CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

6.6 MW Municipal Solid Waste to Electricity Generation Project
Version 1
Date: 04/12/2007

A.2. Description of the small-scale project activity:

Municipal Solid Waste (MSW) to Electricity Generation is one of the major waste-to-energy technologies that allows MSW to be directly combusted in waste-to-energy facilities as a fuel with minimal processing (known as **Mass Burn).** Alternatively, the technology also allows combustion of Refuse Derived Fuel (RDF) that is produced after the MSW undergoes moderate to extensive processing. This technology presents the opportunity for both electricity production as well as an alternative to land filling or composting of MSW.

The 6.6 MW Municipal Solid Waste to electricity generation project essentially undertakes the generation of electricity from the Refuse Derived Fuel produced from the municipal solid waste of the city of Hyderabad as the major (principal) input fuel along with a small portion of agro-waste (rice husk and groundnut shells).

In November 2003, the production of electricity from processed municipal solid waste i.e. RDF and synchronizing with grid was done for the first time in the country at the project site located at Elikatta village, Shadnagar ,Mahabubnagar district , AP. The project activity is hence a first of its kind project in India running since November 2003. The technology provides yet another source of renewable energy similar to that of wind energy and solar energy for power generation best suited for energy intensive Indian cities. The input fuel (RDF) is a coal substitute, further unlike coal RDF has no shellac and has less ash content.

This project activity was therefore considered for execution and commissioning with following motives:

1. Creating a continuous demand for the RDF, thus creating a market for MSW projects based on RDF technology leading to reduction in development of new dumping sites for disposal of municipal solid waste, thus avoiding greenhouse gas emissions.

2. Reduction in generation of anthropogenic emissions from generation of electricity from a renewable source of energy thereby developing it as a potential CDM project.

3. Employment generation and improving the standard of living of rag pickers by converting them into skilled workers and securing their future as permanent employees to the company.

4. Proving the new technology thereby leading way for successful implementation of replication of similar projects across the country and other tropical regions across the globe.

Contribution to sustainable development:

The project activity is a renewable electricity generation project. The generated electricity is exported the electricity to the state grid through the state transmission utility APTRANSCO's sub-station located at the town of Shadnagar. The generated electricity is thus providing to a deficit southern region power grid of India which is largely fossil fuel dominated.

- Social Wellbeing: The project activity has been essentially conceptualised to provide electricity to the southern regional grid. The generated electricity is being fed into the local grid sub-station located at Shadnagar town leading to strengthening of the grid both in terms of frequency as well availability of electricity.

- Economic Wellbeing: The project activity has generated employment for the local community as well as for rag pickers leading to their economic wellbeing.

- Environment Wellbeing: The project activity consumes RDF, which is a renewable source for energy and is derived by processing Municipal Solid Waste. Hence the project activity leads to reduction in municipal solid waste dumping in landfills. The project activity also leads to conservation of water, through reduction of water consumption at the power plant by introducing an air-cooled condenser unit instead of the standard water-cooled condenser unit.

- Technological Wellbeing: The pilot scale technology for converting MSW to RDF pellets was developed by Technology Information Forecasting and Assessment Council (Government of India) and has been successfully scaled up and commercialised for the first time in India by SELCO. The power generation technology was developed by SELCO through their in-house R&D efforts. The developed technology also introduces an air-cooled condenser unit for use in a power plant in AP instead of standard water-cooled units, thereby promoting a new environment friendly technology.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
Government of India (Host Country)	SELCO International Limited	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the party (ies) involved is required.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party (ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Host Party: India

A.4.1.2. Region/State/Province etc.:

Region: Southern India
State: Andhra Pradesh

A.4.1.3. City/Town/Community etc:

City: Mahaboobnagar District
Town: Farooq Nagar (Shadnagar)
Community: Elikatta Village

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

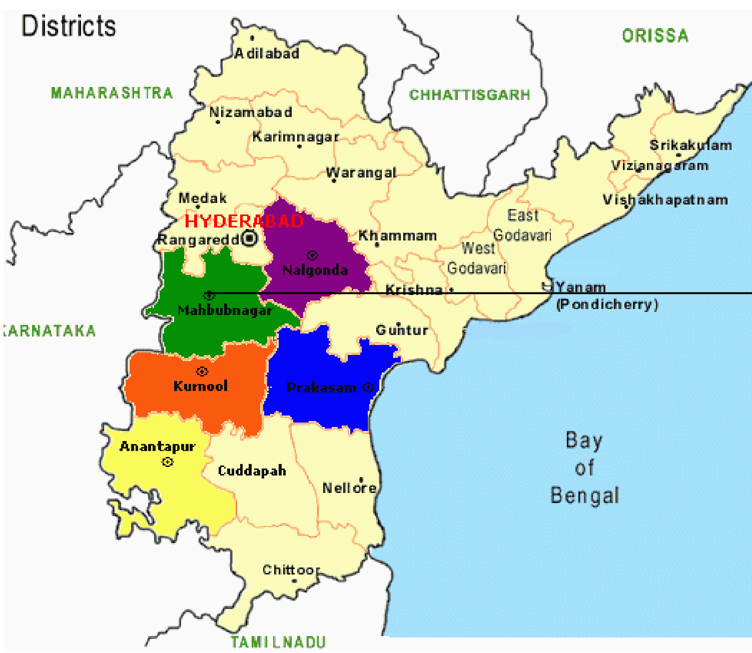
The power plant is located at Survey Nos 199 and 200AA, Elikatta Village, Farooq Nagar Mandal, Mahaboobnagar district, Andhra Pradesh, India. The Power Plant is approximately 55 km away from the city of Hyderabad on Hyderabad – Bangalore National Highway No 7. The 33/11 kV grid sub-station for the evacuation of generated electricity is approximately 3.5 km away from the power plant.

