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Turning A Burden Into Opportunity: A Strategic Scenario For Addressing Blue Oilfield's Economic And Operational Challenges

Menuju Kesempatan Dari Beban: Skenario Strategis Untuk Mengatasi Tantangan Ekonomi Dan Operasional Lapangan Minyak Biru

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ABSTRACT
This study evaluates an internally developed strategic scenario aimed at revitalizing the Blue Oilfield, an offshore oil and gas field operated by Pertamina Hulu Energi Offshore South East Sumatra (PHE OSES), which currently facing high operating costs and declining production. Despite these challenges, the field remains economically promising. The proposed solution emphasizes renegotiation of Production Sharing Contract from Gross Split to Cost Recovery, cost optimization in surface facilities, selective reinvestment in drilling new infill wells, idle well reactivation, and workovers. The economical calculation of the proposed strategy was assessed through an integrated evaluation, combining capital budgeting, sensitivity analysis, and probabilistic modeling using Monte Carlo simulations. The findings reveal a strong financial outlook, with high Net Present Value (NPV) and consistent performance contract period. These results suggest that, with the right operational and contractual shifting, the Blue Oilfield has the potential to transition from a financial burden into a productive and value-added asset. This paper offers both a decision-making tool for stakeholders and a replicable model for similar brownfield revitalization efforts in Indonesia's upstream sector.
Keywords: *Blue Oilfield, Cost Optimization, Economic Feasibility, Monte Carlo Simulation, AHP, Revitalization Strategy*

ABSTRACT
Studi ini mengevaluasi skenario strategis yang dikembangkan secara internal untuk merevitalisasi Lapangan Minyak Biru, lapangan minyak dan gas lepas pantai yang dioperasikan oleh Pertamina Hulu Energi Offshore South East Sumatra (PHE OSES), yang saat ini menghadapi biaya operasional tinggi dan produksi yang menurun. Meskipun menghadapi tantangan tersebut, lapangan ini tetap menjanjikan secara ekonomi. Solusi yang diusulkan menekankan renegosiasi Kontrak Bagi Hasil Produksi dari Gross Split menjadi Cost Recovery, optimasi biaya pada fasilitas permukaan, reinvestasi selektif dalam pengeboran sumur infill baru, reaktivasi sumur yang tidak aktif, dan workover. Perhitungan ekonomi dari strategi yang diusulkan dievaluasi melalui evaluasi terintegrasi, menggabungkan perencanaan modal, analisis sensitivitas, dan pemodelan probabilistik menggunakan simulasi Monte Carlo. Temuan menunjukkan prospek keuangan yang kuat, dengan Nilai Sekarang Bersih (NPV) tinggi dan kinerja yang konsisten selama periode kontrak. Hasil ini menunjukkan bahwa, dengan pergeseran operasional dan kontraktual yang tepat, Lapangan Minyak Biru memiliki potensi untuk bertransisi dari beban finansial menjadi aset produktif dan bernilai tambah. Artikel ini menawarkan alat pengambilan keputusan bagi pemangku kepentingan dan model yang dapat direplikasi untuk upaya revitalisasi lapangan minyak tua serupa di sektor hulu Indonesia.
Kata Kunci: Lapangan Minyak Biru, Optimasi Biaya, Kelayakan Ekonomi, Simulasi Monte Carlo, AHP, Strategi Revitalisasi

1. Introduction

Indonesia's upstream oil and gas sector is at a pivotal juncture. To support Indonesia's goal of reaching 1 million barrels of oil per day by 2030, greater focus is being placed on revitalizing mature oilfields, assets that were once key contributors to national output but have since become costly and difficult to maintain. The Blue Oilfield operated by PHE OSES is a clear example of this issue. Despite being burdened by high operating costs and declining production volumes, it possesses substantial untapped potential in terms of recoverable reserves and existing surface infrastructure. Its marginal status is a result of several compounding factors, including aging facilities, inefficient energy use, and high chemical consumption, rather than a lack of remaining hydrocarbons.

Table 1. PHE OSES FIELDS INFORMATION

FIELD	Oil Production (% of total)	Production Well Number	OPEX (% of total)	Power Consumption	Oil Production / Power Consumption (bopd / MW)
Green	40.6%	110	21%	13.86 MW	614
Red	34.6%	49	19%	8.06 MW	899
Blue	24.7%	86	61%	27.77 MW	187

Currently, the Blue Oilfield operates under the Gross Split PSC model, producing approximately 25% of PHE OSES's total oil output, yet it accounts for around 61% of the overall operational expenditures (OPEX), highlighting significant inefficiencies. Power consumption at the field is also disproportionately high, making up 56% of the total power usage within the asset. Additionally, the Blue Oilfield has the lowest ratio of oil produced to power consumed compared to other fields in PHE OSES. This indicates low energy efficiency and high production costs, further adding to its financial burden and emphasizing the urgent need for a strategic response.

