



Voluntary Carbon Standard 2007.1
Final Validation Report

19 November 2007

Report No. 53603208-08/436

Final Validation Report:

Name of Validation company:	Date of the issue:
TÜV NORD CERT GmbH	13-11-2009
Report Title:	Approved by:
Bundled Biomass Based Thermal Energy Projects in U.P. & Punjab of Sukhbir Agro Energy Limited	Mr. Winter Rainer
Client:	Project Title:
M/s Sukhbir Agro Energy Limited	“Bundled Biomass Based Thermal Energy Projects in U.P. & Punjab of Sukhbir Agro Energy Limited”
Summary:	

VCS 2007.1 Validation Report of the GHG emission reduction project entitled “Bundled Biomass Based Thermal Energy Projects in U.P. & Punjab of Sukhbir Agro Energy Limited”

M/s Sukhbir Agro Energy Limited has commissioned the TÜV NORD JI/CDM Certification Program to validate the project: “Bundled Biomass Based Thermal Energy Projects in U.P. & Punjab of Sukhbir Agro Energy Limited” with regard to the relevant requirements of the VCS Guidelines/ VCSA Rules for project activities, as well as criteria for consistent project operations, monitoring and reporting.

- This project activity involves installation of 10 TPH and 3 TPH rice husk fired boilers by M/s Sukhbir Agro Energy Limited and by M/s Sri Ram solvex to meet the captive steam (heat) requirement, thereby avoiding fossil fuel consumption for generation of steam required for processing of paddy and consequently contributing to GHG emission reduction.
- AMS IC /Version 13: “Thermal Energy for the user, with or without electricity” an approved small scale methodology of UNFCCC CDM GHG program is applied.
- There are no restrictions or uncertainties faced related to the validation of the project.
- A risk-based approach has been followed to perform this validation. In the course of the validation, 06 Corrective Action Requests (CARs) and 11 Clarification Requests (CRs) were raised

The validation is based on the VCS PD, proof of title, additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and supporting documents made available to the validators by project proponent.

As a result of the validation, the validators confirm that:

- The project additionality is sufficiently justified in the PD.
- The monitoring plan is transparent, adequate and inline with applied baseline and monitoring methodology of AMS-I.C.Version 13.
- The calculation of the project emission reductions is carried out in a transparent and conservative manner, so that the estimated emission reductions of 268830 t CO₂e (total) is most likely to be achieved within the 10 years renewable crediting period.

No restrictions or uncertainties were identified related to the validation.

Work carried out by:

Number of pages:

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1 Introduction

1.1 Objective

The purpose of this validation is to have an independent third party assessment of the project design, in particular the project's baseline, the additionality, the monitoring plan (MP) and the project's compliance with

- The requirements of VCS 2007.1 program guidelines;
- Requirements of the CDM Approved methodology, AMS-I.C. version 13, which is approved by VCSA;
- To assess the project's compliance with other relevant rules, including the project country (India) legislation and
- Other relevant rules, of VCS sustainability criteria are validated in order to confirm that the project design as documented is sound and reasonable and meet the stated requirements and identified criteria. Validation is seen as necessary to provide assurance to stakeholders on the quality of the project and its intended generation of Verified emission reductions (VERs/VCUs¹ for double counting)

1.2 Scope and Criteria

The validation scope is given as an independent and objective review of the project design, the project's baseline study and monitoring plan (based on AMS-I.C.Version 13: “Thermal energy for the user with or without electricity”) which are included in the VCS PD and other relevant supporting documents.

The items covered in the validation are described below:

- VCS 2007.1 & Project Country Criteria
 - To meet the requirements of VCS 2007.1 guidelines requirements, in particular,
 - Project country requirements / criteria
- VCS Project Description
 - Project design
 - Project boundaries and Predicted VCS project GHG emissions
- Project Baseline
 - Baseline methodology
 - Baseline GHG emissions
- Monitoring Plan
 - Monitoring methodology

¹ As per VCS, Verified Emission Reductions (VERs) are considered to be VCUs only after successful registration in an approved VCU Registry

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- Indicators/data to be monitored and reported
- Roles and Responsibilities
- Project Additionality
- Background investigation and follow up interviews
- Draft validation reporting with CARs, CRs & FARs, if any
- Final validation reporting

The information included in the VCS PD^{/PD1/} and the supporting documents were reviewed against the requirements and criteria mentioned above. The TÜV NORD CERT GmbH JI/CDM CP has employed a risk-based approach in the validation, focusing on the identification of significant risks for project implementation and the generation of VERs. The validation is based on the information made available to TÜV NORD JI/CDM CP and on the contract conditions.

The validation is not meant to provide any consulting to the project participant. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 VCS project Description

The Project activity is a bundled biomass project activity which involves one rice husk fired boiler of M/s Sukhbir Agro Energy Ltd and one of M/s Sri Ram Solvex to meet the captive steam (heat) requirement to perform number of operations during the manufacturing of rice in M/s Sukhbir Agro Energy Limited (SAEL) and in M/s Sri Ram Solvex (SRS).

SAEL facility is located at Village Fatehullapur; district Ghazipur, Uttar Pradesh, India. The geographical coordinates are 25° 19' and 25° 54' N and 83° 4' and 83° 58' E. SRS facility is located at Guru Har Sahai, Faridkot Road in the District of Ferozpur in the state of Punjab, India. Guru Har Sahai is located approximately at the co-ordinates 30° 43' 0" North, 74° 25' 0" East. The 10 TPH and 3 TPH rice husk fired boilers were procured from M/s Cheema Boilers Limited. The proposed project would generate heat from renewable biomass resources (rice husk) thereby displacing the use of fossil fuel (coal). The biomass is rice husk, mostly obtained during the production of rice from paddy. The heat generated by this process is used in rice manufacturing process. The

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combined thermal energy production capacity of the boilers is 10.09 MW thermal.

The estimated steam generation from both the 10 TPH and 3 TPH boilers are 63,360 tonnes/ year (10 TPH boiler) and 19,008 tonnes/ year (3 TPH boiler). The estimated GHG emission reduction is 268,830 tCO₂e for the ten year crediting period.

1.4 Level of assurance

The validation report is based on VCS PD^{/PD1-PD3/}, investment comparison spreadsheet^{/xls1 to xls2/}, supporting documents made available to the validation team and information collected through interviews, and during the on-site assessment. The validation opinion is assured provided the credibility of all above.

2 Methodology

The validation of the project was carried out from November 2008 to August 2009.

