Oil and gas production in Indonesia keeps declining while consumption increases, resulting in Indonesia being a net oil importer since 2004. The problem that is faced by many producers right now is the mature field with an aging production facility with frequent unplanned shutdowns that could jeopardize production. If not responded to promptly and adequately, the field could lose its production. This is one of the challenges that PT ABC are facing. This study will present an investment project analysis to procure additional permanent offloading pumps at Field-B PT ABC to help revitalize the field after an unplanned shutdown. The additional offloading pump is intended to speed up wells’ potential recovery and minimize potential loss after shutting down. Two scenarios are evaluated for the additional offloading pump: buy case or lease case. The investment study is performed by exercising the business situation analysis and then using discounted cash flow (DCF) method for the financial feasibility. From the business situation analysis of PESTEL for external and VRIO method for internal analysis, both analyses suggest the external and internal aspects support the investment project of having the additional offloading pump. The DCF analysis is performed using the Production Sharing Contract (PSC) scheme applied to PT ABC. For the buy case, the Net Present Value (NPV) is 0.89 million $ with Monte Carlo Simulation showing the possibility of having a negative NPV is 7%. For the lease case, the NPV is 2.32 million $ with Monte Carlo Simulation showing the possibility of a negative NPV of 0%. Based on the DCF parameter analysis then, it is suggested to the management of PT ABC to invest in additional offloading pumps at Field-B by using the lease option, which shows better NPV.

Keywords: Discounted Cash Flow Analysis, Monte Carlo Simulation, Project Financial Valuation, Sensitivity Analysis.

I. INTRODUCTION

The oil and gas industry, both in Indonesia and globally, has experienced significant turmoil in the last few decades. Global geopolitical and economic considerations play an important role in driving oil price sensitivity. In the Indonesian context, the national oil and gas industry has been active for more than 130 years since the first oil discovery in North Sumatra in 1885. The declining oil production and increased consumption have made Indonesia a net oil importer since 2004. To overcome this issue, the government launched a program to increase oil production to 1 million barrels in 2030 by making various efforts and support for contractors. The efforts are optimizing production in existing fields, accelerating the transformation of resources to production by accelerating the development of new fields and pending fields, and intensifying oil and gas exploration.

Many of the existing fields in Indonesia are already mature with aging production facilities. The problem with aging facilities is equipment reliability; frequent unplanned shutdowns could jeopardize production. If not responded to promptly and adequately, the field could lose its production.

PT ABC is a national company Oil and Gas company in Indonesia and one of the biggest national producers. PT ABC manages seven oil and gas fields and one of them is Field-B. PT ABC operates a working area in East Kalimantan with an area of 3,266 Km2.

Field-B is a mature offshore oil and gas field that was discovered in 1972, with initial production in 1974. The field has undergone four development phases in which a total of 95 wells and ten platforms have been built. By the end of 2021, Field-B has produced more than 200 million Barrels of oil and 500 Bcf of Gas. Field-B’s current production is at ± 5000 Bopd oil and 30 MMscfd from 20 wells and four active platforms.

Due to its aging production facilities, repetitive shutdowns frequently occurred. Based on exercise 2019 – mid-2021, repetitive shut down due to aging surface facility contribute to loss of ~300 bopd & 2 MMscfd yearly potential, with 1-2 shut down events per month.

The current approach to recover potential loss (post shut down) uses an offloading pump during a well intervention campaign. However, most of the time, there is a gap between the shutdown of the event and the campaign window (since

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the campaign window offshore is not flexible due to barge sharing with other offshore fields).

To speed up wells’ potential recovery and minimize potential loss after shutdown, it is proposed to have an additional offloading pump dedicated to the platform. Estimated best-case incremental gain vs. current approach: 286 kbbls & 0.83 Bcf, with total monthly workload ~8 wells/month.

This study will present an investment project analysis for the procurement of additional permanent offloading pumps at Field-B. The focus of this study is to determine the valuation of the installation of the additional permanent offloading pump in the Field-B is profitable or not compared to its incremental gain. The procurement strategy also evaluates whether the buy or lease scenario will benefit the company more.

II. LITERATURE REVIEW

A feasibility study is conducted to find out whether the project is feasible or not. Feasibility studies and project evaluations aim to assess the feasibility of a business/project plan. The result of the assessment is used as consideration for decision makers to reject or approve the project proposal.

The first step is to determine if the project of having an additional investment is feasible by assessing the business issue in the external and internal parts. The PESTEL (Political, Economic, Social, Technological, Legal, and Environment) framework will be used for external analysis, while the VRIO (Valuable, Rare, costly to imitate, and Organized to capture value) will be performed for internal analysis. 

