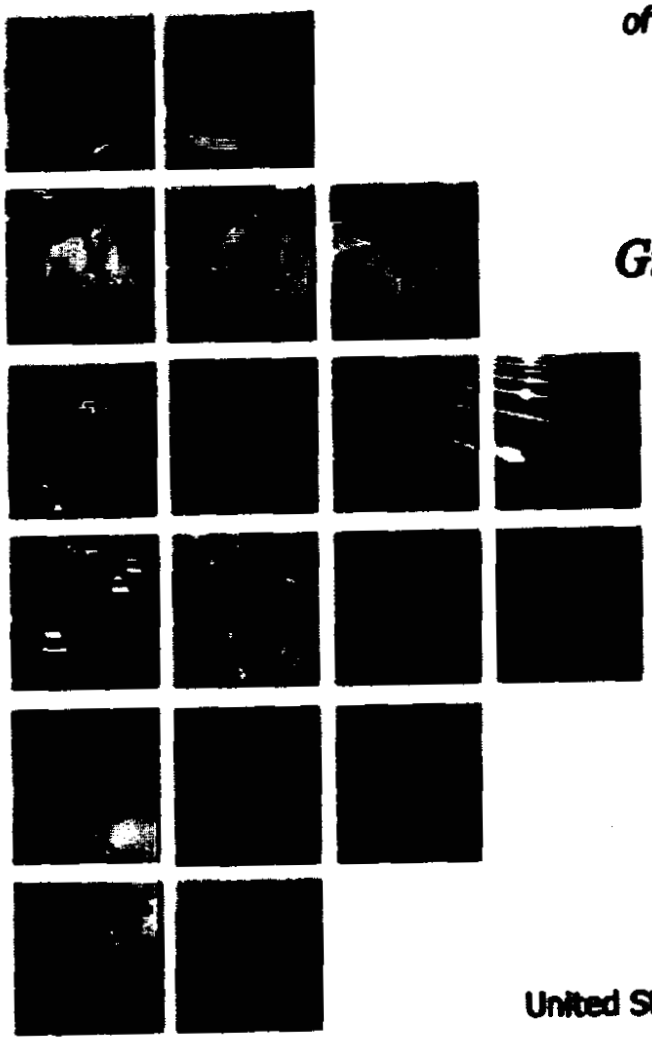
PN-ACY-744

CLIN 3: Project Development and Financing

Subtask 3D: Five Additional Proposals in Pipeline, With at least 8 with Commitment of Funds



Greenhouse Gas Pollution Prevention Project - Climate Change Supplement

A Program of the:
United States Agency for International Development / India Mission

Implemented by:
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EXECUTIVE SUMMARY

I. EXECUTIVE SUMMARY

One of the goals of the Greenhouse Gas Pollution Prevention Project's Climate Change Supplement (GEP-CCS) is to facilitate financing for new projects in India that mitigate greenhouse gas (GHG) emissions. Improving the ability of these projects to receive financing will have a positive impact on economic development in India while minimizing increases in GHG emissions.

To achieve this goal, the GEP-CCS project has supported the development of clean energy projects (CEPs) – those projects that have GHG reduction potential. This support has had two capacity building components. The first component was to work with financial institutions (FIs) in India to improve their understanding of the value of CEPs in reducing GHG emissions and the potential value of those GHG emission reductions as a commodity that could improve the viability of the project from both the financial and social impact aspects. The second concurrently implemented component was to work with other institutions, such as the Climate Change Centre at Development Alternatives, and directly with CEP developers to improve their ability to identify and evaluate the potential GHG mitigation impacts of their projects, thus allowing them to structure and present stronger proposals to the FIs.

This report covers the second phase of the GEP-CCS CLIN 3 project pipeline development and financing component which has resulted in an additional fourteen clean energy proposals being identified subsequent to the original ten that resulted from the work under CLIN 3C of the GEP-CCS project.[1] It also presents the eight projects out of the pipeline of twenty four that have received an indication of funding commitment from FIs.

During the second period of the GEP-CCS CLIN 3 project pipeline development and financing component, an additional financial resource, the Clean Energy Project Fund (CEPF), was designed and developed through the initiative of the US-AID India Mission. This fund was developed to assist clean energy projects that met the GEP-CCS/AID criteria for CEP, to access funding through two designated partner financial institutions, ICICI Bank and IDFC.

[1] *Subtask 3.C: Ten Projects Identified and Guidance Given to Fund Managers. Detailed Project Reports Prepared and Submitted.* October, 2002. Referred to in this document as "Phase I" of project identification.

BACKGROUND : CLIN 3

II. BACKGROUND: CLIN 3

A. *Objective of the Project Development Activity*

A central objective under USAID/India's GEP-CCS project is to provide both capacity building and specific technical assistance to developers of GHG mitigation projects in key sectors that have the potential for significant impact on reducing the rate of growth of GHG emissions in India. The Louis Berger Group, Inc. (LBG) has implemented this task under the GEP-CCS by actively supporting the development of projects that would help mitigate the climate change impact of industry, energy generation and usage and urban growth. In earlier tasks under CLIN 3, LBG GEP-CCS team developed a project tracking format, and worked with a select group of project developers and international funding agencies to develop and provide guidance on climate change mitigation project (CCMP) development. Under CLIN 3B, the process of the development of a clean energy project as a Climate Change Mitigation pilot project in a representative state was demonstrated. A *Roadmap for Climate Change Mitigation Project Development* was prepared based on the pilot, the process and the lessons learned. This "step-by-step" guidance document was prepared in collaboration with, and as part of the capacity building assistance to, the Climate Change Center at Development Alternatives.

B. *CLIN 3C and 3D Project Pipeline Development Approach*

While the international investment community has demonstrated its intent to fund energy efficient and renewable energy development projects worldwide, to date, there has been more demand than supply of qualified projects presented. The main reasons cited for the low acceptance rate of projects is the insufficient data, substandard formulation and mediocre structure of the majority of projects presented. To address these deficiencies, GEP-CCS has conducted a number of capacity building and training activities and has interacted with various stakeholder organizations and individuals to develop and support a "pipeline" of clean energy projects (CEP). The GEP-CCS assistance was targeted specifically to help developers to structure CEP projects to better qualify to receive financial support from FIs. In the CLIN 3C report, the overall strategy, selection criteria, approach and methodology of CEP development and the philosophy for short-listing projects was described in detail.[2]

In order to identify CEPs from the many possible projects being considered by developers in India, a number of criteria were established under CLIN 3C to ensure that projects considered for funding would meet the GEP-CCS/AID project objectives and deliver GHG reductions. Box 1 provides a summary list of these criteria. Further, projects were only considered if they had been approved by the concerned agencies and had prepared the required "detailed project report" (DPR). In addition, FIs could refer projects already under their consideration to GEP-CCS for review of their GHG mitigation potential.

Capacity Building: Interaction with Financial Institutions
The LBG/GEP-CCS team worked very closely with various FIs, including ICICI, IDFC, IREDA, Infrastructure Leasing and Financial Service (IL&FS), Infrastructure Development Corporation (Karnataka) Ltd. (IDeCK), the Power Finance Corporation (PFC) as well as many banks, such as the State Bank of India, the State Bank of Hyderabad, the Bank of

[2] Ibid.

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Baroda and others, to build the capacity of the FIs in regard to greenhouse gas risks and CEP opportunities. GEP-CCS also worked directly with banks and FIs to review their project portfolios to identify the GHG opportunities and risks of existing projects. GHG opportunities would exist in those projects which result in GHG mitigation and therefore carbon offsets. GHG risks would be present in those projects that rely on GHG-intensive technologies. This process helped the five participating institutions to assess GHG assets and liabilities for projects already in their portfolios as well as for those in their respective funding pipelines. GEP-CCS shared specific selection criteria for clean energy projects with the FIs and discussed the approach for providing technical assistance. The project pipeline was also discussed with them and joint visits were conducted to key project developers.

Capacity Building: Leveraging Resources

The capacity building continued with a GEP-CCS organized training symposium, entitled "GHG Emission Reduction Projects: Role of Indian Financial Sector - A Training Symposium on the Current State of Clean Energy Project Finance". Held in Mumbai during April 2002, the symposium provided participants with a structured approach for identifying GHG mitigation projects, assessing the risks and mitigation mechanisms, conducting GHG mitigation potential assessments, and structuring projects in light of potential carbon pricing scenarios.

In addition, to further leverage the capacity building efforts, GEP-CCS organized policy exchange visits of experts from the United States to present detailed information on key issues in climate change. These exchange visits have included Dr. Jayant Sathaye and Dr. William Golove, of Lawrence Berkeley National Laboratory, who provided an overview on a new computer modeling tool that they developed, *ProForm*. *ProForm* quantifies the avoided GHG emissions from an electrical grid that result from a range of GHG mitigation activities, such as energy efficiency measures and renewable energy strategies. Inputs were solicited from Indian financial institutions to develop a customized final version of the tool for the Indian context.

Forward thinking companies and financial institutions such as CII's member companies and IDFC are also looking at the market implications and possibilities of GHG emissions trading. Mr. Wiley Barbour, from Environmental Resources Trust, participated in many meetings throughout India to explain GHG emission trading and the crucial role of a GHG emission registry as a building block.

Capacity building meetings and activities with the FIs that have taken place since the submission of CLIN 3C on January 31, 2002 have included:

Training Symposium	Multiple	Mumbai	April 23-24, 2002
Portfolio Review Preparation	IDECK	Delhi	June 10, 2003
	SIDBI	Lucknow	June 26, 2002
	BOB, UTI Bank, SICOM	Mumbai	June 28, 2002
	IREDA	Delhi	July 1, 2002
	SBI Staff Academy	Delhi	July 11, 2002
	IDECK	Bangalore	July 12, 2002
Study Tour of FIs to U.S.	IREDA, IL&FS, IDECK, IDFC/USAID	Various	July 28, August 3, 2002
Portfolio Reviews	IREDA	Delhi	August 9, 2002

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	IL&FS	Mumbai	August 12 - 13, 2002
	IDECK	Bangalore	August 14, 2002
	IDFC/USAID	Delhi	September 6, 2002
ProForm and Registry "Tools" for Project Development and Financing	CII, FICCI	Delhi	Ongoing
Meetings with Dr. Bill Golove	IDFC, IL&FS	Chennai	October 19, 2002
Meetings with Mr. Wiley Barbour	ICICI Bank	Mumbai	March 10, 2003
Meetings with Ms. Donna Boysen	IDFC	Chennai	September 9, 2003
Meetings on the Clean Energy Project Fund	ICICI Bank	Delhi	February 5-March 7, 2003
	IDFC	Delhi	May 8, 2003
	ICICI Bank, IDFC	Mumbai	June 9, 2003

Technical Assistance

Technical assistance was provided to project developers for projects that met the CEP criteria and had significant potential for GHG reductions. In addition to providing TA in face-to-face meetings, written correspondence and phone conversations, GEP-CCS also employed a number of tools to help structure projects for funding consideration which included the DPR worksheet and the GHG assessment.

DPR Worksheet

Under CLIN 3C and 3D, projects were accepted for review if they had reached the stage of "detailed project report" (DPR) preparation. DPRs are required by financial institutions and describe the technical, financial, market and contractual parameters of the proposed project. The elaborateness of the document depends mainly upon the size of project and its technical dimensions. It is an essential element for funding institutions and other strategic investors as they evaluate their investment risks and returns on the basis of the information contained in DPR. Typically, the quality and size of DPRs are variable from project to project. Typically also, clean energy project developers have been less prepared to structure their projects in a manner that is acceptable to financial institutions for their consideration. In order to make concise quality information on the projects available to FIs and investors, the LBG GEP-CCS team developed a DPR Worksheet. Developed with inputs from and consultation with domestic/international financial institutions, US consulting firms, an emission brokerage firm and USAID, the DPR worksheet synthesizes crucial project information into a form digestible by domestic and international finance and investment interests. The worksheet covers all the major points in a DPR, including the financials and profitability analysis, risk analysis and the assessment of GHG emission reductions from the project. As a marketing tool the worksheet also helps stimulate initial interest on the part of prospective funding and investment institutions and brings out the GHG mitigating nature of the projects.

GHG Assessment

The LBG/GEP-CCS team estimated the GHG reduction potential for each project entering the pipeline. This data was used in the structuring of the projects to strengthen their financial position and thus improve their ability to obtain financing from domestic or international sources. The GHG reduction assessment includes establishing a general GHG emission baseline (i.e., emissions without the project), and estimating the (reduced) GHG emissions in the presence of the project (i.e., emissions with the project). The difference between these two values represents the quantum of GHG emission reductions that are expected to be available for carbon financing. For selected projects, a more detailed GHG assessment was conducted.

BOX 1: GEP-CCS CRITERIA FOR DEVELOPMENT OF CLEAN ENERGY PROJECTS (CEP)

GEP-CCS provides Technical Assistance to clean energy projects to identify their GHG emission reduction potential and to position them to domestic/international investors. GEP-CCS projects should have measurable and clearly identifiable GHG emissions reduction or should lead to avoidance of GHG emissions. It should employ a technology option that is better than the business as usual options in terms of GHG emissions (i.e. specific energy consumption) employed in India. Broad criteria of identifying clean energy projects are illustrated below.

A. Categories of CEPs

Renewable energy technologies for grid feeding/replacing:

- **Biomass-combustion, gasification, bio-methanation power and thermal applications, Cogeneration of power/steam from bagasse or other agri residues;**
- **Solar Thermal- medium temperature applications;**
- **Solar PV-small /medium size systems;**
- **Mini hydro-power generation from small dams/run of the river type;**
- **Waste to Energy-MSW methane generation from landfill/bio-methanation, sewerage based biogas plants for power generation or other applications, industrial waste to power/thermal applications**

Energy Efficiency Improvement technologies:

- **Waste heat recovery-WHR from industrial flue gases or wastewater for power generation or thermal applications,**
- **Renovation and modernization (R&M) of the old power plants to improve efficiency, industrial process efficiency improvements mainly in the utility system but also in process in the key GEP-CCS sectors-cement, steel etc.**

Fuel switching:

Switching from a GHG emission intensive fuel such as coal to a lesser GHG intensive one like natural gas, replacement of fossil based fuels with renewable fuels like oils from plants.

B. Size of the Project

Small and Medium size i.e. non-utility projects (distributed generation preferred), individual criteria mini hydro ≤ 25 MW, bagasse based cogeneration with steam pressure > 65 Bar. The minimum investment in project is flexible. [However, this is subject to the needs of funding sources] Additional set of criteria in this respect is the size defined for fast track projects:

Renewable Energy projects ≤ 15 MW
Energy Efficiency projects with equivalent savings ≤ 15 GWh
Other mitigation projects with carbon potential ≤15 Kilotonne CO_2/year

C. Technology Source

Prefer US technology. However, there is no restriction. Innovative technological approaches are preferred. However, unproven technologies would not be considered due to higher technology risk. Clear cut licensing with the technology providers required.

D. Promoters

Should be genuinely interested in the project, resourceful and have good track record with existing lenders/bankers. Should possess or be ready to acquire the necessary experience and expertise for undertaking the proposed project. Should be open to share data with due precautions with GEP-CCS and the funding agencies.

E. Service Off-take and Providers

Should have sound service off-takers (e.g. power purchasers) or should have proper credit enhancement. In case of power generating for grid supply, a Power Purchase Agreement with proper risk mitigation options should be in place. In case of supply of fuels and other services, proper agreements like FSA should be in place.

F. Funding

GEP-CCS can consider projects with recourse to promoters' balance sheet, corporate loans, and project finance on non-recourse basis and equipment finance in the form of lease or asset lines of credit depending on the needs of the project. The projects should be bearing reasonable performance indicators like IRR/payback etc. to merit consideration by lenders/investors.

D. *CLIN 3C: The First Ten Pipeline Projects*

Under the CLIN 3C phase of the proposal pipeline development activity, the GEP-CCS team received inquiries for technical/financial assistance for forty five projects with GHG reduction potential. Of these forty five projects, ten were ultimately accepted as 3C pipeline projects. These are summarized in Table 1, listed in the order that they matured through the development process. Their total implementation costs are estimated to be Rs. 15,865 million. Their total GHG emission reduction benefit is projected to be 1,408,000 tons per annum.

Table 1: CLIN 3C Project Pipeline

1	Ambutirtha Power Pvt. Ltd.	2 X 10 MW hydel project in Karnataka	1,077	75,000
2	Globe Cogen Power Ltd.	45 MW bagasse based power project	1,810	150,000
3	Asia Bioenergy (I) Ltd.	MSW biomethanation based power 5 MW compost plant	736	192,000
4	Venkatesh Coke & Power Ltd.	Waste heat recovery-based power (65 MW) from coke plant	10,869	440,000
5	Coastal Agro Industries Ltd.	4 MW rice husk based cogeneration plant in Andhra Pradesh	152	19,000
6	Bhoruka Power Corp Ltd.	2 X 2.5 MW mini hydel project in Karnataka	170	130,000
7	Kakatiya Alloys Pvt. Ltd.	6 MW poultry litter based power project in Andhra Pradesh	332	35,000
8	Market Dynamics Pvt. Ltd.	(i) waste biomass briquette plant (ii) PV based home lighting	(i) 7 (ii) 590	250,000
9	RR Bio Energies Ltd.	12 MW biomass IGCC plant using agro residues in Andhra Pradesh	68	97,000
10	Polyene Film Industries Ltd.	Thin film A-Si PV modules based agricultural pumps	54	20,000
		Totals	**15,865**	**1,408,000**

ADDITIONAL CLEAN ENERGY PROJECTS
CLIN 3 D

III. ADDITIONAL CLEAN ENERGY PROJECTS: CLIN 3D

The deliverable under CLIN 3D specified the addition of five additional proposals to the pipeline. GEP-CCS/LBG has been able to add fourteen project proposals, nine more than the required number of five, to the financing pipeline out of an additional forty two projects identified for consideration in the second phase. By establishing a longer pipeline of greenhouse gas mitigation proposals than required under the GEP-CCS contract, it is anticipated that with the creation of the CEPF, clean energy projects in the pipeline will continue to move forward to funding, up to and after the contract end date for GEP-CCS in April 2004.

The project proposals added to the pipeline under CLIN 3D include a balance of projects in hydroelectric power, agro-residue based biomass based power, fuel switching, waste-to-energy, and waste heat recovery. A brief description of these projects is provided in ***Table 2*** below. As a result of the technical assistance, capacity building and outreach activities undertaken by GEP-CCS in the past three years of the project, there is evidence of growing interest among industry and consulting firms in developing and suggesting clean energy projects that include the possible capture of benefits from the GHG reductions. Industry, consulting firms and FIs are also interested in identifying additional sources of funding in order to improve the project economic feasibility.

During this secondary phase of GHG mitigation pipeline development, as a result of the FI capacity building, continued networking and the creation of the CEPF, there were additional streams of project referrals. Indicative of an increased interest in renewable energy, energy efficiency, and green power projects, and in the potential of possible monetization of GHG emissions, were the numerous referrals from various divisions in IDFC and ICICI Bank. ***Detailed project information is provided in Appendix A.***

A. Project Development Approach

The same project development approach was applied during the second phase of the proposal pipeline development as was used in CLIN 3C, with the additional goal of identifying the CEPs from the total pipeline that could receive funding and moving them forward to closure (i.e. receipt of a sanction letter, the first legal document obligating the FI to fund a project). One on one meetings, conferences, seminars, and networking with project developers, companies, GoI ministries, other USAID projects [e.g. Energy Wise India (EWI) and the Clean Technology Initiative (CTI)], and NGOs, were employed to identify quality clean energy projects. One significant difference observed while developing the second batch of proposals for the pipeline, was that there was evidence that GEP's capacity building efforts have had a definite effect on the market interest in GHG mitigation projects. This difference was apparent in the changed approach of the various financial institutions while considering clean energy projects, perhaps best described as moving from negative neutral to proactive positive.

Another very constructive factor has been the ability to talk about the CEPF. The creation of the CEPF further enabled LBG to work even more closely with the two designated 'Host" financial institutions, IDFC and ICICI. This close collaboration with the two financial institutions assisted the GEP-CCS/LBG team to expand the capacity building efforts with other divisions of these institutions, as well as to identify additional GHG mitigation projects that met the CEP criteria.

The GEP-CCS LBG team has noticed a distinct and progressive improvement in the quality of the project proposals submitted to the FIs from the first submissions under CLIN 3C in 2000 and 2001 to the present. This improvement reflects the success of the GEP-CCS capacity-building activities in general, as well as the FI training, portfolio review and roundtables. Taken together, these activities helped the project proponents and FIs to work proactively on CEP development.

Technical Assistance: DPR Worksheets and GHG Assessments

Based on the identification source of the project, different levels of analyses were necessary. GEP-CCS identified clean energy projects based on the selection criteria decided upon in consultation with USAID. For these projects, a review of the DPR was conducted in consultation with the project developer/consultant to judge its technical and economic feasibility. In the case of some of the projects that were referred by IDFC and ICICI Bank from their own pipelines, a project DPR had already been assessed by the respective institutions, therefore a summary DPR worksheet was deemed unnecessary and not prepared. Detailed GHG assessment notes, however, were prepared for these projects and submitted to the respective FIs. An estimate of the greenhouse gas emission reductions that would be generated by each project was prepared for each project based on the information in the DPR. Conversations and correspondence directly with the respective project developers supplied additional necessary data for these estimates.

For the GHG assessment, the relevant project boundary was identified for determining the appropriate baseline scenario. An estimation of baseline emission level was then carried out. For this, various data sources were utilized, including:

- CEA 16th Power survey and data on power generation/consumption in various states;
- Data from regional dispatch centers;
- State electricity board annual reports (compiled by the Planning Commission, GOI);
- IPCC emission factors for different fuels; and
- GHG estimation methodologies as adopted by IPCC/UNFCCC.

Based on the above, a DPR worksheet summarizing the project information on promoters, project cost and profitability, risk analysis, analysis of underlying agreements and GHG assessment was prepared for each. These were submitted along with the original DPR of the company to the FI for consideration.

In the case of projects that were referred by IDFC and ICICI Bank from their pipelines, the DPRs sent by the institutions were reviewed for information pertinent to the GHG assessment which was then prepared by the GEP-CCS team and

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subsequently submitted to the respective financial institutions for consideration as a greenhouse gas mitigation project.

The DPR documentation and GHG assessments prepared for the projects are contained in Appendix A.

B. *Tracking the Process from Pipeline to Funding: Identification of Gaps and Barriers and Strategies to Address*

In tracking the process from pipeline proposals to project financing, the GEP-CCS/LBG team was able to identify certain gaps and barriers that have impeded the pace of progress. The team has worked with the multiple project partners to address these gaps, to develop strategies for the resolution of issues that hinder the development of clean energy projects and to promote the removal of barriers to financial closure.

Gaps were observed in both market information and technical specifics for quantifying and documenting GHG emissions reductions, and how to include this information in accessing funding. Informational gaps, particularly in regards to potential market activity in emissions reductions, are slowly being bridged with the help of GEP-CCS project partners, CII, FICCI and the financial institutions and through policy exchanges and roundtables. Technical tools to help both project developers and FIs assess and quantify emissions reductions from clean energy projects have been shared.

Potential policy barriers to the development of clean energy projects could emerge if stakeholders and policy makers are not fully informed about the benefits of clean energy projects. GEP-CCS project partners are helping to promote a policy environment more conducive to clean energy and GHG mitigation projects by enabling policy makers with more complete information. IDFC, for example, in its advisory role to municipal and state governments, has been able to inform policy makers on the positive potential of clean energy projects, and to consider the development of policies that will promote the development of such projects. GEP-CCS partners and champion industry associations (CII, FICCI, SIAM), as well as the financial institutions, are also assisting to inform policy makers on the economic benefits of energy efficiency and GHG emissions mitigation projects.

C. *Development of the Clean Energy Project Fund*

Funding for new projects is typically obtained from conventional domestic and international lenders. The prospect of non-performing assets is a source of concern among lenders, and a stringent credit rating of project promoters is completed prior to loan approval.

GHG-mitigating projects are often at a disadvantage for funding from traditional sources. The reason for this is that CEPs are generally perceived as employing innovative and/or capital intensive technologies or processes that are often central to the ability of the project to deliver GHG reductions. Lack of experience with the

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CLIN 3 D DELIVERABLES

ability of these innovative elements to perform as promised can raise concerns among investors. In some cases, the project promoters themselves are new to the process and lack the business history and credit history needed to reassure investors. CEP promoters often seek funding over a "medium term" (6-8 years) period that exceeds the short-term preference of some investors.

In some cases, CEPs have the advantage being able to attract socially responsible investors. The pool of funds from these investors, however, is typically considerably smaller than the funding available from traditional sources.

Accordingly, several strategies for providing additional financial support were discussed. USAID decided to develop a Clean Energy Project Fund (CEPF) to be operated by two FIs, IDFC and ICICI Bank. The fund would serve to "buy down" the interest rates on loans extended by these two FIs. As a result, the FIs would not be assuming increased risk and the project developers would enjoy more favorable terms for loan repayment. GEP-CCS provided support to USAID in the design and formulation of the fund. Consultations were held with the two FIs and the terms of the fund were finalized as of June 2003.

IV. CLIN 3D DELIVERABLES

A. Project Descriptions: 14 Additional Proposals in Pipeline

The projects under CLIN 3D are described below, listed in the order in which they have matured through the development process.

*1. **Sainath Power Concepts*** (P) Ltd (SPCL) is setting up a 6 MW biomass based power project at Akkarpur village in Adilabad district of Andhra Pradesh. The net power generated by the plant will be sold to the AP grid and SPCL has entered into a power purchase agreement with APTRANSCO. The PPA provides for a tariff of Rs. 3.49 per kWh, which is as per the MNES policy. The project has been approved by NEDCAP, the nodal agency for renewable energy projects. SPCL proposes to execute the project through package contracts and undertake the operation and maintenance on its own.

The proposed plant would use cotton stalks, maize stalks and rice straw as the renewable fuel. As per the survey conducted by NEDCAP, a surplus supply of 650,000 MT agro residues is available, sufficient to generate 93 MW power. NEDCAP has approved an additional 6MW power project in the district besides SPCL, but has said that they will not approve any more projects based on agro residues. As per the independent survey carried out by the promoters, 544,000 tons of biomass is available in the district, of which 47% is available within 50 KM distance from the proposed plant location. Since the plant would need only 52,500 tons of residues, the fuel availability is not likely to pose any problem.

PFC has appraised the project and approved a loan of Rs. 100 million at the rate of 13% p.a. with a moratorium of 6 months.

*2. **Pioneer Genco Limited*** (PGL), a Special Purpose Vehicle (SPV) promoted by Pioneer Builders and its group companies Penna Cement Industries Limited (PCL)

and Sriba Industries Limited (SIL), proposes to construct, erect and operate a 21 MW (3 x 7MW) run-of-the-river hydroelectric power project on the banks of the river Cauvery near Shivanasamudram village, Malavalli Taluk in Mandya District of Karnataka.

PGL proposes to enter into Power Purchase Agreement (PPA) with Karnataka Power Transmission Company Limited (KPTCL) for the sale of power generated. At the time of writing of this report, Nov 20, 2003, the PPA is under negotiation and expected to be finalized shortly. The project cost is estimated at Rs. 880 million.

3. ***Kalyani Steels Ltd.*** (KSL) has an integrated steel plant in its Kalyani Ferrous Industries in Karnataka State. The plant uses two mini blast furnaces to produce carbon and alloy steel in billets and rounds. Installed capacity of the plant is 290,000 tons of steel products annually. The blast furnaces generate 52,000 m3/hr of off-gases each. The gas contains nitrogen, carbon monoxide, carbon dioxide, and traces of methane. Due to carbon monoxide, the gas is highly poisonous and a health hazard. In view of heat content and volume of the off-gas, KSL proposes to burn the gas in a boiler and generate steam to run steam turbines for power generation. Currently KSL purchases a sizeable amount of power from the Karnataka grid. KSL has designed a system and has had it reviewed by reputable engineering consultants. The proposed waste heat based power system is estimated to meet around 31% of the power requirements of the plant and thus reduces the overall cost of production significantly. KSL has received clearances from the Karnataka Pollution Control Board, and MOEF for the project. The required land and other facilities have been procured. Since there will be no sale of power, there is no need for a PPA. This also establishes the ownership of the carbon offsets that will be generated with the promoter KSL.

4. ***The KCP Ltd.***, (KCP), a well diversified company with businesses in sugar, cement, heavy engineering, hydel projects, technology management and joint ventures in equipment manufacture, and the bio-pesticides sectors is the promoter of the project. KCP has a cement plant with a capacity of 500,000 tons per annum at Macherla in Guntur district of Andhra Pradesh. The company has been focusing on new technologies with a view to reducing specific energy consumption and has already achieved reductions from 135 – 140 kWh/ton to around 90 kWh/ton. Their stated target is to reduce energy consumption to 80 kWh/ton.

To achieve further improvements, the company proposes to utilize two streams of heat produced from the manufacturing processes: a) the hot air from grate type clinker cooler of the rotary kiln and b) gases from the pre-heater. It is proposed to recover waste heat from this stream by cooling it to 220°C. Due to high gas flow rates, the potential for heat recovery is very high. The estimated total capacity is 1,468 kW of power generation. The waste heat recovery plants will generate steam, which will be used in a steam turbine for power generation.

The proposed plant is expected to generate 8.5 million kWh of power at a capacity factor of 66%. For cement plants continuous operation is crucial. Several cement plants in India suffer due to unreliable power supply situations. The proposed power generation plant will help KCP in strengthening its captive power capacity. This power will replace use of power from the grid, thus mitigating an estimated 8,338 tCO_2 p.a.

5. ***Alwar Power Company*** (P) Ltd. (APCL) is being established by Manipal NRI International Ltd. (MNIL) to set up a 7.5 MW biomass based power unit in the Matsya Industrial Area in the Alwar district of Rajasthan state. The biomass fuel will be mainly mustard crop residue such as husk and straw. A detailed biomass assessment study by independent consultants, Technology Projects and Market Research Group (TPMRG) indicates that around 400,000 tons of mustard crop residues are available in an area within 50 KM radius from the site. However, in order to ensure groundwater and biomass availability on a sustained basis, the promoters have decided to build a plant of 7.5 MW size initially, which will only need around 79,000 tons of residue every year. .

The plant will generate power at an average PLF of 75% and feed 44.35 MU into the grid of Rajasthan Rajya Vidyut Prasaran Nigam Ltd. (RVPN). Alwar Power has entered into a Power Purchase Agreement (PPA) with RVPN that provides a rate of Rs. 2.75 per kWh sold with base year 1998-99 and an annual escalation at 5%. (Applicable rate in 2003-04 Rs. 3.51 per kWh). The PPA is for a plant capacity of 2 X 12.5 MW. The developers are setting up an initial capacity of 7.5 MW, with plans for additional capacity to be added. The cost of the project is estimated at Rs. 302 million. The proposed project will replace power from conventional fuel sources in Rajasthan which have a high proportion of thermal power. The project has a potential to reduce 39,200 tCO_2 per year.

6. ***Chattisgarh Electricity Company Limited*** (CECL) is an existing profit making company having diversified businesses including power generation and ferro alloys. The company has set up a ferro alloy plant with a furnace capacity of 18 MVA (equivalent to 35,000 tpa) and a turbo generator set of 30 MW installed capacity with a boiler of 90 tph equivalent to 20 MW generation at Raipur, Chhattisgarh. The company commenced commercial operations in October 2001 and completed its first full year of operation in FY 2002-03. 20 MW of power are being generated by the current facility of which 16MW is consumed in-house by CECL, with the balance 4 MW being sold to Raipur Alloy and Steel Ltd. (RASL), a group company.

The company is expanding its existing facilities at Raipur by setting up an additional 30 MW turbo generator set, 4 waste heat recovery boilers aggregating 51 tph and one boiler of 90 tph. The waste heat recovery boilers will be fed by waste heat from the ferro alloy plant and RASL plant, which is located adjacent to the CECL site. With the expansion, the company will have turbo generator capacity of 60 MW and a steam generation capacity adequate to support 52 MW. The company is also proposing to double the capacity of ferro alloy plant by installing two furnaces of 9 MVA each (equivalent to 35,000 tpa) at a cost of Rs.13 crore. Post expansion, CECL and RASL will consume power to the extent of 34 MW and 10 MW respectively. The balance of 8-10 MW will be sold to the grid/third parties as the company obtains permission for the sale from SERC /authorities. The cost of generation from the power plant after expansion would be Rs 1.40 /unit. The project cost is estimated at Rs.810 million.

7. ***Matrix Agro Private, Ltd.*** (MAPL) is a company promoted to set up the 6 MW biomass based power project at Polakapalli village in Gulbarga Dist of Karnataka State in South India. The plant will use agro-waste including redgram stalks, Subabul

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(Lucena) rice husk and jowar (sorghum) stalks as a fuel. The above listed agro-residues are available in abundance within 20 KM from the plant site.

The proposed plant will generate 37 MU of energy and after meeting the auxiliary energy need, will export 32.4 MU to the Karnataka Power Transmission Corporation Ltd. grid. MAPL will enter into a power purchase agreement with KPTCL to enable this. The PPA negotiation is in an advanced stage. MAPL has carried out a biomass assessment study of the Gulbarga district and the Chincholi Taluka in particular. The study establishes that the required quantity of agro waste for ensuring at least 85% PLF will be easily available within the 20 km vicinity of the project site. The company is also planning to use biomass from an energy plantation of fast growing fuels to partially meet the fuel needs, and it has already leased 1000 acres of suitable land for this purpose.

The project cost including land, site development buildings and civil structure, plant and machinery, design engineering, preliminary and preoperative expenses is estimated at Rs. 229 million. The proposed project uses a carbon neutral fuel, i.e. biomass. There is no net addition of CO_2, since the agro residue is generated by sequestration of atmospheric CO_2 and as the project leads to avoiding burning the biomass in fields while generating useful energy. The power exported to the grid would replace the marginal units that would otherwise have been generated using power from a fossil fuel based power plant (i.e. coal). The GHG abatement assessment shows that on a conservative basis the energy exported by the proposed plant would achieve a GHG reduction of 21,800 tCO_2e p.a.

The project has received approval of Karnataka Renewable Energy Development Ltd (KREDL) the nodal agency of the state.

8. ***Fozal Power Pvt. Ltd.*** proposes a small hydroelectric power project on the Fozal Nala near Kullu in the Himachal Pradesh (HP) state. The project has a generating capacity of 9 MW based on power potential studies in a 75% dependable year. The project is run-of-the-river type that utilizes gradients in the tributaries of the river Beas. The project envisages the construction of a boulder type diversion weir, constructed with locally available material, easy to maintain and which suffers the least damage in case of floods. Since there is no reservoir, the promoters will utilize a strategy that takes advantage of maximum amount of river water in monsoon season to raise the overall availability. As a result of this strategy, the rated capacity of the project has risen to 9 MW. Since run-of-the-river projects have certain size restrictions for civil works, the cost is dictated by the minimum size. The overall project cost is estimated at Rs. 450 million, i.e. Rs. 50 million per MW.

Currently the power requirements of Himachal Pradesh state are not large, and the HP State Electricity Board has offered a rate of Rs. 2.25 per kWh. However, after deducting a mandatory royalty to the state of 12% in free power, the net tariff comes to Rs. 1.98 per kWh. The company therefore is looking at a market outside Himachal Pradesh to sell the power generated to other states in the northern region, e.g. Punjab and/or Delhi.

9. ***Sterlite Industries*** (I) Ltd. (SIIL), is engaged in manufacturing of copper, aluminum metals and various bulk chemicals. SIIL has a copper smelting plant at

Tuticorin, Tamil Nadu with a capacity of 150,000 TPA and plans to double the smelting capacity. To recover the smelting gases, SIIL has set up sulphuric acid plant and envisages modernizing the plant and setting-up a new state-of-the-art system to treat the additional flue gases as a result of the expansion of the smelter capacity. The sulphuric acid plant capacity would increase from the 2125 TPD presently to 3740 TPD. The smelter operation is a continuous process and power dependability is critical. SIIL, therefore, also proposes to expand the captive power generation capacity from the current 24 MW to 46 MW.

SIIL proposes to incorporate fuel efficient technologies with a view to minimizing the operation cost and to avoid emissions of local and global pollutants. These interventions include:

- Recovery of heat from gases after second pass of the converter at $517^0 - 527^0$ C;
- Recovery of heat from gases after the third pass of the converter at $469^0 - 479^0$ C;
- Recovery of heat from diesel engine exhaust gases at 340^0 C; and
- Replacing the atmospheric acid coolers with heat exchangers, which reduce evaporation and wind losses, thereby leading to saving in power and water consumption.

The recovered heat from the first three options will be used in two WHR boilers to generate process steam which will be used in the phosphoric acid plant located in the same complex. The phosphoric acid plant boiler currently uses furnace oil, which will be replaced. The proposed project helps in the reduction of the furnace oil consumed in phosphoric acid plant and in reducing power and water consumption. The project has two distinct GHG reduction opportunities, fuel switching (furnace oil) and replacement of grid power. The project also reduces the use of a scarce resource in Tamil Nadu, water. The cost of these energy efficiency and fuel switching projects are estimated at Rs. 110.7 million.

10. Hemavathy Power and Light Private Limited (HPL), is Special Purpose Vehicle (SPV) promoted by Mr. Anthony DiNapoli, a private equity investor based in Bedford, USA who proposes to (a) acquire and operate the existing 16 MW hydro power project (Phase I) situated on the Hemavathy Left Bank canal located at Gorur village in Hassan district, Karnataka and (b) to acquire the license and construct, erect and operate the 8 MW hydro power project (Phase II) in the vicinity of the existing 16 MW project from Sandur Manganese and Iron Ores Limited (SMIORE). SMIORE is selling the aforesaid assets as part of its reorganisation as approved by Board for Industrial and Financial Reconstruction (BIFR).

Phase I is situated at the foot of the Hemavathy dam near the left abutment and generates power from the irrigation releases into the Left Bank canal. The Phase I project was fully commissioned in April 2001. A surplus arrangement connecting the Left Bank canal and the Hemavathy river has been constructed to increase the water flow to Phase I. Now, Phase I is estimated to generate 39.45 MUs of energy (29% PLF) in a 90 % dependable year. The 20 meter head available between Phase I and the Hemavathy river is proposed to be utilized for setting a 2 x 4 (8 MW) project (Phase II) between the Left Bank canal and the Hemavathy river bed. Phase II is estimated to generate 27.3 MUs / year (in a 90% dependable year). The total project

cost for Phase I and Phase II is estimated at Rs. 1.28 billion, calculating Rs. 853 million for Phase I and Rs. 427 million for Phase II.

*11. **Sandur Power Company**.* Under a Government of India policy to permit private sector participation in the development of the power sector, M/s Sandur Power Company Private Limited has been allotted by the Government of Karnatika, the implementation of the Varahi Tail Race Mini Hydel Project, with an installed capacity of 22.5 MW, and an annual average gross generation of 120 Mu. The project consists of the construction of a diversion weir across the Varahi River just downstream of the tail race with a gravity-based intake system, as well as other components, including three turbines of 7.5 MW each. The total estimated cost of the project, including transmission lines, is approx. Rs. 1.3 billion.

12. ***Cosmos Consulting***. has proposed implementing the Tirthan Hydro Electric Project located near Banjar town in Kullu Distt of Himachal Pradesh. Tirthan project has been contemplated as a small hydro run-of-river project on the Tirthan River, a tributary of the Beas River. The Government of Himachal Pradesh and the Ministry of Non-Conventional Energy Sources (GOI) have set out policy initiatives and guidelines for the speedy development of Small Hydro Projects and is promoting the participation of the private sector in such projects. Himachal Pradesh Energy Development Agency (HIMURJA) – the Nodal Agency for development of Small Hydropower Projects in Himachal Pradesh, identified an opportunity for such a project on the Tirthan River, developed the concept of a 3 MW Tirthan hydro project and offered it to the private sector for implementation by inviting proposals from private entrepreneurs.

*13. **Mailhem Engineers, Ltd.***, will develop a power project in Katraj that will use 20 tons per day municipal solid waste (MSW) for fuel. The technology will be an anaerobic phased solid reactor with a hybrid batch/upflow anaerobic sludge blanket. Given its low capital requirements, this approach could be a replicable model for other municipalities in India. The fuel will be segregated biodegradable organic waste, such as vegetable market waste, and food waste from hotels and residential areas, that will be obtained from the Katraj Garbage Transfer Station in Pune. Design, engineering, construction, and operation and maintenance costs for ten years are projected to total Rs. 20 million.

*14. **Glow Power Ltd.***, a special purpose vehicle, was formed to develop, own and operate a biomass-based power plant and plans to install a power plant at Khamanon, District Fathegarh sahib. Punjab Agro Industries (Government of Punjab) have commissioned a study on the techno-economic feasibility of integrated rice processing with power generation from rice husks. GPL and Punjab Agro Industry have signed an MOU under which Punjab Agro Industry will assist Glow Power in developing the project, and upon government approval, will participate in the equity. The fuel needed to operate the plant will be obtained from Laxmi Over Seas Ltd (LOSL), one of the major rice millers in the area. Power provided by the GPL project will meet the steam and in-house power needs of the LOSL plant. Surplus power from the plant will be sold to the Punjab electrical grid. An evaluation of plant size and module parameters was made considering capital cost, fuel efficiency and plant load factors. Based on the evaluation, a decision was taken to construct two boilers of 35 tons per hour and two turbo-generation sets of 5 MW capacity. Project financials are based on

assumptions for capacity factor, fuel cost, power sales to LOSL and the Punjab grid. The project capital cost is Rs 4,500 Lakh.

B. CLIN 3 D Projects Added to Pipeline: The CLIN 3D project proposals additional to the original CLIN 3C pipeline of ten projects are summarized in Table 2 below and are presented in the order in which they matured through the development process. Three of the listed projects (Pioneer Genco, Chhattisgarh Electricity and Sterlite) have already received or are expected to receive funding from IDFC and/or ICICI under the CEPF

Table 2: List of CLIN 3 D Projects Added to Pipeline

1	Sainath Power Concepts Ltd	6 MW biomass based power project in AP	Power generation using cotton and maize stalks and rice straw for grid	205	25,860
2	Pioneer Genco Ltd.	21 MW Small hydropower plant in Karnataka	A run of the river (Cauvery) hydro power project for Karnataka grid	880	42,000
3	Kalyani Steel Ltd	8 MW Blast Furnace gas based Power Project	Power generation from blast furnace gases consisting carbon monoxide as alternate fuel	270	32,450
4	KCP Cements Ltd.	1.4 MW WHR based Power generation plant in a cement plant	Waste heat recovery from rotary kiln clinker cooler and preheater	60	8,340
5	Alwar Power Private Ltd.	7.5 MW agro-residue biomass based power plant in Rajasthan	Power generation for Rajasthan grid using mustard crop residues	300	39,200
6	Chattisgarh Electricity Co. Ltd	10MW Ferro-alloys furnace gas based power generation plant	Power generation from off gases from ferro-alloys furnaces to replace coal based power	720	57,740
7	Matrix Agro Industries Ltd.	6 MW Biomass based power plant in Karnataka	Power generation using redgram and sorghum stalks, Lucena and rice husk for Karnataka grid	229	21,800
8	Fozal Power Pvt. Ltd.	9 MW small Hydropower project in HP	A run of the river (Beas) hydro power project	450	37,640
9	Sterlite Industries Ltd.	WHR based steam generation plant in a sulfuric acid plant	Steam generation using waste heat from sulphuric acid and captive power plants	111	17,440
10	Hemavathy Lights & Power Ltd	8 MW Small hydropower plant in Karnataka	A run-of-the-river (Hemavathy) hydro power project for Karnataka grid	427	16,000
11	Sandur power Co. (P) Ltd.	3 X 7.5 MW Small hydropower plant in Karnataka	A run-of-the-river (Vanahi) hydro power project for Karnataka grid	1,340	78,880
12	Cosmos Consulting	9MW Tirthan small hydropower plant in Himachal Pradesh	A run-of-the-river (Tirthan) hydro power project for H. P. grid	499	26,830
13	Mailhem Engineers (P) Ltd.@	20 TPD plant for biomethanation of degradable MSW	Biomethanation of vegetable market waste for power generation	25	5,610
14	Glow Power Ltd.	10 MW rice husk biomass power plant in Punjab	Power generation using rice husk for Punjab grid	450	38,710
			Totals	5,966	448,500

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C. Eight Projects with Documentation Indicating Commitment of Funds

Of the 24 CEPs that have been advanced through the two phases of the proposal pipeline development, eight of them have received documentation indicating a commitment of funds from the FIs as follows.

1. **Asia Bio Energy Ltd** – Funding IDFC

   MSW biomethanation-based power/5MW compost plant in UP

2. **Ambutirtha Power Corporation Ltd**. – Funding PFC/REC

   2 x 10 MW small hydel project in Karnataka

3. **Chattisgarh Electricity Co**. – Funding IDFC

   10 MW ferro-alloy furnace gas power plant in Chattisgarh

4. **Coastal Agro (I) Ltd** – Funding SBI/SBH

   4 MW rice husk-based cogeneration plant in AP

5. **Globe Cogeneration Power Ltd.** – Funding PFC

   45 MW bagasse power project in Karnataka

6. **Pioneer Genco Ltd**.– Funding IDFC

   21 MW small hydropower plant in Karnataka

7. **Sainath Power Concepts** (P) Ltd. – Funding PFC

   6 MW biomass-based power project in AP

8. **Sterlite Industries, Ltd**. – Funding ICICI

   Waste heat recovery-based steam plant in TN

The support materials for each of the additional pipeline projects and the documentation indicating funding commitments by FIs for eight projects from the total pipeline can be found in Appendix B.

APPENDICES

APPENDIX A

ADDITIONAL PIPELINE PROJECTS DPR DOCUMENTATION AND GHG ASSESSMENTS

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APPENDIX A

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

Sainath Power Concepts (P) Limited

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Background:

This form is for the purpose of gathering relevant project finance information for projects developed under USAID India's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement (GEP-CCS). It is designed for project developers and financial institutions involved with clean energy or other types of GHG mitigating projects that are placed into the GEP-CCS pipeline.

Format: The form is designed to capture the types of projects seeking Project Finance.

Project Finance is focused on anticipated revenue streams from the project activity (or off-balance sheet financing). For example, a grid-based biomass co-generation facility would likely depend upon energy payments from a local electricity board. Much more detailed information about the project, project promoter, power purchase agreement, debt and equity sponsors and profitability and cash flow analyses are necessary to determine the relative risk and financial viability of the project.

This is a working electronic document/check-list. When each question is answered, place an electronic checkmark (√) in the left-hand box as a reference point for completion of the form.

Project Name: 6 MW biomass based power project in Andhra Pradesh

Project Promoter: M/s S Chandra Reddy, K. Surendranath and Ms M Vijaya Chandra Kalyani

Special Purpose Vehicle: Sainath Power Concepts (P) Ltd (SPCL)

1. Executive Summary: Project at a Glance

SPCL, a new company promoted by the promoters, proposes to set up a 6 MW biomass based power project at Akkarpur village in Adilabad district of Andhra Pradesh. The net power generated by the plant will be sold to AP grid. SPCL has entered into a power purchase agreement with APTRANSCO for the same. The PPA provides for a tariff of Rs. 3.49 Per kWh, which is as per the MNES policy. The tariff would be reviewed in the year 2004 by the APERC. The project has been approved by NEDCAP, the nodal agency for renewable energy projects. SPCL proposes to execute the project through package contracts and undertake operation and maintenance on its own. The promoters are resourceful with business of rice milling, civil construction and miscellaneous other businesses.

The state of AP is in deficit in power capacity as well as peak demand. The cumulative capacity required in the sate is around 1200 MW , which is expected to grow to 3,200 MW by the year 2007. APERC has considered meeting this gap by several sources including renewable energy sources including biomass. The share of biomass considered by it is 250 MW by 2007. Of this projects with a total capacity of 90 MW are under implementation. SPCL project is one of the projects approved by NEDCAP and awaiting implementation.

The proposed plant would use cotton stalks, maize stalks and rice straw. As per the survey conducted by NEDCAP, 650,000 MT agro residues are available in surplus, which are sufficient to generate 93 MW power. NEDCAP has approved one more 6MW power project in the district besides SPCL.NEDCAP has informed that no further project based on agro residues would be approved by it. As per the independent survey carried out by the promoters, 544,000 tons of biomass is available in the district, of which 47% is available within 50 KM distance from the proposed plant location. Since the plant would need only 52,500 tons of residues, the fuel availability is not likely to pose any problem.

PFC has appraised the project and approved a loan of Rs. 100 million at the rate of 13% p.a. with a moratorium of 6 months. The project exhibits a Project IRR of 16%, Equity IRR of 22% and average DSCR of 1.5 at a steady tariff at Rs. 3.25 per kWh. The promoters are looking for options for balance loan amount of Rs. 40 million.

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2. Project Costs

	Plant & Machinery	148.3	3.16	72%
	Land & Building	18.4	0.39	9%
	Design Engineering, construction management	2.5	0.05	1%
	Preliminary & Preoperative Expenses including IDC	24.6	0.52	12%
	Working Capital Margin	2.6	0.06	1%
	Contingencies	8.6	0.18	4%
	Total Project Cost	205.0	4.36	100%

* @ Rs. 47 per US $

3. Proposed Means of Financing

	Total Debt Portion	140.0	2.98	68%
	Total Equity Portion	65.0	1.38	32%
	Total Project Cost	205.0	4.36	100%

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4. Committed Financing (if any)

a. Committed Debt Providers

PFC	Rs. 100 Million	13%	8 years	June 13, 2003

b. Committed Equity Providers

Promoters	1.38 million	100%

5. Estimates of Profitability (Rs '00,000)

Revenue from power sale	481	1030	1127	1127	1127	1127	1127	1127	1127	1127
Other revenue										
Fuel cost	182	409	469	492	516	541	567	594	623	653
O&M Cost	46.90	108.7	115.2	122.1	129.4	137.2	145.4	154.1	163.4	173.2
PBIDT	252	512	543	513	482	450	415	379	341	301
Depreciation	88	192	192	192	192	192	192	192	192	192
Interest Term loan	91	173	151	128	105	82	60	37	14	0
Working cap	21	23	25	25	25	25	25	25	25	0
Preliminary expenses	2	2	2	2	2	0	0	0	0	0
PBT	50	122	173	166	158	150	138	125	109	109
Provision for Tax	4	9	13	13	12	12	11	10	8	8
PAT	47	112	160	153	146	138	127	115	101	100
Dividend	0	0	0	68	68	68	68	68	68	68
Net Cash Flow	135	305	352	278	271	263	252	240	226	225

6. Projected Cash Flow (Rs. '00,000)

Sources of Funds										
PAT	0	47	112	160	153	146	138	127	115	101
Depreciation	0	90	194	194	194	194	192	192	192	192
Inc. in Equity capital	676	0	0	0	0	0	0	0	0	0
Inc. in term loans	1000	400	0	0	0	0	0	0	0	0
Inc. in bank borrowings	0	150	14	16	2	3	2	2	3	3
Inc. in Sundry Creditors	0	29	4	5	2	1	3	2	2	2
Total sources	1676	715	324	375	351	344	336	324	312	298
Application of funds										
Capital Expenditure	1600	416	0	25	25	25	25	25	25	25
Preliminary Expenses	8	0	0	0	0	0	0	0	0	0
Inc. in Current Assets	0	231	21	26	5	5	5	5	6	6
Term loan repayment	0	0	175	175	175	175	175	175	175	175
Inc. in other current assets	0	80	10	25	25	50	50	25	25	20
Dividend	0	0	0	0	68	68	68	68	68	68
Total Application	1608	727	206	251	298	323	323	298	299	294
Net Surplus	68	-12	118	124	54	21	13	26	14	5
DSCR	2.59	1.38	1.55	1.57	1.59	1.00	1.02	1.02	1.03	1.00
Av DSCR	1.60									
Project post tax IRR	15.27%		Equity IRR			36.65%				

7. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame. The promoters applied for finance from Power Finance Corporation (PFC). After negotiations for over 15 months they have received approval of PFC for a part of loan requirement. They are looking for balance of the loan.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations. The promoters have shown interest in availing carbon finance. They have approached few Indian consultants for this. However, they have not been able to monetize offsets from the project so far.

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission. At the moment no such tenders are open.

8. Project Promoter Contact Information

	Name of Project Promoter	Mr.S Chandra Reddy,
	Address	D.No.46-20-1, Dhanavaipeta,
	City, State, Province	Rajahmundry, Andhra Pradesh, India
	Contact Name	Satti Chandra Reddy
	Contact Phone	0883-2465224
	Contact FAX	–
	Contact EMAIL	–

	Name of Project Promoter	Mr. K. Surendranath
	Address	Flat No.501, Ganga Residency, Srinagar Colony,
	City, State, Province	Hyderabad, Andhra Pradesh, India
	Contact Name	K.Surendranath
	Contact Phone	040-55820071
	Contact FAX	040-5580072
	Contact EMAIL	surendranathk@hotmail.com

	Name of Project Promoter	Mrs. M Vijaya Chandra Kalyani
	Address	17-1-18/1-1, Seetampeta,
	City, State, Province	Rajahmundry, Andhra Pradesh, India
	Contact Name	M.Vijaya Chandra Kalyani
	Contact Phone	0883-2461225
	Contact FAX	—
	Contact EMAIL	—

9. Project Management Team

1	Satti Chandra Reddy	Chairman
2	K.Surendranath	Managing Director
3	M.Vijaya Chandra Kalyani	Director
4	S.Venkata Reddy	Technical Director

10. Project Promoter Financial History

	What were profitability figures last 3 years?	**Mr.Satti Chandra Reddy** He is the partner in M/s.Sitaram Reddy & S.Chandra Reddy. The firm is engaged in Civil construction activity and running successfully. His networth as on 31.03.2003 is Rs.44.33 million.
	Book value of firm?	
	EPS reserves and surplus last 3 years?	
	What is current business?	
	What are synergies between business and this project?	

	What were profitability figures last 3 years?	**Mr.K.Surendranath** He is assisting the Murali Mohan Boiled & Raw Rice Mill in procurement of paddy. He is a partner in Sri Laxmi Ganpathi Poultries. He owns a poultry farm with 1.5 lakh birds and is running successfully. His networth as on 31.03.2003 is Rs.45.62 million.
	Book value of firm?	
	EPS reserves and surplus last 3 years?	
	What is current business?	
	What are synergies between business and this project?	

	What were profitability figures last 3 years?	**Mrs.Vijaya Chandra Kalyani**
	Book value of firm?	She is one of the managing partner in M/s.Sri Murali Mohan Boiled & Raw Rice Mill. The rice mill is one of the biggest rice mills in Andhra Pradesh and is running successfully. Her networth as on 31.03.2003 is Rs.39.22 million.
	EPS reserves and surplus last 3 years?	
	What is current business?	
	What are synergies between business and this project?	

11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

The promoters have experience in construction, operation of agro-residue based boilers etc. The promoters also manage rice milling and poultry industry and thus have adequate management experience. The company proposes to hire professional managers for the operation of the proposed power plant. The senior team led by a Managing Director would include experienced Technical Director, General Manager who would have experience in construction and operation of thermal power plants. Similarly, company proposes to hire professional executives for procurement of biomass on a long term.

The company has appointed Mr.S.Venkata Reddy as Director (Tech.). Mr.Venkata Reddy has more than 30 years experience in power sector. He has been with APSEB before he retired as Chief Engineer in the year 2001. He has won gold medals for his achievements at Rayalaseema Thermal Power Station for three continuous years.

12. Special Purpose Vehicle Contact Information (If applicable):

	Name of SPV	Sainath Power Concepts Private Ltd.
	Address	Flat No.501, Ganga Residency, Srinagar Colony,
	City, State, Province	Hyderabad, Andhra Pradesh, India
	Contact Name	Mr.K.Surendranath
	Contact Phone	040-55820071
	Contact FAX	040-55820072
	Contact EMAIL	surendranathk@hotmail.com
	Names and shares of the promoters	Satti Chandra Reddy K.Surendranath M.Vijaya Chandra Kalyani
	Is a Shareholding agreement	Is being executed

	in place	
	Salient terms	

13. Project Details

	Greenfield project or involves existing equipment?	Greenfield
	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Clean Energy Generation using renewable biomass residues
	Size of Project (MW)?	6 MW
	Project Location? City, Province	Akkarpur Village, District Adilabad, Andhra Pradesh, India
	Off or on-grid?	On grid
	State Electricity Board?	AP Transco
	Technology?	Rankine cycle based power plant
	Type of Fuel?	Agro residue biomass
	Source of fuel supply?	Locally produced rice husk from rice mills, cotton and maize stalks

14. Feasibility Details

	Was Feasibility Study prepared independently?	Yes
	What firm prepared the Feasibility Study? List address and contact details	Zenith Corporate Services (P) Ltd. 10-5-6/B, My Home Plaza, Masab Tank Hyderabad 500028 Tel: 2337 6630/31

15. Background on the Power Purchase Agreement (if Applicable)

	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes
	Has a PPA been signed? (Yes or No)	Yes
	Nature of Agreement?	On the MNES guidelines
	Name of state electricity board or primary PPA signatory?	AP Transmission Corporation Ltd. (APTRANSCO)
	What date was the PPA signed?	February 2002
	When does it enter into force?	
	What is the length of the PPA? (Years)	20 years
	What is the initial purchase price?	Rs. 2.25 per kWh in the year 1994 -95 (effective rate in 2002-03 Rs. 3.32 per kWh)
	What is the annual % increase in purchase price?	5% up to 2003-04
	Can the project sell power directly to major consumers? (Yes or No)	No
	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	Letter of Credit from bankers of AP Transco
	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	Entire power generated by the project shall be bought by the APTRANSCO. PFC has reviewed the PPA but felt that it is weak.
	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	Not specified.
	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	Based on MNES guidelines till 2003-04. To be fixed by APERC for period thereafter. No provisions for deemed generation/penalties etc.
	Have the provisions for change in law, termination, liquidated damages , etc. been approved by existing lenders/investors?	Not specified
	Would the SEB/generating utility want a share in the ownership of carbon offsets?	Not clear

16. Other Agreements (where applicable)

	Fuel supply agreement signed?	Already executed
	Water/utility supply agreement signed?	Bore wells are already sunk in the site which will take care of water requirement. Additionally the company is contemplating obtaining permission from Irrigation Department for supply of canal water.
	Shareholder's agreement been entered into between existing equity holders?	Being executed as per the format of PFC.

17. Quantify and Describe Risks

	Risks	Low to High	Describe
	Market?	Medium	The state of AP is currently in deficit. The Government policy encourages renewable energy projects. Therefore the market risk is less. However, since the size of the plant is small, it is at best a decentralized or in-firm power.
	Country/Sovereign?	Low	Private power projects have been implemented on a regular basis and transactions of FDI repatriation are taking place regularly. However, since the promoters do not foresee foreign investments this risk is low.
	Regulatory?	Medium	The electricity sector in AP has been reformed and regulated by APERC, which is fully functional and issues tariff orders.
	Contract/counter party/ Enforceability	Low	The utility entities in AP honor contracts and so this risk is low.
	Construction?	Low	Being a standard technology the construction risk is low.
	Technology?	Low	Being a standard technology the risk is low.
	Management?	Medium	While the promoters do not possess experience in setting up power projects, they propose to hire professionals to manage the venture. Hence Management risk is moderate.
	Competition?	Low	Power generation projects based on biomass are approved by NEDCAP, which has conducted a detailed survey of district-wise biomass availability. Based on this a conservative policy of approving power projects that need only up to 25% of surplus biomass has been adopted by AP Government. The proposed project is one of the approved ventures. In view of this as also the policy of purchasing power generated by renewable energy the competition risk is low.
	Exit?	Low	Since the stock market is well established in India, this risk is low.

18. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
	Market?	Promoters propose to hire experienced professionals for procurement of biomass suitable for the plant. They also propose to engage the regulators and policy makers in convincing the need to off take the RE based power.
	Country/Sovereign?	
	Regulatory?	Since the PPA is likely to be reviewed in 2004, the tariff has been assumed on a conservative basis for the profitability calculations.
	Contract/counter party	
	Construction?	
	Technology?	
	Management?	The company proposes to hire experienced professionals at senior and middle/junior levels for the construction, operation and maintenance of the plant. They have already appointed a Technical Director having the desired experience to set up and run the power plant.
	Enforceability of Contracts?	
	Competition?	
	Exit?	

GHG MITIGATION ASSESSMENT

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
	Does the project rely on ODA?		√
	Has the project received host country approval?		√
	Does project meet size definition for? –under 15 MW for renewables projects –under <15 gigawatthours/year savings for energy efficiency projects –under15 kilotonnes CO2E for emissions reductions from process changes	√	

2. GHG Mitigation Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Have the emissions reductions been estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√
	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?	√	

3. GHG Assessment details

	Parameter	Particulars
1	Baseline methodology	The emission reduction is carried out on the ex-ante basis as suggested in accepted methodology for small scale projects by UNFCCC. The project boundary in this case includes the proposed plant and the grid of Andhra Pradesh state, in which the project shall supply power. Based on power supplied within the state, by the private plants, bought from other states of the southern region and from the central PSU power companies, emission factor was calculated for the last three years (2000,01 and 02). The GHG emission from hydro plants was ignored to be on a conservative side. The average coal fired thermal plant efficiency was assumed at 33%. The emission factor for sub-bituminous coal provided by IPCC was used as basis. Based on this the average emission factor for AP state is 745 tCO2/MU.
2	Baseline Emissions tCO2 p.a.	25,860 (from 2007)
3	Project Emissions tCO2 p.a.	0
4	Emission reductions tCO2 p.a. (2-3)	25,860

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APPENDIX A

GREENHOUSE GAS MITIGATION POTENTIAL ESTIMATION

OF

3 X 7 MW SOMESHWARA MINI HYDEL POWER PROJECT IN KARNATAKA

PROMOTED BY

PIONEER GENCO LIMITED

BY:

GREENHOUSE GAS POLLUTION PREVENTION-CLIMATE CHANGE SUPPLEMENT

A USAID/INDIA PROJECT IMPLEMENTED BY:

THE LOUIS BERGER GROUP, INC.

C-6/7 SAFDARJUNG DEVELOPMENT AREA

NEW DELHI 110 016

SEPTEMBER 2003

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Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the 21 MW hydroelectric power project in Karnataka was prepared for Infrastructure Development Finance Company Ltd. by The Louis Berger Group, Inc. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by Pioneer Genco Ltd.(the project promoter), IDFC and that obtained from public domain. The information contained in the note is solely meant for IDFC and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to IDFC, Pioneer Genco and several other institutions including CEA, IPCC/IEA, UNFCCC, and The World Bank for the background data provided by them through their websites.

This note should not be considered an endorsement or certification to the project or the technology and it should not be deemed to be any undertaking, warranty or endorsement by The Louis Berger Group, Inc. and US Agency for International Development.

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1. Background of the project

Pioneer Genco Limited (PGL), a Special Purpose Vehicle (SPV) company promoted by Pioneer Builders and its group companies Penna Cement Industries Limited (PCL) and Sriba Industries Limited (SIL), proposes to construct, erect and operate a 21 MW (3 x 7MW) hydroelectric power project on the banks of the river Cauvery near Shivasamudram village, Malavalli Taluk in Mandya District of Karnataka. The project involves a run-of-the-river scheme which is based on a diversion of the Cauvery river downstream of the 42 MW Shivasamudram hydro power station and two major reservoirs viz. Krishnarajasagar on the river Cauvery and Kabini on river Kabini

The project shall utilize the flows in the river Cauvery by constructing a diversion structure 140 m in length, which would divert the water to a 110 m long power canal Three penstocks take off from the intake located at the end of the power canal to the 3 turbines in the powerhouse having an installed capacity of 7 MW each. After generation of power, the water would be let back into the river through a 500 m long tailrace canal. The proposed weir shall result in least submergence since the diversion structure has a height of only 4 meters above average riverbed. This will also avoid changes in the upstream regime of the river.

The project would generate a total of 75 million kWh of power and after meeting the auxiliary equipment, net export of 73.5 million kWh is possible. In a 90% dependable year will be 66 million kWh. The power from the project will be supplied in the state power grid of Karnataka. PGL is finalizing the PPA with Karnataka Power Transmission Corporation Limited (KPTCL).

2. GHG emission reduction objectives of the proposed project

India's power sector is characterized by heavy reliance on thermal power. Since 1950 the thermal hydro mix has been steadily deteriorating and tilting heavily towards thermal. As shown in Figure 1 (Source Annual Report of Ministry of Power 2002-03) the All India installed generating capacity mix for utilities was highest at 46:54 at the end of third five year plan in 1966. The main fuel used by thermal power plant is sub-bituminous coal and lignite. Recently few natural gas based power plants have been set up by NTPC. Indian coal quality has also been deteriorating on account of open cast mining, which leads to mixing of rubble with coal. As a result, the overall conversion efficiency of the coal fired power plants in India ranges between 20 – 30% (Source: Anthropogenic Emissions from Thermal Power Generation in India: Generation and Source Characterization Moti Mittal, C. Sharma, OSC, Ohio State University- 2002).

ALL INDIA INSTALLED GENERATING CAPACITY HYDRO-THERMAL MIX (%) (UTILITIES)

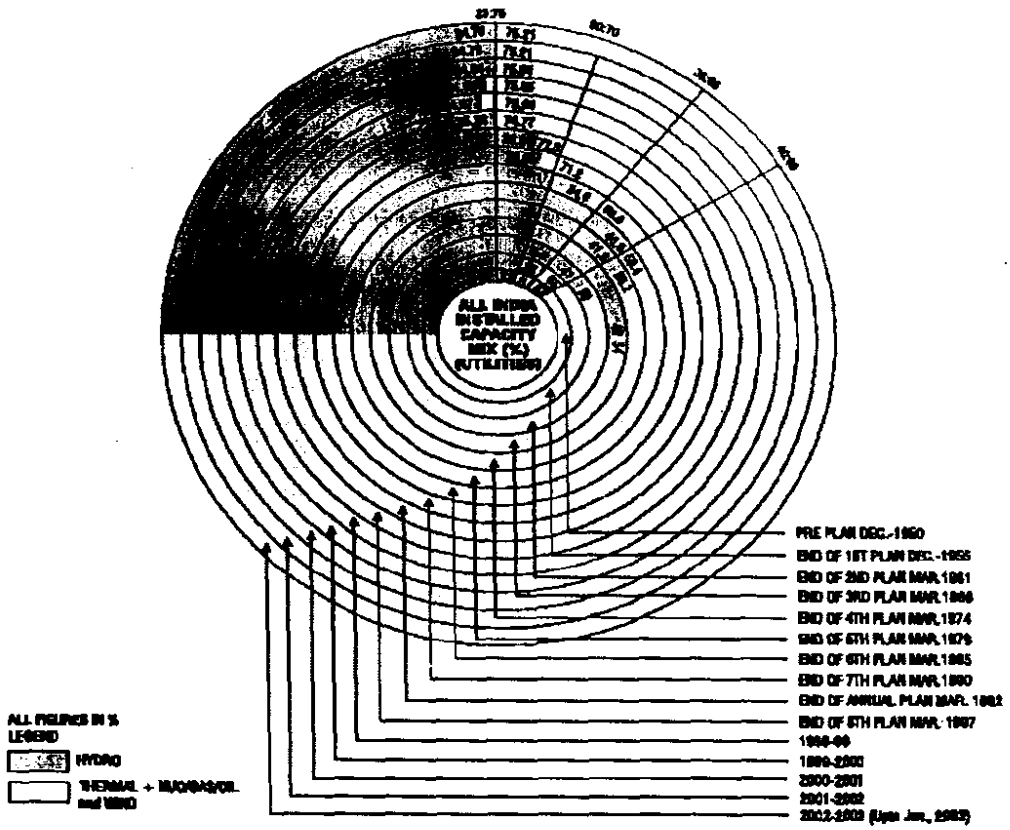

Figure 1: Grid Mix

In the above backdrop, Government of India has been encouraging the use of alternative sources of energy. The proposed project is based on one such form of natural energy supply viz. hydroelectric source, which does not lead to emissions of any type. The project would make use of the gradient available in the river Cauvery and its tributary Kabini in the state of Karnataka without damaging the natural habitat. Since the proposed plant would not involve a dam the submergence would be negligible. This ensures that the project does not damage flora and fauna and also does not lead to resettlement issues. Overall, the project helps in reducing dependence on fossil fuels without leading to additional GHG emissions.

a. ***Clean Technology nature***

The project consists of diversion structures across the Cauvery from the left bank downstream of the Shivasamudram hydro power project. The water would be conveyed across three penstocks which feed it to three 7 MW turbo generator units. Subsequently, water would be released through a 500 m tailrace canal. The diversion structure would have a height of 4 m above mean riverbed. The river banks at this place are steep. All the project construction is close to the river and do not encompass any forest land. These features ensure that there will be least submergence of vegetation, thereby minimizing the methane emission.

b. ***Sustainable Development objectives/aspects***

The project location is 2 KM downstream of the Shivasamudram village and does not have any inhabitation. This means that the project does not involve practically any rehabilitation and resettlement issues. Since the water collection and flows in the project are not likely to result in any reservoir that may affect the geological profile, the project would be safe from seismological point of view. The project would directly employ local people and the power generated would support industrial and commercial activity in the Mandya district. Thus, it would result in ancillary benefits to the local population.

c. ***Host country Government (GOI) objectives***

Government of India, Ministry of Non-Conventional Energy Sources (MNES) and the Karnataka state Government have been encouraging addition of power generating capacity based on renewable sources of energy. Under the schemes of MNES, small hydroelectric power generation (<25 MW) has been promoted as one such option. The power policy of Government of India stresses electrification of villages through renewables. It also encourages decentralized power generation as a means of strengthening and stabilization of the power grid performance. The proposed project meets all the essential requirements and has therefore received approval from the state level nodal agency of MNES i.e. Karnataka Renewable Energy Development Ltd. (KREDL).