Latitude: 16^{o} 46’ North
Longitude: 77^{o} 56’ East

State map of India showing the state of Andhra Pradesh

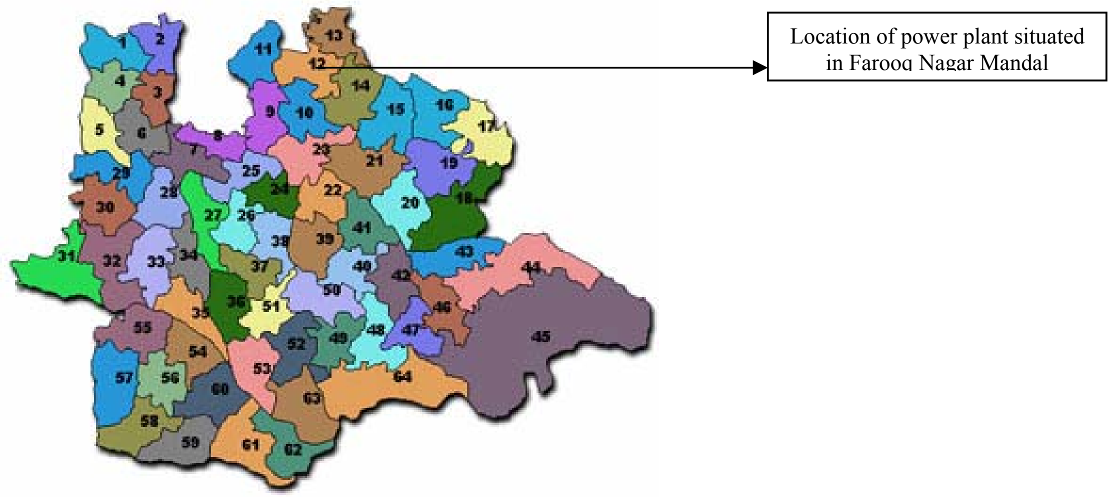
Andhra Pradesh

District Map of Andhra Pradesh showing the district of Mahaboobnagar



Mahaboobnagar

Map of Mahaboobnagar district showing the Farooqnagar Mandal



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Type and Category
According to simplified modalities and procedures for small-scale CDM project activities, the candidate project activity falls under:

Sectoral Scope 1	Energy Industries (renewable / non-renewable sources)
Type – I	Renewable Energy Projects
Category I-D	Grid connected renewable electricity generation

Technology:

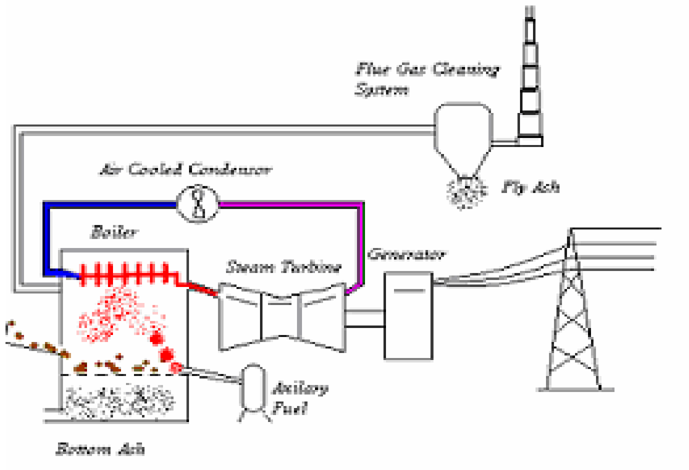
The project activity is 6.6 MW (gross) capacity grid connected RDF based renewable energy project using agro-waste biomass (mainly rice husk & groundnut shell) as auxiliary fuel.

General specifications of the power plant

The power plant consists of a multi fuel fired steam generator, a bleed-cum-condensing Turbo generator, fuel handling system, Ash handling system, Air Cooled Condensor, D.M. water plant, Control Panels, Switch Yard, Transformers, and instrumentation along with relevant piping. The net electricity generation is about 6.0 MW that is exported to the state grid.

RDF is fed to the boiler through proper feeding system/feeders. The high pressure superheated steam generated in the boiler is used to run the power house turbine. The condensing type power house turbine produces about 6.6 MW under normal operating conditions at 11 KV generating voltage of this, approx. 600 kW will be used by the power plant auxiliaries. Power is then stepped up to 33kV through a step up transformer for supplying to the grid.

The flow chart of different activities is shown below:



General Specifications for plant and machinery

1.	Gross Power Generation	6.6 MW
2.	Number of days of availability	Approx 330 days in a year
3.	Steam Generator	
	Steam Capacity (MCR)	32 TPH
	Steam Pressure at S.H. outlet	45 kg/cm2 (g)
	Steam Temperature at S.H. outlet at MCR	485 +/- 5 ^{o} C
4.	Turbo Generator Set	
	Type	Bleed cum Condensing Air Cooled condenser 6.6 MW
	Generation	11 kV, 50 Hz, 3 phase
5.	Power Plant Electrical	
	Power consumption	Approx 600 kW (only for power plant units)
6.	Fuel used for power generation	
	Main fuel	RDF
	Auxiliary fuel	Agro-waste – rice husk and groundnut shell
7.	Export power	6000 kW

The project uses a partial blend of renewable fuel like agro waste along with RDF. The use of agro waste/biomass as auxiliary fuel in MSW based power projects is in line with MNRE (Ministry of New and Renewable Energy) guidelines. Thus RDF based projects have practical availability of two fuels for running of plant and thus use of coal (GHG emission) is not required for running of plant.

The power plant has a condensing stem turbo generator with travelling grate boiler capable of firing multiple fuels, resulting in efficient burning of RDF with minimum requirement of additional auxiliary fuel (biomass).

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

S. No.	Years	Annual estimation of emission reductions in tonnes of CO_2 e
1	2008	31,581
2	2009	31,581
3	2010	31,581
4	2011	31,581
5	2012	31,581
6	2013	31,581
7	2014	31,581
8	2015	31,581
9	2016	31,581
10	2017	31,581
Total estimated reductions (tonnes of CO_2 e)		315,810
Total number of crediting years		10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)		31,581

A.4.4. Public funding of the small-scale project activity:

There is no diversion of ODA to the project activity. The total Project cost is INR 323 million out of which the debt portion is INR 225 million. The promoter has contributed INR 98.9 million as equity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/Add.3), a small-scale project is considered a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants
- In the same project category and technology
- Registered within the previous two years; and
- Whose project boundary is within 1km of the project boundary of the proposed small scale activity

The project participant confirms that there are no other project activities belonging to the same project participant that are in the same project category within a distance of 1km from the project boundary. Therefore the project activity is not a debundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Project Type: I	Renewable energy projects
Project Category:	**I D** Grid connected renewable electricity generation
Reference:	Appendix B of the simplified M&P for small scale CDM project Activities (Latest amended version 12 – EB 33, Valid from 10th August 2007 onwards) (http://cdm.unfccc.int/methodologies/SSC methodologies/approved.html)

B.2 Justification of the choice of the project category:

The capacity of the proposed project is 6.6 MW, which is less than the maximum qualifying capacity of 15MW[1], hence as per the simplified modalities and procedures for small scale CDM project activities of UNFCCC, the project activity has been considered as a small scale CDM project activity. The project proponent also confirms that the total installed capacity will not exceed the threshold limit throughout the 10 year crediting period.

The approved small scale methodology AMS I.D. has the following applicability conditions:

1) This category comprises renewable energy sources, such as photovoltaic, hydro, tidal/wave, wind, geothermal and biomass, that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit.

