VERIFICATION REPORT 21224010

Methane Recovery Project Princepeel Wilbertoord

The Netherlands

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Summary:

TÜV Rheinland Energieund Umwelt GmbH was assigned to perform verification of the second monitoring period for the VCS Methane Recovery Project Princepeel Wilbertoord, against the verification criteria set under the VCS standard v.3.4, VCS Program Guide v3.5 and all other relevant requirements and considering the reasonable materiality threshold of 5% (as defined in ISO 14064 - 3)

The Methane Recovery Project Princepeel Wilbertoord is a combined heat and power plant with 5 CHP units in Wilbertoord, the Netherlands, which produces electric energy and heat from processing manure and other organic substrates and therefore prevent from uncontrolled methane emissions from manure into the atmosphere.

The verification services are requested by PP and cover the second monitoring period from 01/01/2012 until 31/12/2012, for the registered VCS project activity Methane Recovery Project Princepeel Wilbertoord. The verification is performed in accordance to the VCS requirements as specified within the VCS standard v.3.4, VCS Program Guide v3.5.

The verification is performed in 3 main steps, namely

- desk review – covering all provided documents, i.e. current monitoring report, previous monitoring report, JI PDD, ER calculation sheets, records, manuals, etc
- on-site visit – confirming the correctness of the monitoring report, interviews with plant manager, observation of data processing and storage, confirmation of metering devices, plausibility checks
- issuance of verification protocol, including CAR/CL list and eventually verification report for the monitoring period in question

Finally based on the provided documentation and site inspection, TÜV Rheinland Energie und Umwelt GmbH issues a positive verification opinion on the Methane Recovery Project Princepeel Wilbertoord, confirming that for the monitoring period from 01/01/2012 until 31/12/2012, GHG emission reduction of 59,882 $tCO_{2,eq}$ are realised from the aforementioned project activity.

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1 INTRODUCTION

1.1 Objective

As per VCS Standard v3, 'verification is the periodic ex-post independent assessment by a validation/verification body of the GHG emission reductions and removals that have occurred as a result of the project during the monitoring period, conducted in accordance with the VCS rules.' Methane Recovery Project Princepeel Wilbertoord has been developed as domestic GHG offset project according to JI standards in 2007, and has published an addendum to also fulfil VCS requirements in February 2009. The project contributes to the global GHG emission reductions through methane recovery and was verified to have generated emission reductions of 9,005 tCO_{2e} for the 1st Monitoring period (01/06/2007 – 31/12/2007). During the verification of the 1st monitoring period, it was confirmed that the project is implemented as described in the VCS PD with small deviations and the suggested monitoring plan is plausible.

The verification of 2nd monitoring period comprises of qualitative and quantitative evaluation of the emission reduction generated in the period from 01/01/2012 to 31/12/2012.

1.2 Scope and Criteria

Verification is defined in the VCS Standard v3.4 as a risk-based process and therefore is performed in compliance with ISO 14064-3:2006 and ISO 14065:2007, considering the stipulated VCS rules and requirements for the verification process.

Therefore, the verification of the 2nd monitoring period for the Methane Recovery Project Princepeel Wilbertoord is performed by implementing the VCS Standard v3.4, VCS Program Guide v3.5, where the ER calculation are based on the indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories and the recommended methodological tools, i.e.

- AMS - III.D. Methane recovery in agricultural and agro industrial activities, version 11
- AMS - II.F. Energy efficiency and fuel switching measures for agricultural facilities and activities, Version 8
- AMS - I.C. Thermal energy for the user, version 9

In the process of verification of 2nd monitoring period, the VVB proved the accurate implementation of the project and analysed the provided monitoring report and ER calculation spreadsheets, on hand of supporting documents, such as JI PDD, the PDD Addendum for VCS Policy Requirements, ER and baseline calculations, Monitoring Plan, Verification Report of the 1st Monitoring Period, records on electricity generation and self-consumption as well as records on substrates' input, methane content, certificates on calibration of metering devices, etc.

1.3 Level of Assurance

The level of assurance shall be reasonable, with respect to material errors, omissions and misrepresentations, for both validation and verification.

The final verification is based on the latest monitoring report for the 2nd monitoring period v2, dated 20/01/2014, supporting documents disclosed to the auditor, own background research and investigations and information collected through performing interviews during on-site assessment. The correctness of the verification conclusion is guaranteed throughout the credibility of the above mentioned sources of information.

The Verification Statement (see section 6) is made to a reasonable assurance level, and a materiality threshold of 5% is applied for identification of material omissions as required by VCS v3.4 paragraph 5.3.1 item 4. In general it shall be adhered to the procedures as defined in ISO 14064-3.

1.4 Summary Description of the Project

The Methane Recovery Project Princepeel Wilbertoord is a Combined Heat and Power (CHP) Plant in Wilbertoord, the Netherlands, which utilize biogas produced by manure and other organic co-substrates, so that the open storage dwell time of the manure was reduced and thus the uncontrolled methane emission into the atmosphere was prevented. The projects incorporate 5 CHP units, with total installed capacity of 4,568 kW_{el} and average efficiency of 39.5%. the CHP Plant was commissioned in May 2007. During the first phase only 4 CHP units, with installed capacity of 3,153kW_{el}, were in operation.

