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Quarterly Revenue-Forecasting Based Aggregate Gas Pricing: A Business Block Analytical Framework for PT Penyalur Gas Natural

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ABSTRACT

The aims of this study is to analysis reorganizes PGN Group's consolidated quarterly financial and operating data into five business blocks: core natural gas trading, gas transmission or transportation, gas regasification, gas processing, and LNG trading. Natural gas trading is analyzed using ownership-based volume, infrastructure and processing activities using throughput-based volume, and LNG trading using transaction-based volume. The methodology includes account remapping, quarterly data reconstruction, cost analysis, and rolling-window backtesting for forecast model selection. Simple Moving Average, Exponential Smoothing, and Linear Regression are applied to selected accounts using the 2023Q1–2025Q4 period as the validation window. The findings show that PGN Group's gas economics are better explained through business-block indicators than by a single aggregate gas price. Core natural gas trading, gas regasification, and LNG trading show positive spreads, while gas transmission or transportation requires separate evaluation due to cost attribution and throughput effects. Gas processing reflects a cost-revenue matching structure in 2025. The proposed framework provides a simple and replicable model for deriving quarterly revenue rates, cost rates, and indicative spreads to support internal pricing review, quarterly performance interpretation, and revenue-based optimization.

Keyword: Revenue Forecasting, Aggregate Gas Pricing, Business Block and Analytical Framework

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Introduction

Natural gas remains an important component of Indonesia's energy system, while the global gas and LNG market continues to face uncertainty related to supply availability, price volatility, infrastructure constraints, and changing demand patterns [1, 2]. In this context, PT Penyalur Gas Natural and its subsidiaries, hereafter referred to as PGN Group, play a strategic role as the Gas Subholding of Pertamina. PGN Group operates across several gas-related business activities, including natural gas trading, gas transmission or transportation, regasification, gas processing, and LNG trading [3]. These activities make PGN Group an integrated gas business portfolio with diverse revenue, cost, and volume characteristics.

The complexity of PGN Group's gas business creates a managerial challenge in interpreting quarterly portfolio economics. Natural gas trading is mainly influenced by commodity ownership, purchase costs, supporting costs, and traded volume. In contrast, transmission, transportation, and regasification are more closely related to infrastructure-service economics, where revenue and cost are linked to throughput volume. Gas processing has a distinct processing-based cost and revenue

structure, while LNG trading reflects transaction-based economics. Therefore, the economics of PGN Group's gas-related activities cannot be adequately represented by a single tariff, one customer segment, one contract type, or one aggregate revenue line.

Although PGN Group reports several gas-related revenue and cost accounts in its consolidated financial statements, such as gas trading revenue, gas transmission or transportation revenue, regasification revenue, gas processing revenue, LNG trading revenue, purchase of natural gas, LNG-related costs, gas processing costs, and trading and infrastructure costs, these accounts are prepared primarily for financial reporting purposes rather than business-block pricing analysis [4, 5, 6, 3, 7, 8]. As a result, the available financial information still needs to be analytically remapped before it can be used to interpret quarterly gas-pricing economics. This creates a research gap, as there is no systematic quarterly analytical benchmark that converts PGN Group's consolidated gas-related revenues, costs, and operational volumes into economically meaningful pricing indicators.

This study addresses the gap by developing a quarterly revenue-forecasting-based business-block analytical framework for PGN Group. The novelty of the study lies in its attempt to repackage consolidated gas-related financial and operating data into five economically coherent business blocks: core natural gas trading, gas transmission or transportation, gas regasification, gas processing, and LNG trading. Each block is analyzed using an appropriate volume logic. Core natural gas trading is assessed using ownership-based volume, infrastructure and processing activities are assessed using throughput-based volume, and LNG trading is assessed using transaction-based volume. This approach allows the study to derive quarterly revenue rates, cost rates, and indicative spreads that are more useful for internal pricing review than a single aggregate gas price.

In addition, the study incorporates a forecasting approach to strengthen the analytical framework. Selected pricing-relevant accounts are forecast using Simple Moving Average, Exponential Smoothing, and Linear Regression, with rolling-window backtesting used to evaluate the most suitable method for each account. The forecast-based indicators are then compared with actual 2025 indicators to assess how the framework can support quarterly performance interpretation and managerial decision-making.

