

MMRV: A Framework for Oil & Gas Emissions Accountability

A white paper by PureWest Energy¹

Introduction

One of the most pressing challenges facing the oil and gas industry is accurately Measuring, Monitoring, Reporting, and Verifying (MMRV) greenhouse gas emissions from upstream energy production operations. MMRV is essential for ensuring compliance with environmental regulations, enhancing transparency and accountability, and demonstrating corporate social responsibility. However, MMRV has the potential to be complex and costly, requiring a combination of technologies, methods, and data sources that can vary depending on the operation's location, type, and scale.

The US Department of Energy (DOE) developed the Measurement, Monitoring, Reporting, and Verification (MMRV) Framework for methane mitigation actions in the oil and gas sector based on the United Nations Environment Programme's (UNEP) Oil and Gas Methane Partnership (OGMP) 2.0. The MMRV Framework aims to provide a standardized and transparent methodology for quantifying and reporting emissions reductions from various mitigation actions, such as leak detection and repair, equipment upgrades, or flaring reduction.

The MMRV Framework builds on OGMP 2.0 by:

- Expanding the scope of emission mitigation actions beyond the nine key sources to include renewable energy integration, carbon capture and storage, or demand-side management.
- Providing a detailed and consistent approach for estimating the baseline emissions, the mitigation potential, the achieved emissions reductions, and the uncertainty associated with each mitigation action.
- Developing a standardized format and template for reporting the MMRV results, including the metadata, assumptions, and quality assurance and control procedures for each mitigation action.
- Establishing a verification process for ensuring the credibility and reliability of the MMRV results, involving independent third-party verifiers and peer reviewers, as well as a centralized database and platform for storing and sharing the MMRV reports.

The MMRV Framework is intended to support implementing and evaluating methane mitigation actions in the oil and gas sector and inform policy development and decision-making at the national and international levels. By aligning with OGMP 2.0, the MMRV Framework also facilitates the comparability of methane emissions data and mitigation actions across different regions and jurisdictions.

In addition, the MMRV Framework is consistent with the US Environmental Protection Agency's (EPA) regulations for the oil and gas sector, namely the New Source Performance Standards (NSPS) for the Oil

¹ Microsoft Copilot was used as a research efficiency tool in the writing of this document.

and Natural Gas Industry. These regulations require oil and gas operators to measure and monitor emissions from new, modified, and reconstructed sources and implement best practices and technologies to reduce them. The MMRV Framework can help oil and gas operators to comply with these regulations and to demonstrate their environmental performance and social responsibility.

This white paper unveils PureWest's unique and innovative approach to using CleanConnect.ai's Prove Zero platform as the bedrock of its MMRV strategy.

Data and MMRV

Data is the core of any MMRV strategy, serving as the foundation for accurate assessments and informed decisions. The integrity and reliability of data are paramount in the context of environmental and regulatory frameworks, particularly those concerning greenhouse gas emissions.

The measure phase, where data is collected, is critical as it provides the empirical evidence needed to understand the current state of emissions and track changes over time. This data is not just a collection of numbers; it represents a factual basis informing the reporting phase, ensuring stakeholders work with accurate and verifiable information.

As highlighted in the UNEP International Methane Emissions Observatory—2023 Report, the transition from generic estimation methods to empirical measurements marks a significant advancement in measurement-based reporting for the oil and gas industry. This shift underscores the importance of data as a product of the measurement phase, enabling a more transparent and actionable understanding of methane emissions.

The U.S. Department of Energy's initiative to develop an MMRV Framework further reinforces the need for a consistent and credible data collection and verification approach. This framework aims to provide market participants with verified information about life cycle greenhouse gas emissions, which is only possible through the rigorous application of the MMRV process.

In summary, data is not merely a product of the measure phase; it is the cornerstone of the entire MMRV process, enabling accurate reporting, informed decision-making, and, ultimately, the effective management and reduction of greenhouse gas emissions. The integrity of this data is what allows for the verification of reported emissions and the implementation of strategies to mitigate environmental impacts.

Implementing the MMRV Methodology

Measure

PureWest partnered with CleanConnect.ai to deploy their Prove Zero process to measure the methane emissions directly from PureWest's operations. Prove Zero uses a sophisticated software tool called ProMax Data Exchange to simulate natural gas streams' thermodynamic and fluid dynamic properties and the chemical reactions and energy transfers during processing. ProMax simulates the process and calculates the emissions at each production stage using actual production data from the wellhead to the sales meter, solving the mass and energy balances for each operation. The emissions data then informs the overall emission intensity rate for the facility in near real-time. This value reflects the actual

environmental performance of the production site based on the current operating conditions and parameters.

The EPA's Greenhouse Gas Reporting Program (GHGRP) prescribes methodologies for determining GHG emissions from each source category. Operators can choose among several methods to compute GHG emissions, and ProMax is an accepted method for calculating emissions for GHG reporting by the EPA. The existing environmental monitoring systems may influence the decision of which method to use in place and other factors by providing a reliable and consistent methodology for estimating emissions from upstream oil and gas operations based on engineering principles and thermodynamic models.

