PILOT – Decision Summary

Decision Summary – Q2&3 2025

PUBLICATION DATE: **04.09.2025**
VERSION: Pilot 3.0

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SUMMARY

This document outlines the assessment and approval decisions for innovative dMRV (digital Monitoring, Reporting, and Verification) pilot projects submitted under dMRV Pilot Programme. The pilots represent diverse applications of digital technology in for activities spanning electric cooking solutions, biomass cooking systems, safewater supply, sustainable rice cultivation practices and others. Each project has been evaluated for its likely conformance with Gold Standard requirements. The decision includes specific conditions and forward actions required for each pilot before their first verification, ensuring robust implementation of dMRV solutions while maintaining data integrity and verification standards.

CONTENT LIST

1| Pilot – Approved in Previous Round(s)

Pilot	Project ID	Title	Decision
01	PoA - GS11815*, VPAs - GS 11817, 11816	Electric Cooking Program by ATEC	Approved
02	PoA - GS11506, VPAs - GS11507	Fair Climate Programme for Advanced Biomass Cooking Solutions (PoA)	Approved
03	PoA: GS 13121, VPA: GS 13122	Pro-climate paddy cultivation for reducing methane emission and saving water (PoA)	Approved
04	PoA – GS23154*, VPAs GS23177	Project Oasis: India Smallholder Dairy Biogas Project	Approved
05	GS23182*, VPAs - GS23183	Aquacarbon Safewater	Approved

**New VPAs (real case or regular case) may be included provided that VPAs demonstrate conformance with GS4GG requirements and meet any conditions outlined below.*

2| Pilot 06- HYGIENE AND ENVIRONMENTAL CARE FOR TANKS AND OVERHEAD RESERVOIRS (HECTOR)

2.1 | Project Information

Project Title: Hygiene And Environmental Care for Tanks and Overhead Reservoirs (HECTOR)
GS ID: PoA – GS12792*, VPAs – GS13130
**New VPAs (real case or regular case) may be included provided that VPAs demonstrate conformance with GS4GG requirements and meet any conditions outlined below.*
Project Developer: Expert365 Pty Ltd
Submission Date: 25/02/2025
Approval date: 06/08/2025

2.2 | Methodology:

Title: Emission Reductions from Safe Drinking Water Supply
Version: 1.0
Deviations from methodology requirements: None

2.3 | dMRV solution overview

HECTOR represents an innovative solution for water quality management, implementing a comprehensive digital monitoring system for safe drinking water supply. The project utilizes the World Health Organization's (WHO) water quality standards as its methodology framework, focusing on maintaining and verifying potable water quality through automated disinfection and monitoring systems.

The solution's technological infrastructure combines IoT sensors, AI/ML capabilities, and automated disinfection systems (auto-chlorination and UV technologies) to create a comprehensive digital monitoring ecosystem. It uses IoT-driven sensors for water quality parameters (e.g., pH, EC, TDS, Turbidity) and weather data. The platform's AI/ML cloud computing capabilities generate virtual sensors for complex parameters traditionally difficult to measure continuously, such as Coliforms, Pathogens, Fluoride, Iron, and Arsenic. These AI/ML virtual sensors are described as a "WORLD FIRST," with over 5,000,000 datapoints used for external validation. The system automatically determines and administers appropriate dosages of sodium hypochlorite and adjusts UV exposure times based on tank capacity and pathogen load assessments, eliminating the need for manual chlorine handling. It also incorporates automatic fill monitoring and level sensing to prevent water wastage, replacing maintenance-intensive mechanical flow meters.

The comprehensive monitoring system tracks 13 mandatory WHO water quality parameters. Data is collected in near real-time from IoT devices installed at 45 village water distribution points, including timestamped records of water filling and distribution events, and routine measurements multiple times per day. All collected data is automatically sent to a secure cloud-based server for storage and processing, performing carbon emission reduction calculations. This data is continuously monitored and analyzed through an app-based interface, ensuring real-time quality assurance and compliance with WHO standards.

