**Appendix A[1] to the simplified modalities and procedures for small-scale CDM project activities**

**CLEAN DEVELOPMENT MECHANISM**
**SIMPLIFIED PROJECT DESIGN DOCUMENT**
**FOR SMALL SCALE PROJECT ACTIVITIES (SSC-PDD)**
**Version 01 (21 January, 2003)**

## Introductory Note

1. This document contains the clean development mechanism project design document for small-scale project activities (SSC-PDD). It elaborates on the outline of information in appendix B "Project Design Document" to the CDM modalities and procedures (annex to decision 17/CP.7 contained in document FCCC/CP/2001/13/Add.2) and reflects the simplified modalities and procedures (herewith referred as simplified M&P) for small-scale CDM project activities (annex II to decision 21/CP.8 contained in document FCCC/CP/2002/7/Add.3).

2. The SSC-PDD can be obtained electronically through the UNFCCC CDM web site (http://unfccc.int/cdm/ssc.htm), by e-mail (cdm-info@unfccc.int) or in print from the UNFCCC secretariat (Fax: +49-228-8151999).

3. Explanations for project participants are in italicized font *(e.g. explanation)*.

4. The Executive Board may revise the SSC-PDD if necessary. Revisions shall not affect small-scale CDM project activities validated prior to the date at which a revised version of the SSC-PDD enters into effect. Versions of the SSC-PDD shall be consecutively numbered and dated. The SSC-PDD will be available on the UNFCCC CDM web site in all six official languages of the United Nations.

5. In accordance with the CDM modalities and procedures, the working language of the Board is English. The completed SSC-PDD shall therefore be submitted to the Executive Board in English.

6. Small-scale activities submitted as a bundle, in accordance with paragraphs 9 (a) and 19 of the simplified M&P for small-scale CDM project activities, may complete a single SSC-PDD provided that information regarding A.3 (*Project participants*) and A.4.1 *(Location of the project activity)* is completed for each project activity and that an overall monitoring plan is provided in section D.

7. A small-scale project activity with different components eligible to be proposed[2] as a small-scale CDM project activity may submit one SSC-PDD, provided that information regarding subsections A.4.2 (*Type and category(ies) and technology of project activity*), and A.4.3 (*brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by*

[1] This appendix has been developed in accordance with the simplified modalities and procedures for small-scale CDM project activities (contained in annex II to decision 21/CP.8, see document FCCC/CP/2002/7/Add.3) and it constitutes appendix A to that document. For the full text of the annex II to decision 21/CP.8 please see http://unfccc.int/cdm/ssc.htm).

[2] In paragraph 7 of simplified M&P for small-scale CDM project activities, on clarifications by the Executive Board on small-scale CDM project activities, the Board agreed that in a project activity with more than one component that will benefit from simplified CDM modalities and procedures, each component shall meet the threshold criterion of each applicable type, e.g. for a project with both a renewable energy and an energy efficiency component, the renewable energy component shall meet the criterion for "renewable energy" and the energy efficiency component that for "energy efficiency".

*sources are to be reduced by the proposed CDM project activity)* and sections B *(Baseline methodology)*, D *(Monitoring methodology and plan)* and E *(Calculation of GHG emission reductions by sources)* is provided separately for each of the components of the project activity.

8. If the project activity does not fit any of the project categories in appendix B of the simplified M&P for small-scale CDM project activities, project proponents may propose additional project categories for consideration by the Executive Board, in accordance to paragraphs 15 and 16 of the simplified M&P for small-scale CDM project activities. The project design document should, however, only be submitted to the Executive Board for consideration after it has amended appendix B as necessary.

9. A glossary of terms may be found on the UNFCCC CDM web site or from the UNFCCC secretariat by e-mail (cdm-info@unfccc.int) or in print (Fax: +49-228-8151999).

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## A. General description of project activity

### A.1 Title of the project activity:

APCL proposed 7.5 MW Mustard Crop Residue based Power Project

### A.2 Description of the project activity:

The purpose of the project essentially is to utilize available biomass (mustard crop residue) in the region effectively for generation of electricity. The generated electricity will be sold to state grid for further distribution to end-users. The objective of the project activity would therefore be to contribute to the sustainable economic growth of the rural project region and conserve the environment through use of renewable biomass fuel and Green House Gas (GHG) emission reduction. The project will also help to bridge the ever-increasing demand and supply gap of electricity in the state of Rajasthan.

The project activity will generate employment and help reduce the unemployment of the local area. The project will also provide economic value to agricultural wastes and will provide stable and quality power to local industry, farmers and households. The project will create a business opportunity for local stakeholders such as bankers/ consultants, suppliers / manufacturers, contractors, etc. Besides these, the following local benefits are also envisaged due to the setting up of project:

- Proper utilization of surplus biomass;
- Avoidance of burning of agriculture waste; and
- Generation of eco-friendly green power;
- Reduction of $CO_2$ emissions

The promoters perceive that by setting up the biomass-based power plant, they will be participating in contributing to power generation in the state using non-conventional energy resources, hitherto going waste.

The primary fuel for the proposed power plant is Mustard Crop Residue (MCR); other biomass fuel, such as sawdust, soft wood, rice husk may be used as available.

APCL proposes to utilize the fuel available at Alwar district. The fuel will be brought in directly to the collection centers by the farmers themselves. APCL can also utilize the services of some fuel suppliers for the supply of MCR.

The total requirement of mustard waste has been estimated to be 79,131 MT/annum at 100% capacity utilisation for the proposed project. However, the total surplus crop residue after

discounting for various end-uses, available within a radius of 25 km is estimated to be 1,11,800 MT/annum and within 50 km radius more than 4,97,234 MT/annum and has a potential of generating renewable energy to a tune of around 45 MW. For convenient and cost effective collection and transportation of raw material, additional few collection centres may be developed in villages having high density of mustard crop with in 15-25 km radius from the proposed project site.

The availability of MCR in Rajasthan state specially in Alwar district is rather significant as stated above, mainly because there are no alternative uses of this biomass. Since, it is bitter in taste, it cannot be used as fodder for the cattle. The lack of logistics for transportation of the material, mainly due to low density and high volume, is the sole biggest reason why the biomass will continue to remain available primarily for burning. A large quantity of this biomass is burnt in the fields to make room for the new crop following a completely dry period between the harvesting of mustard and the onset of the rainy season.

The project activity will contribute to the 'Sustainable Development of India' in following ways:

The project activity is a renewable energy based power project, with MCR as primary fuel, husk & saw dust etc. as secondary fuel. The project will export clean power to Rajasthan Rajya Vidyut Prasaran Nigam Ltd (RVPN). This electricity generation will substitute the power generation mix of the state grid consisting of conventional fossil fuels. Thus, it will reduce the $CO_2$ emission and will also conserve the conventional fuel.

The project will create jobs, and the sale of MCR to the project will generate additional revenue for the economically backward villagers. The effort, therefore, is more satisfying since this will help the rural upliftment of the farmers in the project region, and is consistent with the Government's Rural Development Programme.

Indian economy is highly dependent on "Coal" as fuel to generate energy and for production processes. Thermal power plants are the major consumers of coal in India, and yet the basic electricity needs of a large section of population are not being met. This results in excessive demands for electricity and place immense stress on the environment. Changing coal consumption patterns will require a multi-pronged strategy focusing on demand, reducing wastage of energy and the optimum use of Renewable Energy (RE) sources.

Since this project activity utilizes renewable energy source, it will positively contribute towards the reduction in use of finite natural resource like coal/gas/oil, minimizing depletion or else increasing its availability to other important processes.

The project activity, by feeding clean power to grid will eliminate an equivalent Carbon Dioxide ($CO_2$), which would be generated to produce electricity to cater to the electricity requirement. Therefore, this project activity has excellent environment benefits in terms of reduction in GHG emissions and coal resource conservation.

This project activity is in the rural setting and will contribute to the environmental and social issues locally and globally through:

- Export of 7.5 MW power, thereby eliminating the generation of same quantity of power using conventional fuel
- Conserving Coal, a non-renewable natural resource
- Making coal available for other important applications
- Reducing GHG (Carbon Dioxide)
- Contributing to a small increase in the local employment in the area of skilled / unskilled jobs for operation and maintenance of the plant and equipment
- Capacity building of local people operation of modern technology power generation.

**A.3 Project participants:**

- Alwar Power Company (P) Limited, A-7/3, DLF Qutab Enclave, Phase-I, Gurgaon-122002, Haryana
- Ministry of Environment and Forest, India (DNA)
- Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (Austrian JI/CDM Programme) for which the programme manager is Kommunalkredit Public Consulting GmbH. Climate and Energy, Tuerkenstrasse 9, A-1092 Vienna, Austria;

Alwar Power Company (P) Limited is the official contact for this CDM project activity.

