

FINAL VERIFICATION REPORT

“REDUCTION OF GHG EMISSIONS IN PROPYLENE OXIDE PRODUCTION AT MTP HPPO MANUFACTURING CO., LTD”



RINA

Document Prepared By RINA SERVICES S.P.A

Contact Information

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Summary:

RINA Services S.p.A. (RINA), commissioned by South Pole Carbon (Thailand) Co.,Ltd. has verified the greenhouse gas emission reductions reported for the project activity activity "Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd" in Thailand, VCS project ID 1502, for the period 04-October-2011 to 31-March-2014. The verification includes confirming the implementation of the monitoring plan of the registered VCS PD (Project ID 1502) and the application of the Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013. A site visit was conducted to verify the data submitted in the monitoring report.

As detailed in the registered VCS PD and observed during the onsite visit, the project involves installation of Hydrogen Peroxide-based Propylene Oxide (HPPO) technology for the manufacture of Propylene Oxide (PO) at the production facility of MTP HPPO Manufacturing Co., Ltd, a joint venture between The Siam Cement Public Co., Ltd and The Dow Chemical Company. The project activity uses Hydrogen Peroxide-based Propylene Oxide (HPPO) technology instead of the conventional Chlorohydrin process. The conventional Chlorohydrin process is one of the typical processes in the Propylene Oxide industry that involves hydrochlorination process. In the Chlorohydrin process, Propylene (C_3H_6) is combined to hypochlorous acid to form a Chlorohydrin intermediate which is subsequently dechlorohydrinated to PO and leads to the formation of salts. While in the HPPO process, Propylene and Hydrogen peroxide is combined to produce PO. The project activity reduces GHG emissions by usage of lesser GHG intensive reagents and reduced process energy requirements in the HPPO technology.

03 Corrective Action Requests (CARs) and 01 Clarification Requests (CLs) were identified related to the monitoring, implementation or operations of the proposed VCS project activity as per the Monitoring Report version 01 of 24-November-2015, in relation to all relevant VCS requirements and all relevant host Party criteria and the applied baseline and monitoring methodology and these CARs and CLs are successfully closed after necessary corrections/clarifications by the client.

In conclusion, it is RINA's opinion that the project activity "Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd", in "Thailand", as described in the Monitoring Report version 05 of 22-June-2016, meets all relevant requirements for VCS activities and all relevant host Party criteria and correctly applies the Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013. Hence RINA is able to certify that the emission reductions from the project during the monitoring period 04-October-2011 to 31-March-2014 amount to 320,900 tCO₂e.

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1 INTRODUCTION

1.1 Objective

RINA has been commissioned by South Pole Carbon (Thailand) Co.,Ltd. to perform an independent verification of its VCS project, "Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd", already registered under VCS with Project ID. 1502 for the reported GHG emission reductions for the given monitoring period 04-October-2011 to 31-March-2014. The VCS projects must undergo independent third party verification and certification of emission reductions as the basis for issuance of Voluntary Emission Reductions (VERs/VCUs).

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the project description (PD) and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.
- To confirm that the monitoring system is implemented and fully functional to generate Voluntary Emission Reductions (VERs/VCUs) without any double counting, and

To establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation.

1.2 Scope and Criteria

The verification scope is:

- to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan;
- to evaluate the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement;
- to verify that reported GHG emission data is sufficiently supported by evidence.

The project is assessed against the requirements of VCS version 3 and related rules and guidance. RINA has, based on the recommendations in the latest version of CDM Validation and Verification Manual, and employed a rule-based approach (as criteria) in the verification, focusing on the identification of significant reporting rules and the reliability of project monitoring.

Verification is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

1.3 Level of Assurance

The project activity happens at a single site and 100% data was available for verification. No sampling of data and information was required. All required data for the calculation of emission reduction are metered and were cross checked with inventory and stock verification data /46/ and ensured that the most conservative value was used in emission reduction calculation /47/ /3/.

All the revisions of the verification report before being submitted to the client were subjected to an independent internal technical review to confirm that all verification activities had been completed according to the pertinent RINA instructions.

The technical review was performed by a technical reviewer(s) qualified in accordance with RINA's qualification scheme for VCS and CDM validation and verification.

The verification team and the technical reviewers consist of the following personnel.

Role	Last Name	First Name	Country
Team Leader, Verifier & Technical Expert TA 5.1	Arokiasamy	Cyril Augustus	India
Technical Reviewer	Valoroso	Rita	Italy
Technical Expert supporting TR – TA 5.1	Severino	Laura	Italy

1.4 Summary Description of the Project

As detailed in the registered VCS PD and observed during the onsite visit, the project involves installation of Hydrogen Peroxide-based Propylene Oxide (HPPO) technology for the manufacture of Propylene Oxide (PO) at the production facility of MTP HPPO Manufacturing Co., Ltd, a joint venture between The Siam Cement Public Co., Ltd and The Dow Chemical Company. The project activity uses Hydrogen Peroxide-based Propylene Oxide (HPPO) technology instead of the conventional Chlorohydrin process. The conventional Chlorohydrin process is one of the typical processes in the Propylene Oxide industry that involves hydrochlorination process. In the Chlorohydrin process, Propylene (C_3H_6) is combined to hypochlorous acid to form a Chlorohydrin intermediate which is subsequently dechlorohydrinated to PO and leads to the formation of salts. While in the HPPO process, Propylene and Hydrogen peroxide is combined to produce PO. The project activity reduces GHG emissions by usage of lesser GHG intensive reagents and reduced process energy requirements in the HPPO technology.

The main information of the VCS project is summarized in the table below:

Project Participant(s)	MTP HPPO Manufacturing Co.,Ltd.
Project Title	Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd
Location of the project	10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand
Methodology(ies)	Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013

Sectoral Scope(s)	05	Technical Area(s)	5.1
Registered PDD	Version 02 of 22-September-2014		
Starting date of the crediting period	04-October-2011		
Project's crediting period	10 years and 0 months, Starting from 04-October-2011 up to 03-October-2021.		
Project documentation link	http://www.vcsprojectdatabase.org/#/project_details/1502		

2 VERIFICATION PROCESS

2.1 Method and Criteria

Verification was conducted using RINA procedures in line with the requirements specified in the VCS Requirements, i.e. VCS Program Guide, VCS Version 3 (v3.5), Requirements Document of 08-October-2013 and VCS Standard, VCS Version 3 (v3.5), Requirements Document of 25-March-2015. The GHG emission reductions are on the basis of the approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013.

The verification consisted of the following three phases

- Document review;
- On-site assessment including Interviews and Site Inspections;
- Resolution of Any Material Discrepancy and the issuance of the final verification report and certification.

The following sections outline each step in more detail.

2.2 Document Review

The monitoring report (MR), version 05 of 22-June-2016 and its previous versions **/01/**, the emission reduction calculations spreadsheet (DOW_ER calculation_ver04_060616.xlsx) version 04 of 06-June-2016 and its previous versions **/03/**, were assessed as part of the verification. In addition the registered Project Document **/02/** in particular the baseline estimations and the monitoring plan for the project were reviewed.

The following table lists the documentation that was reviewed during the verification

/1/	South Pole Carbon (Thailand) Co.,Ltd: VCS monitoring report for the project activity "Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd" in Thailand, version 05 of 22-June-2016 and the previous versions 04 of 06-June-2016, 03 of 22-April-2016, version 02 of 29-February-2016, version 01 of 24-November-2015 for the period 04-October-2011 to 31-March-2014
/2/	Southpole Carbon Asset Management Limited: VCS PD for "Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd" in Thailand, version 02 of 22-September-2014.
/3/	South Pole Carbon (Thailand) Co.,Ltd: Emission Reduction Calculation Spreadsheet

	"DOW_ER calculation_ver04_060616.xlsx" version 04 of 06-June-2016 and the previous spreadsheets "DOW_ER calculation_ver03_220416.xlsx" version 03 of 22-April-2016, "DOW_ER calculation_ver02_290216.xlsx" version 02 of 29-February-2016, "DOW_ER cal_rev01_24Nov15.xlsx" version 01 dated 24-November-2015.
/4/	VCS Verified Carbon Standard: VCS Program Guide, VCS Version 03, v3.5 of 08-October-2013
/5/	VCS Verified Carbon Standard: VCS Standard, VCS Version 03, v3.4 of 08-October-2013
/6/	MTP HPPO Manufacturing Co.,Ltd: Production records for the monitoring period, extract from company database «600320_DOW ER for 1st verification_PS_140418» submitted during site visit on 06-May-2015
/7/	VCS: Monitoring report form (MONITORING REPORT: VCS Version 3) , version 03.3 dated 08-October-2013
/8/	VCS Verified Carbon Standard: VCS Validation and Verification Manual VCS Version 03, v3.1 of 08-October-2013
/9/	CDM Executive Board: Clean Development Mechanism Project Standard, Version 09.0 of 20-February-2015.
/10/	CDM Executive Board: Clean Development Mechanism Validation and Verification Standard, version 09.0 of 20-February-2015.
/11/	VCSA: Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013
/12/	CDM Executive Board, Glossary of CDM terms, version 07.0 of 23-November-2012
/13/	VCS Verified Carbon Standard: Program Definitions VCS Version 03, v3.5 of 08-October-2013
/14/	RINA: Validation report (Report No. 2013-IQ-29-MD, revision 1.1 Aa) for the project activity "Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd". dated 13-November-2014
/15/	Website: http://www.vcsprojectdatabase.org/#/project_details/1502 VCS: Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd – Project documents Language: English Retrieved on: 01-December-2015
/16/	Dow Chemicals website: http://www.dow.com/thailand/about/locations.htm Argument: Location of the project activity Language: English Retrieved on: 16-January-2014.
/17/	CDM Executive Board: Tool to calculate baseline, project and/or leakage emissions from electricity consumption, version 01 of 16-May-2008
/18/	CDM Executive Board: Tool to calculate the emission factor for an electricity system, version 04.0 of 04-October-2013
/19/	CDM Executive Board: Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion, version 02 of 02-August-2008.
/20/	Website: http://www.ipcc-nggip.iges.or.jp/public/2006gl/ Argument: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Language: English Retrieved on: 20-January-2014
/21/	CDM Executive Board: Tool to determine the baseline efficiency of thermal or electric energy generation systems to determine the efficiency of the boiler, version 01 of 17-

	July-2009.
/22/	South Pole Carbon (Thailand) Co. Ltd: Request for verification dated 20/12/2013
/23/	Email dated 18/09/2011 from Mr. Andrew Liveris, Chief Operating Officer, Dow Chemicals Limited on commissioning of the plant
/24/	Website: http://www.dow.com/polyurethane/news/2012/20120104a.htm Argument: Dow's Newsletter dated 04-January-2012- Publicly available Language: English Retrieved on: 20-October-2014
/25/	Industrial Estate Authority of Thailand: Notification certificate - HPPO-2011_Notification No.029-2554 dated:3-October-2011
/26/	CDM Executive Board: Tool to determine the remaining lifetime of equipment, version 01, dated 16-October-2009
/27/	Website: http://www.pcd.go.th/info_serv/en_regulation.html . Argument: Pollution control department, Ministry of Natural Resources and Environment Language: English Retrieved on: 20-October-2014
/28/	RINA – SPCTCL: Request for Validation dated 20-December-2013
/29/	Website: http://www.tgo.or.th/english/index.php?option=com_content&view=article&id=178:thailand-grid-emission-2010-report&catid=50:tgos-research-projects&Itemid=40 Argument: Thailand Greenhouse Gas Management Organization (Public Organization), Published Grid Emission factor. Language: English Retrieved on: 20-October-2014
/30/	Emerson Process Management Flow Technologies Co.,Ltd.: Calibration Data Sheet for Vortex Flowmeter Tag No: FT-4311-18 , Serial No: 06015584 dated 29-April-2010.
/31/	Emerson Process Management Flow Technologies Co.,Ltd.: Calibration Data Sheet for Vortex Flowmeter Tag No: FT-4311-20 , Serial No: 06050847 dated 16-November-2011.
/32/	Emerson Process Management Flow Technologies Co.,Ltd.: Calibration Data Sheet for Vortex Flowmeter Tag No: FT-7409-02, Serial No: 6015616 dated 08-May-2010.
/33/	Siemens Industrial Solutions and Services: Multifunction power meter test reports for meters BF0908074313, BF0908074311, BF0908074317 and BF0908074314 of 14-May-2010
/34/	Endress+Hauser: Standard Density Calibration with Adjustment for PROMASS 80 F 3", D3036216000, FCP-7.1.E dated 04-June-2010
/35/	Krohne: Calibration Certificate for meter serial meter A1071567 dated 17-May-2010
/36/	MTP HPPO Manufacturing Co.,Ltd: As built Piping and Instrument Diagrams Incoming propylene line - P&ID-B1-100-198779-S3-AB of 03/07/2013 Phosphate Solution - P&ID-B1-102-198779-S6-AB of 10/07/2013 Reactor-R-2100Feed - P&ID-B1-103-198779-S4AB of 20/04/2012 Finished NPG and T-6500BTMS loading station - P&ID-B1-730-198779-S5-Rev1 of 21/08/2012 Methanol Truck unloading station - P&ID-B1-735-198779-S2 of 02/11/2011 Finished PO pumps - P&ID-B1-415A-198779-S5-AB of 15/05/2013 HP steam / condensate return – P&ID-B1-951A-198779-S3-AB of 20/04/2012 Waste water pit - P&ID-B1821-198779-Rev5 of 07/09/2012
/37/	Website: http://www.endress.com/en/Tailor-made-field-instrumentation/Flow-measurement-product-overview/Product-Coriolis-flowmeter-Proline-Promass-80F Endress+Hauser: Specification sheet of Proline Promass 80F Coriolis flowmeter Language: English

	Retrieved on: 01-December-2015
/38/	Website: http://cdn.krohne.com/dlc/TD_OPTIMASS3000_en_131105_4000651202_R08.pdf Krohne: Specification sheet of OPTIMASS 3000 Language: English Retrieved on: 01-December-2015
/39/	Website: http://www2.emersonprocess.com/siteadmincenter/PM%20Rosemount%20Documents/00813-0100-4004.pdf Rosemount: Specification sheet of Rosemount 8800D Series Vortex Flowmeter Language: English Retrieved on: 01-December-2015
/40/	Website: http://www.krohne-downloadcenter.com/dlc/TD_UFM3030_en_060424.pdf Krohne: Specification sheet of UFM 3030 Language: English Retrieved on: 01-December-2015
/41/	Website: http://www2.emersonprocess.com/en-us/brands/rosemount/flow/dp-flow-products/annubar-flowmeters/pages/index.aspx Rosemount: Specification sheet of Rosemount Steam flowmeter Language: English Retrieved on: 01-December-2015
/42/	Website: https://www.smartgrid.siemens.pl/Images_IC/Images_SG/SIMEAS_P_en.pdf Siemens: Power Meter SIMEAS P Language: English Retrieved on: 01-December-2015
/43/	Website: https://mer.markit.com/br-reg/public/index.jsp?entity=project&sort=project_name&dir=ASC&start=0&entity_domain=Markit_GoldStandard Markit registry: Gold Standard project registry Language: English Retrieved on: 06-June-2016
/44/	Website: http://cdm.unfccc.int/Projects/projsearch.html CDM: CDM project registry Language: English Retrieved on: 06-June-2016
/45/	MTP HPPO Manufacturing Co.,Ltd: PO production report (exported from IP21) in spreadsheet "Rpt_PO production.xlsx" submitted on 29-March-2016.
/46/	MTP HPPO Manufacturing Co.,Ltd: PO Stock checking report in spreadsheet "Rpt_Stock Checking.xlsx" submitted on 29-February-2016.
/47/	MTP HPPO Manufacturing Co.,Ltd: Data cross check report in spreadsheet "DOW_data comparison rev02_220416.xlsx" submitted on 29-April-2016 and its previous version. "DOW_data comparison rev01.xlsx" submitted on 29-February-2016
/48/	Glow Energy Public Company Limited: Steam consumption invoices for the period October 2011 to March 2014.
/49/	ABB: Calibration certificate for steam flow meter S.No. 02209215 dated 05-January-2011
/50/	Glow Energy Public Company Limited: Electricity supply invoices for the period October 2011 to March 2014.
/51/	Website: http://www.ipcc-nggip.iges.or.jp/public/2006gl/ IPCC: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Language: English Retrieved on: 06-June-2016
/52/	PTT Public Company Limited: Natural Gas supply invoices for the period October 2011 to March 2014.
/53/	Website: http://database.v-c-s.org/rina-spa VCS: List of sectoral scopes RINA S.p.A is accredited

	Language: English Retrieved on: 27-July-2016
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2.3 Interviews

On 06/05/2014, RINA visited the project activity located at 10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand to resolve questions and issues identified during the document review and to perform interviews with relevant stakeholders in the host country.

The key personnel interviewed and the main topics of the interviews are summarized in the table below.

	Date	Name and Role	Organization	Topic
/a/	06/05/2014	Mr. Patana Surawatanapongs Business Development Manager (Thailand)	SPCTCL	VCS documentation, requirements, VER ownership etc. Emission reductions calculations Monitoring plan and monitoring arrangements Environmental and social impacts
/b/	06/05/2014	Mr. Sandeep Kanda Tech. Portfolio Director	SPCTCL	VCS documentation, requirements, VER ownership etc. Emission reductions calculations Monitoring plan and monitoring arrangements Environmental and social impacts
/c/	06/05/2014	Mr. Tirat Wisetrat HPPO Technology Centre Associate	MHMCL	Overview of production of PO using HPPO process, Reagent receipt, Storage, Production, Waste treatment, Disposal, Energy use. Storage of final product and Shipment. Monitoring plan and monitoring arrangements. Project description, evidences for proof of title, Monitoring plan, ownership of GHG emission reductions, Project Start Date, Commercially Sensitive Information, Other Programs.

				Monitoring plan & QA/QC procedures.
/d/	06/05/2014	Mr.Chaiwut, Atthawethworawuth Government Affairs Manager	MHMCL	Local stakeholder consultation process, Environmental and social impacts. Statutory requirements Permits, International operations.

