2023 OUTPUT AUDIT REPORT

For PURO.EARTH

Company / CO_2 Removal Supplier	V-Grid Energy Systems
Production Facility Name	V-Grid Biochar Facility
Production Facility Addresses	Site 1: South Corner Dairy 8150 Ave 360, Visalia, CA 93291 Site 2: V-Grid Energy 513 Calle San Pablo, Camarillo, CA 93012
Production Facility Coordinates	Site 1: 36°26'52.2"N 119°23'26.6"W Site 2: 34°12'26.4"N 119°02'22.0"W
Net Volume of CO_2 Removal	207 CORCs
Removal Method	Biochar
Removal Period	01/01/2023 – 02/29/2024
Auditor	Bill Chatterton 350Solutions, Inc.

APRIL 3, 2024

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2023 OUTPUT AUDIT REPORT

Company: V-Grid Energy Systems	Company Contact: Jeff Norton	Audit Team: *Bill Chatterton Tim Hansen, PE
Removal Method: Biochar		
Report Date: 04-03-2024		
Document No: 350VR-VG-PU2401		
Rev: 2.1		

** primary contact/lead author*

1. INTRODUCTION

350Solutions was contracted to perform an audit of carbon dioxide (CO_2) removal credit (CORC) claims for V-Grid Energy Systems Biochar production and utilization for the period of January 1 through October 31, 2023. 350Solutions declares that we are an impartial auditor, free from any conflicts of interest, capable, and qualified to complete this audit according to Puro Standard and related Validation and Verification Body Requirements.

V-Grid Energy has developed a proprietary gasification system that utilizes biomass to produce energy, biochar, and other products. V-Grid has dubbed the distributed-scale biomass to energy system the BioServer. The biochar produced by V-Grid is a charcoal-like substance with a high carbon content made from biomass. Due to the unique absorbency characteristics and high level of carbon, biochar is often beneficial in agricultural, environmental, and industrial applications. V-Grid currently operates two facilities in California:

- A gasification facility consisting of three gasifier units and one engine generator (V-Grid Bioservers) operating at South Corner Dairy in Visalia, California. The facility utilizes waste pistachio shells from a local supplier to produce raw biochar, wood vinegar, and bio-oil, as well as syngas which is used to operate an engine generator and produce electricity for use on-site by the dairy farm.
- A research, development, and production facility in Camarillo, California which operates one gasifier and generator (V-Grid Bioserver) on pistachio shells, producing biochar, wood vinegar, bio-oil, and electricity, which is exported to the grid. The Camarillo facility also performs raw biochar processing, including biochar grinding, sizing, packaging, and shipping of final product.

Biochar is currently sold primarily to agricultural users and golf courses for soil amendment, and has been utilized for wetland restoration projects, research, and consumer products, such as cat litter deodorizer.

The biochar production process and sub-processes used by V-Grid for carbon removal, with respect to the Cradle-to-Grave lifecycle CO_2 emissions assessment (LCA) and system boundaries according to the Puro Standard General Rules, are shown in Figure 1.

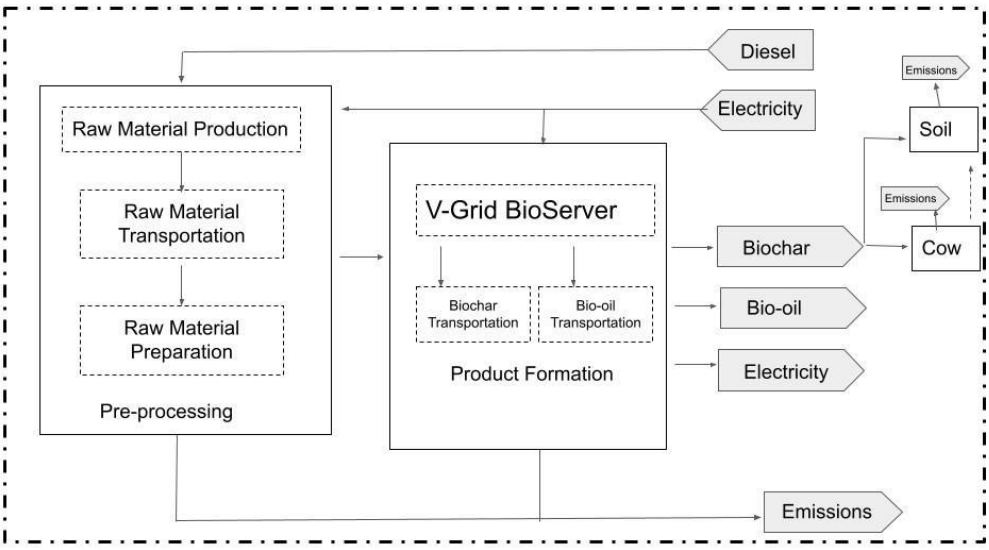

Figure 1. System Boundaries for the V-Grid Energy Systems Biochar Process

In June 2022, 350Solutions conducted an audit of the process, LCA, and other administrative details to verify compliance with the requirements of the Puro.Earth Puro Standard General Rules (Version 3.1) and the Puro Biochar Methodology (Edition 2022, v 2) [1], [2]. This follow-up output audit was conducted to verify VGrid's reported CORCs for the period of January 1 through October 31, 2023.The audit and verification began with a document review followed by a teleconference audit on January 16, 2024 and subsequent follow up document review.

