METHODOLOGY ASSESSMENT REPORT FOR GREENHOUSE GAS CAPTURE AND UTILIZATION IN PLASTIC MATERIALS

Document Prepared By First Environment, Inc.

Methodology Title	Greenhouse Gas Capture and Utilization in Plastic Materials	
Version	5	
Methodology Category	Methodology	X
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	Module	
	Tool	
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Summary:

First Environment, Inc. (First Environment) was retained to provide the first assessment in the VCS double-approval process for the proposed Methodology Element titled, "Greenhouse Gas Capture and Utilization in Plastic Materials." The Methodology Element provides procedures for monitoring and calculating emission reductions associated with the substitution of fossil fuels with biopolymers in the manufacture of plastic materials.

The methodology assessment process consists of an independent third-party review of the new Methodology Element. In particular, the methodology assessment shall confirm that the Methodology Element is consistent with all relevant VCS rules and procedures. The assessment of the new Methodology Element is done through a double-approval process, according to the VCS Standard, and is necessary to provide assurance to stakeholders of the quality of the new Methodology Element.

The methodology assessment was conducted using the VCS Standard, v3.7 as the criteria. Additionally, First Environment followed guidance in the VCS Methodology Approval Process, v3.7 and the VCS Program Guide, v3.7 and applied its professional judgment as informed by ISO 14064-3 in assessing the proposed methodology.

During the assessment process, First Environment issued two clarification requests and eleven corrective action requests – all of which were addressed sufficiently by Newlight. Based upon the results of the first and second assessment, First Environment is of the opinion that the "Greenhouse Gas Capture and Utilization in Plastic Materials," as described in Version 5 of the Methodology Element dated October 31, 2018, meets all relevant VCS requirements.

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1 INTRODUCTION

This report is provided to Newlight Technologies, Inc. (Newlight) as a deliverable of the Verified Carbon Standard (VCS) methodology element (ME) assessment process for the proposed VCS ME titled "Greenhouse Gas Capture and Utilization in Plastic Materials." This report provides a description of the steps involved in conducting the first methodology assessment as a part of the VCS double-approval process and summarizes the findings of the first methodology assessment.

First Environment, Inc. (First Environment) was provided an initial version of the ME dated October 1, 2017. Based on this documentation, the Audit Team performed a document review and desktop audit, which resulted in corrective action and clarification requests (discussed later in this report), and revisions to the ME. The version of the ME, dated July 16, 2018, serves as the basis of the final conclusions presented herewith. The Audit Team subsequently reviewed revisions to the ME resulting from the second assessment process and Verra's review during the reconciliation phase (see Section 5 below).

First Environment communicated primarily with Newlight's consultant, Carbonomics, LLC, during the course of assessment activities.

1.1 Objective

The purpose of the methodology assessment is to have an independent third party assess the conformance of the ME with VCS requirements.

1.2 Summary Description of the Methodology

Newlight has developed a new VCS methodology for the monitoring and quantification of emission reductions for Project Activities that use biologic processes to convert carbon dioxide and/or methane into plastic material that has an expected lifetime of at least 100 years or is biodegradable. Plastic material made using carbon dioxide and/or methane displaces traditional petroleum-based plastics in the marketplace and is manufactured using a less emissions-intensive process than traditional plastics which results in net reduction of CO_2-equivalent emissions.

The ME provides procedures for establishing the project boundary, determining the baseline scenario, demonstrating additionality, monitoring the quantity of plastic produced and other relevant parameters, and finally, quantifying baseline and project emissions and total emission reductions.

2 ASSESSMENT APPROACH

2.1 Method and Criteria

The methodology assessment scope is defined as an independent and objective review of the proposed ME. The methodology assessment is conducted using the VCS Standard, 21 June 2017, v3.7 (VCS Standard) as the criteria. Discrepancies with the requirements in the VCS standard for new Methodology Elements were considered material during the assessment process. The *VCS Methodology Approval Process*, 21 June 2017, v3.7 (VCS Methodology Approval Process); the *VCS Program Guide*, 21 June 2017, v3.7 (VCS Program Guide); and the ISO 14064-3 standards guided First Environment's process.

The assessment process was utilized to evaluate whether the ME is consistent with the stated criteria. A methodology assessment checklist was developed which summarizes the criteria used to evaluate the ME, the conformance of the ME with each criterion, and the Audit Team's assessment findings. First Environment and Newlight have agreed that a reasonable level of assurance be applied to this assessment.