2.4 Site Inspections

As mentioned above RINA visited the project site on 06/05/2014 located at 10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand.

Representatives of project owner and South Pole Carbon Asset Management Limited were interviewed as part of VCS verification site visit /08/. During the on-site assessment of the project RINA assessed the implementation and operation of the proposed project activity, accessed the installed equipment directly, interviewed key personnel of the plant to confirm the operation information, the commissioning of plant and the GHG Programs undertaken. The project activity is located in a designated industrial estate, with a number of large scale industries. There were no hindrances during the site visit and all equipment was accessible. The project activity is located in an industrial complex which produces PO and other chemicals. The project activity is confined only to the PO production process. The electricity and heat energy (steam) required for the project activity are purchased. The monitoring plan and the monitoring system implemented and the quality control and quality assurance procedures were confirmed through the onsite observation and interviews.

2.5 Resolution of Findings

The objective of this phase of the validation is to resolve any outstanding issues which need to be clarified for RINA's positive conclusion on the project description. To guarantee transparency any findings raised regarding to the validation are incorporated in the Verification Protocol and Verification Protocol Tables in Appendix A to this report.

Figure 1 Verification protocol tables

Verification Protocol, Table 1 - Requirement checklist				
Checklist Question	Ref.	MoV	Comments	Conclusion
The checklist is organized in four different sections.	Makes reference to documents where the answer to the checklist question or item is found.	Explain how conformance with the checklist question is investigated. Examples are document review (DR), interview or any other follow-up actions (I), cross checking (CC) with available information relating to projects, (N/A) means not applicable.	The discussion on how the conclusion is arrived at and the conclusion on the compliance with checklist question so far.	For CAR, CL and FAR see the definitions above. OK is used if the information and evidence provided is adequate to demonstrate compliance with VCS requirements.

Verification Protocol, Table 2 - Resolution of Corrective Action Requests and Clarification				
Corrective action requests and/or clarification requests	Reference to Table 1	Response by project participants	Verification conclusion	
The CAR and/or CLs raised in table 1 are repeated here.	Reference to the checklist question number in Table 1 where the CAR or CL is explained.	The responses given by the project participants to address the CARs and/or CLs.	The verification team's assessment and final conclusion of the CARs and/or CLs.	

Verification Protocol, Table 3 - Forward Action Requests (if no FAR table 3 is deleted)		
Forward action request	Reference to Table 1	Response by project participants Verification conclusion
The FAR raised in table 1 is repeated here.	Reference to the checklist question number in Table 1 where the FAR is explained.	Response by the project participants on how forward action request will be addressed.

2.5.1 Forward Action Requests

Based on the review of registered VCS validation report /08/, no FAR was raised during the validation and/or there was no FAR to be addressed during this verification.

2.6 Eligibility for Validation Activities

RINA is accredited for validating and verifying GHG emission reduction project activities falling under sectoral scope 05 Chemical Industries /53/.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

The project has not been registered or seeking registration under other GHG programs as confirmed through the CDM / GS websites /43/ /44/. Also it is to be noted that this project activity is using the new VCS methodology /11/.

3.2 Methodology Deviations

There is no methodology deviations applied to the project.

3.3 Project Description Deviations

The accuracy of the installed flow meters for monitoring the parameters, Quantity of PO produced in year y (PO_y) and Quantity of make-up solvent used in year y (Sol_y) is +/- 0.65% /39/ of reading against +/- 0.15% of reading as identified in the registered PD /02/. The validation and verification site visits were carried out at the same time, hence it is confirmed that there is no change in the model or serial number of the meter and it is only a typographical error in the registered VCS PD.

This deviation does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario, and the project remains in compliance with the applied methodology and consistent with the VCS standard /05/, hence accepted.

3.4 Grouped Project

The verification team confirms that the project is not a grouped project and hence this is not applicable to the project activity.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The findings of the verification related to the monitoring period from 04-October-2011 to 31-March-2014 as documented and described in the VCS monitoring report version 05 of 22-June-2016 and its previous versions/01/ are stated in the following sections. The verification requirements, the means of verification and the results from verifying the identified criteria are documented in more detail in the verification protocol in Appendix A.

It was verified during the site visit conducted on 06/05/2014 that the proposed project activity has been implemented and it is in operation and monitored in accordance to the project activity described in the validated VCS PD /2/. As per the registered VCS PD /01/, The starting date of project activity is defined as 04-October-2011 that has been taken as the actual commissioning date of the new HPPO technology at MTP HPPO Manufacturing Co., Ltd. as confirmed through the Dow Chemicals' News letter dated 04-January-2012 /24/ and Notification certificate dated 03-October-2011 /25/ and it is in line with the VCS Standard /8/.

The project is a Greenfield installation to produce Propylene Oxide (PO) using innovative Hydrogen Peroxide to Propylene Oxide (HPPO) technology. As compared to the conventional processes based on Chlorohydrin technology, the HPPO technology reduces overall energy consumption, thus resulting in significant emission reductions. Furthermore, the HPPO technology diminishes the wastewater volume also significantly, and decreases the infrastructure requirements and physical footprint by using simpler raw material and avoiding co-products. The new HPPO production facility has a production capacity of 390 kilotons per annum of PO /24/.

As per applied methodology/11/ and the VCS-PD/02/, there are 2 (two) classes of emissions that are considered in the proposed project activity, they are up-stream emissions and on-site process emissions. Up-stream emissions will relate to type of reagents used in the chemical reaction in the baseline and project activities while the on-site emissions includes emission sources located within the PO production facility and include emissions associated with the synthesis of the PO as well as emissions associated with by-product and waste treatment. Both emissions are considered in the project activity and baseline.

The project boundary in the validated VCS PD /2/ is in line with the actual project boundary. Based on the onsite inspection and checking the above documents, RINA confirms that there is no material discrepancy between the actual project information and the project description and the project activity has been implemented and it is in operation as described above in accordance with the project activity in the registered VCS PD /2/.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

The emission reduction calculations provided in the Emission reduction calculation spreadsheet /03/ has been verified to be correct and in line with the registered VCS PD /02/.

The emission reductions from the project for the monitoring period 04-October-2011 to 31-March-2014 as reported in the monitoring report version 05 of 22-June-2016 /01/ is equivalent to 320,900 tCO₂e. The reported emission reductions are 46% lower than the estimated emission reduction of 596,094 tCO₂e for the monitoring period as per the registered VCS PD /11/.

The data presented in the monitoring report version 05 of 22-June-2016 /01/ was assessed by reviewing in detail project documentation, collection of monitored data, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment.

Sufficient evidence was presented and verified by RINA for the reported emission reductions as discussed below:

According to the applied Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013 /11/, the emission reductions have been calculated based on the following formula:

Baseline Emissions

Baseline emissions for the chosen baseline scenario are calculated as per equation 1 of the methodology /11/ as below:

$$BE_y = BE_{Upstream,y} + BE_{Process,y}$$

Where:

BE_y	Baseline emission in year y (tCO ₂)
$BE_{Upstream,y}$	Emissions associated with the baseline reagents required for the production of PO in year y (tCO ₂)
$BE_{Process,y}$	Emissions due to energy usage (heat and electricity) for transforming the baseline reagents into the final product (PO) and also for waste and by-product treatment in year y (tCO ₂)

Up-stream emissions ($BE_{Upstream,y}$):

The emissions associated with Chlor-Alkali production are calculated as per equation 2 of the methodology /11/ as below:

$$BE_{Upstream,y} = be_{Chlor-Alkali,y} \times PO_y$$

Where:

$be_{Chlor-Alkali,y}$	Quantity of CO ₂ that would be emitted from Chlor-Alkali production per unit of PO in year y (tonnes)
PO_y	Quantity of PO produced in year y (831,190 tonnes)

The CO₂ emissions associated with Chlor-Alkali production are calculated as per equation 3 of the methodology /11/ as below:

$$be_{Chlor-Alkali,y} = \left(\frac{71}{58} \right) \times ec_{Chlor-Alkali,y} \times EF_{EL,y}$$

Where:

$ec_{Chlor-Alkali,y}$	Energy consumption per ton of Cl ₂ production in year y (2.2 MWh/tCl ₂)
$EF_{EL,y}$	Emission factor for electricity generation in year y (0.5113 tCO ₂ /MWh)
71/58	Ratio between the molecular weights of Cl ₂ and C ₃ H ₆ O (mass units/mass units)

Hence, Up-stream emissions ($BE_{Upstream,y}$) is calculated to be: 1,144,535 tCO₂/year

Process emissions ($BE_{Process,y}$):

The emissions associated with energy usage is calculated as per equation 4 of the methodology /11/ as below:

$$BE_{Process,y} = BE_{Heat,y} + BE_{Elec,y} + BE_{Waste,y}$$

Where:

$BE_{Heat,y}$	Emissions due to thermal energy (heat/steam) for transforming the baseline reagents into the final product (PO) and also for waste treatment in year y (tCO ₂). This is considered zero, conservative, hence accepted.
$BE_{Elec,y}$	Emissions due to electrical energy for transforming the baseline reagents into the final product (PO) and also for waste treatment in year y (tCO ₂)
$BE_{Waste,y}$	Emissions due to treatment of waste products in year y (tCO ₂). This is considered zero, conservative, hence accepted.

The CO₂ emissions from electrical energy are calculated as per equation 7 of the methodology /11/ as below:

$$BE_{Elec,y} = SEC_{CHPO} \times PO_y \times EF_{El,y}$$

Where:

SEC_{CHPO} Specific electrical energy consumption ratio in the PO production through CHPO process (0.100 MWh/tonne of PO).

$EF_{El,y}$ Emission factor for electricity generation in year y (0.5113 tCO₂/MWh)

Hence, process emissions ($BE_{Process,y}$) is calculated to be: 42,537 tCO₂/year and the Baseline emissions is calculated to be: 1,187,072 tCO₂/year.

Project Emissions

Project emissions are calculated as per equation 9 of the methodology /11/ as below:

$$PE_y = PE_{Upstream,y} + PE_{Process,y}$$

Where:

PE_y Project emissions in the year y, (tCO₂)

$PE_{Upstream,y}$ Emissions associated with the project reagents for the production of PO in year y (tCO₂)

$PE_{Process,y}$ Emissions due to energy usage (heat, electricity etc.) for transforming the project reagents into the final product (PO) and also for waste treatment in year y (tCO₂)

Up-stream emissions ($PE_{Upstream,y}$):

The emissions associated with H₂O₂ and solvent production solvents are considered, consistent with the methodology applied /11/. The upstream emissions are calculated as per equation 10 of the methodology /11/ as below:

$$PE_{Upstream,y} = PE_{Upstream,H_2O_2,y} + PE_{Upstream,Solvent,y}$$

The emissions associated with H₂O₂ production are calculated as per equation 11 of the methodology /11/ as below

$$PE_{Upstream,H_2O_2,y} = \left(\frac{34}{58} \right) \times pe_{HP} \times PO_y$$

Where:

peHP Quantity of CO₂ that would be emitted per tonne of H₂O₂ (0.533 tCO₂/tH₂O₂)

PO_y Quantity of PO produced in year y (831,190 tonnes)

34/58 Ratio between the molecular weights of H₂O₂ and C₃H₆O (mass units/mass units)

The emissions associated with make-up solvent are calculated as per equation 12 of the methodology /11/ as below

$$PE_{Upstream,Solvent,y} = pe_{Sol} \times sol_y \times PO_y$$

Where:

peSol Quantity of CO₂ that is emitted per tonne of solvent (0.31 tCO₂/tonne of solvent)

soly Quantity of solvent required per tonne of PO in year y (tonnes)

PO_y Quantity of PO produced in year y (tonnes)

For ex-post calculations, “soly X PO_y” is represented by Soly (50,781 tonnes) in equation 12 above, the value of which is monitored. Consistent with the methodology, hence accepted.

Hence, PE_{Upstream,y} is calculated to be 275,446 tCO₂/year

Process emissions (PE_{Process,y}):

The process emissions are calculated as per equation 13 of the methodology /11/ as below

$$PE_{Process,y} = PE_{Heat,y} + PE_{Elec,y} + PE_{Waste,y}$$

Where:

PE_{Heat,y} Emissions due to thermal energy (heat/steam) for transforming the project reagents into the final product in year y (tCO₂). This is considered zero as it sourced from Glo Grid, cogeneration plants, consistent with the VCS PD /02/.

PE_{Elec,y} Emissions due to electrical energy for transforming the project reagents into the final product in year y (tCO₂)

PE_{Waste,y} Emissions due to treatment of waste products in year y (tCO₂)

The CO₂ emissions from electrical energy are calculated as per equation 15 of the methodology /11/ as below

$$PE_{El,y} = SEC_{HPPO,y} \times PO_y \times EF_{El,y}$$

Where:

$SEC_{HPPO,y}$ Specific electrical energy consumption ratio in PO production through the HPPO process in year y (MWh/tonne of PO)

$EF_{El,y}$ Emission factor for electricity generation in year y (0.5113 tCO₂/MWh)

For ex-post calculations, “ $SEC_{HPPO} \times PO_y$ ” is represented by EC_{HPPO} (557,280 MWh) in equation 15 above, the value of which is monitored.

The emission factor for electricity generation is the same as calculated for the baseline emissions.

Hence, $PE_{Elec,y}$ is calculated to be 284,937 tCO₂/year

The CO₂ emissions from waste treatment are calculated as per equation 16 of the methodology /11/ as below

$$PE_{Waste,y} = \left(\frac{44}{12} \right) \times (CA_{Waste,y}) + FC_{i,y} \times COEF_{i,y}$$

Where:

$CA_{Waste,y}$ Carbon amount in the waste stream derived from the carbon amount in the propylene feed, solvent, PO and by-products in year y (tonnes)

44/12 Ratio between the molecular weights of CO₂ and carbon (mass units/mass units)

$FC_{i,y}$ Quantity of fuel type i (Natural gas) combusted in the incinerator in year y (21,083,048 Nm³).

$COEF_{i,y}$ CO₂ emission coefficient of fuel type i in year y (2.6928 tCO₂/tNG), calculated as per the Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion /17/

The carbon amount in the waste stream must be calculated as per equation 17 of the methodology /10/ as below

$$CA_{Waste,y} = CA_{Propylene,y} + CA_{Solvent,y} - (CA_{PO,y} + CA_{Byproducts,y})$$

Where:

$CA_{\text{Propylene}, y}$ Carbon amount in the propylene feed in year y (tonnes)

$CA_{\text{Solvent}, y}$ Carbon amount in the solvent used in year y (tonnes)

$CA_{\text{PO}, y}$ Carbon amount in PO produced in year y (tonnes)

$CA_{\text{Byproducts}, y}$ Carbon amount in the by-products in year y (tonnes)

The total amount of carbon in a particular product is a function of the respective carbon fraction and the quantity of the product, expressed as per equation 18 of the methodology /11/ as below

$$CA_{x,y} = ca_{x,y} \times Q_{x,y}$$

Where:

$CA_{x,y}$ Carbon amount in the product x in year y (tonnes)

$ca_{x,y}$ Carbon fraction in the product x in year y (mass units/mass units)

$Q_{x,y}$ Quantity of the product x in year y (tonnes)

Quantity: Propylene (661,191 tonnes), solvent (50,781 tonnes), PO (831,190 tonnes), by-product (7,004 tonnes), waste (input-output is considered waste, conservative and consistent with the methodology applied /11/ and the registered VCS PD /02/).

Carbon fraction: Propylene (36/42), solvent 12/32), PO (36/58), by-product – Propylene glycol (36/76).

Applying equation 19 of the methodology, the emissions due to treatment of waste products in year y (tCO_2) $PE_{\text{Waste},y}$ is calculated to be 305,786 tCO_2 /year.

Leakage

No leakage emissions are considered consistent with the methodology /11/ and the registered VCS PD /02/.

Emission Reductions

Emission reductions are calculated as per equation 20 of the methodology /11/ as below

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y Emission reductions in year y (320,900 tCO_2e/yr)

BEy Baseline emissions in year y (1,187,072 tCO₂/yr)

PEy Project emissions in year y (866,170 tCO₂e/yr)

LEy Leakage emissions in year y (0 tCO₂e/yr)

Hence the emission reductions achieved by the project activity is calculated to be 320,900 tCO₂e/year for the monitoring period 04-October-2011 to 31-March-2014.

The following parameters were available at validation as per the registered VCS PD /02/ and the validation report /14/:

	Data / Parameter	Source of data	Reported value for the project period	Assessment/Observation
1	Energy consumption per tonne of Cl ₂ production in year y. (<i>eC_{Chlor-Alkali, y}</i>)	Sourced from Multilateral Investment Guarantee Agency Environmental Guidelines for Chlor-Alkali Industry.	2.2 MWh/tCl ₂	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and consistent. Hence accepted.
2	Specific thermal energy consumption ratio in PO production through the CHPO-chlor-alkali process (<i>SSC_{CHPO}</i>)	Sourced from Nexant report on HPPO.	0.003864 TJ/ton of PO	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and consistent. Hence accepted.
3	Specific electrical energy consumption ratio in PO production through the CHPO-chlor-alkali process. (<i>SEC_{CHPO}</i>)	Sourced from Nexant report on HPPO.	0.100 MWh/ton of PO	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and consistent. Hence accepted.
4	Quantity of CO ₂ that would be emitted per ton of H ₂ O ₂ (<i>pe_{HP}</i>)	Sourced from certified environmental product declaration (EPD) for hydrogen	0.533 tCO ₂ /tH ₂ O ₂	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and

		peroxide.		consistent. Hence accepted.
5	Quantity of CO ₂ emitted per tonne of solvent (pe_{sol})	Sourced from Table 3.12, Chapter 3: Chemical Industry Emissions, IPCC 2006.	0.310 tCO ₂ /tonne of solvent	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and consistent. Hence accepted.
6	Carbon amount in the waste stream combusted in the incinerator in the baseline per ton of PO ($ca_{Waste, Baseline}$)	Conservative hence accepted.	Excluded for simplification	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and consistent. Hence accepted.
7	Quantity of fossil fuel combusted in the incinerator in the baseline per ton of PO production ($fc_{i,baseline}$)	Conservative hence accepted.	Excluded for simplification	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and consistent. Hence accepted.
8	Emission factor for electricity generation in year ($EF_{EL,y}$)	Project uses official published data on operating and build margin emission factors provided by Thailand Greenhouse Gas Management Organization (Public Organization) TGO.	0.5113 tCO ₂ /MWh	The verification team has verified the value from the registered VCS PD /02/ and validation report /14/ and found to be correct and consistent. Hence accepted.