3. Business as usual or Baseline identification

This section describes the existing power supply situation in the state of Karnataka where the power generated by the project is fed.

a. ***Project Boundary***

The project is expected to generate 66 million kWh of power in a 90% dependable year. The power plant has a capability of generating 75 million kWh power corresponding to a plant load factor of 40%, which conforms to the other existing hydro power projects in Karnataka. The state had an energy deficit of 12.5% and a peak shortfall of 17% in the year 2001-02. Additional power generation capacity is being built through both

conventional and non-conventional sources. The power supplied by the project is most likely to be consumed within the state. Each unit of power supplied by the project would, therefore, replace an average unit supplied in the state. The relevant project boundary for the project on supply side is the state power grid.

Karnataka power grid is a part of the Southern Regional grid. The power supplied to the consumers in the state is drawn from a variety of sources, KPCL own generation, private producers, purchase within the southern region from other states and purchase from central power utilities against state's share. During discussion with KPTCL it was understood that its policy is to purchase all the power available within state first. Thus, when an additional unit is available it will back power from central power PSUs. In other words, the marginal unit is the power supply from these sources.

On the demand side that is generation side the project boundary consists of the river basin of Cauvery, Kabini and the catchment area of these rivers.

b. Relevant baseline methodology/scenarios

Baseline is defined as the scenario in the relevant project boundary that would have prevailed in the absence of the project. It is also referred to as "business as usual" scenario. There are two possible methodologies to decide the baseline in situations like this. a) Average of weighted average emissions of all generating sources serving the system, excluding those which do not result in GHG emissions and the weighted average of recent capacity additions defined as the lower of most recent 20% of plants built or the 5 most recent plants; and b) The weighted average emissions of the current generation mix. The first approach is complicated and depends on availability of data. The second approach on the other hand is easy to understand and estimate, as adequate data is available from regular channels. Sometimes the plants under construction and planned are also taken into account. In view of the above, the second approach is suggested.

c. Time dimensions of the baseline

India has an overall installed capacity of 107,534 MW as on March 31, 2003 (MOP Annual Report 2002-03). This includes 76,525 MW thermal power and 26,660 MW of Hydro electric power. The balance is from wind (1,630 MW) and nuclear (2,720 MW). As per MNES report the total installed capacity based on small hydro power projects (up to 25 MW) is 1,450 MW amounting to 1.35%. The total potential for generation from this category in India is estimated at 15,000 MW. Thus, about 10% of the potential has been tapped. It can be concluded that in the foreseeable future, small hydro power will not form significant proportion of the baseline. Large size hydroelectric power projects which form about 23.5% of the total installed capacity should not be included in the baseline. While

these projects lead to high amount of GHG emissions, it is rather difficult to calculate exact amount due to lack of developed methodology. However, the non-inclusion will make the estimate more conservative and reduce chances of "gaming".

d. ***Annual /periodic estimations***

In view of the above status of implementation of projects, the baseline emissions will not change practically. Therefore, it may not be necessary to revise the baseline estimate at least during the first ten years in which investors are likely to purchase the credits.

e. ***Baseline case emissions estimation***

Based on the methodology presented earlier and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

CO_2 Emissions from power used in the state grid

The requirement of power in the state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the KPTCL purchases power from the central public sector power generating companies, in accordance with its allotted share. This is a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 34% of the capacity and 66% of the hydel sources. However, based on the statistics of power generated and purchased for the last three years 2000 - 02, it is observed that in 2001 of a total 49,255 MU consumed by the state grid 63.3 % was supplied from thermal sources, mainly coal fired plants, 35.7 % from hydel and balance 1.0 % by nuclear sources. The thermal plants a majority of which are based on high ash Indian coal use sub bituminous variety coal as fuel. By and large the plants are old and exhibit conversion efficiencies in the range of 25-30%. For conservative considerations this is assumed at a level of 33%. Indian electric power grid especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission & distribution losses, sometimes in the excess of 40%. However, since the proposed project will also feed power in the same grid as the conventional one's this is not significant for the analysis.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like The World Bank. The emission factor of thermal power plants using bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the above mix of supply from various sources as mentioned above, the

weighted average emission factor of the Karnataka state grid is 16.6 tC/TJ. From this analysis it is clear that Karnataka grid is in fact one of the grids which exhibits a well balanced thermal: hydro power mix and emission reductions that can be achieved by green energy projects will be the least.

4. GHG mitigation potential of the project

The proposed power project would use a natural source of energy, i.e. energy in the flowing river water. Moreover, the proposers have taken great care in design to ensure that the submergence on account of the project is minimal. The land area under forest around the project site is almost nil. These factors ensure that the emissions of methane due to submerged plants/vegetation/biomass would be negligible. Therefore, it will be reasonable to assume that the project does not have any GHG emissions.

The GHG emission reductions from the project would be:

Annual GHG Reduction =	**GHG Emission per million kWh of the baseline**	X	**Annual Units fed by the Project million kWh**

As discussed above the GHG emission per MU or the emission factor of the Karnataka grid is 664 tCO_2 per MU under the assumptions discussed above based on the average energy fed by various sources for the past three years. The project is expected to export 63.4 million kWh to the Karnataka grid each year. Thus, the expected Annual GHG reduction from the 21 MW project would be 42,094 tCO_2 p.a. or **42,000 tCO_2 p.a.**

The above methodology, based on weighted average emission factors of the grid, is in conformity with the one for grid feeding small scale projects as specified by the CDM Executive Board of the UNFCCC.

5. Monitoring & Verification

It is very crucial to monitor and verify periodically the actual emission reductions achievable by the CEPs. There are two sides of this M&V, one to ensure that the baseline itself does not change significantly and second the project performs as envisaged in the design. As discussed in detail earlier the composition of entire RE based power generation is not likely to be significant in the foreseeable future. Therefore, the former is taken care of to a major extent. It is therefore important to measure the performance of the project in detail and with greater accuracy.

Performance of projects generating power for export to utility grid can be easily measured based on electric power generated and supplied to the grid. The proposers have signed a power purchase agreement with KPTCL, specifying the Metering and Billing clauses. In fact the project's revenue entirely depends on the

metering. The PPA provides for meters and check meters meeting prescribed standards and accuracy class. Thus, PPA provides the procedure of measuring and invoicing of the meter reading and also maintenance of the meters.

The following M&V mechanism is suggested:

It is proposed to vest the responsibilities of monitoring the parameters identified earlier in to an interdepartmental group consisting of representatives from quality control, production, maintenance and strategic planning departments, which shall *inter alia*

- Meter and record the power generated and sold to the grid
- Keep track of source wise power supply in the southern electric power grid and the status of completing the National Grid
- Measure/keep record of rainfall in the catchment area of the project

APPENDIX A

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

Kalyani Steels Ltd.
8 MW Blast Furnace Gas Firing/Waste Heat Recovery Power Project

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Background:

This form is for the purpose of gathering relevant project finance information for projects developed under USAID India's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement (GEP-CCS). It is designed for project developers and financial institutions involved with clean energy or other types of GHG mitigating projects that are placed into the GEP-CCS pipeline.

Format: The form is designed to capture the types of projects seeking Project Finance.

Project Finance is focused on anticipated revenue streams from the project activity (or off-balance sheet financing). For example, a grid-based biomass co-generation facility would likely depend upon energy payments from a local electricity board. Much more detailed information about the project, project promoter, power purchase agreement, debt and equity sponsors and profitability and cash flow analyses are necessary to determine the relative risk and financial viability of the project.

This is a working electronic document/check-list. When each question is answered, place an electronic checkmark (√) in the left-hand box as a reference point for completion of the form.

Project Name: 8 MW blast furnace gases waste heat recovery power plant

Project Promoter: Kalyani Steels Ltd.

Special Purpose Vehicle: --

1. Executive Summary: Project at a Glance

Kalyani Steels Ltd. (KSL) a company of the Kalyani Group has an integrated steel plant, in its Kalyani Ferrous Industries unit located in Ginigera village near Hospet town in Karnataka State. The plant uses two mini blast furnaces to produce carbon and alloy steel in billets and rounds. Installed capacity of the plant is 290,000 tons of steel products annually. The blast furnaces generate 52,000 m3/hr of off gases each. The gas contains N2 – 52%, CO – 18.4%, CO2 – 18.4%, Moisture – 9.3% H2 1.8% and traces of methane. Due to carbon monoxide, the gas is highly poisonous and a health hazard. Since the gas also contains particulates, it is wet scrubbed. In view of calorific content and volume of the gas, KSL proposes to burn the gas in a boiler and generate steam to run steam turbines for power generation. KSL has designed a system and has had it reviewed by reputable engineering consultants. A part of the blast furnace gases are also used for preheating air. The design confirms that the net available volume of blast furnace gases can support a power plant of 8000 kW for a PLF of 75%. Currently KSL purchases a sizeable amount of power from the Karnataka grid. Proposers have estimated that the proposed waste heat based power plant will meet around 31% of the power requirements and thus reduces the overall cost of production significantly

The power plant would be based on the conventional Rankine cycle technology employing a condensing cum bleeding steam turbine generator. The proposed plant would meet the stipulation in the clearance to the steel plant that 1/3rd of power requirement will be met through continuous captive generation. KSL has received clearances from the Karnataka Pollution Control Board, and MOEF for the project. The required land and other facilities have been procured. Since there will be no sale of power, there is no need for a PPA. This also establishes the ownership of the carbon offsets that will be generated with the promoter KSL.

2. Project Costs

	Plant & Machinery	231.43	4.92	85.7%
	Land & Building	3.86	0.08	1.4%
	Civil, detailed Engineering			
	Erection & Commissioning			
	Preliminary & Preoperative Expenses	22.36	0.48	8.3%
	Working Capital Margin	2.03	0.04	0.8%
	Contingencies	10.39	0.22	3.8%
	Total Project Cost	270.07	5.75	100%

3. Proposed Means of Financing

	Total Debt Portion	190.00	4.3	74%
	Total Equity Portion	80.07	1.45	26%
	Total Project Cost	270.07	5.75	100%

4. Committed Financing (if any)

a. Committed Debt Providers

IREDA*		12.5%		NC
BOB	85	11%		

* Due to the conditionalities attached, KSL may not avail of this loan

b. Committed Equity Providers

KSL and Kalyani Group	80	

5. Estimates of Profitability

Revenue from power sale*	171.1	171.1	171.1	171.1	171.1	171.1	171.1	171.1	171.1	171.1
Other revenue										
Fuel cost	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1	63.1
O&M Cost	13.5	14.2	14.9	15.6	16.4	17.2	18.1	19.0	20.0	20.9
Admn/selling cost										
PBIDT	94.5	93.8	93.1	92.4	91.6	90.8	89.9	89.0	88.0	87.1
Depreciation	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	11.6
Interest Term loan	26.0	21.7	13.0	4.3						
Working cap	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
PBT	43.7	47.3	55.3	63.2	66.8	65.9	65.1	64.2	63.2	73.8
Provision for Tax									21.6	21.3
PAT	43.7	47.3	55.3	63.2	66.8	65.9	65.1	64.2	41.6	52.5
Net Cash Flow	66.8	70.4	78.4	86.3	89.9	89.0	88.2	87.3	64.7	64.1

* Based on avoided cost of purchase of power

6. Projected Cash Flow

Sources of Funds											
PAT		43.7	47.3	55.3	63.2	66.8	65.9	65.1	64.2	41.6	52.5
Depreciation		23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	11.6
Inc. in Equity capital	70										
Inc. in term loans	200										
Inc. in bank borrowings											
Total sources		66.8	70.4	78.4	86.3	89.9	89.0	88.2	87.3	64.7	64.1
Application of funds											
Capital Expenditure	270										
Inc. in Current Assets											
Term loan repayment			66.7	66.7	66.7						
Taxes										21.6	21.3
Interest		27.7	23.3	14.7	6.0	1.7	1.7	1.7	1.7	1.7	1.7
Total Application	270										
Net Surplus	(270)	94.5	93.8	93.1	92.4	91.6	90.7	89.9	89.0	88.0	87.0
IRR	32.2%										
Average DSCR	5.22 Times										

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7. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame. The company had negotiations with IREDA and a preliminary loan approval has been received. However, due to high rates of interest and formalities required to be completed, the promoters may not avail the loan.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations. No

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission. At the moment no such tender is open. Promoters are interested in applying for carbon offset monetization if possible.

8. Project Promoter Contact Information

	Name of Project Promoter	Kalyani Steels Ltd.
	Address	Mundhwa
	City, State, Province	Pune, Maharashtra
	Contact Name	Mr. A. S. Karanth
	Contact Phone	+91 20 6871666
	Contact FAX	020 687 6961
	Contact EMAIL	askaranth@bharatforge.com

9. Project Management Team

10. Project Promoter Financial History

	What were profitability figures last 3 years? Rs. Million	87.8 (1997-98), 82.4 (1998-99), 102.5 (1999-00)
	Book value of firm?	101.0, 101.2, 91.3
	EPS reserves and surplus last 3 years?	2.9, 2.7, 7.1
	What is current business?	Alloy and carbon steel castings
	What are synergies between business and this project?	The source of fuel, viz. the blast furnace off gases is a waste byproduct from the manufacturing operation. Using the same for partially meeting power needs, will bring down the cost of production and hence improve competitiveness

11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

Kalyani Steels Ltd. is a company of the Kalyani Group, which is one of the well known group of companies in India in the field of steel, cast iron and alloys industry. The flagship of the group is Bharat Forge Ltd. The Group's annual turnover is around US $ 500 Million. The group's products are major material inputs/components for the automobile, engineering and manufacturing industry. All the major Indian and many international auto manufacturers are clients of the group. The group has a company called BF Utilities Ltd. which is a dedicated energy supply company which owns and manages wind energy projects. KSL has decided to employ a project consultant specialized in power plant engineering, and construction. The consultant will carry out the basic conceptual design and assist in preparing equipment specifications, procurement erection and commissioning. The group will use in-house expertise and synergize it with external professional consultants to effectively promote the project.

12. Special Purpose Vehicle Contact Information (If applicable):

	Name of SPV	NA
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	
	Names and shares of the promoters	
	Is a Shareholding agreement in place	
	Salient terms	

13. Project Details

	Greenfield project or involves existing equipment?	Greenfield
	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Clean energy generation, conversion of waste into energy
	Size of Project (MW)?	8
	Project Location? City, Province	Village Ginigera, near Hospet town in Karnataka state in Southern India
	Off or on-grid?	Off grid
	State Electricity Board?	NA
	Technology?	Waste gas firing in boiler and power generation using Rankine cycle
	Type of Fuel?	Blast furnace off gases containing carbon monoxide
	Source of fuel supply?	Two Blass Furnaces

14. Feasibility Details

	Was Feasibility Study prepared independently?	No but the company's study was vetted by independent engineering consultants
	What firm prepared the Feasibility Study? List address and contact details	NA

15. Background on the Power Purchase Agreement (if Applicable)

	Does Project involve PPA (Yes or No) If no, skip to next heading.	NO
	Has a PPA been signed? (Yes or No)	
	Nature of Agreement? Take or Pay? Other?	
	Name of state electricity board or primary PPA signatory?	
	What date was the PPA signed?	
	When does it enter into force?	
	What is the length of the PPA? (Years)	
	What is the initial purchase price?	
	What is the annual % increase in purchase price?	
	Can the project sell power directly to major consumers? (Yes or No)	
	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	
	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	
	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	
	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	
	Have the provisions for change in law, termination, liquidated damages , etc. been approved by existing lenders/investors?	
	Would the SEB/generating utility want a share in the ownership of carbon offsets?	

16. Other Agreements (where applicable)

	Fuel supply agreement signed?	NA
	Water/utility supply agreement signed?	
	Shareholder's agreement been entered into between existing equity holders?	
	Special provisions of above agreements?	

17. Quantify and Describe Risks

	Risks	Low to High	Describe
	Market?	Low	The project will enhance the power supply and also reduce cost of production thereby making KSL more competitive.
	Country/Sovereign?	Low	NA
	Regulatory?	Low	The project reduces future regulatory risk by establishing a pattern of avoided emissions.
	Contract/counter party	Low	NA
	Construction?	Low	Involves standard equipment
	Technology?	Low	Proven Rankine cycle technology
	Management?	Low	Successfully running the existing units profitably
	Enforceability of Contracts?	Low	NA
	Competition?	Low	NA
	Exit?	Low	NA

18. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
	Market?	
	Country/Sovereign?	
	Regulatory?	

	Contract/counter party	
	Construction?	
	Technology?	
	Management?	
	Enforceability of Contracts?	
	Competition?	
	Exit?	

GHG MITIGATION ASSESSMENT

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
	Does the project rely on ODA from Annex B Countries?		√
	Has the project received host country approval?		√
	Does project meet size definition for Bonn Fast Track CDM? --under 15 MW for renewables projects --under <15 gigawatthours/year savings for energy efficiency projects --under15 kilotonnes CO2E for emissions reductions from process changes	√	

2. GHG Mitigation Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Have the emissions reductions been estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√
	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?	√	

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3. GHG Assessment details

	Parameter	Particulars
1	Baseline methodology	The proposed project replaces the power off take from the Karnataka grid, which is comprised of a mix of power sources. Based on the power supply figures published by the Planning Commission of India from the SEB annual reports, the power supplied in Karnataka comprises 63% thermal, 36% hydel and 1% nuclear and others. This translates into an emission factor of 664 tCO2/million kWh assuming an overall conversion efficiency of 33%. The plant would generate ~49 million kWh p.a. after meeting the auxiliary needs. An equivalent amount of power would be replaced from the grid. As the project capacity is less than 15 MW it meets the small scale project criteria and weighted average emission factor of the replaced power can be used as the baseline or business as usual scenario. With the above emission factor the project would generate offsets of 32,450 tCO2 p.a.
2	Baseline Emissions tCO2 p.a.	32,450
3	Project Emissions tCO2 p.a.	0
4	Emission reductions tCO2 p.a.	32,450

APPENDIX A

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

KCP Cements Limited

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Background:

This form is for the purpose of gathering relevant project finance information for projects developed under USAID India's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement (GEP-CCS). It is designed for project developers and financial institutions involved with clean energy or other types of GHG mitigating projects that are placed into the GEP-CCS pipeline.

Format: The form is designed to capture the types of projects seeking Project Finance.

Project Finance is focused on anticipated revenue streams from the project activity (or off-balance sheet financing). For example, a grid-based biomass co-generation facility would likely depend upon energy payments from a local electricity board. Much more detailed information about the project, project promoter, power purchase agreement, debt and equity sponsors and profitability and cash flow analyses are necessary to determine the relative risk and financial viability of the project.

This is a working electronic document/check-list. When each question is answered, place an electronic checkmark (√) in the left-hand box as a reference point for completion of the form.

Project Name: Power generation from Pre-heater gas and clinker cooler of cement plant

Project Promoter: The KCP Ltd.

Special Purpose Vehicle: NA

1. Executive Summary: Project at a Glance

The KCP Ltd., (KCP), a well diversified company with forays in Sugar, Cement, Heavy engineering, Hydel projects, technology management and joint ventures in equipment manufacture, sugar, bio-pesticides sectors is the promoter of the project. KCP has a cement plant with a capacity of 500,000 tons per annum at Macherla in Guntur district of Andhra Pradesh. The first plant set up way back in 1940s essentially for meeting cement requirement for building of the Nagarjunasagar dam. The company has been focusing on new technologies with a view to reducing specific energy consumption. In 1956 it set up the first plant based on dry technology but later shifted to wet process. KCP availed of loans under the World Bank line of credit. These efforts have enabled the company to reduce the power consumption from 135 – 140 kWh/ton to around 90 kWh/ton. The target is to reduce it to 80 kWh/ton. To achieve these improvements, the company proposes to take up the proposed project.

It is proposed to utilize sensible heat in two streams: a) the hot air from grate type clinker cooler of the rotary kiln and b) gases from the pre-heater. At present the 78,000NM^3/hr of gases from the grate cooler at around 300^{0}C are cooled in a gas to air heat exchanger to 120^{0}C – 140^{0}C. in the proposed system the heat in these gases will be recovered in a waste heat recovery system to generate 3.6 tons/hr of steam. In case of the preheater, the 255,000 NM^3/hr gases at 310^{0}Care used in raw mill and coal mill after cooling. It is proposed to recover waste heat from this stream by cooling it to 220^{0}C, which is permissible in the mills. Due to high gas flow rates, the potential for heat recovery is very high. The proposers have estimated a total capacity of 1468 kW of power generation. The waste heat recovery plants will generate steam, which will be used in a steam turbine for power generation.

The proposed plant is expected to generate 8.5 million kWh of power at a capacity factor of 66%, at which level the cement unit needs the power. For cement plants continuous operation is crucial. Several cement plants in India suffer due to unreliable power supply situation. The proposed power generation plant will help KCP in strengthening captive power capacity. The power so generated will replace power from grid. The power grid of AP is comprised of high proportion of thermal power, with an emission factor of 981 tCO_2/MU. The proposed plant would thus help in mitigating 8,338 tCO_2 p.a.

2. Project Costs

	Plant & Machinery	56.26	1.15	
	Land & Building			
	Civil, detailed Engg	1.46	0.03	
	Erection & Commissioning	0.00		
	Preliminary & Preoperative Expenses	0.00		
	Working Capital Margin	0.00		
	Contingencies	2.28	0.43	
	Total Project Cost	60.00	1.22	

3. Proposed Means of Financing

	Total Debt Portion	48.0	1.04	80
	Total Equity Portion	12.0	0.26	20
	Total Project Cost	60.0	1.30	

4. Committed Financing (if any)

a. Committed Debt Providers

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b. Committed Equity Providers

Internal Accruals	0.26 million	20%

5. Estimates of Profitability (Rs. '00,000)

Power saving (net)		321.0	321.0	321.0	321.0	321.0	321.0	321.0	321.0	321.0
Other revenue										
Fuel cost										
O&M Cost		34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0
Admn/selling cost										
PBIDT										
Depreciation		31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7
Interest Term loan	19.2	32.0	19.2	6.40						
PBT	-19.2	223.3	236.1	248.9	255.3	255.3	255.3	255.3	255.3	255.3
Provision for Tax*	0	0	0	0	0	0	0	0	0	0
PAT	-19.2	223.3	236.1	248.9	255.3	255.3	255.3	255.3	255.3	255.3
Net Cash Flow	-19.2	255.0	267.8	280.6	287.0	287.0	287.0	287.0	287.0	287.0

6. Projected Indicators

The proposed project is one of the investment projects being taken up by the company. As such the profitability and other indicators would not be workable. Moreover, since the project is for improvement of energy efficiency, it is eligible for tax deduction. With all these the company's bottom line would improve.

Cash Flow Analysis

Sources of Funds										
PAT										
Depreciation										
Inc. in Equity capital										
Inc. in term loans										
Inc. in bank borrowings										
Total sources										
Application of funds										
Capital Expenditure										
Inc. in Current Assets										
Term loan repayment										
Taxes										
Dividend										
Total Application										
Net Surplus										
IRR										
DSCR										
Av DSCR										

7. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame. No. The Project has been conceived recently. So far the company has not decided to approach lenders.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations. No.

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission. Yes. However, no tenders are open at this point of time. KCP is also interested in monetizing the carbon offsets from the projects if possible.

8. Project Promoter Contact Information

	Name of Project Promoter	KCP Cements Limited.
	Address	Ramakrishna Buildings, 2, Dr. P. V. Cherian Cresent
	City, State, Province	Chennai, Tamil Nadu
	Contact Name	Mr. K. B. Pranesh, Secretary & Corporate General Manager (Finance)
	Contact Phone	044 28270687
	Contact FAX	044 28255762
	Contact EMAIL	pranesh@kcp.co.in

9. Project Management Team

	Mr. K. B. Pranesh	Secretary & Corporate General Manager (Finance)
	Mr. Ravi Chitturi	Managing Director, KCP Technologies Ltd.

10. Project Promoter Financial History

	What were profitability figures last 2 years? PAT	Rs. 79 mn (2001-02), Rs. 57 mn (2000-01)
	Book value of firm?	Rs. 75.4, Rs. 77.8,
	EPS reserves and surplus last 3 years?	Rs. 6.13, Rs. 4.40 Rs. 843.5 mn, Rs. 874 mn
	What is current business?	Cement, Engineering, Sugar, power generation
	What are synergies between business and this project?	The project is for conservation of energy in its cement plant. It would directly enhance the profitability and operations of the plant.

11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

The company is in the business of cement manufacture since the past 65 years. It is a well diversified and profit making company. It has both manufacturing as well as engineering businesses. It has vast experience in setting up large size projects in India and abroad. The company has sizeable commodity and project export income. Company has also the option of implementing the project through an EPC contract. In the KCP Group there is a technology development and commercialization company KCP Technologies Ltd. With all this background the promoter has the necessary experience to establish the project. Moreover, the proposed project is concerning modification of the hot air/flue streams. The company's workforce is capable to operate and maintain the equipment.

12. Special Purpose Vehicle Contact Information (If applicable):

	Name of SPV	NA
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	
	Names and shares of the promoters	
	Is a Shareholding agreement in place	
	Salient terms	

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13. Project Details

	Greenfield project or involves existing equipment?	Modifications to the existing equipment.
	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Process improvement as well as clean energy generation
	Size of Project (MW)?	1.4 MW
	Project Location? City, Province	Macherla in Guntur district of Andhra Pradesh
	Off or on-grid?	Off grid
	State Electricity Board?	
	Technology?	Bottoming cycle waste heat recovery based power plant using Rankine cycle.
	Type of Fuel?	Waste heat
	Source of fuel supply?	Gases from grate cooler and preheater

14. Feasibility Details

	Was Feasibility Study prepared independently?	Yes
	What firm prepared the Feasibility Study? List address and contact details	KCP Technologies and MKRC

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15. Background on the Power Purchase Agreement (if Applicable)

	Does Project involve PPA (Yes or No) If no, skip to next heading.	No
	Has a PPA been signed? (Yes or No)	
	Nature of Agreement? Take or Pay? Other?	
	Name of state electricity board or primary PPA signatory?	
	What date was the PPA signed?	
	When does it enter into force?	
	What is the length of the PPA? (Years)	
	What is the initial purchase price?	
	What is the annual % increase in purchase price?	
	Can the project sell power directly to major consumers? (Yes or No)	
	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	
	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	
	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeuere clauses?	
	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	
	Have the provisions for change in law, termination, liquidated damages , etc. been approved by existing lenders/investors?	
	Would the SEB/generating utility want a share in the ownership of carbon offsets?	

16. Other Agreements (where applicable)

	Fuel supply agreement signed?	NA
	Water/utility supply agreement signed?	
	Shareholder's agreement been entered into between existing equity holders?	
	Special provisions of above agreements?	

17. Quantify and Describe Risks

	Risks	Low to High	Describe
	Market?	Low	The company's products have an established market. The proposed project would boost the bottom-line and improve competitiveness of the product.
	Country/Sovereign?		NA
	Regulatory?		NA
	Contract/counter party		NA
	Construction?	Low	Simple equipment
	Technology?	Low	Standard technology
	Management?	Low	Skilled and capable management. Recognized group of companies.
	Enforceability of Contracts?		NA
	Competition?		NA
	Exit?		NA

18. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
	Market?	
	Country/Sovereign?	
	Regulatory?	
	Contract/counter party	
	Construction?	
	Technology?	
	Management?	
	Enforceability of Contracts?	
	Competition?	
	Exit?	

GHG Mitigation Assessment

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
	Does the project rely on ODA ?		√
	Has the project received host country approval?		√
	Does project meet size definition? --under 15 MW for renewables projects --under <15 gigawatthours/year savings for energy efficiency projects --under15 kilotonnes CO2E for emissions reductions from process changes	√	

2. GHG Mitigation Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Have the emissions reductions been estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√
	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?	√	

3. GHG Assessment details

	Parameter	Particulars
1	Baseline methodology	The project envisages use of waste heat being let out at present. Thus, the overall efficiency of using the fuel improves. The power generated using the waste gas streams, would be used for captive purpose. This would reduce purchased of grid power to the extent of 8.5 MU. The proposed plant will be in KCP's plant in AP. Therefore, the project boundary would be the power grid of AP. Based on the figures of power supplied in the Andhra Pradesh; the AP grid exhibits an emission factor of 981 tCO2 per MU. This is assuming the T&D losses are 24% and the efficiency of thermal power generation is 33%. The proposed project would, therefore result in GHG emission reduction of 8,338 tCO2 per annum. If monetized, this stream will marginally improve the profitability indicators of the project.
2	Baseline Emissions	8,338 tCO_2 p.a.
3	Project Emissions	0
4	Emission reductions	8,338 tCO_2 p.a.

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APPENDIX A

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

Alwar Power Company Private Ltd.
7.5 MW Biomass Based Power Plant

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Project Name: 7.5 MW biomass based power project at Alwar, Rajasthan

Project Promoter: Manipal NRI International Ltd. (MNIL)

Special Purpose Vehicle: Alwar Power Company (P) Ltd. (APCL)

1. Executive Summary: Project at a Glance

Manipal NRI International Ltd. (MNIL) has promoted the Alwar Power Company (P) Ltd. (APCL) for setting up a 7.5 MW biomass based power unit using mainly mustard crop residue (MCR) like husk and straw. MNIL was promoted by Dr. Ajai Bararia, a first generation entrepreneur having vast experience in bi and multi lateral financial institutions in project development and financing. MNIL has implemented projects in Alwar and Delhi area for briquetting of MCR for use in industrial boilers as alternate fuel. Three such plants are functioning and the fourth is expected to be started soon.

The proposed plant would be located in the Matsya Industrial Area in the Alwar district of Rajasthan state. Proposers have conducted a detailed biomass assessment study through independent consultants, Technology Projects and Market Research Group (TPMRG). The plant will need around 79,000 tons of MCR every year. As against this, the biomass assessment suggests that around 400,000 tons of MCR are available in an area within 50 KM radius from the site. However, in order to ensure the ground water and biomass availability on a sustained basis, the promoters have decided to build a plant of 7.5 MW size initially.

The plant will generate power at an average PLF of 75% and feed 44.35 MU into the grid of Rajasthan Rajya Vidyut Prasaran Nigam Ltd. (RVPN). It has entered into a Power Purchase Agreement (PPA) with RVPN to enable this. The PPA provides purchase at a rate of Rs. 2.75 per kWh sold with base year 1998-99 and an annual escalation at 5%. (Applicable rate in 2003-04 Rs. 3.51 per kWh). The PPA is for a plant capacity of 2 X 12.5 MW. The proposers are setting up a capacity of 7.5 MW to begin with. Subsequently, additional capacity would be added. One of the preconditions of Rajasthan Government for this tariff is that the project has to arrange financing on or before September 30, 2003. The cost of the project is estimated at Rs. 302 million, which is proposed to be financed at a debt: equity ratio of 70:30. APCL has met this condition by identifying investors from UK who have in principle agreed to invest both in the form of debt and part equity. However, proposers are interested in using this alternative as a last resort.

The proposed project helps in replacing power from conventional fuel sources in Rajasthan which have a high proportion of thermal power. The project has a potential to reduce – tCO_2 per annum.

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a. **Project Costs (Million)**

	Plant & Machinery	191.70	4.17	63.5%
	Land & Building	37.16	0.81	12.3%
	Civil, detailed Engg	0.00	0.00	0.0%
	Erection & Commissioning	0.00	0.00	0.0%
	Preliminary & Preoperative Expenses (inclusive of IDC)	38.70	0.84	12.8%
	Working Capital Margin	7.93	0.17	2.6%
	Contingencies	26.56	0.58	8.8%
	Total Project Cost	302.05	6.57	100%

2. **Proposed Means of Financing**

	Total Debt Portion	211.43	4.60	70%
	Total Equity Portion	90.62	1.97	30%
	Total Project Cost	302.05	6.57	

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3. **Committed Financing (if any)** – Under negotiations with select PSU Banks

a. **Committed Debt Providers**

b. Committed Equity Providers

Manipal NRI International	1.99	100%

4. Estimates of Profitability

Revenue from power sale	134.9	152.5	171.6	180.2	189.2	198.7	208.6	219.0	230.0	241.5
Other revenue										
Fuel and O&M cost	59.0	66.0	73.6	77.5	81.5	85.7	90.1	94.7	99.5	104.5
Administrative OH	2.2	2.3	2.4	2.5	2.7	2.8	3.0	3.2	3.3	3.5
Selling cost	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7
PBIDT	73.3	83.8	95.2	99.7	104.5	109.5	114.9	120.5	126.5	132.8
Depreciation	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
Financial Expenses	26.8	27.2	27.0	24.3	21.6	18.9	16.2	13.6	11.0	8.3
PBT	26.1	36.2	47.8	55.0	62.5	70.2	78.2	86.5	95.1	104.0
Provision for Tax	0	0	1.8	4.7	6.1	7.4	8.6	9.7	29.1	31.9
PAT	26.1	36.2	46.0	50.3	56.4	62.8	69.6	76.8	66.0	72.1
Net Cash Flow	46.5	56.6	66.4	70.7	76.8	83.2	90.0	97.2	86.4	92.5

5. Projected Cash Flow

Sources of Funds											
PAT		26.1	36.2	47.8	55.0	62.5	70.2	78.2	86.5	95.1	104.0
Depreciation		20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
Inc. in Equity capital	91.6										
Inc. in term loans	211.4										
Inc. in bank borrowings		23.8	3.1	3.3	1.5	1.6	1.7	1.8	1.9	1.9	2.0
Total sources	302.0	70.3	59.7	71.5	76.9	84.5	92.3	100.4	108.8	117.4	126.4
Application of funds											
Capital Expenditure	294.1										
Inc. in Current Assets		31.7	4.1	4.4	2.0	2.1	2.3	2.4	2.5	2.6	2.7
Term loan repayment				26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
Taxes		0	0	1.8	4.7	6.1	7.4	8.6	9.7	29.1	31.9
Dividend		5.2	7.2	9.2	10.1	11.3	12.6	13.9	15.4	13.2	14.4
Total Application	294.1	36.9	11.3	41.8	43.2	45.9	48.7	51.3	54.0	71.3	75.4
Net Surplus	7.9	33.4	48.4	29.7	33.7	38.6	43.6	49.1	54.8	114.8	51.0
IRR	29.2%										
DSCR	3.01	3.44	1.82	1.97	2.17	2.42	2.71	3.06	2.91	3.32	3.01
Av DSCR	2.68										

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6. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame.

Yes. Currently negotiations are in progress and at an advanced stage with few PSU Banks including Allahabad Bank.

Do you plan to submit this project to a private venture capital firm or an international equity organization? If yes identify specific fund and elaborate on negotiations.

No plans yet.

Are you aware of and interested in preparing this project as GHG Mitigation project for monetizing carbon emissions reductions from it? If yes, please elaborate.

Would be interested in developing this as a GHG mitigation project, provided the market for carbon offsets looks up.

7. Project Promoter Contact Information

	Name of Project Promoter	Manipal NRI International
	Address	A – 7/3, DLF Qutab Enclave, Phase I
	City, State, Province	Gurgaon, Haryana, India
	Contact Name	Dr. Ajai Bararia, Managing Director
	Contact Phone	+91 124 2364700
	Contact FAX	+91 124 2359039
	Contact EMAIL	bhavna@del2.vsnl.net.in

8. Project Management Team

	Dr. Ajai Bararia	Managing Director

9. Project Promoter Financial History

	Profit After Tax figures last 3 years?			
	Book value?			
	EPS last 3 years?			
	Reserves and surplus			
	What is current business?			
	What are synergies between business and this project?			
	Group Companies			

10. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

Dr. Bararia and his team has built up three plants for manufacture of MCR briquettes that are supplied as fuel to various industries around Alwar. These plants have been working satisfactorily for past couple of years. This has provided a valuable experience to the promoters. The major risk of collection and supply of biomass fuel for the plant has thus been addressed to a large extent. Dr. Bararia has a vast experience in developing, promoting and assisting projects through multilateral and bilateral funding agencies like World Bank and USAID.

Please add as appropriate.

11. Special Purpose Vehicle Contact Information (If applicable):

	Name of SPV	Alwar Power Company Ltd.
	Address	
	City, State, Province	
	Contact Name	Dr. Ajai Bararia, Managing Director
	Contact Phone	+91 124 2364700
	Contact FAX	+91 124 2359039
	Contact EMAIL	bhavna@del2.vsnl.net.in
	Names and shares of the promoters	
	Is a Shareholding agreement in place	
	Salient terms	

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12. Project Details

	Greenfield project or involves existing equipment?	Greenfield project
	Nature of the project – RE based Power generation, Waste Heat/energy recovery, Energy efficiency improvement or other	RE – agro-residue based power generation
	Size of Project (MW)	7.5 MW
	Project Location?	Matsya Industrial Area, Alwar, Rajasthan.
	Off or on-grid?	On grid
	Does it involve sale of power to utility? Name of SEB/TRANSCO	Rajasthan Vidyut Prasaran Nigam Ltd. (RVPNL)
	Technology?	Rankine cycle
	Type of Fuel?	Mustard Crop Residues (husks and straw) in loose as well as briquettes
	Source of fuel supply?	Through current arrangements with mustard processing units.
	Level of generation KV	33 KV

13. Feasibility Details

	Was Feasibility Study prepared independently?	Yes
	What firm prepared the Feasibility Study?	Shriram EPC Ltd., Chennai and M. N. Dastur & Co. (P) Ltd.

14. Background on the Power Purchase Agreement (if Applicable)

	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes
	Has a PPA been signed? (Yes or No) Date of signing.	Yes.
	Nature of Agreement?	
	Name of state electricity board or primary PPA signatory?	RVPNL
	Does the state have a purchase policy for RE based power? Provide details.	Yes. Purchase at Rs. 2.75 per kWh in the base year 1998-99 and escalated @ 5% p.a. for 10 years. The policy is up for revision in last quarter of 2003.
	Term of the PPA? (Years)	Initial period 20 years. Extendable by 10 years.
	What is the initial purchase price? What is the annual % increase in purchase price?	Rs. 3.51/kWh in 2003-04. 5% p.a. annual escalation
	Does the PPA provide for Third-Party sale? Specify state policy on this.	No
	Payment securities provided in the PPA for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	Irrevocable, divisible, revolving and confirmed stand by LC for amount equivalent to one month energy bill. Late payments to attract interest of bank rate plus 8%
	Conditions Precedents, if any.	Financial closure must be obtained on or before Sept. 30, 2003
	What are the major provisions relating to Force Majeure (event definitions, treatment of the off time, etc.) of the clauses?	No provisions. Could be addressed under the Disputes clause.
	Method of tariff fixation (MNES, state policy)?	In line with MNES policy.
	Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	No
	Are there any provisions for change in law, termination, liquidated damages, etc. Have these been approved by existing lenders and investors?	No
	Provide details of user center proposed by the off taker, if available.	NA

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15. Other Agreements (where applicable)

	Fuel supply agreement signed?	No. However, the promoters have an existing arrangement for their briquetting plant, which is working smoothly.
	Water/utility supply agreement signed?	
	Shareholder's agreement been entered into between existing equity holders?	
	Special provisions, if any, of above agreements?	

16. Quantify and Describe Risks

	Risks	Low to High	Describe
	Market?	Low	Rajasthan state is deficit in power and is therefore encouraging small size distributed power generation projects especially those based on renewable energy. Market is therefore more or less assured.
	Country/Sovereign?	Low	The markets are well established. Country legal system, electric power policies are stable. The economic indicators like GDP growth and inflation are satisfactory. Hence the country risk is low.
	Regulatory?	Low	The Rajasthan state electric power sector regulator is in place and has announced tariff orders. The proposed power project is in line with existing power policy.
	Contract/counter party	Medium	The existing PPA is for 2 X12.5 MW capacity and is contingent upon the promoters being able to achieve financial closure by September 30, 2003. If this is not satisfied, the tariff will be lowered significantly, resulting in erosion of profitability.
	Construction?	Low	Standard process of power generation meaning simple construction and low risk.
	Technology?	Low	As above
	Management?	Low to medium	At present the project team is not in place. However, promoters would hire professionals in all the major positions.
	Enforceability of Contracts?	Low	The project involves very few contracts main one being the PPA. RVPNL has been honoring contracts in the past.
	Competition?	Low/medium	Rajasthan state is deficit in power. The state government does not allow power plant based on the same feedstock in the 50 KM vicinity of existing or awarded plants. This would ensure that the MCR fuel will not be diverted by the producers from the proposed plant.
	Exit?	Low	The investors can sell their stakes to the promoters or other investors in well established stock market in India.

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17. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
	Market?	
	Country/Sovereign?	
	Regulatory?	
	Contract/counter party	The promoters have made a fall back arrangement for financing so as not miss the deadline set up by the RVPNL.
	Construction?	
	Technology?	
	Management?	
	Enforceability of Contracts?	
	Competition?	
	Exit?	

GHG MITIGATION ASSESSMENT (OPTIONAL)

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
	Does the project rely on ODA from Annex B Countries?		√
	Has the project received host country approval?		√
	Is the project --capacity under 15 MW for renewables projects? --for energy savings under 15 giga watt hours/year? --for emissions reductions from process changes under15 kilo tons CO2e?	√	

2. GHG Mitigation Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Can the emissions reductions be estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√
	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?	√	

3. GHG Assessment details

	Parameter	Particulars
1	Baseline methodology	The project will be located in the Alwar town of Rajasthan state. Rajasthan state is in deficit both in terms of peak power and energy requirements. The state purchases energy from outside sources like central power PSUs and other states in the region. Major effect of the deficit is on the GDP of the region. The power plant would help the development of the region without impacting the environment adversely. Based on the three year data on power supplied in the Rajasthan state, the power supply comprises 84% thermal, 10% hydel and 6% nuclear and others. A majority of thermal power is supplied by coal fired plants. Based on IPCC guidelines, the baseline emission factor of the state grid is 884 tCO2 per MU. At this rate, the 44.35 MU power fed annually by the plant would result in emission reductions as mentioned below.
2	Baseline Emissions tCO_2 p.a.	39,198
3	Project Emissions tCO_2 p.a.	0
4	Emission reductions tCO_2 p.a. (2-3)	39,198

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APPENDIX A

GREENHOUSE GAS MITIGATION POTENTIAL ESTIMATION

OF

10 MW WASTE GAS BASED POWER PROJECT

PROMOTED BY

CHATTISGARH ELECTRICITY COMPANY LTD.

BY:

GREENHOUSE GAS POLLUTION PREVENTION-CLIMATE CHANGE SUPPLEMENT

A USAID/INDIA PROJECT IMPLEMENTED BY:

THE LOUIS BERGER GROUP, INC.

C-6/7 SAFDARJUNG DEVELOPMENT AREA

NEW DELHI 110 016

OCTOBER 2003

Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the 10 MW waste gas based power project in Chattisgarh was prepared for Infrastructure Development Finance Company Ltd. by The Louis Berger Group, Inc under the GEP-CCS project. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by Chattisgarh Electricity Company Ltd. (the project promoter), IDFC and that obtained from public domain. The information contained in the note is solely meant for IDFC and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to IDFC, Chattisgarh Electricity Company Ltd and several other institutions including CEA, IPCC/IEA, UNFCCC, Chattisgarh state and The World Bank for the background data provided by them through their websites.

This note should not be considered an endorsement or certification to the project or the technology and it should not be deemed to be any undertaking, warranty or endorsement by The Louis Berger Group, Inc. and US Agency for International Development.

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1. Background of the project

Chattisgarh Electricity Company Ltd. (CECL), an existing company promoted by Mr. KK. Sarda in 1998. CECL has a ferro alloys plant based on electro smelting process at Raipur, Chattisgarh with a transformer capacity of 18MVA. The main product is the high carbon silico manganese alloy in various grades. The process is highly energy intensive with 60% - 80% of the cost being electricity cost. The specific electricity consumption is in the range of 2,800 kWh/ton to 3,000 kWh/ton for ferro manganese and 3,800 – 4,200 kWh/ton for silico manganese. Since power is crucial for operation of the plant, ferro-alloys manufacturers have captive power plants. CECL has a captive power plant of 25 MW capacity based on coal, using a 90 TPH fluidized bed boiler. This plant also supplies 4 MW power to Raipur Alloy and Steel Ltd. (RASL), a sister unit of CECL.

The company is expanding the capacity of the ferro-alloys unit by 100% and is also setting up necessary capacity power plant. The proposed project involves setting up of a CPP of 30 MW capacity comprising 20 MW based on coal and 10 MW on firing the gas from ferro alloys furnaces comprising 67% carbon monoxide (CO) from existing, proposed and RASL furnaces. The proposed plant will include special boilers generating 16.5 Tons per hour of superheated steam at 64 ata and 500 ± 10^0C. At present power is generated using coal in these units. CECL will also export surplus power to the grid. As Chattisgarh state is surplus in power its policy does not allow purchase of excess power from CPPs. Therefore, CECL may have to sale power outside the state to neighboring Madhya Pradesh state.

Thus, the project has two components, coal as well as a non-conventional fuel. The latter improves environmental performance of the plant by reducing reliance on coal to an extent of 17%. Coal being a fossil fuel, the project helps in mitigation of GHG emissions to that extent.

The project would generate a total of 315 million kWh of power of which 52.6 million kWh will be from the CO rich furnace off gases, or "Green" power. After meeting the auxiliary power requirement, net export of 284 million kWh is possible. As explained earlier, the green power from the project will be utilized mainly by the proposers in their manufacturing unit, thereby replacing coal to that extent. The total cost of the power generation project is estimated at Rs. 720 million.

2. GHG emission reduction objectives of the proposed project

India's power sector is characterized by heavy reliance on thermal power. Since 1950 the thermal hydro mix has been steadily deteriorating and tilting heavily towards thermal. All India installed generating capacity mix for utilities was highest at 46:54 at the end of third five year plan in 1966. The main fuel used by thermal power plant is sub-bituminous coal and lignite. Recently few natural gas based power plants have been set up by NTPC. Indian coal quality has also been deteriorating on account of open cast mining, which leads to mixing of rubble with coal. As a result, the overall conversion efficiency of the coal fired power plants in India ranges between 20 – 30% (Source: Anthropogenic Emissions from

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Thermal Power Generation in India: Generation and Source Characterization Moti Mittal, C. Sharma, OSC, Ohio State University- 2002).

In the above backdrop, Government of India has been encouraging the use of alternative sources of energy and also on energy conservation. The Energy Conservation Act and recent Electricity Act provide encouragement for enhancing the resource use efficiency and using non-conventional energy. The proposed project is based on one such form of non-conventional form of energy viz. switching to alternate and waste fuel, which does not lead to additional GHG emissions. The project would make use of the chemical energy available in the furnace off-gases form the process operations of CECL. As explained earlier, these gases replace power that would otherwise have to be generated using locally available coal. Overall, the project helps in reducing dependence on fossil fuels without leading to additional GHG emissions.

a. Clean Technology nature

The project consists of a CO based boiler that would generate high pressure superheated steam for generation of power. The off gases from the ferro-alloys furnace contain ~67% CO, which is a poisonous gas. Hitherto, the gases were being flared, for want of a technology that could utilize the energy. The proposed plant offers a GHG mitigation technology option.

b. Sustainable Development objectives/aspects

The project will be located in the Industrial Growth Center Siltara, Raipur. The ferro-alloys plants need uninterrupted power for the production process. As a result the plants essentially have to have an assured source of power. This necessitates captive power plants as the grid power is not reliable in the state (and in the country as a whole). The company has an option of setting up power plants with 100% capacity based on coal. However, the proposers have envisaged meeting a part of power requirement through he proposed technology from the environmental as well as commercial viewpoint.

The project would directly employ local people and the power generated would support industrial and commercial activity in the Raipur district. Thus, it would result in ancillary benefits to the local population.

c. Host country Government (GOI) objectives

Government of India, Ministry of Power (MOP) has been encouraging conservation of energy. After the passage of the Energy Conservation Act (2001), the Bureau of Energy Efficiency was established. Thus, GOI has been encouraging maximization of overall energy efficiency of industry. Similarly the Ministry of Non-Conventional Energy Sources (MNES) promotes non-conventional energy sources, one of them being waste based fuels. The proposed project also envisages a waste fuel containing

combustible CO gas, which incidentally is also a hazardous gas. In view of this, the project meets GOI objectives.

3. Business as usual or Baseline identification

This section describes the existing power supply situation in the state of Chattisgarh, where the energy produced is used and power generated by the project is fed.

a. Project Boundary

The project has essentially two streams. One is to replace conventional fuel coal within the plant itself and second is to supply excess power to the grid for replacing the grid power. The project is expected to generate a total of 315 million kWh of power from both coal as well as the waste gas streams. Out of this 83% will be from coal firing and would not qualify as green power. The power generated using sponge iron kiln and alloy furnace waste gases contributes up to 8MW capacity. Since these plants need more power than this, it can be noted that the appropriate project boundary is effectively restricted to the ferro alloys plants of CECL and RASL. As described earlier, energy is the most prominent input for the alloy steel industry. In view of the delicate power situation in India, it is an accepted practice to set up dedicated power generation plants using fossil fuels in such type of industries (other examples being cement plants). Thus, the proposed waste gas based power can be visualized as that replacing coal fired power captively generated. By replacing power from the coal fired boilers the overall emission mix of the power consumed by ferro-alloys plant improves by 17%. Moreover, if one considers alternate power source from grid, it on-site generation also helps by cutting down on T&D losses, which for the CSEB are around 25% (Unofficially, T&D losses range from 30% - 50%. *Source: Infrastructure Development Action Plan for Chattisgarh – Final Report- Position Paper – Power Price Waterhouse Cooers – 2000-01*)

Alternatively, if one considers that the waste gas based power replaces power from the Chattisgarh state grid, which is a part of Western Regional Grid, the state grid becomes the project boundary. The power supplied by the project is most likely to be consumed within the state itself or exported to units in neighboring Madhya Pradesh (MP) state. Each unit of power supplied by the project would, therefore, replace an average unit supplied in this region. It may be noted that Chattisgarh state was a part of the MP state and hence has almost similar mix of power generation sources.

Chattisgarh and MP power grids are a part of the Western Regional grid. The power supplied to the consumers in the state is drawn from a variety of sources, CSEB own generation, private producers, purchase within the western region from other states and purchase from central power utilities against state's share. During discussion with various state utilities it was

understood that their policy is to purchase all the power available within state first. Thus, when an additional unit is available they will back power from central power PSUs. In other words, the marginal unit is the power supply from these sources.

On the demand side, since the power is generated from a waste gas, which was being flared earlier, the plant itself is the baseline. The avoided coal could also lead to reduction in emission of GHGs in its mining and transport. However, for simplicity and to be on a conservative side the same is ignored.

b. ***Relevant baseline methodology/scenarios***

Baseline is defined as the scenario in the relevant project boundary that would have prevailed in the absence of the project. It is also referred fo as "business as usual" scenario. Under the two project boundary approaches different methods are applicable. For the first applicable boundary, viz. replacement of captive power by waste gas based power the information on consumption of coal per unit is relevant. Based on the proximate analysis of the coal used, the emission factor can be calculated.

For the second approach, viz. replacement of grid power by waste gas based power; there are two possible methodologies to decide the baseline in situations like this. a) Average of weighted average emissions of all generating sources serving the system, excluding those which do not result in GHG emissions and the weighted average of recent capacity additions defined as the lower of most recent 20% of plants built or the 5 most recent plants; or b) The weighted average emissions of the current generation mix. The first approach is complicated and depends on availability of data. The second approach on the other hand is easy to understand and estimate, as adequate data is available from regular channels. Sometimes the plants under construction and planned are also taken into account. In view of the above, the second approach is suggested.

c. ***Time dimensions of the baseline***

India has an overall installed capacity of 107,534 MW as on March 31, 2003 (MOP Annual Report 2002-03). This includes 76,525 MW thermal power and 26,660 MW of Hydro electric power. The balance is from wind (1,630 MW) and nuclear (2,720 MW). The waste fuels based power generation, is negligible. As per estimates, potential capacity based on waste heat and energy conservation is 15,000 MW amounting to 15%. Thus far only a small portion of this has been tapped. It can be concluded that in the foreseeable future, waste heat or fuels based power will not form significant proportion of the baseline. Thus, the baseline as discussed earlier will be valid for a long time horizon.

d. ***Annual /periodic estimations***

In view of the above status of implementation of projects, the baseline emissions will not change practically. Therefore, it may not be necessary to revise the baseline estimate at least during the first ten years in which investors are likely to purchase the credits.

e. ***Baseline case emissions estimation***

Based on the methodology presented earlier for the two approaches and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

CO2 Emissions from replacing captive power using coal

CECL purchases coal from Dipka Mines of South Eastern Coal Fields. As per the proximate analysis, this coal has a fixed carbon content of 30.55% and ash content of 38.56%. Based on the existing power plant, the promoters have estimated that power requirement of the plant is 1 kg coal/kWh. Thus, the emission factor of the captive coal fired power generation is 1.0978 $kgCO_2/kWh$.

CO_2 Emissions from power used in the state grid

As mentioned earlier the Chattisgarh state was created three years back. However, its power grid is still closely integrated with that of Madhya Pradesh state. Since data on the state's power position is not yet compiled, analysis is based on MP power figures. The requirement of power in the state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the CSEB purchases power from the central public sector power generating companies, in accordance with its allotted share. This is a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 91% of the capacity and 9% of the hydel sources. However, based on the statistics of power generated and purchased for the last three years 2000 - 02, it is observed that over the past three years power consumed by the state grid was made up of 88 % from thermal sources, mainly coal fired plants, 8 % from hydel and balance 4 % by nuclear sources. According to the Directorate of Economics and Statistics, 97% of the power generation in the year 2002 in Chattisgarh was from thermal power and 3% by hydel sources.

A majority of the thermal plants are based on high ash sub bituminous coal as fuel that is mined predominantly in central India including Chattisgarh state. By and large the plants are old and exhibit conversion efficiencies in the range of 25-30%. For conservative considerations this is assumed at a level of 33%. Since, the purchase of equivalent amount of power from cleaner sources is "avoided" from the grid; the plant would also be able to save on the T&D losses. Indian electric power grid, especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission

& distribution losses, sometimes in the excess of 40%. However, again for conservative estimation it is assumed at 25%.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like the World Bank. The emission factor of thermal power plants using sub bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the above mix of supply from various sources as mentioned above, the weighted average emission factor of the Chattisgarh (MP) state grid is 1,229 tCO_2/MU or 1.229 tCO_2/kWh.

4. GHG mitigation potential of the project

Based on the ***first baseline methodology***, i.e. replacement of captive power by the waste gas based power; each unit generated from this source will replace 1.0978 kg of CO2. In a stabilized production year CECL will generate 52.6 MU from the waste gases (17% of total). Assuming that 98% of the carbon is combusted this would amount to GHG reduction of **57,740** tons CO2 p. a..

Based on the ***second baseline methodology***, i.e. avoiding purchase of grid power. The proposed power project would use an alternative source of energy, i.e. hazardous waste gases. Moreover, the proposers have taken great care in design to of the boilers to ensure that other pollutants like Sox and particulates do not escape in the atmosphere. Therefore, it will be reasonable to assume that the project does not have any GHG emissions.

The GHG emission reductions from the project would be:

Annual GHG Reduction =	**GHG emission per million kWh of the baseline** (tCO2/million kWh)	X	**Annual units avoided by the project** (million kWh)

As discussed above the GHG emission per MU or the emission factor of the MP grid is 1,229 tCO2 per MU under the assumptions discussed above based on the average energy fed by various sources for the past three years. The project is expected to avoid purchase of 52.6 million kWh from the state grid each year. Thus, the expected Annual GHG reduction from the 10 MW clean power project would be **64,645** tCO2 p.a.

The above methodology, based on weighted average emission factors of the grid, is in conformity with the one for grid feeding small scale projects as specified by the CDM Executive Board of the UNFCCC.

5. Monitoring & Verification

It is very crucial to monitor and verify periodically the actual emission reductions achievable by the CEPs. There are two sides of this M&V, one to ensure that the baseline itself does not change significantly and second the project performs as envisaged in the design. As discussed in detail earlier the composition of entire RE based power generation is not likely to be significant in the foreseeable future. Therefore, the former is taken care of to a major extent. It is therefore important to measure the performance of the project in detail and with greater accuracy.

Performance of projects generating power for export to utility grid can be easily measured based on electric power generated and supplied to the grid. However, in the proposed power, the clean power would be consumed by the plants themselves. In view of this adequate in-house measurement would be necessary. It is, therefore, suggested that suitable meters and check meters meeting prescribed standards and accuracy class be installed. These meters will measure overall power generated and also the proportion using coal and waste gases. It is also suggested that these meters be checked and certified by an external agency so as to lend authenticity to the measurement.

The following M&V mechanism is suggested:
It is proposed to vest the responsibilities of monitoring the parameters identified earlier in to an interdepartmental group consisting of representatives from quality control, production, maintenance and strategic planning departments, which shall *inter alia*

1. Collect data on existing power generation from the plant and consumption of coal
2. Meter and record the total power generated.
3. Measure the coal consumption
4. Back calculate the units generated from this coal quantity based on
   i. The data as mentioned in point 1 and
   ii. Based on boiler/turbine suppliers guarantee norms.

   The higher of these two will be the contribution of coal generated portion.
5. Calculate the power generation from waste gases [(2) – Max {4(i), 4(ii)}]
6. Keep track of source wise power supply in the electric power grid and the status of completion of the National Grid

6. Conclusion

The proposed project involves use of a waste fuel for generating useful power. It helps in avoiding fossil fuel based power. It leads to mitigation of GHGs predominantly Carbon dioxide due to use of coal. The project involves a clean energy technology and may need support for mitigation of risk. The project has been promoted by a private enterprise, which will also part finance the same. The project, thus, meets the GEP-CCS criteria.

APPENDIX A

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

Matrix Agro Private Ltd.
6 MW Biomass based power plant in Karnataka

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Background:

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Format: The form is designed to capture the types of projects seeking Project Finance.

Project Finance is focused on anticipated revenue streams from the project activity (or off-balance sheet financing). For example, a grid-based biomass co-generation facility would likely depend upon energy payments from a local electricity board. Much more detailed information about the project, project promoter, power purchase agreement, debt and equity sponsors and profitability and cash flow analyses are necessary to determine the relative risk and financial viability of the project.

This is a working electronic document/check-list. When each question is answered, place an electronic checkmark (√) in the left-hand box as a reference point for completion of the form.

Project Name: 6 MW biomass based grid connected power plant

Project Promoter: K. Abhiram Reddy and Matrix Power Private Ltd. (MPPL)

Special Purpose Vehicle: Matrix Agro Private Ltd. (MAPL)

1. Executive Summary: Project at a Glance

MAPL is a company promoted by Mr. K. Abhiram Reddy and his associates to set up the 6 MW biomass based power project at Polakapalli village in Gulbarga Dist of Karnataka State in South India. The plant will use agrowaste including redgram stalks, Subabul (Lucena) rice husk and jowar (sorghum) stalks as a fuel. The above listed agro-residues are available in abundance within 20 KM from the plant site. The promoters are qualified and have adequate past experience in setting up power projects of the proposed type. MPPL has set up and commissioned a 4.5 MW biomass based power plant. MAPL has retained M/s Fitchner Consulting Engineers (India) Pvt. Ltd. as a consultant for preparing the detailed project report.

The proposed plant will be based on conventional Rankine cycle technology involving combustion of the biomass to generate high pressure superheated steam. This steam will be throttled in a condensing type turbogenerator to generate power. The condensate will be recycled in the steam system.

The power plant will generate 37 MU of energy and after meeting the auxiliary energy need, export 32.4 MU to the Karnataka Power Transmission Corporation Ltd. grid. MAPL will enter into a power purchase agreement with KPTCL to enable this. The PPA negotiation is in an advanced stage. MAPL has carried out a biomass assessment study of the Gulbarga district and the Chincholi Taluka in particular. The study establishes that the required quantity of agro waste for ensuring at least 85% PLF will be easily available within the 20 km vicinity of the project site. The company is also planning to use biomass from energy plantation to partially meet the fuel needs. It has already taken on lease 1000 acres of suitable land on lease and proposes to plant fast growing species on it.

The project cost including land, site development buildings and civil structure, plant and machinery, design engineering, preliminary and preoperative expenses is estimated at Rs. 229 million. MAPL proposes to bring in 25% of this in the form of equity capital and apply for loan for the balance. Under several assumptions like the interest rate at 12.5% with a three years moratorium and seven years repayment, and primary fuel cost of Rs. 600 per ton, the project exhibits an internal rate of return of 28% and an average DSCR of 2.11. The cost of energy generation from the plant is expected to be Rs. 1.84 per kWh.

The proposed project uses a carbon neutral fuel i.e. biomass. There is no net addition of CO_2, since the agro residue is generated by sequestration of atmospheric CO_2 and as the project leads to avoiding burning the biomass in fields while generating useful energy,. As such it is considered a GHG mitigating technology. The power exported to the grid, which at present is in deficit, would replace the marginal units that would otherwise have been generated using power from a fossil fuel based power plant (i.e. coal). The GHG abatement assessment shows that on a conservative basis the energy exported by the proposed plant would achieve a GHG reduction of 21,800 tCO_2e p.a. If one considers net revenue from sale of these offsets at \$ 2.5/tCO_2e this would improve the IRR by 1.2%.

The project has received approval of Karnataka Renewable Energy Development Ltd. (KREDL) the nodal agency of the state.

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2. Project Costs

	Plant & Machinery	155.3	3.27	67.83
	Land & Building	6.5	0.14	2.84
	Civil, detailed Engg	20.7	0.44	9.03
	Erection & Commissioning	0.0	0.0	0.00
	Preliminary & Preoperative Expenses	38.2	0.80	16.67
	Working Capital Margin	4.3	0.09	1.89
	Contingencies	4.0	0.08	1.75
	Total Project Cost	229.0	4.82	100.00

3. Proposed Means of Financing

	Total Debt Portion	171.7	3.61	75%
	Total Equity Portion	57.3	1.21	25%
	Total Project Cost	229.0	4.82	

4. Committed Financing (if any) - Nil

a. Committed Debt Providers

b. Committed Equity Providers

Mr. K. Abhiram Reddy and associates and MPPL	1.21 million	100%

5. Estimates of Profitability

Revenue from power sale	104.9	110.0	115.4	115.4	115.4	115.4	115.4	115.4	115.4	115.4
Other revenue										
Fuel cost	22.2	24.1	26.0	27.8	29.7	31.5	33.4	35.2	37.1	38.9
O&M Cost	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Admn/selling cost	8.2	8.5	8.9	9.1	10.4	10.6	10.9	10.3	10.5	10.7
PBIDT	70.1	73.0	76.1	74.1	70.9	68.9	66.7	65.5	63.4	61.4
Depreciation	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
Prel exp write off	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.0
Interest										
Term loan	21.5	21.3	18.9	15.9	13.0	10.0	7.0	4.1	1.1	0.0
Working cap	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
PBT	36.7	39.8	45.3	46.3	46.0	47.0	47.8	49.5	50.4	50.7
Provision for Tax	6.0	6.2	6.6	6.7	6.8	6.8	6.9	7.0	7.0	7.1
PAT	30.7	33.6	38.7	39.6	39.2	40.2	40.9	42.5	43.4	43.6
Net Cash Flow	40.3	43.2	48.3	49.2	48.8	49.8	50.5	52.1	53.0	53.2

6. Projected Cash Flow

SOURCES OF FUNDS											
1.	Cash Accruals	0	59.3	62.2	65.4	63.3	61.2	59.1	56.9	54.8	52.6
2.	Increase in Share Capital	57.3	0	0	0	0	0	0	0	0	0
3.	Depreciation	0	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
4.	Increase in Long Term Loans	171.7	0	0	0	0	0	0	0	0	0
5.	Increase in Bank Borrowings for working capital	0	7	0	0	0	0	0	0	0	0
6.	Preliminary Expenses W/o		1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Total Sources	229.0	77.1	73.0	76.2	74.1	72.0	69.9	67.8	65.6	63.5
DISPOSITION OF FUNDS											
1.	P & P. Exp.	12.2	0	0	0	0	0	0	0	0	0
2.	Increase in Cap Ex.	195.4	0.00	0	0	0	0	0	0	0	0
3.	Increase in Current Assets:										
	1. Inventories	4.3	7.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	2. Others	17.0	0	0	0	0	0	0	0	0	0
4.	Decrease in Long term loans/ Debentures	0	0	11.8	23.7	23.7	23.7	23.7	23.7	23.7	17.8
5.	Interest	0	22.6	22.4	20.0	17.0	14.0	11.1	8.1	5.2	2.2
6.	Taxation	0	6.0	6.2	6.7	6.7	6.8	6.8	6.9	7.0	7.0
7.	Dividend	0	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
	Total Disposition	229.0	47.0	52.8	62.6	59.7	56.8	53.9	51.4	48.1	39.3
Opening balance		0	0.0	30.1	50.3	63.9	78.3	93.5	109.4	126.1	143.6
Net surplus		0	30.1	20.3	13.6	14.4	15.2	16.0	16.7	17.5	24.1
Closing balance		0	30.1	50.3	63.9	78.3	93.5	109.4	126.1	143.6	167.8
DSCR		2.11	1.71	1.53	1.60	1.69	1.80	1.95	2.16	3.18	
IRR			28.2%								

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7. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame. The negotiations have not begun yet

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations. No

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission. At the moment no such tender is open. Promoters are interested in applying for carbon offset monetization if possible.

8. Project Promoter Contact Information

	Name of Project Promoter	Mr. K. Abhiram Reddy and Associates
	Address	8-2-269/3/1, 257, Road # 2, Banjara Hills,
	City, State, Province	Hyderabad Andhra Pradesh India
	Contact Name	Mr. Kasu Abhiram Reddy
	Contact Phone	040 - 23544029
	Contact FAX	040 - 23546776
	Contact EMAIL	abhiramkasu@hotmail.com

9. Project Management Team

	Mr. Kasu Abhiram Reddy	Managing Director

10. Project Promoter Financial History

	What were profitability figures last 3 years?	Yr ended March 31, 2003 – Rs. 8 mn (First full operation year)
	Book value of firm?	Rs. 10.3
	EPS reserves and surplus last 3 years?	Rs. 1.6 in FY 2002 - 03
	What is current business?	Power generation from a biomass based power plant in AP
	What are synergies between business and this project?	Logical expansion of business in the same sector

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11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

The promoter of MAPL viz. Mr. Reddy and the group company MPPL have set up a similar 4.5 MW biomass based plant in the state of Andhra Pradesh, which is operating for the last year and selling power to AP Transco. This plant is working well and has reached the designed PLF. The plant has generated revenue of Rs. 93 million from sale of power in the first full operational year i.e. 2002 – 03. It may, therefore, be seen that the promoters have adequate experience in promoting and operating biomass based power projects.