The project activity utilizes the RDF pellets derived from MSW for power generation. This falls under the category of renewable biomass as per the definition of renewable biomass given by the UNFCCC[2]. The electricity produced is exported to the grid.

2. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.

There is no addition of non renewable components / co-firing of fossil fuel in this project.

3. Combined heat and power (co-generation) systems are not eligible under this category.

The project activity produces only electricity.

4. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.

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[1] In accordance with the simplified modalities and procedures for small-scale CDM project activities (annex II to decision 21/CP.8 contained in document FCCC/CP/2002/7/Add.3) http://cdm.unfccc.int/Panels/ssc/ProjectActivities/clarssc7add3.pdf

[2] Reference – UNFCCC EB 23 report, Annex 18.

There was no renewable power generation facility prior to the implementation of the project activity.

5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

There is no retrofit or modification involved in the project as there is no renewable energy generation unit existing prior to the implementation of the candidate project activity.

From the above, it can be concluded that the project activity falls under the small scale category I.D.

B.3. Description of the project boundary:

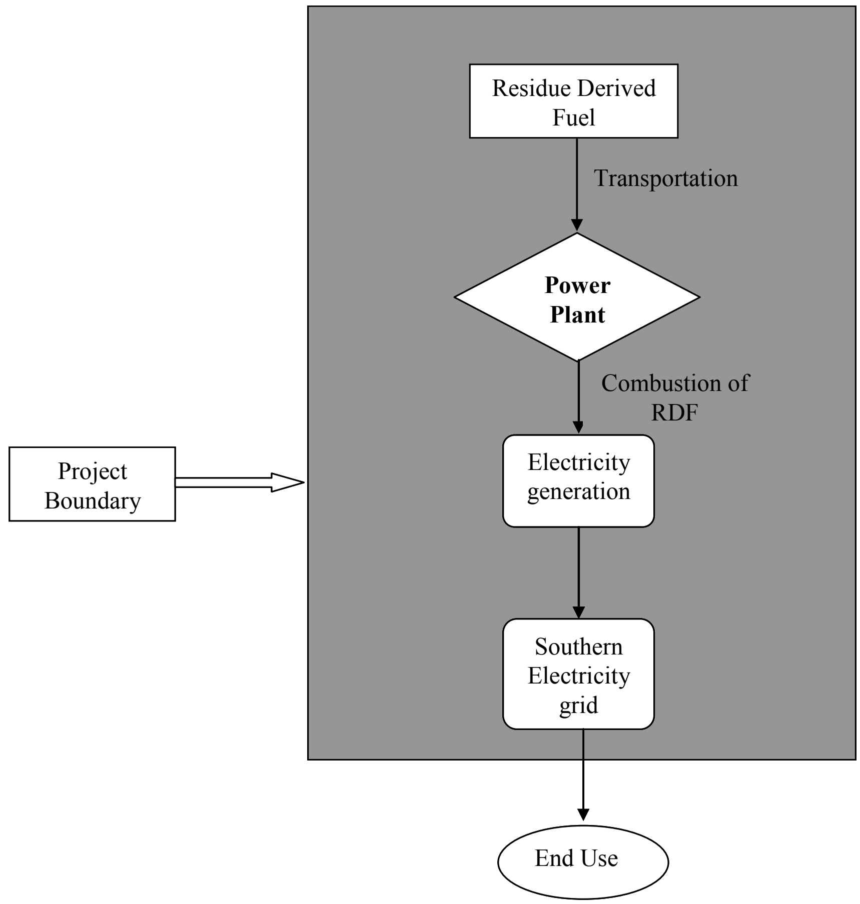
The project boundary is defined as the notional margin around a project within which the project's impact (in terms of GHG reduction) is assessed. As defined in the Annex B for small-scale project activities, the project boundary for a small-scale project that provides electricity to a grid encompasses the physical, geographical site of the renewable energy generation source along with the specific grid to which it supplies the electricity to.

The Indian electricity system is divided into five regional grids, viz. Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. As the regional grids are interconnected, there is inter-state and inter-regional exchange. A small power exchange also takes place with neighbouring countries like Bhutan and Nepal.

Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid. Each state in a regional grid meets its demand with its own generation facilities and also with allocation from power plants owned by the Central Sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the Central Sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. The regional grid thus represents the largest electricity grid where power plants can be dispatched without significant constraints and thus, represents the "project electricity system" for the Project. As the Project is connected to the Southern regional electricity grid, the Southern grid is the "project electricity system".

Hence, the project boundary encompasses the physical extent of the southern regional electricity grid which includes the project site and all power plants connected physically to the electricity system. Thus the Southern grid has been chosen as the grid system for the baseline calculation.

The project boundary is depicted in the figure below:



B.4. Description of baseline and its development:

As per the Indicative Simplified Baseline and Monitoring Methodologies for selected small scale CDM Project activity categories (I.D Version 12), the baseline for the renewable electricity generation systems is the electricity (measured in KWh) produced by the generating unit multiplied by an emission coefficient (measured in tCO2e/MWh) calculated in a transparent and conservative manner as either of the following.

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered

OR

(b) The weighted average emissions (in tCO2e/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

We have used option (a) i.e. combined margin as per approved methodology ACM0002 as the emission co-efficient for calculating the baseline emissions. It assumes that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined-margin calculations.

Accordingly the baseline emissions are given as:

$$BE_y = EG_y * EF_y$$

Where
BE_y = Baseline emissions in year *y* (tCO_2).
EG_y = Electricity generation by the project in year *y* (MWh).
EF_y = Combined margin emissions factor (Baseline emission factor) for the year *y* (tCO_2/MWh).

Data Used for Baseline Emission calculations.

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO2 Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided in ACM0002. We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

Details of Baseline data:

Data of Operating and Build Margin for the three financial years from 2003-04 to 2005-06 has been obtained from -

The CO2 Baseline Database for the Indian Power Sector
Ministry of Power: Central Electricity Authority (CEA)
Version 2
Dated: 21st June 2007
Key baseline information is reproduced in annexure 3.
The detailed excel sheet is available at:
http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to the simplified modalities and procedures for small scale project activities given by the UNFCCC, a project needs to demonstrate additionality as per Attachment A to Appendix B. This attachment lists various barriers out of which at least one barrier shall be identified due to which the project would not have occurred any way.

Project participants identified the following barriers for the proposed project activity:

Financial Barriers

SELCO International had made an investment of about Rs. 323 million to set up the power plant. The project financials indicate that the project even at the inception stage was not an attractive proposition for the project proponent without any extra financial incentives. The project proponent was aware that the candidate project faced several uncertainties and risks, being a first of its kind initiative. The company had factored in CDM revenue as a source of additional revenue to mitigate some of the risks that were faced by the project.