The assessment process consisted of the following steps, each described in further detail below:

- conflict of interest review;

- selection of assessment team;
- kick-off meeting with Newlight;
- development of the validation plan;
- desktop review of the ME and other relevant documentation;
- follow-up discussions with Newlight for supplemental information, as needed, as well as the corrective action cycle; and
- report development.

Conflict of Interest Review

Prior to beginning any assessment project such as this, First Environment conducts an evaluation to identify any potential conflicts of interest associated with the project. No potential conflicts were found for this project.

Audit Team

Members of the Audit Team were selected based on their qualifications, as further described in Section 2.4 below.

Audit Kick-off

The assessment process was initiated with a kick-off conference call on February 1, 2018 between First Environment and Newlight. The communication focused on confirming the assessment scope, objectives, criteria, schedule, and the information required for the methodology assessment.

Development of the Validation Plan

Based on the information discussed during the kick-off conference call, the Audit Team formally documented its validation plan and provided the validation plan to Newlight.

Desktop Review

The Audit Team performed a desktop review of the ME and supporting documentation, as further described in Section 2.2 below.

Corrective Actions and Supplemental Information

The Audit Team issued requests for corrective action and clarification during the methodology assessment process, as described in Section 2.5. The corrective action and clarification requests and the responses provided by Newlight are summarized in the Appendix to this report.

Assessment Reporting

This methodology assessment report documents the methodology assessment process and identifies its findings and results.

2.2 Document Review

Applicability requirements, baseline approach, additionality, project boundary, emissions quantification, leakage, monitoring, data and parameters, and other pertinent criteria were assessed to evaluate the ME against VCS program requirements. Discrepancies between the assessment criteria and the ME were considered material and identified for corrective action, as further described in Section 2.5.

During the desktop review, the Audit Team reviewed the following:

- US Environmental Protection Agency: Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM), Containers, Packaging and Non-Durable Goods Materials Chapter, February 2016.
- Winnipeg Sewage Treatment Program South End Plant, Process Selection Report. July 2011.
- Historical Newlight product sales records.
- CDM methodologies and tools listed in Table 1 of the ME.
- Sample calculations that applied the quantification methodologies given in the ME.

2.3 Interviews

The Audit Team held teleconferences with the following individuals during the course of the methodology assessment:

- Mark Herrema, Newlight Technologies, Inc. – President and CEO of methodology developer; inventor of project technology for bioplastics
- Seth Baruch, Carbonomics, LLC – methodology element author and methodology developer's consultant

2.4 Assessment Team

Michael Carim, Lead Assessor - Mr. Carim is a Senior Associate on First Environment's team with over a decade of experience in GHG validation and verification. His competency as a lead assessor for VCS assessments and in the ME's sectoral scope is confirmed through documentation in First Environment's ISO14065 accredited management system.

Luca Nencetti, Assessor - Mr. Nencetti is an Associate on First Environment's team with over a decade of experience in GHG management. His competency in the ME's sectoral scope is confirmed through documentation in First Environment's ISO14065 accredited management system and is further evidenced by his status as a registered Professional Engineer.

James Wintergreen, Independent Internal Reviewer - Mr. Wintergreen is a Senior Associate on First Environment's team with nearly two decades of experience in GHG validation and verification. His competency as an independent internal reviewer and in the ME's sectoral scope is confirmed through documentation in First Environment's ISO14065 accredited management system.

A VCS-approved expert was not retained during the assessment of methodology element's Standardized Method. An expert was retained by the second assessor in the VCS-double approval process.

2.5 Resolution of Findings

As described above, the Audit Team issued formal requests for corrective action, clarification, and supplemental information during the methodology assessment process. In particular, discrepancies between the ME and the requirements of the VCS Standard were identified for corrective action and required appropriate justification. Clarification and supplemental information requests served to provide the Audit Team additional context or background information in order to complete the assessment process. Newlight was given the opportunity to resolve the requests through the submittal of additional evidence or justification, revisions to the ME, and/or other means as appropriate.

The Audit Team raised a total of eleven corrective action requests and two clarification requests during the assessment process. The key findings raised by First Environment during the methodology assessment process included:

- inconsistencies and/or misstatements in the emission factors and equations used to quantify baseline emissions;

- omissions, inconsistencies, and/or lack of detail surrounding the quantification methodologies and parameters identified in the ME;
- inconsistencies with requirements of the VCS New Methodology template; and
- inadequate consideration of potential sources of leakage.