12. Special Purpose Vehicle Contact Information (If applicable):

	Name of SPV	Matrix Agro Private Ltd.
	Address	8-2-269/3/1, 257, Road # 2, Banjara Hills,
	City, State, Province	Hyderabad Andhra Pradesh India
	Contact Name	Mr. Kasu Abhiram Reddy
	Contact Phone	040 - 23544029
	Contact FAX	040 - 23546776
	Contact EMAIL	abhiramkasu@hotmail.com
	Names and shares of the promoters	
	Is a Shareholding agreement in place	
	Salient terms	

13. Project Details

	Greenfield project or involves existing equipment?	Greenfield
	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Clean energy generation
	Size of Project (MW)?	6MW
	Project Location? City, Province	Village Polkampali, Taluk Chincholi District Gulbarga Karnataka
	Off or on-grid?	On Grid
	State Electricity Board?	Karnataka Power Transmission Corporation Ltd.
	Technology?	Rankine cycle
	Type of Fuel?	Biomass agro residues
	Source of fuel supply?	Agricultural activities in the areas surrounding the plant site. The main crop from which residues will be available is redgram. The stalks of redgram will be used as fuel. At present these residues are burnt on the fields. The Estimated quantity of surplus available is ~55,000 tons p.a. as against a requirement of 37,000 tons. In addition, biomass from MAPL's proposed energy plantation may also be used to meet a part of fuel needs.

14. Feasibility Details

	Was Feasibility Study prepared independently?	Yes
	What firm prepared the Feasibility Study? List address and contact details	Fitchner Consulting Engineers (India) Pvt. Ltd.
		Chennai

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15. Background on the Power Purchase Agreement (if Applicable)

	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes
	Has a PPA been signed? (Yes or No)	No. It is being negotiated
	Nature of Agreement? Take or Pay? Other?	Firm power supply.
	Name of state electricity board or primary PPA signatory?	KPTCL
	What date was the PPA signed?	Being negotiated and is in an advanced stage.
	When does it enter into force?	
	What is the length of the PPA? (Years)	
	What is the initial purchase price?	
	What is the annual % increase in purchase price?	
	Can the project sell power directly to major consumers? (Yes or No)	
	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	
	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	
	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	
	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	
	Have the provisions for change in law, termination, liquidated damages , etc. been approved by existing lenders/investors?	
	Would the SEB/generating utility want a share in the ownership of carbon offsets?	

16. Other Agreements (where applicable)

	Fuel supply agreement signed?	No
	Water/utility supply agreement signed?	No
	Shareholder's agreement been entered into between existing equity holders?	NA
	Special provisions of above agreements?	

17. Quantify and Describe Risks

	Market?	Low	Since the state of Karnataka is in deficit there is still an unmet power demand. The Government of Karnataka is encouraging such distributed power generation projects
	Country/Sovereign?	Low	Indian laws are well established. Moreover, no foreign investment is envisaged.
	Regulatory?	Low	The power sector structure is well established. At the center the CERC and in the Karnataka state the KERC are functional and have also issued tariff orders over the past two years.
	Contract/counter party	Low	So far the PPAs have been honored by the KPTCL. The banks have been accepting the security mechanisms available in the PPA. So this risk is low.
	Construction?	Low	The construction is of a standard type. The promoters have adequate experience in such projects.
	Technology?	Low	The project will employ standard Rankine cycle technology, with proven equipment.
	Management?	Low	The promoters have adequate experience in such projects.
	Enforceability of Contracts?	Low	Same as in contract risk.
	Competition?	Medium	Karnataka state has awarded many RE based projects in the last 2-3 years. If and when all these become operational, there may be a surplus situation at least in off peak. In case merit order dispatch is introduced the project could encounter availability loss.
	Exit?	Low	For investors, there are several avenues of exiting the investments in such projects like strategic sale, sale on the stock exchanges, buy back by the core promoters etc.

18. For risks identified in section 14, discuss Mitigation/Coverage measures

	Market?	NA
	Country/Sovereign?	NA
	Regulatory?	NA
	Contract/counter party	The PPA shall be vetted by the lenders and mutually acceptable clauses to the three parties would be incorporated in consultation with KERC.
	Construction?	NA
	Technology?	NA
	Management?	Experienced operations staff would be employed to ensure smooth operation
	Enforceability of Contracts?	NA
	Competition?	Promoters have conducted biomass assessment studies through professional agencies. These have been accepted by KREDL
	Exit?	NA

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GHG MITIGATION ASSESSMENT

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
	Does the project rely on ODA ?		√
	Has the project received host country approval?		√
	Does project meet size definition for Bonn Fast Track CDM? –under 15 MW for renewable energy projects –under <15 giga Watt hours/year savings for energy efficiency projects –under15 kilo tones CO2E for emissions reductions from process changes	√	

2. GHG Mitigation Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Have the emissions reductions been estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√
	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?		√

3. GHG Assessment details

	Parameter	Particulars
1	Baseline methodology	The proposed project would use agro-residues, which are currently being burnt on fields. Biomass is a carbon neutral fuel, i.e. the carbon fixed by plants is being put back in the atmosphere. Therefore, these type of plants have been accepted as GHG mitigation options. Moreover, the project will supply power to the state grid which has high carbon emission intensity. The baseline in this case will be emission intensity of each unit replaced based on the weighted average emission factor of the grid supply. This is one of the accepted methodology by the UNFCCC CDM Executive board. The emission factor of the grid was calculated from the power generated and supplied in the Karnataka state from the state's own generation, purchase from private producers and share in the central PSU pool. To be on a conservative side all hydroelectric and nuclear power was considered carbon neutral.
2	Baseline Emissions TCO2	21,800
3	Project Emissions TCO2	0
4	Emission reductions TCO2	21,800

At present market for carbon offsets is evolving. The only known benchmarks of price for carbon offsets is the tender floated by the Netherlands Government and the World Bank Prototype Carbon Fund. The price quoted by these range from $3 to $4 per ton of CO2. However, the transaction cost for preparing projects for these would be high. In view of this a price of $ 2.5/tCO2 was assumed and its impact on the project financials was tested. It is found that the IRR improves by 1.2% with carbon to 29. 4%, while the DSCR improves from 2.11 to 2.19.

APPENDIX A

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

Fozal Power Private Limited

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Project Name: Fozal Small Hydro Project

Project Promoter: Cosmos Consulting

Special Purpose Vehicle: Fozal Power Private Ltd. (FPPL)

1. Executive Summary: Project at a Glance

Cosmos Consulting an organization promoted by Mr. K. L. Chugh is promoting the Fozal Power Pvt. Ltd. for setting up a small hydroelectric power project on the Fozal Nala near Kullu in the Himachal Pradesh (HP) state. The project has a generating capacity of 9 MW based on power potential studies in a 75% dependable year. The project is run-of-the-river (ROR) type that utilizes gradients available in the streams of the tributaries of river Beas. The project envisages construction of a boulder type diversion weir, that is simple to construct with locally available material, easy to maintain and suffers least damage in case of floods. Since there is no reservoir, the promoters have decided a strategy to use maximum amount of river water in monsoon so as to raise the overall availability. As a result of this strategy, the rated capacity of the project has risen to 9 MW. Since the ROR projects have certain minimum sizes of civil works, the cost towards this components e.g. tunnel, is dictated by the minimum size. As a result the overall project cost estimated at Rs. 450 million, i.e. Rs. 50 million per MW. Which looking at the topography / geological conditions and the tunnel length with no reservoir upstream and with an aim of maximizing potential, appears reasonable.

Since the power requirement of Himachal Pradesh state are not much, HPSEB has offered a rate of Rs. 2.25 per kWh. After deducting 12% free power as royalty, the net tariff comes to Rs. 1.98 per kWh Therefore the company has envisaged sale of power outside Himachal Pradesh to other states in the northern region viz. Punjab and / or Delhi. Negotiations are in progress. With the passage of the Electricity Act, and formation of Electricity regulators, the promoters are confident that they would have a remunerative tariff as per the Electricity Act 2003 and MNES guidelines for Renewable Energy.

Since the project is ROR type, it would lead to a minimum submergence of vegetation. The height of diversion weir would be marginally higher than the river bed. This would ensure least methane generation. The proposed project site is in hilly region and is not populated. Thus, the rehabilitation and resettlement issues will not arise. The project would lead to employment of local population. Thus, the proposed project activity is sustainable and would lead to clean energy delivery thereby reducing GHG impact.

2. Project Costs

	Civil Works	260.0	5.78	57.8
	Plant & Machinery	112.0	2.49	24.9
	Preliminary & Preoperative Expenses (incl. IDC)	43.0	0.96	9.6
	Contingencies & Misc. Expenses	35.0	0.78	7.8
	Total Project Cost	450.0	10.01	100.0

3. Proposed Means of Financing

	Total Debt Portion	337.5	7.5	75.0
	Total Equity Portion	112.5	2.5	25.0
	Total Project Cost	450.0	10.0	100.0

4. Committed Financing (if any)

a. Debt Providers-Committed or under negotiations

IREDA	**337.5 Mn**	**IREDA standard rate for SHPs**		**In process**

b. Committed Equity Providers

Cosmos Consulting/K. L. Chugh	750,000	30
Modicorp /Spice Corp.	750,000	30
Gati Corp	500,000	20
Capital Fortune Ltd.	250,000	10
Sanskriti Engg.	250,000	10

5. Estimates of Profitability

Revenue - power sale	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6	89.6
O&M Cost	9.0	9.3	9.6	9.8	10.1	10.4	10.8	11.1	11.4	11.7
PBIDT	80.6	80.3	80.0	79.8	79.5	79.2	78.8	78.5	78.2	77.9
Prelim Exp W/o	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Depreciation	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Interest Term loan	31.9	27.1	22.3	17.5	12.7	7.8	3.0			
Interest working cap	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
PBT	32.1	36.6	41.2	45.7	50.2	54.8	59.3	61.9	61.6	61.3
Provision for Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PAT	32.1	36.6	41.2	45.7	50.2	54.8	59.3	61.9	61.6	61.3
Net Cash Flow	45.6	50.1	54.7	59.2	63.7	68.3	72.8	75.4	75.1	74.8

6. Projected Cash Flow

Sources of Funds											
PBIDT		80.6	80.3	80.0	79.8	79.5	79.2	78.8	78.5	78.2	77.9
Inc. in Equity capital	112.5										
Inc. in term loans	337.5										
Inc. in bank borrowings		11.8									
Total sources	450.0	92.4	80.3	80.0	79.8	79.5	79.2	78.8	78.5	78.2	77.9
Application of funds											
Capital Expenditure	434.3										
Preliminary Exp	11.8										
Inc. in Current Assets		15.7									
Term loan repayment		48.2	48.2	48.2	48.2	48.2	48.2	48.0			
Interest on term loan		31.9	27.1	22.3	17.5	12.7	7.8	3.0			
Interest on Working capital		1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Taxes											

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Dividend					18.0	18.0	18.0	18.0	18.0	18.0	18.0
Total Application	446.1	97.7	77.2	72.4	76.6	71.8	75.9	71.1	19.9	19.9	19.9
Net Surplus	3.9	(5.4)	3.1	7.6	3.2	7.7	3.2	7.7	58.6	58.3	58.0
IRR (10 yrs)	11.97%										
DSCR		0.98	1.04	1.11	1.19	1.27	1.38	1.5			
Av DSCR	1.2										

---

7. Status of Finance Negotiations

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame.

With the signing of PPA, the promoters will provide equity. We have been in discussions with IREDA as well as Foreign Funds for availability of debt. This would be arranged expeditiously.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations.

We have not discussed the funding issue with a private venture capital firm, but we are exploring the possibility to discuss the same with some International Equity Organization.

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission.

Promotors are interested in developing the project as a climate change mitigation project. At present no tenders are open. However, promoters are approaching various carbon investors in Annex I nations.

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8. Project Promoter Contact Information

	Name of Project Promoter	K. L. Chugh, Chairman, Cosmos Consulting
	Address	N-79, Panchsheel Park
	City, State, Province	New Delhi 110017
	Contact Name	Dr. Inderjeet Singh
	Contact Phone	+91 11 2649 0350/1536
	Contact FAX	26491910
	Contact EMAIL	chughkl@satyam.net.in

9. Project Management Team

	Mr. K. L. Chugh	**Chairman & Managing Director**
	Mr. H. C. Verma	**General Manager**
	Dr. Inderjeet Singh	**Project Manager**

10. Project Promoter Financial History

	What were profitability figures last year?	Rs 3657328.61	Rs. 33774088.00
	Book value of firm?	Rs. 1015336.00	Rs. 1469401125.00
	EPS reserves and surplus last year?	Nil	Rs. 0.31
	What is current business?	Consulting	Cellular Operator
	What are synergies between business and this project?	Mr. K. L. Chugh, as Chairman of ITC, has always been keen to invest in power sector. His commitment to invest in Hydropower in the state continues.	Keen interest in diversifying.

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11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

Cosmos Consulting has been promoted by Mr. K. L. Chugh. He has extensive experience in management of business at high level. He has worked with the ITC group of companies for over 24 years. He was Chairman of ITC for four years during which ITC performance improved manifold. Mr. Chugh spearheaded several major projects of the group, including those of ITC Bhadrachalam Paperboards and the flagship ITC Ltd. Mr. Chugh has a ten-year experience in heavy engineering industry as well.

Spice Corp. formerly Modicorp is a part of established business house of Modi's headed by Dr. B. K. Modi. Modi Group has good hands on experience through (Modi Champion, Modi Continental Tyre, Modi Threads, Modi Pharma, Mcorp Global, Spice Corp. etc)

Gati Ltd. is one of the major logistics company in the business of cargo handling throughout the country.

Capital Fortune is in the business of facilitating companies through consultancy both in terms of Project Design & Financial Arrangements.

Sanskriti Engg. is the BPO unit of Carrier Aircon Ltd.

The company will employ professional management for construction and operation of the project.

12. Special Purpose Vehicle Contact Information (If applicable):

	Name of SPV	Fozal Power Pvt. Ltd.
	Address	N-79, Panchsheel Park
	City, State, Province	New Delhi 110017
	Contact Name	Dr. Inderjeet Singh
	Contact Phone	+91 11 2649 0350/1536
	Contact FAX	26491910
	Contact EMAIL	chughkl@satyam.net.in
	Names and shares of the promoters	It was in place at the time of filing the bid for Fozal SHP (3 years back)
	Is a Shareholding agreement in place	Not as on date.
	Salient terms	

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13. Project Details

	Greenfield project or involves existing equipment?	Greenfield
	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Clean Energy Generation
	Size of Project (MW)?	9 MW [3 X 3000 kW]
	Project Location? City, Province	Fozal Nala, Dist. Kullu, Himachal Pradesh
	Off or on-grid?	On-grid
	State Electricity Board?	Punjab State Electricity Board and Delhi state through HPSEB
	Technology?	Run of the river using horizontal Francis type hydro turbines
	Type of Fuel?	Potential energy in downhill river water
	Source of fuel supply?	Fozal stream a tributary of Beas river

14. Feasibility Details

	Was Feasibility Study prepared independently?	Yes
	What firm prepared the Feasibility Study? List address and contact details	Dr. Hutarew & Partner (India) Pvt. Ltd. 5/6 Saket, New Delhi Mr. P. K. Sood Tel: +91 11 26527064, 26857098 Fax: +91 11 26527060

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15. Background on the Power Purchase Agreement (if Applicable)

	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes
	Has a PPA been signed? (Yes or No)	No, under negotiation
	Name of state electricity board or primary PPA signatory?	HPSEB, PSEB
	What date was the PPA signed?	NA
	When does it enter into force?	NA
	What is the length of the PPA? (Years)	20 years
	What is the initial purchase price?	2.10
	What is the annual % increase in purchase price?	2%
	Can the project sell power directly to major consumers? (Yes or No)	It is proposed to sell the power out of HP state to Punjab and Delhi.
	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	
	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	Payment to be made by purchaser within 30 days of receipt of invoice.
	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	Definition of FM provided. Payments due to be made.
	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	Policy of the state buying the power, rates applicable to RE based power.
	Have the provisions for change in law, termination, liquidated damages, etc. been approved by existing lenders/investors?	No provisions
	Would the SEB/generating utility want a share in the ownership of carbon offsets?	Not clear

16. Other Agreements (where applicable)

	Fuel supply agreement signed?	NA
	Water/utility supply agreement signed?	Implementation agreement with HP state government is proposed to be signed. HPSEB has also issued techno-economic clearance.
	Shareholder's agreement been entered into between existing equity holders?	Not in place, has to be renewed
	Special provisions of above agreements?	N/A

17. Quantify and Describe Risks

	Risks	Low to High	Describe
	Market?	Medium	Northern region of India is deficit in power. Therefore, the off take of power does not face risk. However, since industrial activity in HP is low, the promoters have to sale power to other states like Punjab, Haryana and Delhi. This entails wheeling charges and free power/royalty by HP.
	Country/Sovereign?	Low	Legal and political system in India is stable and by so large the sovereign risk is low.
	Regulatory?	Low	The electricity regulatory commission has been established in the state.
	Supply side?	Medium	The hydroelectric power projects are exposed to the risk of shortage of water. It has been observed that the availability of hydro power projects is low; in a 75% dependable year, the availability being 59%. For a 90% dependable year the availability would reduce considerably.
	Construction?	Low	Standard construction
	Technology?	Low	Proven technology
	Management?	Low	Professional and experienced personnel
	Enforceability of Contracts?	Low	Legal system is well established and regular recourse is available
	Competition?	Low	Since the northern region is in deficit,
	Exit?	Low	Regular exit routes like sale through market, strategic sale and buy back by core promoters are available.

18. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
	Market?	The promoters are negotiating with the states of Punjab, Haryana and Delhi for sale of power. They are also in dialogue with the HP government for reduction in the free power/royalty to the state.
	Country/Sovereign?	Low risk
	Regulatory?	Low risk
	Supply side?	The promoters have taken all the technology measures in the design of the proposed plant. They propose to utilize all the available water in the allotted basin so as to maximize the power potential. As a result the project which otherwise would have had a capacity of 6 MW can generate power equivalent to 9 MW.
	Construction?	Low risk
	Technology?	Low risk
	Management?	Low risk
	Enforceability of Contracts?	Low risk
	Competition?	Low risk
	Exit?	Low risk

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GHG MITIGATION ASSESSMENT

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
	Does the project rely on ODA from Annex B Countries?		√
	Has the project received host country approval?		√
	Does project meet size definition for Bonn Fast Track CDM? --under 15 MW for renewables projects --under <15 giga watt hours/year savings for energy efficiency projects --under15 kilo tonnes CO2E for emissions reductions from process changes	√	

2. GHG Mitigation Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Have the emissions reductions been estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√
	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?	√	

3. GHG Assessment details

	Parameter	Particulars		
1	Baseline methodology	The proposed project would supply power to a state Punjab, Haryana or Delhi in the North India, which is a part of the NRLDC. The northern grid in India is characterized by heavy reliance on thermal power, mainly comprising coal based power plants. Depending on the state in which the power would be sold, the GHG emission reduction by the project would vary. The project would supply 42.7 MU of power.		
	tCO_2 p.a.	Punjab	Haryana	Delhi
2	Baseline Emissions	36,253	37,622	37,642
3	Project Emissions	0	0	0
4	Emission reductions	36,253	37,622	37,642

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APPENDIX A

Waste Heat Recovery based Steam Generation from Sulphuric Acid and Captive Power Plants and Cooling water conservation

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

Sterlite Industries (India) Limited

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Background:

This form is for the purpose of gathering relevant project finance information for projects developed under USAID India's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement (GEP-CCS). It is designed for project developers and financial institutions involved with clean energy or other types of GHG mitigating projects that are placed into the GEP-CCS pipeline.

Format: The form is designed to capture the types of projects seeking Project Finance.

Project Finance is focused on anticipated revenue streams from the project activity (or off-balance sheet financing). For example, a grid-based biomass co-generation facility would likely depend upon energy payments from a local electricity board. Much more detailed information about the project, project promoter, power purchase agreement, debt and equity sponsors and profitability and cash flow analyses are necessary to determine the relative risk and financial viability of the project.

This is a working electronic document/check-list. When each question is answered, place an electronic checkmark (√) in the left-hand box as a reference point for completion of the form.

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Project Name: Waste Heat Recovery based Steam Generation from Sulphuric Acid and Captive Power Plants

Project Promoter: Sterlite Industries (India) Ltd.

Special Purpose Vehicle: NA

1. Executive Summary: Project at a Glance

Sterlite Industries (I) Ltd. (SIIL) a company promoted by Mr. Anil and Navin Agarwal, is engaged in manufacturing of copper, aluminum metals and various bulk chemicals. SIIL has a copper smeting plant at Tuticorin, Tamil Nadu with a capacity of 150,000 TPA. SIIL is doubling the smelting capacity. The sulphur from the pyrites ore is converted into oxides, which are emitted through the flue gases. To recover these, SIIL has set up sulphuric acid plant based on the DCDA process. SIIL envisages modernizing the SAP and also set up a new state-of-the-art SAP to treat the additional flue gases as a result of expansion in the smelter capacity. Thus, the SAP capacity would increase from present 2125 TPD to 3740 TPD. Since smelter operation is a continuous one and critically depends on power availability, SIIL also proposes to expand the captive power generation capacity from present 24 MW to 46 MW. The overall cost of the project is estimated at Rs. 110.7 million SIIL has approached ICICI Bank to part fund the project.

SIIL proposes to incorporate fuel efficient technologies with a view to minimizing the operation cost and to avoid emissions of local and global pollutants. These interventions include:

- Recovery of heat from gases after Secon pass of the converter at $517^0 - 527^0$ C
- Recovery of heat from gases after the third pass of the converter at $469^0 - 479^0$ C; and
- Recovery of heat from diesel engine exhaust gases at 340^0 C
- Replacing the atmospheric acid coolers with heat exchangers, which reduce evaporation and wind losses, thereby leading to saving in power and water consumption.

The recovered heat from the first three options will be used in two WHR boilers to generate process steam at 10 Kg/cm^2g. The steam so generated will be used in the Phosphoric acid plant (PAP) located in the same complex. The PAP boiler currently uses furnace oil that will be replaced. The cost of these components is estimated at Rs. 110.7 million. It is proposed to meet this cost at a debt equity ratio of 59:41.

The proposed project helps in reduction of the furnace oil consumed in PAP as also helps in reducing power and water consumption. Thus, it has two distinct GHG reduction opportunities, saving of furnace oil and power from grid of Tamil Nadu. The project also helps in reducing use of precious natural resource; water, which particularly in the state of Tamil Nadu is scarce.

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2. Project Costs

The cost of this project is estimated at Rupees 110.7 million. The break -up of the cost is as follows.

(Rs in million)

Particulars	Amount
Waste Heat Recovery Boiler with DM Plant	20.7
Captive Power Plant (DG Sets)	25.0
Water Recycling/Water conservation	55.0
Contingencies	10.0
TOTAL	110.7

The cost for all the aforesaid items of plant and machinery for the project are based on quotations. Thermax, Pune, is supplying the boiler and the pumps for both, the waste heat recovery project in the sulphuric acid plant and the captive power plant. Kvaerner is supplying the acid cooler for the water conservation project (being funded out of sponsor's contribution) whereas Coil Engineering Company, New Delhi, is supplying the air cooler and the double hood heat exchanger. Contingencies have been provided @ 10% of the total cost.

3. Proposed Means of Financing

The cost of the project estimated at Rupees 110.7 million is proposed to be financed as follows:

(Rs million)

Particulars	Amount
Cash accruals/Other sources	45.7
ICICI Bank- GEP Programme	25.0
ICICI Bank- TDC Programme	40.0
Total	110.7

ICICI Bank propose to provide rupee term loans of Rs 25 million from GEP Programme and Rs 40 million under TDC program of USAID reflows. Since the project is a unique combination of cogeneration, energy efficiency and water conservation, which meets the objectives of the respective programs as well, ICICI Bank have proposed a lower interest rate of 7% p.a.

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4. Committed Financing (if any)

a. Committed Debt Providers

ICICI Bank Ltd.	65.0	7% p.a.	7 years	Under Process

b. Committed Equity Providers

Promoter-Cash accruals/others	1 Million	41.3%

5. Estimates of Profitability

Waste Heat Recovery Project: Sulphuric Acid Plant & CPP

	2003-04	2004-05	2005-06	2006-07
LP Steam production (MT per annum)	53679	129,753	129,753	129,753
Cost of production (Rs /MT of steam)	----	----	----	----
Cost of steam from FO boiler (Rs/MT)	732	747	762	777
Savings (Rs in million)	**39.3**	**97.0**	**98.9**	**100.1**

Water Conservation/recycling project

	2003-04	2004-05	2005-06	2006-07
Water savings (lac m3)	3.0	5.0	5.0	5.0
Internal power savings (million units)	2.13	3.55	3.55	3.55
External power savings (lac units)	0.79	1.32	1.32	1.32
Savings (Rs in million)	13.9	23.2	23.7	24.1

This being a very small subset of the entire project, only the savings in terms of energy and the equivalent value has been calculated. The simple payback is just over a year in the said project.

---

6. Status of Finance Negotiations

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame.

Yes. We are discussing this and other projects with our bankers, ICICI Bank. These projects are being considered under their Technology Development department.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations.

No.

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission.

We are interested in availing of investments in lieu of the carbon offsets that the project may generate. However, no such fund is open for investment currently.

7. Project Promoter Contact Information

	Name of Project Promoter	Sterlite Industries (I) Ltd.
	Address	SIPCOT Industrial Complex Tuticorin 628002
	City, State, Province	Tamil Nadu
	Contact Name	Prasanth
	Contact Phone	0461 2340591 (Ext. 2278)
	Contact FAX	
	Contact EMAIL	tuprojfin@sterlite.com

8. Project Management Team

	Thiyagarajan	
	Prasanth	0461 2340591 (Ext. 2278)

9. Project Promoter Financial History (Rs. Billion)

	What were profitability figures last 3 years? (PBID)	4.32	2.86	3.44
	Book value of firm?			
	EPS reserves and surplus last 3 years?			
	What is current business?			
	What are synergies between business and this project?	The project seeks to utilize the waste heat available from the new plants for generating steam for use in the Phosphoric acid plant located in the same complex. Thus, the proposed plant will enhance the energy end use efficiency as also replace the fossil based fuel presently used to generate steam in the PAP.		

10. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

Sterlite Industries (India) Limited (SIL) has facilities for the smelting of 165,000 tonnes per annum (tpa) of copper, manufacture of 196,000 tpa of continuous cast copper rods (CCR) copper cathodes and 43,300 kms of power transmission line aluminium conductors (PTLAC). SIL's manufacturing facilities are located at Lonavala and Sanaswadi in Maharashtra (PTLAC Division), Silvassa (Dadra & Nagar Haveli) (Refinery) and Tuticorin, Tamilnadu (smelter & captive power plant).

In the year 1995, SIIL acquired Madras Aluminium Company Limited (MALCO), a BIFR company and turned it around in one year. However, MALCO was a small player with a limited capacity of 30,000 MT per annum so SIIL acquired Bharat Aluminium Company Limited (BALCO), a public sector undertaking with an annual installed capacity of 1 lac tonnes per annum. In the year 2002, the operations of BALCO have been streamlined and this company now proposes to expend its capacity to 4 lac tonnes per annum in the near future.

India Foils Limited (IFL), SIIL group company is one of the country's largest producers of aluminium foil in Asia with an annual installed capacity of 19000 tonnes per annum. IFL has a 60% market share in the Indian market. IFL is also the largest exporter of aluminium foil from India and caters to all segments of the foil industry. The company has integrated facilities and a state of the art rolling mill backed by the latest technology in conversion. This has enabled IFL to cater to aluminium foil demand of 29 countries globally.

SIIL also acquired a 26% stake in Hindustan Zinc Limited (HZL) in March 2002. HZL has an installed capacity of 1.6 lakh tonnes per annum of zinc and 43000 tonnes per annum of lead production in Udaipur. The company has a 80% market share in zinc.

SIIL is one of the largest manufacturers of copper in the country. Its copper smelter with a capacity of 165,000 tons per annum (tpa) is the largest in the country. Until July 1, 2000, SIL also had a telecom division with capacities to manufacture polyethylene-insulated jelly filled (PIJF) telephone cables, optical fibres (OF) and optical fibre cables (OFCs). SIL was split into two separate companies i.e. SIL and Sterlite Optical Technologies Limited (SOTL) with focus on the non-ferrous metals and telecom business respectively, with

11. Special Purpose Vehicle Contact Information (If applicable):

	Name of SPV	NA
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	
	Names and shares of the promoters	
	Is a Shareholding agreement in place	
	Salient terms	

12. Project Details

	Greenfield project or involves existing equipment?	Existing plant modification
	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Process improvement to recover heat from waste streams
	Size of Project (MW)?	Equivalent to ~ 5.4 MW
	Project Location? City, Province	Tuticorin, Tamil Nadu
	Off or on-grid?	Off grid
	State Electricity Board?	NA
	Technology?	Waste heat recovery boilers
	Type of Fuel?	Waste heat from SAP and CPP
	Source of fuel supply?	

13. Feasibility Details

	Was Feasibility Study prepared independently?	
	What firm prepared the Feasibility Study? List address and contact details	

14. Background on the Power Purchase Agreement (if Applicable)

	Does Project involve PPA (Yes or No) If no, skip to next heading.	NO
	Has a PPA been signed? (Yes or No)	
	Nature of Agreement? Take or Pay? Other?	
	Name of state electricity board or primary PPA signatory?	
	What date was the PPA signed?	
	When does it enter into force?	
	What is the length of the PPA? (Years)	
	What is the initial purchase price?	
	What is the annual % increase in purchase price?	
	Can the project sell power directly to major consumers? (Yes or No)	
	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	
	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	
	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	
	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	
	Have the provisions for change in law, termination, liquidated damages , etc. been approved by existing lenders/investors?	
	Would the SEB/generating utility want a share in the ownership of carbon offsets?	

15. Other Agreements (where applicable)

	Fuel supply agreement signed?	NA
	Water/utility supply agreement signed?	
	Shareholder's agreement been entered into between existing equity holders?	
	Special provisions of above agreements?	

16. Quantify and Describe Risks

	Risks	Low to High	Describe
	Market?		
	Counry/Sovereign?		
	Regulatory?		
	Contract/counter party		
	Construction?		
	Technology?		
	Management?		
	Enforceability of Contracts?		
	Competition?		
	Exit?		

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17. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
	Market?	
	Country/Sovereign?	
	Regulatory?	
	Contract/counter party	
	Construction?	
	Technology?	
	Management?	
	Enforceability of Contracts?	
	Competition?	
	Exit?	

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GHG MITIGATION ASSESSMENT

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
	Does the project rely on ODA from Annex B Countries?		√
	Has the project received host country approval?		√
	Does project meet size definition for Bonn Fast Track CDM? –under 15 MW for renewables projects –under <15 gigawatthours/year savings for energy efficiency projects –under15 kilotonnes CO2E for emissions reductions from process changes	√	

2. GHG Mitigation Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Have the emissions reductions been estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√
	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?	√	

3. GHG Assessment details

	Parameter	Particulars
1	Baseline methodology	The project aims at replacing fuel oil used in the phosphoric acid plant for steam generation with that generated from waste heat in the SAP and CPP. Thus, the use of fuel oil is the baseline. Besides this the saving due to cooling water as translated in power saving is another stream of emission reductions. Since Sterlite is drawing power from the TNEB grid, this is the baseline for this stream.
2	Baseline Emissions tCO2 p.a.	13,462 + 3,980 = 17,442
3	Project Emissions tCO2 p.a.	0
4	Emission reductions tCO2 p.a.	13,462 + 3,980 = 17,442

GREENHOUSE GAS MITIGATION POTENTIAL ESTIMATION

OF

Waste Heat Recovery based Steam Generation from Sulphuric Acid and Captive Power Plants and Cooling water conservation

PROMOTED BY

STERLITE INDUSTRIES (INDIA) LTD.

BY:

GREENHOUSE GAS POLLUTION PREVENTION-CLIMATE CHANGE SUPPLEMENT

A USAID/INDIA PROJECT IMPLEMENTED BY:

THE LOUIS BERGER GROUP, INC.

C-6/7 SAFDARJUNG DEVELOPMENT AREA

NEW DELHI 110 016

OCTOBER 2003

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Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the Waste Heat Recovery based Steam Generation from Sulphuric Acid and Captive Power Plants was prepared for ICICI Bank Ltd. by The Louis Berger Group, Inc under the GEP-CCS project. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by Sterlite Industries (I) Ltd. (the project promoter), ICICI Bank and that obtained from public domain. The information contained in the note is solely meant for ICICI Bank and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to ICICI Bank, Sterlite Industries (I) Ltd. and several other institutions including IPCC/IEA, UNFCCC and The World Bank for the background data provided by them through their websites.

This note should not be considered an endorsement or certification to the project or the technology and it should not be deemed to be any undertaking, warranty or endorsement by The Louis Berger Group, Inc. and US Agency for International Development.

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1. Background of the project

Sterlite Industries (India) Ltd. (SIIL), an existing company promoted by Mr. Anil and Navin Agarwal in 1975 originally as an investment company. The company has grown into the Sterlite Group over years through diversification and acquisitions. SIIL is engaged in the manufacture of PE insulated Jelly filled telecom cables, continuous cast copper rods, aluminum cold-rolled products, zinc metal and paper. Sterlite Group acquired controlling stakes in public sector company BALCO and 26% stake in Hindustan Zinc Ltd.

SIIL has an industrial complex at Tuticorin, Tamil Nadu for manufacture of copper rods and other products. The copper smelting plant at Tuticorin has a capacity of 150,000 TPA. SIIL is doubling the smelting capacity. The sulphur from the pyrites ore is converted into oxides, which are emitted through the flue gases. To recover these, SIIL has set up sulphuric acid plant based on the DCDA process. SIIL envisages modernizing the SAP and also set up a new state-of-the-art SAP to treat the additional flue gases as a result of expansion in the smelter capacity. Thus, the SAP capacity would increase from present 2125 TPD to 3740 TPD. Since smelter operation is a continuous one and critically depends on power availability, SIIL also proposes to expand the captive power generation capacity from present 24 MW to 46 MW. As a part of the copper smelting facility, it has also set up a phosphoric acid plant.

SIIL proposes to incorporate fuel efficient technologies with a view to minimizing the operation cost and to avoid emissions of local and global pollutants. These interventions include:

- Recovery of heat from gases after second pass of the converter at $517^0 - 527^0$ C
- Recovery of heat from gases after the third pass of the converter at $469^0 - 479^0$ C; and
- Recovery of heat from diesel engine exhaust gases at 340^0 C
- Replacing the atmospheric acid coolers with plate type heat exchangers, which reduce evaporation and wind losses, thereby leading to saving in water consumption. Simultaneously, the head of cooling water pump also reduces from 45 m to 15 m. these two together reduce the power load from 794 kW to 374 kW.

The recovered heat from the first three options will be used in two WHR boilers to generate low pressure process steam at 14.5 Kg/cm^2g. The steam so generated will be used in the Phosphoric acid plant (PAP) located in the same complex. The PAP boiler currently uses furnace oil that will be replaced. The last option would result in reduction of a) power consumption and b) water savings.

The project would save around 9 tons steam per hour leading to a drastic reduction in consumption of furnace oil and 3.5 million kWh of power from the Tamil Nadu grid. The total cost of the power generation project is estimated at Rs. 110.7 million.

2. GHG emission reduction objectives of the proposed project

The consumption of oil products has been increasing ever since industrialization began in India. The current consumption of oil products is 107 Million tons. Since

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the domestic oil resources are limited, around 73% of this is met with imported crude. Thus, consumption of petroleum products adds to both environmental degradation and also foreign exchange outgo. Majority of oil usage is in transport and to meet industrial energy requirements. The proposed project would help in recovering energy efficiently and converting it into a useful energy form viz. process steam. The overall end use efficiency of the industrial complex of SHL would improve.

Government of India has been encouraging the use of alternative sources of energy and also stressing on energy conservation. The Energy Conservation Act and recent Electricity Act provide encouragement for enhancing the resource use efficiency and using non-conventional energy. The proposed project is based on one such form energy conservation viz. waste heat recovery, for generating steam for use in process. This has an added advantage over power generation, since the entire enthalpy is used, leading to higher overall efficiency. Overall, the project helps in reducing dependence on fossil fuels without leading to additional GHG emissions.

a. ***Clean Technology nature***

The project involves waste heat recovery technology to generate low pressure saturated steam for process applications. The heat of gases from two streams after the second and third beds of converter of the sulphuric acid plant at temperature ranging between 470^{0}C – 520^{0}C and in the flue gases of the diesel generating set is used in three different fire tube boilers. Although the gases from converter were being used, the main application was for economizers. Proposed project would help in recovering heat at a higher degree. In a nutshell, the proposed plant offers a better GHG mitigation technology option.

Moreover, the other intervention in the proposed project viz. saving of cooling water and power is also a cleaner option.

b. ***Sustainable Development objectives/aspects***

The cooling water conservation component of the proposed project would lead to an important and scarce natural resource, namely ground water. Besides, the project would also help in reducing emission of local pollutants from the avoided furnace oil.

c. ***Host country Government (GOI) objectives***

Government of India, Ministry of Power (MOP) has been encouraging conservation of energy. After the passage of the Energy Conservation Act (2001), the Bureau of Energy Efficiency was established. Thus, GOI has been encouraging maximization of overall energy efficiency of industry. Similarly the Ministry of Non-Conventional Energy Sources (MNES) promotes non-conventional energy sources, one of them being waste based

fuels. The proposed project also envisages use of waste heat. In view of this, the project meets GOI objectives.

3. Business as usual or Baseline identification

This section describes the existing power supply situation in the state of Tamil Nadu, where the energy produced is used and power generated by the project is fed.

a. Project Boundary

The project has essentially two streams. One is to replace conventional fuel furnace oil within the SIIL complex itself and second is saving of power from the grid. The project is expected to generate a total of 84,000 tons of LP steam every year. This would be piped to the phosphoric acid plant (PAP) located in the same complex. This in turn would reduce the consumption of furnace oil (residual fuel oil). Since the emission reduction results in the complex itself, the project boundary for this stream would be the SIIL Tuticorin industrial complex.

The second stream is the saving in cooling water by incorporation of a plate type acid cooler. This brings down the evaporation and windage losses of water. The reduced water quantity and head for the circulation pumps and avoidance of cooling tower fans would lead to reduction in power consumption. At present the SIIL complex purchases power from Tamil Nadu (TN) grid for meeting power needs. TN grid is a part of the Southern power grid. The project boundary for this stream is therefore the entire southern grid and in particular the TN grid.

b. Relevant baseline methodology/scenarios

Baseline is defined as the scenario in the relevant project boundary that would have prevailed in the absence of the project. It is also referred to as "business as usual" scenario. The proposed project reduces the consumption of furnace oil within the industrial complex of SIIL in Tuticorin. In view of this, the baseline for this is the furnace oil used for generating steam. The consumption of fuel for steam generation is generally represented in tons/ton of steam, as an observed benchmark by the promoters.

For the second stream of reductions namely the power saved by reducing cooling water quantity and pump head, the baseline is replacement of units supplied by the Tamil Nadu grid to the SIIL complex. There are two possible methodologies to decide the baseline in situations like this. a) Average of weighted average emissions of all generating sources serving the system, excluding those which do not result in GHG emissions and the weighted average of recent capacity additions defined as the lower of most recent 20% of plants built or the 5 most recent plants; or b) The weighted average emissions of the current generation mix. The first approach is

complicated and depends on availability of data. The second approach on the other hand is easy to understand and estimate, as adequate data is available from regular channels. Sometimes the plants under construction and planned are also taken into account. In view of the above, the second approach is suggested. Since the project avoids the units supplied by the grid, it is also able to avoid the T&D losses. In other words, the actual units at the bus bar would be correspondingly higher after accounting for the T&D losses.

c. ***Time dimensions of the baseline***

India has an overall installed capacity of 107,534 MW as on March 31, 2003 (MOP Annual Report 2002-03). This includes 76,525 MW thermal power and 26,660 MW of Hydro electric power. The balance is from wind (1,630 MW) and nuclear (2,720 MW). The waste heat based power generation, is negligible. As per estimates, potential capacity based on waste heat and energy conservation is 15,000 MW amounting to 15%. Thus far only a miniscule portion of this has been tapped. It can be concluded that in the foreseeable future, waste heat or fuels based power will not form significant proportion of the baseline. Thus, the baseline as discussed earlier will be valid for a long time horizon.

d. ***Annual /periodic estimations***

In view of the above status of implementation of projects, the baseline emissions will not change practically. Therefore, it may not be necessary to revise the baseline estimate at least during the first ten years in which investors are likely to purchase the credits.

e. ***Baseline case emissions estimation***

Based on the methodology presented earlier for the two streams and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

(i) CO2 Emissions from replacing furnace oil used

SIIL purchases furnace oil from local distributors who procure these from standard channels of the oil companies. The furnace oil is of residual fuel oil grade, which is normally used in industrial boilers. As per revised 1996 IPCC guidelines for GHG inventories, residual fuel oil has an emission factor of 21.1 tC/TJ and a NCV of 40.19 TJ/Kiloton. Based on these figures the emission factor of the furnace oil is 3.1094 tCO2/ton of fuel oil.

(ii) CO_2 Emissions from avoided power from the state grid

The requirement of power in the Tamil Nadu state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the TNEB purchases power from the central public sector power generating

companies, in accordance with its allotted share. This is a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 64% of the capacity and 36% of the hydel sources. However, based on the statistics of power generated and purchased for the last three years 2000 - 02, it is observed that over the past three years power consumed by the state grid was made up of 80 % from thermal sources, mainly coal fired plants, 18 % from hydel and balance 2 % by nuclear sources.

A majority of the thermal plants are based on high ash sub bituminous coal as fuel that is mined predominantly in central India. By and large the plants are old and exhibit conversion efficiencies in the range of 25-30%. For conservative considerations this is assumed at a level of 33%. Since, the purchase of equivalent amount of power from cleaner sources is "avoided" from the grid; the plant would also be able to save on the T&D losses. Indian electric power grid, especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission & distribution losses, sometimes in the excess of 40%. However, again for conservative estimation it is assumed at 25%.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like the World Bank. The emission factor of thermal power plants using sub bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the above mix of supply from various sources as mentioned above, the weighted average emission factor of the Tamil Nadu state grid is 1,119 tCO_2/MU or 1.119 tCO_2/kWh.

4. GHG mitigation potential of the project

Based on the above discussion for the stream 1 i.e. savings of furnace oil the emission reductions resulting are summarized below:

Stream 1: Furnace oil Savings

Steam generation with three WHR boilers	9.92	tons/hr
Pipeline losses to PAP	10%	
Steam received at PAP	8.93	tons/hr
Total steam in year (353 days)	75,653	TPA
Specific fuel consumption of PAP boiler	66.545	lit/ton steam
Furnace oil replaced	5,034,347	litres
	4,330	TPA
Emission factor of residual Fuel oil	21.1	tC/TJ
NCV of residual Fuel oil	40.19	TJ/KT
Emission factor of residual Fuel oil	3.1094	tCO_2/ton oil
Emission reductions	13,462	tCO_2 p.a.

Stream 2: Emission reduction from avoided grid power

Based on the above baseline methodology, avoiding purchase of grid power would help in mitigation of GHG emission to a small extent.

The GHG emission reductions from the project would be:

Annual GHG Reduction =	**GHG emission per million kWh of the baseline** (tCO2/million kWh)	X	**Annual units avoided by the project** (million kWh)

As discussed above the GHG emission per MU or the emission factor of the Tamil Nadu grid is 1,119 tCO_2 per MU under the assumptions discussed above based on the average energy fed by various sources for the past three years. The project is expected to avoid purchase of 3.56 million kWh from the state grid each year. Thus, the expected Annual GHG reduction from this stream would be 3,980 tCO_2 p.a.

The above methodology, based on weighted average emission factors of the grid, is in conformity with the one for grid feeding small scale projects as specified by the CDM Executive Board of the UNFCCC.

Thus, the overall emission reduction potential of the proposed project is **17,442** tCO_2 p.a.

5. Monitoring & Verification

It is very crucial to monitor and verify periodically the actual emission reductions achievable by the CEPs. There are two sides of this M&V, one to ensure that the baseline itself does not change significantly and second the project performs as envisaged in the design. As discussed in detail earlier the contribution of energy conservation in the overall power generation in the country is not likely to be significant in the foreseeable future. Therefore, the former is taken care of to a major extent. It is therefore important to measure the performance of the project in detail and with greater accuracy.

Stream 1:

The emission reductions from the project are on account of the reduction in fuel oil consumption in the PAP. It is therefore essential to measure the current fuel oil consumption. Alternatively the last three years of records should be compiled from which the consumption pattern can be decided and documented. After implementation of the project this consumption should be continued to be measured. This could be carried out through usual methods, i.e. stock records in the beginning and end. In order to cross check the validity of the measurement it is also suggested that the steam flow rate from the WHR boilers be measured.

These two together would provide adequate measurement of the reduction in consumption of fuel oil.

Stream 2:
Performance of projects generating power for export to utility grid can be easily measured based on electric power generated and supplied to the grid. However, in the proposed project, the grid power consumption is expected to reduce. It is therefore essential to measure the power consumed by the existing motors and cooling water system corresponding existing SAP capacity. Thereafter, the actual power consumed after implementation of project must be measured. In view of this adequate in-house measurement would be necessary.

It is, therefore, suggested that suitable meters and check meters meeting prescribed standards and accuracy class be installed for measuring power consumption by the cooling water system. These meters will measure power consumed by the cooling water system. It is also suggested that these meters be checked and certified by an external agency so as to lend authenticity to the measurement.

The following M&V mechanism is suggested:
It is suggested that the responsibilities of monitoring the parameters identified earlier be vested to an interdepartmental group consisting of representatives from quality control, production, maintenance and strategic planning departments, which shall *inter alia*

1. Collect data on existing power consumption by the electric equipment in the cooling water system
2. Meter and record the total power consumed prior and after implementation of the project.
3. Measure the consumption of fuel oil before and after project completion
4. Calculate the furnace oil savings and power savings
5. Keep track of source wise power supply in the electric power grid and the status of completion of the National Grid

6. Conclusion

The proposed project involves use of a waste heat for generating useful steam. It helps in avoiding fossil fuel based steam generation. It also helps in reducing power/water consumption. It leads to mitigation of GHGs predominantly Carbon dioxide due to use of furnace oil. The project involves a clean energy technology and may need support for mitigation of risk. The project has been promoted by a private enterprise, which will also part finance the same. The project, thus, meets the GEP-CCS criteria.

APPENDIX A

EXECUTIVE SUMMARY

Applicant:	**Hemavathy Power and Light Private Limited**
Sector:	**Energy**
Assistance Required:	**Rupee Debt Assistance of Rs.70 crore**

HEMAVATHY POWER & LIGHT PRIVATE LIMITED (HPL)

Introduction

Hemavathy Power and Light Private Limited (HPL), a Special Purpose Vehicle (SPV) promoted by Mr. Anthony DiNapoli, a private equity investor based in Bedford, USA proposes to (a) acquire and operate the existing 16 MW hydro power project (Phase I) situated on the Hemavathy Left Bank canal located at Gorur village in Hassan district, Karnataka and (b) to acquire the license and construct, erect and operate the 8 MW hydro power project (Phase II) in the vicinity of the existing 16 MW project from Sandur Manganese and Iron Ores Limited (SMIORE). SMIORE is selling the aforesaid assets as part of its reorganisation as approved by Board for Industrial and Financial Reconstruction (BIFR)

Sponsor Review

Background

HPL has been promoted by Mr. Anthony DiNapoli of Bedford, USA. Mr. DiNapoli is a private equity investor, investing primarily in non-conventional energy projects and new technologies for power generation and has made significant investments / undertaken project development activities in USA, Italy, China and India.

Mr. Anthony DiNapoli has extensive experience spanning over two decades in energy project development and management. As per the tax filings of Mr. DiNapoli for the year ended December 31, 2001 his total income for the year was $ 1.8 million. His primary sources of income are salaries and management income received from his group companies and dividend income. As on October 31, 2002, Mr. Anthony DiNapoli's networth is estimated at $ 66.6 million (as certified by his Certified Public Accountant – CPA).

Banker's Report

Satisfactory bank references have been obtained and details are given in the appraisal memorandum.

Group Structure

The financial summary of key group companies is given below.

($ million)

Name of the Company	Le Calorie Inc	Bio Energy Corporation	Petrofibre Corporation	Le Calorie S.r.l.
Business Engaged in	Project Management & Investment	12.5MW Wood-fired biomass plant	Wood fuel procurement & supply company	Waste-to-Energy & Levulinic Acid Plant
For 2001				
Revenue	2.6	11.7	2.1	-
Net Profit	-1.2	-0.5	0.3	-
Networth	2.1	70.0*	0.7	20.0
Long Term Debt	-	2.0	-	-
For 9 months ended 2002				
Revenue	1.2	2.0	0.4	-
Net Profit	-0.5	-	-	-
Networth	3.6	3.3	0.7	62.7
Long Term Debt	-	-	-	-

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**The networth of $ 70 million is due to the sale of the PPA. The sale payments were received in the month of February 2002. However, since the financial statements of Bio Energy for the year ended 2001 were prepared after the said date, the payment was considered as a "subsequent event" and accounted for in the previous financial year. The higher networth was not reflected in the D&B report because the report was prepared in the month of January 2002.The cash arising out of the sale of the PPA was withdrawn by the equity holders and hence the reduction in networth in the current year.*

Project *Background*

Sandur Manganese and Iron Ores Ltd. (SMIORE) was engaged in the business of manganese ore mining, exports and manufacture of ferro alloys. The performance of SMIORE was severely affected due to power cuts coupled with substantial hikes in power tariffs. The company started incurring losses from 1995-96 onwards, which resulted in the company's entire networth being eroded. SMIORE was forced to shut off all its furnaces in August 1998. SMIORE was declared a 'sick company' as on May 4, 2000 by Board for Industrial and Financial Reconstruction (BIFR) and IDBI was appointed as Operating Agency (OA). Since, SMIORE had stopped its ferro alloy manufacturing activity the power generated by its 16 MW hydel power plant (Phase I) was being sold to KPTCL. In addition to the 16 MW plant, SMIORE also had license to set up the 8 MW power project (Phase II) and Varahi Tailrace Project of 15 MW capacity.

As part of the BIFR scheme, all the secured lenders of SMIORE agreed to the sale of Phase I project and licenses of the other two power projects. The sale of project and the licenses required the concurrence of KPTCL. KPTCL agreed to allow the sale provided its dues were settled first. All the secured lenders have agreed to payment of the outstanding dues of KPTCL (even though KPTCL is an unsecured creditor). The payments to Sulzer will also be settled under the BIFR scheme.

HPL has purchased the Phase I project for Rs. 70 crore and the license to set up the Phase II project for Rs. 0.32 crore. HPL has already deposited Rs. 1.21 crore with IDBI – the operating agency – as deposit. From the above sale considerations, Rs. 22 crore will go towards settlement of KPTCL dues, Rs. 1.75 crore towards settlement of Sulzer dues and the remaining Rs. 46.32 crore towards settlement of secured lenders. **The project to be sold to HPL will be free of all encumbrances, with both secured creditors and unsecured creditors releasing charges established on the projects.** The other details of reorganisation of SMIORE under the BIFR are being worked out separately.

Project Hemavathy is one of the main tributaries of Cauvery originating in Ballarayanadurga in the Western Ghats in Karnataka. It flows through Hassan and Mandya districts before joining the Cauvery in the Krishnarajasagar dam near Mysore. A masonry dam is built across the river Hemavathy near Gorur village in Hassan district having a storage capacity of 1053 million cubic meters (mcm). The water in the reservoir is used primarily for irrigation purposes through the Left Bank canal, Right Bank canal and Right Bank High Level canal. Almost 80% of the releases out of the dam are through

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the Left Bank canal. Water is also released through the Hemavathy river for downstream uses and for meeting the requirements of the Krishnarajasagar (KRS) dam. Discharges from the dam are controlled and determined by the state irrigation department.

Phase I – 16 MW hydro power plant located at Hemavathy Left Bank canal

Phase I is situated at the foot of the Hemavathy dam near the left abutment and generates power from the irrigation releases into the Left Bank canal. Phase I project has been fully commissioned in April 2001. A surplussing arrangement connecting the Left Bank canal and the Hemavathy river has been constructed to increase the water flow to Phase I. Now, Phase I is estimated to generate 39.45 MUs of energy (29% PLF) in a 90 % dependable year.

Phase II – 8 MW hydro power plant

The 20 meter head available between Phase I and the Hemavathy river is proposed to be utilized for setting a 2*4 (8 MW) project (Phase II) between the Left Bank canal and the Hemavathy river bed. Phase II is estimated to generate 27.3 MUs / year (in a 90% dependable year).

Hydrology

A reservoir simulation was carried out by Tata Consulting Engineers (TCE) on a monthly basis to find out the head and flow available both at Phase I and Phase II power house. The simulation was carried out for a 10-year period from 1991-92 to 2000-2001 on monthly basis. As per the study, energy generation at 90% dependable level is 66.72 MUs.

Project Cost

The total project cost for Phase I and Phase II is estimated at Rs. 128 crore comprising of Rs. 85.3 crore for Phase I and Rs. 42.7 crore for Phase II. The surplussing cost of Rs. 12.2 crore already incurred as been apportioned to Phase I and Phase II in the ratio of 1 : 2. The break up of the project cost is given below.

(Rs. Crore)

Particulars	Phase I	Phase II	Total
Purchase Consideration (Acquisition Cost)	70.0	0.3	70.3
Additional Jobs	5.0	-	5.0
Surplussing Cost*	4.1	8.1	12.2
Pre Operative Expenses	3.1	0.8	3.9
KREDL Fees	-	0.2	0.2
Project Consultants	3.0	1.0	4.0
Civil Works	-	9.4	9.4
Plant & Machinery	-	17.0	17.0
Supervision & Other Charges	0.1	1.3	1.4
Contingencies	-	2.6	2.6
IDC	-	1.9	1.9
Total	85.3	42.7	128.0

Means of Finance

The project is proposed to be funded with a DER of 1.2 : 1 against the norm of 2.33 : 1 in power projects. The promoter proposes to bring in his contribution of Rs. 58 crore by a combination of equity and subordinate debt. The promoter has already spent Rs. 23.5 crore on the project. The promoter will bring a further Rs. 11.8 crore i.e. a total of Rs. 35.3 crore for Phase I before seeking disbursement of IDFC's debt of Rs. 50 crore for Phase I. The summary of the proposed means of finance is given below.

(Rs. crore)

Particulars	Phase I	Phase II	Total
Equity / Subordinate Debt	35.3	22.7	58.0
Debt	50.0	20.0	70.0
Total	85.3	42.7	128.0
DER	1.4	0.9	1.2

The capital cost / unit for HPL is Rs. 19.1. The project cost of HPL is on the higher side due to improvements required to be carried to the Phase I of Rs. 11.3 crore after payment of acquisition cost of Rs. 70 crore. HPL also incurred a cost of Rs. 12.2 crore on the surplussing arrangement. To overcome the adverse effect of high capital cost and lower PLF on the debt servicing ability of the project, IDFC has restricted the debt to HPL at Rs. 70 crore. The debt / unit for HPL at Rs. 10.44 compares favourably with those of other hydro projects funded by IDFC.

Marketing & Selling Arrangements

HPL proposes to enter into separate Power Purchase Agreements (PPA's) with KPTCL to sell the power generated by Phase I and Phase II at Ministry of Non-conventional Energy Sources (MNES) tariffs. The tariff for the current year 2002-is Rs.3.32/unit and the rate would escalate at rate of 5% p.a. As per the draft PPA, the MNES tariff would be applicable only for the first 10 years of operations. The draft PPA has been approved by Karnataka Electricity Regulatory Commission (KERC). Third party sales are permitted in case of payment default by KPTCL for a continuous period of three months on payment of wheeling and banking charges. In the event of offtake default by KPTCL for a continuous period of 3 months, HPL is entitled to be compensated by KPTCL. The amount of compensation to be paid will be determined by the arbitrator.

Financial Projections *Summary of Financial Projections (Base Case)*

Year ending March 31,	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Net Generation	41.0	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9
Revenue from sale of power	12.5	20.3	20.7	21.1	21.5	21.9	22.4	22.8	23.3	23.7	24.2
Total Income	12.5	20.5	21.0	21.5	21.9	22.3	22.7	23.1	23.5	24.0	24.4
Total expenses	11.1	15.8	17.0	16.3	15.6	14.9	14.2	13.5	12.8	12.1	11.5
PBT	1.5	4.7	4.1	5.1	6.3	7.4	8.5	9.6	10.7	11.9	12.9
Tax	0.1	0.4	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0
PAT	1.4	4.4	3.8	4.7	5.8	6.8	7.8	8.9	9.9	10.9	11.9
Gross Cash Accruals	3.9	8.0	7.6	8.6	9.6	10.6	11.7	12.7	13.7	14.8	15.7
Cost of Generation	2.1	1.9	3.0	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5

(excluding RoE) DSCR	1.67	2.01	1.12	1.05	1.13	1.21	1.31	1.43	1.57	1.74	1.93

Key Indicators

Particulars	Base Case	Expected Value (EV)
DSCR		
Minimum	1.05	1.2
Average	1.47	1.8
LLR	1.30	

The base case financials have been projected taking into account conservative energy generation (at 90 % dependability) and tariff rate which is less then the contractual tariff. Even under such a scenario, the financials for HPL look comfortable. The cost of generation is competitive at Rs. 3.2 / unit (excluding RoE) in the first full year of debt repayment i.e. 2006 – 07. The cost of generation in the first full year of operations is Rs. 2.1 / unit which compares favorably with the current incremental cost of power purchase by KPTCL at Rs. 3 / unit.

General Observations The project has the following key features.

(a) Low cost of generation. The cost of generation in the year 2006 – 07 is Rs. 3.2 / unit. KPTCL's current cost of incremental power purchase is Rs. 3 / unit.

(b) Promoter has established presence in the field of non conventional energy projects. SMIORE – the asset manager has local presence and strong liasoning abilities.

(c) Strong promoter commitment. The project is being funded with a DER of 1.2 : 1 against the norm of 2.33 : 1 for power projects. The promoter is bringing in Rs. 58 crore by way of equity / subordinate debt.

(d) The small sized hydel projects are ideally suited as a distributed generation source to provide a solution towards rural electrification.

(e) Eco friendly and renewable power generation option.

(f) The PPA with KPTCL provides for third party sale in the event of payment default by KPTCL for three consecutive months.

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APPENDIX A

Vinay Deodhar

From: "VINAYAK MAVINKURVE" <VINAYAK@idfc.com>
To: "'Tandon, Sandeep (New Delhi/EEE)'" <standon@usaid.gov>
Cc: <vdeodhar.gep@vsnl.net>
Sent: Saturday, November 29, 2003 11:27 AM
Attach: GHG Assessment - Sandur power.doc; Interest rate reduction.xls
Subject: Re: Sandur Power Co. Ltd.

Dear Sandeep

I am attaching the GHG Assessment Report for Sandur Power Company Limited prepared by Vinay Deodhar, of Lou Berger Group. An excel sheet has also been attached which indicates the extent to which interest rate reduction is possible. Our interest rate as stipulated in our LoI was 11.25% p.a. An upfront interest subsidy from USAID of Rs.2.22 crore routed through IDFC would permit an interest rate reduction of approx. 75 basis points. The project has been approved by IDFC recently and we propose to issue the letter of intent shortly. Presently, IDFC's PLR for this duration works out to 8.58% p.a. which gives a risk spread of 267 basis points, which is the risk premium charged for a grass root project. The interest subsidy would go towards meeting part of the risk spread and also interest risk spread of IDFC due to variation in PLR in short-to-medium term. We would need a clearance from USAID on availability of the interest subsidy before signing of the loan agreement.

Regards

Vinayak Mavinkurve
Head - Energy

-----Original Message-----
From: Vinay Deodhar [mailto:vdeodhar.gep@vsnl.net]
Sent: Friday, November 21, 2003 7:26 PM
To: Vinayak Mavinkurve; NARAYANAN G
Subject: Sandur Power Co. Ltd.

Dear Vinayak:
Please refer to our discussion this Monday about the above project. I have

reviewed the project and the latest presentation that you sent. Based on these I have prepared the GHG assessment note for the project and have attached the same for your reference. Should you need any clarifications, please do not hesitate to call or mail me. You may proceed further as earlier and decide the rate of interest in consultation with USAID. I would appreciate if you could keep us posted on the same and send a copy of your letter of sanction to the company.

P.S.: Have you received any response from Sandeep on Chattisgarh project. Please send me copy of your letter of sanction for that project too.
With regards,
Sincerely,
Vinay Deodhar
----- Original Message -----
From: "NARAYANAN G" <narayanan@idfc.com>
To: <vdeodhar.gep@vsnl.net>
Sent: Wednesday, November 12, 2003 2:20 PM

> **********
> Warning: Your file, DPR 2.01.zip, contains more than 20 files after decompression and cannot be scanned.
> **********
>
>
> Dear Vinay,
>
> As discussed with Vinayak, I am attaching the Detailed Project Report for
> Sandur power Company Limited which is setting up a 22.5 MW mini hydel plant
> in the state of Karnataka.
>
> Since the file did not reach in the first instance, request you to confirm
> receipt of the same.
>
> Regards
>
> Narayanan.G
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GREENHOUSE GAS MITIGATION POTENTIAL ESTIMATION

OF

3 X 7.5 MW VARAHI TAILRACE MINI HYDEL POWER PROJECT IN KARNATAKA

PROMOTED BY

SANDUR POWER COMPANY LIMITED

BY:

GREENHOUSE GAS POLLUTION PREVENTION-CLIMATE CHANGE SUPPLEMENT

A USAID/INDIA PROJECT IMPLEMENTED BY:

THE LOUIS BERGER GROUP, INC.

C-6/7 SAFDARJUNG DEVELOPMENT AREA

NEW DELHI 110 016

NOVEMBER 2003

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Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the 3 X 7.5 MW hydroelectric power project in Karnataka was prepared for Infrastructure Development Finance Company Ltd. by The Louis Berger Group, Inc. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by Sandur Power Company Ltd. (the project promoter), IDFC and that obtained from public domain. The information contained in the note is solely meant for IDFC and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to IDFC, Sandur Power Company and several other institutions including CEA, IPCC/IEA, UNFCCC, and The World Bank for the background data provided by them through their websites.

This note should not be considered an endorsement or certification to the project or the technology and it should not be deemed to be any undertaking, warranty or endorsement by The Louis Berger Group, Inc. and US Agency for International Development.

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1. Background of the project

Sandur Power Company Limited (SPCL), a Special Purpose Vehicle (SPV) company promoted by Mr. Y. S. Jagan Mohan Reddy and friends, proposes to construct, erect and operate a 22.5 MW (3 x 7.5 MW) hydroelectric power project on the tail race of Varahi hydel power station near Agumbe, in Shimoga District of Karnataka. The project involves a run-of-the-river scheme which is based on tailrace of the 230 MW Varahi underground hydro power (VUHP) station set up by Karnataka Power Corporation Ltd. (KPCL).

The project shall utilize the water released in the tailrace by the VUHP by constructing a diversion structure 216 m in length, which would divert the water to a 88 m long approach channel. A 2300 m long horse shoe shaped head race tunnel leads the water to three penstocks tunnels. 3 turbines in the powerhouse with a capacity of 7.5 MW each are proposed to be installed in this phase. After generation of power, the water would be let back into the river through a 330 m long tailrace canal. The proposed weir shall result in least submergence since the maximum height of the weir up to the crest level from foundation level is only 7.5 meters. This will also avoid changes in the upstream regime of the river.

The project would generate a total of 108 million kWh of power in a 90% dependable year. The power from the project will be supplied in the state power grid of Karnataka. SPCL has entered into a PPA with Karnataka Power Transmission Corporation Limited (KPTCL) which provides an initial tariff of Rs. 2.90 per unit to be escalated at 2% p.a..

2. GHG emission reduction objectives of the proposed project

India's power sector is characterized by heavy reliance on thermal power. Since 1950 the thermal hydro mix has been steadily deteriorating and tilting heavily towards thermal. As shown in Figure 1 (Source Annual Report of Ministry of Power 2002-03) the All India installed generating capacity mix for utilities was highest at 46:54 at the end of third five year plan in 1966. The main fuel used by thermal power plant is sub-bituminous coal and lignite. Recently few natural gas based power plants have been set up by NTPC. Indian coal quality has also been deteriorating on account of open cast mining, which leads to mixing of rubble with coal. As a result, the overall conversion efficiency of the coal fired power plants in India ranges between 20 – 30% (Source: Anthropogenic Emissions from Thermal Power Generation in India: Generation and Source Characterization Moti Mittal, C. Sharma, OSC, Ohio State University- 2002).

ALL INDIA INSTALLED GENERATING CAPACITY HYDRO-THERMAL MIX (%) (UTILITIES)

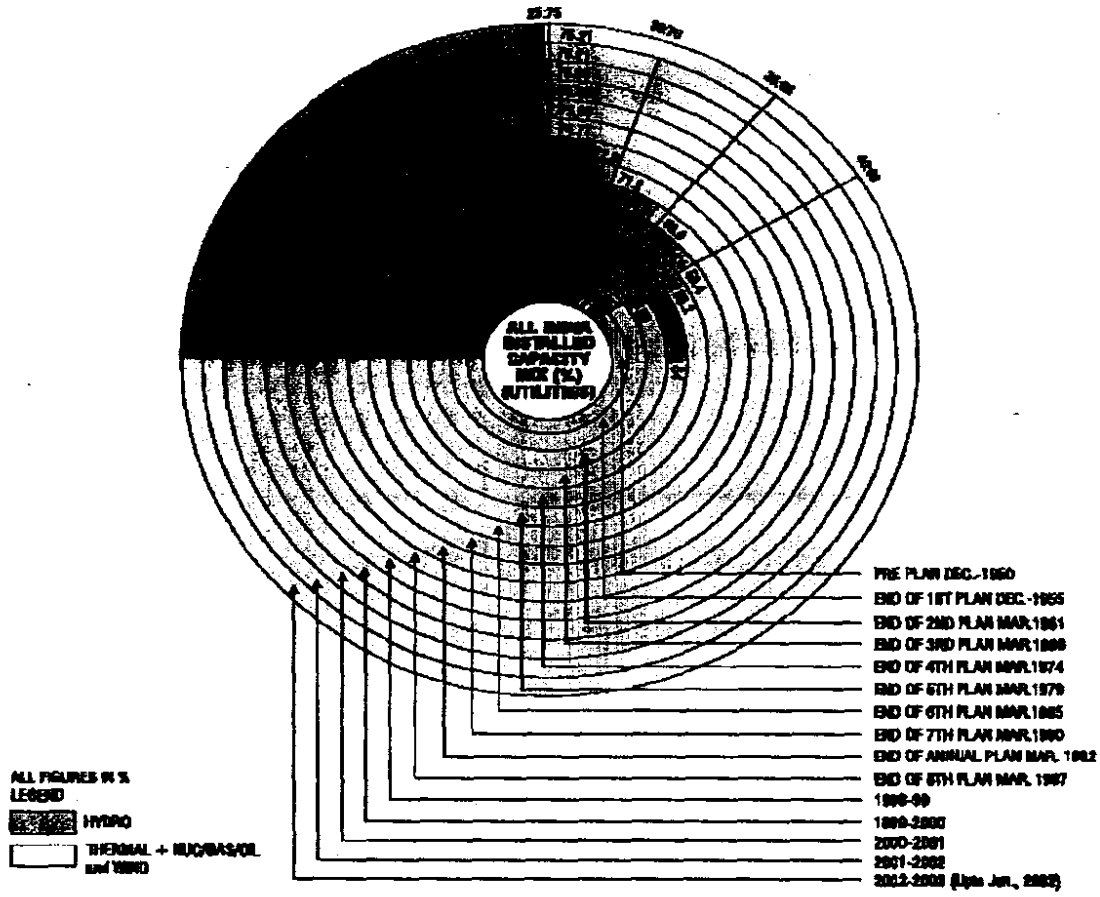

Figure 1: Grid Mix

In the above backdrop, Government of India has been encouraging the use of alternative sources of energy. The proposed project is based on one such form of natural energy supply viz. hydroelectric source, which does not lead to emissions of any type. The situation in the state of Karnataka is quite the reverse, with hydro power having a larger share. The project would make use of the gradient available in the river Varahi without damaging the natural habitat. Since the proposed plant would not involve a dam the submergence would be negligible. This ensures that the project does not damage flora and fauna and also does not lead to resettlement issues. Overall, the project helps in reducing dependence on fossil fuels without leading to additional GHG emissions.

a. ***Clean Technology nature***

The project consists of diversion structures across the tailrace stream from VUHP station on the river Varahi. The water would be conveyed ultimately across three penstocks which feed it to three 7.5 MW turbo generator units. Subsequently, water would be released through a 330 m tailrace canal. The diversion structure would have a height of 7.5 m/. The river banks at this place are steep. All the project construction is close to the river and do not encompass any forest land. These features ensure that there will be least submergence of vegetation, thereby minimizing the methane emission.

b. ***Sustainable Development objectives/aspects***

The project location is 2 KM downstream of the Shivasamudram village and does not have any inhabitation. This means that the project does not involve practically any rehabilitation and resettlement issues. Since the water collection and flows in the project are not likely to result in any reservoir that may affect the geological profile, the project would be safe from seismological point of view. The project would directly employ local people and the power generated would support industrial and commercial activity in the Mandya district. Thus, it would result in ancillary benefits to the local population.

c. ***Host country Government (GOI) objectives***

Government of India, Ministry of Non-Conventional Energy Sources (MNES) and the Karnataka state Government have been encouraging addition of power generating capacity based on renewable sources of energy. Under the schemes of MNES, small hydroelectric power generation (<25 MW) has been promoted as one such option. The power policy of Government of India stresses electrification of villages through renewables. It also encourages decentralized power generation as a means of strengthening and stabilization of the power grid performance. The proposed project meets all the essential requirements and has therefore received approval from the state level nodal agency of MNES i.e. Karnataka Renewable Energy Development Ltd. (KREDL).

