Climeworks

Orca Facility Output Audit Report

For Puro.Earth

CO_2 Removal Supplier	Climeworks
Removal Method	Direct Air Capture & CO_2 Storage in Basalt Formations
Production Facility	Climeworks Orca
Production Facility Address	Capture Facility: Nordurvellir 4, 816 Ölfus, Iceland
Net Volume of CO_2 Removal	357.636 CORCs
Removal Period	May 1st, 2025 – August 31st, 2025
Auditors	350Solutions: Guy Hardwick Kelly Nesbitt Tim Hansen
Report Date	December 3, 2025
Version	V1.2

Contents

Acronyms

CDR	Carbon dioxide removal
CO_2	Carbon dioxide
CORC	CO_2 Removal Certificate
DAC	Direct air capture
EF	Emissions factor
GHG	Greenhouse gas
MRV	Measurement, Reporting, Verification
RECs	Renewable energy certificates

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OUTPUT AUDIT REPORT		
Company: Climeworks Orca	Company Contact: Pietro Rossi* Fintan Tuohy	VVB: 350 Solutions Guy Hardwick Kelly Nesbitt Tim Hansen
Removal Method: Direct Air Capture & CO_2 Storage in Basalt Formations		
Report Date: December 3, 2025		
Document No: 350-PU2507.01-OA		
Revision: V1.2		

**primary contact(s)/lead author(s)*

1. Introduction

Puro.Earth contracted 350Solutions to perform an audit of carbon dioxide removal credit (CORC) claims for Climeworks Orca Direct Air Capture (DAC) process. The Output Audit included observation of operations during a site visit, collection of files and evidence, review of data collection and handling procedures, and evaluation of adherence of the project to the relevant Puro.Earth Standard, and Methodology. The crediting period for the validation is Dec 1, 2023 – Dec 1, 2028.

This audit involved a site visit to the Orca project on Sep 16, 2025 and a desk review of documents provided by Climeworks, including the facility audit documentation completed by DNV. 350Solutions affirms that Orca has the appropriate equipment, procedures, and protocols in place to quantify GHG removal through DAC and CO_2 storage in Basalt Formations in accordance with the requirements of the relevant Puro.Earth General Rules and Geologically Stored Carbon methodology:

- Puro.Earth General Rules v3.1 [1]
- Geologically Stored Carbon v1.0 (2021) [2]

A summary of the project and output audit is provided below.

Table 1: Output Audit Summary

Audit Summary	
CO_2 Removal Supplier	Climeworks AG
Removal Method	Direct Air Capture & CO2 Storage in Basalt Formations
Verification Type	Supplier Output Audit; Puro Standard General Rules (v3.1) and Geologically Stored Carbon Methodology (Edition 2021, v1.0)
Production Facility Name and Registry	Climeworks Orca, Facility ID: 631817
Production Facility Locations	Capture Facility: Nordurvellir 4, 816 Ölfus, Iceland
Verified CORCs	357.636 tonnes CO2-eq
Audit Kickoff Date	July 17, 2025
Audit Report Date	November 30, 2025

2. Technology Description

2.1. Process Overview

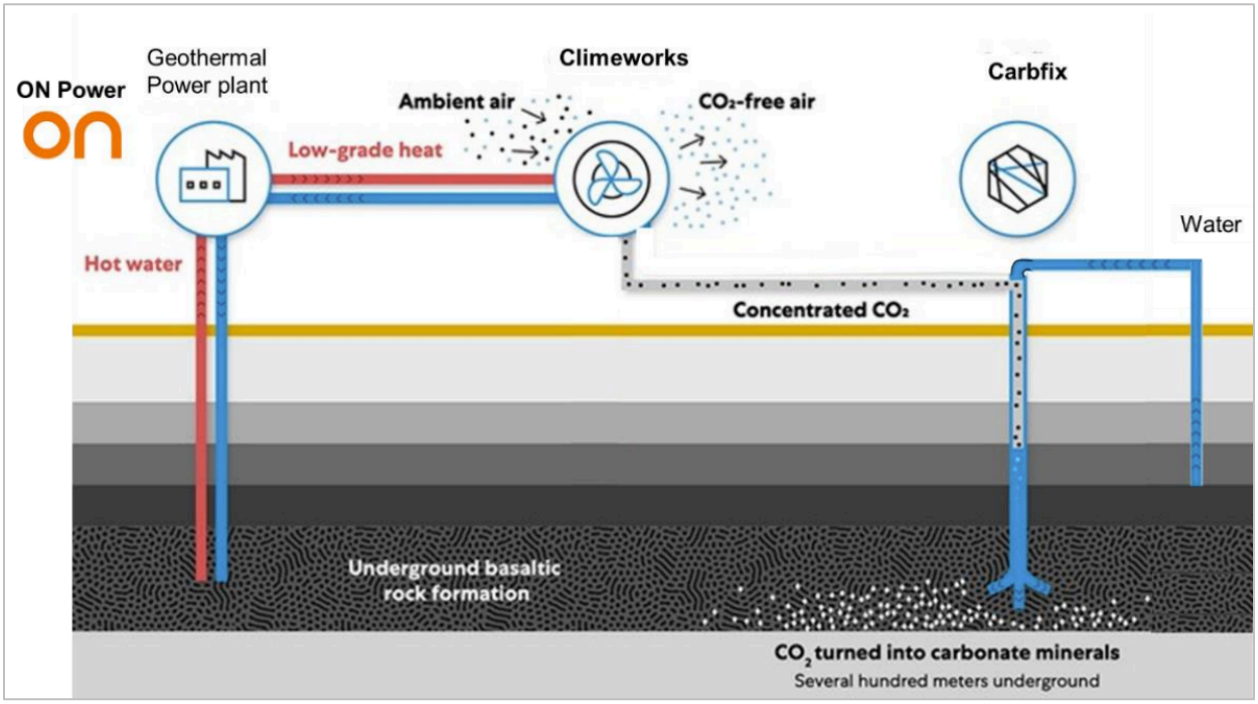

Figure 1: Orca process description (Source: Climeworks)

Climeworks Project Orca is the first DAC facility with permanent storage capabilities built by Climeworks and is based at the Hellisheiði geothermal powerplant, 50km southeast of Reykjavik. Orca is a three-step project consisting of DAC, transport and geological storage of carbon dioxide, all powered by the locally produced geothermal energy plant operated by ONPower, a subsidiary of Orkuveita Reykjavík (Reykjavík Energy). ONPower reports power and water usage monthly to Climeworks for use as part of their CORC calculations. Figure 1 shows a simplified process flow diagram for the Orca capture and storage system.