Data and parameters monitored ex-post:

DATA/PARAMETER	PO _y												
Data Unit	tonnes												
Description	Quantity of PO produced in year y												
Source of data to be used	Sourced from plant records, measured using vortex flow meter and cross-checked with stock verification records.												
Value data for the monitoring period	<table border="1"> <tr> <td>2011</td><td>62,167</td></tr> <tr> <td>2012</td><td>321,724</td></tr> <tr> <td>2013</td><td>357,912</td></tr> <tr> <td>2014</td><td>89,387</td></tr> </table>	2011	62,167	2012	321,724	2013	357,912	2014	89,387				
2011	62,167												
2012	321,724												
2013	357,912												
2014	89,387												
Measuring frequency	Continuous.												
Reporting frequency and recording procedure	Continuous monitoring, integrated daily and at least monthly recordings. The same is in line with the registered PD /02/ and the methodology applied /11/ hence accepted. The production values are cross checked with stock verification records /46/ and the most conservative data /47/ is used for emission reduction calculation /03/. Confirmed during verification site visit.												
Type of monitoring equipment	<table border="1"> <tr> <td>Meter type</td><td>Vortex</td></tr> <tr> <td>Model</td><td>ROSEMOUNT, 8800DF040SA3N2D1E5T1CNQ4</td></tr> <tr> <td>S. No</td><td>6015584, 6050847</td></tr> <tr> <td>Tag No.</td><td>FT-4311-18, FT-4311-20</td></tr> <tr> <td>Accuracy</td><td>+/- 0.65% /39/</td></tr> <tr> <td>Calibration date</td><td>29-April-2010 and 16-November-2011 respectively /30/ /31/.</td></tr> </table>	Meter type	Vortex	Model	ROSEMOUNT, 8800DF040SA3N2D1E5T1CNQ4	S. No	6015584, 6050847	Tag No.	FT-4311-18, FT-4311-20	Accuracy	+/- 0.65% /39/	Calibration date	29-April-2010 and 16-November-2011 respectively /30/ /31/.
Meter type	Vortex												
Model	ROSEMOUNT, 8800DF040SA3N2D1E5T1CNQ4												
S. No	6015584, 6050847												
Tag No.	FT-4311-18, FT-4311-20												
Accuracy	+/- 0.65% /39/												
Calibration date	29-April-2010 and 16-November-2011 respectively /30/ /31/.												
Is accuracy of the monitoring equipment as stated in the PDD?	The flow meter is of +/- 0.65% accuracy. The same was confirmed during the site visit and from manufacturers specification sheet /39/. The accuracy of the installed flow is +/- 0.65% /39/ +/- 0.15% as identified in the registered PD /02/. The validation and verification site visits were carried out at the same time, hence it is confirmed that there is no change in the model or serial number of the meter and												

	it is only a typographical error in the registered VCS PD. This deviation does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario, and the project remains in compliance with the applied methodology and consistent with the VCS standard /05/, hence accepted.
Calibration frequency/interval	The flow meter is calibrated once every 60 months / 5 years, during shutdown as they are online. Calibration has been carried out by the manufacturers of the meter /30/ /31/, credible, hence accepted.
Is the calibration interval in line with the monitoring plan of the PDD?	The registered VCS PD does not specify the calibration interval and neither the manufacturers'specification. The flow meter is calibrated once every 60 months / 5 years, during shutdown. Accepted as the values are cross verified with stock records and the most conservative value is applied for emission reduction calculations /03/.
How were the values in the monitoring report verified and cross-checked?	As per the registered VCS PD, the production values /45/ can be cross checked with the stock records /47/. PP has submitted the stock verification records for the monitoring period /46//47/. The validation team has verified the above documents and found that the values used for emission reduction calculations /03/ are conservative.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	As observed during site visit, all meters are recorded under Manufacturing Execution Suit / IP21 (MES) server. From meters all monitoring data are stored in logs and in electronic format as excel sheets and can an excel sheet can be retrieved for any said period and cross checked with sales/ production/ stock values. Hence the transfer of data is deemed accurate.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.

DATA/PARAMETER	Sol _y												
Data Unit	tonnes												
Description	Quantity of make-up solvent used in year y												
Source of data to be used	Sourced from plant records, measured using vortex flow meter and cross-checked with stock verification records.												
Value data for the monitoring period	<table> <tr> <td>2011</td><td>5,049</td></tr> <tr> <td>2012</td><td>19,061</td></tr> <tr> <td>2013</td><td>21,634</td></tr> <tr> <td>2014</td><td>4,366</td></tr> </table>	2011	5,049	2012	19,061	2013	21,634	2014	4,366				
2011	5,049												
2012	19,061												
2013	21,634												
2014	4,366												
Measuring frequency	Continuous.												
Reporting frequency and recording procedure	Continuous monitoring, integrated daily and at least monthly recordings. The same is in line with the registered PD /02/ and the methodology applied /11/ hence accepted. The production values are cross checked with stock verification and the most conservative data is used for emission reduction calculation /03/. Confirmed during verification site visit.												
Type of monitoring equipment	<table> <tr> <td>Meter type</td><td>Vortex</td></tr> <tr> <td>Model</td><td>ROSEMOUNT, 8800DF020SA1N2D1E5T1CNQ4</td></tr> <tr> <td>S. No</td><td>6015616</td></tr> <tr> <td>Tag No.</td><td>FT-7409-02</td></tr> <tr> <td>Accuracy</td><td>+/- 0.65 % /39/</td></tr> <tr> <td>Calibration date</td><td>08-May-2010 /32/</td></tr> </table>	Meter type	Vortex	Model	ROSEMOUNT, 8800DF020SA1N2D1E5T1CNQ4	S. No	6015616	Tag No.	FT-7409-02	Accuracy	+/- 0.65 % /39/	Calibration date	08-May-2010 /32/
Meter type	Vortex												
Model	ROSEMOUNT, 8800DF020SA1N2D1E5T1CNQ4												
S. No	6015616												
Tag No.	FT-7409-02												
Accuracy	+/- 0.65 % /39/												
Calibration date	08-May-2010 /32/												
Is accuracy of the monitoring equipment as stated in the PDD?	The flow meter is of +/- 0.65 % accuracy. The same was confirmed during the site visit and from manufacturers specification sheet /39/. The accuracy of the installed flow is +/- 0.65% /39/ +/- 0.15% as identified in the registered PD /02/. The validation and verification site visits were carried out at the same time, hence it is confirmed that there is no change in the model or serial number of the meter and it is only a typographical error in the registered VCS PD. This deviation does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario, and the project remains in compliance with the applied methodology and												

	consistent with the VCS standard /05/, hence accepted.
Calibration frequency/interval	The flow meter is calibrated once every 60 months / 5 years, during shutdown as they are online. Calibration has been carried out by the manufacturers of the meter /32/, credible, hence accepted.
Is the calibration interval in line with the monitoring plan of the PDD?	The registered VCS PD does not specify the calibration interval and neither the manufacturers'specification. The flow meter is calibrated once every 60 months / 5 years, during shutdown. Accepted as the values are cross verified with stock records and the most conservative value is applied for emission reduction calculations.
How were the values in the monitoring report verified and cross-checked?	As per the registered VCS PD, the production values /45/ can be cross checked with the stock records /47/. PP has submitted the stock verification records for the monitoring period /46//47/. The validation team has verified the above documents and found that the values used for emission reduction calculations are conservative.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	As observed during site visit, all meters are recorded under Manufacturing Execution Suit / IP21 (MES) server. From meters all monitoring data are stored in logs and in electronic format as excel sheets and can an excel sheet can be retrieved for any said period and cross checked with sales/ production/ stock values. Hence the transfer of data is deemed accurate.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.

DATA/PARAMETER	EFCO _{2, i, y}				
Data Unit	tCO ₂ /TJ				
Description	Weighted average CO ₂ emission factor of fossil fuel used during year y				
Source of data to be used	Default value from IPCC Table 2.3: Default emission factors for stationary combustion in manufacturing industries and construction /51/.				
Value data for the monitoring period	<table border="1"> <tr> <th>Type</th><th>tCO₂/TJ</th></tr> <tr> <td>Natural gas</td><td>56.1</td></tr> </table>	Type	tCO ₂ /TJ	Natural gas	56.1
Type	tCO ₂ /TJ				
Natural gas	56.1				
Measuring frequency	Annually. The same is in line with the registered PD /02/ and the methodology applied /11/ hence accepted.				
Reporting frequency and recording procedure	Annually. The same is in line with the registered PD /02/ and the methodology applied /11/ hence accepted.				
Type of monitoring equipment	Not applicable				
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable				
Calibration frequency/interval	Not applicable				
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable				
How were the values in the monitoring report verified and cross-checked?	Not applicable				
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	Not applicable				
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.				

DATA/PARAMETER	$\eta_{Boiler,y}$
Data Unit	%
Description	Efficiency of the steam generating system.
Source of data to be used	Not applicable
Value data for the monitoring period	This parameter is not considered in both baseline and project scenario, the same is in line with the registered VCS-PD /02/ and is hence accepted.
Measuring frequency	Not applicable
Reporting frequency and recording procedure	Not applicable
Type of monitoring equipment	Not applicable
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable
Calibration frequency/interval	Not applicable
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable
How were the values in the monitoring report verified and cross-checked?	Not applicable
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	Not applicable
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.

DATA/PARAMETER	$SC_{HPPO, y}$								
Data Unit	TJ								
Description	Thermal energy consumption in the PO production through HPPO process in year y.								
Source of data to be used	Data taken from the meters calibrated regularly according to manufacturer's guidelines. Steam consumption is converted into energy using enthalpy values and accounting for any condensate return. However as per the registered VCS PD /02/ since the steam is sourced from the cogeneration plants of Glow grid, the emissions get accounted in the electricity component therefore to avoid double counting and applying conservative principle the emission factor for steam has been considered as zero. Hence the emission from steam consumption is zero. The same is in line with the registered PD /02/ hence accepted.								
Value data for the monitoring period	<table border="1"> <tr> <td>2011</td><td>343</td></tr> <tr> <td>2012</td><td>1,396</td></tr> <tr> <td>2013</td><td>1,280</td></tr> <tr> <td>2014</td><td>287</td></tr> </table>	2011	343	2012	1,396	2013	1,280	2014	287
2011	343								
2012	1,396								
2013	1,280								
2014	287								
Measuring frequency	Continuous monitoring, integrated daily and at least monthly recordings.								
Reporting frequency and recording procedure	Steam reading is obtained as ton/hour. Temperature and pressure are averaged automatically by the system and reported in tonnes/hour. Average pressure and temperature monthly readings are available hence enthalpy is calculated from steam table /03/. Steam and electricity are supplied and billed by the Utility company.								
Type of monitoring equipment	<table border="1"> <tr> <td>Meter type</td><td>Probar flowmeter (Pitot type), RTD (PT100), Pressure transmitter, for mass, temperature and pressure measurements respectively.</td></tr> <tr> <td>Model</td><td>ROSEMOUNT, 3051SFADS240ZCHFS3A3D0072AA1B2 G9E1F2F0052 ABB, A5Y0W9S3D1D6P3D2L1H4/OPT ROSEMOUNT, 3051CA3A02A1BK6H2L4T1P1CN respectively</td></tr> <tr> <td>S. No</td><td>02209215 for Steam flow meter and 210000853587001 and 2284871 for the</td></tr> </table>	Meter type	Probar flowmeter (Pitot type), RTD (PT100), Pressure transmitter, for mass, temperature and pressure measurements respectively.	Model	ROSEMOUNT, 3051SFADS240ZCHFS3A3D0072AA1B2 G9E1F2F0052 ABB, A5Y0W9S3D1D6P3D2L1H4/OPT ROSEMOUNT, 3051CA3A02A1BK6H2L4T1P1CN respectively	S. No	02209215 for Steam flow meter and 210000853587001 and 2284871 for the		
Meter type	Probar flowmeter (Pitot type), RTD (PT100), Pressure transmitter, for mass, temperature and pressure measurements respectively.								
Model	ROSEMOUNT, 3051SFADS240ZCHFS3A3D0072AA1B2 G9E1F2F0052 ABB, A5Y0W9S3D1D6P3D2L1H4/OPT ROSEMOUNT, 3051CA3A02A1BK6H2L4T1P1CN respectively								
S. No	02209215 for Steam flow meter and 210000853587001 and 2284871 for the								

		temperature and pressure indicators respectively.
	Tag No.	FT-9500-01, TT950001, PT950001 respectively
	Accuracy	0.8%, +/- 0.06%, +/- 1% respectively /41/
	Calibration date	05-January-2011 for the steam flow meter and 17-May-2011 for both temperature and pressure indicators /49/
Is accuracy of the monitoring equipment as stated in the PDD?	The flow meter is of +/- 0.8 % accuracy. The same was confirmed during the site visit and from manufacturers specification sheet /41/.	
Calibration frequency/interval	The flow meter is calibrated once every 60 months / 5 years, during shutdown as they are online. Calibration has been carried out by the manufacturers of the meter /49/, credible, hence accepted.	
Is the calibration interval in line with the monitoring plan of the PDD?	The registered VCS PD does not specify the calibration interval and neither the manufacturers' specification. The flow meter is calibrated once every 60 months / 5 years, during shutdown. Accepted as the values are cross verified with steam supply invoices and the most conservative value is applied for emission reduction calculations.	
How were the values in the monitoring report verified and cross-checked?	PP has submitted the Steam supply invoices for the monitoring period /48/. The validation team has verified the above documents and found that the values used for emission reduction calculations are conservative.	
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	As observed during site visit, all meters are recorded under Manufacturing Execution Suit / IP21 (MES) server. From meters all monitoring data are stored in logs and in electronic format as excel sheets and can an excel sheet can be retrieved for any said period and cross checked with invoices. Hence the transfer of data is deemed accurate.	
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.	

DATA/PARAMETER	EC _{HPPO, y}												
Data Unit	MWh												
Description	Electrical energy consumption in the PO production through HPPO process in year y.												
Source of data to be used	Sourced from plant records, measured using electricity meters												
Value data for the monitoring period	<table border="1"> <tr> <td>2011</td><td>55,428</td></tr> <tr> <td>2012</td><td>217,095</td></tr> <tr> <td>2013</td><td>227,688</td></tr> <tr> <td>2014</td><td>57,069</td></tr> </table>	2011	55,428	2012	217,095	2013	227,688	2014	57,069				
2011	55,428												
2012	217,095												
2013	227,688												
2014	57,069												
Measuring frequency	Continuous.												
Reporting frequency and recording procedure	Continuous monitoring, integrated daily and at least monthly recordings, consistent with the registered VCD PD /02/.												
Type of monitoring equipment	<table border="1"> <tr> <td>Meter type</td><td>7KG7750-0GA01-00AA0</td></tr> <tr> <td>Model</td><td>Siemens, SIMEAS P50</td></tr> <tr> <td>S. No</td><td>BF0908074313, BF0908074311, BF0908074317 and BF0908074314</td></tr> <tr> <td>Tag No.</td><td>JT700214ACalc, JT700211ACalc, JT700220ACalc and JT700223ACalc</td></tr> <tr> <td>Accuracy</td><td>+/- 0.5% /42/</td></tr> <tr> <td>Calibration date</td><td>14-May-2010 /33/</td></tr> </table>	Meter type	7KG7750-0GA01-00AA0	Model	Siemens, SIMEAS P50	S. No	BF0908074313, BF0908074311, BF0908074317 and BF0908074314	Tag No.	JT700214ACalc, JT700211ACalc, JT700220ACalc and JT700223ACalc	Accuracy	+/- 0.5% /42/	Calibration date	14-May-2010 /33/
Meter type	7KG7750-0GA01-00AA0												
Model	Siemens, SIMEAS P50												
S. No	BF0908074313, BF0908074311, BF0908074317 and BF0908074314												
Tag No.	JT700214ACalc, JT700211ACalc, JT700220ACalc and JT700223ACalc												
Accuracy	+/- 0.5% /42/												
Calibration date	14-May-2010 /33/												
Is accuracy of the monitoring equipment as stated in the PDD?	The flow meter is of +/- 0.5 % accuracy. The same was confirmed during the site visit and from manufacturers specification sheet /41/.												
Calibration frequency/interval	The flow meter is calibrated once every 60 months / 5 years, during shutdown as they are online. Calibration has been carried out by the manufacturers of the meter /33/, credible, hence accepted.												
Is the calibration interval in line with the monitoring plan of the PDD?	The registered VCS PD does not specify the calibration interval and neither the manufacturers' specification. The flow meter is calibrated once every 60 months / 5 years, during shutdown. Accepted as the values are cross verified with electricity supply invoices and the most conservative value is applied for emission reduction calculations.												

How were the values in the monitoring report verified and cross-checked?	PP has submitted the electricity supply invoices for the monitoring period /50/. The validation team has verified the above documents and found that the values used for emission reduction calculations are conservative /03/.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	As observed during site visit, all meters are recorded under Manufacturing Execution Suit / IP21 (MES) server. From meters all monitoring data are stored in logs and in electronic format as excel sheets and can an excel sheet can be retrieved for any said period and cross checked with invoices. Hence the transfer of data is deemed accurate.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.