3. Business as usual or Baseline identification

This section describes the existing power supply situation in the state of Karnataka where the power generated by the project is fed.

a. ***Project Boundary***

The project is expected to generate 108 million kWh of power in a 90% dependable year. The power plant has a capability of generating 118 million kWh power corresponding to a plant load factor of 54.8%, which is quite attractive in comparison to the other existing hydro power projects in Karnataka. The state had an energy deficit of 12.5% and a peak shortfall of 17% in the year 2001-02. Additional power generation capacity is being

built through both conventional and non-conventional sources. The power supplied by the project is most likely to be consumed within the state. Each unit of power supplied by the project would, therefore, replace an average unit supplied in the state. The relevant project boundary for the project on supply side is the state power grid.

Karnataka power grid is a part of the Southern Regional grid. The power supplied to the consumers in the state is drawn from a variety of sources, KPCL own generation, private producers, purchase within the southern region from other states and purchase from central power utilities against state's share. During discussion with KPTCL it was understood that its policy is to purchase all the power available within state first. Thus, when an additional unit is available it will back power from central power PSUs. In other words, the marginal unit is the power supply from these sources.

On the demand side that is generation side the project boundary consists of the existing VUHP project and the catchment area of the river Varahi.

b. Relevant baseline methodology/scenarios

Baseline is defined as the scenario in the relevant project boundary that would have prevailed in the absence of the project. It is also referred to as "business as usual" scenario. There are two possible methodologies to decide the baseline in situations like this. a) Average of weighted average emissions of all generating sources serving the system, excluding those which do not result in GHG emissions and the weighted average of recent capacity additions defined as the lower of most recent 20% of plants built or the 5 most recent plants; and b) The weighted average emissions of the current generation mix. The first approach is complicated and depends on availability of data. The second approach on the other hand is easy to understand and estimate, as adequate data is available from regular channels. Sometimes the plants under construction and planned are also taken into account. In view of the above, the second approach is suggested.

c. Time dimensions of the baseline

India has an overall installed capacity of 107,534 MW as on March 31, 2003 (MOP Annual Report 2002-03). This includes 76,525 MW thermal power and 26,660 MW of Hydro electric power. The balance is from wind (1,630 MW) and nuclear (2,720 MW). As per MNES report the total installed capacity based on small hydro power projects (up to 25 MW) is 1,450 MW amounting to 1.35%. The total potential for generation from this category in India is estimated at 15,000 MW. Thus, about 10% of the potential has been tapped. It can be concluded that in the foreseeable future, small hydro power will not form significant proportion of the baseline. Large size hydroelectric power projects which form about 23.5% of the total installed capacity should not be included in the baseline. While

these projects lead to high amount of GHG emissions, it is rather difficult to calculate exact amount due to lack of developed methodology. However, the non-inclusion will make the estimate more conservative and reduce chances of "gaming".

d. ***Annual /periodic estimations***

In view of the above status of implementation of projects, the baseline emissions will not change practically. Therefore, it may not be necessary to revise the baseline estimate at least during the first ten years in which investors are likely to purchase the credits.

e. ***Baseline case emissions estimation***

Based on the methodology presented earlier and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

CO_2 Emissions from power used in the state grid

The requirement of power in the state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the KPTCL purchases power from the central public sector power generating companies, in accordance with its allotted share. This is a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 34% of the capacity and 66% of the hydel sources. However, based on the statistics of power generated and purchased for the last three years 2000 - 02, it is observed that in 2001 of a total 49,255 MU consumed by the state grid 63.3 % was supplied from thermal sources, mainly coal fired plants, 35.7 % from hydel and balance 1.0 % by nuclear sources. The thermal plants a majority of which are based on high ash Indian coal use sub bituminous variety coal as fuel. By and large the plants are old and exhibit conversion efficiencies in the range of 25-30%. For conservative considerations this is assumed at a level of 33%. Indian electric power grid especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission & distribution losses, sometimes in the excess of 40%. However, since the proposed project will also feed power in the same grid as the conventional one's this is not significant for the analysis.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like The World Bank. The emission factor of thermal power plants using bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the above mix of supply from various sources as mentioned above, the

weighted average emission factor of the Karnataka state grid is 16.6 tC/TJ. From this analysis it is clear that Karnataka grid is in fact one of the grids which exhibits a well balanced thermal: hydro power mix and emission reductions that can be achieved by green energy projects will be the least.

4. GHG mitigation potential of the project

The proposed power project would use a natural source of energy, i.e. energy in the flowing river water. Moreover, the proposers have taken great care in design to ensure that the submergence on account of the project is minimal. The land area under forest around the project site is almost nil. These factors ensure that the emissions of methane due to submerged plants/vegetation/biomass would be negligible. Therefore, it will be reasonable to assume that the project does not have any GHG emissions.

The GHG emission reductions from the project would be:

Annual GHG Reduction =	**GHG Emission per million kWh of the baseline**	X	**Annual Units fed by the Project million kWh**

As discussed above the GHG emission per MU or the emission factor of the Karnataka grid is 664 tCO2 per MU under the assumptions discussed above based on the average energy fed by various sources for the past three years. The project is expected to export 108 million kWh to the Karnataka grid each year. Thus, the expected Annual GHG reduction from the 22.5 MW project would be 71,706 tCO2 p.a. or **71,700 tCO2 p.a.**

The above methodology, based on weighted average emission factors of the grid, is in conformity with the one for grid feeding small scale projects as specified by the CDM Executive Board of the UNFCCC.

5. Monitoring & Verification

It is very crucial to monitor and verify periodically the actual emission reductions achievable by the CEPs. There are two sides of this M&V, one to ensure that the baseline itself does not change significantly and second the project performs as envisaged in the design. As discussed in detail earlier the composition of entire RE based power generation is not likely to be significant in the foreseeable future. Therefore, the former is taken care of to a major extent. It is therefore important to measure the performance of the project in detail and with greater accuracy.

Performance of projects generating power for export to utility grid can be easily measured based on electric power generated and supplied to the grid. The proposers have signed a power purchase agreement with KPTCL, specifying the Metering and Billing clauses. In fact the project's revenue entirely depends on the

metering. The PPA provides for meters and check meters meeting prescribed standards and accuracy class. Thus, PPA provides the procedure of measuring and invoicing of the meter reading and also maintenance of the meters.

The following M&V mechanism is suggested:

It is proposed to vest the responsibilities of monitoring the parameters identified earlier in to an interdepartmental group consisting of representatives from quality control, production, maintenance and strategic planning departments, which shall *inter alia*

- Meter and record the power generated and sold to the grid
- Keep track of source wise power supply in the southern electric power grid and the status of completing the National Grid
- Measure/keep record of rainfall in the catchment area of the project

DESIGN GROUP

VTR MINI HYDEL SCHEME

Detailed Project Report

Sandur Power Co.(P) Ltd.

Bangalore

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VTR MINI HYDEL SCHEME

1. SCHEME AT A GLANCE

1. Name of the scheme	**VTR Mini Hydel Scheme**
2. Location:	
a) Vicinity	**Near Varahi Under Ground Power House**
b) Taluk	**Kundapura**
c) District	**Udupi**
d) State	**Karnataka**
3. Installed Capacity	**3 x 7.5 MW = 22.5 MW**
4. Average Annual Energy generation	**120 MU**
5. Basic Estimated Cost of the Scheme:	
a) Civil Works	**Rs. 5204.00 Lakhs**
b) P-Production, Hydraulic & E&M.	**Rs. 5165.00 Lakhs**
Transmission Lines.	**Rs. 221.00 Lakhs**
Total:	**Rs. 10590.00 Lakhs**
6. Sum at charge:	**Rs. 12953.00 Lakhs**
(Basic Cost + Escalation + IDC + Fina.Ch.)	
7. Cost per KW of Installed Capacity:	
a) On Sum at charge	**Rs. 57569.00**
a) Cost of energy generation per unit as per Govt. Norms for the First Year.	**Rs.3.13 per unit**
b) Sale rate of energy generated as per PPA.	**Rs.3.85 per unit**

2. Synopsis

1.00 The development of Power Sector until recently in India has been primarily with the State and Central Governments with very little participation by Private Sector. The country faces an energy shortage of around 7.8% and peak load capacity shortage to the extent of 13%. The situation in Karnataka State is no better and is hindering its economic growth. In order to mobilize more funds for development of the Power Sector, Government of India has framed a policy to permit private sector participation in the development of the power sector. Under this policy, M/s Sandur Power Company Private Limited has been allotted by the Government of Karnataka, the implementation of the Varahi Tail Race Mini Hydel Scheme with an installed capacity of 22.5 MW, with an annual average gross generation of 120 Mu.

2.00 River Varahi is an important West flowing river of Karnataka State with large hydel power potential situated in Western Ghats. Power development in the Varahi Valley with an installed capacity of (i) Mani Dam Power House 2 x 4.5 MW (ii) Varahi Underground Power House 2 x 115MW started in 1982. The Varahi Tail Race Mini Hydel scheme would be the last but one in the Varahi river Valley, the last one being Varahi Irrigation Scheme with 8 MW power potential.

3.00 Varahi Tail Race Mini Hydel Scheme utilises the tail race discharges of Varahi Underground Power House and the available head between this tail

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race and FRL of Varahi Irrigation Dam for generation of power. The proposed scheme comprises of the construction of (i) a diversion weir across Varahi river just downstream confluence of river Varahi and tail race of VUGPH, (ii) a gravity type intake (iii) a 2290m long, 7m dia horse shoe shaped head race tunnel (iv) 22m simple type surge tank (v) 7m dia penstocks tunnel (vi) 3 Nos. penstocks (vii) a power house in which three standard vertical shaft type full Kaplan turbines of 7.5 MW capacity each are proposed to be installed (viii) and a tail race joining the Varahi River on its right flank.

4.00 The total estimated cost of the scheme inclusive of Transmission Lines according to the price level of the year 2001-02 is Rs10590 lakhs. The civil engineering works are estimated to cost Rs.5204 lakhs and the electrical engineering works including Transmission lines are estimated to cost at Rs. 5386 lakhs. The completed cost of the project inclusive of escalation in costs during construction and financial charges is placed at Rs. 12953 lakhs. The project can be implemented in 30 months.

5.0 The cost of energy generation as per Govt. of India norms is Rs.3.13 per unit with ROE in the first year for a net annual generation of 118.80 mu. The sale rate of energy is Rs.3.85 per unit, during the first year of generation as per the PPA norms.

6.0 From the **Detailed Project Report**, now presented, it would be observed that the project being implemented in a hilly terrain of Western Ghat

devoid of infrastructure facilities. To reduce the acquisition of Forestland to minimum HRT has been proposed as Water Conductor system in lieu of pond age envisaged by KPCL. Provision has been made in the HRT to handle ultimate discharge capacity of 122 cumecs to operate in synchronization with VUGPH when two more units are added later by KPCL to improve the peak load operation of the generating station. Correspondingly space provision have made in all other components of civil works resulting in increased cost of civil works. In spite of all the above, availability of 61 % of PLF has increased the annual average energy generation to 120 MU for the given installations. On the whole the return on investment is high and attractive making the scheme technically feasible and economically viable.

7.0 In the context of the power and energy shortage in the State of Karnataka and the ever increasing demand for more electricity, the implementation of Varahi Tail Race Mini Hydel Scheme is very essential to partially meet the shortage of peak power and energy in the State of Karnataka. The significant aspects of the Varahi Tail Race Mini Hydel Scheme are:

(i) There is an assured available net head of about 36 to 47m.

(ii) The project being situated downstream of VUG Power Station is assured of continuous availability of water from the tail race of Varahi Underground Power Station, which is presently run as peaking station.

(iii) In addition, there is availability of considerable inflow from the independent catchment area also.

(iv) The Project is economical and provides adequate income generation to meet all financing commitments and provides adequate return for the investments.

APPENDIX A

TIRTHAN

HYDRO ELECTRIC PROJECT

(9 MW)

Detailed Project Report

VOLUME - I

Submitted by

Cosmos Consulting

Consultants:

Dr. Hutarew & Partner (I) Pvt. Ltd.

New Delhi

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EXECUTIVE SUMMARY

Himachal Pradesh is endowed with nearly 21000 MW of hydro potential, including about 1700 MW in the Small Hydro Section (projects upto 25 MW capacity), in its five river basins. Having harnessed only about 4000 MW till date, the Govt of Himachal Pradesh, with its renewed set of incentives has encouraged participation of the Private Sector. Thrust has been laid on the development of Small Hydro Projects (up to 25 MW capacity).

Govt of Himachal Pradesh selected **Cosmos Consulting** as an IPP for the implementation of **Tirthan** Hydro Electric Project having an estimated capacity of **3MW** in the **Private Sector** on **Build, Own, Operate & Maintain** (BOOM) basis.

Memorandum of Understanding (MOU) between Government of Himachal Pradesh and Cosmos Consulting has accordingly been signed on **February 21, 2000** for the investigation and implementation of Tirthan Hydro Electric Project in Kullu District of Himachal Pradesh.

Promoter

Cosmos Consulting has been promoted by **Shri. K.L. Chugh, Chairman Emeritus, ITC Limited,** (a Rs.9000 Crore Company).

Mr K L Chugh, Chairman Cosmos Consulting is a widely recognized professional known for excellence in management leadership. Mr Chugh has stewarded and guided the ITC Group for well over 25 years, has won laurels and received a number of international & national awards for commendable growth of all the institutions, he has been associated with.

Consultants

Cosmos Consulting has appointed **Dr Hutarew & Partner (India) Private Limited**, an associate of Internationally renowned, Germany based Consulting Organisation, as consultants for preparation of the DPR. Dr Hutarew & Partner have also been responsible for

Supervision of Detailed Surveys of the Project Site and Detailed Geological Investigations, that have been undertaken for preparation of the DPR.

Project

Tirthan Hydro Electric Project (HEP) has been contemplated as a **run-of-river scheme.** The Project envisages transporting water of Tirthan River (a tributary of Beas River), through a tunnel approximately **2.9 Km** long to utilize a **net head of 107.76** Mtrs.

Detailed **Surveys and Geological Investigations** for the scheme have been carried out from March' 2000 to January ' 2003 for preparation of the DPR. Discharge Site to conduct Hydro-meteorological observations was set up in March' 2000, to obtain discharge data for two lean seasons and the monsoon season.

Power House for the Tirthan SHP is proposed in Sidhwan village near Banjar town on the State Highway Aut – Banjar – Bathad. The Project envisages to utilize a **Net Head of 107.76 Mtrs,** at a design discharge of **9.90 cumecs** for a generation capacity of **9 MW**. It is estimated that in a **75 % availability year,** the project will produce **annual** energy of about **52.88 million units.**

Construction of the Project is planned to commence during last quarter of 2004 and it is aimed to complete the construction **within 42 months.**

Capital Cost

The scheme is estimated to cost about **Rs. 49.93 crore.** The Capital Cost per unit of energy generated in 75% dependable year works out to Rs. 9.44 per unit, which is comparable to other SHPs in hilly areas.

Sale of Power

HPSEB offers a rate of **Rs 2.25 per unit** for projects over and above 5 MW capacity. All the financial calculations are, therefore, carried out using the selling price of Rs. 2.25 per unit.

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Financials

The project has Debt Service Coverage Ratio of 1.6. Loan will be repaid within 8 years after commissioning, **Project IRR** is 16.1% over a period of 15 years.

SALIENT FEATURES

1.	**LOCATION**	
(i)	State	Himachal Pradesh
(ii)	District	Kullu
(iii)	Village	Banjar
(iv)	Access Road	29 km from Kullu Town.
(v)	Geographical Coordinates of nearest major town (Kullu)	
	i) Longitudes	77^0 07' E
	ii) Latitudes	31^0 39' N
2. (a)	**RIVER CATCHMENT**	
(i)	Catchment	374 sq. km (upto diversion weir site)
(ii)	River	Tirthan
(iii)	Tributary	Tributary of Beas
3.	**HYDROLOGY**	
(i)	Catchment area of the stream / Nala	374.0 sq. km
(ii)	Dependable yield (wherever applicable)	Not applicable
(iii)	Climate data Atmospheric Temperature (^{0}C)	**Maximum** **Minimum** 30^0 C 0^0 C
4.	**HIGH HEAD SCHEME**	
(a)	*Diversion Structure (Head works)*	
i)	Type of Structure	Boulder Type Weir
ii)	Length	42.25 m
iii)	Maximum Discharging Capacity	1235 cumecs with 4.6 m depth of flow over the crest
iv)	Gates	
	Number of gates	1 no. at Intake & 2 nos. at Bottom Outlet
	Type of gates	Vertical Lift Gates
	Size of gates	Intake: 4.0m (wide) x 4.5m (high) & Bottom Outlet: 4.5m (wide) x 3.0m (high)

(b)	*Water Conductor System*	
1.	*Intake & Approach Channel*	
	Length	3.5 m
	Size	9.5 m x 3.0 m
	Bed Level	EL 1389.0 m
2.	*Desilting Tank*	
	Type	Dufour Type
	Length	116.0 m (including u/s & d/s transitions)
	Width	13.5 m
	Depth	5.0 m
3.	*Cut and Cover*	
	Type	D – Shaped, RCC Construction
	Length	51.1 m
	Size	2.2 m x 2.7 m
	Gate	1 no., 2.2m (wide) x 2.7m (high)
4.	*Power Tunnel*	
i)	Length	2917.4 m
ii)	Shape & Type	D - Shaped Concrete lined Tunnel
iii)	Size	Width = 2.2 m, Height = 2.7 m
v)	Thickness of Concrete lining	150 mm
vi)	Design Discharge	9.90 cumecs
(c)	*Surge Shaft*	
i)	Type of surge shaft	Restricted Orifice, 934 mm diameter
ii)	Size of surge shaft	Diameter of 4.0 m
iii)	Max. Up Surge Level	EL 1412.65 m
iv)	Min. Down Surge Level	EL 1379.08 m
v)	Lining	300 mm thick RCC Lining
(d)	*Penstocks*	
i)	Number	1 no.
ii)	Diameter and thickness	2000 mm dia, 10 mm thick
iii)	Length	322 m (from surge shaft to center line of Grit)

iv)	No. of Bifurcation at lower end	Two Bifurcations yielding three pipes of 1150 mm dia each.
v)	Invert Level at inlet	EL 1386.50 m
vi)	Design discharge	9.90 cumecs
vii)	Material	ASTM 285 Grade "C"

6.	**POWER HOUSE**	
(i)	Type	Surface
(ii)	Head (m):	
	- Gross	114.0 m
	- Design	107.76 m
(iii)	Size of power house:	
	(a) Length (m)	40.0 m
	(b) Width (m)	9.5 m
	(c) Height (m)	14.80 m
	(d) Machine Hall floor level	EL 1279.0 m
(iv)	Installed capacity	3 x 3000 kW
(v)	Turbine (s):	
	- Type	Horizontal Francis
	- Number	3 nos.
	- Capacity	3000 kW
(vi)	Type of Generator:	Synchronous , Brushless Type
(vii)	Power house crane / lifting tackle capacity	EOT Crane, 20 T capacity of main hook, 5T capacity of auxiliary hook
7.	**TAILRACE**	
(i)	Shape	Three Rectangular RCC ducts emanating from each unit and merging together in a rectangular open channel
(ii)	Length from centre line of units	85 m
(iii)	Tail Water Level	EL 1278 m

(iv)	Number of draft-tube gates	3 nos., Vertical Lift gates, 4000 mm (wide) x 3550 mm (high)

8.	**POWER**	
(i)	Installed capacity	3 x 3000 kW
(ii)	Seasonal (max.) power	9651 kW
(iii)	Total Annual energy	
	- 50% Dependable Year	58.06 million kWh
	- 75% Dependable Year	52.88 million kWh
	- 90% Dependable Year	37.04 million kWh

9.	**SWITCHYARD**	
(i)	Voltage level / Basic undulation level	3.3/33 kV
(ii)	No. Of bays	One
(iii)	Size	
	(a) Length	20 m
	(b) Width	15 m

APPENDIX A

Ref : MH/PMC/MSW/11 Date : 22/09/2003

The Commissioner
Pune Municipal Corporation
PUNE

Sub : Additional Information for Power Generation Project from 10 & 20 TPD MSW on BOT basis at Aundh & Katraj

Dear Sir

Reference meeting of the BOT cell on 16th Sept 2003.
The additional information required by you is submitted as under :-

1. **Sharing of Carbon Credit -**
   The detail working of the carbon credit is enclosed. Carbon credit factor has been taken for combined 30 TPD Power generation plant by Louis Berger Group, New Delhi. Please note that these are approximate values and will only be available to us once approved and sanctioned. As per the calculations the carbon credits available per year will range between Rs. 7 to 10 Lacs depending on the rate per ton of carbon. We are willing to share this with Pune Municipal Corporation in the ratio of 65% to Mailhem and 35% to Pune Municipal Corporation.

2. **Sharing of Subsidies from M.N.E.S. -**
   Presently there are no subsidies for the project as the policy has not yet been notified by M.N.E.S. (A copy of their letter is enclosed). However if any promotional capital subsidy is made available for the project Mailhem is willing to share the same with Pune Municipal Corporation in the ratio of 75% to Mailhem and 25% to Pune Municipal Corporation. However please note that if any specific subsidy is made available for providing land at nominal lease rent and MSW free of cost at site, 100% of the same will be handed over to Pune Municipal Corporation.

3. **Transfering of the Plant after 10 years -**
   We had carried out the financial projections for ten years as per the requirement of financial institutions. We would certainly like to run the plant for the next 10 years. However if Pune Municipal Corporation is keen to take over the plant after 10 years, the minimum cost which Pune Municipal Corporation will have to pay to Mailhem along with the likely profit per year is given below -

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c) Mailhem Engineers Pvt. Ltd. has agreed not only to set up the project on turnkey basis but operate and maintain it for the next ten years.
d) Income generated from sale of power and organic manure will be able to set off the loan repayment.
e) 80% accelerated depreciation will offset the tax liabilities of the financers

Profit Sharing with Pune Municipal Corporation

We would like the Pune Municipal Corporation to keep in mind the follow[illegible]

a) This being pilot project and first of its kind in India, with [illegible] have been able to convince the economic viability of the project to [illegible] and financial institutions. It is pertinent to mention the approach of HDF[illegible] of financing this project as per their letter (Photocopy enclosed). We [illegible] and to Pune Municipal Corporation taking the initiative as envisaged in HDFC letter for Public Private Partnership.
b) The financial projections made based on our experience gained at Vijaywada and the acceptance of tariff for sale of electricity and organic manure indicates very limited margin of direct profit to the financers. A photocopy of the order value of Vijaywada project is also enclosed to substantiate the cost of the project indicated in the techno economic feasibility report.
c) We visualise that Pune municipal Corporation's share of profit will be in terms of saving of diesel and manpower on account of reduction of 4 trips of Bulk Refuge Carrier from Katraj to Devachi Uruli. 30 litres of Diesel per day and manpower saving is likely to result in saving of Rs. 3,60,000/- per annum.
d) Pune Municipal Corporation is likely to benefit from saving in electricity for its PMT depot and Fire station.
e) Pune Municipal Corporation is likely to get one time grant for promoting MSW project from Mininstry of Non-Conventional Energy (M.N.E.S.) Exact amount will only be known once the new policy is announced by M.N.E.S. The policy is expected shortly.
f) From the financial projections it will be seen that, there is no scope for direct sharing of profits unless Pune Municipal Corporation also wants to contribute a share to 30% equity and get 12% on investment.

We are sure that after giving due consideration to the above points and taking into account our techno economic details, we will be in a position to complete other formalities for execution of the project.

Thanking You
Yours faithfully
For Mailhem Engineers Pvt. Ltd.

Lt. Col. Suresh Rege (Retd.).
Director

Cc : 1. Additional Commissioner (Special), HOD Cell, PMC, Pune.
2. Dr. R. R. Pardeshi, Deputy MOH, Solid Waste Management, PMC, Pune

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MAILHEM
ENGINEERS
PVT. LTD.

Ref : MH/KWTP/PMC/07

Date : 25/08/2003

The Municipal Commissioner
Pune Municipal Corporation
Pune

Sub : Forwarding of Techno Economic Details for Power Generation from 20 Ton per Day Presorted MSW at Katraj on BOT basis

Dear Sir

We are glad to know that you have accepted in principle to set up the [illegible] on BOT basis. The techno economic details are enclosed for your perusal. We [illegible] like to highlight certain points on the above subject :-

- **The plant will be the first of its kind on BOT basis and could be a trend setter for Decentralised disposal of MSW based on the principle of Disposal of Waste at its Source of Generation.**
- **Till date, Companies with foreigh technology, have signed agreements for Power Generation from 300 Tons and more MSW per day.**
- **We (Mailhem) have been able to put up the proposal for Power Generation from 20 Ton per day because of the following reasons :**
  - a) Ours is an indegenously developed technology.
  - b) Segregated (presorted) MSW is being made available at site by Pune Municipal Corporation as per the directives of the Supreme Court.
  - c) Land will be alloted by Pune Municipal Corporation on nominal rent (almost free) for a minimum period of ten years.
  - d) We are gaining experience in setting up demonstration power generation project for 20 TPD of Vegetable and Slaughter House Waste at Vijaywada Municipal Corporation. The main digesters have been completed at site. The plant is to be commissioned by Nov / Dec 2003 on receipt of Biogas Engine from Austria.
  - e) Promulgation of Electricity Act 2003 which enables Mailhem to sign PPA (Power Purchase Agreement) directly with the consumers and also decide the tariff rate & thereby saving in the cost of setting up and feeding the power into MSEB grid.
- Our financers have agreed to finance the project on BOT basis for the following reasons :
  - a) This being the first project (Pilot Project) HDFC has agreed to finance loan of 70% of the project cost against mortgage of plant and machinery at 11% interest per annum under their new Decentralised Infrastructure and Public Private Partnership initiative. (Photocopy enclosed)
  - b) Louis Berger Group of U.S.A. has also agreed in principle to reduce the interest rate by further 4% to facilitate setting up of this Pilot Project. HDFC as also Louis Berger group are of the opinion that a lot of promoters will come forward if this pilot project is successfully commissioned, thus tackling the major issue of disposal of MSW.

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14, Vishrambag Society, Sinhgad Rajgad Road, Pune - 411 016. Dial (020) 4002285 ● Tel Fax 4002286 Email [illegible]
Works : Plot No 19, IDA Bhandup Industrial Estate, PO [illegible], Pune Nagar Road, Lohegaon [illegible]

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DINT Introduction

Approaches to infrastructure development essentially consider large solutions to be the only answer to problems. For instance, approaches addressing the shortage of power in the country automatically consider large-scale generation as the first and possibly only option. Urban infrastructure requirements such as waste handling and disposal, water supply and sanitation are also approached in the same manner. There is a strong trend towards the large-scale creation of centralized infrastructure for all situations.

These projects have however failed to provide access to infrastructure services at the last mile. For instance, 80,000 villages in India are yet to receive electricity and of the 'electrified' villages, only 31% households have power in their houses. This coupled with the long gestation period, high costs, environment and social issues and time and cost overruns associated with large-scale projects have raised issues about the relevance and viability of these projects.

There is also the issue of ensuring that development impacts reach the 'last mile', enabling the benefits of liberalization of the economy to directly benefit the community at large. While there are arguments on both sides the 'trickle down' impact of liberalization has not been as effective as was anticipated.

Thus the case exists for considering complimentary, more locally focused approaches to development based on commercial principles. It is with this perspective that IDFC has created the Decentralized Infrastructure & new Technologies (DINT) Group.

Sectors of Activity

The key parameters that define DINT activities for IDFC are:

- It must be linked to the infrastructure service provision and the sectors of IDFC's operations
- It must be linked either to
  - Last mile infrastructure service provision

  Or
  - A new business model or technology
- Must be in the core sectors of IDFC's interest
- Must be replicable and sustainable
- Must be based on commercial principles

DINT activities so far

Some of the important initiatives which have been undertaken so far include :

- Exploring models for financing rural telephony and internet service providers
- Developing schemes/structures for financing retail solar devices such as home lighting systems, lanterns and solar pumps using various mechanisms such as state subsidies, international development support, tax and depreciation models, leasing, utilization of local self help groups and micro-finance etc
- Working on facilitating and financing Rural electrification pilots based on harnessing power from rural feeders to local entrepreneurs institutions that can manage the local power distribution.
- Working with donors to establish PPP facilities for utilizing low cost donor funds to leverage commercial capital for financing civic infrastructure services for the poor.
- Introduced the concept high capacity bus systems for catering the transportation needs of the growing cities.
- Working on development and financing of projects on decentralized wastewater treatment & management
- Exploring Rural water supply and sanitation models based on conservation and locally manageable solutions

Public Private Partnerships

Donor programs are based on financing of assets and soft costs and the accountability is restricted to reputation risk for the implementing agencies. There is normally no commercial stake for the players and the project risk of failure increases after the donor involvement comes to an end

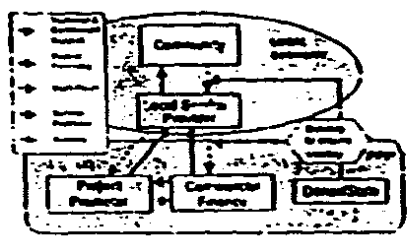
Recognizing this as well as its own interest in creating new approaches for infrastructure service provision IDFC is seeking to combining the development agenda of development agencies and commercial principles through DINT projects. The models being explored are based on commercial risk sharing principles with the leveraging development finance

DINT projects are not completely commercially viable due to the nature of the beneficiary as well as the sector. In this connection there would be some need for soft or direct subsidy to cover the following

- Project development costs
- Subsidy to reduce user payment requirements
- To create risk mitigation/sharing facilities to reduce risk for commercial finance

A schematic for a DI model is shown below

A PPP Model for Decentralized Infrastructure



The DINT premise is that private sector collaboration with the development sector would actually help projects to provide last-mile impact and would be expandable and sustainable even after the development support comes to an end.

The model seeks to address

- Stakeholder/beneficiary interest in project that should sustain after the project development process.
- Reduced monitoring and evaluation costs as the commercial model is seen as self regulating

It is widely believed that if pilot developmental projects are successful then they can be easily replicated with the subsidy coming from the state. In a sense for the pilots, the donor is a proxy for the state role for enabling development and poverty alleviation

Further Information

IDFC is keen to work with various state and central government departments, donors, bilaterals and multilateral agencies that have an interest in leveraging their development assistance with commercial financing in partnership with IDFC. IDFC from its own has set aside money to be able to finance the commercial aspects of these projects and has already started working on a number of project ideas

For further information on DINT please contact
Mr. Bhaw Solanki
Specialist , DINT Group
IDFC, New Delhi
Tel (9111) 6711135/6712/55 | Mail [illegible]

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(2)

By Reg. ... Ack. ...

VIJAYAWADA MUNICIPAL CORPORATION

Rc.No.EE-III/23334/97 Dated 28-07-2002

WORK ORDER

Sub: Vijayawada Municipal Corporation – Setting up of high Rate Bio-Methanation Plant for Power Generation from vegetable waste and Slaughter house waste in Vijayawada – Work Order issued to M/S MAILHEM Engineers Private Limited, Pune – For turnkey execution to proceed - Regarding.

Ref: 1) Tender Notice No. Rc.No.EE-III/23334/97 dated 24-05-2001
2) Letter No.MH/01/VMC/14 Dated 28-01-2002 from M/s Mailhem Engineers Private limited, Pune.
3) V.M.C. Council Resolution No.1045 dated 21-03-2002
4) Letter No.PMC/156-96/Vegetable/vol.II dated 21-06-2002 from National Bio-energy Board, M.N.E.S., New Delhi.

******

With reference to 1 to 4 cited above, the work for "Setting up of High Rate Biomethanation Plant for Power Generation from vegetable market wastes and slaughter house waste in Vijayawada" on turnkey contract for detailed engineering Design,Drawings,Fabrication,Construction,Supply,Delivery,Erection,Testing,Commissioning, Operation and maintenance of Anaerobic High Rate Biomethanation Plant including Civil,Mechanical,Electrical piping and Intrumentation works complete for the project funded by M.N.E.S. under UNDP/GEF assisted programme, the lowest and qualified tenderer M/S MAILHEM Engineers Private Limited, Pune is herewith awarded the turnkey contract for execution of the project for a total contract cost of Rs.303.45 lakh (Rupees Threehundred and three lakh and forty five thousand only). This contract cost is inclusive of all Central and state Governaments taxes and duties including applicable works contract tax, excise duty and other applicable municipal taxes except custom duties on import of 145 kW Gas Engine with in built Co-generation unit and other associated accessories. The project execution should be completed for commissioning, operation and maintenace with in one year from the date of agreement. Operation and maintenance should be done for 12 months after commissioning of the project.

The firm is requested to send their acceptance with in 7 days and to enter in to agreement with in 15 days of reciept of this work order duely producing Bank guarantee at 15% of total contract cost with a validation period of one year.

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COMMISSIONER,
VIJAYAWADA MUNICIPAL CORPORATION

TO,
M/S MAILHEM Engineers Private Limited,
14, Vishrambag Society, Senapathi Bapat road,
PUNE-411 016

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Techno-Economic Feasibility Report

For

Setting up of High Rate Biomethanation System

For Generation of Power

From

20 ton per day of segregated organic biodegradable Municipal Solid Waste (MSW)

At

Katraj Garbage Transfer Station, Pune

For

Pune Municipal Corporation, Pune

On Build - Operate - Transfer (BOT) basis

By

Mailhem Engineers Pvt. Ltd.
Pune

2003 - 2004

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TECHNOLOGY SELECTED

Plant Capacity :

To treat 20 ton per day of segregated biodegradable organic waste like vegetable market waste, food waste from hotels and residential areas at Katraj Garbage Transfer Station, Pune.

Salient Features of the Biomethanation Technology offered :

Among the various configurations of the methane digesters, which [illegible] an important equipment in the anaerobic treatment plant design, Upflow Anaerobic Sludge Blanket (UASB) design of the methane digester has become a very popular design since the introduction of the same by Dr. Lettingah of the Wageighen University in the Netherlands.

We, *Mailhem Engineers*, have analyzed the biological and technical performance, reliability, advantages and disadvantages of the various anaerobic digesters available for MSW treatment and subsequently have developed an optimum configuration using ***Anaerobic Phased Solid (APS) Reactor With Hybrid Batch / Upflow Anaerobic Sludge Blanket (UASB) Combination***. This is an ideal design for a country like India where intermediate technology with its low capital input is of critical importance, seasonal variation in the input quality of presorted MSW and from point of view of long-term operation and maintenance.

Batch systems are the low-end technology of all systems and also the cheapest as compared to one-stage, two-stage systems and hence have a high potential for application in developing countries. Two-stage systems are the most complex, and most expensive but their greatest advantage lies in the buffering of the organic loading rate taking place in the first stage, allowing a more constant feeding rate of the methanogenic second stage. Considering all these aspects *Mailhem Engineers* have arrived at this APS BATCH / UASB Configuration. With this combination, the performance of the plant can reach biogas yields equivalent to 80-90 % of the maximum theoretical yield!

Mailhem Engineers Pvt. Ltd., Pune, have modified and developed this special hybrid design to treat solid slurry wastes. This is a two stage design. The sizes of the digesters for the first stage and the second stage are decided on the basis of the suspended organic contents of the slurry to be treated. The first stage fermentation is hydrolysis stage and the second methanation and polishing stage. The first stage is designed to give maximum solid retention time for the hydrolysis and the second stage is either proprietary modular UASB construction or specially developed hybrid design. The design has been tried in a number of applications like kitchen, poultry, cow dung and slaughter house waste.

This technology has by now been well established, hence has been selected to give desired results for treatment of biodegradable organic waste for 20 ton per day at the Katraj Garbage Transfer Station.

The design is highly flexible and can be scaled up from 1 ton to 500 ton, which makes it suitable both for highly urbanized areas like metropolitan cities and smaller towns.

SUBUNIT-WISE DETAILS OF VARIOUS SECTIONS OF THE PLANT

Feed Preparation Section :

a) **Loading area with ramp** (1 Nos.) :- The trucks / dumpers carrying the pre-sorted vegetable waste will be brought near the loading dock onto the ramp and the waste unloaded. The waste will be further sorted manually by personnel stationed on the ramp. The waste will be immediately pushed into the bucket conveyor.

b) **Bucket conveyor** (1 Nos.) :- The waste material will be [illegible] into a slow moving bucket conveyor with a suitable angle of inclination.

c) **Pulveriser** (2 Nos.) :- A Pulveriser will be used to shred the vegetable waste and other biodegradable waste and convert it into slurry form along with water. It has a crushing capacity of 3 ton /hour. It is mounted on a Mild Steel support.

d) **Mixing tank** (1 Nos.) :- Made in RCC/ Brickwork having a volume of about 25 m^3. It is provided with a recycle stream for complete mixing of the waste slurry.

e) **Cutter pumps** (2 Nos.) :- Cutter pump is a submersible pump with cutter blades mounted at the bottom of mixing tank. This pump perfoms the dual function of shredding the waste matter further and also pumping it. It will pump the waste slurry from the mixing tank to the primary digester.

Anaerobic Digestion Section :-

a) **Primary Digester** (1 Nos.) :- This digester will be of the Anaerobic Phased Solid type. It will be of "bin" type construction. Depending on the site conditions and detailed engineering the array will be decided. It will have a solid waste distribution system at the top. It will contain proprietary internal modules made in FRP reinforced with Mild Steel and the bin/s are provided with a top cover made in Mild Steel with FRP lining. Proprietary drive mechanism is provided. Bottom sludge removal mechanism is also provided.

b) **Recycle Chamber** (1 Nos.):- Made in brickwork having 8m^3 volume. It serves as a collection sump of leachate for the digester pumps.

c) **Pumps for Secondary Digester** (2 Nos.) :- These pumps will pump the partially treated slurry / leachate from the primary digester to the secondary digester and will also be used for recycling.

d) **Secondary Digester** (1 Nos.) :- This digester has a volume of 1000 m^3 and will be made in RCC. It will contain proprietary internal modules made in FRP reinforced with Mild Steel and is provided with a top cover made in Mild Steel with FRP lining. Proprietary stirrer cum scum breaking mechanism is provided.

NOTE: Incase after the experience gained at Vijaywada Municipal Corporation, the digester volumes and configurations may change.

DESIGN PARAMETERS AND SAFETY CONSIDERATIONS

Waste Characteristics adopted for design

a) Organic waste : Total quantity = 20 ton per day (pre sorted waste)
Total solids = 18%
Total Volatile Solids = 80%

a) **Type of process :** Anaerobic Phased Solid / Batch Hybrid digester

b) **Process temperature :** Mesophillic

c) **Extent of Automation :** The entire process will have the requisite process controllers, indicators, sensors, transmitters etc.

d) **Safety Measures appropriate to the process : The general safety features adopted are :**

- "No Smoking" and hazard / danger warning stickers will be put up
- provision of fire extinguishers
- over pressure relief devices
- safe and proper storage of all chemical and fuels
- grounding / earthing of all electric equipment
- safe location of auxiliary electric gear
- covers for all drives
- proper building and equipment layout
- instrumentation alarms
- guard rails and safety ladders
- security personnel

Expected total gas production : 1800 m^3 per day

Constituents of Biogas :
Methane content 50 60 %
Carbon dioxide content 30 40 %
Hydrogen sulphide content 0.5 % maximum
Moisture Content balance

Expected biogas yield : 90 m^3 / ton of solid waste loaded

Electrical units available for use : approx. 3000 units per day

Bio manure generated per annum : 60 ton

Area required : 80m x 80m

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Gas Cleaning and Storage Section :-

a) **Biogas storage** :- will be of Dry type Membrane Gas storage system having a storage capacity of 5 hours. These neoprene rubber balloon gas holders (100 m^3 capacity each) will be enclosed in an enclosure and properly housed. They will be provided with all the necessary and requisite safety devices.
b) **Biogas Compressor** (2 Nos.) :- Roots type twin lobe blowers will be used. It will have all the necessary accessories, gauges and safety [illegible] one will be used for pressurizing the gas from the gas storage to the [illegible] section and the other for pressurizing the gas from the scrubber to Gas [illegible]
c) **Gas Receiving tank** (2 Nos.) :- This tank is made in Mild Steel with FRP lining. It is used for temporary pressurizing the biogas and also serves as moisture trap.
d) **Flare** (1 Nos.) :- Biogas flare is an essential item and will be used to flare the biogas when not in use, excess generation or during shut down. It will have pilot flame and the requisite automation.
e) **Biological Biogas Scrubber Tower** (1 Nos.) :- The biogas generated will contain a small percentage of H_2S and hence the biogas needs to be scrubbed. The system provided will be a proprietary scrubber using specially developed microbial culture on a packing media. It will have nutrient dosing system and necessary automation.

Power generation Section :-

A Cummins/ Greaves make genset of capacity 150 Kw will have all accessories like auto lube oil replenishing system, starting system, fuel gas train and cooling system, engine room, ventilation etc. It will operate at a maximum of 40°C in Indian conditions. It is expected to perform for 8000 hours per year.

Digested Products Section :-

a) **Effluent Buffer tank** (1 Nos.) :- This tank will have a capacity of 40m^3 and will be constructed in RCC/brickwork. It will store the treated water from the secondary digester as well as the under drain from the digesters. The water will be loaded in the tankers and carted away to be used as manure.
b) **Sludge drying beds** for temporary storage of under drain from the digesters. The sludge will be loaded in the tankers and carted away to be used as manure. The under drain from these beds will be connected back to the recycle chamber.

SALIENT POINTS

Details of proprietary equipment proposed to be incorporated in the system :

- Proprietary internal modules and drive for Primary and Secondary digester : These comprise of internal modular structures made out of Fibre Reinforced Plastic (FRP) and reinforced with Mild Steel. They have a header distribution system [illegible] digesters are provided with drive mechanism and /or scrapper cum scum breaker [illegible] Patent applied for.

- Proprietary Biogas Holder : The biogas holders are polychloroprene (neoprene) rubberized textile balloon type of gas holders with moisture separator and cylindrical shape along with vertical movement arrangement.

- Proprietary biogas scrubber : This biological scrubber contains a packing media and specially developed microbial culture consortium. The biogas is passed through this media which scrubs off the H_2S from the biogas - thus cleaning the biogas.

Requirement of utilities and services :
Process water : 10 m^3 fresh water at any point for cleaning and general maintenance.
Dilution water : 20 m^3 of recycled water / sewage water for preparation of slurry.

Manpower requirements for Operation and Maintenance:

Plant In-charge	:	1	
Supervisor	:	1	
Laboratory technician	:	1	
Electrician	:	1	
Maintenance fitter	:	1	
Operators	:	8	
Security personnel	:	1 per shift	(total 3)
TOTAL:	:	16 personnel	

Operation and Maintenance cost (for 12 months) Rs. **9,00,000/-**

Salaries and wages	Rs. 6,50,000/
Spares of biogas plant	Rs. 1,00,000/
Chemicals and lubrication cost	Rs. 1,00,000/
Administration charges	Rs. 50,000/
	Rs. 9,00,000/

SCHEDULE OF LUMP SUM PRICE ON BOT BASIS

Design, Detailed Engineering, Supply, Fabrication, Erection, Construction, Testing, Commissioning, Operation and Maintenance on a BOT BASIS for a period of 10 years	Rs. 2,00,00,000/- Rupees Two Crore only.

NOTE: This being the first pilot plant of its kind, the decision [illegible] continue to operate and maintain after 10 years or to handover the plant to PMC [illegible] transfer will be decided mutually.

COST BREAK UP OF THE TOTAL PROJECT COST

Item Description	Qty / Unit	TOTAL (Rs.)
Loading area with ramp	1	2,50,000
Bucket elevator	1	4,00,000
Pulveriser	2	3,00,000
Mixing tank (with screw conveyor)	1	2,50,000
Cutter pumps	2	1,00,000
Covered shed	1	2,50,000
Primary digester	1	40,00,000
Recycle pumps	2	50,000
Secondary digester	1	35,00,000
Gas storage with enclosure	1	14,00,000
Gas compressors	2	1,00,000
Gas receiver tanks	2	1,00,000
Gas flare	1	1,20,000
Biological gas scrubber	1	16,00,000
Biogas engine with enclosure	1	56,00,000
Treated effluent storage tank	1	1,00,000
Sludge drying beds and manure removal area	1	1,00,000
Effluent disposal pumps	2	80,000
MCC room	1	1,00,000
Instrumentation, Electrical & Laboratory items	Lumpsum	1,00,000
Internal roads, lighting and fencing	Lumpsum	2,00,000
Technical know-how & designing fees		4,50,000
Contingency		2,50,000
TOTAL		2,00,00,000/-

FINANCIAL PROJECTIONS
PROJECT COST SUMMARY

Power Generation from 20 MT plant at Katraj Transfer Station from pre-segregated waste

Rs in Lakhs

Project Cost		200.00
Equity	30.00%	60.00
Loan	70.00%	140.00
Total		200.00
Additional Equity for working capital		10.00
Total Equity		70.00
Interest on loan @	7.50%	
Period of loan	10 years	with a moratorium of 2 years on principal repayment
Loan repayment over	8.00 years	
Instalment	17.50	

Benefits

Depreciation	80.00%

Income generated from infrastructure project is tax free

BEST AVAILABLE COPY

FINANCIAL PROJECTIONS
INCOME & EXPENDITURE STATEMENT

Power Generation from 20 MT plant at Katraj Transfer Station from pre-segregated waste

Calculation of Income

Electricity

Biogas generated	1800 cu mtr
Units / day	3060
Rate / unit sold	3.50
Days / year	365
Income / year	3909150

Others

Manure	60 MT
Rate / kg	2.50
Total	150000

Total Income	4059150

Expenditure
(O & M Costs)

Monthly	75000
Yearly	900000

FINANCIAL PROJECTIONS
LOAN WORKING

Power Generation from 20 MT plant at Katraj Transfer Station from pre-segregated waste

Loan Amount 140.00

Calculation of interest and repayment

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Loan										
Opening Balance		140.00	140.00	122.50	105.00	87.50	70.00	52.50	35.00	17.50
Loan taken	140.00									
Loan repaid			17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50
Closing balance	140.00	140.00	122.50	105.00	87.50	70.00	52.50	35.00	17.50	0.00
Interest										
No of months	6	12	12	12	12	12	12	12	12	12
Interest	5.25	10.5	10.5	9.19	7.88	6.56	5.25	3.94	2.63	1.31

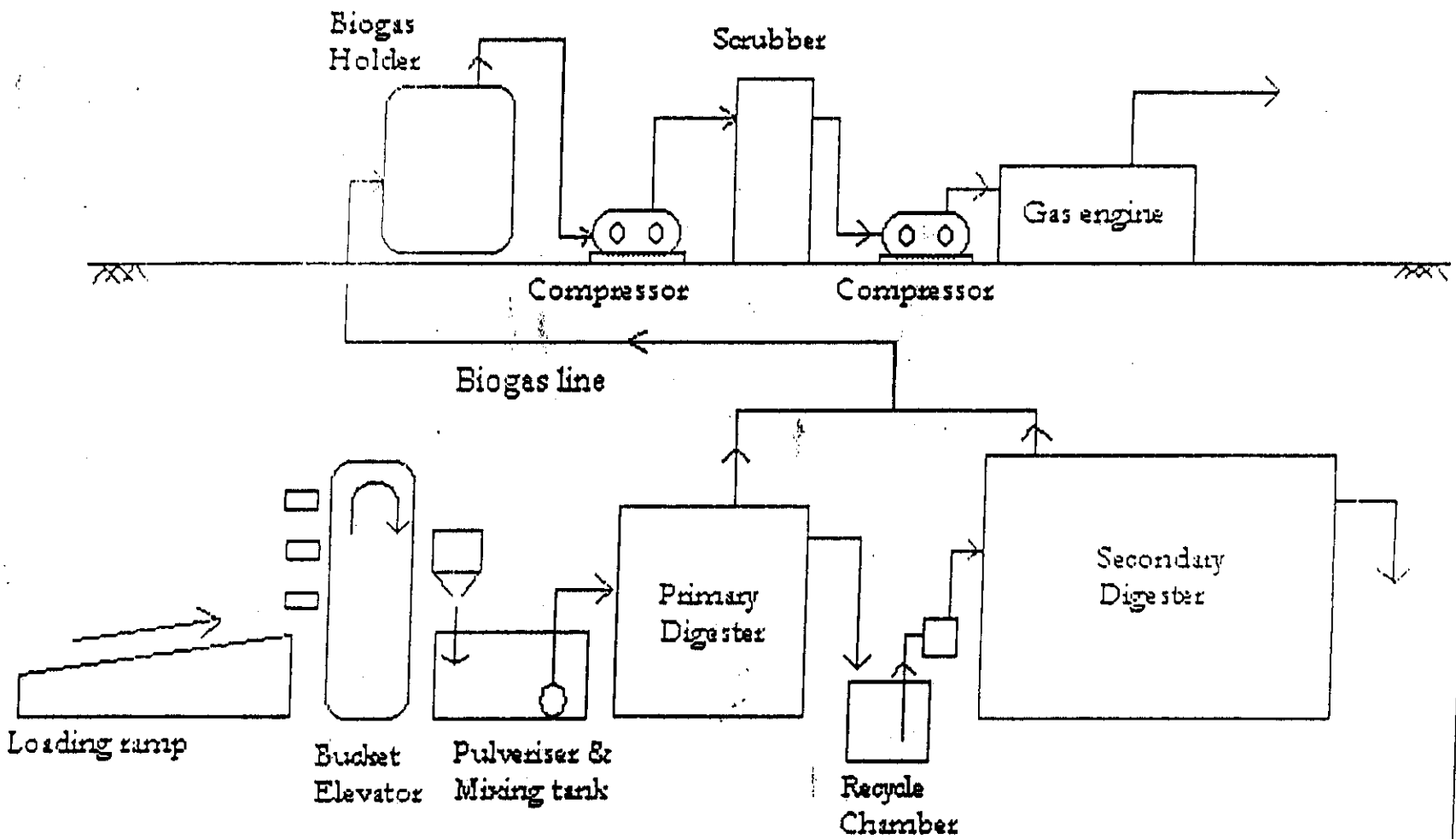
FINANCIAL PROJECTIONS
CASH FLOW STATEMENTS

Power Generation from 20 MT plant at Katraj Transfer Station from pre-segregated waste

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Income											
Sales		40.59	42.62	44.75	46.99	49.34	51.80	54.39	57.11	59.97	447.57
Total Income		40.59	42.62	44.75	46.99	49.34	51.80	54.39	57.11	59.97	447.57
Expenditure											
O & M Costs		9.00	9.90	10.89	11.98	13.18	14.49	15.94	17.54	19.29	122.22
Interest	5.25	10.50	10.50	9.19	7.88	6.56	5.25	3.94	2.63	1.31	63.01
Total Expenditure	5.25	19.50	20.40	20.08	19.86	19.74	19.74	19.88	20.17	20.60	185.23
Cash Profit / Loss	-5.25	21.09	22.22	24.67	27.13	29.60	32.06	34.51	36.95	39.37	262.34

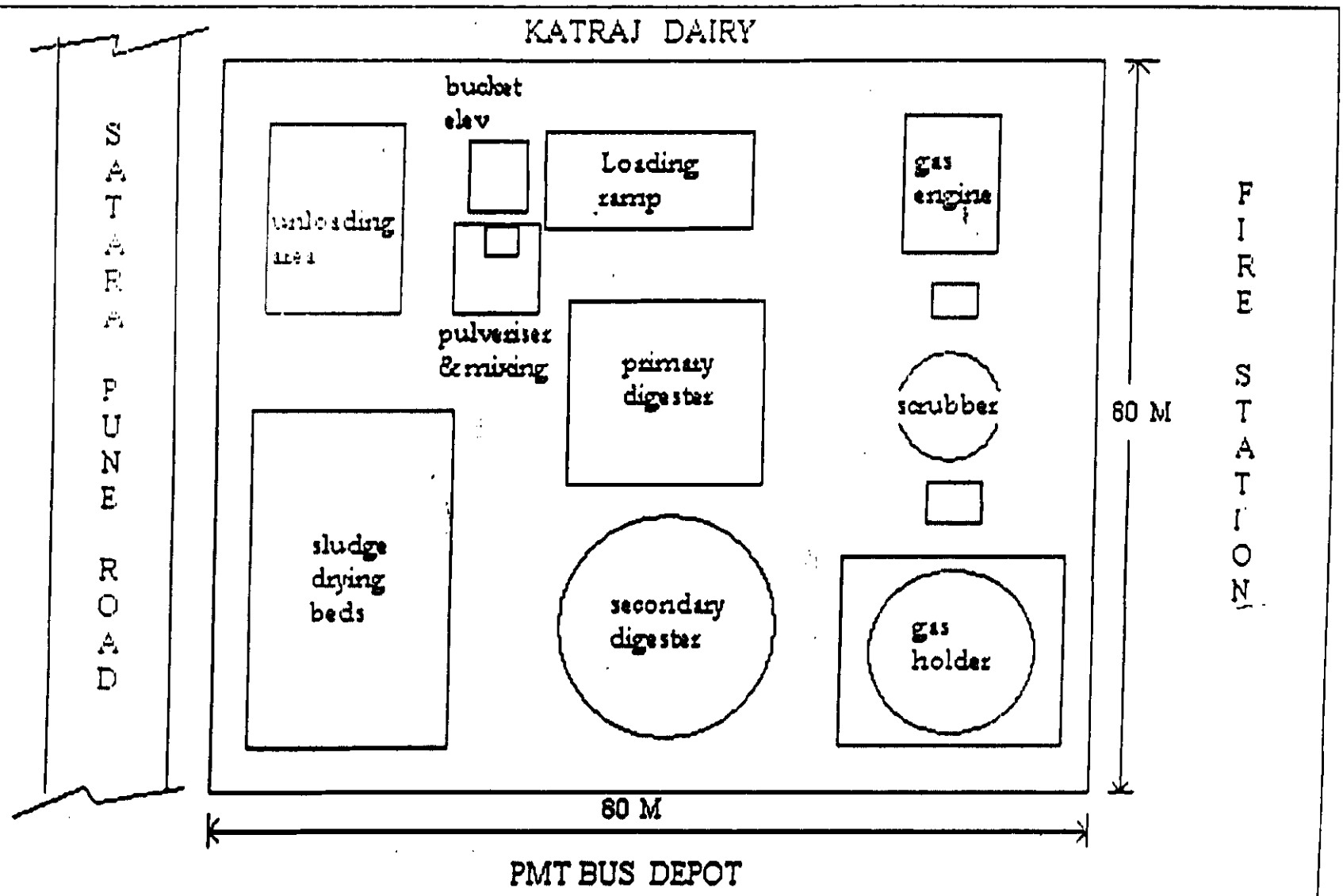
CASH FLOW STATEMENTS CONTD.

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Cashflows												
Inflow												
Loan		140.00										0.00
Cash Profit / Loss		-5.25	21.09	22.22	24.67	27.13	29.60	32.06	34.51	36.95	39.37	0.00
Total Inflow		134.75	21.09	22.22	24.67	27.13	29.6	32.06	34.51	36.95	39.3676	0.00
Outflow												
Plant Cost		200.00										0.00
Loan Refund				17.50	17.50	17.50	17.50	17.50	17.50	17.50	17.50	0.00
Return to Investors	12%		8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40	8.40	0.00
Total Outflow		200.00	8.40	25.90	25.90	25.90	25.90	25.90	25.90	25.90	25.90	0.00
Closing Balance		-65.25	12.69	-3.68	-1.23	1.23	3.70	6.16	8.61	11.05	13.47	0.00



Flow sheet for 20 ton per day biomethanation system for power generation at Katraj Transfer Station, Pune on BOT basis

Mailhem Engineers P Ltd
Pune
Dwg: FS/Msw/001 21/8/03



Layout for 20 ton per day biomethanation system for power generation at Katraj Transfer Station, Pune on BOT basis

Mailhem Engineers P Ltd
Pune
Dwg: LO/Msw/002 21/8/03

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MAILHEM ENGINEERS PVT. LTD.

STANDARD BIOGAS PLANTS FOR COMBINED SEWAGE WATER & FOOD WASTE FOR RESIDENTIAL AREAS

No. of Flats	No. of people	Wet garbage kg/ day	Sewage waste water in lit / day	Biogas generated in m^3/ day	Equivalent LPG in kg / day	Budgetary price for Mailhem	Budgetary cost for civil works	Budgetary cost per flat (one time investment)
50	250	25	40000	8 - 9	3.5 - 4	1,75,000/-	1,00,000/-	5500
100	500	50	75000	16 - 18	7 - 8	4,00,000/-	1,25,000/-	5250
200	1000	100	150000	32 -35	14 - 16	6,50,000/-	3,50,000/-	5000
300	1500	150	230000	50 - 54	22 - 24	9,00,000/-	4,50,000/-	4500
400	2000	200	300000	65 - 70	30 - 32	12,00,000/-	6,00,000/-	4500
500	2500	250	380000	80 - 85	35 - 40	15,00,000/-	7,50,000/-	4500
600	3000	300	450000	95 - 100	40 - 45	17,50,000/-	8,00,000/-	4250

- The prices / designs are subject to change depending on the soil conditions and other site constraints.
- We consider 100 gm of food waste per person per day and 150 lit of sewage and sullage waste water per person per day.
- The basic system comprises of the following :-
  - i) Bar screen chamber & Food waste Shredder
  - ii) Anaerobic digester/s & internals
  - iii) Aeration section & accessories
  - iv) Pressure sand filter
  - v) Chlorination
  - vi) Biogas storage and utilisation
  - vii) Automation Control panel
- Operation & Maintenance cost of these integrated sewage & wet garbage plants will range between Rs. 40 - 55 per flat / month

Office : 14, Vishwambag Society, Senapati Bapat Road, Pune - 411 016. Dial (020) 4002285 ● Tel Fax 4002286 Email sarathi@vsnl.com
Works : Plot No. 19, B.U. Bhandari Industrial Estate, PO - Sanaswadi, Pune-Nagar Road, Taluka - Shirur, Dist. Pune 412 208

MAILHEM ENGINEERS PVT. LTD.

STANDARD BIOGAS PLANTS FOR FOOD WASTE TREATMENT FOR INDUSTRIAL HOUSES.

No. of people eating	Quantity of Food Waste Kg/day	Biogas generated in m^3/day	Equivalent LPG in kg / day	Area Required	Budgetary price for Mailhem	Budgetary cost for civil works (will vary from site to site)
250	50	4 - 5	2 - 2.5	6 ft x 6 ft	85,000/-	10,000/-
375	75	6 - 7	3 - 3.5	6 ft x 6 ft	1,05,000/-	15,000/-
500	100	8 - 9	4 - 4.5	10 ft x 10 ft	1,25,000/-	20,000/-
750	150	12 - 14	6 - 7	12 ft x 12 ft	1,60,000/-	30,000/-
1000	200	16 - 18	8 - 9	13 ft x 13 ft	2,15,000/-	35,000/-
1250	250	20 - 22	10 - 11	14 ft x 14 ft	2,40,000/-	45,000/-
1500	300	24 - 26	12 - 13	16 ft x 16 ft	2,80,000/-	55,000/-
2000	400	34 - 36	17 - 18	20 ft x 20 ft	3,65,000/-	75,000/-
2500	500	42 - 45	21 - 22	22 ft x 22 ft	4,50,000/-	1,20,000/-
3000	600	52 - 54	25 - 27	24 ft x 24 ft	5,10,000/-	1,50,000/-
3750	750	62 - 65	30 - 32	26 ft x 26 ft	6,40,000/-	1,85,000/-
4500	900	72 - 75	35 - 38	28 ft x 28 ft	7,90,000/-	2,00,000/-
5000	1000	80 - 85	41 - 43	30 ft x 30 ft	8,60,000/-	2,40,000/-
7500	1500	120 - 130	60 - 64	50 ft x 50 ft	13,50,000/-	3,00,000/-
10000	2000	160 - 170	80 - 85	60 ft x 60 ft	17,00,000/-	4,00,000/-

STANDARD BIOGAS PLANTS FOR WET GARBAGE TREATMENT FOR MUNICIPAL WARDS.

Quantity of wet garbage	Biogas generated in m^3/day	Equivalent LPG in kg / day	OR Equivalent electricity in units per day	Area Required	Manure generated ton / annum	Budgetary price for Mailhem BOT Basis
5 ton / day	350 - 400	155 - 180	720	30 m x 30 m	15	Rs. 75 Lac
10 ton / day	750 - 800	335 - 360	1440	40 m x 40 m	30	Rs. 140 Lac
20 ton / day	1450 - 1600	650 - 720	2880	80 m x 80 m	60	Rs. 220 Lac

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MAILHEM ENGINEERS PVT. LTD.

STANDARD BIOGAS PLANTS FOR FOOD WASTE TREATMENT FOR RESIDENTIAL AREAS.

No. of Flats	Quantity of Food Waste Kg/day	Biogas generated in m^3/day	Equivalent LPG in kg / day	Area Required	Budgetary price for Mailhem	Budgetary cost for civil works (will vary from site to site)	Budgetary cost per flat (one time investment)
200	100	8 - 9	4 - 4.5	10 ft x 10 ft	1,15,000/-	20,000/-	675
300	150	12 - 14	6 - 7	12 ft x 12 ft	1,45,000/-	30,000/-	580
400	200	16 - 18	8 - 9	13 ft x 13 ft	1,95,000/-	35,000/-	575
500	250	20 - 22	10 - 11	14 ft x 14 ft	2,35,000/-	45,000/-	560
600	300	24 - 26	12 - 13	16 ft x 16 ft	2,80,000/-	55,000/-	555
800	400	34 - 36	17 - 18	20 ft x 20 ft	3,65,000/-	75,000/-	550
1000	500	42 - 45	21 - 22	22 ft x 22 ft	4,30,000/-	1,20,000/-	550
1200	600	52 - 54	25 - 27	24 ft x 24 ft	5,10,000/-	1,50,000/-	550
1500	750	62 - 65	30 - 32	26 ft x 26 ft	6,40,000/-	1,85,000/-	550
1800	900	72 - 75	35 - 38	28 ft x 28 ft	7,90,000/-	2,00,000/-	550
2000	1000	80 - 85	41 - 43	30 ft x 30 ft	8,50,000/-	2,50,000/-	550
3000	1500	120 - 130	60 - 64	50 ft x 50 ft	13,50,000/-	3,00,000/-	550
4000	2000	160 - 170	80 - 85	60 ft x 60 ft	17,00,000/-	4,00,000/-	525
5000	2500	200 - 215	100 - 105	68 ft x 68 ft	20,00,000/-	5,00,000/-	500
6000	3000	245 - 255	125 - 130	75 ft x 75 ft	21,50,000/-	5,50,000/-	450

- The sizes & prices are subject to change depending on the soil conditions and other site / design constraints.
- Per flat we have assumed ½ kg of wet garbage per day.
- If excavation depth is not possible then the entire plant can be above ground and the price will vary accordingly.
- We can have tailor made designs if the above standard specifications are not suitable for a particular site.
- Biogas can be used as a fuel in lieu of LPG in common amenities in the society or nearby commercial establishments.

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APPENDIX A

2 EXECUTIVE SUMMARY

2.1 INTRODUTION

In response to the initiative taken by Punjab Agro industries for developing integrated rice mill and biomass power project, Glow Power Limited plans to install a power plant at Khamanon, District Fathegarh sahib. The feasibility study for the project has been carried out by DSCL Energy Services, who has earlier been engaged in successfully commissioning over 20 MW power capacities on biomass at different plants.

The feasibility study included study on availability of biomass and water for the project, power evacuation arrangement and techno economic and financial evaluations.

2.2 PLANT CAPACITY

Capacity potential has been estimated at:

- 25 MW on biomass availability from the area
- 10 MW based on biomass availability from a possible integrated operation with an adjoining rice mill
- 12 MW on the basis of water availability

2.3 ACCORDINGLY, CAPACITY HAS BEEN FROZEN AT 10 M PLANT MODULE

Plant size and module parameters have been revaluated considering capital cost, fuel efficiency and plant load factor. Summary evaluation for different options are given in the following table:

Table 1 Plant Configuration

S/N	Options	Capital cost	Plant Load factor	Project IRR
1	10 MW TG set & 1x 70 T Boiler	4150	70%	16.40%
2	10 MW TG set & 2x35T Boiler	4300	75%	16.20%
3	2X5MW TG set & 2X35T Boiler	4500	80%	17.30%
4	2X5MW TG set & 3X35T Boiler	5300	90%	16.90%

The plant modules would accordingly be configured as under:

- Boilers-2 Nos of 35 TPH capacity each at 63 bar pressure and 480oC temperature
- TG Set-2 Nos of 5 MW capacity each extraction-condensing type

2.4 PROJECT FINANCIALS

Project financials have been worked out based on the assumption of fuel cost of Rs1100/MT, plant load factor 80%, debt equity ration 70:30,steam credit of Rs100 lacs/year, power sale of 1.5MW to M/s LOIL rice mill and surplus power to PSEB at Rs.3.19/Kwh (base year 2002-2003) with 3% escalation up to five year. The project IRR works out to17.30%

2.5 RISK AND SENSITIVITY ANALYSIS

Sensitivity analysis has been carried to quantify the extent risks their impact of project IRR. Following table illustrate the variation in IRR with different conditions

Table 2 Sensitivity Analyses

Risk factor	Sensitivity Variation	Project IRR
Base case		17.30%
Project cost	10% increase	14.50%
Fuel Cost	10% increase	14.40%
Fuel CV	10% decrease	14.10%
PLF	10% decrease	12.40%

It is therefore evident that the project has enough inbuilt margin to maintain the project IRR at 12% even under all conditions of generally perceivable adverse variations.