The Methane Recovery Project Princepeel Wilbertoord was developed as domestic GHG offset project under the JI standard by the ARA Carbon Finance GmbH, where the final JI PDD was issued on 18/08/2007. The final version of the PDD Addendum for VCS Policy Requirements was published on 09/02/2009 and therefore, the project was considered as a VCS project activity. The project was developed to generate emission reductions due to 3 aspects, i.e. Methane recovery, Thermal energy utilization, Fuel switching. Nevertheless, only ERs for the methane recovery are claimed so far, since no meters to record the thermal energy are installed and the fuel switch wasn't implemented yet.

The Methane Recovery Project Princepeel Wilbertoord underwent VCS verification for the 1st Monitoring Period, namely from 01/06/2007 to 31/12/2007, where emission reductions of 9,005 t CO_{2e} were certified in the verification report issued on 24/02/2009.

During the 2nd monitoring period 01/01/2012 – 31/12/2012, all 5 CHP units have been operational and the project activity generated 59,882 t CO_{2e} due to methane recovery.

Project milestones and dates, which deem of particular importance for the verification of the 2nd monitoring period are summarised in Table 1.

Table 1: Significant dates to project's monitoring

Date	Milestone	Reference
01/05/2007	Commissioning of the project activity, where initially only 4 of the 5 CHP motors are in operation.	
01/06/2007	Start of the crediting period	Validated JI PDD issued on 18/08/2007
25/08/2007	The project is validated as domestic GHG offset project according to JI standards with certificate Nr VER 200612-5025	Final JI Determination Report issued on 25/08/2007
01/06/2007 –	1st Monitoring Period	Verification report for the

31/12/2007		Period issued by TÜV Rheinland Japan Ltd.
2008	The 5th CHP was also commissioned and the full project's capacity, as indicated in the JI PDD, was reached	
24/02/2009	Issuance of the 1st Verification Report	Final Verification Report
01/01/2012 – 31/12/2012	2nd Monitoring Period	
05/04/2011	Calibration of the balance SN 801430 8070 for the delivered substrates	Calibration report issued on 05/04/2011
13/12/2012	Calibration of the 5 electricity meters	Calibration report issued on 13/12/2012
01/06/2012	Calibration of the methane meter SN: 04701000064, type Ex-tec SR 2-DO (4)	Calibration report Calibration on 01/06/2012 with validity of 12 months
18/06/2013	Calibration of the methane meter SN: 04701000064, type Ex-tec SR 2-DO (4)	Calibration certificate Calibration on 18/06/2013 with validity of 12 months
31/05/2017	End of first crediting period	

2 VERIFICATION PROCESS

2.1 Method and Criteria

The verification is based on the final Monitoring Report for the 2nd monitoring period 01/01/2012 – 31/12/2012 issued on 20/01/2014, the final Monitoring Report for the 1st monitoring period 01/06/2007 – 31/12/2007 issued on 24/02/2009 and the JI PDD issued on 18/08/2007, including baseline calculations and the monitoring plan. These documents are reviewed against VCS Version 3 requirements, stipulated in the VCS Standard v3.4 and the VCS Program Guide v3.5. TÜV Rheinland Energie und Umwelt GmbH has, based on the recommendations in the "Validation and Verification Manual", employed a risk-based approach in the verification, focusing on the identification of significant risks and reliability of project monitoring and generation of emission reductions.

The essential components of the verification process for the relevant monitoring period, 01/01/2012 – 31/12/2012 are specified as:

- desk review of the monitoring report for the 2nd monitoring period and supporting documents
- on-site visit and follow-up interviews,
- resolution of outstanding issues, and
- issuance of the final verification report and opinion

Those components are thoroughly discussed in the following sub-chapters.

2.2 Document Review

In the course of the verification of GHG emission reductions generated by Methane Recovery Project Princepeel Wilbertoordduring the 2nd monitoring period from 01/01/2012 until 31/12/2012, bundle of documents, incl. methodologies, methodological tools, protocols, reports, official letters, etc., have been provided to the verification team. Furthermore, confidential information, such as contracts and agreements, was disclosed as well. Full list of documents reviewed in the verification process is outlined below

Table 2: List of official documents, supportive workbooks and other evidences reviewed in the course of the verification of the 2nd monitoring period of Methane Recovery Project Princepeel Wilbertoord VCS Project.

Ref Nr & Document/Name		Comment
/1/	VCS Guidance - Validation and Verification Manual v3.1	The manual is followed strictly in order to fulfil the VCS requirements for the verification of GHG emission reductions generated by the Methane Recovery Project Princepeel Wilbertoord The latest available version of the Validation and VerificationManuel, released on 08/10/2013, is to be obeyed
/2/	VCS Program Guide, v3.5	The latest available version of the VCS Program Guide, released on 08/10/2013, is to be obeyed
/3/	VCS Standard, v3.4	The latest available version of the VCS Standard, released on 08/10/2013, is to be obeyed
/4/	AMS - III.D. Methane recovery in agricultural and agro industrial activities, version 11	The Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, i.e. Methane recovery, is applied for the development of the Methane Recovery Project Princepeel Wilbertoord VCS project activity, where the indicated version was the latest available at the time of validation.
/5/	AMS - II.F. Energy efficiency and fuel switching measures for agricultural facilities and activities, Version 8	The Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, i.e. fuel switching, is applied for the development of the Methane Recovery Project Princepeel Wilbertoord VCS project activity, where the indicated version was the latest available at the time of validation.
/6/	AMS - I.C. Thermal energy for the user, version 9	The Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, i.e. utilization of thermal energy, is applied for the development of the Methane Recovery Project Princepeel Wilbertoord VCS project activity, where the indicated version was the latest available at the time of validation.
/7/	Joint Implementation Project Design Document for Methane Recovery Project Princepeel Wilbertoord, Version 5	The final JI PDD, which was issued on 18/08/2007 by ARA Carbon Finance GmbH and approved by the assigned VVB on 25/08/2007