DATA/PARAMETER	Q _{Propylene,y}												
Data Unit	Tonnes												
Description	Quantity of propylene used in year y.												
Source of data to be used	Sourced from plant production records, measured using mass flow meter and cross-checked with stock verification records.												
Value data for the monitoring period	<table border="1"> <tr> <td>2011</td><td>50,849</td></tr> <tr> <td>2012</td><td>253,606</td></tr> <tr> <td>2013</td><td>285,016</td></tr> <tr> <td>2014</td><td>71,720</td></tr> </table>	2011	50,849	2012	253,606	2013	285,016	2014	71,720				
2011	50,849												
2012	253,606												
2013	285,016												
2014	71,720												
Measuring frequency	Continuous.												
Reporting frequency and recording procedure	Continuous monitoring, integrated daily and at least monthly recordings. The same is in line with the methodology /11/ requirement and the registered PD /02/ is hence accepted. The production values are cross checked with stock reconciliation / verification and the most conservative data is used for emission reduction calculation /03/. Confirmed during verification site visit.												
Type of monitoring equipment	<table border="1"> <tr> <td>Meter type</td><td>Coriolis Mass Flow Meter</td></tr> <tr> <td>Model</td><td>Endress+Hauser, PROMASS 80F</td></tr> <tr> <td>S. No</td><td>D303621600</td></tr> <tr> <td>Tag No.</td><td>FT-1164-01</td></tr> <tr> <td>Accuracy</td><td>+/- 0.15%/37/</td></tr> <tr> <td>Calibration date</td><td>04-06-2010 /34/</td></tr> </table>	Meter type	Coriolis Mass Flow Meter	Model	Endress+Hauser, PROMASS 80F	S. No	D303621600	Tag No.	FT-1164-01	Accuracy	+/- 0.15%/37/	Calibration date	04-06-2010 /34/
Meter type	Coriolis Mass Flow Meter												
Model	Endress+Hauser, PROMASS 80F												
S. No	D303621600												
Tag No.	FT-1164-01												
Accuracy	+/- 0.15%/37/												
Calibration date	04-06-2010 /34/												
Is accuracy of the monitoring equipment as stated in the PDD?	The flow meter is of +/- 0.15% accuracy. The same was confirmed during the site visit and from manufacturers specification sheet /37/.												
Calibration frequency/interval	The flow meter is calibrated once every 60 months / 5 years, during shutdown as they are online. Calibration has been carried out by the manufacturers of the meter /34/, credible, hence accepted.												
Is the calibration interval in line with the monitoring plan of the PDD?	The registered VCS PD does not specify the calibration interval and neither the manufacturers' specification. The flow meter is calibrated once every 60 months / 5 years, during shutdown. Accepted as the values are cross verified												

	with stock records and the most conservative value is applied for emission reduction calculations /03/.
How were the values in the monitoring report verified and cross-checked?	As per the registered VCS PD, the production values /45/ can be cross checked with the stock records /47/. PP has submitted the stock verification records for the monitoring period /46//47/. The validation team has verified the above documents and found that the values used for emission reduction calculations are conservative.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	As observed during site visit, all meters are recorded under Manufacturing Execution Suit / IP21 (MES) server. From meters all monitoring data are stored in logs and in electronic format as excel sheets and can an excel sheet can be retrieved for any said period and cross checked with sales/ production/ stock values. Hence the transfer of data is deemed accurate.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.

DATA/PARAMETER	$Q_{By-product,y}$												
Data Unit	Tonnes												
Description	Quantity of by-product produced in year y.												
Source of data to be used	Sourced from plant records, measured using vortex flow meter and cross-checked with stock verification records.												
Value data for the monitoring period	<table border="1"> <tr> <td>2011</td><td>943</td></tr> <tr> <td>2012</td><td>1,855</td></tr> <tr> <td>2013</td><td>3,303</td></tr> <tr> <td>2014</td><td>903</td></tr> </table>	2011	943	2012	1,855	2013	3,303	2014	903				
2011	943												
2012	1,855												
2013	3,303												
2014	903												
Measuring frequency	Continuous monitoring, integrated daily and at least monthly recordings. The same is in line with the methodology requirement and is hence accepted.												
Reporting frequency and recording procedure	Values are measured continuously, integrated daily and recorded at least on monthly basis. The production values are cross checked with stock reconciliation / verification and the most conservative data is used for emission reduction calculation. Confirmed during verification site visit.												
Type of monitoring equipment	<table border="1"> <tr> <td>Meter type</td><td>Ultrasonic</td></tr> <tr> <td>Model</td><td>KROHNE, UFM3030/UFS3000</td></tr> <tr> <td>S. No</td><td>A1071567</td></tr> <tr> <td>Tag No.</td><td>FT722001</td></tr> <tr> <td>Accuracy</td><td>+/- 0.5% /40/</td></tr> <tr> <td>Calibration date</td><td>17-05-2010 /35/</td></tr> </table>	Meter type	Ultrasonic	Model	KROHNE, UFM3030/UFS3000	S. No	A1071567	Tag No.	FT722001	Accuracy	+/- 0.5% /40/	Calibration date	17-05-2010 /35/
Meter type	Ultrasonic												
Model	KROHNE, UFM3030/UFS3000												
S. No	A1071567												
Tag No.	FT722001												
Accuracy	+/- 0.5% /40/												
Calibration date	17-05-2010 /35/												
Is accuracy of the monitoring equipment as stated in the PDD?	The flow meter is of +/- 0.5% accuracy. The same was confirmed during the site visit and from manufacturers specification sheet /40/.												
Calibration frequency/interval	The flow meter is calibrated once every 60 months / 5 years, during shutdown as they are online. Calibration has been carried out by the manufacturers of the meter /35/, credible, hence accepted.												
Is the calibration interval in line with the monitoring plan of the PDD?	The registered VCS PD does not specify the calibration interval and neither the manufacturers'specification. The flow meter is calibrated once every 60 months / 5 years, during shutdown. Accepted as the values are cross verified with stock records and the most conservative value is												

	applied for emission reduction calculations /03/.
How were the values in the monitoring report verified and cross-checked?	As per the registered VCS PD, the production values /45/ can be cross checked with the stock records /47/. PP has submitted the stock verification records for the monitoring period /46//47/. The validation team has verified the above documents and found that the values used for emission reduction calculations are conservative /03/.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	As observed during site visit, all meters are recorded under Manufacturing Execution Suit / IP21 (MES) server. From meters all monitoring data are stored in logs and in electronic format as excel sheets and can an excel sheet can be retrieved for any said period and cross checked with sales/ production/ stock values. Hence the transfer of data is deemed accurate.
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.

DATA/PARAMETER	FC _{i,y}								
Data Unit	Nm3								
Description	Quantity of NG combusted in the incinerator during the year y								
Source of data to be used	Sourced from supplier data (NG supplied by PTT – meter is installed on PTT skid).								
Value data for the monitoring period	<table border="1"> <tr> <td>2011</td><td>2,663,207</td></tr> <tr> <td>2012</td><td>10,495,944</td></tr> <tr> <td>2013</td><td>5,241,471</td></tr> <tr> <td>2014</td><td>1,536,048</td></tr> </table>	2011	2,663,207	2012	10,495,944	2013	5,241,471	2014	1,536,048
2011	2,663,207								
2012	10,495,944								
2013	5,241,471								
2014	1,536,048								
Measuring frequency	Continuous monitoring, integrated daily and at least monthly recordings. The same is in line with the methodology requirement and is hence accepted.								
Reporting frequency and recording procedure	Values are measured continuously, integrated daily and recorded at least on monthly basis. The production values are cross checked with stock reconciliation / verification and the most conservative data is used for emission reduction calculation. Confirmed during verification site visit.								
Type of monitoring equipment	Measured through turbine meter belonging to PTT, values from supplier invoice are used for emission reduction calculation. Emission reductions through NG volume measurements and NG energy supplied were compared /47//03/ and energy values from supplier invoice /52/ is considered as it is conservative.								
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable.								
Calibration frequency/interval	Not applicable								
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable								
How were the values in the monitoring report verified and cross-checked?	Supplier invoices for the period was verified and found to be consistent / 52/								
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	Direct energy supply values from the NG supply invoice are used (monthly values). Supplier invoices for the period was verified and found to be consistent /52/								
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.								

DATA/PARAMETER	COEF _{i,y}
Data Unit	tCO ₂ /t of Natural gas
Description	CO ₂ emission coefficient of Natural gas.
Source of data to be used	Sourced from IPCC Data /51/
Value data for the monitoring period	2.6928
Measuring frequency	Annually. The same is in line with the methodology requirement and is hence accepted.
Reporting frequency and recording procedure	Annually. The same is in line with the methodology requirement and is hence accepted.
Type of monitoring equipment	Not applicable
Is accuracy of the monitoring equipment as stated in the PDD?	Not applicable
Calibration frequency/interval	Not applicable
Is the calibration interval in line with the monitoring plan of the PDD?	Not applicable
How were the values in the monitoring report verified and cross-checked?	Not applicable
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	Not applicable
If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	Not Applicable.

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

All production values are monitored continuously using calibrated meters /45/ and cross checked with stock verification /46/, which reconciles production, invoice and stock data. The differences between logistic and production values are less than 5% which defined in clause 5.3.1 of VCS standard /05/, however the most conservative value /47/ is taken for emission reduction calculations /03/.

Purchased Utilities including Electricity, steam and natural gas measured using calibrated meters and cross checked with supplier invoices and the most conservative value /47/ is taken for emission reduction calculations /03/.

Meters used for monitoring are calibrated through manufacturers themselves and hence deemed credible.

The verification team has cross checked production records, stock verification records and monthly invoices against the values applied in the emission reduction calculations and found to be in order.

CO₂ emission factor and CO₂ emission coefficient for Natural gas has been taken as 56.1 tCO₂/TJ and 2.6928 tCO₂/t of Natural gas respectively. The verification team has verified the value with IPCC data /51/ and found to be correct and consistent.

The baseline emission is calculated to be 1,187,072 tCO₂. The project emission is calculated to be 866,170 tCO₂. As per the registered VCS PD the project does not need to consider leakage emissions. Thus the emission reductions are calculated to be 320,900 tCO₂ e for this monitoring period.

4.4 Non-Permanence Risk Analysis

The project is non-AFOLU project activity. Hence not applicable.

5 VERIFICATION CONCLUSION

RINA Service Spa (RINA) has performed verification of the emission reductions reported for the project activity “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” in Thailand, VCS project ID 1502, for the period 04-October-2011 to 31-March-2014 with regard to the relevant requirements for VCS activities.

The project participants of the “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” project are responsible for:

- The preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the registered VCS project document version 02 of 22-September-2014
- The development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project

It is the responsibility of RINA to express an independent verification opinion about the project's conformity with the requirements of VCSA and on the reported greenhouse gas emission reductions from the project.

Based on documented evidence and corroborated by an on-site assessment RINA can confirm that:

- the project has been implemented and operated as per the registered VCS-PD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS requirements;
- the monitoring is in place as per the applied baseline and monitoring methodology;
- the monitoring complies with the monitoring plan in the registered VCS-PD;
- the monitoring plan in the registered VCS_PD is as per the applied baseline and monitoring methodology.

It is RINA's opinion that the GHG emission reduction stated in the monitoring report version 05 of 22-June-2016 for the “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” project in Thailand for the period 04-October-2011 to 31-March-2014 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved VCS Methodology VM0023, “Reduction of GHG Emissions in Propylene Oxide Production”, version 1.0 of 09-September-2013 and the monitoring plan contained in the registered VCS-PD.

Hence RINA is able to certify that the emission reductions from the project during the monitoring period 04-October-2011 to 31-March-2014 amount to 320,900 tCO_{2e}.

Verification period: From 04-October-2011 to 31-March-2014.

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

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
04-October-2011 to 31-December-2011	88,784	82,320	0	6,464
01-January-2012 to 31-December-2012	459,473	335,831	0	123,641
01-January-2013 to 31-December-2013	511,155	358,122	0	153,033
01-January-2014 to 31-March-2014	127,660	89,897	0	37,762
Total	1,187,072	866,170	0	320,900

Genova, 02/08/2016



Laura Severino
Authorized officer signing for the DOE
RINA Services S.p.A.

APPENDIX A

VERIFICATION PROTOCOL

TABLE 1 REQUIREMENTS CHECK LIST

Checklist Question		Reference	MoV ¹	Comments	Conclusion
A Monitoring Report					
A.1	Does the used project title clearly enable the reader to identify the unique VCS project activity? Is there an indication of a revision number, the date of the revision and the monitoring period?	/01/, /02/, /08/, /09/, /11/	DR/CC	Yes; the title of the project activity is “Reduction of GHG emissions in Propylene Oxide production at MTP HPPO Manufacturing Co., Ltd” consistent with the registered VCS PD. The Monitoring report also provides the revision number i.e. version 01 dated 24-November-2015. The monitoring period for the project activity is 04-October-2011 to 31-March-2014. <i>PP is requested to justify on how the monitoring period is consistent with the VCS requirements on the date of registration and crediting period.</i> <i>The project ID as mentioned in the MR is not consistent with the one available in VCS portal.</i>	~~CAR-1~~ OK
A.2	Does the project comply with the applicable requirements for completing the Monitoring Reports (latest version available)?	/01/, /04/, /05/, /07/	DR	PP has used the latest MR template available and meets all applicable requirements for completing the monitoring report.	OK
A.3	Does the MR comply with the template available (latest version)?	/01/, /07/	DR	The PP has used the latest MR template available.	OK
B Description of Project Activity					
B.1	Is the actual implementation and operation of the	/01/, /02/	DR	As detailed in the registered VCS PD and observed	OK

¹ MoV: DR document review, I interview, CC cross checking

Checklist Question	Reference	MoV ¹	Comments	Conclusion
proposed project activity in accordance with the project activity in the registered PDD?	/08/, /11/		during the onsite visit, the project involves installation of Hydrogen Peroxide-based Propylene Oxide (HPPO) technology for the manufacture of Propylene Oxide (PO) at the production facility of MTP HPPO Manufacturing Co., Ltd, a joint venture between The Siam Cement Public Co., Ltd and The Dow Chemical Company. The project activity uses Hydrogen Peroxide-based Propylene Oxide (HPPO) technology instead of the conventional Chlorohydrin process. The conventional Chlorohydrin process is one of the typical processes in the Propylene Oxide industry that involves hydrochlorination process. In the Chlorohydrin process, Propylene (C_3H_6) is combined to hypochlorous acid to form a Chlorohydrin intermediate which is subsequently dechlorohydrinated to PO and leads to the formation of salts. While in the HPPO process, Propylene and Hydrogen peroxide is combined to produce PO. The project activity reduces GHG emissions by usage of lesser GHG intensive reagents and reduced process energy requirements in the HPPO technology. The plant is located within the Asia Industrial Estates (AIE) site near Map Ta Phut, Rayong, Thailand. The project description is found consistent with the registered PD and validation report. RINA has performed a site visit to verify the real	

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				implementation of the project and found that the project implementation is in accordance with the monitoring report.	
B.2	In case of deviation between the registered project and the actual implementation/operation, do they comply with the requirements of the Project Standards?	/01/, /02/, /08/, /11/	DR	Not applicable. Please refer to section B.1 above.	OK
B.3	For project activity that consist of more than one site: describe the status of the implementation and starting date of operation of each site; For project activity with phased implementation: describe the progress of the proposed project activity achieved in each phase number; if the phased implementation is delayed, described the reasons and the expected implementation dates.	/01/, /02/, /08/, /11/, /12/, /16/, /24/, /25/	DR/CC /I	The project activity is located at 10 Moo 2, Asia Industrial Estate, Banchang, Rayong, Thailand. The coordinate of the production facility are Latitude: 12.7342 (12° 44' 03" N); Longitude 101.0485 (101° 02' 54" E) as confirmed through the Dow website, Notification certificate dated 03-October-2011 and the coordinates measured at site. The physical location has been confirmed during the site visit. The project activity is in operation stage. The project started on 04-October-2011 that has been taken as the actual commissioning date of the new HPPO technology at MTP HPPO Manufacturing Co., Ltd. as confirmed through the Dow Chemicals' News letter dated 04-January-2012 and Notification certificate dated 03-October-2011 and it is in line with the VCS Standard.	OK
B.4	Methodology and methodological tool applied for the registered project activity	/01/, /02/, /06/, /08/, /11/	DR/CC	Project activity applies the Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013, consistent with the registered PD.	OK
C Compliance of the monitoring activities with the registered monitoring plan / Compliance of the monitoring plan with the monitoring methodology and methodological tool					
C.1 Monitoring plan					

Checklist Question		Reference	MoV ¹	Comments	Conclusion
C.1.1	Does the monitoring plan included in the registered CDM project activity comply with the applied methodology?	/01/, /02/, /06/, /08/, /09/	DR/CC	Yes, the monitoring plan in the registered VCS-PD complies with the applied Approved VCS Methodology VM0023, "Reduction of GHG Emissions in Propylene Oxide Production", version 1.0 of 09-September-2013.	OK
C.1.2	Does the monitoring comply with the monitoring plan in the registered VCS-PD?	/01/, /02/, /03/, /08/, /09/, /11/, /14/	DR/I	Yes, the monitoring during this monitoring period complies with the registered VCS-PD.	OK
C.2 Data and parameters fixed ex-ante or at renewal crediting period					
C.2.1	Which parameters were available at validation and how were they verified?	/01/, /02/, /03/, /08/, /09/, /11/, /14/, /18/, /50/	DR/CC	EF_{EL,y}: Emission factor for electricity generation in year. Value for this parameter is 0.5113 tCO₂/MWh, this is available and fixed as per the registered VCS PD; The emission factor is calculated according to the latest 'Tool to calculate the emission factor for an electricity system' Version 04.0 provided by Thailand Greenhouse Gas Management Organization (Public Organization) TGO. The correctness of the value has been confirmed by the verification team. The value of the all the parameters available ex ante are derived from the registered VCS PD and is consistent with the value in the validation report, the value of the parameter is fixed during the whole fixed crediting period.	OK
C.2.2	What default data were selected and applied?	/01/, /02/, /03/, /08/, /09/, /11/, /14/, /18/, /50/	DR/CC	Please refer to section C.2.1 above.	OK
C.3 Data and parameters monitored ex-post					