3 PROJECT CONFIGURATION

The most important factors for successful commercial operation of a power plant are availability of fuel and water. In case of biomass, logistics become quite critical, as biomass cannot be economically transported without densification. Cost of such densification makes such projects often unviable. Hence, it is important to do a thorough investigation in the following areas before taking a decision on the project configuration and location.

- Fuel availability
- Water availability
- Site assessment

3.1 FUEL ASSESSMENT

The biomass availability for power generation would be dependent upon available surplus after meeting the current demand for fodder and fuel in the area. Important factors governing the availability are cropping pattern, yields of residue, present usage and commercial applications. All these aspects were studied for making proper assessment of availability of fuel for the proposed power plant using the following methodology:

- Perusal of the biomass assessment report prepared by PEDA
- Interaction with local government officials at Taluka and district levels
- Interaction with industries generating and consuming biomass
- Interaction with Mandi dealers engaged in biomass trade

The primary source of biomass for the proposed power plant would be the adjoining LOIL rice mill. Paddy availability of the rice mill would be governed by allocation from Government agencies and also local purchases. Any shortfall would be met by supplementary purchase of biomass available locally. The availability survey was therefore, carried out considering an area of 25 KM radius around the LOIL rice mill covering Fathegarh Sahib district in general and Samarala Taluka in particular.

Table 3: Agricultural activities in Fathegarh Sahib district

Total geographical area	114779Ha
No of tehsil	4
Total No. of village	454
Cultivated area	102678 Ha
Non-Cultivated Area	12101Ha
Cultivated %total	89.5%
Major crops	Wheat and paddy

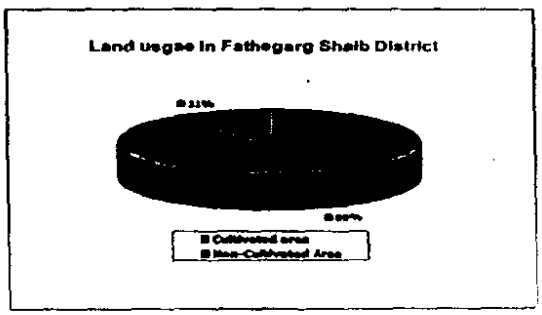

Table 4 : Biomass generation from agricultural activities in fathegarh sahib district

S/N	Crop	Biomass	Crop Area (Ha's)	Yield MT	Biomass residue MT
1	Wheat	Straw	85307	426535	601414.35
2	Paddy	Straw	79998	457131.4	493701.943
3	Fodder	Straw	9081	363240	363240
4	Maize	Stalk	800	2560	6272
5	Arhar	Stalk	210	315	582.75
Total					**1465211**

Table 5 : Agricultural activity in samarala tehsil

Total geographical area	49798 Ha
Forest Land	2269Ha
Cultivated area	42388Ha
Non-Cultivated Area	5137Ha
Cultivated %total	85.12%
Major crops	Wheat and paddy

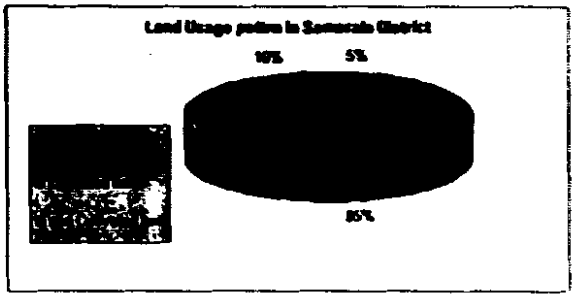

Table 6 : Biomass generation from agricultural activity in Samarala tehsil

S/N	Crop	Biomass	Cropped Area (Ha's)	Yield	Biomass residue
1	Wheat	Straw	36144	160479	226276
2	Paddy	Straw	33345	104036	112359
3	Fodder	Straw	8331	333240	333240
4	Maize	Stalk	1375	4510	11050
5	Mustard	Stalk	639	620	1760
6	Arhar	Stalk	250	185	342
Total					**685027**

3.1.1 SURPLUS BIOMASS AVAILABILITY FROM AGRICULTURAL ACTIVITY

The availability of biomass depends upon the harvesting method and post harvesting collection system. Harvesting methods and collection system were studied for major crops.

- Paddy straw

Around 70% of the area is harvested by Combines Machines and rest is harvested manually. Usually Basmati rice is harvested manually. Combine harvesting leaves around 60% to 70% of the straw in the fields. Balance 30% to 40% goes with the grains. The left over straw and straw separated after thrashing is generally burnt in the field. The left over straw can be cut and used as fuel. However the cutting operation should take place within a week time to cater to the need for land preparation for

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sowing of the next crop. *(Source PEDA report on biomass fuel assessment).*

Table 7 : Rice straw Surplus availability

S/N	Crop	Biomass	Biomass Residue MT	Left over Bio mass MT	Burnt Bio Mass MT
1	Paddy	Straw	606061	424242.7	254546

All figures in MT

- Wheat straw

About 50% of the area is harvested by Combine Machines. In this case about 30% of the straw is left in the field. In case of manual harvesting, this percentage can vary as about six inches of straw is left in the field. The left over straw after harvesting is then manually cut and stored for subsequent use as fodder or sale. The fodder shops purchase bundled stocks from the farmers and do further preparation by cutting and mincing. The prepared stock is sold in the open market as tudi. Though most of the available straw is used, it is estimated that about 30% of the left over straw is still not harvested due to practical difficulties and are usually burnt in the field.

Table 8 : Wheat straw surplus availability

S/N	Crop	Biomass	Biomass Residue MT	Left over Bio mass MT	Burnt Bio Mass MT
1	Wheat	Straw	827690	413845	124153

3.1.2 BIO – MASS GENERATION FROM AGRO BASED INDUSTRY

Rice mills in the area are the major producer of biomass. There are two mills of 65MT per hr and 20 MT per hr each respectively in the Khamanon tehsil close to project site. There are around 68 small mills of 2 -3 MT per hr capacity each located in and around Khanna and Samarala close to the proposed site. Three are four sugar factories in the area having aggregated capacity of eleven thousand tons crushing capacity per day.

Table 9: Details of Major rice Mills in Fathegarh Sahib District

S/N	Rice Mill Name	Milling capacity
1	Laxmi Over seas limited	65MT per Hour
2	Ghnesha Over seas limited	20 MT per hour
	Total	85 MT per Hour
	Annual Milling Capacity	500000 MT per year

The availability of husk from the milling plant is dependent upon the paddy availability. Most of the mills depend upon allotment from the Government agencies. Small quantities are sometime procured from private trade also.

Table 10 ;Allotment of paddy to rice mills in Fathegarh sahib district

Year	MT
2000-2001	381235
2001-2002	414695
2002- 2003	394692

Source DSFC Fathegarh sahib

Table 11 : Paddy allotted in Khanna

Year	MT
2000-2001	370746
2001-2002	317208
2002- 2003	350790

Source DSFC Khanna

3.1.3 SURPLUS BIOMASS GENERATION FROM INDUSTRY

Biomass residue generation from the rice mills and sugar mills have been calculated based on standard residue ratio for this area and primary discussions with plant staff.

Table 12 : Biomass Generation from agro industry

S/N	Area	Crop	Total Quantity MT	Residue %	Residue generation	Residue type
1	Fathegarh Sahib	Paddy	400000	20%	80000	Husk
2	Khanna	Paddy	360000	20%	72000	Husk
3	Samarala	Paddy	123600	20%	24720	Husk
4	Sirhind	Sugar cane	1320000	32%	422400	Bagasse
				Total Rice Husk Generation	**176720**	
				Total Bagasse Generation	**422400**	

3.1.3.1 Biomass consumption in agro based industry

Based on the discussions with various rice mill staff internal consumption of rice husk has been estimated around 5%.Rice husk is stored in most of the rice mill for selling. Residue from sugar factory is generally consumed for their own use and around 4 to 5% surplus Bagasse is available.

Table 13 : Biomass surplus availability in agro industry

Biomass	Availability	Own Consumption	Surplus
Husk	176720	8836	167884
Bagasse	422400	388608	33792

3.1.4 POWER GENERATION POTENTIAL IN THE AREA

Power generation potential through Biomass is largely governed by fuel collection efficiency, availability period and fuel preparation. There is no proper mechanism established for residue collection generated from agriculture activities. Collection efficiency and availability of residue from agro based Industry is significantly high as most of the industry operates round the year and having own storage facility.

Power generation from surplus biomass availability has been calculated based on :

- Collection efficiency
- 80% plant load factor

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Table 14;Power Generation potential from agriculture activity :

	Paddy Straw			Wheat straw			Total Power generation
CE	Availability	Tons/MW	Potential	Availability	Tons/MW	Potential	
100%	254546	1.5	21.1066	124154	1.5	10.29465	31
70%	178181.9	1.5	14.77462	86907	1.5	7.206256	22
50%	127272.8	1.5	10.5533	62077	1.5	5.147326	16
30%	76363.68	1.5	6.33198	37246	1.5	3.088396	9

Table 15 ;Power generation Potential from Agro based industry residue

Biomass	Surplus MT	T/MW	Potential MW
Husk	167884	1.41	14.8
Bagasse	33792	2.45	1.7
Total power generation Potential			16.5

From the above it is evident that under worst condition of collection efficiency, fuel requirement of 25 MW power plant with 80% PLF can be met.

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3.2 WATER ASSESSMENT

Water survey exercise was carried out for the proposed site with the following objectives;

- To demarcate potential ground water worthy areas using hydro geological and geo electric survey.
- To evaluate the water resources for long term under indicated category.
- To determine the depth and thickness of saturated aquifer zones up to a depth of 150 m below ground level.
- To quantify ground water withdrawal based on utilizable ground water resources.
- To recommend feasible sites for the construction of exploratory tube wells so that aquifer performance tests for determination of actual hydraulic parameters can be conducted and ground water reserves can be reassessed under proved category.

Geo physical equipments were used for Hydro-geological studies and geo electric survey. In hydro-geological studies, entire area was examined through observations about geology and type of aquifer, surface drainage system, geo-botanical guides and hydro-geological inventory of existing ground water structures in and around the area. These studies have been used in selecting sites for geo-electric survey. A total of 10 vertical electrical soundings were carried out down to 150m depth at 80 x 100 m. grid pattern to assess availability of subsurface water. Qualitative & quantitative interpretations were made based on calibrated values of resistivity during geo-electric survey and also on standard hydro-geological and hydro-chemical values obtained as part of hydro-geological survey.

3.2.1 FINDINGS

Based on the studies and test conducted following findings were made;

- Ground water occurs with medium saturation in fine to medium & medium to coarse sand down to 40m. Depth also occurs Medium to coarse sand with medium to high saturation in unconfined & confined conditions.
- The expected potential zones based on hydro geological & geo- electric survey is depicted in plate no 3.

* The regional water level ranges between 14m. To 18m. Below ground level during the pre monsoon period. Post monsoon water levels are 12m to 16m below ground level.
* The quality of water appears to be good for general industrial and domestic use.
* Utilizable ground water reserves at normal rainfall (500m.m.) in the investigated area have been estimated of the order of 0.747 mcm/annum under inferred category based on presumed hydraulic parameters. Beside these reserves, static reserves of the order of 572120 m^3 are also available for the years of deficient rainfall.
* Considering inferred reserves, it appears that about 2 to 3 tube wells in the investigated area are feasible & can sustain long term continuous water withdrawal @ 800 to900 M^3 per day each approximately. Thus, about 2700 M^3/day water would be available for the power plant.

3.3 SITE SELECTION

An adjoining site close to the LOIL rice mill became the natural choice as fuel can be directly fed by a conveying system from the milling plant. Following additional advantages would derived by siting the plant at this location:

- Land availability : abandoned land is available
- Availability of roads for fuel transportation : Site is located on Chandigarh – Ludhiana State highway
- Proximity of PSEB substation for Power evacuation: PSEB 66/11KV substation is 1KM from identified site.

4 PLANT CAPACITY

4.1 PLANT CAPACITY BASED ON BIOMASS ASSESSMENT

The biomass availability and power generation potential estimates are once again summarized in the following table #14

Table 16;Power Generation potential from agriculture activity :

	Paddy Straw			Wheat straw			Total Power generation
CE	Availability	Tons/MW	Potential	Availability	Tons/MW	Potential	
100%	254546	1.5	21.1066	124154	1.5	10.29465	31
70%	178181.9	1.5	14.77462	86907	1.5	7.206256	22
50%	127272.8	1.5	10.5533	62077	1.5	5.147326	16
30%	76363.68	1.5	6.33198	37246	1.5	3.088396	9

Table 17 ;Power generation Potential from Agro based industry residue

Biomass	Surplus MT	T/MW	Potential MW
Husk	167884	1.41	14.8
Bagasse	33792	2.45	1.7
Total power generation Potential			16.5

The over all power Generation capacity considering all biomass and worst fuels collection efficiency is 25.5 MW. Power generation from M/s Laxmi overseas limited and M/s Ghanesha overseas limited very near to the proposed site alone is mentioned in the table # 16

Table 18 : Power Generation from Khamanon Tehsil

S/N	Rice Mill Name	Milling capacity
1	Annual Milling Capacity of both the plant	500000 MT per year
2	Annual Husk Generation	100000 MT per year
3	Plant load factor	80%
4	Power Generation potential	10MW

Considering the fuel security issue, it has been decided to go for a 10 mw capacity plant.

4.2 PLANT CAPACITY BASED ON WATER AVAILABILITY

Water availability on a sustainable basis has been estimated at 2400 –2700 m^3 per day. Requirement of water per MW of installed capacity at PLF 80% has been estimated at 2200m^3 per day.
Sustainable power capacity therefore works out to ; 11MW -12MW

Thus, water availability is adequate to meet the requirement of the 10 MW plant.

4.3. PLANT TECHNICAL PARAMETER

The primary fuel for the plant is rice husk. This is a very good fuel for fluidised bed boiler. Many of the supplementary fuel including agro and forest residues can be burnt in fluidised bed boilers. The boiler technology has therefore been chosen accordingly. The steam turbine generator would be extraction-condensing type so that the process steam need of the adjoining rice and solvent extraction plants of LOIL can be met from the power plant. This would improve the overall operational efficiency of the plant and financial viability of the plant.

Next important steps are to choose the appropriate pressure and temperature parameters for the boiler and turbine. Higher the steam pressure and temperature, lower would be the specific fuel consumption. However, there would also be increase in capital expenditure.

The specific steam & fuel consumption for power generation have been worked using DSCL ESCOGEN software as shown in the following table :

Steam parameters	
63 bar /480^{0}C	
Specific steam consumption –Kg/Kwh	4.45
Specific fuel consumption - Kg/Kwh	1.22
63 bar / 430 ^{0}C	
Specific steam consumption –Kg/Kwh	4.73
Specific fuel consumption - Kg/Kwh	1.24
45 bar / 430 ^{0}C	
Specific steam consumption –Kg/Kwh	4.87
Specific fuel consumption - Kg/Kwh	1.29
45 bar / 410 ^{0}C	
Specific steam consumption –Kg/Kwh	4.97
Specific fuel consumption - Kg/Kwh	1.30

Turbine mechanical efficiency- 75%

From the above it is evident that opting for higher pressure and temperature gives a benefit of higher fuel efficiency of about 7%.

The plant has therefore, been configured for 63Bar and 480°C. At the present time the impact of higher capital cost of a higher-pressure system at 85 bar and above more than offsets the gain on account of fuel as the size of the plant is small at 10 MW.

5 PLANT MODULES

Ideally, a single unit of 10 MW capacity would be financially the most attractive option. However, this would have the following disadvantages:

- Minimum downtime of 20 to 25 days in year for statutory inspection of boiler
- Further impact on PLF due to unscheduled stoppages
- Difficult to manage multi-fuel operation at the same time
- Carrying out shorter time modification for emergency arising out of non-availability of rice husk any time would be difficult
- Trying out new fuels would also not be possible

On the other hand, increasing the number of units would certainly have some impact on capital cost. There would also be some negative impact on overall heat rate. The plant economics have therefore, been examined considering the following options.

1. Single turbo – generator set of 10 MW with one boiler of 70 T capacity
2. Single Turbo – generator set of 10MW with two boiler of 35 T each
3. Two Turbo – generator set of 5MW each with two boiler of 35 T
4. Two Turbo – generator set of 5MW each with three boiler of 35 T

Efficiency of most of the condensing turbine manufactured in India and elsewhere for the size range of 5 to 10MW is usually around 75%. The boiler efficiency for 70 T to 35T is around 80%.

5.1 SINGLE TURBO – GENERATOR SET OF 10 MW WITH ONE BOILER OF 70 T CAPACITY

Plant heat rate with single TG set and single boiler option will be marginally lower as compared to the other three options on account less auxiliary power consumption. The capital cost in this case will be lower as compared to other options on account of less number, space piping etc. Plant load factor will be lowest as compared to other options due to lower availability of boiler. As per the Indian Boiler regulations boiler shut down is mandatory after eleven months of operation for overhauling.

5.2 SINGLE TURBO – GENERATOR SET OF 10MW WITH TWO BOILER OF 35 T EACH.

Fuel efficiency with single TG set and two boiler of 35T boiler option will be slightly less as compared to option one on account of increased auxiliary consumption and but would be more compared to option three & four on account of less auxiliary power consumption. Capital cost as compared to option one will be higher on account of additional boiler auxiliary and associated piping requirements. Plant load factor as compared to option one will be higher on account of increased boiler

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availability. Scheduling rice mill overhaul with single boiler operation can optimize PSEB export.

5.3 TWO TURBO–GENERATOR SET OF 5MW EACH WITH TWO BOILER OF 35 T EACH :

Fuel efficiency with Two Turbo–generator set of 5MW each with two boiler of 35 T each option will be less as compared to option one & two on account increase in auxiliary power consumption of boiler and turbine. Capital cost as compared to option one & two will be higher on account of increased auxiliary equipment and associated piping and civil cost. Plant load factor with this option will be higher than option one & two on account of availability of boiler. Fuel efficiency as compared to option two under one-boiler operation will not suffer as there will be no load reduction for the turbine in operation. Scheduling rice mill overhaul, PSEB export can be optimized during one boiler shut down.

5.4 TWO TURBO – GENERATOR SET OF 5MW EACH WITH THREE BOILER OF 35 T

Fuel efficiency as compared to option one & two will be lower and remain same with the option three on the similar account mentioned in above options. The capital cost will be higher among all options on account of spare boiler, associated piping, auxiliary, interconnection and civil cost. 90% Plant load factor can be achieved with this option, but the plant capacity of 10 MW has been decided based on fuel availability at 80% PLF from the existing rice mill rice husk capacity. Fuel cost will increase on account of transportation and handling for additional fuel requirement to achieve 90%.

Based on plant load factor and cost IRR have been calculated for different options and tabulated in the table below ;

Table 19 : Option selection

S/N	Options	Capital cost	Plant Load factor	Project IRR
1	10 MW TG set & 1x 70 T Boiler	4150	70%	16.40%
2	10 MW TG set & 2x35T Boiler	4300	75%	16.20%
3	2X5MW TG set & 2X35T Boiler	4500	80%	17.30%
4	2X5MW TG set & 3X35T Boiler	5300	90 %	16.9%

From the table # 17 and above analysis the option 3 is most attractive option and can be considered for implementation.

6 PROJECT FINANCIAL ANALYSIS

Table 20 : Key Assumptions

FY ENDING --->	2005	2006
CAPACITY (MW)		10.00
Plant Load Factor		70%
Auxiliary Power Consumption in MW		1.30
In house Power Consumption in MW		1.5
Sale to PSEB in MW		7.2
PROJECT COST ESTIMATION		
Project Cost Lakh Rs		4500
MEANS OF FINANCING		
Equity Lakh Rs	30%	1,350.00
Debt Lakh Rs	70%	3,150.00
Total Project Cost Lakh Rs		4,500.00
TERMS OF DEBT		
Period (Including Moratorium) years		10
Moratorium years		3
Interest Rate		10.00%
TERMS OF POWER PURCHASE		
Power Purchase Price Rs./kWh base year 2003-2004		3.19
Escalation in Power Purchase Price Compounded Annually for 5 years, than No escalation after 5 years		3%
OTHER ASSUMPTIONS		
Credit for Steam Savings Lakh Rs/ Year		100
Opportunity Cost for in-house power Rs./kWh for 2003-04		3.19
Annual escalation Compounded Annually for 5 years		3%

6.1 PROJECT FINANCIAL SHEET

Table 21 sales Realization

Financial Year Ending		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
PRODUCTION													
Capacity	kW	0	0	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Plant Load Factor	%	0	0	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Operating Period	Hours	0	0	6570	8760	8760	8760	8760	8760	8760	8760	8760	8760
Gross Energy Generation	Lakh kWh	-	-	526	701	701	701	701	701	701	701	701	701
Auxiliary Consumption	Lakh kWh	0	0	85	114	114	114	114	114	114	114	114	114
In-house consumption	Lakh kWh	-	-	99	131	131	131	131	131	131	131	131	131
Net Saleable Energy	Lakh kWh	0	0	342	456	456	456	456	456	456	456	456	456
Selling Price	Rs./kWh	3.19	3.29	3.39	3.49	3.59	3.70	3.81	3.93	3.93	3.93	3.93	3.93
Sales Realization	**Lakh Rs**	-	-	**1,157**	**1,589**	**1,637**	**1,686**	**1,737**	**1,789**	**1,789**	**1,789**	**1,789**	**1,789**

Table 22 Project IRR

Financial Year Ending -->	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Annual Fuel Cost Lakh Rs			**758**	**1041**	**1073**	**1105**	**1138**	**1172**	1172	1172	**1172**	**1172**
Total Fixed Costs Lakh Rs	-	-	**126**	**130**	**134**	**138**	**142**	**146**	150	155	**160**	**164**
Total Other Income Lakh Rs	-	-	**434**	**559**	**572**	**586**	**601**	**616**	616	616	**616**	**616**
GROSS PROFIT Lakh Rs	-	-	**707**	**977**	**1,003**	**1,030**	**1,058**	**1,087**	**1,083**	**1,078**	**1,073**	**1,069**
Project IRR	**17.30%**											

6.2 SENSTIVITY ANALYSIS

Sensitivity analysis has been carried out to quantify the extent of risks and their impact on project IRR. Following table illustrate the variation in IRR with different conditions

Table 23 : Sensitivity Analysis

Risk factor	Sensitivity Variation	Project IRR
Base case		17.30%
Project cost	10% increase	14.50%
Fuel Cost	10% increase	14.40%
Fuel CV	10% decrease	14.10%
PLF	10% decrease	12.40%

It is therefore evident that the project has enough inbuilt margin to maintain the project IRR at 12% even under all conditions of generally perceivable adverse variations.

APPENDIX B

DOCUMENTATION INDICATING COMMITMENT OF FUNDS FOR EIGHT PROJECTS

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APPENDIX B

APPENDIX B

DOCUMENTATION INDICATING COMMITMENT OF FUNDS FOR EIGHT PROJECTS

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APPENDIX B - 1

DOCUMENTATION INDICATING COMMITMENT OF FUNDS

IDFC

168/ URB/ 03

February 6, 2003

Mr Vinay Deodhar
Project Finance Specialist
Global Environment Team
THE Louis Berger Group, INC.
C-6/7, Safdarjung Development Area
New Delhi – 110 016

Dear Sir,

Waste to Energy Project at Lucknow – Asia Bio Energy (India) Limited

With reference to the tele conversation we had recently on the subject project, we wish to inform that IDFC has participated in part financing the project by way of rupee term loan and equity contribution assistance.

We at IDFC firmly believe that, with the rapid pace of urbanisation and industrialisation, efficient collection and effective disposal of solid waste are posing a challenge to local governments all over India. Therefore, the project that envisages setting up facilities for converting solid waste to energy provides probably the optimal and holistic solution for managing municipal solid waste. Further, the positive environmental spin-off from these projects adds to the value creation.

IDFC is witnessing a steady progress at the plant site and at this juncture we believe that the mechanical completion of the project should be achieved in the very near term.

Yours sincerely,

Jayalakshmi

Jayalakshmi Jayaraman
(Vice President - Operations)

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

L
B

Asia Bioenergy (India) Ltd.
(Project Finance)

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1. Contact Information for the Prospective Borrower

	Name of Company	Asia Bioenergy (India) Ltd.
	Address	824 Poonamallee High Road, Kilpauk
	City, State, Province	Chennai, Tamil Nadu
	Contact Name	
	Contact Phone	+91 44 641 1362, 642 8992
	Contact FAX	+91 44 641 1788
	Contact EMAIL	enkem99@md3.vsnl.net.in

2. Availability of Financial Information on Borrower

	Audited financial statements available for last 3 fiscal years?	√	
	Was firm in same general line of business for last 3 years?	√	
	Has firm reported operating profits AND net income during each of last 2 years?	√	

3. Borrower's Financial History (last three Fiscal Years)

	EBIDT			
	EBIDT/Total Income			
	Operating Profit (OP)			
	OP/TI			
	Net worth			
	Equity			
	EPS			
	Dividend			
	Major Capital Investments			
	Debt:Equity ratio			
	Fixed Asset Coverage Ratio			
	Current Ratio			
	Credit Rating by Lead FI/Bank			
	Depreciation/Amortization Expense			

	Interest Expense			
	Current maturity of LTD			

4. Background information on all used and unused short and long-term debt

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SECTION A: CLEAN ENERGY AND GHG MITIGATION EQUIPMENT FINANCE

About the Equipment/Technology: Larger clean energy or GHG mitigating projects (Project Finance) may involve more than one type of environmental equipment. Complete sections A 5 through A 10 for each piece of relevant GHG mitigating equipment.

5. Description of technology/service to be purchased

Not Applicable

6. Description of the GHG mitigating potential of the technology

Not Applicable

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7. About the Business Negotiations

	Is the manufacturer of the technology a domestic company?		
	Is the manufacturer located overseas (exporter)?		
	Is the manufacturer a US company?		
	Have any price negotiations occurred?		
	Has a purchase order been submitted?		

How many units are in the Purchase Order? _____
What is the estimated unit cost of technology (US$)? _____
What is the total cost for the Purchase Order? _____

8. Contact Information on the Manufacturer

√	Name of Manufacturer	
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	

9. About the Trade Financing (For Equipment Imported Into India)

Is trade financing being sought for the import of the equipment to India? _____

What type of trade financing is being sought (insurance,guarantees, working capital?

_____

_____

10. Has a domestic or overseas lender been identified?

Yes. _____

	Name of Lender	Infrastructure Development Finance Company Ltd
	Address	ITC Center, 3rd Floor, 760 Anna Salai
	City, State, Province	Chennai, 600 002 Tamil Nadu India
	Contact Name	Mohan Kumar
	Contact Phone	+91 44 855 9440/48/56
	Contact FAX	+91 44 854 7597
	Contact EMAIL	mohan@idfc.com

SECTION B: PROJECT FINANCE FOR CLEAN ENERGY AND GHG MITIGATION

Project Name: Power generation & organic fertilizer production from Lucknow MSW

Project Promoter: Asia Bioenergy India Limited (ABIL)

Special Purpose Vehicle: Yes

1. Executive Summary: Project at a Glance

ABIL, a special purpose vehicle company set up by Enkem Engineers India Ltd., proposes to set up a 5 MW power generation plant using biogas generated by biomethanation of Municipal Solid Waste (MSW) supplied by the Lucknow Nagar Nigam (Lucknow Municipal Corporation). The plant leads to capturing methane that would otherwise have been emitted had the MSW been dumped on open dumpsites as is practiced in all the Indian cities. The project shall serve as a demonstration project to illustrate the use of advanced anaerobic digestion technology to enhance the biodegradation process. The gas after cleaning shall be fired in a gas engine to generate power for export to the UP Power Corporation's grid. The process would also result in production of nutrient rich organic manure, which can substitute chemical fertilizers for horticulture, fruits, plantations and gardens. The project awarded to ABIL under a competitive bidding process, costs about Rs. 740 million. ABIL is a Special Purpose Vehicle company promoted by Enkem Engineers India Ltd. M/s Entec GmbH, Austria, is providing the anaerobic digestion technology. The project is being implemented through EPC contract to several reputed international and Indian companies.

ABIL approached IDFC for loan for the project. IDFC has a mission of encouraging environmentally safer technologies for the projects funded by them. IDFC and The Louis Berger Group, Inc. the contractor for USAID/India GEP-CCS project identified this project as a possible opportunity to demonstrate the identification of GHG emission reduction and its possible use. The project demonstrates environmental and social sustainability as it leads to reduction of a major health and methane (a major GHG) emission hazard. It leads to employment opportunities to the local population. It also helps the local rag pickers (scavengers of valued items like paper, plastics and rags) to collect these items in a safe way that helps in recycling of these items.

The project has three major streams of GHG mitigation (i) Methane captured from the MSW; (ii) reduction in the emission of carbon dioxide from the coal fired power stations in Northern India; and (iii) Partial replacement of use of chemical fertilizers like urea, DAP which are manufactured in GHG intensive processes. The current way of disposal of MSW in India is predominantly dumping in the open.

This leads to methane emissions through the degradation of volatile organics and also to pollution of the ground water by the leachate generated on the dumpsites. The power supply in India in general and in the northern region in particular is dominated by thermal sources mainly coal fired power stations. The output of the project would replace this carbon intensive power source thereby lead to reduction in carbon dioxide emission. Similarly, the organic manure will replace the chemical fertilizers thereby reduce the CO2 that would have been generated in the manufacture.

ABIL shall set up measurement and verification systems to monitor and control the GHG reductions. The project risks have been identified and mechanisms to mitigate/cover them have been set in. Major project agreements like power purchase agreement, waste supply agreement etc. have been signed and approved by the funding agencies. Thus, overall the project offers an attractive opportunity for investment by investors especially the carbon investors.

2. Project Costs

	Plant & Machinery	188.75	6,000,000	61.75
	Land & Building			
	Civil, detailed Eng.	211.53	190,000	29.73
	Erection & Commissioning			
	Preliminary & Preoperative Expenses	63.00		8.52
	Working Capital Margin			
	Contingencies			
	Total Project Cost	463.28	6,190,000*	100

* Equivalent to Rs. 276.32 million @ Rs. 44.66 per US $. Total cost Rs. 739.60 million

3. **Proposed Means of Financing**

	Total Debt Portion	265.00	35.83
	Total Equity Portion#	350.00	47.32
	Total Deferred Credit	114.60	15.50
	Total lease	10.00	1.35
	Total	739.60	100.00

 # Including MNES subsidy of Rs. 150 Million

4. **Committed Financing**
   a. **Committed Debt Providers**

IDFC	**200.00**	**15.5%**	**10 years, 2 yrs moratorium**	**Under negotiations**
LIC	**65.00**	**15.5%**		
DC-Enkem	**20.00**	**15%**	**Repayable in 3 years from completion**	
DC-JEL	**66.60**	**15%**		
DC-ENTEC	**28.00**	**15%**		

   b. **Committed Equity Providers**

Enkem	50.00	25
JEL	30.00	15
ENTEC	27.00	13.5
IDFC	25.00	12.5
Investment Funds	68.00	34
Total	200.00	100

5. Estimates of Profitability

(Rs. Million)

	2004	2005	2006	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Revenue from power sale	119.16	130.81	137.35	144.22	151.43	159.00	166.95	175.30	184.06	193.26
Other revenue*	51.12	53.68	56.36	59.18	62.14	65.24	68.51	71.93	75.53	79.30
Total Revenue	170.28	184.48	193.71	203.39	213.56	224.24	235.45	247.23	259.59	272.57
Fuel cost										
O&M Cost	9.75	10.05	30.16	11.47	36.7	12.9	12.85	9.68	36.7	13.5
Admn/selling cost										
PBIDT	136.53	148.75	136.07	162.52	145.40	177.68	186.59	199.01	181.65	214.94
Depreciation	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69	32.69
Interest Term loan Working cap	59.77	54.46	43.43	32.40	21.37	16.06	10.76	5.46		
PBT	44.08	61.60	59.95	97.44	91.35	128.93	143.14	160.86	148.96	182.25
Provision for Tax	3.31	4.62	4.50	7.31	6.85	9.67	10.74	12.06	11.17	13.67
PAT	40.77	56.98	55.45	90.13	84.50	119.26	132.40	148.80	137.79	168.58
Net Cash Flow	73.46	89.67	88.14	122.82	117.19	151.95	165.09	181.49	170.48	201.27

* Manure price assumed at Rs. 2,200 per ton without escalation each year as against Promoters assumption of Rs. 2,900 per ton with 5% annual escalation

6. Projected Cash Flow

	2002	2003	2004	2005	2006										
Sources of Funds															
Inc. in Equity capital	200														
Inc. in term loans	265														
Inc. in Suppliers credit	124.6														
Subsidy	150														
Net Cash Flows		0.00	73.46	89.67	88.14	122.82	117.19	151.95	165.09	181.49	170.48	201.27	211.10	205.63	232.06
Total sources	**739.60**	**0.00**	**73.46**	**89.67**	**88.14**	**122.82**	**117.19**	**151.95**	**165.09**	**181.49**	**170.48**	**201.27**	**211.10**	**205.63**	**232.06**
Application of funds															
Capital Expenditure	739.6														
loan repayment		0	94.02	126.91	115.88	104.85	55.62	50.31	45.01	40.71	0	0			
Total Application	**739.6**	**0**	**94.02**	**126.91**	**115.88**	**104.85**	**55.62**	**50.31**	**45.01**	**40.71**	**0**	**0**			
Net Surplus	0.00	0.00	(20.55)	(37.24)	(27.74)	17.97	61.57	101.64	120.08	140.78	170.48	201.27	211.10	205.63	232.06
IRR*	23%														
DSCR			2.7203	1.6829	1.6461	2.1126	4.4062	5.3842	5.6541	5.8532					
Av DSCR	3.6825														

* IRR with carbon revenue (at $ 3 per tCO2) 27%

7. Status of Finance Negotiations

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame. Yes. The company is negotiating a loan from IDFC and LIC for a part of the project cost. IDFC is in an advanced stage of appraisal and is likely to approve the project soon. The current thrust is on validating the contracts for sale of organic manure. PPA has been signed with UPSEB as also the contract with Lucknow MC has been signed.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations. No. This has not been planned.

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission. Promoters are interested in availing finance/investments in lieu of the carbon offsets from the project. IDFC, the main lender has also evinced interest in structuring this project with carbon offset. It is in contact with PCF and may like to prepare the project for their consideration at an appropriate stage. IDFC in consultation with ABIL has approached LBG for technical assistance on estimating GHG reduction Potential.

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8. Project Promoter Contact Information

√		
√	Name of Project Promoter	Enkem Engineers Pvt. Ltd.
√	Address	824 Poonamallee High Road, Kilpauk
√	City, State, Province	Chennai, Tamil Nadu India
√	Contact Name	Mr. Ragurajan, Director
√	Contact Phone	+91 44 641 1362 /91 44 642 8992
√	Contact FAX	+91 44 641 1788
√	Contact EMAIL	enkem99@md3.vsnl.net.in

9. Project Management Team

√	**Mr. Ragurajan**	**Director, ABIL**
√	**Mr. Rajendran**	**Project Engineer**
√	**Mr. Ravi Shankar**	**Electrical Engineer**
√	**Dr. C. A. Sastry**	**Advisor – Microbiology**
√	**Dr. G. Rangaswami**	**Advisor – Organic Fertilizer**
√	**Mr. N. Raghurajan**	**Advisor – Digestor Technology**

10. Project Promoter Financial History

√	What were profitability figures last 3 years?	Rs. 180 Mn (2000-01), Rs. 70 Mn (1999-00), Rs. 21 Mn (1998-99)
	Book value of firm?	
	EPS reserves and surplus last 3 years?	
	What is current business?	Consultancy and Turnkey contracts in the area of sewage and effluent treatment plants. They have so far executed more than 200 industrial effluent treatment plants in India for a variety of industrial effluents like municipal sewage, tannery CETPs, sugar mills, distillery spent wash, textile, coffee, pharma, food industries waste, chemical/petrochemical, tyre, solvent extraction and mechanical engg industries. Enkem has also established municipal water supply plants, pumping stations etc.
	What are synergies between business and this project?	The project is a diversification of their services in the area of solid waste treatment. The technology tie-up with a recognized supplier would be enhancing their capability. Enkem is also executing several orders for biogas plants from effluents from tanneries, poultries etc. This project has good synergies with their overall business plan.

11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

Enkem Engineers Pvt. Ltd.- The company has executed over 200 plants all over India with capacities ranging from 100 to 40, 000 m3/day for a value of US $ 7 – 8 million in the last 5 years.

Entec GmBH, Austria, the technology provider is promoted by Rund Stahl Bau GmbH Austria a manufacturer of chemical reactors. Entec has developed the anaerobic digestion systems for solid and liquid waste capable of handling up to 12% solid content. They have established over 50 plants world over for a variety of substrates.

Innovative Umwelttechnik GesmBH (IUT) have vast experience in design of MSW treatment projects. The major area of their focus is MSW segregation plants. They have designed plants with handling capacity of 300,000 tons/year, which is similar to the proposed plant.

JEL, Singapore shall be the supplier of the entire power plant including the gas engine and waste heat based power plant. JEL has a wide experience in manufacture, erection and operation of these systems and have executed many such projects world over.

CGEA – Onyx France a subsidiary of Vivendi would be the O&M contractor. CGEA's turnover in the waste management business is over US $ 3.6 Bn. They are operating over 50 solid waste management projects of various types world over.

12. Special Purpose Vehicle Contact Information:

√		
	Name of SPV	Asia Bioenergy (India) Ltd.
	Address	824 Poonamallee High Road, Kilpauk
	City, State, Province	Chennai, Tamil Nadu
	Contact Name	Mr. Ragurajan, Director
	Contact Phone	+91 44 641 1362, 642 8992
	Contact FAX	+91 44 641 1788
	Contact EMAIL	enkem99@md3.vsnl.net.in
	Names and shares of the promoters	Enkem Engineers Pvt. Ltd.
	Is a Shareholding agreement in place	Under negotiations
	Salient terms	NA

13. Project Details

	Greenfield project or involves existing equipment?	Greenfield
	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Clean energy generation
	Size of Project (MW)?	5.1 MW
	Project Location? City, Province	Lucknow, Uttar Pradesh, India
	Off or on-grid?	On grid
	State Electricity Board?	UP Power Corporation Ltd.
	Technology?	Biomethanization followed by gas engine and waste heat recovery
	Type of Fuel?	MSW derived methane rich biogas
	Source of fuel supply?	City garbage supplied by Lucknow Municipal Corporation

14. Feasibility Details

	Was Feasibility Study prepared independently?	No. But independent analysis carried out.
	What firm prepared the Feasibility Study? List address and contact details	Independent economic analysis prepared by Madras School of Economics.

15. Background on the Power Purchase Agreement

	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes
	Has a PPA been signed? (Yes or No)	Yes
	Nature of Agreement? Take or Pay? Other?	Take or pay
	Name of state electricity board or primary PPA signatory?	UP Power Corporation Ltd.
	What date was the PPA signed?	
	When does it enter into force?	After satisfaction of the Conditions Precedents.
	What is the length of the PPA? (Years)	15 years
	What is the initial purchase price?	Rs. 3.16 in 2002
	What is the annual % increase in purchase price?	5%
	Can the project sell power directly to major consumers? (Yes or No)	No
	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	Letter of Credit followed by Escrow and then State Govt. Guarantee
	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	Payment to be made on the –th day from raising the bill, failing which the LC would be revoked. Incentives @ % for payments in – days. IDFC has approved the PPA.
	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	FM clauses are fair to the promoters.
	What is the method of fixation of tariff (two-part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	Availability based.
	Have the provisions for change in law, termination, liquidated damages, etc. been approved by existing lenders/investors?	Yes
	Would the SEB/generating utility want a share in the ownership of carbon offsets?	Not clear yet. TBD

16. Other Agreements

	Fuel supply agreement signed?	Garbage supply with LMC
	Organic Manure Purchase	Letter from the tea estate received. To be converted into an agreement in due course.
	Water/utility supply agreement signed?	Land lease agreement
	Shareholder's agreement been entered into between existing equity holders?	Being formulated.
	Special provisions of above agreements?	NA

17. Quantify and Describe Risks

Risks	Low to High	Description
Market?	Low	The commodities produced by the project power and organic manure are in deficit. Therefore, market risks are low except for the sale of manure, because it is not widely promoted to the farmers yet.
Country/Sovereign?	Low	India has stable legal system and has by and large following the legal process. Contracts have been honored and businesses of the multinationals have flourished. Thus, the sovereign risk is minimal.
Regulatory?	Low	The UP state has a functional electricity regulatory commission. The PPA has a legal validity. Also, the proposed project activity has overall support of the local/state/central govt. support
Contract/counter party	Low	The PPA and the waste supply agreements have been entered into. These agreements are sound and fair. The other contractual structure is also established and is robust. Although, UPPCL is not in good financial health, this project has a special status and is also small in size. As such, no contract related problems are expected.
Construction?	Low	The promoters have gathered strong EPC and other contractors. They have earlier experience in setting up such projects. The materials to be used are standard. Thus, construction is not likely to pose major challenges.
Technology?	Medium	The technology providers have set up similar facilities elsewhere in the world. The promoters have experience in working with other effluent treatment projects in India. Combined, their strengths are sufficient to address any technology related issues.
Management?	Low	The promoters have a very lean and efficient management, which is evident from a large number of projects they have implemented in a short span of time. In addition, they can draw any necessary

			resource from India or Austria.
	Competition?	Low	MSW treatment is a nascent activity in India and competition in the field of MSW methanation project is very low. Also the overall size of the MSW treatment market is quite large [with over 300 Class I cities generating over 39 million tons of MSW daily]
	Exit?	Low	GOI is currently in the process of easing the companies act to allow easier closure of firms. The investment rules have already been relaxed. The Indian financial market is mature and transactions such as leveraged buyouts, creeping acquisitions etc. are common. Therefore, Exit from the companies in general and better performing ones in particular is not difficult and risky.

18. Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
	Market?	Promoters have received letter from a tea garden for purchasing the entire production of the manure. This is proposed to be converted into a proper agreement for sale once the financial closure takes place.
	Country/Sovereign?	The PPA has been securitized with additional payment mechanisms namely, Escrow and State Government Guarantee. It also stipulates arbitration as per accepted international norms.
	Regulatory?	No major risk.
	Contract/counter party	PPA has been signed and validated by the UPERC.
	Construction?	No major risk.

	Technology?	Performance guarantees have been stipulated.
	Management?	No major risk.
	Enforceability of Contracts?	No major risk.
	Competition?	No major risk.
	Exit?	No major risk.

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3. Carbon accounting details

	Parameter	Particulars
1	Baseline methodology* (Refer to the note on GHG analysis)	For methane abatement open dumping as practiced today For Power supply to grid Power mix in the Northern region and For fertilizer supplement- Emission from manufacture of urea/ammonia
2	Baseline Emissions TCO2	192,000 t CO2 per annum
3	Project Emissions TCO2	Nil
4	Emission reductions TCO2 (2-3)	192,000 t CO2 per annum

Greenhouse Gas Mitigation Potential Estimation

Of

5 MW solid waste biomethanation cum power project in Lucknow

Promoted by

Asia Bioenergy India Limited

By:

Greenhouse Gas Pollution Prevention-Climate Change Supplement
AUSAID/India project implemented by:
The Louis Berger Group, Inc.
C-6/7 Safdarjung Development Area
New Delhi 110 016

December 2001

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Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the 5 MW MSW biomethanation power project in Lucknow was prepared for Asia Bioenergy India Ltd (ABIL) and Infrastructure Development Finance Company Ltd. by The Louis Berger Group, Inc. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by ABIL, IDFC and that obtained from public domain. The information contained in the note is solely meant for ABIL and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to ABIL, IDFC and several other institutions including CEA, IPCC/IEA, UNFCCC, and The World Bank for the background data provided by them through their websites.

This note should not be considered an endorsement or certification to the project or the technology and it should not be deemed to be any undertaking, warranty or endorsement by The Louis Berger Group, Inc. and US Agency for International Development.

Executive Summary

Asia Bioenergy India Limited (ABIL) proposes to set up a 5 MW power generation plant using biogas generated by biomethanation of Municipal Solid Waste (MSW) supplied by the Lucknow Nagar Nigam (Lucknow Municipal Corporation-LMC). The plant leads to capturing methane that would otherwise have been emitted had the MSW been dumped on open dumpsites as is practiced in all the Indian cities. The project shall serve as a demonstration project to illustrate the use of advanced anaerobic digestion technology to enhance the biodegradation process. The gas, after cleaning, shall be fired in a gas engine to generate power for export to the UP Power Corporation's grid. The process would also result in production of nutrient rich organic manure, which can substitute chemical fertilizers for horticulture, fruits, plantations and gardens. The project awarded to ABIL through a competitive bidding process costs about Rs. 740 million. ABIL, a Special Purpose Vehicle company promoted by Enkem Engineers India Ltd., Entec GmbH, Austria, Jurong Engg. Ltd. (JEL) and few funds and financial institutions is providing the anaerobic digestion technology. The project is being implemented through EPC contract to several reputed international and Indian companies.

ABIL approached IDFC for funds in the form of loan and equity for the project, which is under active consideration. IDFC has a mission of encouraging environmentally safer technologies for the projects funded by them. IDFC and The Louis Berger Group, Inc. the contractor for USAID/India GEP-CCS project identified this project as a possible opportunity to demonstrate the identification of GHG emission reduction and its possible use. The project demonstrates environmental and social sustainability as it leads to reduction of a major health and methane (a major GHG) emission hazard. It leads to employment opportunities to the local population. It also helps the local rag pickers (scavengers of valued items like paper, plastics and rags) to collect these items in a safe way that helps in recycling of these items.

The project has three major streams of GHG mitigation (i) Methane captured from the MSW; (ii) reduction in the emission of carbon dioxide from the coal fired power stations in Northern India; and (iii) Avoidance of use of chemical fertilizers like urea, DAP which are manufactured in GHG intensive processes. The current way of disposal of MSW in India is predominantly dumping in the open. This leads to methane emissions through the degradation of volatile organics and also to pollution of the ground water by the leachate generated on the dumpsites. The power supply in India in general and in the northern region in particular is dominated by thermal sources mainly coal fired power stations. The output of the project would replace this carbon intensive power source thereby lead to reduction in carbon dioxide emission. Similarly, the organic manure will replace the chemical fertilizers thereby reduce the CO_2 that would have been generated in the manufacture.

ABIL shall set up measurement and verification systems to monitor and control the GHG reductions. The project risks have been identified and mechanisms to mitigate/cover them have been set in. Major project agreements like power purchase agreement, waste supply agreement etc. have been signed and approved by the funding agencies. Thus, overall the project offers an attractive opportunity for investment by investors especially the carbon investors.

ABIL PROJECT - GREENHOUSE GAS (GHG) MITIGATION ASSESSMENT

1. Background of the project

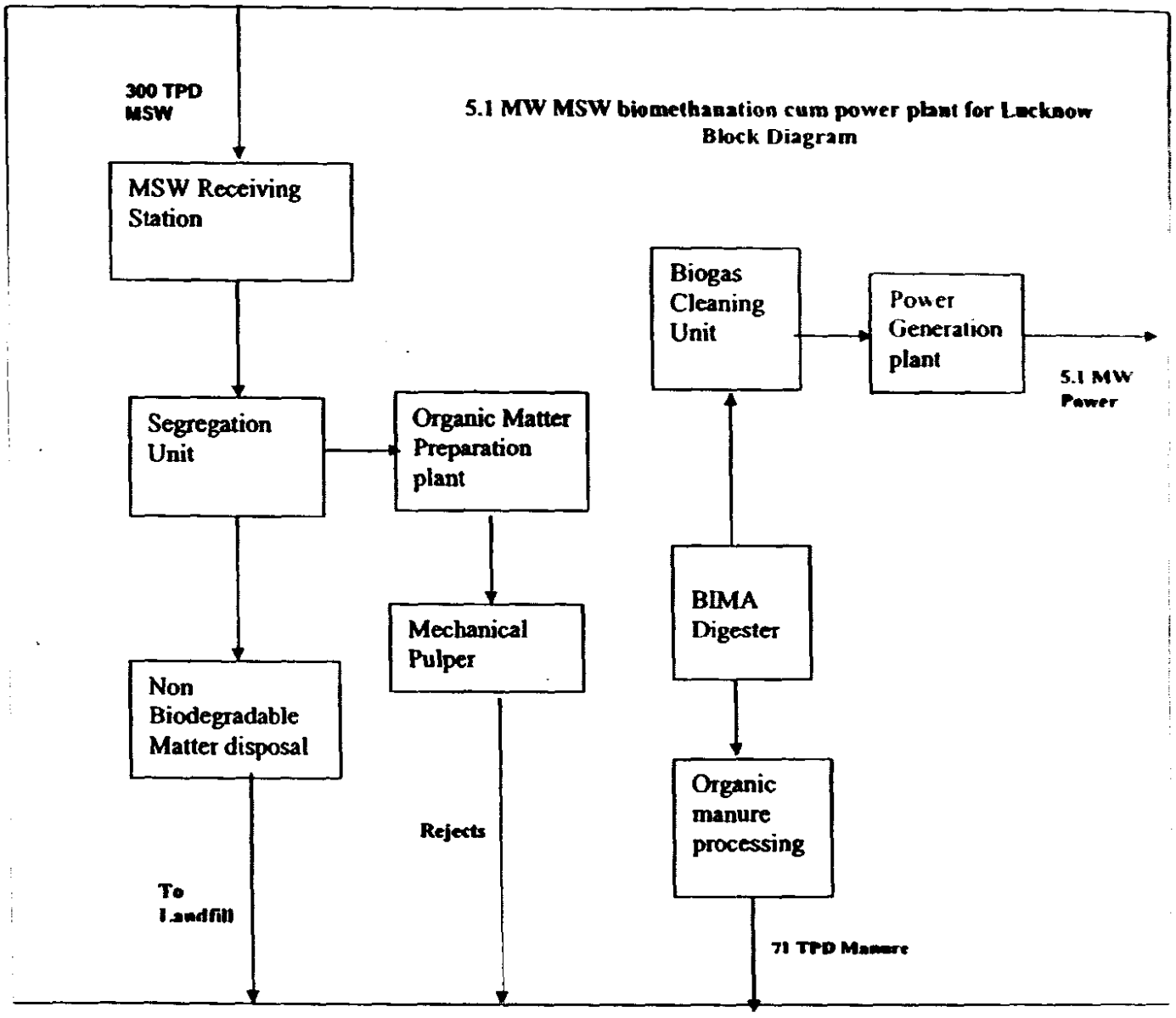
Asia Bioenergy India Limited (ABIL), a new Special Purpose Vehicle (SPV) company promoted by M/s Enkem Engineers Pvt. Ltd. (Enkem), Chennai, proposes to set up a project to generate 5.1 MW power (net) and 75 TPD Organic Manure from the municipal solid waste (MSW) to be supplied by the Lucknow Municipal Corporation (LMC), Lucknow, Uttar Pradesh (UP). Lucknow, the capital of the state of UP with a population of around 3 million generates about 1500 Tons per day (TPD) of solid waste of this about 66% is collected. LMC has agreed to supply 300 TPD of the MSW to ABIL for the above purpose that meets specifications as stated in the agreement.

ABIL shall segregate the biodegradable matter from the MSW and process the same through anaerobic digestion in specifically designed reactors to generate a biogas rich in methane content. This gas shall be used, after due treatment, in gas engines to generate electric power. The waste heat contained in the flue gases from the engine shall be recovered for generation of additional electric power. After meeting the auxiliary power generation, ABIL shall export power to the grid of UP Power Corporation Ltd. (UPPCL), originally known as UP State Electricity Board (UPSEB). ABIL's contracted capacity to UPPCL is stated at 5.1 MW. After the generation and recovery of the biogas, the remaining material shall be dried and sold as bacteria free manure rich in organics. This manure shall be suitable to agricultural and gardening / plantation purposes. The organic manure would be available to the extent of 75 TPD from the project. The plant shall be operating for 23 hours a day for about 324 days in a year and thus available to the extent of 85%. A flow chart of the plant is given in Figure 1.

ABIL has entered into a 30-year power purchase agreement (PPA) with UPSEB on July 31, 1998 [renewable for a further period of 30 years] and a Waste Supply agreement with LMC on February 14, 1997 also for an equal term. It has received a letter of intent for purchase of organic manure from a tea estate, which is to be converted in a five-year agreement for 2500 Tons per month of bio fertilizer of specific characteristics.

The cost of proposed project is estimated at Rs. 760 million (including foreign currency expenses of US $ 5.81 million @ Rs. 43.5 per US $), which is proposed to be financed by equity of Rs. 244 million, and debt of Rs. 366 million. The National Bio-energy Board of Ministry of Non-Conventional Energy Sources (MNES) of Government of India (GOI) has accepted the project as a "National Demonstration Project". MNES has agreed to provide a subsidy of Rs. 150 million as per the scheme in view of the GHG mitigating nature of the project and its ability to demonstrate generation of energy from waste to other cities in India.

Figure 1: Process Flows



The primary Indian lender to the project appointed M/S Ernst & Young (E&Y) an international consulting of repute for conducting Techno-economic review of the project. E&Y conducted a careful review of the project documents, made a site visit and had discussions with concerned authorities for an independent assessment as also conducted some experiments with the MSW. Key conclusions of their report are as follows:

- The guarantees provided by LMC are enforceable and protect the project promoters from variations in waste quality
- The treatment system as proposed should be able to handle the MSW and generate power and biofertilizer

- The biogas generation and the associated power generation would be close to design figures (lower by about 2.5% than the design figures)
- The project risks are adequately covered to the maximum extent possible

2. GHG emission reduction objectives of the proposed project

Technology options for MSW treatment

Municipal solid waste comprises various substances and differs from place to place. Thus, the approach to treat MSW from different countries differs. There are various options for this, starting from reducing waste and recycling to composting, incineration/pyrolysis, sanitary land filling and biomethanization. The first two options are desirable irrespective of the technology for treating the waste, as these reduce the quantity of the waste and thereby the load on the treatment plant. In the incineration or pyrolysis process the biodegradable matter is burnt off, thereby using the heating value. However, as the MSW is wet, major portion of heat is taken away in evaporating the water. Also, this process may result in emission of undesirable substances like dioxins; SOx etc. These gases are more dangerous as compared with main GHGs. The composting option enables treatment of bio-degradable matter, but the gases evolved in the aerobic digestion process mainly carbon dioxide escapes in the atmosphere and thereby does not help in GHG reduction. Also, the only saleable product in this process is the compost produced. This reduces the financial viability of the process. While, this could be the advisable option for smaller municipalities where the MSW generation is not enough to economically sustain higher treatment options such as biomethanation and engineered landfill. Engineered landfill is an option, which also permits recovery of methane. However, this requires comparatively larger land and elaborate and expensive construction. It is also essential to prevent leakage of leachate in land, which could contaminate the ground water. This option may also need a similar demonstration in India before it can be used on a wider scale by municipalities. Though costlier, biomethanation offers several advantages over these options as discussed further.

a. Clean Technology nature

In the biomethanization process, the process of digestion of biodegradable matter is carried out in a closed vessel, which helps in avoidance of emission of methane (a greenhouse gas with high global warming potential) as also any leachate that is generated. Further, since the process is catalyzed by enzyme secreted by microorganisms in the culture, it helps in recovering more methane than the composting process. The methane rich biogas is collected and gainfully utilized to produce power, which is fed to the grid, thereby replacing power from carbon intensive thermal sources. The process leaves behind organic manure, free of bacteria and can be a substitute for chemical fertilizers like ammonia and urea, which generate large amounts of CO_2 during manufacture. Thus, biomethanization process helps in mitigating three sources of potential GHG emission (i) Methane gas which could have otherwise escaped from open dumpsites or composting yards (ii) GHG emissions from coal fired thermal plants while producing equivalent amount of power; and (iii) substituting chemical fertilizers, during the manufacture of which GHG emission occurs.

b. Sustainable Development objectives/aspects

The treatment cum power plant would employ about 30 persons directly and a large number of persons in the waste collection, marketing of fertilizers indirectly

The project helps in bettering environment in the city of Lucknow by a hygienic treatment of solid waste. It therefore, improves health standard in the city. The segregation prior to biomethanization results in a large quantity of inert non-biodegradable matter like metals, earth etc. Many of these items could be recycled, thereby providing employment to poor local folks especially women. This would otherwise result in unorganized, which is fraught with hazards. [redacted] local stakeho[redacted] representa[redacted] shall be dis[redacted] on these sha[redacted]

c. ***Host country Government (GOI) objectives/approvals***

The Ministry of Non-Conventional Energy Sources (MNES) of the GOI has declared the current project as a demo project under its national program of waste to energy. GOI is providing support to the project in order to help reduce the initial cost burden. The Honorable Supreme Court of India has directed the GOI to ensure proper treatment of MSW and disallowed its dumping. In view of this, the Ministry of Environment & Forests (MOEF) has issued a Notification for proper management of MSW. In view of this, the GOI approval for this project is imminent. ABIL in cooperation with LMC and MNES is in the process of approaching MOEF for a formal host country approval for the project.

3. Business as usual or Baseline identification

The current practice of management of MSW in India comprises collection of the garbage and dumping it at specified sites within the city limits. These sites are generally unused land in the outskirts of the cities, which have large pits. These sites enable a large storage of solid waste therefore a larger life. The 300 class I cities covering a population of 250 million generate about 39 million tons of MSW every day. Only a few of these cities have initiated ways of treating their solid waste, which mainly resort to composting and land filling. The UP government, with MNES assistance conducted a survey of waste generation and collection in the state's ten major municipalities. This has resulted in identification of the present project as a showcase to other municipalities. The current practice of solid waste management in the city of Lucknow (which represents a general Indian city) is dumping in open area at various sites.

a. Project boundary

The project shall encompass the city of Lucknow from where the city garbage is collected, which was dumped otherwise on open sites. The project boundary for the first stream of GHG reduction viz. methane is the boundary of city of Lucknow.

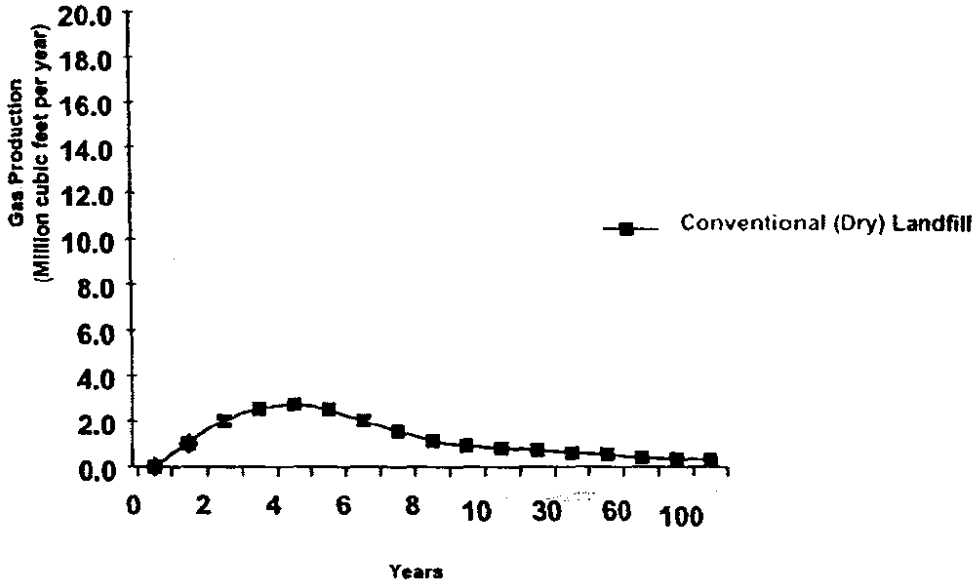
As the power is fed in the grid, which connects the city with UP state, which in turn, is well integrated with the Northern Regional grid becomes the boundary for the power supply. The overall grid in India is divided in five main geographic regions (North, West, South, East and the North-East). These regions come under individual Regional Load Despatch Centers (RLDCs), which are represented by Regional Electricity Boards formed under the Indian Electricity Act, 1948. The power transfers within the RLDCs are common. The RLDCs in turn are being connected through inter regional bulk power transmission lines. However, this process of formation of a National Grid is yet to take place (At present only 3 inter regional bulk transmission lines have been functional). Thus, the RLDCs should generally be considered as independent power centers. In this case the Northern Regional Load Despatch center (NRLDC), which consists of the states of Jammu & Kashmir, Punjab, Himachal Pradesh, Haryana, Rajasthan and Uttar Pradesh and the UT of Chandigarh is considered as the project's boundary.

The organic manure avoids/substitutes the use of chemical fertilizers like urea, DAP etc. the manufacturing process of these chemicals leads to emission of CO2 and other GHGs. For the purpose of this stream of GHG reduction, it would be essential to include the fertilizer manufacturing plants in the project boundary. Although it would be desirous to include all these, it would be practical to consider average plants of these two and accord due weightage proportional to the consumption (by the intended users).

b. Relevant baseline methodology/scenarios

(i) For methane recovery: The proposed project essentially is first of its kind, capturing methane from the biodegradable material of the MSW. If the material were dumped in the open as is practiced today, these would degrade in aerobic conditions. The biological processes are shown to follow a bell

shaped curve Figure 1. Over a span of 2 to 6 years, this material would degenerate fully.



Source: Global Energy Partners LLC
Figure 1: Biogas production from dry landfills

Thus, the volatile degradable material in the waste forms methane rich biogas at a slow rate and is released in the atmosphere. Carbon contained in the biodegradable matter of the solid waste would degrade over a long period. The proposed process enables faster digestion of majority of carbonaceous material in gas. Therefore, the baseline for this stream of reduction is the total emission of methane that could occur from the typical MSW from the Lucknow city. [However, since the proposed project would capture methane reduction as per the process designed by ENTEC, the net reduction is restricted to this amount.]

(ii) For power export to grid: The power generation is using a gas engine as against the normal Rankine cycle or gas turbine. This is an innovative approach. The project would feed about 5000 kW worth of power in the grid of UP Power Corporation Ltd. (UPPCL), which is an integral part of NRLDC. The emission factor of NRLDC would therefore be the baseline as this would be the source of power in the absence of the project. A careful analysis of the performance of the regional grid suggests that on an average in the year 2001 the UP grid had ~81% of power from thermal sources, both of UPPCL's own and procurements from the central power sector utilities (CPSU). About 14% was from hydroelectric sources and rest purchased from nuclear plants of CPSUs. The thermal power mentioned above is mainly from coal fired plants using sub bituminous coal mined in central India. The coal has large amounts of ash, which leads to low conversion efficiency. Indian power grid exhibits very high transmission and distribution losses. Although the actual figures revealed off late arte quite high in many states including UP, it is preferable to use the published figure of 20% to be on a conservative side.

Since this a grid feeding power plant with a capacity < 15 MW, it would qualify for the fast track projects as defined under the Bonn agreement. The baseline is calculated from the data on installed capacities and generation details from various sources for both UPPCL and NRLDC. The data is available from the Planning Commission of India's Annual report of SEBs for June 2001 and Central Electricity Authority's report on NREB. The thermal plants are in majority based on pulverized coal fired technology. These plants mainly use sub-bituminous coal from the mines around central India. Based on the emission factors for this fuel for India as specified in the IPCC report and used by the World Bank GHG assessment handbook. The results are presented later.

(iii) For replacement of chemical fertilizer by organic manure: The proposed plant would generate 75 TPD of organic manure. The manure shall replace the use of chemical fertilizers like urea, di-ammonium phosphate (DAP), Potash and super phosphates mainly by plantations like tea/coffee gardens, horticultural use in municipal gardens etc. Since the manure has lower concentrations of N, P and K the release of these nutrients is slower than Chemical fertilizers. Based on the experience of the major users viz. the tea estates the equivalent amount of the manure to one ton of chemical fertilizer is found. Based on the specific energy consumption of urea and ammonia and the average of usage of these fertilizers in India, the weighted average emission factors of the chemical fertilizers are found out. The baseline emission reduction is the amount of emission by the equivalent amount of chemical fertilizers used. While, the manufacturing processes of chemical fertilizers also lead to emission of N_2O, for want of precise data these were not quantifiable and hence were not accounted for in the present analysis.

Here it needs to be clarified that the project generates organic manure, which replaces use of chemically manufactured fertilizers (in the same manner that the power generated replaces grid power.) therefore, these are NOT of the nature of embodied GHG emissions that the project replaces. Moreover, these reductions are measurable from the quantity of the chemical fertilizers, a product that would be used in absence of project's output; the carbon emission reductions from this source should qualify for CERs.

c. *Time dimensions of the baseline*

The biomethanization technology is being introduced for the first time in the country. There are over 300 Class I cities in the country, which generate an estimated quantity of about 39 million tons of solid waste per year. It s expected that the use of the technology will take a long time before it becomes a common practice. Thus, the baseline is not likely to shifty during at least a decade during which the investors would buy the carbon offsets.

d. *Annual /periodic estimations*

In view of the innovative nature of the proposed technology, it may not be necessary to revise the baseline estimate during the course of the first ten years during which investors are likely to purchase the credits.

e. Baseline case emissions estimation

Based on the methodology presented earlier and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

I Methane Capture from Solid wastes

Methane generated due to biological degradation of the volatile solids in the solid waste. If the solid waste were dumped in open a majority of this amount of methane would have been generated over a period of over ten years. In the proposed process the degradation takes place at enhanced rate with the help of microbial reaction. Thus, in the absence of the project activity, there could be entire degradation of the organic matter.

Parameter	Value	Unit
Total waste received	300	Tons/day
Inert material segregated	99	Tons/day
Treatable material	201	Tons/day
Dry volatile solids	104	Tons/day
Biogas generated at STP	42320	Nm3/day
Methane recovered	25392	Nm3/day
Annual methane captured	5627	TPA
Equivalent* CO_2	118,169	TPA

* GWP of methane for 100 year horizon = 21

II CO_2 Emissions from power used in the state grid

The requirement of power in the state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the UP Power Corporation purchases power from the central public sector power generating companies, which have a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 80% of the capacity and 20% of the hydel sources. However, based on the statistics of power generated and purchased, it is observed that in 2001 of a total 39879 MU consumed by the state grid 82.2 % was supplied from thermal sources, mainly coal fired plants, 14.4 % from hydel and 3.4 % by nuclear sources. The composition was more or less same in the year 2000, with 81.4%, 15.5% and 3.1%. The thermal plants which are based on high ash Indian coal use sub bituminous variety coal as fuel. By and large the plants are old and exhibit conversion efficiencies in the range of 33%. Indian electric power grid especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission & distribution losses, sometimes in the excess of 40%. However, to be on a conservative side an estimated 20% T&D losses are assumed in the analysis.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like The World Bank. The emission factor of thermal power plants using

bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the mix of supply from various sources as mentioned above, the weighted average emission factor of the UP state grid is 21.5 tC/TJ.

III CO_2 Emission from inorganic fertilizers during manufacture

One of the features of the proposed project is the generation of organic manure that substitutes the use of chemical fertilizers like urea, di ammonium phosphate, and potash. During the manufacture of the chemical fertilizers like urea, ammonia, single/triple super phosphate (SSP/TSP), di-ammonium phosphate (DAP) a large amount of energy is consumed. This energy is in both thermal as well as electrical forms. In addition, during processing, raw material, intermediates and finished goods are lost due to spillages, evaporation etc. Some of the reactions also evolve CO2; nitrous oxide, perfluoro carbons and many other pollutants like SO_2, NO_x, particulate matter etc. The use of the chemical fertilizers (popularly referred as NPK fertilizers in India) has increased over a last few decades. While, it has contributed greatly to the green revolution to increase the food output in the country, excessive use also leads to increase in acidity of the soil, thereby degrading its quality.

The most important step in producing ammonia (NH3) is the production of hydrogen, which is followed by the reaction between hydrogen and nitrogen. A number of processes are available to produce hydrogen, differing primarily in type of feedstock used. The hydrogen production route predominantly used worldwide is steam reforming of natural gas. In this process natural gas (CH4) is mixed with water (steam) and air to produce hydrogen (H2), carbon monoxide (CO) and carbon dioxide (CO2). Waste heat is used for preheating and steam production, and part of the methane is burnt to generate the energy required to drive the reaction. CO is further converted to Co_2 and H_2 using the water gas shift reaction. After CO and Co_2 is removed from the gas mixture ammonia (NH_3) is obtained by synthesis reaction.

