 to March 2016. Due to lack of strong support for biomass projects by MNRE, there has been no confirmation of any more recent publications of the Biopower Magazine since March 2016.

Table 7: Outcome 2 achievements against targets

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>48</sup>
<b>Outcome 2:</b> Enhanced Capacities and confidence of Project Promoters, Financial Institutions, Regulators, Policy Makers, SNAs, other stakeholders through effective information development & dissemination program, along with capacity building initiatives	Enhanced capacities of key stakeholders involved in the facilitation and implementation of selected biomass power technologies	Wide variation in policy and regulatory environment and inadequate information on various aspects of BPP and bagasse cogeneration in sugar industries, to project developers & other key stakeholders	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 & management) and promotional material and awareness raised significantly in pilot states	Pilot portfolio of project profiles not fully developed.  Model formats for agreements established for the targeted biomass technologies (on fuel supply, energy purchase, project development & management).  Promotional material and awareness raised in pilot states, but not significantly to catalyse biomass power project investments to desired levels.	See Paras 93-103	4
Output 2.1: Increased information available with project promoters and all stakeholders in the focused states and their enhanced knowledge base	Quarterly Newsletter – Bio energy India published and disseminated.	0	12 by EoP (2016)	12 issues of the Bioenergy and Biopower magazines have been uploaded on MNRE and UNDP websites circulated with articles on promoting biomass project development. Latest magazine issue was March 2016 with no further publications of the magazine.	See Para 94	4
	Good Practice documents (model DPR and fuel purchase agreement, energy purchase/ wheeling/ banking, and project development agreements) of biomass power plants prepared	0	1 in each category (total 3 good practice documents)	More than 3 good practice documents have been posted on the MNRE Biomass website: <a href="http://viainfotech.biz/Biomass/theme5/library-forms.php">http://viainfotech.biz/Biomass/theme5/library-forms.php</a>  A 6 minute audio-visual was prepared on Biomass power based on MIP [model investment project] at Ankur Technologies.	See Para 95	5
Output 2.2: Improved capacity of key stakeholders and project promoters in the targeted states						

<sup>48</sup> Ibid 36

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>48</sup>
2.2.1 Communication and advocacy on biomass power become regular feature	Documents on support provided to IBPA on various tariff, regulatory, and policy related issues.	0	1	<i>A number of documents on various tariff, regulatory and policy related issues have been issued and posted on the MNRE website which can be easily accessed by the IBPA. PIRs, however, do not report any specific documentation support to IBPA on these issues.</i>	<i>See Paras 96-97</i>	4
	Discussion papers prepared on various issues.	0	6	<i>5 discussion papers were prepared, some of which were presented at the CII-Exim Bank Conclave on India-Africa Project Partnership in March 2012 in New Delhi.</i>	<i>See Para 98</i>	5
	Minutes/proceedings of thematic discussion forums, brain-storming meetings.	0	6	<i>This indicator has not been reported in the PIRs, and has been assumed to be subsumed into the previous indicator on “discussion papers”.</i>		
2.2.2 Improved access to information through website	User interactive knowledge portal for the Biomass Power Sector launched and regularly updated over project period.	0	1	<i>A web based Knowledge Portal (<a href="http://www.biomasspower.gov.in">www.biomasspower.gov.in</a>) has been launched in May 2015 and was regularly updated until March 2016.</i>	<i>See Para 99</i>	4
2.2.3 Capacity building modules developed and tested in target states/sectors	Consultative meetings with SNAs, SEBs, industry associations and project promoters organized and documented. Capacity building modules developed and implemented in target states and sectors.	0	4	<i>More than 4 consultative meetings conducted between 2010 and 2013 to meet address the challenges and barriers in implementing biomass power projects. However, the purpose of these meetings overlaps with the networking meetings in Outcome 3.</i>	<i>See Paras 100 to 104</i>	5
2.2.4 Study tours organized for missions in national events	Specific number of study tours organized.	0	3	<i>Two study tours, one to EU in June 2014, and another in Tunisia in March 2015.</i>	<i>See Para 105</i>	4
<b>Overall Rating – Outcome 2</b>						<b>4</b>

95. By 2010, good practice documents were available to potential biomass power plant developers including documents related to:
- policy framework reviews currently in place in developed and developing countries (by MITCON in 2009);
  - major barriers for sustained operation of BMPPs (by MITCON in 2009);
  - feasibility report for setting up large capacity (up to 25 MW) biomass based power plant BPPs;
  - “Review of Performance of Grid-Connected Biomass Power Plants in India” that was used to identify biomass power projects in the category of a “non-polluting industry”, a study completed by Deloitte and DSCL that was instrumental in the Ministry of Environment and Forest providing exemption of BPPs from submitting environmental impact assessments for EIAs with capacities of less than 15 MW;
  - a study of biomass supplies from wastelands, forest and shrubs prepared by MITCON and Pranam in 2009 to improve biomass estimates and better understand barriers to improved biomass storage and biomass power production. This report also provides recommendations on biomass power plant management for fuel supply, quality, trade, and utilization practices. The TE team, however, has not seen a copy of this report;
  - a template for power purchase agreements developed in 2011 to aid project promoters and support the implementation of MIPs.

These as well as several other knowledge products have been posted on MNRE’s biomass knowledge portal (<http://www.biomasspower.gov.in/>) facilitating easy access to basic information on developing biomass power projects in India.

96. By 2010, the outcomes of various studies undertaken during the project implementation created positive advocacy to regulators and policy makers as well as directly impacting some National Programmes being implemented by the Ministry including:
- providing inputs to the formulation of revised Guidelines by CERC for determination of normative tariff for biomass power and bagasse cogeneration projects in 2009;
  - a policy that exempted biomass power projects having capacity  $\leq 15$  MW from an EIA study;
  - modification of the National Program on Biomass Gasification Technology to enable effective involvement of manufacturers, beneficiary industries and non-governmental organizations;
  - development of guidelines for setting up of biomass power projects with reduced risk that include sustainable biomass fuel linkages;
  - modification in the national program on bagasse cogeneration to facilitate cooperative sector sugar mills to take up cogeneration projects through BOOT (Build, Own, Operate, Transfer) model; and
  - benchmark norms for material specifications and performance standards for biomass gasifiers and revised procedure for empanelment of gasifier manufacturers.
97. A number of the aforementioned knowledge products were to be used for supporting IBPA. Discussions between the MNRE-PMC and the IBPA, however, were infrequent throughout the duration of the RBBPG Project (Part I). IBPA were only involved with the Project when they were invited to present at these workshops and provide knowledge products for biomass power projects. As such, the IBPA did not receive strategic or systematic support from the Project to be able to

effectively promote biomass power projects in India, especially for biomass projects that would be viable such as captive biomass power projects and those that mitigate adverse environmental impacts.

98. The Project did support the preparation of a number of discussion papers to support biomass power project developments including:

- “Overview of the Indian Biomass Power sector – Challenges & Trends” by V. K. Jain, Tanushree Bhowmik, presented at the International Renewable Energy Congress held in Sousse, Tunisia, March 24-26, 2015;
- “Biomass Power Issues and Challenges – Discussion Paper” by V. K. Jain, Tanushree Bhowmik, A. Chilamburaj, published in the Proceedings of “Regulatory and Financial Barriers and Challenges in Power Generation using Biomass” at the India International Centre, New Delhi on June 9, 2014, Pp.21-36;
- Papers presented in UNDP Session on Biomass Power - Business Opportunities at the CII-Exim Bank Conclave on India-Africa Project Partnership, March 18-20, 2012 at the Hotel Taj Palace in New Delhi including:
  - “Biomass Gasification and Distributed Power Generation for Sustainable Economic Development of Rural India and Africa”, by Ashok Chaudhuri, General Manager of Ankur Scientific Energy Technologies Pvt. Limited, Vadodara;
  - “Malwa Power Plant Limited, Muktsar Biomass Power: The Next Wave in Power Generation” by K. L. Bansal, Director;
  - “Biomass Power in India – An Overview” by V. K. Jain, Director, MNRE.

While the target of 5 documents was achieved, the effectiveness of these discussion papers is questionable considering the outcome of this Project which has not succeeded in catalyzing biomass power project investments in India.

99. By 2015, a web based Knowledge Portal for biomass power project development was developed ([www.biomasspower.gov.in](http://www.biomasspower.gov.in)). The knowledge portal did serve as a user-friendly single point source for information and data related to biomass power, covering biomass power generation, grid connected as well as off-grid and captive applications; and thermal energy from biomass. While the biomass web portal was formally launched by Mr. Piyush Goyal, Honourable Minister of State for Power, Coal and New & Renewable Energy on 14 May 2015, updating of the website was last conducted in March 2016. Since then, no new information has been posted on the website, leading to speculation that the website will not be supported after the EOP. The effectiveness of this website is questionable considering inception of the website in 2015, a time when there was a decline in interest in biomass investments due to decreasing solar PV tariffs, and when MNRE were not actively promoting viable biomass opportunities such as captive applications for agro-processing industries and biomass power generation to avoid burning of rice stalk and associated air pollution problems.

100. The Project over its duration between 2011 and 2015 conducted a steady stream of knowledge products, awareness raising events, and consultative meetings designed for the promotion of biomass power project developments. These outputs were also designed to increase the capacities of all stakeholders at the state-level to more efficiently and effectively develop and implement biomass power projects. A summary of these outputs includes:

- A 1-day workshop in September 2011 on “Biomass Power- Potential, Issues & Challenges” attended by over 100 participants from state nodal agencies, and project developers;
- A 1-day workshop in May 2012 on issues related to state approvals, clearances and tariff with the secretaries of state governments and chairmen of state regulatory commissions. This resulted in several key recommendations for:

⇒ CERC/SERCs/Utilities:

- Existing policies and guidelines for long term PPA may be amended and the developer and utility may be given the freedom to exit out of the PPA and sell its power in open access or to third party on conditions as specified by the regulators including price and availability;
- State utilities may commission a detailed study on issues related to making the actual connections to the 11 kV line for Biomass Power Projects up to 2 MW capacity;
- CERC may consider conducting a yearly independent survey for determining biomass fuel price by appointing an expert committee;
- Normative guidelines on methodology should be issued to guide SERC in setting tariff support for off grid power supply to local mini grids or captive users. This tariff support is important for viability.

⇒ State Governments and State Nodal Agencies:

- States may simplify and streamline the process and procedure for statutory approvals and clearances and other requirements within a given time frame for biomass power plants;
- State level policies and guidelines should be made to encourage small capacity (up to 2 MW) decentralised biomass power projects;
- Fast track clearance from State Pollution Control Boards (PCB) for biomass power projects since they are green projects;
- SERCs may determine biomass prices for purposes of determining biomass power project tariffs for sustained power plant operations;
- State government may consider leasing, allocating waste or degraded land for an energy plantation to supply biomass power plants, similar to the policy announced by Government of Rajasthan;
- Fuel linkages and evacuation shall be made part of the DPR and PPA;
- States may consider encouraging dedicated ventures and companies to handle the fuel supply as a distinct business; and
- National targets for the development of biomass power was set through adoption of a 2-phase approach, culminating in 13,050 MW of biomass power by 2022.

101. During late 2012 and 2013, there was a surge in the number of workshops including:

- Four 2-day biomass awareness raising workshops targeting potential investors in biomass power in sub-megawatt scale (2 in Bangalore by IISc and 2 in Dehradun by consortium of TERI and University of Petroleum & Energy Studies) resulting in 10 expressions of interest. IISc and TERI were expected to support potential investors to prepare DPRs;
- Two 10-day skill development workshops were conducted by IISc and TERI attended by 41 participants. Training was focused on skill development in O&M of sub megawatt range biomass power production with gasifier suppliers and power producers providing classroom and hands-on training operators of gasifier based power plant. The workshops also covered working principles of the technologies, an understanding of specifications for different technology package, gasifier testing protocols, performance guarantees to be tested, troubleshooting,



minimum instrumentation for on-site testing of gasifier. Capacity building modules for participating operators and technicians were made available for wider dissemination and use through the UNDP website;

- A 2-day workshop on “Promoting adoption of biomass power technologies and identification of pipeline projects” with 70 participants from existing and potential biomass power producers, sector experts and regulators;
- Two 1-day workshops on “BOOT” model for cooperative sugar mills in Maharashtra and Punjab;
- Two 1-day awareness and training programs on sugar mill cogeneration in Vadodara, Gujarat and in Tamil Nadu;
- Two 1-day workshops on biomass power generation for rural applications in Andhra Pradesh and Karnataka;
- Two 1-day workshops on “Biomass Power- Potential, Issues & Challenges” in Shimla and New Delhi (in 2013 and 2014 respectively) to discuss issues related to state approvals, clearances and tariff that was led by Secretary, MNRE and attended by Chairman of Regulatory Commissions<sup>49</sup>. This workshop had discussions on the difficulties experienced by State Nodal agencies on developing biomass power projects due to prevailing tariff structures with key recommendations including:
  - setting unique tariffs in consideration of different biomass that can be categorized into woody biomass and residual biomass. Prior to this workshop, all biomass were considered at 4000 kcal/kg;
  - normative guidelines to be formulated by a “Forum of Regulators” for off-grid tariff;
  - off grid biomass power to get priority sector status;
  - capital cost of biomass projects should include costs for secure biomass supplies and processing costs to determine levels of required financial support, incentives, and tariffs to be levied;

Key recommendations are contained in the Workshop Proceedings of the Shimla workshop<sup>50</sup>.

102. In 2013, the Project also facilitated the formation of a working group chaired by the NPD to work on the removal of barriers and challenges in the development of biomass power. The working group sought to identify biomass power development issues related to tariff, financing, fuel supply security, suitable policy interventions, actions required at regular intervals for re-validation of biomass resource atlas and appropriate studies on fuel pricing. Efforts of the working group resulted in the CERC revising the tariff for biomass power plants to Rs.7 per kWh to be implemented by SERCs<sup>51</sup>.

103. The challenge after the CERC ruling was for the PMC to work with SERCs to implement these tariffs for biomass power plant developers. This also catalysed the Project into demonstrating the strengthening of biomass fuel supply chains of existing projects to increase their PLF, based on a successful model by Malwa Power in Punjab. Project support has been provided to setup biomass depots, supply of baling machines to local entrepreneurs, and boiler corrections. This also dovetailed

<sup>49</sup> As reported in the 2013 PIR

<sup>50</sup> This is Reference 9 in Appendix D

<sup>51</sup> CERC issued new Tariff Guidelines for Gasifiers, “Performance/Viability of biomass based plants operating in India, including prevailing prices”, available on: <http://www.cercind.gov.in/2015/orders/SO4.pdf> (March 2015 order), and <http://www.cercind.gov.in/2014/orders/SO354.pdf> (May 2014 order)

into the Government of Punjab's subsidy support to farmers and local entrepreneurs to purchase baling machines for the timely removal of rice stalk in October and November for the winter wheat crop. To date, however, the Project through its monitoring efforts have not established a correlation between these activities and the increase in PLF.

104. The working group was also further challenged in 2013 by the fact that the SERC feed in tariff of Rs. 7/kWh was not sufficient for small scale biomass power plants of less than 5 MW, and that some states were not revising FITs aligning with revised FIT guidance of CERC. Efforts were made by the PMC, UNDP and the consultant carrying out revision of LFA to introduce a "generation-based incentive" for a few MIPs with a proposed rate of Rs. 1 - 2 Rs per kWh. This proposal, however, was never implemented by the PMC.

105. Two study tours were organized by the Project to the:

- European Biomass Conference in Hamburg, Germany in June 2014, attended by representatives from the State Finance Corporation of India, PMC, and UNDP. The purpose of participation was to understand the technology progress, benchmarking, issues, solutions and scope for learning from outside country. The delegation learned that the biomass power sector was also experiencing problems in Europe and Asia similar to the situation in India with few case studies available on biomass gasifier plants for power generation. Follow-up discussions and meetings were with:
  - A biomass processing equipment manufacturing facility in Germany resulting in collaboration with an Indian biomass power developer;
  - Eqtec, Bulgaria and exploring transfer of gasification technology; and
  - ETA Renewables on a partnership in knowledge management in the biomass sector.
- International Renewable Energy Congress held in Sousse, Tunisia during 24-26 March 2015.

106. In conclusion, the results of Outcome 2 can be rated as **moderately satisfactory** based on the RBBPG Project Part I developing knowledge products and supporting discussions amongst regulators at the central and state levels and biomass developers and professionals on resolving tariff issues and other regulatory issues, but not catalysing biomass investments to levels set in the Project goal and objective.