Figure 2: Left. Rear of contactor containers showing array of fans for drawing CO_2 across sorbent material. Right. Isolation door of contactor container sub-units for application of heat and vacuum for CO2 desorption.

2.2. Capture and Processing

The first step of the system involves DAC which utilizes a series of fans and 'collector containers' containing solid sorbent material to chemically bind atmospheric carbon dioxide (CO_2). Air with reduced CO_2 concentration is released back into the atmosphere. Orca has 8 'contactor containers', each consisting of 6 container sub-units which operate independently. Once the sorbent in a sub-unit is saturated with CO_2, it enters a desorption phase where the sub-unit is isolated and heated to around 100°C with a vacuum applied, liberating the CO_2 from the sorbent. The process makes use of low-grade waste heat from the geothermal facility. The sorbent material can complete several thousand cycles before needing replacement.

Figure 3: Depiction of the Climeworks vacuum-temperature swing adsorption process displays the front and back of each of the contactor containers, and how individual sub-units are isolated with a door that slides across each container.

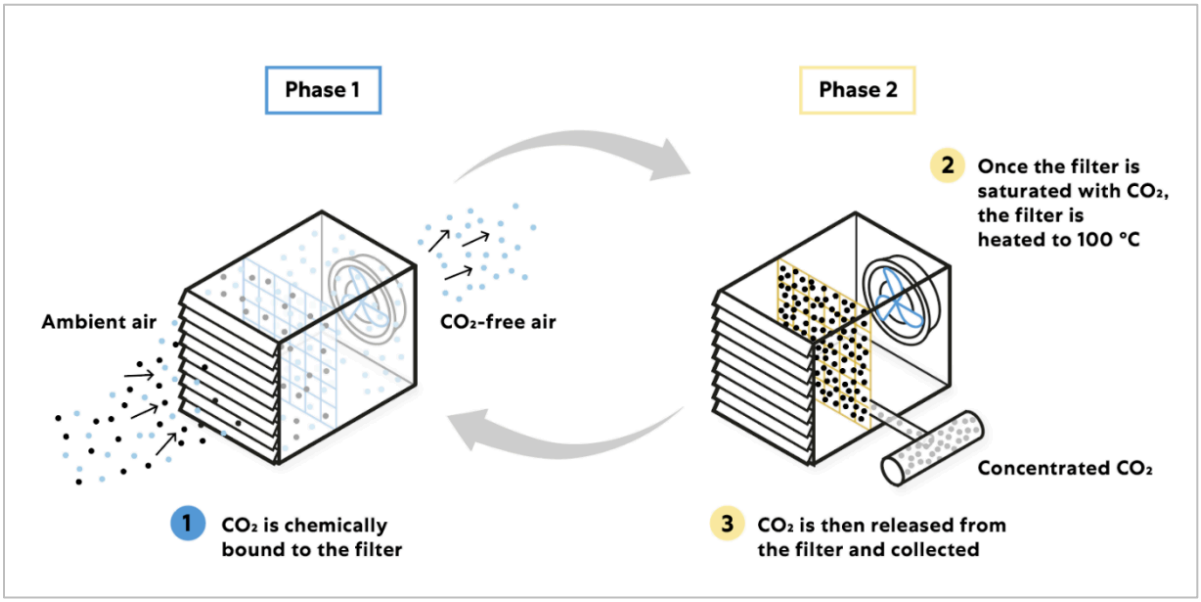

Figure 3 shows a simplified depiction of the vacuum- temperature swing adsorption process.

Figure 3: Depiction of the Climeworks vacuum-temperature swing adsorption process

The liberated CO_2 from each collector container feeds a centralized, temporary storage vessel before it is further conditioned into grades of CO_2; high quality, medium quality and low quality. The high-quality CO_2 goes directly to a liquefaction unit, where it is dehydrated, cooled, and condensed, producing liquified CO_2 with 99.99% purity. The liquified CO_2 is then contained in a pressurized tank for temporary storage, prior to transportation for injection and permanent storage. The medium grade quality CO_2 is further conditioned prior to liquefaction. Low grade CO_2 is vented out. The system is estimated to be [redacted] efficient in overall recovery of CO_2 from the sorbent material based on measurements from electromagnetic volumetric flow meters and concentration meters placed throughout the system.

2.3. CO2 Transportation

The liquified CO_2 is then transported in gaseous form, via a 3,282m long, buried, plastic pipeline running to the geological storage injection site, þrengsli, operated by the project partner, CarbFix.

The gas is transported at 20-bar. The pipeline itself is rated for operations at 24.5-bar and is fitted with release valves which are activated if the pipeline pressure exceeds 25-bar. The total mass of CO_2 transported is measured leaving the DAC facility and upon injection into the well. This enables Climeworks to quantify any leakage associated to the transportation pipe.

2.4. Injection and Storage

Carbfix then mixes the gaseous CO_2 stream into a water stream, pumped from two local wells, at a depth of 200m below the injection well. The pressure at this depth enables the CO_2 to dissolve in the water inside the injection pipe, before it reaches the point of injection, at least 400m below the surface. The water is sampled to characterize any CO_2 already dissolved in the water prior to injection of CO_2 to determine the baseline for CORC calculation. Water metering is reported by Carbfix to Climeworks for reporting as part of their CORC calculations. The CO_2 charged water is then injected where, due to its density being greater than the surrounding water, it sinks into the cracks and pores of the basaltic rock and can't rise back to the surface. Overtime, the CO_2 reacts with the basalt divalent cations, to form carbonate minerals, permanently storing the CO_2 in the pores of the basaltic geological reservoir. This storage mechanism is commonly known as mineral trapping. It has been demonstrated that after two years, all the CO_2 will have mineralized, ensuring long term storage [3]. The well is managed by Carbfix in line with all local laws and regulations and follows the EU CCS directive. During injection, pressure, temperature, and flow for both the gaseous CO_2 stream and the injected water are recorded continuously as part of Carbfix normal operations. Figure 4 depicts the route taken by the underground pipeline to the injection well as well as locations of the water supply wells, monitoring wells and boundary of the geological storage site. Carbfix assumes full responsibility for injection, monitoring, and long-term liability of the injection and storage site.