Accordingly, this study aims to: first, remap PGN Group's consolidated quarterly gas-related revenues, costs, and operational volumes into economically coherent business blocks; second, construct and evaluate a quarterly forecasting framework for selected pricing-relevant accounts; third, derive forecast-based quarterly pricing indicators for the main gas-related business blocks and compare them with actual 2025 indicators; and fourth, propose a simple and replicable analytical model to support internal pricing review, quarterly performance interpretation, and managerial decision support within PGN Group. The framework does not seek to determine official regulated tariffs, final commercial prices, contract-level prices, or customer-specific prices. Instead, it is intended as an internal analytical benchmark for understanding the quarterly economics of PGN Group's gas-related business portfolio.

An integrated gas company cannot be interpreted as a single homogeneous business because its activities may involve commodity trading, infrastructure services, processing activities, and transaction-based LNG operations. In the context of PGN Group, the gas-related portfolio consists of core natural gas trading, gas transmission or transportation, gas regasification, gas processing, and LNG trading. Each activity has different revenue, cost, and volume characteristics. Therefore, analyzing the portfolio through one aggregate gas price may obscure the economic logic of each business activity.

The concept of gas aggregation supports the view that PGN Group should be analyzed as a portfolio-level gas business. Gas aggregation involves the coordination of gas supply, infrastructure access, allocation, transportation, and delivery to different users and activities [9]. Similarly, natural gas supply chain literature explains that gas business operations involve integrated processes across supply, transportation, processing, storage, and delivery systems [10]. This supports the need to separate PGN Group's consolidated gas-related business into several analytical blocks.

The business-block approach in this study classifies PGN Group's gas-related activities into five blocks: core natural gas trading, gas transmission or transportation, gas regasification, gas processing,

and LNG trading. Core natural gas trading represents commodity ownership-based activities, where the economic interpretation is mainly based on gas trading revenue, purchase cost, support cost, and trading volume. Gas transmission or transportation and regasification represent infrastructure-service activities, where revenue and cost are closely related to throughput volume and service utilization. Gas processing has a distinct cost-revenue structure based on processing activities, while LNG trading is interpreted as a transaction-based activity.

This classification is also supported by cost-of-service and revenue-requirement logic. In infrastructure and utility-related businesses, pricing analysis is commonly linked to operating cost, service volume, utilization, and revenue sufficiency [11, 12, 13]. Although this study does not calculate official tariffs, this logic is useful for interpreting whether infrastructure-related business blocks generate sufficient revenue relative to their costs and operating scale. Thus, the business-block approach allows each activity to be assessed according to its own economic characteristics rather than being forced into one consolidated pricing measure.

PGN Group's consolidated financial statements contain several gas-related revenue and cost accounts, such as gas trading revenue, transmission or transportation revenue, regasification revenue, gas processing revenue, LNG trading revenue, purchase of natural gas, LNG-related costs, processing costs, and trading and infrastructure costs. However, financial statements are primarily prepared for general-purpose reporting and external users, not specifically for internal business-block pricing analysis [4]. Therefore, the reported financial accounts need to be analytically remapped into managerial categories before they can be used to interpret quarterly gas-pricing economics.

Managerial accounting literature emphasizes that accounting data must often be reorganized into decision-useful categories to support planning, control, performance evaluation, and managerial decision-making [14]. In this study, financial statement remapping is conducted by assigning consolidated gas-related revenues, costs, and operating volumes into five economically coherent business blocks. The remapping process is based on the economic role of each account, not only on its financial statement label.

Each business block is then linked to the most appropriate volume basis. Core natural gas trading is analyzed using ownership-based volume because its economics are related to gas purchase, ownership, resale, and trading spread. Gas transmission or transportation, regasification, and gas processing are analyzed using throughput-based volume because their economics depend on the volume handled by infrastructure or processing facilities. LNG trading is analyzed using transaction-based volume because its economics reflect transaction or intermediary activities rather than only physical throughput.