Discounted Cash Flow (DCF) is used for the investment valuation and defines the feasibility study result. The two approaches within the Discounted Cash Flow (DCF) techniques are the Net Present value (NPV) and Internal Rate of Return (IRR) (Gitman & Zutter, 2012), which written as follows:

- Net Present Value

\[
NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - CF_0
\]

- Internal Rate of Return

\[
0 = \sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} - CF_0
\]

Sensitivity analysis studies how the uncertainty of the model's output (numeric or otherwise) can be apportioned to a different source of uncertainty in the model input (Saltelli et al., 2004). In this study, the author performed a sensitivity analysis on the variables that are considered that will impact the project's feasibility. The parameters for sensitivities are Oil and gas production, Oil and gas price, Capital Expenditures, and Operating Expenditure.

For the risk analysis, the author also performed the Monte Carlo Simulation. A Monte Carlo simulation randomly generates values for uncertain variables over and over to simulate a model. The simulation then requires project practitioners to develop low, high, and most likely cost estimates along with correlation coefficients.

III. METHODOLOGY

This research uses quantitative and qualitative methodology. The research also uses primary and secondary data. Primary data is acquired from the company directly, while secondary data was collected from books, journals, articles, and websites. Both primary and secondary data consist of quantitative and qualitative information.

IV. FINDINGS AND ARGUMENT

A. External Environment: PESTEL (Political, Economic, Social, Technological, Legal, and Environment) Analysis

1) Political Factors

With the decline of national oil production in Indonesia, the government highly encourages and supports any project that can help lift production. The support from the government is shown by the amendment of Government Regulation (PP) Number 79 of 2010 as to be PP 27/2017 regarding cost recovery profit-sharing contracts and PP 53/2017 regarding gross split profit-sharing contracts. These two policies provide options for investors in developing...
investments in Indonesia according to the risks. Another support is that through SKK Migas, the contractor can propose financial incentives such as split updates and tax exemptions to make the investment more attractive.

2) Economic

According to the latest data published by the Bureau of Statistics of Indonesia, the national economic recovery currently underway in Indonesia remains intact, given increasing community mobility and amidst escalating geopolitical tensions between Russia and Ukraine. Domestic economic growth was solid and stable in the first quarter of 2022 at 5.01% (YoY) compared with 5.02% (YoY) in the previous quarter. Moving forward, the Indonesian economy is expected to gain momentum, with Bank Indonesia projecting growth at 4.5–5.3% in 2022, supported by a faster vaccination rollout, broad reopening of economic sectors, as well as policy stimuli instituted by Bank Indonesia, the government, and other relevant authorities.

3) Sociocultural Factors

Oil and gas are one of Indonesia’s most important energy sources and are widely used in transportation, industry, and households. IEA (International Energy Agency) data shows that energy consumption in Indonesia from 1990 to 2019 has risen sharply due to the high population. Despite the increasing awareness of green energy, people in Indonesia still need oil and gas fuel to fulfill their energy needs.

4) Technological Factors

Innovative technologies help oil and gas companies streamline operations by creating intelligent enterprises. Adaptation of new technology is even more critical to mature fields in Indonesia, like enhanced oil recovery to grow production. In Indonesia itself, the most widespread EOR method is steam flooding.

5) Ecological Factors

Meeting the energy needs of society reliably and economically has been the mission of the oil and gas industry since its inception. However, decades of high-profile disasters like oil spills, severe pollution, and incessant stories about the need to cut carbon emissions have placed oil and gas sustainability firmly in the spotlight. The good news is that oil & gas leaders know the need for sustainability and are acting to address it.

6) Legal factors

Indonesia’s oil and gas sector is governed by Law 22/2001 regarding Oil and Natural Gas, as amended by Law 11/2020 regarding Job Creation (collectively, the ‘Oil and Gas Law’). Upstream activities include exploration and exploitation and are regulated under Government Regulation 35/2004 regarding Upstream Oil and Natural Gas Business Activities, as amended by Government Regulation 55/2009.

B. Internal Analysis with VRIO framework

1) Valuable(V)

PT ABC production is one of Indonesia’s biggest oil and gas producers with a proven record of excellent operation and safety performance. PT ABC also has a proven record of performing many development project activities in the past. Installation of a permanent offloading pump is not new at PT ABC, where this project has been carried out in fields such as Field-S. Therefore, in terms of technical aspects, PT ABC already has the experience and competence to perform this project.

2) Rare (R)

PT ABC already has the complete infrastructure and commercial to monetize the potential hydrocarbon resources. PT ABC produces oil and gas production which is nonrenewable resources. PT ABC also operates swamp and offshore gas fields, which is a rare competency for oil and gas operators in Indonesia.

3) Costly to Imitate (I)

The oil and gas industry are a capital-intensive business with high risk; therefore, only limited company operates in this industry. To be a major oil and gas company, it needs years for PT ABC to develop its competency and reputation.