TABLE 1. V-GRID ENERGY SYSTEMS OUTPUT AUDIT SUMMARY

Verification Summary	
CO_2 Removal Supplier	V-Grid Energy Systems
Production Facility Name	V-Grid Biochar Facilities: Site 1 – South Corner Dairy, Visalia, CA, GSRN: 643002406801000633 Site 2 – V-Grid Energy Systems, Camarillo, CA, GSRN: 643002406801000626
Removal Method	Biochar – Production from agricultural waste (pistachio shells) and use as soil amendment
Verified CORC Factor	2.50 tonne CO_{2eq} / tonne dry biochar
Verified CORCs	207 CORCs (207 at Site 1 South Corner Dairy, 0 at Site 2 Camarillo)
Output Audit Date	03-20-2024
Audit Report Date	04-03-2024
Production Facility Locations (Address and GPS Coordinates)	Site 1: South Corner Dairy 8150 Ave 360, Visalia, CA 93291 36°26'52.2"N 119°23'26.6"W Site 2: V-Grid Energy 513 Calle San Pablo, Camarillo, CA 93012 34°12'26.4"N 119°02'22.0"W
Audit Type	Output Audit for Puro.Earth Puro Standard General Rules Version 4 and Puro Biochar Methodology Version 2

2. AUDIT SUMMARY

2.1. AUDIT APPROACH

A planned series of audit activities were conducted by 350Solutions to independently validate and verify facility operations, production and output data, and CORC claims. The audit was conducted following the specifications of Puro General Rules the Puro Biochar Methodology. Specific audit activities conducted are summarized in Table 2. A completed Puro Biochar Methodology Compliance Checklist used during the audit is attached to this report as Appendix 1. Verifier qualifications are attached as Appendix 2.

TABLE 2. AUDIT ACTIVITIES

Date(s)	Verification Activity	Verification Tasks	Documents Reviewed
01/10-3/20/2024	Document and Data Review	- Review of LCA and supporting documentation - Review of Puro CORC calculations - Review of facility registries and permits - Review of raw material sources and sustainability - Review of system inputs and outputs - Review evidence of product output - Review of product properties - Review of product end use	- Facility information Puro registry_South Corner Dairy_06222022.pdf - Facility information Puro registry_V-Grid Energy Systems_06232022.pdf - LCA calculation spreadsheet (file: Vgrid LCA Calc V17_Annual Audit_2024_2) - Calibration-Measure Certificates 2023-03-Vgrid Energy Annual S31821.pdf - Scale Certifications.pdf, Scale Certification_Camarillo_2023-03-VGrid Energy-Annual-S31821.pdf - Daily Rpt Extract_PURO Daily Operations Carbon Report V1.xlsx - EXAMPLE_Daily Site Log_29-Jun-2023_SCD Auto. Feed REV N629.xlsm - 0_EXAMPLE_Inv 2023-0345.pdf - 0_EXAMPLE_Persist BIOCHAR Quote - 2023-10-11 - GAR Bennett (1).pdf - EXAMPLE_Scale Receipt_Trucking of Pistachio Shell Feedstock.pdf - Pistachio Shell_Truck Weight-Schedule_Jan-Oct 2023.xls - Pistachio Shell_Truck Weight-Schedule_Jan2023--Feb2024.xlsx - Proof - Source of AG Waste Biomass - Pistactio Shells.pdf - Raw Material Pistachio Shells Analysis.pdf, 17-MAR-2023_3030378-01 Proximate Biochar Report.pdf - VGrid Biochar Sales Report_2023-Jan-1 to 2024-Feb-29_Norton_1 - VGrid--puro_biochar_Calculator for biochar carbon stored_v2022-05-09--2.xlsx - 02_CORC Calculation Biochar_SCD Visalia California
01/16 and 3/20/2024	Teleconference Audits	- Opening meeting and review of operational and procedural changes - Review of LCA and supporting documentation - Review of Puro CORC calculations - Review of system inputs and outputs - Review evidence of product properties and output - Review of product end use - Review of equipment and calibrations	- Review of operations, measurement points, and instrumentation - Documentation review of feedstock receipt, production logs, equipment utilized, data collected, material handling equipment and procedures, Bioserver and other process operations. - Discussion and review of information provided in documents listed above.

2.2. PROCESS INPUTS & OUTPUTS

The V-Grid Bioserver uses waste biomass as its primary feedstock, with air input to support gasification (internal heating), emission control via thermal oxidizer or combustion in the Bioserver engine-generator, and production of biochar, electricity, bio-oil, and wood vinegar products. Energy related inputs include fuel (diesel and propane) for materials handling equipment, electricity for systems operation (fully provided by the V-Grid system typically and net-metered, power generation, and fuel (propane) for occasional engine or thermal oxidizer startup. Gasifier startup is completed via ignition of biomass with an electrical heater. The process uses water for biochar handling safety and moisture content management for final product. Table 3 summarizes the observed inputs and outputs from the process and typical rates from supplied operational data.