/8/	VCS Monitoring Report for the 1st Monitoring Period 01/06/2007 – 31/12/2007 of Methane Recovery Project Princepeel Wilbertoord, Version 2	The final VCS Monitoring Report for the 1st Monitoring Period 01/06/2007 – 31/12/2007, which was issued on 17/03/2008 by ARA Carbon Finance GmbH
/9/	Final VCS Verification Report for Methane Recovery Project Princepeel Wilbertoord / 1st monitoring perion	The final VCS Verification Report for the 1st Monitoring Period 01/06/2007 – 31/12/2007, which was issued on 24/02/2009 by TÜV Rheinland Japan Ltd. to certify the ER claimed for the monitored period.
/10/	PDD Addendum for VCS Policy Requirements for the Methane Recovery Project Princepeel Wilbertoord	The Addendum was issued on 09/02/2009 in order the Methane Recovery Project to be considered as VCS project activity.
/11/	VCS Monitoring Report for the 2nd Monitoring Period 01/01/2012 – 31/12/2012 of Methane Recovery Project Princepeel Wilbertoord, Version 2	The final VCS Monitoring Report for the 2nd Monitoring Period 01/01/2012 – 31/12/2012, which was issued on 08/01/2014 by GES Biogas GmbH
/12/	CHP units' Specification sheets	The documents substantiate the installed capacity and the average efficiency of the 5 CHP units, which were finally operational during the monitoring period.
/13/	Calibration certificate and calibration report for the methane meter	The certificate confirms that annual calibration of the measuring device is performed by a third party (Euro Index b.v.), where the 2 last calibrations took place on 01/06/2012 and 18/06/2013
/14/	Calibration report for the balance	The report reveals that the last calibration of the balance was performed on05/04/2011 by a third party (Verispect b.v.). It was further clarified that the calibration of the balance is performed, whenever required by the national authorities.
/15/	Inventory of the substrates for the years 2011 and 2012	The inventory sheets provide information on the utilised amount of each substrate during the monitored period, as well as its dry matter content.
/16/	Records on the electricity generation of each CHP unit for the monitoring period	The total gross electricity generation of the CHP plant is determined as the sum of electricity generation by all units for the period. It is required for the determination of net electricity generation, which is defined as the gross electricity generation minus the imported electricity.
/17/	Electricity Invoices of the Methane	The invoices indicate the gross electricity delivered to the

	Recovery Project Princepeel Wilbertoord for the monitored period	grid, the electricity imported from the grid. Therefore the difference is the net electricity generation.
/18/	ER calculation workbook '20140120_VCS_NL_ER_calc_princepeel.xlsx'	All calculations related to the determination of the GHG reductions are performed within the workbook. The VVB proved that all cells are traceable, references for the literature values are provided and the given formulas are correct and appropriately used.
/19/	Measurement protocol for the CHP installation	The document provides general information on the installation units, monitoring method, procedures for reporting, process control and maintenance. Some technical data of the CHP units, their commissioning date as well as diagram representation of the electricity flow, system boundary and installed meters are also part of the document

2.3 Interviews

In the course of the site inspection, the verification team carried out interviews with plant manager and contact person, Mr Jos van Heugten, and the carbon consultant, Mr Marius Bossen, who were pleased to provide in detailed information on the Methane Recovery Project Princepeel Wilbertoord.

2.4 Site Inspections

The obligatory site visit took place on 15/01/2014 on the project site Methane Recovery Project Princepeel Wilbertoord, Wilbertoord, the Netherlands. The objective of the on-site visit is to confirm that project is managed and operates in accordance to the validated JI PDD v5 /7/ and the PDD Addendum for VCS Policy Requirements v1 /10/. Furthermore, validity and authenticity of delivered supporting documents as well as consistency of the monitoring and reporting with the established procedures and the validated monitoring plan suggested in the JI PDD v5 /7/ is confirmed. The site visit was carried out by means of interviews with the persons indicated in section 2.3, documents review as indicated in section 2.2 and monitoring system check.

2.5 Resolution of Findings

In order to ensure transparency a verification protocol, which shows in a transparent manner criteria (requirements), means of verification and VVB findings and final VVB conclusions, is customised for the project. All findings and outstanding issues, identified during the desk review and discussed during the site inspection, are included in a list of Corrective action requests (CAR) and clarifications (CL).

All CAR/CLs, which are organized in *Annex B*, have been resolved by PPs via provision of additional supporting evidence and appropriate revision of the Monitoring Report. For the purpose of completeness, the completed verification protocol is also enclosed to the verification report in *Annex A*.

2.5.1 Forward Action Requests

N.A.

2.6 Eligibility for Validation Activities

N.A.

TÜV Rheinland Energie und Umwelt is accredited Validation and Verification Body eligible to validation and verification services under the VCS program

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The Methane Recovery Project Princepeel Wilbertoord was initially developed as a domestic GHG offset project according to JI standards, and in 2009 was listed in the VCS Program, after the submission of the PDD Addendum for VCS Policy Requirements /10/. Furthermore, the project underwent the VCS verification of the 1st monitoring period 01/06/2007 – 31/12/2007 and was awarded the corresponding VCUs.

