Rebellion Energy Solutions

Summary: Certainty in Forecasting Policy for GHG Emission Reductions from Plugging Orphaned Oil and Gas Wells

This policy reflects Rebellion Energy Solutions' commitment to a robust and conservative approach to maximizing confidence in their orphaned oil and gas well plugging carbon projects.

Introduction and Background

This is an outline of the Certainty in Forecasting Policy that Rebellion Energy Solutions has developed for quantifying greenhouse gas (GHG) emission reductions achieved through plugging orphaned oil and gas (OOG) wells.

Rebellion Energy Solutions currently operates in accordance with the ACR Methodology for Plugging Orphaned Oil and Gas Wells (version 1.0) and, as a contributing author, expresses strong confidence in the methodology's framework. However, Rebellion Energy acknowledges the need for continued growth in the methodology as more information is gathered on the orphan wells,, their baseline emission measurements, and volumes associated with potential future emissions.

The core purpose of this policy is to establish an incremental framework for quantifying and maximizing the certainty associated with Rebellion Energy Solutions carbon projects – some of which incorporate higher energy wells, not previously contemplated. This involves differentiating between carbon credits issued, and those with a high degree of certainty. Rebellion Energy Solutions emphasizes its responsibility to maximize certainty and apply conservative estimations when possible.

Key Quote: "Rebellion considers itself responsible for generating a high degree of confidence in its projects and combatting any over-crediting risk with a conservative estimation."

Main Themes and Important Ideas

- **Transparency and Acknowledgment of degrees of certainty:** Rebellion Energy Solutions openly acknowledges the inherent variation in wells and therefore in levels of certainty when forecasting GHG emission reductions from plugging OOG wells.

- **Layered Conservatism:** The policy incorporates multiple layers of conservatism, particularly in situations with higher emissions potential, to prevent over-crediting.
- **Data-Driven Approach:** Rebellion Energy Solutions emphasizes the importance of utilizing all available data, including historical production data and measurement data, to inform their analysis and increase certainty.
- **Well-Specific Considerations:** The policy recognizes that each well is unique and may require tailored analysis, especially for "Super Emitters".
- **Differentiated Credit Certainty:** Rebellion Energy Solutions distinguishes between carbon credits with a "high degree of certainty" and those that meet the standard requirements.
- **Application of Terminal Decline:** Recognizing the limitations of a 0% decline rate, but with a 5% standard certainty deduction applied across the project, Rebellion Energy Solutions incorporates terminal decline rates based on industry standards and historical production trends into their sensitivity analysis.
- **Expert Engineering Oversight:** On-staff petroleum engineers play a critical role in analyzing data, determining increased measurement periods, downward adjustments, assigning terminal decline rates, and defining "High Certainty" volumes.
- **Retirement of Lower Certainty Credits:** Rebellion Energy Solutions commits to retiring credits that meet Industry standard but are not considered "High Certainty," demonstrating a commitment to the integrity and confidence in the credits they bring to market.

Overview of Forecasting Requirement

Industry methodologies calculates issued credit volumes based on the following steps:

1. **Determination of baseline emission rate:** Measured in standard cubic feet per hour (scf/hr).
2. **Linear extrapolation:** Assumes a 0% annual decline in the emission rate.
3. **20-year crediting period:** The forecast is applied over this duration.
4. **Conversion to $MTCO_2e$:** Methane volume is converted to metric tons of carbon dioxide equivalent.

The policy highlights that methodologies generally assume the initial baseline emission rate will remain constant for 20 years – an appropriate assumption for the stereotypical low rate and low pressure orphan wells. While recognizing the robust criteria for establishing this baseline, Rebellion Energy Solutions emphasizes the importance of considering well-specific and field-level factors that can complicate this assumption.

A crucial aspect for a well to qualify under methodologies is that it must be leaking in its untouched state due to a failure in its mechanical integrity or wellhead. . The policy notes research that indicates corrosion rates can be significant once a failure occurs, increasing the likelihood of even small leaks escalating over time.

Key Quote: "It is both Rebellion Energy Solutions practice and required that a well must be leaking in its untouched state in order qualify as eligible."

Rebellion Energy Solutions clarifies that the project developer's role is to determine the potential volume of emissions a well might reasonably have emitted, with the 20-year crediting period serving as a conservative

cap on potential future emissions. The most proven method for forecasting this volume is by determining the current deliverability using stabilized pressure and methane measurement data and applying a decline rateover the 20-year period.

Acknowledgement of Confidence

Rebellion Energy Solutions explicitly acknowledges that 100% accurate quantification of emission reductions would require continuous measurement, which does not lead to abatement. Therefore, varying degrees of certainty are inherent in the process of forecasting. The two most critical drivers of this certainty are:

- **Baseline emissions rate:** The starting point for calculations.
- **Rate of decline:** The assumed decrease in emissions over time.