**A.4 Technical description of the project activity:**

**A.4.1 Location of the project activity:**

**A.4.1.1** Host country Party (ies): India

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

**A.4.1.3** City/Town/Community etc: Alwar

**A.4.1.4** Detailed description of the physical location, including information allowing the unique identification of this project activity

The project is being implanted at Alwar Power Company (P) Ltd., Matsya Industrial Estate, District Alwar, Rajasthan. The proposed site is located about 8 km from Alwar City. The site

measuring about 34 acres has already been acquired. The nearest Railway station is Alwar. Power generated from the plant will be evacuated to RVPN grid through their 132 kV sub station, which is less than 500 m from the plant.

### A.4.2 Type and category (ies) and technology of project activity

Main Category: Type I - Renewable Energy Power project

Sub Category: "D" Electricity Generation for a Grid (Biomass based Power Project)

The project activity meets all the applicability criteria of small-scale CDM project activity category under Type-I: Renewable Energy Projects (***D. Renewable electricity generation for a grid***) of the indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories

As per the provisions of Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities, (Version 03) Type ID "comprises renewables, such as photovoltaics, 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 ". "If the unit added co-fires [non-] renewable biomass and fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW."

Project is a grid-connected biomass based 7.5 MW power plant with high-pressure steam turbine configuration, which is below the required power capacity cap of 15MW. Therefore we may conclude that the Type I.D. is the most appropriate category for the project under discussion.

The baseline and emission reductions calculations from the project would therefore be based on paragraph 29 of Appendix B. The monitoring methodology would be based on the guidance provided in the paragraph 31 of Appendix B.

The proposed plant will have boiler sized to produce a maximum of 38 TPH of steam and steam turbine, which will be a multistage, extraction cum condensing type machine. The steam conditions at the boiler heat outlet are a pressure of 66 kg/cm$^2$ and temperature of 485 $\pm$ 5 $^0$C. Traveling grate type boiler has been selected, primarily due to its flexibility in fuel firing in terms of its capability to burn fuels of practically any type and size and high moisture content. This type of boiler has other incidental advantages like lower power consumption, reduced dust emissions in flue gas, etc. All the necessary auxiliary facilities of the power plant including water demineralization plant, recirculating cooling water system, fuel storage

and handling systems, electrical power evacuation system, ash handling system, fire fighting system, compressed air system, instrumentation and control system etc. will be provided for the power plant. The plant and equipment facilities will be designed to comply with the applicable stipulations / guidelines of statutory authorities such as State Pollution Control Board etc. Power generated from the plant will be evacuated to Rajasthan Rajya Vidyut Prasaran Nigam Ltd. (RVPN) grid through their 132 kV sub station, which is les than 500 m from the plant.

Combustion technology is selected for the power plant, wherein biomass is burnt as fuel in a steam generator to produce high-pressure steam, which is then expanded in turbo-generators to generate power. The technology proposed is easily available in India from reputed manufacturers and is well proven worldwide.

In India, till date, only one plant based on MCR as primary fuel, has been commissioned[3]. This will be the second project of this type in India.

The Manager who will be supported by administrative staff, the shift incharge, and the operation & maintenance staff will head the plant.

**A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:**

The project will use sustainably grown biomass as fuel and incase of exigencies it will use coal as fuel. The GHG emissions from the biomass combustion process, mainly $CO_2$, are consumed by plant species, representing a cyclic process. Since, the biomass contains only negligible quantities of other elements like Nitrogen, Sulphur etc. release of other GHG are considered as negligible The biomass is $CO_2$ neutral and thus environmentally benign, limiting greenhouse effect.

Without the proposed project activity, the same energy load would have been supplied to the grid customers from a mix of fossil-fuel based thermal power plants. Emission of $CO_2$ would have occurred due to combustion of conventional fuels like coal by the state grid.

The Rajasthan grid relies heavily on coal, as does most of India, and this reliance is predicted to increase overtime given the significant power shortages and exponential demand growth in Rajasthan. As per the future energy requirement and peak demand projections by Central Electrical Authority (CEA) 16th power survey, the expected rise in energy requirement is about 7.18% and demand of power is about 7.30% per annum.

[3] *Kalpataru Power Transmission Limited commissioned in October 2003*

The Project will therefore reduce the combined margin carbon intensity of the grid (i.e. the average carbon intensity of the operating margin and the built margin) given the generation mix of the grid. In the project scenario, the Rajasthan Grid's conventional energy equivalent of 301.3 Million kWh for the first crediting period of 7 years would be replaced by power generated from the 7.5 MW non-conventional renewable sources biomass based power plant. The project will thereby result in $CO_2$ emission reduction of 277,196 tonnes over the first 7 year crediting period.

No transmission and distribution losses have been considered since the project will export power at high voltage of 132 kV at a short distance.

**A.4.4 Public funding of the project activity:**

No public funding from parties included in Annex-I is proposed for the project.

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

The biomass power plant is not a debundled component of a large project activity as the project proponents:

- do not propose another biomass power plant with higher capacity;
- have not registered within the previous two years; and
- Project boundary is not within 1 km radius of any other proposed small-scale activity.

## B. Baseline methodology

**B.1 Title and reference of the project category applicable to the project activity:**

The project activity meets the eligibility criteria to use simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6(c) of decision 17/CP.7.

Details of approved methodology for baseline calculations for CDM projects of capacity less than 15 MW is available in the "Appendix B of the simplified modalities and procedure for small scale CDM project activities". Reference has been taken from indicative simplified baseline and monitoring methodologies for selected small scale (CDM projects less than 15 MW) project activity categories.

Renewable technologies that supply electricity to the grid are covered in category I.D. The category comprises renewable such as hydro, 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 nonrenewable biomass fired generation unit.

Main Category: Type I - Renewable Energy Power project

Sub Category: I. D. Electricity Generation for a Grid (Biomass based Power Project)

**B.2 Project category applicable to the project activity:**

Project will use surplus biomass available as a fuel to generate electricity and export to RVPN grid. As stated above in the baseline scenario, in absence of the proposed project the same energy load would be met by the operating and future generation mix of RVPN grid (which is dominated by coal and gas based power projects). The baseline emissions from the most likely baseline scenario are in line with the guidance provided in Appendix B.

The guidance given in 'Appendix B of the simplified M&P for small-scale CDM project activities's of the UNFCCC CDM website, provides indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories guidelines for preparation of Project Design Document (PDD) including baseline calculations. As mentioned above in Section A.4.2, the proposed project activity falls under Type I.D – Renewable electricity generation for a grid.

Baseline methodology for projects under Type I. D has been detailed in point no. 29 of the above mentioned document. It states that the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner as:

a) The average of the "approximate operating margin" and the "build margin", where:

   i. The "approximate operating margin" is the weighted average emissions (in $kgCO_2equ/kWh$) of all generating sources surviving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

   ii. The "build margin" is the weighted average emissions (in $kgCO_2equ/kWh$) of recent capacity additions to the system, defined as the higher (in MWh) of most recent 20% of plants built or the 5 most recent plants; The "approximate operating margin" is the weighted average emissions (in kg $CO_2equ/kWh$) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

OR

b) The weighted average emissions (in $kgCO_2equ/kWh$) of current generation mix.

Therefore we may conclude that the project may use the 'applicable baseline calculation for the Type I-D Project category. Hence, the baseline emissions calculated using "The average of the approximate operating margin and the build margin", represent the realistic anthropogenic emissions by sources that would occur in absence of the project activity.

**B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity**

As per the decision 17/cp.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

The Appendix B of the simplified M&P for small-scale CDM project activities's of the UNFCCC requires the project activity to determine its additionality as per the guidance provided in Attachment A to Appendix B.

In order to establish the project activity is additional, APCL identified plausible project options, which include all possible courses of actions that could be adopted in order to produce electricity for the end –users of the Rajasthan State. These plausible options were further analysed as per the guidance in Attachment A to Appendix B of the small scale modalities and procedures to establish project additionality and arrive at an appropriate and conservative baseline scenario. APCL has excluded options that

- do not comply with legal requirements and/or

- encounter barriers related to availability of key resources such as fuels, materials, technology, or other circumstances that could not be overcome.

There are five plausible options available with project proponent to meet the power requirement equivalent to 7.5 MW.

**Project Option 1 – Present Grid Mix**

In this scenario the end user would get electricity from the current grid mix which consists of a mix of thermal (coal and gas), hydro, nuclear and other renewable energy based power plants and an equivalent amount of carbon dioxide would be generated at the thermal power generation end**.**

**Project Option 2 - 7.5 MW fossil fuel (coal) based power plant, supplying power to the present grid mix.**

In this scenario the end user would get power from the grid mix consisting of the project option 2 along with the present generation mix. With an increased thermal capacity addition of 7.5MW coal based power plant, there would be an increase in the amount of carbon dioxide generated at the thermal power plants for equivalent electricity. Such small capacity coal based independent power plants to supply electricity to the grid are not a common practice due to the techno-economic circumstances that cannot be overcome. There is no small size coal based power plant supplying power to the grid, the minimum capacity of the coal-based power plant, which supplies electricity to the state grid is 195 MW[4]. Therefore, project option – 2 is not an option available with APCL as developer of small size independent power project and hence excluded.

