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A. GENERAL DESCRIPTION OF PROJECT ACTIVITY

A.1 Title of the Project Activity:

26 MW Bagasse / Biomass based Cogeneration Power Project

A.2 Description of the project activity:

M/s SCM Sugars Limited (SCMSL) has proposed cogeneration power project with installed capacity of 26 MW, which will be implemented along with the green-field sugar project of crushing capacity 3500 Tones of Cane per Day (TCD) expandable to 5000 TCD. The project is an integrated sugar - cogen project.

Chief promoter of SCMSL is a visionary leader of Maddur *Taluk,* Mr. S.M.Shankar and M/s Nuziveedu Seeds Ltd., the second largest seeds production company in India with annual turnover of more than Indian Rupees (INR) 1000 million. Mr. S.M.Sankar represents as Chairman and M/s Nuziveedu Seeds is represented by Mr. M. Prabhakar Rao as Managing Director, Mr.K.R.Koteshwar Rao as Executive Director, Mr.Venkatramaiah and Ms. M. Asha Priya as Director. Other directors of the SCMSL are Mr. M.C.Satish and Dr. K. Ramesh.

Purpose

The purpose of the project essentially is to utilize available mill generated bagasse efficiently for generation of steam and electricity required for sugar manufacturing and export surplus power to state electricity grid and generate additional revenue.

The project will meet the captive steam and power requirement of sugar unit, co-generation (cogen) plant auxiliaries and power requirement of the colony. The balance power will be sold to state grid for additional revenue generation. In addition to this project activity will also lead to sustainable economic growth, conservation of environment through use of biomass fuel and Green House Gas (GHG) emission reduction. The project will also contribute in reduction of ever-increasing demand and supply gap of electricity.

The project promoters of SCMSL are of progressive nature and have adopted an efficient and modern technology, which is costlier than conventional technologies as well. To be competitive in the open market economy of India, SCMSL is developing this project under the Clean Development Mechanism (CDM) of United Nations Framework Convention for Climate Change (UNFCCC).

Project Abstract

SCMSL is implementing a modern Cogeneration Power Project (cogen plant) integrated with their Sugar project. The cogen plant will export surplus power to Karnataka Power Transmission Corporation Limited (KPTCL) grid after meeting captive requirement of steam and power, using mill generated bagasse as a fuel.

The major equipments of cogeneration power project under implementation comprises of 100 Tones Per Hour (TPH) capacity steam generator with the outlet steam parameters of 87 kg/cm^2 and 515^{o}C, 26 MW capacity turbine generator set of Double Extraction cum Condensing (DEC) type and electrical evacuation package for power export to KPTCL grid of 132 kV. The plant is designed with all other auxiliary plant systems like bagasse / biomass handling system with storage and processing arrangements, ash handling system, water treatment plant, cooling water system and cooling tower, De-Mineralized (DM) water plant, compressed air system and balance of plant including high pressure piping *etc.* for its successful operation.

Plant will operate for 340 days per annum, which includes 270 days of crushing season, and balance 70 days during off-season. Total power of 19 MW will be generated during season and 25.85 MW during off-season operation. After meeting steam and power requirements of Sugar plant and cogen auxiliaries 12.50 MW surplus power during season and 23.85 MW during off season is proposed to be exported to KPTCL grid. The power will be generated at 11 kV level and exported to 66 kV grid.

The bagasse generated will be used as fuel during the crushing season of 270 days and bagasse saved (33858 MT) during season along with the procured bagasse or equivalent biomass (36702 MT) will be used as a fuel for off-season operation of the cogen power project. Thus the proposed cogen plant will operate for 330 days in a year and export the green power to KPTCL grid.

Comparison of situation with business usual scenario and with proposed CDM project

Promoter being a progressive nature, has selected a “modern and energy efficient technology” with high pressure and temperature configuration of 87 kg/cm^2 for generation of steam and power as against the conventional trend of medium pressure configuration like 32 kg/cm^2 and 45 kg/cm^2. At some places, sugar mills have selected more than 60 kg/cm^2 pressure configurations and now sugar mills have started adopting high-pressure configuration of more than 80 kg/cm^2. Till date not more than three projects have been implemented in India with this configuration.

Detailed comparison of situation with business usual scenario and with proposed CDM project is tabulated as under.

Sr. No.	Parameters	With business as usual scenario	With new technology CDM project
1.	Cane crushing	3500 TCD (159 TCH)	3500 TCD (159 TCH)
2.	Bagasse generation/ available as fuel	30 % (47.70)	30 % (47.70)
3.	Steam Configuration	45 kg/cm^2	87 kg/cm^2
4.	Steam requirement (sugar mill + cogen plant)	75 TPH	85 TPH
5.	Condensing steam	Nil	15 TPH (season)/ 84 TPH(off-season)
6.	Power requirement (sugar mill + cogen plant)	5.00 MW	6.25 MW
7.	Boiler capacity	75 TPH	100 TPH
8.	STG capacity and Type	6 MW (Back Pressure type)	26 MW (DEC type)
9.	Bagasse combustion in boiler	34 TPH	42 TPH
10.	Bagasse Saving	13.7 TPH	5.70 TPH
11.	Use of saved bagasse	Sell out in the market	For off-season operation of cogen plant.
12.	Additional bagasse or equivalent biomass to be procured for off-season operation.	Nil	36702 MT
13.	Total power generation	5.00 MW	19.00 MW
14.	Power export to KPTCL grid during cane crushing season	Nil	12.50 MW (74.25 MU)
16.	Off-season power generation	Nil	25.85 MW
17.	Off-season power export to KPTCL grid	Nil	23.85 MW (40.00 MU)
18.	CO_2 emission reduction	Nil	Refer baseline

Implementation schedule

For complete erection and commissioning of high-pressure sugar co-generation plant requires around 14 -18 months from the zero date. The zero date can be the date of placement of the order for the main plant and equipment, which includes boiler and Steam Turbine Generator (STG) set. To achieve on time project implementation, good planning, scheduling and monitoring is required.