The dMRV solution offers high accuracy and reliability through patented AI-ML virtual sensors and continuous, direct measurements. It achieves significant efficiency gains by automating water quality, quantity, and system parameter monitoring. Robust data integrity and transparency are ensured by an eight-stage digitization model, extensive laboratory validation (over 5,000,000 validations), and an in-built self-verification mechanism using Structural Causal Modelling (SCM). The system provides proactive intervention capabilities due to real-time data monitoring and has demonstrated a positive impact on public health. It exhibits high technological maturity and scalability, resulting from six years of development and extensive field testing.

Initially, the proposed solution was not approved because it primarily focused on water quality monitoring, which represented only one aspect of the complete MRV requirements for safe water supply projects. However, new information clarifies that the HECTOR system now actively monitors and documents water supply and discharge across ALL sites using IoT-enabled telemetry, with daily timestamped records, visual validation, cross-verification, and anomaly flagging. This fully digitizes the monitoring as per methodology requirements.

2.4 | Decision

Final Assessment: **Approved**

2.5 | Conditions (if any):

The following Forward Actions to be completed before the first verification:

1. **FAR #1:** The developer shall estimate the energy usage attributable to the use of digital monitoring and reporting infrastructure attributable to the project activity in a conservative manner and account these emissions as project emissions to estimate the net emission reductions from the project.
2. **FAR #2:** The developer shall document data security protocols:
    i. Detail user authentication and authorization frameworks.
    ii. Compliance with GDPR and local data protection regulations.

3. **FAR #3:** The developer shall implement a robust data recovery system:
    i. Create automated backup schedule with specified retention periods.
    ii. Document failover procedures and emergency response protocols.
4. **FAR #4:** The Project Design Document (PDD) shall be supplemented with thoroughly documented AI/ML implementation strategy. This strategy must clearly delineate and isolate the AI/ML methodology, including detailed model architectures, training methodologies, and data pre-processing techniques, from general system documentation. It should specify the complete training dataset sources, data quality assurance measures, and comprehensive model validation procedures. Additionally, the document must outline how the AI systems maintain transparency and auditability through clear version control and granular logging mechanisms for both data inputs and model outputs, presented in a distinct and auditable section.
5. **FAR #5:** The Validation and Verification Body (VVB) shall assess the following aspects during validation/verification — as applicable:
    i. Completeness and accuracy of AI model documentation.
    ii. Appropriateness of training data selection and pre-processing methods.
    iii. Implementation of model performance monitoring and quality control measures.
    iv. Compliance with relevant data protection and privacy regulations.
    v. Presence of adequate audit trails for model decisions and outputs.
    vi. The Validation and Verification Body (VVB) shall specifically assess the statistical significance, confidence scores, and uncertainty quantification of the AI/ML-generated virtual sensor outputs. The VVB must verify that these metrics are clearly reported within the PDD and meet a predefined threshold for reliability for each parameter.
6. **FAR #6:** Both the project developer and VVB shall ensure that all AI/ML systems maintain clear accountability channels and include appropriate safeguards against potential system failures or biases.
7. **FAR 7#:** Regarding water consumption volume monitoring, as it is currently monitored at the source level and not at the user level as required by the methodology, the cap value shall be applied unless user-level monitoring is implemented.
8. **FAR #8:** The Project Developer shall identify and propose an alternative, scientifically precise, and unambiguous term to replace 'virtual sensors' within the Project Design Document (PDD) and all associated project documentation. This replacement aims to enhance clarity, mitigate concerns

regarding language integrity, and accurately reflect the nature of these advanced computational measurements.

9. **FAR #9:** The Project Developer shall comprehensively demonstrate and document how the 'eight-stage digitization model, extensive laboratory validation (over 5,000,000 validations), and an in-built self-verification mechanism using Structural Causal Modelling (SCM)' collectively ensure robust data integrity and transparency. This demonstration should include practical examples of SCM's role in cross-checking and self-verifying ML output, as well as a clear explanation of how the extensive validation data contributes to the reliability claims.

2.6 | Next Steps & Guidelines:

- The **CME** shall update status of dMRV implementation at six months time from approval publication date.
- The project developer may submit the request for validation/verification following the requirements outlined in **Application of GS4GG requirements with dMRV solution**.
- The **VVB** shall follow the requirements outlined in **dMRV - Validation and verification requirements** for further assessment.