TABLE 3. VERIFIED PRODUCTION FACILITY INPUTS & OUTPUTS – 01/01/2023 - 02/29/2024

Input/Output	Verified Rate	Notes (Specifications, source, etc.)
Waste Biomass input (pistachio shells)*	626.6 tonne	Waste biomass used is pistachio shells, from delivery load log
Biomass supply inputs (collection, handling, transportation emissions), (Ebiomass)	49 kg CO_{2eq} per tonne biochar	Emissions are from transport of biomass feed to facility. Verified average transport distance is 82.5 mi.
Production inputs: - materials handling equipment (diesel) - process startup, material handling (propane) - site electricity use (zero, as it is net metered from on-site production)	0.60 gal/tonne biomass 43 scf/tonne biomass 88.9 kwh/tonne biomass	Note that site electricity usage is typically provided by the VGrid Bioserver units and is therefore zero.
Production water input	0.88 gal/hr	Water use for evaporative cooling (primary use) and biochar quench (as needed), from LCA
Biochar production output	82.78 tonne, dry basis	Biochar production during normal operations from LCA data and production logs
Production and operation emissions output (Eproduction)	257 kg CO_2e per tonne biochar	Emissions from all production process and supporting equipment, including gasifier startup, burnout, and operation, engine startup, material handling equipment fuel usage, water production for process usage, packaging, equipment manufacture, and biochar transport to packaging facility.
Product distribution emissions output (Euse)	79 kg CO_2e per tonne biochar	Verified based on transport distance from Camarillo CA to purchaser

**Values based on data for the 1/1/2023 – 02/29/2024*
Values based on LCA input data and production log data.

2.3. VERIFIED OUTPUT & CORCS

Table 4 includes the specific CORCs claimed by V-Grid Energy Systems for its Visalia and Camarillo facilities, as well as the level verified by 350Solutions during the on-site audit and data review.

TABLE 4. VERIFIED CORCS FOR V-GRID ENERGY SYSTEMS

Performance Metric Name / Description	Claimed Value*	Verified Value	Data Source	Reporting Period
CORC Factor	2.50 tonne CO_{2e} / tonne biochar	2.50 tonne CO_{2e} / tonne biochar	- LCA calculation spreadsheet (file: Vgrid LCA Calc V17_Annual Audit_2024_2) - Raw Material Pistachio Shells Analysis.pdf, 17-MAR-2023_3030378-01 Proximate Biochar Report.pdf - VGrid production data log (file Daily Site Log_29-Jun-2023_SCD Auto. Feed REV N629.xlsm - VGrid Biochar Sales Report_2023-Jan-1 to 2024-Feb-29_Norton_1 - Puro CORC Calculator file (02_CORC Calculation Biochar_SCD Visalia California	01/01/2023 -02/29/2024
Biochar Volume	82.8 tonne (dry)	82.8 tonne (dry)		
Total CORCs	Site 1 South Corner Dairy: 207 CORCs, Site 2 Camarillo : 0 CORCs, **207 Total CORCs**	Site 1 South Corner Dairy: 207 CORCs, Site 2 Camarillo : 0 CORCs, **207 Total CORCs**		

**Claimed values are those submitted by VGrid after completion of revisions based on results of audit.*

3. AUDIT FINDINGS

3.1. SUMMARY OF AUDIT FINDINGS

350Solutions has reviewed and audited the documentation of the technology, the instrumentation, the procedures, performance and collected data and has found that the data presented in the Puro Audit Package and follow up conversations:

☒ ***Meets the requirements of the Puro General Rules and the Annex A Biochar Methodology***

☐ ***Meets the requirements of the Puro General Rules and the Annex A Biochar Methodology with minor modifications***

☐ ***Does Not Meet the requirements of the Puro Standard General Rules and the Annex A Biochar Methodology***

A summary of specific findings associated with each requirement of the Puro Standard and Biochar Methodology and any identified issues with the audit are summarized below.

TABLE 5. AUDIT FINDINGS

Puro Standard Biochar Method. Section Ref.	Audit Verification Topic	Final Findings
1.1.1 *5.2.1*	*Sustainable Feedstock*	Acceptable. V-Grid obtains waste pistachio shells for all operations locally. All pistachio shells would typically be disposed of in local landfills.
1.1.2 *5.4.2*	*Biochar Use*	Acceptable. V-Grid has demonstrated demand for biochar product for soil amendment use from several end users. All invoices indicate use for soil amendment, wetland restoration, or other similar land application. No biochar claimed for CORCs is used in energy