### 3.3.4 Outcome 3: Development of business, commercial and support services networks

107. Activities under Component 3 were intended to "develop business, commercial and support services networks in focused states". The RBBPG Project Part I resources were to be utilized to support national level events as well as state and regional level events to bring together biomass power practitioners, project developers and other relevant stakeholders to share their expertise and promote learning and the strengthening of commercial and support services for biomass power projects. Unfortunately, activities in Outcome 3 only were designed to support 3 networking events and thus making it difficult to understand how these activities contributed towards the development of business, commercial and support services networks, which have not been clearly defined in any of the Project documents. A summary of the actual achievements of Outcome 3 with evaluation ratings are provided on Table 8.

**Table 8: Outcome 3 achievements against targets**

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>52</sup>
<b>Outcome 3:</b> Development of business, commercial and support services networks in focused states	Definition and implementation of biomass power business dissemination models in the project pilot states.	Inadequate Institutional Framework at National, Regional and Local Levels for large scale multiplication of biomass power technology and projects.	Appropriate biomass power business models have been widely disseminated and established in the initial pilot states.	Appropriate biomass power business models for grid-connected plants were not established until 2014, at which time biomass power was becoming less competitive to other renewables such as solar PV. Despite competition from lower solar PV tariffs, the Project made strong efforts to obtain CERC commitment to a national biomass tariff, and to stress the importance of supporting the strengthening of biomass supply chains to biomass power plants. However, the evaluation team is having difficulty linking this outcome with Output 3.1 which was the delivery of 3 networking events.	See Paras 107-109	4
Output 3.1: Information sharing and networking of Biomass Power practitioners at the regional/state level strengthened	National level event organized annually involving participant of various partners, stakeholders, project developers.  Various state/regional level events organized involving particular category of stakeholders to brainstorm/ discuss key topics/issue by sharing expertise, knowledge.	0	3	3 national level events were completed between 2013 and 2014 on the removal of barriers to biomass power project development. The delivery of these networking events was designed to generate the outcome of this component; however, the PMC did not share any further details of follow-up to these events or to monitor if these biomass business models were widely disseminated in pilot states. As such, the effectiveness of this component is questionable.	See Paras 108-109	4
<b>Overall Rating – Component 3</b>						<b>4</b>

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<sup>52</sup> Ibid 36

108. The only output from Outcome 3 is “strengthened information sharing and networking of biomass power practitioners at the regional and state levels”. A target of 3 events to be held by the EOP was achieved with the reported delivery of the following events:

- Shimla workshop in May 2013 that contributed to revision of FIT for biomass power<sup>53</sup>;
- Vadodara workshop in April 2013;
- A 1-day workshop on “Regulatory and Financial Barriers and Challenges in Power Generation from Biomass” on 9 June 2014<sup>54</sup>. Over 100 persons attended the workshop including chairpersons and members of CERC, several SERCs, and senior officials of state energy departments, state nodal agencies, distribution companies from more than 15 states, UNDP, financial institutions, IBPA and biomass project developers. Key recommendations from this workshop includes:
  - CERC increasing the FIT from Rs. 4 to 6/kWh to more than Rs. 7/kWh to be implemented by SERCs;
  - States should have mechanisms to revise tariffs periodically depending on price escalations;
  - SERCs should monitor enforcement of Renewable Purchase Obligation (RPO). Separate RPOs for biomass power should be considered;
  - MNRE should approach Ministry of Rural Development for including biomass collection in the rural areas under the MNREGA scheme; and
  - MNRE should leverage the National Clean Energy Fund (NCEF) for supporting revival of biomass power projects.

109. In conclusion, the results of Outcome 3 can be assessed as **moderately satisfactory** in consideration that the targets set were met, but with questions arising concerning the effectiveness of these contributions in achieving the stated outcome of developing business, commercial and support services networks in focused states.

### 3.3.5 Outcome 4: Creation of fund for contingent financing

110. The original Outcome 4 (referred to in the ProDoc as Activity 4) was the “identification and selection of MIP models”. At a point unknown to the evaluation team, this outcome was changed to the “creation of fund for contingent financing” under which resources from the RBBPG Project Part 1 were utilized for this purpose up to 2013. The purpose for the contingent financing was never clearly defined; however, both GEF and GoI committed US\$5 million for the fund. Various project documents stated that the contingent fund was to provide project preparation funds for biomass project developers as well as funds to be used for unforeseen circumstances in the development and operation of biomass power plants. This was thought to have included funds for working capital during the initial year of operation of a biomass plant after commissioning.

111. RBBPG project resources were used to solicit interest in the capitalization and management of a contingent fund. From 2009 to 2010, the Project received 18 expressions of interest from National level financial institutions for the operation and management of a contingent fund to support MIPs. By 2011, a study was undertaken<sup>55</sup> on revealed that 20 banks were willing to provide term loans to

<sup>53</sup> This is Reference 9 in Appendix D

<sup>54</sup> As reported in the 2014 PIR. This workshop was also a follow-up to the aforementioned Shimla workshop of May 2013.

<sup>55</sup> “Identification of Financial Institutions for Operation of Fund for Contingent Financing and Development of Financial Models for MIPs” by Ernst & Young, January 2011.

the biomass power projects, precluding the need for contingent financing from GEF. This finding was presented to the Project Executive Meeting in 2012 which followed with a recommendation to drop all activities in Outcome 4.

112. In 2015, the Reserve Bank of India (RBI) approved renewable energy as a priority sector for loans including borrowers for biomass based and other RE power generators, and for non-conventional energy based public utilities. This action was to allow banks to increase lending limits to Rs. 15 Crore (equivalent to US\$ 2.3 million), an action made possible due to efforts of a Working Group set up under the Project which leveraged Rs. 200 Crore from a “National Clean Energy Fund” to rehabilitate non-functional plants by MNRE. The PMC had proposed the use of remaining GEF funds into this pool of funding. However, this was not approved since the incremental activities and benefits towards meeting GEF objectives could not be defined.

### **3.3.6 Outcome 5: Model Investment Projects (MIPs)**

113. Activities under Component 5 were intended to “commence implementation and commissioning of model investment projects (MIPs)”. Project resources were to be utilized to commission and stabilize MIPs, implement green field MIPs, and document lessons and evolution of replication strategy for biomass MIPs. A summary of the actual delivery of outputs from Outcome 5 with evaluation ratings are provided on Table 9.

114. With regards to the commissioning and stabilization of MIPs and implementation of greenfield MIPs, the evaluation team refers the reader to Table 3 on the latest status of the MIPs as of the EOP. There was no progress towards achieving the targets set in 2013 for new MIPs. With regards to the intended targets of entire outcome, the Project took considerable time to strategize its approach on how to support the MIPs:

- In 2007-08, the Project supported Malwa Power to establish 25 collection centres equipped with chipping and transportation arrangements to secure the supply of rice stalks to their 6.0 MW biomass power plant in Gulabewela Village (north of Muktsar, Punjab);
- In 2008, based on extensive stakeholder consultations and the experience at Malwa, the importance of strengthening the fuel supply chain for biomass supply security to BMPPs was recognized. As such, Project support was proposed to assist more entrepreneurs to improve the reliability of biomass delivery to BMPPs through the use of equipment to bale and briquette biomass for delivery;
- In 2009, ToRs were developed for inviting expressions of interest in developing MIPs;
- In 2010, the PSC also stressed the need to demonstrate viability of biomass power projects smaller than 2 MW. As a follow-up to adopting actions to strengthen the fuel supply chain for existing BMPPs as a means to improve their PLF and improve their economic viability, 87 EoIs were submitted for setting up MIPs with the following categorizations for Project support:
  - biomass combustion and biomass gasification technologies for grid connected projects;
  - strengthened fuel supply linkages to existing biomass or bagasse cogeneration power plants;
  - 1-2 MW biomass projects for cogeneration in SMEs such as oil extractions plants, and for decentralised distributed power;

**Table 9: Outcome 5 achievements against targets**

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>56</sup>
<b>Outcome 5: Model Investment Projects (MIPs)</b>	Model Investment Projects (MIP) commissioned and implementation started	Models for implementing BPP do not exist either for captive or distributed biomass resources	MIPs cumulating to 15.2 MW (comprising of 9 MW for gasification/ combustion based power generation including open access sale, 4 MW for non-bagasse based co/tri-generation using captive biomass, 2.2 MW small gasifier systems/ packages for greening about 200 telecom towers in cluster mode) contracted and implemented in remaining extended project period till March 2016 (EOP)	<p>The Project supported 3 MIPs totaling of 4.2 MW of greenfield biomass power. Only 1.0 MW (1 out of 3 MIPs) can be considered operational. None of these are the small gasifier systems for greening 200 telecom towers which was not implemented.</p> <p>The Project supported 4 MIPs totaling 47 MW of brownfield MIPs or existing power plants by supporting strengthened fuel supply linkages to improve PLFs of the plants.</p>	<i>See Paras 115 to 112</i>	3
Output 5.1 Commissioning and stabilization of MIPs Implementation of green-field MIPs	MIPs cumulating to 12MW additional capacity selected, all financial closure effected and MIPs got commissioned and stabilized for its operation in focus states and target sectors	0	<p>Cumulating 15.2 MW (in remaining period) covering:</p> <ul style="list-style-type: none"> <li>• 9 MW cumulative open access sale</li> <li>• 4 MW cumulative non bagasse based co/tri-generation</li> <li>• 2.2 MW small gasifier systems for telecom tower clusters</li> </ul>	<p>There was no progress on any of these targets between 2013 and the EOP. This includes:</p> <ul style="list-style-type: none"> <li>• No plants with cumulative open access electricity sales;</li> <li>• No cumulative non-biogasse co/tri-generation. However, a 9.0 MW cogeneration plant owned by Shree SSK Pandurang Pvt. Ltd, in Solapur, Maharashtra is operational;</li> <li>• No small gasifiers installed for telecom tower clusters;</li> </ul> <p>However, by EOP, the Project was involved with supporting the following MIPs:</p> <ul style="list-style-type: none"> <li>• Strengthening of fuel supply linkages for BMPPs (total installed capacity of 45.6 MW) with: <ul style="list-style-type: none"> <li>○ Universal Biomass' 14.5 MW biomass combustion plant at Muksar, Punjab;</li> <li>○ Malwa Power's 6.0 MW biomass combustion plant at Gulabewela Village, Punjab;</li> <li>○ Shree SSK Pandurang's 19 MW bagasse and sugarcane trash cogeneration plant at Solapur, Maharashtra;</li> </ul> </li> </ul>	<i>See Paras 114 to 122</i>	3

<sup>56</sup> Ibid 36

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating <sup>56</sup>
				<ul style="list-style-type: none"> <li>○ SLS Power's 6.0 MW plant in Nellore, Andhra Pradesh which stopped operations in June 2017;</li> <li>● Providing financial assistance to 3 greenfield MIPs totalling 4.2 MW, none of which are fully operational for reasons mentioned below:               <ul style="list-style-type: none"> <li>○ Ruchi Soya's 1.0 MW plant in Washim, Maharashtra which will be operational in late 2017 but to be mainly used for captive purposes which is not mentioned in the targets for this indicator. Due to load shedding in India, captive power generation is attractive to many companies. The Project, despite the absence of such an indicator, needed to encourage captive power generation using biomass systems;</li> <li>○ Ankur Scientific Energy Technology's 1.2 MW in Sankheda, Gujarat which has not been operational since January 2014 due to tariff dispute with Gujarat SERC; and</li> <li>○ Dee Vee Power's 2.0 MW biomass combustion plant in Kushal Nagar, Karnataka which is not operational due to failure of proponent to complete project and demonstrate 3 months of sustained operations (to qualify for Project grant).</li> </ul> </li> </ul>		
Output 5.2 Documentation of lessons and evolution of replication strategy/plan	Performance of all MIPs commissioned got monitored, evaluated and documented. The future replication strategy/plan evolved based on major learnings/findings documented from MIPs commissioned.	0	1 for each MIP implemented (cluster in case of telecom towers)	No documentation on the performance of the MIPs was made available to the Evaluation Team. PIRs from 2013 to 2015 made mention of visits by the NPD and NPC to some of the MIPs (specifically to Ruchi Soya in 2015 and SLS Nellore in 2013) with an evaluation report prepared for each visit which the Evaluation Team have not seen.	-	2
<b>Overall Rating – Outcome 5</b>						<b>3</b>

- By mid-2011, the geographical scope of the existing and proposed biomass power plants for Project support was expanded to include all states in India. This was done with the Project with MNRE issuing sanctioning letters to MIPs and letters to SNAs and financial institutions of the intention of the RBBPG Project to support project developers, and build confidence in the process for obtaining regulatory clearances approvals for PPAs and capital cost financing;
- By early 2012, the Project committed support with first payment instalments for:
  - fuel supply linkage support for Shree SSK Pandurang Pvt. Ltd, Solapur, Maharashtra for the collection of 25,000 metric tonnes of cane trash to fuel its 8 MW cogeneration plant and extend its off season operation by 60-80 days;
  - biomass gasification technology for Ruchi Soya Industries, Washim, Maharashtra for the supply and installation of a fluidized bed gasification technology to be installed in a 1 MW<sub>e</sub> capacity plant that was sanctioned in May 2012. Technology installation was performed by Thermax Ltd. based on gasification technology from the Energy Research Center, the Netherlands. The total cost of the project was US\$ 3.0 million out of which US\$ 400,000 was financial support from the Project;
- By early 2013, the PMC recognized that there were insufficient number of MIPs to meet the objectives of the Project. In March 2013, the PMC engaged Zenith, a consulting firm, to identify pipeline projects that can be supported as MIPs. This was partly achieved through a 2-day workshop on “Promoting adoption of biomass power technologies and identification of pipeline projects” in Vadodara, Gujarat. The workshop was a forum for experts to present past and existing biomass power projects, challenges faced and strategies in effective development of biomass power projects, funding and technological options for establishing MIPs, the process of statutory approvals required for commissioning BPPs, and industry responses to low tariff and issues related to fuel supply security as major constraints to growth of biomass power sector. More than 70 delegates attended the workshop;
- By 2013, the Project provided grant instalments to more MIPs for equipment procurement, commissioning and civil works including:
  - fuel supply linkage support for Universal Biomass Energy Pvt. Ltd, Muktsar, Punjab, 14.5 MW;
  - fuel supply linkage support for SLS Power Ltd., Nellore, Andhra Pradesh, 6 MW; and
  - biomass gasification technology for Ankur Scientific Energy Technology Pvt. Ltd, for its 1.0 MW in Sankheda, Gujarat;
  - biomass combustion of coffee waste at Dee Vee Power, Kushalnagar, Karnataka, 2.0 MW. This plant, however, was not completed (see Para 115);
- In summary, the Project took almost 5 years to commence support for 7 MIPs. Many of these delays were due to time taken for approvals and commissioning. A detailed study to document the complete cycle for setting up the MIPs was undertaken in 2014 with the conclusion that the time required for obtaining 8-10 statutory approvals, clearances, signing of PPAs and sanctioning term loans was between 18 to 24 months, plus another 12 to 15 months for installation and commissioning of the BMPP.

115. By the EOP, two projects were not operational:

- The 1.0 MW biomass gasification technology in Sankheda, Gujarat owned by Ankur Scientific Energy Technology Pvt. Ltd. The primary reason for the plant shut down has been the crash of REC prices and the failure of Ankur to secure the PPA with Gujarat SERC at a tariff that could sustain plant operations<sup>57</sup>; and

<sup>57</sup> The minimum tariff required by small biomass power plants is in the order of Rs.7/kWh.