The capital budgeting analysis for current condition of Blue Oilfield reflects this challenge clearly. The projection reveals discounted cashflow from this field is unsatisfactory, and will delivers negative return starting 2028 through the end of PSC contract period in 2038. The resulting Net Present Value (NPV) is negative USD 55.2 million, indicating a non-profitable condition. The field will continue to deliver oil but suffers from declining production efficiency and financial performance, and deemed to be a burden for total profitability of PHE OSES until the contract ends in 2038.

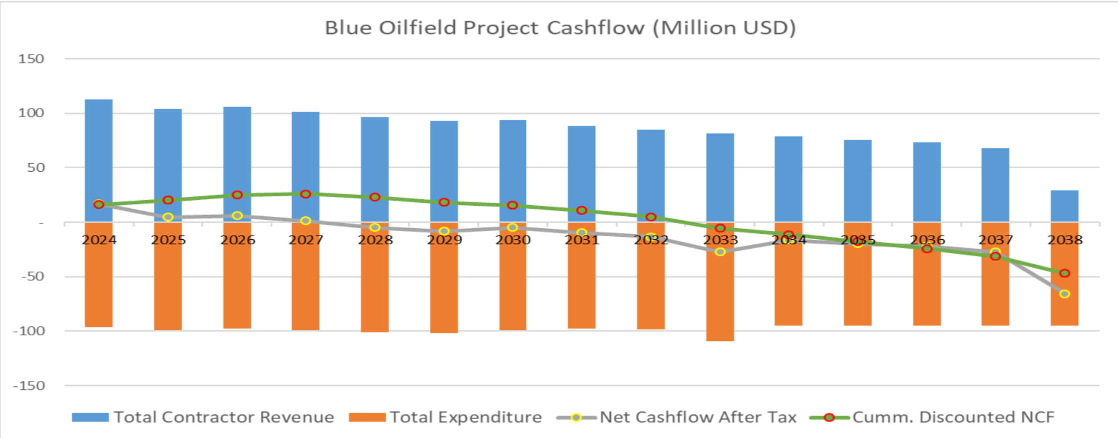


Figure 1. BLUE OILFIELD FORECASTED CASHFLOW

To address the challenges at the Blue Oilfield, PHE OSES formed a special task force made up of experts from production, engineering (both surface and subsurface), finance, and development and planning. This team was tasked with developing practical scenarios to improve the field's financial performance and day-to-day operations. The strategy developed by the team focuses on building a negotiation process with government to get approval for adopting cost recovery PSC model for the field, optimizing existing expenditures to reduce operational spending, and planning capital investment into new production wells through drilling activity, workovers, and idle well reactivation.

This study evaluates the economic potential of a strategic scenario developed by the operational and planning team at PHE OSES. Its main goal is to assess whether the proposed plan is financially sound and worth pursuing. To do this, it applies a structured approach using Capital Budgeting Analysis, sensitivity testing, and Monte Carlo simulations to explore possible outcomes and risks. By combining financial modeling with risk analysis, the study aims to determine if the Blue Oilfield can be turned into a sustainable and value-generating asset.

Given the investment risks and complex economical evaluation from decision makers, this analysis plays a key role in bridging the gap between operational ideas and financial evidence. In the past, hesitation to invest was largely due to a lack of strong economic justification, not technical issues. This research helps fill that gap by offering solid financial insights to guide strategic decisions going forward.

2. Literature Review

The selection of a PSC model, either Gross Split or Cost Recovery, plays a key role in shaping the financial results for contractors. In a comparative study focused on the Indonesian oil and gas sector, Pratama et al. (2023) highlighted that differences in fiscal structures under each scheme play a crucial role in shaping investment attractiveness, revenue allocation, and the degree of risk borne by contractors. Capital budgeting analysis serves as the foundation of economic evaluation in this study. Michelon et al. (2020) in their systematic review emphasized the critical role of Net Present Value (NPV), Internal Rate of Return (IRR), and Modified IRR in determining investment viability under various financial constraints. These indicators help managers choose the most value-accretive scenario for long-term projects.