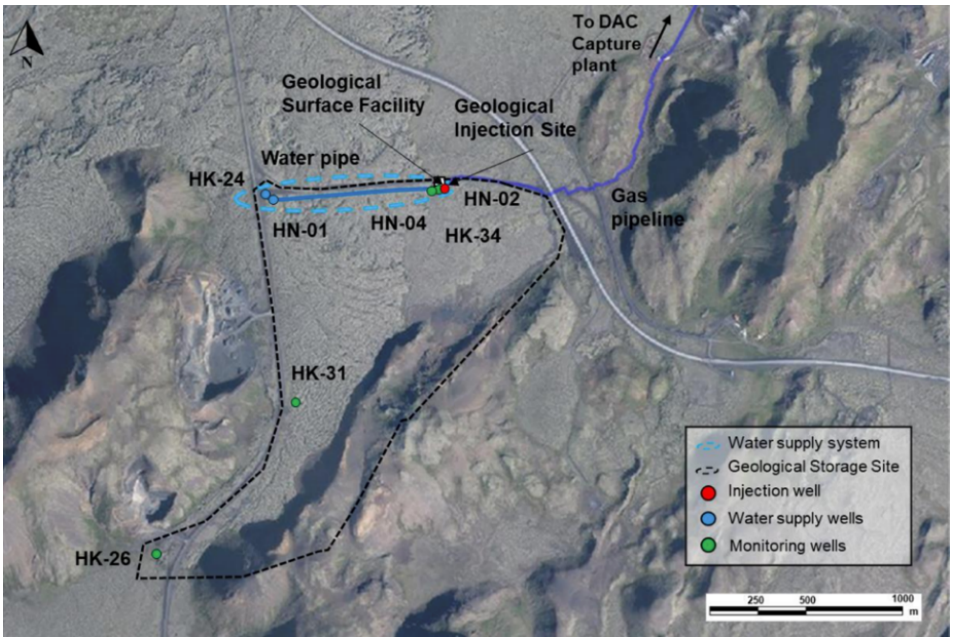

Figure 4: Diagram depicting CO_2 pipeline leading from Orca to injection site þrengsli alongside injection site, water wells, monitoring wells and boundary of the geological storage site.

2.5. Inputs and Outputs

A summary of process inputs and outputs for Orca's operations are included in Table 2.

Table 2: Verified DAC Production Data

Input / Output	Item	Verified Amount Over Monitoring Period[1]	Notes (Specifications, source, etc.)
INPUTS			
Electrical Energy	DAC, liquefaction, filtration, compression, misc. site usage	[Redacted]	100% provided by ONPower Geothermal power facility. Market leakage determined to be 0.
Thermal Energy	DAC, misc. site usage	[Redacted]	100% provided by ONPower Geothermal power facility. Market leakage determined to be 0.
Water	Injection usage, freshwater usage during ONPower energy generation	[Redacted]	ONPower provides water to Climeworks for DAC operations, who return cooling water once used. Injection water is pumped from the reservoir by Climeworks
DAC Units & Infrastructure	DAC containers, liquefaction, filtration, compression, storage, misc. site usage	-	Orca facility lifetime is expected to be until at least 2031. Embodied emissions amortization starting again 2026
DAC Sorbent	Sorbent consumed during monitoring period	[Redacted]	Spent sorbent
Maintenance and Repairs	Consumables used during associated maintenance for DAC units and Orca infrastructure	-	Internally tracked and compared to designated number of emissions within the total grey emissions to be amortized.
OUTPUTS			
Captured CO_2	Gross CO_2 captured during DAC process	413.114 tonnes*	Total CO_2 captured during DAC measured by Climeworks
Stored CO_2	Gross CO_2 injected into geological storage	419.997 tonnes	Total CO_2 injected, measured by Carbfix and reported to Climeworks
CO_2 released	Total amount of CO_2 released during injection and storage	4.665 tonnes	Total CO_2 released during injection and storage, measured by Carbfix and reported to Climeworks
Operational Emissions	Emissions released during Climeworks and Carbfix operations	57.697 tonnes	Total operational emissions related to heat, electricity, sorbent and water usage.

** Discrepancy between Captured CO_2 (413.114) and Total CO_2 stored and released (424.662 tonnes) is within the margin of error for the instrumentation being used. As the Stored CO_2 measurement is the closest to the injection pipeline, this is the one that is used for quantification of CORCs*

2.6. Changes since last Output Audit

Since the last Output Audit conducted in March 2025, Project Orca has updated its amortization schedule for the emissions associated to the construction, maintenance and decommissioning of the plant. Originally, Climeworks had planned to amortize these emissions at a rate of 12.5% of the

total between 2023 and 2030. This arrangement ran between October 2023 and June 2024, resulting in 9.4% of these embodied emissions being amortized. For alignment with the Mammoth facility amortization schedule, as well as to follow a principle of commencing amortization once the production ramp-up phase is completed and the facility has reached nominal capture capacity, amortization of grey emissions shall be paused until late 2026. Then, between October and December 2026, 4.5% of these emissions shall be amortized before 18.5% being amortized yearly until 2030. A final amortization of the remaining 13.6% shall then occur in 2031.

Furthermore, Climeworks have reduced the emissions factors associated with the thermal energy supply, electrical energy supply, water supply and sorbents supply during this reporting period.

- The reductions in emissions from the thermal and electrical energy and water supplies were a direct result of operational changes made by ONPower from the implementation of project Silverstone. Project Silverstone reduces CO_2 emissions by dissolving waste gases from the geothermal electricity production process, into water and injecting into basaltic formations for permanent storage.
- The emissions reductions for sorbent production and use are due to Climeworks purchasing renewable energy credits for sorbent supply chain emissions. Puro Advisory Board approved an update to Rule 5.2.19 allowing ongoing fractional use of RECs to adjust LCA emission factors for long-lived consumables such as sorbents. Previously, only up-front in-full REC procurement was permitted. The updated rule now includes clarified conditions for REC eligibility (spatial matching, temporal matching, energy-source specification, and commissioning disclosure). This ensures Climeworks can legally and consistently apply REC-based emission adjustments for their future sorbent use.

3. Audit Summary

3.1. Audit Approach

A planned series of audit activities were conducted by 350Solutions to independently validate and verify production and output data, and CORC claims for the reporting period. The audit was conducted following the specifications of Puro General Rules (V3.1) and Geologically Stored Carbon Methodology (Edition 2024, v2). Specific audit activities conducted are summarized in Table 3. Auditor qualifications are attached as Appendix 2.