The specific Energy Consumption of fertilizer plants in India were 12.3 Gcal/ton of ammonia, 13.5 Gcal/ton of urea, and 0.06 Gcal/ton of DAP. The consumption of major fertilizers namely urea, DAP and SSP are 72%, 14% and 14% respectively. Based on the feedstock from which the fertilizers derive energy and the power consumption of process, the average emission factor of each ton of chemical fertilizer works out to approximately 2.63 tons CO_2/ton of fertilizer.[1,2,3]

[1] India's Fertilizer Industry: Productivity and Energy Efficiency *Katja Schumacher and Jayant Sathaye* Environmental Energy Technologies Division July 1999

[2] Energy Conservation at design stage, CII Energy Management Cell, under the ADB-ESP project

[3] TERI Energy Data Directory & Yearbook 1999/2000

4. GHG mitigation potential of the project

The project helps in avoiding emission of two main greenhouse gases; methane and carbon dioxide.

I The project enables capture of the methane from the biological degradation processes. If the waste is left in open it would require a long time for the microbes present in the waste as well as the soil and air to break the organic molecules into smaller molecules and ultimately methane gas. Estimated time of 15 – 20 years is needed to break various complex compounds. In the proposed plant the seed culture of microbes uses the nutrients in the waste to enhance the biodegradation process in absence of air. Thus, the anaerobic process enhanced by the enzymatic catalysis hastens the biodegradation process and increases the yield of methane. The left over solids in the waste are non degradable for all practical purposes. Based on the estimates from laboratory results and experience of the technology suppliers elsewhere, the gas generation is estimated to be around 0.86 m3/kg of volatile solids (49,290 m3/day from the project at 37^0 C) containing about 65% methane and the rest carbon dioxide, moisture etc. However, as per the technology review conducted by Ernst & Young, the gas generation has been over estimated by about 2.5%. When this is applied to the estimates gas generation is likely to be ~ 48,055 m3/day. Thus, the project helps in capturing about 25,392 m3 of methane gas at Standard Temperature and Pressure. This works out to 118,169 Tons per annum of CO_2 (GWP of methane is 21)

II The project generates a total of 5.6 MW of electric power and after meeting the plant needs exports power worth about 5.1 MW. Under assumptions of availability of 85%, the proposed project would feed 38.6 MU in the state grid of UP. In the absence of project activity, this could have been met with grid power, which has a high thermal power concentration. The state of UP generates its own power and also receives power from its share from the central power sector PSUs (Viz. NTPC, NHPC, NPC etc.). Based on the scenario outlined in the earlier section, the power generated by combustion of the methane captured would lead to reduction of carbon emissions from the coal fired grid power to the extent of 40,375 Tons per annum of CO_2.

III The proposed project generates organic manure to the extent of 71 TPD. The manure has adequate quantities of N, P and K as desired by plants especially plantations. The composition of the manure is given below:

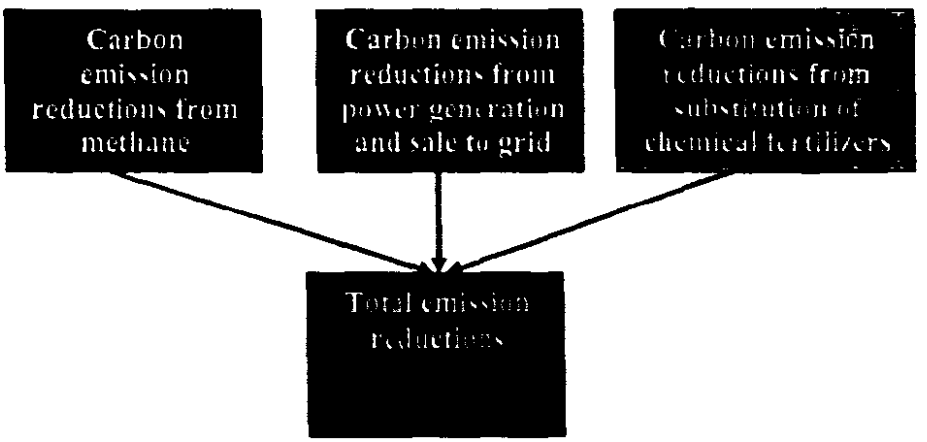
Parameter	Range %
Moisture	25 – 30
Solids	70 – 75
Organics	40 – 50
Nitrogen	0.2 - 0.6
Phosphorus	0.8 – 6.8
Potassium	0.3 – 1.4
Fe, Cu, Zn	Traces
PH value	6.0 – 7.0

The plantations and even the other crops prefer this type of fertilizer on account of the slow release of nutrients, which are absorbed properly by the soil and hence the plants. In addition, the manure does not allow drainage of the nutrients and also preserves the pH of the soil. The organic manure generated from the project is assumed to be able to supplement the chemical fertilizers. It assumed that each ton to the manure should replace 500 kg of chemical fertilizers.

Therefore, the overall reduction from the project's sale of 25,560 tons of organic manure per annum works at 33,587 tons CO_2 per annum.

To summarize, the total carbon emission reductions from the project would be as given below:

Stream of carbon reductions	Carbon emission reduction tons CO_2 per annum
Capture of methane from solid waste	118,169
Power generation from methane gas	40,375
Replacement of chemical fertilizers	33,587
Total	192,131



Leakages

Leakages are defined as net change of anthropogenic emissions occurring outside the project boundary, which are measurable and attributable to the proposed project activity. The possibilities of such emissions occurring on account of this project are remote, in view of its size and its nature. Hence the leakages from this project activity are taken as nil.

5. Monitoring & Verification

Monitoring and Verification (M&V) of the emission reductions from a project is a key to ensure that the projected reductions indeed take place. The investors risk from a project are addressed to a large extent through the M&V process. The M&V for the proposed project is outlined below.

a. M&V philosophy

The proposed project has three distinct components of the emission reduction. Therefore, the M&V approach for these streams is designed separately.

For the solid waste treatment, the measure of reductions shall be from the quantity of solid waste treated, which has a relationship with the methane generated. The proposed plant would have a measurement system for the solid waste as specified in the contract with LMC. The measure of the solid waste treated will be as measured by the weighbridge to be installed by the company conforming to the Indian standards. The quantities of solid waste received through each vehicle shall be recorded in a logbook, which will be endorsed by the representatives of the company and LMC.

For the power fed to the regional grid, the measurement system is relatively clear as the metering of power is clearly specified in the PPA with UPPCL. It specifies that there shall be two meters one for export and the other for import of power. Each of these meters shall have check meters to be installed by UPPCL to maintain checks as per prudent utility practices. All the meters shall be of 0.2 accuracy class. The power supplied by the company shall be metered and tested at regular intervals.

As regards the organic manure sale, the measurement of the weight of the manure sale shall be as per the sale records of the company. These would be recorded as per the usual standards of sale of goods.

The company proposes to appoint internationally reputed engineering and auditing firms to validate the baseline methodology, estimation of emission reductions and the year-to-year achievement of the target reductions. Specialist agencies shall also review the baseline periodically at intervals suggested under the international rules to be framed.

b. M&V system specification

The M&V system based on the above philosophy will be properly documented so that it is strictly implemented. An audit of the records and system maintenance practices shall be conducted annually. The M&V system will also keep a track of the parameters such as power plant capacities added in the northern region, fertilizer consumption and developments on solid waste management and methane capture projects in the country. The major assumptions made in the GHG reduction analysis shall also be confirmed from time to time, so as to keep a track of achievement of the carbon offsets and also to account for any Leakages that may occur. These could for example be on the account of increase/decrease in emissions from the open

dumping of MSW. These could lead to the project acquiring less offsets than projected.

c. ***Hardware needs***

Equipment for Measurement of weights of MSW received, organic manure sold, composition of MSW, measurement of temperature, quantity and composition of biogas generated, metering of power exported to the grid at the bus bar (load curve) and computers, data loggers and other related hardware. All the above measurement equipment is a part of the project and its cost is included in the capital cost.

d. ***M&V protocol***

It is proposed to vest the responsibilities of monitoring the parameters identified earlier in to an [redacted], which shall *inter alia*:

- Measure and record the quantity and composition of the MSW received
- Measure and record the quantity of biogas produced and its composition
- Meter and record the power generated and sold to the grid
- Measure and record quality/quantity of manure sold
- Keep track of solid waste management practices in the city and the country
- Keep track of source wise power supply in the northern electric power grid and the status of completing the National Grid
- Keep track of production and use of chemical and organic fertilizers

This will enable securing quality emission reductions. The documents so generated shall be available for review of any interested party.

e. ***Agencies to certify annual M&V***

[redacted]

f. M&V Cost estimates

Item	Estimated cost Rs Million	Equivalent $ (Rs. 48 per US $)
Additional Hardware - Specialized MIS	[redacted]	[redacted]
GHG monitoring system design and maintenance expenses	[redacted]	[redacted]
Baseline methodology, emissions and reduction verification	[redacted]	[redacted]
Annual certification of emission reductions (10 years capitalized)	[redacted]	[redacted]

Annual adaptation cost @2% of revenues [$2X 214,035X0.02] = $ 8561.4 p.a. (@ US $ 2 per ton CO_2)

6. Estimation of cost of carbon reductions

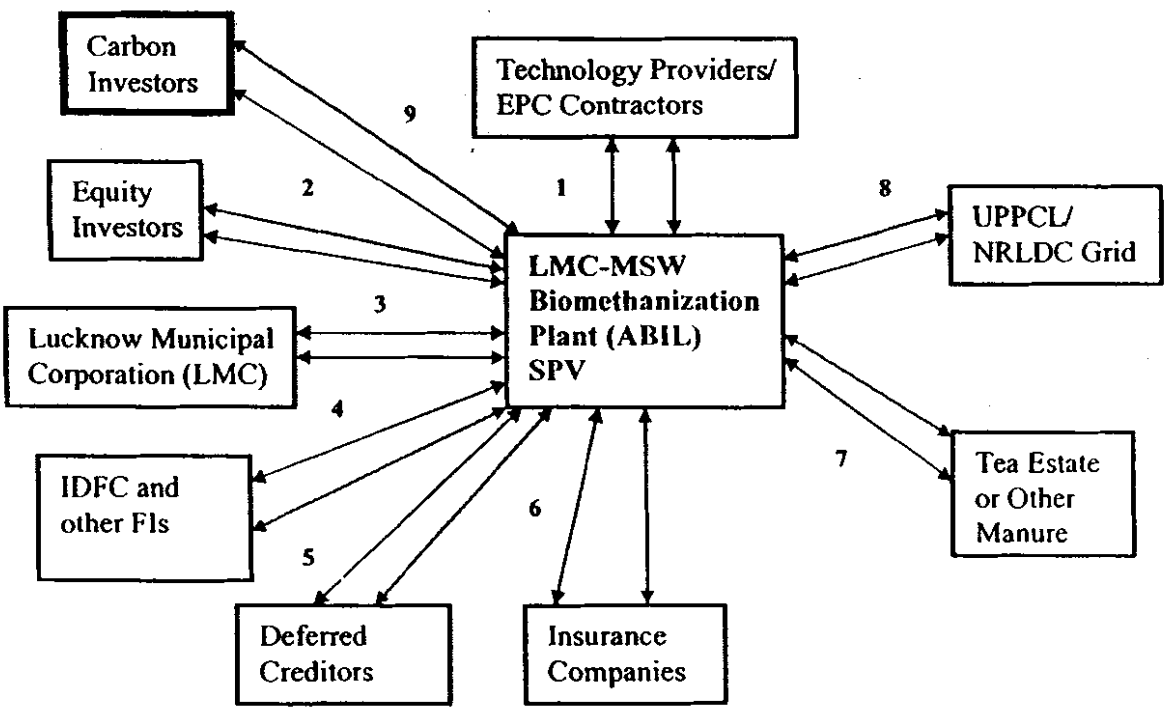
There are basically two approaches to estimating cost of carbon reductions in case of non established markets, where no pricing signals are available. (i) The difference in the total cost of production between the project and a similar project using a traditional technology divided by the total tons of carbon reductions produced; or (ii) The total amount necessary to make the project profitable (or meet the hurdle rate) divided by the total tons of carbon reductions produced. In case of the proposed project the valuable products/services provided include treatment of 300 TPD of MSW, 5 MW power generation and 71 TPD of Organic manure production. Since conventionally there is no technology that can provide such heterogeneous services, it would be appropriate to adopt the second approach.

The IRR on equity with the two valuable products from the project namely power and manure was calculated based on the price of power specified by the PPA and the market acceptable price of organic manure without accounting for the carbon reductions. This analysis suggests that at a price of Rs. 2,200 per ton for the manure in year 1, escalating @5% p.a., and for a hurdle IRR of 20%, the carbon price works out at **$ 3.00 per ton**. It is observed that the IRR is sensitive to organic manure price; therefore the market acceptable price has been taken into account. The comparable commodity in this respect has been assumed to be the compost being produced in the Okhla plant in New Delhi, which is sold at Rs. 4 per KG in the retail market.

7. Risk assessment and mitigation mechanisms

The proposed project is exposed to various risks of various operational, technical, contractual and sovereign types. ABIL has obtained performance guarantees from various technology/equipment suppliers to ensure proper working of the plant. In addition, Ernst & Young, a reputed consulting firm has reviewed the technology, waste characteristics and the underlying contracts. Addressing these business and political risks is one of the major factors for attracting investments in the project. It may be noted that this project has been awarded to ABIL through a competitive bidding process that was conducted in a transparent manner. Thus, the risks of political acceptability are minimal. Moreover, India is faced with a formidable task of improving the solid waste disposal practices owing to various reasons like health, hygiene and aesthetics. Thus, the proposed activity is a highly socially desirable activity. The project not only addresses the problems of solid waste and emissions but also generates valuable resources and employment. In other words this is a socially and environmentally sustainable activity. All the major project agreements have been signed, reviewed and accepted by the FIs. The contractual framework is depicted in Figure 2.

Figure 2: ABIL Contractual/Performance Structure



Sr. No.	Service/performance	Agreement ←→	Transaction ←→	Annual Transactions
1	Equipment/Technology	EPC contract/Tech transfer	Purchase of Eqpt/Tech	-
2	Equity capital	Shareholders Agreement	Equity infusion	Dividend
3	Garbage	Garbage Supply Agreement	Supply of garbage of specified quality	
4	Loan	Loan Agreement	Provide Loan	Interest/Principle
5	Deferred Credit	DC/Loan Agreement	Deferred credit on specified equipment cost	Lease rental
6	Insurance Policy	Policy document	Cover fire and other risks	Insurance Premium
7	Organic Manure	Manure Purchase Agreement	Sale of power	Payment for manure
8	Power	Power Purchase Agreement	Sale of manure	Payment of Power tariff
9	Carbon offsets	Carbon Offset Purchase Agreement	Initial Investment	Payment for Offsets

Various risks faced by the project along with the respective mitigation measures is described below.

Risks	Low to High	*Description*
Market?	Low	The commodities produced by the project power and organic manure are in deficit. Therefore, market risks are low except for the sale of manure, because it is not widely promoted to the farmers yet.
Country/Sovereign?	Low	India has stable legal system and has by and large following the legal process. Contracts have been honored and businesses of the multinationals have flourished. Thus, the sovereign risk is minimal.
Regulatory?	Low	The UP state has a functional electricity regulatory commission. The PPA has a legal validity. Also, the proposed project activity has overall support of the local/state/central govt. support

Contract/counter party	Low	The PPA and the waste supply agreements have been entered into. These agreements are sound and fair. The other contractual structure is also established and is robust. Although, UPPCL is not in good financial health, this project has a special status and is also small in size. As such, no contract related problems are expected.
Construction?	Low	The promoters have gathered strong EPC and other contractors. They have earlier experience in setting up such projects. The materials to be used are standard. Thus, construction is not likely to pose major challenges.
Technology?	Medium	The technology providers have set up similar facilities elsewhere in the world. The promoters have experience in working with other effluent treatment projects in India. Combined, their strengths are sufficient to address any technology related issues.
Management?	Low	The promoters have a very lean and efficient management, which is evident from a large number of projects they have implemented in a short span of time. In addition, they can draw any necessary resource from India or Austria.
Competition?	Low	MSW treatment is a nascent activity in India and competition in the field of MSW methanation project is very low. Also the overall size of the MSW treatment market is quite large [with over 300 Class I cities generating over 39 million tons of MSW daily]
Exit?	Low	GOI is currently in the process of easing the Companies Act to allow easier closure of firms. The investment rules have already been relaxed. The Indian financial market is mature and transactions such as leveraged buyouts, mergers & acquisitions etc. are common. Therefore, Exit from the companies in general and

		better performing ones in particular is not difficult and risky.

APPENDIX B

Speed post/ Courier

पावर फाइनेंस कारपोरेशन लिमिटेड
POWER FINANCE CORPORATION LTD.
(भारत सरकार का उपक्रम) (A Govt. of India Undertaking)

Loan No. A04 02001.
January 29, 2003

Sh. K. Sadananda Shetty
Chairman
Ambuthirtha Power Private Limited
2nd Floor 21/19, Craig Park Road.
M.G. Road,Cross,
Bangalore-560001

Sub: Loan proposal for financing of 2x10 MW MGHE Tail Race Project in Karnataka by AMBUTHIRTHA Power Pvt Ltd.

Ref: (i) M/s APPL's letter dated 29/12/2001 to PFC seeking financial assistance from PFC.
(ii) PFC's letter dated 18/10/2002 to M/s APPL intimating shortlisting of the project by PFC for detailed appraisal.

Dear Sir,

With reference to your application for financial assistance vide letter cited at reference above and further correspondences and discussions you had with us for setting up of a 2x10 MW power project at Shimoga in Karnataka , we are pleased to inform that Power Finance Corporation Ltd. is agreeable, in principle, to provide to M/s APPL a rupee term loan of Rs. 35.0 crores for the above project subject to the following :

1. The aforesaid term loan facility is subject to the terms and conditions including additional terms and conditions enclosed herewith at Appendix-A and Appendix-B respectively.

2. M/s APPL shall enter into a Loan Agreement with PFC in the format enclosed at Appendix-C.

3. In case these terms and conditions are acceptable to you, you may furnish to us within 30 days of receipt of this letter two certified copy of the resolutions duly passed by the Board of Directors of your Company as per the proforma in Appendix-D.

4. Your attention is also invited to **Appendix-E** of this letter which lists the various documents that are required to be submitted by you in connection with the said financial assistance.

5. This communication should not in any way be construed as giving rise to any binding obligation on the part of PFC unless M/s APPL communicates to PFC within 30 days from the date of receipt of this letter that the terms and conditions set out herein are acceptable to it and unless the Loan Agreement and the Guarantee Agreement and other documents relating to the above assistance are executed by M/s APPL in such form as may be required by PFC within six months from the date of this letter or such further time as may be allowed by PFC in its absolute discretion.

One set of formats for (i) undertaking for non-disposal of shareholding, (ii) deed of corporate guarantee and (iii) declaration in the matter of mortgage/hypothecation are also enclosed at **Appendix-F**.

Meanwhile kindly acknowledge receipt of this letter.

Thanking you,

Yours faithfully,

(Mohan Lal)
Manager (PA-SR) & SC- Karnataka

Copy for information to:

1. The Principal Secretary to Government of Karnataka ,Energy Department, M.S.Building ,6th Floor, Bangalore-560001
2. Chairman , KPTCL, Cauvery Bhawan, Bangalore-560009
3. Chairman,KREDL, Queen's Road,Bangalore-560052
4. AGM (P&FO) , PFC along with a copy of special terms & conditions
5. GM (LD & R), PFC
6. AGM (IPP), PFC along with a copy of special terms & conditions
7. AGM (CMIS), PFC
8. GM (L&D), PFC along with a copy of special terms & conditions
9. GM (EAP), PFC

रूरल इलेक्ट्रीफिकेशन कारपोरेशन लिमिटेड
RURAL ELECTRIFICATION CORPORATION LTD.
भारत सरकार का उपक्रम A Government of India Enterprise
Regd. Office Core-4 SCOPE Complex 7 Lodi Road New Delhi 110003
Tele. 24365161 Fax 24360644 E-mail reccorp@recl.nic.in Gram RECTRIC
Website www.recindia.com www.recindia.nic.in

FAX/SPEED POST

FAX NO. 91-80-5597617

No.REC/OD/SC/SAN/2002-03/71/1252 **Dated: 13.03.03**

M/s Ambuthirtha Power Private Limited
2 nd floor, 21/19, Craig Park Road
MG Road Cross
Bangalore-560 001.

Sub: Sanction of MGHE Tailrace Hydro Electric Project (2x10MW) in Shimoga district of Karnataka State during 2002-03

Dear Sirs,

Please refer to your letter dated 21.11.01 requesting for obtaining loan assistance for MGHE Tailrace Hydro Electric Project (2x10MW) in Shimoga district of Karnataka State.

In this connection, it is to inform you that our Corporation is agreeable to provide loan assistance to the extent of Rs. 3059.574 lakh (including IDC) for the above mentioned project, in Consortium with PFC as Lead Financial Institution.

The terms and conditions of the loan from REC will be governed in accordance with the terms and conditions as may be agreed to between the members of the Consortium. The concerned Consortium Agreement would also include the special conditions for release of loan as given in enclosed annexure.

Yours faithfully,

Encl: Sanction details

Satish Dhawan 13/03/03
(Satish K.Dhawan)
Chief (Operations)

Annexure

Details of MGHE Tailrace Hydro Electric Project in Shimoga district of Karnataka State promoted by M/s Ambuthirtha Power Private Ltd. (APPL)

(Rs. lakh)

Name of the Project/ Distt.	Code No.	Installed Capacity (MW)	Modified cost as indicated by promoter (11.02.03)	Eligible cost of the project (based on AHEC)	Promoter's contribution as equity	Debt. Compo-nent	Loan Amt. proposed (50% of debt compo-nent)	IDC on loan amount pro-posed	Loan assistance (including IDC) sanctioned
1	2	3	4	5	6	7	8	9	10
MGHE Tailrace/ Shimoga	Utaes	2x10	9047.75	8430.00	2940.15	5489.85	2744.925	314.649	3059.574

Special Conditions for release of loan

1. An undertaking is to be given by M/s Ambuthirtha Power Private Ltd.(APPL) to the effect that no problem remains to be resolved with regard to rehabilitation and litigation and all the necessary project clearances are available.

2. M/s Ambuthirtha Power Private Ltd. (APPL) undertakes not to transfer or abandon the project at any stage or in any manner whatsoever without prior written consent of REC. Also the APPL undertakes that in case of transfer/abandonment of the project or assets, the entire outstanding dues from them shall be paid to REC in one installment before such transfer is effected.

3. No advance money shall be provided and all eligible claims shall be released on reimbursement basis subject to compliance/completion of formalities related to loan documentation which may also cover the following commitments made by the company under a legally binding contract(s) to be vetted by the Lawyers:-

   i) Commitment to bring entire equity upfront before disbursement (or part by way of a bank guarantee)
   ii) Commitment to submit legally binding contracts with Asian Tech. Ltd.(EPC Contractor), Alstom Ltd. (Equipment Supplier) and TCE Consulting Engineers Ltd. (Project Construction managers) prior to disbursement.
   iii) Commitment to furnish contracts with key personnel identified by the company prior to disbursement. Such contracts should be valid for the loan duration. Further the company should undertake to replace such people (with REC's consent) with equally qualified personnel in the event of their quitting the organization.
   iv) Commitment by the company to meet cost over run without recourse to REC

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

Ambuthirtha Power Private Limited,
MGHE Tailrace Hydro Scheme
Karnataka
(Project Finance)

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SECTION A: CLEAN ENERGY AND GHG MITIGATION EQUIPMENT FINANCE

1. Contact Information for the Prospective Borrower

	Name of Company	
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	

2. Availability of Financial Information on Borrower

	Audited financial statements available for last 3 fiscal years?		
	Audited financials being provided to LBG Washington?		
	Was firm in same general line of business for last 3 years?		
	Has firm reported operating profits AND net income during each of last 2 years?		

3. Borrower's Financial History (last three Fiscal Years)

	EBIDT			
	EBIDT/Total Income			
	Operating Profit (OP)			
	OP/TI			
	Net worth			
	Equity			
	EPS			
	Dividend			
	Major Capital Investments			
	Debt:Equity ratio			
	Fixed Asset Coverage Ratio			
	Current Ratio			

	Credit Rating by Lead FI/Bank			
	Depreciation/Amortization Expense			
	Interest Expense			
	Current maturity of LTD			

4. Background information on all used and unused short and long-term debt

NA

About the Equipment/Technology: Larger clean energy or GHG mitigating projects (Project Finance) may involve more than one type of environmental equipment. Complete sections A 5 through A 10 for each piece of relevant GHG mitigating equipment.

5. Description of technology/service to be purchased

NA

6. Description of the GHG mitigating potential of the technology

The project envisages setting up two sets of mini hydroelectric power plant of 10 MW each. The technology used is primarily based on diversion of tailrace stream of the larger hydroelectric power plant upstream. As such it does not result in submergence and inundation of forestland. This feature helps in generating power in an environmentally friendly manner. In India, a large proportion of power is generated by thermal plants burning the coal available in central India. The proposed project enables switching to renewable energy source in a sustainable way.

7. About the Business Negotiations

	Is the manufacturer of the technology a domestic company?		
	Is the manufacturer located overseas (exporter)?		
	Is the manufacturer a US company?		
	Have any price negotiations occurred?		
	Has a purchase order been submitted?		

How many units are in the Purchase Order? _____

What is the estimated unit cost of technology (US$)? _____

What is the total cost for the Purchase Order? _____

8. Contact Information on the Manufacturer

√	Name of Manufacturer	
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	

9. About the Trade Financing (For Equipment Imported Into India)

Is trade financing being sought for the import of the equipment to India? _____

What type of trade financing is being sought (insurance,guarantees, working capital?

_____

_____

10. Has a domestic or overseas lender been identified? _____

	Name of Lender	
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	

SECTION B: PROJECT FINANCE FOR CLEAN ENERGY AND GHG MITIGATION

Project Name: Mahatma Gandhi Hydro-Electric Tail Race Scheme, Karnataka

Project Promoter: M/s Suchindra Investments Pvt. Limited

Special Purpose Vehicle: Ambuthirtha Power Private Limited

1. Executive Summary: Project at a Glance

Ambuthirtha Power Private Limited proposes to construct and operate a mini hydro-electric power generating plant of 20 MW capacity (2 – 10 MW units) at the down-stream of the existing 120 MW Mahatma Gandhi Hydro-Electric (MGHE) station, and upstream of the existing 1035 MW Sharavathy Generating Station (SGS).

The river-bed fall between the MGHE generating station and SGS is 69 meters. The MGHE Tailrace Project proposes to be located between these stations, and would utilize the river-bed fall, the tailrace discharge flow from the MGHE station and flows from an independent catchment. It is proposed to construct a diversion dam complex across the Sharavathy River, with a trench weir across the Talakalale Nale, a tributary of the Sharavathy.

The project will have three primary sources of water:

- Discharge from the MGHE Power House (est. 38-42 cumecs)
- Catchment from Talakalale Nale
- Run-off from independent catchments of Sharavathi River below Linganamakki, reservoir up to Jog Falls.

The combined flows would be conducted through the head race tunnel (HRT), surge tank, pressure shaft and penstocks to the MGHE Tail Race Power Generating Plant. The Plant is proposed to be commissioned by October 2004, and the station is anticipated to generate 113 million units (MU) annually.

Approximately 8.75 Hectares of land will be required for locating various components of the project.

Infrastructure Development Finance Company Ltd., (IDFC) is the presumptive debt provider for this activity. Under the renewable framework, the project is under a tax holiday for the first 10 years of its operation. A power purchase agreement with the Karnataka Electricity board has been signed on October 16, 1999. The PPA provides for payment of 2.87 Rs/kWh calculated from the base year 1999-2000, and assuming a 5% annual increase until the 10th year of operation.

2. Project Costs

				%
√	**Plant & Machinery**	2,755.00		25.58
√	**Land & Building**	85.00		0.79
√	**Civil, detailed Eng.**	5,365.00		49.82
√	**Evacuation of Power**	139.00		1.29
√	**Preliminary & Preoperative Expenses**	700.00		6.50
√	**Working Capital Margin**	--		
√	**Escalation during Construction**	--		
√	**Contingencies**	400.00		3.71
√	**Interest during Construction**	1204.00		11.18
√	**Finance Charges**	121.00		1.12
√	**Total Project Cost**	10769.00		

3. Proposed Means of Financing

√	**Total Debt Portion**	7,538		70%
√	**Total Equity Portion**	3,231		30%
√	**Total Project Cost**	10,769		

4. Committed Financing (if any)

a. Committed Debt Providers

Financial Inst.	Amount of Tranche	Rate	Tenor	Date of Commitment
IDFC		**15%**		in negotiations
Canara Bank		**15%**		in negotiations
HUDCO		**15%**		in negotiations
IDBI		**15%**		in negotiations

b. Committed Equity Providers

[illegible]	[illegible]	[illegible]
IDFC		
IDBI		
LIC		
M/S KSK Energy Ventures		

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5. (a) Estimates of Profitability (For Generation at 113 MU)

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10
Revenue from power sale				4135.80	4339.20	4553.90	4779.90	5017.20	5265.80	5525.70
Other revenue				0	0	0	0	0	0	0
Fuel cost				0	0	0	0	0	0	0
O&M Cost				161.53	174.45	188.41	203.48	219.76	237.34	256.33
Administrative cost				53.84	58.15	62.80	67.83	73.25	79.11	85.44
Selling cost				19.74	19.74	19.74	19.74	19.74	19.74	19.74
PBIDT				3900.69	4086.86	4282.95	4488.85	4704.45	4929.61	5164.19
Depreciation				435.63	435.63	435.63	435.63	435.63	435.63	435.63
Interest on Term-loan				1130.71	1049.95	888.42	726.89	565.36	403.83	242.30
PBT				2334.35	2601.28	2958.90	3326.33	3703.46	4090.15	4486.26
Provision for Tax				0	0	0	0	0	0	0
PAT				2334.35	2601.28	2956.90	3326.33	3703.46	4090.15	4486.26
Net Cash Flow Year Wise				2116.71	1929.15	2285.13	2650.95	3026.47	3411.58	3806.14
Net Cash Flow Cum				2116.71	4045.86	6330.99	8981.94	12008.41	15419.99	19226.13

	Yr11	Yr12	Yr13	Yr14	Yr15	Yr16	Yr17	Yr18	Yr19	Yr20
Revenue from power sale	5796.90	6090.7	6395.8	6395.8						
Other revenue	0	0	0	0						
Fuel cost	0	0	0	0						
O&M Cost	276.83	298.98	322.90	348.73						
Administrative Cost	92.28	99.66	107.63	116.24						
Selling Cost	19.74	19.74	19.74	19.74						
PBIDT	5408.05	5672.32	5945.53	5911.08						
Depreciation	435.63	434.51	429.04	429.04						
Interest on Term-loan	80.77	0	0	0						
PBT	4891.65	5237.81	5516.49	5482.04						
Provision for Tax	0	0	0	1918.72						
PAT	4891.65	5237.81	5516.49	3563.32						
Net Cash Flow Year Wise	4210.00	5628.52	59009.26	3998.39						
Net Cash Flow Cum	23436.13	29064.65	34964.91	38963.30						

5. (b) Estimates of Profitability (For Generation at 102.12 MU)

	Yr1									
Revenue from power sale				3737.59	3921.41	4115.44	4319.68	4534.13	4758.79	4993.67
Other revenue				0	0	0	0	0	0	0
Fuel cost				0	0	0	0	0	0	0
O&M Cost				161.53	174.45	188.41	203.48	219.76	237.34	256.33
Administrative cost				53.84	58.15	62.80	67.83	73.25	79.11	85.44
Selling cost				19.74	19.74	19.74	19.74	19.74	19.74	19.74
PBIDT				3502.48	3669.06	3844.48	4028.63	4221.37	4422.60	4632.16
Depreciation				435.63	435.63	435.63	435.63	435.63	435.63	435.63
Interest on Term-loan				1130.71	1049.95	888.42	726.89	565.36	403.83	242.30
PBT				1936.13	2183.48	2520.43	2866.11	3220.38	3583.14	3954.23
Provision for Tax				0	0	0	0	0	0	0
PAT				1936.13	2183.48	2520.43	2866.11	3220.38	3583.14	3954.23
Net Cash Flow Year Wise				1784.87	1514.62	1850.11	2194.34	2547.20	2908.55	3278.27
Net Cash Flow Cum				1784.87	3299.49	5149.60	7343.94	9891.14	12799.69	16077.96

Revenue from power sale	5238.76	5504.27	5779.99	5779.99						
Other revenue	0	0	0	0						
Fuel cost	0	0	0	0						
O&M Cost	276.83	298.98	322.90	348.73						
Administrative Cost	92.28	99.66	107.63	116.24						
Selling Cost	19.74	19.74	19.74	19.74						
PBIDT	4849.90	5085.89	5329.72	5295.28						
Depreciation	435.63	434.51	429.04	429.04						
Interest on Term-loan	80.77	0	0	0						
PBT	4333.50	4651.38	4900.68	4866.24						
Provision for Tax	0	0	0	1703.18						
PAT	4333.50	4651.38	4900.68	3163.06						
Net Cash Flow Year Wise	3656.20	5046.80	5289.34	3598.12						
Net Cash Flow Cum	19734.16	24780.96	30070.30	33668.42						

6. (a) Projected Cash Flow (For Generation at 113 MU)

	Yr1	Yr2								
Sources of Funds										
PAT				2334.35	2601.28	2958.90	3326.33	3703.46	4090.15	4486.26
Depreciation				435.63	435.63	435.63	435.63	435.63	435.63	435.63
Inc. in Equity capital				0	0	0	0	0	0	0
Inc. in term loans				0	0	0	0	0	0	0
Inc. in bank borrowings				0	0	0	0	0	0	0
Total sources				2769.98	3036.91	3394.53	3761.96	4139.09	4525.78	4921.89
Application of funds										
Capital Expenditure					0	0	0	0	0	0
Inc. in Current Assets				653.25	30.89	32.53	34.15	35.75	37.33	38.89
Term loan repayment					1056.36	1056.36	1056.36	1056.36	1056.36	1056.36
Taxes	-	-	-	-	0	0	0	0	0	0
Dividend					0	0	0	0	0	0
Total Application				653.25	1087.25	1088.89	1090.51	1092.11	1093.69	1095.25
Net Surplus				2116.73	1949.66	2305.64	2671.45	3046.98	3432.09	3826.64
IRR				31.03%						
DSCR					1.92	2.18	2.49	2.86	3.33	3.91
Av DSCR				3.05						

	Yr11	Yr12	Yr13	Yr14	Yr15	Yr16	Yr17	Yr18	Yr19
Sources of Funds									
PAT	4891.65	5237.81	5516.49	3563.32					
Depreciation	435.63	434.51	429.04	429.04					
Inc. in Equity capital	0	0	0	0					
Inc. in term loans	0	0	0	0					
Inc. in bank borrowings	0	0	0	0					
Total sources	5327.28	5672.32	5945.53	3992.36					
Application of funds									
Capital Expenditure	0	0	0	0					
Inc. in Current Assets	40.41	43.80	45.27	-6.03					

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Term loan repayment	1056.36	0	0	0						
Taxes	0	0	0	1918.72						
Dividend	0	0	0	0						
Total Application	1096.77	43.80	45.27	1912.69						
Net Surplus	4230.51	5628.52	5900.26	2079.67						
IRR										
DSCR										
Av DSCR										

6. (b) Projected Cash Flow (For Generation at 102.12)

	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Y-7	Y-8	Y-9	Y-10
Sources of Funds										
PAT				1936.13	2183.48	2520.43	2866.11	3220.38	3583.14	3954.23
Depreciation				435.63	435.63	435.63	435.63	435.63	435.63	435.63
Inc. in Equity capital				0	0	0	0	0	0	0
Inc. in term loans				0	0	0	0	0	0	0
Inc. in bank borrowings				0	0	0	0	0	0	0
Total sources				2371.76	2619.11	2956.06	3301.74	3656.01	4018.77	4389.86
Application of funds										
Capital Expenditure					0	0	0	0	0	0
Inc. in Current Assets				586.89	27.62	29.08	30.52	31.95	33.34	34.71
Term Loan Repayment					1056.36	1056.36	1056.36	1056.36	1056.36	1056.36
Taxes	-	-	-	-	0	0	0	0	0	0
Dividend					0	0	0	0	0	0
Total Application				586.89	1083.98	1085.44	1086.88	1088.31	1069.70	1091.07
Net Surplus				1784.87	1535.13	1870.62	2214.86	2567.70	2929.07	3298.79
IRR				29.14%						
DSCR					1.73	1.96	2.23	2.57	2.99	3.51
Av DSCR				2.74						

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	Yr11	Yr12	Yr13							
Sources of Funds										
PAT	4333.50	4651.38	4900.68	3163.06						
Depreciation	435.63	434.51	429.04	429.04						
Inc. in Equity capital	0	0	0	0						
Inc. in term loans	0	0	0	0						
Inc. in bank borrowings	0	0	0	0						
Total sources	4769.13	5085.89	5329.72	3592.10						
Application of funds										
Capital Expenditure	0	0	0	0						
Inc. in Current Assets	36.07	39.08	40.37	-6.02						
Term loan repayment	1056.36	0	0	0						
Taxes	0	0	0	1918.72						
Dividend	0	0	0	0						
Total Application	1092.43	39.08	40.37	1912.7						
Net Surplus	3676.70	5046.81	5289.35	1679.40						
IRR										
DSCR	4.19									
Av DSCR										

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7. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame. Project developer is in negotiations with Infrastructure Development Finance Co. Ltd., on the following terms: 3 years moratorium period, interest rate @ 15% p.a. and repayment period of 10 years (including moratorium period).

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations. -No-

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission. –No-

8. Project Promoter Contact Information

√	Name of Project Promoter	M/S Suchindra Investments (P) Limited
√	Address	II Floor, 21/19, Craig Park Road, M.G. Road Cross
√	City, State, Province	Bangalore, Karnataka, India
√	Contact Name	Mr. K Sadananda Shetty, Chairman Mr. Sanjith Shetty, Managing Director
√	Contact Phone	080-559-7616/559-9654/559-5315
√	Contact FAX	080-559-7617
√	Contact EMAIL	suchind@giasbg01.vsnl.net.in

9. Project Management Team

√	Mr. K Sadananda Shetty	Chairman
√	Mr. Sanjith S Shetty	Managing Director
√	Mr. K.G. V. Murthy	Chief Engineer - Projects
√	Mr. J. Philomen Raj	Electrical Engineer
√	Mr. D. Nagaraj	Electrical Engineer
√	Mr. K. Vishnu Prasad	Electrical Engineer
√	Mr. K. Kristappa Shetty	Financial Management

10. Project Promoter Financial History

√	What were profitability figures last 3 years?	31/3/1999 = 5,56,161.27 Lakhs 31/3/2000 = 10,70,401.64 Lakhs Profit 31/3/2001 = 9,00,000 Lakhs (subject to audit)
√	Book value of firm?	-
√	EPS reserves and surplus last 3 years?	-
√	What is current business?	Nil
√	What are synergies between business and this project?	-

11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

1. Project promoters are first generation entrepreneurs to the power sector.
2. Chairman Mr. K. Sadanada Shetty – Former Chairman & Managing Director, Vijaya Bank, which according to project promoters is 8th highest profitable Bank in India. According to PD, Mr. Shetty was formerly Deputy Chairman of Indian Banks Association and was on the Boards of Air India, IRBI, AFC.
3. Managing Director Sanjith S. Shetty. According to project promoter, Mr. Shetty holds a degree of Masters in Business Administration from Fuqua School of Business, Duke University.

12. Special Purpose Vehicle Contact Information (If applicable):

√	Name of SPV	M/s Ambuthirtha Power Private limited
√	Address	II Floor, 21/19, Craig Park Road, M.G. Road Cross Bangalore 560 001
√	City, State, Province	Bangalore, Karnataka, India
√	Contact Name	Mr. K. Sadananda Shetty, Chairman Mr. Sanjith S. Shetty, Managing Director
	Contact Phone	080-559-7616/559-9654/559-5315
	Contact FAX.	080-559-7617
√	Contact EMAIL	suchind@giasbg01.vsnl.net.in
	Names and shares of the promoters	Suchindra Investments Pvt. Ltd = Total 1000 shares K. Sadananda Shetty = 500 shares Sanjith Shetty = 250 shares Mrs. Sujatha Shetty = 250 shares Mr. Suchindra Shetty = 1 share (cash share of Rs 100)
√	Is a Shareholding agreement in place	In terms of Memorandum & Articles of Association
	Salient terms	--

13. Project Details

√	Greenfield project or involves existing equipment?	Greenfield
√	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Clean Energy Generation
√	Size of Project (MW)?	20 MW
√	Project Location? City, Province	Sharavathy River, near Sharavathy Generating Station in Shimoga District, Sagar Taluk, Karnataka State.
√	Off or on-grid?	On-grid
√	State Electricity Board?	Karnataka Power Transmission Corp, Ltd. (erstwhile Karntaka Electricity Board)
√	Technology?	Mini-hydel
√	Type of Fuel?	Hydro
√	Source of fuel supply?	Sharavathy River

14. Feasibility Details

√	Was Feasibility Study prepared independently?	Yes. Titled "Preliminary Report on Modified Layout and Estimate of Cost", February 2001
√	What firm prepared the Feasibility Study? List address and contact details	Consulting Engineering Services (India) Ltd. 57 Nehru Place (5th Floor) New Delhi, India 110 019

15. Background on the Power Purchase Agreement (if Applicable)

√	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes
√	Has a PPA been signed? (Yes or No)	Yes
√	Nature of Agreement? Take or Pay? Other?	Take or Pay

√	Name of state electricity board or primary PPA signatory?	Karnataka Power Transmission Corporation Limited (KPTCL)
√	What date was the PPA signed?	16 October 1999
√	When does it enter into force?	Upon commencement of commercial operation of the plant
√	What is the length of the PPA? (Years)	10 years after commencement of commercial operation of the plant
√	What is the initial purchase price?	2.87 Rs/kWH for base year 1999-2000
√	What is the annual % increase in purchase price?	5%
√	Can the project sell power directly to major consumers? (Yes or No)	-No-
√	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	Letter of Credit from Bank
√	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	Within 15 days of receipt of tariff invoice, backed by irrevocable revolving Letter of Credit
√	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	Provided in PPA
√	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	PPA, provides for fixation of tariff, penalties, etc.
√	Have the provisions for change in law, termination, liquidated damages, etc. been approved by existing lenders/investors?	Still in the process of scrutiny
√	Would the SEB/generating utility want a share in the ownership of carbon offsets?	-No-

16. Other Agreements (where applicable)

√	Fuel supply agreement signed?	n/a
√	Water/utility supply agreement signed?	n/a
√	Shareholder's agreement been entered into between existing equity holders?	n/a
√	Special provisions of above agreements?	n/a

17. Quantify and Describe Risks

	Risks	Low to High	Describe
√	Market?	Low	Entire power generated will be sold to SEB as per terms of PPA.
√	Country/Sovereign?	Low	Project is allotted by the Govt of Karnataka as per agreement.
√	Regulatory?	Low	Construction/Operation through terms of agreements. Power is sold to KPTCL through PPA approved by Regulators (in this case KERC).
√	Contract/counter party?	Low	Insurance Policy to mitigate the construction risk is taken – CAR policy.
√	Construction?	Medium	Yet to commence work to be awarded through competitive tender
√	Technology?		Proven Technology
√	Management?	Medium	Management have no track record in power projects.
√	Enforceability of Contracts?	High	Payment default risk is significant. But defaults are coverd by L.C./Bank Guarantee.
√	Competition?	Low	Power is deficit in State.
	Exit?		

18. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
√	Market?	During the financial year 1999-2000 the total availability of power in the State of Karnataka was 22626 MU against a demand of 26061 MU. Peak demand shortage of 15.5%. Gap between supply and demand widening – Supply is through PPA with KPTCL covered by Revolving L/Cs.
√	Country/Sovereign?	Karnataka Power Transmission Corporation Ltd. Is Govt. of Karnataka undertaking. Moreover, supply to them is covered by PPA with Revolving L/C.
√	Regulatory?	Power Purchase Agreement is recognized by Power Regulatory Authorityof the State , i.e. KERC
√	Contract/counter party	KPTCL has entered into agreement with Ambuthirtha Power Pvt. Ltd, to purchase power at agreed rate through PPA, which is futher strengthened by Revolving L/C – Risks such as non-payment/non-taking of power is mitigated by 3rd party sale/Arbitrator.
√	Construction?	Construction through competitive selective bid route selected through BSES Ltd., reputed EPC contractors. Only very competent contractors are considered for inviting bid.
√	Technology?	Proven Technology: Karnataka's main stay in Hydel.
√	Management?	Competent Management Team. During construction BSES, highly reputed company in Power Generation will attend to the construction management. If successful we even consider giving them O & M contract.
√	Enforceability of Contracts?	Performance guaranteed from Banks are insisted

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√	Competition?	Gap between power generation and demand is increasing.
	Exit?	

SECTION C: CARBON COMPONENT.

Checklists were adapted from a variety of sources including Natsource, LLC

1. GHG Mitigation Applicability Macro Checklist

		Yes	No
√	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
√	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
√	Is the project sustainable without ODA from Annex B Countries?	√	
√	Has the project received host country approval?		√
√	Does project meet size definition for Bonn Fast Track CDM*? --under 15 MW for renewables projects --under <15 gigawatthours/year savings for energy efficiency projects --under15 kilotonnes CO2E for emissions reductions from process changes	√	

*Fast track is ideal, but non fast-track projects will still be considered.

Describe the baseline scenario: Karnataka has just over 4000 MW of installed generation capacity with a mix of 34:66 thermal/hydro. On the base of actual generation this ratio was 50:50 in the year 2000-01. However, the state is in deficit and imports power from other states in the Southern Regional Load Despatch Center (SRLDC) and from the central power Public Sector Undertakings(PSU), viz. National Thermal Power Corporation Ltd. (NTPC), National Hydroelectric Power Corporation Ltd. (NHPC) and Nuclear Power Corporation Ltd. (NPC) to the extent of about 53% of its consumption. Both of these compose higher thermal power supply CPSUs (86:5:9 including nuclear 9%) and southern states (72:28). With a result the overall mix in the consumption by Karnataka is 63:37 thermal/hydro. The emission intensity of the southern grid at this mix is 17tC/TJ.

2. Emission Reduction Calculations, Monitoring and Verification Checklist

√		Yes	No
	Does the project involve a discrete reduction of emissions?	√	
	Have the emissions reductions been estimated with an accepted methodology?	√	
	Has a monitoring methodology been established?		√

	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
	Has clear ownership of emissions reductions been determined and documented?		√

3. Carbon accounting details

	Parameter	Particulars	
1	Baseline methodology	Refer to the note above	
	Generation level	113 MU	102 MU
2	Baseline Emissions TCO2 per annum	95,703	86,489
3	Project Emissions TCO2	0	0
4	Emission reductions TCO2 per annum (2-3)	95,703	86,489

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APPENDIX B

Vinay Deodhar

From: "VINAYAK MAVINKURVE" <VINAYAK@idfc.com>
To: "'Tandon, Sandeep (New Delhi/EEE)'" <standon@usaid.gov>; <vdeodhar.gep@vsnl.net>
Cc: "NARAYANAN G" <narayanan@idfc.com>; "SADASHIV S RAO" <SADASHIV@idfc.com>; "AJAY NARAYANAN" <AJAYN@IDFC.com>
Sent: Monday, November 17, 2003 10:22 AM
Attach: GHG Assessment - Chattisgarh Electricity Co.doc; Interest rate reduction.xls
Subject: FW: Chattisgarh Electricity Co Ltd.

Dear Sandeep

I am attaching the GHG Assessment Report for Chhattisgarh Electric Supply Co. prepared by Vinay Deodhar, of Lou Berger Group. An excel sheet has also been attached which indicates the extent to which interest rate reduction is possible. Our interest rate as stipulated in our LoI was 11.75% p.a. An upfront interest subsidy from USAID of Rs.1.95 crore routed through IDFC would permit an interest rate reduction of approx. 125 basis points. We propose to sign the loan agreement on Thursday. Presently, IDFC's PLR for this duration works out to 8.25% p.a. which gives a risk spread of 350 basis points, which is the risk premium charged for a grass root project. The interest subsidy would go towards meeting part of the risk spread and also interest risk spread of IDFC due to variation in PLR in short-to-medium term. We would need a clearance from USAID on availability of the interest subsidy before signing of the loan agreement. In addition, we would also need to know the time frame for availability of the Rs.1.95 crore (interest subsidy amount).

We are working on number of projects which are eligible for these benefits simultaneously and will be referring them to you in the near future.

Regards

Vinayak Mavinkurve
Head - Energy

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Chhattisgarh Electricity Company Limited (CECL)

	15-Oct-03	15-Jan-04	15-Apr-04	15-Jul-04	15-Oct-04	15-Jan-05	15-Apr-05	15-Jul-05
		92	91	91	92	92	90	91
Opening Balance		-	25.00	50.00	50.00	50.00	50.00	50.00
Add Disbursement during quarter		25.00	25.00					
Repayment during the quarter								2.50
Closing Balance		25.00	50.00	50.00	50.00	50.00	50.00	47.50
Interest during the quarter	11.75%	0.37	1.10	1.48	1.48	1.48	1.48	1.46
	10.50%	0.33	0.96	1.31	1.32	1.32	1.29	1.31
		0.04	0.12	0.16	0.16	0.16	0.15	0.16
		1.94	1.94	1.88	1.77	1.66	1.53	1.41

Infrastructure Development and Finance Company Ltd. (IDFC)

	15-Oct-05	15-Jan-06	15-Apr-06	15-Jul-06	15-Oct-06	15-Jan-07	15-Apr-07	15-Jul-07	15-Oct-07	15-Jan-08
	92	92	90	91	92	92	90	91	92	93
Opening Balance	47.50	45.00	42.50	40.00	37.50	35.00	32.50	30.00	27.50	25.00
Add Disbursement during quarter										
Repayment during the quarter	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Closing Balance	45.00	42.50	40.00	37.50	35.00	32.50	30.00	27.50	25.00	22.50
Interest during the quarter	1.41	1.33	1.23	1.17	1.11	1.04	0.94	0.88	0.81	0.74
	1.26	1.19	1.10	1.05	0.99	0.93	0.84	0.79	0.73	0.66
	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.09	0.08	0.08
	1.29	1.17	1.06	0.94	0.84	0.74	0.64	0.56	0.48	0.40

Chhattisgarh Elect

	15-Apr-08	15-Jul-08	15-Oct-08	15-Jan-09	15-Apr-09	15-Jul-09	15-Oct-09	15-Jan-10	15-Apr-10	15-Jul-10	15-Oct-10	15-Jan-11	15-Apr-11	15-Jul-11	15-Oct-11	15-Jan-12	15-Apr-12
	91	91	92	92	90	91	92	92	90	91	92	92	90	91	92	92	91
Opening Balance	22.50	20.00	17.50	15.00	12.50	10.00	7.50	5.00	2.50	-	-	-	-	-	-	-	-
Add Disbursement during quarter																	
Repayment during the quarter	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50								
Closing Balance	20.00	17.50	15.00	12.50	10.00	7.50	5.00	2.50	-	-	-	-	-	-	-	-	-
Interest during the quarter	0.66	0.59	0.52	0.44	0.36	0.29	0.22	0.15	0.07	-	-	-	-	-	-	-	-
	0.59	0.52	0.46	0.40	0.32	0.26	0.20	0.13	0.06	-	-	-	-	-	-	-	-
	0.07	0.06	0.06	0.05	0.04	0.03	0.02	0.02	0.01	-	-	-	-	-	-	-	-
	0.33	0.27	0.21	0.16	0.11	0.08	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GREENHOUSE GAS MITIGATION POTENTIAL ESTIMATION

OF

10 MW WASTE GAS BASED POWER PROJECT

PROMOTED BY

CHATTISGARH ELECTRICITY COMPANY LTD.

BY:

GREENHOUSE GAS POLLUTION PREVENTION-CLIMATE CHANGE SUPPLEMENT

A USAID/INDIA PROJECT IMPLEMENTED BY:

THE LOUIS BERGER GROUP, INC.

C-6/7 SAFDARJUNG DEVELOPMENT AREA

NEW DELHI 110 016

OCTOBER 2003

Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the 10 MW waste gas based power project in Chattisgarh was prepared for Infrastructure Development Finance Company Ltd. by The Louis Berger Group, Inc under the GEP-CCS project. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by Chattisgarh Electricity Company Ltd. (the project promoter), IDFC and that obtained from public domain. The information contained in the note is solely meant for IDFC and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to IDFC, Chattisgarh Electricity Company Ltd and several other institutions including CEA, IPCC/IEA, UNFCCC, Chattisgarh state and The World Bank for the background data provided by them through their websites.

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1. Background of the project

Chattisgarh Electricity Company Ltd. (CECL), an existing company promoted by Mr. KK. Sarda in 1998. CECL has a ferro alloys plant based on electro smelting process at Raipur, Chattisgarh with a transformer capacity of 18MVA. The main product is the high carbon silico manganese alloy in various grades. The process is highly energy intensive with 60% - 80% of the cost being electricity cost. The specific electricity consumption is in the range of 2,800 kWh/ton to 3,000 kWh/ton for ferro manganese and 3,800 – 4,200 kWh/ton for silico manganese. Since power is crucial for operation of the plant, ferro-alloys manufacturers have captive power plants. CECL has a captive power plant of 25 MW capacity based on coal, using a 90 TPH fluidized bed boiler. This plant also supplies 4 MW power to Raipur Alloy and Steel Ltd. (RASL), a sister unit of CECL.

The company is expanding the capacity of the ferro-alloys unit by 100% and is also setting up necessary capacity power plant. The proposed project involves setting up of a CPP of 30 MW capacity comprising 20 MW based on coal and 10 MW on firing the gas from ferro alloys furnaces comprising 67% carbon monoxide (CO) from existing, proposed and RASL furnaces. The proposed plant will include special boilers generating 16.5 Tons per hour of superheated steam at 64 ata and 500 ± 10^{0}C. At present power is generated using coal in these units. CECL will also export surplus power to the grid. As Chattisgarh state is surplus in power its policy does not allow purchase of excess power from CPPs. Therefore, CECL may have to sale power outside the state to neighboring Madhya Pradesh state.

Thus, the project has two components, coal as well as a non-conventional fuel. The latter improves environmental performance of the plant by reducing reliance on coal to an extent of 17%. Coal being a fossil fuel, the project helps in mitigation of GHG emissions to that extent.

The project would generate a total of 315 million kWh of power of which 52.6 million kWh will be from the CO rich furnace off gases, or "Green" power. After meeting the auxiliary power requirement, net export of 284 million kWh is possible. As explained earlier, the green power from the project will be utilized mainly by the proposers in their manufacturing unit, thereby replacing coal to that extent. The total cost of the power generation project is estimated at Rs. 720 million.

2. GHG emission reduction objectives of the proposed project

India's power sector is characterized by heavy reliance on thermal power. Since 1950 the thermal hydro mix has been steadily deteriorating and tilting heavily towards thermal. All India installed generating capacity mix for utilities was highest at 46:54 at the end of third five year plan in 1966. The main fuel used by thermal power plant is sub-bituminous coal and lignite. Recently few natural gas based power plants have been set up by NTPC. Indian coal quality has also been deteriorating on account of open cast mining, which leads to mixing of rubble with coal. As a result, the overall conversion efficiency of the coal fired power plants in India ranges between 20 – 30% (Source: Anthropogenic Emissions from

Thermal Power Generation in India: Generation and Source Characterization Moti Mittal, C. Sharma, OSC, Ohio State University- 2002).

In the above backdrop, Government of India has been encouraging the use of alternative sources of energy and also on energy conservation. The Energy Conservation Act and recent Electricity Act provide encouragement for enhancing the resource use efficiency and using non-conventional energy. The proposed project is based on one such form of non-conventional form of energy viz. switching to alternate and waste fuel, which does not lead to additional GHG emissions. The project would make use of the chemical energy available in the furnace off-gases form the process operations of CECL. As explained earlier, these gases replace power that would otherwise have to be generated using locally available coal. Overall, the project helps in reducing dependence on fossil fuels without leading to additional GHG emissions.

a. ***Clean Technology nature***

The project consists of a CO based boiler that would generate high pressure superheated steam for generation of power. The off gases from the ferro-alloys furnace contain ~67% CO, which is a poisonous gas. Hitherto, the gases were being flared, for want of a technology that could utilize the energy. The proposed plant offers a GHG mitigation technology option.

b. ***Sustainable Development objectives/aspects***

The project will be located in the Industrial Growth Center Siltara, Raipur. The ferro-alloys plants need uninterrupted power for the production process. As a result the plants essentially have to have an assured source of power. This necessitates captive power plants as the grid power is not reliable in the state (and in the country as a whole). The company has an option of setting up power plants with 100% capacity based on coal. However, the proposers have envisaged meeting a part of power requirement through he proposed technology from the environmental as well as commercial viewpoint.

The project would directly employ local people and the power generated would support industrial and commercial activity in the Raipur district. Thus, it would result in ancillary benefits to the local population.

c. ***Host country Government (GOI) objectives***

Government of India, Ministry of Power (MOP) has been encouraging conservation of energy. After the passage of the Energy Conservation Act (2001), the Bureau of Energy Efficiency was established. Thus, GOI has been encouraging maximization of overall energy efficiency of industry. Similarly the Ministry of Non-Conventional Energy Sources (MNES) promotes non-conventional energy sources, one of them being waste based fuels. The proposed project also envisages a waste fuel containing

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combustible CO gas, which incidentally is also a hazardous gas. In view of this, the project meets GOI objectives.

3. Business as usual or Baseline identification

This section describes the existing power supply situation in the state of Chattisgarh, where the energy produced is used and power generated by the project is fed.

a. Project Boundary

The project has essentially two streams. One is to replace conventional fuel coal within the plant itself and second is to supply excess power to the grid for replacing the grid power. The project is expected to generate a total of 315 million kWh of power from both coal as well as the waste gas streams. Out of this 83% will be from coal firing and would not qualify as green power. The power generated using sponge iron kiln and alloy furnace waste gases contributes up to 8MW capacity. Since these plants need more power than this, it can be noted that the appropriate project boundary is effectively restricted to the ferro alloys plants of CECL and RASL. As described earlier, energy is the most prominent input for the alloy steel industry. In view of the delicate power situation in India, it is an accepted practice to set up dedicated power generation plants using fossil fuels in such type of industries (other examples being cement plants). Thus, the proposed waste gas based power can be visualized as that replacing coal fired power captively generated. By replacing power from the coal fired boilers the overall emission mix of the power consumed by ferro-alloys plant improves by 17%. Moreover, if one considers alternate power source from grid, it on-site generation also helps by cutting down on T&D losses, which for the CSEB are around 25% (Unofficially, T&D losses range from 30% - 50%. *Source: Infrastructure Development Action Plan for Chattisgarh – Final Report- Position Paper – Power Price Waterhouse Cooers – 2000-01*)

Alternatively, if one considers that the waste gas based power replaces power from the Chattisgarh state grid, which is a part of Western Regional Grid, the state grid becomes the project boundary. The power supplied by the project is most likely to be consumed within the state itself or exported to units in neighboring Madhya Pradesh (MP) state. Each unit of power supplied by the project would, therefore, replace an average unit supplied in this region. It may be noted that Chattisgarh state was a part of the MP state and hence has almost similar mix of power generation sources.

Chattisgarh and MP power grids are a part of the Western Regional grid. The power supplied to the consumers in the state is drawn from a variety of sources, CSEB own generation, private producers, purchase within the western region from other states and purchase from central power utilities against state's share. During discussion with various state utilities it was

understood that their policy is to purchase all the power available within state first. Thus, when an additional unit is available they will back power from central power PSUs. In other words, the marginal unit is the power supply from these sources.

On the demand side, since the power is generated from a waste gas, which was being flared earlier, the plant itself is the baseline. The avoided coal could also lead to reduction in emission of GHGs in its mining and transport. However, for simplicity and to be on a conservative side the same is ignored.

b. Relevant baseline methodology/scenarios

Baseline is defined as the scenario in the relevant project boundary that would have prevailed in the absence of the project. It is also referred to as "business as usual" scenario. Under the two project boundary approaches different methods are applicable. For the first applicable boundary, viz. replacement of captive power by waste gas based power the information on consumption of coal per unit is relevant. Based on the proximate analysis of the coal used, the emission factor can be calculated.

For the second approach, viz. replacement of grid power by waste gas based power; there are two possible methodologies to decide the baseline in situations like this. a) Average of weighted average emissions of all generating sources serving the system, excluding those which do not result in GHG emissions and the weighted average of recent capacity additions defined as the lower of most recent 20% of plants built or the 5 most recent plants; or b) The weighted average emissions of the current generation mix. The first approach is complicated and depends on availability of data. The second approach on the other hand is easy to understand and estimate, as adequate data is available from regular channels. Sometimes the plants under construction and planned are also taken into account. In view of the above, the second approach is suggested.

c. Time dimensions of the baseline

India has an overall installed capacity of 107,534 MW as on March 31, 2003 (MOP Annual Report 2002-03). This includes 76,525 MW thermal power and 26,660 MW of Hydro electric power. The balance is from wind (1,630 MW) and nuclear (2,720 MW). The waste fuels based power generation, is negligible. As per estimates, potential capacity based on waste heat and energy conservation is 15,000 MW amounting to 15%. Thus far only a small portion of this has been tapped. It can be concluded that in the foreseeable future, waste heat or fuels based power will not form significant proportion of the baseline. Thus, the baseline as discussed earlier will be valid for a long time horizon.

d. ***Annual /periodic estimations***

In view of the above status of implementation of projects, the baseline emissions will not change practically. Therefore, it may not be necessary to revise the baseline estimate at least during the first ten years in which investors are likely to purchase the credits.

e. ***Baseline case emissions estimation***

Based on the methodology presented earlier for the two approaches and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

CO2 Emissions from replacing captive power using coal

CECL purchases coal from Dipka Mines of South Eastern Coal Fields. As per the proximate analysis, this coal has a fixed carbon content of 30.55% and ash content of 38.56%. Based on the existing power plant, the promoters have estimated that power requirement of the plant is 1 kg coal/kWh. Thus, the emission factor of the captive coal fired power generation is 1.0978 $kgCO_2/kWh$.

CO_2 Emissions from power used in the state grid

As mentioned earlier the Chattisgarh state was created three years back. However, its power grid is still closely integrated with that of Madhya Pradesh state. Since data on the state's power position is not yet compiled, analysis is based on MP power figures. The requirement of power in the state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the CSEB purchases power from the central public sector power generating companies, in accordance with its allotted share. This is a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 91% of the capacity and 9% of the hydel sources. However, based on the statistics of power generated and purchased for the last three years 2000 - 02, it is observed that over the past three years power consumed by the state grid was made up of 88 % from thermal sources, mainly coal fired plants, 8 % from hydel and balance 4 % by nuclear sources. According to the Directorate of Economics and Statistics, 97% of the power generation in the year 2002 in Chattisgarh was from thermal power and 3% by hydel sources.

A majority of the thermal plants are based on high ash sub bituminous coal as fuel that is mined predominantly in central India including Chattisgarh state. By and large the plants are old and exhibit conversion efficiencies in the range of 25-30%. For conservative considerations this is assumed at a level of 33%. Since, the purchase of equivalent amount of power from cleaner sources is "avoided" from the grid; the plant would also be able to save on the T&D losses. Indian electric power grid, especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission

& distribution losses, sometimes in the excess of 40%. However, again for conservative estimation it is assumed at 25%.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like the World Bank. The emission factor of thermal power plants using sub bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the above mix of supply from various sources as mentioned above, the weighted average emission factor of the Chattisgarh (MP) state grid is 1,229 tCO_2/MU or 1.229 tCO_2/kWh.

4. GHG mitigation potential of the project

Based on the ***first baseline methodology***, i.e. replacement of captive power by the waste gas based power; each unit generated from this source will replace 1.0978 kg of CO2. In a stabilized production year CECL will generate 52.6 MU from the waste gases (17% of total). Assuming that 98% of the carbon is combusted this would amount to GHG reduction of **57,740** tons CO2 p. a.

Based on the ***second baseline methodology***, i.e. avoiding purchase of grid power. The proposed power project would use an alternative source of energy, i.e. hazardous waste gases. Moreover, the proposers have taken great care in design to of the boilers to ensure that other pollutants like Sox and particulates do not escape in the atmosphere. Therefore, it will be reasonable to assume that the project does not have any GHG emissions.

The GHG emission reductions from the project would be:

Annual GHG Reduction =	**GHG emission per million kWh of the baseline** (tCO2/million kWh)	X	**Annual units avoided by the project** (million kWh)

As discussed above the GHG emission per MU or the emission factor of the MP grid is 1,229 tCO2 per MU under the assumptions discussed above based on the average energy fed by various sources for the past three years. The project is expected to avoid purchase of 52.6 million kWh from the state grid each year. Thus, the expected Annual GHG reduction from the 10 MW clean power project would be **64,645** tCO2 p.a.

The above methodology, based on weighted average emission factors of the grid, is in conformity with the one for grid feeding small scale projects as specified by the CDM Executive Board of the UNFCCC.

5. Monitoring & Verification

It is very crucial to monitor and verify periodically the actual emission reductions achievable by the CEPs. There are two sides of this M&V, one to ensure that the baseline itself does not change significantly and second the project performs as envisaged in the design. As discussed in detail earlier the composition of entire RE based power generation is not likely to be significant in the foreseeable future. Therefore, the former is taken care of to a major extent. It is therefore important to measure the performance of the project in detail and with greater accuracy.

Performance of projects generating power for export to utility grid can be easily measured based on electric power generated and supplied to the grid. However, in the proposed power, the clean power would be consumed by the plants themselves. In view of this adequate in-house measurement would be necessary. It is, therefore, suggested that suitable meters and check meters meeting prescribed standards and accuracy class be installed. These meters will measure overall power generated and also the proportion using coal and waste gases. It is also suggested that these meters be checked and certified by an external agency so as to lend authenticity to the measurement.

The following M&V mechanism is suggested:
It is proposed to vest the responsibilities of monitoring the parameters identified earlier in to an interdepartmental group consisting of representatives from quality control, production, maintenance and strategic planning departments, which shall *inter alia*

1. Collect data on existing power generation from the plant and consumption of coal
2. Meter and record the total power generated.
3. Measure the coal consumption
4. Back calculate the units generated from this coal quantity based on
   i. The data as mentioned in point 1 and
   ii. Based on boiler/turbine suppliers guarantee norms.

   The higher of these two will be the contribution of coal generated portion.
5. Calculate the power generation from waste gases [(2) – Max {4(i), 4(ii)}]
6. Keep track of source wise power supply in the electric power grid and the status of completion of the National Grid

6. Conclusion

The proposed project involves use of a waste fuel for generating useful power. It helps in avoiding fossil fuel based power. It leads to mitigation of GHGs predominantly Carbon dioxide due to use of coal. The project involves a clean energy technology and may need support for mitigation of risk. The project has been promoted by a private enterprise, which will also part finance the same. The project, thus, meets the GEP-CCS criteria.

APPENDIX B

LI No. 18/18

STATE BANK OF INDIA
PATAMATA
VIJAYAVADA-520 007
PHONES : 555704 555239 555734
FAX : 0866 555425
Datanet : 0866 555247

Coastal Agro Industries Limited
K. Savaram,
Tanuku,
West Godavari (A.P.)

F.No. Date : 23rd August 2002

Dear Sir,

SANCTION OF TERM LOAN LIMIT

With reference to your application for sanction of Term loan, we have pleasure in advising that the Term loan has been sanctioned to you on the terms and conditions detailed hereunder:

NATURE OF FACILITY	LIMIT(Rs in lacs)	REMARKS
FUND BASED		
TERM LOAN	250.00	-
TOTAL	250.00	

PURPOSE:

The Term loan is sanctioned to meet part cost of setting up of 4 MW Biomass based co-generation Power plant.