- The 2.0 MW biomass combustion plant developed by Dee Vee Power in Kushal Nagar, Karnataka. Plant was never completed due to the owner not being able to comply with the conditions of MNRE and Project support which requires the plant equipment to be erected and commissioned as well as demonstrating successful operations for 3 months. The plant owner despite having purchased all equipment, is unable to find financing to complete the plant which may be dismantled within the next 3 to 4 months.
116. MIP operations were to be documented for the purposes of learning and dissemination to other potential biomass power plant owners. Given the difficulties in the long development periods of the MIPs, the Project produced few monitoring reports on the operations of the MIPs, none of which were made available to the Evaluation Team. Moreover, the quality of operational information in the PIRs was not reliable or consistent. A primary reason for this deficiency may be that very few visits were made by PMC personnel to the MIPs (as noted in the interviews with owners of 5 MIPs).
117. The 2013 Ankur plant operations were reported for 2015 PIR. The plant operated with an average PLF of 64% and GHG emissions reduced by 6,350 tCO<sub>2e</sub>, on the basis of the operation of a 100% producer gas engine that provided a benchmark for a gasifier system package, useful in determining gasification plant costs and required tariffs. The plant also contained innovations including a pyro-gasifier capable of using biomass mixtures of varying properties, a dry gas cleaning system reducing wastewater generation significantly, effective use of waste heat for drying biomass, obtaining chilled water for cooling producer gas, gas cleaning train using a vapour absorption machine, demonstrating the use of a biochar by-product as a substitute for phosphorous-fertilizer through experimental plantation sites, sale of bio-char to farmers and distribution of appropriate cook stoves for use of char briquette. Unfortunately, the plant halted operations in December 2013. There have been no updates since the 2015 PIR on discussions to resume the operations of the plant. The visit of the TE team to Vadodara with Ankur revealed no ongoing activities to revive the plant.
118. At the EOP date of July 31, 2017, the RBBPG Project had several other biomass projects in the pipeline that have not yet received Project support including:
- Kandra Energy's 2 MW biomass-based distributed power generation plant at Bellary, Karnataka: The project was to use cotton stalk, paddy straw, rice husk, bamboo chips biomass residues with 25% of the power being sold to local communities at Rs. 4.2/kWh with 2% annual escalation and the remainder to Karnataka Power Corporation Limited (KPCL) at a feed-in tariff of Rs. 3.72/kWh with 2% annual escalation. Initiated in 2010, this project has not yet achieved financial closure, partly due to the low feed-in tariff. Project will not likely be implemented unless the Government of Karnataka increases the feed-in tariff for biomass power plants;
  - Three greenfield biomass power plants (3 MW + 3 MW + 1 MW) on three islands in Lakshadweep that are currently being developed;
  - One greenfield biomass power plant (1 MW) in Andaman & Nicobar islands currently under development;
  - A greenfield 1 MW Gasifier being commissioned by Cummins Cogeneration Ltd. In Tamil Nadu.
119. In 2013, other opportunities to develop biomass power generation explored in Haryana State with the Haryana Chamber of Commerce and Industries (HCCI). Over 30 EoIs were received from HCCI members, primarily rice mill operators. Given that biomass comes as by-product to these rice mills, the Rs 5.30 per kWh cost of the grid power was less costly than developing a 1 to 2 MW biomass power plant. These discussions were terminated in early 2014.

120. The difficulties in developing biomass power plants in several states can be tied to the low tariff and long-term PPAs with no exit options. Despite many biomass plant owners filing petitions to SERCs for tariff revision between 2014 and 2015, and some upward movement of tariffs, bridging the difference between the cost of electricity generation from biomass power plants and the tariff offered, combined with a crash in carbon prices and decreasing solar PV tariffs, several new biomass plants were hesitant to enter into long term PPAs with distribution companies and state utilities. Furthermore, there is precedence set with previously negotiated PPAs with higher tariffs not being honoured (such as in Gujarat and Karnataka), and the lack of support for wheeled power (as in the case of Ankur Technologies in Gujarat).

121. These aforementioned outcomes had a strong impact on the planning of RBBPG Project's activities in 2014. The PMC did not appear to be active in helping biomass investors in search of viable biomass power projects, notably in captive power generation. UNDP also put together a scheme to implement a "generation-based incentive" (GBI) that was designed to maximize electricity generation by small scale projects (bypassing the requirement of 3 months of continuous operation to qualify for Project assistance) and providing much needed information and lessons for developing a national strategy for small scale biomass power plants. Unfortunately, GBI was never implemented.

122. With the notable surplus of GEF funds still remaining as of 2016 (upwards of US\$2.4 million), the MNRE suggested the restructuring of the RBBPG Project during the review meeting held on February 23, 2016 (and in MNRE's proposal to GEF - OFP and UNDP on March 10, 2016) in a last attempt to catalyze biomass power generation investments, with the following conditions:

- include biomethanation of green organic waste to include fruits, vegetables, flower market wastes, agro-industrial wastes (pressed mud from sugar industry, wastewater residues from fruits, maize tapioca starch processing industry), and livestock manure;
- hold a consultation meeting with potential stakeholders immediately to discuss plant layouts, cost of waste to power plants, financial support requirements and preliminary feasibility;
- set a target of the minimum 5 biomethanation projects with a cumulative capacity of 5 MW;
- extend the Project for a period of 2 years to utilize the remaining US\$2.4 million of GEF funds.

123. This request for extension of the project to 2018 was subsequently not approved by GEF<sup>58</sup> for a variety of reasons including:

- the requirement to provide major amendments and clearance by GEF Council for concurrence to a different technology of biomethanation;
- amending and extending an 11-year project with a poor track record of implementation;
- lack of innovation in the proposed amended project, notably on "pilot demonstrations on anaerobic digestion", which is a proven technology that is well established in India; and
- current support of digestors by GEF and UNDP in India through GEF Project 4900, "Scale-up of Access to Clean Energy for Rural Productive and Domestic Uses".

As a consequence, these funds will need to be returned to GEF.

124. In conclusion, the results of Outcome 5 can be assessed as **moderately unsatisfactory** in consideration of:

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<sup>58</sup> Letter from Mr. Gustavo Fonseca of GEF to Mr. Andrew Hudson of UNDP, August 29, 2016

- several projects successfully supported to strengthen the supply chain for biomass fuel to biomass power projects, and increasing their PLF, notwithstanding the lack of monitoring to gauge the impact of the strengthened biomass fuel supply chain on the PLFs;
- successful demonstration of biomass power projects using bagasse for captive power generation;
- failing to successfully implement sustained operations of biomass power plants with open access;
- late implementation of one captive non-bagasse power plants;
- failure to implement several captive non-bagasse power plants and gasifier systems for telecom companies to demonstrate financial viability of this implementation model;
- failure to adaptively manage to the changing policy management; and
- failure to notice the immense environmental benefits as well as employment potential that could possibly help in overriding and compensating the high cost of biomass power production.

### 3.3.7 Relevance

125. The RBBPG Project Part I still remains **relevant** to the development priorities of India, notably the Integrated Energy Policy (IEP) of 2006 and the National Action Plan on Climate Change (NAPCC). The objective of the RBBPG Project Part I of “accelerating the adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas” is in line with the Government’s strategy to increase India’s energy security, and to undertake and implement key strategies and actions to mitigate the impacts of climate change. Although the Project has taken 10 years to implement with profound changes to the market conditions for renewable energy, the promotion of biomass energy in India still remains relevant to India’s development goals in consideration of the availability of biomass, the number of SME industries still utilizing fossil fuels many of which are imported, and the opportunities to convert biomass to energy to resolve significant environmental issues in India.

126. The RBBPG Project Part I was funded under GEF 3 under OP 6 which was designed to promote the adoption of renewable energy through assistance in removing barriers and reducing implementation costs. Despite the difficulties the Project has experienced over the past 10 years in meeting its goal and objective, the Project is still relevant with the objective of OP 6.

### 3.3.8 Effectiveness and Efficiency

127. The effectiveness of the RBBPG Project Part I has been **moderately unsatisfactory**, given the shortcoming of the Project goal in not achieving GHG emission reduction targets, and not achieving the Project objective of accelerating adoption of biomass power technologies and distributed biomass materials. The Project was successful in formulating and successfully lobbying the CERC for a biomass tariff of Rs. 7/kWh for dissemination to SERCs. However, the lack of Project effectiveness can be largely attributed to:

- the changing marketplace for renewable energies (with the falling price of solar PV power);
- a general lack of active and focused adaptive management to promote biomass power projects that are viable in captive applications and for resolving significant environmental problems;
- experiencing of difficulties to provide sufficient influence over SERCs to honour long-standing PPAs with tariffs to sustain BMPP operations;
- too much focus on the sale of electricity to the grid.

128. The efficiency of the RBBPG Project Part I has been **unsatisfactory** for a range of reasons:

- the Project was designed to be implemented within 3 years. The original Project duration specified in the ProDoc was 3 years although the Project took 11 years with just over 40% of the original GEF funds remaining of US\$2.4 million;
- during the first 2 years of the Project in 2006 to 2008, close to US\$1.4 million was expended with very few if any outputs delivered;
- approximately US\$1.85 million of Project funds was expended between 2009 and the termination date of July 31, 2017, a span of almost 8 years. During this 8 years, the Project managed to support 7 MIPs, all of which were completed with varying degrees of success. In consideration of the modest level of funds spent to achieve support for 7 MIPs as well as project outputs that assisted biomass Project developers (such as model templates for PPAs and agreements, and the recommended national biomass tariff of Rs.7 recommended by the CERC), these outputs have been delivered with moderate cost-effectiveness. However, these expenditures have not resulted in the delivery of the objective of the Project, which was to accelerate the adoption of biomass power technologies and distributed biomass materials.

### 3.3.9 Country Ownership and Drivenness

129. In consideration of the current state of the biomass power generation market, the RBBPG Project has not resulted in improvements in the regulatory framework for the approval of biomass projects in India. Moreover, despite the financial attractiveness of cogeneration biomass projects and over 2,000 MW of cogeneration projects in operation, the RBBPG Project has not resulted in any improvements in streamlining regulatory approvals for biomass power generation projects. In particular, this would apply to biomass power generation projects which have open access for sale of electricity to the national grid. The complexities of promoting biomass power generation in India are strongly linked to working at state level institutions to ensure security of power purchase agreements between biomass power producing entities and state level utilities for the sale of electricity.

130. In view of what the Terminal Evaluation team has observed during its mission to India in July 2017 and recent trends in renewable energy where wind and solar power are generating electricity at lower costs, the capacities of state level institutions to support implementation of biomass power projects in India is clearly an obstacle. Moreover, MNRE has not promoted the positive aspects of biomass power generation in the captive market (to offset the use of expensive imported fossil fuels) as well as biomass power generation to mitigate adverse environmental impacts (such as avoidance of rice stalk burning in the Punjab). Furthermore, MNRE has not come forward with any national policy regarding the promotion and support for biomass power generation projects in India. As such, the TE team can only conclude notwithstanding the continued strong relevance of developing biomass power generation in India, that country ownership and drivenness of the RBBPG Project is very weak and rated as **unsatisfactory**.

### 3.3.10 Mainstreaming

131. The intended objective and outcomes of the RBBPG Project Part I are successfully mainstreamed with:

- the UNDAF for India 2008 to 2012<sup>59</sup>, specifically UNDAF CP Outcome 4.2: Communities are aware of their vulnerabilities and adequately prepared to manage and reduce disaster and environmental related risks, Output 4.3.2: Capacities build and pro poor initiatives supported at national and local levels to directly address environmental issues. One of the targets for this output is to “increase access to clean energy with focus on renewable energy technologies for remote areas”;
- UNDAF for India for 2013 to 2017<sup>60</sup>, specifically UNDAF/CPD Outcome: Government, industry and other relevant stakeholders actively promote environmental sustainability and enhanced resilience of communities in the face of challenges of climate change, disaster risk and natural resource depletion”, with CP output of “access to clean energy is expanded to underserved communities and small-scale industries” by “demonstrating solutions to reduce barriers for investment into biomass projects”.

132. However, given the actual outcomes of the RBBPG Project Part I, the Project has had some positive effects in creating employment and improving the utilization of agricultural waste in areas where MIPs have been successfully implemented. This has, to some extent, improved access to clean energy in agricultural communities, but not to the extent envisaged in the objectives which was to accelerate the use of biomass for power generation. Moreover, with the lack of proactive promotion of biomass power generation opportunities, the sustainability of activities of the RBBPG Project Part I is unlikely after the EOP (see Section 3.3.11). This outcome is truly unfortunate given the potential of accelerated use of biomass for power generation strongly aligning with UNDP’s priorities of poverty alleviation in rural areas. In addition, the expanded use of biomass for power generation in the Punjab would be a significant contribution to avoiding air pollution episodes (that severely impacts communities including New Delhi in the upper Ganges River Basin) resulting from the burning of rice stalk by farmers during the months of October and November each year.

### 3.3.11 Sustainability of Project Outcomes

133. In assessing sustainability of the RBBPG Project Part I, the evaluators asked “how likely will the Project outcomes be sustained beyond Project termination?” Sustainability of these objectives was evaluated in the dimensions of financial resources, socio-political risks, institutional framework and governance, and environmental factors, using a simple ranking scheme:

- 4 = *Likely (L)*: negligible risks to sustainability;
- 3 = *Moderately Likely (ML)*: moderate risks to sustainability;
- 2 = *Moderately Unlikely (MU)*: significant risks to sustainability; and
- 1 = *Unlikely (U)*: severe risks to sustainability; and
- U/A = *unable to assess*.

Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions.

<sup>59</sup> [http://www.in.undp.org/content/dam/india/docs/country\\_programme\\_action\\_plan.pdf](http://www.in.undp.org/content/dam/india/docs/country_programme_action_plan.pdf) - see pg 51

<sup>60</sup> [http://in.one.un.org/wp-content/uploads/2016/09/India\\_UNDAF202013-17\\_9Jul2012-1.pdf](http://in.one.un.org/wp-content/uploads/2016/09/India_UNDAF202013-17_9Jul2012-1.pdf) - see pgs 11 and 29

134. The overall RBBPG Project Part I sustainability rating is unlikely (U). This is primarily due to:

- lack of financial resources and political will of MNRE to promote grid-connected biomass power projects in India due to higher operational costs of these projects and the lower cost of competing renewable energy sources such as solar PV;
- failure of Project to focus on financially viable biomass power projects for captive power generation for industrial SMEs and avoidance of rice stalk burning in the Punjab;
- failure to streamline regulatory approvals and clearances at the central and state levels for biomass power projects.

Details of sustainability ratings for the RBBPG Project Part I are provided on Table 10.

### 3.3.12 Impacts

135. The RBBPG Project Part I did not achieve the desired impacts of accelerating the adoption of biomass power generation and increased use of biomass materials for power generation. The resulting impact of the RBBPG Project Part I was a low level of GHG emission reductions from biomass MIPs considering the expenditure of US\$3.25 million of GEF grant funds. Despite Project support for 7 MIPs, the impact of Project support has not been significant in the context of catalyzing biomass power project investments over and above the baseline growth of biomass power projects (which was estimated by MNRE to be 1,677 MW in 2008 and 2,808 MW in 2013 as mentioned in Para 21). Much of this growth was fuelled by CDM (with an estimated 2,933 MW in the CDM pipeline as of 2008)<sup>61</sup>. Of the 7 MIPs:

- 4 were existing plants totaling 40.5 MW that received assistance in the securitization of biomass supplies which had the impact of increasing the PLF (estimated to be between 2 and 10% although this was not monitored or measured by the Project). These MIPs also generated substantial employment in the collection, baling and transport of rice stalk supplies and other agricultural waste to the BMPPs;
- 3 MIPs totaling 4.2 MW were greenfield investments out of which one is to be operational in late 2017, one was completed but has not been operational since 2014 (due to tariff dispute), and the other one has not been completed and is not operational.

This outcome severely limits the global environmental impact of the Project.

136. There were several reasons why the RBBPG Project Part I did not have significant impacts:

- As a GEF-3 Project, there were no GHG emission reduction targets and the LFA was vague;
- The Project design was overambitious in achieving 26.7 MW of operational BMPPs within a 3-year period, considering the barriers that were to be removed by the Project (see Para 35);
- Project was implemented at a slow pace without successfully removing some of the obstacles impeding accelerated development of biomass power generation in India;
- Despite a full complement of personnel within the PMC, Project supervision was constrained and limited (in terms of monitoring and evaluating activities) leading to a paucity of field information and limited and ineffective feedback at PSC meetings towards approval of adaptive management measures.