VV% confirms that no risk of double counting is faced since only ER credits for the methane recovery due to the project are claimed. It was proved that these activities are not counted towards the national emission targets because biogas production is not mentioned in the national inventory of the Netherlands. 7hus, ER credits are claimed only under the Verified Carbon Standard (VCS).

3.2 Methodology Deviations

The verification team assessed the proposed project activity and related project description in detail and witnessed that the selected methodologies /4/, /5/, /6/ and the monitoring plan suggested in the validated JI PDD /7/ are implemented with the following deviations

- The biogas flow is not measured, since no flow meter has been installed. During the 1st Monitoring Period, it was agreed to determine the biogas flow based on the net electricity generation of the 5 CHP units, i.e. implementing calculations from the CCX Agricultural Methane Gas Project Guidelines

$$\mathrm{BGP} = \frac{\mathrm{EEP}}{(\mathrm{ETA}_{\mathrm{CHP-el}}) * \mathrm{HV}_{\mathrm{Biogas}}}$$

Where

  - *BGP:* Biogas produced [m³]
  - *EEP:* Electricity energy produced [MWh]
  - $ETA_{CHP\text{-}el}$ Electric efficiency of the CHP engines = 0,39 (as per engine data sheet)
  - $HV_{Biogas:}$ Caloric value biogas [MWh/m³], $HV_{bioga} = 0.1 \frac{kWh}{m^3} * \chi_{CH_4}$
  - χ_{CH_4}: CH_4 volume content of biogas flow

The same formula and calculation procedure has been implemented for the determination of the generated GHG emissions from methane recovery due to the project activity during the 1st monitoring period.

- The methodology AMS - II.F. Energy efficiency and fuel switching measures for agricultural facilities and activities, Version 8 /5/ has not been implemented during the current monitoring period, since no fuel switch has taken place so far. The verification team witnessed the lack of fuel switch and confirm that no related ERs are claimed.
- The methodology AMS - I.C. Thermal energy for the user, version 9 /6/ has not been implemented during the current monitoring period, since no heat meters were installed during that period, i.e. the utilized heat was not measured and no related ERs are claimed.

Therefore, the VVB witnessed that the methodology and monitoring plan, as suggested in the JI PDD and used during the 1st monitoring period, has been implemented for the 2nd monitoring period as well, and considered them for appropriate and reasonable.

3.3 Project Description Deviations

In the course of the verification of the 2nd monitoring period, the VVB visited the Methane Recovery Project Princepeel Wilbertoord and reviewed number of project documents, such as JI PDD /7/, VCS Monitoring Report for the 1st monitoring period /8/, CHP units' specification sheets /12/, etc and concluded that the Monitoring Report for the 2nd monitoring period 01/01/2012 – 31/12/2012 illustrates the actual project accurately, displaying project deviations from the JI PDD /7/ and the VCS Monitoring Report for the 1st monitoring period /8/, i.e.

- During the current monitoring period 5 CHP units have been in operation, which corresponds to the technical project description within the JI PDD. However during the previous monitoring period, only 4 CHP units were installed.
- The fuel switch, which was foreseen and described in the JI PDD has not taken place during the current monitoring period, as well. Therefore, no ER due to fuel switch were calculated and taken into consideration.
- The heat meters, which were supposed to determine the amount of utilized heat, and therefore to claim emission reductions due to utilization of thermal energy, have not been installed during the monitored period, and therefore no ER due to thermal energy use has been claimed.

3.4 Grouped Project

N.A.

The Methane Recovery Project Princepeel Wilbertoord Project is a single Combined Heat and Power plant, i.e. not part of a grouped project.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

- Implementation status of the project activity

Methane Recovery Project Princepeel Wilbertoord was commissioned in May 2007 and the first crediting period was set to 01/06/2007, as indicated in the validated JI PDD /7/. The combined heat and power plant utilizes biogas gained from manure and other organic co-substrates for the generation of heat and

electrical energy. The project encompasses 5 CHP units with average efficiency of 39.5%. During the site-visit the nameplates of all CHP units and their technical specification were perceived.

During the monitored period 79,933 t manure, 29,906 t of waste co-substrates and 6,891 t non-waste co-substrates were processed in the plant, which resulted in ca. 35.5 GWh electric energy. Based on the average methane content for the monitored period and the suggested calculation procedure, it was determined that 16,003,970 m^3 biogas was generated.

In comparison to the time of the project development and the first monitoring report, higher amounts of manure and manure with a dry matter content have been treated than initially planned. This has resulted in an increase in emission reductions. This development is attributed to the higher manure surpluses that the Netherlands have been experiencing and that could not have been anticipated. Dutch policies have been developed to address these issues on a national level and reduce the amount of manure surplus again.

The VVB is of the opinion that the project has been correctly validated under the small scale methodology AMS III.D 1.1. and that the original assumptions from the PDD are still valid today. The project developer could convincingly demonstrate that the increased emission reductions in the following years resulted from the higher manure surpluses available in the Netherlands, a development that could not have been anticipated at the time of project development. The manure surpluses are projected to decrease again in the future.

The VVB confirmed that the project is implemented in accordance to the validated JI PDD /7/ with the deviations indicated in the section 3.2 Methodology Deviations and section 3.3 Project Description Deviations of the this report.