UTILISATION OF ADVANCE:

The Bank finance should be utilised strictly for the project as detailed in the application and in the manner prescribed.

TERMS OF REPAYMENT:

The term loan is repayable in 22 quarterly instalments, i.e., 21quarterly instalments of Rs.11.36 lacs and the final instalment of Rs.11.44 lacs commencing from six months after the declaration of the commercial production or March 2004, whichever is earlier.

Moratorium, interest to be met as and when applied

For COASTAL AGRO INDUSTRIES LTD.

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INTEREST:

2.25% below/above SBMTLR, presently 13.75% per annum with monthly rests. The rate is subject to revision as per the directives of the Bank/RBI.

PENAL INTEREST :

Penal interest is recoverable at the rate of 2% above interest chargeable on the advance under the following circumstances.

i. Irregularity in the Term Loan Account.
ii. Non-submission/delay in submission of financial statements.
iii. Non-compliance of any of the terms of sanction.

Other Fees/Upfront fee:

Upfront fee @ 1% of the term loan sanctioned and Rs.10,000/- towards Equitable Mortgage service charges. (Rs.250,000/-+Rs.10,000/-).

SECURITY:
i. PRIMARY:

Pari passu first charge on the existing and proposed fixed assets of the company. The first pari passu charge shall be shared with APSFC/any other lending Bank or FI, for the remaining term loan of Rs.750.00 lacs to be sanctioned by them.

ii. COLLATERAL:

Equitable Mortgage of immovable properties worth Rs.32.50 lacs.

iii. GUARANTEE:

Personal guarantee of a) Shri Ch. K. Vishweshwar Rao
b) Shri Ch.Ramakrishna
c) Personal guarantee of the owners of the properties mentioned under the collateral security.

MARGINS:

Buildings	40%
Machinery & Equipment	25%

INSURANCE :

Machinery & Equipment and Buildings under charge to the Bank should be fully insured for full market value against the risks in the joint names of the Bank, APSFC/any other lending Bank or FI and the Company, with the insurance company approved by the Bank and the relative policies deposited with the Bank.

For COASTAL AGRO INDUSTRIES LTD.

INSPECTION:

The Bank shall have the right to examine at all times the machinery, books of accounts etc and the factory/office should be open for inspection by officials of the Bank.

OTHER TERMS AND CONDITIONS:

a) FINANCIAL STATEMENTS:

Financial statements like Profit & Loss Account, Balance Sheet etc., should be submitted to the Bank within a period of 3 months after completion of an accounting year. The copies of the returns submitted to the Sales Tax and Income Tax authorities should also be produced to the Bank annually for perusal and record.

b) CHANGE IN CONSTITUTION:

If any change in the constitution of the company is contemplated, prior approval of the Bank for such a change should be obtained in writing. If no such approval has been obtained in advance, the Bank shall have the right to suspend further operations on the account consequent upon such reconstitution/change.

c) PERIODICAL REPORTS TO THE BANK:

Important events like suspension of production/manufacturing activities, change of premises, labour troubles/strikes or any event that is likely to affect the production and endanger the Bank's security should be immediately brought to the notice of the Bank, detailing the reasons leading to such an eventuality and steps taken to overcome it.

d) OUTSIDE BORROWINGS:

The company shall not create any charges without our prior written consent on their fixed assets and properties other than in favour of the Bank and the other consortium Term loan lenders during the currency of the advance.

e) GENERAL :

i) The Bank's name boards should be displayed prominently at the entrance of the premises/rooms wherein the machinery pledged to the Bank are placed.

ii) Proper books of accounts should be maintained and yearly accounts should be submitted to the Bank and these account books should be accessible to the field staff during the course of their periodical inspection.

iii) The Bank has every right to call up the loan at any time in the happening of any event which in the opinion of the Bank is likely to jeopardise the Bank's interest.

iv) All the legal and incidental charges which may have to be incurred by the Bank in the conduct of your account are to be borne by you and such charges will be debited to your account maintained with us.

The Bank's standard covenants as applicable to the limit sanctioned to the company are furnished in the annexure.

2. The promoters shall bring in the proposed capital initially or proportionate with the progress in implementation of the project and/or term loan disbursement.

3. The company shall submit a certificate from their auditors confirming that there are adequate internal accruals for investment in the proposed project, with specific details of deployment as on that date, and ready availability of such funds as and when required for the project implementation.

4. The Company shall also bring in the additional unsecured loans to meet any contingent increase in the project cost. The Company shall also bring in unsecured loans if the current ratio falls below 1.33 after dilution of Net Working Capital for implementation of the project. These unsecured loans shall be subordinate to the term loan sanctioned by the Bank and shall be on long term basis.

5. The Company shall obtain extention of validity of license from NEDCAP for required period.

6. The disbursement under the term loan is subject to obtention of sanction letters from APSFC/ any other Bank or FI for the remaining part of the term loan required for implementation of the Project. The disbursement under the term loan is also subject to obtention of in-principle sanction letter from SBH for the additional working capital required on implementation of the Project.

7. Please return the duplicate copy of this letter and covenants and the annexure there to duly signed by the authorized signatories of the company and the guarantors in token of acceptance of the terms and conditions and covenants stipulated.

8. Please arrange to pass the necessary resolutions for creation of the security, execution of documents etc., and submit duly certified copies (two each) thereof for our Information and record.

9. The authorised signatories of the company and the guarantors may please be requested to call on us with prior information to us, for execution of necessary security documents.

Yours faithfully,

ASST.GENERAL MANAGER.

For CAPITAL ADVANCE INDUSTRIES LTD.

Director

Director

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TERM LOAN LIMIT

Company : Coastal Agro Industries Limited

The above advance is sanctioned towards the purchase of machinery and equipment which will be decided in consultation with APSFC/any other Bank/FI financing the remaining part of the Term loan required (hereinafter referred to as other lender), payment of which will be made by us direct to the suppliers.

2. The advance sanctioned is primarily secured by the pledge of existing and proposed machinery and equipment on pari-passu basis with the other lenders.

3. The documents stipulated by the Bank in connection with the disbursal of this advance have to be executed by the Company and the guarantor(s). The stamp duty on these documents has to be borne by the Company.

4. A statement of expenditure is to be submitted to the Bank after the Term Loan is completely availed.

5. The Company must certify at half-yearly intervals, that the machinery are in a good working condition and that they are being properly maintained.

6. None of the machinery/equipment should be disposed of by you in any way except with the Banks prior consent in writing.

7. A list of the machinery pledged to the Bank with a certificate appended to the effect should be predominantly displayed on the factory premises, where the machinery are installed.

8. These terms and conditions are supplemental to those contained in the documents, referred to clause 3 above, to be executed by you and the guarantors.

For COASTAL AGRO INDUSTRIES LTD.

(DR. K. VISWESWARA RAO)
Managing Director.

STANDARD COVENANTS
Company : Coastal Agro Industries Limited

1. The Bank will have the right to examine at all times the company's books of accounts and have the company's factories inspected, from time to time, by officers of the Bank and/or qualified auditors and/or technical experts and/or management consultants of the Bank's choice. Cost of such inspection shall be borne by the company.

2. During the currency of the advance/loan/deferred payment guarantee, the company shall not, without the Bank's permission in writing,

   (a) effect any change in the company's capital structure;

   (b) formulate any scheme of amalgamation or reconstitution;

   (c) undertake any new project, implement any scheme of expansion or acquire fixed assets except those indicated in the funds flow statements submitted to the Bank from time to time and approved by the Bank;

   (d) invest by way of share capital in or lend or advance funds to or place deposits with any other concern including group companies, other than those normal trade credits or security deposits or advances to employees in the normal course of business;

   (e) entering to borrowing arrangements either secured or unsecured with any other Bank, Financial Institution, company or otherwise or accept deposits apart from the arrangements indicated in the project submitted to the Bank;

   (f) undertake any guarantee obligations on behalf of any other company including group companies;

   (g) declare dividends for any year except out of profits relating to that year after making all due and necessary provisions and provided further that no default had occurred in any repayment obligations;

   (h) create any charge, lien or encumbrance over its undertaking or any part thereof in favour of any financial institution, Bank, company, firm or persons other than those indicated in the project submitted to the Bank;

   (i) sell, assign, mortgage or otherwise dispose off any of the fixed assets charged to the Bank;

   (j) entering to any contractual obligation of a long term nature or affecting the company financially to a significant extent;

   and

   (k) permit any transfer of the controlling interest or make any drastic change in the management set up.

3. The company should maintain proper books of accounts and should correctly reflect its financial position and scale of operations and should not radically change its accounting system without prior notice to the bank.

4. The company should submit to the Bank such financial statements as may be required by the Bank from time to time, apart from the set of such statements to be furnished by the company to the Bank as on the date of publication of the companies annual accounts.

5. The company shall keep the Bank informed of the happening of any event likely to have substantial effect on their profit or business; for instance, the monthly production or sales are substantially less than what had been indicated to the Bank, the company will inform accordingly with explanations and the remedial steps proposed to be taken.

6. The company shall keep the bank advised of any circumstance adversely affecting the financial position of their subsidiaries/group companies or companies in which it had invested, including any action taken by any creditor against the said companies legally or otherwise.

7. Monies brought in by the promoters/directors/principal shareholders and their friends and relatives by way of deposits/loans/advances will not be allowed to be repaid by the company without the Bank's prior permission in writing. Further, the rate of interest if any, payable on such deposits/loans/advances should be lower than the rate of interest charged by the bank on its term loan and payment of such interest will be subject to regular payment instalments under term loans granted/deferred payment guarantees executed by the Bank or other repayment obligations, if any, due from the company to the Bank.

8. The Bank will have first charge on the profits of the company, after provision for taxation, for repayment of instalments under term loans granted/deferred payment guarantees executed by the Bank or other repayment obligation, if any, due from the company to the Bank.

9. The Bank will have the option of appointing its nominee on the Board of Directors of the company to look after its interests. The company will defray the director's normal fees and expenses. Such director shall not be required to hold qualification shares and shall not be liable to retirement so long as the credit facilities granted by the bank to the company are outstanding. When the option is exercised by the Bank, the company shall submit sufficiently in advance agenda papers relating to meetings of the Board of Directors or any committees thereof and forward duly certified copies of the proceedings of such meetings. The Bank will have the right to appoint a nominee to attend the meetings of shareholders; where the right is exercised, the agenda papers and proceedings should be sent to the Bank sufficiently in advance.

For COASTAL AGRO INDUSTRIES LTD.

(CH. K. VISWESWARA RAO)
Managing Director

Andhra Pradesh State Financial Corporation

(Incorporated under the State Financial Corporation Act. LXIII of 1951)

APSFC

BY REGD. POST – ACK DUE

Ref:AFC/PROJS/T-I/2002-03/ Dated : 12th September, 2002

M/s Coastal Agro Industries Ltd
P B No 27
TANUKU – 534 211
WEST GODAVARI DISTRICT

Dear Sirs,

Sub: Your application for a term loan of Rs.500.00 ranking pari passu incharge with SBI and SBH for the balance term loan of Rs 250.00 lakhs each for setting up of a 4 MW Bio-mass based Co-generation power plant at K Savaram (V), Undrajavaram (M) West Godavari District, under SES Scheme – Communication of Sanction – Reg.

With reference to the above, we have the pleasure to inform you that our **BOARD OF DIRECTORS** at their meeting held on **07.09.2002** have sanctioned you a term loan of **Rs. 500.00 lakhs** (Rupees Five Hundred lakhs only) ranking pari passu incharge with SBI and SBH for the balance term loan of Rs 250.00 lakhs each for setting up of a 4 MW Bio-mass based Co-generation power plant at K Savaram (V), Undrajavaram (M) West Godavari District, under SES Scheme subject to special terms & conditions annexed herewith, in addition to the standard terms and conditions as applicable to Limited Companies.

This letter is issued to you in duplicate together with two copies of the terms and conditions governing advances which form part of the terms of sanction. Kindly return one copy of this letter and terms & conditions both signed by you to our **ELURU BRANCH**, in token of your acceptance of the terms of sanction.

Please make arrangements for the submission of necessary papers to the Branch Office for scrutiny.

Alternatively, you may get the title examined by one of our panel Advocates at your cost and submit the papers to our Branch Office together with the unconditional legal opinion of the Advocate. However, such opinion of the Advocate shall be subject to the final acceptance by our Legal Officer.

Thanking you,

Yours faithfully,

GENERAL MANAGER (PROJECTS)

Encl : 1. Terms & Conditions in duplicate
2. Cost of Scheme & Means of Finance
3. Civil Estimates 4. List of Plant & Machinery 5. Erection cost estimates.

5-9-194, Chirag Ali Lane, P B No 165 HYDERABAD - 500 001
☎ (040) 3201398, 3201646, 3202547, 3202550 - 53
Fax (040) 3202972 e-mail apsfc@hd1.vsnl.net.in URL www.apsfc.com

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State Bank of Hyderabad
Tanuku Branch

Dt: 12-12-2002.

The Managing Director
Coastal Agro Industries
K.Savaram
Tanuku
W.G.Dt.,

Dear Sir,

Ref: Sanction of Term Loan and enhancement in your Working Capital limits.

- x -

Please refer your application seeking sanction of Term Loan for setting up 4MW Biomass based project and also enhancement in your existing Working Capital limits.

We have pleasure in advising that Bank has sanctioned the following facilities on the terms and conditions detailed here under as per enclosures.

Nature of Facility		Limit		Remarks
		Existing (Rs.in lacs)	Proposed (Rs.in lacs)	
A.	Cash Credit (Hyp)	200	225	Enhancement cum Renewal
	Sublimits within above limits			
	OD – Book Debts	(75)	(125)	
	OD- BCC	(50)	(50)	No Change
	DDP- Clean	(20)	(20)	No Change
B.	Term Loan – other lenders SBI and APSFC	-NIL-	250	For setting 4 MW Biomass based Power Project
C.	Bank Guarantee	20	20	No Change

Detailed Terms & Conditions for each facility are enclosed.

Please return the duplicate copy of the letter duly signed having accepted the terms and conditions and arrange to complete the documentation formalities at the earliest.

Yours faithfully

Chief Manager.

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State Bank of Hyderabad
Tanuku Branch

Annexure-1

TERMS & CONDITIONS

Facility : CASH CREDIT (HYP)

1. SECURITY:

a) Primary: Hypothecation of raw materials , stocks-in-process, finished goods, consumable spares, book debts and receivables.

b) Collateral :

i) Personal guarantee of the following Director/persons. (Rs. In lacs)

S.No.	Name	Net Worth	I.P.
1	Ch.K.Visweshawara Rao	85.73	(57.35)
2	Ch.Rama Krishna	40.00	(19.44)
3	Smt. Ch. Krishnaveni *	33.04	(21.24)

( ) She is not a director. However her personal guarantee is required since some properties offered as security are in her name.*

ii). Equitable Mortgage of Land / Building:

S.No	Standing in the name of	Particulars of security	Extent (Sq.yds)	Value (Rs.in lacs)	Date of Valuation
1	CH.K.Visweswara Rao	R.S.No.8/3 at K.Savaram D 2045	2424	5.09	22-2-01
2	-do-	R.S.No.8/8 at K.Savaram D 2038	3490	6.45	22-2-01
3	-do-	R.S.No.8/4 at K.Savaram D 2039	1212	2.42	11-7-02
4	-do-	Residential Bldg. Sajjapuram	933.32	30.76	22-2-01
5	Smt. Ch.Krishnaveni	2 shops at D.No. 33-50 , R.P.Road Tanuku	--	10.30	20-6-02
6	-do-	R.S.No.377/3, Tetali, D.No.3133	2520	5.09	20-6-02
7	-do-	R.S.No.377/3A, Tetali, D.No.4030	2520	3.82	20-6-02
8.	Additional security	To be furnished		35.00	
			Total:	98.93	

- *These securities are exclusive to our Bank and also extends to term loan of Rs 250 lacs sanctioned . Valuation & legal clearance of the additional collateral to be arranged before release of enhanced limits*

iii). Second Charge on all the present and future fixed assets of the company.
First charge ranking pari-passu with other lenders APSFC, SBI and SBH.

2. Storage and possession : In the borrower's own godowns or rented godowns within the company's premises in open or any other place of storage with the prior approval of Bank.

3. Basis of : As per market value, cost price or invoice price, valuation whichever is lower.In case of imported goods, the cost price will be inclusive of import duty paid.

4. Margin : Indigenous raw materials. }
Stocks-in-process. } 25%
Stores & spares. }
Finished goods. }
Book-debts (of age upto 90 days only) 50%

5. Insurance : Entire stocks, hypothecated to the Bank to be fully insured against all risks with Bank's interest clause and the policies to be retained with Bank.

6. Inspection : Monthly by FO/quarterly by Div.Mgr/halfyearly by Chief Mgr.

7. Submission of periodical statements: : a. Stock Statements } At monthly
b. Select Operational Data } intervals
c. FFR I & II : Quarterly / Halfyearly.

8. Repayment : CC(Hyp): On Demand.

9.Rate of interest:
Applicable to SBH-2 rating. Present being 1.75% above SBHPLR (. now 11.50%),i.e.,13.25% p.a. The same is subject to revision from time to time based on SBH PLR and also spreads as stipulated by Bank Interest will be charged at monthly rests as per RBI directives.

10. Penal Rate of Interest:
a) For delay in submission of stock statements - 1% on entire outstandings for the months the stock statement was not submitted)
b) For delay in submission of renewal data - 1% on entire outstandings beyond 3 months from the date the renewal has fallen due)
a) For irregularities in accounts -1% on the irregular portion of drawings in the account incl. devolvement of LCs, invocation of Bank Guarantees for p74riod of irregularity on the first 2 occasions not exceeding 60 days in a calender year and on the entire outstandings incl. WCDL for the period of irregularity on subsequent occasions OR if the irregularity is persistent i.e continuing beyond 60 days.

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

L
B

Coastal Agro Industries, Ltd.
4 MW Cogeneration Facility Using Biomass
P.B. No. 27, TANUKU – 534 211
West Godavari District, Andhra Pradesh
(Project Finance)

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1. Contact Information for the Prospective Borrower

	Name of Company	Coastal Agro Industries Ltd.
	Address	P. B. No. 27
	City, State, Province	Tanuku, West Godavari District, Andhra Pradesh 534 211
	Contact Name	Mr. Ch. K. Visweswara Rao, CMD
	Contact Phone	08819 24982/3/42
	Contact FAX	08819 24927
	Contact EMAIL	Coastalagro_tanuku@rediffmail.com

2. Availability of Financial Information on Borrower

	Audited financial statements available for last 3 fiscal years?	√	
	Audited financials being provided to LBG Washington?	√	
	Was firm in same general line of business for last 3 years?	√	
	Has firm reported operating profits AND net income during each of last 2 years?	√	

3. Borrower's Financial History (last three Fiscal Years)

Rs. Lakhs

	EBIDT	323.58	138.95	125.57
	EBIDT/Total Income	24.8%	17.21%	21.10%
	Operating Profit (OP)	224.44	13.43	36.21
	OP/TI	17.2%	1.66%	6.08%
	Net worth	998.08	370.22	358.79
	Equity	137.80	137.8	137.8
	EPS	11.93	0.83	2.34
	Major Capital Investments	35.00	11.61	336.98
	Debt:Equity ratio	1.86	1.97	2.15
	Current Ratio	1.37	3.08	2.88
	Depreciation/Amortization Expense	43.19	45.54	34.38
	Interest Exp	55.95	79.98	54.97

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4. Background information on all used and unused short and long-term debt

The company has taken loan from AP Industrial Development Corporation for modernization of equipment during the year 1998-99. It has been secured by equitable mortgage of land and buildings and hypothecation of plant and machinery. The company services the loan regularly. The company has availed of working capital loans from State Bank of Hyderabad. SBH has given a good rating to the company.

SECTION A: CLEAN ENERGY AND GHG MITIGATION EQUIPMENT FINANCE

Not Applicable

About the Equipment/Technology: Larger clean energy or GHG mitigating projects (Project Finance) may involve more than one type of environmental equipment. Complete sections A 5 through A 10 for each piece of relevant GHG mitigating equipment.

5. Description of technology/service to be purchased

NA

6. Description of the GHG mitigating potential of the technology

NA

7. **About the Business Negotiations**

NA

	Is the manufacturer of the technology a domestic company?		
	Is the manufacturer located overseas (exporter)?		
	Is the manufacturer a US company?		
	Have any price negotiations occurred?		
	Has a purchase order been submitted?		

How many units are in the Purchase Order? _____
What is the estimated unit cost of technology (US$)? _____
What is the total cost for the Purchase Order? _____

8. **Contact Information on the Manufacturer**

√	Name of Manufacturer	
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	

9. **About the Trade Financing (For Equipment Imported Into India)**

Is trade financing being sought for the import of the equipment to India? _____

What type of trade financing is being sought (insurance,guarantees, working capital?

_____

_____

10. **Has a domestic or overseas lender been identified?** _____

	Name of Lender	
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	

SECTION B: PROJECT FINANCE FOR CLEAN ENERGY AND GHG MITIGATION

Project Name: 4 MW biomass based cogeneration plant

Project Promoter: Coastal Agro Industries Ltd.

Special Purpose Vehicle: --

1. Executive Summary: Project at a Glance

Coastal Agro Industries Limited (CAIL) is a manufacturer of straw boards and kraft boards at K. Savaram village, Undrajavaram Mandal in West Godavarai District of Andhra Pradesh. The company has been in operation since 1981.

The company, in its processes, has a requirement for steam as well as power. Therefore, it has decided to set up a 4 MW co-generation project at the existing complex to meet process steam and electricity requirements. It plans to export excess power to the grid. The co-generation plant expects to generate 317 lakhs kwh power based on 24 hours by 330 days. Plant load factor is assumed to increase from 70% in first year to 80% in second year to 90% in third year and onwards. The plant will also provide 13 TPH of steam to the paper unit at a pressure of 6 kg/cm^{2}g. At present the company is drawing power from AP Transco and generating steam by burning coal.

The primary fuel will be rice paddy husk. The fuel requirement is estimated at 52,801 tons per annum based on a need for 160 tons per day for 4 MW generation and process steam. Risk husk is estimated to constitute 80% of the fuel requirement, with the balance made up of coal.

A Power Purchase and Wheeling Agreement was signed between the Transmission Corporation of Andhra Pradesh Limited (APTRANSCO) and M/s Coastal Agro Industries Limited, on 30th May, 2000. The negotiated price was Rs. 2.25 paise per unit escalating at 5% annually with 1997-98 being the base year. The PPA was applicable through 17 November, 2000. The prices will therefore have to be re-negotiated by the Government of A.P. and APERC.

---

2. **Project Costs**

			%
√	**Plant & Machinery**	1219.00	80.20
√	**Land & Building**	1.40	0.09
√	**Civil, detailed Eng.**	142.00	9.34
√	**Erection & Commissioning**		
√	**Preliminary & Preoperative Expenses**	112.00	7.37
√	**Working Capital Margin**	17.00	1.12
√	**Contingencies**	28.60	1.88
√	**Total Project Cost**	1520.00	

3. **Proposed Means of Financing**

√	**Total Debt Portion**	1064.00	70
√	**Total Equity Portion**	456.00	30
√	**Total Project Cost**	1520.00	

4. **Committed Financing (if any)**

a. **Committed Debt Providers**

Financial Inst	Amount in Debt	Rate	Tenor	Date of Commitment
State Bank of India (Lead)	500	14%	10 Years	
Other FIs & Banks	564	14%	10 Years	

b. **Committed Equity Providers**

Investment Institution	**Stake (in Rs. Lakhs)**	**Stake (as % of total equity)**
Promoters Equity & cash accruals	456.00	100%

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5. Estimates of Profitability

Rs. In Lakhs

	Yr1	Yr2	Yr3	[redacted]						
Revenue from power sale	610.03	715.20	820.38	820.38	820.38	820.38	820.38	820.38	820.38	
Other revenue										
Fuel cost	236.55	270.34	304.14	304.14	304.14	304.14	304.14	304.14	304.14	
O&M Cost	36.20	39.82	41.81	43.90	46.10	48.40	[redacted]	53.36	56.03	
Admn/selling cost	1.80	1.80	1.98	2.18	2.40	2.64	2.90	3.19	3.51	
PBIDT	335.48	403.24	472.45	470.16	467.75	465.20	462.52	459.69	456.70	
Depreciation	140.50	140.50	140.50	140.50	140.50	140.50	140.50	140.50	140.50	
Interest Term loan	159.60	158.18	139.65	116.85	94.05	71.25	48.45	25.65	4.28	
Working Cap	8.32	10.40	12.32	12.32	12.32	12.32	12.32	12.32	12.32	
Preliminary Expenses	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
PBT	26.56	93.67	179.48	199.99	220.37	240.63	260.75	280.72	299.10	
Provision for Tax	0.00	0.00	0.00	0.00	0.00	107.78	95.74	104.89	112.01	
PAT	26.56	93.67	179.48	199.99	220.37	132.85	165.01	175.83	187.09	
EPS	1.40	4.93	9.45	10.53	11.60	6.99	8.68	9.25	9.85	
Dividend	0.00	28.50	38.00	38.00	38.00	38.00	38.00	38.00	38.00	
Retained Profit	26.56	65.17	141.48	161.99	182.37	94.85	127.01	137.83	149.09	
Depreciation and Other Writeoffs	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	
Net Cash Flow	167.56	206.17	282.48	302.99	323.38	235.85	268.01	278.83	290.10	

6. Projected Cash Flow

Rs. In lakhs

	Yr1	Yr2	Yr3		Yr5					
Sources of Funds										
PAT	0.00	26.56	93.67	179.48	199.99	220.37	132.85	165.01	175.83	187.09
Depreciation	0.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00	141.00
Inc. in Equity capital	228.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inc. in term loans	1064.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inc. in bank borrowings	0.00	52.00	13.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00
Internal accruals	228.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total sources	1520.00	219.56	247.67	332.48	340.99	361.38	273.85	306.01	316.83	328.10
Application of funds										
Capital Expenditure	1498.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Preliminary Expenses	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inc. in Current Assets	0.00	69.00	17.00	17.00	0.00	0.00	0.00	0.00	0.00	0.00
Term loan repayment	0.00	0.00	81.43	162.86	162.86	162.86	162.86	162.86	162.86	81.43
Taxes										
Dividend	0.00	0.00	28.50	38.00	38.00	38.00	38.00	38.00	38.00	38.00
Total Application	1503.00	69.00	126.93	217.86	200.86	200.86	200.86	200.86	200.86	119.43
Net Surplus	17.00	150.56	120.74	114.62	140.13	160.52	72.99	105.15	115.97	208.67
IRR	20.80%									
DSCR	2.05	1.64	1.52	1.64	1.77	1.47	1.68	1.82	3.88	1.77
Av DSCR	1.77									

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7. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame. The Company is in advanced stage of negotiations with State Bank of India for the term loan. Though this is a project that qualifies for assistance from IREDA as a renewable energy based power generation plant, IREDA informed that its overall exposure to the state of AP was high and hence it has stopped considering any more projects from AP for the time being. The project is in advanced stage of financial closure.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations. No.

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission. The company is interested in availing of funds in lieu of the carbon offsets generated by the project. It is discussing the same with key GOI ministries of MNES and MOEF. However, there is no such fund available at the moment. It is keen to build in the structure to satisfy the needs of prospective market based mechanism.

---

8. Project Promoter Contact Information

√		
√	Name of Project Promoter	Coastal Agro Industries, Ltd.
√	Address	P.B. No. 27
√	City, State, Province	Tanuku, 534 211 West Godavari , Andhra Pradesh
√	Contact Name	Shri CH.K Visveswara Rao
√	Contact Phone	08819-24982, 24983, 24984
	Contact FAX	08819-24927
	Contact EMAIL	Coastalagro_tanuku@rediffmail.com

9. Project Management Team

√	Shri CH.K Visveswara Rao	**Chairman & Managing Director**
√	Shri CH. Rama Krishna	**Executive Director**

10. Project Promoter Financial History

√		
√	What were profitability figures last 3 years?	Net Profit after Tax (Rs Lakhs): **2001**: 166.35 **2000**: 11.43 **1999**: 32.22
√	Book value of firm?	Rs. 38.94 per share as on March 31, 2001
√	EPS for 3 years?	(2001) Rs.12.07; (2000) Rs. 0.82; (1999) Rs 2.33
√	What is current business?	Straw Board and Kraft Board Manufacturing
√	What are synergies between business and this project?	Many of the suppliers of straw for board manufacturing also will source the rice paddy husk.

11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

Company has been in operation since 1981 and has worked with rice straw suppliers in the area. Sri Visveswara Rao has over 30 years experience in the oil industry as well as straw and paper board industry. He was one of the promoters of Gouthami Solvents Limited, Tanuku, who promoted the first co-generation project in Andhra Pradesh. The company shall hire experienced personnel to operate the cogeneration plant.

12. Special Purpose Vehicle Contact Information (If applicable):

√		
	Name of SPV	NA
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	
	Names and shares of the promoters	
	Is a Shareholding agreement in place	
	Salient terms	

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13. Project Details

√		
√	Greenfield project or involves existing equipment?	Addition of cogeneration system to existing strawboard and kraft board manufacturing operations
√	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Both. Clean Energy Generation and Biomass Management (methane emission reduction)
√	Size of Project (MW)?	4 MW
√	Project Location? City, Province	Tanuku, West Godarvi District, Andhra Pradesh
√	Off or on-grid?	On-grid
√	State Electricity Board?	Transmission Corporation of Andhra Pradesh Limited
√	Technology?	Cogeneration of power and steam using biomass
√	Type of Fuel?	Paddy Husk
√	Source of fuel supply?	Local Rice Mills

14. Feasibility Details

√		
√	Was Feasibility Study prepared independently?	Yes
√	What firm prepared the Feasibility Study? List address and contact details	**Zenith Corporate Services (P) Ltd.** Mr. A. Mohan Reddy, Director 1-5-6/B, My Home Plaza, Masab Tank Hyderabad 500 028

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15. Background on the Power Purchase Agreement (if Applicable)

√	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes a PP cum Wheeling Agreement
√	Has the PPA been signed? (Yes or No)	Yes
√	Nature of Agreement? Take or Pay? Other?	Purchase of surplus energy
√	Name of state electricity board or primary PPA signatory?	APTRANSCO
√	What date was the PPA signed?	30, May, 2000
√	When does it enter into force?	Immediate
√	What is the length of the PPA? (Years)	20 years
√	What is the initial purchase price?	Rs. 2.25 paise per unit based on 1997-8 base year
√	What is the annual % increase in purchase price?	5%
√	Can the project sell power directly to major consumers? (Yes or No)	Yes
√	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	None. As the amount of energy purchased is variable over each billing period.
√	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	TRANSCO is to purchase only the surplus energy. The delayed payments shall attract interest @ 14% p.a.
√	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	FM clauses not included in the agreement.
√	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	MNES notified method as adapted by the AP State Govt.
√	Have the provisions for change in law, termination, liquidated damages, etc. been approved by existing lenders/investors?	No provisions
√	Would the SEB/generating utility want a share in the ownership of carbon offsets?	Not discussed yet

16. Other Agreements (where applicable)

√	Fuel supply agreement signed?	Yes, with rice millers for supply of rice husk
√	Water/utility supply agreement signed?	NA
√	Shareholder's agreement been entered into between existing equity holders?	NA
√	Special provisions of above agreements?	NA

17. Quantify and Describe Risks

√	Market?	Low to medium	AP state is in deficit in power supply (peak deficit of 13%, energy deficit of 7.8%[8]). The per capita electricity consumption in the Southern region has grown at a CAGR of 9.1% p.a. in the last 12 years. The only risk is in the event of non availability of the raw material due to drought etc.
√	Country/Sovereign?	Low	India has opened its economy in the last decade and has made its laws and institutions as per international standards. The sovereign risks for this project are especially low as the state of AP is among the most proactive states.
√	Regulatory?	Low	AP Electricity Regulatory Commission has been set up two years ago and is functioning properly.
√	Contract/counter party	Low	The Contract with AP TRANSCO has no unsatisfactory terms. The same is being firmed up.
√	Construction?	Low	Site location already owned.
√	Technology?	Low	Known Technology
√	Management?	Low	Experienced entrepreneurs
√	Enforceability of Contracts?	Low	Many similar contracts have been in operation and the AP TRANSCO has been honouring them. In addition, thie revenue depends marginally on the AP TRANSCO payments as the promoters may develop

			additional consumers in case there is a delay in payments from APTRANSCO
√	Competition?	Low	AP State being deficit in power and the per capita consumption rising, the size of market is large enough to allow the current and projected competition.
√	Exit?	Low	The capital markets, M&A practices and Company's Act and other relevant statutes are well developed and many such transactions take place in the country.

Annual Report of the Working of SEBs Planning Commission, GOI June 2001

18. For risks identified in section 14, discuss Mitigation/Coverage measures

√	Market?	The equipment selected allows use of a variety of fuel stocks and thereby use of alternate raw materials in the event of non-availability of rice husk.
√	Country/Sovereign?	--
√	Regulatory?	--
√	Contract/counter party	--
√	Construction?	--
√	Technology?	--
√	Management?	--
√	Enforceability of Contracts?	--
√	Competition?	--
√	Exit?	--

SECTION C: CARBON COMPONENT.

Checklists were adapted from a variety of sources including Natsource, LLC

1. GHG Mitigation Applicability Macro Checklist

√		Yes	No
√	Does project generate real, measurable, long-term, additional and verifiable emissions reductions vis-à-vis current baseline alternatives?	√	
√	Are there sustainable development benefits such as increased employment and protecting biodiversity?	√	
√	Does the project rely on ODA from Annex B Countries?		√
√	Has the project received host country approval? **		√
√	Does project meet size definition for Bonn Fast Track CDM? --under 15 MW for renewables projects --under <15 gigawatthours/year savings for energy efficiency projects --under15 kilotonnes CO2E for emissions reductions from process changes	√	

** Promoters have discussed the project with MNES and MOEF and both are positively inclined.

2. Emission Reduction Calculations, Monitoring and Verification Checklist

√		Yes	No
√	Does the project involve a discrete reduction of emissions?	√	
√	Have the emissions reductions been estimated with an accepted methodology?	√	
√	Has a monitoring methodology been established?		√
√	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
√	Has clear ownership of emissions reductions been determined and documented?		√

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3. Carbon accounting details

	Parameter	Particulars
1	Baseline methodology	The project is supplying power to the AP TRANSCO which is well integrated with the Southern Grid and therefore is the project boundary. The supply to users in southern grid is comprised of 72% thermal, 27% Hydel and rest nuclear. The emission factor of the supply in AP is 18.9 tC/TJ based on the sub bituminous coal as the major fuel stock. For the Steam provided to the paper plant the baseline is coal since it is the primary fuel used.
2	Baseline Emissions -Power exported to grid	23,305 tCO2 per year
3	Project Emissions TCO2	0 t CO2 per year
4	Emission reductions TCO2 (2-3)	23,305 tCO2 per year

APPENDIX B

By hand

पावर फाइनेंस कारपोरेशन लिमिटेड
POWER FINANCE CORPORATION LTD.
(भारत सरकार का उपक्रम) (A Govt. of India Undertaking)

Loan No. G0701001

No.PD/SR/GCPL

September 04, 2002.

Mr. V.K.Agrawal
Chairman
Globe Cogeneration Power Limited
201,T.V.Industrial Estate,
Worli, Mumbai – 400 025

Sub: Financial assistance for M/s Globe Cogeneration Power Limited (GCPL) for 45 MW (site) bagasse based cogeneration power plant to be set up in Belgaum district of Karnataka

Ref: (i) M/s GCPL's letter dated 05.12.2001 to PFC seeking financial assistance from PFC.
(ii) PFC's letter dated 30.05.2002 to M/s GCPL intimating shortlisting of the project by PFC for detailed appraisal

Dear Sir,

With reference to your application for financial assistance vide letter cited at reference above and further correspondences and discussions you had with us for setting up 45 MW (site) bagasse based cogeneration power plant in Belgaum district of Karnataka, we are pleased to inform that Power Finance Corporation Ltd. is agreeable, in principle, to provide to M/s GCPL a rupee term loan of Rs. 75.25 crores(including Rs. 3.85 crores on account of sugar mill modernisation works) on the following terms and conditions:

1. The above said facilities are subject to the terms and conditions and General conditions placed at ***Annexure-A*** and the Special terms and Conditions placed at ***Annexure –B*** which are deemed to be a part of this letter of sanction.

2. The loan shall be repaid in 32 equal quarterly instalments. The first repayment shall fall due on the standard date of PFC falling immediately after the completion of six months from the scheduled date of commissioning of the project. The scheduled date of commissioning will be stipulated in the loan agreement.

3. M/s GCPL shall enter into a loan agreement with PFC in the format enclosed at ***Annexure-C***.

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पावर फाइनेंस कारपोरेशन लिमिटेड
POWER FINANCE CORPORATION LTD.
(भारत सरकार का उपक्रम) (A Govt. of India Undertaking)

Loan No. G0701001

4. In case the terms and conditions are acceptable to you, you may furnish to us within 30 days of receipt of this letter two certified copies of the resolutions duly passed by the Board of Directors of your Company as per the Performa in *Annexure-D*.

5. Your attention is also invited to *Annexure-E* of this letter which lists the various documents that are required to be submitted by you in connection with the said financial assistance.

6. This communication not in any way be construed as giving rise to any binding obligation on the part of PFC unless M/s GCPL communicates to PFC within 30 days from the date of receipt of this letter that the terms and conditions set out herein are acceptable to it and unless the Loan Agreement and the Guarantee Agreement and other documents relating to the above assistance are executed by M/s GCPL in such form as may be required by PFC within six months from the date of this letter or such further time as may be allowed by PFC in its absolute discretion.

   One set of formats for (I) undertaking for non-disposal of shareholding ,(ii) deed of corporate guarantee and (iii) declaration in the matter of mortgage /hypothecation are also enclosed at *Appendix-F*.

Meanwhile kindly acknowledge the receipt of this letter.

Thanking you,

Yours sincerely,

(Mohan Lal) 04/09/2002
Manager (PA-SR) & State Co-ordinator (Karnataka)

Copy for information to:

1. The Principal Secretary to Government of Karnataka ,Energy Department, M.S.Building ,6th Floor, Bangalore-560001
2. Chairman , KPTCL, Cauvery Bhawan, Bangalore-560009
3. Chairman,KREDL, Queen's Road,Bangalore-560052
4. GM(L&D),PFC—alongwith a copy of terms and conditions
5. GM(LD&R),PFC—alongwith a copy of terms and conditions
6. AGM(P&FO),PFC—alongwith a copy of terms and conditions
7. AGM(IAD),PFC
8. AGM(CMIS),PFC

पंजीकृत कार्यालय : चन्द्रलोक, 36, जनपथ, नई दिल्ली-110001 दूरभाष : 3722301-08 तार : पोफीकोरप फैक्स : 011-3315822
Regd. Office : Chandra Lok, 36, Janpath, New Delhi-110001 Phones : 3722301-08 Grams : POFICORP Fax : 011-3315822
वैबसाईट / Website : www.pfcindia.com

GLOBE COGENERATION POWER LIMITED

201, T. V. Industrial Estate, Worli, Mumbai - 400 025.
Tel. 2496 4767 / 2496 5132 • Fax : 0091-22-2498 4154
E-mail : trimbak@bom3.vsnl.net.in

Date : 30th June, 2003

Mr. Vinay Deodhar
Project Finance Specialist,
The Louis Berger Group Inc.
C-6/7, Safdarjung Development Area,
New Delhi – 110 016.

Reg. : 45 MW Cogeneration Power Project at Sankeshwar

Dear Sir,

This is in continuation of on going correspondences in connection with seeking assistances of you for achieving financial closure, we are pleased to inform you that Power Finance Corporation Limited has already sanctioned Rs. 75.25 crores as term loan vide their sanction letter dated 5th September, 2002.

The balance finance requirement is as under :

1.	Term Loan	Rs. 30.25 crores
2.	Equity (private placement)	Rs. 20.00 crores

Further, recall personal discussion had in our office on 28th April, 2003 regarding the possibilities of arranging an international investor for CDM benefits.

We are enclosing herewith the project profile, present status of the project and power finance sanction letter for your ready perusal and further needful action in the matter.

Looking forward to hear from you at the earliest.

Thanking you,

Yours sincerely,
For **Globe Cogeneration Power Ltd.**

Anil Bhattar
Finance Manager

Encl. : As above.

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vinay deodhar

From: "Trimbak" <trimbak@bom3.vsnl.net.in>
To: "Vinay Deodhar" <vdeodhar.gep@vsnl.net>
Sent: Saturday, May 03, 2003 12:21 AM
Attach: status-project.doc

Dear Mr. Deodhar,

We are in receipt of your mail dated may 01, 2003 seeking details of our project as per the discussion had in our office on 28th April, 2003. First of all, on behalf of our Chairman, we thank you for visiting our office and reviving the matter after a long gap of nearly one year.

As per the personal discussion we had, you have asked for the present status of the project in terms of finance, project implementation and CDM. The same is elaborated hereunder :

1. **FINANCE**

As you are aware that our project is of 45 MW and the cost of project is Rs. 150.50 Cr. Detailed Project Report (DPR) and relevant documents of our project as submitted to the institutions (sent to you earlier) are with you. The financing pattern of the project as per Power Finance Corporation, which is lead institution in our case, is as under :

A.	Equity	30%	45.00 Cr.
B.	Term Loan	70%	105.50 Cr.

We are required to bring 100% equity up front before seeking any disbursement of term loan from PFC and other banks. Out of Term Loan requirement of Rs. 105.50 Cr., PFC has already sanctioned Term Loan of Rs. 75.25 Cr. (50% of the total cost of project). The balance term loan requirement of Rs. 30.25 Cr. is in the process of tie-up.

2. **PROJECT**

Present status of project is attached herewith. You would observe from the same that we have already obtained all the permission and approval for implementation of project.

3. **CDM**

The project is eligible for CDM benefits in terms of Kyoto Protocol. Though, we have received few offers from international consultants to render services in this regard, the same is still in the stage of exploration and we have not done significant work in this matter.

4. **FINANCIAL ASSISTANCE**

As discussed with you in our office, we may look forward for your assistance in the following matter :

A. Equity Participation: We shall be retaining minimum 51% of the equity and balance 49% i.e. Rs. 22 cr. may be offered to the investor, who may be interested in our project for any reason, commercial or investment or CDM purpose.

B. Borrowings: Gap of term loan can be met through sourcing funds from various development institutions such as USAID, UNDP or any other institutions (as may be suggested and approached by you in this regard) extending cheaper/subsidised term loan funds or grants to reduce the overall outflow on account of interest. We may also look forward for external commercial borrowing, which is at present cheaper than Indian Term Loans.

We hope that above would be sufficient to meet your requirement for achieving the objectives as discussed.

Looking forward to hear from you soon.

With best regards,

Anil Bhattar
Finance Manager
Globe Cogeneration Power Ltd.

5.5.2003

STATUS OF CLEARANCES / PERMISSIONS

We have obtained all the permissions and approvals as required for implementation of the project. We have also appointed EPC Contractor after floating Global Tender for selection of EPC Contractor. All the major plant and equipment have been finalised and LOIs have been issued to the respective reputed vendors through EPC Contractor. The following activities have been completed as on date :

Sl. No.	APPROVALS AND LICENCES	RELEVANT PARTY	STATUS
1	Formation of Company as Special Purpose Vehicle	Registrar of Companies	Completed
2	Entering into Project Development Agreement (PDA) with M/s. Shri Hiranyakeshi Sahakari Sakkare Karkhana Niyamit, Sankeshwar	Sugar Mill	Completed
3	Entering into and Registration of Land Lease Agreement with Shri Hiranyakeshi Sahakari Sakkare Karkhana Niyamit, Sankeshwar	Land Revenue Authorities	Completed
4	NOC (In-principle Clearance) from Government of Karnataka	Govt. of Karnataka	Obtained
5	Compliance under Section 18A of Indian Electricity (Supply) Act, 1910	Govt. of Karnataka	Completed
6	Sanction from Irrigation Department, Government of Karnataka for lifting of required quantity of water in favour of sugar mill	Govt. of Karnataka	Obtained
7	Entering into Power Purchase Agreement with Karnataka Power Transmission Corporation Limited	KPTCL	Completed
8	Approval from Karnataka Electricity Regulatory Commission for Power Purchase Agreement	KERC	Obtained
9	Evacuation permission from Karnataka Power Transmission Corporation Limited for evacuation of power from Power Plant to KPTCL Sub-station at Sankeshwar	KPTCL	Obtained
10	Preparation and submission of Rapid "Environment Impact Assessment (EIA)" Report to Karnataka State Pollution Control Board	KSPBC	Completed
11	Holding of public hearing for obtaining Environment Clearance	KSPBC	Completed
12	"Consent to Establish" from Karnataka State Pollution Control Board	KSPBC	Obtained
13	Obtaining "NOC" from Forest Department	Local Forest Office	Obtained

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Sl. No.	APPROVALS AND LICENCES	RELEVANT PARTY	STATUS
14	Approval from "Ministry of Environment & Forest"	MOEF	Expected Shortly
15	NOC from Airport Authorities of India	AAI	Letter Awaited
16	Appointment of M/s Development Consultants Pvt. Ltd. as Owner's Engineer Cum Project Consultant	DCPL	Completed
17	Floating Global Tender for selection of EPC Contractor	--	Completed
18	Tender Evaluation and selection of EPC Contractor	DCPL	Completed
19	Appointment of M/s UB Engineering Ltd., as EPC Contractor on fixed price basis	UBEL	Completed
20	Selection and finalisation of main plant & equipment vendor and placement of LOIs	Various	Completed
21	Obtaining "Final Sanction" from Power Finance Corporation Limited for financing 50% of the cost of project (70% of the debt)	PFC	Obtained

As per above, you would observe that the Company has already obtained all the permissions and approvals for implementation of the said power project except clearance from Ministry of Environment and Forest (MOEF). Necessary application in this regard has already been submitted to MOEF and the approval is expected in a short period, as the Company has already obtained the key approval of Karnataka State Pollution Control Board (KSPCB).

Detailed Project Report (DPR) Worksheet

For GHG mitigating projects under
USAID's Greenhouse Gas Pollution Prevention Project – Climate Change Supplement

Managed by The Louis Berger Group, Inc.

L
B

GLOBE COGENERATION POWER LIMITED (GCPL)
Sankewshwar, Balgaum, Karnataka
(Project Finance)

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1. Contact Information for the Prospective Borrower

	Name of Company	Globe Cogeneration Power Limited
	Address	201/202 T. V. Industrial Estate, Worli
	City, State, Province	Mumbai, Maharashtra, India
	Contact Name	Anil Bhattar, Finance Manager
	Contact Phone	+91 22 496 4767
	Contact FAX	498 4154
	Contact EMAIL	trimbak@bom3.vsnl.net.in

2. Availability of Financial Information on Borrower

	Audited financial statements available for last 3 fiscal years?		
	Audited financials being provided to LBG Washington?		
	Was firm in same general line of business for last 3 years?		
	Has firm reported operating profits AND net income during each of last 2 years?		

3. Borrower's Financial History (last three Fiscal Years)

NA Since it is a new company

	EBIDT			
	EBIDT/Total Income			
	Operating Profit (OP)			
	OP/TI			
	Net worth			
	Equity			
	EPS			
	Dividend			
	Major Capital Investments			
	Debt:Equity ratio			
	Fixed Asset Coverage Ratio			
	Current Ratio			
	Credit Rating by Lead FI/Bank			
	Depreciation/Amortization Expense			

	Interest Expense			
	Current maturity of LTD			

4. Background information on all used and unused short and long-term debt

NA

SECTION A: CLEAN ENERGY AND GHG MITIGATION EQUIPMENT FINANCE

About the Equipment/Technology: Larger clean energy or GHG mitigating projects (Project Finance) may involve more than one type of environmental equipment. Complete sections A 5 through A 10 for each piece of relevant GHG mitigating equipment.

5. Description of technology/service to be purchased

NA

6. Description of the GHG mitigating potential of the technology

The Proposed project would utilize bagasse as fuel for most part of the year. Bagasse is an agro residue that is generated sustainably in sugar cane production of sugar. Thus, it is a renewable source of energy and does not lead to additional emission of carbon dioxide The Company will procure bagasse from the host sugar mill under the proposed agreement with them during the season. During the off-season period, the company shall utilize bagasse saved by incorporating energy efficiency measures in the mill, procured from other mills nearby and also on other biomass such as cane trash and other crop residues. In other words the company shall make efforts to run the power plant on renewable fuels for most part of the year.

7. About the Business Negotiations

	Is the manufacturer of the technology a domestic company?		
	Is the manufacturer located overseas (exporter)?		
	Is the manufacturer a US company?		
	Have any price negotiations occurred?		
	Has a purchase order been submitted?		

How many units are in the Purchase Order? _____
What is the estimated unit cost of technology (US$)? _____
What is the total cost for the Purchase Order? _____

8. Contact Information on the Manufacturer

√	Name of Manufacturer	
	Address	
	City, State, Province	
	Contact Name	
	Contact Phone	
	Contact FAX	
	Contact EMAIL	

9. About the Trade Financing (For Equipment Imported Into India)

Is trade financing being sought for the import of the equipment to India? _____

What type of trade financing is being sought (insurance,guarantees, working capital?

_____

_____

10. Has a domestic or overseas lender been identified? _____

	Name of Lender	Power Finance Corporation Ltd.
	Address	36, Chandralok, Janpath
	City, State, Province	New Delhi India
	Contact Name	Mr. D. Ravi, AGM
	Contact Phone	+91 11 372 1103
	Contact FAX	331 5822
	Contact EMAIL	dravi@pfc.delhi.nic.in

SECTION B: PROJECT FINANCE FOR CLEAN ENERGY AND GHG MITIGATION

Project Name: 45 MW Bagasse Based Cogeneration Power Project at M/S Shri Hiranyakeshi Sahakari Sakkare Karkhane Niyamit, Sankeshwar, Belgaum, Karnataka

Project Promoter(s): Mr. V.K. Agrawal & Associates

Mr. M.S. Dewan & Associates

Special Purpose Vehicle: Globe Cogeneration Power Limited (GCPL)

Shri Hirenyakeshi Sahakari Sakkare Karkhane Niyamit (SHSSKN) is a sugar mill in Sankeshwar, Belgaum District, at a distance of 45 kms from Belgaum, Karnataka State. The sugar mill, created in 1956, has installed capacity for 5000 Tons Crushed per Day (TCD).

Globe Cogeneration Power Limited (GCPL) proposes to develop a 45MW co-generation plant at the facility. GCPL is a special purpose vehicle established by Mr. V.K. Agrawal (& associates) and Mr. M.S. Dewan (& associates). Mr. Agrawal is the Chairman of the Trimbak Group which was established in 1990 and has operations in the following industries: textiles, power, non-ferrous metals, exports, real estate, finance and investments. The Trimbak Group's net worth is more than US $ 10 million. Mr. Dewan is Chairman of The Globe Group, established in 1962, which has an annual turnover of US$ 100 million. The Globe group's net worth is more than US$ 20 million. GCPL is being promoted by Mssrs. Agrawal and Dewan as individuals, and not through their respective firms.

GCPL has entered into a Power Purchase Agreement (PPA) with Karnataka Power Transmission Corporate Limited (KPTCL) on 7th September 2001. The same is has also been approved by Karnataka Electricity Regulatory Commission (KERC). KPTCL has agreed to pay GCPL a tariff of Rs. 2.25 per kilowatt-hour for the base year 1994-95, with an escalation rate of 5% per annum, for the first 10 years from the date of commencement of commercial operation by the Power Plant. Based on this the tariff applicable to GCPL the financial year 2003-04 is Rs.3.49 per kilowatt-hour.

GCPL has entered into a Project Development Agreement (PDA) with the host sugar mill, on 18 October 2000. In that agreement, GCPL will provide the host sugar mill with free power and steam supply for the sugar mill process. Additionally, the sugar mill will receive a royalty of 6% of energy export revenue during season and 2% of the export during the off-season. GCPL will operate the co-generation plant on a BOOT basis for a period of 20 years, after which it will be transferred to the sugar mill. During the operating phase of the PDA, the sugar mill will provide GCPL with 40 acres of land, all of the mill-generated bagasse, return steam condensate, access to ash and effluent discharge system and water.

The project developers enlisted a consulting firm to perform a technology feasibility study of the different technology options. The firm advised that "double extraction cum condensing turbine" to provide sugar process steam and "in-house" and "exportable" power during the cane season would be the optimum option for GCPL. The turbine could then be used as "straight through condensing turbine" during the off-season (non-crushing season) and not generate any backpressure steam.

The project developers propose that the 45 MW cogeneration power plant will mainly utilize bagasse, cane trash and other agro residues during the season (approximately 240 days) and for off-season period of 90 days. However, to meet any contingency in meeting availability requirements under the PPA, and/or availability of these residues (possibility of which is very remote), during the 90 days of off-season, they propose to rely on imported coal.

---

2. Project Costs

√				
√	**Land & Building**	40,000,000	$ 869,565	2.2%
√	**Civil Works**	175,000,000	$3,804,347	9.7%
√	**Plant & Machinery**	1,000,000,000	$21,739,130	55.2%
√	**Misc. Fixed Assets**	90,000,000	$1,956,521	4.9%
√	**Preliminary & Preoperative Expenses**	300,000,000	$6,521,739	16.6%
√	**Contingencies**	161,000,000	$3,500,000	8.9%
√	**Working Capital Margin**	44,000,000	$956,521	2.4%
√	**Total Project Cost**	1,810,000,000	$39,347,826	100%

3. Proposed Means of Financing

√				%
√	**Total Debt Portion**	1,279,000,000	$27,804,347	70.6%
√	**Total Equity Portion**	450,000,000	$9,782,608	24.8%
√	**Total Subsidy**	81,000,000	$1,760,869	4.5%
√	**Total Project Cost**	1,810,000,000	$39,347,826	100%

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4. Committed Financing (if any)

a. Committed Debt Providers

Under negotiations

[redacted]				Date of Commitment

b. Committed Equity Providers

[redacted]			
V.K. Agrawal and Associates (Trimbak)	119,500,000	$ 2,597,826	26.55%
M.S. Dewan & Associates (Globe)	70,000,000	$ 1,521,739	15.55%
Govt of Karnataka	40,500,000	$ 880,434	9.00%
Subtotal	230,000,000	$ 5,000,000	51.11%
Outsiders	220,000,000	$ 4,782,608	48.89%
Total Equity	450,000,000	$ 9,782,608	100.00%
MNES Capital Subsidy	81,000,000		

Government of Karnataka providing a Rs 405 Lacs grant. GOK has policy that cogeneration power is eligible for RS 25 Lac/MW of exportable surplus. [1]

[1] DPR, Section 14.2.2 Incentives & Grants, Page 123

5. Estimates of Profitability (rupees lakhs)

	Yr1	Yr2	[redacted]							
Revenue from power sale	6132.37	6868.25	7662.39	8518.78	8944.72	9391.95	9861.55	10354.63	10872.36	11415.98
Other revenue	0	0	0	0	0	0	0	0	0	0
Fuel (Raw Material) cost	1428.12	1592.06	1768.82	1959.28	2057.25	2160.11	2268.12	2381.52	2500.60	2625.63
O&M Cost	589.94	627.60	667.55	710.00	744.72	782.14	[redacted]	865.92	912.79	963.37
Admin/selling cost	105.38	113.14	121.54	130.63	140.49	151.16	162.73	175.29	188.91	203.70
PBIDT	4008.93	4535.45	5104.49	5718.89	6002.26	6298.54	6608.24	6931.90	7270.06	7623.28
Depreciation	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92
Interest Term loan	1790.60	1790.60	1734.64	1510.82	1286.99	1063.17	839.34	615.52	391.69	167.87
Working Capital Loan	209.23	230.60	253.58	278.27	292.07	306.57	321.78	337.76	354.54	372.16
PBT	484.28	960.04	1530.34	2309.68	2786.06	3273.81	3773.37	4285.18	4809.71	5347.43
Provision for Tax	36.32	72.00	114.78	173.23	208.95	245.54	283.00	321.39	360.73	401.06
PAT	447.96	888.04	1415.57	2136.45	2577.11	3028.27	3490.36	3963.79	4448.98	4946.37
Dividend (%)	8%	15%	20%	25%	30%	30%	30%	30%	30%	30%
Dividend (incl.tax at 10%)	371.25	742.50	990.00	1237.50	1485.00	1485.00	1485.00	1485.00	1485.00	1485.00
Net Cash Flow	76.71	145.54	425.57	898.95	1092.11	1543.27	2005.36	2478.79	2963.98	3461.37

6. Projected Cash Flow

	Year									
Sources of Funds										
PBT	484.28	960.04	1530.34	2309.68	2786.06	3273.81	3773.37	4285.18	4809.71	5347.43
Depreciation	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92	1279.92
Equity capital	4500									
Term loans	12790.00									
Working Capital	1307.67	133.58	143.62	154.33	86.27	90.58	95.11	99.87	104.86	110.10
Grants/Aid/Assistance	810.00									
Total sources	**21171.88**	**2373.54**	**2953.88**	**3743.93**	**4152.25**	**4644.32**	**5148.40**	**5664.97**	**6194.49**	**6737.45**
Application of funds										
Capital Expenditure	17660.00									
Inc. in Current Assets	1743.56	178.10	191.49	205.77	115.03	120.78	126.82	133.16	139.81	146.80
Term loan repayment	0	0	1598.75	1598.75	1598.75	1598.75	1598.75	1598.75	1598.75	1598.75
Taxes	36.32	72.00	114.78	173.23	208.95	245.54	283.00	321.39	360.73	401.06
Dividend	371.25	742.50	990.00	1237.50	1485.00	1485.00	1485.00	1485.00	1485.00	1485.00
Total Application	**19811.13**	**992.60**	**2895.01**	**3215.25**	**3407.73**	**3450.06**	**3493.57**	**3538.29**	**3584.29**	**3631.61**
Net Surplus	1360.75	1380.94	58.87	528.68	744.52	1194.25	1654.83	2126.67	2610.20	3105.84
IRR (pretax)	15.79%									
IRR (PAT)	33.25%									
DSCR	1.96	2.21	1.33	1.58	1.78	2.02	2.30	2.65	3.07	3.62
Av DSCR	2.14									

7. **Status of Finance Negotiations**

Are you in negotiations with any prospective debt providers? If yes, please specify and elaborate on expected time frame.

The promoters are in dialogue with few Indian lenders like Power Finance Corporation (PFC), IDFC, Andhra Bank, IREDA etc. the expected timeframe for obtaining commitment would be 2 to 3 months.

Do you plan to submit this project to a private venture capital firm or an international equity organization (e.g. REEF)? If yes identify specific fund and elaborate on negotiations.

The Project promoters are interested in discussing the project with suitable funds including REEF and other renewable energy funds.

Do you plan to submit this project to an international tender for carbon emissions reductions (e.g. Oregon Climate Trust)? If yes, please specify tender and closing date for submission.

No

8. Project Promoter Contact Information (See Section 12 for SPV if applicable)

√		
√	Name of Project Promoter	Mr. V.K. Agrawal & Associates
√	Address	201, T.V. Industrial Estate
√	City, State, Province	Worli, Mumbai – 400 025
√	Contact Name	Mr. V.K. Agrawal, Chairman
√	Contact Phone	91-22-496-4767
√	Contact FAX	91-22-498-4154
√	Contact EMAIL	trimbak@bom3.vsnl.net.in

9. Project Management Team

√	Mr. V.K. Agrawal	Chairman of Trimbak Group
√	Mr. Vineet Agrawal	Director
√	Mr. M.S. Dewan	Director
√	Mr. Sanjay Jain	Director
√	Mr. S.B. Jijina	Director

10. Project Promoter(s) Financial History

√		
√	Project Promoter	Mr. V.K. Agrawal & Associates
√	What were profitability figures last 3 years?	Personal Net worth of Shri V. K. Agrawal is Rs 18.00 Crores, as of 31, March 2001

√		
√	Project Promoter	Mr. M.S. Dewan & Associates
√	What were profitability figures last 3 years?	Personal Net Worth of Mr. Dewan is Rs. 50 crorers.

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11. Project Promoter Relevant Experience:

Briefly describe the relevant experience, if any, possessed by the project promoter. Has the promoter developed similar projects?

This is the first tangible investment by both Mssrs. Agrawal and Dewan in the power sector. While both project promoters have other business interests, they do not have a proven track record in energy production in general, or co-generation in specific.

According to the DPR, Globe Cogeneration has signed a Project Development Agreement (PDA) with two other sugar mills for co-generation projects. These include: M/S Ajinkyatara SSKL, Satara, Maharashtra (30MW Plant); and M/S Hirenyakeshi SSKN, Sankeshwar, Karnataka (45 MW Plant).

GCPL has already obtained all the approvals for the project and is engaged in implementation of the same. They have retained service of M/s Development Consulting Ltd., as affiliate of Kuljian Corporation of Philadelphia, US as its engineers cum consultant. DCL possesses experience in power consultancy over 50 years and has a strength of 900 persons in India.

12. Special Purpose Vehicle Contact Information (If applicable):

√	Name of SPV	Globe Co-Generation Power Limited
√	Address	201, T.V. Industrial Estate
√	City, State, Province	Worli, Mumbai – 400 025
√	Contact Name	Mr. V.K. Agrawal, Chairman
√	Contact Phone	91-22-496-4767
√	Contact FAX	91-22-498-4154
√	Contact EMAIL	trimbak@bom3.vsnl.net.in
√	Names and shares of the promoters	V.K. Agrawal & Associates (%) M.S. Dewan & Associates (%)
√	Is a Shareholding agreement in place	Under formulation

13. Project Details

√	Greenfield project or involves existing equipment?	New construction of co-generation plant at existing sugar mill site
√	Is GHG mitigation achieved by Process Improvement or Clean Energy Generation?	Clean Energy Generation and offset of baseline biomass management situation (untreated biomass leaking methane)
√	Size of Project (MW)?	45 MW
√	Project Location? City, Province	Sankeshwar, Belgaum, Karnataka
√	Off or on-grid?	On-grid
√	State Electricity Board?	Karnataka Power Transmission Corporation Limited
√	Technology?	Double extraction, condensing turbine providing both process steam and "in house" and "exportable power."
√	Type of Fuel?	In-season (240 days): Sugar Cane Bagasse Off-season (90 days): Procured bagasse, cane trash, other biomass and imported coal, if required.
√	Source of fuel supply?	In season: SHSSKN will supply all mill-generated bagasse to GCPL co-gen plant. Offseason: Saved bagasse by SHSSKN, bagasse from near by mills and cane trash from SHSSKN farmers.

14. Feasibility Details

√	Was Feasibility Study prepared independently?	Yes
√	What firm prepared the Feasibility Study? List address and contact details	A technical consulting firm

15. Background on the Power Purchase Agreement (if Applicable)

√	Does Project involve PPA (Yes or No) If no, skip to next heading.	Yes
√	Has a PPA been signed? (Yes or No)	Yes
√	Nature of Agreement? Take or Pay? Other?	Take or pay.
√	Name of state electricity board or primary PPA signatory?	Karnataka Power Transmission Corporation Limited
√	What date was the PPA signed?	7 September, 2001
	When does it enter into force?	On completion of Conditions Precedent
√	What is the length of the PPA? (Years)	20 years
√	What is the initial purchase price?	3.49 Rs/kWh
√	What is the annual % increase in purchase price?	5%
√	Can the project sell power directly to major consumers? (Yes or No)	No. However, if KPTCL defaults on payment for a continuous period of 90 days, the third party sale is allowed.
√	What are the securities provided for the revenues? Have the domestic lenders approved these mechanisms? Are there any special clauses, or provisions of relevance to the investors?	Irrevocable, revolving Letter of Credit from KPTCL
√	What are the terms of Payment to the project developers? Any special clauses of relevance to the investors/lenders? Have the domestic lenders approved the payment terms?	Payment in 15 days against invoice (late payment to attract penal interest of SBI PLR + 2% p.a. for the period of delay). Non payment to lead revocation of LC
√	What are the major provisions (event definitions, treatment of the off time, etc.) of the Force Majeure clauses?	Events defined. But obligations during FM not clear.
√	What is the method of fixation of tariff (two part, availability etc.)? Are there any provisions for deemed generating/penalties? What is the treatment for infirm power?	Based on MNES policy as adopted by Karnataka State Govt.
√	Have the provisions for change in law, termination, liquidated damages , etc. been approved by existing lenders/investors?	Provisions incorporated and would be vetted by lenders.
√	Would the SEB/generating utility want a share in the ownership of carbon offsets?	NA

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16. Other Agreements (where applicable)

√	Fuel supply agreement signed?	Yes
√	Project Development Agreement with Host Sugar Mill Signed?	Yes
√	Water/utility supply agreement signed?	NA.
	Shareholder's agreement been entered into between existing equity holders?	
	Special provisions of above agreements?	

17. Quantify and Describe Risks

	Risks	Low to High	Describe
√	Market?	Low	PPA in place. Power offtake should be of no concern.
√	Country/Sovereign?	Low	India has a stable financial and legal system as well as established market practices/institutions.
√	Regulatory?	Low	Power supply is governed by the Electricity Acts under which regulators are functioning in each state.
√	Contract/counter party	Low	Although power sector utilities in general are not in sound financial health, KPTCL is relatively in sound position. Karnataka Govt. has undertaken a reform based assistance program with IDFC which is spearheaded by KPTCL.
√	Construction?	Low	Standard equipment and availability of suitable workforce make construction easier.
√	Technology?	Low	Co-generation technology is well-known
√	Management?	Medium	Project developers have no previous experience in co-generation/energy development.
√	Enforceability of Contracts?	Low	Not a major area of concern especially in view of the IDFC program.
√	Competition?	Low	Karnataka state needs power to keep the growth rate hence the state is likely to need all the power generated by the RE based projects. In addition the excess power can be easily exported to other states in the common Southern region grid.
√	Exit?	Low	The laws of India like Companies Act, SEBI Act permit various modes of offloading equity stake.

18. For risks identified in section 14, discuss Mitigation/Coverage measures

	Risks	Describe Mitigation/Coverage
√	Market?	--
√	Country/Sovereign?	--
√	Regulatory?	--
√	Contract/counter party	--
√	Construction?	--
√	Technology?	--
√	Management?	Company has appointed experienced firm as project consultant. Further, the Company shall be appointing experienced personnel for operation, and management of the project.
√	Enforceability of Contracts?	--
√	Competition?	--
√	Exit?	--

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2. Emission Reduction Calculations, Monitoring and Verification Checklist

√		Yes	No
√	Does the project involve a discrete reduction of emissions?	√	
√	Have the emissions reductions been estimated with an accepted methodology?	√	
√	Has a monitoring methodology been established?		√
√	Has a third party verifier been contracted to verify actual emissions reductions and sustainable development gains?		√
√	Has clear ownership of emissions reductions been determined and documented?		√

3. Carbon accounting details

	Parameter	Particulars
1	Baseline methodology	Refer to the note above
2	Baseline Emissions TCO2	150,535
3	Project Emissions TCO2	0
4	Emission reductions TCO2 (2-3)	150,535

APPENDIX B

ANNEX 4

IDFC

CONFIDENTIAL

July 11, 2003

Pioneer Genco Limited
703, Sriniketan Colony
Road No. 3, Banjara Hills
Hyderabad – 500 034

Dear Sirs,

Application for financial assistance

Please refer to your application for financial assistance and the subsequent correspondence / discussions your representatives had with us regarding financial assistance to provide rupee debt assistance to the extent of Rs. 58 crore for construction, erection and commissioning of 21 MW (3 x 7) run-of-the-river hydroelectric power project on the banks of the river Cauvery located near Shivanasamudram village, Malavalli Taluk in Mandya District of Karnataka.

The proposal has been considered and Infrastructure Development Finance Company Limited (IDFC) is in-principle agreeable to grant to you Rupee debt assistance upto the extent of Rs. 58 crores (hereinafter referred to as "the Rupee Debt").

1. All the appendices are deemed to be a part of this Letter of Intent.

2. The aforesaid Rupee Debt is subject to the terms and conditions set out in Appendix I hereto and would further be subject to the conditions set out in the Rupee Debt Agreement to be finalized at a later date.