<sup>61</sup> [https://www.researchgate.net/profile/Goeran\\_Berndes/publication/257434426\\_Determining\\_factor\\_for\\_the\\_development\\_of\\_CDM\\_biomass\\_power\\_projects/links/551e96530cf29dcabb043273/Determining-factor-for-the-development-of-CDM-biomass-power-projects.pdf](https://www.researchgate.net/profile/Goeran_Berndes/publication/257434426_Determining_factor_for_the_development_of_CDM_biomass_power_projects/links/551e96530cf29dcabb043273/Determining-factor-for-the-development-of-CDM-biomass-power-projects.pdf)

Table 10: Assessment of Sustainability of Outcomes

Actual Outcomes (as of July 2017) against revised PRF of 2013	Assessment of Sustainability	Dimensions of Sustainability
<p><b>Actual Outcome 1:</b> Technology benchmarks for MIPs has been made available including plans for the utilization of wastelands as energy plantations for biomass resources; however, benchmarking for biomass hybrid systems was not established during the Project</p>	<ul style="list-style-type: none"> <li>• <i>Financial Resources:</i> Financial resources are not in place to continue technology benchmarking for biomass power generation and the sourcing of biomass;</li> <li>• <i>Socio-Political Risks:</i> State governments view biomass power generation as being too costly in comparison with solar PV power generation, halting any further promoting of MIP technologies for biomass power plants, notwithstanding the significant benefits of biomass power generation for industrial SMEs using fossil fuels, and for the avoidance of rice stalk burning in the Punjab;</li> <li>• <i>Institutional Framework and Governance:</i> Awareness of state level governments of the benefits of biomass power generation remains low, and thus biomass technologies used in the MIPs will not be promoted by central or state governments;</li> <li>• <i>Environmental Factors:</i> Activities in this outcome strongly support the development of indigenous renewable energy which can significantly reduce GHG emissions.</li> </ul> <p style="text-align: right;"><b>Overall Rating</b></p>	<p style="text-align: center;">1</p> <p style="text-align: center;">1</p> <p style="text-align: center;">1</p> <p style="text-align: center;">4</p> <p style="text-align: center;"><b>1</b></p>
<p><b>Actual Outcome 2:</b> The capacities of project promoters, financial institutions, regulators, policy makers, SNAs, and other stakeholders has been enhanced through increased availability of information on biomass project development, the government’s biomass website, and capacity building activities of the Project.</p>	<ul style="list-style-type: none"> <li>• <i>Financial Resources:</i> MNRE has not made a financial commitment to continue maintenance of the Government’s biomass website;</li> <li>• <i>Socio-Political Risks:</i> MNRE’s role in promoting biomass power generation has been passive with more emphasis on promoting the less costly solar PV power generation projects. As such, it is doubtful that MNRE would sustain information flows on best practices in developing and maintaining biomass power generation projects, either through its website or awareness raising programs;</li> <li>• <i>Institutional Framework and Governance:</i> The capacities of SNAs and other state level stakeholders has been improved, but not to the level where biomass power projects can be promoted to benefit industrial SMEs and to mitigate air pollution episodes resulting from the burning of rice stocks in the Punjab in October and November annually;</li> <li>• <i>Environmental Factors:</i> Activities in this outcome do not generate any adverse environmental impacts.</li> </ul> <p style="text-align: right;"><b>Overall Rating</b></p>	<p style="text-align: center;">2</p> <p style="text-align: center;">2</p> <p style="text-align: center;">2</p> <p style="text-align: center;">4</p> <p style="text-align: center;"><b>2</b></p>
<p><b>Actual Outcome 3:</b> Information sharing and networking of biomass power practitioners was developed by the Project.</p>	<ul style="list-style-type: none"> <li>• <i>Financial Resources:</i> Financial resources are in place with the Indian Biomass Power Association to continue promoting biomass power projects. However, without proactive government support for biomass power projects, membership of IBPA is likely to dwindle reducing the availability of financial resources for the promotion of biomass power projects;</li> <li>• <i>Socio-Political Risks:</i> Passive promotion of biomass power projects by MNRE will not support sustained and continued development and networking of biomass power practitioners for information sharing. This is being evidenced by the lack of maintenance on MNRE’s Biomass Knowledge Portal (<a href="http://www.biomasspower.gov.in/">http://www.biomasspower.gov.in/</a>);</li> </ul>	<p style="text-align: center;">3</p> <p style="text-align: center;">2</p>

**Table 10: Assessment of Sustainability of Outcomes**

Actual Outcomes (as of July 2017) against revised PRF of 2013	Assessment of Sustainability	Dimensions of Sustainability
	<ul style="list-style-type: none"> <li>• <i>Institutional Framework and Governance:</i> There is poor state level support for biomass power generation which would discourage further networking of biomass power practitioners on information sharing;</li> <li>• <i>Environmental Factors:</i> Activities in this outcome do not generate any adverse environmental impacts.</li> </ul> <p style="text-align: right;"><b><i>Overall Rating</i></b></p>	<p style="text-align: center;">1</p> <p style="text-align: center;">4</p> <p style="text-align: center;"><b>1</b></p>
<p><b>Actual Outcome 5:</b> Model investment projects have been implemented but have generated a poor level of information regarding their performance and lessons learned that can be used to improve future biomass power project development.</p>	<ul style="list-style-type: none"> <li>• <i>Financial Resources:</i> Financial resources are available for biomass power projects; however, there have been few MIPs that demonstrate financial viability that would attract further investment;</li> <li>• <i>Socio-Political Risks:</i> The Project has not promoted viable and environmentally beneficial biomass power projects such as captive power generation using biomass for industrial SMEs and biomass power generation to avoid rice stalk burning in the Punjab;</li> <li>• <i>Institutional Framework and Governance:</i> Regulatory approvals and clearances for biomass power projects still requires considerable effort and time, creating uncertainties for potential biomass power project investors;</li> <li>• <i>Environmental Factors:</i> Activities in this outcome strongly demonstrate the environmental benefits of biomass power generation to avoid rice stalk burning in the Punjab.</li> </ul> <p style="text-align: right;"><b><i>Overall Rating</i></b></p>	<p style="text-align: center;">3</p> <p style="text-align: center;">2</p> <p style="text-align: center;">1</p> <p style="text-align: center;">4</p> <p style="text-align: center;"><b>1</b></p>
	<p><b><i>Overall Rating of Project Sustainability:</i></b></p>	<p style="text-align: center;"><b>1</b></p>



## 4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS

137. The RBBPG Project Part I did not catalyze investments into biomass power projects and expended less than 60% of the GEF grant of US\$5.65 million over an 11-year period. A primary reason for this outcome was in the overambitious design that expected to remove a number of regulatory, fiscal, institutional and capacity barriers that impede the accelerated the development of biomass power generation projects, all within a 3-year period.

138. Another important reason for this outcome was failure of the Project to adapt to changing market conditions in the renewable energy market and move away from the development of grid-connected biomass power plants which were under threat from less costly solar PV power generation. The Project, instead, should have placed more emphasis on more attractive biomass power generation development models such as captive power generation in agro-industries and biomass power generation for the avoidance of rice stalk burning in the Punjab.

139. At the EOP, the Project has been unable to remove barriers to create an investor-friendly environment for biomass energy development in India. Current barriers discouraging biomass power generation investments include:

- A long drawn-out regulatory approval process for these projects or other construction projects that has yet to be streamlined;
- SNAs being unable to formulate policies to effectively promote biomass power that are in line with CERC regulations including:
  - allotment of biomass energy licenses for developers based on estimates of available surplus biomass (instead of the existing rules that provide licenses within a 75-km radius);
  - the inclusion of the mechanisms and costs of biomass collection and processing as part of a biomass power project. This would aid regulators in determining fair and appropriate tariffs for biomass-based electricity generation;
  - flexibilities in the adjustment of biomass prices (as opposed to one fixed price over a long term);
  - flexibilities in the structures of PPAs in all states (that would contain escalation clauses for long-term PPAs and less penalties if the plant were to underdeliver in its obligations for minimum electricity delivery);
  - state approvals of biomass power projects based on market rates of electricity, not other benefits such as reduction of air pollution (avoidance of burning straw) and steady rural employment;
- Financial institutions becoming unwilling to approve financing of new biomass power projects due to the aforementioned regulatory risks;
- The lack of a national policy towards biomass energy development that would have forced state nodal agencies and SERCs to recognize the value of biomass power development in India as a means of reducing the country's dependence on imported fossil fuels and mitigating global environmental impacts such as GHG emissions.

140. The slow pace of RBBPG Project Part I implementation can be attributed to several factors:

- Progress during the 2006-08 period when there were few reported achievements coupled with an expenditure of US\$1.4 million or nearly 25% of the GEF budget. This outcome resulted in the replacement of the entire project team in September 2008 by MNRE;
- GEF funds being disbursed from UNDP to MNRE but also pooled with Gol budgets setup to support MIPs on biomass power project developments. After 2008, this resulted in:
  - the Project being implemented closely following all Government of India rules and regulations for procurement under the direction of a National Project Director within MNRE. While strict adherence to national procurement rules and regulations was positive for the transparency of the Project's transactions, it also had the impact of slowing Project progress. For example, the selection process for MIPs took more than one year;
  - MNRE difficulties in distinguishing GEF expenditures from Gol funds used to support MIPs. Given the level of detail required by GEF terminal evaluations on how GEF funds were expended, M&E reporting on GEF activities and expenditures was unsatisfactory;
- The appointment of an MNRE-based NPD who was also tasked with other similar duties on several other projects. As a consequence, this NPD had less time to make crucial decisions towards the achievement of the Project goal and objective within a reasonable time period of less than 6 years. As a result, the Project still has not addressed the barriers to sustainability mentioned in Para 134;
- The passive promotion of biomass power projects with Project stakeholders. Based on interviews with several project proponents (i.e. biomass promoters, biomass power project proponents, biomass energy practitioners), there were few monitoring visits made to MIPs sites to monitor progress and assist project proponents in troubleshooting during the 11-year period of the Project. Furthermore, there is little evidence of effective follow-up on national level information sharing events (Outcome 3) and other capacity building activities of the project (Outcome 2);
- The less than optimal performance of MIPs that were grid-connected biomass power projects. This created reluctance amongst financial institutions such as IREDA to support further funding of biomass projects and blunting interest in new MIPs;
- Diversion of significant Project assistance away from developing greenfield biomass power projects (considering the difficulties and time experienced in their development) to existing biomass power projects to improve their PLFs by strengthening the biomass supply chain (referred to in the project generally as strengthening fuel linkages). Despite slowing the pace of greenfield project development, support of this nature to these existing biomass plants can be considered as an important adaptive management measure that contributed to further improvements to the performance of biomass power projects in India.

141. By the end of the RBBPG Project Part I, biomass power generation is still highly relevant for India despite the aforementioned setbacks and higher operational costs (resulting in a need for higher tariffs that are higher than solar PV tariffs):

- Use of rice straw as feedstock for power generation in Punjab could lead to elimination major pollution source in North India through the annual burning of paddy straw by farmers in October and November. Instead of regular air pollution episodes in North India, clean power can be the by-product of the removal of this rice stalk;
- Use of biomass for captive power generation could contribute significantly to reduction in operational costs of agro-industries and improve their market competitiveness. Other advantages

include efficient and clean disposal of agricultural waste, offsetting the use of imported fossil fuels, additional employment opportunities for local community, and circumventing the need for any SERC approvals (since no energy is sold to grid). In the event that excess power is available, the feasibility of its purchase by state utilities at prices competitive with solar could be explored;

- Bagasse co-generation is successful with significant benefits to sugar mills in reducing their energy costs.

#### 4.1 Corrective actions for the design, implementation, monitoring and evaluation of the project

142. *Action 1 (to MNRE and UNDP): To improve design of these projects, especially where the objective is to catalyze of multimillion dollar investments for biomass power generation projects, project preparations should include appropriate capacity building activities including:*

- Focus on efforts to ensure the setup of a biomass power demonstration plant where lessons of design, implementation and operation can be disseminated. Without such a demonstration, future investors and project developers will not have confidence in the process of developing these investment projects;
- Extensive handholding with project proponents and state level regulators to ensure all aspects of demonstration plant design, contracting, construction supervision, community outreach, commissioning, maintenance and operation are addressed. Failure to address these aspects would lead to a loss of confidence in the demonstration, and dissuade potential investors from implementing biomass power plants. The rationale to emphasize handholding is to not underestimate the efforts required to ensure the outcome of a functional and attractive demonstration, and to appreciate that every biomass power plant will have unique circumstances requiring due attention to manage local issues.

143. *Action 2 (to MNRE and UNDP): To improve implementation of this project, the PMC needed to drive the project with project personnel making more efforts for face-to-face meetings with stakeholders. This would include:*

- prospective investors that would be a part of a process to “know your client” especially if the investors are seeking Project support for their investment. Moreover, the PMC could have met with more prospective industrial SMEs especially in the rural agro-processing industries where biomass should be considered a local fuel to offset imported fossil fuels and reduce grid electricity costs (especially if the supply of grid electricity is intermittent);
- project implementers to understand their comprehension of biomass project investment risks, notably the assessment of risks to security of biomass supplies to each BMPP, and mitigating risks of biomass supply disruptions from climate related events such as drought or flooding; and
- state regulators to improve their capacity and knowledge of BMPP development, promote and facilitate their implementation, and to use these successes for replication to other states.

144. *Action 3 (to MNRE and UNDP): To improve implementation of this project, the Project could have been implemented under direct execution by UNDP. Advantages of this implementation approach include:*

- the utilization of funds that are not under a GoI budget line, and can be used to test innovative implementation approaches on projects (that were required under this Project for the purposes

of catalyzing biomass power plant investments). As such, different models of biomass power project development could have been tried under this mode of execution without the intense scrutiny for approval of funds under a GoI budget line. Examples of implementation approaches included generation based incentives, power purchase agreements with escalation clauses and reduced penalties for nondelivery of electricity, biomass supply pricing based on estimates of available surplus biomass;

- the PMC being more capable of reporting GEF expenditures, and the impact of GEF funds on achieving the Project goal and objective; and
- a faster procurement process.

## 4.2 Actions to follow up or reinforce initial benefits from the project

145. *Action 4 (to current MIP proponents, MNRE and UNDP). All MIPs or demonstration projects should employ a monitoring officer to compile data and information pertaining to energy generation, plant revenue and GHG emission reductions.* Since MIPs serve as demonstrations of functional biomass power projects for the purposes of replicating these types of projects, there is a strong need for a focus on reporting credible energy savings of these investments as well as sharing rates of investment returns and GHG emission reductions. None of the MIPs met during the mission had any such report available to the evaluation team. Since many of them are very focused on ensuring construction, commissioning and optimal operations of the plants, they did not have any staff dedicated to the compiling of such data and information which can be shared with other potential biomass power plant investors as well as other plant owners seeking to improve their PLFs.

146. *Action 5 (to MNRE): The aforementioned information of MIP energy savings and investment rates of return needs to be disseminated to a large forum.* At the EOP, the 2 MIP biomass power plants in the Punjab as well as a biogas cogeneration plant in Maharashtra were experiencing sustained operations over a number of years. Unfortunately, this Project did not compile any data from these operations for dissemination in the larger forum which could have sent a number of positive indicators to the prospective investors that biomass power generation can be profitable and generate positive environmental impacts. In addition, this positive information from these MIPs should interest agro-industries on the benefits of captive biomass energy investments, and facilitate acceleration of biomass power adoption.

## 4.3 Proposals for future directions underlining main objectives

147. *Action 6 (to MNRE): MNRE needs to improve its collaboration with appropriate biomass associations to promote captive biomass projects with agro-industrial owners and operators, notably those projects that can displace imported fossil fuel usage.* The MIP information generated in the aforementioned Actions 4 and 5 can utilize the positive investment and operational information from MIPs to promote captive biomass power with the following benefits for the agro-processing industry:

- reduced demand for grid connected electricity;
- displacing the use of imported fossil fuels;
- reduced operational costs leading to improved market competitiveness of each industrial SME;
- approval process for captive power generation that would minimize SERC involvement since no energy is sold to grid;

- if excess power was available, its purchase by state utilities at prices competitive with solar should be explored as a possible additional benefit to the captive biomass power plant.

148. Action 7 (to MNRE): MNRE should propose NCEF compensation to a Punjab state utility for purchase of more costly biomass power as “credit” for air pollution alleviation. The Punjabi MIPs at Universal Biomass and Malwa Power are excellent examples of the generation of renewable energy as a means of avoiding air pollution from the burning of rice stalk in the Punjab annually during October and November. The issue for the Punjab SERC is the purchase of renewable energy and a rate higher than electricity from the solar PV source. As such, the Punjab SERC does not have incentive to purchase power from any more biomass power sources such as Universal and Malwa. Both BMPPs at Universal Biomass and Malwa Power are reportedly avoiding the field burning of rice stalk through its collection from over 1,100 ha in the proximity of these plants. The area over which to eliminate the burning of rice stalk throughout the entire Punjab State would be equivalent to more than 30,000 MW of installed capacity. MNRE should seek an environmental surcharge to be added to the electricity price (from NCEF or an equivalent environmental fund in the Central Government) for biomass power plants using rice stalk as fuel with the following justifications:

- Burning of rice straw can be considered an anthropogenic CO<sub>2</sub> emission activity;
- Collection of rice straw for biomass power generation will avoid straw burning and CO<sub>2</sub> emissions;
- A biomass power company can receive electricity tariff at state utility market rates plus a government sanctioned surcharge (as a “carbon” credit) to ensure purchase of biomass electricity and avoidance of air pollution.

#### 4.4 Best and worst practices in addressing issues relating to relevance, performance and success

149. Poor practice: Promotion multi-crore rupee investments into biomass power generation cannot be merely done through a top-down approach. This cannot be done solely through national workshops, coupled with an absence of extensive discussions with the investors, project developers and state regulators. Decisions to invest this level of funds requires detailed face-to-face interactions with project proponents and close facilitation on issues such as biomass supply security and costs, feed-in tariffs, all to ensure low risks to investments. This would closely align to the need for all these types of projects to emphasize more effective capacity building of the stakeholders involved in biomass power generation.

150. Poor practice: Project failed to adapt to changing market conditions, focusing only on promotion of distributed generation instead of the captive power market and projects driven by environmental benefits. The failure of the Project to adapt to changing market conditions in the renewable energy sector did not facilitate the project in addressing other more favourable biomass power generation models including captive power generation for agro processing industries (see Action 6) and biomass power generation to avoid air pollution from the burning of rice stalks in Punjab and Haryana states (see Action 7).