After remapping, the study derives three main quarterly pricing indicators: revenue rate, cost rate, and indicative spread. Revenue rate reflects revenue per MMBTU or equivalent transaction unit. Cost rate reflects cost per MMBTU or equivalent transaction unit. Indicative spread reflects the difference between revenue rate and cost rate. These indicators are not official tariffs, regulated prices, or contract-level commercial prices. Instead, they serve as internal analytical benchmarks to interpret the quarterly economics of each business block.

Forecasting is incorporated to make the framework more useful for managerial planning. Forecasting allows historical data to be converted into forward-looking estimates that can support future-oriented decision-making [15, 16]. This study applies account-level forecasting rather than total profit-and-loss forecasting because different business blocks may have different revenue, cost, and volume behavior. Three transparent and practical forecasting methods are used: Simple Moving Average, Exponential Smoothing, and Linear Regression. These methods are selected because they are understandable, replicable, and suitable for spreadsheet-based managerial analysis.

To select the most appropriate forecasting method, this study applies rolling-window backtesting. Forecast validation is important because a model that fits historical data does not necessarily provide accurate future estimates [17, 16]. Forecast accuracy is evaluated mainly using

Mean Absolute Percentage Error (MAPE), supported by Root Mean Squared Error (RMSE), interpretability, and practical usability [18]. This account-specific model selection allows each pricing-relevant account to use the forecasting method that best fits its own data behavior.

The conceptual framework of this study connects consolidated financial data, business-block remapping, forecasting, and managerial pricing interpretation. The framework begins with PGN Group's consolidated quarterly gas-related revenues, costs, and operational volumes. These data are then remapped into five business blocks: core natural gas trading, gas transmission or transportation, gas regasification, gas processing, and LNG trading. This step transforms general-purpose financial statement data into managerial categories that are more suitable for internal pricing analysis.

The next stage assigns each business block to the most relevant volume logic. Core natural gas trading uses ownership-based volume, infrastructure and processing activities use throughput-based volume, and LNG trading uses transaction-based volume. This classification ensures that each business block is analyzed based on the economic nature of its activities. The framework then calculates quarterly revenue rates, cost rates, and indicative spreads for each block.

After the business-block indicators are established, selected pricing-relevant accounts are forecast using Simple Moving Average, Exponential Smoothing, and Linear Regression. Rolling-window backtesting is used to evaluate the accuracy of each method and to select the best forecasting model for each account. The selected models are then used to generate forecast-based quarterly pricing indicators. These indicators are compared with actual 2025 indicators to assess whether the framework can explain quarterly portfolio economics in a useful and practical way.

The final stage of the framework is managerial interpretation. The resulting indicators help management identify whether quarterly performance changes are driven by revenue rate, cost rate, operating volume, or indicative spread movement. In this way, the framework supports internal pricing review, quarterly performance interpretation, and managerial decision support. The framework is not intended to replace official regulated tariffs or contract-level commercial pricing. Instead, it provides a simple, transparent, and replicable analytical benchmark for understanding PGN Group's quarterly gas-related business economics.

Method

This study applies a quantitative single-case study design using PGN Group as the unit of analysis. A case study design is appropriate because the study examines a contemporary business issue within a real organizational context, namely the interpretation of PGN Group's quarterly gas-pricing economics. PGN Group is selected because it represents an integrated gas business portfolio that combines commodity-trading activities, infrastructure-service activities, processing activities, and LNG transaction-based activities.

The study is also design-based because it develops a practical and replicable analytical framework for quarterly business-block pricing interpretation. The analysis covers PGN Group's consolidated gas-related business portfolio during the 2023Q1–2025Q4 period. The 2023Q1–2024Q4 period is used as the initial estimation window, while 2025Q1–2025Q4 is used for rolling-window forecast validation and comparison between forecast-based indicators and actual indicators.

The analysis is conducted at the business-block level rather than at the customer, contract, asset, or pipeline-segment level. The five business blocks analyzed in this study are core natural gas trading, gas transmission or transportation, gas regasification, gas processing, and LNG trading. Each block is interpreted based on its own revenue, cost, and volume logic.

This study uses secondary data obtained from PGN Group's published annual reports, interim consolidated financial statements, audited consolidated financial statements, note disclosures, and operational volume information. The financial data consist of selected gas-related revenue and cost accounts, including gas trading revenue, gas transmission or transportation revenue, regasification

revenue, gas processing revenue, LNG trading revenue, purchase of natural gas, LNG-related costs, gas processing costs, and trading and infrastructure costs.