The specific corrective action and clarification requests issued by the Audit Team, as well as the responses provided by Newlight, are summarized in the attached appendix. As indicated, Newlight adequately resolved all of these requests.

3 ASSESSMENT FINDINGS

3.1 Relationship to Approved or Pending Methodologies

First Environment concluded that no similar methodologies under the VCS or an approved GHG programme exist; therefore, none could reasonably be revised.

Potentially similar methodologies consist of all approved methodologies within Sectoral Scope 3. Energy Demand and the CDM Methodology AM0027, which is potentially relevant because its scope involves the substitution of CO_2 of fossil origin in the production of inorganic compounds. The ME includes a complete list of all approved methodologies within Sectoral Scope 3 Energy Demand plus AM0027.

None of the methodologies in Sectoral Scope 3 include the sequestration of GHGs in plastic material or carbon capture and use within their scope; therefore, none could reasonably be revised and a new ME is warranted. With respect to AM0027, this methodology requires a renewable source CO_2 that is processed on site. Additionally, the methodology was developed for use at facilities that manufacture sodium and ammonium bicarbonate and does not involve the use of CH_4 as a feedstock; therefore, it is not appropriate to adapt this methodology for use at facilities that produce plastics from biopolymers using CO_2 or CH_4 as feedstocks.

The ME cites the CDM methodology AMS-III.BA, *Recovery and recycling of materials from E-Waste* as conceptual inspiration for the approach to quantifying baseline emissions. However, the scope of AMS-III.BA is specific to e-waste recycling activities and does not address GHG sequestration in plastic material, therefore it could not reasonably be revised for the purpose served by the ME.

3.2 Stakeholder Comments

No comments were received during the public stakeholder consultation.

3.3 Structure and Clarity of Methodology

The Audit Team confirmed that the instructions in the VCS methodology template were followed accurately and the methodology criteria and procedures are appropriately documented throughout the ME. The terminology utilized in the ME is consistent with that of the VCS program and the language appropriately and unambiguously identifies the necessary level of adherence to the methodology requirements. The criteria and procedures are appropriately described and are readily applicable and consistent for appropriate auditing of the project activities. Based on these observations, the Audit Team concluded that the overall structure and clarity of the ME meets VCS requirements.

3.4 Definitions

The ME introduces definitions of key terms relevant to the application of the procedures and requirements given elsewhere in the ME. These definitions are given in alphabetical order and provide the necessary clarity to ensure the terms are used consistently throughout the ME and by project proponents. With the exception of various types of conventional plastic material that may be displaced by a Project Activity, no acronyms are defined.

3.5 Applicability Conditions

The ME clearly identifies criteria by which to assess the eligibility of candidate Project Activities at the time of project validation. Specifically, the ME requires eligible projects to meet the following four applicability conditions:

- The Project Activity must produce plastic material that sequesters GHG for a period of at least 100 years. Biodegradable plastic products are eligible under the methodology but can only claim credit for the displacement of emissions associated with traditional plastic, not baseline reductions associated with the sequestration of GHGs because the GHGs entrained in a biodegradable material will be emitted at end-of-life.

The Audit Team concluded that the applicability condition given in the ME is precisely written, appropriate, adequate, and consistent with the VCS Standard. Further, it is demonstrably verifiable at the time of validation because it relates to known characteristics and/or properties of the plastic material being produced.

- The Project Activity must produce a useful plastic material for a commercial market.

The Audit Team concluded that the applicability condition given in the ME is precisely written, appropriate, adequate, and consistent with the VCS Standard. Further, it is demonstrably verifiable at the time of validation because it relates to known characteristics and/or properties of the plastic material being produced.

- Project Activities that utilize CH_4 as a feedstock must hold a contract with the supplier of the CH_4.

The Audit Team concluded that the applicability condition given in the ME is precisely written, appropriate, adequate, and consistent with the VCS Standard. Further, it is demonstrably verifiable at the time of validation because it relates to the possession of contractual rights to the feedstock.

- The plastic material displaced by plastic made from biopolymers must be one of the following:
    - Polypropylene (PP),
    - Polystyrene (PS),
    - Polyethylene (PE), including high-density and low-density polyethylene (HDPE, LDPE) as well as linear low-density polyethylene,
    - Thermoplastic urethane (TPU),
    - Acrylonitrile butadiene styrene (ABS),
    - Polycarbonate (PC),
    - Polyethylene terephthalate (PET),
    - Polyvinyl Chloride (PVC).