Checklist Question		Reference	MoV ¹	Comments	Conclusion																						
C.3.1	Which parameter have been monitored during the monitoring period? (Data/Parameter monitored / Data unit / Description / Source of data to be used / Value data for the monitoring period)	/01/, /02/, /06/, /09/, /08/, /11/, /18/, /19/, /14/	DR/CC	All monitored data is stored in the DCS system. The following parameters are monitored during the current monitoring period which is in line with the registered VCS PD: <table><tr><td>Data/Parameter:</td><td>PO_y</td></tr><tr><td>Data unit:</td><td>tonnes</td></tr><tr><td>Description:</td><td>Quantity of PO produced in year y</td></tr><tr><td>Source of data:</td><td>Sourced from plant production records, measured using vortex flow meters</td></tr><tr><td>Value(s) of monitored parameter:</td><td><table><tr><td>2011</td><td>67,864</td></tr><tr><td>2012</td><td>320,866</td></tr><tr><td>2013</td><td>355,742</td></tr><tr><td>2014</td><td>88,885</td></tr></table></td></tr></table> Values were checked with the plant production records during the site visit; however it is noted that the <i>production values have not been rounded down. PP is requested to submit the stock verification records for the monitoring period.</i> <table><tr><td>Data/Parameter:</td><td>Sol_y</td></tr><tr><td>Data unit:</td><td>tonnes</td></tr></table>	Data/Parameter:	PO _y	Data unit:	tonnes	Description:	Quantity of PO produced in year y	Source of data:	Sourced from plant production records, measured using vortex flow meters	Value(s) of monitored parameter:	<table><tr><td>2011</td><td>67,864</td></tr><tr><td>2012</td><td>320,866</td></tr><tr><td>2013</td><td>355,742</td></tr><tr><td>2014</td><td>88,885</td></tr></table>	2011	67,864	2012	320,866	2013	355,742	2014	88,885	Data/Parameter:	Sol _y	Data unit:	tonnes	CAR-2 OK
Data/Parameter:	PO _y																										
Data unit:	tonnes																										
Description:	Quantity of PO produced in year y																										
Source of data:	Sourced from plant production records, measured using vortex flow meters																										
Value(s) of monitored parameter:	<table><tr><td>2011</td><td>67,864</td></tr><tr><td>2012</td><td>320,866</td></tr><tr><td>2013</td><td>355,742</td></tr><tr><td>2014</td><td>88,885</td></tr></table>	2011	67,864	2012	320,866	2013	355,742	2014	88,885																		
2011	67,864																										
2012	320,866																										
2013	355,742																										
2014	88,885																										
Data/Parameter:	Sol _y																										
Data unit:	tonnes																										

Checklist Question	Reference	MoV ¹	Comments	Conclusion																																									
			<table><tr><td>Description:</td><td colspan="3">Quantity of make-up solvent used in year y</td></tr><tr><td>Source of data:</td><td colspan="3">Sourced from plant production records, measured using vortex flow meters</td></tr><tr><td rowspan="4">Value(s) of monitored parameter:</td><td>2011</td><td>6,247</td><td rowspan="4"></td></tr><tr><td>2012</td><td>17,866</td></tr><tr><td>2013</td><td>19,847</td></tr><tr><td>2014</td><td>4,190</td></tr></table> Values in the MR are not consistent with the records verified during site visit. PP is requested to submit the stock verification records for the monitoring period. <table><tr><td>Data/Parameter:</td><td colspan="3">EFCO₂, i, y</td></tr><tr><td>Data unit:</td><td colspan="3">tCO₂/TJ</td></tr><tr><td>Description:</td><td colspan="3">Weighted average CO₂ emission factor of fossil fuel used during year y</td></tr><tr><td>Source of data:</td><td colspan="3">IPCC default value</td></tr><tr><td rowspan="2">Value(s) of monitored parameter:</td><td>Type</td><td colspan="2">tCO₂/TJ</td></tr><tr><td>Natural gas</td><td colspan="2">56.1</td></tr></table>	Description:	Quantity of make-up solvent used in year y			Source of data:	Sourced from plant production records, measured using vortex flow meters			Value(s) of monitored parameter:	2011	6,247		2012	17,866	2013	19,847	2014	4,190	Data/Parameter:	EFCO ₂ , i, y			Data unit:	tCO ₂ /TJ			Description:	Weighted average CO ₂ emission factor of fossil fuel used during year y			Source of data:	IPCC default value			Value(s) of monitored parameter:	Type	tCO ₂ /TJ		Natural gas	56.1		
Description:	Quantity of make-up solvent used in year y																																												
Source of data:	Sourced from plant production records, measured using vortex flow meters																																												
Value(s) of monitored parameter:	2011	6,247																																											
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Value(s) of monitored parameter:	Type	tCO ₂ /TJ																																											
	Natural gas	56.1																																											

Checklist Question	Reference	MoV ¹	Comments	Conclusion																
			<i>The emission factor is sourced from IPCC data; however PP is requested give the exact table reference for the value in the MR and in the ER sheet.</i> <table><tr><td>Data/Parameter:</td><td>$\eta_{Boiler,y}$</td></tr><tr><td>Data unit:</td><td>%</td></tr><tr><td>Description:</td><td>Efficiency of the steam generating system</td></tr><tr><td>Source of data:</td><td>Not applicable</td></tr><tr><td>Value(s) of monitored parameter:</td><td>This parameter is not considered in both baseline and project scenario and is conservative since baseline energy consumption is higher as compared to project.</td></tr></table> <i>The approach is not consistent with the registered VCS PD</i> <table><tr><td><i>Data/Parameter:</i></td><td><i>SC_{HPPO, y}</i></td></tr><tr><td>Data unit:</td><td>TJ</td></tr><tr><td>Description:</td><td>Thermal energy consumption in the PO</td></tr></table>	Data/Parameter:	$\eta_{Boiler,y}$	Data unit:	%	Description:	Efficiency of the steam generating system	Source of data:	Not applicable	Value(s) of monitored parameter:	This parameter is not considered in both baseline and project scenario and is conservative since baseline energy consumption is higher as compared to project.	<i>Data/Parameter:</i>	<i>SC_{HPPO, y}</i>	Data unit:	TJ	Description:	Thermal energy consumption in the PO	
Data/Parameter:	$\eta_{Boiler,y}$																			
Data unit:	%																			
Description:	Efficiency of the steam generating system																			
Source of data:	Not applicable																			
Value(s) of monitored parameter:	This parameter is not considered in both baseline and project scenario and is conservative since baseline energy consumption is higher as compared to project.																			
<i>Data/Parameter:</i>	<i>SC_{HPPO, y}</i>																			
Data unit:	TJ																			
Description:	Thermal energy consumption in the PO																			

Checklist Question	Reference	MoV ¹	Comments	Conclusion														
			<table><tr><td></td><td>production through HPPO process in year y.</td></tr><tr><td>Source of data:</td><td>Data shall be taken from the meters calibrated regularly according to manufacturer's guidelines. Steam consumption would be converted conservatively into energy terms using enthalpy values and accounting for any condensate return.</td></tr><tr><td>Value(s) of monitored parameter:</td><td><table><tr><td>2011</td><td>343</td></tr><tr><td>2012</td><td>1,396</td></tr><tr><td>2013</td><td>1,280</td></tr><tr><td>2014</td><td>287</td></tr></table></td></tr></table> Steam reading is obtained as ton/hour. Temperature and pressure are averaged automatically by the system and reported in tonnes/hour. Average pressure and temperature monthly readings are available hence enthalpy is calculated from steam table. Steam and electricity are supplied and billed by the Utility company.		production through HPPO process in year y.	Source of data:	Data shall be taken from the meters calibrated regularly according to manufacturer's guidelines. Steam consumption would be converted conservatively into energy terms using enthalpy values and accounting for any condensate return.	Value(s) of monitored parameter:	<table><tr><td>2011</td><td>343</td></tr><tr><td>2012</td><td>1,396</td></tr><tr><td>2013</td><td>1,280</td></tr><tr><td>2014</td><td>287</td></tr></table>	2011	343	2012	1,396	2013	1,280	2014	287	
	production through HPPO process in year y.																	
Source of data:	Data shall be taken from the meters calibrated regularly according to manufacturer's guidelines. Steam consumption would be converted conservatively into energy terms using enthalpy values and accounting for any condensate return.																	
Value(s) of monitored parameter:	<table><tr><td>2011</td><td>343</td></tr><tr><td>2012</td><td>1,396</td></tr><tr><td>2013</td><td>1,280</td></tr><tr><td>2014</td><td>287</td></tr></table>	2011	343	2012	1,396	2013	1,280	2014	287									
2011	343																	
2012	1,396																	
2013	1,280																	
2014	287																	

Checklist Question	Reference	MoV ¹	Comments	Conclusion																											
			The approach is not consistent with the registered VCS PD. Values in the MR are not consistent with the records verified during site visit. PP is requested to submit energy purchase receipts from the thermal energy supplier for the monitoring period. <table><tr><td>Data/Parameter:</td><td colspan="2">EC_{HPPO, y}</td></tr><tr><td>Data unit:</td><td colspan="2">MWh</td></tr><tr><td>Description:</td><td colspan="2">Electrical energy consumption in the PO production through HPPO process in year y.</td></tr><tr><td>Source of data:</td><td colspan="2">Sourced from plant records, measured using electricity meters</td></tr><tr><td rowspan="4">Value(s) of monitored parameter:</td><td>2011</td><td>68,576</td></tr><tr><td>2012</td><td>216,646</td></tr><tr><td>2013</td><td>227,688</td></tr><tr><td>2014</td><td>57,069</td></tr></table> Values were checked with the plant records during the site visit and found to be rounded up, conservative. PP is requested to submit the energy purchase receipts for the monitoring period. <table><tr><td>Data/Parameter:</td><td colspan="2">Q_{Propylene,y}</td></tr><tr><td>Data unit:</td><td colspan="2">Tonnes</td></tr></table>	Data/Parameter:	EC _{HPPO, y}		Data unit:	MWh		Description:	Electrical energy consumption in the PO production through HPPO process in year y.		Source of data:	Sourced from plant records, measured using electricity meters		Value(s) of monitored parameter:	2011	68,576	2012	216,646	2013	227,688	2014	57,069	Data/Parameter:	Q _{Propylene,y}		Data unit:	Tonnes		
Data/Parameter:	EC _{HPPO, y}																														
Data unit:	MWh																														
Description:	Electrical energy consumption in the PO production through HPPO process in year y.																														
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Data unit:	Tonnes																														

Checklist Question	Reference	MoV ¹	Comments	Conclusion																						
			<table><tr><td>Description:</td><td>Quantity of propylene used in year y.</td></tr><tr><td>Source of data:</td><td>Sourced from plant records, measured using mass flow meters</td></tr><tr><td>Value(s) of monitored parameter:</td><td><table><tr><td>2011</td><td>55,222</td></tr><tr><td>2012</td><td>253,600</td></tr><tr><td>2013</td><td>284,960</td></tr><tr><td>2014</td><td>71,788</td></tr></table></td></tr></table> Values were checked with the plant production records during the site visit; however it is noted that the production values have not been rounded down. PP is requested to submit the stock verification records for the monitoring period. <table><tr><td>Data/Parameter:</td><td>$Q_{By-product,y}$</td></tr><tr><td>Data unit:</td><td>Tonnes</td></tr><tr><td>Description:</td><td>Quantity of by-product produced in year y.</td></tr><tr><td>Source of data:</td><td>Sourced from plant records, measured using vortex flow meters</td></tr></table>	Description:	Quantity of propylene used in year y.	Source of data:	Sourced from plant records, measured using mass flow meters	Value(s) of monitored parameter:	<table><tr><td>2011</td><td>55,222</td></tr><tr><td>2012</td><td>253,600</td></tr><tr><td>2013</td><td>284,960</td></tr><tr><td>2014</td><td>71,788</td></tr></table>	2011	55,222	2012	253,600	2013	284,960	2014	71,788	Data/Parameter:	$Q_{By-product,y}$	Data unit:	Tonnes	Description:	Quantity of by-product produced in year y.	Source of data:	Sourced from plant records, measured using vortex flow meters	
Description:	Quantity of propylene used in year y.																									
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2011	55,222																									
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Data/Parameter:	$Q_{By-product,y}$																									
Data unit:	Tonnes																									
Description:	Quantity of by-product produced in year y.																									
Source of data:	Sourced from plant records, measured using vortex flow meters																									

Checklist Question	Reference	MoV ¹	Comments	Conclusion																										
			<table><tr><td rowspan="4">Value(s) of monitored parameter:</td><td>2011</td><td>920</td></tr><tr><td>2012</td><td>1,780</td></tr><tr><td>2013</td><td>3,207</td></tr><tr><td>2014</td><td>842</td></tr></table> Values were checked with the plant production records during the site visit; however it is noted that the production values have not been rounded down. PP is requested to submit the stock verification records for the monitoring period. <table><tr><td>Data/Parameter:</td><td>FC_{i,y}</td></tr><tr><td>Data unit:</td><td>Mass or volume units</td></tr><tr><td>Description:</td><td>Quantity of NG combusted in the incinerator during the year y</td></tr><tr><td>Source of data:</td><td>Sourced from supplier data, Measured through turbine meter.</td></tr><tr><td rowspan="4">Value(s) of monitored parameter:</td><td>2011</td><td>3,809,585</td></tr><tr><td>2012</td><td>10,495,943</td></tr><tr><td>2013</td><td>5,241,471</td></tr><tr><td>2014</td><td>1,536,048</td></tr></table> The approach used by the PP is not consistent with the registered VCS PD. Values were checked with	Value(s) of monitored parameter:	2011	920	2012	1,780	2013	3,207	2014	842	Data/Parameter:	FC _{i,y}	Data unit:	Mass or volume units	Description:	Quantity of NG combusted in the incinerator during the year y	Source of data:	Sourced from supplier data, Measured through turbine meter.	Value(s) of monitored parameter:	2011	3,809,585	2012	10,495,943	2013	5,241,471	2014	1,536,048	
Value(s) of monitored parameter:	2011	920																												
	2012	1,780																												
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Data/Parameter:	FC _{i,y}																													
Data unit:	Mass or volume units																													
Description:	Quantity of NG combusted in the incinerator during the year y																													
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	2013	5,241,471																												
	2014	1,536,048																												

Checklist Question			Reference	MoV ¹	Comments	Conclusion										
					the plant records during the site visit; however it is noted that the values have been rounded down, hence not conservative. PP is requested to submit the NG purchase records from PTT for the monitoring period. <table><tr><td>Data/Parameter:</td><td>COEF_{i,y}</td></tr><tr><td>Data unit:</td><td>tCO₂/t of Natural gas</td></tr><tr><td>Description:</td><td>CO₂ emission coefficient of Natural gas.</td></tr><tr><td>Source of data:</td><td>Sourced from IPCC Data.</td></tr><tr><td>Value(s) of monitored parameter:</td><td>2.6928</td></tr></table> Based on option B, equation 4 of the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”. NCV = 48.0 TJ/Gg (IPCC 2006, Energy volume: Overview, Table 1.2) EF = 56.1 Tons/TJ (IPCC 2006, Energy volume: Overview, Table 1.4) However PP is requested to refer to the comment raised for the parameter FC_{i,y}.	Data/Parameter:	COEF _{i,y}	Data unit:	tCO ₂ /t of Natural gas	Description:	CO ₂ emission coefficient of Natural gas.	Source of data:	Sourced from IPCC Data.	Value(s) of monitored parameter:	2.6928	
Data/Parameter:	COEF _{i,y}															
Data unit:	tCO ₂ /t of Natural gas															
Description:	CO ₂ emission coefficient of Natural gas.															
Source of data:	Sourced from IPCC Data.															
Value(s) of monitored parameter:	2.6928															
C.3.2	Is the measurement equipment described?	Is the	/01/, /02/,	DR/CC	Following are the measurement equipment used:	CAR-3 OK										

Checklist Question	Reference	MoV ¹	Comments	Conclusion
accuracy of the measurement equipment addressed and deemed appropriate?	/06/, /08/, /11/, /36/, /37/ - /42/		Data/Parameter:	PO _y
			Data unit:	tonnes
			Description:	Quantity of PO produced in year y
			Meter type	Vortex
			Model	ROSEMOUNT, 8800DF040SA3N2D1E5T1CNQ4
			S. No	6015584, 6050847
			Tag No.	FT-4311-18, FT-4311-20
			Accuracy	+/- 1%
			Calibration date	29-04-2010 and 12-12-2011 respectively
			Calibration date is prior to the start date of the project; PP is requested to clarify on how the calibration details submitted cover the entire monitoring period. The calibration dates in the MR is not consistent with the records submitted. Instruments used for calibration are traceable to national standards.	
			Data/Parameter:	Sol _y

Checklist Question	Reference	MoV ¹	Comments	Conclusion																				
			<table><tr><td>Data unit:</td><td>tonnes</td></tr><tr><td>Description:</td><td>Quantity of make-up solvent used in year y</td></tr><tr><td>Meter type</td><td>Vortex</td></tr><tr><td>Model</td><td>ROSEMOUNT, 8800DF020SA1N2D1E5T1CNQ4</td></tr><tr><td>S. No</td><td>6015616</td></tr><tr><td>Tag No.</td><td>FT-7409-02</td></tr><tr><td>Accuracy</td><td>+/- 1%</td></tr><tr><td>Calibration date</td><td>08-05-2010</td></tr></table> Calibration date is prior to the start date of the project; PP is requested to clarify on how the calibration details submitted cover the entire monitoring period. The calibration dates in the MR is not consistent with the records submitted. Instruments used for calibration are traceable to national standards. <table><tr><td>Data/Parameter:</td><td>SC_{HPP0}, y</td></tr><tr><td>Data unit:</td><td>TJ</td></tr></table>	Data unit:	tonnes	Description:	Quantity of make-up solvent used in year y	Meter type	Vortex	Model	ROSEMOUNT, 8800DF020SA1N2D1E5T1CNQ4	S. No	6015616	Tag No.	FT-7409-02	Accuracy	+/- 1%	Calibration date	08-05-2010	Data/Parameter:	SC _{HPP0} , y	Data unit:	TJ	
Data unit:	tonnes																							
Description:	Quantity of make-up solvent used in year y																							
Meter type	Vortex																							
Model	ROSEMOUNT, 8800DF020SA1N2D1E5T1CNQ4																							
S. No	6015616																							
Tag No.	FT-7409-02																							
Accuracy	+/- 1%																							
Calibration date	08-05-2010																							
Data/Parameter:	SC _{HPP0} , y																							
Data unit:	TJ																							