- Implementation status of the monitoring plan and the completeness of monitoring

Due to the methodology and project description deviations, which have been already discussed, the final monitoring report for the 2nd monitoring period /11/ follows only partially the monitoring plan for the Methane Recovery Project Princepeel Wilbertoord, which is presented in the JI PDD v5 /7/, and is in compliance with the implemented approved methodologies AMS – III.D, AMS – II.F and AMS – I.C. In total 9 parameters are indicated to be monitored. However, 4 of them (oil, diesel, imported electric energy and runtime of the CHP) are not relevant, because of the project deviations. During the verification process the suggested plan is proved to be applicable and credible for the 2nd (current) monitoring period.

Monitored parameter 1: **Biogas produced (BGP**) - As per monitoring plan, the biogas amount generated in Methane Recovery Project Princepeel Wilbertoord during the monitored period has been determined based on the electricity energy generation and the average efficiency of the CHP units. For the considered period, 5 CHP units, with average efficiency of 39.5% (as per technical specification of CHP units' /12/) were in operation. For the determination of the baseline emissions, VVB perceived the monthly calculation of the BGP. It has been determined that total amount of 16,003,970 m^3 biogas was gained I the plant.

Monitored parameter 2: **Electricity energy produced (EEP)** – during the site visit the VVB confirmed that the electricity energy produced has been measured continuously. The data are obtained from the electricity meter for each CHP unit, which are located in a control room at project site. In addition, the invoices for electricity from the local utility are used for the data quality control. The EEP is important for the determination of the biogas produced in the plant.

Monitored parameter 3: **Methane content of the biogas (MC) and Calorific Value**– the parameter is monitored on a daily basis. The plant manager explained that the methane content of the generated biogas is measured once a day by metering device from the type Ex-tec SR 2-DO (4) with serial Nr: 04701000064, which is located in a control room. Furthermore, he stated that the device is calibrated annually and disclosed the calibration report and certificate /13/ to the VVB. It was proved that the last 2 calibrations took place on 01/06/2012 and 18/06/2013.

The methane content was correctly used for determination of the calorific value of the biogas flow, and directly employed in the formula for calculation of GHG emission reductions due to methane recovery. The calorific value itself has been derived from common stoichiometric combustion calculation of methane, since methane is measured. The calculation is common knowledge, hence known to the VVB and was therefore verified to be correct by means of reviewing the stoichiometric combustion calculation of Methane: 802,6 kJ/mol / 0.02241 m^3/mol = 35,81 MJ/m^3 = 10 kWh/m^3.

Monitored parameter 4: **Mass of each co-ferment *i* ($MCOF_i$)** – during the site visit, VVB witnessed that the mass of each delivered co-ferment is recorded in a database, managed by the plant manager.

Mr Jos van Heugten pointed out that each track which enters the plant is noted, including information on the delivered co-ferment, its origin and dry matter content. List of co-ferments, their average dry matter content (measured values), organic matter content (based on literature[1]), methane content (based on literature) and the amount used during the monitored period was provided to the VVB as part of the ER calculation workbook /18/.

Monitored parameter 5: **Volume of manure fed into the digester (Manure)** – the amount of manure processed in the plant is significant for the determination of prevented GHG emission to the atmosphere. Data such as the organic matter content, biogas production potential and methane content of the manure are obtained from the Bavarian State Research Institute for Agriculture works (http://www.lfl-design3.bayern.de/ilb/technik/10225/).

Data for the remaining monitoring parameters are also included in the monitoring report, however those are not incorporated in the ER calculation, and therefore are not of importance for the GHG emission reductions due to methane recovery.

- Any remaining issues from previous validation or verification.

During the monitoring period VVB observed that PP took acknowledgement the 2 FARs, indicated in the VCS verification report for the 1st monitoring period 01/06/2007 – 31/12/2007.

FAR 1: The project proponents have to inform VCS Association with a separate letter prior to the registration, that the VCUs being registered have not been registered, transferred or retired prior to the registration with the official VCS registry, which is in place since 2009

To FAR 1: The project activity is registered under the Verified Carbon Standard. The Issuance representation was issued on 02/03/2010 and uploaded to the VCS project database on 05/03/2010. Furthermore 6000 VCUs from the 1st monitoring period have been retired on 27/01/2012.

Therefore the FAR is not relevant any more.

FAR 2: Project participants shall electronically archive all data collected as part of monitoring for a period of 2 years from the end of the crediting period.

To FAR 2: During the site visit, it was observed that the data relevant for the monitoring plan have been collected in an electronic form and archived for at least 2 years after the end of the crediting period.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

- Baseline emissions

The Monitoring Plan describes how the requirements related to the data acquisition and storage are being met. As described in the Monitoring Report for the 2nd monitoring period /11/ and physically observed by the VVB during the on-site visit, 5 electricity meters were installed in the control room of the Princepeel

[1] Data source is the Lfl - Bavarian State Research Institute for Agriculture works
http://www.lfl-design3.bayern.de/ilb/technik/10225/

CHP Plant to measure the generated electricity. Furthermore, all co-substrates are weighted when delivered to the plant, and the corresponding records are managed by the plant manager. The VVB confirmed that the methane content of the generated biogas has been measured by a appropriate and regularly calibrated methane metering device, which is installed in the control room of the plant.