The project activity is located in the state of Andhra Pradesh where a 16% post tax equity IRR is considered appropriate for power projects (source: APERC terms and conditions of tariff). Therefore the equity IRR from the project is benchmarked against a 16% post tax IRR to establish its financial viability.

The equity IRR of the project is 6.74% which is lower than the benchmark rate of 16%. This clearly shows that the proposed project activity was not a financially attractive option for the project proponent.

Technological barriers

Combustion of municipal solid waste to produce energy is a very new technology in India and it is widely acknowledged that many technical developments are still needed in this sector. The APERC[3] in its order dated 20/03/2004 for power procurement from non conventional energy sources, has noted that such projects are at a nascent stage and the capacity factor of these projects can not be predicted as earlier performance data for such projects in India is not available.

It is important to note that RDF firing energy plants are complex and call for specialized design, automatic control sophistication and construction. Material handling, fuel feeding, ash removal, air pollution control and overall operating procedures for such projects are very complicated. The combustion of RDF poses several complications for a boiler designer in the areas such as fuel handling, combustion, staging/fouling and corrosion/erosion[4]. Further, it was the first time municipal waste to energy technology was being used in the country and therefore the project proponent and equipment supplier were unfamiliar to the specific adjustments required in the boiler design to make it suitable for burning RDF. Because of these technical difficulties and uncertainties SELCO has had to undergo many changes in its boiler design to customize it to specifically suit the combustion of RDF. The details of these changes have been given in annexure 5 to the PDD.

Combustion products from municipal refuse derived fuel are very corrosive. Refuse derived fuel boilers operating at higher steam pressures have higher temperature saturated water in the furnace tubes (as compared to standard biomass based boilers) resulting in higher tube metal temperature, and this higher tube metal temperature increases the corrosion rate. The acidic gases from the RDF firing also contribute to the damage of the boiler parts. SELCO was forced to make design changes and take up special protective measures to protect the boiler from the firing effects of the RDF. These problems have actually materialized in case of SELCO, when it faced problems due to corrosion of the boiler tubes.

SELCO was conscious of the fact that in the absence of any operational experience of combustion of RDF in India, the technology for the project would in itself present many uncertainties and would require constant modification to suit specific requirements. There was a strong possibility that the power plant could face frequent shut downs owing to the modifications that would need to be made thereby resulting in significant losses to the company. The company after almost 4 years of operation continues to face a significant number of shut downs and ensuing losses. The plant operation data and PLF variations since

[3] APERC order - R.P No 84 / 2003 in OP No 1075 / 2000 dated 20-03-2004

[4] Reference: UNFCCC registered PDD titled “SESL 6 MW Municipal solid waste based power project”

November 2003 clearly indicate the frequent shutdowns of the plant for the maintenance and modifications.

Barriers due to Prevailing Practice

The project activity was the first such initiative of generating electricity by combustion of RDF in India[5], the project activity was commissioned in 2003. In Andhra Pradesh, in 2003-04, there were only two waste to energy projects (including the project activity) with a combined capacity of 12.6 MW, representing a less than 3% share of the state's renewable energy capacity (450.6 MW). The only other project was commissioned in January 2004. It is to be noted that this project has also applied for CDM and was recently registered[6].

Further, as explained earlier, in India the technology for waste to energy has remained largely untested. As of March 2007, the total installed capacity of waste to energy projects in India was 63.21 MW as compared to 10,407 MW from non conventional energy sources[7]. This represents a meager 0.6 % of the total installed capacity from non conventional energy sources.

Clearly, waste to energy projects can not be considered as a prevailing practice, either in A.P or India.

The discussion above clearly shows that the project faces substantial barriers and that the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the approved small scale methodology ASM I.D. version 12, the emission reductions ***ERy*** by the project activity during a given year "*y*" is

ERy = BEy – PEy – Ly……………….(1)

Where: *BEy* is the baseline emissions
PEy is project activity emissions and;
Ly is the amount of emissions leakage resulting from the project activity.

Baseline Emissions for the amount of electricity supplied by project activity, *BEy* is calculated as

BEy = EGy * EFy …………………….(2)

Where, *EGy* is the electricity supplied to the grid, *EFy* is the CO_2 emission factor of the grid as calculated below.

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[5] The data on all waste to energy projects in the country and their status are available in the chapter titled "waste to energy" in the MNES Annual Report. This clearly shows that the only other RDF based power plant was commissioned in January 2004. SELCO's power plant was commissioned in November 2003.

[6] Reference: http://cdm.unfccc.int, UNFCCC project reference number 0959

[7] Source: MNRE

Calculation of Baseline Emission Factor:

As per AMS I.D. the baseline emission coefficient for wind power projects could be either of the following:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered.

(b) The weighted average emissions (in kg CO2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

We have used option (a) Combined Margin consisting of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002, as the applicable emission coefficient for determining baseline emissions.

As per approved baseline methodology ACM0002, the combined margin emission factor (denoted as "*EFy")* is represented as a combination of the Operating Margin (OM) and the Build Margin (BM) of the project electricity system i.e. the Western region electricity grid. Considering the emission factors for these two margins as $EF_{OM,y}$ and $EF_{BM,y}$, the *EFy* is given by:

$$EFy = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y} \quad \ldots\ldots\ldots(3)$$

with respective weight factors w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$). The default weights for w_{OM} and w_{BM} of 50% and 50% respectively has been considered for Combined Margin calculations. No other weights are proposed.

Step 1: Calculation of the Operating Margin emission factor (EFOM,y)

According to ACM0002, Baseline emission factor is calculated as combined margin, consisting of a combination of operating margin (OM) and build margin (BM) factors. ACM0002 also provides four options for calculating the operating margin, and guidance for how to choose which options for the corresponding project activity. The options are:

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch Data Analysis OM, or
d) Average OM.

As per ACM0002, dispatch data analysis should be the first methodological choice. However, this option is not selected because the information required to calculate OM based on dispatch data is not available in the public domain for the southern region electricity grid.

The choice of other options for calculating the operating margin emission factor depend on the generation of electricity from low cost/must run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation. The Simple Operating Margin approach is appropriate for calculating the Operating Margin emission factor applicable in this case. As per ACM 0002 the Simple OM method can only be used where low cost must run resources constitute less than 50% of grid generation based on average of the five most recent years. The generation profile of the southern grid in the last five years is as follows:

Share of Low Cost / Must-Run (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Source: CO_2 Baseline Database for the Indian Power Sector – Central Electricity Authority

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) for the southern regional grid is less than 50 % of the total generation.

The operating margin emission factor has been calculated using a 3 year data vintage excluding low operating cost and must run plants where low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. The operating margin emission factor has been calculated and fixed *ex-ante* using the data available at the time of PDD submission.