3. In case the above terms and conditions are acceptable to you, you may furnish to us within 30 days from the date of receipt of this Letter of Intent two certified copies of the resolutions duly passed by your Board of Directors as per pro forma in Appendix II.

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4. Please note that this communication should not be construed as giving rise to any binding obligation on the part of IDFC unless a communication is received by IDFC within 30 days from the date of receipt of this Letter of Intent that the terms and conditions set out herein are acceptable to you and unless the Rupee Debt Agreement and other documents relating to above assistance are executed by you in such form as may be required by IDFC within 4 months from the date of this Letter of Intent or such further time as may be allowed by IDFC in its absolute discretion.

Meanwhile, kindly acknowledge the receipt of this Letter.

Yours faithfully,

For Infrastructure Development Finance Company Limited

VRMavinkurve

Vinayak Mavinkurve
Head – Energy
Encl.: as above

IDFC

Appendix 1

Indicative terms and conditions of sanction

A. Financial Terms

1. Financial Assistance

Rupee debt assistance to the extent of Rs.58 crore (Rupees fifty eight crore) (hereinafter referred to as "the Rupee Debt").

2. Project / Purpose

The proceeds of the Rupee Debt shall be utilized towards construction, erection and commissioning of the 21 MW Pioneer Genco Limited's (hereinafter referred to as the Company) hydro power project located on the banks of the Cauvery river near Shivanasamudram village, Malavalli Taluk in Mandya District of Karnataka (hereinafter referred to as "the Project").

3. Estimated project cost and means of finance

(Rs. in crore)

Particulars	Total
Project Cost	88.0
Means of finance	
- Equity	30.0
- Rupee debt from IDFC	58.0
Total	88.0

4. Interest

(i). The Company shall pay to IDFC interest on the principal amounts of the Rupee Debt outstanding from time to time, quarterly in arrears on January 15, April 15, July 15 and October 15 each year (each an Interest Payment Date) at the rate of 11.50 % per annum. Such interest shall be payable from the first Interest Payment Date falling after the date of first disbursement.

(ii). IDFC shall have the right to reset aforesaid interest rate in respect of the Rupee Debt on the expiry of five years and one day from the date of first disbursement (the "Reset Date") by giving 60 days prior notice to the Company. The Company shall pay interest at such reset rate as may be notified by IDFC to the company

IDFC

(iii). All interest on the Rupee Debt and all other monies accruing due under the financing documents to be entered into between the Company and IDFC shall, in case the same be not paid on the respective due dates, carry interest/further interest @ 2% per annum over and above the rates stipulated in (i) above computed from the respective due date until the date of actual payment. Such further interest shall be compounded quarterly and shall become payable on demand or in the absence of any such demand, on the next Interest Payment Date falling after the date of default.

(iv). Disbursements made pending creation of security stipulated in Clause 11 herein below shall carry further interest @1% per annum after the expiry of six months from the date of first disbursement till creation of such security.

5. **Upfront Fee**

The Company shall pay to IDFC non-refundable and non-adjustable up-front fee of 1 % of the Rupee Debt. 50% of the upfront fee shall be payable on issue of LoI by IDFC and remaining 50% shall be payable on or before the date of signing of the Rupee Debt Agreement.

6. **Last Date of Drawl**

Unless IDFC otherwise agrees, the Company's right to make drawls from the Rupee Debt shall cease on October 15, 2004.

7. **Liquidated damages**

In case of default in payment of any instalment of principal amount of the Rupee Debt or payment of interest or other monies (except liquidated damages) becoming due on their respective due dates, the Company shall pay on the defaulted amounts, liquidated damages at the rate of 2% per annum for the period of default. Liquidated damages shall be payable on demand and in the absence of any such demand on the next Interest Payment Date falling after the date of default. Arrears of liquidated damages shall carry interest at the rate of 2% per annum over and above the rate of interest stipulated in Clause 5(i) above till the date of payment of the defaulted amounts.

8. **Repayment**

The Company shall repay the Rupee Debt in 40 quarterly installments as per the Schedule hereto commencing from October 15, 2005.

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9. **Prepayment**

The Company shall have the option to prepay the outstanding amount of the Rupee Debt Assistance on the Reset Date without payment of any prepayment premium by giving 45 days prior written notice to IDFC. Any prepayment of the Rupee Debt except on the Reset Date shall be by giving a prior written notice of not less than 90 days to IDFC and subject to payment by the Company of Prepayment Premium calculated as under.

The Prepayment Premium shall be an amount expressed as:

$$[\ Max\{\ (0), (\ C + NPV(B, CFi))\ \}\ ]$$

where:

i = number of years remaining from date of prepayment to the last date of repayment,

$CFi = CFi_A - CFi_B$

CFi_A = stream of cash flow, calculated as the post-tax income for IDFC from the interest payable on the outstanding loan amount in the year i, as per the original repayment schedule, @ A, with the income tax benefit under section 36 (1) (viii).

CFi_B = stream of cash flow, calculated as the post-tax income for IDFC from the interest payable on the outstanding loan amount in the year i, as per the original repayment schedule, @ B, without the income tax benefit under section 36 (1) (viii).

A = contractual rate of interest on the debt assistance payable by the Company to IDFC;

B = yield on Government of India Security for the number of years remaining from date of prepayment to the last date of repayment.(For a broken period in a year, the rate of interest will be on a proportionate basis).

C = Additional income tax payable, if any, by IDFC on the interest income earned from the date of disbursement(s) till the date of prepayment (due to non-availability of Income tax benefit under Section 36 (1)(viii), as a result of prepayment).

10. **Interest tax, levies & duties**

All rates of interest mentioned herein are exclusive of interest tax and/or any such other levies / duties. Such interest tax / other levies / duties, if any, applicable, shall be payable by the Company to IDFC over and above the rates mentioned hereinabove

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11. Security

The Rupee Debt together with interest, liquidated damages, costs, charges expenses and all other monies whatsoever payable by the Company shall be secured by:

(a) A first charge and mortgage in favour of the IDFC in a form satisfactory to IDFC of all the Company's immovable properties, present and future;

(b) A first charge by way of hypothecation in favour of IDFC of all the Company's movables, including movable machinery, machinery spares, tools and accessories, present and future, subject to prior charges created /to be created in favour of the Company's bankers on the Company's stocks of raw materials, semi-finished and finished goods and consumable goods for securing the borrowings for working capital requirements in the ordinary course of business;

(c) A first charge in favour of IDFC on Company's book debts, operating cash flows, receivables, commissions, revenues of whatsoever nature and wherever arising, present and future;

(d) A first charge in favour of IDFC on all intangibles of the Company including but not limited to goodwill, uncalled capital, present and future;

(e) A first charge by way of assignment or creation of charge in favour of IDFC of (i) all the right, title, interest, benefits, claims and demands whatsoever of the Borrower in the Project Documents (including but not limited to the Power Purchase Agreement, the Equipment Procurement and Construction (EPC) Contract, O&M Contract), duly acknowledged and consented to by the relevant counter-parties to such Project Documents, all as amended, varied or supplemented from time to time; (ii) all the rights, title, interest, benefits, claims and demands whatsoever of the Borrower in the Clearances; (iii) all the right title, interest, benefits, claims and demands whatsoever of the Borrower in any letter of credit, guarantee, performance bond provided by any party to the Project Documents and (iv) all Insurance Contracts/Insurance Proceeds;

(f) A first charge on the Trust and Retention Account, Debt Service Reserve Account and other reserves and any other bank accounts of the Borrower wherever maintained;

(g) Pledge of shares held by the Sponsors (Penna Cements Ltd., Sriba Industries Ltd., M/s. Pioneer Builders and Associates) in the equity share capital of the Company representing 100% of the total paid up equity share capital of the Company in dematerialized form.

(h) IDFC reserves the right to modify the above security structure in its absolute discretion, prior to financial closure/execution of financing documents.

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B. Pre Commitment Conditions

The obligation of IDFC to commit the Rupee Debt shall be subject to the Company complying with the conditions given below to the satisfaction of IDFC.

1. The Company shall have obtained all approvals from the Government of Karnataka (GoK) / Karnataka Power Transmission Corporation Ltd. (KPTCL) for setting up of the Project.

2. PGL shall have entered into Power Purchase Agreement approved by Karnataka Electricity Regulatory Commission (KERC) with Karnataka Power Transmission Corporation Ltd. (KPTCL) for the Project to the satisfaction of IDFC.

3. The Company shall have obtained and submitted to IDFC the Environmental clearance from the Department of Forest, Environment and Ecology of Govt. of Karnataka.

C. Pre-disbursement Conditions

The obligation of IDFC to make disbursements out of the Rupee Debt shall be subject to the Company complying with the conditions given below. The Company shall have:

1. Increased the authorised share capital of the Company in line with the means of financing for the Project;

2. Confirmed that 50% of its equity share capital (aggregating to Rs. 15 crore) is paid up prior to seeking first disbursement towards the Rupee Debt and obtained firm commitments by means of an acceptable credit support for the balance equity of 50% aggregating to Rs. 15 crore;

3. Procured and furnished an undertaking from Sponsors to the effect that any shortfall in the resources of the Company for completing the said Project and overrun in the cost of the Project due to any circumstances shall be met by Sponsors by infusion of fresh equity / preference capital / unsecured interest free loans/ subordinated debt, without recourse to IDFC;

4. Procured and furnished an undertaking from the Sponsors for non-disposal of their respective shareholding in the share capital of the Company during the tenure of the Rupee Debt without prior written approval of IDFC.

5. Entered into a contract with Boving Fouress Limited for Design, Manufacturing, Supply & Commissioning of Electro Mechanical Equipment and with Pioneer Builders for civil works on terms and conditions to the satisfaction of IDFC

IDFC

invest the funds in DSRA only in permitted investments and securities as approved by IDFC.

iv. Implement the Project within the overall project cost of Rs.88 crore (the "Project Cost") and in accordance with the financing plan ("The Financing Plan") both as agreed to between the Company and IDFC and which will be set out in the Rupee Debt Agreement and shall achieve Project completion on or before June 30, 2004 (the "Scheduled Project Completion Date").

v. Obtain all the required statutory/ non-statutory clearances for the Project.

vi. Obtain comprehensive insurance covers for hydrology (if available), third party liabilities, contractor's all risks insurance, delay in start up insurance, transit insurance, Labour insurance and employee liability insurance, property all risk and business interruption insurance, etc. for the project assets, plant and machinery, labour etc. including cover against earthquake risks and war, within 6 months from the date of first disbursement. The insurance cover would be kept alive throughout the tenure of the Rupee Debt.

vii. Appoint technical, financial and executive personnel of proper qualifications and experience for the key posts and that its organisational set up is adequate to ensure smooth implementation and operation of the Project.

viii. Provide quarterly progress reports on the Project both during the construction and during operating phases to IDFC in such form and manner as may be required by IDFC.

ix. IDFC shall have a right to monitor the operations of the Project after the commencement of operations during the currency of the Rupee Debt. The Company shall furnish to IDFC such information and data as may be required by it from time to time.

x. Any saving in the Project Cost on the completion of the Project shall result in proportionate reduction in the amount of Rupee Debt.

xi. The Company shall tie-up the working capital requirement (if any) in consultation with IDFC and furnish a letter from the bankers in this regard.

The Company shall agree that in the event of the Company committing default in the repayment of installment of the Rupee Debt or payment of interest on due dates, IDFC shall have an unqualified right to disclose the

IDFC

name of the Company and its Directors to the Reserve Bank of India (RBI). The Company shall give its consent to IDFC and / or RBI to publish its name and the name of its Directors as defaulters in such manner and through such medium as IDFC in its absolute discretion may deem fit

2. The Company shall not without the prior written approval of IDFC:

   i. Make any modifications to any of the Project Documents;

   ii. Undertake any new project, or augment, modernise, expand, or otherwise change the scope of the Project;

   iii. Exceed the long term debt: equity ratio of 1.94:1 for the Project.

3. IDFC would conduct one or more reviews of the Project before completion of the Project. The Company would provide all necessary information to IDFC as may be required for this purpose.

   If, as a result of such review, IDFC determines that the company has not implemented/nor is likely to implement the Project within the Project Cost and/or in accordance with the Financing Plan and/or the Company has not commenced/nor is likely to commence commercial operations after implementation of the proposed project by the completion date, IDFC may revise the terms of sanction and stipulate such additional conditions (including strengthening of the management set up, change in means of financing, raising of additional equity capital/other interest free unsecured funds from the Promoters) as IDFC in its absolute discretion may deem fit and require the company to take such measures as may be stipulated by IDFC in the light of the revised cost of the Project/Means of Finance/date of commencement of commercial operations.

4. IDFC shall retain the right to advance the repayment of the Rupee Debt in the event of the cash flows of the Company being adequate for such advancement.

5. IDFC reserves the right to appoint a reputed engineering firm/consultant as "Lenders' Engineer" for monitoring and reporting on the progress of the project during the construction as well as the operations phase directly to IDFC. All costs/expenses for the same shall be borne by the Company.

6. IDFC shall have a right appoint a nominee director on the Board of Directors of the Company, during the currency of the Rupee Debt. The Company shall suitably amend its Articles of Association to provide for such appointment

IDFC

7. Company shall submit the authorization for handling and disposal of waste oil under 'Hazardous Waste (Management & Handling) Amendment Rules 2002 'once the plant is operational.

8. Company shall obtain and submit 'consent to operate' the plant from local pollution control board once the plant is operational.

9. The Project shall, at all times during the currency of the assistance, comply with the environmental, health, safety and social (EHSS) requirements specified below:

   (a) Ensure compliance with provisions of all applicable legislation, and clearances issued there under, and maintenance of documents to be able to demonstrate compliance with the same.

   (b) Ensure compliance with all conditions stipulated in the State and Central environmental clearances obtained by the company for the project.

   (c) Report to IDFC on the environment, health and safety status of the project as per the format to be specified by IDFC.

   (d) Provide the requisite information (if required) and provide access to IDFC or a consultant appointed by IDFC to carry out periodic Environment & Social Monitoring and Review (ESMR) of the project.

   (e) Forward copies of any relevant internal or consultant's reports or annual reports on the environmental status and performance of the operations.

   (f) Ensure compliance with specified recommendations made by IDFC following ESMR report.

IDFC

Loan Repayment Schedule

(Rs. Crore)

No.	Date	Repayment Amount
1	15-Oct-05	1.93
2	15-Jan-06	1.93
3	15-Apr-06	0.97
4	15-Jul-06	0.97
5	15-Oct-06	1.93
6	15-Jan-07	1.93
7	15-Apr-07	0.97
8	15-Jul-07	0.97
9	15-Oct-07	1.93
10	15-Jan-08	1.93
11	15-Apr-08	0.97
12	15-Jul-08	0.97
13	15-Oct-08	1.93
14	15-Jan-09	1.93
15	15-Apr-09	0.97
16	15-Jul-09	0.97
17	15-Oct-09	1.93
18	15-Jan-10	1.93
19	15-Apr-10	0.97
20	15-Jul-10	0.97
21	15-Oct-10	1.93
22	15-Jan-11	1.93
23	15-Apr-11	0.97
24	15-Jul-11	0.97
25	15-Oct-11	1.93
26	15-Jan-12	1.93
27	15-Apr-12	0.97
28	15-Jul-12	0.97
29	15-Oct-12	1.93
30	15-Jan-13	1.93
31	15-Apr-13	0.97
32	15-Jul-13	0.97
33	15-Oct-13	1.93
34	15-Jan-14	1.93
35	15-Apr-14	0.97
36	15-Jul-14	0.97

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37	15-Oct-14	1.93
38	15-Jan-15	1.93
39	15-Apr-15	0.97
40	15-Jul-15	0.97
	Total	**58.00**

IDFC

Appendix II

Resolutions to be passed at a meeting of the Board of Directors of the Borrower for acceptance of the terms and conditions of letter of intent and execution of documents.

The Chairman informed the Board that arrangements have since been made with Infrastructure Development Finance Company Limited (IDFC) for part financing the construction, erection and commissioning of 21 MW (3 x 7) run-of-the-river hydroelectric power project on the banks of the river Cauvery located near Shivanasamudram village, Malavalli Taluk in Mandya District of Karnataka and that IDFC has agreed, in principle to provide rupee term loan to the extent of Rs. 58 crore.

After some discussions, the following resolutions were passed;

1 "RESOLVED

1. That the Company do accept the offer of IDFC to grant to the Company rupee debt assistance of Rs. 58 crore (the financial assistance) on the terms and conditions contained in the Letter of Intent dated ------ received from IDFC (a copy whereof duly signed by the Chairman for the purpose of identification has been circulated to the Board placed on the table of the meeting.

2. That the following directors viz. Shri ----------, Shri ---------, Shri ---------- and Shri ---------- be and are hereby authorised severally to convey to IDFC acceptance on behalf of the Company of the said offer of financial assistance on the terms and conditions contained in the Letter of Intent dated ---------- and agree to such changes and modifications in the said terms and conditions as may be suggested and acceptable to IDFC from time to time and to execute such deeds, documents and other writings as may be necessary or required for this purpose.

3. That the Company do borrow/avail from IDFC the financial assistance on the terms and conditions to be set out in the Loan Agreement, Deed of Hypothecation and any other financing/security documents to be entered into between the Company and IDFC including the special terms and conditions mentioned in the Letter of Intent dated -------- -------- received from IDFC.

4. That the following directors viz. Shri ----------, Shri ---------- -- and Shri ---------- be and hereby authorised to approve on behalf of the Company the Loan Agreement, Deed(s) of Hypothecation and all such other documents including Security Documents to be executed, accept and finalise on behalf of the Company the said documents and writings together with such modifications as may be required by IDFC in connection with the above financial assistance

IDFC

5. That the Common Seal of the Company be affixed to the stamped engrossment(s) in duplicate of the Loan Agreement and Deed of Hypothecation (as per the forms to be settled by IDFC with such modifications as may be agreed between IDFC and the Company) in presence of any one of the following directors viz. Shri ----------, Shri ---------- and Shri ---------- who shall sign the same in token thereof.

6. That the Company shall execute the Loan Agreement and Deed of Hypothecation and such other documents including Security Documents relating to the financial assistance within the period stipulated by IDFC condition being that till such Agreement(s) is/are executed, there is no binding obligation or commitment on the part of the IDFC to advance any money or incur any obligation there under.

7. That the Common Seal of the Company be affixed to the stamped engrossment(s) of the Deed of Hypothecation and to such other documents including Security Documents as may be required to be executed under the Common Seal of the Company in favour of IDFC to secure the aforesaid financial assistance in the presence of any one of the following directors, viz. Shri ----------, Shri ---------- and Shri ---------- who shall sign the same in token thereof.

8. That Shri ----------, Shri ---------- and Shri ---------- - Directors of the Company be and are hereby severally authorised to accepts amendments to such executed Loan Agreement, Deed of Hypothecation and other documents including Security Documents as and when become necessary and to sign letter(s) of undertakings, declarations, agreements and other papers which the Company may be required to sign for availing of the aforesaid financial assistance and if so required the Common Seal of the Company be affixed thereto in the presence of any one of the said Directors, who shall also sign the same in token thereof.

10. THAT as stipulated by Infrastructure Development Finance Company Limited (IDFC) the Company do request the Sponsors (Penna Cements Ltd., Sriba Industries Ltd., Ms. Pioneer Builders and Associates) to execute an Agreement for Pledge of Shares for securing the repayment by the Company of the rupee debt and the disbursement(s)/interim disbursement(s) from/against the financial assistance of Rs. 58 crore sanctioned to the Company by IDFC together with interest, and all other moneys payable by the Company to IDFC; an Agreement for Pledge of Shares to be executed in such form and manner as may be required by the IDFC.

NOTE: - The Common Seal to be affixed as per the provisions of the Articles of Association of the Company.

Pioneer Gases Ltd. (PGL)

Infrastructure Development and Finance Company Ltd. (IDFC)

	15-Oct-03	15-Jan-04	15-Apr-04	15-Jul-04	15-Oct-04	15-Jan-05	15-Apr-05	15-Jul-05	15-Oct-05	15-Jan-06	15-Apr-06	15-Jul-06	15-Oct-06	15-Jan-07	15-Apr-07	15-Jul-07	15-Oct-07	15-Jan-08
		92	91	91	92	92	90	91	92	92	90	91	92	92	90	91	92	92
Opening Balance		-	25.00	56.00	56.00	56.00	56.00	56.00	56.00	56.07	54.14	53.17	52.20	50.27	48.34	47.37	46.40	44.47
Add Disbursement during quarter		25.00	33.00															
Repayment during the quarter									1.93	1.93	0.97	0.97	1.93	1.93	0.97	0.97	1.93	1.93
Closing Balance		25.00	58.00	56.00	56.00	56.00	56.00	56.00	56.07	54.14	53.17	52.20	50.27	48.34	47.37	46.40	44.47	42.54
Interest during the quarter	11.[illegible]%	0.36	1.18	1.66	1.66	1.66	1.64	1.66	1.66	1.63	1.54	1.52	1.51	1.46	1.37	1.35	1.34	1.29
	10.[illegible]%	0.34	1.11	1.55	1.57	1.57	1.54	1.55	1.57	1.52	1.44	1.43	1.41	1.36	1.28	1.27	1.26	1.20
		0.02	0.08	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.08	0.08
		1.86	1.86	1.66	1.68	1.62	1.76	1.66	1.62	1.65	1.49	1.42	1.36	1.29	1.23	1.17	1.10	1.04

Pioneer Gence Ltd

	15-Apr-08 91	15-Jul-08 91	15-Oct-08 92	15-Jan-09 92	15-Apr-09 90	15-Jul-09 91	15-Oct-09 92	15-Jan-10 92	15-Apr-10 90	15-Jul-10 91	15-Oct-10 92	15-Jan-11 92	15-Apr-11 90	15-Jul-11 91	15-Oct-11 92	15-Jan-12 92	15-Apr-12 91
Opening Balance	42.54	41.57	40.60	38.67	36.74	35.77	34.80	32.87	30.94	29.97	29.00	27.07	25.14	24.17	23.20	21.27	19.34
Add: Disbursement during quarter																	
Repayment during the quarter	0.97	0.97	1.93	1.93	0.97	0.97	1.93	1.93	0.97	0.97	1.93	1.93	0.97	0.97	1.93	1.93	0.97
Closing Balance	41.57	40.60	38.67	36.74	35.77	34.80	32.87	30.94	29.97	29.00	27.07	25.14	24.17	23.20	21.27	19.34	18.37
Interest during the quarter	1.22	1.19	1.18	1.12	1.04	1.03	1.01	0.95	0.88	0.86	0.84	0.78	0.71	0.69	0.67	0.62	0.56
	1.14	1.11	1.10	1.05	0.97	0.96	0.94	0.89	0.82	0.80	0.79	0.73	0.67	0.65	0.63	0.58	0.52
	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
	0.96	0.93	0.87	0.82	0.76	0.71	0.66	0.61	0.56	0.52	0.48	0.43	0.39	0.35	0.32	0.28	0.25

Pioneer Gases Ltd

	15-Jul-12	15-Oct-12	15-Jan-13	15-Apr-13	15-Jul-13	15-Oct-13	15-Jan-14	15-Apr-14	15-Jul-14	15-Oct-14	15-Jan-15	15-Apr-15	15-Jul-15
	91	92	92	90	91	92	92	90	91	92	92	90	91
Opening Balance	18.37	17.40	15.47	13.54	12.57	11.60	9.67	7.74	6.77	5.80	3.87	1.94	0.97
Add Disbursement during quarter													
Repayment during the quarter	0.97	1.93	1.93	0.97	0.97	1.93	1.93	0.97	0.97	1.93	1.93	0.97	0.97
Closing Balance	17.40	15.47	13.54	12.57	11.60	9.67	7.74	6.77	5.80	3.87	1.94	0.97	0.00
Interest during the quarter	0.53	0.50	0.46	0.36	0.36	0.34	0.28	0.22	0.19	0.17	0.11	0.06	0.03
	0.49	0.47	0.42	0.36	0.34	0.31	0.26	0.21	0.18	0.16	0.10	0.06	0.03
	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00
	0.21	0.18	0.16	0.13	0.11	0.09	0.07	0.06	0.04	0.02	0.01	0.01	0.00

GREENHOUSE GAS MITIGATION POTENTIAL ESTIMATION

OF

3 X 7 MW SOMESHWARA MINI HYDEL POWER PROJECT IN KARNATAKA

PROMOTED BY

PIONEER GENCO LIMITED

BY:

GREENHOUSE GAS POLLUTION PREVENTION-CLIMATE CHANGE SUPPLEMENT

A USAID/INDIA PROJECT IMPLEMENTED BY:

THE LOUIS BERGER GROUP, INC.

C-6/7 SAFDARJUNG DEVELOPMENT AREA

NEW DELHI 110 016

SEPTEMBER 2003

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Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the 21 MW hydroelectric power project in Karnataka was prepared for Infrastructure Development Finance Company Ltd. by The Louis Berger Group, Inc. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by Pioneer Genco Ltd.(the project promoter), IDFC and that obtained from public domain. The information contained in the note is solely meant for IDFC and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to IDFC, Pioneer Genco and several other institutions including CEA, IPCC/IEA, UNFCCC, and The World Bank for the background data provided by them through their websites.

This note should not be considered an endorsement or certification to the project or the technology and it should not be deemed to be any undertaking, warranty or endorsement by The Louis Berger Group, Inc. and US Agency for International Development.

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1. Background of the project

Pioneer Genco Limited (PGL), a Special Purpose Vehicle (SPV) company promoted by Pioneer Builders and its group companies Penna Cement Industries Limited (PCL) and Sriba Industries Limited (SIL), proposes to construct, erect and operate a 21 MW (3 x 7MW) hydroelectric power project on the banks of the river Cauvery near Shivasamudram village, Malavalli Taluk in Mandya District of Karnataka. The project involves a run-of-the-river scheme which is based on a diversion of the Cauvery river downstream of the 42 MW Shivasamudram hydro power station and two major reservoirs viz. Krishnarajasagar on the river Cauvery and Kabini on river Kabini..

The project shall utilize the flows in the river Cauvery by constructing a diversion structure 140 m in length, which would divert the water to a 110 m long power canal. Three penstocks take off from the intake located at the end of the power canal to the 3 turbines in the powerhouse having an installed capacity of 7 MW each. After generation of power, the water would be let back into the river through a 500 m long tailrace canal. The proposed weir shall result in least submergence since the diversion structure has a height of only 4 meters above average riverbed. This will also avoid changes in the upstream regime of the river.

The project would generate a total of 75 million kWh of power and after meeting the auxiliary equipment, net export of 73.5 million kWh is possible. In a 90% dependable year will be 66 million kWh. The power from the project will be supplied in the state power grid of Karnataka. PGL is finalizing the PPA with Karnataka Power Transmission Corporation Limited (KPTCL).

2. GHG emission reduction objectives of the proposed project

India's power sector is characterized by heavy reliance on thermal power. Since 1950 the thermal hydro mix has been steadily deteriorating and tilting heavily towards thermal. As shown in Figure 1 (Source Annual Report of Ministry of Power 2002-03) the All India installed generating capacity mix for utilities was highest at 46:54 at the end of third five year plan in 1966. The main fuel used by thermal power plant is sub-bituminous coal and lignite. Recently few natural gas based power plants have been set up by NTPC. Indian coal quality has also been deteriorating on account of open cast mining, which leads to mixing of rubble with coal. As a result, the overall conversion efficiency of the coal fired power plants in India ranges between 20 – 30% (Source: Anthropogenic Emissions from Thermal Power Generation in India: Generation and Source Characterization Moti Mittal, C. Sharma, OSC, Ohio State University- 2002).

ALL INDIA INSTALLED GENERATING CAPACITY
HYDRO-THERMAL MIX (%) (UTILITIES)

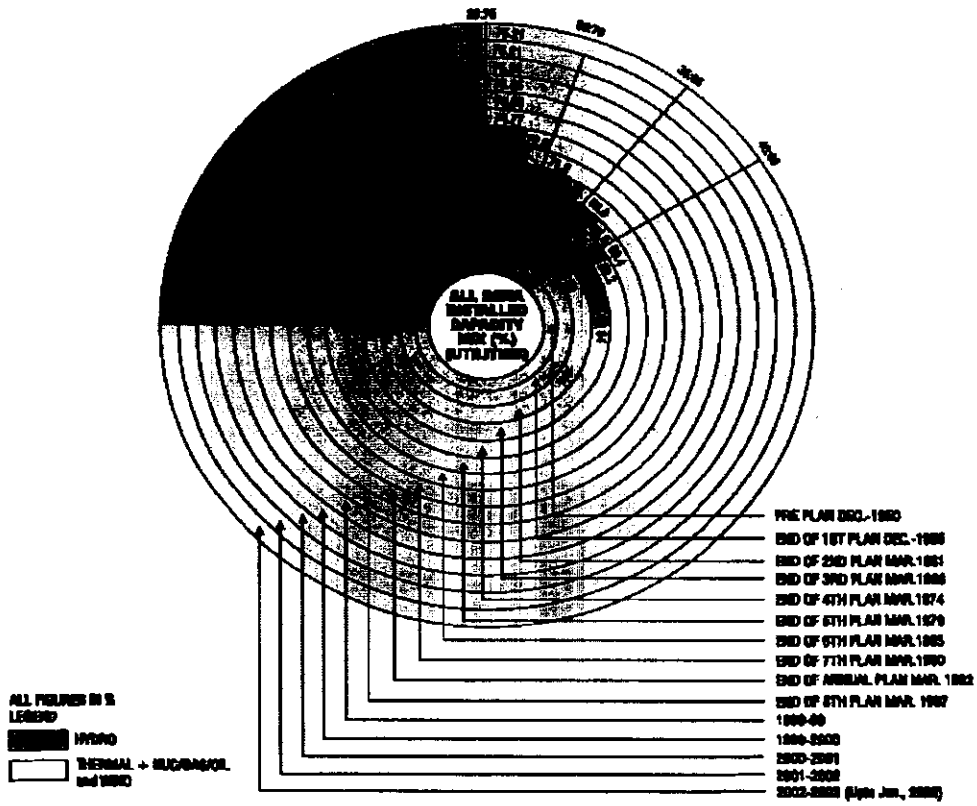

Figure 1: Grid Mix

In the above backdrop, Government of India has been encouraging the use of alternative sources of energy. The proposed project is based on one such form of natural energy supply viz. hydroelectric source, which does not lead to emissions of any type. The project would make use of the gradient available in the river Cauvery and its tributary Kabini in the state of Karnataka without damaging the natural habitat. Since the proposed plant would not involve a dam the submergence would be negligible. This ensures that the project does not damage flora and fauna and also does not lead to resettlement issues. Overall, the project helps in reducing dependence on fossil fuels without leading to additional GHG emissions.

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a. ***Clean Technology nature***

The project consists of diversion structures across the Cauvery from the left bank downstream of the Shivasamudram hydro power project. The water would be conveyed across three penstocks which feed it to three 7 MW turbo generator units. Subsequently, water would be released through a 500 m tailrace canal. The diversion structure would have a height of 4 m above mean riverbed. The river banks at this place are steep. All the project construction is close to the river and do not encompass any forest land. These features ensure that there will be least submergence of vegetation, thereby minimizing the methane emission.

b. ***Sustainable Development objectives/aspects***

The project location is 2 KM downstream of the Shivasamudram village and does not have any inhabitation. This means that the project does not involve practically any rehabilitation and resettlement issues. Since the water collection and flows in the project are not likely to result in any reservoir that may affect the geological profile, the project would be safe from seismological point of view. The project would directly employ local people and the power generated would support industrial and commercial activity in the Mandya district. Thus, it would result in ancillary benefits to the local population.

c. ***Host country Government (GOI) objectives***

Government of India, Ministry of Non-Conventional Energy Sources (MNES) and the Karnataka state Government have been encouraging addition of power generating capacity based on renewable sources of energy. Under the schemes of MNES, small hydroelectric power generation (<25 MW) has been promoted as one such option. The power policy of Government of India stresses electrification of villages through renewables. It also encourages decentralized power generation as a means of strengthening and stabilization of the power grid performance. The proposed project meets all the essential requirements and has therefore received approval from the state level nodal agency of MNES i.e. Karnataka Renewable Energy Development Ltd. (KREDL).

3. Business as usual or Baseline identification

This section describes the existing power supply situation in the state of Karnataka where the power generated by the project is fed.

a. ***Project Boundary***

The project is expected to generate 66 million kWh of power in a 90% dependable year. The power plant has a capability of generating 75 million kWh power corresponding to a plant load factor of 40%, which conforms to the other existing hydro power projects in Karnataka. The state had an energy deficit of 12.5% and a peak shortfall of 17% in the year 2001-02. Additional power generation capacity is being built through both

conventional and non-conventional sources. The power supplied by the project is most likely to be consumed within the state. Each unit of power supplied by the project would, therefore, replace an average unit supplied in the state. The relevant project boundary for the project on supply side is the state power grid.

Karnataka power grid is a part of the Southern Regional grid. The power supplied to the consumers in the state is drawn from a variety of sources, KPCL own generation, private producers, purchase within the southern region from other states and purchase from central power utilities against state's share. During discussion with KPTCL it was understood that its policy is to purchase all the power available within state first. Thus, when an additional unit is available it will back power from central power PSUs. In other words, the marginal unit is the power supply from these sources.

On the demand side that is generation side the project boundary consists of the river basin of Cauvery, Kabini and the catchment area of these rivers.

b. Relevant baseline methodology/scenarios

Baseline is defined as the scenario in the relevant project boundary that would have prevailed in the absence of the project. It is also referred to as "business as usual" scenario. There are two possible methodologies to decide the baseline in situations like this. a) Average of weighted average emissions of all generating sources serving the system, excluding those which do not result in GHG emissions and the weighted average of recent capacity additions defined as the lower of most recent 20% of plants built or the 5 most recent plants; and b) The weighted average emissions of the current generation mix. The first approach is complicated and depends on availability of data. The second approach on the other hand is easy to understand and estimate, as adequate data is available from regular channels. Sometimes the plants under construction and planned are also taken into account. In view of the above, the second approach is suggested.

c. Time dimensions of the baseline

India has an overall installed capacity of 107,534 MW as on March 31, 2003 (MOP Annual Report 2002-03). This includes 76,525 MW thermal power and 26,660 MW of Hydro electric power. The balance is from wind (1,630 MW) and nuclear (2,720 MW). As per MNES report the total installed capacity based on small hydro power projects (up to 25 MW) is 1,450 MW amounting to 1.35%. The total potential for generation from this category in India is estimated at 15,000 MW. Thus, about 10% of the potential has been tapped. It can be concluded that in the foreseeable future, small hydro power will not form significant proportion of the baseline. Large size hydroelectric power projects which form about 23.5% of the total installed capacity should not be included in the baseline. While

these projects lead to high amount of GHG emissions, it is rather difficult to calculate exact amount due to lack of developed methodology. However, the non-inclusion will make the estimate more conservative and reduce chances of "gaming".

d. ***Annual /periodic estimations***

In view of the above status of implementation of projects, the baseline emissions will not change practically. Therefore, it may not be necessary to revise the baseline estimate at least during the first ten years in which investors are likely to purchase the credits.

e. ***Baseline case emissions estimation***

Based on the methodology presented earlier and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

CO_2 Emissions from power used in the state grid

The requirement of power in the state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the KPTCL purchases power from the central public sector power generating companies, in accordance with its allotted share. This is a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 34% of the capacity and 66% of the hydel sources. However, based on the statistics of power generated and purchased for the last three years 2000 - 02, it is observed that in 2001 of a total 49,255 MU consumed by the state grid 63.3 % was supplied from thermal sources, mainly coal fired plants, 35.7 % from hydel and balance 1.0 % by nuclear sources. The thermal plants a majority of which are based on high ash Indian coal use sub bituminous variety coal as fuel. By and large the plants are old and exhibit conversion efficiencies in the range of 25-30%. For conservative considerations this is assumed at a level of 33%. Indian electric power grid especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission & distribution losses, sometimes in the excess of 40%. However, since the proposed project will also feed power in the same grid as the conventional one's this is not significant for the analysis.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like The World Bank. The emission factor of thermal power plants using bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the above mix of supply from various sources as mentioned above, the

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weighted average emission factor of the Karnataka state grid is 16.6 tC/TJ. From this analysis it is clear that Karnataka grid is in fact one of the grids which exhibits a well balanced thermal: hydro power mix and emission reductions that can be achieved by green energy projects will be the least.

4. GHG mitigation potential of the project

The proposed power project would use a natural source of energy, i.e. energy in the flowing river water. Moreover, the proposers have taken great care in design to ensure that the submergence on account of the project is minimal. The land area under forest around the project site is almost nil. These factors ensure that the emissions of methane due to submerged plants/vegetation/biomass would be negligible. Therefore, it will be reasonable to assume that the project does not have any GHG emissions.

The GHG emission reductions from the project would be:

Annual GHG Reduction =	**GHG Emission per million kWh of the baseline**	X	**Annual Units fed by the Project million kWh**

As discussed above the GHG emission per MU or the emission factor of the Karnataka grid is 664 tCO2 per MU under the assumptions discussed above based on the average energy fed by various sources for the past three years. The project is expected to export 63.4 million kWh to the Karnataka grid each year. Thus, the expected Annual GHG reduction from the 21 MW project would be 42,094 tCO2 p.a. or **42,000 tCO2 p.a.**

The above methodology, based on weighted average emission factors of the grid, is in conformity with the one for grid feeding small scale projects as specified by the CDM Executive Board of the UNFCCC.

5. Monitoring & Verification

It is very crucial to monitor and verify periodically the actual emission reductions achievable by the CEPs. There are two sides of this M&V, one to ensure that the baseline itself does not change significantly and second the project performs as envisaged in the design. As discussed in detail earlier the composition of entire RE based power generation is not likely to be significant in the foreseeable future. Therefore, the former is taken care of to a major extent. It is therefore important to measure the performance of the project in detail and with greater accuracy.

Performance of projects generating power for export to utility grid can be easily measured based on electric power generated and supplied to the grid. The proposers have signed a power purchase agreement with KPTCL, specifying the Metering and Billing clauses. In fact the project's revenue entirely depends on the

metering. The PPA provides for meters and check meters meeting prescribed standards and accuracy class. Thus, PPA provides the procedure of measuring and invoicing of the meter reading and also maintenance of the meters.

The following M&V mechanism is suggested:

It is proposed to vest the responsibilities of monitoring the parameters identified earlier in to an interdepartmental group consisting of representatives from quality control, production, maintenance and strategic planning departments, which shall *inter alia*

- Meter and record the power generated and sold to the grid
- Keep track of source wise power supply in the southern electric power grid and the status of completing the National Grid
- Measure/keep record of rainfall in the catchment area of the project

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APPENDIX B

पावर फाइनेंस कारपोरेशन लिमिटेड
POWER FINANCE CORPORATION LTD.
(भारत सरकार का उपक्रम) (A Govt. of India Undertaking)

No.PD/SR/SPCL June 13, 2003.

Mr.K.Surendranath,
Director,
Sainath Power Concepts Pvt. Ltd.
Flat No. 501,Ganga Residency,
Plot No. 54,Sri Nagar Colony,
Hyderabad – 500 073(A.P.)

Sub: Financial assistance for M/s Sainath Power Concepts Pvt. Ltd. setting up 6 MW biomass based project in Adilabad district, Andhra Pradesh.

Ref: (i) M/s SPCL's letter dated 20th March 2002 to PFC seeking financial assistance from PFC.
(ii) PFC's letter dated 18th October 2002 to M/s SPCL intimating shortlisting of the project by PFC for detailed appraisal

Dear Sir,

With reference to your application for financial assistance vide letter cited at reference above and further correspondences and discussions you had with us for setting up 6 MW (site) biomass based power plant in Adilabad district of Andhra Pradesh, we are pleased to inform that Power Finance Corporation Ltd. is agreeable, in principle, to provide to M/s SPCL a rupee term loan of Rs. 10 crore on the following terms and conditions:

1. The above said facilities are subject to the terms and conditions and General conditions placed at *Annexure-A* and the Special terms and Conditions, security package placed at *Annexure – B* which are deemed to be a part of this letter of sanction.

2. The loan shall be repaid in 32 equal quarterly instalments. The first repayment shall fall due on the standard date of PFC falling immediately after the completion of six months from the scheduled date of commissioning of the project. The scheduled date of commissioning will be stipulated in the loan agreement.

3. M/s SPCL shall enter into a loan agreement with PFC in the format enclosed at *Annexure-C*

पंजीकृत कार्यालय : चन्द्रलोक, 36, जनपथ, नई दिल्ली–110001 दूरभाष : 3722301-08 तार : पोफीकोरप फैक्स : 011-3315822
Regd. Office : Chandra Lok, 36, Janpath, New Delhi-110001 Phones : 3722301-08 Grams : POFICORP Fax : 011-3315822

4. In case the terms and conditions are acceptable to you, you may furnish to us within 30 days of receipt of this letter two certified copies of the resolutions duly passed by the Board of Directors of your Company as per the Performa in *Annexure-D*.

5. Your attention is also invited to *Annexure-E* of this letter which lists the various documents that are required to be submitted by you in connection with the said financial assistance.

6. This communication not in any way be construed as giving rise to any binding obligation on the part of PFC unless M/s SPCL communicates to PFC within 30 days from the date of receipt of this letter that the terms and conditions set out herein are acceptable to it and unless the Loan Agreement and other documents relating to the above assistance are executed by M/s SPCL in such form as may be required by PFC within six months from the date of this letter or such further time as may be allowed by PFC in its absolute discretion.

   One set of formats for (I) undertaking for non-disposal of shareholding ,(ii) deed of corporate guarantee and (iii) declaration in the matter of mortgage /hypothecation are also enclosed at *Appendix-F*.

Meanwhile kindly acknowledge the receipt of this letter.

Thanking you,

Yours sincerely,

D. Ravi

(D. Ravi)
AGM (PA-SR) & State Coordinator (AP)

Copy for information to:

1. The Principal Secretary (Energy), Govt. of Andhra Pradesh, Secretariat, Hyderabad - 500082.
2. The Member (Planning), CEA, Sewa Bhawan, R. K. Puram, New Delhi.
3. The Advisor (Energy), Planning Commission , Yojana Bhawan, Parliament Street, New Delhi.
4. Chairman and Managing Director , APTRANSCO, Vidyut Soudha, Hyderabad - 500082.
5. Director (Transmission), APTRANSCO
6. Director (Distribution), APTRANSCO
7. GM (L&D), PFC – alongwith a copy of terms and conditions
8. GM(LD&R), PFC - alongwith a copy of terms and conditions
9. AGM (P&FO), PFC - alongwith a copy of terms and conditions
10. AGM(IAD-IPP), PFC- alongwith a copy of terms and conditions
11. AGM (CMIS), PFC

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Annexure-B

Pre-Commitment Conditions:

Before the assistance from PFC become effective, the Company shall, to the satisfaction of PFC:

1. Provide first charge on immovable and movable assets of the project to the lenders on pari passu basis.
2. Provide personal guarantee of Sri S.Chandra Reddy, Sri.K. Surendranath, Smt. M. Vijaya Chandra Kalyani , K. Varalakshmi along with documents w.r.t title and valuation of property.
3. Provide default escrow on the revenue of Murali Mohana Boiled and Raw Rice Mill Pvt Ltd (on standard terms) equivalent to a minimum of 1.25 times of the quarterly loan installment including interest payable during the repayment period through a tripartite agreement.
4. Provide corporate guarantee of Murali Mohana Boiled and Raw Rice Mill Pvt Ltd.
5. Provide an undertaking to PFC from the promoters stating that they would meet the full amount of cost overrun, if any, from their own resources or through unsecured loans.
6. The technical configuration and the package contracts will be reviewed by Lenders Engineer and Lenders Legal Counsel. PFC reserves the right to insist on the recommended changes(if any).
7. Tie up the balance requirement of debt i.e Rs. 4 crores from other financial institutions/banks.
8. Submit plans ensuring effective O&M of plant for review by PFC/Lenders Engineer.
9. Agree that the preliminary expenses shall be allowed as part of the project cost only to the extent they are certified by concurrent auditors/lenders Engineers that they relate to the proposed project only and as accepted by PFC.
10. Enter into an agreement with PFC for meeting the expenses on Lenders Engineer, Lenders Legal Counsel, Concurrent auditors, Insurance Consultant appointed by PFC.
11. Finalize a suitable insurance package acceptable to PFC.
12. Obtain statutory clearances and in specific forest clearance, civil aviation clearance for chimney height and permission for drawl of water.
13. Pay the fees (applicable as per the PFC policy) to PFC for assuming the role of the Lead FI.

Pre-disbursement conditions:

Before seeking disbursement of assistance sanctioned, the Company shall to the satisfaction of PFC comply with the following conditions:

1. Submit the shareholder's agreement.
2. Pledge of total shares held/ to be held by promoters / promoters directors of SPCPL as security for the loan which shall in no case be less than 51% of total share capital of the company.
3. 100% upfront equity contribution (amounting to Rs. 6.5 crore) to be brought in by all the equity contributors in form of investments in the project/ cash.
4. Modify the memorandum and article of association to enhance the authorized share capital and borrowing power as envisaged in means of financing.
5. Comply with the following conditions precedent in PPA :

- The company shall fulfil the conditions of Agreement entered with NEDCAP and obtain extensions wherever required till the Project is completed..

6. Open a trust and retention account (TRA) in a bank through which all cash inflows/outflows shall be regulated to the satisfaction of PFC The entire loan amount by all lenders and balance equity (unspent equity as on the date of opening of TRA) would flow in the TRA. At the operational stage of the plant, all proceeds from the sale of power to flow into this account. The proceeds shall be utilised, both at construction and operation stage, in a manner and priority to the satisfaction of Lenders. The Company shall appoint a Trust and Retention Agent approved by PFC and enter into a separate agreement for the same.
7. Constitute a Project Review Committee of Promoters/Engineers/Lenders for monitoring the progress and ensure smooth implementation of the project.
8. Submit documents for proof of the ownership of the land.
9. Agree that PFC shall be entitled to appoint upto two nominees on the Board of Directors of SPCPL during the currency of financial assistance.
10. Agree not to undertake any new major investment on project or liabilities in terms of assets on lease without prior approval of PFC during the currency of the proposed loan.
11. Undertake to furnish to PFC at the beginning of each financial year (FY), firmed up monthly fuel cost for the current year and projections for the next year.
12. Agree that PFC shall have the right to appoint an Independent Consultant and Fuel Monitoring Committee of Promoters/Engineers/Lenders during currency of loan at the cost of the borrower to review the availability, pricing and procurement of biomass for the project.
13. Agree that the disbursement schedule approved by PFC would be applicable for regulating disbursement.

Other special conditions:

The company shall to the satisfaction of PFC comply with the following conditions :

1. Submit an undertaking that it will obtain all non statutory clearances as and when required.
2. Shall obtain prior approval of PFC for utilising the amount of the loans equivalent to the contingency provision in the cost of the project.
3. Undertake to furnish to PFC such information as may be required by PFC to review that the physical progress of the project as well as expenditure incurred on the project.
4. Agree that in case the company obtains any benefits from MNES the same shall be credited to the TRA. Further agree that in the event of default by the borrower, the subsidy amount received from MNES Government of India shall be recoverable along with the applicable penalty and pari passu charge shall be created on the assets for the recovery of subsidy as well as applicable penalty.
5. Appoint technical, financial and other executives with suitable qualifications and adequate experience for the key posts and put in place an organisational set-up adequate enough to ensure smooth implementation and operation of the project.
6. Agree that any favourable terms and conditions of sanction stipulated by other participating Indian/ foreign institutions/banks shall be applicable to the proposed sanction as well to the extent they are relevant.

7. Make satisfactory arrangements with it's bankers for meeting its working capital requirements and shall furnish a letter from its bankers in this regard.
8. Demonstrate that suitable arrangements have been made for power evacuation from the project.
9. Agree that PFC, at its absolute discretion, shall have the right to stipulate any other condition it may desire prior to financial closure.
10. Provide an undertaking that SPCPL and all other contracted parties have complied with all the conditions precedent in all the project documents and in various statutory & non-statutory clearances of the project.

APPENDIX B

Tandon, Sandeep

From: ANIL MALHOTRA /TLG/IBANK/BKC [anil.malhotra@icicibank.com]
Sent: Monday, August 11, 2003 10:57 AM
To: Berry, R.K.; Tandon, Sandeep
Cc: JOACHIM COLACO /TLG/IBANK/BKC; Walia, Archana
Subject: approvals under GEP-CCS

<<SIL.ppt>>

Dear Ram & Sandeep

We are pleased to inform that the Approval Committee on Saturday (09.08.2003) has approved the following project under ECO programme & TDC programme

Company : Sterlite Industries Ltd

Assistance : GEP-CCS – Rs. 25 million

TDC - Rs. 40 million

Project : Waste heat recovery from sulphuric acid plant & DG sets for generation of steam and water conservation

The project is unique as we have been doing intense marketing efforts for waste heat recovery. Further, the project has included a unique water conservation portion that would not only reduce water requirement but also energy for pumping. This would fit the activities of water-energy conservation that USAID is pursuing.

A brief of the proposal is attached

Regards

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9/3/2003

ICICI Bank

Sterlite Industries (India) Ltd

9/08/2003

Company Profile

- promoters : Anil & Navin Agarwal
- business : copper
- current capacity : 0.15 million tpa
- exp capacity : 0. 3 million tpa
- exports (2003) : Rs 6650 million
- % exports : 70%

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Financials

(Rs. bn)

Sl.No	Year ending March 31,	2002	2003
1	TI	15.55	22.08
2	PBID	2.86	4.32
3	% PBID to TI	18.39%	19.56%
4	Interest	1.05	1.51
5	Depreciation	0.72	1.06
6	OP	1.08	1.75
7	% OP to TI	6.9%	7.9%

ICICI Bank

Projects - Main

- expanding copper capacity from 0.15 million tpa to 0.3 million tpa
- installing copper refining facilities for 127,000 tpa
- expanding sulphuric acid capacity from 2125 tpd to 3740 tpd
- expanding DG capacity from 24 MW to 46 MW

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Project - Proposal

under GEP-CCS Programme

- waste heat recovery from sulphuric acid plant & DG sets
  - production of steam for process
- water conservation by adopting closed loop system

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Cost of Project

	Rs in million
Project cost	110 7

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Assistance for WHR(SAP),CPP & WRP

(Rs. In million)

Facility	Existing		Proposed
	Limits	Balance	Limits (i)
Fund Based			
Cash accruals/other sources	-	-	45.7
Term Loan-GEP	-	-	25 0
-TDC			40 0
Sub total		-	110 7

ICICI Bank

Assistance - Terms

- location : Tuticorin, Tamilnadu
- assistance : Rs 165 million
- facility : term Loan from funds available under GEP-CCS & TDC programmes
- interest rate : 7 %
- security : hypothecation of assets
- tenure : 7 years

ICICI Bank

Project - Brief

WHR

- sulphuric acid plant capacity to increase to 3740 tpd
- inlet gas temperature 350°C
- conversion of SO_2 to SO_3 – exothermic
- gas cooled before absorption
- presently heat energy wasted to atmosphere
- no. of DG sets to increase from 4 nos. to 7 nos.
- flue/ waste gases heat to be recovered to produce steam for use in process

ICICI Bank

Project - Brief

Water Conservation

- water evaporation in sulphuric acid cooling towers
- constant replenishment required
- water pumped to plant from Tuticorin
- modifications in acid plant so as to reduce requirement
- convert to close loop system to avoid evaporation loss
- requirement of water reduces significantly thereby reducing pumping and consequent energy

ICICI Bank

Project – Impact

WHR

- production of low pressure steam : 129,000 tpa
- savings (assuming fuel oil based system) : Rs 95 million/annum
- CO_2 emissions savings : 22,000 tpa

Water Conservation

- water usage saving : 500 mill. litres/annum
- energy (for pumping saving): 3.7 million units/annum
- amount saved : Rs 23.7 million/annum
- CO_2 emissions saving : 5

ICICI Bank

Project – Impact

Aggregate

- savings : Rs 118.7 million
- simple payback : < 1 year
- CO_2 emission savings : 27,250 tpa
- likely additional service from carbon trading : Rs 6.3 million/annum

Thank You

ICICI Bank

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GREENHOUSE GAS MITIGATION POTENTIAL ESTIMATION

OF

Waste Heat Recovery based Steam Generation from Sulphuric Acid and Captive Power Plants and Cooling water conservation

PROMOTED BY

STERLITE INDUSTRIES (INDIA) LTD.

BY:

GREENHOUSE GAS POLLUTION PREVENTION-CLIMATE CHANGE SUPPLEMENT

A USAID/INDIA PROJECT IMPLEMENTED BY:

THE LOUIS BERGER GROUP, INC.

C-6/7 SAFDARJUNG DEVELOPMENT AREA

NEW DELHI 110 016

OCTOBER 2003

Acknowledgement & Disclaimer

This note assessing the Greenhouse Gas emission reduction potential of the Waste Heat Recovery based Steam Generation from Sulphuric Acid and Captive Power Plants was prepared for ICICI Bank Ltd. by The Louis Berger Group, Inc under the GEP-CCS project. The Louis Berger Group, Inc. is not responsible for the accuracy of data provided by Sterlite Industries (I) Ltd. (the project promoter), ICICI Bank and that obtained from public domain. The information contained in the note is solely meant for ICICI Bank and can be used by it to approach different funding mechanisms. The Louis Berger Group, Inc. is grateful to ICICI Bank, Sterlite Industries (I) Ltd. and several other institutions including IPCC/IEA, UNFCCC and The World Bank for the background data provided by them through their websites.

This note should not be considered an endorsement or certification to the project or the technology and it should not be deemed to be any undertaking, warranty or endorsement by The Louis Berger Group, Inc. and US Agency for International Development.

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1. Background of the project

Sterlite Industries (India) Ltd. (SIIL), an existing company promoted by Mr. Anil and Navin Agarwal in 1975 originally as an investment company. The company has grown into the Sterlite Group over years through diversification and acquisitions. SIIL is engaged in the manufacture of PE insulated Jelly filled telecom cables, continuous cast copper rods, aluminum cold-rolled products, zinc metal and paper. Sterlite Group acquired controlling stakes in public sector company BALCO and 26% stake in Hindustan Zinc Ltd.

SIIL has an industrial complex at Tuticorin, Tamil Nadu for manufacture of copper rods and other products. The copper smelting plant at Tuticorin has a capacity of 150,000 TPA. SIIL is doubling the smelting capacity. The sulphur from the pyrites ore is converted into oxides, which are emitted through the flue gases. To recover these, SIIL has set up sulphuric acid plant based on the DCDA process. SIIL envisages modernizing the SAP and also set up a new state-of-the-art SAP to treat the additional flue gases as a result of expansion in the smelter capacity. Thus, the SAP capacity would increase from present 2125 TPD to 3740 TPD. Since smelter operation is a continuous one and critically depends on power availability, SIIL also proposes to expand the captive power generation capacity from present 24 MW to 46 MW. As a part of the copper smelting facility, it has also set up a phosphoric acid plant.

SIIL proposes to incorporate fuel efficient technologies with a view to minimizing the operation cost and to avoid emissions of local and global pollutants. These interventions include:

- Recovery of heat from gases after second pass of the converter at $517^0 - 527^0$ C
- Recovery of heat from gases after the third pass of the converter at $469^0 - 479^0$ C; and
- Recovery of heat from diesel engine exhaust gases at 340^0 C
- Replacing the atmospheric acid coolers with plate type heat exchangers, which reduce evaporation and wind losses, thereby leading to saving in water consumption. Simultaneously, the head of cooling water pump also reduces from 45 m to 15 m. these two together reduce the power load from 794 kW to 374 kW.

The recovered heat from the first three options will be used in two WHR boilers to generate low pressure process steam at 14.5 Kg/cm^2g. The steam so generated will be used in the Phosphoric acid plant (PAP) located in the same complex. The PAP boiler currently uses furnace oil that will be replaced. The last option would result in reduction of a) power consumption and b) water savings.

The project would save around 9 tons steam per hour leading to a drastic reduction in consumption of furnace oil and 3.5 million kWh of power from the Tamil Nadu grid. The total cost of the power generation project is estimated at Rs. 110.7 million.

2. GHG emission reduction objectives of the proposed project

The consumption of oil products has been increasing ever since industrialization began in India. The current consumption of oil products is 107 Million tons. Since

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the domestic oil resources are limited, around 73% of this is met with imported crude. Thus, consumption of petroleum products adds to both environmental degradation and also foreign exchange outgo. Majority of oil usage is in transport and to meet industrial energy requirements. The proposed project would help in recovering energy efficiently and converting it into a useful energy form viz. process steam. The overall end use efficiency of the industrial complex of SIIL would improve.

Government of India has been encouraging the use of alternative sources of energy and also stressing on energy conservation. The Energy Conservation Act and recent Electricity Act provide encouragement for enhancing the resource use efficiency and using non-conventional energy. The proposed project is based on one such form energy conservation viz. waste heat recovery, for generating steam for use in process. This has an added advantage over power generation, since the entire enthalpy is used, leading to higher overall efficiency. Overall, the project helps in reducing dependence on fossil fuels without leading to additional GHG emissions.

a. ***Clean Technology nature***

The project involves waste heat recovery technology to generate low pressure saturated steam for process applications. The heat of gases from two streams after the second and third beds of converter of the sulphuric acid plant at temperature ranging between 470^0C – 520^0C and in the flue gases of the diesel generating set is used in three different fire tube boilers. Although the gases from converter were being used, the main application was for economizers. Proposed project would help in recovering heat at a higher degree. In a nutshell, the proposed plant offers a better GHG mitigation technology option.

Moreover, the other intervention in the proposed project viz. saving of cooling water and power is also a cleaner option.

b. ***Sustainable Development objectives/aspects***

The cooling water conservation component of the proposed project would lead to an important and scarce natural resource, namely ground water. Besides, the project would also help in reducing emission of local pollutants from the avoided furnace oil.

c. ***Host country Government (GOI) objectives***

Government of India, Ministry of Power (MOP) has been encouraging conservation of energy. After the passage of the Energy Conservation Act (2001), the Bureau of Energy Efficiency was established. Thus, GOI has been encouraging maximization of overall energy efficiency of industry. Similarly the Ministry of Non-Conventional Energy Sources (MNES) promotes non-conventional energy sources, one of them being waste based

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fuels. The proposed project also envisages use of waste heat. In view of this, the project meets GOI objectives.

3. Business as usual or Baseline identification

This section describes the existing power supply situation in the state of Tamil Nadu, where the energy produced is used and power generated by the project is fed.

a. Project Boundary

The project has essentially two streams. One is to replace conventional fuel furnace oil within the SIIL complex itself and second is saving of power from the grid. The project is expected to generate a total of 84,000 tons of LP steam every year. This would be piped to the phosphoric acid plant (PAP) located in the same complex. This in turn would reduce the consumption of furnace oil (residual fuel oil). Since the emission reduction results in the complex itself, the project boundary for this stream would be the SIIL Tuticorin industrial complex.

The second stream is the saving in cooling water by incorporation of a plate type acid cooler. This brings down the evaporation and windage losses of water. The reduced water quantity and head for the circulation pumps and avoidance of cooling tower fans would lead to reduction in power consumption. At present the SIIL complex purchases power from Tamil Nadu (TN) grid for meeting power needs. TN grid is a part of the Southern power grid. The project boundary for this stream is therefore the entire southern grid and in particular the TN grid.

b. Relevant baseline methodology/scenarios

Baseline is defined as the scenario in the relevant project boundary that would have prevailed in the absence of the project. It is also referred to as "business as usual" scenario. The proposed project reduces the consumption of furnace oil within the industrial complex of SIIL in Tuticorin. In view of this, the baseline for this is the furnace oil used for generating steam. The consumption of fuel for steam generation is generally represented in tons/ton of steam, as an observed benchmark by the promoters.

For the second stream of reductions namely the power saved by reducing cooling water quantity and pump head, the baseline is replacement of units supplied by the Tamil Nadu grid to the SIIL complex. There are two possible methodologies to decide the baseline in situations like this. a) Average of weighted average emissions of all generating sources serving the system, excluding those which do not result in GHG emissions and the weighted average of recent capacity additions defined as the lower of most recent 20% of plants built or the 5 most recent plants; or b) The weighted average emissions of the current generation mix. The first approach is

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complicated and depends on availability of data. The second approach on the other hand is easy to understand and estimate, as adequate data is available from regular channels. Sometimes the plants under construction and planned are also taken into account. In view of the above, the second approach is suggested. Since the project avoids the units supplied by the grid, it is also able to avoid the T&D losses. In other words, the actual units at the bus bar would be correspondingly higher after accounting for the T&D losses.

c. ***Time dimensions of the baseline***

India has an overall installed capacity of 107,534 MW as on March 31, 2003 (MOP Annual Report 2002-03). This includes 76,525 MW thermal power and 26,660 MW of Hydro electric power. The balance is from wind (1,630 MW) and nuclear (2,720 MW). The waste heat based power generation, is negligible. As per estimates, potential capacity based on waste heat and energy conservation is 15,000 MW amounting to 15%. Thus far only a miniscule portion of this has been tapped. It can be concluded that in the foreseeable future, waste heat or fuels based power will not form significant proportion of the baseline. Thus, the baseline as discussed earlier will be valid for a long time horizon.

d. ***Annual /periodic estimations***

In view of the above status of implementation of projects, the baseline emissions will not change practically. Therefore, it may not be necessary to revise the baseline estimate at least during the first ten years in which investors are likely to purchase the credits.

e. ***Baseline case emissions estimation***

Based on the methodology presented earlier for the two streams and data collected from various sources, the baseline GHG emissions were estimated. The summary of the same is presented below.

(i) CO2 Emissions from replacing furnace oil used

SIIL purchases furnace oil from local distributors who procure these from standard channels of the oil companies. The furnace oil is of residual fuel oil grade, which is normally used in industrial boilers. As per revised 1996 IPCC guidelines for GHG inventories, residual fuel oil has an emission factor of 21.1 tC/TJ and a NCV of 40.19 TJ/Kiloton. Based on these figures the emission factor of the furnace oil is 3.1094 tCO2/ton of fuel oil.

(ii) CO_2 Emissions from avoided power from the state grid

The requirement of power in the Tamil Nadu state is met through own generation, which includes coal fired thermal and hydroelectric power plants. In addition, the TNEB purchases power from the central public sector power generating

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companies, in accordance with its allotted share. This is a mix of thermal, hydel and nuclear power. Based on the respective capacities, it is found that thermal power contributes about 64% of the capacity and 36% of the hydel sources. However, based on the statistics of power generated and purchased for the last three years 2000 - 02, it is observed that over the past three years power consumed by the state grid was made up of 80 % from thermal sources, mainly coal fired plants, 18 % from hydel and balance 2 % by nuclear sources.

A majority of the thermal plants are based on high ash sub bituminous coal as fuel that is mined predominantly in central India. By and large the plants are old and exhibit conversion efficiencies in the range of 25-30%. For conservative considerations this is assumed at a level of 33%. Since, the purchase of equivalent amount of power from cleaner sources is "avoided" from the grid; the plant would also be able to save on the T&D losses. Indian electric power grid, especially at the sub transmission and distribution levels, which operate at low voltage ratings of 33 KVA and 11 KVA, exhibit high transmission & distribution losses, sometimes in the excess of 40%. However, again for conservative estimation it is assumed at 25%.

The emission factors of these plants have been assumed on the basis of IPCC methodology (as discussed in: UNEP/OECD/IEA/IPCC 1995) for India, which is also being followed by several multilateral institutions like the World Bank. The emission factor of thermal power plants using sub bituminous/anthracite coals from India is 26.2 tons Carbon/TJ. To be on a conservative side, even though many of the hydel plants of National Hydroelectric Power Corporation (NHPC) are large in size it is assumed that they do not lead to any indirect GHG emissions. After considering the above mix of supply from various sources as mentioned above, the weighted average emission factor of the Tamil Nadu state grid is 1,119 tCO_2/MU or 1.119 tCO_2/kWh.

4. GHG mitigation potential of the project

Based on the above discussion for the stream 1 i.e. savings of furnace oil the emission reductions resulting are summarized below:

Stream 1: Furnace oil Savings

Steam generation with three WHR boilers	9.92	tons/hr
Pipeline losses to PAP	10%	
Steam received at PAP	8.93	tons/hr
Total steam in year (353 days)	75,653	TPA
Specific fuel consumption of PAP boiler	66.545	lit/ton steam
Furnace oil replaced	5,034,347	litres
	4,330	TPA
Emission factor of residual Fuel oil	21.1	tC/TJ
NCV of residual Fuel oil	40.19	TJ/KT
Emission factor of residual Fuel oil	3.1094	tCO_2/ton oil
Emission reductions	13,462	tCO_2 p.a.

Stream 2: Emission reduction from avoi power

Based on the above baseline methodology, purchase of grid power would help in mitigation of GHG emission to a ent.

The GHG emission reductions from the project v

Annual GHG Reduction = **GHG emission p million kWh of th baseline** (tCO2/milio kWh) **Annual units avoided by the project** (million kWh)

As discussed above the GHG emission per MU mission factor of the Tamil Nadu grid is 1,119 tCO_2 per MU under the tions discussed above based on the average energy fed by various source past three years. The project is expected to avoid purchase of 3.56 million m the state grid each year. Thus, the expected Annual GHG reduction fro team would be **3,980** tCO_2 p.a.

The above methodology, based on weighted average factors of the grid, is in conformity with the one for grid feeding small s ects as specified by the CDM Executive Board of the UNFCCC.

Thus, the overall emission reduction potential of the project is **17,442** tCO_2 p.a.

5. Monitoring & Verification

It is very crucial to monitor and verify periodically the ac ssion reductions achievable by the CEPs. There are two sides of this M&V ensure that the baseline itself does not change significantly and second ct performs as envisaged in the design. As discussed in detail earlier the tion of energy conservation in the overall power generation in the coun ot likely to be significant in the foreseeable future. Therefore, the former n care of to a major extent. It is therefore important to measure the perfo of the project in detail and with greater accuracy.

Stream 1:
The emission reductions from the project are on account of t ction in fuel oil consumption in the PAP. It is therefore essential to measure rent fuel oil consumption. Alternatively the last three years of records s e compiled from which the consumption pattern can be decided and c nted. After implementation of the project this consumption should be ued to be measured. This could be carried out through usual methods, i.e records in the beginning and end. In order to cross check the validity of th urement it is also suggested that the steam flow rate from the WHR boil measured.

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These two together would provide adequate measurement of the reduction in consumption of fuel oil.

Stream 2:
Performance of projects generating power for export to utility grid can be easily measured based on electric power generated and supplied to the grid. However, in the proposed project, the grid power consumption is expected to reduce. It is therefore essential to measure the power consumed by the existing motors and cooling water system corresponding existing SAP capacity. Thereafter, the actual power consumed after implementation of project must be measured. In view of this adequate in-house measurement would be necessary.

It is, therefore, suggested that suitable meters and check meters meeting prescribed standards and accuracy class be installed for measuring power consumption by the cooling water system. These meters will measure power consumed by the cooling water system. It is also suggested that these meters be checked and certified by an external agency so as to lend authenticity to the measurement.

The following M&V mechanism is suggested:
It is suggested that the responsibilities of monitoring the parameters identified earlier be vested to an interdepartmental group consisting of representatives from quality control, production, maintenance and strategic planning departments, which shall *inter alia*

1. Collect data on existing power consumption by the electric equipment in the cooling water system
2. Meter and record the total power consumed prior and after implementation of the project.
3. Measure the consumption of fuel oil before and after project completion
4. Calculate the furnace oil savings and power savings
5. Keep track of source wise power supply in the electric power grid and the status of completion of the National Grid

6. Conclusion

The proposed project involves use of a waste heat for generating useful steam. It helps in avoiding fossil fuel based steam generation. It also helps in reducing power/water consumption. It leads to mitigation of GHGs predominantly Carbon dioxide due to use of furnace oil. The project involves a clean energy technology and may need support for mitigation of risk. The project has been promoted by a private enterprise, which will also part finance the same. The project, thus, meets the GEP-CCS criteria.