The Audit Team concluded that the applicability condition given in the ME is precisely written, appropriate, adequate, and consistent with the VCS Standard. Further, it is demonstrably verifiable at the time of validation because it relates to known characteristics and/or properties of the plastic material being produced.

All criteria identified provide a clear, unambiguous basis for determining the ME's applicability to potential project activities by delineating eligible plastic materials and qualities. Additionally, the criteria help ensure that the underlying assumptions related to project boundary, emissions quantifications, and monitoring and measurement are satisfied for any project applying the ME. Therefore, it is deemed unlikely that a project successfully demonstrating conformance with the stated applicability conditions at validation would later fall out of line with these criteria.

3.6 Project Boundary

The project boundary is comprised of:

- the project facility where plastic materials are produced;
- the facilities from which the GHG feedstock is sourced (if not direct air capture);
- the facilities where displaced conventional plastic material is manufactured.

The ME identifies relevant sources of baseline and project emissions and indicates whether each is included or excluded from the project boundary. The SSRs included in the project boundary represent emissions from the production of traditional and bioplastics in the baseline and project scenarios, respectively. The baseline scenario also includes emissions of GHG sequestered in bioplastics. Where GHG emission sources are minuscule, SSRs are generally excluded for simplicity. Additionally, the ME includes a clearly drawn figure to help illustrate the baseline and project SSRs.

The Audit Team determined that the ME provided sufficient criteria to establish the project boundary, adequate justification for the SSRs presented, and that all relevant emission sources and GHGs are included. First Environment concluded that the specification of the project boundary is appropriate because it incorporates all relevant GHG sources, sinks, or reservoirs that are affected, related, and/or controlled by a potential Project Activity. Given the ME's scope, relevant GHG SSRs logically cannot extend beyond changes in emissions associated with the production of plastic material.

3.7 Baseline Scenario

The ME applies an activity method, therefore, no specific requirements from the VCS standard apply, per clause 4.5.8.

The baseline scenario is the continued production of plastic material from traditional (i.e., petroleum) resources. This is appropriate and the most plausible baseline scenario because, in First Environment's professional judgement, it is the method employed for the vast majority of plastic production in the world and therefore represents the most likely emissions scenario in the absence of plastics produced from CH_4 and/or CO_2. The baseline scenario specified by the ME is appropriate because the ME is intended for projects that reduce GHG emissions by making plastic material from non-traditional resources. The Audit Team considered the use of the baseline scenario specified to be an acceptable approach and consistent with the requirements of the VCS Standard for determining the baseline scenario. The conclusions in the ME relative to the baseline scenario were deemed appropriate based on a review of the documentation cited in Appendix I of the ME.

3.8 Additionality

The ME uses an activity method for the demonstration of additionality through the application of a positive list. Specifically, projects that satisfy the applicability conditions in the ME are considered additional because they manufacture qualifying plastic materials from qualifying feedstocks.

The positive list was established using the activity penetration option (Option A in the VCS Standard). Justification for the activity method is provided in Appendix I of the ME. Evidence provided by the methodology developer demonstrates that the production of plastic from biopolymers is a 'first of its kind' technology for manufacturing plastic material. This establishes that the positive list in the ME is appropriate and the Observed Activity level is correctly assessed as zero. As a result, the applicability conditions in the ME are deemed adequate to exclude non-additional project activities.

The ME also includes a requirement for project activities to demonstrate regulatory surplus. This is consistent with the requirements in the VCS Standard for activity methods.

3.9 Quantification of GHG Emission Reductions and Removals

3.9.1 Baseline Emissions

The ME provides procedures and equations for the calculation of baseline emissions. Specifically, baseline emissions within the project boundary are quantified as the sum of two components: avoided

emissions associated with traditional petroleum-based plastic manufacturing, and emissions reductions associated with the capture and sequestration of CO_2 and/or CH_4 in plastic material produced.