		generation. Future applications (currently in inventory) and sales also include consumer products, such as small bags of biochar, odor absorbent, and cat litter with biochar.
1.1.3 *5.2.2* *5.3.3* *5.4.1*	*Net-Negative LCA*	Acceptable with modifications. V-Grid has demonstrated an appropriate basis for CORCs according to the Puro Biochar Methodology after required LCA modifications were completed. Because of continuing process, operations, product, and end-user changes, an updated LCA was provided for this output audit.
1.1.4	*Prohibition of Fossil fuel use for process heat*	Acceptable. Process heat is provided by internal combustion of biomass-derived syngas. Propane is occasionally used for engine and oxidizer startup during process startup and transition to steady operation.
1.1.5	*Negligible methane emissions*	Emissions from the process only occur from the engine exhaust or the thermal oxidizer exhaust. The thermal oxidizer operates at conditions such that no methane emissions are anticipated. The engine-generator may have minor VOC emissions, as documented in the emission test results provided by Engine Distributors for the Ford Engine operating on LPG and based on syngas composition data provided in the Appendices of 'Application to Construct One VGrid Bioserver Unit – December, 2019'. Methane emissions will be negligible based on the <3% C2 or greater hydrocarbon content in syngas and anticipated max emission factor of 0.11g/kwh.
1.1.6, 5.3.4	*Molar H:C Ratio < 0.7*	Acceptable. Biochar analytical results have demonstrated molar H:C ratio of 0.23
1.1.7	*Safe Environment & Biochar Handling*	Acceptable. V-Grid continues to operate legally under an authorization to construct and temporary operating air permit issued by Ventura County Air Pollution Control District (4-27-2022) for its Camarillo facility. It also operates under an Authorization to Construct construction air permit for its Visalia facility (02/16/2022 and 06/18/2020). Final permits to operate from both jurisdictions remain pending. Biochar is kept in reduced air environments after collection with a fully integrated quench system.
1.2.2	*Environmental & Social Safeguards*	Acceptable. V-Grid operates under air permits discussed above and written internal safety and operational procedures.
1.2.3	*Demonstrated Additionality*	Acceptable. V-Grid has submitted that: The project is not required by existing laws, regulations, or other binding obligations. Additional revenue derived from Carbon Credits will support V-grid by providing needed revenue to improve system and company financials (operations are currently cash-flow negative) and by providing revenue to scale up and operate additional facilities, for which additional capital for equipment purchases is required and will be supported by CORC sales.
1.2.4 *5.3.1* *5.3.2*	*Biochar Quantification*	Acceptable. The final packaged biochar products are measured at the Camarillo facility (ALL biochar is shipped to and processed in Camarillo) using a calibrated weigh scale, and all final product amounts included in inventory spreadsheets as are all sales. V-Grid also documents biochar and other product production in daily production logs. The LCA inputs are complete (see revised LCA file v17-2).
1.2.5	*Verified Production Facility standing data*	Acceptable. Conformance to the requirements of Section 1.2.5 of the Biochar methodology is documented and verified.

5.2.1	*Feedstock Sustainability Proof*	V-Grid has demonstrated that its feedstock is solely waste pistachio shell which are otherwise destined for landfilling. Shipping documents from the supplier, Wonderful Corp. were provided as evidence.
5.4.3	*Justification of Soil Temperature*	Acceptable. An appropriate soil temperature of 15°C was used for LCA use in the California region or as a default value.
5.5.2	*Statement re: Double Counting*	Acceptable. V-Grid is aware of end-user customer practices and assures no-double counting is taking place. For future orders, V-Grid will be incorporating language in its quotes prohibiting double-counting and claiming of carbon credits for use of its product.
5.5.3	*Marketing / Branding Restrictions on end-user*	Acceptable. Documentation of product sales and shipment were reviewed and verified. Documentation of end-use is included in sales invoices log. V-Grid will also be incorporating language prohibiting use of biochar for energy purposes in future quotes.

Additional details regarding audit activities, documents reviewed, and observations during the audit process are summarized in Appendix 1.

The output audit identified certain updates to V-Grid operations and biochar production data that impact the LCA and quantification of CORCs including:

- All CORCs from this reporting period were generated by biochar production at Site 1 – South Corner Dairy.

- The carbon content of biochar produced is revised down from 90.58% to 87.80% based on the latest independent laboratory analysis.

- In 2023, V-Grid began changing biochar cooling systems to chillers, compared to an evaporative cooling system seen in the initial audit. The chiller is a model NQA10 manufactured by Thermal Care, Inc. (https://www.thermalcare.com/nq-ton-air-cooled-portable-and-packaged-chiller/). While the chiller uses more power, it requires significantly less water for production. The net result is a decrease in the CORC rate.

- Water Usage is revised to 0.88 gal/hr due to the operational change to closed-loop chiller systems.

- The LCA was updated to include emissions associated with product shipping for e-commerce, and embodied emissions from the added chiller equipment.

- The distance shipped to customers increased significantly in 2023. The previous LCA was an average of 200 miles, while the average distance for 2023-2024 has increased to 756 miles, resulting in a net increase in E_{use} emissions.

3.2. AUDIT ISSUES

Between the initial production facility and output audit and this 2023 output audit, reporting and implementation requirements have all been addressed by V-Grid. No further action is required.

Sufficient information was provided by V-Grid to support the output audit for the reporting period with respect to all data, claims, and verified CORC values.

After initial review of the audit data package for 2023 V-Grid production, auditors requested revisions to the LCA and CORC calculations that addressed certain issues. In response, V-Grid provided Version 17 of the LCA which included emissions estimates for transport of product for e-commerce (adjustments to Euse), updated biochar moisture content values according to most recent laboratory analysis of biochar and updated the reporting period through February 29, 2024.

The following items are those that did not require immediate action and are recommendations for improvement of future LCAs, as well as monitoring and recordkeeping procedures. Addressing these recommendations to improve future data quality is suggested but is not required.

3.3. RECOMMENDATIONS & OPPORTUNITIES FOR IMPROVEMENT

Based on the above audit findings, 350Solutions has the following requirements and recommendations for improvements prior to the next output audit and verification.