Preparations: 2009-04-04

On-site validation: 2009-07-01

(Draft) Reporting: 2009-07-03

(Final) Reporting: 2009-08-28

The validation consisted of the following three phases:

- a desk review of the project design and the baseline and monitoring methodology
- follow-up interviews
- the resolution of outstanding issues and the issuance of the final validation report and opinion
-

2.1 Review of Document

The draft PD^{/PD1/} submitted by M/s Sukhbir Agro Private Limited in April 2009 and supporting background documents related to the project design and baseline were reviewed on 25/06/2009. Furthermore, the validation team used additional documentation by third parties like technical reports referring to the project design or to the basic conditions and technical data.

The documents that were considered during the validation process are given in chapter 5 of this report. They are listed as follows:

- Documents provided by the project proponent (Table 5-1)

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- Background investigation and assessment documents (Table 5-2)
- Websites used (Table 5-3).

2.2 Follow-up Interviews

On 01/07/2009 and 02/07/2009, the TÜV NORD JI/CDM CP performed validation site visit with the project proponent at M/s Sukhbir Agro Energy Limited in Ghazipur region of Uttar Pradesh and at Sri Ram Solvex in Ferozepur, Punjab

During this visit, as well as earlier and after, interviews with the project proponent, the consultant, project stakeholders and with local authorities were carried out to confirm selected information and to resolve issues identified in the document review.

The key interviewee and main topics of the interviews are summarised in Table 2-1.

Table 2-1 Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
1. Projects & Operations Personnel /IM01/	- Desk review findings - General aspects of the project - Project design, Commissioning and implementation - Technical equipment and operation of the project - Performance of the project - Involved personnel and responsibilities - Training and practice of the operational personnel - Implementation of the monitoring plan - Monitoring and measurement equipment - QA/QC Testing and calibration procedures - Monitored data management - Data quality, archiving and reporting procedures - Data uncertainty and residual risks - GHG calculation - Procedural aspects of the verification

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A detailed list including the functions or designations of the interviewed persons is given in chapter 5 (see Table 5-4). This table also includes reference codes to be used in the validation protocol.

2.3 Resolution of any material discrepancy

A few discrepancies were found during the validation and the validation report containing a set of CARs & CRs were submitted to the project proponent. The project design document was revised addressing the CARs & CRs issued by TÜV NORD JI/CDM CP.

After reviewing the revised and resubmitted project documentation^{/PD3/}; resolving the CARs & CRs raised and outstanding concerns, TÜV NORD JI/CDM CP issues this final validation report and opinion.

6 Corrective Action Requests (CARs) and 11 Clarification Requests (CRs) were found during Validation. Please refer to Section 3, table 3.

3 Validation Findings

The findings of validation are summarised in table 3:

Table 3: Summary of CAR, CR and FAR issued

Validation topic	No. of CAR	No. of FAR	No. of CR
D- Project Design	1		8
B- Baseline and additionality	3		
M- Monitoring plan	1		
C- Calculation of GHG emissions	1		1
E- Environmental Impact			1
L- Local Stakeholder Comments			1
SUM	6		11

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For an in depth analysis/evaluation of all CARs and CRs, the sections 3.1 to 3.6 below can be referred:

3.1 Project Design

The proposed project utilizes renewable biomass for generation of thermal energy. The project consists of one in-house boiler with a capacity of 10 TPH in M/s Sukhbir Agro Energy Limited (SAEL) facility and one 3 TPH Sri Ram Solvex (SRS) facility. The technology being used for generation of steam is the fluidized bed combustion (FBC) of rice husk in the boiler. The FBC technology is proven, indigenous and safe. The steam generated by this process is used to meet the captive steam (heat) requirement to perform number of operations during the manufacturing of rice in M/s Sukhbir Agro Private Limited and Sri Ram Solvex.

The estimated steam generation from both the boilers are 82368 tonnes/ year i.e 19008 tonnes per year from 3TPH boiler and 63360 tonnes per year from 10 TPH boiler. The estimated GHG emission reduction is 268,830 tCO₂e for the ten year crediting period.

The Fluidized bed rice husk boiler of both 10 TPH and 3 TPH capacity have been supplied by M/s Cheema Boilers Ltd.

Supporting documents like purchase orders of both 10 TPH and 3 TPH boilers /PO1 & PO2/ and boiler inspection certificates /IC1 & IC2/ were made available to the TÜV NORD JI/CDM CP. Boiler manufacturers certificates /MC1 & MC 2/ issued by the Manufacturers M/s Cheema Boilers Limited specifies the technical details of the boilers. Information was also collected through interviews with the PP and during the on-site assessment.

Technical details and equipment specifications used in the project are as detailed below:

Table 3-1: Technical details of the boilers.

M/s Sukhbir Agro Energy Limited	
Boiler pressure rating	17. 5 kg/cm ²
Boiler steam generation rate (capacity)	10 tons/hour
Steam generation rate	8 tons/hour

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(average @ 80% PLF)	
No. of operating hours a day	24
Type of boiler	water tube type
Fuel used	Rice husk
Method of firing of fuel	Furnace
Calorific value of the fuel	3100 kcal/kg

M/s Sri Ram Solvex	
Boiler pressure rating	10. 54 kg/cm ²
Boiler steam generation rate (capacity)	3 tons/hour
Steam generation rate (average @ 80% PLF)	2.4 tons/hour
No. of operating hours a day	24
Type of boiler	water tube type
Fuel used	Rice husk
Method of firing of fuel	Furnace
Calorific value of the fuel	3200 kcal/kg

The project duration is: 30 years.

Start date of the project is 30 August 2007

Renewable crediting period for the project activity: 30 August 2007 to 29 August 2017

The project activity comprises of 1 rice husk fired boiler of 10 TPH belonging to M/s Sukhbir Agro Energy Limited and 1 rice husk fired boiler of 3 TPH capacity belonging to M/s Sri Ram Solvex.

The Copy of purchase orders placed by project proponent M/s Sukhbir Agro Energy Limited and M/s Sri Ram Solvex to the boiler were submitted to supplier (M/s Cheema Boilers Ltd. were submitted to the DOE as proof of title. Refer to Table 5-1.

The emission reduction has not been double counted. The project has not applied for other carbon benefits. There is no rejection history for the project activity.

Since there are 2 investors in the Project activity, M/s Sukhbir Agro Energy Limited has been authorised to take up the responsibility of this VCS project activity on behalf of M/s Sri Ram Solvex also. Authorization letter in this regard have been submitted to the DOE.

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More over No objection certificates /NOC 1/ /NOC 2/ from
Pollution control Board Uttar Pradesh have been submitted
compliance with the local laws and regulations.
However, CAR 1, and CRs 1 -8 were raised and successfully
closed out.