Project implementation work of SCMSL is under progress and it is expected to commission and commence the commercial operations of the project by April, 2004.

Project's contribution to sustainable development

The project activity will contribute to the 'Sustainable Development of India' in following ways. The project activity is a renewable energy power project, which will use mill generated bagasse of sugar mill as a fuel for power generation and export clean power to KPTCL grid. This electricity generation will substitute the power generation by KPTCL using conventional fuels. Thus will reduce the CO_2 emission reductions and save the conventional fuel.

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 humanity 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 sources.

Since this project activity will generate green power, it positively contributes towards the reduction in (demand) use of finite natural resource like coal/gas/oil, minimizing depletion or else increasing its availability to other important purposes.

The project activity, by feeding clean power to grid will eliminate an equivalent Carbon Dioxide which would be generated to produce electricity to cater to the electricity requirement, this will also include the electricity lost during transmission and distribution. Therefore this project activity has excellent environment benefits in terms of reduction in carbon emissions and coal resource conservation.

Thus the project activity will contribute to the Environmental and Social issues locally and globally by

- Export of 12.5 MW during season and 23.85 MW during off-season and thereby eliminating the generation of same quantity of power using conventional fuel.
- Conserving coal/oil, a non-renewable natural resource
- Making coal/oil available for other important applications
- Reducing GHG (Carbon Dioxide) emissions
- Contributing to a small increase in the local employment in the area of skilled jobs for operation and maintenance of the equipment.

A.3. Project Participants

- SCM Sugars Limited
  Koppa Village, Maddur Taluk
  Mandya District, Karnataka
  Pin code - 571428 INDIA
- INDIA

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 : Karnataka

A.4.1.3 City / Town / Community : Mandya/Maddur/Koppa

A.4.1.4 Detail on physical location, including information allowing the unique identification of this project activity:

Project is being implemented at SCM Sugars Limited (SCMSL), Koppa, District– Mandya, Karnataka, India. The propose site is situated at17 kms from Maddur town in Mandya district of the Karnataka State. Infrastructural requirements including water, motorable road, electricity *etc*. are available at proposed site. KPTCL electrical substation of 66 kV for power export is 2.5 km from site.

A.4.2 Category of the project activity

The project very closely matches the UNFCCC small-scale CDM project activity categories under Type-I, Electricity Generation for a system.

Main Category : **Renewable Energy Power project (Type-I)**

Sub Category : **Electricity Generation for a System (Bagasse / Biomass based Cogeneration Project)**

A.4.3 Technology to be employed by the project activity

Project is a grid-connected bagasse / biomass based cogeneration power plant with high-pressure steam turbine configuration.

The plant is designed to operate with boiler outlet steam parameters of 87 kg/cm^2 and 515^{0}C using bagasse as a main fuel. Turbo-generator is of double extraction cum condensing type with two low-pressure extractions. The cogeneration cycle for the plant is designed as regenerative cycle with high pressure feed water heater and one low-pressure feed water heater. The plant will generate more than three to four tones power as compared to the power generated by the sugar mill of same capacity having conventional low pressure and temperature steam configuration with back pressure turbines, common in India.

Although very few bagasse / biomass based cogeneration power plants are designed with above mentioned high pressure and temperature parameters in India, the technology is well proven worldwide. In India also, about three plants with 87-kg/cm^2 pressure and 515^{0}C temperature configuration have been commissioned (at the time of writing this report) and are operating successfully.

A.4.4 Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The proposed cogen power plant uses environmentally sustainable grown bagasse / biomass, that project leads to zero net GHG on-site emissions. The GHG emissions of the combustion process, mainly CO_2, will be consumed by sugar cane / plant species, representing a cyclic process. Since, the bagasse / biomass contains only negligible quantities of other elements like Nitrogen, Sulphur *etc*. release of other GHG are considered as negligible. The bagasse is expected to contain 50% moisture; this will keep the temperatures at steam generator burners low enough not to produce nitrogen oxides.

During season, SCMSL project will generate 19.00 MW and export 12.50 MW to KPTCL grid after meeting captive steam and power requirements of sugar and cogeneration plant. During off-season project will generate 25.85 MW and export 23.85 MW to KPTCL grid after meeting steam and power needs of cogen auxiliary along with small power requirement of sugar plant for maintenance purpose.

The plant will run at an availability factor of 70 % in first with gradual increase of 5% every year up-to 90 % from fifth year onwards. The crushing season is of 270 days and non-crushing /off-season period of around 60 days is envisaged for cogen plant operation. It is expected that the plant will be commissioned by April 2004 with full capacity, delivering 76.02 GWh of electric energy in the first year of project operation and 97.74 GWh from fifth year onwards to the KPTCL grid. No transmission and distribution losses are considered since the project is exporting power at high voltage of 66 kV at a short distance of around 2.5 km.

Therefore a conventional energy equivalent of 827.01 million kWh for a period of 7 years in Karnataka would be replaced by the exporting power from the proposed 26 MW bagasse/biomass based cogeneration power plant with CO_2 emission reduction of 696,167 tonnes. Without project activity, the same energy load would have been taken-up by thermal power plants and emission of CO_2 would have been occurred due to combustion of conventional fuels like coal / oil /gas.