The operating data consist of gas trading volume, gas transmission or transportation throughput, regasification throughput, gas processing throughput, and LNG trading or MMBTU-equivalent transaction volume. These volume data are used as denominators to calculate quarterly pricing indicators, including revenue rate, cost rate, and indicative spread.

Each business block uses a different volume logic. Core natural gas trading uses ownership-based volume because its economics are related to gas ownership, purchase, and resale. Gas transmission or transportation, gas regasification, and gas processing use throughput-based volume because their economics depend on the volume handled through infrastructure or processing facilities. LNG trading uses transaction-based volume because its economics reflect transaction or intermediary activities.

Regulatory and policy documents are used only as contextual support to explain the operating environment of PGN Group, particularly in relation to infrastructure-service economics, cost recovery, revenue adequacy, and downstream gas-pricing sensitivity. This study does not calculate official regulated tariffs, final commercial prices, or contract-level prices.

The data analysis consists of six main stages. The first stage is business-block analytical remapping. In this stage, PGN Group's consolidated gas-related financial and operating data are reorganized into five economically coherent business blocks: core natural gas trading, gas transmission or transportation, gas regasification, gas processing, and LNG trading. This remapping is conducted based on the economic role of each account, not merely its financial statement label.

The second stage is quarterly data reconstruction. Several interim financial statement items are reported cumulatively; therefore, they are converted into individual quarterly values. The quarterization process is conducted as follows: Q1 equals the reported Q1 value, Q2 equals H1 minus Q1, Q3 equals 9M minus H1, and Q4 equals the full-year value minus 9M. This process allows the study to construct comparable quarterly revenue, cost, and volume data.

The third stage is analytical reclassification of mixed costs. Trading and infrastructure costs are separated into transportation or transmission-dominant costs and gas trading support costs. This classification is analytical and does not replace PGN Group's official accounting presentation. Its purpose is to improve the economic interpretation of quarterly business-block indicators.

The fourth stage is the construction of historical quarterly pricing indicators. For each business block, three main indicators are calculated: revenue rate, cost rate, and indicative spread. The general formulas are as follows:

Forecast revenue rate:

$$\widehat{\boldsymbol{P}}_{\boldsymbol{b,t}} = \frac{\widehat{\boldsymbol{R}}_{\boldsymbol{b,t}}}{\widehat{\boldsymbol{Q}}_{\boldsymbol{b,t}}}$$

Forecast cost rate:

$$\widehat{\boldsymbol{C}}\boldsymbol{ost}_{\boldsymbol{b,t}}^{\boldsymbol{rate}} = \frac{\widehat{\boldsymbol{C}}_{\boldsymbol{b,t}}}{\widehat{\boldsymbol{Q}}_{\boldsymbol{b,t}}}$$

Forecast spread:

$$\widehat{\boldsymbol{S}}\boldsymbol{pread}_{\boldsymbol{b,t}} = \frac{\widehat{\boldsymbol{R}}_{\boldsymbol{b,t}} - \widehat{\boldsymbol{C}}_{\boldsymbol{b,t}}}{\widehat{\boldsymbol{Q}}_{\boldsymbol{b,t}}}$$

For core natural gas trading:

$$\widehat{\boldsymbol{S}}\boldsymbol{pread}_{\boldsymbol{gt,t}} = \frac{\widehat{\boldsymbol{R}}_{\boldsymbol{gt,PGNG,t}} - \widehat{\boldsymbol{C}}_{\boldsymbol{gt,core,t}} - \widehat{\boldsymbol{C}}_{\boldsymbol{gt,support,t}}}{\widehat{\boldsymbol{Q}}_{\boldsymbol{gt,PGNG,t}}}$$

For the core natural gas trading block, total cost consists of purchase of natural gas and gas trading support cost. Therefore, the gas trading spread is calculated by subtracting both core trading cost and support cost from gas trading revenue, then dividing the result by gas trading volume.