Table 3: Audit Activities

Date(s)	Verification Activity	Verification Tasks	Documents Reviewed
July 17, 2025	Introductory Document Review and information exchange	- Opening meeting and review of operational and procedural changes - Review of LCA and supporting documentation - Requested previous audit reports and supporting documentation - Review of Puro CORC calculations	- Community_Engagement_Iceland_Sep2025_Update.docx - Climeworks update on SDG goals progress - Sep 2025.pptx - Trade Registry Certificate - Carbfix (Icelandic).pdf - Trade Registry Certificate - Orca náttúrunnar (Icelandic).pdf - Statement of Ownership Climeworks.pdf - 20231013_CHCO_Commercial Register Excerpt_Full EN.pdf - Facility Details in Puro Registry (ORCA).pdf

		- Review of product properties - Review of product end use - Discussed operational changes - Discussed audit process and site visit dates Discussed scope as "expanded output audit"	- Additionality_Orca_v1.8.pdf - Building permit (Orca) dated 11 November 2020 (certified English translation).pdf - Environmental impact assessment waiver (Orca) dated 15 July 2019 (EN) - File: Evidence of safe working Environment - Stakeholder engagement report submitted to EU Innovation Fund - June 2023 (English).pdf - Injection related Construction Permit 1 (Icelandic).pdf - Injection related Construction Permit 2 (Icelandic).pdf - Storage permit application - CONFIDENTIAL and section 210 condensed (English).pdf - CerabarMPMP51_AS132023.pdf - Permit Letter Carbfix Hellisheidi (Icelandic).pdf - Permit Carbfix Hellisheidi (Iclandic)).pdf - Operating License Carbfix Hellisheidi (Icelandic).pdf - AnnexII Monitoring Plan Carbfix_Hellisheidi (Icelandic).pdf - Annex Post Closure Monitoring Plan (Icelandic).pdf - Annex Corrective Actions CO2 Storage (Icelandic).pdf - Orca PDD.pdf - 2024_02 Orca Monitoring Plan Climeworks.xlsx - 2024_02_29 Carbfix Orca Monitoring Plan.xlsx - CDR Report Orca - 31-08-2025.pdf - Puro CORC Output Report - Orca 31-08-20251 no RECs.xlsx - Puro CORC Output Report - Orca 31-08-20251 with RECs.xlsx - Hellisheidi Emission Factors.xlsx - Project Silverstone Overview, July Aug 2025.pdf - 2025-08-25 LE121590-0001 test report.pdf - Monitoring Plan Orca - 31-08-2025.xlsx - File: Operational Records-Energy-DAC - File: Operational Records-Energy-Injection - Orca Recs and heat certs retirement, May-August 2025 – Copy.xlsx - Orca Revised Amortization Schedule.docx - Calibration records for this period
September 16, 2025	Site Visit	- Conducted onsite walkthroughs of Orca, Mammoth, and Carbfix facilities - Reviewed CO_2 capture, transfer, and injection operations - Verified measurement instruments and calibration records - Assessed CO_2 capture, injection, energy, and monitoring datasets - Reviewed CORC quantification and LCA supporting documents - Evaluated site permits, environmental safeguards, and monitoring plans Reviewed additionality evidence and community engagement practices	
October 20 – 28, 2025	Data Review	- Review of LCA and supporting documentation - Review of Puro CORC calculations - 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 - Review of equipment and calibrations - Reviewed previous Output Audit Reports - Reviewed original production facility audit documentation	
November 26 – December 3, 2025	Report Writing	- Compose Audit Report - Internal quality control	Puro CORC Report Orca_V1.1 - 2025-08-31_Puro modification with up front RECs.xlsx CDR Report Orca.pdf

3.2. Verified Output & CORCs

Table 4 includes the specific CORCs claimed by Climeworks for its Orca facility during the reporting period, as well as the level verified by 350Solutions during the data review.

Table 4: Verified CORCs for the Orca Facility

Performance Metric Name / Description	Revised Value	Verified Value[1]	Data Source	Reporting Period
CO_2 Stored	419.997 tonnes	419.997 tonnes	- Puro CORC Output Report – Orca 31-08-20251 with RECs	May 1st 2025 - August 31st 2025
CO_2 Emissions	57.697 tonnes	57.697 tonnes		
CO_2 Releases/ Reversals	4.665 tonnes	4.665 tonnes		
Total CORCs	357.636	357.636		

[1] *Verified values are based on verification of final production records for the reporting period.*

4. Audit Findings

4.1. 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 during the site visit and follow up:

☒ ***Meets the requirements of the Puro General Rules V3.1 and* Geologically Stored Carbon Methodology (Edition 2021, v1)**

☐ ***Meets the requirements of the Puro General Rules V3.1 and* Geologically Stored Carbon Methodology (Edition 2021, v1) *with minor modifications***

☐ ***Does Not Meet the requirements of the Puro General Rules V3.1 and* Geologically Stored Carbon Methodology (Edition 2021, v1)**

350Solutions utilized a reasonable level of assurance in performance of the output audit. A summary of findings associated with each primary requirement of the *Puro General Rules* and *Geologically Stored Carbon Methodology* and any identified issues with the audit are summarized below.