As per the prevailing policy of the Government of Karnataka (GoK) and the provisions of KPTCL, Power Purchase Agreement (PPA) duly approved by Karnataka Electricity Regulatory Commission (KERC), an energy producer can export the surplus power only to KPTCL at Rupees 2.25 per unit (base year 1999-2000) with annual escalation of 5% for each succeeding year and shall be subject to revision from time to time. KERC is state's apex body for electricity regulations. For third party sale of electricity, SCMSL has to apply separately. (Source: PPA of SCMSL signed with KPTCL)

As per the projections by Central Electrical Authority power survey, the future energy requirement during the year 2006-07 and 2011-12 will be 44,748 MU's and 60,478 MU's and peak demand requirement for the same period will 7,740 MW and 10,460 MW respectively. Considering these projections, demand-supply gap is expected to widen in future. (Source – Infraline services)

In view of the above, the KPTCL will be a continuous buyer of energy from the SCMSL project. Further, the fulfilment of obligation to generate power from non-conventional energy sources by

at least 10% of the total installed generation capacity, in near future will be binding upon KPTCL to purchase power from projects of renewable energy type. (Such policy measures are under discussions). So far there is no such binding on KPTCL and SCMSL has taken a pro-active step to develop such technically advanced cogen project in the Karnataka state. The proposed cogen power plant is not only justified in view of shortage both in peak power availability and in energy but also due to eco-friendly power generation. This also justifies and explains that there will be no reduction of GHG in absence of the proposed SCMSL project.

A.4.5 Public funding of the project activity

No public funding from parties included in Annex I is available so far to the project.

B. BASELINE METHEDOLOGY

B.1 Title and reference of the methodology applied to the project activity

The methodology selected for baseline is "the weighted average emissions of current generation mix excluding historically identified must run projects".

At present details of approved methodology for baseline calculations for CDM projects of capacity more than 15 MW is not available on the UNFCCC website. However, reference has been taken from indicative simplified baseline and monitoring methodologies for selected small scale (CDM projects less than 15 MW) project activity categories.

As per the Kyoto Protocol (KP) baseline should be in accordance with the additionality criteria of article 12, paragraph 5(c), which states that the project activity must reduce emissions that are additional to any that, would occur in the absence of the certified project activity.

As per the paragraph 48 of decision-/CP –7 of Modalities and Procedures for CDM as defined in article 12 of KP, project participants shall select baseline methodology for a project activity from the following three alternative approaches mentioned, the one deemed most appropriate for the project activity, taking into account any guidance by executive board and justify the appropriateness of their choice.

a) Existing actual or historical emissions, as applicable;
OR
b) Emissions from a technology that represents an economically attractive course of action, taking into barriers to investment;
OR
c) The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 percent of their category.

In the selected methodology, so as to get the realistic baseline values, large hydro projects owned by state government, central government and private parties have been excluded. Since the implemented hydro projects requires very less operating cost and generate clean power without polluting the environment, considered here as 'must run' projects. By the proposed project there is remote possibility of replacement of such must-run projects. For conservative baseline

estimates the low-cost renewable projects have been included in the estimation of realistic baseline.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity

Since the project activity is a renewable energy power project it exports green power to state electricity grid. State grid generation mix comprises of power generated through various sources such as coal, oil and gas based thermal power plants, hydro power stations, renewable energy sources including small/micro hydro projects, bagasse/biomass based cogeneration/power projects *etc.* For baseline calculations this grid mix of Karnataka state excluding must-run large hydro power projects have been taken.

The grid analysis ensures that calculation of baseline factor is irrespective of the CDM project size.

B.3 Description of how the methodology is applied in the context of the project

The project activity feeds power to Karnataka state grid (KPTCL). Karnataka state is a power deficit state with energy shortage of about 9.1% and peak load shortage of about 13.2% (Infraline data). Project activity will increase installed capacity (marginally) of state grid, which will help to reduce energy and demand shortage. This addition will also avoid and delay/restrict the capacity addition of equivalent of project size, by implementation of conventional fossil fuel based power plant.

With respect to above, consideration of present and future scenario of Karnataka state electricity grid is the most appropriate boundary condition for analysis and baseline calculations. For detailed analysis, data/information was collected from government/non-government organisations and other authentic sources; a separate reference list is attached (Appendix–B) with this PDD. Above-mentioned methodology of baseline analysis is used as under for baseline calculation.

Required data / information from authentic sources regarding present generation mix, sector wise installed capacities, generation efficiencies, technology used for power generation, present condition to meet peak demand and energy requirements *etc.*

- Study of state and central governments installed capacity addition plans for next 7 years.

- Estimation of capacity additions by state / central / private sectors, based on the available information / policies.
- Study of present status of renewable energy and policy / plan for development of renewable energy projects in the state.
- Study of Karnataka government policy/guidelines of KERC/KPTCL for generation of electricity by private participants.
- To develop future electricity scenario for next 10 years.
- Calculation of CO_2 emission factors for conventional fossil fuels used by the state / central power generating stations.
- Calculation of net baseline factor of KPTCL grid using individual emission factors for conventional fuels used for power generation.
- Estimation of electricity generation by the project activity, which will replace grid electricity, which receives power from various power generation stations.
- Estimation of CO_2 emission reductions due to supply of clean electricity to KPTCL grid by the proposed project.

B.4 Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (i.e. explanation of how and why this project is additional and therefore not the baseline scenario)

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.

