CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Revision history of this document

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

SECTION A. General description of the <u>small-scale</u> <u>project</u> <u>activity</u>

A.1. Title of the <u>small-scale</u> project activity:

8.0 MW Bagasse based power project at Naranja Sahakari Sakkare Karkhane Limited (NSSKL), Imampur Village, Bidar, Karnataka

A.2. Description of the <u>small-scale</u> <u>project</u> <u>activity:</u>

Naranja Sahakari Sakkare Karkhane Limited (NSSKL) a co-operative sugar factory was established in the year 2002 and commenced commercial operations in March 2002. The sugar mill has installed capacity to crush 2500 tons of sugar cane per day. NSSKL has set up a 8 MW cogeneration power plant (project activity) at Imampur Village (Near Janwada), Bidar district of Karnataka. The power from the 8 MW is used for auxiliary consumption during the season and the balance power is exported to the Karnataka State Electricity Board (KSEB) through Power Purchase Agreement (PPA) contract.

The project activity was commissioned in July 2002 along with the sugar mill. The cogeneration plant was generating steam and power of approximately 4.5 MW only for the auxiliary consumption due to the delay in the PPA being signed and laying of transmission lines and setting up the switchyard. NSSKL have started exporting power to the grid from 30th May 2005.

Bagasse from the mill is conveyed through the conveyors to the cogeneration plant and fed to the boiler. A 8 MW backpressure turbine is installed to utilize the steam. Boiler of 80 tons per hour, 45 kg/ cm^2, 440 °C, is installed to consume the bagasse. The turbine is connected with 11 KV, 3 phase , 50 Hz generators. The electricity is produced at 11 KV. The power required for the sugar mill operations is consumed at 11 KV and the excess power is stepped up to 110 KV substation at Kolar Substation for export to Karnataka Electricity Supply Company.

The purpose of the project activity is to utilize the bagasse available in the plant for effective generation of electricity for supply to state grid to meet the ever-increasing demand for energy in the state. The project activity would reduce the Green House Gas (GHG) emissions produced by the state grid generation mix, which is mainly dominated by fossil fuel based power plants.

Availability of Bagasse

The plant operates for a period of 230 days in a year. The plant operates in the season for 160 days and the balance 70 days during the off season. The sugar mill has a capacity to generate bagasse, which caters for the whole season and also a part of the off season. In case of exigencies, NSSKL procure bagasse from the nearby sugar mills to operate the plant.

Project activity's contribution to sustainable development

Government of India has stipulated social, economic, environmental and technological well-being as indicators for sustainable development in the interim approval guidelines[1] for CDM projects. NSSKL believes that the project activity has beneficial effect on agriculture, rural industries and employment in the region and has the potential to shape the economic, environmental and social life of the people in the region, specially unemployed educated/uneducated youth with meagre resources.

The co-operative structure of the sugar factory results in all the profits of the factory being returned to the members (who are all farmers supplying cane to the factory) in the form of a higher cane price. Therefore any improvements carried out at the factory will filter back to the farmers. The factory is directly involved in a number of extension activities with the farmers and provides educational and health facilities to its workers. The project itself has resulted in employment of more than 40 people and any profits from the project is invested back into the project itself.

The project will contribute to the sustainability of the factory and thus foster further economic development in the surrounding area through the existing activities outlined above. The renewable electricity generation will also reduce the existing and proposed fossil fuel based generation. This will have a positive impact on the environment by reducing the greenhouse gas emissions from the fossil fuel based power plants.

NSSKL is amongst the first co-operative sugar factory in Karnataka to initiate the CDM activity for its cogeneration power plant. This is of significant importance in the state given that there are over 20 co-operative factories that contribute to the livelihoods of the rural population.

In view of the above arguments, NSSKL considers that the project activity contributes to the sustainable development.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants(as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	Naranja Sahakari Sakkare Karkhane Limited	No

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

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

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A.4.1.1. Host Party(ies):

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[1] Ministry of Environment and Forest web site: http://envfor.nic.in:80/divisions/ccd/cdm_iac.html

India

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

Karnataka

A.4.1.3. City/Town/Community etc:

Village Imampur, Near Janwada, Bidar District

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

The project activity is located in the Survey number 64 of Village Imampur, Near Janwada, Bidar District. Imampur village is about 10 Km from Bidar town in of Karnataka state. The plant is located at an intersection of North Latitude $17^0 21$ to $18^0 16$' and East Longitude $77^0 12$' to $77^0 42$'. Sugar mill is located in the close vicinity of sugar cane producing areas. The geographical location of NSSKL is detailed in the maps below.
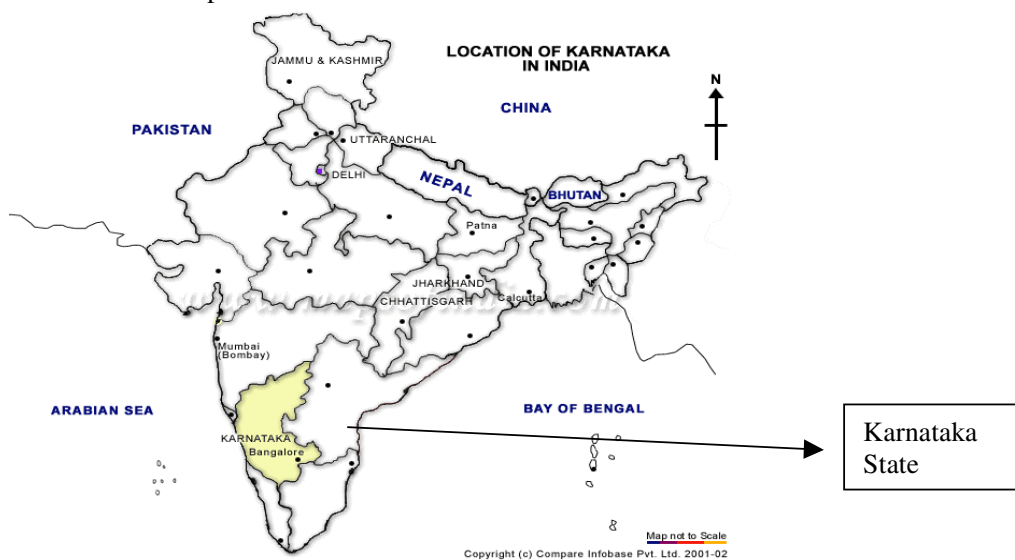
Bidar district
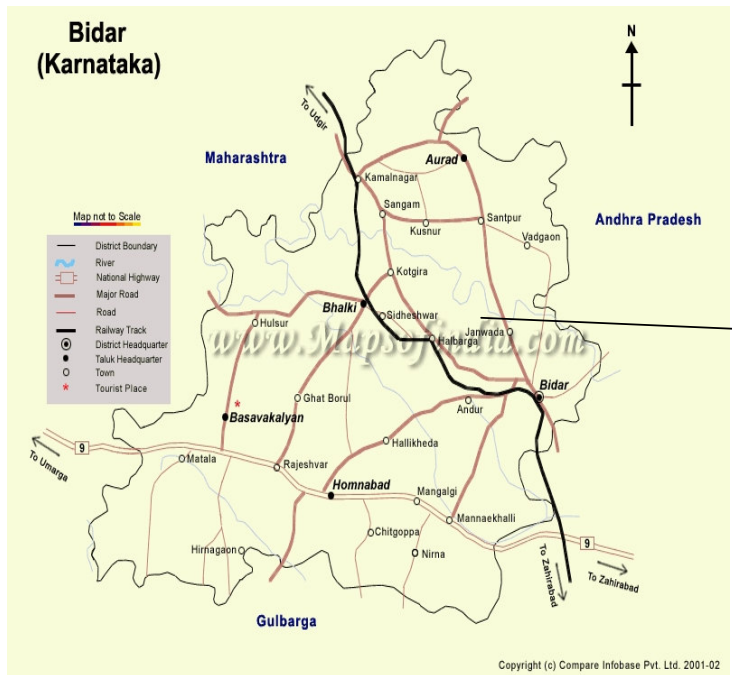
Naranja SSK Sugar mill