The process of calculation of emission reductions was thoroughly discussed during the site visit with the carbon consultant. Therefore, VVB confirmed that the main source of data for determining project's baseline emissions is the electricity meter reading protocol, the records on methane content and records on delivered substrates for the monitoring period, which are managed by the plant manager. Eventually, the carbon consultant developed a monitoring workbook /18/, where the generated biogas amount was determined as

$$BGP = \frac{EEP}{(ETA_{CHP-el}) * HV_{Biogas}} = 16{,}003{,}970\ m^3$$

And the GHG reductions due to methane recovery, generated by the Methane Recovery Project Princepeel Wilbertoord are calculated as following

$$GHG_{red,IIID} = AF * \left(BGP * MC - \sum BGCO_i * MCCO_i\right) * D * GWP_{CHP4}$$

The ER calculation workbook /18/ was carefully studied by the VVB, and the enclosed calculation re-computed. Following the requirements of the methodology AMS – III.D v11 /4/ and the monitoring plan specified within the validated JI PDD /7/, and using the validated values for methane density

*D=0.7168*10^4 t /m^3* and for global warming potential *GWH_{CH4} = 21 t CO_{2eq}/tCH_4* resulted in calculated *$GHG_{red, IIID}$ = 119,765 t $CO_{2,eq}$.*

However, in order to be conservative a security factor of 0.5 has been implemented to determine only the ER due to the methane recovery, which is finally indicated as

$$GHG_{red, IIID} = 59,882 \text{ t } CO_{2,eq.}$$

The project was developed a long time ago when the methodological approaches and guidelines were immature. The VVB sees the application of a security factor of 0.5 as an appropriate step of the project developer following the conservativeness principle prescribed by the VCS methodology as well as ISO 14064.

- Project emissions

During the sit-visit, the plant manager confirmed that the emergency generators have not been used during the monitored period. Therefore, no project emissions occurred, i.e.

$$PE = 0 \text{ t } CO_{2,eq.}$$

Finally, the verification team confirms that the total emission reduction (ER) due to methane recovery at Methane Recovery Project Princepeel Wilbertoord for the monitoring period from 01/01/2012 – 31/12/2012 is calculated correctly as

$$GHG_{RED, total} = GHG_{RED,IIID} + GHG_{RED,IIF} + GHG_{RED,IC}$$
$$GHG_{RED, total} = 59,882 \text{ t}CO_{2,eq} + 0 \text{ t}CO_{2,eq} + 0 \text{ t}CO_{2,eq}$$

$$\mathbf{GHG_{RED, total} = 59,882 \text{ t}CO_{2,eq}}$$

In conclusion, all calculations made in the monitoring workbook /18/ have been verified through re-computation by the Verification Team. The data used in the spreadsheet was tracked back to its origin at a coverage rate of 100% and the consistency of all values has been verified.

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

jThe monitoring procedure follows strictly the validated monitoring plan included in JI PDD /7/ and the monitoring procedure stated in AMS- III.D. Emission reduction calculations are based on the electricity production records of the plantt, the average efficiency of the CHP units, and on the amount of manure and other co-substrates.

In order to ensure data accuracy and reliability, the values implied for the emission reduction calculation are compared to ones obtained from other unbiased source. Hence the electricity generation is determined as sum of the electricity meter for each CHP unit, and is cross-checked by the electricity bill to the local utility.

TÜV Rheinland Energie und Umwelt GmbH verifies that adequate monitoring mechanisms have been implemented at Methane Recovery Project Princepeel Wilbertoord. The required parameters have been monitored on a regular basis, as indicated in the validated monitoring plan. This was verified during the site visit when the plant records were verified to assess the correctness of the reported data.

5 VERIFICATION CONCLUSION

The verification team of TÜV Rheinland Energie und Umwelt GmbH performed the verification for the Methane Recovery Project Princepeel Wilbertoord in the Nitherlands against the VCS Standard v3.4 and UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The verification team concluded that the project as described in the VCS Monitoring Report v1.2 meets all relevant requirements of the above-defined criteria. TÜV Rheinland Energie und Umwelt GmbH therefore issues a positive verification opinion.

Verification period: From 01/01/2012 to 31/12/2012

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 2012	59,882	0	0	59,882
Total	59,882	0	0	59,882

6 VERIFICATION STATEMENT

B.V. Landgoed de Principeel
Molenstraat 40
5446 PL Wanroij
The Nitherlands 21/01/2014

RE: Verification Statement – Methane Recovery Project Princepeel Wilbertoord, The Nitherlands under VCS, 2nd monitoring period from 01/01/2012 until 31/12/2012

B.V. Landgoed de Principeel with registered office at Molenstraat 40, 5446 PL Wanroij/ The Nitherlands, has engaged TÜV Rheinland Energie und Umwelt GmbH to review and verify the VCS Monitoring Report for the 2nd monitoring period from 01/01/2012 until 31/12/2012 for the VCS project activity Methane Recovery Project Princepeel Wilbertoord and all assertions related to the GHG project against the latest VCS version 3 requirements.

The verification of the Emission Reductions generated from the VCS project activity for the indicated period is conducted in accordance to the VCS standard v3.4, VCS Program Guide v3.5, the standard ISO 14064-3 and the approved CDM methodology AMS – III.D version 11 and methodological tools to a reasonable level of assurance by applying a materiality threshold of 5%. The project information has been verified and the VCS Verification Report 21224010 "*Verification report for Methane Recovery Project Princepeel Wilbertoord*" issued on 21/01/2014 The Verification Report includes all relevant information and evidence acquired during the Verification process.