Step 2: Calculation of the Build Margin Emission Factor $EF_{BM,Y}$

The Build Margin emission factor *EF_BMy* (tCO_2/GWh) is given as the generation-weighted average emission factor of the selected representative set of recent power plants represented by the 5 most recent plants or the most recent 20% of the generating units built (summation is over such plants specified by k):

$$EF_{BM,y} = [\sum_i F_{i,m,y} * COEFi] / [\sum_k GEN_{k,m,y}] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(4)$$

The summation over *i* and *k* is for the fuels and electricity generation of the plants in sample *m* mentioned above.

The choice of method for the sample plant is the most recent 20% of the generating units built as this represents a significantly larger set of plants, for a large regional electricity grid having a large number of power plants connected to it, and is therefore appropriate.

B.6.2. Data and parameters that are available at validation:

a) EFy

Data / Parameter:	EF_y
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 2, 21st June 2007
Value Applied:	0.8575

Justification of the choice of data or description of measurement methods and procedures actually applied :	- Emission factor is used in the calculation of baseline emissions. - The emission factor is calculated. - This is calculated ex ante at the time of PDD submission.
Any comment:	Calculated as a combination of the OM and BM emission factors as indicated in ACM0002.

b) $EF_{OM,y}$

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Operating margin emission factor of the grid
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 2, 21st June 2007
Value Applied:	1.0037
Justification of the choice of data or description of measurement methods and procedures actually applied :	- Emission factor is used in the calculation of baseline emissions. - The emission factor is calculated. - This is calculated ex ante at the time of PDD submission.
Any comment:	Calculated as indicated in ACM0002

c) $EF_{BM,y}$

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 Build margin emission factor of the grid
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 2, 21st June 2007
Value Applied:	0.7113
Justification of the choice of data or description of measurement methods and procedures actually applied :	- Emission factor is used in the calculation of baseline emissions. - The emission factor is calculated. - This is calculated ex ante at the time of PDD submission.
Any comment:	Calculated as indicated in ACM0002.

d) CEA Baseline database

Data / Parameter:	CEA Baseline database
Data unit:	-
Description:	Database prepared by CEA for calculation of Baseline Emission factor for different grids of India
Source of data to be used:	CEA : 'The CO2 Baseline Database for the Indian Power Sector' Version 2, 21st June 2007
Value Applied:	-

Justification of the choice of data or description of measurement methods and procedures actually applied :	- The database details all the formulae, equations and other data used for its calculation of the baseline emission factor. - The database consist of details of data on electricity generation, fuel emission factors, power plants considered for OM and BM, etc. - This emission factor has been calculated by CEA as per methods given in the UNFCCC approved methodology ACM0002.
Any comment:	The database is available in public domain at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

B.6.3 Ex-ante calculation of emission reductions:

The emission reductions from the project activity are calculated in the following steps:

Step 1: Calculating the Operating Margin emission factor ($EF_{OM,y}$)

The operating margin emission factor has been calculated using 3 year data calculated by Central Electricity Authority (CEA) in their CO_2 baseline database.
The $EF_{OM,Y}$ is estimated to be:
For the year 2003-2004 the $EF_{OM,Y}$ is 1.0041 tCO_2/MWh
For the year 2004-2005 the $EF_{OM,Y}$ is 0.9999 tCO_2/MWh
For the year 2005-2006 the $EF_{OM,Y}$ is 1.0073 tCO2/MWh

Thus the final $EF_{OM,Y}$ based on three years average is estimated to be **1.0037 tCO_2/MWh**.

Step 2: Calculation of the Build Margin Emission Factor $EF_{BM,Y}$

The $EF_{BM,y}$ is estimated as **0.7113 tCO_2/MWh** (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation), for the year 2005-06 as given in CEA database.

Step 3:.Calculation of Baseline Emission Factor EF_y

Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM}\, EF_{OM,y} + w_{BM} \,.EF_{BM,y}$$

AMS I.D mandates the use of emission reduction calculation procedures given in ACM0002 hence default weights have been taken as 0.5 and 0.5, as specified in ACM0002.

Baseline Emission factor: 0.5* EF_{OM} + 0.5 * EF_{BM} = **0.8575 tCO_2/MWh**

Step 4: Calculation of Baseline Emissions (BE_y)

According to AMS I.D the baseline emissions is calculated as the net kWh produced by the renewable generating unit multiplied by an emission factor (measured in kgCO2/kWh) calculated in a transparent and conservative manner.

$BE_y = EG_y * EF_y$

Where
BE_y = Baseline emissions in year *y* (tCO_2).
EG_y = Net Electricity generation by the project in year *y* (MWh).
EF_y = Combined margin emissions factor (Baseline emission factor) for the year *y* (tCO_2/MWh).

The net electricity generated by the project in a year is estimated to be:

6 MW x 70% (PLF) x 8760 (hours) = 36.83 GWh

Baseline emissions = 36.83 (GWh) x 1000 x 0.8575 (tCO2e/MWh) = 31,581 tCO2e

Baseline Emissions = 31,581 tCO2e/yr

Step5: Calculation of Emission Reductions (ER_y)

The emission reductions by the project activity during a given year y is the difference between Baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y).

$ERy = BE_y – PE_y – L_y$

Project Emissions

The auxiliary fuel used in the power plant is also renewable biomass[8] in the form of agro-waste (rice husk and groundnut shells). Renewable biomass is considered carbon neutral and hence GHG emission free. Therefore there are no project activity emissions.

Leakage

As per the approved methodology AMS I.D, leakage is to be considered, if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity. The project is a green field activity and there is no transfer of equipment to or from the project activity. Hence leakage due to transfer of equipment is zero.

Total project activity emissions, including leakage are zero for the project activity.

Therefore, Net anthropogenic emission reductions due to the proposed project are equal to the baseline emissions on a yearly basis. The project activity will evacuate approximately 36.84 Million units of renewable power annually to the power deficit Southern Region Grid and the annual emissions reductions are equal to 31,581 tCO2e.

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project emissions	Estimation of baseline emission	Estimation of leakage (tCO_{2e})	Estimation of total emission reduction

[8] As per UNFCCC's definition of renewable biomass, Reference – UNFCCC EB 23 report, Annex 18.