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

Type I: Renewable Energy Projects
Category-D: Grid Connected Renewable electricity generation

The project activity is a Bagasse based power plant. The installed/rated capacity of the turbine is only 8.0 MW, which is less than the limit of 15 MW for renewable energy project activities to qualify under Type I project activities.

As per the provisions of Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities, (Version 09: 28th July 2006) 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 fired generating unit".

Project activity comprises biomass based power plant supplying electricity to the Karnatka state grid which is a part of the Southern Grid. The emission factor of the southern grid is 0.957 kg CO_2/kWh. With above considerations, the Type I.D. is the most appropriate category for the project under discussion. The project activity does not comprise any electricity generation from non-renewable energy sources.

Technology of project activity

The power plant has boiler sized to produce a maximum of 80 TPH of steam and a backpressure turbine of 8.0 MW. The 8 MW turbine was installed in July 2002 The steam conditions at the boiler heat outlet are a pressure of 45 kg/cm^2 and temperature of 440 ^{0}C. The plant and equipment facilities have been designed to comply with the applicable stipulations / guidelines of statutory authorities such as State Pollution Control Board etc. Power is generated at 11 kV at the plant and is evacuated to grid at 110 kV.

Equipment Technical Details

Sr. No	Parameter	Details
A.	**Turbine**	
1.	Make	Triveni Industrial Engineering Ltd.
2.	Rating	8000 kw
3.	Inlet steam pressure	42 ata
4.	Inlet steam temperature	425^{0}C
5.	Turbine Speed	8200 rpm
6.	Alternator speed	1500 rpm
7.	Alternator Voltage	11 KV
B.	**Boiler**	
8.	Make	LIPI
9.	Net Steaming Capacity at MCR	80 TPH
10.	Working pressure	45 ata
11.	Working Temperature	440$\pm$5^{0}C
12.	Heating Surface Area	3816.53

There is no transfer of technology to the host country since the technology is available in India from reputed manufacturers.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

The emission reductions from the project will arise directly from exports of electricity to the grid. These exports result directly from the combustion of biomass (bagasse) which is a renewable source of energy. Hence energy generation from project activity does not lead to any GHG emissions.

The energy supplied by project activity to the state grid would reduce anthropogenic GHG emissions as per the combined margin carbon intensity of the grid, which is mainly dominated by fossil fuel based power plants.

Project activity would supply energy equivalent of approximately 77.0 million kWh to the grid in a period of 7 years thereby resulting in total CO_2 emission reduction of 73,700 tons. In the absence of the project activity equivalent electricity would have to be supplied to the grid customers from a mix of power plants supplying power to grid and consequent CO_2 emissions would occur.

A.4.3.1   Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2006-2007	10,529
2007-2008	10,529
2008-2009	10,529
2009-2010	10,529
2010-2011	10,529
2011-2012	10,529
2012-2013	10,529
Total Credits	**73,700**
Total number of crediting years	7 Years
Annual average over the crediting period of estimated reductions ((tonnes of CO_2 e)	10,529

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

No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

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

The project activity is not a debundled component of a large project activity as the project proponents have not registered or applied to register any small scale project activity:
   ➢ With the same project participants;
   ➢ Registered within the previous 2 years;
   ➢ in same project category and technology/measure; or
   ➢ whose project boundary is within 1 km of project boundary of the proposed small scale project activity

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SECTION B. Application of a baseline methodology:

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

Main Category: Type I - Renewable Energy Projects

Sub Category: I.D.-Grid connected renewable electricity generation

The reference has been taken from the list of the small-scale CDM project activity categories contained in 'Appendix B of the simplified M&P for small-scale CDM project activities-Version 09, 28th July 2006'

B.2 Project category applicable to the small-scale project activity:

Appendix B of the simplified M&P for small-scale CDM project activities (Version 09) provides indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories. The excess power generated by the cogeneration power plant after meeting the sugar plant requirements is exported to the state grid and hence also falls under category: I.D.-Grid Connected renewable electricity generation.

Baseline for projects under Type I.D has been detailed in paragraph 9 of Type I.D. described in Annex B of the simplified modalities and procedures for small-scale CDM project activities. 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;

OR

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

Considering the available guidelines and the present project scenario, Southern grid has been chosen for baseline analysis by selecting "The average of the approximate operating margin and the build margin (combined margin)" for baseline calculations. Further details of the baseline are given in section B.5.

The operating margin estimates the effect of the project activity on the operation of existing power plants and the build margin estimates the effect of the project activity on the building of future power plants. There is a gap between demand and supply in the Southern grid so there is likely addition of more power plants in the grid mix. Combined margin is calculated as average of operating and build margin, which takes into account the trend of the types of power plant coming up in the grid, thus the uncertainties get addressed by taking the said approach for baseline calculation

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The implementation of the bagasse based project activity is a voluntary step undertaken by NSSKL with no direct or indirect mandate by law. The main driving forces to this 'Climate change initiative' have been:

- GHG reduction and subsequent carbon financing against sale consideration of carbon credits.
- Rural Development of the region by creating job opportunities for the local people.
- Demonstration of developing such projects to the other entrepreneurs.