- Ensure any significant new equipment is identified and the lifecycle emissions from manufacturing the equipment is added to future iterations of the LCA;
- Collect and analyze samples of biochar product for carbon, hydrogen, and moisture content on a more frequent basis. 350Solutions recommends monthly sampling and analysis due to the potential variability in process operations and feedstock;
- Obtain an annual statement or other evidence from the feedstock supplier indicating that the feedstock is a waste that is otherwise disposed of via landfilling or other method.
- Due to ongoing changes in operations and process improvements, we recommend an annual review and update of the LCA to ensure all activities, equipment, and processes are accounted for.
- There is potential for use of significant amounts of spare parts in the process, due to engine rebuilds and other equipment replacements (pall rings, filters, bellows, etc.). Over the predicted product life, these spare parts may add up to a significant quantity of materials, which should be accounted for in the LCA. Monitoring spare parts usage is recommended.

4. REVISION HISTORY

Original date of issue: March 29, 2024

Version	Date Issued	Noted Changes
Draft Versions (v1.0)	March 22, 2024	NA
Final Version (v2.0)	March 29, 2024	Internal review, final review of facility permits, addition of chiller embodied emissions to LCA

References

[1] Puro.Earth, *Puro Standard General Rules, Version 4.0, Edition Jan 2024.* *https://puro.earth/documents/*

[2] Puro.Earth, *Biochar Methodology, Version 2, Edition 2022.* https://puro.earth/methodologies/

See Appendix 1 for list of specific files reviewed during the output audit.

APPENDIX 1: PURO.EARTH BIOCHAR METHODOLOGY AUDIT CHECKLIST

2023 Output Audit - Biochar Methodology	
Audit ID	350PU-VG-02
Audit Inception Date	10 January 2024
Production Facility ID	V-Grid Biochar Facility / V-Grid Energy Systems
Production Facility Location	487 Calle San Pablo, Camarillo, CA 93012 South Corner Dairy 8150 Ave 360, Visalia, CA 93291
Auditing Body	350Solutions, Inc.
Auditor Initials	BC
QA	TH

Guideline Ref	Requirement	Requirement Met Y/N	Verification Remarks Insert auditors comments	Evidence Document Insert evidence used to verify requirement	Value Insert numerical value or description (if applicable)	Units Insert unit (if applicable)
Evidence Confirmation						
5	**All necessary evidence has been provided to the auditor by the Production facility as per Section 5 of the Biochar Guidelines and has been used to complete the compliance checklist.** **- Proof of sustainability of raw material for forest biomass (FSC, SFI, PEFC, other certifications)** **- Proof of sustainability of raw material for waste biomass** **- LCA data for biomass and biochar production, supply and use, including climate change impact and the contribution of each life cycle stages.** **- Proof of product quality: laboratory analysis of total organic carbon content, hydrogen content and H/Corg** **- Proof of production volume: documentation for the whole period and methodology applied to calculate the dry mass of biochar produced.** **- For mobile units or carbonizer operator: proof of load cell measurement of the biochar for the whole period, and water input measurement.** **- Proof of end use of biochar: offtake agreement, shipment, and other records indicating the intended use of biochar.** **- Justification on the soil temperature selected for the calculation of the biochar sequestration.** **- Proof of sales** **- Proof of no double counting/C positive marketing**	Y	1. Raw material is waste Pistachios from Wonderful Co. that are slated for landfill disposal or management and decomposition in site. VGrid obtained email confirmation from supplier, Wonderful Co. 2. LCA is complete and accurate. Initial findings were addressed and LCA revised to reflect all requirements and site operations. See Audit Report for details. 3. Lab test completed for biochar ult/prox analysis (and HC ratio). VGrid also analyzes product for moisture content using moisture balance/meter and BET surface area for char quality indicator 4. Production logs are provided documenting all biochar production, including weighed biochar amount and moisture content of biochar using appropriate methods. 5. Biochar is measured on calibrated weigh scale at Camarillo facility. Camarillo scale calibrated anually by certified calibration service (ANAB accredited for ISO 17025) AAA Weigh, Inc. Also weighed on weigh scale at Visalia . Water usage is now monitored. 6. Biochar use is documented in all invoices and in sales tracking spreadsheet. All uses for soil amendment, bioswales, or cattle feed supplement. Vgrid has added statements on quotes requiring end use to be non-energy purpose. 7. Soil temp used is average soil temp and meets average for california area where biochar is sold and used 8. VGrid has supplied invoices for all sales of biochar and current inventory claimed for CORCs 9. VGrid has added language to quotes stating C positive/C credit claims cannot be marketed by end users of biochar. No evidence of any such double counting or marketing observed, but no requirements currently in place.	1. Proof - Source of AG Waste Biomass - Pistactio Shells.pdf 2. LCA calc spreadsheet (file: Vgrid LCA Calc V17_Annual Audit_2024_1), 3. 17-MAR-2023_3030378-01 Proximate Biochar Report.pdf, 3080143-01 IBI Biochar Report.pdf 4. VGrid utilizes a spreadsheet log of all production data (file: (files:EXAMPLE_Daily Site Log_29-Jun-2023_SCD Auto. Feed REV N629.xlsm) 5. Camarillo weigh scale calibration (file: -Scale Certification_Camarillo_2023-03-VGrid Energy-Annual-S31821.pdf). 6. VGrid Biochar Sales Report_2023-Jan-1 to 2024-Feb-29_Norton_1, Biochar sales invoices also provided (numerous PDF files). 7. documented in Puro CORC Calculator file (02_CORC Calculation Biochar_SCD Visalia Californi) 8. Invoice files provided (numersou PDFs ex INV 2021-0181.pdf, etc.) 9. verbal discussion with VGrid.		
Eligibility Checklist						
1.1.1	**Biochar is used in applications other than energy.**	Y	All applications claimed for CORCs are indicated in invoices and records as soil amendments or animal feed supplement or bioswale application.	VGrid Biochar Sales Report_2023-Jan-1 to 2024-Feb-29_Norton_1		
1.1.2	**Biochar is produced from sustainable forest or waste biomass raw materials (consult list of raw materials).**	Y	Biomass used is waste pistachio shells from local farm and processors	Shipping documents for deliveries from Wonderful (file: Proof - Source of AG Waste Biomass - Pistactio Shells.pdf, Pistachio Shell_Truck Weight-Schedule_Jan-Oct 2023.xls)		
1.1.3	**LCA shows:** **- carbon footprint of the biomass production and supply** **- emissions from the biochar production process** **- carbon footprint of the biochar end use** **- cradle to grave**	Y	See 5 (item 2) above. LCA is complete and accurate with minor modifications required by 350 post-audit and completed by VGrid to comply with Puro methodology. Recommendations for improving LCA data and methods are provided in Audit Report.	LCA calculation spreadsheet (file: Vgrid LCA Calc V17_Annual Audit_2024_1)		
1.1.4	**Pyrolysis reactor input fuel for heating is not a fossil fuel. Unless only used for ignition/pre heating or in a mobile unit and the emissions are fully included in the LCA. The use of waste heat from other industrial processess (eg. Biodigesters, cement production) is permitted.**	Y	Gasifier produces syngas which is used for self-sustaining process heating. No additional inputs observed or observed in records.	Verified during initial production facility audit - On site observation, syngas analysis (file: ATC Ventura County ii - Appendix);		
1.1.5	**Pyrolysis gases are combusted or recovered. Bio-oil and pyrolysis gases can be stored for later use as renewable energy or materials.**	Y	Syngas from gasifier is combusted in on-site connected genset to produce electricity. Startup and burnout processes produce poor quality syngas which is then destroyed in a thermal oxidizer.	Initial production facility audit - Production / Operation logs (file: (files: DataFileExtract Rev05.xls (summary data), 06032022 Daily Site Log SCD Auto Feed REV 21 (logs provided for daily operation from 1/1/23-2/29/24)		
1.1.6	**The molar H/Corg ratio is less than 0.7.**	Y	Confirmed. 0.23 via calc based on lab result for biochar (prox / ult analysis)	17-MAR-2023_3030378-01 Proximate Biochar Report.pdf, 3080143-01 IBI Biochar Report.pdf		
1.1.7	**Evidence of safe handling and transport is provided and adequate for the production facility.**	Y	Vgrid controls moisture content to ~20% minimum unless customer specification requires less or more (some required 15%). Past sales have been completed of 0% mositure, but was problematicand practice discontinued. Moisture contents are measured via in-house lab analysis.	VGrid Biochar Sales Report_2023-Jan-1 to 2024-Feb-29_Norton_1		