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR D1 In section 1.9, Please provide source / reference for the technical parameters of the rice husk fired boilers (both in Sukhbir Agro Energy Limited and in Sri Ram Solvex.)	/PD 1/	The technical parameters of both the boilers are as per the design from the boilers manufacturer. A certificate from the boiler manufacturer for both the boilers is being provided	/PD 2/	The certificates from boiler manufacturer M/s Cheema boilers Limited stating the technical specifications of both 10 TPH and 3 TPH capacity boilers were verified. Thus the technical parameters given in the PD i.e., Boiler pressure rating , boiler steam generation rate , type of boiler and calorific value of the fuel for both 10 TPH and 3 TPH capacity boilers are in line with the technical parameters certified by the boiler manufacturers . Hence CAR D1 is closed.

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CR D1 In section 1.3, pages 3, amount of emission reductions are mentioned as 13603 tCO ₂ e. This differs from the value of annual average of the estimated reductions over the crediting Period given in the table above. Please modify.	/PD 1/	The modification has been done in section 1.3 of the PD.	/PD 2/	The proposed changes have been correctly applied by modifying the value of annual emission reductions in the PD. CR D1 is closed.
CR D2 In section 1.4, provide details about rice mill capacity and the requirement of rice husk for the project activity.	/PD 1/	The details regarding rice mill capacity and the requirement of rice husk have been provided in section 1.4 of the PD	/PD 2/	The capacities of rice mills of both M/s Sukhbir Agro Energy Limited and M/s Sri Ram Solvex have been provided. More over the requirement of rice husk for the project activities 10 TPH and 3 TPH boilers are also included.

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
				The required details have been provided by the PP. CR D2 is closed.
CR D3 Please provide precise geographical coordinates for SAEL facility i.e., 10 TPH boiler project activity under section 1.5	/PD 1/	The geographical coordinates have been provided in section 1.5 of the PD.	/PD 2/	The precise geographical coordinates of Gazhipur District where SAEL Project facility is located have been included in the PD as per the requirement. The coordinates were verified from http://www.satSIG.net/maps/lat-long-finder.htm and found to have applied correctly. CR D3 is closed.
CR D4 In section 1.6, boiler commissioning date, start date of the Project	/PD 1/	The boiler commissioning date and start date of the project activity have been put in dd/mm/yyyy	/PD 2/	Necessary changes have been made. CR D4 is closed.

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
activity and start date of the crediting period have to be mentioned in the format dd/mm/yy.		format in section 1.6 of the PD		
CR D5 In section 1.9, page 10, provide reference for the boiler efficiencies mentioned under normal boiler and fluidized bed boiler.	/PD 1/	The reference for the boiler efficiencies is the document from IGES - “Asia-Pacific Environmental Innovation Strategies (APEIS) Research on Innovative and Strategic Policy Options (RISPO) Good Practices Inventory Use of Rice Husks as Fuel in Process Steam Boilers”. A copy of the document is being sent for reference	/PD 2/	The reference document as well as reference web link http://www.iges.or.jp/APEIS/RISPO/inventory/db/pdf/0004.pdf was checked and thus the efficiencies mentioned under normal and FBC boilers are deemed to be acceptable. CR D5 is closed.
CR D6 In section 1.11, no risk affecting GHG emission reductions of the Project activity has been mentioned. Please clarify?	/PD 1/	The minor risk associated with breakdown of boiler has been entailed in section 1.11 of the PD	/PD 2/	Minor risks that may substantially affect the project's GHG emission reductions or removal enhancements are discussed in the PD as per

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
				requirement. The risks stated in the PD are deemed to be acceptable. CR D6 is closed.
CR D7 In section 1.15, contact details of the Project Proponent (PP) have been provided. Please do mention the roles & responsibilities of PP also.	/PD 1/	The roles and responsibility of project participants have been entailed in section 1.15 of the PD.	/PD 2/	Required changes have been correctly made in the PD. CR D7 is closed.
CR D8 All the following statutory clearances and documents have to be provided for verification. 1. Purchase order for the rice husk boiler - 10 TPH & 3 TPH 2. Permission for Erection/Installation of the husk	/PD 1/	All statutory clearance are provided.		The following documents were verified. 1. Purchase order for Rice husk fired FBC boiler of 10 TPH capacity from Cheema Industries dated 3-02-2007 by M/s

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
fired boiler from the Deputy Chief Inspector of Boilers 3. Grant of "Consent to Operate", for the manufacturing facility from State Environment Protection and Pollution Control Board 4. Authorisation letter for considering Sukhbir Agro Energy Limited as the Project Proponent.				Sukhbir Agro Energy Limited. 2. Purchase order for Rice husk FBC boiler of 3 TPH capacity from Cheema Industries 7-05-2007 by M/s Sri Ram Solvex Limited. 3. Boiler Inspection certificate for 10 TPH boiler in M/s Sukhbir Agro Energy Limited dated 26-11-2007 4. Boiler Inspection certificate for 10 TPH boiler in M/s Sri Ram Solvex dated 30-08-2007. 5. Grant of "Consent to Operate", for the manufacturing

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
				facility M/s Sri Ram Solvex from Punjab Pollution Control Board dated 18-03-2009. 6. Authorisation letter for considering Sukhbir Agro Energy Limited as the Project Proponent. All the above documents were found to be in order. CR D8 is closed.

3.2 Baseline

The proposed project adopts CDM approved methodology AMS-I.C. /Version 13: “Thermal energy for the user with or without electricity” which is approved under VCS 2007.1. The project satisfies all applicability criteria for AMS-I.D. The application of baseline methodology is assessed as correct. There is no methodology deviation or revision.

The project participant has used the approved methodology approach to determine the emission coefficient of the

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Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity. As per paragraph 6 of the small scale methodology AMS IC ver 13 “For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used.” The same has been chosen as the baseline for the project activity. The emission coefficient has been chosen as 95810 kgCO₂/TJ which has been taken from Initial National Communication to UNFCCC 2004 by India referred from www.natcomindia.org/publication_document1.htm website.

The validation team is convinced of the result of the emission coefficient calculation. It is deemed to be adequate, transparent and conservative

The additionality has been assessed using project test. The implementation barrier: investment barrier, technological barrier and common practice approach have been established to demonstrate the additionality.