However, the project proponent was aware of the various barriers associated to project implementation. This project activity is a renewable energy project with net zero CO_2 emission due to the carbon sequestration. Plants, which are sources of biomass are re-grown at the same rate as it is being harvested, act as a sink for atmospheric carbon dioxide and the net flux of CO_2 to the atmosphere is zero. The power generated by the project activity will replace the Southern State electricity and an analysis of the southern state grid generation mix gives the conservative baseline CO_2 emission factor of 0.957 $kgCO_2/kWh$ for the credit period. Therefore the project activity will reduce the anthropogenic emissions of greenhouse gases by sources below those that would have occurred in absence of the registered CDM project activity.

The barriers faced by the project activity are discussed below:

Barriers

Although it is well known fact that, power generation with biomass fuels has various advantages, however, it is still not widely applied, particularly in the developing countries like India. For private parties to venture into such an unexplored area, it is a steep diversification from their core industrial economics to power sector economics, where the project proponents needs to meet requirements and challenges of power policies, delivery/non-delivery of power, techno-commercial, social, environmental problems etc. associated with the power project.

Although there is a good potential for IPP's to implement such power projects in India very few have adopted for the similar project activity. The project overcomes the various barriers by taking up the risk of implementing power project, which is not a core business of the promoter group. Further, as per the Electricity Act 2003, the projects that have the lowest tariff will be the market players in future as it encourages competitive tariffs. In this view, the cost of generation of unit with coal will be lower due generation at higher capacity and with use of advanced technologies. Therefore, as a result of enactment of the Electricity Act 2003, the new power projects that would come up will be of coal based so as to be feasible and be competitive in market. This is a policy related threat to the project activity.

As per the attachment A to Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website, to prove that the project is an additional, explanation regarding the project activity would not have occurred anyway due to at least one of the following barriers is required:

    (a) Investment barrier
    (b) Barrier due to prevailing practice
    (c) Other barriers

In this view, the significant barriers to the project that NSSKL has over come and continue to face and operate the power plant are as under:

a)   Investment Barrier to project implementation

In order to implement the project, the project proponent was required to Secure Financial Closure

High upfront cost, lack of easy and long-term financing, project cash flows *etc.* are the known 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 CDM renewable energy project is a quite difficult proposition.

The project has faced significant funding barriers and the delay in funding has been a major problem in implementing the project. As highlighted earlier the co-operative sugar factories distribute their entire "profits" through their cane payment system. This results in no internal accruals to carry out major investments.

Financial closure for the project activity has been achieved at high interest costs. In NSSKL project, 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 biomass as primary fuel and in selling power to the grid are some of the reasons for the delay in financial closure.

The total project cost of the project was estimated at about INR 236.5 Million. The means of finance for the project were from the farmers, Government Share Capital i.e. National Cooperative Development Cooperation (NCDC) and the term loan from the financial institutions. NSSKL had applied for the loan to various financial institutions and IREDA. However, as the project was of a cooperative sector, with no prior power generation experience, IREDA and the nationalized bank[2] rejected the application.

The government share capital from NCDC was also withheld as NCDC indicated that they would release the finance only when the term loan from the financial institutions was sanctioned. NSSKL in order to commence the operations and also secure the finance from NCDC, approached the District Central Co-operative bank of Bidar and secured the bridge loan at a higher interest rate of 16%. Meanwhile, NSSKL approached the Rural Electrification Cooperation (REC) New Delhi and Power Finance Cooperation[3], for the term loan. There has been considerable delay in sanctioning the loan by the REC and the loan has not been approved as yet resulting in NSSKL continuing to pay higher rate of about 8% and thereby incurring additional financial burden. Till date NSSKL has paid an additional interest on the term loan of about

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[2] Central Bank of India

[3] Rural Electrification Cooperation on 29/10/2001 and Power Finance Cooperation on 16/11/2002

INR 55.08 Million. CDM revenues if made available, will offset the financial burden of NSSKL. Carbon financing over the crediting period as one of the cash in flows of the project will add more credibility to NSSKL's loan repayment capability.

b) Prevailing practice barrier:

The Business As Usual (BAU) situation for power generation in Karnataka can be considered as coal based thermal power generation with dominating share of more than 55% in the total power generation. At present, power generation with Biomass (bagasse) as a fuel, is not a common prevailing practice in India and Karnataka State also. The barriers inherent in bagasse cogeneration projects may also be highlighted by the lack of projects that have come up. Before the project activity was implemented there were only few cooperative sugar mills in the state of Karnataka generating and exporting power to the grid. Till date, amongst the 21[4] cooperative sugar mills, there are only about 5 cooperative sugar mills who export power to the grid. NSSKL is amongst the first few cooperative sugar mills who have set up a cogeneration system with power export to the grid.

The table below shows the status of all the cogeneration projects commissioned as on December 2004 in the state of Karnataka. As per the latest data available from KREDL, the total potential available in the Karnataka state for cogeneration projects is about 1000[5] MW and the Karnataka government has allotted about 46 projects totalling to about 815.1 MW. However, there are about only 15 projects totalling to about 293.8 MW, which have been commissioned.

Table B1: Common Practice Analysis for NSSKL project activity

Total number of Sugar Mills in Karnataka (as on Dec 2004)	46
Cooperative Sugar Mills	21
Sugar Mills under private sector	22
Sugar Mills under joint sector	3
Sugar Mills with co-generation and export of power to grid (as on December 2004)	10
Karnataka Renewable Energy Development Limited (KREDL)	

This illustrates the low penetration of such renewable energy projects. We may conclude from the above statistics that the project under discussion is not a common practice in the region.

It is very evident from the table below that the project activity was not a business as usual during its commissioning.

c) Other barriers

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[4] Karnataka Renewable Energy Development Limited (KREDL)

[5] Karnataka Renewable Energy Development Limited (KREDL), as of 30/9/2005

Institutional barriers:

NSSKL is selling power to KSEB through a 10 year Power Purchase Agreement (PPA) contract. For their cash in-flows the project proponent depends on the payments from KSEB against the sale of electricity to the grid. KSEB need to pay NSSKL against the sale of electricity within a period of one month. However, since the project has exported power to state electricity board, there has been a delay of about 2-3 months in the payment. This has resulted in delay of payment by NSSKL to the financial institutions, for which NSSKL is paying additional interest on the interest. It is envisaged that the delay in payment from KSEB would continue which would result in a financial burden to NSSKL.

NSSKL had approached KPCL in the year 2002 to sign the PPA and the prevailing rate during that period was INR 3.10/kWh with 5% escalation. However, there had been considerable delay in signing the PPA with KPCL and after many deliberations, the PPA was signed in March 2005 at the prevailing rate of INR 2.80/kWh with 2% escalation. The delay in signing the PPA and reduction in tariff has resulted in a financial loss of about INR 12.62 millions.