Calculation Checklist						
4.2	**Qbiochar = Quantity of biochar produced and sold to end user. (dry char)**	Y	Confirmed	V Grid Biochar Sales Report_2023-Jan-1 to 2024-Feb-29_Norton_1 and 02_CORC Calculation Biochar_SCD Visalia Californi, DataFileExtract Rev05.xls (summary data), EXAMPLE_Daily Site Log_29-Jun-2023_SCD Auto. Feed REV N629.xlsm (logs provided for daily operation from 1/1/23-2/29/24	82.78	tonne
	FpTHTs = c + m x H/Corg	Y	Confirmed	V grid LCA Calc V 17_Annual Audit_2024_1	89.6%	%
	C Biochar = carbon content of biochar	Y	Confirmed	V grid LCA Calc V 17_Annual Audit_2024_1	87.8%	%
	Estored = biochar carbon storage = Qbiochar x Cbiocharorg x FpTHTs x 44/12	Y	Confirmed	V grid LCA Calc V 17_Annual Audit_2024_1	2884	kg CO2e/tonne biochar (dry)
4.3	**Ebiomass = LCA emissions of production and supply of biomass**	Y	Confirmed	V grid LCA Calc V 17_Annual Audit_2024_1	49	kg CO2e/tonne biochar (dry)
4.4	**Eproduction = LCA emissions from biochar manufacturing**	Y	Confirmed	V grid LCA Calc V 17_Annual Audit_2024_1	254	kg CO2e/tonne biochar (dry)
4.5	**Euse = LCA emissions of the use of biochar, including distribution up to the point of final use**	Y	Confirmed	V grid LCA Calc V 17_Annual Audit_2024_1	79	kg CO2e/tonne biochar (dry)
4.1	**CORCs = Estored - Ebiomass - Eproduction - Euse**	Y	Confirmed	V grid LCA Calc V 17_Annual Audit_2024_1	2502	kg CO2e/tonne biochar (dry)
	Quantity of CORCs (in evidence).	Y	Confirmed	02_CORC Calculation Biochar_SCD Visalia California	207	CORC

APPENDIX 2: VERIFIER QUALIFICATIONS

Supporting documentation, including verifier resumes, and verifier or corporate accreditations are also included in this appendix.