**Project Option 3 - 7.5 MW fossil fuel (gas) based power plant, supplying power to the present grid mix.**

In this scenario the end user would get power from the grid mix consisting of the project option 3 along with the present generation mix. With an increased thermal capacity addition of 7.5MW gas based power plant, there would be an increase in the amount of carbon dioxide generated at the thermal (gas) power plants for equivalent electricity. The gas based power plants are possible only if the gas is available as fuel. Due to its locational disadvantage gas as fuel for power generation to the plant is not available. Thence, this project option 3 is not available with APCL - an independent power producer from Rajasthan and may be excluded.

**Project Option 4 - 7.5 MW fossil fuel (diesel) based power plant, supplying power to the present grid mix.**

[4] http://rajenergy.com/

In this scenario the end user would get power from the grid mix consisting of the project option 4 along with the present generation mix. With an increased thermal capacity addition of 7.5MW diesel based power plant, there would be an increase in the amount of carbon dioxide generated at the thermal power plants for equivalent electricity. However, this project option would not be an appropriate baseline due its techno-economic circumstances that cannot be overcome. The operating costs of the project option are significant and with the diesel oil prices on an increasing trend the option is not economically viable. This is further complemented by the fact that this option is not a common practice. There is no diesel based power plant supplying power to grid[5]. Therefore we may conclude that this is not a project option available with APCL - an independent power producer and may be excluded.

**Project Option 5 – Project scenario supplying power to the present grid mix.**

In this scenario the end user would get power from the grid mix consisting of the project option 5 along with the present generation mix. In the project scenario the $CO_2$ released during the biomass combustion will be consumed by the plant species for their growth. In view of the above, biomass combustion, biomass growth and its associated $CO_2$ emissions and consumption can be treated as cyclic process resulting in no net increase of $CO_2$ in the atmosphere. Therefore, biomass based power generation is considered as carbon neutral. Mustard crop residue is the available biomass in the region. With an increased renewable energy capacity addition of 7.5MW mustard crop residue based power plant, there would be a reduction in the amount of carbon dioxide generated for equivalent electricity.

From the above assessment we may conclude that APCL has only two project options available

Project Option 1 – Present Grid Mix

Project Option 5 – Project scenario supplying power to the present grid mix.

**Barrier analysis**

[Referring to Attachment A to Appendix B document of "Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories", project participants are required to provide a qualitative explanation to show that the project activity would not have occurred anyway, **at least one** of the listed elements should be identified in concrete terms to show that the activity is either beyond the regulatory and policy requirement or improves compliance to the requirement by removing barrier(s) ; The guidance provided herein has been used to establish project additionality.]

[5] http://rajenergy.com/

The APCL was aware of the various barriers which prevent a wide spread implementation of the type of project. The barriers are detailed below. APCL proposes to overcome these barriers with the availability of carbon financing against a sale consideration of carbon credits. APCL took this CDM revenue stream into consideration before taking the initial steps to project planning.

Investment barrier

In order to implement the project, the project proponent was required to

a) Develop an adequate infrastructure for the Fuel Collection System

The project proponent has to develop an infrastructure in terms of manpower and financial resources, in order to ensure continuous fuel availability. This is a daunting task for the project proponent since one single supplier cannot supply the quantity of fuel required for the power plant. Negotiations will have to be done with atleast 30-40 suppliers/farmers for providing sufficient quantity of MCR. Six –seven collection centers will be opened in the interiors and 30-40 tractors will be taken to lease to transport the biomass to the project activity site. This demands a rich experience in the rural economics. But this has its inherent advantages, since it will be a source of income to the local rural population and will contribute to sustainable development. The project proponent also plans to develop a briquetting unit to form the briquettes using MCR, which makes the handling of fuel easy and enhances the combustion potential. Carbon financing will help project proponent develop a robust Fuel Collection System.

b) Secure Financial Closure

High upfront cost, lack of easy and long-term financing, project cash flows etc. are the investment barriers to the high efficiency renewable energy projects. Due to restrictions like institutional barriers and low penetration in the region, the accumulation of sufficient funds to finance a high investment and capital-intensive project, such as the proposed CDM renewable energy project is a quite difficult proposition.

Financial closure for the project activity is yet to be achieved. In APCL project too the restrictions like high upfront cost, technological issues to project implementation, institutional aspects related to project cash flows and no prior experience in power generation with MCR as primary fuel and in selling power to the grid or other users are some of the reasons for this delay in financial closure. This is APCL's first venture into the business of power generation. These restrictions to project implementation have been detailed below in point [B] and [C]. Carbon financing over the crediting periods (7 x 3 upto 21 years) as one of the cash in flows of the project will add more credibility to APCL's loan repayment capability thereby helping

them secure private financing to implement the proposed power project. APCL is conducting discussions with some banks/financial institutions for project financing. APCL anticipates better loan repayment terms from the banks/financial institutions in view of proposed carbon financing. APCL, proposes to shoulder the significant market or financial risk and taking a pro-active approach by showing confidence in the Kyoto Protocol/CDM system. Without the proposed carbon revenues securing private financing will be difficult. Besides the direct financing risk, APCL is shouldering the additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfil CDM requirements.

Technological barrier

Use of MCR for power generation is not a time-tested business proposition. The project proposes to use modern energy efficient technology with high pressure and temperature configuration. Major equipments of power plants are boiler and Steam Turbine and Generator (STG) set. The power plant will have one condensing steam turbo generator unit with a matching boiler of travelling grate type design capable of firing multi-fuel with MCR as the primary fuel. The boiler is sized to produce a maximum of 38 TPH of steam. The steam turbine will be a multistage, extraction cum condensing type machine. The steam conditions at the boiler heat outlet are a pressure of 66 kg/cm2 and temperature of 485 + $5^0$C.

There are certain known risks associated with the project implementation. There are uncertainties related to achieving higher steam temperature and pressure parameters by using MCR as primary fuel because it has tendency of sticking to the boiler tube surface. The project proponent plans to bring in the expertise of people in the field of power generation to further develop the technology for effective utilisation of MCR as fuel in boilers. The plant would initially be operated at lower boiler outlet steam parameters (44kg/$cm^2$ and 445$^o$C). After initial stabilisation and overcoming operational problems of firing MCR at lower steam parameters the APCL will put efforts to achieve higher steam parameters (66kg/$cm^2$ and 485$^o$C) for which the boiler is designed. The perceived technological risks associated with MCR utilization as primary fuel are too high for APCL to take the initiative of proposing to implement the project and to attract investment without ensured revenue from sale of carbon credits of the project.

Barrier due to prevailing practice

The project proponent conducted a comprehensive analysis on the common practices adopted in Rajasthan for power generation in order to substantiate that the project is not a part of the

baseline and the most appropriate baseline, in absence of project would be the grid mix of RVPN.

The state generation mix comprises of:

- ✓ 77.65 % thermal power plants;
- ✓ 9.47 % nuclear plant
- ✓ 12.61 % hydro projects; and
- ✓ 0.27 % wind and cogeneration projects

In thermal power plant category, coal based plants contribute for 69.82 % and balance 7.82 % is contributed by the gas based power plants.

There has been an increase of 1479 MW during last four and half years in the installed capacity in state of Rajasthan. The Govt. of Rajasthan had brought out a policy for promotion of Generation of power from Non-Conventional Sources on 11.3.99. Some agreements for implementation of biomass, waste fuel and Mustard Husk based power plants totalling 113 MW capacity additions have been executed. However till date a total of 7 MW[6] capacity has been commissioned. Hence renewable energy projects just comprise of 0.47 % of the total addition in last four and a half years.

This illustrates the low penetration of such renewable energy projects and little willingness of entrepreneurs to change the current operating practices in the region. We may conclude from the above statistics that the proposed project under discussion is not a common practice in the region. In India, till date, only one plant based on MCR as primary fuel, has been commissioned i.e. *Kalpataru Power Transmission Limited, commissioned in October 2003*. The practice of generating power by using MCR as primary fuel has not penetrated in the region due certain prohibitive barriers to project implementation. The comprehensive analysis on the common practices adopted for power generation in Rajasthan further justifies that the project is not a part of the baseline. This project will be the second project of this type to be commissioned once all the barriers associated to project implementation are overcome. The data on the state of MCR based power projects, suggests that the barriers, which are discussed below have hindered the growth of the sector.

Though the project is not a common practice, the project proponent was keen to take up this new initiative of utilizing MCR (waste material) as primary fuel by overcoming the barriers to prevailing practises and set examples for other entrepreneurs to follow. Some of the driving forces to this 'Climate change initiative' were

[6] http://www.rajenergy.com/

- rural development of the region by creating a new demand for the waste biomass thereby carving a source of additional revenue for the farmers involved in sourcing the raw material and
- GHG reduction
- demonstrating to other entrepreneurs the un-tapped potential of generating clean power from combustion of MCR

Although Government of Rajasthan had brought out a policy for promotion of generation of power from Non-Conventional Sources, but APCL is not legally bound to invest in the high efficiency biomass based power plant. Also there are no planned regulations that will coerce the Independent Power Producers (IPP) to implement the project activity within the crediting period. The implementation of the MCR based project activity is a voluntary step undertaken by APCL with no direct or indirect mandate by law.