Further referring to Appendix A to Annex B document of indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories, project participants shall provide a qualitative explanation to show that the project activity would not have occurred anyway, at least one of the following 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) ;

- Investment barrier
- Technological barrier
- Barrier due to low penetration
- Barrier due to prevailing practice
- Regulatory barrier
- Competitive disadvantage barrier

- Managerial resources barrier
- Other barriers

Considering above, the proposed bagasse / biomass based cogeneration power project proves its additionality with following reasons;

a) Project will use mill generated bagasse of sugar mill as a fuel to generate electricity and export to KPTCL grid. In absence of project activity, the same electricity load would have been shared by power generation mix. Present KPTCL generation mix (for year 2001) comprises of around 59.43% thermal power plants, 40.36 % hydro projects and balance of only around 0.21% renewable energy projects. In thermal power plant category, coal based plants contributes for 91.35% and balance of 8.65% is diesel based plants. Both fossil fuels are responsible for substantial CO_2 emissions. Exports of power to KPTCL grid by the project activity will replace the conventional power received from generation mix by the clean power with net zero GHG emission.

b) Project activity will only use bagasse and biomass as a fuel which leads to zero net CO_2 on site emission. The CO_2 emissions of the combustion process, due to burning of bagasse will be consumed by sugar cane/plant species, representing a cyclic process.

c) In "business as usual scenario" portion of bagasse will be utilised by the SCMSL to meet the steam and power requirement of sugar mill and balance bagasse will be sold out and hence not used for power generation purpose and subsequent export to grid.

d) The project will use modern energy efficient technology with high pressure and temperature configuration. Major equipments of power plants are boilers and Steam Turbine and Generator (STG) sets. For the proposed project Boiler is of 87 kg/cm^2 pressure and STG is of double extraction cum condensing type. This is one of the most efficient way of power generation through bagasse / biomass with high power to fuel ratio. Thus the project removes technological barrier

e) Project cost of conventional cogeneration project with low-pressure configuration (below 40 kg/cm^2) for power generation with bagasse as a primary fuel will be drastically lower than the project cost of proposed high-pressure configuration. Since, low-pressure configuration will reduce power to fuel (bagasse) ratio, power generation/export to grid will be very less as compared to high-pressure configuration. Hence any other project under normal circumstances would propose the above route, whereas the current project by adopting a high cost, high efficiency option qualifies to remove the investment and technological barrier, respectively.

f) Proposed technology is new in India and only few projects have been implemented using above mentioned high-pressure configuration and modern technology. In the state of Karnataka there are more that 30 sugar mills, SCMSL is the third / fourth plant to adopt this efficient technology hence removes the barriers due to low penetration and barrier of prevailing practices.

g) The risks associated with this new and low penetrated technology is related to efficiencies of major equipments, trouble-free plant operation, availability of spares, availability of skilled manpower to operate the plant continuously *etc*. SCMSL will help in developing capacity building among the people of the region to run, operate and maintain cogen plant with advance technology by removing managerial resources barrier.

h) In India it is not mandatory for sugar mills to use high-pressure configuration for power generation from bagasse / biomass. Also export of surplus power to state / central grid is not mandatory. Thus by removing regulatory barrier, SCMSL is voluntarily implementing the proposed project with average exportable capacity of 14.56 MW, considering various technical, commercial, environmental, social and other benefits.

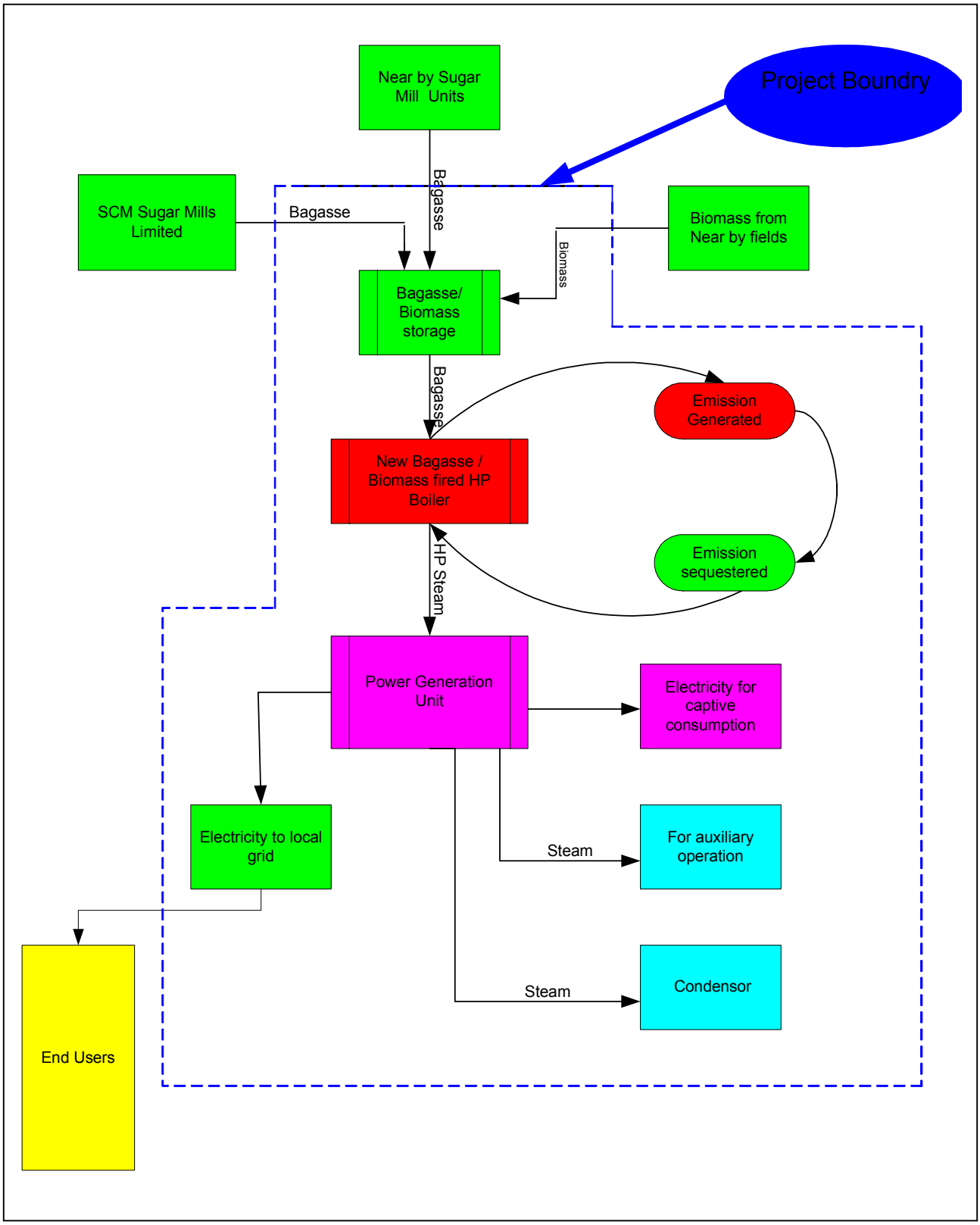
B.5 Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity:

The project boundary covers the point of fuel supply to the point of power export to the grid where the project proponent has a full control. Hence, project boundary is considered within these terminal points. However, for the purpose of calculation of baseline emissions UP state electricity grid is also included in the project boundary.