Sensitivity analysis plays a key role in assessing risk. Saltelli et al. (2004) developed a framework to test how changes in input variables influence model outcomes. This method is particularly useful for analyzing economic uncertainty in fast-changing industries like oil and gas. Incorporating Monte Carlo simulations into this process enhances decision-making by introducing a probabilistic dimension to risk evaluation. A study by Andriana and Anggono (2023) titled "Project Investment Analysis on New Oil and Gas Field Development (M-X) at PT. PTM" provides a comprehensive evaluation of a new field development project using both Discounted and Non-Discounted Cash Flow methods. The research employs Monte Carlo simulation to assess financial risks due to dynamic changes in oil and gas.

Lastly, a study by Jamal and Sudrajat (2022) titled "Project Capital Rationing using Discounted Cash Flow Method, Sensitivity Analysis and Monte Carlo Simulation: Case Study Tambura Oil Development" provides a comprehensive evaluation of a new field development project using Discounted Cash Flow (DCF) analysis. The research employs sensitivity analysis to determine the most impactful parameters and Monte Carlo simulation to assess financial risks. The study reveals that while all options are economically feasible, the rental basis option offers the most favorable balance between Net Present Value (NPV) and risk, with a probability of negative NPV ranging from 10% to 30%. This approach shows how important risk assessment methods are when making capital budgeting decisions, especially in high-risk sectors like oil and gas.

3. Research Methods

This study employs a mixed-methods framework that combines qualitative insights and quantitative analysis to assess the internally formulated cost-efficiency and field reactivation strategy proposed by PHE OSES. This framework is extended to include contract scheme analysis, specifically the potential renegotiation from a gross split to cost recovery PSC model. The process follows a classic research funnel, beginning with problem identification, continuing through data collection and technical screening, and culminating in financial validation and risk analysis. The research initiates with problem scoping through root cause analysis and stakeholder interviews, helping to define key operational and contractual constraints impacting the Blue Oilfield. This is followed by a technical review and screening of inactive and underperforming wells, identifying viable candidates for reactivation and workovers based on reservoir potential, well integrity, and cost-efficiency.

Financial evaluation employs Capital Budgeting Analysis to estimate economic returns by comparing projected benefits, derived from increased production and reduced OPEX, against the necessary investment. To evaluate economic resilience under uncertainty, Monte Carlo simulations and sensitivity analyses are incorporated. These tools assess the impact of fluctuating oil prices, project delays, equipment failures, and productivity variances on financial outcomes such as NPV and IRR. In parallel, the effect of contractual restructuring is modeled by comparing projected outcomes under both gross split and cost recovery PSC models.

This combined approach shows that the proposed strategy can work technically, makes financial sense, and fits within current regulations and contract terms. The results offer clear support for decision-makers when evaluating investments in older fields with complex cost and revenue issues.

4. Results and Discussions

To develop an actionable strategy, the appointed task force developed a long-term strategy that summarized in "Depletion Plan and Incentive Proposal of PHE OSES" document. The strategy focuses on reducing operational spending without compromising production levels until the PSC contract ends in 2038. Key areas identified for optimization include the pipeline replacement project, electrical infrastructure (switchgear, relay, motors, transformers), instrumentation and safety systems, crane engine retrofits, chemical usage, and routine maintenance activities. Each expenditure category was critically reviewed and adjusted to ensure operational integrity while achieving meaningful cost savings. The resulting optimized OPEX forecast is presented in the table below from year 2025 until end of contract in 2038.

Table 2. YEARLY OPEX OPTIMIZATION 2025 – 2038 (million USD)

OPEX Optimization	2025	2026	2027	2028	2029	2030	2031
	8.52	8.43	9.13	16.40	17.08	17.62	20.60

OPEX Optimization	2032	2033	2034	2035	2036	2037	2038
	21.33	22.66	22.29	22.83	23.81	24.39	31.27

Concurrently, the team outlined an investment strategy targeting production enhancement and reservoir optimization. The plan includes the drilling of five new oil wells, execution of three workover programs, reactivation of three previously idle wells, and the development of one additional water injection well aimed at maintaining reservoir pressure. These interventions are expected to boost overall output and improve recovery efficiency across the Blue Oilfield.