Institutional barriers

In Rajasthan, a serious deterrent to the private sector participation in the non-conventional power generation is the lack of adequate infrastructure. A realistic policy and regulatory network, a good transmission network and conventional sources of funding are the fundamental necessities to promote such projects. The first non-conventional power policy in the State was introduced in 1999 for a periods of five (5) years. The entrepreneurs are not keen to take the project related risks, in absence of very supportive renewable energy policies. The transmission lines in the state are aging and require huge investment for replacement / repairs. The lack of adequate financial resources is likely to continue due to the prevailing practice barrier. A sustained effort in this direction is required to overcome these institutional barriers.

Further this is APCL's first venture into the business of power generation. They have to understand and deal with the economics of electricity generation, distribution and dealing with power sector economics, bureaucracy etc.

APCL has signed a Power Purchase Agreement (PPA) with RVPN. For their cash in flows the project depends on the payments from RVPN against the sale of electricity to the grid. Electricity boards in India are not very financially healthy. Total outstanding dues against Rajasthan payable to CPSUs as on 31st March 2003 were 480.75 crores[7]. It's likely that there could be problems with the cash inflows of project. APCL was well aware of the situation but with the proposed carbon financing as one of the revenue streams, the management has

[7] http://powermin.nic.in/indian_electricity_scenario/pdf/NR1104.pdf

decided to take this risk and face this institutional barrier on which they have limited or no control.

In view of the above analysis it is understood that the Project Option 5 – Project scenario supplying power to the present grid mix has its associated barriers to implementation. In spite of these limitations, APCL is one such entrepreneur to have proposed to overcome these barriers by initiating this GHG abatement project under Clean Development Mechanism. If APCL is successful in overcoming the above-identified barriers, it will encourage other entrepreneurs to come up with similar project activities. We may also conclude that the project activity is additional.

The Project Option 1 – Present Grid mix does-not face any of the above-mentioned barriers and is the status quo situation. In absence of project implementation this scenario would continue. Hence, the 'Option 1- Present Generation Mix, is the most likely baseline scenario and has been considered for the baseline emission calculations.

With the implementation of the project, 301.3 million kWh of electricity would be exported to the RVPN grid over the first 7 years crediting period and reduce the combined margin carbon intensity of the grid.

**B.4 Description of the project boundary for the project activity:**

As per the guidelines mentioned in Type I.D. of Annex-B of the simplified modalities and procedures for small-scale CDM project activities, project boundary encompasses the physical and geographical site of the renewable generation source.

For the proposed project activity the project boundary is from the point of fuel storage to the point of power supply to nearest HT line where the project proponent has a full control. Thus, boundary covers fuel storage, boiler, steam turbine generator and all other accessory equipments. However, for the purpose of calculation of baseline emissions, Rajasthan state electricity grid is also included in the project boundary.

Thus, boundary covers fuel storage and processing, boiler, STG and electricity grid as shown in the diagram on the next page.

**B.5 Details of the baseline and its development:**

**B.5.1** Specify the baseline for the project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix-B of the simplified M&P for small-scale CDM project activities:

Since the project activity is feeding power to RVPN grid, the baseline for this project activity is the function of the generation mix of Rajasthan state grid. Using the methodology available

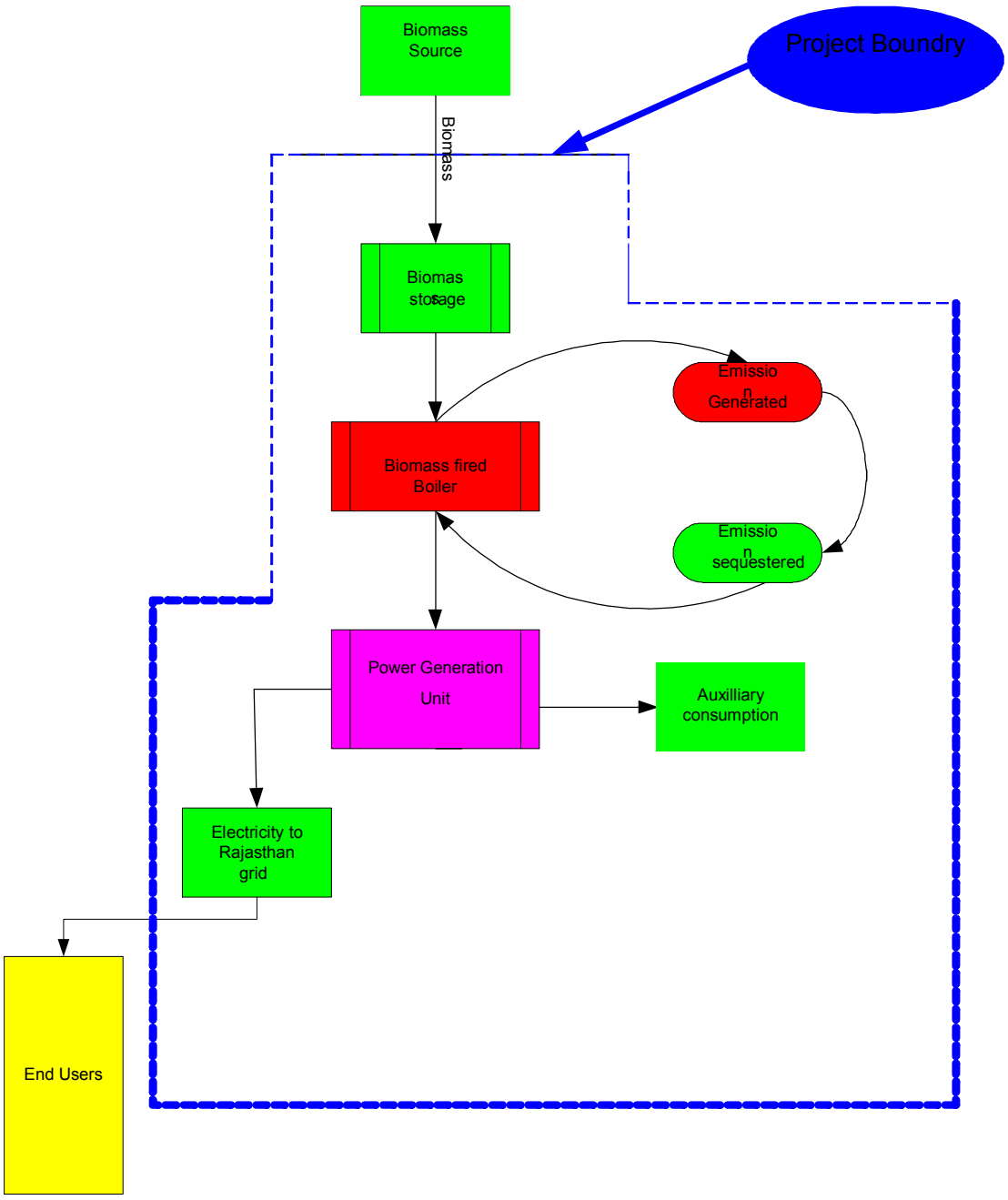
for small-scale project activities, the average of operating and build margin (in $kgCO_2equ/kWh$) of current generation mix of Rajasthan is used for the calculation of baseline. Actual $CO_2$ emission factors are used for the purpose. The project baseline would be revisited every 7 years to ensure that the assumptions made, still hold true or they would be revised accordingly.

**B.5.2** Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

15/02/2004

**B.5.3** Name of person/entity determining the baseline:

APCL and their consultants



## C. Duration of the project activity and crediting period

**C.1 Duration of the project activity:**

**C.1.1** Starting date of the project activity:

November 2004

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

25 years

**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 (DD/MM/YYYY):

September 2005

**C.2.1.2** Length of the first crediting period

7 years

**C.2.2 Fixed crediting period (at most ten (10) years):**

**C.2.2.1** Starting date *(DD/MM/YYY*Y):

**C.2.2.2** Length (max 10 years):

## D. Monitoring methodology and plan

### D.1 Name and reference of approved methodology applied to the project activity:

**Title:** Monitoring Methodology for the category I D – Renewable electricity generation for a grid

**Reference:** 'Paragraph 31 ' as provided in Appendix B of the simplified modalities and procedures for small-scale CDM project activities - Indicative Simplified Baseline And Monitoring Methodologies For Selected Small-Scale CDM Project Activity Categories.

The document requires the project-monitoring plan to consist of metering the electricity generated by the renewable technology.

### D.2 Justification of the choice of the methodology and why it is applicable to the project activity:

As per the provisions of paragraph 12 of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21] the "Project participants may use the **simplified baseline and monitoring methodologies specified in appendix B** for their project category" if they meet the applicability criteria of Small scale CDM project activity. Since the project activity is a small-scale CDM project of Type I.D category, the monitoring methodology and plan has been developed in line with the guidance provided in paragraph 31 of Appendix B.