3| Pilot 07- Summit Carbon

Decision reserved

4| PILOT 08- PROYECTO MIRADOR ENHANCED DISTRIBUTION OF IMPROVED COOKSTOVES IN LATIN AMERICA

4.1 | Project Information

Project Title: Proyecto Mirador Enhanced Distribution of Improved Cookstoves in Latin America
GS ID: GS1988 (PoA)*, GS2758 (VPA1/Real Case), GS10457 (VPA2/Regular Case), GS12798 (VPA4/Regular Case)
**New VPAs (real case or regular case) may be included provided that VPAs demonstrate conformance with GS4GG requirements and meet any conditions outlined below.*
Project Developer: Proyecto Mirador Foundation (CME)
Submission Date: 04/06/2025
Approval date: 28/06/2025

4.2 | Methodology:

Title: Reduced emissions from cooking and heating – Technologies and Practices to Displace Decentralised Thermal Energy Consumption (TPDDTEC)

Version: 4.0

Deviations from methodology requirements: None

4.3 | dMRV solution overview

The proposed dMRV solution is a suite of complementary software solutions, centered around a customized, cloud-based Salesforce instance, designed to ensure data quality, accuracy, transparency, and consistent workflow. It enables seamless data collection in the field through an Android application that supports offline data entry and subsequent synchronization with the Salesforce cloud. This system aims to deliver improved data quality, consistency, and transparency, lower operational costs, provide real-time information access, and consolidate all project data into a single reporting system.

Key technologies include a cloud-based Salesforce instance with robust backup plans, Double Factor Authentication, and restricted user access for core system security. Field data collection utilizes Android Smartphones, laser thermometers, wood humidity sensors, thermal cameras, heat monitoring devices (SUMs), usage/temperature sensors (EXACT Pro Stove Use Monitor), and datalogging scales for firewood measurements (FUEL data-logging scale). The system maintains a comprehensive audit trail with GPS tracking, ID verification, and photo storage to prevent duplicates and verify implementation. It incorporates automated calculations with real-time reporting, leveraging Salesforce Einstein and Google AI for predictive analysis and image processing. The technology has achieved TRL 9 status, indicating high maturity.

The system is fully automated, encompassing survey data collection syncing, data tabulation for real-time insights, and data recalculations after new entries. Digital Kitchen Performance Test (KPT) measurements are performed using sensors, collecting parameters like quantity of fuel consumed in baseline and project scenarios, specific fuel savings, and weighted average usage rates. While core fuel consumption data capture through sensors is automated, some data, such as digital KPT humidity readings and transportation records, still require manual entry. The solution generates dashboards and automated reports. Proyecto Mirador's pilot app has been used in existing Gold Standard projects (GS1988, GS2758, GS10457, GS12798), demonstrating its performance and capabilities in practical contexts.

4.4 | Decision

Final Assessment: **Approved**

4.5 | Conditions (if any):

The following Forward Actions (FARs) are to be completed before the first verification:

Forward action items identified here must be addressed at the time of validation (may be combined with 1st verification), including documentation of data digitization and quality control, transparency of data flows and processing logic, and explanation of data integrity measures. The pilot will proceed with a learning-oriented approach, allowing flexibility for system refinements based on implementation experience.:

10. **FAR #1: Data Digitization Process Documentation:** The CME is required to document the process of converting manual records to digital format as currently lacks details of quality control checks and verification steps. Clear documentation is crucial to ensure data integrity during the transition from paper to digital records and to identify potential sources of errors or delays.
11. **FAR #2: Project-Specific Configuration Documentation:** The PD must document the customization and data flow within the Salesforce platform as it is not provided. Understanding the specific configuration helps assess system reliability and ensures proper implementation of Gold Standard requirements.
12. **FAR #3: AI Output Validation Procedures:** Additional documentation is required for the validation and verification processes for AI-generated outputs, especially regarding their impact on MRV activities. Clear validation procedures are essential to maintain data integrity and ensure AI applications contribute accurately to the verification process.

4.6 | Next Steps & Guidelines:

- The **CME** shall update status of dMRV implementation at six months time from approval publication date.
- The project developer may submit the request for validation/verification following the requirements outlined in **Application of GS4GG requirements with dMRV solution**.

- The **VVB** shall follow the requirements outlined in **dMRV - Validation and verification requirements** for further assessment.