NSSKL had implemented the cogeneration project in May 2002 and could have exported power since it's commissioning. However, due to the delay in signing the PPA, NSSKL could not export power to the grid and not operate the plant at its full capacity. This has resulted in huge financial loss in the tune of INR 93.5 Million to NSSKL. The CDM funds if made available, would offset the financial burden of NSSKL and also ensure that the project does not incur any further financial losses.

NSSKL has signed the PPA that has a penalty clause for non-supply of a certain monthly amount of electricity. In summary the terms of the PPA present a number of risks to the project and the CER revenue will act as a financial buffer that can alleviate the impact of these risks.

Expected policy effects:

The project will have a major effect of The New Electricity Act-2003. This Act consolidates laws relating to electricity generation, transmission, distribution and trading.

As per this Act, bulk purchase of power by SEB's should be routed through tendering process with selection of power supplier offering lowest rate on competitive basis. Since, this Act supports the power generation with lower tariffs, the power generated by the cheaper but carbon emissive fossil fuels like coal and lignite will be purchased by the SEB's and individual bulk consumers with preference. As a result, the power generated using renewable fuels like biomass will get lower priority from these buyers as its generation cost is higher than the generation cost from conventional fuels like coal and lignite.

Due to this new Electricity Act 2003, promoters of NSSKL may be required to compromise on the selling price of electricity, which will adversely affect the economics of the project. This is a policy related threat to this project.

In such scenario, where the promoter may get forced to offer much lower tariff than the present PPA, CDM funds will certainly help to reduce the gap between the tariff offered by the project activity and the other power generators/suppliers which generate power with lower cost but high carbon emissive fuels like coal and lignite.

This further justifies the need of CDM funds for the project activity, which will help to improve the project feasibility and financial sustainability if the electricity tariffs reduce in future.

Increased Fuel Prices

A further barrier of the project is the period over which the plant operates. The plant operates during the season for about 160 days and during off-season for another 70 days. However over the last three years the average days of operation have been 150 days with a low of 107 in 2003/04. Whilst these have been exceptional it does highlight the volatility in cane production and a further risk to the project.

NSSKL had set up the project activity with an intention of procuring bagasse from outside during the off season and operate the plant at its full capacity as it was financially viable for NSSKL to purchase the fuel. However, with the increasing prices of the fuel for the past few years, it was and is not financially viable for NSSKL to purchase fuel and operate the plant for the whole year at its 100% capacity. NSSKL, presently operates the plant at 70% capacity, though it could operate at its full capacity and export more to the grid thereby replacing more fossil fuel power. The prices of fuel in the past three years have ranged between INR 600/ton to INR 1200/ton. The CDM funds, if available, would ensure NSSKL operates the plant at its full capacity and export more green power.

NSSKL as an effort towards sustainable development and improving the socio economic condition of the farmers, pay the farmers INR 1375 per ton of cane as against the Statutory Minimum Prices (SMP) prescribed by the Government of India of INR 1075 per ton of cane.
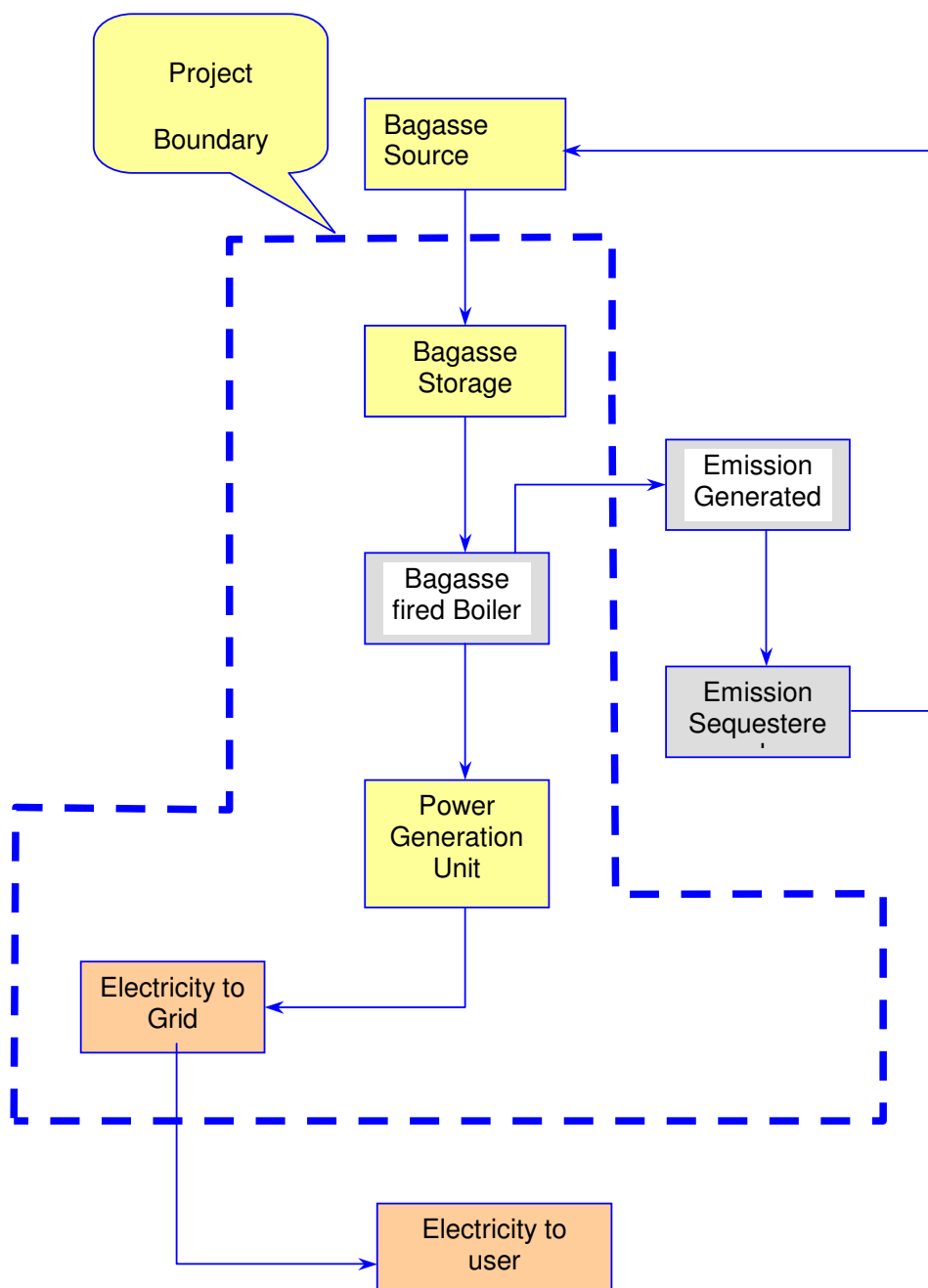
Above barriers are strong enough to affect the decision of project implementation and in case if due to any of the above reason project implementation cancels, the proposed grid to which the project will feed power will alternatively get the power from the project alternatives as discussed above. Since, these alternatives are more GHG emissive, project option only can reduce the GHG emissions. Although there is a good potential for cogeneration projects in India very few have adopted for the similar project activity due to above strong barriers. Therefore, the proposed renewable energy project is an additional activity as it over comes the above barriers by taking up additional risk of implementation.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

As mentioned under paragraph 4 of Type I.D. of '*Annex-B of the simplified modalities and procedures for small-scale CDM project activities*', project boundary encompasses the physical, geographical site of the renewable generation source. For the project activity the project boundary is from the point of fuel storage to the point of electricity supply to the grid interconnection point where the project proponent has full control.