Step as per VCS 2007.1	Argument	Assessment
Step 1: Regulatory Surplus	The proposed project activity is not mandated by any enforced law, statute or other regulatory framework. Entities in India are not enforced under any law to generate steam and electricity from biomass fuels for captive consumption.	Validation team has checked all the National Regulations and Local legal requirements. It was found that there is no legal requisite in India which enforces the implementation of biomass project for generation of steam and used for captive consumption. Hence the argument is appropriate for this project activity. ☒ Step passed ☐ Step not passed ☐ Not applicable
Step 2:	Considering the option	Investment Barrier:

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Step as per VCS 2007.1	Argument	Assessment
Investment Barrier	available of installing a coal based boiler, the project proponent has chosen a more expensive option of installing a rice husk based boiler. So the barrier faced by PP by investing in rice husk based boiler is demonstrated by estimating the levelized cost of generation of steam from boilers using rice husk, coal and furnace oil i.e. for comparative analysis of the project activity vis a vis the baseline scenario unit cost of energy is taken as the financial indicator. In the investment comparison analysis, the 10 TPH biomass based boiler of SAEL has been compared with the same capacity of coal based boiler and Furnace oil based boiler More over the cost comparisons have been done separately for 3 TPH biomass based boiler of SRS with the same capacity of coal based and furnace oil based boiler. From the cost comparison analysis, it is noted that the cost of steam generation from the rice husk was much higher than while using coal and furnace oil. The parameters used for the cost comparison of coal, biomass and furnace oil are steam generation, calorific Value, boiler efficiency, quantity of fuel used, and cost of fuel.	The capital cost (investment) is assumed to be same for all biomass, coal and furnace oil fired boiler. More over the operating non-fuel costs are exactly the same whether on biomass or on coal or on furnace oil. In such a scenario, the only determinant from the perspective of analysis is the fuel cost (on INR/GCal basis) for coal, biomass and furnace oil. Hence identified financial indicator i.e levelized cost of delivered heat is found to be suitable for the project type and have applied correctly. More over , For rice husk based boiler, 1. 10 TPH boiler manufacturers certificate from Cheema Boilers Limited 2. 3 TPH boiler manufacturers certificate from Cheema Boilers Limited 3. Cost of Rice husk for 10 TPH boiler given by Arvind Enterprises to M/s Sukhbir Agro Energy Limited dated 5-01-2007

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Step as per VCS 2007.1	Argument	Assessment
	The parameters used in calculating for unit cost of steam generation are referred from Rice husk boiler Calorific Value - Boiler manufacturer certificate Boiler efficiency - Boiler manufacturer certificate Cost of fuel - Quotation from local supplier Quantity of fuel used - It has been determined by using the calorific value and efficiency of boiler as mentioned above. The steam enthalpy (referred from SPIRAX website) has also been used to determine the quantity of fuel. Coal Boiler Calorific Value - TEDDY database from TERI and quotation from the local coal supplier Boiler efficiency - Thermax India website. Features of COMBIPAC coal fired boilers Cost of fuel - Quotation from local coal supplier Quantity of fuel used - It has been determined by using the calorific value and efficiency of boiler as mentioned above. The steam enthalpy (referred from	4. Cost of Rice husk for 3 TPH boiler given by Shivalik Gram Udyog Samiti to M/s Sri Ram Solvex dated 8-03-2007 5.http://www.spiraxsarco.com/esc/SS_Properties.aspx All the above documents and reference websites were verified in respect to the values applied for calorific value, boiler efficiency, fuel cost and enthalpy of steam which were used in calculating the unit cost of steam from rice husk based boiler and thus concluded that all the values have been correctly applied. For coal based boiler; 1. TEDDY database document from TERI^{/GCV/} 2.http://www.thermaxindia.com/v2/ProductPage.asp?levelno=2&divid=1&pageno=1 2. Cost of coal for 10 TPH boiler given by Adarsh Coal Traders to M/s Sukhbir Agro Energy Limited dated 10-03-2007 3. Cost of coal for 3 TPH boiler given by Jey

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Step as per VCS 2007.1	Argument	Assessment
Technologic al barrier:	SPIRAX website) has also been used to determine the quantity of fuel. Furnace oil boiler Calorific Value - PCRA booklet series on "Energy Conservation in Thermal Utilities" Boiler efficiency - Thermax India website. Features of SHELLMAX oil fired boilers Cost of fuel - From NCDEX website Quantity of fuel used - It has been determined by using the calorific value and efficiency of boiler as mentioned above. The steam enthalpy (referred from SPIRAX website) has also been used to determine the quantity of fuel. Thus it is concluded that coal based heat energy generation is a more viable alternative to the project and this would lead to higher emissions as compared to the project activity.	Maa Ambey Coal Merchant to M/s Sri Ram Solvex dated 07-01-2007 4.http://www.spiraxsarc.o.com/esc/SS_Properties.aspx All the above documents and reference websites were verified in respect to the values applied for calorific value, boiler efficiency, fuel cost and enthalpy of steam which were used in calculating the unit cost of steam from coal based boiler and thus concluded that all the values have been correctly applied. Furnace oil boiler 1. PCRA website 2..http://www.thermaxindia.com/v2/ProductPage.asp?levelno=2&divid=1&pageno=1 3.http://contentlinks.siancerc.com/manoramacommodity/GetCommodityDetails.asp?tic... 4.http://www.spiraxsarc.o.com/esc/SS_Properties.aspx All the above web links were verified in respect to the values applied for calorific value, boiler efficiency, fuel cost and enthalpy of steam which were used in

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Step as per VCS 2007.1	Argument	Assessment
	The arguments under technological barrier are in terms that a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions. • The characteristics of rice husk - the low density and high volume crop residue being used in the project activity imply a series of technological innovations like innovative boiler design, anti-corrosive piping, improved fuel management and boiler operation to be carried out, as compared to standard design of conventional coal fired boilers. • The efficiency difference	calculating the unit cost of steam from furnace oil based boiler and thus concluded that all the values have been correctly applied. More over the Levelised cost calculation sheet for 10 TPH and 3 TPH boilers were verified and the calculations were found to be correct. Thus the arguments under investment barrier are found to be real and acceptable. ☒ Step passed ☐ Step not passed ☐ Not applicable From the boiler Manufacturers certificate, it is found that the efficiency of rice husk fired boiler is less compared to other fuels operating boilers and thus affecting the fuel consumption rate. More over the high silica content of rice husk is observed from chemical composition of rice husk referred from the web site http://lejpt.academicdirect.org/A08/58_70.htm Thus the corrosion of