Thus, boundary covers fuel storage and processing, boiler, STG and all other power generating equipments, captive consumption units, Low Pressure (LP) steam consuming equipments, electricity grid, the transport of the bagasse from other nearby sugar factories and biomass from nearby region, if required. Low pressure extraction steam will be used for distillery process along with the auxiliary consumption of cogen plant, part of the electricity generated will be supplied to distillery, composting and proposed CO_2 plant along with the cogen auxiliaries.

Further, upstream emissions should be placed within the project boundary when the project developer can significantly influence these emissions. In principle this could mean that the bagasse / biomass source should be included within the system boundaries. However, the project will only use mill generated bagasse and agricultural residues that are available in abundance, *i.e.* the biomass source will not be influenced by the project. The project boundary will therefore not include the bagasse / biomass source. Using part of the available biomass in the proposed project will not disturb current domestic fuel needs; therefore the emissions from domestic fuel use are also not included in the system boundary.

Figure B.5: Flow chart and project boundary



B.6 Details of baseline development

B.6.1 Date of completing the final draft of this baseline section:

April 10, 2003

B.6.2 Name of person/entity determining the baseline:

Experts and Consultants of SCM Sugars Limited.

C. DURATION OF PROJECT ACTIVITY / CREDITING PERIOD

C.1 Duration of the project activity :

C.1.1 Starting date of the project activity :

The project is scheduled to commence commercial production by April 2004. Options are open to go for 7 years crediting period or 10 years crediting period as per UNFCCC guidelines.

Start date of the project : April 2004

C.1.2 Expected operational lifetime of the project activity:

Life time of the project : 20 to 25 years

C.2 Choice of crediting period and related information:

Option – 1 : 7 years (2004-2010) with two renewals
Option – 2 : 10 years (2004-2014)

For proposed project, the preferred credit time opted is for 7 years.

C.2.1 Renewable crediting period; at most seven (7) years per period

C.2.1.1 Starting date of first crediting period : April 2004
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 : April 2004
C.2.2.2 Length (max 10 years) : 10 years

D. MONITORING METHODOLOGY AND PLAN

The SCMSL project is primarily bagasse based cogeneration power project which utilises mill generated bagasse of sugar mill as a main fuel along-with biomass materials as supplementary fuel for generation of power and export to KPTCL grid. Being a renewable energy project, emissions generated during the operation of project will be sequestered in the growth of sugar cane / plant species and hence the project will have zero CO_2 emissions.

As the project is being implemented by SCMSL for power exporting purpose, its economic feasibility is predicated on the estimations of power tariff revenues. These revenues are based on the units exported as measured by meters at plant and check meters at the high-tension substation of the KPTCL. The monitoring and verification system would mainly comprise of these meters as far as power export is concerned.

The project employs latest state of art monitoring and control equipment that will measure, record, report, monitor and control various key parameters. The Major parameters monitored will be quantity and quality of bagasse / biomass fuels used, total power generated, power exported to the grid *etc.* These monitoring and controls will be the part of the Distributed Control System (DCS) of the entire plant. All monitoring and control functions will be done as per the internally accepted standards and norms of SCMSL.

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

At present guidelines regarding approved methodology for monitoring of CDM projects of capacity more than 15 MW is not available on the UNFCCC website. Out of 26.00 MW of total installed capacity of power generation by the project activity, a part of power is exported to KPTCL grid *i.e.* 12.50 MW during season and 23.85 MW during off-season, hence an average of 14.56 MW is considered for CDM benefit which is quite closer to 15 MW capacity. Hence monitoring methodologies / guidelines mentioned in the UNFCCC document available for small scale projects (Type:I-D) is considered as basis for developing new monitoring methodology for the proposed project. The new monitoring methodology designed for the project is attached with this PDD as Annex 4.

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

Since the project is a grid connected renewable energy project, emission reduction quantity totally depends on the units exported to the grid. The new methodology as mentioned as Annexure 4, covers the monitoring of units exported along with the other parameters affecting the power export and CO_2 emissions. Hence this is the most suitable monitoring methodology applicable for the project.

D.3. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

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
D.3.1	Power	Electricity generated	kWh	Measured	Continuous	> 95%	Electronic	2 years	
D.3.2	Power	Auxiliary consumption	kWh	Measured	Continuous	> 95%	Electronic	2 years	
D.3.3	Power	Power export	kWh	Measured	Continuous	> 95%	Electronic	2 years	
D.3.4	Fuel	Bagasse	MT	Measured	Hourly	> 95%*	Paper	2 years	
D.3.5	Fuel	Biomass	MT	Measured	Hourly	> 95%*	Paper	2 years	
D.3.6	Fuel	Bagasse	Kcal/kg	Actual sample testing	Fortnightly		Paper	2 years	
D.3.7	Fuel	Biomass	Kcal/kg	Actual sample testing	Fortnightly		Paper	2 years	
* 95% is of the hourly data recorded.									

D.4. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources.