Thus, project boundary covers fuel storage, boiler, steam turbine generator and all other accessory equipments. However, for the purpose of calculation of baseline emissions, Karnataka state electricity grid is also included in the boundary.

Flow chart and project boundary is illustrated in the following diagram:

Project

Boundary

Bagasse
Source

Bagasse
Storage

Emission
Generated

Bagasse
fired Boiler

Emission
Sequestere

Power
Generation
Unit

Electricity to
Grid

Electricity to
user

B.5. Details of the <u>baseline</u> and its development:

Using the methodology available in paragraph 9 of Type I.D. described in Annex B of the simplified modalities and procedures for small-scale CDM project activities, **the average of the approximate operating margin and the build margin** (in $kgCO_{2e}qu/kWh$) of current generation mix of Southern grid is used for the calculation of baseline.

Base line data

Carbon emission factor of grid

Southern Grid's present generation mix, sector wise installed capacities, thermal efficiency, and emission co-efficient 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 9 of Type I.D. mentioned in Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities for grid systems.

The provisions require the emission coefficient (measured in kg CO_2equ/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_2equ/kWh) of the current generation mix.

Complete analysis of the electricity generation has been carried out for the calculation of the emission coefficient as per paragraph 9 (a) given above.

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 grid mix) and the build margin (i.e. weighted average emissions of recent capacity additions) of the selected grid and the baseline emission factor would therefore incorporate an average of both these elements.

Operating Margin

The "approximate operating margin" is defined as 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;

The project activity would have some effect on the operating margin of the Southern Grid. The carbon emission factor as per the operating margin takes into consideration the power generation mix of 2005-2006 excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation of the selected grid, thermal efficiency and the default value of emission factors of the fuel used for power generation.

The formulae are presented in Section-E and the calculations are presented in an excel sheet as Enclosure

1. Carbon Emission Factor of grid as per Operating Margin is 1.164 kg CO_2/kWh electricity generation.

Build Margin

The "build margin" emission factor is the weighted average emissions (in kg CO_2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants. In order to calculate the build margin, most recent 20% of the existing plants is taken into consideration, the details of which are given in Annexure-3.

Carbon Emission Factor of grid as per Build Margin is 0.750 kg CO_2/kWh electricity generation.

Net Carbon Emission Factor Grid as per combined margin = (OM + BM)/2 = 0.957 kg of CO_2 / kWh generation respectively. (Refer to Excel Sheet Annex 3).

B.5.2 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:
10/06/2006

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

Naranja SSK Limited

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

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C.1.1. Starting date of the small-scale project activity:

18/01/01

C.1.2. Expected operational lifetime of the small-scale project activity:

25y

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

Project activity would use renewable 7 year crediting period

C.2.1. Renewable crediting period:

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

01/01/2007

C.2.1.2. Length of the first crediting period:

7 y, 0m

C.2.2. Fixed crediting period:

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C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Application of a <u>monitoring methodology</u> and plan:

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D.1. Name and reference of approved <u>monitoring methodology</u> applied to the <u>small-scale project activity</u>:

Title: Monitoring Methodology for the categories:

I D – Grid Connected Renewable electricity generation

Reference: 'Paragraph 13' as provided in Type I.D. of 'Appendix B of the simplified M&P for small-scale CDM project activities-Version 09, 28th July 2006'

D.2. Justification of the choice of the methodology and why it is applicable to the <u>small-scale project activity</u>:

As established in Section A.4.2, the project activity falls under Category I.D and can use the monitoring methodology for type I.D project activities.

The methodology requires the project-monitoring plan to consist of metering the electricity generated by the renewable technology. In order to monitor the mitigation of GHG due to the project activity, the total energy generated and exported needs to be measured. The net energy supplied to grid by the project activity multiplied by emission factor for southern grid, would form the baseline for the project activity.

GHG SOURCES

Direct On-Site Emissions

Direct on-site emissions after implementation of the project arise from the combustion of bagasse in the boiler. These emissions mainly include CO_2. However, CO_2 released is taken up by the sugar cane when it grows, therefore no net emissions occur.

Direct Off-Site Emissions

Direct off-site emissions in the project activity arise from the biomass transport.

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 power plant. Considering the life of the cogeneration plant and the emissions to be avoided in the life span, 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 include GHG emissions resulting from the 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, emissions from this source is also too small and hence neglected.

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	Total electricity generated	kWh	m	Continuous	Total	Electronic/Paper	2 years after crediting period	Measured in plant premises and monitored and recorded continuously
2	Power	Power export	kWh	m	continuous	Total	Electronic/Paper	2 years after crediting period	Measured at supply and receiving end.
3	Power	Auxiliary Consumption	KWH	M	Continuous	Total	Paper	2 years after crediting period	Measured in the plant.

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	Bagasse Quantity	MT	M	Hourly	100 %	Paper	2 years after end of crediting period	-
2	Fuel	Biomass (other than bagasse) Quantity	MT	M	Hourly	100 %	Paper	2 years after end of crediting period	-

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

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.(a)1	Low	Yes	This data will be used as supporting information to calculated emission reductions by project activity.
D.3.(a)2	Low	Yes	This data will be used for calculation of emission reductions by project activity.
D.3.(a)3	Low	Yes	This data will be used for calculation of emission reductions by project activity.
D.3.(b)1	Low	Yes	This data will be used as supporting information to calculated emission reductions by project activity.
D.3.(b)2	Low	Yes	This data will be used as supporting information to calculate emission reductions by project activity.

Key Project Parameters affecting Emission Reductions

Total Power generated by the project: The power exported by NSSKL would be monitored to the best accuracy and as per the table given in section D.3.

Auxiliary consumption:

The power consumed by the Sugar plant and the cogeneration plant would be monitored to the best accuracy and as per the table given in section D.3.

Net Power exported to the grid:

The project revenue is based on the net units exported by NSSKL.