Avoided emissions from the displacement of traditional plastics are determined from the product of the quantity of plastic material produced and an appropriate emission factor. Default emission factors by plastic type for the United States are provided in an appendix to the ME. The Audit Team confirmed that the US EPA reference for the emission factors referenced is appropriate and meets VCS requirements for default factors, as specified in the VCS Standard at 4.1.7. The overall approach to the first component of baseline emissions was also deemed appropriate because quantification relies on the direct measurement of the quantity of bioplastic produced. The quantification is also conservative because it requires the mass of any plastic additives to be deducted from the total quantity of plastic material produced. This step is appropriate as it ensures that baseline emissions are based solely upon the quantity of plastic material produced exclusive of any additives included in the final product weight. The ME also provides a procedure for determining emission factors for projects located outside the United States. The Audit Team confirmed that the procedure for emission factors referenced is appropriate and meets VCS requirements for default factors, as specified in the VCS Standard at 4.1.7.

The second component of baseline emissions - emissions from the sequestration of CO_2 and CH_4 - is quantified based upon the stoichiometric ratio of GHGs to carbon in the plastic material produced. For any plastic material, a ratio is calculated from its chemical composition that represents the metric tonnes of GHG consumed per metric tonne of plastic produced. This approach is justified because the reactions that take place to form plastic material occur in precise ratios of inputs to outputs. Therefore, the result that is quantified conservatively represents the minimum quantity of GHG that would chemically be required to produce the quantity of plastic material created by the project. This ensures that baseline emissions exclude any quantity of GHG that a project may consume above and beyond what is chemically necessary to produce the eligible plastic material.

Where CH_4 is used as a feedstock, the ME accounts for any fraction that would have been destroyed through flaring in the baseline scenario. This is considered “non-qualifying” methane and therefore is assumed to be oxidized to CO_2 in the baseline scenario. Accordingly, baseline emission equations credit the sequestration of “non-qualifying methane” as CO_2 (i.e., the non-qualifying CH_4 quantity is converted to CO_2 and a GWP of 1 is applied); credit for the full GWP of CH_4 is given only to the fraction of CH_4 sequestered that is “qualifying methane.” The Audit Team assessed this procedure to be sufficient and conservative because it ensures that only the fraction of methane that would not already be destroyed is accounted as sequestered.

The ME provides completed quantification procedures for all SSRs included in the baseline scenario. The Audit Team reviewed all formulae and quantification methods for accuracy and concluded that the approach to calculate baseline emissions is appropriate, adequate, without arithmetic error, and consistent with the VCS Standard.

The procedure for estimating baseline emissions also includes a QA/QC step to validate the quantity of GHG sequestered, as determined from the stoichiometric ratio of GHG to plastic material. Specifically, a project must use direct flow measurements to record the quantity of CO_2 or CH_4 used to make plastic material. The quantity metered must be greater than the quantity of GHG sequestered in plastic as calculated from the ME’s baseline equations. This requirement provides a check on the stoichiometry used in the second component of baseline emissions quantification as well as the overall efficiency of the plastic manufacturing process by providing a real, direct measurement of GHGs sequestered. It ensures the integrity and appropriateness of the baseline emission equations through review and justification of any material discrepancies between the calculated and metered quantities of GHG sequestered during subsequent verification activities, where they will be subject to verifier professional judgement.

3.9.2 Project Emissions

The ME provides procedures and equations for the calculation of baseline emissions. Specifically, project emissions within the project boundary consistent of three components:

- emissions released during end-of-life incineration of plastic material;

- emissions from purchased electricity at the project facility; and
- emissions from fossil fuel combustion at the project facility.

CO_2 is released back to the atmosphere if plastic material is incinerated at its end-of-life. The methodology accounts for project emissions of CO_2 from end-of-life plastic incineration to ensure that credit for GHGs sequestered in the baseline scenario are not overstated. Appendix II provides details on requirements for selection of appropriate data sources for the fraction of plastic material incinerated at end-of-life, including a global default factor. The procedure is appropriate because it explicitly requires conformance to all VCS requirements for default factors.

Emissions from electricity consumption at the project facility are quantified based on the quantity of electricity consumed at the project facility. The quantity of electricity consumed is multiplied by an regional emission factor for project activities located in the United States. Project activities located outside the United States use the CDM *Tool to calculate the emission factor for an electricity system"* to determine the appropriate emission factor for electricity consumed.

Emissions from fossil fuel consumption at the project facility are quantified based on the fuels consumed during the plastic production process. The quantity of fuel consumed is multiplied by an appropriate IPCC emission factor.

The ME provides complete quantification procedures for all SSRs included in the project scenario. The Audit Team reviewed all formulae and quantification methods for accuracy and concluded that the approach to calculate project emissions is appropriate, adequate, without arithmetic error, and consistent with the VCS Standard.