Table 5: Audit Findings

Puro GSC Method. Section Ref.	Audit Verification Topic	Final Findings
1.1	Eligible Activity Type	Acceptable. The project activity aligns with the Puro Geologically Stored Carbon Methodology v1.0 and meets the definition of a long-term CO_2 Removal activity.
1.1	Eligible Geological Storage Type	Acceptable. The geological storage approach conforms to the Methodology's requirements for long-term, durable storage exceeding 100 years.
1.1	Eligible Carbon Capture Type	Acceptable. The carbon capture technology is consistent with the eligible capture types described in the Methodology and demonstrates capability to produce long-term CO_2 removal within the defined activity boundary.
1.2	Eligibility Requirements for Activities	Acceptable. Climeworks demonstrated compliance with all activity-level eligibility criteria, including demonstration of Environmental and Social Safeguards, additionality, and leakage assessment. Supporting documentation was complete and consistent with Puro's expectations.
1.3	Eligibility Requirements for the CO_2 Removal Supplier	Acceptable. Climeworks is a registered account holder, fulfills all governance and contractual requirements, and demonstrated the necessary legal control over the facility.
2	Point of CORC Creation	Acceptable. Climeworks clearly identified the point at which CO_2 becomes eligible for CORC issuance.
3	Activity Boundary for Net-Negativity	Acceptable. The system boundary is correctly defined and includes all relevant SSR components required for a full LCA. Climeworks demonstrated that the activity remains net-negative within the defined boundary.
4.1	Quantification of Net CO_2 Removal	Acceptable. Quantification of Net CDR follows the Methodology's calculation rules, with transparent inputs and conservative assumptions. Net CDR aligns with the requirement to subtract process emissions from gross CO_2 captured to derive CORC-eligible Output.
4.2 & 5.1	Evidence for Captured CO_2	Acceptable. Climeworks provided complete measurement records demonstrating accurate, continuous, and verifiable CO_2 capture volumes. Evidence meets Methodology requirements for demonstrating CO_2 capture prior to issuance and for Output validation.
4.3	Project Emissions Within Activity Boundary	Acceptable. All relevant emissions sources within the activity boundary were accounted for in accordance with the Methodology. Supporting documents and calculations confirm that emissions were accurately quantified and applied in the Net CDR balance.
5.2	Data Records for CO_2 Quantities	Acceptable. Data records were complete, traceable, and consistent with audit requirements. Measurements were supported by calibrated instruments and logs were available for the full reporting period.
5.3	Evidence of Permanent Storage	Acceptable. Climeworks provided documentation demonstrating that CO_2 is stored in a geological reservoir compliant with the permanence criteria of the Methodology and with the Puro Standard definition of long-term storage (100yrs).

5.4	Evidence of No Double Counting	Acceptable. Climeworks demonstrated that CO_2 storage claims are attributed solely to CORCs and that no overlapping claims, product-based claims, or NDC-linked claims exist.
4.5	Uncertainty Assessment & Conservative Approach	Acceptable. Climeworks applied conservative assumptions and conducted appropriate uncertainty analysis consistent with Methodology requirements. No material sources of unquantified uncertainty were identified.
5	Verification Evidence & Documentation Completeness	Acceptable. All documentation required under the Methodology and Puro General Rules was provided, well-organized, and sufficient to complete the audit. The information demonstrated traceability, accuracy, and alignment with all verification requirements.

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

4.2. Critical Findings and Exceptions

Assessment of the output audit package and associated CORC report identified several initial findings (Appendix 1). All findings, primarily associated with missing supporting evidence, have been addressed and closed. Findings of note include the following:

Table 6: Critical Findings

ID No	Type	Finding / Issue	Supplier Response	Conclusion / Resolution
11	Clarification	Data discrepancy between the emission factors reported in the CDR Report and the CORC calculation file. CDR Report EF's have not been updated to account for reductions associated to the use of RECs or Project Silverstone. Furthermore, the sorbent EF was deemed to be calculated incorrectly.	Emission factors in CORC file are to be used as the source of truth. EFs in report are to be updated to reflect the use of RECs, with EF for sorbent to be assessed and corrected for next Output Audit package.	Confirmed, forward action request to ensure continuity between the two documents in future verifications
11	Clarification	Amount of sorbent used differs between the CDR report (2.08 tonnes) and the CORC report (2.03 tonnes). Please clarify which is correct and provide updated document	CDR report figure is correct. CORC calculation file updated with correct figure and resubmitted for verification.	Change in sorbent use resulted in a minor reduction in the amount of CORCs calculated for the monitoring period.

29	Omission	The 0.5% uncertainty associated to the CO_2 metering instruments has not been included within the CORC quantification. Please update the CORC file accordingly.	CORC file adjusted to account for uncertainty associated to measurements of CO_2 stream (Climeworks measurement at capture site and Carbfix measurement prior to injection)	Uncertainty included within updated CORC file.

4.3. Forward Action Requests and Recommendations

A full list of Output Audit findings is provided in Appendix 1. Section 4.3 outlines the forward action requests (FARs) and recommendations for this reporting period, supporting improvements in future operations and CORC calculations while enabling monitoring of any emerging issues in subsequent Output Audits. A summary of open FARs and opportunities for improvement is presented below for reference in future verifications.

Table 7: FARs and Recommendations

ID No	Type	Finding / Issue	Conclusion / Resolution
11	FAR	Ensure the CDR reports are updated with the correct emission factors, with update made to the sorbent EF and update to all EF's to account for the use of RECs and project Silverstone.	Climeworks shall update the file for the next Output Audit data package submission.

5. Revision History

Version	Date Issued	Noted Changes
Draft v1.0	November 28, 2025	Initial Draft
Draft v1.1	December 1, 2025	Post internal quality assurance review, minor edits
Final v1.2	December 3, 2025	Edits following review by Puro

6. Auditor Signatures

Auditor Information		
VVB	**Auditor**	**350Solutions Project ID No.**
350Solutions, Inc.	Guy Hardwick (Lead Verifier)	PU2507.01
350Solutions, Inc.	Kelly Nesbitt (Supporting Verifier)	
350Solutions, Inc.	Tim Hansen (Quality Assurance)	

Guy Hardwick

Digitally signed by Guy Hardwick
Date: 2025.12.04 15:43:37 Z

Signed: Guy Hardwick (Lead Verifier)

Kelly Inder-Nesbitt

Digitally signed by Kelly Inder-Nesbitt
Date: 2025.12.04 09:49:42 -05'00'

Kelly Nesbitt (Supporting Verifier)

Timothy A. Hansen

Digitally signed by Timothy A. Hansen
Date: 2025.12.04 10:32:58 -05'00'

Signed: Tim Hansen (Quality Assurance)

6.1. Validation and Verification Body Details

350Solutions Inc. declares that we are an impartial verifying body, free from any conflicts of interest, capable, and qualified to complete this verification for the current operational period according to the Puro Standard and applicable methodologies.

350Solutions is an accredited inspection & verification body by ANAB under ISO 17020:2012 for completion of ISO 14034:2016 Technology Verifications and was the first accredited entity in North America for ISO 14034. 350Solutions is based out of Raleigh, North Carolina, USA. 350Solutions Technical Lead for the Climeworks Output Audit is Guy Hardwick supported by Kelly Nesbitt. Quality assurance was provided by Tim Hansen. Complete qualifications are attached as Appendix 2. Our opinion is provided with a reasonable level of assurance for Climeworks' activities at the Orca project.