151. Best practice: The Project recognized the importance of biomass supply security by diverting project resources in an adaptive management measure to strengthen biomass applies to existing biomass power plants. The Project was instrumental in the setup of adequate and appropriate infrastructure

as a key to the successful running of biomass power projects in the Punjab. The Project also supported the setup of biomass collection centres, identified equipment needed to process various types of biomass before it can be used as a fuel, and facilitated local entrepreneur investments into these equipment for the sustained supply of biomass fuel to biomass power plants. While the Project did not measure the incremental benefit of strengthening fuel supply linkages, project proponents all spoke strongly about the benefits of these efforts and the enhancement of their PLF.

## APPENDIX A – MISSION TERMS OF REFERENCE FOR RBBPG PROJECT TERMINAL EVALUATION

### INTRODUCTION

It is proposed to conduct terminal evaluation of UNDP-GEF-MNRE project “Removal of barriers to Biomass Power Generation”. A team of 2 consultants will be engaged to conduct the terminal evaluation. One of them as *international and the other is national consultant*. The international consultant will be designated as the Team Leader and will be responsible for finalizing the report. The consultants shall have prior experience in evaluating similar projects. Experience with GEF financed projects is an advantage.

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation. These terms of reference (TOR) sets out the expectations for a Terminal Evaluation (TE) of the *Removal of Barriers to Biomass Power Generation in India Phase-I (PIMS 740)*

The essentials of the project to be evaluated are as follows:

#### • PROJECT SUMMARY TABLE

Project Title:	Removal of Barriers to Biomass Power Generation in India Phase-I			
GEF Project ID:	740 (GEF PMIS ID)		at endorsement (million US\$)	<u>at completion (million US\$)</u>
UNDP Project ID:	(UNDP PIMS ID) 00051271 (Atlas ID)	GEF financing:	5.650	....
Country:	India	IA/EA own:		
Region:	Asia Pacific	Government:	5.240	....
Focal Area:	Climate Change	Other:	3.440	....
FA Objectives, (OP/SP):	OP-5	Total co-financing:	8.680	....
Executing Agency:	Ministry of New and Renewable Energy Resources (MNRE)	Total Project Cost:	14.330	....
	erstwhile Ministry of Non-Conventional Energy Sources (MNES)			
Other Partners involved:	ProDoc Signature (date project began):			22 September 2006
	(Operational) Closing Date:	Proposed: 2012 31May 2009	Actual: 2017 Dec 2016	

## OBJECTIVE AND SCOPE

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The project was designed with the overall development goal of improving the electricity supply using renewable energy sources without increasing the greenhouse gas (GHG) emissions through wide-scale application of biomass power generation technologies by removing barriers to the increased use of power energy sources for generating electricity for its own consumption and export to grid.

The immediate project objectives of the project are to accelerate the adoption of environmentally sustainable biomass power technologies (combustion /gasification) technologies by removal of the key identified barriers, thereby laying the foundation for large-scale commercialization of biomass power. This is envisaged through exploitation of captive and distributed biomass materials in niche areas (including captive power use and open access power sale), through demonstration of model investment projects (MIPs) demonstrating development models and establishment of sustainable business/support services network and undertaking enabling activities for removal of the identified key barriers.

Project's envisaged outcomes are:

- (i) Technology package benchmarking and validation for different biomass power technologies, including feasibility of energy plantation
  - (ii) Enhanced capacities and confidence of key stakeholders viz. Project Promoters, Financial Institutions, Regulators, Policy Makers, SNAs, etc
  - (iii) Development of business, commercial and support services networks in focused states
  - (iv) Creation of fund for contingent financing (Since this funding component is dropped)
  - (v) Model Investment Projects (MIPs)
- **Component 1: Technology package benchmarking and validation for different biomass power technologies, including feasibility of energy plantation**

The activities under this component focused on technology improvement and identified upgrade needs including assessment of capabilities of Indian technology and equipment suppliers as well as developing long term perspective plan for ensuring sustainable biomass supply for power generation.

Various sub activities included under this component are as follows:

- Review of state-of-the-art technologies, both nationally and internationally, for biomass power application (combustion and gasification) and develop plan for its adoption. This also included evaluation of techno- commercial feasibility of each technology in terms of its specifications, inputs, outputs, capital and operating cost etc.
- Developing technology performance benchmarks for planned model investment projects (MIPs) defining major technology parameters for MIPs and monitoring indicators for same.



- Developing long term perspective plan for utilization of wasteland and biomass resources for power generation. This activity focused on carrying out techno-commercial viability study of utilizing waste land for biomass production for power generation for ensuring the sustainability of biomass power plants and developing long term perspective plan for utilization of waste land and energy plantations for ensuring sustained supply of biomass resources for power generation.

- **Component 2: Enhanced capacities and confidence of key stakeholders**

The main focus of activities included under this component are to identify the capacity building needs of the stakeholders, enhance their capacities and make available information for knowledge generation, enhancement and sharing. The various activities planned to achieve set outcomes are as follows:

- Creating online data bases for biomass project promotions and development including potential biomass depots in focus states.
- Develop project profiles in the focused states providing information on biomass depot, technology and plant size, market, equipment, space/manpower requirement, investments required and potential risks etc to help decisions by potential entrepreneurs
- Develop profiles for service providers like technology/equipment suppliers, EPC and O7M contractors, consultant, engineering companies etc
- Develop institutional profiles of NGOs, SHGs, financial institutions, local banks, financial intermediaries, service entrepreneurs, etc
- Prepare model feasibility reports and detailed project reports for different types of biomass power projects,
- Develop model fuel supply agreements energy purchase agreements, banking agreements etc
- Improve communication and advocacy and improve access to information through website
- Develop and implement information and knowledge sharing programs through organized study tours

- **Component 3: Development of business, commercial and support services networks in focused states**

The activities involved included reviewing existing networks and institutions and human resource requirement for the biomass sector with focus on capacity building for managing biomass collection and supply for power generation. Various sub activities involved included

- Study of required institutional mechanism for biomass power projects development
- Evaluating existing commercial and institutional framework in focus states for their suitability to promote biomass power projects
- Providing orientation to select institutions on institutional requirements to participate in biomass power sector development
- Developing master plan for creation of dynamic and sustainable institutional framework in focus states

- **Component 4: Creation of fund for contingent financing (Since this funding component is dropped Component 5: Model Investment Projects (MIPs)**

Based on criterion established in first component the Model investment projects (MIPs) for various sectors, technologies will be finalized and implemented. In all 40 MIPs in distributed biomass sector with capacity upto 1000 kW configuration were planned in different geographic locations covering different types and combinations of biomass material, technologies and sizes. The first five of these projects are

included in Phase-1 of the project while remaining 35 are targeted for the support under Phase-2. The distribution of the MIPs under different categories as mentioned in ProDoc is as follows:

- MIP Category Cooperative Sugar Mills: 1 No 16.73 MW in Maharashtra
- MIP Category Captive Biomass: 1 or 2 Nos (MW) in Haryana or Rajasthan or Punjab
- MIP Category Distributed biomass: 4 or 5 Nos (5MW) in Haryana, Rajasthan, Punjab, Maharashtra.

Thus, the various sub activities under this component included generating pipeline of projects for selection as MIPs, effective financial closure and commissioning of MIPs. Other major activity under this component included documentation on lessons learned and evolution of replication plan/strategy for future promotions of biomass power plants in the country.

The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects. The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

#### • **EVALUATION APPROACH AND METHOD**

An overall approach and method<sup>62</sup> for conducting project terminal evaluations of UNDP supported GEF financed projects have developed over time. The evaluation should include a mixed methodology of document review, interviews, and observations from project site visits, at minimum, and the evaluators should make an effort to triangulate information. The evaluator is expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact**, as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects. The international consultant will be the team leader and coordinate the evaluation process to ensure quality of the report and its timely submission. The national consultant will provide supportive roles both in terms of professional back up, translation etc. The evaluation team is expected to become well versed as to the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. Information will be gathered through document review, group and individual interviews and site visits.

A set of questions covering each of these criteria have been drafted and are included with this TOR ([Annex C](#)) The evaluator is expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report.

The evaluation must provide evidence-based information that is credible, reliable and useful. The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region and key stakeholders. The evaluator is expected to conduct a field mission to various project stakeholder locations including the following project field sites viz. Muktsar, Shreepur, Sankheda, Nellore, Washim, etc. Interviews will be held with the following organizations and individuals at a minimum but not limited to:

<sup>62</sup> For additional information on methods, see the Handbook on Planning, Monitoring and Evaluating for Development Results, Chapter 7, pg. 163

- Relevant personnel at UNDP Country Office in New Delhi, India and Program Officer in-charge of the Project
- National Project Director (NPD)
- National Project Coordinator (NPC)
- Project Management Unit (PMU)
- Relevant project stakeholders like biomass power plant association, financial institutions, technology suppliers etc.

The evaluator will review all relevant sources of information, such as the project document, mid-term review (MTR) report, project reports – including Annual APR/PIR, project budget revisions, midterm review, progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, and any other materials that the evaluator considers useful for this evidence-based assessment. A list of documents that the project team will provide to the evaluator for review is included in [Annex B](#) of this Terms of Reference.

### • EVALUATION CRITERIA & RATINGS

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework (see [Annex A](#)), which provides performance and impact indicators for project implementation along with their corresponding means of verification. The evaluation will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact**. Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary. The obligatory rating scales are included in [Annex D](#).

<b>Evaluation Ratings:</b>			
<b>1. Monitoring and Evaluation</b>	<i>rating</i>	<b>2. IA&amp; EA Execution</b>	<i>rating</i>
M&E design at entry		Quality of UNDP Implementation (IA)	
M&E Plan Implementation		Quality of Execution - Executing Agency (EA)	
Overall quality of M&E		Overall quality of Implementation / Execution	
<b>3. Assessment of Outcomes</b>	<i>rating</i>	<b>4. Sustainability</b>	<i>rating</i>
Relevance		Financial resources:	
Effectiveness		Socio-political:	
Efficiency		Institutional framework and governance:	
Overall Project Outcome Rating		Environmental:	
		Overall likelihood of sustainability:	

### • PROJECT FINANCE / COFINANCE

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Country Office (CO) and Project Team to obtain financial data in order to complete the co-financing table below, which will be included in the terminal evaluation report.

Co-financing (type/source)	UNDP own financing (mill. US\$)		Government (mill. US\$)		Partner Agency (mill. US\$)		Total (mill. US\$)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants								
Loans/Concessions								
• In-kind support								
• Other								
Totals								

## • MAINSTREAMING

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will assess the extent to which the project was successfully mainstreamed with other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and gender. The evaluation will examine this project's contribution to the United Nations Development Assistance Framework (UNDAF).

## • IMPACT

The evaluator will assess the extent to which the project is achieving impacts or progressing towards the achievement of impacts. Key findings that should be brought out in the evaluations include whether the project has demonstrated: a) verifiable improvements in ecological status, b) verifiable reductions in stress on ecological systems, and/or c) demonstrated progress towards these impact achievements<sup>63</sup>.

## • CONCLUSIONS, RECOMMENDATIONS & LESSONS

The evaluation report must include a chapter providing a set of **conclusions, recommendations and lessons**. Conclusions should build on findings and be based in evidence. Recommendations should be prioritized, specific, relevant, and targeted, with suggested implementers of the recommendations. Lessons should have wider applicability to other initiatives across the region, the area of intervention, and for the future.

## • IMPLEMENTATION ARRANGEMENTS

The principal responsibility for managing this evaluation resides with the UNDP CO in (New Delhi). The UNDP CO will contract the evaluators and ensure the timely provision of per diems and travel arrangements within the country for the evaluation team. The Project Team will be responsible for liaising with the Evaluators team to set up stakeholder interviews, arrange field visits, coordinate with the Government etc.

Throughout the period of evaluation, the evaluation team will liaise closely with the Programme Officer/

<sup>63</sup> A useful tool for gauging progress to impact is the Review of Outcomes to Impacts (ROtI) method developed by the GEF Evaluation Office: [ROtI Handbook 2009](#)

Adviser/Project Manager, the concerned agencies of the Government, any members of the international team of experts under the project and the counterpart staff assigned to the project. The team can raise or discuss any issue or topic it deems necessary to fulfill its task, the team, however, is not authorized to make any commitments to any part on behalf of UNDP/GEF or the Government.

### **Logistics**

The evaluation team will conduct a mission visit to New Delhi and selected project sites, to meet with relevant project stakeholders. This visit will also include meetings with the officials of UNDP, the Implementing Partner, stakeholders from other institutions and ministries related to the project.

After the initial briefing by UNDP CO, the review team will meet with the National Project Director (NPD), National Project Coordinator (NPC) and the GEF Operational Focal Point as required.

### • **EVALUATION TIMEFRAME**

The total duration of the evaluation will be 25 working days according to the following plan:

Activity	Timing	Completion Date
<b>Preparation</b>	2 days	16-17 May 2017
<b>Evaluation Mission</b>	6 days	22-26 May 2017
<b>Draft Evaluation Report</b>	12 days	10 June 2017
<b>Final Report</b>	5 days	19-23 June 2017

### • **EVALUATION DELIVERABLES**

The evaluation team is expected to deliver the following:

Deliverable	Content	Timing	Responsibilities
<b>Inception Report</b>	Evaluator provides clarifications on timing and method	No later than 2 weeks before the evaluation mission.	Evaluator submits to UNDP CO
<b>Presentation</b>	Initial Findings	End of evaluation mission	To project management, UNDP CO
<b>Draft Final Report</b>	Full report, (per annexed template) with annexes	Within 2 weeks of the evaluation mission	Sent to CO, reviewed by RTA, PCU, GEF OFPs
<b>Final Report</b> <sup>64</sup>	Revised report	Within 1 week of receiving UNDP comments on draft	Sent to CO for uploading to UNDP ERC.

<sup>64</sup> When submitting the final evaluation report, the evaluator is required also to provide an 'audit trail', detailing how all received comments have (and have not) been addressed in the final evaluation report. See Annex I for an audit trail template

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## • TEAM COMPOSITION

The evaluation team will be composed of 2 consultants (*1 international /1 national evaluators*). The international consultant will be designated as the Team Leader and will be responsible for finalizing the report. The consultants shall have prior experience in evaluating similar projects. Experience with GEF financed projects is an advantage. The evaluators selected should not have participated in the project preparation and/or implementation and should not have conflict of interest with project related activities.

The International Consultant (Team Leader) must possess the following qualifications and professional background:

### Years of experience

- Professional background in project evaluations of renewable energy, biomass energy and climate change mitigation projects is essential. Experience in evaluating projects on renewable energy, biomass energy, specifically in the biomass power sector is desirable. A minimum of 15 years of relevant experience in monitoring and evaluating donor driven projects (preferably GEF, World Bank, or UN);

### Competencies:

- Highly knowledgeable of participatory monitoring, review and evaluation processes, and experience in review and evaluation of technical assistance projects with major donor agencies;
- Familiar with biomass energy policies, technologies and power projects through management and / or implementation or through consultancies in review and evaluation of donor funded projects.
- Understanding of CO2 emission reduction calculations (including IPCC, GEF procedure and implementation of its recommendations, that contribute to global benefits;
- Familiar with GEF rules, regulations and project reviews and evaluations;
- Demonstrated ability to assess complex situations, succinctly, distil critical issues, and draw forward-looking conclusions and recommendations;
- Ability and experience to lead multi-disciplinary and national teams, and deliver quality reports within the given time.
- Writing and communication will be in English, and he/she must have excellent communication skills in English. The consultant must bring his/her own computer/ laptop and related equipment.

The evaluation team shall conduct debriefing for the UNDP Country Office, NPD, NPC, Project Management Unit and UNDP BRH, in India towards the end of the evaluation mission. The international consultant shall lead presentation of the draft review findings, creating the recommendations, and shall lead the drafting and finalization of the terminal evaluation.