5| PILOT 09- SISTEMA.BIO INDIAN CARBON PROGRAM: BIODIGESTERS IN INDIA 2024

5.1 | Project Information

Project Title: Sistema.bio Indian Carbon Program: Biodigesters In India 2024
GS ID: GS 12647* (PoA ID), GS 12424 (VPA ID)
**New VPAs (real case or regular case) may be included provided that VPAs demonstrate conformance with GS4GG requirements and meet any conditions outlined below.*
Project Developer: Sistema.bio Inc. (CME)
Submission Date: 22/04/2025
Approval date: 28/06/2025

5.2 | Methodology:

Title: Methodology for Animal Manure Management and Biogas Use for Thermal Energy Generation

Version: 1.0

Deviations from methodology requirements:

- The project developer requested to allow the use of monitored physical leakage values instead of the default 10% currently required as default in the methodology. Additionally, the developer proposed differentiating between physical biogas leakage and venting (intentional release for safety reasons). This deviation is approved with the condition that both physical leakage and venting are measured and accounted for in the net emission reduction calculation.

5.3 | dMRV solution overview

The dMRV solution for Pilot 09 is designed to accurately quantify biogas usage rates and differentiate between leakage and venting in biogas systems. It integrates two primary components: IoT-connected gas flow meters and temperature sensors.

- **Gas flow meters (specifically, the Smart Biogas Meter)** are installed between the biodigester and the point of use (e.g., a cookstove). These meters measure gas flow and pressure in real-time, providing data on biogas usage and potential leakage. They are IoT-connected, solar-powered, and can store data locally for up to 30 days before cloud upload. The meters can detect leakage (when pressure drops with low flow) and venting (when pressure reaches its maximum threshold). Data from the system indicates a combined leakage and venting rate of 1-3%, which is a significant improvement over the traditional 10% assumption.
- **Temperature sensors** serve as a secondary control mechanism to confirm that the gas flowing through the pipe is actually being burned. While they convert temperature data into metrics like cooking time, these sensors

currently require manual data downloads via a USB-C connection. The Smart Bio-Temp Sensor has a data storage capacity of five years with data logging every 30 seconds and an approximate battery life of five years.

The dMRV solution enhances monitoring accuracy compared to traditional methods, leading to more reliable emissions reduction calculations and carbon credit generation. It also provides real-time data, enabling proactive maintenance and performance optimization.

The technology is ready for large-scale deployment and has undergone extensive field testing. Case studies include:

- India: A case study demonstrated a 60% increase in biogas availability for users, expanding consumption from 6 to 10m³, equivalent to 10 hours of extra cooking time.
- Kenya: A case study illustrated the system's effectiveness in diagnosing issues such as leakage and venting, allowing for targeted interventions with farmers.

Sistema.bio's acquisition of Inclusive Energy in November 2024 has integrated the Smart Biogas technology into its operations, enhancing installation and maintenance capabilities. Inclusive Energy is recognized as a pioneer in remote sensors for biogas systems and is at the forefront of digital Monitoring, Reporting, and Verification (dMRV). The Smart Biogas meter is specifically designed for small and medium-sized biodigesters.

5.4 | Decision

Final Assessment: **Approved**

5.5 | Conditions (if any):

The following Forward Actions are to be completed before the first verification:

1. **FAR 1#: Sensor reliability and accuracy.** The CME shall implement rigorous sensor testing and calibration protocols to ensure data accuracy and provide evidence to the Validation and Verification Body (VVB) for validation.
2. **FAR 2: Partially manual system**. The CME shall explore IoT connectivity options for temperature sensors to eliminate manual downloads in the long term. For the short term, the Project Developer shall document the data cross-verification protocol to ensure accuracy.
3. **FAR 3: Technology limitation for larger biodigesters**. The CME shall present an alternative solution for biodigesters larger than 2m³/h, if such units are part of the project.

5.6 | Next Steps & Guidelines:

- The **CME** shall update status of dMRV implementation at six months time from approval publication date.
- The project developer may submit the request for validation/verification following the requirements outlined in **Application of GS4GG requirements with dMRV solution**.
- The **VVB** shall follow the requirements outlined in **dMRV - Validation and verification requirements** for further assessment.
- The Secretariat will continue to follow progress and collect learnings that may inform future updates to the methodology or support broader adoption across the sector.