Notice: 350Solutions, Inc. declares that we are an impartial auditor, free from any conflicts of interest, capable, and qualified to complete this audit according to the Puro Standard and related Validation and Verification Body Requirements. Verifications and audits conducted by 350Solutions are based on an evaluation of technology performance and CO_2 removal claims via site visit observations and review of data submitted by the audited company. Audits are completed in accordance with rules and methodologies specified by Puro and utilizing the appropriate quality assurance procedures established under the 350Solutions accredited ISO 17020/14034 Quality Management Program, noting that this verification is not a fully compliant ISO 14034 verification. 350Solutions makes no expressed or implied warranties as to the performance of the technology and does not certify that a technology will always operate at the levels verified, nor that it meets all state, local, or federal legal requirements.

7. References

[1] Puro.Earth, Puro.Earth General Rules version 3.1, 2023, Website: https://puro.earth/document-library?tab=methodologies

[2] Puro.Earth, Puro.Earth Geologically Stored Carbon version 1, 2021, Website: https://puro.earth/document-library?tab=methodologies

[3] Matter et al., Rapid carbon mineralization for permanent disposal of anthropogenic carbon dioxide emissions, 2016, Website: https://www.science.org/doi/10.1126/science.aad8132

Appendix 1: Log of Findings

All material clarifications, misstatements, and omissions have been resolved.

Type	Finding/Issue	Required Action	Supplier Response	350 Response	2nd Supplier Response	Conclusion/Resolution
Clarify	How can stakeholders contact you / authorities / convey their concerns?		Stakeholders: Climeworks has circa 160 **business customers**. Each business customer has a Climeworks account owner. The business can reach out to the respective account owner with concerns and any concern from a business is treated as a priority. If the account owner moves on from Climeworks, the account ownership is transferred to a colleague. Account owners actively arrange regular business reviews with their business customers.	How do new, interested and /or affected parties contact you? (Community Engagement Iceland - Update 2025) Point 5. you provide information where people can submit complaints or queries, but how do people find this information? Is it displayed on a sign board at your premises entrance and on your company website?	Community Engagement Iceland - Update 2025 Point 5: this is a communication channel specific for official complaints through the Icelandic authorities, not a communication channel established by Climeworks. Here it is assumed that stakeholders know our business since their complaint would be specific to us. As we are a registered business in Iceland the municipality or other relevant agencies have our business contact and would contact us to handle any such complaint. More in general, our website provides a contact form where any interested stakeholder can get in contact with us. Those emails are routinely checked by our Communications team. (https://climeworks.com/contact)	Climeworks have conducted sufficient stakeholder engagement previously. See line 6 for recommendations.
Clarify			Stakeholders: Individual consumers or **Pioneers** can contact Climeworks via the Climeworks Pioneers email address. Climeworks has a dedicated Pioneers and Sustainability Lead responsible for dealing with any concerns from Pioneers.			See line 6
Clarify			Stakeholders: A number of **carbon rating agencies** have contacted Climeworks with concerns and questions regarding our operations. Climeworks has a Senior Science and Technology Manager responsible for dealing with concerns from carbon rating agencies.			See line 6
Clarify			Stakeholders: Climeworks employs a Project Director Country Director for Iceland who to only handles concerns which are raised by the **local community** but proactively reaches out to community members in Iceland.			See line 6
			Stakeholders: **The Government**			See line 6
Clarify	Is there a grievance register in place?	Provide document	No, but we have a robust communication process that connects external stakeholders with the relevant Climeworks employee and the plant manager.			Recommendation that Climeworks put together a robust grievance mechanism which is easily

					accessible via their website and communicated to the wider community. Grievance log is recommended to monitor grievances, when they were raised and how/ if they were resolved.
Omission	The current risk register does not address CO_2 transport risks, geological storage risks, or include a reversal-risk assessment.	Update the risk register to include: - CO_2 transport risks - pipeline (operational interruptions, handling, accidental release, regulatory compliance). - Geological storage risks (well integrity, mineralization performance, monitoring failure, leakage pathways). - A clear reversal-risk assessment outlining potential reversal mechanisms and mitigation measures.	Lines 41 to 51 address CO2 transport risks (line 47) and geological risks (43-46, 48, 50) as well as other CO2 injection risks. Reversal risks are covered by answer in line 5 of this RFI. A line in the Risk Register for reversal risk has been added as well		Thank you for pointing out these items and updating the risk register
Omission	A documented reversal-risk assessment	Please provide documentation in which you discuss/evaluate project specific factors that could increase the overall reversal			See above
Clarify	Please confirm the location of the CO2 purity tests for the CO2 captured at both facilities	CO2 stream tests	Purity tests are conducted for Orca on a monthly basis. Results are in "2025-08-25 LE121590-0001 test report.pdf" In Mammoth, dissolved CO2 is injected (not pure CO2), therefore the requirement of purity test doesn't apply. The CO2 stream is continuously monitored at the point of injection		Thank you for clarifying this item
Omission	Documentation for roles and responsibilities for Mammoth facility with Carbfix is missing. Please confirm whether the Monitoring plan for Orca, which calls out responsibilities of each party is appropriate.	Confirm Monitoring Plan for Mammoth is the same as Orca or provide Mammoth monitoring plan	The monitoring plan details who between Carbfix and Climeworks is responsible for which instrument (column Q). The ownership of each instrument is complete (data quality, maintenance, inspections...)		Updated monitoring plan received. Thank you