## EVALUATOR ETHICS

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Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the [UNEG 'Ethical Guidelines for Evaluations'](#)

## APPENDIX B – MISSION ITINERARY (FOR JULY AND AUGUST 2017)

#	Activity	Stakeholder involved	Place
<b>July 11, 2017 (Tuesday)</b>			
	Arrival of Roland Wong in New Delhi		
<b>July 12, 2017 (Wednesday)</b>			
1	Evaluation debriefing meeting with Dr. S.N. Srinivas, Programme Officer and Ms. Pretti Soni, Energy and Environment Cluster Leader	UNDP	New Delhi
2	Meeting with Mr. V.K. Jain, NPD, RBBPG Project	MNRE	New Delhi
3	Phone call with Mr. S. Venkatachalam, President, and Mr. R. Kulothungan, Treasurer of the Indian Biomass Power Association	Indian Biomass Power Association	New Delhi
	Travel by train to Bathinda, Punjab		
<b>July 13, 2017 (Thursday)</b>			
4	Meeting with Mr. Narinder Singh Bhullar, General Manager, Mr. S.K. Singh, Vice President (Power Plant)	Universal Biomass Energy Pvt. Ltd.	Malout, Punjab
	Tour of the Channu District 14.5 MW biomass power plant near Malout, Punjab		Malout, Punjab
5	Meeting with Mr. B.S. Jangra, CEO of Malwa Power Private Ltd.	Malwa Power Private Ltd.	Village Gulabelawa, north of Muktsar, Punjab
	Tour of 7.5 MW power plant at Village Gulabelawa, north of Muktsar, Punjab		Village Gulabelawa, north of Muktsar, Punjab
	Travel by train to New Delhi		
<b>July 14, 2017 (Friday)</b>			
	Travel by air to Nagpur		
	Travel by car from Nagpur to Washim, Maharashtra		
	Overnight in Washim, Maharashtra		
<b>July 15, 2017 (Saturday)</b>			
6	Meeting with Mr. Chaitanya Mitra, Principal Technologist and plant technical staff of Thermax Limited – <i>was there anyone from Ruchi Soya?</i>	Thermax Ltd., and Ruchi Soya in Washim	Washim, Maharashtra

#	Activity	Stakeholder involved	Place
	Tour of 1.0 MW power plant at Ruchi Soya plant southeast of Washim, Maharashtra		
	Travel back to Nagpur		
	Overnight in Nagpur		
<b>July 16, 2017 (Sunday)</b>			
	Air travel from Nagpur to Vadodara, Gujarat		
	Overnight in Vadodara		
<b>July 17, 2017 (Monday)</b>			
7	Meeting with Mr. Ankur Jain, Managing Director, Dr. B.C. Jain, and Mr. Gaurav Patel, Deputy Manager of BD of Ankur Scientific Energy Technologies (Pvt) Ltd.	Ankur Scientific Energy Technologies Ltd.	Vadodara, Gujarat
	Visit and tour of Ankur Scientific workshop north of Vadodara		
	Air travel back to New Delhi		
<b>July 18, 2017 (Tuesday)</b>			
8	Meeting with Mr. Chandrashekar, Assistant General Manager and K.B.K. Reddy, Deputy General Manager, IREDA	IREDA	New Delhi
9	Skype meeting with Ms. Milou Beerepoot, RTA at Bangkok Regional Hub	UNDP	New Delhi
10	Meeting with Mr. N.P. Singh, Senior Technical Adviser for UNIDO and former RBBPG NPD	MNRE	New Delhi
11	Telephone call with Mr. Mohan Reddy, National Biomass Consultant	Private biomass professional	New Delhi
12	Meeting with with Dr. S.N. Srinivas, Programme Officer	UNDP	New Delhi
13	Telephone call with Professor Dasappa of IISC, Bangalore	IISC	New Delhi
<b>July 19, 2017 (Wednesday)</b>			
14	Telephone call with Ms. Tanushree Bhowmik, former Project Manager with RBBPG	UNDP	New Delhi
<b>July 20, 2017 (Thursday)</b>			
	Working on report		
<b>July 21, 2017 (Friday)</b>			



#	Activity	Stakeholder involved	Place
15	Evaluation debriefing meeting with MNRE and UNDP at MNRE offices with the Joint Secretary for MNRE, NPD and Dr. Srinivas	MNRE, UNDP	New Delhi
<b>July 22, 2017 (Saturday)</b>			
	Departure of Roland Wong from New Delhi offices		
<b>August 8, 2017 (Saturday)</b>			
	Visit of Mr. Pariaml Sadaphal to Dee Vee Power Plant 2.0 MW in Kushalnagar, Karnataka		Kushalnagar, Karnataka
<b>August 9, 2017 (Saturday)</b>			
	Visit of Mr. Pariaml Sadaphal to ???		
<b>August 10, 2017 (Saturday)</b>			
	Visit of Mr. Pariaml Sadaphal to M/S Shree Panduranga 19 MW power plant in Maharashtra?		??, Maharashtra

Total number of meetings conducted: 15

## APPENDIX C – LIST OF PERSONS INTERVIEWED

This is a listing of persons contacted in New Delhi, Punjab, Maharashtra, Gujarat and Karnataka (unless otherwise noted) during the Terminal Evaluation Period only. The Evaluation Team regrets any omissions to this list.

1. Ms. Preeti Soni, Energy and Environment Cluster Lead, UNDP India, New Delhi;
2. Dr. S.N. Srinivas, Programme Officer, UNDP India, New Delhi;
3. Ms. Tanushree Bhowmik, former Project Manager with RBBPG;
4. Mr. N.P. Singh, Senior Technical Adviser for UNIDO and former RBBPG NPD;
5. Mr. V.K. Jain, Joint Secretary, MNRE and NPD, RBBPG Project, New Delhi;
6. Mr. Chandrashekar, Assistant General Manager, IREDA;
7. Mr. K.B.K. Reddy, Deputy General Manager, IREDA;
8. Mr. Narinder Singh Bhullar, General Manager, Universal Biomass Energy Pvt. Ltd. Malout, Punjab;
9. Mr. S.K. Singh, Vice President (Power Plant), Universal Biomass Energy Pvt. Ltd. Malout, Punjab;
10. Mr. B.S. Jangra, CEO of Malwa Power Private Ltd. Village Gulabelawa, north of Muktsar, Punjab;
11. Mr. Chaitanya Mitra, Principal Technologist, Thermax Ltd; Pune, Maharashtra;
12. **Thermax plant technical staff??**
13. Mr. Ankur Jain, Managing Director of BD of Ankur Scientific Energy Technologies (Pvt) Ltd., Vadodara, Gujarat;
14. Dr. B.C. Jain of BD of Ankur Scientific Energy Technologies (Pvt) Ltd., Vadodara, Gujarat
15. Mr. Gaurav Patel, Deputy Manager of BD of Ankur Scientific Energy Technologies (Pvt) Ltd., Vadodara, Gujarat;
16. Mr. Mohan Reddy, National Biomass Consultant;
17. Professor Dasappa of IISC, Bangalore.

## APPENDIX D – LIST OF DOCUMENTS REVIEWED

1. UNDP Project Document for the “Re3moval of Barriers to Biomass Power Generation”, April 2006;
2. UNDP-GEF Mid-Term Review Report for the RBBPG Project, Phase I, July 2011;
3. UNDP-GEF LFA Revision to RBBPG in India (Project ID: 51271) by Dr. Sanjay Mande, 2013;
4. UNDP-GEF PIRs for RBBPG Project from 2008 to 2017 (2016 PIR was missing);
5. UNDP-GEF AWP for RBBPG Project from 2008 to 2015;
6. UNDP India, “Closure Note for RBBPG Project of April 2017” including Annexures 1 to 4;
7. UNDP-GEF, “A Generic Report on Removal of Barriers to Biomass Power Plants in India” by Pranam Consultants, 2013?;
8. UNDP, “Techno-Economic Feasibility Report on Fuel Linkage Demonstration Report at SPSSKL, Solapur, Maharashtra, May 2008;
9. UNDP, “Evaluation Report on Biomass MIP for Annual Work Plans from 2012 to 2016; MW Biomass Gasifier Based Power Plant installed at Sankheda, Gujarat”, by Dr. Sanjay Mande, 2013;
10. UNDP India, “A Generic Report on Removal of Barriers in Biomass Power Plants in India” by Pranam Consultants, Pune, 2014;
11. UNDP India, “Discussion Paper on Removal of Barriers to Biomass Power Generation in India, Phase-I (UNDP Project ID: 00051271)”, May 2013 by P.R. Reddy, Dwarka, New Delhi;
12. UNDP India, “Tour Report of the Delegation deputed to the Conference on EU Biomass Conference 2014 on 23 – 26 June, 2014 at the Congress Centre, Hamburg, Germany by V K Jain, Director & NPC, Tanushree Bhowmik, National Project Manager;
13. MNRE, “Study of Bagasse Co-Generation in Sugar Mills in India”, by Winrock International India, March 2010;
14. MNRE, “Study of Techno-Economic Feasibility of Biomass Briquetting of Agro-Residues in India”, by Winrock International India, November, 2009; Amatayakul, Wathanyu and Berndes, Göran, “Determining factor for the development of CDM biomass power projects”, January 16, 2012, Energy for Sustainable Development, available on: [https://www.researchgate.net/profile/Goeran\\_Berndes/publication/257434426\\_Determining\\_factor\\_for\\_the\\_development\\_of\\_CDM\\_biomass\\_power\\_projects/links/551e96530cf29dcabb043273/Determining-factor-for-the-development-of-CDM-biomass-power-projects.pdf](https://www.researchgate.net/profile/Goeran_Berndes/publication/257434426_Determining_factor_for_the_development_of_CDM_biomass_power_projects/links/551e96530cf29dcabb043273/Determining-factor-for-the-development-of-CDM-biomass-power-projects.pdf);
15. MNRE Sanction 2011 Sanction Letters for MIPs for Dee Vee Power, Ruchi Soya, Ankur, SLS and Universal Power;

16. Thermax Presentation of April 2014 on “Project Details and Report on 1.0 MWe Biomass Gasification Technology Demonstration Plant;
17. DFID, “Assessment of Options for Biomass Power Generation” by Dalkia Energy Services, November 2011;
18. UNDP India, “Global Status Report on Solar-Biomass Hybrid Project” (Draft for Discussion) by STEAG Energy Services of India, November 2014;
19. “Identification of Financial Institutions for Operation of Fund for Contingent Financing and Development of Financial Models for MIPs” by Ernst & Young, January 2011;
20. UNDP India, “Review of Policy and Regulatory Framework” by MITCON, August 2009;
21. UNDP India, “Development of Guidelines / Norms For Defining Catchment / Command Areas, Identification & Mapping of Sites For Establishment of Biomass Depots” by MITCON, June 2009;
22. UNDP India, “Technology Status Review Report Feedstock Processing Equipment & Multi-Fuel Fired Boilers” by MITCON, August 2009;
23. UNDP India, “Identification / Evaluation of Institutional Framework & Capacity Building / Entrepreneurship Development Models / Action Plans” by MITCON, July 2010;
24. UNDP-GEF, Proceedings from “One Day Workshop on Regulatory and Financial Barriers and Challenges in Power Generation using Biomass India International Centre, New Delhi, June 9, 2014;
25. MNRE Issues of Bioenergy Newsletter from 2009 to 2011;
26. PAP between Government of India and UNDP 2008-2012.

## **APPENDIX E – COMPLETED TRACKING TOOL**

*GEF Tracking tool not necessary for GEF3 Projects.*

## APPENDIX F – PROJECT PLANNING MATRIX FOR RBBPG PROJECT (FROM 2013)

Strategy	Indicator (quantified and time-bound)	Baseline	Target	Sources of verification	Risks and Assumptions
<p><b>Overall Project Goal:</b> To improve electricity supply without increasing GHG emissions through widescale application of biomass power generation technologies.</p>	Extent of supply and energy needs met by biomass power projects, reduction of CO <sub>2</sub> emissions. By EOP, additional MIPs up to 15.2 MW <sub>e</sub> of biomass power generation contracted.		<ul style="list-style-type: none"> <li>EOP target (2016): additional 15.2 MW you look of capacity MIPs implemented</li> <li>approximately over 460,000 tonnes CO<sub>2</sub> during project duration and over 3.7 million tonnes CO<sub>2</sub> over lifetime of all MIPs implemented under project</li> </ul>	Project documentation and commissioning and operation reports.	Globally biomass power will continue to be one of the key climate change mitigation options and Government of India is committed towards reduction in GHG emissions.
<p><b>Project Objective:</b> To accelerate the adoption of environmentally sustainable biomass power technologies for captive and distributed biomass materials in niche areas through demonstration of project development model and establishment of sustainable business/ support services network and undertaking enabling activities for removal of the key barriers.</p>	Rate of commercial adoption of sustainable biomass power technologies in India	No Model Investment Projects exist.	<p>By the end of Phase-1, 7 MIPs contracted covering cogeneration, gasification and combustion technologies in 3-5 different states of India.</p> <p>By end of Phase-2, a total of 43 MIPs contracted covering cogeneration, gasification and combustion technologies covering &gt;5 different states of India.</p>	Project documentation on agreements signed for MIPs in Phase-1 and data from the Ministry of Power and the MNES (MNRE)	Conducive policy & regulatory framework for bio-mass power projects gets sustained over the project and follow-up periods
<p><b>Outcome 1:</b> Technology package benchmarking and validation for different biomass power technologies, including feasibility of energy plantation</p>	Status of manufacturing capacities and standards for different biomass power technologies	Poor reliability of biomass power technologies, both captive and distributed biomass. Energy plantation as potential biomass resource for commercial power is yet to get established.	<p>By the end of Phase-1, the parameters and technical standards for the different biomass power technologies targeted by the project have been finalized.</p> <p>By end of Phase-2, access to biomass power technology benchmarks available to project developers and a long term national action plan for bioenergy plantation developed.</p>	Project documentation and information from the dedicated ministries and institutions.	Available information on existing capacities data/ information to establish standards and benchmarks.
<p><b>Outcome 2:</b> Enhanced Capacities and confidence of Project Promoters, Financial Institutions, Regulators, Policy Makers, SNAs, other stakeholders</p>	Enhanced capacities of key stakeholders involved in the facilitation and	Wide variation in policy and regulatory environment and inadequate	By the end of phase 1, pilot portfolio of project profiles developed, model formats/ agreements established for	Documentation from practice documents, established	Biomass power remains as a major focus for renewable energy power development in the

Strategy	Indicator (quantified and time-bound)	Baseline	Target	Sources of verification	Risks and Assumptions
through effective information development & dissemination program, along with capacity building initiatives (Phase-1+2)	implementation of selected biomass power technologies	information on various aspects of BPP and bagasse cogeneration in sugar industries, to project developers & other key stakeholders	the targeted biomass technologies (on fuel supply, energy purchase, project development & management) and promotional material and awareness raised significantly in pilot states.  By end of Phase-2, wide accessibility to a web based clearing house mechanism on biomass power and inter sector dedicated capacities established.	databases and their usage, together with workshop and training tours.	target states and at the national level.
<b>Outcome 3:</b> Improved knowledge on technology, including marketing	Definition and implementation of biomass power business dissemination models in the project pilot states	Inadequate Institutional Framework at National, Regional and Local Levels for large scale multiplication of biomass power technology and projects.	By end of Phase-1, the appropriate biomass power business models have been widely disseminated and established in the initial pilot states.  By end of Phase-2, a menu of viable biomass power models have been successfully demonstrated in >5 states of India.	Dissemination program and user feedback from workshops and seminars held on biomass power business, together with Master Plans for dissemination and follow-up	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
<b>Outcome 4:</b> Creation of fund for contingent financing (this component was dropped in 2013)					
<b>Outcome 5:</b> Model Investment Projects (MIPs)	Model Investment Projects (MIP) commissioned and implementation started	Models for implementing BPP do not exist either for captive or distributed biomass resources	By end of Phase-1, 7 model investment projects will have been successfully commissioned and have started initial implementation in 3-5 states demonstrating 3 different biomass power technologies targeted.  By end of Phase-2, a total of 43 model investment projects successfully established and in operation in >5 states of India.	Project documentation on from dedicated financial institutions, on the MIPs	Continued political interest and commitment on the state and national level

## APPENDIX G - EVALUATION CRITERIA QUESTIONS

Evaluation Criteria	Questions	Indicators	Sources	Methodology
<b>Relevance: How does the Project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels?</b>				
Is the project relevant to national priorities and commitments under international conventions?	Is the project country driven?	Existence of national legislation related to sustainable development, climate change and renewable energy power generation development (specifically for biomass) development	National and regional strategy and policy documents	Desk review, interviews with Indian government representatives (GEF operational focal point, MNRE NPD)
	Does the project adequately taken into account the national realities, both in terms of institutional and policy framework and its implementation?	Existence of national legislation related to sustainable development, climate change and renewable energy generation for biomass	National and regional strategy and policy documents	Desk review, interviews with Indian government representatives (GEF operational focal point, MNRE NPD)
	How effective is the project in terms of supporting and facilitating energy sector?	Number of biomass power generation plants developed by local governments and private developers	PIRs and information from stakeholders including PMU	Desk review of PIRs and interviews with PMU and stakeholders
	What was the level of stakeholder participation in project design and ownership and project implementation?	Number of stakeholders participating in PPG  Number of stakeholders participating in project sponsored training sessions and meetings	PPG stakeholder meeting minutes  Project designers  PIRs	Desk review of PIRs and interviews with project designers, PMU, stakeholders
Is the project internally coherent in its design?	Are there logical linkages between expected results of the project (log frame) and the project design (in terms of project components, choice of partners, structure,	Quality of outcomes and indicators on log frame	Project document	Desk review