Based on the on-site inspection and review of all available documentation, the validation team comes to the conclusion that the assertions are made in accordance with the requirements of the VCS program and are material correct and fairly represent the required parameters without material discrepancies. The Emission Reductions claimed for the 2nd monitoring period (01/01/2012 – 31/12/2012) of the first crediting period, are verified to be 59,882 $tCO_{2,eq.}$

Cologne, 21/01/2014

Denitsa Gaydarova-Itrib

ANNEX A

Verification protocol

Checklist question	Ref.	MoV[1] DR	MoV[1] I	MoV[1] FA	Findings, comments, references, data sources	Draft conclusion	Final conclusion
1. Implementation							
1.1 Have all physical features proposed in the registered PDD been implemented at the project site? *3 vertical Francis turbines* *Reservoir* *Powerhouse, pen stock, etc.* *Meter installations and coverage*					yes > it was witnessed that the 5 CHPs were in operation during the monitored period 2012 > the meters for the thermal energy were not installed at the monitoring time. Therefore no claim for credits	ok	ok
1.2 Has the project activity been operated in accordance with the project scenario described in the registered PDD and relevant guidance?					partly, credits are claimed only for the CH4 recovery	ok	ok
1.3 If the project activity is implemented on a number of different locations, has the Monitoring report provided the verifiable starting dates for each site?					only 1 location	ok	ok
2. Monitoring plan and methodology							
2.1 Is the monitoring plan established in accordance with the monitoring methodology?					at the time of PDD, the monitoring methodology was not explecete. The monitoring plan is in line with the PDD	ok	ok
2.2 In case the implemented monitoring plan defers from the monitoring methodology, has any requests for revision to or deviation from the monitoring methodology been officially communicated to the CDM EB (if applicable methodology is subject to EB approval)?					N.A.	Ok	Ok

2.2.1 Have the above changes to the monitoring plan been approved by the CDM EB?					N.A.	Ok	Ok
3. Monitoring and the monitoring plan							
3.1 Is monitoring established in full compliance with the monitoring plan, contained in the registered PDD (or new monitoring plan approved by the applicable standard) *Monitoring period* *Parameters* *Meter Ser.-No., physical location, transcription*					yes > monitoring perion 01.01.2012 - 31.12.2012 > the parameters, which are listed in the PDD have been monitored. > relevant meters are the methan metering device, the weight, which is used for all components that enter the facility, etc	Ok	Ok
3.2 Are all baseline emission parameters monitored and updated in accordance with monitoring plan, monitoring methodology and relevant CDM EB decisions? *EF(combined)* *EG(PP-gross) and EG(PP-selfconsumption)* *See parameters in section 4*					N.A.	ok	Ok
3.2.1 Was the monitoring equipment for baseline emission parameters controlled and monitoring results recorded as per approved frequency? *On-site implementation of data transfer & management*					yes	Ok	Ok
3.2.2 Was the monitoring equipment for baseline emission parameters calibrated in accordance with QA&QC procedures described in the registered monitoring plan? *Calibration certificates for all meters*					yes	ok	Ok
3.3 Are all project emission parameters monitored and updated in accordance with monitoring plan, monitoring methodology and relevant CDM EB decisions? *FC(iy) and A(PJ) see below parameters*					yes, the calibration certificates have been provided	Ok	Ok

3.3.1 Was the monitoring equipment for project emission parameters controlled and monitoring results recorded as per approved frequency? *Transcription procedure on site*					yes	ok	Ok
3.3.2 Was the monitoring equipment for project emission parameters calibrated in accordance with QA&QC procedures described in the registered monitoring plan? *E.g. name plates of turbines, google earth image*					Calibration reports were provided to the VVB	Ok	Ok
3.4 Are all leakage emission parameters monitored and updated in accordance with monitoring plan, monitoring methodology and relevant CDM EB decisions?					N.A.	Ok	Ok
3.4.1 Was the monitoring equipment for leakage emission parameters controlled and monitoring results recorded as per approved frequency?					N.A.	Ok	Ok
3.4.2 Was the monitoring equipment for leakage emission parameters calibrated in accordance with QA&QC procedures described in the registered monitoring plan?						Ok	Ok
3.5 Were all monitoring parameters available and verifiable through the whole monitoring period?					N.A.		
3.5.1 In case, only partial monitoring data is available and PP(s) provide estimations or assumptions for the rest of data, was it possible to verify those estimations and assumptions? Reference: <http://cdm.unfccc.int/EB/026/eb26rep.pdf>, §109(b)					N.A	Ok	Ok

3.6 Was management and operation system established and operated in accordance with the monitoring plan?						Ok	Ok
3.7 Was is it possible to verify that involved management and operation personal is fully aware of the responsibilities and perform all operations according to the registered monitoring plan and internally developed manuals?					yes	Ok	Ok
4. Parameters							
4.1 **Monitored parameter** Title: Indication: Units: Estimated value (ex-ante): Measured value (ex-post):					Biogas produced (BGP) - during the monitored period has been determined based on the electricity energy generation and the average efficiency of the CHP units. For the considered period, 5 CHP units, with average efficiency of 39.5% (as per technical specification of CHP units' /12/) were in operation. For the determination of the baseline emissions, VVB perceived the monthly calculation of the BGP. It has been determined that total amount of 16,003,970 m3 biogas was gained I the plant	ok	Ok
Monitored parameter Title: Indication: Units: Estimated value (ex-ante): Measured value (ex-post):					Electricity energy produced (EEP) - electricity energy produced has been measured continuously. The data are obtained from the electricity meter for each CHP unit, which are located in a control room at project site. In addition, the invoices for electricity from the local utility are used for the data quality control. The EEP is important for the determination of the biogas produced in the plant	ok	ok
Monitored parameter Title: Indication:					**Methane content of the biogas (MC)** - he parameter is monitored on a daily basis. The plant manager explained that the methane	ok	ok