Generation of power using mustard crop residue, as fuel will lead to mitigation of GHG in the fossil fuel based plants, which supply power to RVPN. In order to monitor the mitigation of GHG due to generation of power at APCL, it is required that the total power produced and auxiliary power consumed is measured.

**Description of monitoring plan**

The Monitoring and Verification (M&V) procedures define a project-specific standard against which the project's performance (*i.e.* GHG reductions) and conformance with all relevant criteria will be monitored and verified. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

## GHG SOURCES

### Direct On-Site Emissions

Direct on-site emissions after implementation of the project arise from the burning of biomass in the boiler. These emissions mainly include $CO_2$. Since the biomass is formed by fixing the atmospheric $CO_2$ by the action of photosynthesis in the presence of sunlight, the $CO_2$ released due to combustion of biomass is assumed to be equal to the $CO_2$ fixed by the photosynthesis. The $CO_2$ released during the combustion will be consumed by the plant species for their growth. In view of the above, biomass combustion and growth of biomass and associated $CO_2$ consumption and release can be treated as cyclic process resulting in no net increase of $CO_2$ in the atmosphere. Hence, the project will not lead to GHG emissions.

### Direct Off-Site Emissions

In the proposed project scenario the direct off-site emissions arise from the biomass transport. The collection of MCR will be done through the farmers. They bring the biomass to these fuel processing centers in their own vehicles. Although some farmers also have tractors, the major means of transporting MCR is the camel cart. But 30% of total biomass transportation by tractor trolley has been considered.

However in the baseline scenario $CO_2$ emissions will occur during the transportation of coal from the mines to respective coal based power plants. The distance between the coal mines and the power plants is higher as compared to the transportation distance between biomass collection centers to biomass power project site and hence the higher $CO_2$ emissions. To be on conservative side, this leakage due to coal transportation has not been added while calculating the baseline of RVPN grid and hence a small leakage due to transportation of biomass has been neglected from the calculations.

### Indirect On-Site Emissions

The indirect on site GHG source is the consumption of energy and the emission of GHGs involved in the construction of Biomass based power plant.

Considering the life of the power plant and the emissions to be avoided in the life span of 15 – 20 years, emissions from the above-mentioned source is too small and hence neglected.

No other indirect on-site emissions are anticipated from the project activity.

### Indirect Off-Site Emissions

The indirect off-site emissions would include GHG emissions resulting from the process construction and erection of the HT lines from the point of generation to the nearest HT lines.

Considering the life of the power plant and the emissions to be avoided in the life span of 15–20 years, emissions from this source is also too small and hence neglected.

**Key Project Parameters affecting Emission Reductions**

**Total Power generated by the project:** The total power generated by the power project will be measured to the best accuracy and will be recorded, monitored on a continuous basis. The parameter will substantiate the smooth operations of the power plant.

**Auxiliary consumption:** The power consumed by plant auxiliaries will also be recorded to the best accuracy. This will be recorded monitored on a continuous basis. The total quantum of power consumed by the auxiliaries would affect the net power exported to the grid and therefore the amount of GHG reductions. Therefore any increase in the consumption pattern of the auxiliary system would be attended to.

**Net Power exported to the grid:** The project revenue is based on the net units exported as measured by main metering system and/or backup metering system. The monitoring and verification system would mainly comprise of these meters as far as power export is concerned. RVPN will be billed by APCL based on joint meter reading promptly following the end of each month for energy supplied.

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and reporting

Since the emission reduction from the project are determined by the net units exported to the grid (and then multiplying with appropriate emission factor) it becomes important for the project to monitor the net export of power to the grid on real time basis.

**Frequency of monitoring:** APCL will carry out the hourly data recording. The RVPN and APCL shall jointly read the main and backup metering system on the first day of every month.

**Reliability:** The amount of emission reduction is proportional to the net energy generation from the project. Thus the final kWh meter reading is the final value from project side. The reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result.

The project proponent would ensure accuracy of the measurement system as follows:

- The shift incharge will be responsible for the hourly data recording and the plant manager will ensure that that the data is properly archived.
- The plant manager will be a qualified engineer with 10-15 year experience in power industry. All the shift incharges will be diploma holders and will undergo an exhaustive training programme, including plant operations, data monitoring, report generation etc.

The project proponent would also ensure quality of the equipment used for monitoring.

The RVPN shall own, test and maintain the main metering system. The backup metering system shall be installed, tested, owned and maintained by APCL. The main and backup metering system shall be sealed in the presence of both parties.

Meters shall be calibrated on annual basis so that the accuracy of measurement can be ensured. When the main metering system and/or backup metering system and/or any component is found to be outside the acceptable limits of accuracy or otherwise not functioning properly, it shall be repaired, re-calibrated or replaced by APCL and/or RVPN, as soon as possible. Any meter seal shall be broken only by RVPN's representative in the presence of APCL's representative whenever the main or backup metering system is to be inspected, tested, adjusted, repaired or replaced.

**Registration and reporting:** The RVPN and APCL shall jointly read the metering system and shall keep the complete and accurate records for proper administration.

Hourly data recording by the shift incharge will be there. Daily, weekly and monthly reports stating the generation are prepared by the shift incharge and verified by the plant manager . In addition to the records maintained by APCL, RVPN also monitors the actual power exported to the grid and certify the same.

**Other Parameter to be monitored**

**Quantity and Quality of the biomass used in the boiler as fuel**

The biomass received from the dealers will be stored in the plants storage area specially designed for such storage. From the storage area the biomass will be transferred to the intermediate bunkers by bucket elevator/belt conveyor.

Belt conveyors transfer the biomass from the bunkers to the feeding hopper of the boiler, from where biomass is fed into the boiler. An online weighing system has to be provided to the belt conveyors to measure, record and transmit, the actual quantity of the fuel entering into the boiler for online monitoring in the DCS. The weighing system needs to be calibrated regularly to ensure the accuracy of the measurement. The data will be recorded for further verification.

The amount of biomass purchased, will be based on invoices / receipts from fuel contractors.

The main type of fuel proposed for the power generation is only biomass like mustard crop residue. The properties of the biomass from ultimate analysis, calorific value, ash composition etc. will be consistent in the region. However, it is proposed to monitor various properties of biomass used as fuel, by taking samples at random, so that in case of any drastic change in the properties, corrective actions can be taken. The measurement of fuel properties like calorific value will be conducted as per standard national/international practices and data or documents will be kept open for verifiers.

**Quantity and Quality of coal (if any) used in the boiler**

Though the project proponent proposes to use 100% biomass for power generation the project proponent will provide for

- a proper online coal weighing system in order measure the quantity of coal used
- necessary provisions to measure carbon content of the coal samples

  to arrive at project emissions from coal combustion if any.

**Verification**

The performance of the project leads to CO2 emission reductions. In other words, the higher the electricity exports to the grid the more would be the emission reductions.

There are two aspects of Verification

[A] Verification of the Monitoring System which includes

- Verification of various measurement and monitoring methods
- Verification of instrument calibration methods
- Verification of measurement accuracy

[B] Verification of Data collected which includes

- Total generation of power and auxiliary power requirements.
- Quantity and quality of the Biomass
- Coal consumption (if any)

The project proponent will provide the necessary supportive documents to enable verification of both the monitoring system and the data archived as per Section D3.

**D.3 Data to be monitored:**

**a) Parameters affecting the emission reduction potential of the project activity**

| ID Number | Data type | Data variable | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/paper) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Power | Electricity generated | KWh | M | Continuous | Total | Electronic | 3 years after issue of CERs | |
| 2 | Power | Auxiliary consumption | KWh | M | Continuous | Total | Electronic | 3 years after issue of CERs | |
| 3 | Power | Net Electricity Exported | KWh | M | Continuous | Total | Electronic | 3 years after issue of CERs | |

**b) Fuel related parameters**

| ID Number | Data type | Data variable | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/paper) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Fuel | Biomass Quantity | MT | m | hourly | >95%* | paper | 3 years after issue of CERs | |
| 2 | Fuel | Biomass – Calorific Value | Kcal/Kg | Actual sample testing | fortnightly | | paper | 3 years after issue of CERs | Through sample testing |
| 3 | Fuel | Coal Quantity | MT | m | Daily | >95%* | paper | 3 years after issue of CERs | |
| 4 | Fuel | Carbon content in coal | % | Actual sample testing | For each batch of coal | Grab Sample | paper | 3 years after issue of CERs | Through sample testing |

**D.4 Name of person/entity determining the monitoring methodology:**

Alwar Power Corporation Ltd.

The person/entity is also a project participant as listed in Annex 1 of this document.

## E. Calculation of GHG emissions by sources

### E.1 Formulae used:

#### E.1.1 Selected formulae as provided in Appendix B:

Not applicable.