The fifth stage is forecasting and model selection. Selected pricing-relevant accounts are forecast using three methods: Simple Moving Average, Exponential Smoothing, and Linear Regression. These methods are selected because they are transparent, practical, and suitable for spreadsheet-based managerial analysis. The study applies one-step-ahead rolling-window backtesting. Each forecast uses the latest eight quarters of actual data to predict the next quarter. The validation period covers 2025Q1–2025Q4.

Forecast accuracy is evaluated using Mean Absolute Percentage Error (MAPE) as the primary criterion and Root Mean Squared Error (RMSE) as a supporting criterion. The method with the lowest MAPE is selected for each account, while RMSE, interpretability, and practical usability are also considered. This account-specific model selection is used because different revenue, cost, and volume accounts may have different data behavior.

The final stage is the construction and interpretation of forecast-based 2025 pricing indicators. The selected forecasting models are used to estimate revenue, cost, and quantity variables for each business block. These forecasted variables are then converted into forecast-based revenue rates, cost rates, and indicative spreads. The forecast-based indicators are compared with actual 2025 indicators to identify whether the differences are driven by revenue movement, cost movement, volume movement, or spread movement.

Through these stages, the methodology provides a structured framework for converting consolidated quarterly financial and operating data into business-block pricing indicators. The framework is intended to support internal pricing review, quarterly performance interpretation, and managerial decision-making within PGN Group.

Results and Discussion

The first stage of the analysis reconstructs PGN Group's consolidated gas-related revenues, costs, and operating volumes into five business blocks: core natural gas trading, gas transmission or transportation, gas regasification, gas processing, and LNG trading. The reconstruction confirms that PGN Group's quarterly gas economics cannot be meaningfully interpreted using a single aggregate gas price. Each business block has a different economic profile because each activity follows a different revenue, cost, and volume logic.

The historical annual weighted indicators for 2023–2024 show that core natural gas trading generated positive spreads in both years. The indicative spread increased from USD 1.58/MMBTU in 2023 to USD 1.76/MMBTU in 2024. This indicates that the core trading portfolio remained economically positive, although its performance still depended on the interaction between revenue rate, purchase cost rate, support cost, and trading volume.

In contrast, gas transmission or transportation showed negative spreads under the analytical cost attribution used in this study. The spread improved slightly from USD -0.32/MMBTU in 2023 to USD -0.28/MMBTU in 2024. This result does not represent a final profitability conclusion for transmission assets, but indicates that infrastructure-service activities need to be evaluated separately through revenue rate, cost rate, throughput utilization, and cost attribution. This finding is consistent with the cost-of-service and revenue-requirement logic, which emphasizes the relationship between service volume, cost burden, infrastructure utilization, and revenue sufficiency.

Table 1. Historical Annual Weighted Business-Block Pricing Indicators (2023–2024)
Unit: USD/MMBTU, except LNG trading as USD/MMBTU-equivalent transaction unit

Business block	Year	Revenue rate	Cost rate	Indicative spread	Main interpretation
Core Natural Gas Trading	2023	7,57	5,99	1,58	Positive trading spread
Core Natural Gas Trading	2024	8	6,24	1,76	Positive spread with higher revenue and cost rate
Gas Transmission/ Transportation	2023	0,39	0,71	-0,32	Negative spread under analytical cost attribution
Gas Transmission/ Transportation	2024	0,42	0,7	-0,28	Negative spread, but slightly improved
Gas Regasification	2023	1,65	0,82	0,83	Positive service-based spread
Gas Regasification	2024	2,17	0,81	1,35	Improved annual spread
Gas Processing	2023	9,44	3,95	5,49	High positive processing spread
Gas Processing	2024	3,59	3,59	0	Near cost-revenue matched structure
LNG Trading	2023	0	0	0	No active indicator in dataset
LNG Trading	2024	10,14	9,55	0,59	Stable transaction-based spread

Source: The author used the series of financial statements and interim statements, annual statement, note disclosures, and the amount of operations carried out by the PGN Group to calculate [5, 3, 7, 8]. Annual indicators are weighted indicators that are calculated by adding annual revenue, cost and volume values, instead of average quarterly rates.

