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Research on the Relationship between SEC Oil and Gas Reserves and Oilfield Production and Operations Management

Fan Guoquan, Guo Mengyue, Wang Yun

PetroChina Co Ltd. Dagang Oilfield Company, Tianjin, China

Abstract: *SEC reserves, as a commonly used disclosure standard in the international oil and gas industry, can exert certain regulatory constraints on geological understanding, engineering technology, and economic conditions, thereby linking underground resources to above-ground assets. This article focuses on the intrinsic relationship between oil and gas SEC reserves and the production and operation management of oil and gas field enterprises. On the one hand, it examines the practical role of SEC reserves in enterprise value assessment, financial accounting, production optimization, and ongoing operations, revealing their profound impact on oil and gas field development, capital allocation, and risk management and control. On the other hand, this paper reconstructs management thinking with SEC reserves at its core, and explores strategic approaches from the perspectives of developing an integrated business management system, deepening the application of critical processes, enhancing system capabilities, and improving risk prevention and control mechanisms, thereby offering insights for reference.*

Keywords: *SEC reserves; oilfield production; business management*

1. Introduction

With the significant adjustment of the global energy landscape and the periodic violent fluctuations in oil and gas prices, the production and management models of oil and gas field enterprises have been subtly affected. In the face of the current industry model, resource abundance is no longer equated with the steady development of enterprises. Capital markets are paying more attention to which part of the resource base can be converted into long-term cash flow under given conditions. The standardized disclosure framework established by the Securities and Exchange Commission (SEC) around oil and gas reserves is precisely in this context that adjusts the complex judgments of "whether it can be exploited", "whether it is worth exploiting", and "under what conditions it should be exploited" to a relatively unified and comparable reserve caliber. For oil and gas enterprises, SEC reserves have become an important fulcrum that runs through asset quality recognition, credit image shaping, and international competitiveness enhancement. How to break out of the narrow perspective of "compliant disclosure", embed this indicator into the entire process of oil and gas field production and operation, and formulate refined management measures is a realistic issue worthy of deep consideration at present.

2. Overview of SEC Reserves

2.1 Definition of SEC Reserves

In the industry discourse system, "SEC reserves" is regarded as a strictly defined category of recoverable reserves, which are oil and gas reserves confirmed in accordance with the relevant disclosure rules of the U.S. Securities and Exchange Commission (SEC). It is premised on the ability to actually extract and achieve reasonable economic returns, emphasizing the joint constraints of geological understanding, engineering technology, and economic conditions. SEC reserves refer to that portion of oil and gas resources that, under a given economic environment, are highly confidently extractable and commercially viable through comprehensive analysis of geological and engineering data, as well as recognized "reliable technologies". The "current economic conditions" are defined using the arithmetic average of the first day prices of each of the 12 months preceding the reporting period. Within this framework, reserves are not only stratified according to certainty levels such as proven, probable, and possible, but also classified according to the status of being developed or undeveloped, forming a reserve

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system that considers both technical feasibility and economic feasibility. For oil and gas companies, "SEC reserves" are more like a widely accepted "unified language" in the market, used to translate geological resources into asset scales that can be recognized and measured by the capital market.[1]

2.2 The Importance of SEC Reserves

Firstly, for oil and gas companies listed in the United States or connected to international capital, the proven reserves disclosed in accordance with SEC rules are one of the core data in annual reports and regulatory documents, serving as the basic variables for market value assessment, merger and acquisition pricing, project financing quotas, and reserve replacement ratio calculations. Changes in these reserves are immediately reflected in investor expectations and credit evaluations. At the same time, reserves confirmed by SEC standards also define the "resource boundaries" for the production and operation management of oil and gas fields. The arrangement of development schedules, the selection of development plans, and the calculation of depletion amortization and cost recovery are all centered around this standard. The SEC has included unconventional oil and gas in the scope of disclosure in its modernization rules for reserves, with "reasonable certainty" and "reliable technology" as the core standards, making reserve information more aligned with the current technological advancements and the realities of resource structures. It can be said that SEC reserves are both a "hard support condition" on the balance sheet of oil and gas companies and a key indicator for judging production and operation strategies and risk management capabilities.[2]