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
D.4.1	Fuel	Bagass / Biomass trucks	Nos.	Measured	Daily	> 95%	Electronic/Paper	-	Not to be considered for calculation of emission reduction
D.4.2	Gas	Emission by trucks	kg	Calculated	Daily	> 95%	Electronic/Paper	-	Not to be considered for calculation of emission reduction

D.5. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

ID number	Data type	Data variable	Data unit	Will data be collected on this item? (If no, explain).	How is data archived? (electronic/paper)	For how long is data archived to be kept?	Comment
D.5.1	Power	Coal based generation	kWh	Yes, from SEB*	Paper	Till completion of crediting period	SCMSL will communicate KPTCL and request to provide the required data
D.5.2	Power	Diesel/oil based generation	kWh	Yes, from SEB	Paper	Till completion of crediting period	SCMSL will communicate KPTCL and request to provide the required data
D.5.3	Power	Naptha based generation	kWh	Yes, from SEB	Paper	Till completion of crediting period	SCMSL will communicate KPTCL and request to provide the required data
D.5.4	Gas	CO_2 emissions of coal plants	%	Yes, from SEB	Paper	Till completion of crediting period	SCMSL will communicate KPTCL and request to provide the required data
D.5.5	Gas	CO_2 emissions of Diesel /oil plants	%	Yes, from SEB	Paper	Till completion of crediting period	SCMSL will communicate KPTCL and request to provide the required data
D.5.6	Gas	CO_2 emissions of naphtha plants	%	Yes, from SEB	Paper	Till completion of crediting period	SCMSL will communicate KPTCL and request to provide the required data
* SEB : State Electricity Boards							

D.6. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored. (data items in tables contained in section D.3., D.4. and D.5 above, as applicable)

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
D.3.1	Low	Yes	This data will be used as supporting information to calculated emission reductions by project activity
D.3.2	Low	Yes	This data will be used as supporting information to calculated emission reductions by project activity
D.3.3	Low	Yes	This data will be directly used for calculation of emission reductions
D.3.4	Low	Yes	This data will be used as supporting information to calculated emission reductions by project activity
D.3.5	Low	Yes	This data will be directly used for calculation of emission reductions
D.3.6	Low	Yes	This data will be directly used for calculation of emission reductions
D.3.7	Low	Yes	This data will be directly used for calculation of emission reductions
D.4.1	Low	No	Not to be considered for emission reduction calculations
D.4.2	Medium	No	Not to be considered for emission reduction calculations
D.5.1	Low	No	This data will be collected from KPTCL
D.5.2	Low	No	This data will be collected from KPTCL
D.5.3	Low	No	This data will be collected from KPTCL
D.5.4	Medium	No	This data will be collected from KPTCL
D.5.5	Medium	No	This data will be collected from KPTCL
D.5.6	Medium	No	This data will be collected from KPTCL

D.7 Name of person/entity determining the monitoring methodology:

Experts and Consultants of SCMSL

E. CALCULATION OF GHG EMISSION BY SOURCES

E.1 Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary: (for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)

Since the proposed cogen power plant uses environmentally sustainable grown bagasse as main fuel, the project leads to zero net GHG on-site emissions. The GHG emissions of the combustion process, mainly CO_2, will be consumed by sugar cane / plant species, representing a cyclic process of carbon sequestration. Since, the bagasse / biomass contains only negligible quantities of other elements like Nitrogen, Sulphur *etc*. release of other GHG emissions are considered as negligible. The bagasse is expected to contain 50% moisture; this will keep the temperatures at steam generator burners low enough not to produce nitrogen oxides. Hence there is no net emission within the project boundary.

E.2 Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the project activity: (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 bagasse from nearby sugar mills or equivalent biomass from near by areas to proposed cogen power project at Koppa village. Calculation of leakage has been carried-out as under:

- Bagasse / equi. Biomass to be procured - 36,702 MT
- Average travel distance considered - 30 km
- Bagasse / biomass load per truck - 4 MT
- Number of return trips - 9176
- Consumption of Diesel per trip - 15 litres (4km/litre)
- Total Diesel consumption - 137,640 litre per annum
- CO_2 emission factor for Diesel (as per IPCC guidelines) - 74.1 tons of CO_2 / TJ
- Emissions per annum - 410 tons CO_2

The same type of CO_2 emission (leakage) occurs during transportation of coal from coal mines to respective power plants and distance between the coal mine and power plant is quite higher as compared to the average transportation distance considered between project site and bagasse / biomass collection centres 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 Karnataka grid and hence a small leakage due to transportation of bagasse/biomass has been neglected from the calculations.

E.3 The sum of E.1 and E.2 representing the project activity emissions:

Net emission by project activity is zero.

E.4 Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline: (for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)

KPTCL grid is considered for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. As mentioned in section C, in the KPTCL generation mix, coal, diesel/FO and naphtha based power projects are responsible for GHG emissions. Formulae used for estimation of the anthropogenic emissions by sources of greenhouse gases of the baseline.

- **Baseline Power generation**

$$P_{eh} = P_t - P_h$$

Where,

P_{eh} - Power generation by all sources, excluding large hydro projects.

P_t - Power generation by all sources of grid mix

P_h - Power generation by large hydro projects.

- **Sectorwise baseline Power generation**

$$\% P_{ceh} = P_c / P_{eh} * 100$$

$$\% P_{deh} = P_d / P_{eh} * 100$$

$$\% P_{neh} = P_n / P_{eh} * 100$$

Where,

$\%P_{ceh}$ - Percentage share of power generation by coal plants, out of total power generation excluding, power from large hydro projects.

$\%P_{deh}$ - Percentage share of power generation by diesel/FO plants, out of total power generation excluding, power from large hydro projects.

$\%P_{neh}$ - Percentage share of power generation by naphtha plants, out of total power generation excluding, power from large hydro projects.