	(tCO_{2e})	reductions (tCO_{2e})		(tCO_{2e})
1	0	31,581	0	31,581
2	0	31,581	0	31,581
3	0	31,581	0	31,581
4	0	31,581	0	31,581
5	0	31,581	0	31,581
6	0	31,581	0	31,581
7	0	31,581	0	31,581
8	0	31,581	0	31,581
9	0	31,581	0	31,581
10	0	31,581	0	31,581
Total	0	315,810	0	315,810

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	EGy
Data unit:	MWh or kWh
Description:	Net electricity generated by the plant and supplied to the grid during any year 'y'.
Source of data to be used:	To be monitored during each year of the crediting period utilizing a Trivector meter.
Value of data	As per actual net annual generation from the plant that is supplied to the grid.
Description of measurement methods and procedures to be applied:	Net electricity generated by the project activity will be measured through a 0.2 class trivector meter installed at the 33/11 kV APTRANSCO sub station at Shadnagar (grid interconnection point). The procedure for meter reading, testing and calibration are elaborated in Annexure 4.
QA/QC procedures to be applied:	There are 2 meters present at the grid interconnection point, a main meter and a check meter. Quality assurance procedures with regard to metering of electricity are detailed in Annexure 4.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	RDFy
Data unit:	Tonnes
Description:	Quantity of RDF used in the power plant in year y.
Source of data to be used:	To be monitored during each year of the crediting period
Value of data	As per actual monitoring records
Description of measurement methods and procedures to be applied:	The quantity of the RDF used will be measured using a electronic weigh bridge located in the project premises. The procedure for taking such readings has been elaborated in Annexure 4.
QA/QC procedures to be applied:	The electronic weigh bridge is calibrated regularly with the help of standard weights over the weighing platform. The Govt department certification for the installation of the same is also taken. The weighment is directly recorded in the computer connected to the weigh bridge.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$SFC_{RDF,y}$
Data unit:	Tonnes/kWh
Description:	The specific fuel consumption of RDF which is the fuel consumption per unit of electricity generated.
Source of data to be used:	To be monitored during each year of the crediting period
Value of data	As per actual monitoring records and calculations
Description of measurement methods and procedures to be applied:	This value will be calculated using the monitored values of tonnes of RDF used and electricity generated.
QA/QC procedures to be applied:	This is calculated on the basis of the quantity of RDF recorded at the weigh bridge and the electricity generated. The shift engineer in co-ordination with the fuel supervisor and the lab assistant will be recording the data periodically in the shift operations.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$Agro_y$
Data unit:	Tonnes
Description:	Quantity of agro-waste used in the power plant in year y.
Source of data to be used:	To be monitored during each year of the crediting period
Value of data	As per actual monitoring records
Description of measurement methods and procedures to be applied:	The quantity of the agro-waste used will be measured using electronic weigh bridge. The procedure for taking such readings has been elaborated in Annexure 4.
QA/QC procedures to be applied:	The electronic weigh bridge is calibrated regularly with the help of standard weights over the weighing platform. The Govt department certification for the installation of the same is also taken. The weighment is directly recorded in the computer connected to the weigh bridge.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$SFC_{agro,y}$
Data unit:	Tonnes/kWh
Description:	The specific fuel consumption of agro-waste which is the fuel consumption per unit of electricity generated.
Source of data to be used:	To be monitored during each year of the crediting period
Value of data	As per actual monitoring records and calculations
Description of measurement methods and procedures to be applied:	This value will be calculated using the monitored values of tonnes of agro waste used and electricity generated.
QA/QC procedures to be applied:	This is calculated on the basis of the quantity of agro waste recorded at the weigh bridge and the electricity generated. The shift engineer in co-ordination with the fuel supervisor and the lab assistant will be recording the data periodically in the shift operations.
Any comment:	The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

B.7.2 Description of the monitoring plan:

According to the approved small scale methodology AMS I.D, Monitoring shall consist of:

- Metering the electricity generated by the renewable technology.
- Amount of different types of biomass used
- The specific fuel consumption in tonnes / kWh of each biomass

Monitoring and metering of the electricity generated

The net electricity generated by the renewable energy technology evacuated to the grid is monitored using energy meters that are installed at the grid interconnection point at the 33/11 kV APTRANSCO sub-station at Shadnager. Details of the type of energy meters installed, calibration procedures, etc are given in Annexure 4.

Monthly meter readings are taken at the grid interconnection point by authorized representatives of both APTRANSCO (APCPDCL) and SELCO. These monthly records are maintained and archived by the APTRANSCO (APCPDCL) and SELCO International limited.

Monitoring of the Biomass and the specific fuel consumption

The RDF and the agro-waste are monitored continuously and their quantities are measured using an electronic weigh bridge. Monthly records of the quantity of each biomass used are maintained by the administrative staff of the power plant and the process plant. These details including the details of the net electricity generated by the project are also maintained in the form of monthly progress reports.

General Monitoring plan for the project

- Person responsible for project management:
  - Dr. G.V. Ramakrishna (Chairman and Managing Director)
  - The authority and responsibility of project registration and overall project management lies with Dr. Ramakrishna.

- Persons responsible for monitoring of power plant:
  - Mr. Y.V. Mallikarjuna Reddy (Chief General Manager, Projects)
  - Mr. S.V.Chalapathi Rao (Chief General Manager, Production)
  - Mr.Subramanyam (General Manager , Maintenance)

- The authority and responsibility for registration, monitoring, measurement and reporting:
  - Dr. G.V. Ramakrishna (Chairman and Managing Director)
  - Mr. Y.V. Mallikarjuna Reddy (Chief General Manager, Projects)
  - Mr. S.V.Chalapathi Rao (Chief General Manager, Production)

Procedures for training of monitoring personnel

- The company has entered into an Operations and Maintenance agreement with M/s APT Services Pvt. Ltd. for operation and maintenance of plant for one year from the date of commissioning as per the prescribed procedures indicated in the operation manuals of the plant and machinery supplied for generation of Power. During this period the above company has inducted and trained 37 personnel for carrying out various tasks pertaining to successful operation of the plant.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completion of application of baseline and monitoring methodology: 13/08/2007
Responsible entity: PricewaterhouseCoopers Private Limited (not a Project Participant)

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

21/03/2002, being the date of financial closure of the project activity

C.1.2. Expected operational lifetime of the project activity:

25 years 0 months

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

Not opted for

C.2.1.2. Length of the first crediting period:

NA

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/05/2008 or the date of registration whichever is later

C.2.2.2. Length:

10 years and 0 months

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The project was commissioned in 2003, and as per the Ministry of Environment and Forests' notification on Environmental Impact Assessment of development projects dated 27th January 1994, amended on 04th May 1994, EIA is[9] not mandatory if the investment is less than INR 500 Million. The candidate CDM project therefore qualifies for implementation without EIA.

The company has taken clearances from the state pollution control board for 'consent to establish and operate the subject 6.6 MW power plant' and the same is renewed on a regular basis by the pollution control board on the basis of the tests carried out by third party and its reporting to the Andhra Pradesh State pollution control board.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

There are no significant negative environmental impacts of the project.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The land for carrying out project activity has been purchased by SELCO International limited for the life time of project at Survey Nos 199, 200AA, Elikatta village, Farooqnagar Mandal, Mahabubnagar district, AP.
The project site is surrounded by agriculture fields with no habitation within 500 meters radial distance from the plant boundary.