3. The Relationship between SEC Oil and Gas Reserves and Enterprise Production and Operations Management

3.1 Determining Enterprise Value and Global Position

In the oil and gas industry, proven reserves as defined by the U.S. Securities and Exchange Commission (SEC) are almost equivalent to the "hard currency" of enterprises. What the capital market truly cares about is the portion of resource base that can be converted into stable cash flow under given economic conditions, and SEC reserves are the centralized representation of this expectation. Research shows that proven reserves, together with current production, are key explanatory variables for the market value and stock price performance of exploration and development enterprises. The scale, structure, and lifespan of reserves directly affect valuation levels and shareholder return expectations. The original intention of the SEC in promoting the modernization of oil and gas disclosure rules is to help investors more accurately judge the relative value and development potential of different companies through more transparent and comparable reserve information. For enterprises participating in global allocation, SEC reserves not only enter valuation models but also penetrate into key aspects such as credit ratings, mergers and acquisitions negotiations, and project joint ventures, affecting their position and voice in the international oil and gas landscape. An enterprise with clear reserve standards, stable replacement rates, and a reasonable asset portfolio is more likely to obtain patient support from long-term capital and stabilize its "fundamentals" amidst cyclical fluctuations, which actually constitutes the core support for its international status.

3.2 Serving as the Foundation for Enterprise Financial Reporting

From a financial perspective, SEC reserves constitute the "invisible supporting conditions" of the accounting system for oil and gas companies. Although contingent resources are typically not directly listed as asset accounts, under the SEC framework, listed companies must disclose standardized future net cash flows calculated based on proven reserves and 12-month average prices in their notes. This disclosure has become an important component of financial reports. When using the production method to accrue depletion and amortization, proven reserves are also used as the basis for allocation, affecting the distribution pattern of costs across accounting periods. In impairment testing, the scale of reserves and development cost assumptions jointly determine the recoverable amount of assets. In other words, SEC reserves run through the complete chain of "disclosure, measurement, impairment, and taxation", exerting a linkage impact on the income statement, balance sheet, and cash flow statement. If reserve assessments deviate from reality, whether overly optimistic or overly conservative, they will distort the level of depletion and asset quality judgments, thereby affecting dividend policies, capital expenditure rhythms, and debt covenant constraints. Therefore, establishing a robust and traceable financial accounting logic centered around SEC reserves is a prerequisite for oil and gas companies to stabilize

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their financial narrative.

3.3 Directing Production Activities and Strategic Optimization

In terms of the production and operation model of enterprises, SEC reserves provide a resource annotation with economic constraints. They are categorized according to proven developed, undeveloped, and other types, and the "economically recoverable" is defined based on the average price over 12 months. This naturally imprints the time value and cost constraints on reserve data, providing a structured decision-making foundation for development plans and production planning. Management can compare different blocks and reserve categories to identify development targets with better unit investment returns and more controllable risk exposures, and then arrange the drilling and completion pace, adjust the recovery technology path, and the injection sequence. The annual rolling update of SEC reserves also provides "feedback information" for production optimization. By comparing reserve increments, utilization ratios, and changes in economic assumptions, the effectiveness of existing development strategies can be tested, and overly aggressive or overly conservative production arrangements can be promptly corrected. In this way, reserve disclosure no longer remains at the compliance level, but is further embedded in the comprehensive optimization of capacity allocation, cost control, and medium-to-long-term development pace, enabling geological engineering knowledge to be truly transformed into executable business plans.

3.4 Impacting Business Risk and Sustainable Operations

SEC reserves are also a sensitive indicator of an enterprise's risk profile and sustainable operating capacity. The size and lifespan of proven reserves directly reflect the enterprise's production guarantee capacity and cash flow "safety cushion" in the foreseeable future. The distribution of reserve structure across different oil and gas types, regions, and development stages determines its exposure to price fluctuations, cost increases, and policy changes. According to data from the U.S. Energy Information Administration, in 2023, against the backdrop of a significant decline in oil and gas prices, proven reserves of crude oil and natural gas in the United States decreased by approximately 3.9% and 12.6% respectively compared to the previous year, indicating that price changes can quickly "rewrite" the reserve book through economic recoverability limits. The contraction of reserves due to changes in price and cost assumptions will bring about chain reactions such as accelerated depletion, increased impairment pressure, and deterioration of asset-liability structure. Recently, professional institutions have also pointed out in discussions on oil and gas reserve valuation that assumption setting and uncertainty management are key links to avoid systematic underestimation of risks. For enterprises, maintaining a reasonable reserve lifespan and a stable reserve replacement rate is the foundation for maintaining expectations of "sustainable operation"; at the same time, by combining and allocating reserves across different regions and types, the concentration risk brought by a single price and a single block can be diversified, allowing for strategic adjustment time and space in the context of energy transformation and market cycles.[3]