Table 3. INVESTMENT ON NEW PRODUCTION WELLS

Investment	2025	2026
Projects	3 Drilling Wells 2 Workover Wells 2 Reactivation Wells 1 Water Injection Well	2 Drilling Wells 1 Workover Well 1 Reactivation Well

Tangible CAPEX (million USD)	11.53	7.48
Intangible CAPEX (million USD)	40.10	22.05

The team conclude that this investment will increase Blue Oilfield production as shown in below chart. Oil production with current condition of the field without any investment is represented by baseline.

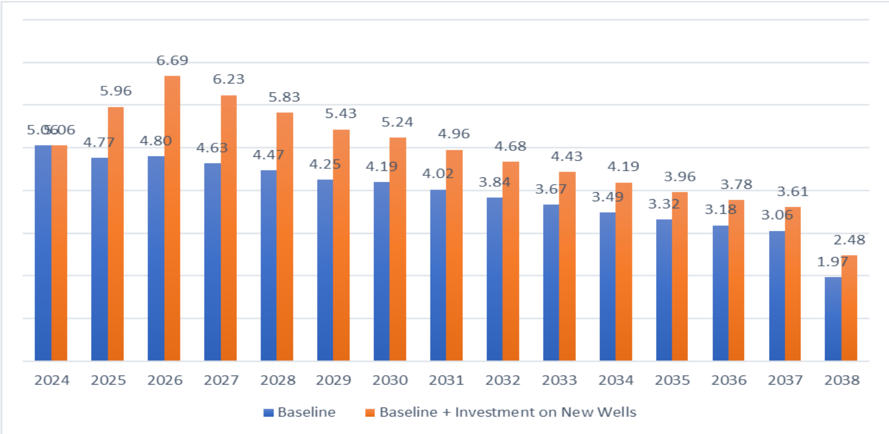


Figure 2. YEARLY PRODUCTION FORECAST (thousands bopd)

Finally, recognizing the substantial impact of fiscal terms on project viability, the team proposed initiating formal negotiations with SKK Migas and government stakeholders to shift from the Gross Split to the Cost Recovery PSC model. This transition is considered a pivotal move that could deliver mutual benefits to all parties involved and align with long-term development goals of the Blue Oilfield.

Although the strategic scenario featuring operational cost optimization, new well investments, and a transition to the Cost Recovery PSC model shows strong feasibility from a technical and operational perspective, its financial viability must be validated. To determine whether the plan is economically sound and implementable, a thorough financial assessment was carried out. This includes Capital Budgeting Analysis complemented by sensitivity analysis and risk assessment using Monte Carlo simulation.

Financial analysis using Capital Budgeting Analysis under the Cost Recovery PSC model highlights a strong economic case. The total non-discounted cumulative contractor cash flow over the life of the project is projected to reach USD 360 million. Yearly return which previously predicted will deliver negative number since year 2028 until end of contract, with the application of this strategic scenario, the projected number is showing healthy cash flow up until 2037. Also, the project remaining cash positive even during high-investment years such as 2025 and 2026.

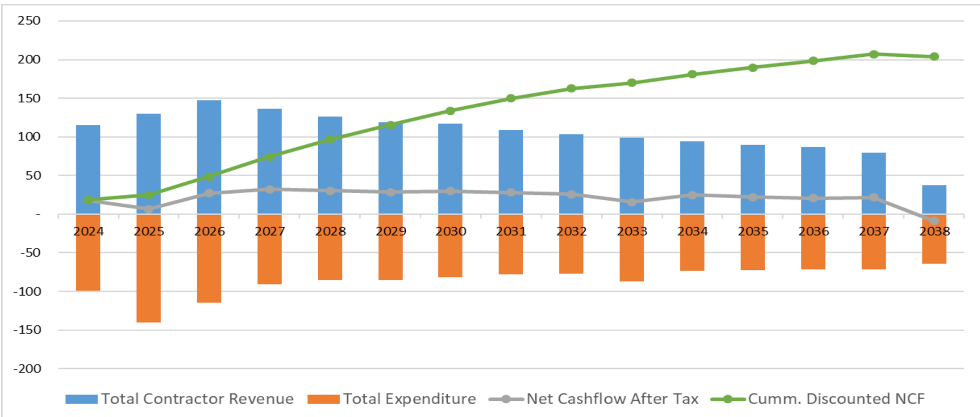


Figure 3. FORECASTED CASHFLOW AFTER OPTIMIZATION+INVESTMENT

The Net Present Value (NPV), calculated using a WACC of 9.38%, is USD 203.86 million, confirming a significant economic upside. The Modified Internal Rate of Return (MIRR) reaches 49.68%.