Clarify	Please confirm that Climeworks operations do not fall under the NDC's for Iceland	Confirm information	Climeworks' CDR activities at the Orca and Mammoth in Iceland are certified under the Puro Geologically Stored Carbon Methodology and verified by external auditors. Certification ensures that each ton of CO_2 removed is issued as a Carbon Removal Certificate (CORC) in the Puro.Earth registry, which is designed for voluntary carbon markets—not Iceland's own NDC.			Thank you for providing the statement.
Omission	Documentation associated to the permitting for water use is not present in the Carbfix permits, or any other documentation	Please provide water use permits for Carbfix and Climeworks	No documentation, Climeworks is not the licensee for water extraction. ON Energy provides water for Climeworks in Iceland. ON Energy has a license to extract 2,000 liters / second from the Engidalur well 5 km north of Hellisheidi. Currently, ON avails of approximately 900 liters / second.	Is the water that is also used by Carbfix for Orca operations also provided by ONPower? Specifically, I am thinking about the water sourced from the two local wells. Is this the case for the well that feeds into Mammoth also?	Water for Mammoth is provided by ON Power. In case of Orca, Carbfix extracts the water where CO2 is dissolved and reinjects that underground. The water permit from Carbfix has been added (Water Permit Carbfix Orca - Leyfi-OS-2015-L026-02, relevant part in articles 4 and 6). Make-up water for Climeworks process is provided by ON Power. Orca cooling water is provided and circulated back to ON Power. Water for Mammoth is fully provided by ON Power, and CO2 is dissolved in water before the CO2-rich water is delivered to Carbfix. In the case of Mammoth, Carbfix doesn't use any additional water.	Confirmed permit for Carbfix added to shared file. Thank you for confirming the water sources for each facility.
Clarify	Confirm that the flow meter for the CO2 injected has a measurement frequency of 15 minutes or less	Please clarify	The flow sensors for the injection water flow have a measurement frequency of 10 sec. Average minute values are used for the calculation of CO2 injected.			Confirmed - thank you
Omission	Please provide a copy of the LCA report which justifies the modelling choices made for the CORCs model	Please provide LCA explainer document	Documentation provided for all relevant LCA's			Confirmed in Facility audit package provided
Clarify	Please clarify that emissions associated to ongoing monitoring are less than 1% of the emissions of the storage stage.	Please clarify	The only material monitoring emissions are related to water samples extracted from the monitoring well, few kg per sample. The monitoring plan post-closure calls for no more than 5 samples per year which renders these emissions negligible (against a total construction emission of the storage stage of ~500 tCO2). Monitoring emissions before closure are duly accounted for as intentional reversals (see CORC report)			Explanation covers this requirement. Thank you

Clarify	Confirm when Carbfix last conducted monitoring of well pressure decay and ensured location of charged water was what was expected by the well model	Please confirm date and report if any.	The wellhead pressure is monitored continuously (see document with hourly averaged values). The results of the updated model will be submitted for the storage permit report in April 26.		Confirmed. Thank you for clarifying. FAR for review of updated well model
Omission	No Stakeholder engagement report provided.	Provide document	This document is part of the facility audits documentation. Puro.Earth should have given access to the facility audit documentation to 350 Solutions. In addition, the file (Puro Stakeholder Engagement Report_final) has been added to the RFI folder. A short update on the activities relevant for the year 2025 has also been provided (Community Engagement Iceland - Update 2025.docx)		Document provided for review
Omission	Missing a copy of the explicit anti-discrimination policy	Provide document			Document provided for review
Omission	Missing a copy of the document referencing human rights principles	Provide document			Document provided for review
Omission	Missing documentation on Labor rights and working conditions	Provide document			
Omission	Missing documentation on Gender and non-discrimination	Provide document			Document provided for review
Omission	Climeworks does not address pollution prevention to air, water and soil as well as noise and vibration	Provide document, EIA?			sufficient data/clarification provided
Omission	Avoiding or minimizing adverse impacts to community health and safety	Provide EIA for review	There is one EIA covering the entire Hellisheidi site, comprising of both Climeworks and Carbfix facilities for both Orca and Mammoth projects. This was prepared by Carbfix in 2023 and is provided both in original language, Icelandic, and in English translation. This document is part of the facility audits documentation. Puro.Earth should have given access to the facility audit documentation to 350 Solutions. In addition, the file (EIA for Hellisheiði - Report		Document provided for review

			Submitted by Carbfix - Jan 2023) have been added to the RFI folder.		
Omission	Missing documentation covering assumption, model, parameter representativeness and default-value justification, System-level and storage-related uncertainty factors, Full uncertainty propagation to final CO_2 removal values	Provide documents	Sources added to the uncertainty calculation. Error propagation formula valid as is. Details for injected water and DIC values for the monitored period have been added and the final uncertainty updated		sufficient data/clarification provided
Clarify	Climeworks outlines their monitoring system including QA/QC procedures and a secure data management system, quantitative monitoring information is collected and managed appropriately. Omission in documentation: Documentation does not explicitly outline that time stamp data is occurring (this is assumed)	Is this occurring? Revise applicable documentation to include this process	The Monitoring Plan outlines how often sensors, which are relevant to the CDR calculation chain, are validated or calibrated. The document "QA/QC procedures for measurement device" still applies as in the facility audit. The chapter 3.5 of the Project Description still applies as in the facility audit. SOPs for internally validated instruments are added (O4131-GEN--ALL-SOP-10005 and O4131-GEN--ALL-SOP-10006). Externally calibrated instruments are calibrated as per manufacturers procedures. Reports for Master instruments are submitted during output audits whenever due, as per the Monitoring Plan		sufficient data/clarification provided
Omission	Monitoring Plan required, reference is made to this document in the PPD.	Provide a copy of mammoths monitoring plan for review	It looks like the Monitoring Plan is not there anymore, despite having discuss a few changes about that during the Eligibility Check with Puro.Earth. It has now been uploaded again in "02 Updated facility documents"		Document provided for review
Omission	documentation showing continuously monitoring of temp and pressure at the well	Please provide copies for review	The temperature and pressure sensors for the injection have a measurement frequency of 10 sec. Average hourly data is provided in the additional documents.		Monitored by storage partner and parameters reported monthly.
Clarify	Where do you take your chemical sampling from?	Please clarify	Chemical samples of the CO2 stream are taken at the interface between Climeworks		sufficient data/clarification provided

			and Carbfix facilities in Orca and at the injection well in Mammoth		
Omission	Uncertainty of 0.5% associated to CO2 measurement has not been attributed to the calculations within the CORC file.	Please make the necessary adjustments within the CORC file to account for the 0.5% uncertainty.	CORC file adjusted to account for uncertainty associated to measurements of CO_2 stream (Climeworks measurement at capture site and Carbfix measurement prior to injection)		Appropriate adjustment made to the CORC file. New CORC value verified.

Appendix 2: Verifier Qualifications

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

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 Isometric Standard. Note that verifications completed for Isometric 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 Isometric Registry	☑	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 Isometric 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.	☑	

Guy Ingram-Hardwick
Carbon Removal Verification Engineer, 350Solutions

EDUCATION:
MEng Materials Science and Engineering, Loughborough University, UK - 2022

EXPERIENCE SUMMARY:
Guy Ingram-Hardwick is a Carbon Removal Verification Engineer, with experience in materials engineering, process engineering, MRV protocol development, experimental design and life cycle analysis (LCA). At 350 Solutions, Guy's efforts center on validation and verification of varied carbon removal pathways, including biochar, biomass storage, and DAC+S. Guy has led the verification of a biochar CDR supplier registered with Puro.Earth and supported verifications of bio-oil and biomass geologic storage pathways as well as DAC technology assessments. Guy began his experience in carbon removal working to develop an LCA model for Brilliant Planet, a marine based carbon removal company growing, processing and burying microalgae for carbon sequestration. Once completing the LCA model, Guy managed the third-party verification and co-authored the MRV methodology for Brilliant Planet before managing its adoption with carbon market registries and developing relevant documentation required for carbon removal verification and crediting.