Prove Zero's mass and energy balance calculation using ProMax, which is the foundation for PureWest's MMRV Framework. The other steps of the framework also leverage the Prove Zero process.

Monitor

The next step of the MMRV Framework is to monitor the methane emissions from the production site over time, using the baseline estimate provided by the Prove Zero process. Monitoring is essential for identifying any anomalies or deviations from the baseline, tracking the actual performance of the emission reduction measures, and evaluating the effectiveness of the mitigation actions. Monitoring also provides data and evidence to support the results of the Measure Phase in the reporting and verification processes.

For the case of PureWest, Prove Zero also serves as a critical component of the monitoring process. Prove Zero monitors for anomalies and patterns in data that signal the potential for an emission event or operational upset. Prove Zero also allows PureWest to identify and locate the significant emissions sources and prioritize the mitigation actions based on the process parameters and the ProMax analytics. However, Prove Zero alone cannot capture the complete picture of the methane emissions from PureWest's operations. Therefore, PureWest complements Prove Zero with other monitoring methods, such as stationary optical gas imagery cameras, fence-line monitors, or periodic aerial surveys, to provide a broader and more holistic view of methane emissions from the top down. When Prove Zero is used in conjunction with other monitoring technologies, the emissions predicted from the process can be matched with the actual emission outcomes of the process, providing PureWest with a complete and reconciled view of its emissions performance by site.

Report

The report phase of the MMRV Framework involves collecting, compiling, and disclosing the methane emissions data and information from the measure and monitor phases to different stakeholders, using various reporting platforms and formats. The report phase demonstrates PureWest's commitment to improving its environmental performance and complying with the regulatory requirements and voluntary initiatives.

Some of the reporting activities and outcomes for PureWest are:

- Subpart W Green House Gas Report to the EPA
- Annual emission inventories, ozone season reporting, and air permit compliance to Wyoming DEQ
- Voluntarily reporting to OGMP 2.0 and various energy-focused trade groups
- PureWest's sustainability report

- Internal air quality improvement projects

The report phase also involves evaluating the performance and progress of the mitigation actions implemented by PureWest and identifying the gaps and challenges in the measurement and monitoring processes. The report phase should use the data and information from the measure and monitor phases to assess the effectiveness and efficiency of the mitigation actions and to compare the actual emissions with the estimated emissions, the baseline emissions, and the reduction targets. The report phase also uses the data and information from the measure and monitor phases to identify and quantify the sources and causes of uncertainty and error in the measurement and monitoring processes and to recommend and implement corrective and preventive actions to improve the data quality and accuracy.

Verify

The final step of the MMRV Framework is verification. This phase assesses the data, methods, and systems used to measure, monitor, and report methane emissions, identifying and correcting any mistakes or uncertainties. Verification must be impartial, material, and diligent, adhering to established standards and guidelines for verifying methane emissions.

PureWest employs ISO 14067 as its emissions verification standard, ensuring transparency, accuracy, and credibility in the verification process. Following international standards like ISO 14067, PureWest demonstrates its commitment to environmental stewardship and contributes to global efforts to minimize unnecessary emissions.

PureWest engages third-party verifiers to review and confirm methane emissions data and information to enhance credibility. These third-party verifiers provide an objective and unbiased assessment of the measurement, monitoring, and reporting systems, identifying and addressing discrepancies or errors.

By combining the internationally accepted ISO 14067 standard with third-party verification, PureWest uses the most transparent and robust method to verify emission performance.

Conclusions

Benefits and Challenges of Implementing MMRV

- A focused MMRV strategy can help operators:
 - Identify and prioritize the most significant and cost-effective emission reduction opportunities
 - Demonstrate commitment to environmental leadership
 - Improve stakeholder relations and reputation
- The challenges and barriers to implementing MMRV include:
 - Potential high upfront capital and resource costs
 - A lack of standardized methodologies and protocols for emission estimation and verification
 - Uncertainty of the regulatory requirements and incentives
 - Potential skepticism from some stakeholders

Key Takeaways

- Implementing MMRV can bring multiple benefits to operators, such as improving environmental performance, reducing operational risks, enhancing stakeholder engagement, increasing investor confidence, and strengthening regulatory compliance.
- Prove Zero provides a reliable and consistent methodology for estimating emissions from upstream oil and gas operations based on engineering principles and thermodynamic models. It can account for various sources and types of emissions and handle complex and dynamic operational scenarios.
- Using complementary monitoring technologies, such as Bridger Photonics, Honeywell, and LongPath, enhances the accuracy and granularity of the emission estimates from Prove Zero by providing direct measurements and validations from the source or the atmosphere. These technologies can also help operators identify and address leaks and anomalies, verify their calculated emissions, and demonstrate compliance.
- Integrating Prove Zero and other monitoring technologies into a comprehensive MMRV framework requires careful planning and coordination involving technical, operational, and organizational aspects.