3.9.3 Leakage

The ME establishes the potential for leakage emissions associated with the diversion of biomethane from beneficial uses to the production of plastic material. If a Project Activity consumes an existing source of biomethane that was previously utilized in a different application, the potential exists for that application to be continued with fossil fuels instead. The ME requires projects to demonstrate that the quantity of methane utilized as a feedstock is the result of an expansion of gas collection activities at the methane source or represents hitherto unutilized gas.

The Audit Team concluded that this procedure is sufficient to mitigate the potential of any leakage emissions. Diversion of methane gas, which has energy value, from other productive uses and its subsequent replacement by fossil fuels is the only potential avenue by which a Project Activity may cause an increase in GHG emissions outside the GHG assessment boundary. The procedure provided requires demonstration that the potential for such an increase does not exist at the project level; therefore, First Environment concluded that the ME's procedure for addressing leakage is appropriate and sufficient.

3.9.4 Net GHG Emission Reductions and Removals

Emission reductions are calculated as the difference between baseline and project emissions. The Audit Team determined that this approach to calculate emission reductions is appropriate, adequate, and consistent with the VCS Standard. The equations laid out in the ME are without error. The Audit Team did not identify any uncertainties associated with the quantification of net GHG emission reductions.

3.10 Monitoring

The monitoring of all data and parameters required to quantify emissions are described and appropriately defined in the ME. Specifically, the ME identifies all data and parameters as either monitored or not monitored. The descriptions include source of data, unit of measurement, measurement procedures and frequency, default values where appropriate, quality control and quality assurance procedures, and other comments necessary for project implementation or validation/verification. The ME requires that factors used in the emission reduction calculations are from reputable sources and/or representative of the emission source or activity for which they relate.

All parameters defined in Sections 9.1 and 9.2 of the ME can be mapped to equations in Section 8. The data/parameters available at validation and data/parameters monitored described in the ME provide an exhaustive set of parameters needed to populate all equations used for the quantification of baseline and project emissions.

Further detail on the data and parameters provided in the ME, as well as the Audit Team's assessment conclusion, is summarized in the tables below.

Parameters Available at Validation

Parameter	Assessment Conclusion
DF_{EL}	ME provides adequate detail for project proponents to identify the most appropriate value based on country-specific information. A default factor of 15% is provided from the US EPA for projects in the United States. Additional guidance is provided in Appendix II. All information is appropriate for the intended application.
EF_i	ME identifies that the default values in Appendix II may be used for projects in the United States or projects must use data sourced from a national environmental authority. Appendix II provides detailed instruction on the selection of appropriate emission factors. These sources provide adequate accuracy for the purpose of quantifying baseline emissions associated with the displacement of traditional plastic materials. All information is appropriate for the intended application.
Molecular weights of CO_2, CH_4 and plastic material	ME specifies values of 44 and 16 for CO_2 and CH_4, respectively. These values are the known molecular masses of the gases. All information is appropriate for the intended application.
RCM_{C02} and RCM_{CH4}	ME specifies values of 27.27% and 75% for the percentage carbon by molar weight in CO_2 and CH_4, respectively. These values are calculated correctly from the known chemical formula of each gas. All information is appropriate for the intended application.
GWP of CH_4	ME identifies that the current IPCC value for the GWP is to be used. This is consistent with the requirements of the VCS standard. All information is appropriate for the intended application.
$FC_{,y}$	ME identifies that IPCC default fuel-specific energy content factors are to be applied. This resource provides adequate accuracy for the purpose of quantifying project emissions associated with fuel consumption. All information is appropriate for the intended application.
$EF_{a,y}$	ME identifies that IPCC emission factors are to be applied. This resource provides adequate accuracy for the purpose of quantifying project emissions associated with fuel consumption. All information is appropriate for the intended application.

Monitored Parameters

Parameter	Assessment Conclusion
$Q_{gross,i,y}$ and $Q_{add,i,y}$	ME provides adequate detail for project proponents to establish monitoring procedures for determining mass of plastic material produced as well as any additives used. The ME further specifies specific QA/QC procedures for measurement devices relevant to the monitored parameter. All information is appropriate for the intended application.
$Q_{CO2,meter,y}$ and $Q_{CH4,meter,y}$	ME identifies that the parameter is measured using volumetric of mass flow meters at the project facility. Data must be monitored continuously and recorded at least daily, which is sufficient frequency to ensure data integrity and usefulness. The ME further specifies specific QA/QC procedures for measurement devices relevant to the monitored parameter. All information is appropriate for the intended application.