Checklist Question	Reference	MoV ¹	Comments	Conclusion
			Description: Meter type Model S. No Tag No. Accuracy Calibration	Thermal energy consumption in the PO production through HPPO process in year y. Probar flowmeter (Pitot type), RTD (PT100), Pressure transmitter, for mass, temperature and pressure measurements respectively. ROSEMOUNT, 3051SFADS240ZCHFS3A3D0072 AA1B2G9E1F2F0052 ABB, A5Y0W9S3D1D6P3D2L1H4/OPT ROSEMOUNT, 3051CA3A02A1BK6H2L4T1P1CN respectively 210000853587001 and 2284871 for the temperature and pressure indicators respectively. FT-9500-01, TT950001, PT950001 respectively 0.8%, +/- 0.06%, +/- 1% respectively 17-05-2011 for both temperature

Checklist Question	Reference	MoV ¹	Comments	Conclusion																
			<table><tr><td>details</td><td>and pressure indicators</td></tr></table> Serial number of the Steam mass flow meter is not available. Calibration records for are not available in the documents submitted. PP is requested to clarify on how the calibration details submitted cover the entire monitoring period. Also, accuracy data could not be confirmed with the specification sheet submitted; PP is requested to detail the page number reference for the same. <table><tr><td>Data/Parameter:</td><td>EC_{HPPO, y}</td></tr><tr><td>Data unit:</td><td>MWh</td></tr><tr><td>Description:</td><td>Electrical energy consumption in the PO production through HPPO process in year y.</td></tr><tr><td>Meter type</td><td>7KG7750-0GA01-00AA0</td></tr><tr><td>Model</td><td>Siemens, SIMEAS P50</td></tr><tr><td>S. No</td><td>BF0908074313, BF0908074311, BF0908074317 and BF0908074314</td></tr><tr><td>Tag No.</td><td>JT700214ACalc, JT700211ACalc, JT700220ACalc and JT700223ACalc</td></tr></table>	details	and pressure indicators	Data/Parameter:	EC _{HPPO, y}	Data unit:	MWh	Description:	Electrical energy consumption in the PO production through HPPO process in year y.	Meter type	7KG7750-0GA01-00AA0	Model	Siemens, SIMEAS P50	S. No	BF0908074313, BF0908074311, BF0908074317 and BF0908074314	Tag No.	JT700214ACalc, JT700211ACalc, JT700220ACalc and JT700223ACalc	
details	and pressure indicators																			
Data/Parameter:	EC _{HPPO, y}																			
Data unit:	MWh																			
Description:	Electrical energy consumption in the PO production through HPPO process in year y.																			
Meter type	7KG7750-0GA01-00AA0																			
Model	Siemens, SIMEAS P50																			
S. No	BF0908074313, BF0908074311, BF0908074317 and BF0908074314																			
Tag No.	JT700214ACalc, JT700211ACalc, JT700220ACalc and JT700223ACalc																			

Checklist Question	Reference	MoV ¹	Comments	Conclusion																						
			<table><tr><td>Accuracy</td><td>+/- 0.5%</td></tr><tr><td>Calibration details</td><td>Not available</td></tr></table> Meter type as mentioned in the MR is not consistent with the test certificates submitted. Calibration records for the energy meters are not available. <table><tr><td>Data/Parameter:</td><td>Q_{Propylene,y}</td></tr><tr><td>Data unit:</td><td>Tonnes</td></tr><tr><td>Description:</td><td>Quantity of propylene used in year y.</td></tr><tr><td>Meter type</td><td>Coriolis Mass Flow Meter</td></tr><tr><td>Model</td><td>Endress+Hauser, PROMASS 80F</td></tr><tr><td>S. No</td><td>D303621600</td></tr><tr><td>Tag No.</td><td>FT-1164-01</td></tr><tr><td>Accuracy</td><td>0.15%</td></tr><tr><td>Calibration details</td><td>06-04-2010</td></tr></table> Calibration date is prior to the start date of the project; PP is requested to clarify on how the	Accuracy	+/- 0.5%	Calibration details	Not available	Data/Parameter:	Q _{Propylene,y}	Data unit:	Tonnes	Description:	Quantity of propylene used in year y.	Meter type	Coriolis Mass Flow Meter	Model	Endress+Hauser, PROMASS 80F	S. No	D303621600	Tag No.	FT-1164-01	Accuracy	0.15%	Calibration details	06-04-2010	
Accuracy	+/- 0.5%																									
Calibration details	Not available																									
Data/Parameter:	Q _{Propylene,y}																									
Data unit:	Tonnes																									
Description:	Quantity of propylene used in year y.																									
Meter type	Coriolis Mass Flow Meter																									
Model	Endress+Hauser, PROMASS 80F																									
S. No	D303621600																									
Tag No.	FT-1164-01																									
Accuracy	0.15%																									
Calibration details	06-04-2010																									

Checklist Question	Reference	MoV ¹	Comments	Conclusion																		
			calibration details submitted cover the entire monitoring period. Also, the accuracy data as available in the MR is not consistent with the specification sheet submitted <table><tr><td>Data/Parameter:</td><td>$Q_{By-product,y}$</td></tr><tr><td>Data unit:</td><td>Tonnes</td></tr><tr><td>Description:</td><td>Quantity of by-product produced in year y.</td></tr><tr><td>Meter type</td><td>Ultrasonic</td></tr><tr><td>Model</td><td>KROHNE, UFM3030/UFS3000</td></tr><tr><td>S. No</td><td>A1071567</td></tr><tr><td>Tag No.</td><td>FT722001</td></tr><tr><td>Accuracy</td><td>0.5%</td></tr><tr><td>Calibration details</td><td>17-05-2010</td></tr></table> Calibration date is prior to the start date of the project; PP is requested to clarify on how the calibration details submitted cover the entire monitoring period.	Data/Parameter:	$Q_{By-product,y}$	Data unit:	Tonnes	Description:	Quantity of by-product produced in year y.	Meter type	Ultrasonic	Model	KROHNE, UFM3030/UFS3000	S. No	A1071567	Tag No.	FT722001	Accuracy	0.5%	Calibration details	17-05-2010	
Data/Parameter:	$Q_{By-product,y}$																					
Data unit:	Tonnes																					
Description:	Quantity of by-product produced in year y.																					
Meter type	Ultrasonic																					
Model	KROHNE, UFM3030/UFS3000																					
S. No	A1071567																					
Tag No.	FT722001																					
Accuracy	0.5%																					
Calibration details	17-05-2010																					

Checklist Question		Reference	MoV ¹	Comments	Conclusion																		
				<table><tr><td>Data/Parameter:</td><td>FC_{i,y}</td></tr><tr><td>Data unit:</td><td>Mass or volume units</td></tr><tr><td>Description:</td><td>Quantity of NG combusted in the incinerator during the year y</td></tr><tr><td>Meter type</td><td>NG is meter and billed by the supplier. The meter belongs to PTT and installed on PTT skid. Consistent with site visit observations</td></tr><tr><td>Model</td><td></td></tr><tr><td>S. No</td><td></td></tr><tr><td>Tag No.</td><td></td></tr><tr><td>Accuracy</td><td></td></tr><tr><td>Calibration details</td><td></td></tr></table> PP is requested to submit the supplier invoices for NG for the monitoring period.	Data/Parameter:	FC _{i,y}	Data unit:	Mass or volume units	Description:	Quantity of NG combusted in the incinerator during the year y	Meter type	NG is meter and billed by the supplier. The meter belongs to PTT and installed on PTT skid. Consistent with site visit observations	Model		S. No		Tag No.		Accuracy		Calibration details		
Data/Parameter:	FC _{i,y}																						
Data unit:	Mass or volume units																						
Description:	Quantity of NG combusted in the incinerator during the year y																						
Meter type	NG is meter and billed by the supplier. The meter belongs to PTT and installed on PTT skid. Consistent with site visit observations																						
Model																							
S. No																							
Tag No.																							
Accuracy																							
Calibration details																							
C.3.3	Is the measuring/reading/recording frequency adequate for all monitoring parameters? Is it in line with the registered monitoring plan?	/01/, /02/, /06/, /08/	DR/CC	Yes, the measuring, reading and recording frequency is adequate for the monitoring parameter. However Please refer to section C.3.1	CAR3 OK																		

Checklist Question		Reference	MoV ¹	Comments	Conclusion
		/11/		above.	
C.4 Calibration requirements					
C.4.1	Are the requirements for maintenance and calibration of measurement equipment described and deemed appropriate?	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
C.4.2	Does the calibration cover the monitoring period?	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
C.4.3	Has the calibration frequency been respected?	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
C.4.4	Does the calibration of meters have to be done by an accredited person or institution?	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
C.4.5	In case of delay, describe the applied maximum permissible error	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
C.5 Monitoring of the sustainable indicators					
C.5.1	Is the monitoring of sustainable development indicators/environmental impacts warranted by legislation in the host Country?	/01/, /02/, /06/, /11/	DR	The monitoring of sustainable development indicators/environmental impacts is not required by legislation of the host country, nor required by the applied methodology.	OK
C.6 Management system and quality control					
C.6.1	How has it been assessed that the monitoring arrangements described in the monitoring plan are	/01/, /02/, /06/, /08/	DR/I	On the date of the site visit, RINA can confirm that the monitoring arrangements described in the	OK

Checklist Question	Reference	MoV ¹	Comments	Conclusion
feasible within the project design?	/11/		monitoring plan are feasible within the project design which follows the methodology requirements.	
C.6.2 Are procedures identified for day-to-day record handling (including what records to keep, storage area of records and how to process performance documentation)? Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later?	/01/, /02/, /06/, /08/, /11/	DR	Please refer to section C.3 above. All monitoring data are stored in logs and in electronic format as excel sheets. Primary source of data for emission reduction calculation is derived from the electronic system while in case of emergency or data error, support monitoring data from the log book is used instead. The monitoring records shall be archived for a period of the crediting period plus two years. The MR is not transparent on the systems and procedure in place to handle emergencies with respect to the monitoring systems.	~~CAR2, CAR3,~~ ~~CL1~~ OK
C.6.3 Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified?	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 and C.6.2 above	~~CAR2, CAR3,~~ ~~CL1~~ OK
C.6.4 Are the responsibilities and authorities for monitoring and reporting in accordance with the responsibilities and authorities stated in the monitoring plan?	/01/, /02/, /06/, /08/, /11/	DR	Yes, the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan as confirmed through the onsite visit and interview with related staff.	OK
C.6.5 Does data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions?	/01/, /02/, /06/, /08/, /11/	DR, CC, I	As confirmed by the on-site visit, the operational and management structure set up by the project developer can ensure the correct transfer of data	OK

Checklist Question		Reference	MoV ¹	Comments	Conclusion
				and ER reporting.	
D.1 Assessment of data and calculation of emission reductions/Accuracy of emission reduction calculations					
D.1.1	How were the values in the monitoring report verified and cross-checked?	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
D.1.2	If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, has the most conservative assumption theoretically possible been applied or has a request for deviation been approved?	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
D.1.3	Emission reductions reported	/01/, /02/, /06/, /08/, /11/	DR/CC	Please refer to section C.3 above.	~~CAR2, CAR3~~ OK
D.1.4	Difference between the emission reductions estimated in the registered PDD and the emission reductions reported for the monitoring period.	/01/, /02/, /06/, /08/, /11/	DR/CC	The project activity is expected to result in a reduction of 239,356 emissions in a year, however the net GHG reductions for October – December 2011 is 3,363 tCO ₂ , 2012 is 127,932, 2013 is 153,917 and for January-March 2014 is 37,332. However please refer to section C.3 above.	~~CAR2, CAR3~~ OK

TABLE 2 RESOLUTION OF CORRECTIVE ACTION REQUESTS AND CLARIFICATION REQUESTS

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
CAR1 1. The monitoring period for the project activity is	A.1	1 st Response on January 27, 2016 1. As per section 1.5 and 1.6 of the	1st response: 1. The monitoring period is consistent

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																								
04-October-2011 to 31-March-2014. PP is requested to justify on how the monitoring period is consistent with the VCS requirements on the date of registration and crediting period. 2. The project ID as mentioned in the MR is not consistent with the one available in VCS portal.		registered VCS PD , 04 October 2011 is the project start date which is from the actual commisioning date of the new HPPO technology at MTP HPPO Manufacturing Co.,Ltd.. This chosen start date is as per with the paragraph 3.7.1 of VCS stardard. Hence the defined monitoring period from 04-October-2011 to 31-March-2014 (before site visit date on 06-May-2014) is in line with the VCS requirements. 2. The project ID and the link to VCS portal in MR is updated (project ID. 1502 : http://www.vcsprojectdatabase.org/#/project_details/1502).	with the registered PDD and the VCS standard, hence accepted. 2. Revision is consistent with the information available in VCS portal hence accepted. CAR 1 is closed.																								
CAR2 1. PO_y- Production values have not been rounded down. PP is requested to submit the stock verification records for the monitoring period.	C.3.1, C.3.3, C.4,C.6.2, C.6.3, D.1	1st Response on January 27, 2016 1. The PO_y is used for both BE and PE calculations , hence the monitored values are not rounded. The final emission reduction results are rounded down for conservativeness. The PO production report (exported from IP21) is submitted. <table><tr><th>Source</th><th>Reference</th><th>2011</th><th>2012</th><th>2013</th><th>2014</th></tr><tr><td>Flow meter</td><td>Production number : Rpt_PO production</td><td>67,864</td><td>320,866</td><td>355,742</td><td>88,885</td></tr><tr><td>Invoice</td><td>Logistic number : Rpt_PO production</td><td>68,591</td><td>321,724</td><td>357,912</td><td>89,387</td></tr><tr><td>Diff (%)</td><td></td><td>(1.07)</td><td>(0.27)</td><td>(0.61)</td><td>(0.57)</td></tr></table> The differences between logistic and production values are less than 5% which defined in clause 5.3.1 of VCS standard v 3.5 , hence the monitored values	Source	Reference	2011	2012	2013	2014	Flow meter	Production number : Rpt_PO production	67,864	320,866	355,742	88,885	Invoice	Logistic number : Rpt_PO production	68,591	321,724	357,912	89,387	Diff (%)		(1.07)	(0.27)	(0.61)	(0.57)	1st response: 1. Response consistent with site visit findings. The flow meter values are actual production values, cross checked with invoice values and are found conservative. The file RPt_Production is not available in the supportive documents submitted .
Source	Reference	2011	2012	2013	2014																						
Flow meter	Production number : Rpt_PO production	67,864	320,866	355,742	88,885																						
Invoice	Logistic number : Rpt_PO production	68,591	321,724	357,912	89,387																						
Diff (%)		(1.07)	(0.27)	(0.61)	(0.57)																						

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																								
2. Sol_y: Values in the MR are not consistent with the records verified during site visit. PP is requested to submit the stock verification records for the monitoring period. 3. EFCO_{2, i, y} : The emission factor is sourced from IPCC data; however PP is requested give the exact table reference for the value in the MR and in the ER sheet. 4. $\eta_{Boiler, y}$: The approach is not consistent with the registered VCS PD 5. SC_{HPPO, y}: The approach is not consistent with the registered VCS PD. Values in the MR are not consistent with the records verified during site		(production values) can be used for emission reduction calculation. Ref : Rpt_PO Production 2. The raw data file (in t/h unit , exported from IP21) and stock verification report are submitted. <table><tr><td>Flow meter (t/h)</td><td>Rpt_raw data</td><td>5,311</td><td>19,061</td><td>21,634</td><td>4,366</td></tr><tr><td></td><td>GMID 00369989 :</td><td></td><td></td><td></td><td></td></tr><tr><td>Invoice</td><td>Rpt_Stock Checking</td><td>6,187</td><td>17,795</td><td>19,757</td><td>4,172</td></tr><tr><td>Diff (%)</td><td></td><td>(16.50)</td><td>6.64</td><td>8.67</td><td>4.45</td></tr></table> The differences between logistic and production values are less than 5% which defined in clause 5.3.1 of VCS standard v 3.5 , hence the monitored values (production values) can be used for emission reduction calculation. Except in 2011 , the value from stock checking report is used for calculation as per conservativeness principle when the difference is higher than 5%. Ref : Rpt_raw data , Rpt_Stock Checking 3. The reference for EFCO_{2, i, y} in section 3.2 of MR is updated by referring to table 2.3 of IPCC , with the provided weblink. 4. The approach is consistence with page 29 of the registered VCS PD. 5. The approach is consistence with page 29 of the registered VCS PD. The energy consumption	Flow meter (t/h)	Rpt_raw data	5,311	19,061	21,634	4,366		GMID 00369989 :					Invoice	Rpt_Stock Checking	6,187	17,795	19,757	4,172	Diff (%)		(16.50)	6.64	8.67	4.45	2. The file RPT_raw data is not available in the supportive documents submitted. The file Rpt-Stock Checking does not contain data post Nov 2015. 3. MR revised appropriately hence accepted. 4. It is noted that the actual heat energy consumption is more than that that of the baseline heat energy consumption values. PP is requested to justify conservativeness. 5. As above. Also Thermal energy purchase receipts are required for cross check as per the registered PDD.
Flow meter (t/h)	Rpt_raw data	5,311	19,061	21,634	4,366																						
	GMID 00369989 :																										
Invoice	Rpt_Stock Checking	6,187	17,795	19,757	4,172																						
Diff (%)		(16.50)	6.64	8.67	4.45																						