Guy also studied degradation mechanisms for biodegradable polymers which was the focus of his Master's thesis. His work during the Master's thesis and at Brilliant Planet provided experience in experimental design and execution, including conducting field trials for developing novel technologies. This included leading design and execution of demonstration and testing of processing and storage of the microalgae, displaying the long-term permanence of the carbon removal system. Prior to his experience at Brilliant Planet, Guy worked as a process engineer at Pirelli's rubber compound manufacturing plant in Burton-on-Trent with a focus on data analytics for driving continuous improvement, as well as developing familiarity with industrial manufacturing operations and data, quality assurance, and international standards.

RESEARCH AND PROFESSIONAL EXPERIENCE:
January 2025 – Present: Carbon Removal Verification Engineer, 350Solutions
Verify carbon dioxide removal technologies on behalf of registries and private companies ensuring high quality and meaningful climate impact.

Jul 2022 – Dec 2025: LCA and MRV Associate, Brilliant Planet
Quantified the carbon removal efficiency of the Brilliant Planet system across a variety of engineering designs using LCA. Developed the proprietary MRV methodology and PDD as well as setting up a novel experimental design to display the permanence of the stored carbon.

July 2019 – September 2020: Process engineer, Pirelli
Completed data analytics to drive continuous improvement for increasing efficiency, safety and rubber compound quality.

Kelly Inder-Nesbitt

Senior Carbon Removal Verification Engineer, 350Solutions Inc

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Education:

- Master of Science in Geography, Archaeology, and Environmental Studies, University of the Witwatersrand, 2014
- Bachelor of Science with Honors in Geography, University of the Witwatersrand, 2011
- Bachelor of Arts in Geography and Archaeology, University of the Witwatersrand, 2010

Experience Summary:

At 350Solutions, Kelly specializes in verifying carbon removal projects to ensure compliance with ISO 14034 standards and carbon registry requirements. With over a decade of experience in environmental compliance and carbon management, she brings extensive expertise in operational compliance and MRV framework implementation, enhancing accuracy, transparency and integrity in the voluntary carbon market.

Kelly's career spans multiple sectors, including aquaculture, mining, and carbon removal technology, where she has developed and audited environmental management systems that promote sustainable practices and attract investor finance. At 350Solutions, she leads the validation of diverse carbon removal pathways, including biochar, BECCS, DAC and direct ocean capture and biomass burial. Her responsibilities encompass site audits and rigorous evaluation of MRV systems to ensure scientifically validated project claims.

Previously Kelly led the development of Brilliant Planet's carbon dioxide removal methodology protocol for algal biomass burial and contributed as an author. She was also responsible for developing and implementing an ISO 14001 compliant EHSS Management System for the FirstWave Group, who are aquaculture industry leaders in Southern and Eastern Africa. This system is also aligned with IFC World Bank Best Practices and leveraged software tools to streamline compliance monitoring and enhance ESG reporting for investor and regulatory alignment.

Throughout her career, Kelly has consistently collaborated with project developers, communities, regulators, and clients to enhance the credibility of environmental initiatives through rigorous documentation and alignment with international standards. Her approach emphasizes precise data management and actionable reporting, elevating compliance practices into a strategic, value-adding process that drives sustainable business growth.

Kelly's strong communication skills and commitment to fostering collaboration enable her to manage complex compliance initiatives effectively. Her ability to bridge the gap between technical requirements and stakeholder expectations continues to advance science-driven, impactful solutions in the carbon removal industry.

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 28 years of experience in management of energy and environmental technology development and demonstration projects and programs, as well as multimedia environmental engineering efforts. The majority of his recent work has focused on the evaluation of carbon removal (CDR) technologies, including validation of projects and verification of credits for multiple CDR pathways. Mr. Hansen's primary technical focus has been the management and technical performance of large technology evaluation programs in the advanced energy, transportation, and climate change areas, with a specific focus on verification of innovative low-carbon and carbon removal technologies.

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 and low-carbon innovations and their impacts, with a current focus on carbon removal technologies. Provides independent technology verification, carbon removal credit verification, engineering consulting, testing and evaluation, techno-economic assessment, and other support to companies developing, using, or investing in new low-carbon technology innovations.

2012-2019: Director - Energy and Environment, Southern Research
Managed scientific and technical staff performing research, development, and evaluation of innovative clean energy technologies. Projects range from $25,000 to $6 million in size. Technical focus areas included biofuels and biochemicals, carbon capture and utilization, and renewable energy.

PROJECT EXPERIENCE:

Mr. Hansen has executed several independent technology performance verifications of emerging climatetech and carbontech innovations, 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 recently focused on carbon removal technologies, completing verifications of carbon removal credit projects (biochar, carbonated materials, biomass injection) for registries, due diligence audits of enhanced weathering, DAC, direct ocean capture, and CO2 to polymer technologies for credit offtake buyers, and leading development of independent methodologies for bio-oil sequestration for a novel CDR registry. Mr. Hansen has completed clean technology evaluations for various commercial and government clients, involving evaluation of commercial feasibility, economic and environmental impacts, and technology performance. Mr. Hansen has evaluated and verified technologies for the XPRIZE Carbon Removal in 2022 and 2024 and served as the contracted Measurement and Verification Program Lead for the NRG COSIA Carbon XPrize. Mr. Hansen served as U.S. Technical Expert for the development and implementation of ISO 14034 – Environmental Technology Verification.

RECENT PUBLICATIONS:

- Hansen, et al. Pilot Scale Demonstration & Independent Verification of Carbon Utilization Technologies for the NRG COSIA Carbon XPRIZE. TechConnect Briefs 2019. June 17, 2019.
- Tim Hansen, Kevin McCabe, Bill Chatterton, Michael Leitch, Integrating the ISO 14034 standard as a platform for carbon capture and utilization technology performance evaluation, *Clean Energy*, Volume 5, Issue 4, December 2021, Pages 600–610, https://doi.org/10.1093/ce/zkab033