6| PILOT 10 - POWERUP SMART ELECTRIC STOVES FOR CLEAN AIR-UGANDA-VPA10

6.1 | Project Information

Project Title: PowerUP Smart Electric Stoves for Clean Air-Uganda-VPA10
GS ID: GS11578* (POA), GS 12536
**New VPAs (real case or regular case) may be included provided that VPAs demonstrate conformance with GS4GG requirements and meet any conditions outlined below.*
Project Developer: PowerUP (CME)
Submission Date: 28/04/2025
Approval date: 28/06/2025

6.2 | Methodology:

Title: Methodology for Metered & Measured Energy Cooking Devices

Version: 1.2

Deviations from methodology requirements: None.

6.3 | dMRV solution overview

The PowerUP + CarbonHQ dMRV solution is an end-to-end digital Measurement, Reporting, and Verification (dMRV) system specifically designed for clean cooking carbon projects using Electric Pressure Cookers (EPCs). The system integrates smart cooking appliances with embedded energy meters (PowerUP's EPCs), PowerUP's data analytics platform, Upya's CRM for beneficiary data, and CarbonHQ's cloud-based dMRV platform. This comprehensive integration automates the entire MRV workflow, from data collection at the appliance level to emissions calculations and reporting.

PowerUP's EPCs are equipped with in-built, calibrated energy meters that automatically record usage data, including energy consumption (kWh), cooking duration, frequency, and timestamps. This data is stored locally for up to a year and extracted via a secure Android mobile app by trained field agents. The data is then securely uploaded to PowerUP's AWS-based cloud platform for processing and validation. CarbonHQ integrates this processed usage data with beneficiary records and impact survey data from Upya to automatically calculate emissions reductions using Gold Standard's Metered & Measured Energy Cooking Devices methodology.

The solution aims to significantly improve accuracy (reducing errors by an estimated 80-90% compared to manual methods), enhance efficiency (50-70% lower costs, 70% faster verification timelines), and ensure transparency and traceability of data from sensor to reporting. It is a mature system (TRL 8-9), demonstrated in operational environments across Africa with over 20,000 EPCs deployed and under remote monitoring. It boasts a >98% device data capture rate and a post-cleaning error rate of less than 0.5%. The solution was recognized with the 2023 Digital Innovations Challenge award by the UNCDF

and Clean Cooking Alliance. The system is designed for scalability and replicability, and will be made available to other project developers via a subscription model to reduce financial barriers for digital MRV in the clean cooking sector.

6.4 | Decision

Final Assessment: **Approved**

6.5 | Conditions (if any):

The following Forward Actions are to be completed before the first verification:

1. **FAR 1#: Data Consistency:** The CME shall implement stronger automated validation checks and review processes to address challenges in maintaining consistency between automated and manual data.
2. **FAR 2#: Technical Risks:** The CME shall develop comprehensive risk mitigation strategies to address potential risks from sensor failures and data transmission issues.
3. **FAR 3#: User Adoption:** The CME shall create comprehensive training programs and support systems to address the extensive training and support required for stakeholders during scaling.

6.6 | Next Steps & Guidelines:

- The **CME** shall update status of dMRV implementation at six months time from approval publication date.
- The CME may submit the request for validation/verification following the requirements outlined in **Application of GS4GG requirements with dMRV solution.**
- The **VVB** shall follow the requirements outlined in **dMRV - Validation and verification requirements** for further assessment.

7| PILOT 11 - THE OASIS BOX™ SUSTAINABLE PROJECT

7.1 | Project Information

Project Title: The OASIS Box Sustainable Project
GS ID: GS11721
Project Developer: Bondh-E-Shams Inc.
Submission Date: 17/04/2025
Approval date: 28/06/2025

7.2 | Methodology:

Title: Methodology for Emission Reductions from Safe Drinking Water Supply

Version: 1.0

Deviations from methodology requirements: None.

7.3 | dMRV solution overview

The OASIS Box™ Sustainable Project is an innovative clean water initiative in Nowshera District, Pakistan, which utilizes solar-powered filtration units capable of producing up to 10,000 liters of safe drinking water daily. This project aims to reduce greenhouse gas (GHG) emissions by replacing traditional fuelwood boiling methods for water purification.