P_c - Power generation by coal based power plants

P_d - Power generation by diesel/FO based power plants

P_n - Power generation by naphtha based power plants

P_{eh} - Power generation by all sources, excluding large hydro projects

- **Calculation of emission factor for each source of baseline generation mix**

$$NEF_B = NEF_C + NEF_D + NEF_N$$

$$NEF_C = EF_C * \%P_{ceh}$$

$$NEF_D = EF_D * \%P_{deh}$$

$$NEF_N = EF_N * \%P_{neh}$$

Where,

NEF_B - Net Emission factor of baseline

NEF_C - Net Emission factor for coal

NEF_D - Net Emission factor for diesel/FO

NEF_N - Net Emission factor for naphtha

EF_C - Actual Emission factor for coal

EF_D - Standard Emission factor for diesel / FO

EF_N - Calculated Emission factor for diesel / FO

- **Power generation and export by project activity**

$$TP_{exp} = SP_{exp} + OP_{exp}$$

$$SP_{exp} = SP_{gen} - SP_{cap}$$

$$OP_{exp} = OP_{gen} - OP_{cap}$$

Where,

TP_{exp} - Total clean power export to grid per annum by project activity

SP_{exp} - Power export to grid during crushing season only

OP_{exp} - Power export to grid during off- season only

SP_{gen} - Power generated during season period

OP_{gen} - Power generated during off-season period

SP_{cap} - Captive power consumption during season period

OP_{cap} - Captive power consumption during off-season period

- **Emission Reduction by project activity**

$$\mathbf{ER = TP_{exp} * (NEF_B - NEF_P)}$$

Where,

ER - Emission reduction per annum by project activity

TP_{exp} - Total clean power export to grid per annum

NEF_B - Net Emission Factor of baseline

NEF_P - Net Emission Factor of project activitybaseline

We have calculated Karnataka baseline as per the following new methodology, explained in Annex 4. as "The weighted average emissions of the current generation mix excluding must run projects"

As explained in Annex.4, baseline calculations were carried out as under

- For estimation of emissions of the current generation mix, weighted average of all resources, excluding only large hydro projects is considered.
- Actual performance data including CO_2 emission figures of coal based thermal power plants operating in Karnataka state are considered. Details of coal-based projects are as per table mentioned in Annex.5.
- Share of diesel-based projects is very small (5.14%) as compared to coal based; hence value of CO_2 emission by combustion of diesel is considered as 0.80 kg/ kWh as mentioned in the table I.D.1 of point no. 28 of UNFCCC guidelines for CDM PDD for small scale projects.
- For estimation of future variations in operating margin, 2 % improvement in emission reduction over a crediting period of 7 years is considering gradual improvement in efficiencies of thermal power plants of India.

- As per the data available, average CO_2 emission per kWh is considered as 1.010 kg/kWh for coal based plants, 0.80 for diesel / FO based plants, 0.65 for naphtha based plants.
- Step by step calculation of CO_2 emissions due to burning of coal, diesel / FO and naphtha for power generation and emission reductions by project activity is as under.

Step 1	**:**	Net emission factor for coal	=	Actual emission factor for coal x % of generation by coal out of total generation.
Step 2	**:**	Net emission factor for diesel/FO	=	Step 1 is to be repeated for diesel / FO.
Step 3	**:**	Net emission factor for naphtha	=	Step 2 is to be repeated for naphtha
Step 4	**:**	Total net emission factor	=	Net emission factor for coal + Net emission factor for diesel / FO + Net emission factor for naphtha
Step 5	**:**	Units exported to UPPCL		(Power export in season x season days x hours of operation) + (Power export in off-season x off-season days x hours of operation)
Step 6	**:**	Co_2 emission reduction	=	Units exported to UPPCL grid x total net emission factor.

Since there is a gap in demand and supply in KPTCL grid the export of power to KPTCL grid will replace or get absorbed to partially fulfil the KPTCL power requirement. If the same amount of electricity generated by a mix of coal and gas based power project, it will add to the emissions that is 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 proposed project activity.

E.5 Difference between E.4 and E.3 representing the emission reductions of the project activity:

Following formula is used to determine Emission reduction

$$ER = TP_{exp} * (NEF_B - NEF_P)$$

Where,

ER - CO_2 Emission reduction per annum by project activity

TP_{exp} - Total clean power export to grid per annum

NEF_B - Net CO_2 Emission Factor of baseline

NEF_P - Net CO_2 Emission Factor of project activity

E.6 Table providing values obtained when applying formulae above:

Using new baseline methodology for the proposed 26 MW CDM projects, CO_2 emission reductions are calculated and are tabulated as under.

Table E.6 Emission Reduction potential

Sr. No	Operating Years	Net Baseline Emission Factor (kg CO_2 /kWh)	Baseline Emissions (tones of CO_2)	Project Emissions (tones of CO_2)	Certified Emission Reductions, CERs (tones of CO_2)
1.	2004	0.85	89,036	0	89,036
2.	2005	0.85	93,703	0	93,703
3.	2006	0.84	97,082	0	97,082
4.	2007	0.85	101,769	0	101,769
5.	2008	0.85	106,312	0	106,312
6.	2009	0.84	105,029	0	105,029
7.	2010	0.82	103,236	0	103,236
		Avg. 0.842	Total 696167	0	Total 696167

Details are provided in the Appendix – C : Baseline Calculations.

F. ENVIRONMENTAL IMPACTS

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts

Assessment of Environmental Impact due to the project activity is carried out. A separate report is available with project proponent which is prepared as per the requirement of host country.

F.2. If 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 that has been undertaken in accordance with the procedures as required by the host Party.

The proposed project would create an impact on the environment in two distinct phases:

- During the construction phase and
- During the operation phase which would have long term and transboundary impacts.