Rebellion Energy Solutions expresses confidence in achieving stable baseline measurements, which include two 2-hour tests – separated by a 30-day shut-in period – with consistent emission rate and flowing pressure readings on a constant choke setting. Additional factors detailed in the Policy that can further **increase** certainty include the degree of stability in longer measurement times, and comparison to historical production data. The policy also notes that higher measured emission rates inherently carry more uncertainty and should be treated with more conservatism.

Regarding the rate of decline, Rebellion Energy Solutions highlights that a 0% decline rate, industry standards for late-stage wells (terminal decline) with remaining energy held behind surface equipment often involve a gradual decrease. Citing the Society of Petroleum Engineers, the policy mentions that a 7% exponential annual decline is considered the high range for terminal decline. Rebellion Energy recognizes the confidence in selecting a decline rate between 0% and 7%, and occasionally higher if the well's characteristics call for it, and sees this as an area for applying a conservative approach.

Key Quote: "The two most critical drivers associated with that certainty are the baseline emissions rate used as a starting point for the calculations and the rate of decline that is applied to that starting point."

Available Data

Rebellion Energy emphasizes the importance of utilizing all available data to maximize certainty, even if such data for OOG wells is often sparse or incomplete. Commercially relevant data sources include:

- **Historical Production Data:** Monthly reporting data, available publicly and through services like ENVERUS. Rebellion Energy uses this data to contextualize the stable baseline emission rate.Comparisons are made to assess if the current rate aligns with historical trends or if mechanical issues might have influenced recent production. Reservoir and production engineers on staff at Rebellion Energy perform this analysis.
- **Measurement Data:** Emission rates and flowing pressures are collected during baseline testing. Rebellion Energy considers the interplay between these factors and the timing of stability. Additional testing time beyond methodology requirements requirements may be valuable but must be balanced against the associated costs.

- **Terminal Decline Studies:** Historical production trends can inform the appropriate terminal decline rate. Analogous wells and empirical studies (including one co-authored by Rebellion Energy Solutions) can also provide insights.

Key Quote: "Once a stable baseline emission rate is established, it is important to consider that rate within the context of the wells historic production."

Certainty Analysis

The core objective of Rebellion Energy's Certainty in Forecasting policy is to increase confidence in forecasting emissions over time. Rebellion Energy Solutions employs a strategy of layering in conservatism to mitigate the risk of over-crediting. This policy consists of three key parts:

1. **Baseline Emissions Buckets:** Rebellion Energy Solutions uses an "emitter bucketing technique" based on the measured emission rate to categorize wells (Low, Mid, High, and Super Emitters). Each bucket has a corresponding minimum total stable test time requirement . This acknowledges that higher emission rates warrant more extensive measurements to increase confidence.
    - **Low Emitter:** <= 417 scf/hr (4 hours minimum test time)
    - **Mid Emitter:** >= 417 - <= 1,255 scf/hr (6 hours minimum test time)
    - **High Emitter:** > 1,250 - <= 3,750 scf/hr (8 hours minimum test time)
    - **Super Emitter:** > 3,750 scf/hr (24 hours minimum test time)

    Furthermore, Rebellion Energy Solutions compares the stable baseline emission rate to historical production data. Ideally, these should be within 10% of the most recent stable trend. If a reasonable match is not found, Rebellion Energy's petroleum engineer may adjust the baseline emission rate *downward* (not upward) for volume calculations, adding a layer of conservatism. This adjustment does not affect the minimum stable test time requirement or "bucketing technique".
2. **Sensitivity of Terminal Decline Application:** Rebellion Energy Solutions calculates emission volumes using a standard 0% decline. Then, based on the Baseline Emissions Buckets category, a terminal decline rate (ranging from 1% to 7% annual exponential decline) is assigned, and a second volume calculation is performed using this decline rate over the 20-year crediting period. The specific matrix for assigning these terminal decline rates based on emitter type is provided in the document. Super Emitters are treated individually with a tailored reservoir ngineering study. The forecast is capped at the 20-year crediting period, or earlier if the emission rate reaches zero before the crediting period expires.
3. **Scenario Analysis:** Each calculated volume from the sensitivity analysis is associated with a scenario, labeled either "High-Certainty."A Rebellion Energy staff petroleum engineer reviews these scenarios and determines the "High Certainty" volumes within the fully issued volumes. A write-up of this analysis is included in Rebellion Energy project data rooms. This in-depth review is particularly important for Super Emitters and may involve audit by a professional engineer.

Policy Mechanics

Rebellion Energy will market and sell “High Certainty” credit volumes according to their Rebellion Price Matrix. Credits that meet the standard for issuance but are not classified as “High Certainty” will not be brought to market.

Key Quote: “All High Certainty credit volumes will be marketed and sold according to the Rebellion Price Matrix. Those credits that meet the standard (are issued) but are not considered High Certainty volumes will not be brought to market by Rebellion Energy Solutions .”

Additional Considerations & Policy Updates

Rebellion Energy reserves the right to update its policy as new information becomes available.