Parameter	Assessment Conclusion
$QF_{Per,y}$	ME provides definitions for qualifying methane and outlines a procedure to determine this fraction at the project-level. Specifically, the supplier of methane must provide information about regulatory requirements to destroy methane and historical utilization of methane at the source. This approach provides adequate guidance for the determination of the quantity of methane that would be destroyed in the baseline scenario. All information is appropriate for the intended application.
$Q_{elec,y}$	ME provides adequate detail for project proponents to establish monitoring procedures for determining electricity consumption by the project. All information is appropriate for the intended application.
EF_{elec}	ME identifies that the US EPA eGrid database or utility-specific emission factors will be used for projects in the United States and specifies the use of similar resources for projects elsewhere. The CDM Tool *'Tool to calculate the emission factor for an electricity system'* may be used for projects in developing countries. These sources provide adequate accuracy for the purpose of quantifying project emissions associated with electricity consumption. All information is appropriate for the intended application.
$Q_{ff,y}$	ME provides adequate detail for project proponents to establish monitoring procedures for determining fossil fuel consumption by the project. All information is appropriate for the intended application.

Section 9.3 of the ME includes a qualitative narrative of the major components of the Monitoring Plan. The ME provides sufficient detail in this section to allow users to develop a comprehensive programme for monitoring all relevant inputs to baseline and project emissions quantification. The ME also specifies that all data shall be retained for at least two years after the end of the last crediting period, consistent with VCS requirements.

The Audit Team determined that the monitoring approach, including the identification of specific requirements for data and parameters, is appropriate and sufficient to obtain the necessary information for accurate emission reduction quantification as well as meets relevant requirements in the VCS Standard.

4 ASSESSMENT CONCLUSION

First Environment performed the methodology assessment of the ME as part of the VCS double-approval process. First Environment used the VCS Standard as the criteria for the assessment. The assessment process was further guided by the VCS Methodology Approval Process and the VCS Program Guide.

The review of the ME and the satisfaction of corrective action and clarification requests have provided First Environment with sufficient evidence to determine the fulfillment of stated criteria.

The ME was prepared in accordance with the VCS Standard, the VCS Methodology Approval Process, and the VCS Program Guide. The proposed methodology belongs to Sectoral Scope 3 – Energy demand.

In summary, it is First Environment's opinion that the ME titled, "Greenhouse Gas Capture and Utilization in Plastic Materials," Version 4, dated July 16 2018, meets all relevant VCS requirements without limitation or qualification.

5 REPORT RECONCILIATION

The second assessment resulted in minor revisions to the ME, including:

- the addition of several additional terms in Section 3, Definitions;

- addition of several new applicability requirements in Section 4, Applicability Conditions;
- separation of parameters into multiple parameter boxes;
- formatting and other minor edits throughout the ME for clarity and ease of use.

First Environment reviewed these revisions in the final ME, Version 5, dated October 31, 2018. Based on this review and discussion with the Verra and ME developer representatives, First Environment concluded that these revisions do not affect our determination that the ME meets all relevant VCS requirements.

6 EVIDENCE OF FULFILLMENT OF VVB ELIGIBILITY REQUIREMENTS

The ME is classified under VCS Sectoral Scope 3 – Energy demand, which falls within the Sectoral Scope Group 01 (GHG emission reductions from fuel consumption), as defined by the American National Standards Institute (ANSI). First Environment, Inc. holds accreditation to perform validation for projects under Group 01. First Environment has also completed more than 10 methodology and project validations, collectively, in ANSI Group 01 as documented in the VCS Project Database and Catalog of Approved Methodologies, Modules & Tools. First Environment, therefore, is eligible under the VCS program to perform assessments for the ME.