Gas regasification produced positive service-based spreads, increasing from USD 0.83/MMBTU in 2023 to USD 1.35/MMBTU in 2024. This suggests that regasification should be treated as a distinct infrastructure-service block rather than being combined with LNG trading or natural gas trading. Gas processing showed a material change between 2023 and 2024. It recorded a high positive spread of USD 5.49/MMBTU in 2023, but moved toward a cost-revenue matched structure in 2024. LNG trading became an active analytical block in 2024 and produced a relatively stable transaction-based spread of USD 0.59/MMBTU-equivalent.

Overall, the historical reconstruction supports the business-block approach. The results show that core gas trading, transmission or transportation, regasification, processing, and LNG trading cannot be interpreted as one homogeneous activity. Instead, each block requires its own pricing indicator based on the relevant revenue, cost, and volume relationship.

The second stage evaluates the forecasting performance of Simple Moving Average, Exponential Smoothing, and Linear Regression for selected pricing-relevant accounts. The forecasting exercise applies one-step-ahead rolling-window backtesting using the latest eight quarters of actual data to forecast each quarter in 2025. Forecast accuracy is measured primarily using Mean Absolute Percentage Error (MAPE), supported by Root Mean Squared Error (RMSE), interpretability, and practical usability.

Table 2. Forecast Accuracy Summary and Selected Method by Account
Unit: USD/MMBTU, except LNG trading as USD/MMBTU-equivalent transaction unit

Business block	Selected account	Selected method	Best MAPE (%)
Core Natural Gas Trading	Gas trading revenue	Linear Regression	3,95
Core Natural Gas Trading	Gas trading volume	Simple Moving Average	2,66
Core Natural Gas Trading	Purchase of natural gas	Linear Regression	6,36
Core Natural Gas Trading	Gas trading support cost	Linear Regression	41,36
Gas Transmission / Transportation	Transmission / transportation revenue	Exponential Smoothing	6,16
Gas Transmission / Transportation	Transmission / transportation throughput	Exponential Smoothing	6,58
Gas Transmission / Transportation	Transportation / transmission cost	Simple Moving Average	20,2
Gas Regasification	Regasification revenue	Simple Moving Average	46,84
Gas Regasification	Regasification throughput	Simple Moving Average	51,54
Gas Regasification	Regasification cost	Simple Moving Average	2,87
Gas Processing	Gas processing revenue	Exponential Smoothing	7
Gas Processing	Gas processing throughput	Exponential Smoothing	8,08
Gas Processing	Gas processing cost	Simple Moving Average	6,2
LNG Trading	LNG trading revenue	Simple Moving Average	29,8
LNG Trading	LNG trading transaction volume	Simple Moving Average	30,4
LNG Trading	LNG trading cost	Simple Moving Average	29,79

Source: The calculation of source is based on rolling-window one-step-ahead backtesting of reconstructed quarterly data on the PGN Group. The main selection measure is MAPE, which is in line with the literature on forecast accuracy [18, 16].

The results show that no single forecasting method performs best across all accounts. Simple Moving Average is selected for nine accounts, Exponential Smoothing for four accounts, and Linear Regression for three accounts. This confirms that account-specific model selection is more appropriate than applying one uniform forecasting method to all revenue, cost, and volume variables.

For the core natural gas trading block, Linear Regression performs best for gas trading revenue and purchase of natural gas, while Simple Moving Average performs best for gas trading volume. However, gas trading support cost shows a relatively high MAPE of 41.36%, indicating that support cost may contain irregular timing or reclassification effects that are difficult to capture using simple forecasting models.

For gas transmission or transportation, Exponential Smoothing performs best for revenue and throughput, suggesting that recent observations are useful for forecasting this block. However, transportation or transmission cost shows higher forecast error, which may reflect the timing of infrastructure-related expenses, maintenance costs, or cost recognition patterns.

For gas regasification, the forecasting results are mixed. Regasification cost is highly predictable with a MAPE of 2.87%, while regasification revenue and throughput have higher errors. This indicates that regasification economics are sensitive to utilization patterns, LNG cargo timing, and operational schedules. For gas processing, revenue and throughput are relatively predictable using Exponential Smoothing, while cost is better forecast using Simple Moving Average. For LNG trading, Simple Moving Average is selected for all main accounts, although the error level remains relatively high because the effective historical data series is limited and the activity became analytically active only in 2024.