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Step as per VCS 2007.1	Argument	Assessment
	would affect the fuel consumption rate in the system and hence it would cost more for the same amount of energy generation. • The ash generated after combustion of rice husk contains high percentage of silica which leads to rapid erosion the equipments. • Further, in rice husk fired boiler, escape of fluidized media along with flue gas is a common problem. To compensate this and to maintain fluidized bed thickness, fluidizing media is required to be added at regular intervals. This leads to variation in the air requirements. • In a nutshell the operation and control of biomass fired boiler requires skilled boiler operators. • Project owners of this project activity have ventured first time into such an activity and have no prior experience. Apart from the enhanced cost of steam generation as compared to the baseline option of using coal, their inexperience in this field may be barrier & pose difficulties in its operation and	equipments due to silica deposits are deemed to be acceptable. Hence the overall arguments under technological barrier are found to be deemed acceptable As the PP has ventured first time into project activity, without any prior experience in this field, hence it is deemed to be acceptable that they pose difficulties in its operation and maintenance and facing technological barrier. ☒ Step passed ☐ Step not passed ☐ Not applicable

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Step as per VCS 2007.1	Argument	Assessment
	maintenance. Thus Carbon credit benefits through the VCS route would support the project activity financially and to some extent cover the risks involved.	
Step 3: Common Practice	Rice husk based steam generation is not a common practice in the region of project activity in Ghazipur and it is the first rice husk based boiler in the region. This is evident from the certificate received from the district industry centre. The rice husk based boiler installed in Guru Har Sahai is one of its kind installed in the region. It is the only boiler in the region to be installed with a heat recovery unit, an air pre-heater. This is certified by the letter from the Rice Millers Association. Based on the above analysis, it is concluded that the project activity is not a common practice in their respective regions.	Certificate from the District Industry Centre stating that the 10 TPH boiler is the first rice husk based boiler in the region /CP 1/ And Certificate from Rice Millers Association states that the 3 TPH rice husk boiler of M/s Sri Ram Solvex is the only boiler in the region to be installed with a heat recovery unit, an air pre-heater /CP 2/ All the above certificates were verified and found that the project activities of both 10 TPH and 3 TPH boilers using rice husk are not commonly practiced activities in their respective regions. ☒ Step passed ☐ Step not passed ☐ Not applicable

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Thus the validation team arrived at the opinion that the project activity is assessed to be additional.

However, following CAR was raised and consequent upon the satisfactory response received from the project promoter, the issues have been closed out.

CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR B1 Under section 2.5, 1. In page 16, the following particulars used for arriving unit cost of steam (table 1 and 2) need to be backed with references or source of data: The particulars are: • Calorific value • Boiler Efficiency • Cost of fuel • Quantity used • Steam generation Please provide references for the particulars	/PD 1/ 2.5	The steam generation is determined by using a Plant Load Factor (PLF) of 80% for the boiler and 330 operating days in a year. The references of other data used for determination of unit cost of steam are provided as under: Rice Husk Boiler Calorific Value - Boiler manufacturer certificate Boiler efficiency - Boiler manufacturer certificate Cost of fuel - Quotation from local supplier Quantity of fuel used - It has been determined by	/PD 2/	All the reference documents /MC1/ /MC2/ /COST H1/ /COST H2/ /COST C1/ /COST C2/ and reference websites /therm 1/ /spirax/ were verified in respect to the parameters used for levelised cost comparison of steam production from both rice husk and coal based boilers

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
corresponding to both biomass and coal. 2. Please state about specific fuel consumption (Kg of rice husk used / Kg of steam) in the PD.		using the calorific value and efficiency of boiler as mentioned above. The steam enthalpy (referred from SPIRAX website) has also been used to determine the quantity of fuel. Coal Boiler Calorific Value - quotation from the local coal supplier Boiler efficiency - Thermax India website. Features of COMBIPAC coal fired boilers Cost of fuel - Quotation from local coal supplier Quantity of fuel used - It has been determined by using the calorific value and efficiency of boiler as mentioned above. The steam enthalpy (referred from SPIRAX website) has also been used to determine the quantity of fuel.		(10 TPH & 3 TPH) and found that the values have been applied correctly . CAR B1 is closed.

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
		The same has already been mentioned in the monitoring section 3.3 of the VCS PD.		
CAR B2 For comparative analysis, levelized cost of steam generation has been compared for biomass & coal. Please calculate and compare the cost with at least one more fossil fuel in addition to coal.	/PD 1/ 2.5	The levelized cost of steam generation has also been done for furnace oil based boiler. The same has been included in VCS PD under section 2.5. The source of data used is as follows: Calorific Value - PCRA booklet series on "Energy Conservation in Thermal Utilities" Boiler efficiency - Thermax India website. Features of SHELLMAX oil fired boilers Cost of fuel - From NCDEX website Quantity of fuel used - It has been determined by using the calorific value and efficiency of boiler as mentioned above.	/PD 2/	Necessary changes have been made by including the unit cost generation of steam using furnace oil as fuel. Moreover, the web links http://www.pcraindia.org/ /therm 2/ /ncdex/ and /spirax/ were verified and thus all the values are found to have applied correctly.

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
		The steam enthalpy (referred from SPIRAX website) has also been used to determine the quantity of fuel.		CAR B2 is closed.
CAR B3 Additionality has been determined using Test 1 of VCS 2007.1. However, STEP 3 has been omitted. Additionality needs to be established by a comprehensive analysis which includes common practice.	/PD 1/	The step 3 of common practice analysis under Test 1 - The project test has been added in section 2.5 of PD to determine the additionality of the project.	/PD 2/	The arguments under common practice analysis have been included. More over the references /CP1/ and /CP2/ were checked and found that the project activities of both 10 TPH and 3 TPH boilers using rice husk are not commonly practiced activities in their respective regions.

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
				Hence CAR B3 is closed.

3.3 Monitoring Plan

The proposed project uses CDM approved methodology AMS-I.C./Version 13: “Thermal energy for the user with or without electricity” which is approved under VCS 2007.1.

The project satisfies all criteria for AMS-I.C. The application of monitoring methodology is assessed as correct.

In accordance with the guidelines laid down in the applicable methodology, “AMS IC, monitoring shall consist of;

- Metering the energy produced by a sample of the systems where simplified baseline is based on the energy produced multiplied by the emission coefficient.

The methodology also states that “for projects where only biomass or biomass and fossil fuel are used the amount of biomass and fossil fuel input shall be monitored”.

This in accordance with the provisions in the approved methodology AMS IC, emission reductions due to the project activity will be determined as per the following formula:

$$BE_y = H_y * EF / \eta$$

BE_y = Baseline emissions of GHG from steam/heat displaced by the project activity during the year y in tCO₂e.

H_y = Net quantity of heat supplied by the project activity in the form of steam during the year y in TJ.