4. Optimization Strategies for Production and Operations Management Centered on SEC Reserves

4.1 Establishing an Integrated Business Management System

To truly leverage the "driving" role of SEC reserves, it is first necessary to establish a collaborative operation and management system within the enterprise that revolves around reserve operations, transforming this seemingly "technical" indicator into a shared decision-making benchmark for various business segments. Instead of treating SEC reserves as a "centralized accounting" before annual report disclosure, it is better to embed them into the entire process of annual business plans, capital expenditure arrangements, and medium-to-long-term development planning, so that reserve evaluation can shift from being a back-end technical support to being the starting point and end result of front-end business decision-making.

In terms of organizational structure, it is necessary to break down the relatively fragmented work patterns of exploration, development, production, and finance, and establish a cross-departmental joint working mechanism centered around SEC reserves. The determination of reserve assumptions, the unification of classification standards, and the adjustment of economic parameters should not be "internally digested" by a single professional line. Instead, they should be jointly reviewed and confirmed by management, professional technical personnel, and financial teams under a unified governance

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framework. Through a routine reserve communication mechanism, the changes in SEC reserves can be aligned with key aspects such as production forecasting, cash flow calculations, and investment plan revisions, prompting various departments to work under the same set of resource boundaries and economic assumptions, thereby reducing the disconnect between "technical language" and "financial language".

In terms of process system, SEC reserve management and rolling plan management should be organically integrated. On the one hand, the annual reserve update results should serve as a hard constraint for adjusting the development pace, optimizing well site deployment, and asset portfolio. On the other hand, necessary dynamic flexibility should be retained at the execution level, so that new geological insights, engineering practices, and price environments can be promptly reflected in the reserve model, avoiding the constraints of "static one-time evaluation" that may hinder the enterprise's progress. By establishing a unified data platform and information system, integrated management of geological models, engineering parameters, economic assumptions, and disclosure standards can be achieved, making reserve data the "core narrative" that horizontally connects various business lines and vertically links strategy and on-site operations.

4.2 Enhancing the Application Depth of Critical Processes

In the investment decision-making process, SEC reserves can serve as an important criterion for project screening and prioritization. Under unified assumptions of price, cost, and technology, a comparison can be made between the proven reserve scale, lifespan, and unit economic benefit of different blocks. This not only provides an objective reference for resource allocation but also avoids short-sighted behavior that arises from solely using production or single-well indicators as the basis for decision-making. In capital budgeting, the changes in SEC reserves should be incorporated into the evaluation logic, establishing a corresponding relationship between new reserves, producing reserves, and capital expenditure. This strengthens management awareness and improves the quality of investment decisions from the source. Furthermore, in the production and operation phase of the enterprise, SEC reserves can be used as an important tool for rhythm adjustment. Through structural analysis of developed and undeveloped reserves, conventional and unconventional reserves, the management of the enterprise can more accurately identify development targets with high marginal contribution. Based on this, reasonable arrangements can be made for wellbore structure, recovery technology combination, and injection-production intensity, balancing production targets and cost control while ensuring the economic recoverability of SEC reserves.[4]

4.3 Improving Data and System Utilization Capabilities

To ensure that SEC reserves can play a long-term role in the business development of enterprises, it is necessary to further enhance the application capabilities of data and systems, and fully undertake the construction of infrastructure. As we know from the previous content, SEC reserves are essentially the result of comprehensive deduction of geological, engineering, price, cost, and other information based on unified assumptions. If the underlying data applied is scattered across different departments, with inconsistent standards and lagging updates, even the most rigorous evaluation methods will inevitably lead to distortions. Therefore, it is necessary to first establish a data architecture centered around SEC standards at the enterprise level, unifying the coding and master data management of core entities such as reservoirs, wellbores, blocks, and projects. This will open up data interfaces across exploration, development, production, finance, and other lines, ensuring that the "identity" of the same well and the same block remains completely consistent across different systems. Focusing on the classification and economic assumptions of SEC proven reserves, we should establish standardized data models and indicator systems, incorporating key parameters such as price curves, operating costs, and tax policies into the models to avoid repeated fluctuations in reserve standards due to arbitrary changes in subjective assumptions.