#### E.1.2 Description of formulae when not provided in Appendix B:

**E.1.2.1** Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of $CO_2$ equivalent)*

The project proponent in case of exigencies proposes to use coal as fuel instead of biomass. The $CO_2$ emissions during the usage of coal has been calculated in the following manner:

**$CO_2$ Emission [in kgs]= Stoichiometric $CO_2$ from carbon content of coal [based on total carbon content ]**

To have an estimate of the project $CO_2$ emission quantity due to combustion of coal along with the biomass, total carbon content of the coal should be known. Combustion reaction for $CO_2$ emission is as under.

$C + O_2 = CO_2$

Assuming complete combustion of coal, following formula can be used for conservative estimation of CO2 emissions.

$$CE_c = (44/12) * C * Q$$

where,

CEc - Stoichiometric carbon-dioxide emission due to coal burning at project, MT

C - Carbon percentage in coal, %

Q - Quantity of coal burned, MT

Although calculation for project emissions have been incorporated in Chapter E, carbondioxide emissions from coal combustion are considered as zero since the APCL does not propose to use coal as fuel for power generation. APCL proposes to use 100% biomass since there is surplus crop residue after discounting for various end-uses, available within a radius of 25 km which is estimated to be 1,11,800 MT/annum and within 50 km radius more

than 4,97,234 MT/annum. There is a potential of generating renewable energy to a tune of around 45 MW from this resource.

**E.1.2.2** Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in Appendix B of the simplified modalities and procedures for small-scale CDM project activities *(for each gas, source, formulae/algorithm, emissions in units of $CO_2$ equivalent)*

The leakage activity identified, which contributes for GHG emissions outside the project boundary is transportation of biomass (MCR) from biomass collection centers to biomass power project site. The collection of MCR will be done through the farmers. They bring the biomass to these fuel processing centers in their own vehicles. Although some farmers also have tractors, the major means of transporting MCR is the camel cart. Rajasthan is a poor State, with fragmented land holdings. Also, there are no tracks through the fields that can be used to transport the MCR to these centers. Therefore, camel cart is the most successful means of transporting the MCR to the collection centers. On an average, a camel cart can carry between 1.0-1.5 tons of MCR depending on the type of trolley used. Calculation of leakage has been carried-out as under: [For details refer to Enclosure B-Leakage Calculations]

- Biomass to be procured - 60,000 MT

*(Based on the assumption, 70% of total biomass transportation by camel cart & 30% by tractor trolley)*

- Average Distance between project site and biomass collection centers - 25 km
- Biomass load per tractor trolley - 1.5 MT
- Number of trips - 12000
- Consumption of Diesel per trip - 10 litres (5 km/litre)
- Total Diesel consumption - 1,20,000 litres/annum
- $CO_2$ emission factor for Diesel (as per IPCC guidelines) - 74.10 tons $CO_2$/ TJ
- $CO_2$ emission per annum - 252 tons

The $CO_2$ emission (leakage) occurs during the transportation of coal from the mines to respective coal based power plants. Since state of Rajasthan gets coal from other states, the distance between the coal mines and the power plants is higher as compared to the transportation distance between biomass collection centers to biomass power project site and hence the higher $CO_2$ emissions. To be on conservative side, this leakage due to coal

transportation has not been added while calculating the baseline of RVPN grid and hence a small leakage due to transportation of biomass has been neglected from the calculations.

**E.1.2.3** The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

The emissions from the project using coal as supplementary fuel would give the project activity emissions.

**E.1.2.4** Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in Appendix-B of the simplified modalities and procedures for small-scale CDM project activities

Rajasthan grid has been considered as the system boundary for the baseline emission calculations. Rajasthan's present generation mix, sector wise installed capacities and emission co-efficients are used to arrive at the net carbon intensity/baseline factor of the chosen grid. As per the provisions of the methodology the emission coefficient for the electricity displaced would be calculated in accordance with provisions of paragraph 29 of Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities for grid systems.

The emission coefficient has been calculated in a transparent and conservative manner as:

**The average of the "approximate operating margin" and the "build margin"**

(i) The "approximate operating margin (OM)" is the weighted average emissions of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation

(ii) The "build margin (BM)" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system

The step-by-step calculation is as follows:

| | | | | |
|---|---|---|---|---|
| **Step 1** | **:** | Net emission factor for coal | = | Actual emission factor for coal x % of generation by coal out of total generation (Excluding nuclear, hydro and renewable energy projects) |
| **Step 2** | **:** | Net emission factor for gas | = | Step 1 is to be repeated for gas. |
| **Step 3** | **:** | Thermal efficiency of coal based power plant | = | 35.26% |
| **Step 4** | **:** | Thermal efficiency of gas based power plant | | 50% |
| **Step 5** | **:** | Net operating margin (OM) | = | (Net emission factor for coal/Thermal |

| | | | | |
|---|---|---|---|---|
| | | factor | | efficiency of coal) + (Net emission factor for gas/Thermal efficiency of gas) |
| **Step 6** | **:** | Net built margin (BM) factor | = | 0.7 |
| **Step 7** | **:** | Net carbon emission factor | = | (Net operating margin factor + Net built margin factor)/2 |
| **Step 8** | **:** | Units exported to RVPN | = | Total Energy generation –Total auxiliary consumption. |
| **Step 9** | **:** | Baseline emission | = | Net carbon emission factor x Units exported to RVPN |

Since there is a gap between demand and supply in Rajasthan grid, the export of power from the project activity to Rajasthan grid will replace or get absorbed to partially fulfill the Rajasthan power requirement.

If the same amount of electricity is generated by the coal and gas based power projects, supplying electricity to the grid it adds to the emissions that are getting reduced by the project activity. Hence, the baseline calculated using above methods / scenarios would represent the realistic anthropogenic emissions by sources that would occur in absence of the project activity. No transmission and distribution losses have been considered since project will export power at high voltage of 132 kV. Combined margin factor that incorporates 'built margin', takes into consideration the uncertainties expected in the baseline scenario.

**E.1.2.5** Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Following formula is used to determine Emission reduction

| | | | | |
|---|---|---|---|---|
| **$CO_2$ emission reduction due to project activity** | = | Net $CO_2$ baseline emission – Project emission | X | Electricity exported to grid (in kWh) |

**E.2 Table providing values obtained when applying formulae above:**

Using UNFCCC baseline methodology for small-scale CDM project, emission reductions by project activity for first 7 year crediting period has been calculated and tabulated as under.

Emission Reductions

| Sr. No. | Operating Years | Net Baseline Emission Factor (Kg of $CO_2$ / kWh) | Baseline Emissions (Tones of $CO_2$) | Project Emissions (Tones of $CO_2$) | Emission Reductions, ERs (Tones of $CO_2$) |
|---|---|---|---|---|---|
| 1. | 2005-2006 | 0.92 | 35328.00 | 0 | 35328.00 |
| 2. | 2006-2007 | 0.92 | 38088.00 | 0 | 38088.00 |
| 3. | 2007-2008 | 0.92 | 40756.00 | 0 | 40756.00 |
| 4. | 2008-2009 | 0.92 | 40756.00 | 0 | 40756.00 |
| 5. | 2009-2010 | 0.92 | 40756.00 | 0 | 40756.00 |
| 6. | 2010-2011 | 0.92 | 40756.00 | 0 | 40756.00 |
| 7. | 2011-2012 | 0.92 | 40756.00 | 0 | 40756.00 |
| | | **Total ERs** | **277196.00** | **0** | **277196.00** |

Therefore an conventional energy equivalent of 301.3 Million kWh for the first crediting period of 7 years in Rajasthan would be saved by exporting power from the 7.5 MW Biomass based power plant which in turn will reduce 277,196 tonnes of $CO_2$ emissions considering baseline calculations.

The methodology adopted to calculate the baseline is given in detail in Annex-3.

## F. Environmental impacts

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

The project does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India. Hence, not required by the host party. However, Rajasthan State Pollution Control Board (RSPCB) has prescribed standards of environmental compliance and monitors the adherence to the standards. RSPCB have issued Consent To Establish (CTE also termed as NOC) to APCL under the provisions of Water (Prevention and Control of Pollution) Act, 1974 / Air (Prevention and Control of Pollution) Act, 1981, Environment Protection Act, 1986 with following terms and conditions.

1) The treated trade effluent shall confirm to the limits of the general standards prescribed under the provisions of EP act 1986 for discharge of effluent into inland surface water. The overall quantity shall not exceed 60 kl/day from the premises.
2) Quantity of domestic waste water shall not exceed 8 kl/day.
3) Air emissions shall confirm to Emission Regulations issued by the Central Pollution Control Board and as adopted by the State Pollution Control Board.
4) The infrastructure facility for monitoring of stack emissions on each stack and flow measuring devices at each unit of effluent treatment plant shall be provided.

## G. Stakeholders comments

### G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

The 7.5 MW non-conventional renewable energy source biomass (MCR) power plant is implemented by Alwar Power Company (P) Limted. The project will use biomass that is abundantly available.

The various stakeholders identified for the project are as under.