The general principles for monitoring above parameters are based on:

> ➢ Frequency

> ➢ Data recording

> ➢ Reliability

> ➢ Experience and training

Frequency

Monthly joint meter reading of main meters installed at interconnection point are taken and signed by authorised officials of NSSKL and KSEB on the first day of every month. Hourly data recording by the shift in-charge of NSSKL will be there at generation end.

Data recording

Records of this joint meter reading is maintained by NSSKL and KSEB. Daily and monthly reports stating the generation, auxiliary consumption, and net power export is prepared by the shift in-charge and verified by the plant manager.

Reliability

For measuring the delivery and import of energy by NSSKL one main meter and check meter are maintained at interconnection point. Main meter reading would form the basis of billing and emission reduction calculations, so long the meter is found to be within prescribed limits of error during half yearly check.

Monthly joint meter reading of main meters installed at interconnection point is taken and signed by authorised officials of NSSKL and KSEB on the first day of every month. Records of this joint meter reading is maintained by NSSKL and KSEB.

Main or Check meter would be replaced by spare set of meter by KSEB with, mutual consent of the parties when a faulty meter is required to be removed.

The Main and Check meter installed at interconnection point would be jointly inspected and sealed on behalf of the parties and shall not be interfered with, by either party except in presence of the other party.

If during half yearly test check, main meter is found to be within permissible limits of error and check meter is found to be beyond permissible limits, then billing as well as emission reduction calculation would be as per main meter as usual. However, the check meter would be calibrated and replaced with spare tested calibrated meter, as may be necessary.

If during the check, the main meter is found to be beyond permissible limits of error but check meter is found to be within permissible limits, then billing as well as emission reduction calculation for the month and upto date and time of the calibration/replacement of defective main meter shall be as per check meter. The main meter would be immediately calibrated and replaced with spare tested calibrated meter, as may be necessary where after billing as well as emission reduction calculation would be as per main meter.

If during yearly test checks, the main meter and check meter are both found to be beyond permissible limits of error, then both meters would be immediately replaced with spare calibrated meters and correction would be applied to data recorded by main meter to arrive at correct energy figures for billing as well as emission reduction calculation purposes for period of the month and upto time of calibration/replacement of defective meter. Corrections in billing whenever necessary shall be applicable to the period between date and time of previous test calibration and date and time of test calibration in current month when error is observed and correction would be for full value of absolute error. For the purpose of correction to be applied the meter shall be tested at 100, 75, 50, 25 and 10 % load at 1.0, 0.85 and 0.75 lag power factors. Of these fifteen values, the error at load and power factor nearest the average monthly load served at the point during the period shall be taken as error to be applied for correction.

In case main meter at interconnection point becomes defective, billing and emission reduction calculation would be based on readings of check meter installed. The defective equipment would be immediately replaced by KSEB.

If both, main and check meters become defective, then emission reduction calculations for the month would be based on hourly generation and auxiliary consumption data recorded by NSSKL at generation end.

The meter installed at generation end would be test checked for accuracy yearly. If during test check, meter is found to be beyond permissible limits, then the meter would be calibrated or replaced with spare tested calibrated meter, as may be necessary.

NSSKL shall archive and preserve all the monthly invoices raised against net saleable energy, for at least two years after end of the crediting period. NSSKL shall also archive the complete metering data at generation end on paper and all the data would be preserved for at least two years after end of the crediting period.

The amount of biomass purchased, if any, will be based on invoices / receipts from fuel contractors. The amount of biomass fed to the boiler would also be verified through audit reports.

All the records shall be kept at site itself.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

The Deputy Chief Engineer (Cogeneration) is responsible for the operation and maintenance of the power plant. Mechanical engineers for the operation and maintenance of the power plant assist the dy. chief engineer. Similarly, electrical engineers assist the Deputy Chief Engineer for the power generation. The Deputy Chief Engineer is a qualified diploma/degree engineer with 5-7 year experience in power industry. The General Manager would be overall responsible for the operation and maintenance of the power plant.

Deputy Chief Engineer is responsible for the hourly data recording of NSSKL at generation end. The Daily and monthly reports stating the generation and net power export would be prepared by the Engineer and verified by the Deputy Chief Engineer who would maintain the records. Records of joint meter reading would be maintained at site. The Deputy Chief Engineer maintains records with regard to the operation and maintenance of the boiler and turbine.

As and when required and identified, people are sent to short term training courses on operation and maintenance of the power plant. Similarly, in house training is also provided on need basis. The General Manager and the Deputy Chief Engineer are responsible for identifying the training needs and maintaining the undergone training records.

Adequate fire fighting and safety equipment are installed in the plant. The Deputy Chief engineer is responsible for the upkeep of the safety and fire fighting and maintain necessary records.

Calibration of the main meters recording the power exported is done by KPTCL every year and necessary records are maintained by both KPTCL and NSSKL. Similarly, calibration of the weigh bridge recording

the quantity of fuel, is done by department of weights and measures every year and the monitoring is done every month. The Assistant Manger- Personnel department maintains records of the same.

In order to ensure that the project emissions are being regularly monitored and to ensure the function of the monitoring system, the General Manager would carry out an audit every six months and maintain necessary records of the same. Necessary corrective and preventive action based on the audit findings would be carried out.

D.6. Name of person/entity determining the <u>monitoring methodology</u>:

Naranja SSK has determined the monitoring methodology and they are project participant as listed in Annex 1 of this document.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:
>>

E.1.1   Selected formulae as provided in appendix B:

Since category I.D. does not indicate a specific formula to calculate the GHG emission reduction by sources, the formula is described below in E.1.2

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:

The project activity leads to GHG on-site emissions in the form of CO_2 emissions from combustion of bagasse. The project activity uses an environmentally renewable resource as fuel for power generation. The plantations, representing a cyclic process of carbon sequestration, will consume the CO2 emissions from bagasse combustion process. Since the bagasse contains negligible quantities of other elements like Nitrogen, Sulphur etc. release of other GHG emissions are considered negligible. GHG emissions during on-site construction work are negligible compared to GHG reductions in the project lifetime and are not accounted for. Similarly emissions associated with transportation of construction materials are ignored. Hence there would be zero emissions from the project activity.

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

As prescribed in Appendix B of the Simplified Modalities and Procedure for small-scale CDM project activities, for Category I.D leakage estimation is only required if there has been any transportation of either any equipment or fuel. As biomass is transported from nearby area, leakage due to the transport of fuel is taken into account.