Verifier Qualifications

Company Name:	**V-Grid**
Date:	**1/16/2024**

Verifier Name:	**Bill Chatterton**
Company Name (where applicable):	**350Solutions**
Verifier Contact Information:	**bill@350solutions.com, 984-215-0585**
Verifier Address:	**1053 E. Whitaker Mill Rd. Suite 115, Raleigh, NC 27604**
Verifier Scope of Activities:	**Output Audit through review of key technology components, operational data, and documentation.**

Verifier Qualifications	**Criteria Met?**	**Evidence / Notes** *(note how the criteria was met, specific documents - resume/CV, publications, certifications, etc.).*
Verifier has relevant technical knowledge of the type of technology being evaluated and carbon removal processes in general		
A) Does Verifier have:		
1. An in-depth technical knowledge of the technology type under verification;	☑	350Solutions is accredited to ISO/IEC 17020:2012 and ISO 14034 Environmental Technology Verification (ETV) as a Type A (third party) Inspection Body (ANAB Certificate Number: AI-2618). The technical scope of 350's accreditation includes verification of performance and environmental impact as it relates to design, materials, equipment, installation and operations of technologies in the categories of Energy, Clean Production and Process, and Air Pollution Monitoring and Abatement. As documented in 350Solutions' ETV Standard Operating Procedure (ETV QPM 350-223-03), and Quality Systems Procedures for verifier qualifications (QSP-350-005-02), 350Solutions conforms to the requirements of ISO 17020 Annex A with respect to verifier qualifications and procedures. These procedures and quality management programs are generally relevant to verification under the Puro.Earth General Standard. Note that verifications completed for Puro.Earth are not equivalent to ISO 14034 verifications. 350 staff have participated in the evaluation and verification of novel technologies that sequester carbon via various methods, including biomass conversion to liquids, solids, and other products which are then permanantly stored in ways such as land application or geologic storage, conversion of captured CO2 into building materials and co-products, and the production of chemicals, fuels, and products via biomass pyrolysis and gasification. 350 also served as lead verifier for the Carbon XPrize competition and contributed to the development of procedures and processes for verification of relevant calculations, modeling, and statistical methods in order to assess team results and calculations of performance metrics and uncertainty. 350 has demonstrated knowledge of data quality and data validation approaches and execution in supporting verification of performance claims and results.
2. Knowledge of specific risk areas associated with performance of such technologies (i.e. common failure points, performance issues, barriers to scaleup);	☑	
3. Knowledge of the environmental implications related to the use of the technology from a life cycle perspective, such as impact of the technology on lifecycle CO2 emissions and carbon removal;	☑	
4. Knowledge of relevant applicable test methods and standards for evaluating performance or impact of the technology;	☑	
5. Knowledge of relevant calculation, modeling, and statistical methods in order to assess test results and calculations of performance metrics and uncertainty, as applicable;	☑	
6. Knowledge of data quality and data validation approaches, including QA/QC procedures, for example.	☑	
Verifier is a credible independent 3rd party		
B) Is Verifier:		
1. third-party body independent of the team registered for the Puro Earth CORCs;	☑	350Solutions is accredited to ISO/IEC 17020:2012 and ISO 14034 ETV as a Type A (third party) Inspection Body. As documented in 350Solutions ETV Policy Manual (ETV QPM 350-200-03), 350Solutions conforms to the requirements of ISO 17020 Annex A with respect to impartiality for Type A inspections, pursuant to ISO 14034 activities.
2. Not directly involved in the design, manufacture or construction, marketing, installation, use or maintenance of the specific technologies submitted to Puro.Eargh for verification, or represent the parties engaged in those activities.	☑	
3. Not part of a legal entity that is engaged in design, manufacture, supply, installation, purchase, ownership, use or maintenance of the items inspected.	☑	

William Chatterton
350Solutions, Verification Program Manager

EDUCATION
B.S. Environmental Science, SUNY at Plattsburgh, 1982
Certified Measurement and Verification Professional (CMVP), 2019

Professional Experience
William Chatterton is an Environmental Scientist with 28 years' experience in technology evaluation and demonstration, project management, air pollution monitoring, testing, and regulation. He serves as Program Manager at 350Solutions and manages projects and programs for commercial and government clients. Previously the past 20 years at Southern Research, Mr. Chatterton has managed, and supported programs designed to integrate, demonstrate, and evaluate technology performance in the advanced energy field. Technology demonstrations and evaluations that he has been involved with include technologies designed to promote sustainable energy sources, increase energy use and efficiency, mitigate GHG and other emissions, and in most cases provide other social and economic benefits to potential users. Mr. Chatterton has been heavily involved in the evaluation of numerous emerging energy technologies, distributed generation technologies, and technologies relevant to transportation and oil and gas markets. Mr. Chatterton's roles in support of these projects has included program and project management from administrative and technical perspectives, lead or technical support on test plan development, method development and validation, design and implementation of field-testing activities, data evaluation and presentation, and reporting of results. He has managed numerous projects for both commercial and government clients.

350Solutions: 08-2019 – Present
Verification Program Manager: As Verification Program Manager, Mr. Chatterton manages and executes technology performance demonstrations and verifications of emerging energy (efficiency and green building) and transportation technologies, primarily for U.S. governmental agencies, energy research associations, and state energy agencies. These performance evaluations generally involve evaluation of commercial feasibility, economic impacts (installation, operating, and capital costs, simple payback, and return on investment), environmental impacts (primarily greenhouse gas and criteria pollutant emission reductions), and technology performance. He also manages and monitors 350Solutions' quality management programs and ISO accreditations.