Units: Estimated value (ex-ante): Measured value (ex-post):					content of the generated biogas is measured once a day by metering device from the type Ex-tec SR 2-DO (4) with serial Nr: 04701000064, which is located in a control room.		
Monitored parameter Title: Indication: Units: Estimated value (ex-ante): Measured value (ex-post):					**Mass of each co-ferment *i* ($MCOF_i$) -** the mass of each delivered co-ferment is recorded in a database, managed by the plant manager. List of co-ferments, their average dry matter content (measured values), organic matter content (based on literature), methane content (based on literature) and the amount used during the monitored period was provided to the VVB as part of the ER calculation workbook /18/.	Ok	Ok
Monitored parameter Title: Indication: Units: Estimated value (ex-ante): Measured value (ex-post):					**Volume of manure fed into the digester (Manure) -** Data such as the organic matter content, biogas production potential and methane content of the manure are obtained from the Bavarian State Research Institute for Agriculture works (http://www.lfl-design3.bayern.de/ilb/technik/10225/)**.**	Ok	Ok
Monitored parameter Title: Indication: Units: Estimated value (ex-ante): Measured value (ex-post):					Oil – N.A. due to project deviation	Ok	Ok
4.2 **Default parameter** Title: Indication: Unit Default/Used value:					Diesel – N.A. due to project deviation	ok	ok

4.2 **Default parameter** Title: Indication: Unit: Default/Used value:					EEI – N.A. for the monitored period, due to project deviation	ok	Ok
5. Calculations							
5.1 Have all the calculations related to the baseline emissions been carried according to the formulae and methods described in the registered PDD and applied methodology? *Validated EF(CM) XXX*					Yes, all calculations are in line with the formula provided in the validated JI PDD and the applied methodology, beside the indicated methodology deviations.	Ok	Ok
5.2 Have all the calculations related to the project emissions been carried according to the formulae and methods described in the registered PDD and applied methodology?					No project emissions	Ok	Ok
5.3 Have all the calculations related to the leakage emissions been carried according to the formulae and methods described in the registered PDD and applied methodology?					N.A.	OK	Ok

[1]MoV = Means of Verification, DR = Document Review, I = Interview, FA = Field Assessment, www = internet search.

ANNEX B

List of Requests for Corrective Action (CAR) and Clarification (CL)

CAR CL	List of Requests for Corrective Action (CAR) and Clarification (CL)		
	Observation (CAR/CL)	**Summary of project owner response**	**Validation team conclusion**
CAR 1.	please provide references for the dry matter content and organic DM, biogas production, etc. for the values on sheet 'Substrates and factors'	Link to the reference source has been included in the calculation sheet	ok
CL 1.	please clarify why the biogas flow, as indicated in 'biogas production_calculation' H30, differs from the biogas potential calculated based on the substrates, as in 'Substrate and factors' I31 ?	Both values have been calculated in a different way, one from the electricity production and one from the theoretical value of biogas production of the input materials. Calculation of theoretical biogas production has the problem that for varying sources of input the theoretical values may not apply as the composition of material can vary a lot. The calculation from the electricity production is deemed to be much more plausible because the electricity measurement is very precise and the correlation to the biogas amount burned in the CHP is strong.	ok
CL 2.	please clarify why the average methane content arising in the biogas through digestion non-waste co-ferment is set to 0.55	The conservative methane content assumption of 0.55 has been replaced by a value that is derived from the theoretical methane building potential of the input materials (0.523).	ok
CAR 2.	please revise table numbering and the rela ted references.	Tables have been updated in the report	ok
CAR 3.	Please indicate the Project ID and report I D on the title page of monitoring report	Project and Report ID have been inserted in the Monitoring Report	ok
CAR 4.	Please clearly indicate that you apply the SSC methodology and the exact methodology name	Reference to small scale has been added, exact names of the methodologies in the version that has been effective during	ok

	(chapter 1.8, p.4).	the validation of the PDD have been used.	
CAR 5.	Please check the correct usage of decimal point '.' and 1000 separator throughout the entire monitoring plan	Decimal points have been changed	ok
CL 3.	Please clarify. In chapter 3.2 of monitoring report, **parameter MCOFi** (p.9) is indicated that the mass is to be monitored via 'weighting scale in the feed in devices' (monitoring equipment). Nevertheless during the site visit it was observed that the co-ferments are weighted by the delivery.	The corresponding passage have been corrected, the measurement takes place at delivery. A comment has been added to that monitoring value. Inventory data made available to the DOE showed that the annual inventory showed a deviation of 66 t between beginning and end of 2012. It can be assumed that all materials that are delivered are fed into the biogas systems in the short term.	Ok
CL 4.	Please clarify. According to the provided CHPs ' specification sheets the efficiency of the turbines range from 0.368 to 42.1, with arithmetic average of 39.5. this impacts the calculated biogas flow and therefore the recovered CH4 amount	The more precise value of 39.5 % electric efficiency has been used for the calculation of biogas potential. The Report has been updated with the new results.	ok