These findings show that forecasting is not only a statistical exercise but also a managerial interpretation tool. The selected methods provide a transparent and replicable way to convert account-level forecasts into business-block pricing indicators.

Forecast-Based and Actual 2025 Pricing Indicators

The selected forecasting methods are used to construct forecast-based annual weighted pricing indicators for 2025. The results show that core natural gas trading, gas regasification, and LNG trading are forecast to generate positive spreads. Gas transmission or transportation is forecast to remain negative under analytical cost attribution, while gas processing is forecast to operate near a cost-revenue matched position.

The comparison between forecast-based and actual 2025 indicators shows that the framework captures the general direction of the business-block economics. Core natural gas trading remains positive in both forecast-based and actual indicators. However, the actual spread of USD 1.34/MMBTU is slightly lower than the forecast spread of USD 1.44/MMBTU because the actual cost rate is higher than forecast. This indicates that the forecast correctly anticipated a positive trading spread, but underestimated the actual annual cost rate.

Table 3. Forecast-Based Annual Weighted Business-Block Pricing Indicators for 2025
Annual weighted indicators; unit: USD/MMBTU, except LNG trading as USD/MMBTU-equivalent transaction unit

Business block	Forecast revenue rate	Forecast cost rate	Forecast spread	Forecast-based interpretation
Core Natural Gas Trading	8,19	6,74	1,44	Positive trading spread
Gas Transmission / Transportation	0,41	0,69	-0,28	Negative spread under analytical cost attribution
Gas Regasification	2,01	0,85	1,16	Positive service-based spread
Gas Processing	3,79	3,83	-0,05	Near cost-revenue matched
LNG Trading	10,02	9,44	0,58	Stable transaction spread

Source: Author's calculation based on selected forecasting methods and reconstructed quarterly PGN Group dataset.

Gas transmission or transportation records negative spreads in both forecast-based and actual indicators. The actual spread of USD -0.20/MMBTU is better than the forecast spread of USD -0.28/MMBTU, mainly because the actual annual cost rate is lower than forecast. This reinforces the importance of monitoring cost attribution, infrastructure utilization, and revenue sufficiency separately from commodity-trading activities.

Gas regasification records positive spreads in both forecast-based and actual indicators. The actual spread of USD 1.46/MMBTU is higher than the forecast spread of USD 1.16/MMBTU. Although the annual result is positive, the quarterly pattern indicates that regasification remains sensitive to

throughput movement and cost-rate changes. This supports the need to monitor regasification as a separate service-based block.

Gas processing is close to a cost-revenue matched structure in actual 2025 data, with an actual spread of only USD 0.02/MMBTU. This supports the interpretation that gas processing has its own cost-revenue dynamic and should not be automatically treated as part of the core natural gas trading margin. LNG trading shows the smallest spread difference between forecast and actual indicators. The forecast spread is USD 0.58/MMBTU-equivalent, while the actual spread is USD 0.57/MMBTU-equivalent. This indicates that although account-level forecast errors exist, revenue, cost, and transaction volume movements are relatively aligned, resulting in a stable transaction-based spread.

The comparison demonstrates that the most useful contribution of the framework is not simply forecasting accuracy, but the ability to identify where forecast deviations become economically meaningful. In core gas trading, the key issue is the relationship between revenue rate and total cost rate. In transmission or transportation, the main concern is cost rate and throughput utilization. In regasification, the key driver is utilization-sensitive cost rate. In gas processing, the focus is cost-revenue matching. In LNG trading, the main issue is transaction spread stability.

The results suggest that PGN Group should adopt a structured quarterly business-block pricing review. The framework enables management to separate commodity-trading economics, infrastructure-service economics, processing economics, and LNG transaction economics. This separation is important because each block has different managerial implications.

For core natural gas trading, management should monitor revenue rate, purchase cost rate, support cost rate, total cost rate, and indicative spread. For gas transmission or transportation, management should focus on service revenue rate, throughput, cost rate, cost attribution, and revenue sufficiency. For gas regasification, management should monitor throughput-sensitive revenue and cost rates, especially in relation to LNG cargo timing and facility utilization. For gas processing, the key issue is whether the block maintains a reasonable cost-revenue matching structure. For LNG trading, management should monitor transaction revenue rate, transaction cost rate, and transaction spread.