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
visit. PP is requested to submit energy purchase receipts from the thermal energy supplier for the monitoring period. 6. ECHPPO, y: PP is requested to submit the energy purchase receipts for the monitoring period. 7 Q_{Propylene,y}: Values were checked with the plant production records during the site visit; however it is noted that the production values have not been rounded down. PP is requested to submit the stock verification records for the monitoring period.		report (exported from IP21) and the example of invoice (April-2012) are submitted. The value in invoice (pg.3:ASD_total) is from calculation. While the value in energy consumption report is from meter , it is chosen for emission reduction calculation. Ref : Rpt_Energy Consumption , Invoice_HPPO_Steam_2012_04 6. The energy consumption report (exported from IP21) and the example of invoice (April-2012) are submitted. The value in invoice (pg.3:CNED_MTPHPPO) is from calculation. While the value in energy consumption report is from meter , it is chosen for emission reduction calculation. Ref : Rpt_Energy Consumption , Invoice_HPPO_Power_2012_04 7. The monitored value is not rowndowned. The rowndowned has been done in the final ER results for conservativeness. The production report , exported from IP21, is submitted. The report shows both logistic (invoice) and production values. The comparison report is also provided. The differences between logistic and production values are less than 5% which defined in clause 5.3.1 of VCS standard v	Receipts for the entire monitoring period is not available. 6. Electrical energy purchase receipts are required for cross check as per the registered PDD. Receipts for the entire monitoring period is not available. 8. The monitored value is not rowndowned. The rowndowned has been done in the final ER results, accepted. The file Rpt_PO production is not available in the supportive documents submitted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																																				
8. Q _{By-product,y} : Values were checked with the plant production records during the site visit; however it is noted that the production values have not been rounded down. PP is requested to submit the stock verification records for the monitoring period.		3.5², hence the monitored values (production values) can be used for emission reduction calculation. <table><tr><td>Flow metter</td><td>Production number : Rpt_PO production</td><td>55,222</td><td>253,600</td><td>284,960</td><td>71,788</td></tr><tr><td>Invoice</td><td>Logistic number : Rpt_PO production</td><td>55,012</td><td>253,606</td><td>285,016</td><td>71,720</td></tr><tr><td>Diff (%)</td><td></td><td>0.38%</td><td>0.00%</td><td>-0.02%</td><td>0.09%</td></tr></table> Ref : Rpt_PO Production, DOW_Data comparison 9. The round down function is not used for the monitored value. The final ER results are rounded down for conservativeness. The raw data (exported from IP21 in t/h unit) and stock checking report are submitted. The comparison report is also provided. The differences between raw data and stock values are less than 5% which defined in clause 5.3.1 of VCS standard v 3.5, hence the monitored values (production values) can be used for emission reduction calculation. Except in 2014, where the difference is more than 5% and the higher value is used in ER calculation as per conservativeness principle. <table><tr><td>Flow meter (t/h)</td><td>Rpt_raw data</td><td>943</td><td>1,855</td><td>3,303</td><td>903</td></tr><tr><td>Invoice</td><td>GMID 00375015 : Rpt_Stock Checking</td><td>920</td><td>1,780</td><td>3,207</td><td>842</td></tr><tr><td>Diff (%)</td><td></td><td>2.48%</td><td>4.06%</td><td>2.90%</td><td>6.70%</td></tr></table> Ref : Rpt raw data, Rpt Stock	Flow metter	Production number : Rpt_PO production	55,222	253,600	284,960	71,788	Invoice	Logistic number : Rpt_PO production	55,012	253,606	285,016	71,720	Diff (%)		0.38%	0.00%	-0.02%	0.09%	Flow meter (t/h)	Rpt_raw data	943	1,855	3,303	903	Invoice	GMID 00375015 : Rpt_Stock Checking	920	1,780	3,207	842	Diff (%)		2.48%	4.06%	2.90%	6.70%	8. The round down function is not used for the monitored value. The final ER results are rounded down for conservativeness. The file Rpt_raw data is not available in the supportive documents submitted. The file Rpt-Stock Checking does not contain data post Nov 2015.
Flow metter	Production number : Rpt_PO production	55,222	253,600	284,960	71,788																																		
Invoice	Logistic number : Rpt_PO production	55,012	253,606	285,016	71,720																																		
Diff (%)		0.38%	0.00%	-0.02%	0.09%																																		
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Diff (%)		2.48%	4.06%	2.90%	6.70%																																		

² [http://www.v-c-s.org/sites/v-c-s.org/files/VCS%20Standard,%20v3.5\(0\).pdf](http://www.v-c-s.org/sites/v-c-s.org/files/VCS%20Standard,%20v3.5(0).pdf)

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
9. FC_{1y}: The approach used by the PP is not consistent with the registered VCS PD. Values were checked with the plant records during the site visit; however it is noted that the values have been rounded down, hence not conservative. PP is requested to submit the NG purchase records from PTT for the monitoring period.		Checking 10. The approach is rechecked. The flow is measured by turbine meter in volume unit (Nm³) which is consistency with monitoring plan defined in PD. The round down function is not used for the monitored value. The final ER results are rounded down for conservativeness. The energy consumption report (exported from IP21) and the example of invoice (April-2012) are submitted. Ref : Rpt_Energy_Consumption , Invoice_HPPO_NG_2012_04 2nd response on April 22 , 2016 1. The file Rpt_Production is submitted. 2. The file Rpt_PO Production is submitted. 3. Refer to section 2.3 – Project boundary of the registered PD , The spatial extent for the heat (steam) system is similar, including the heat/steam generating systems that are physically connected to the project activity and that can be displaced without significant constraints. The heat (steam) requirements of the project are	9. The corrected approach is consistent with the registered PDD. PP is requested to submit invoices for the period. 2nd response: 1. Values are consistent except values for the year 2011. 2. Values are consistent except values for the year 2011. 3. As per section 4.2 and 2.3 of the registered PD and the justification by the PP given here. This approach is accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
		met by the steam extracted from the cogeneration plants of Glow grid. As the emissions get accounted in the electricity component therefore to avoid double counting and applying conservative principle the emission factor for steam has been considered as zero. Hence after including the higher thermal energy consumption in the ER calculation. The result of BE and PE calculation will be zero as the result from the approach above. 4. The example of invoice is submitted , along with the invoices summary file. 5. The file Rpt_PO production is submitted. 6. The file Rpt_raw data is submitted. 7. The example of invoice is submitted , along with the invoices summary file. 3rd response on 07-Jun-16 1. PO_y : The monitored values (measured by meter) are from the Rpt_Production – PO Produced (Operation number). The cross-checked with the Logistic number	4. Copy of purchase receipts submitted. Values of electricity consumed as per raw data and the MR is consistent. However these values are not consistent with the invoices. PP is requested to explain. 5. Requested data submitted. 6. Requested data submitted. 7. NG Values for 2011 is not consistent with the data submitted. 3rd response: 1. MR and ER sheet corrected appropriately, Monitoring period now starts from 4th October 2011.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																																																																								
		from the same report has been done in sheet 'Crosscheck-Meter'. Since the difference is within 5% , the values in gray – Operation numbers are used for ER calculation. The value in 2011 is from 4th October. <table><tr><td rowspan="4">PO_y</td><td rowspan="4">tonnes</td><td>Flow meter</td><td colspan="4">Operation number : Rpt_PO production</td><td>62,143</td><td>321,724</td><td>357,912</td><td>89,387</td></tr><tr><td rowspan="2">Stock</td><td colspan="4">Logistic number : Rpt_PO production</td><td>63,705</td><td>320,866</td><td>355,742</td><td>88,885</td></tr><tr><td colspan="4">Rpt_PO production</td><td>63,705</td><td>320,866</td><td>355,742</td><td>88,885</td></tr><tr><td colspan="4">Diff (%)</td><td>-2.47%</td><td>0.27%</td><td>0.61%</td><td>0.56%</td></tr></table> 2. Sol_y : The monitored values (measured by meter) are from the Rpt_raw data in ton/hour unit , multiplied by 24 to be ton. The cross-checked with the stock number from the Rpt_Stock checking has been done in sheet 'Crosscheck-Meter'. Since the difference is over than 5% , the values in gray – higher values are used for ER calculation as per conservativeness approach. The value in 2011 is from 1st October. <table><tr><td rowspan="4">Sol_y</td><td rowspan="4">tonnes</td><td>Flow meter</td><td colspan="4">Rpt_raw data</td><td>5,049</td><td>19,063</td><td>21,634</td><td>4,366</td></tr><tr><td rowspan="2">Stock</td><td colspan="4">GMID 00369989 :</td><td>5,218</td><td>17,795</td><td>19,757</td><td>4,172</td></tr><tr><td colspan="4">Rpt_Stock Checking</td><td>5,218</td><td>17,795</td><td>19,757</td><td>4,172</td></tr><tr><td colspan="4">Diff (%)</td><td>-13.3%</td><td>6.6%</td><td>8.7%</td><td>4.4%</td></tr></table> 3. EC_{HPPO,y} - The monitored values (measured by meter) are from the Rpt_Energy consumption – PO. The cross-checked with the invoice number from Glow has been done in sheet 'Crosscheck-Inv'. Since invoiced value is included with the usage at WWTP. The energy usage by	PO _y	tonnes	Flow meter	Operation number : Rpt_PO production				62,143	321,724	357,912	89,387	Stock	Logistic number : Rpt_PO production				63,705	320,866	355,742	88,885	Rpt_PO production				63,705	320,866	355,742	88,885	Diff (%)				-2.47%	0.27%	0.61%	0.56%	Sol _y	tonnes	Flow meter	Rpt_raw data				5,049	19,063	21,634	4,366	Stock	GMID 00369989 :				5,218	17,795	19,757	4,172	Rpt_Stock Checking				5,218	17,795	19,757	4,172	Diff (%)				-13.3%	6.6%	8.7%	4.4%	hence accepted. 2. MR and ER sheet corrected appropriately, the cross check values are taken for the whole month of October 2011, conservative, hence accepted. 2. MR and ER sheet corrected appropriately, the cross check values are taken for the whole month of October 2011, conservative, hence accepted.
PO _y	tonnes	Flow meter			Operation number : Rpt_PO production				62,143	321,724	357,912	89,387																																																															
		Stock			Logistic number : Rpt_PO production				63,705	320,866	355,742	88,885																																																															
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Sol _y	tonnes	Flow meter	Rpt_raw data				5,049	19,063	21,634	4,366																																																																	
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Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																																																																																										
		WWTP (PUI) from Rpt_Energy consumption is deducted from the invoice value before comparing. As the difference is within 5% , the values in gray are used for ER calculation. <table><tr><th colspan="5">POWER</th></tr><tr><th>Power (PO + WWTP)</th><th>Power (WWTP-PUI)</th><th>Power (PO)</th><th>Power (PO) - ER cal</th><th>Power</th></tr><tr><th>Invoice</th><th>Rpt_Energy consumption (PUI)</th><th>Deduction from invoice</th><th>Rpt_Energy consumption</th><th>Diff</th></tr><tr><td>Glow</td><td>DOW</td><td></td><td>DOW</td><td>Average</td></tr><tr><td>MWh</td><td>MWh</td><td>MWh</td><td>MWh</td><td>-1%</td></tr><tr><td>63,507</td><td>7,566</td><td>55,941</td><td>55,428</td><td>-1%</td></tr><tr><td>251,775</td><td>31,743</td><td>220,032</td><td>217,095</td><td>-1%</td></tr><tr><td>262,101</td><td>32,030</td><td>230,071</td><td>227,688</td><td>-1%</td></tr><tr><td>64,856</td><td>7,961</td><td>56,895</td><td>57,069</td><td>0%</td></tr></table> 4. FC_{i,y} - The monitored values (measured by meter) are from the Rpt_Energy consumption – Tox No.1,2. The cross-checked with the invoice number from PTT in TJ unit has been done in sheet ‘Crosscheck-Inv’. Since the difference is over than 5% , the values in gray – higher values are used for ER calculation as per conservativeness approach. <table><tr><th colspan="5">NG</th></tr><tr><th>NG</th><th>NG</th><th>NG</th><th>NG - ER cal</th><th>NG</th></tr><tr><th>Invoice</th><th>MMBTU to TJ</th><th>Rpt_Energy consumption</th><th>Rpt_Energy consumption</th><th>Diff</th></tr><tr><td>PTT</td><td>0.00105587</td><td>DOW (Tox No.1,2)</td><td>DOW (Tox No.1,2)</td><td>Average</td></tr><tr><td>MMBTU</td><td>TJ</td><td>m3</td><td>TJ</td><td>-31%</td></tr><tr><td>138,874</td><td>147</td><td>2,663,207</td><td>115</td><td>-27%</td></tr><tr><td>515,988</td><td>545</td><td>10,495,944</td><td>454</td><td>-20%</td></tr><tr><td>303,093</td><td>320</td><td>5,241,471</td><td>227</td><td>-41%</td></tr><tr><td>84,873</td><td>90</td><td>1,536,048</td><td>67</td><td>-35%</td></tr></table>	POWER					Power (PO + WWTP)	Power (WWTP-PUI)	Power (PO)	Power (PO) - ER cal	Power	Invoice	Rpt_Energy consumption (PUI)	Deduction from invoice	Rpt_Energy consumption	Diff	Glow	DOW		DOW	Average	MWh	MWh	MWh	MWh	-1%	63,507	7,566	55,941	55,428	-1%	251,775	31,743	220,032	217,095	-1%	262,101	32,030	230,071	227,688	-1%	64,856	7,961	56,895	57,069	0%	NG					NG	NG	NG	NG - ER cal	NG	Invoice	MMBTU to TJ	Rpt_Energy consumption	Rpt_Energy consumption	Diff	PTT	0.00105587	DOW (Tox No.1,2)	DOW (Tox No.1,2)	Average	MMBTU	TJ	m3	TJ	-31%	138,874	147	2,663,207	115	-27%	515,988	545	10,495,944	454	-20%	303,093	320	5,241,471	227	-41%	84,873	90	1,536,048	67	-35%	2. MR and ER sheet corrected appropriately, the cross check values are taken for the whole month of October 2011, conservative, hence accepted. CAR 2 is closed.
POWER																																																																																													
Power (PO + WWTP)	Power (WWTP-PUI)	Power (PO)	Power (PO) - ER cal	Power																																																																																									
Invoice	Rpt_Energy consumption (PUI)	Deduction from invoice	Rpt_Energy consumption	Diff																																																																																									
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MWh	MWh	MWh	MWh	-1%																																																																																									
63,507	7,566	55,941	55,428	-1%																																																																																									
251,775	31,743	220,032	217,095	-1%																																																																																									
262,101	32,030	230,071	227,688	-1%																																																																																									
64,856	7,961	56,895	57,069	0%																																																																																									
NG																																																																																													
NG	NG	NG	NG - ER cal	NG																																																																																									
Invoice	MMBTU to TJ	Rpt_Energy consumption	Rpt_Energy consumption	Diff																																																																																									
PTT	0.00105587	DOW (Tox No.1,2)	DOW (Tox No.1,2)	Average																																																																																									
MMBTU	TJ	m3	TJ	-31%																																																																																									
138,874	147	2,663,207	115	-27%																																																																																									
515,988	545	10,495,944	454	-20%																																																																																									
303,093	320	5,241,471	227	-41%																																																																																									
84,873	90	1,536,048	67	-35%																																																																																									
CAR3 1. PO _y : Calibration date is prior to the start date of the project; PP is requested to clarify on how the	C.3.2, C.3.3, C.4,C.6.2, C.6.3, D.1	1 st Response on January 27, 2016 1. The calibration date defined in Table 2 of MR is rechecked and corrected.	1. Calibration is done once in 5 years during shutdown. There is no recommendation from the supplier on calibration due dates. The																																																																																										