1. Elected body of representatives administering the local area (village Panchayat)
2. Rajasthan Rajya Vidyut Prasaran Nigam Ltd (RVPN)
3. Rajasthan State Pollution Control Board (RSPCB)
4. Ministry of Environment & Forest (MoEF), Government of India
5. Consultants
6. Equipment Suppliers

Stakeholders list includes the government and non-government parties, which are involved in the project at various stages. At the appropriate stage of the project development, stakeholders/ relevant bodies were involved to get the project clearance

### G.2 Summary of the comments received:

Stakeholder's involvement

The village *Panchayat* /local elected body of representatives administering the local area is a true representative of the local population in a democracy like India. Hence, their consent / permission to set up the project is necessary. APCL has already completed the necessary consultation and documented their approval for the project.

Local population comprises of the local people in and around the project area. The roles of the local people are as a beneficiary of the project. The local population will be involved in the supply of the biomass and hence the project would be a beneficial project for the local population. In addition to this, the project would also lead to local manpower working at the plant site. Since, the project will provide good direct and indirect employment opportunities the local populace is encouraging the project.

The project does not require displacement of any local population. In addition, the local population is also an indirect consumer of the power that is supplied from the power plants. This is essential because the power sold to the grid is expected to improve the stability in the local electricity network. Since, the distance between the electrical substation for power evacuation and the plant is rather small, installation of transmission lines will not create any inconvenience to the local population.

Thus, the project will not cause any adverse social impacts on local population. Rather, it will help in improvising their quality of life.

Rajasthan State Pollution Control Board (RSPCB) has prescribed standards of environmental compliance and monitors the adherence to the standards. The project has already received Consent to Establish from RSPCB to start commissioning of the plant.

Rajasthan Renewable Energy Corporation Limited (RREC) implements policies in respect of non-conventional renewable power projects in the state of Rajasthan and has accorded approval to the project.

As a buyer of the power, the RVPN is a major stakeholder in the project. They hold the key to the commercial success of the project. RVPN has already cleared the project and APCL has already signed Power Purchase Agreement (PPA) with RVPN.

The government of India, through Ministry of Non-conventional Energy Sources (MNES), has been promoting energy conservation, demand side management and viable renewable energy projects including wind, small hydro and bagasse cogeneration / bio-mass power.

The stakeholder's comments are summarized in the table given below:

| S.No | Stakeholder | Comments | Remarks |
|---|---|---|---|
| 1. | Village Panchayat | Refer the attached comments. | The local population will be involved in the supply of the biomass and the project will provide good direct and indirect employment opportunities hence, the local populace is encouraging the project. |
| 2. | Rajasthan Rajya Vidyut Prasaran Nigam Ltd | No comments | PPA has been signed with RVPN. The initial term of agreement shall be 20 years from commercial operation date. (PPA can be shared with the validator on site visit) |
| 3. | Rajasthan State | ➢ Treated trade | ➢ Electrostatic precipitator (ESP) |

| S.No | Stakeholder | Comments | Remarks |
|---|---|---|---|
| | Pollution Control Board | effluent shall conform to limits of EPA, 1986 for discharge into inland surface water.<br>➢ Domestic waste water shall be treated as per IS:2470 and treated effluent should conform to standards as prescribed by State Board.<br>➢ The air emission shall conform to emission regulations Part-I, II & IV issued by Central Board and as adopted by State Board. | will be installed at exit of boiler.<br>➢ There will be no discharge of effluent from plant outside the plant site<br>➢ Domestic waste will be conveyed through separate drains to septic tank before being discharged.<br>Consent to establish the proposed power plant has been issued under provisions of Water Act, 1974, Air Act, 1981 and Environment Protection Act (EPA), 1986. |
| 4. | Ministry of Environment & Forest, Government of India | No comments | Copy of host country endorsement is attached |
| 5. | Consultants | No comments | Project consultants are involved in the project to take care of various pre contract and post contract project activities like preparation of Detailed Project Report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, successful commissioning and trial runs |
| 6. | Equipment Suppliers | No comments | Equipment suppliers will be supplying the equipments as per the specifications finalized for the project and will be responsible for successful erection & commissioning of the same at the |

| S.No | Stakeholder | Comments | Remarks |
|---|---|---|---|
| | | | site and for performance. |

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

The relevant comments and important clauses mentioned in the project documents like Detailed Project Report (DPR), Biomass assessment study, environmental clearances, power purchase agreement, local clearance, etc. were considered in the preparation of CDM project development document. Further, the CDM-PDD will be posted on the UNFCCC or validator's web site for public viewing and comments.

**Annex 1**

**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

| | |
|---|---|
| Organization: | Alwar Power Company (P) Limited |
| Street/P.O.Box: | DLF Qutab Enclave, Phase-II |
| Building: | L1/22 |
| City: | Gurgaon |
| State/Region: | Haryana |
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| Title: | Dr. |
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[8] The project is under active discussion with Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, for which Kommunalkredit Public Consulting GmbH is programme manager.

## Annex-2

### Information Regarding Public Funding

No Public Funding is available to the project.

# Annex-3

## BASE LINE DATA

**Carbon emission factor of grid**

Rajasthan's Power Generation, Present generation mix, sector wise installed capacities, emission co-efficient and generation efficiencies are used to arrive at the net carbon intensity/baseline factor of the chosen grid. As per the provisions of the proposed methodology the emission coefficient for the electricity displaced would be calculated in accordance with provisions of paragraph 29 of Appendix B of Draft Simplified Modalities and Procedures for Small Scale CDM Project Activities [Reference: FCCC/CP/2002/7/Add.3, English, Page 21] for grid systems.

The provisions of paragraphs 29 of Appendix B requires the emission coefficient (measured in kg $CO_2$equ/kWh) to be calculated in a transparent and conservative manner as:

(a) The average of the "approximate operating margin" and the "build margin" (or combined margin)

OR

(b) The weighted average emissions (in kg $CO_2$equ/kWh) of the current generation mix.

Complete analysis of the system boundary's electricity generation has been carried out for the calculation of the emission coefficient as per point 29 (a) given below with baseline emission factor calculations.

**Combined Margin**

The baseline methodology suggests that the project activity will have an effect on both the operating margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the state grid mix) and the build margin (i.e. weighted average emissions of recent capacity additions) of the selected Rajasthan grid and the baseline emission factor would therefore incorporate an average of both these elements.

**Operating Margin**

As mentioned above the project activity will have some effect on the Operating Margin (OM) of the Rajasthan State Grid. The carbon emission factor as per the Operating Margin takes into consideration the present power generation mix of 2003-2004 excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation of the selected grid, efficiency of thermal power plants and the default value of emission factors of the fuel used for power generation.

The consumer of a state of Rajasthan gets a mix of power from the different sources. The figures of installed power capacity, share of the state in the central pool, and actual plant availability decides the content of power. The real mix of power in a particular year is however based on actual units generated from various sources of power. The power system in Rajasthan comprises of Rajsthan Rajya Vidyut Utpadan Nigam Ltd. – generating company, Rajasthan Vidyut Prasaran Nigam Ltd – transmission company and three regional distribution companies namely Jaipur Vidyut Vitran Nigam Ltd, Ajmer Vidyut Vitran Nigam Ltd and Jodhpur Vitran Nigam Ltd. RVPNL is operating major thermal and hydel power stations in Rajasthan. The state also gets share from the central sector generation plants and interstate power projects. The data collected and used are presented in Tables A3.1 to A3.3

The most important parameter in estimating the emissions is the thermal efficiency of the power plant. The net energy consumption norms were based on best efficiency for each of the technologies considered. As per the CEA report, it is assumed that all the coal & lignite based plants coming up in tenth & eleventh & plan will use pulverized coal sub-critical / super critical pressure technology with the thermal efficiency of around 34%. The percentage of carbon that is not burnt is very low and, hence, complete combustion was assumed. The thermal efficiency of existing old power plants is less than 30% and for new modern power plants it is expected to be around 34%. Central Electricity Authority has presented the analysis of Station Heat Rates (SHR) for 43 thermal power plants using coal, in India, in the report 'Performance Review of Thermal Power Stations 2003-04 Section 13'[9]. As per this report 'Suratgarh thermal power plant' (located in Rajasthan) has the second highest efficiency of 35.26 % among all the coal based power plants in Northern grid. Lehra Mohabbat, a plant located in Punjab has the highest efficiency of 35.51 %. But this plant does not supply electricity to Rajasthan grid. Hence the efficiency of 'Suratgarh thermal power plant' has been considered for the calculations. Average efficiency of gas based thermal plants in Rajasthan as against the standard norms works out to be around 40-45% On conservative basis average efficiency for base line calculations is considered as 50%. Standard emission factors given in IPCC for coal and gas (thermal generation) are applied over the expected generation mix and net emission factors are determined.

The formulae are presented in Section-E and the calculations are presented in an excel sheet Enclosure A. Carbon Emission Factor of grid as per OM is 0.93 kg $CO_2$/kWh electricity generation.