Table 4. SUMMARY CAPITAL BUDGETING ANALYSIS

Parameter	Unit	Value
Oil Production	MMSTB	26.23
Gross Revenue	Million USD	2,210
Total Capex	Million USD	123.51
Total Opex	Million USD	1,170.60
Contractor Profitability		
Total Contr Net Cash Flow	Juta USD	360.49
(% Gross Rev)	%	16.31%
Contr NPV	**Million USD**	**203.86**
Contr MIRR	**%**	**49.68%**
Government Profitability		
Gov Gross Share	Million USD	919.76
Tax	Million USD	104.39
GOI Take	Million USD	1,024.16
(% Gross Rev)	%	46.35%

To confirm how well the strategy holds up under changing conditions, a detailed sensitivity analysis was carried out. Seven key variables; oil production, crude oil price, OPEX, contractor-government oil split, CAPEX tangible and intangible, and WACC, were tested. Four of these (oil production, crude price, OPEX, and PSC oil split) exhibited over 20% impact on NPV, as shown in the tornado chart. This insight allows management to identify and focus on high-leverage levers when mitigating risks.

Table 5. SENSITIVITY ANALYSIS

	Current NPV	+20% Swing NPV	-20% Swing NP	Percentage +20% Swing	Percentage -20% Swin
Capex Intangible	203.86	203.52	204.19	-0.16%	0.16%
Capex Tangible	203.86	203.12	204.59	-0.36%	0.36%
WACC	203.86	188.58	221.37	-7.50%	8.59%
Oil Base Split	203.86	246.46	161.25	20.90%	-20.90%
Opex	203.86	135.75	269.69	-33.41%	32.29%
Crude Oil Price	203.86	304.62	102.16	49.43%	-49.89%
Oil Production	203.86	308.84	95.38	51.50%	-53.21%

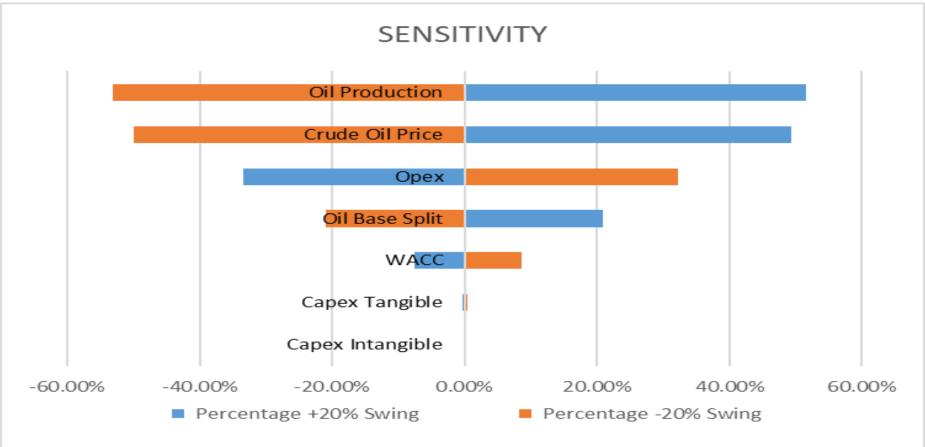
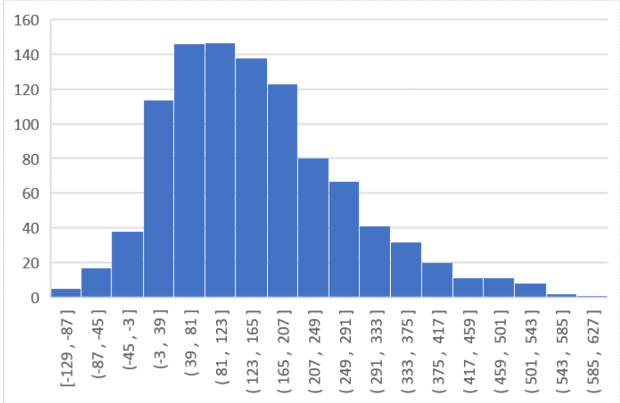


Figure 4. TORNADO CHART OF SENSITIVE VARIABLES

Complementing the sensitivity results, a Monte Carlo simulation (1,000 iterations) introduced variability across the same key inputs. The outcome was decisively favorable: the probability of achieving a positive NPV exceeded 90%, while downside risk remained below 10%. These results underscore the robustness and confidence in project resilience under fluctuating market or operational conditions.