The comparison with actual 2025 indicators is presented in Table 4.

Table 4. Annual Weighted Comparison of Forecast-Based and Actual 2025 Indicators

Unit: USD/MMBTU, except LNG trading as USD/MMBTU-equivalent transaction unit

Business block	Forecast revenue rate	Actual revenue rate	Forecast cost rate	Actual cost rate	Forecast spread	Actual spread	Spread difference
Core Natural Gas Trading	8,19	8,39	6,74	7,06	1,44	1,34	-0,11
Gas Transmission/ Transportation	0,41	0,4	0,69	0,6	-0,28	-0,2	0,08
Gas Regasification	2,01	2,24	0,85	0,78	1,16	1,46	0,29
Gas Processing	3,79	3,52	3,83	3,51	-0,05	0,02	0,07
LNG Trading	10,02	9,68	9,44	9,11	0,58	0,57	-0,01

Source: Author-calculated regarding the chosen forecasting techniques, re-created quarterly data of the PGN Group and the actual data of 2025 financial and operations [5, 3, 7, 8]. Spread difference = actual-forecast spread.

Based on these findings, this study proposes the use of a Quarterly Business-Block Pricing Dashboard. The dashboard should consist of four modules: a data input module, a business-block indicator module, a forecasting and validation module, and a managerial diagnostic module. The data input module standardizes revenue, cost, and volume variables by business block. The indicator module calculates revenue rate, cost rate, and indicative spread. The forecasting and validation module

applies account-specific forecasting methods and compares forecast-based indicators with actual indicators. The managerial diagnostic module identifies whether deviations are mainly driven by revenue movement, cost movement, volume movement, or spread movement.

The framework should initially be implemented using a spreadsheet-based dashboard because the model relies on transparent formulas and simple forecasting methods. After validation, it can be developed into a more formal business intelligence or corporate performance management system. The framework does not replace official tariffs, contract-level pricing, or regulated pricing mechanisms. Instead, it provides an internal analytical benchmark to support pricing review, quarterly performance interpretation, and managerial decision-making.

In summary, the results show that a business-block analytical framework can bridge the gap between consolidated financial reporting and managerial pricing interpretation. It helps PGN Group move from fragmented quarterly analysis toward a more structured interpretation of its gas-related business portfolio. Although the framework does not eliminate forecast error, it helps management identify whether the error is economically relevant through its impact on revenue rate, cost rate, volume, or indicative spread.

Conclusions

This study develops a quarterly revenue-forecasting-based business-block analytical framework to interpret the gas-pricing economics of PGN Group. The findings show that PGN Group's gas-related business portfolio cannot be meaningfully explained through a single aggregate gas price because each activity has different revenue, cost, and volume characteristics. Core natural gas trading is best interpreted using ownership-based volume, gas transmission or transportation, regasification, and gas processing using throughput-based volume, and LNG trading using transaction-based volume. Through this remapping, consolidated financial and operating data can be transformed into quarterly pricing indicators, namely revenue rate, cost rate, and indicative spread. The forecasting results also show that no single method performs best for all accounts; therefore, account-specific model selection using Simple Moving Average, Exponential Smoothing, and Linear Regression is more appropriate for constructing forecast-based pricing indicators.

The comparison between forecast-based and actual 2025 indicators indicates that the proposed framework can generate useful business-block pricing signals. Core natural gas trading, gas regasification, and LNG trading show positive spreads, while gas transmission or transportation requires separate monitoring due to cost attribution and throughput effects. Gas processing reflects a near cost-revenue matched structure in 2025. The main contribution of this study is the development of a simple, transparent, and replicable framework that bridges consolidated financial reporting and managerial pricing interpretation. The framework can support internal pricing review, quarterly performance interpretation, and managerial decision-making through a Quarterly Business-Block Pricing Dashboard. However, this study is limited to business-block-level analysis and does not cover customer-level, contract-level, asset-level, or cargo-level pricing. Future research may extend the framework by using more granular data, longer time-series observations, and more advanced forecasting models.

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