At the system level, it is necessary to promote the rapid implementation of the concept of "business as rules" and upgrade reserve management from discrete table operations to a traceable process system. Through a unified application platform, key modules such as reserve evaluation, budget preparation, production planning, and investment decision-making are connected in series, forming a closed loop of "data collection", "model operation", "decision-making use", and "result backfilling". The production, pressure, water content, and operation information of the front-line production system can be returned to the data platform in near real-time, providing fresh and vivid evidence for reserve parameter correction and scenario calculation.

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4.4 Constructing a Comprehensive Risk Prevention and Control Mechanism

From the perspective of risk management, SEC reserves serve as both an asset "health report" and a mirror that magnifies the contours of corporate risks. Fluctuations in oil prices, cost rigidity, technological uncertainty, and changes in the regulatory environment will ultimately be reflected in adjustments to reserve scale and structure through the threshold of "economically recoverable". Once the reserve life is shortened and the replacement rate declines, production guarantee capabilities, cash flow stability, and asset impairment pressures will emerge simultaneously. Therefore, establishing a comprehensive risk prevention and control mechanism based on SEC reserves is essentially setting aside a safety margin for the sustained operation of the enterprise.

Firstly, SEC reserves should be embedded into the risk identification and early warning system. A set of quantifiable and traceable risk scales should be established based on key indicators such as reserve life, reserve replacement ratio, and standardized future cash flow sensitivity, to systematically measure the sensitivity of reserves to price, cost, tax, and technical assumptions under different scenarios. When the economic viability of reserves in a certain block is highly sensitive to changes in oil prices, or when a certain type of reserve accounts for an excessively high proportion in the portfolio, it should trigger adjustments to investment pace, structural rebalancing, or review of technical solutions, to avoid over-reliance on a single assumption. Secondly, the reserve evaluation process should be set as a management focus for internal control and compliance management. Enterprises need to clarify the authorization mechanism and review process for SEC reserve assumptions, and form a closed-loop management mechanism that includes modules such as "model development", "parameter setting", "independent review", and "regular backtracking", to prevent deliberate relaxation of conditions based on short-term reporting performance. Additionally, access management should be implemented for key reserve models to ensure that external disclosure is highly consistent with internal management standards, and constraints should be strengthened through audits and professional assessments, so that reserve figures can both support market expectations and withstand professional scrutiny. Finally, reserve risks should be managed in conjunction with financial risks, operational risks, and strategic risks. Reserve contraction not only means a weakening of the resource base, but also potentially magnifies financial pressure through paths such as accelerated depletion, impairment provisioning, and debt covenant constraints. In extreme scenarios, it can also affect credit ratings and refinancing capabilities. In medium and long-term planning, enterprises need to integrate SEC reserve scenario analysis with capital structure optimization, price hedging strategies, and asset portfolio adjustments, ensuring that the chain of "reserves, production, cash flow, and liabilities" maintains a basic balance across different cyclical environments.[5]

5. Conclusion

In summary, from a longer-term perspective, SEC reserves represent both a set of "technical-economic" rules and a continuous interrogation of corporate governance capabilities. Whoever can clearly articulate their resource base, operational boundaries, and risk tolerance under unified conditions is more likely to maintain a steady development pace in an uncertain market environment. Treating SEC reserves as a strategic coordinate means that oil and gas companies need to establish a closer internal connection between geological understanding, engineering practice, financial measurement, and risk management, allowing different departments to collaborate on management based on the same set of hypothetical data, and ensuring that every adjustment to reserves triggers a calibration of operational thinking. In the future, with the continuous advancement of unconventional oil and gas development, digital reservoir management, and climate policy evolution, the hypothetical system behind SEC reserves will continue to evolve. Oil and gas companies can only seize opportunities and maintain their bottom line in rule updates by maintaining an open learning ability and a multidisciplinary personnel team.

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