The integrated digital Measurement, Reporting, and Verification (dMRV) system, centered around the Waterhub monitoring device, ensures real-time data collection on water consumption, quality, system functionality, and geolocation. This data is automatically transmitted via GSM every two hours to a centralized web portal, eliminating the need for human intervention in data flow. The system is classified as TRL 9 technology, indicating its maturity and proven operation across diverse environments for over a decade, serving 373,201 people across 7 countries and having delivered 1.18 billion cups of water since 2014.

The dMRV solution enhances the accuracy, efficiency, and transparency of GHG emissions monitoring and reporting by minimizing human error and leveraging real-time data. It streamlines MRV activities by fully automating the monitoring of water volume dispensed (SDWS 23), volume of drinking water per person per day (SDWS 24), and operational days tracking (SDWS 27). The system also incorporates partially digitized activities like household and premises data verification and emission reduction calculations, with ongoing efforts to further digitize manual processes.

This hybrid approach, blending robust digital automation with targeted manual oversight, ensures high data integrity and reliability, significantly reducing

verification timelines and operational costs compared to traditional methods. The project's dMRV component ensures that emission reductions are transparently quantified, monitored, and verified, aligning with Gold Standard requirements and supporting the long-term sustainability of the intervention.

7.4 | Decision

Final Assessment: **Approved**

7.5 | Conditions (if any):

The following Forward Actions are to be completed before the first verification:

1. **FAR 1#:** Project Developer (PD) shall document mitigation strategies for data accuracy and reliability despite hardware and environmental risks. These strategies must include initial and periodic recalibration of sensors, cross-verification with analog meters, tamper-proof housing, data buffering on EEPROM, hash verification of JSON payloads, monthly backups, and trained regional response teams for maintenance and troubleshooting.
2. **FAR 2#:** Regarding water consumption volume monitoring, as it is currently monitored at the source level and not at the user level as required by the methodology, the cap value shall be applied unless user-level monitoring is implemented.

7.6 | Next Steps & Guidelines:

- The **CME** shall update status of dMRV implementation at six months time from approval publication date.
- The CME may submit the request for validation/verification following the requirements outlined in **Application of GS4GG requirements with dMRV solution.**
- The **VVB** shall follow the requirements outlined in **dMRV - Validation and verification requirements** for further assessment.

8| PILOT 12 - ECOA CLIMATE CAPITAL (THE CARBON AFFILIATE OF BURN)

8.1 | Project Information

Project Title: Efficient and Clean Cooking for households in Nigeria
GS ID: PoA GS10789, VPA GS12506
**New VPAs (real case or regular case) may be included provided that VPAs demonstrate conformance with GS4GG requirements and meet any conditions outlined below.*
Project Developer: ECOA Climate Capital (the carbon affiliate of BURN)
Submission Date: 05/05/2025
Approval date: 08/06/2025

8.2 | Methodology:

Title: Technologies and Practices to Displace Decentralised Thermal Energy Consumption (TPDDTEC)

Version: 4.0

Deviations from methodology requirements: The project proposes utilizing the "Digital Monitoring for Cookstove Program" tool as an add-on to the existing TPDDTEC v4.0 methodology. This tool specifically outlines digital methods for monitoring the performance and adoption of cooking technologies, directly addressing and revising the standard TPDDTEC monitoring requirements. The Tool applicability and scope will reviewed and assessed separately. The developer is encouraged to review the upcoming publication for consultation for further steps.

8.3 | dMRV solution overview

This dMRV solution focuses on a clean cooking carbon project distributing 1,000 'Jikokoa' charcoal stoves in Nigeria. It is designed to significantly enhance the accuracy, transparency, and trust in carbon credits by moving beyond traditional survey-based methods to continuous, sensor-based monitoring.