Emissions due to transportation of biomass		
Total biomass required	Ton/year	12500
Biomass transported by truck/tractor	Ton/year	12500
Biomass load per truck	Ton	10
Total no. of trips		1250
Average distance between project site and collection centres	Km	50

Consumption of diesel per trip (to and fro)(@5km/lit)	Litres	20
Total diesel consumption	Litres	25000
Calorific value of diesel	TJ/lit	0.0000283
Emission factor for diesel	t CO_2/TJ	74.1
Emissions due to transportation of biomass	**t CO_2 /year**	**5**

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

5 T of project activity emissions are envisaged.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs 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:

Southern grid is considered for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. As mentioned in Chapter B, in the southern grid generation mix, coal and gas based power projects are responsible for GHG emissions. We have considered here the average of the approximate operating margin and the build margin (Combined Margin) for baseline calculations

Formula used for estimation of the anthropogenic emissions by sources of greenhouse gases of the baseline is as under.

Scenario I: The average of the approximate operating margin and the build margin   **(Combined Margin Method)**

● **Baseline Power generation**

$$P_{wlc} = P_{tot} - P_{lrc}$$

Where,
P_{wlc} - Power generation by all sources, excluding hydro, biomass and nuclear.
P_{tot} - Power generation by all sources of grid mix.
P_{lrc} - Power generation by hydel, nuclear, biomass projects

● **Sector wise baseline Power generation**

$$P_{fuel} = \frac{P_f}{P_{wlc}} x100$$

Where,
P_{fuel} -   Share (in %) of power generation by each fuel used (coal, gas and diesel in present scenario), out of total power generation excluding P_{lrc}
P_f -   Power generation by fuel used. (in Million kWh units)

- **Calculation of Operating Margin emission factor**

$$OM_{bef} = \sum P_{fuel} \, x \, E_{fuel} \quad \text{for base year for Scenario 1}$$

Where,

      OM_{bef} - OM Emission factor of baseline for base year (kg/kWh)

      E_{fuel} - Emission factor (actual or IPCC) for each fuel type considered (*e.g.* coal, gas, etc.).

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

BM_{yr} = weighted average of emissions by recent 20% capacity additions.

Where

BM_{yr} = Build Margin for base year.(kg/kWh) = $\left(\dfrac{\sum P'_f E'_f}{\sum P'_f} \right)$

Where

P'_f - Generation capacity from specific fuel in the most recent 20% power plants

E'_f - Emission factor for the specific fuel in the most recent 20% power plants built

- **Combined Margin Factor**

CMF for crediting period

    = $(OM_{bef} + BM_{yr}) / 2$ (in Kg/kWh)

[Refer to Baseline Excel sheet in Annex 3]

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

$$TP_{gen} = TP_{exp} + TP_{loss}$$

Where,

      TP_{gen} - Total power generated

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

      TP_{loss} - T & D Loss

      (all power units are in Million kWh)

The metered value of power export to grid is to be used for further estimations.

- **Emission Reduction by project activity due to power export**

$$ER_1 = TP_{exp} \, x \left(NEF_B - NEF_P \right) - PE - EL$$

Where,

ER_1 - Emission reduction per annum by project activity due to power export (tones/year)

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

NEF_B - Final Emission Factor of baseline

NEF_P - Net Emission Factor of project activity [= 0]

PE – Project emissions

EL – Emission Leakage (tones/year) [= 0]

Since there is a gap in demand and supply scenario in Karnataka, the export of power to grid will replace or get absorbed to partially fulfill the Karnataka State power requirement. If the same amount of electricity would have been 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 method would represent the anthropogenic emissions by sources (due to use of carbon emissive fuels) that would occur in absence of the proposed project activity.

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	=	Baseline emission	–	Project Activity emission

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

Emission reductions by project activity for 7-year crediting period have been calculated and tabulated below:

Table E.2.1: Emission Reductions

Sr. No.	Operating Years	Net Baseline Emission Factor (kg of CO$_2$ / kWh)	Emissions due to export (Tons of CO$_2$)	Project Emissions (Tons of CO$_2$)	Emission Reductions, (Tons of CO$_2$)
1.	2006-2007	0.957	10,534	5	10,529
2.	2007-2008	0.957	10,534	5	10,529
3.	2008-2009	0.957	10,534	5	10,529
4.	2009-2010	0.957	10,534	5	10,529
5.	2010-2011	0.957	10,534	5	10,529
6.	2011-2012	0.957	10,534	5	10,529
7.	20012-2013	0.957	10,534	5	10,529
		Total CERs	**73,735**	**35**	**73,700**

SECTION F.: Environmental impacts:

F.1. If required by the <u>host Party</u>, documentation on the analysis of the environmental impacts of the <u>project activity</u>:

A detailed Environmental Impact Assessment report highlighting the impacts arising from the project has been prepared and submitted to the Karnataka State Pollution Control Board (KSPCB). On reviewing the EIA report, the KSPCB has accorded the 'Consent to Operate'.

The design philosophy of this project activity is driven by the concept of providing the energy with no impact on the environment. The environmental aspects of the project activity are discussed below.

The pollutants generated from the power plant include:

- Dust and particulate matter
- Fly ash from the hoppers
- Effluent from water treatment plant
- Sewage from the plant

Control methods for air pollution

Dust and particulate matters

The pollution control norms stipulate a maximum dust concentration of 115 mg//Nm^3. The power plant has installed Air Pollution control equipment, which separates the dust from the flue gas and dust concentration is the flue gas meets the prescribed standards.

The dust concentration level in the chimney is periodically monitored. Corrective steps are taken, if the concentration is not as per the acceptable limits.

Sulphur-di-oxide and Nitrogen-di-oxide

The main fuel in the power plant is bagasse, which does not have significant amount of sulphur in it. Hence, the sulphur dioxide is not produced. However, the stack height is as per the local pollution control board stipulations.

The nitrogen-di-oxides are not produced in firing.

Control methods for water pollution

Effluents from Water Treatment Plant

NSSKL has installed an Effluent Treatment Plant to treat the effluent generation. The treated effluent meets the statutory requirements and is used for gardening.

Sewage from the Power Plant Buildings

The sewage from the various power plant buildings is taken to a common septic tank through trenches. The sewage from the septic tank is disposed off manually.

Control methods for noise pollution

The major source of noise pollution in the power plant power plant is from the following:

- Rotating equipments like ID, FD and SA fans

- Feed pumps

- Boiler and superheater safety valves

- Start up vent

- Steam turbine

The start up vent, safety valve outlets and the DG sets are provided with silencers to reduce the noise level to the acceptable limits. The power house building has been constructed suitably to keep the noise level within the acceptable limits.

SECTION G. Stakeholders' comments:

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

NSSKL organised stakeholder consultation meetings with individual village panchayat (elected body of representatives administering the local area) in the area with the objective to inform the interested stakeholders on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity. Invitation for stakeholder consultation meetings were sent out requesting the members of village panchayat to participate and communicate any suggestions/objections regarding the project activity in writing. On the day of meeting, NSSKL representatives presented the salient features of the company and the project activity to the participants and requested their suggestions/objections.