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
calibration details submitted cover the entire monitoring period. The calibration dates in the MR is not consistent with the records submitted. 2. Sol_y. Calibration date is prior to the start date of the project; PP is requested to clarify on how the calibration details submitted cover the entire monitoring period. The calibration dates in the MR is not consistent with the records submitted. 3. SCH_{PP}O, y: Serial number of the Steam mass flow meter is not available. Calibration records for are not available in the documents submitted. PP is requested to clarify on how the calibration details submitted cover the entire monitoring period. Also, accuracy data could not be confirmed with the specification sheet submitted; PP is requested		The flow meters were calibrated before installation. Although the validity of calibration report is not defined. But when referring to section 4.2 of PD for monitoring table of PO_y , the cross-checking with production stock inventory can be applied for QA/QC. The calibration frequency is planned for every 60 months or 5 years as per the shutdown plan recommended by technology provider , which can cover this monitoring period. 2. The calibration date defined in Table 2 of MR is rechecked. Please note that the date defined in calibration report is in mm/dd/yy. The flow meter was calibrated before installation. Although the validity of calibration report is not defined. But when referring to section 4.2 of PD for monitoring table of Sol_y , the cross-checking with stock inventory can be applied for QA/QC. The calibration frequency is planned for every 60 months or 5 years as per the shutdown plan recommended by technology provider , which can cover this monitoring period. 3. The calibration report is provided with the serial number. The accuracy can be found when clicks on specification tab at the end of page.	correctness is crosss checked with production stock inventory. However please refer to CAR2 above. 2. Calibration is done once in 5 years during shutdown. There is no recommendation from the supplier on calibration due dates. The correctness is crosss checked with production stock inventory. However please refer to CAR2 above. 3. Requested information provided now. However, PP is requested to clarify on how the calibration details submitted cover the entire monitoring period.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																				
to detail the page number reference for the same. 4. ECHPPO, y: Meter type as mentioned in the MR is not consistent with the test certificates submitted. Calibration records for the energy meters are not available. 5. QPropylene,y: Calibration date is prior to the start date of the project; PP is requested to clarify on how the calibration details submitted cover the entire monitoring period. Also, the accuracy data as available in the MR is not consistent with the specification sheet submitted		<table><tr><th>Documentation</th><th>Features & Benefits</th><th>Specifications</th><th>Applications</th><th>Associated Products</th></tr><tr><td>Fully Integrated Flowmeter</td><td></td><td></td><td></td><td></td></tr><tr><td>Accuracy</td><td>•Mass flow up to 0.8% of mass flow rate, 14:1 turndown •Classic MV up to ±0.85 % of flow rate, 8:1 flow turndown</td><td>•Volumetric flow up to 0.8% of volumetric flow rate, 14:1 turndown •Classic MV up to ±0.85% of volumetric flow rate, 8:1 turndown</td><td></td><td></td></tr><tr><td>Repeatability</td><td>± 0.1 %</td><td>± 0.1 %</td><td></td><td></td></tr></table> Ref : Cal FT-9500-01 4. The type of installed meters is multifunction power meter from Siemens which can continuously monitor the power consumption and summarize on monthly basis which is in line with monitoring equipment mentioned in PD and MR. The calibration report has been submitted. 5. The flow meter was calibrated before installation. Although the validity of calibration report is not defined. But when referring to section 4.2 of PD for monitoring table of QPropylene,y , the cross-checking with stock inventory can be applied for QA/QC. The calibration frequency is planned for every 60 months or 5 years as per the shutdown plan recommended by technology provider , which can cover this monitoring period. The accuracy provided in MR at 0.15% for mass flow is consistent with the technical specification sheet.	Documentation	Features & Benefits	Specifications	Applications	Associated Products	Fully Integrated Flowmeter					Accuracy	•Mass flow up to 0.8% of mass flow rate, 14:1 turndown •Classic MV up to ±0.85 % of flow rate, 8:1 flow turndown	•Volumetric flow up to 0.8% of volumetric flow rate, 14:1 turndown •Classic MV up to ±0.85% of volumetric flow rate, 8:1 turndown			Repeatability	± 0.1 %	± 0.1 %			4. In the space provided for type of meters in the table 2 of the MR the some numbers are given instead of the actual type of meter installed being multifunction power meter. 5. Calibration is done once in 5 years during shutdown. There is no recommendation from the supplier on calibration due dates. The correctness is cross checked with production stock inventory. However please refer to CAR2 above. Supportive document for accuracy is now made available.
Documentation	Features & Benefits	Specifications	Applications	Associated Products																			
Fully Integrated Flowmeter																							
Accuracy	•Mass flow up to 0.8% of mass flow rate, 14:1 turndown •Classic MV up to ±0.85 % of flow rate, 8:1 flow turndown	•Volumetric flow up to 0.8% of volumetric flow rate, 14:1 turndown •Classic MV up to ±0.85% of volumetric flow rate, 8:1 turndown																					
Repeatability	± 0.1 %	± 0.1 %																					

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
6. $Q_{By-product,y}$: Calibration date is prior to the start date of the project; PP is requested to clarify on how the calibration details submitted cover the entire monitoring period. 7. $FC_{i,y}$: PP is requested to submit the supplier invoices for NG for the monitoring period.		Max. measured error Mass flow (liquid): $\pm 0.15\%$ (standard), 0.1% (option) Volume flow (liquid): $\pm 0.15\%$ Mass flow (gas): $\pm 0.35\%$ Density (liquid): $\pm 0.0005\text{ g/cm}^3$ 6. The flow meter was calibrated before installation. Although the validity of calibration report is not defined. But when referring to section 4.2 of PD for monitoring table of $Q_{By-product,y}$, the cross-checking with stock inventory can be applied for QA/QC. The calibration frequency is planned for every 60 months or 5 years as per the shutdown plan recommended by technology provider, which can cover this monitoring period. 7. The energy consumption report (from internal meters) and the example of invoice are submitted. Ref : Rpt_Energy Consumption , Invoice_HPPO_NG_2012_04 2nd response on April 22 , 2016 1. Please refer to the response of CAR2 above. 2. Please refer to the response of CAR2 above. 3. The monitored value for steam consumption can be cross-checked with invoice value which is from purchasing meter installed at Glow plant. The values applied for ER calculation is accurate since the difference between 2 sources of data, during the sampling	6. Calibration is done once in 5 years during shutdown. There is no recommendation from the supplier on calibration due dates. The correctness is cross checked with production stock inventory. However please refer to CAR2 above. 7. PP is requested to submit the supplier invoices for NG for the monitoring period. 2nd response: 1. Please refer to CAR2 above 2. Please refer to CAR2 above 3. This parameter has no impact of ER calculations as it is neglected both in baseline and project scenarios. Hence accepted.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																																																																								
		period of 18 months , is less than 5% which is in line with clause 5.3.1 of VCS standard v 3.5. <table><tr><td></td><td colspan="3">STEAM</td></tr><tr><td></td><td>Steam</td><td>Steam - ER cal</td><td>Steam</td></tr><tr><td>Source</td><td>Invoice</td><td>Rpt_Energy consumption</td><td>Diff</td></tr><tr><td>Meter</td><td>Glow</td><td>DOW</td><td>Average</td></tr><tr><td>Unit</td><td>Tons</td><td>Tons</td><td>-3%</td></tr><tr><td>2011</td><td>418,438</td><td>368,259</td><td>-14%</td></tr><tr><td>2012</td><td>1,562,525</td><td>1,499,443</td><td>-4%</td></tr><tr><td>2013</td><td>1,370,025</td><td>1,374,612</td><td>0%</td></tr><tr><td>2014</td><td>290,626</td><td>308,676</td><td>6%</td></tr></table> 4. The type of meter is from the manufactrer's calibration report. <table><tr><td colspan="2">MUL</td></tr><tr><td>Customer : MTP HPPO MANUFACTURING</td><td>Lc</td></tr><tr><td>MNF : SIEMENS</td><td>Fe</td></tr><tr><td>Type : 7KG7750-0GA01-00AA0</td><td>C</td></tr><tr><td>Serial no : BF 0908074313</td><td>Rz</td></tr><tr><td>Device no : -P01</td><td>Fr</td></tr></table> <table><tr><td colspan="2">MUL</td></tr><tr><td>Customer : MTP HPPO MANUFACTURING</td><td></td></tr><tr><td>MNF : SIEMENS</td><td></td></tr><tr><td>Type : 7KG7750-0GA01-00AA0</td><td></td></tr><tr><td>Serial no : BF 0908074311</td><td></td></tr><tr><td>Device no : -P01</td><td></td></tr></table> <table><tr><td colspan="2">MUL</td></tr><tr><td>Customer : MTP HPPO MANUFACTURING</td><td></td></tr><tr><td>MNF : SIEMENS</td><td></td></tr><tr><td>Type : 7KG7750-0GA01-00AA0</td><td></td></tr><tr><td>Serial no : BF 0908074317</td><td></td></tr><tr><td>Device no : -P01</td><td></td></tr></table> The cross-checking of electricity consumption between 2 sources of data shows that the difference is within 5% which is in line with clause 5.3.1 of VCS		STEAM				Steam	Steam - ER cal	Steam	Source	Invoice	Rpt_Energy consumption	Diff	Meter	Glow	DOW	Average	Unit	Tons	Tons	-3%	2011	418,438	368,259	-14%	2012	1,562,525	1,499,443	-4%	2013	1,370,025	1,374,612	0%	2014	290,626	308,676	6%	MUL		Customer : MTP HPPO MANUFACTURING	Lc	MNF : SIEMENS	Fe	Type : 7KG7750-0GA01-00AA0	C	Serial no : BF 0908074313	Rz	Device no : -P01	Fr	MUL		Customer : MTP HPPO MANUFACTURING		MNF : SIEMENS		Type : 7KG7750-0GA01-00AA0		Serial no : BF 0908074311		Device no : -P01		MUL		Customer : MTP HPPO MANUFACTURING		MNF : SIEMENS		Type : 7KG7750-0GA01-00AA0		Serial no : BF 0908074317		Device no : -P01		4. PP's response is accepted as it is consistent with the supportive documents submitted.
	STEAM																																																																										
	Steam	Steam - ER cal	Steam																																																																								
Source	Invoice	Rpt_Energy consumption	Diff																																																																								
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Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion																																																																																								
		standard v 3.5. The power consumption in invoice is the total consumption from HPPO and wastewater plant (PUI). The power consumption for PUI from Rpt_Energy consumption (DOW meter) is used for deduction from values in invoice , in order to get the purchased amount of HPPO only. <table><tr><th></th><th>Power (PO + WWTP)</th><th>Power (WWTP-PUI) Rpt_Energy consumption (PUI)</th><th>Power (PO) Deduction from invoice</th><th>Power (PO) - ER cal Rpt_Energy consumption</th><th>Power Diff</th></tr><tr><td>Source</td><td>Invoice</td><td></td><td></td><td></td><td></td></tr><tr><td>Meter</td><td>Glow</td><td>DOW</td><td></td><td>DOW</td><td>Average</td></tr><tr><td>Unit</td><td>MWh</td><td>MWh</td><td>MWh</td><td>MWh</td><td>-1%</td></tr><tr><td>2011</td><td>79,223</td><td>10,022</td><td>69,201</td><td>68,576</td><td>-1%</td></tr><tr><td>2012</td><td>251,775</td><td>31,743</td><td>220,032</td><td>217,095</td><td>-1%</td></tr><tr><td>2013</td><td>262,101</td><td>32,030</td><td>230,071</td><td>227,688</td><td>-1%</td></tr><tr><td>2014</td><td>64,856</td><td>7,961</td><td>56,895</td><td>57,069</td><td>0%</td></tr></table> 5. Please refer to the response of CAR2 above. 6. Please refer to the response of CAR2 above. 5. The example invoice of NG is submitted , along with the invoices summary file. The NG consumption from purchahsing invoice (PTT meter) is in MMBTU unit. The conversion factor of 1.05587 GJ/MMBTU is applied. The difference of NG consumption in invoices and DOW meter is larger than 5% , the higher value from purchasing invoices are used in the ER calculation. By applying this approach , the PE is increased which is complied with conservative approach. <table><tr><th></th><th>NG</th><th>NG</th><th>NG</th><th>NG - ER cal</th></tr><tr><td>Source</td><td>Invoice</td><td>MMBTU to TJ</td><td>Rpt_Energy consumption DOW (Tox No.1,2)</td><td>Rpt_Energy consumption DOW (Tox No.1,2)</td></tr><tr><td>Meter</td><td>PTT</td><td>0.00105587</td><td></td><td></td></tr><tr><td>Unit</td><td>MMBTU</td><td>TJ</td><td>m3</td><td>TJ</td></tr><tr><td>2011</td><td>167,752</td><td>177</td><td>3,809,585</td><td>165</td></tr><tr><td>2012</td><td>515,988</td><td>545</td><td>10,495,944</td><td>454</td></tr><tr><td>2013</td><td>303,093</td><td>320</td><td>5,241,471</td><td>227</td></tr><tr><td>2014</td><td>84,873</td><td>90</td><td>1,536,048</td><td>67</td></tr></table>		Power (PO + WWTP)	Power (WWTP-PUI) Rpt_Energy consumption (PUI)	Power (PO) Deduction from invoice	Power (PO) - ER cal Rpt_Energy consumption	Power Diff	Source	Invoice					Meter	Glow	DOW		DOW	Average	Unit	MWh	MWh	MWh	MWh	-1%	2011	79,223	10,022	69,201	68,576	-1%	2012	251,775	31,743	220,032	217,095	-1%	2013	262,101	32,030	230,071	227,688	-1%	2014	64,856	7,961	56,895	57,069	0%		NG	NG	NG	NG - ER cal	Source	Invoice	MMBTU to TJ	Rpt_Energy consumption DOW (Tox No.1,2)	Rpt_Energy consumption DOW (Tox No.1,2)	Meter	PTT	0.00105587			Unit	MMBTU	TJ	m3	TJ	2011	167,752	177	3,809,585	165	2012	515,988	545	10,495,944	454	2013	303,093	320	5,241,471	227	2014	84,873	90	1,536,048	67	5. Please refer to CAR 2 above 6. Please refer to CAR 2 above 7. Cross checked with PP's measurement value as per registered PD. The supplier invoices are consistent , hence accepted.
	Power (PO + WWTP)	Power (WWTP-PUI) Rpt_Energy consumption (PUI)	Power (PO) Deduction from invoice	Power (PO) - ER cal Rpt_Energy consumption	Power Diff																																																																																						
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Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Verification Conclusion
		The ER calculation is revised accordingly. 3rd response on 07-Jun-16 Please refer to the response of CAR2 above.	3rd response: Please refer to CAR2 above. CAR 3 is closed.
CL1 The MR is not transparent on the systems and procedure in place to handle emergencies with respect to the monitoring systems.	C.6.2, C.6.3	The emergency procedure provided in MR is consistence with registered PD. Howvere , the content in section 3.3 of MR is revised for monitoring system and emergency procedure.	MR has been revised adequately, hence accepted. CL1 is closed.

CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI* QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES*

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Cyril Augustus Arokiasamy Amalorpavanathan

è qualificato come:
is qualified as:

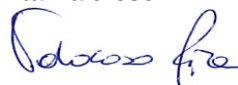
TEC, VAL, VER, TL

per le seguenti aree tecniche:
for the following technical areas:

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.1	Thermal energy generation	1
1.2	Renewables	1
3.1	Energy Demand	3
5.1	Chemical industry	5
13.1	Solid Waste and wastewater	13

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)

Responsabile di schema
Scheme Leader
Rita Valoroso



*SCHEMI VOLONTARI/ VOLUNTARY SCHEMES: ACR American Carbon Registry, CCB The Climate, Community & Biodiversity Alliance, GS Gold Standard, JI Joint Implementation, SCS Social Carbon Standard, VCS Verified Carbon Standard.

TEC: Technical expert; VAL: Validator; VER: Verifier; TL: Team leader; FIN EXP: Financial Expert; ITRP: Independent technical reviewer

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RINA Services S.p.A. is accredited /recognized by

UNFCCC	quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM <i>as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects</i>
VCSA	per condurre la Validazione e la Verifica di Progetti VCS <i>to carry out Validation and Verification of VCS Projects</i>
GS Foundation	per condurre la Validazione e la Verifica di Progetti GS <i>to carry out Validation and Verification of GS Projects</i>
Ecologica Institute	per condurre la Validazione e la Verifica di rapporti SCS <i>to carry out Validation and Verification of SCS Reports</i>
American Carbon Registry ACR	per condurre la Validazione e la Verifica di Progetti ACR <i>to carry out Validation and Verification of ACR projects</i>
The Climate, Community & Biodiversity Alliance CCB	per condurre la Validazione e la Verifica di Progetti co-benefit CCB <i>to carry out Validation and Verification of co-benefit CCB projects</i>

CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI* QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES*

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Rita Valoroso

è qualificato come:
is qualified as:

TEC, VAL, VER, TL, ITRP

per le seguenti aree tecniche:
for the following technical areas:

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
1.2	Renewables	1
3.1	Energy demand	3
13.1	Solid waste and wastewater	13

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)

Responsabile QPT
Head of QPT
Laura Severino



*SCHEMI VOLONTARI/ VOLUNTARY SCHEMES: ACR American Carbon Registry, CCB The Climate, Community & Biodiversity Alliance, GS Gold Standard, JI Joint Implementation, SCS Social Carbon Standard, VCS Verified Carbon Standard.

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VCSA	per condurre la Validazione e la Verifica di Progetti VCS <i>to carry out Validation and Verification of VCS Projects</i>
GS Foundation	per condurre la Validazione e la Verifica di Progetti GS <i>to carry out Validation and Verification of GS Projects</i>
Ecologica Institute	per condurre la Validazione e la Verifica di rapporti SCS <i>to carry out Validation and Verification of SCS Reports</i>
American Carbon Registry ACR	per condurre la Validazione e la Verifica di Progetti ACR <i>to carry out Validation and Verification of ACR projects</i>
The Climate, Community & Biodiversity Alliance CCB	per condurre la Validazione e la Verifica di Progetti co-benefit CCB <i>to carry out Validation and Verification of co-benefit CCB projects</i>

CERTIFICATO DI QUALIFICA PER GLI SCHEMI VOLONTARI* QUALIFICATION CERTIFICATE FOR VOLUNTARY SCHEMES*

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Laura Severino

è qualificato come:
is qualified as:

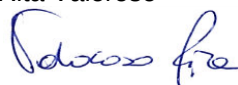
TEC, VAL, ITRP

per le seguenti aree tecniche:
for the following technical areas:

AREE TECNICHE TECHNICAL AREAS	DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION	SCOPO SETTORIALE SECTORAL SCOPE
5.1	Chemical industry	5

REVISIONE REVISION	DATA DATE	MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION
0	19/07/2016	First issue with new template (this certificate is linked to CDM qualification)

Responsabile di schema
Scheme Leader
Rita Valoroso



*SCHEMI VOLONTARI/ VOLUNTARY SCHEMES: ACR American Carbon Registry, CCB The Climate, Community & Biodiversity Alliance, GS Gold Standard, JI Joint Implementation, SCS Social Carbon Standard, VCS Verified Carbon Standard.

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UNFCCC	quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM <i>as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects</i>
VCSA	per condurre la Validazione e la Verifica di Progetti VCS <i>to carry out Validation and Verification of VCS Projects</i>
GS Foundation	per condurre la Validazione e la Verifica di Progetti GS <i>to carry out Validation and Verification of GS Projects</i>
Ecologica Institute	per condurre la Validazione e la Verifica di rapporti SCS <i>to carry out Validation and Verification of SCS Reports</i>
American Carbon Registry ACR	per condurre la Validazione e la Verifica di Progetti ACR <i>to carry out Validation and Verification of ACR projects</i>
The Climate, Community & Biodiversity Alliance CCB	per condurre la Validazione e la Verifica di Progetti co-benefit CCB <i>to carry out Validation and Verification of co-benefit CCB projects</i>