Evaluation Criteria	Questions	Indicators	Sources	Methodology
	delivery mechanism, scope, budget, use of resources)?			
	Even after several extensions, does the project achieve its expected outcomes?	Log frame outcome and output targets	PIRs Report on log-frame review	Desk review, interviews with PMU and stakeholders
	Did the project make satisfactory accomplishments in achieving project outputs vis-à-vis the targets and related delivery of inputs and activities?	Log frame output targets	PIRs Report on log-frame review	Desk review, interviews with PMU and stakeholders
Does the project provide relevant lessons and experiences for other similar projects in the future?	Has the experience of the project provided relevant lessons for other future projects targeted at similar objectives?	Effectiveness and efficiency ratings of the project by the evaluation	PIRs Stakeholders (investors and government personnel)	Desk review, interviews with PMU and stakeholders
<b>Effectiveness: The extent to which an objective has been achieved or how likely it is to be achieved?</b>				
Has the project been effective in achieving the expected outcomes and objectives?	Whether the performance measurement indicators and targets used in the Project monitoring system are accomplished and able to achieve desired project outcomes by the 31 December 2016?	Effectiveness ratings of the project by the evaluation	PIRs	Desk review, interviews with PMU and stakeholders
How is risk and risk mitigation being managed?	How well are risks, assumptions and impact drivers being managed?	Content of risk management in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders
	What was the quality of risk mitigation strategies developed? Were these sufficient?	Content of risk management in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders
	Are there clear strategies for risk mitigation related with long-term sustainability of the project?	Content of risk management in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders
Consideration of recommendations and reporting of information	Did the project consider midterm review and recommendations conducted on time and reflected in subsequent project activities?	Content of management responses to MTR	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders

Evaluation Criteria	Questions	Indicators	Sources	Methodology
	Reporting of the petroleum fuels and the power reduction in each of the model units from implementing eco- tech options and the corresponding carbon emission reductions.			Desk review, interviews with PMU and stakeholders
What lessons can be drawn regarding effectiveness for other similar projects in the future?	What lessons have been learned from the project regarding achievement of outcomes?	Evaluation assessment of Project effectiveness and efficiency	PIRs	Desk review, interviews with PMU and training participants
	What changes could have been made (if any) to the project design to improve the achievement of the project's expected results?	Evaluation assessment of Project effectiveness and efficiency	PIRs and information from PMU and training participants	Desk review, interviews with PMU and training participants
<b>Efficiency: was the project implemented efficiently, in-line with international and national norms and standards and delivered results with the least costly resources possible?</b>				
Was project support provided in an efficient way?	How does the project management systems, including progress reporting, administrative and financial systems in monitoring and evaluation systems were operating as effective management tools, aid in effective implementation and provide sufficient basis for evaluating performance and decision-making?	Evaluation assessment of M&E design and implementation, and quality of feedback from M&E activities	PIRs and information from PMU personnel	Desk review, interviews with PMU
	How effective was adaptive management practised under the Project and lessons learned?	Adaptive management reporting in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU
	Did the project logical framework and work plans and any changes made to them used as management tools during implementation?	Adaptive management reporting in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU
	Utilization of resources (including human and financial) towards producing the outputs and adjustments made to the project strategies and scope	Annual financial disbursements against each component	PIRs, CDRs and information from PMU personnel	Desk review, interviews with PMU

Evaluation Criteria	Questions	Indicators	Sources	Methodology
	Details of co-funding provided (industry of urban development, GEO I and financing units) and its impact on the activities	Cofinancing of each stakeholder	PIRs, CDRs and information from PMU personnel	Desk review, interviews with PMU
	How does the APR/PIR process help in monitoring and evaluating the project implementation and achievement of results?	APR/PIR qualitative assessments	PIRs and information from PMU personnel	Desk review, interviews with PMU
How efficient is our partnership arrangements for the project?	Appropriateness of the institutional arrangement and whether there was adequate commitment to the project	Institutional arrangements of the project	PIRs and information from PMU and MNRE personnel	Desk review, interviews with PMU and MNRE personnel
	Was there an effective collaboration between institutions responsible for implementing the Project?	Institutional arrangements of the project	PIRs and information from PMU and MNRE personnel	Desk review, interviews with PMU and MNRE personnel
	Is technical assistance and support received from project partners and stakeholders appropriate, adequate and timely specifically for the project PMU?	Institutional arrangements of the project	PIRs and information from PMU and MNRE personnel	Desk review, interviews with PMU and MNRE personnel
<b>Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?</b>				
Will the Project be sustainable on its conclusion and stimulate replications and its potential?	How effective is the project in terms of strengthening the capacity of biomass power generation professionals?	Opinions of training participants	Survey of feedback of training sessions, and testimonial evidence from investors and stakeholders	Desk review, interviews with investors and stakeholders
	Was an exit strategy prepared and implemented by the project? What the “Expected situation at the end of the Project” is as envisioned at the time of terminal evaluation?	Existence of exit strategy prepared by the project	Report on exit strategy, and information from PMU and MNRE personnel	Desk review, interviews with investors and stakeholders
	Appropriateness of the institutional arrangement and whether there was adequate commitment to the project	Number of institutions and local government agencies that have streamlined biomass power generation plant investments	Progress reports, PIRs, and information from PMU and MNRE personnel	Desk review, interviews with investors and stakeholders

Evaluation Criteria	Questions	Indicators	Sources	Methodology
<b>Impact: Are there indications that the project has contributed to, or enabled progress toward maximizing environmental benefits?</b>				
What was the project impact under different components?	To what extent has the project contributed to the following: <ul style="list-style-type: none"> <li>• institutional arrangements strengthened</li> <li>• effective information dissemination program developed</li> <li>• stakeholder capacity enhanced</li> </ul>	Indicator targets of MNRE strengthening  Indicator targets of state-level strengthening  Number of biomass project plans prepared by state governments	Progress reports, PIRs, and information from PMU and MNRE personnel	Desk review, interviews with with PMU and MNRE personnel
What are the indirect benefits that can be attributed to the project?	Were there spinoffs created by the project, if any, as a result of the various workshops held nationwide, toolkits, case studies developed?	Number of knowledge products created by Project  Number of hits on project website	Survey of feedback of training sessions, and testimonial evidence from training participants	Desk review, interviews with training participants
Impacts due to information dissemination under the Project	To what extent did the dissemination activities facilitate progress towards project impacts?	Number of knowledge products created by Project  Number of biomass plans prepared by state governments	Survey of feedback of training sessions, testimonial evidence from training participants, and information from PMU and MNRE personnel	Desk review, interviews with training participants, PMU and MNRE personnel

## APPENDIX H – RESPONSES TO COMMENTS RECEIVED ON DRAFT TE REPORT

To the comments received on October 31, 2017 from the Terminal Evaluation of “India: Removal of Barriers to Biomass Power Generation – Part I” (UNDP PIMS 740)

The following comments were provided in track changes to the draft Terminal Evaluation report; they are referenced by institution (“Author” column) and track change comment number (“#” column):

<b>Author</b>	<b>#</b>	<b>Para #/ Comment location</b>	<b>Comment/Feedback on draft TE report</b>	<b>TE response and actions taken</b>
UNDP CO/NPD	1	Table 4, pg 32 regarding the SLS Power Ltd. In Nellore, Andhra Pradesh	In the TE report, you had mentioned data was not provided on this plant by PMU. Mr. Jain has shared the data as enclosed. You may like to rephrase the sentence to indicate plant operational data for 3 months has been provided by the SLS Power	Unfortunately, the 3 files sent by the PMU are only for the submission of the power bill by the plant owner for reimbursement. The files, however, do not contain any of the sheets with the joint meter readings that referred to in these letters. As such, I have re-worded the Table 4 entry for this plant on Nellore where we still imply that we did not have all the information required to calculate GHG emission reductions from this MIP.

## APPENDIX I – MIP PROFILES

These are notes taken during field visits to these respective model investment projects

### 1. UNIVERSAL BIOMASS, MUKTSAR PUNJAB

- 14.5 MW plant, requiring 450 to 500 tpd of paddy straw
- Unit is steam based (using biomass based boiler) and deploys a steam turbine
- The plant is operational and producing power
- The fuel (paddy straw) is available in abundance
- It has no other competing use and farmers need to dispose it quickly in order to be able to prepare their field for the next crop. Therefore, they burn it on their fields itself leading to release of large quantities of pollutants that inundate nearby cities including Delhi.
- Plant is designed for multiple feedstock such as cotton, dung cakes and mustard but Company is interested to convert it to 100% rice straw mode for which it is in touch with a Danish Company
- However, use of dung is not preferred as it has Sulphur content that destroys the boiler tubes
- Biomass is purchased from a 50 km radius
- Since commissioning, only 60% of the capacity has been utilized and ***some profit has been generated*** in the last 2 years
- Transport costs of biomass are key to profitability
- Company has tried to minimize rice straw transport costs by undertaking baling of the material at site. As bales are somewhat compacted, more material can be transported per trolley load
- Company undertakes baling through use of baling machines, each costing about Rs. 19 to 20 lakhs
- One baler harvests about 2000 tonnes of rice straw in a month and employs about 25 people for that period
- Baling activity is undertaken only for one month in a year. Rest of the time the baler machines sit idle
- Each tractor-trolley carries about 5 – 8 tons of bales per trip. Each trolley load of rice straw bales is clearly too large in dimensions. This is done in order to carry maximum quantity per trip and becomes a major traffic hazard on the route these trolleys travel.
- Company has a vast biomass storage area with appropriate fire safety arrangements
- The BMP is required to be closed down twice a month for 2 days each time for maintenance

### 2. MALWA POWER

- Unit is 6 MW and is operational at 92.7% PLF
- Technology consists of boiler-steam turbine-alternator combination (feedstock: paddy straw)
- 88% of power produced is sold to grid. Rest is consumed internally
- Company has sizeable biomass storage area with fire safety arrangements
- Extra security personnel deployed to prevent occurrence of fire
- The Company has 6 additional BMPs in Punjab. All are doing well
- Company has evolved an efficient biomass collection network deploying several biomass suppliers, more than 100 baling machines (purchased and owned by several biomass suppliers) thereby creating considerable employment. Company has taken up a leadership role biomass collection activity and have developed close personal rapport with suppliers as well as the farmers

- Company has lobbied with Government and has managed to get subsidy approved for baler machines purchased by the biomass suppliers
- Since many biomass suppliers and transporters have purchased baler machines and transport equipment in good faith in anticipation of getting work from the Company, the Company now feels obligated to give them work despite biomass availability declining in recent times.
- Company claims to have prevented uncontrolled biomass burning from as much as 1.5 lakh acres
- No officials from UNDP or MNRE have visited the plant
- Plant is shut once a month for cleaning and 15 days per year for annual maintenance

### 3. RUCHI SOYA

- Plant Capacity is 1 MW and technology involves gasification – IC Engine route for power production
- Plant intended as a captive power unit to supply power to m/s Ruchi Soya's soyabean processing and oil production unit located just beside this plant
- The entire plant has been designed, fabricated and erected by m/s Thermax, who had accessed some funds from MNRE for technology development
- The plant campus has a storage yard where it can store an entire season's biomass requirement
- Plant operates at 66% combined heat and power efficiency
- The soyabean processing plant derives its power as well as process heat from the BMP. The power is provided by the producer gas based generators and the process heat is provided by exhaust flue gases of the gasifier
- Company had to shut down plant last year due to unavailability of biomass on account of drought. The Company's soyabean processing and oil production unit has also remained shut for the same reason. Both plants remain shut till date
- As rains are better this year, it expects to re-open the plant by November this year
- Despite the plant being closed down, m/s Thermax are operating on a limited scale at their own cost to conduct trials for further optimization of the technology. M/s Ruchi Soya are also cooperating in this activity by providing some personnel and other support. The power produced during these trials is being dumped in a dummy load consisting of heating coils

#### Biomass Collection

- Company leverages soya dealers to procure biomass. Mission interacted with one such dealer
- Reaping is manual. The Company has also deployed some reaping machines for use of soya dealers
- Soyabean is usually intercropped with *Tur* (or *Arhar* – a pulse crop). Alternatively it is rotated with a pulse crop such as Chana. Harvesting is done manually at the farmer's field itself
- Threshing is also done at the farmer's site itself using threshing machines
- Usually the ratio of soya crop residue to the soya beans of 1:1, meaning thereby that for every ton of soyabean harvested, about one ton of biomass is generated
- Current main challenges, according the owners are (a) availability of biomass and (b) working capital
- Biomass collection is manual (no machines used). Usually it is collected after the threshing operation is over. It is purchased on basis of visual estimation only – it is not weighed
- Company is considering supplementing its biomass feed by use of biomass from other crops such as *Tur* and Cotton

### Advantages

- The plant creates additional business opportunities for several soya dealers who source the biomass for this plant from a radius of about 25 km around Washim
- Captive power generated by the plant is of immense help to the adjoining soyabean processing and soya oil production facility. This is because they were earlier paying Rs. 7.2 per unit for power purchased from the grid and another Re. 1 per kg for the steam generated coal fired through boilers. Both power and steam are now much cheaper and available for a fraction of their original cost.

#### 4. M/S SHREE PANDURANGA SAHAKARI SAKHAR KARKHANA (Visit by Mr. Parimal Sadaphal on 10 Aug 2017)

- **Established:** Cogen Plant established in 2006
- **Size:** total 19 MW consisting of 2 units - 9 MW and 10 MW (former supported under BMP)
- **Project Cost:** Rs. 44.9 Cr for Cogen plant + Rs. 5.65 Cr for energy efficiency enhancement of sugar factory
- **Cost break-up:** NCD<sup>65</sup> loan (at 11% interest) – Rs. 14.66 Cr; SDF<sup>66</sup> Loan (at 4% interest) – Rs 9.25 Cr; MSCB<sup>67</sup> Loan (at 9% interest) – 20.69 Cr; UNDP/MNRE grant - Rs. 2 Cr
- **Use of UNDP/MNRE subsidy:** UNDP/MNRE subsidy was used to purchase 10 Trash Baler Machines to collect sugarcane “trash” from the field and not for funding any component of the Cogen Plant (see next section for details). The mission inspected some of these machines stabled in the plant premises and found them to be identical to the “baling machines” used by m/s Malwa Power and m/s Universal Power in Punjab.
- **Technology:** Boiler – Turbine – Alternator
- **Cogen features:** Essential features of cogen system are as follows-
  - A lot of drives earlier operated on steam (including conveyors) due to which, power requirement was low but steam requirement was high;
  - Now many steam driven mechanical equipment has been converted to electrical drives;
  - Steam production is 125 tons per hour, the use of which is as below:
    - 110 tons is used for power production in the two units. Exhaust steam from both turbines is diverted to the sugar production process where it is used before being condensed in case of 9 MW unit and released in case of 10 MW unit;
    - 7 tons is used for boiler operations;
    - 8 tons is used in the distillery owned by the same cooperative, located adjacent to the sugar factory;
- **Feedstock:** Bagasse, sugarcane trash (leaves, etc. at the top of the sugarcane plant that are cut and discarded in the field)
- **Estimated biomass requirement:** 1320 tons of biomass per day is required for operating both 9 and 10 MW units. Bagasse-sugarcane trash blend (ratio of 95:5) is used
- **Selling rate as per PPA:** Rs. 6.53 per kWh
- **Estimated power production:** Total generation in a season spanning 180 days is 82 million kWh. Of this, generally 35% is used for internal consumption during season and 10% during the 45 day off-season period when the sugar factory is closed
- **Intended use of produced power:** Meeting internal power requirements of sugar factory and distillery when they are in operation. Remaining power is fed to the grid;