Southern Research Institute: 1999 - 2019
Program Manager, Energy & Environment Technologies: As Program Manager, Mr. Chatterton has managed and executed several technology performance demonstrations and verifications of emerging energy (efficiency and green building) and transportation technologies, primarily for U.S. governmental agencies, energy research associations, and state energy agencies. Mr. Chatterton also has direct experience with management and execution of projects under DOE and DoD grants and contracts. He has recently managed activities on three large DoD projects including Demonstration of a Solar Thermal Combined Heating, Cooling and Hot Water System Utilizing an Adsorption Chiller for DoD Installations, Demonstration and Verification of the Performance of Microturbine Power Generation Systems Utilizing Renewable Fuels, and the Electric Power with Small Scale Organic Rankine Cycle (ORC) Engine/Generator Technology demonstration.

Tim Hansen, P.E.
Founder and CEO, 350Solutions

EDUCATION:
B.S., Chemical Engineering, University of Virginia, 1993
M.S., Engineering Science, Thayer School of Engineering, Dartmouth College, 1995

EXPERIENCE SUMMARY:
Mr. Hansen has 26 years of experience in management of energy and environmental technology development and demonstration projects and programs, as well as multimedia environmental engineering efforts. These majority of his recent work has focused on the evaluation of innovative carbon capture, utilization, and removal technologies. Mr. Hansen has led the development and management of large technology evaluation programs in the advanced energy, transportation, and climate change areas.

RESEARCH AND PROFESSIONAL EXPERIENCE:
2019-Present Founder – CEO, 350Solutions, Inc.
Owns and operates a small cleantech engineering consulting business focused on the independent evaluation of new cleantech innovations and their impact on the environment and carbon emissions. Provides engineering consulting, testing and evaluation, techno-economic assessment, and other support to companies developing, using, or investing in new clean technology innovations. Manages administrative, business development, and project activities for 350Solutions.

2012-2019: Director - Energy and Environment, Southern Research
Manages scientific and technical staff performing research, development, and evaluation of innovative clean energy technologies. Projects range from $25,000 to $6million in size, and are funded by the US Department of Energy, Department of Defense, and commercial partners. Technical focus areas are conversion of biomass to fuels and chemicals, carbon capture and utilization, energy efficient building technologies and renewable energy generation.

2009-2012: Program Manager – Transportation & Climate Change Technology, Southern Research
2003-2009 Sr. Project Leader, Environmental Engineer, Southern Research
1996-2003 Environmental Engineer, Bensinger & Garrison Environmental

PROJECT EXPERIENCE:
Mr. Hansen has executed several independent technology performance verifications of emerging carbon, energy and transportation technologies, as CEO of 350Solutions, Director of Energy & Environment at Southern Research, and Director of the U.S. EPA's Greenhouse Gas Technology Center. Mr. Hansen has completed clean technology evaluations for the Department of Defense, state energy agencies, commercial clients, investors, and technology developers, involving evaluation of commercial feasibility, economic and environmental impacts, and technology performance. Mr. Hansen served as the Measurement and Verification Program Lead for the NRG COSIA Carbon XPrize – a $20M prize competition for technologies that capture and beneficially utilize CO_2. Mr. Hansen also served as U.S. Technical Expert for the development and implementation of ISO 14034 – Environmental Technology Verification, an international standard, issued in 2016

350Solutions, Inc. Corporate Experience

350Solutions serves as an independent expert in cleantech, low carbon, and environmental technologies. We provide an unbiased assessment of innovative technologies. 350Solutions is accredited through ANAB under ISO 17020 as an independent inspection body to provide independent technology evaluation services using the ISO 14034 ETV process. In addition, 350Solutions staff include a Certified Measurement and Verification Professional (CMVP for IPMVP) and a North Carolina Registered Professional Engineer (P.E.). 350Solutions ANAB Accreditation certificate is provided below.

CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

350Solutions, Inc.
1053 E. Whitaker Mill Rd., Suite 115
Raleigh, NC 27604

Fulfills the requirements of

ISO/IEC 17020:2012

and

ISO 14034:2016, Environmental Management - Environmental Technology Verification (ETV)

In the field of

INSPECTION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 25 September 2024
Certificate Number: AI-2618

An inspection body's fulfilment of the requirements of ISO/IEC 17020:2012 means the inspection body meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid inspection results (refer to joint ISO-ILAC-IAF Communiqué dated Sept 2013).

ANAB
ANSI National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17020:2012

and

ISO 14034:2016, Environmental Management - Environmental Technology Verification (ETV)

350Solutions, Inc.
1053 E. Whitaker Mill Rd., Suite 115
Raleigh, NC 27604
Tim Hansen tim@350Solutions.com
(919) 675-6432

INSPECTION
TYPE A (THIRD-PARTY) BODY

Valid to: **September 25, 2024** Certificate Number: **AI-2618**

General

Products Categories	Range	Stage	Methods and Procedures
Energy Technologies (ET):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP-350-223-02 - *SOP ISO 14034 ETV*
Cleaner Production and Processes (CPP):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - *SOP ISO 14034 ETV*
Air pollution monitoring and abatement (APP):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - *SOP ISO 14034 ETV*
Water monitoring and treatment (WMT)	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - *SOP ISO 14034 ETV*

Note:
1. This scope is formatted as part of a single document including Certificate of Accreditation No. AI-2618.

R. Douglas Leonard Jr., VP, PILR SBU

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