[9] http://cea.nic.in/opm/0304/sec-13_sush777.pdf

**Build Margin**

The project activity will have some effect on the Build Margin (BM) of the Rajasthan State Grid. The baseline factor as per the Build Margin takes into consideration the delay effect on the future projects and assumes that the past trend will continue in the future. As per the baseline methodology, the baseline factor for Build Margin is calculated as the weighted average emissions of recent capacity additions to the system, defined as the top of most recent 20% of plants built or the 5 most recent plants which ever is greater. Since some major thermal plants have started operation in the year 2003 we have considered them during built margin calculations. In case of Rajasthan grid the total number of plants supplying power to grid is 25 hence, 20% of the most recent plants sum up to 5 power plants. For our built margin calculation we would therefore take into consideration 5 most recent plants built in Rajasthan given in Table-A.3.4. Carbon Emission Factor of grid as per BM is 0.9 kg $CO_2$/kWh electricity generation.

Net Carbon Emission FactorGrid for 2003-2004 as per CM = (OM + BM)/2 = 0.92 kg of $CO_2$ / kwh[10] generation respectively. (Refer to Excel Sheet Enclosure A and C: Calculation of the Emissions Factor of the Grid).

**Grid data for calculation of baseline emission factor of grid**

| Table A3.1: Power Generation Mix of Rajasthan from the State Generating Stations[11] | | |
|---|---|---|
| Sr. No. | Energy Source | Net Generation in MkWh (2003-2004) |
| I. | Rajasthan State | |
| 1. | Thermal (coal) | |
| | Kota TPS | 6283.81 |
| | Suratgarh TPS | 7524.32 |
| | Thermal (Coal) Total | **13808.13** |
| 2. | Thermal (Gas) | |
| | Ramgarh Gas TPS | 221.8 |
| | Thermal (Gas) Total | **221.8** |
| 3. | Hydro | |
| | Mahi Bajaj Sagar | 188.24 |
| | Rana Pratap Sagar | 239.49 |
| | Jawahar Sagar | 203.11 |
| | Anoopgarh | 8.54 |
| | Small Hydro | 11.44 |
| | Hydro Total | 650.82 |
| 4. | Wind | |
| | Wind Total | 104.67 |

[11] Northern region-Annual Grid Report 2003-04

| **Table A3.2: Power Generation Mix of Rajasthan from the Central Generating Stations[12]** | | |
|---|---|---|
| Sr No | Energy Source | Generation (2003-2004) |
| II. | Rajasthan's share in Central Schemes | In MkWh |
| 1. | Thermal (Coal) | |
| | Singrauli TPS | 2700 |
| | Rihand TPS | 900 |
| | Unchar TPS Stage I | 190 |
| | Unchar TPS Stage II | 350 |
| | Thermal (Coal) Total | **4140** |
| 2. | Thermal (Gas) | |
| | Anta | 646 |
| | Auriya | 549 |
| | Dadri | 520 |
| | Thermal (Gas) Total | **1715** |
| 3. | Hydro | |
| | Tanakpur | 40 |
| | Salal | 84 |
| | Chamera | 207 |
| | Uri | 190 |
| | Total Hydro | **521** |
| 4. | Nuclear | |
| | RAPP II | 1090 |
| | RAPP III | 615 |
| | RAPP IV | 404 |
| | NAPP | 500 |
| | Total Nuclear | **2609** |

[12] Source - OrderonARR03-04ofRVPN –Table 8 – Power purchase cost from different sources

| Table A3.3: Power Generation Mix of Rajasthan from the Power Stations in Partnership Projects[13] | | |
|---|---|---|
| Sr No | Energy Source | Generation (2003-2004) |
| III. | Rajasthan's share in Partnership Projects | in MkWh |
| 1. | Thermal (Coal) | |
| | Satpura TPS | 630 |
| | Thermal (Coal) Total | **630** |
| 2. | Hydro | |
| | BBMB - Bhakara | 897 |
| | BBMB - Pong | 644 |
| | BBMB - Dehar | 631 |
| | Chambal - Hydro | 244 |
| | Chambal - Satpura | 681 |
| | BBMB for RFF | 183 |
| | Hydro Total | **3280** |

[13] Source : OrderonARR03-04ofRVPN – Table 8 – Power purchase cost from different sources

| Table A.3.4: Five most recent plants built in Rajasthan[14] | | | | | |
|---|---|---|---|---|---|
| **S.No.** | **Year of Commissioning** | **Energy Source** | **Installed Capacity (for the unit) (MW)** | **Total Installed Capacity (MW)** | **Million kWh (per annum)** |
| 1 | Oct, 2003 | Central Sector - Chamera – II (8.6% share) | 3x100 | 3x100 | 99.5<br>Oct' 2003-Sep' 2004 |
| 2 | Sep-2003 | M/s Kalpataru Power Ltd. (Biomass) | 7.0 | 7.0 | 30.857<br>Sep' 2003-Aug' 2004 |
| 3 | Jul-2003 | KTPS Stage IV (Coal) | 195.0 | 1045.0 | 1148.04<br>Jul' 2003-Jun' 2004 |
| 4 | Jun-2003 | Suratgarh Stage –III (Coal) | 250.0 | 1250.0 | 1583.21<br>Jun' 2003-May' 2004 |
| 5 | Apr-2003 | Ramgarh Gas Extn. (Gas) | 37.5 | 103.5 | 213<br>Apr' 2003-March' 2004 |

[14] Northern region-Annual Grid Report 2003-04

**Emission factors**

The emission factors are based on IPCC Guidelines for National Greenhouse Gas Inventories and are given below.

| **Fuel** | **Emission factor[15] (tC/TJ)** | **Emission factor ($tCO_2$/TJ)** |
|---|---|---|
| Natural gas | 15.3 | 56.1 |
| Sub-bituminous coal | 26.2 | 96.1 |

[15] Page 1.13, Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual

**Appendix A**

## Abbreviations

| | |
|---|---|
| % | Percentage |
| APCL | Alwar Power Company (P) Limited |
| BM | Build Margin |
| CDM | Clean Development Mechanism |
| CEA | Central Electricity Authority |
| CER | Certified Emission Reductions |
| CM | Combined Margin |
| Cm | Centimeter |
| $CO_2$ | Carbon Di oxide |
| CPSUs | Central Power Sector Utilities |
| DPR | Detailed Project Report |
| GHG | Greeenhouse Gas |
| IPCC | Intra governmental Panel for Climate Change |
| IPP | Independent Power Producers |
| IREDA | India Renewable Energy Development Agency |
| Kcal | Kilo Calories |
| Kg | Kilogram |
| Km | Kilometer |
| KP | Kyoto Protocol |
| KW | Kilowatt |
| KV | Kilovoltage |
| KWh | Kilowatt hour |
| LP | Low Pressure |
| MCR | Mustard Crop Residue |
| MNES | Ministry of Non-Conventional Energy Sources |
| MT | Metric Tons |
| MU | Million Units |
| MW | Megawatt |
| NGO | Non Government Organizations |
| NOC | No Objection Certificate |
| PDD | Project Design Document |
| PIN | Project Idea Note |
| PLF | Plant Load Factor |
| PPA | Power Purchase Agreement |
| QA | Quality Assurance |
| QC | Quality Control |
| RE | Renewable Energy |
| RSPCB | Rajasthan State Pollution Control Board |

| | |
|---|---|
| RVPN | Rajasthan Rajya Vidyut Prasaran Nigam Ltd |
| RREC | Rajasthan Renewable Energy Corporation Limited |
| SEB | State Electric Board |
| STG | Steam Turbine Generator |
| T&D | Transmission and Distribution |
| TPH | Tonnes Per Hours |
| TJ | Trillion Joule |
| UNFCCC | United Nations Framework Convention on Climate Change |

## Appendix B

## REFERENCE LIST


- Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)
- Website of United Nations Framework Convention on Climate Change, **http://unfccc.int**
- UNFCCC decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol
- UNFCCC, Clean Development Mechanism, Project Design Document (CDM-PDD) version 01 (with effect as of: August 29, 2002)
- UNFCCC document: Annx B to attachment 3, Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories
- Further Clarification on Methodological Issues, EB 10 Report, Annex 1, http://unfccc.int
- Annex 2 : Amendment to Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, EB 12 Report. http://unfccc.int
- Detailed project report on 7.5 MW Biomass based power project – Alwar Power Company Private Limited
- Website of Central Electric Authority (CEA), Ministry of Power, Govt. of India- **www.cea.nic.in**
- CEA published document "16th Electric Power Survey of India"
- Website of Department of Energy, Government of Rajasthan - http://www.rajenergy.com
- Website of Ministry Non-Conventional Energy Sources (MNES), Government of India, **www.mnes.nic.in**
- Website of Indian Renewable Energy Development Agency (IREDA), **www.ireda.nic.in**

- Order on Annual Revenue Requirement Filed by Rajasthan Rajya Vidyut Prasaran Nigam Ltd. Dated 31st July 2003
- Power Purchase Agreement between Project Promoter and Rajasthan Rajya Vidyut Prasaran Nigam Limited
- District level biomass assessment study of Alwar District, Rajasthan prepared by Technology, Projects and Market Research Group, New Delhi