Descriptive Statistics

Min	(89.32)
Max	651.41
Mean	144.15
Standard Deviation	112.16
Median	122.81
Kurtosis	1.02
Skewness	0.91
Prob NPV<0	**9.94%**
Prob NPV>0	**90.06%**

Figure 5. MONTE CARLO SIMULATION

In conclusion, the proposed scenario shows strong potential for profitability with manageable risk. Its NPV of USD 204 million, MIRR of 50%, cumulative cash flow of USD 360 million, and calculated risk to not achieve the target only around 10%, make it an attractive and justifiable option for Blue Oilfield revitalization.

Discussion

The findings highlight that the proposed scenario is both practical and financially viable. Compared to the current baseline, which reflects the Blue Oilfield's existing operations, this approach represents an improvement in financial outlook. While the baseline is projected to yield continued financial deficits, the new plan introduces disciplined expenditure and focused investments that collectively boost production output and revenue generation.

Capital budgeting analysis confirms the superior financial performance of this scenario, with a Net Present Value (NPV) exceeding USD 200 million and a Modified Internal Rate of Return (MIRR) approaching 50%. Sensitivity analysis further confirms this result by highlighting key financial drivers, namely oil output, OPEX, and crude price, as levers that can be managed to protect value creation. These insights allow PHE OSES to concentrate its risk management efforts on the factors that matter most. Additionally, the Monte Carlo simulation confirms the strength of the proposed strategy, showing a greater than 90% likelihood of achieving a positive NPV, even with market and operational uncertainties. This level of certainty offers strong justification for moving forward.

A key takeaway from this analysis is the decisive role of the PSC model in shaping project outcomes. Under the current gross split scheme, the lack of cost recovery limits financial flexibility, making it difficult to justify significant investment in mature assets. Transitioning to a cost recovery model would improve investment recovery predictability and give contractors the financial clarity necessary to support long-term development. This shift is essential for high-cost offshore assets like the Blue Oilfield. Importantly, the analysis confirms that the proposed combination of PSC renegotiation, operational cost optimization, and selective reinvestment in drilling and reactivation is economically very favorable for PHE OSES.

Table 5. COMPARISON BETWEEN BASELINE AND PROPOSED SCENARIO

Parameter	Unit	Baseline	Proposed Scenario
Oil Production	MMSTB	21.21	26.23
Gross Revenue	Million USD	1,789.51	2,210
Total Capex	Million USD	48.34	123.51
Total Opex	Million USD	1,425.33	1,170.60
Contractor Profitability			
Total Contr Net Cash Flow	Juta USD	-189.90	360.49
(% Gross Rev)	%	-10.61%	16.31%
Contr NPV	**Million USD**	**-55.20**	**203.86**
Contr MIRR	**%**	**0.76%**	**49.68%**
Government Profitability			
Gov Gross Share	Million USD	501.83	919.76
Tax	Million USD	3.41	104.39
GOI Take	Million USD	505.24	1,024.16
(% Gross Rev)	%	28.23%	46.35%

5. Conclusion

The Blue Oilfield has long represented a complex challenge for PHE OSES, combining disproportionate costs with contributions to production. This study demonstrates that by applying a structured and multidisciplinary approach, integrating capital budgeting analysis, and sensitivity and risk evaluation, it is possible to identify a high-value strategic solution.

The strategic scenario developed by the appointed task force which combines operational cost reductions, targeted drilling and well workovers, and a shift to the cost recovery PSC model, emerges as the most viable path forward. Financially, it demonstrates strong performance, with a projected Net Present Value (NPV) of USD 204 million and a Modified Internal Rate of Return (MIRR) of 50%. Cash flow remains positive throughout the contract period, with the exception of the final year, indicating overall financial sustainability. On a strategic level, the scenario aligns with operational goals and regulatory expectations, offering a compelling case for revitalizing the Blue Oilfield.

Based on these findings, it is recommended that PHE OSES move ahead with implementing this strategy. An early priority should be the formation of a negotiation team to engage SKK Migas and government authorities in discussions on transitioning to a cost recovery PSC scheme. At the same time, internal business process must be strengthened to optimize spending and maximize production performance, ensuring that the anticipated economic gains are achieved.

The proposed PSC shift plays a pivotal role in enabling this transformation. It enhances investment certainty and aligns contractor incentives with long-term field development, fostering shared benefits between the contractor and the government. In summary, the strategic scenario outlined in this study provides not only a realistic and profitable roadmap for the Blue Oilfield but also a scalable model for optimizing mature oilfields across Indonesia's upstream energy sector.

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