Regarding the local stakeholder review this has been conducted through the approval to install cogeneration from the member of the co-operative society. The members of the co-operative have agreed to proceed with the investment and hence support the project activity.

Stakeholders list includes the government and non-government parties, which were involved in the project activity at various stages. At the appropriate stage of the project development, NSSKL consulted them to get their approvals.

G.2. Summary of the comments received:

No comments were received.

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY.

Organization:	Naranja Sahakari Sakkare Karkhane Limited (NSSKL),
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Direct FAX:	--
Direct tel:	--
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

Annex 3

Baseline and CER calculation excel sheets
Separate File attached

The methodology adopted for the calculation of the baseline is 'the combined margin emissions of the current generation mix". Year 2005-06 is considered as the base year for prediction of future capacity additions during the crediting period. Southern Grid generation data as tabulated in Excel sheet is used for consideration of installed southern grid capacity and energy availability during the period 2005-06.

GENERATION DETAILS FOR 2003-04, 2004-05 2005-06 IN THE SOUTHERN REGIONAL GRID

All units in GWh

2003-2004							
Fuel type	**Andhra**	**Kerala**	**Karnataka**	**Tamil Nadu**	**Pondy**	**Total**	**%**
Coal based generation from state electric utilities	22229	0	11400	20424		54053	37.7
Coal based generation from central electric utilities	24054	0	0	0		24054	16.8
Lignite based generation	0	0	0	17791		17791	12.4
Gas based generation	8239	3109	1631	2927	277	16949	11.8
Diesel based generation	0	657	661	1907		3225	2.3
Blast furnace gas based generation -IPPs	0	0	766	0	0	0	0.0
Hydro electric generation from state and private	3210	3957	7459	2044		16670	11.6
Nuclear based generation (Central)	0		3123	1577		4700	3.3
Non -conventional energy	3152.7	2.49	1034.31	1690	0	5879.626	4.1
Total	**60884.7**	**7725.49**	**26074.31**	**48360.126**	**277**	**143321.63**	**100.0**

2004-2005							
Fuel type	**Andhra**	**Kerala**	**Karnataka**	**Tamil Nadu**	**Pondy**	**Total**	**%**
Coal based generation from state electric utilities	23356.6	0	10717.93	20002.89	0	54077.42	35.9
Coal based generation from central electric utilities	25291.3	0	0	0	0	25291.3	16.8
Lignite based generation	0	0	0	18078.66	0	18078.66	12.0
Gas based generation	8174.29	732.33	629.55	2466.47	275.69	12794.33	8.5
Diesel based generation	0	312.64	549.92	1501.57	0	2364.13	1.6
Blast furnace gas based generation -IPPs	0	0	516.33	0	0	516.33	0.3
Hydro electric generation	5812.57	6144.02	8910.08	4413.11	0	25279.78	16.8
Nuclear based generation(Central)	0	0	2926.25	1480.48	0	4406.73	2.9
Non -conventional energy (Cogeneration, biomass, wind, mini hydro etc)	3467.2	2.44	1505.65	2650	0	7625.29	5.1
Total	**66101.96**	**7191.43**	**25755.71**	**50593.18**	**275.69**	**150433.97**	**100.0**

2005-2006							
Fuel type	**Andhra**	**Kerala**	**Karnataka**	**Tamil Nadu**	**Pondy**	**Total**	**%**
Coal based generation from state electric utilities	20741.83	0	9173.48	18794.79	0	48710.1	31.3
Coal based generation from central electric utilities	27432.5	0	0	0	0	27432.5	17.6
Lignite based generation	0	0	0	17696.6	0	17696.6	11.4
Gas based generation	7422.17	395.65	241.49	2868.61	256.71	11184.63	7.2
Diesel based generation	0	156.96	247.07	1406.56	0	1810.59	1.2
Blast furnace gas based generation -IPPs	0	0	1382.95	0	0	1382.95	0.9
Hydro electric generation from state and private	8321.57	7538.55	11534.97	6110.47	0	33505.56	21.5
Nuclear based generation(Central)	0	0	2859.58	1853.41	0	4712.99	3.0
Non -conventional energy (Cogeneration, biomass, wind, mini hydro etc)	3813.92	2.5	2626.85	2850	0	9293.27	6.0
Total	**67731.99**	**8093.66**	**28066.39**	**51580.44**	**256.71**	**155729.19**	**100.0**

Source:
 CEA Annual Generation data -   www.cea.nic.in

Annex 4
Abbreviations

BAU	Business As Usual
BM	Build Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reduction
CO₂	Carbon dioxide
CPU	Central Power Units
DPR	Detailed Project Report
EIA	Environment Impact Assessment
EPS	Electric Power Supply
GHG	Greenhouse gas
INR	Indian Rupees
IPCC	Inter Governmental Panel On Climate Change
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
ISPLAN	Integrated System Plan
Kg	Kilogram
Km	Kilometer
KERC	Karnataka Electricity Regulatory Commission
KPCL	Karnataka Power Corporation Limited
KPTCL	Karnataka Power Transmission Company Limited
KREDL	Karnataka Renewable Energy Development Agency Limited
KSPCB	Karnataka State Pollution Control Board
KSEB	Karnataka State Electricity Board
KW	Kilo watt
KWh	Kilo watt hour
MNES	Ministry of Non Conventional Energy Sources
MoEF	Ministry of Environment and Forest
MOU	Memorandum of Understanding
MW	Mega watt
MWh	Megawatt Hour
NCDC	National Cooperative Development Cooperation
NSSKL	Naranja Sahakari Sakkare Karkhane Limited
NGO	Non Government Organization
OM	Operating Margin
PDD	Project design document
PLF	Plant Load Factor
PPA	Power Purchase Agreement
REC	Regional Electrification Cooperation
SEB	State Electricity Board
SHR	Station Heat Rate
SPM	Suspended Particulate Matter
TPH	Tons per Hour
T&D	Transmission & Distribution
UNFCCC	United Nations Framework Convention on Climate Change

Annex 5
List Of References

Sl. No.	Particulars of the references
1.	United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int
2.	UNFCCC document: Clean Development Mechanism, Simplified Project Design Document For Small Scale Project Activities (SSC-PDD), Version 02
3.	UNFCCC document: Simplified modalities and procedures for small–scale clean development mechanism project activities
4.	UNFCCC document: Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, Version 05
5.	UNFCCC document: Determining the occurrence of debundling
6.	Ministry of Power (MoP), Govt. of India, www.powermin.nic.in
7.	Central Electricity Authority (CEA), Govt. of India, www.cea.nic.in
8.	Emission Baselines-Estimating the Unknown, International Energy Agency
9.	Ministry of Environment and Forest, http://envfor.nic.in/cdm/host_approval_criteria.htm
10.	Detailed Project Report for Naranja SSK Limited.