Impacts During Construction

The impacts envisaged during the construction of the proposed plant are:

- Impact on Landuse
- Impact on Soil Quality
- Impact on Air Quality
- Impact on Noise Levels
- Impact on Terrestrial Ecology
- Impact on Aquatic Ecology
- Demography and Socio-Economics

The impacts during the construction phase are regarded as temporary or short term and hence do not affect the environment.

Impacts During Operation

The operational phase will involve power production using bagasse. The following activities in relation to the operational phase will have varying impact on the environment and are considered for impact prediction.

- Air quality
- Water Resources

- Noise Levels
- Soil
- Terrestrial Ecology
- Aquatic Ecology

Impact on Air Quality

The high-pressure boiler with biomass as fuel is primary source of air pollution from the plant. The pollutants envisaged from the proposed plant are Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_x) and Carbon mono-oxide (CO).

As such the bagasse has very low ash content (1.5%). The SPM as ash is controlled by proposed Electro-Static Precipitator (ESP) to ensure SPM levels less than 150 mg/Nm^3 in the stack. There will not be any Sulpher di-oxide (SO_2) emission considering bagasse do not contain sulphur. Moisture content of 50% in bagasse will keep the burner temperatures low so that NO_X formation will not take place. Similarly efficient combustion is envisaged so that CO formation do not take place and the CO_2 gets absorbed by the sugar canes harvested each year.

The stack height is 75m which will further help is fast dispersion of pollutants into the atmosphere, thus, reducing their impact in the vicinity of the project area.

Adverse impact on air quality are expected from truck/tractor exhaust and dust due to transport of bagasse and biomass from nearby sugar mills/regions. It is envisage that the truck/tractor will follow more stringent 'Bharat-II' emission norms which will reduce emission from truck/tractor in future. Further its is suggested to transport bagasse in compact 'bales' to reduce transportation cost, as the number of trips will reduce, emission due to truck/tractor exhaust will reduce.

Impact On Water Resources

The proposed plant's water requirement of 3000 m^3/day will be met by Shimsha river. Sufficient water is available to meet the plant requirement.

Impact on Water Quality

The wastewater is from de-mineralized (DM) water plant blow down which by design will have less than prescribed limit of 2100 mg/l Total Dissolved Solids (TDS). Other organic pollutant load of water is not expected from the power plant, however a two stage effluent treatment plant is proposed at the adjacent SCM sugar mill.

Impact on Noise

Plant equipments are designed to keep noise levels less than 90 dB(A). This is considering damage risk criteria as enforced by OSHA (Occupational Safety and Health Administration) to reduce hearing loss, stipulates that noise level upto 90 dB(A) are acceptable for 8 hour working shift per day. The noise levels in the work areas like generator room and boiler room are on the higher side but at these places, continuous attendance of workers is not required and workers will be on duty only in shifts as required. Provision of protective personnel equipment in addition will reduce the impact of noise level. Hence these noise levels may not be of much concern from occupational health point of view.

Impact on Soil

Most of the impacts on soil due to the project are negligible and restricted to the construction phase and will get stabilized during the operational phase. Solid waste generation as ash may get spilled over but due to its high nutrient value is used as manure and will not have adverse long term effect. In the region it is also used as soil conditioner.

Impact on Ecology

Air emissions from the plant are very low. SPM will contain primarily ash with high nutrient value and will be beneficial to the plants. Other pollutants like NO_X and CO are not envisaged in much quantity to adversely affect the plants or animals. There are no significant forests in the region.

The proposed project will also not put human pressure in the ecology. Only possibility is use of additional area which switch over from other crops to sugar cane farming.

General

The trans-boundary impact from the project are not envisaged. The project will directly employ 160 to 170 Skilled workers, about 200 unskilled workers and 32 Managerial staff. Apart from this there will by indirect employment. The employment and flow of funds due to project will help in improving socio-economic aspects of the region and improve quality of life of the people and farmers in the region.

G. Stakeholders Comments

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

Identification of Stakeholders

The proposed 26 MW bagasse / biomass based cogeneration power plant will be implemented by SCM Sugar Mills Limited in their proposed sugar factory premises, simultaneously. The proposed cogen project will use mill-generated bagasse as a fuel during season. In the off-season, saved bagasse and procured bagasse / biomass will be used as a fuel for cogen plant operation. The GHG emissions of the combustion process, mainly CO_2, will be sequestered by sugar cane / plant species, representing a cyclic process. So the project leads to zero net GHG on-site emissions.

The stakeholders identified for the project are as under.

- Elected body of representatives administering the local area (village *Panchayat*)
- Karnataka Power Transmission Corporation Limited (KPTCL)
- Karnataka Electricity Regulatory Commission (KERC)
- Karnataka Renewable Energy Development Agency Limited (KREDL)
- Karnataka Pollution Control Board (KPCB)
- Environment Department, Government of Karnataka
- Ministry of Environment & Forest (MoEF), Government of India
- Ministry of Non Conventional Energy Sources (MNES)
- Ground water / Irrigation department
- Non-Governmental Organisations (NGOs) of the nearby area
- Project Consultants
- Equipment Manufacturers / Suppliers

Stakeholders list includes the government and non-government parties, which are involved in the project at various stages. SCMSL applied / communicated to the relevant stakeholders to get the necessary clearances.

G.2. Summary of the comments received:

Stakeholders 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. SCMSL 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 role of the local people are as a beneficiary of the project. They supply raw material *i.e.* sugar cane for sugar mills and biomass for cogen plant. In addition to this, it also includes 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 will 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 essentially 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 not very high, 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 will help in improvising their quality of life.

Karnataka Pollution Control Board (KPCB) and Environment Department of Government of Karnataka have prescribed standards of environmental compliance and monitor the adherence to the standards

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

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.

Project consultants are to be 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.

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 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/clearances like Detailed Project Report (DPR), environmental clearances, power purchase agreement, local clearance *etc*. were considered while preparation of CDM project development document.