Core components of the dMRV solution integrate the following key components:

- **Digital Kitchen Performance Test (dKPT)**: This test is conducted in both baseline and project households. It uses datalogging scales to record fuel consumption and Stove Usage Monitors (SUMs) to track usage during the test period. This method replaces traditional surveys, which can be prone to recall bias, with continuous measurements, resulting in greater accuracy and transparency in GHG emissions monitoring. It also improves data quality by providing less intrusive, more transparent fuel consumption data and reducing behavioral biases. The dKPT allows for the quantification and correction of the Hawthorne Effect by comparing project stove use during the dKPT to long-term usage intensity.
- **Continuous Usage Monitoring**: Cookstove usage sensors (SUMs) are used to continuously monitor the intensity of stove usage (number of cooking

events per day) on 10% of the project stoves, which exceeds the minimum 5% requirement of the methodology. The dMRV solution treats usage intensity as a continuous variable, providing a more nuanced understanding of stove use compared to a simple user/non-user outcome.

- **Ensuring Data Representativeness**: The baseline dKPT is updated every two years, with baseline households selected to match project households' socio-economic levels and willingness to pay, ensuring ongoing representativeness of the counterfactual scenario.

The dMRV solution leverages a suite of technologies for clean cooking carbon projects. Its key components include:

- **Data collection** relies on EXACT temperature sensors (Stove Use Monitors) for continuous usage monitoring and FUEL Pro weight sensors for digital Kitchen Performance Tests (dKPTs).
- A dedicated **Android app** facilitates data download from sensors via Bluetooth and uploads data to the cloud using cellular networks, while also using the smartphone's GPS and camera for documentation.
- **On-the-fly algorithms** in the sensors process temperature data into usage events, and Python algorithms are used to process dKPT data for fuel consumption and savings calculations.
- All data is securely uploaded to a **cloud repository** (Microsoft 365 & AWS) for centralized management. These cloud environments adhere to ISO/IEC 27001 standards, employing encryption for data at rest and in transit, multi-factor authentication (MFA), and role-based access control (RBAC). Raw data is retained on a shared platform for 10 years after the crediting period.
- The core technologies—sensors, the Android app, and the cloud platform—are currently at **Technology Readiness Level (TRL) 7**, indicating a high level of development and successful piloting.
- The solution is **highly scalable** and can be adapted to various clean cooking methodologies, becoming more cost-effective at larger scales due to sampling requirements not increasing linearly and expected sensor cost reductions. While some manual human intervention is still needed for sensor installation and data collection in remote areas, these processes are integrated with the digital app.
- The project is also currently assessing the use of a **blockchain ledger (Hedera Guardian)** to further digitize the carbon project value chain.

8.4 | Decision

Final Assessment: **Approved**

8.5 | Conditions (if any):

The following Forward Actions are to be completed before the first verification:

1. **FAR #1**: The Project Developer (PD) should finalize the assessment and provide comprehensive documentation for the proposed blockchain integration or alternative consolidated data infrastructure. This must include validating data transfer mechanisms and process integrity.
2. **FAR #2**: The Project Developer (PD) shall collaborate with Validation and Verification Bodies (VVBs) and digital stakeholders to fully define and document the automated process for data verification, as it is currently only partially automated.
3. **FAR #3**: Validation and Verification Bodies (VVBs) shall ensure the scope of validation covers all essential dMRV solution aspects, including monitoring device installation, the monitoring plan, frequency, and other dMRV components as per the registered monitoring plan. For this project, which has a certified design, the validation of dMRV components may be combined with the verification audit.

8.6 | Next Steps & Guidelines:

- The **CME** shall update status of dMRV implementation at six months time from approval publication date.
- The CME may submit the request for validation/verification following the requirements outlined in **Application of GS4GG requirements with dMRV solution**.
- The **VVB** shall follow the requirements outlined in **dMRV - Validation and verification requirements** for further assessment.

9| PILOT 13 – UPENERGY

Status: Under review

10| PILOT 14 – VIRRIDY INSTITUTIONAL WATER TREATMENT PROJECT IN RWANDA

10.1 |Project Information

Project Title: Amazi Meza Rwanda Water Supply Project For Schools
GS ID: PoA - GS12240, VPA GS12239
**New VPAs (real case or regular case) may be included provided that VPAs demonstrate conformance with GS4GG requirements and meet any conditions outlined below.*

Project Developer: Virridy Carbon LLC (CME)

Submission Date: 22/08/2025

Approval Date: 03/09/2025

10.2 |Methodology:

Title: Methodology for Emission Reductions from Safe Drinking Water Supply

Version: 1.0

Deviations from methodology requirements: Approved.