EF = Emission factor per unit of energy of fuel that would have been used in the baseline plant in (tCO₂ / TJ)

η = Efficiency of the boiler using fossil

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fuel is chosen as highest of the two values provided by two or more manufacturers for units with similar specifications that would have been used in the absence of the project activity

$$H_y = QY * HS$$

Where;

QY = Quantity of steam supplied by the project activity during the year y in Tons.
HS = Average enthalpy of the steam generated during the year y in TJ / Ton

For determining the enthalpy of steam, pressure of the steam will be monitored.

Accordingly the parameters being monitored in case of the proposed project activity include the quantum of process steam generated, quantity of rice husk used and pressure of steam generated.

The monitoring plan/^{PD2/} provides detailed information related to the collection and archiving of all relevant data needed to:

- Quantity of process steam generated
- Pressure of the process steam generated
- Quantity of rice husk used
- Specific fuel consumption of rice husk

The parameters to be monitored in the project activity are determined by following means. Mass flow meter will be used to determine steam flow rate. The pressure of the steam is determined by the online pressure recorder. Calibration of flow meter will be done as per the recommendations of the supplier. Thermal efficiency of the process steam boilers using coal as fuel is determined from thermax website ^{/therm 1/}

Pressure of the steam generated in the husk fired boiler is determined on the online pressure recorder. The calibration of pressure recorder will be carried out from time to time as per the recommendations of the suppliers of the recorder.

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Enthalpy of steam is determined from the steam tables, using the average value of pressure (PS) of the steam generated during the shift.

Quantity of rice husk used during the year is determined by the receipt of rice husk during the year plus the inventory at the beginning of the year less the inventory of husk carried forward.

Calorific value of rice husk is determined from the measurements carried out at reputed laboratories and according to relevant international standards.

The moisture content of biomass residue will be determined in the in-house laboratory. Standard testing procedure will be used.

The specific fuel consumption of the rice husk is determined using the calorific value of the fuel used, efficiency of the boiler and enthalpy of steam. The values for the above are obtained from the boiler quotations provided by the vendor and the steam tables.

All these parameters will be monitored and recorded on per shift basis. The source of generation of all these data is the boiler house. Thus all these parameters will be entered in the log book of the boiler house on per shift basis.

In case of steam pressure the average value will be used. The values of the monitored parameters will also be stored in electronic form archived for a period of 2 years after its crediting period.

Thus the project conforms to the requirement of clauses 18, 19 and 20 of AMS-I.C.Version 13.

The on-site visit was carried out on 1-07-2009. One member of the Validation team attended the site visit and photographs were taken.

Before and during the on-site visit, the validation team performed interviews with the project participants to confirm selected information and to resolve issues identified in the document review.

During the on site-visit the information above was verified by the biomass consumption records and invoices

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and moisture content measurements. This was found to be in line with the monitoring plan /PD2/.

Responsibilities related to monitoring are clearly defined in the monitoring plan and were assessed and found to be OK.

However, one CAR & CR were raised and successfully closed out.

CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
CAR M1 In Section 3.4 1. Are there any back up arrangements for data storing? 2. Monitoring of calorific value, moisture content of the fuel, are not mentioned. Please clarify.	/PD 1/	1. The data monitored is stored as paper backup. This data is also transferred to electronic format and archived for a period of 2 years. This has been mentioned in section 3.4 of the PD. 2. The monitoring of calorific value and moisture content of rice husk has been included in section 3.3 of the PD	/PD 2/	The necessary informations under monitoring plan have been added in the PD. Thus the monitoring plan is complete with all required details. CAR M1 is closed.

3.4 Calculation of GHG Emissions

GHG emission reduction achieved by the project activity is calculated as the difference between the baseline emissions and the project emissions as well as leakage

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emissions. There are no GHG emissions arising from the project as it is a renewable biomass project. Hence, the project emissions are zero. As the project activity does not involve transfer of equipment, leakage due to the project activity is not applicable as per version 13 of AMS-I.C.

As per the methodology AMS-I.C, Version 13, the baseline scenario is the use of fossil fuels in this case, coal. Therefore the emission factor (EF_{CO_2}) is the default emission factor for coal from NATCOM - India's Initial National Communication to UNFCCC 2004 which is equal to 95810 kg CO₂ / TJ.

Baseline emissions are equal to Net quantity of heat generated by the project activity (HGy) multiplied by the grid emission factor. Efficiency (η) of the fossil fuel based boiler which would have been used in the baseline scenario is calculated as 82% . The efficiency of the coal based boiler has been verified from from <http://www.thermaxindia.com/v2/ProductPage.asp?levelno=2&divid=1&pageno=1> and efficiency of 82% is found to have applied correctly. It is the highest efficiency provided by the Manufacturer Thermax compared to Siston India Pvt Ltd, a boiler Manufacturer offering an efficiency of 80%. Thus the efficiency calculation is in line with para 13 of AMS IC.

Therefore, baseline emissions, $BE_y = HG_y * EFCO_2 / \eta_{th}$

$$HG_y = Q_y * H_s$$

Q_y -Expected generation of saturated steam from the husk fired boiler is calculated as 63, 360 T/yr for 10TPH boiler in SAEL and expected generation of saturated steam from the husk fired boiler of 3 TPH in SRS is calculated as 19,008 T/yr.

H_s - Enthalpy of steam is used as 2796.65 KJ/Kg of steam for 10 TPH boiler & Enthalpy of steam is used as 2782.41 KJ/Kg of steam for 3 TPH boiler. Spirax sarco website was referred and the value of enthalpy of steam is found to have applied correctly.

Specific fuel consumption is the ratio determined using the calorific value of the rice husk, efficiency of the boiler and enthalpy of steam. This has been calculated

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ex-ante. Calorific value and efficiency of the boiler has been verified to be correct from Boiler Manufacturer's certificate / MC/ and Spirax sarco website was referred and the value of enthalpy of steam is found to have applied correctly

It has been assessed that no fossil fuel is used in the project activity, so no GHG emissions due to project activity.

The validation team has checked the underlying input values as well as the computation in the emission reduction spreadsheet^{/ER1/}. The estimation of the emission reduction was realized in a transparent and conservative manner and is well documented under section 4.1 - 4.4 of the PD.

As per the final PD^{/PD3/} this project is expected to reduce emissions of 268,830 tCO₂e over a 10 year crediting period which can be renewed once.