<sup>65</sup> NCD: National Cooperative Development Corporation

<sup>66</sup> SDF: Sugar Development Fund

<sup>67</sup> MSCB: Maharashtra State Cooperative Bank



- **Operations:** Plant has operated consistently since commissioning

#### **BIOMASS AVAILABILITY AND FEATURES**

- While harvesting sugarcane, the leaves and cuttings of the top portion of the sugarcane plant are discarded and left in the field. This waste material is termed as “trash” and is generally burnt before the new crop of sugarcane is planted;
- The calorific value of sugarcane trash is about 1.7 times that of bagasse;
- Generally, about 3 to 5 tons of ‘trash’ is generated per acre of sugarcane crop;
- The SPSSK has arranged for this waste material to be collected from the sugarcane fields using Trash Baling Machines (TBMs), which on inspection were found to be identical to the baling machines used in Punjab;
- SPSSK has acquired 10 trash baling machines (TBMs) through use of UNDP/MNRE grant. These machines are owned by the SPSSK and “issued” to specific contractors for sugarcane trash collection;
- Each machine covers about 5 acres per day and collects about 20 tons of sugarcane trash;
- Daily bagasse production in the sugar factory is 1620 tons and per day sugarcane trash collection is about 90 tons;
- Considering that the daily requirement of biomass is 1320 tons, the excess 390 tons of fuel (bagasse + sugarcane trash) which is left unutilized per day keeps accumulating over the season. Consequently, the management to operate the 9 MW unit for an additional 45 - 60 days using the accumulated fuel even after closure of the main sugar factory at the end of the season;
- **EXPENSES:** Following is the per day manpower required and cost of sugarcane trash collection operation using a TBM (as told by an actual TBM contractor in an interview):
  - TBM Driver / Operator (1 No) @Rs. 600/- per day;
  - TBM Helper (1 No) @ Rs. 300/- per day;
  - Diesel cost @ Rs. 4,800/- per day;
  - 4 persons for loading @ Rs. 2,800/- per day;
  - **Total per day cost to TBM contractor: Rs. 7,700/-.**
- **REVENUES:** The SPSSK *issues* each TBM to a specific local person (contractor?) for organizing and conducting the trash collection operation. No rent is charged from these persons for using these machines. Their revenues from the trash collection operation are as below:
  - They are paid Rs. 700/- per ton of trash bales delivered. Therefore, for 20 tons of trash bales, each contractor should earn about Rs. 14,000/-;
  - In addition, they are paid the following amounts for the purposes mentioned alongside (basically these are other expenses / payments which the SPSSK routes through the contractors (they do not benefit the contractor in any way):
    - Rs. 3,200/- towards purchase of 16 kg nylon rope, which costs about Rs. 200/- per kg, for tying up the bales;
    - Rs. 4,000/- (@ Rs. 200/- per ton for 20 tons) to be paid to farmers from for allowing the trash to be collected from their fields;
- Further, the trash collection operation also deploys transporters, who are essentially tractor-trolley owners. They get paid Re. 500/- per ton. Therefore, for 20 tons, their earning is about Rs. 10,000/-. They might make about 2 trips to transport 20 tons;
- In the whole, the trash collection contractors stand to earn about Rs. 6,300/- per day during trash collecting season which lasts for about 180 days a year, if not more which totals up to a handsome Rs. 11.34 Lakhs;

- With the existing 10 TBMs, the SPSSK can typically cover about 9,000 acres of sugarcane crop area for sugarcane trash collection thereby preventing its burning over this area. In addition, the farmers also get some monetary benefit from the sugarcane trash collected from their fields
- However, the SPSSK sources sugarcane from 28,000 acres and collection of trash from the entire area is impossible with the existing 10 TBMs. It would need 30 TBMs to cover that area.

### DISCUSSION

- The plant is functioning well since commissioning. However, it operated only for 75 days last year because of drought;
- Carbon credits have been claimed for three years. However, currently no carbon credits are being claimed now as their value is very low;
- Most loans have been paid off: entire loan for 9 MW unit cleared. For 10 MW unit only two more instalments remain to be paid;
- Cogen is now almost a standard norm in sugar factories all over Maharashtra. Almost 50% of the sugar factories have Cogen installed in them. However, of late the Maharashtra Government has decided to discontinue signing of any more PPAs merely due to higher biomass power production costs;
- **Employment Generation:** There are two types of employment generated as a consequence of sugarcane trash baling and transport to the Cogen plant. These are as follows:
  - A crew of 7 persons required for operating 10 TBMs productively to produce 20 tons of sugarcane trash bales per machine per day. This amounts to 12,600 man-days;
  - If manpower engaged in transport of bales is considered, this figure jumps to 13,320 man-days;
  - As mentioned earlier, sugarcane for SPSSK is collected from about 28,000 acres. Therefore, the number of TBMs required will be 30, in which case, the number of man-days of employment creation will be about 38,520.

### POINTS TO PONDER

- The decision of the Government of Maharashtra to discontinue signing of any more PPAs merely due to higher biomass power production costs will be detrimental to promotion of useful disposal of biomass waste in the state;
- This is also because most Cogen units produce more power than what is required for their internal consumption in sugar production. This power is available for the grid;
- Don't know if the SPSSK could be accused of favoritism since they seem to just give the TBMs to certain individuals without any specified selection process;
- Using TBM contractors to disburse payment to farmers could lead to possible exploitation of the farmers unless adequate checks and balances are in place.

### 5. M/S SLS POWER CORPORATION, NELLORE, ANDHRA PRADESH (Visit by Mr. Parimal Sadaphal on 9 Aug 2017)

- **Established:** 2001 (very old plant) ; Fuel yard developed with UNDP/MNRE support in 2007
- **Size:** 6 MW
- **Project Cost:** Rs. 24.3 Crores
- **Cost break-up:** IREDA loan – Rs. 18.75 Cr; Entrepreneur – Rs 6.05 Cr; UNDP/MNRE grant of Rs. 1.5 Cr was availed to set up fuel yard (owns 3-4 yards)
- **Technology:** Boiler – Turbine – Alternator (single unit)

- **Feedstock:** Rice husk (by product rice mills); *prosopis juliflora* (collected from abundant growths in nearby areas); palm tree leaves
- **Estimated biomass requirement:** 185 tons per day
- **Selling rate as per PPA:** Rs. 5.93 per kWh
- **Estimated power production cost:**
- **Intended use of produced power:** Grid feeding;
- **Operations:** Plant has operated quite consistently since its commissioning in 2001. The only times it did not operate were as follows:
  - **2007-08:** It was closed for 1 year because of boiler burst
  - **2011-13:** It was closed for 3 years because of unviability. It was unviable to operate the plant at the power purchase price (Rs. 2.60 per kWh) prevailing at that time. It was later restarted when the power purchase price was revised to Rs. 5.93 per kWh
- **Current status:** The plant has been shut down and remains closed on instructions of regulator since June 2017. Regulator has sent a notice to management asking them to shut down the plant. No reason is mentioned in the order but presumably this is because they are unable to pay the high power evacuation price agreed to in the PPA since cheaper power is available from other sources. However, the plant owner has some indication that they are likely to be given permission to re-start operations by 15 September 2017.
- The plant has been experiencing substantial difficulties on account of unstable / wavering offtake pricing structures / policies, frequent and sudden changes in purchase prices and prolonged litigation with the Electricity Board / Regulator. Consequently, the plant owner is very frustrated and repents profusely for having opted for BMP in the first place, despite having kept the plant running for so long. He vows to never go in for biomass based technology ever in future.

#### **BIOMASS AVAILABILITY AND FEATURES**

- The area is known for intensive paddy cultivation. Two crops of paddy are taken every year
- There are about 200 rice mills in and around Nellore city. Therefore rice husk is available in abundance
- However, the mission was informed that paddy straw is not burnt in the area as it is used as cattle feed due to which it is not available for use in the power plant (needs to be verified)
- Also there is profuse growth of *prosopis juliflora* shrubs in the area and the supply is almost unlimited. Other fuels such as palm leaves are also available
- The plant uses a blend of rice husk and *prosopis juliflora* as fuel. No rice straw is used as in Punjab because it has an alternative use as cattle feed in this area
- Rice husk is available for Rs. 3,400/- per ton (price varies according to seasons).
- *Prosopis juliflora* is simply collected from nearby areas. The power plant has its own collection mechanism consisting of 4 fuel yards manned by a number of persons employed as fuel collectors. Each yard is managed by a yard manager, who is paid an incentive / commission of Rs. 50/- per ton of fuel collected. The cost of collection of *prosopis juliflora* works out to about Rs. 3,000/- per ton
- The blend of rice husk and *prosopis* is adjusted according to prevailing prices to arrive at the most economical blend for the plant at any given time

#### **DISCUSSION ON CURRENT STATUS (NOT IN OPERATION)**

- The plant was functioning well since commissioning in 2001

- The main litigation started in 2004 when the power purchase price was arbitrarily reduced from Rs. 3.48/- per kWh to Rs. 2.60/- per kWh despite there being a PPA which promised the former price for a period of 13 years. The reason quoted was cheaper price of other competitive technologies
- SLS Power went to Appellate Tribunal which ruled that they be paid as per the PPA, that is Rs. 3.48/- per kWh with 5% yearly escalation
- AP (Andhra Pradesh) TRANSCO (the aggrieved party on account of above ruling) then approached the Supreme Court, which referred the case to AP Regulatory Commission (APRC)
- A 3 member bench of APRC hearing the case, gave 3 different rulings (one by each bench member):
  - Member-1 ruled that the original PPA (Rs. 3.48/- per kWh) should be honored
  - Member-2 ruled that the purchase price should be Rs. 1.36/- per kWh
  - Member-3 ruled that the purchase price should be Rs. 1.16/- per kWh
- SLS Power again approached the Appellate Tribunal, which accepted the ruling of APRC Member-2 (Rs. 1.36/- per kWh) along with a certain lumpsum relief amount
- AP TRANSCO (the aggrieved party on account of above ruling) has again approached Supreme Court. The Supreme Court has awarded certain lumpsum as interim relief but its final ruling is currently awaited.
- Further, SLS Power received a communication from AP TRANSCO on 9 June 2017 that all biomass, baggase and waste to energy power plants should be shut down till further instructions. The reason for this was not mentioned in the letter but this was ostensibly due to the power purchase price being substantially higher than other sources of power.

#### **IMPLICATIONS**

- Frequent and arbitrary changes in pricing and lack of honoring PPA causes unnecessary pressure on BMP operator and frustrates him
- There is lack of appreciation in the regulator's mind about the complexities of running a BMP operation as well as its environmental benefits and employment creation potential. They seem to give too much emphasis to comparative economics thereby completely negating large investments made on establishing these plants, promoted by them in the first place. Also, there is no recognition of the apparent environmental benefits and their inclusion in the decision making process
- It is sad to see scant regard given to substantial investments made by the private sector and rendering them useless on basis of an insufficiently thought out decision
- No regard is also shown to the losses accrued by the entrepreneur on account of such arbitrary treatment
- The mission was told that out of 35 BMP projects that came up in AP, only 13 are operating, that too with considerable difficulty
- Alternate and sudden closure and re-starting of plant imposes heavy stress on the workforce due to sudden loss of work causing immense hardships to them, which is avoidable given that these power plants are environmentally friendly and generate significant employment

#### **POINTS TO PONDER**

- Why is the regulator changing policy from time to time?
- Despite so many negative circumstances, the promoter has kept the plant operational for such long time and paid back all loans. Is it not time he be rewarded for his perseverance and the policy framework revised to make things simpler for him as well as others like him?

- Why are the rulings of various courts so varied? Are they being provided with the correct facts, figures and consequences?
- Should environmental cost be a major considering in deciding the pricing?

#### **6. M/S DEE VEE POWER, KUSHALNAGAR, COORG, KARNATAKA (Visit by Mr. Parimal Sadaphal on 8 Aug 2017)**

- **Size:** 2 MW
- **Project Cost:** Rs. 12 Crores
- **Cost break-up:** Karnataka State Finance Corporation (KSFC) loan – Rs. 5 Cr; UNDP / MNRE grant– Rs. 4 Cr; Entrepreneur – Rs 3 Cr
- **Technology:** Boiler – Turbine – Alternator (2.5 MW)
- **Feedstock:** Coffee husk (by product of coffee curing units); also under consideration: maize & sugarcane leaves
- **Estimated biomass requirement:** 50 tons per day
- **Selling rate as per PPA:** Rs. 5.71 per kWh
- **Estimated power production cost:** Rs. 1.5 to Rs. 3.00 per kWh depending on season
- **Intended use of produced power:** Grid feeding; selling to nearby consumers under consideration
- **Current status:** Partially constructed, equipment procured, construction work halted; most equipment suppliers are paid off except for turbine supplier (Rs. 0.55 Cr) and boiler supplier (Rs. 1 Cr);
- **Financiers:** KSFC is taking considerable interest in supporting entrepreneur and trying to get the plant working.

#### **BIOMASS AVAILABILITY AND FEATURES**

- 90% of India's coffee growers as well as processing units are in Coorg, Karnataka
- There are about 46 Coffee Curing Units (CCU) of different capacities in and around Coorg. More in adjoining districts
- Each CCU generates at least 10 to 20 tons of coffee husk (larger units generate more)
- Coffee pod harvesting season is generally 8 months in a year. However in the balance 4 months (during rainy season) harvesting still takes place but yield is lesser
- Price of coffee husk goes up during the 4 “off-season” months, varies from Rs. 1.8 to Rs. 3/- per kg. These days it is available for entire year.
- Coffee husk is in great demand – used in boilers by various industries in Mysore; also by tobacco industry in tobacco processing; it is also briquetted commonly
- Coffee husk has an attractive calorific value of 4,200. However, it needs to be sufficiently dry
- Coffee husk is highly inflammable and therefore a fire hazard risk

#### **REASONS FOR CURRENT STATUS (CONSTRUCTION INCOMPLETE)**

- KSFC loan is disbursed, MNRE advance (Rs. 0.6 Cr) received, Entrepreneur has put in his own investment
- Using the above, civil works were completed, equipment ordered and delivered at site (it still lies there)
- Further tranche of MNRE grant was not received for considerable time. After much persuasion, MNRE disbursed another instalment of 1.4 Cr in 2015 thereby bringing its contribution to 50%
- Due to lack of the balance 2 Cr, the equipment could not be assembled and erected, neither the balance civil work completed due to paucity of funds

- Consequently the entrepreneur blames MNRE for non-completion of his power plant – he says the construction could not be completed and plant not commissioned because this portion of grant was not released
- As per MNRE's sanction letter, the next instalment of funds can be released only after 'equipment is erected and commissioned'. Subsequently another (final) instalment of funds is to be released only 'after the entrepreneur operates the plant successfully for 3 months
- Entrepreneur expresses inability to comply with above condition and requested relaxation of the same, thereby enabling him access to funds to complete and commission the plant
- MNRE has not replied despite several requests and reminders

#### **IMPLICATIONS OF THE ABOVE IMPASSE**

- Chances of unique demonstration obliterated
- Entrepreneur is making considerable losses on account of:
  - Cost escalation
  - Interest burden on loan already taken (he was expected to pay about Rs. 0.2 Cr as interest till construction is over but has already paid in excess of Rs. 1.1 Cr as interest)
  - Machinery is lying around and exposed to elements, getting rusted and may run into operational issues during commissioning
- If funds are not released within two to three weeks, the losses and interest burden might become so high that entrepreneur might be at risk of becoming bankrupt
- To avoid bankruptcy, the entrepreneur has the following contingency plan: sell off the land on which the unit is located, which has appreciated considerably in value and settle all debts / liabilities. Equipment (which is brand new) will have to be sold as junk
- It would be extremely difficult to take this concept forward due to lack of knowledge and experience this unit could have generated
- Banks and financial institutions could lose interest in financing BMP projects

#### **POINTS TO PONDER**

- Why is MNRE not replying despite several requests and reminders?
- Why could not the entrepreneur try to obtain the required funds from some other source and complete the project?
  - Tried asking him: He says MNRE always assured him (verbally) that the grant funds would be paid soon, due to which he did not look for additional options
- Since KSFC (the financial agency giving loan to the entrepreneur) has been so supportive, would it be an idea for UNDP to partner with such an agency to implement such kind of projects instead of partnering with MNRE in future? (Can UNDP directly finance agencies such as KSFC?)
- With the BMP project being declared closed on 31 July (is that true?) would it be possible for MNRE to still transfer the remaining funds to Dee Vee Power even it desires so? It would be a pity to see a project so close to being a historical milestone disintegrate only due to bureaucratic red tape;
- What kind of swift action can be taken to save this project?

## APPENDIX J - EVALUATION CONSULTANT AGREEMENT FORM

### Evaluator 1:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

### Evaluation Consultant Agreement Form<sup>68</sup>

#### Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Roland Wong

Name of Consultancy Organization (where relevant): \_\_\_\_\_

**I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.**

Signed at Surrey, BC, Canada on November 6, 2017



<sup>68</sup> [www.unevaluation.org/unegcodeofconduct](http://www.unevaluation.org/unegcodeofconduct)

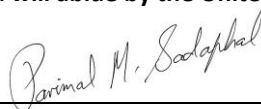
**Evaluator 2:**

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people’s right not to engage. Evaluators must respect people’s right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
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6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

**Evaluation Consultant Agreement Form<sup>69</sup>****Agreement to abide by the Code of Conduct for Evaluation in the UN System**Name of Consultant: Parimal Sadaphal

Name of Consultancy Organization (where relevant): \_\_\_\_\_

**I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.**

Signed at *New Delhi, India* on *November 6, 2017*


<sup>69</sup> [www.unevaluation.org/unegcodeofconduct](http://www.unevaluation.org/unegcodeofconduct)