The project promoter and the government representatives represented by the Mandal Revenue officer and Collector of the Revenue Department have contacted the owners of the neighbouring agriculture fields before allotting permissions for the setting up the power plant in the land purchased by SELCO International Limited and again before implementation of the project activity.

The neighbouring agriculture land owners were apprised of the project activity both by one-to-one meetings and written communication to the village governing council (Panchayat). The meeting with the panchayat was carried out during January and February 2002 and the concerned village governing council accorded no objection certificate to the project proponent vide their letter dated February 11, 2002.

E.2. Summary of the comments received:

The following were the concerns / observations made by the local stakeholders:

[9] At that time the EIA notification of 1994 was applicable as the next set of guidelines were available only in 2006, much after the commissioning of the project.

1. Odour from operation of RDF based power station
2. Noise / Sound level due to project activity and plant operation
3. Effect on crop quality and quantity due to project activity

E.3. Report on how due account was taken of any comments received:

The project promoter and government representatives assured them for following

1. The project is not using raw MSW, instead RDF is used as feed for power generation, and thus the level of odour beyond the project site is negligible. Simultaneously assurances have been given for continuous monitoring of the odour levels in the project site vicinity.

2. The villages are free to report for odours to higher authorities at AP Pollution Control Board, if the same is not been closely monitored by the project promoter.

3. The boiler and generator for production of power are based on latest state-of-art technology, thus the noise levels are well within the standard norms. No noise of power plant is heard outside the project site and the same is practically maintained after commissioning. The same is being checked regularly by AP pollution control board.

4. Technically there will be no effect on the quality and quantity of the crop produced because of project activity, thus an assurance for the same is given.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Selco International Limited
Street/P.O.Box:	309, 3rd Floor, Oasis Plaza
Building:	H.No. 4-1-898, Tilak Road, Abids
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500 001
Country:	India
Telephone:	+91 40 24750990, +91 40 24750991
FAX:	+91 40 24750990
E-Mail:	selco@selco.co.in , cmd@selco.co.in
URL:	http://www.selco.co.in
Represented by:	Dr.G.V.Ramakrishna
Title:	Chairman & Managing Director
Salutation:	
Last Name:	Rama Krishna
Middle Name:	V.
First Name:	G.
Department:	Management
Mobile:	+91 9848047634
Direct Fax:	+91 40 24750990
Direct Tel:	+91 40 24750991
Personal E-Mail:	cmd@selco.co.in

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the project activity

Annex 3

BASELINE INFORMATION

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**2.0**
DATE	**21 June 2007**
BASELINE METHODOLOGY	**ACM0002 / Ver 06**

EMISSION FACTORS

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.72	0.73	0.74	0.71	0.71	0.71
East	1.09	1.06	1.11	1.10	1.08	1.08
South	0.73	0.75	0.82	0.84	0.78	0.74
West	0.90	0.92	0.90	0.90	0.92	0.87
North-East	0.42	0.41	0.40	0.43	0.32	0.33
India	0.82	0.83	0.85	0.85	0.84	0.82

Weighted Average Emission Rate (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.72	0.73	0.74	0.71	0.72	0.72
East	1.09	1.03	1.09	1.08	1.05	1.05
South	0.74	0.75	0.82	0.84	0.78	0.74
West	0.90	0.92	0.90	0.90	0.92	0.88
North-East	0.42	0.41	0.40	0.43	0.48	0.33
India	0.82	0.83	0.85	0.85	0.84	0.81

Simple Operating Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.98	0.98	1.00	0.99	0.97	0.99
East	1.22	1.22	1.20	1.23	1.20	1.16
South	1.02	1.00	1.01	1.00	1.00	1.01
West	0.98	1.01	0.98	0.99	1.01	0.99
North-East	0.73	0.71	0.74	0.74	0.71	0.70
India	1.02	1.02	1.02	1.03	1.03	1.02

Simple Operating Margin (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.98	0.98	1.00	0.99	0.98	0.99
East	1.22	1.19	1.17	1.20	1.17	1.13
South	1.03	1.00	1.01	1.00	1.00	1.01
West	0.98	1.01	0.98	0.99	1.01	0.99
North-East	0.73	0.71	0.74	0.74	0.84	0.70
India	1.01	1.02	1.02	1.02	1.02	1.02

Build Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06

Build Margin (tCO2/MWh) (not adjusted for imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06

North	0.53	0.60
East	0.90	0.97
South	0.71	0.71
West	0.77	0.63
North-East	0.15	0.15
India	0.70	0.68

North	0.53	0.60
East	0.90	0.97
South	0.71	0.71
West	0.77	0.63
North-East	0.15	0.15
India	0.70	0.68

Combined Margin (tCO2/MWh) (excl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.76	0.76	0.77	0.76	0.75	0.80
East	1.06	1.06	1.05	1.07	1.05	1.06
South	0.87	0.85	0.86	0.86	0.85	0.86
West	0.87	0.89	0.88	0.88	0.89	0.81
North-East	0.44	0.43	0.44	0.44	0.43	0.42
India	0.86	0.86	0.86	0.86	0.86	0.85

Combined Margin in tCO2/MWh (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.76	0.76	0.77	0.76	0.75	0.80
East	1.06	1.05	1.04	1.05	1.04	1.05
South	0.87	0.85	0.86	0.86	0.85	0.86
West	0.87	0.89	0.88	0.88	0.89	0.81
North-East	0.44	0.43	0.44	0.44	0.49	0.42
India	0.85	0.86	0.86	0.86	0.86	0.85

GENERATION DATA

Gross Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	144,292	151,185	155,385	165,735	168,438	179,751
East	58,936	64,048	66,257	75,374	85,776	93,902
South	129,035	131,902	136,916	138,517	144,086	147,355
West	162,329	165,805	177,399	172,682	183,955	188,606
North-East	5,319	5,332	5,808	5,867	7,883	7,778
India	499,911	518,272	541,764	558,175	590,138	617,392

Net Generation Total (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	135,230	141,415	144,743	155,043	157,291	168,206
East	53,350	58,097	59,841	68,428	77,968	86,014
South	121,158	123,630	127,789	128,373	134,676	138,329
West	150,412	153,125	164,448	159,780	170,726	176,003
North-East	5,195	5,213	5,671	5,752	7,762	7,655
India	465,345	481,479	502,492	517,376	548,423	576,206