The following CAR and CR were raised and were subsequently closed out in view of the satisfactory response received from the project promoters:

CAR/CR	Referen ce	Summary of project owner response	Revised section s (as applica ble)	Conclusio n
CAR C1 Under section 4.4, in quantifying GHG emissions, leakage has been neglected. But, no justification has been provided. Please refer to Attachment C to Appendix B, for general guidance on leakage in biomass activities.	 /PD1/ /ER 1/	 For the 10 TPH boiler, rice husk will be available in house from the rice mill. This has been demonstrated in a separate sheet. For the 3 TPH boiler, rice husk will be procured from outside. The Guru Har Sahai area has surplus amount of rice husk available. This is evident	 /PD 2/ ER2/	Calculati on sheet showing the surplus availabil ity of rice husk in M/s Sukhbir Agro Energy Limited / SURP 1/ and Certifica te given by Rice Millers Associati on for

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
Please provide supporting documents to justify that leakage of the project may be neglected.		from the certificate provided by the Rice Millers Association of the region. Hence leakage is neglected.		surplus availability of rice husk in Guruharsa hai region / SURP 2/ . were verified and concluded that biomass availability is in surplus in both the regions and the arguments are in line with Attachment C to Appendix B “ general guidance of leakage in biomass activities”. Hence neglecting of leakage is acceptable. CAR C1 is

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CAR/CR	Referen ce	Summary of project owner response	Revised section s (as applica ble)	Conclusio n
				closed.
CR C1 Under section 4.2 provide correct / specific reference for the values used for fossil fuel emission factor coefficient and enthalpy of steam generated.	/PD1/	Reference for the emission factor coefficient has been provided in the section 3.3 of Monitoring under the in the table for parameter/data EF. In the same section the reference for determination of enthalpy of steam has been provided. The enthalpy has been determined using the SPIRAX steam tables available on their web site. (http://www.spiraxsarco.com/resources/steam-tables/saturated-steam.asp). The exact snap shot of the same is also being sent along with this DVR.	/PD 2/	The reference NATCOM - Initial National Communication to UNFCCC 2004 was checked and found that the IPCC Emission factor value for coal has been correctly applied. Spiraxsarco website was referred and the value of enthalpy of steam is found to have applied correctly. . CR C1 is closed.

3.5 Environmental Impact

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As per the Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated 14th September 2006, 38 Categories of project activities are required to undertake environmental impact assessment studies. The details of these activities are available at:
<http://envfor.nic.in/legis/eia/sol533.pdf>

The proposed project doesn't fall under the list of activities requiring EIA as it will not involve any negative environmental impacts, as the small scale biomass based thermal energy generation is a form of cleanest possible source of renewable energy. However, some environment and safety aspects that are taken care by project activity are :

- The project activity follows the norms set up by the Punjab Pollution Control Board.
- It maintains and operates the pollution control devices as per the norms prescribed in Environment Protection Rules 1986, Water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of Pollution) Act 1981 for example the dry fly ash is collected by using trolleys.

Grant of "Consent to Operate" /CSO/, for the manufacturing facility M/s Sri Ram Solvex from Punjab Pollution Control Board submitted by PP. It has been verified and found to be OK.

More over clearance certificates for air pollution control / AP 1/ /AP 2/ and water pollution control / WP 1/ /WP 2/ from Uttar Pradesh Pollution Control Board to Sukhbir Agro Energy Limited was submitted by PP, which have been verified and found to be OK.

However, one CR was raised and successfully closed out.

CAR/CR	Referen ce	Summary of project owner response	Revised section s (as applica ble)	Conclusio n
CR E1 Under section 5, Environmental impact, please	/PD1/	The project proponents have installed air pollution control equipments (TREMA	/PD 2/	The arguments given by PP are satisfact

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CAR/CR	Reference	Summary of project owner response	Revised sections (as applicable)	Conclusion
state the arrangements that have been made for controlling particulate matter in stack emissions and also mention how the ash generated due to burning of rice husk is treated after its removal from boiler.		Cyclone) in their boilers to control the emission of particulate matter under the statutory limits. Ash is manually collected from boiler sections in the trolley. As a goodwill gesture the farmers are given the ash to use as manure in their fields. This has been mentioned in section 5 of the PD.		ory. CR E1 is closed.

3.5 Comments by stakeholders

The stakeholders meetings were conducted on 27th March 2008 for 3 TPH boiler at M/s Sri Ram Solvex and on 15th September 2008 for 10 TPH boiler at M/S Sukhbir Agro Energy Limited. The stakeholders were identified and approached with necessary document related to the project activity. The stakeholders were invited by distributing pamphlets in the nearby areas /SHC1/&/SHC 2/. The entire procedure of procurement of biomass to reduction in the gases in the surrounding areas was satisfactorily described to the people. The queries put by the people were answered to their contentment by the SAPL representatives.

The overall response to the project, from local stakeholders, was encouraging and positive. Overall there was no significant negative comment by any of the stakeholders.

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However, one CR was raised and successfully closed out.

CAR/CR	Referen ce	Summary of project owner response	Revised section s (as applica ble)	Conclusio n
CR L1 Under section 6, Please provide copies of notice (invitation) for conducting stakeholder meeting, name and designation of persons who attended the meeting and a copy of the minutes of meeting.	/PD1/	Following documents have been submitted: Pamphlet distributed for invitation to the stakeholders meeting Minutes of Stakeholder meeting along with list of persons attended.	/PD 2/	Invitation to stakeholders, minutes of meeting and attendance list in respect to stakeholders meeting conducted for 10 TPH rice husk fired boiler in M/s Sukhbir Agro Energy Limited. Invitation to stakeholders, minutes of meeting and attendance list in respect to stakeholders meeting

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CAR/CR	Referen ce	Summary of project owner response	Revised section s (as applica ble)	Conclusio n
				conducted for 3 TPH rice husk fired boiler in M/s Sri Ram Solvex were verified and found to be OK. CR L1 is closed.

4 Validation conclusion

M/s Sukhbir Agro Energy Limited has commissioned the TÜV NORD JI/CDM Certification Program to carry out the validation of the project – “Bundled Biomass Based Thermal Energy Projects in U.P. & Punjab of Sukhbir Agro Energy Limited”

With regard to the relevant requirements of VCS 2007.1 Standard as well as criteria for consistent project operations, monitoring and reporting.

The project activity involves installation of in-house rice husk fired boiler of 10 TPH capacity in M/s Sukhbir Agro Energy Limited and 3 TPH capacity in M/s Sri Ram Solvex. The steam generation through these boilers are used in the rice manufacturing unit.

The review of the VCS PD and additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and review of comments by parties have provided TÜV NORD JI/CDM CP with sufficient evidence to validate the fulfilment of the stated criteria.

A risk based approach has been followed to perform this validation. In the course of the validation 6 Corrective Action Requests (CAR) and 11 Clarification Requests (CR) were raised and successfully closed out.

The validation is based on the VCS PD, proof of title, additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and supporting documents made available to the validators by project proponent.