- The project proposes to allow the use of automated microbial monitoring devices (e.g., the Lume sensor) on a statistically random and valid sample of installed water treatment systems to estimate E. coli concentrations in place of traditional lab-based water quality sampling or the use of field kits. This is justified by providing a higher-resolution dataset, improving confidence in the actual delivery of microbiologically safe water, and maintaining the methodology's intent to conservatively quantify GHG emission reductions. This deviation is approved, subject to rigorous validation of the Lume sensor's E. coli estimation against laboratory-enumerated samples.

10.3 |dMRV solution overview

Virridy's dMRV solution integrates the Lume sensor into institutional water treatment (IWT) projects in Rwanda. The sensor uses a combination of tryptophan-like fluorescence (TLF), machine learning (ML) analytics, and a water sensor to continuously monitor water filter use, estimate treatment volumes, and assess microbial drinking water quality. This digitized approach enhances the accuracy and efficiency of water system monitoring compared to manual, periodic sampling.

The system provides high-frequency monitoring (hourly or daily), which significantly exceeds traditional annual testing and improves the detection of contamination events and overall data reliability. The digitized MRV activities include continuous sensor estimates, automated data upload to secure cloud-based dashboards with time-stamped records, and the generation of transparent, auditable datasets for third-party verification.

The solution also includes an exploratory assessment of the Lume's capability to monitor "Monitored quantity of safe water provided" (SDWS 23) and "Days the project technology is operational for end-users" (SDWS 27).

The technology is assessed at TRL 7, indicating it has been prototyped, validated in the lab, and deployed in various field conditions, supporting its readiness for significant market deployment.

Automated Quality Assurance/Quality Control (QA/QC) measures include internal checks on sensor function, real-time anomaly flagging, and generation of maintenance tickets for field technicians. Manual QA/QC involves field technician maintenance and calibration logs, as well as periodic water quality validation using field kits or lab tests.

Robust security measures are integrated, including SSL/TLS encryption for data transmission, role-based access controls, immutable raw data storage with automated backups, and no collection of personally identifiable user data.

The dMRV solution is designed for scalability and replicability across various water project types and geographies, with per-site costs decreasing significantly at scale. Virridy provides technical support through a subscription-based service model, reducing the long-term technical burden on local project owners..

10.4 | Decision

Final Assessment: **Approved**

10.5 | Conditions (if any):

The following Forward Actions (FARs) are to be completed before the first verification:

1. FAR 1#: **Sensor Validation and Calibration Protocols:** The CME shall implement rigorous sensor testing and calibration protocols to ensure the ongoing accuracy and reliability of the Lume sensor's *E. coli* estimations. Evidence of these protocols, including results from periodic manual water quality testing and comparison with sensor outputs, shall be provided to the Validation and Verification Body (VVB) for validation.
2. FAR 2#: **Documentation of AI/ML Implementation and Validation:** The CME shall provide comprehensive documentation of the machine learning model, including model architectures, training methodologies, detailed data pre-processing techniques, and the complete training dataset sources. The documentation must clearly outline how the AI system maintains transparency and auditability through version control, logging mechanisms, and validation procedures for AI-generated outputs, including

an independent analysis of the Lume's performance against field-collected, lab-enumerated samples.

3. FAR 3#: **Integration of Manual and Digital Processes:** The CME shall document a clear protocol for the integration and cross-verification of manual data (e.g., field technician maintenance logs, periodic water quality validation results from field kits or lab tests) with automated sensor data. This documentation must detail quality control checks and verification steps to ensure data integrity and consistency between digital and manual records.
4. FAR 4#: **Exploration of SDWS 23 and SDWS 27:** For the exploratory parameters SDWS 23 (Quantity of Safe Water Provided) and SDWS 27 (Days of Operation), the CME should provide a detailed plan for further development and validation of the Lume's capability to monitor these parameters, especially regarding volume estimations and operational days inference. A clear pathway for how these parameters might be integrated into emission reduction calculations in future applications should also be outlined.

10.6 | Next Steps & Guidelines:

- The **CME** shall update status of dMRV implementation at six months time from approval publication date.
- The CME may submit the request for validation/verification following the requirements outlined in **Application of GS4GG requirements with dMRV solution.**
- The **VVB** shall follow the requirements outlined in **dMRV - Validation and verification requirements** for further assessment.

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