EMISSION DATA

Absolute Emissions Total (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	97,866,565	102,743,113	106,808,582	109,996,544	112,212,597	120,056,079
East	58,026,488	61,427,499	66,593,200	75,512,010	83,956,860	92,517,515
South	89,019,263	92,112,060	105,187,726	108,049,156	105,539,862	101,712,149
West	135,192,153	141,597,621	148,557,341	144,127,175	157,781,065	153,933,199
North-East	2,202,108	2,158,348	2,280,049	2,462,796	2,468,463	2,532,819
India	382,306,576	400,038,640	429,426,898	440,147,681	461,958,846	470,751,761

Absolute Emissions OM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	97,866,565	102,743,113	106,808,582	109,996,544	112,212,597	120,056,079
East	58,026,488	61,427,499	66,593,200	75,512,010	83,956,860	92,517,515
South	89,019,263	92,112,060	105,187,726	108,049,156	105,539,862	101,712,149
West	135,192,153	141,597,621	148,557,341	144,127,175	157,781,065	153,933,199
North-East	2,202,108	2,158,348	2,280,049	2,462,796	2,468,463	2,532,819
India	382,306,576	400,038,640	429,426,898	440,147,681	461,958,846	470,751,761

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	25.9%	25.7%	26.1%	28.1%	26.8%	28.1%
East	10.8%	13.4%	7.5%	10.3%	10.5%	7.2%
South	28.1%	25.5%	18.3%	16.2%	21.6%	27.0%
West	8.2%	8.5%	8.2%	9.1%	8.8%	12.0%
North-East	42.2%	41.7%	45.8%	41.9%	55.5%	52.7%
India	19.2%	18.9%	16.3%	17.1%	18.0%	20.1%

Net Generation in Operating Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	100,189	105,076	106,942	111,450	115,151	120,869
East	47,570	50,308	55,377	61,378	69,746	79,863
South	87,114	92,103	104,449	107,603	105,568	100,978
West	138,071	140,173	150,889	145,264	155,731	154,918
North-East	3,002	3,039	3,074	3,343	3,456	3,621
India	375,947	390,700	420,730	429,040	449,653	460,249

20% of Net Generation (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	27,046	28,283	28,949	31,009	31,458	33,641
East	10,670	11,619	11,968	13,686	15,594	17,203
South	24,232	24,726	25,558	25,675	26,935	27,666
West	30,082	30,625	32,890	31,956	34,145	35,201
North-East	1,039	1,043	1,134	1,150	1,552	1,531
India	93,069	96,296	100,498	103,475	109,685	115,241

Net Generation in Build Margin (GWh)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					32,064	34,340
East					15,818	17,567
South					27,987	28,158
West					35,257	35,425

Absolute Emissions BM (tCO2)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					17,108,583	20,622,114
East					14,303,611	16,990,438
South					19,839,024	20,029,713
West					27,148,870	22,318,133
North-East					299,121	266,981
India					78,699,210	80,227,378

IMPORT DATA

Net Imports (GWh) - Net exporting grids are set to zero

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0	0	0	0	3,616	5,748
East	489	555	357	1,689	0	0
South	1,162	1,357	518	0	0	0
West	321	0	797	962	285	11,982
North-East	0	0	0	0	2,099	0

Share of Net Imports (% of Net Generation)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.0%	0.0%	0.0%	0.0%	2.3%	3.4%
East	0.9%	1.0%	0.6%	2.5%	0.0%	0.0%
South	1.0%	1.1%	0.4%	0.0%	0.0%	0.0%
West	0.2%	0.0%	0.5%	0.6%	0.2%	6.8%

North-East	2,055	1,793
India	113,181	117,283

North-East	0.0%	0.0%	0.0%	0.0%	27.0%	0%

Annex 4

MONITORING INFORMATION

Energy meters used for Electricity Monitoring

1. The net electricity generated by the project through the renewable technology and supplied to the grid is measured at the trivector meter installed at the grid interconnection point at the APTRANSCO Shadnagar substation.
2. There are two trivector meters installed at the grid intersection point. One is a main meter and a check meter installed at the sub-station and the meters are of static type and accuracy class 0.2.
3. The main and the check meters each are export and import meters with facility for recording meter readings using meter recording instruments.
4. All the meters are jointly inspected and sealed by the representatives of both parties, APTRANSCO (APCPDCL) and SELCO. Both the meters are enclosed in a metal casing to protect it from rain and sun, and also the doors are sealed.

Meter testing and calibration

1. The main and the check meters are tested on an annual basis at ETDC labs a public sector enterprise of high reputation in the presence of personnel from APTRANSCO and SELCO.
2. If the meter test indicates an error in the main meter beyond the permissible limits, but no such error is indicated in the corresponding check meter, then the meter reading of the check meter will be taken as the final reading and the main meter will be replaced immediately.
3. If both main and check meters are found to be beyond permissible limits of error, both meters shall be immediately replaced. Detailed procedure of recording the data is mentioned in the Power purchase agreement of APTRANSCO and SELCO.
4. The task of calibration of the meters, has been outsourced to Electronics Test and Development Centre, an NABL accredited laboratory of the Dept. of Information Technology, Govt. of India. The lab is responsible for carrying out calibration of 3 phased 4 wire electronic trivector meter on annual basis. The calibration is witnessed by officials from state electricity utility (AP TRANSCO) and SELCO International Limited.

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Annexure 5

LIST OF MODIFICATIONS CARRIED OUT IN THE POWER PLANT

Installation of second feeding system

The fuel feeding system of the RDF based power plant is different from a similar biomass based power project. The steam parameters that are required for the turbine are maintained by adjusting the fuel combination i.e. RDF and auxiliary fuel in order to ensure stable furnace conditions. The RDF fuel characteristics vary from batch to batch. Because of the frequent variations in the RDF quality, the addition of the auxiliary fuel needed to be maintained very carefully and this gave rise to the need for specialized separate feeding systems for the both the fuels. SELCO international subsequently had to add a second feeding system for the power plant.

Wear and Tear of Boiler Tubes

Due to the difference in the quality of the RDF, there is a variation in the fuel combination and therefore different types of air conditions have to be maintained in the furnace. This leads to carry over of fine sand and non combustible matter and high deviation in flue gas velocity which in turn leads to more wear and tear of the boiler tubes.

Modifications of Traveling Grate

Wear and tear of the traveling grate parts was observed as early as the first year of operation of the plant. Even though due care is taken during the MSW processing and screening, RDF still contains some hard and inert material. This foreign material leads to increased wear and tear to moving chain, T-bars and cast iron cleats. The RDF contains high moisture and also has fluctuating calorific value, hence needing high ignition temperature, which further leads to wear and tear of the boiler traveling grate and related moving parts. Specialized traveling parts were later designed with metallurgical changes for the increasing their operational life. For maintaining the furnace temperature, the fuel bed width of RDF over the traveling grate needed to be increased which also forced many modifications in the hydraulic drive of the traveling grate shaft.