As a result of the validation, the validators confirm that:

The project fulfils criteria of VCS 2007.1 As,

- The project additionality is sufficiently justified in the PD.
- The monitoring plan is transparent, adequate and inline with applied baseline and monitoring methodology of AMS-I.C Version 13.
- The calculation of the project emission reductions is carried out in a transparent and conservative manner, so that the calculated emission reductions of 268,830 t CO₂e (total) is most likely to be achieved within the 10 years renewable crediting period which will be renewed once.

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Team Leader

Bangalore, 2009-08-25



Rainer Winter

Final approval

Essen, 2009-11-13

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5 References

Table 5-1: Documents provided by the project proponent

Reference	Document
/IC1/	Boiler Inspection certificate for 10 TPH boiler in M/s Sukhbir Agro Energy Limited dated 26-11-2007
/IC 2/	Boiler Inspection certificate for 10 TPH boiler in M/s Sri Ram Solvex dated 30-08-2007
/MC1/	10 TPH boiler manufacturers certificate from Cheema Boilers Limited
/MC2/	3 TPH boiler manufacturers certificate from Cheema Boilers Limited
/PD1/	VCS PD for M/s Sukhbir Agro Energy Limited dated 21 November 2008, Version 1
/PD2/	VCS PD for M/s Sukhbir Agro Energy Limited dated 1 August 2009, Version 2
/PD 3/	VCS PD for M/s Sukhbir Agro Energy Limited dated 7 November 2009, Version 3
/PO 1 /	Purchase order for Rice husk fired FBC boiler of 10 TPH capacity from Cheema Industries dated 3-02-2007 by M/s Sukhbir Agro Energy Limited
/PO 2/	Purchase order for Rice husk FBC boiler of 3 TPH capacity from Cheema Industries 7-05 -2007 by M/s Sri Ram Solvex Limited
/ CP 1/	Certificate from the District Industry Centre stating that the 10 TPH boiler is the first rice husk based boiler in the region
/CP2/	Certificate from Rice Millers Association that the 3 TPH rice husk boiler of M/s Sri Ram Solvex is the only boiler in the region to be installed with a heat recovery unit, an air pre-heater dated 17-10-2007.

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Reference	Document
/CSO/	Grant of “Consent to Operate”, for the manufacturing facility M/s Sri Ram Solvex from Punjab Pollution Control Board dated 18-03-2009
/COST H1/	Cost of Rice husk for 10 TPH boiler given by Arvind Enterprises to M/s Sukhbir Agro Energy Limited dated 5-01-2007
/COST H2/	Cost of Rice husk for 3 TPH boiler given by Shivalik Gram Udyog Samiti to M/s Sri Ram Solvex dated 8-03-2007
/COST C1/	Cost of coal for 10 TPH boiler given by Adarsh Coal Traders to M/s Sukhbir Agro Energy Limited dated 10-03-2007
/COST C2/	Cost of coal for 3 TPH boiler given by Jey Maa Ambey Coal Merchant to M/s Sri Ram Solvex dated 07-01-2007
/COST FO/	Cost of furnace oil from NCDEX website during 2007.
/SURP 1/	Calculation sheet showing the surplus availability of rice husk in M/s Sukhbir Agro Energy Limited.
/SURP 2/	Certificate given by Rice Millers Association for surplus availability of rice husk in Guruharsahai region dated 15 July 2009.
/SHC1/	Invitation to stake holders, minutes of meeting and attendance list in respect to stakeholders meeting conducted for 10 TPH rice husk fired boiler in M/s Sukhbir Agro Energy Limited 15-09-2008.
/SHC 2/	Invitation to stake holders, minutes of meeting and attendance list in respect to stakeholders meeting conducted for 3 TPH rice husk fired boiler in M/s Sri Ram Solvex dated 27-03-2008.
/XLS1/	Levelised cost calculation sheet for 10 TPH and 3 TPH
/ER 1/	Emission Reduction calculations

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Reference	Document
/NOC 1/	No Objection Certificate from Uttar Pradesh Pollution Control Board to Sukhbir Agro Energy Limited dated 5-09-2006
/NOC 2/	No Objection Certificate from Uttar Pradesh Pollution Control Board to Sukhbir Agro Energy Limited dated 8-09-2006
/AP 1/	Air Pollution clearance from Uttar Pradesh Pollution Control Board, 30-11-2007
/AP 2/	Air Pollution clearance from Uttar Pradesh Pollution Control Board, 28-02-2008
/WP 1/	Water Pollution clearance from Uttar Pradesh Pollution Control Board, 30-11-2007
/WP 2/	Water Pollution clearance from Uttar Pradesh Pollution Control Board, 28-02-2008

Table 5-2: Background investigation and assessment documents

Reference	Document
/AMS-I.C./	Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories- Thermal energy for the user with or without electricity (Version 13)
/Att C. App B/	Attachment C to Appendix B - General guidance on leakage in biomass project activities

Table 5-3: Websites used

Reference	Link	Organisation
/vcs/	www.v-c-s.org	VCS website

VCS 2007.1 Validation Report of the GHG emission reduction project entitled “
Bundled Biomass Based Thermal Energy Projects in U.P. & Punjab of Sukhbir Agro
Energy Limited”

Reference	Link	Organisation
/unfccc/	www.unfccc.int	UNFCCC website
/ipcc/	http://www.ipcc.ch/	Intergovernmental Panel on Climate Change
/cea/	www.cea.nic.in	Central Electricity Authority, Government of India
/env/	http://envfor.nic.in/legis/eia/so1533.pdf	Ministry of Environment and Forests, Government of India.
/mapland/	http://www.maplandia.com/india/punjab/firozpur/guru-har-sahai/	Mapland India
/spirax/	http://www.spiraxsarco.com/esc/SS_Properties.aspx	Spiraxsarco
/therm 1/	http://www.thermaxindia.com/v2/ProductPage.asp?levelno=2&divid=1&pageno=1	Thermax
/therm 2/	http://www.thermaxindia.com/v2/ProductPage.asp?levelno=2&divid=1&pageno=1	Thermax
/ncdex/	http://contentlinks.asiancerc.com/manoramacommodity/GetCommodityDetails.asp?tic...	NCDEX
/pcra/	http://www.pcra.org/	PCRA

VCS 2007.1 Validation Report of the GHG emission reduction project entitled “
Bundled Biomass Based Thermal Energy Projects in U.P. & Punjab of Sukhbir Agro
Energy Limited”

Table 5-4: Interviewed Persons

Reference		Name	Organisation / Function
/IM01/	☒ Mr. ☐ Ms.	M.L. Arora	M/s. Sukhbir Agro Energy Ltd.,
/IM01/	☒ Mr. ☐ Ms.	Mr. Sharma	Consultant