7 SIGNATURE

Signed for and on behalf of:

Name of entity: *First Environment, Inc.*

Signature: 

Name of signatory: *James Wintergreen*

Date: *March 26, 2019*

APPENDIX A

Resolution of Corrective Action Requests and Clarification Requests

ID	Corrective Action Request	Summary of Methodology Developer Response	Assessment Conclusion
1	The default baseline emission factors for EF_i in Table 4 of Appendix II are not converted correctly from short tons to metric tonnes. Additionally, default emission factors for the United States should be updated to utilize the most recent version of U.S. EPA WARM model (i.e. v14)	The default emission factors for EF_i in Appendix II were revised for consistency with the most recent version of the US EPA Warm tool. Additionally, transformations of look up values were reviewed to ensure the correct conversion from short tons to metric tonnes.	Response is acceptable.
2	The methodology does not contemplate the potential use of recycled plastics in the baseline scenario. See emission factors from US EPA WARM.	Emission factors in Appendix II were revised to account for the fraction of plastic that is recycled and are consistent with the most recently available data from the US EPA WARM tool.	Response is acceptable.
3	The description of the Activity Method in Appendix I of the methodology is missing information with respect to Applicability Conditions and the Baseline Scenario, as required by the VCS New Methodology template.	Appendix I was revised to be consistent with the requirements of the VCS New Methodology template.	Response is acceptable.
4	Please justify why sectoral scope 5 (chemical industries) was not considered during the evaluation of similar approved or pending methodologies. See CDM methodology AM0027 for example.	Table 1 in the ME was revised to include discussion of AM0027 and provide justification for dissimilarities.	Response is acceptable.

ID	Corrective Action Request	Summary of Methodology Developer Response	Assessment Conclusion
5	Potential fugitive emissions of captured CH_4 and/or CO_2, and other potential process non-energy emissions associated with the project activity are not accounted for as an SSR in the project scenario nor are monitoring and quantification procedures provided. As a result, the procedure for the quantification of baseline emissions has the potential to result in overstatement of the total reductions attributable to a project.	The quantification of baseline emissions in Section 8 of the ME and the associated monitoring parameters in Section 9 were revised to include a comparison between the metered quantity of CO_2 or CH_4 consumed and the calculated quantity determined from the stoichiometric ratio of the feedstock and the plastic material produced. Total baseline emissions are calculated as a function of the quantity of plastic produced. Because the production process is not 100% efficient and will always require more inputs than the stoichiometric ideal, this quantity will always be lower than the metered quantity of GHG feedstock. If this condition does not hold, the project developer must provide sufficient documentation and explanation to the verifier.	This procedure ensures that no fugitive emissions of feedstock gas are credited as baseline emissions. Response is acceptable.
6	Please provide justification that no leakage emissions need to be considered with regard to alternative uses of qualifying CH_4 utilized in project activities.	Section 8.3 of the ME was revised to include a procedure to assess the potential for leakage at the project-level.	Response is acceptable.
7	The parameters Q_{CO2y} and Q_{CH4y} in Section 9.2 of the ME do not provide a procedure for converting volumetric measurements recorded by flow meters to mass flows of GHGs or performing an analysis to determine the composition of feedstocks.	The boxes for the parameters Q_{CO2y} and Q_{CH4y} in Section 9.2 of the ME were updated to include information on the use of volumetric flow measurements. Additional clarification was added to specify that CO_2 and CH_4 may not be blended in a project activity for the production of plastic.	Response is acceptable.
8	Please justify the inclusion of biogenic emissions of CO_2 in the baseline scenario SSR 'Captured GHGs.'	VCS provided clarification that the inclusion of biogenic emissions of CO_2 in the baseline scenario is acceptable.	Response is acceptable.
9	Please provide justification for setting the margin of error in the input/output QA check at 10%.	The QA check in the ME was revised as a result of revisions made in response to Issue #5 above, so the finding is moot.	Resolution to Issue #5 provides an adequate QA check. Response is acceptable.

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10	Please include a requirement for the project developer to hold a contract with the supplier of the eligible CH_4.	Section 4 of the ME was revised to include the specified applicability condition.	Response is acceptable.
11	The methodology inconsistently uses tCO_2 and tCO_2e in reference to data units for emission and conversion factors.	All unit labels in the ME were revised to specify units of tCO_2e in equations and conversion factors when applying global warming potentials.	Response is acceptable.

ID	Clarification Request	Summary of Methodology Developer Response	Assessment Conclusion
1	Regarding the project scenario SSR, please clarify whether the methodology limits relevant to emissions to purchased electricity and natural gas combustion or if other fuel and energy types are incorporated.	Newlight clarified that the SSR encompasses all solid, liquid, and gaseous fossil fuels. Additional detail was added to the description of the SSR in the ME.	Response is acceptable.
2	Please clarify why the exclusion of CH_4, N_2O, and other GHGs in the project scenario is considered to be conservative.	Text in the ME was revised to clarify that these emissions are excluded for simplicity, not conservatism.	Response is acceptable.