4) Organized to capture value (O)

PT ABC and its holding company is an integrated oil company whose operation ranges from upstream to downstream business in oil and gas. This integrated organization structure gives PT ABC the additional advantage of having support also from another part of the industry sector.

Based on the VRIO analysis, the competencies that can help PT ABC to achieve a competitive advantage are:

1. Current significant production from PT ABC in Indonesia oil and gas production.
2. PT ABC has a proven record of excellent performance in operation and safety.
3. PT ABC has the competency to develop major field development
4. Support from its holding companies that can support in technical and commercial aspects.

C. SWOT Analysis

By combining external and internal environment analysis, we can synthesize SWOT analysis that allows us to evaluate the firm’s current situation and prospects.

D. Discounted Factor and Sensitivity Analysis (DCF)

Two scenarios are evaluated in the proposal for the investment of an additional permanent offloading pump at Field-B: Buy option vs. Lease Option.

1) Buy Option

PT ABC will buy and install the new offloading pump in the buy option. The operation also will be handled internally.
by personnel in the company. Therefore, an additional internal workforce will be required. With the buy option, the offloading pump is estimated to be put in service in 2025; this long duration until project readiness assumes a longer duration for study and execution (> 2 years), and more processes are needed for FID due to categorized as Capital Expenditure (CAPEX).

Based on data in Table II, the investment project of buying an additional permanent offloading pump is still economical since the NPV is still positive (+0.89 Million $) with the IRR of 18% is still higher than the discount factor used of 10.6%. The profitability index is also greater than 1, with a discounted payback period of estimated 5 years.

The sensitivity analysis is carried out by modifying the presumption of one variable while keeping the other variables constant. The scenario's sensitivity uses a 25% variance of the variables input, which are:

- Oil and Gas Production;
- OPEX;
- CAPEX;
- Oil and Gas Price.

Table III shows that with the lowest scenario, which is with a 25% discount, all the NVP is still positive. This means the project is robust enough, and the risk of having a negative NPV is low.

Fig. 1 shows that the most sensitive parameters for the project NPV are the Oil/Gas Production and Oil/Gas price.

![Tornado Chart NPV Buy Case](image)

Fig. 1. Tornado chart sensitivity buy case.

Fig. 2 illustrates the simulation result of the NPV based on the parameter sensitivity input using Monte Carlo Simulation. From the summary in Table IV, the mean for the NPV in the buy case is 0.89 million $, with the risk of having a negative NPV being 77 out of 1000 simulations (8%). This data shows that the project can be categorized as robust economically as the mean NPV is positive and the risk of having a negative NPV is very low.

![Monte Carlo simulation buy case](image)

Fig. 2. Monte Carlo simulation buy case.

**TABLE II: BUY CASE DCF ANALYSIS**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>75%</th>
<th>100%</th>
<th>125%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil&amp;Gas Prod.</td>
<td>0.20</td>
<td>0.89</td>
<td>1.40</td>
</tr>
<tr>
<td>Oil&amp;Gas Price</td>
<td>0.20</td>
<td>0.89</td>
<td>1.40</td>
</tr>
<tr>
<td>CAPEX</td>
<td>0.48</td>
<td>0.89</td>
<td>1.20</td>
</tr>
<tr>
<td>OPEX</td>
<td>0.86</td>
<td>0.89</td>
<td>0.92</td>
</tr>
</tbody>
</table>

2) **Lease Option**

With this lease option, the operation of the offloading pump will be handled by the workforce from the contractor. The operation cost and maintenance are assumed to be included in the contract. With the lease option, the project is expected to be ready to be put in service in Q3-2023 since this project will be treated as an OPEX budget and will have less process needed for budget approval.

Table V summarizes the DCF parameter analysis for the lease option. The project can be categorized as economically feasible since its NPV is positive (2.32 million $). However, the IRR and the discounted payback period could not be calculated since the cash flow is always positive from the beginning. The profitability index is also higher than 1 (1.37).

![Monte Carlo simulation lease case](image)

Sensitivity analysis was also performed for the lease case using the same sensitivity parameter analysis in the buy case. Table VI summarizes the sensitivity analysis for the lease option. From this table, it can be seen that in the lowest scenario, with a 25% discount on the price and production of oil and gas, the NPV is still 1.67 million $.

**TABLE V: LEASE CASE DCF ANALYSIS**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>75%</th>
<th>100%</th>
<th>125%</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV</td>
<td>2.32</td>
<td>2.32</td>
<td>2.32</td>
</tr>
<tr>
<td>IRR</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Profitability Index</td>
<td>1.37</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Payback Period</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**TABLE VI: SENSITIVITY ANALYSIS LEASE CASE (NPV IN MILLION $)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>75%</th>
<th>100%</th>
<th>125%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil&amp;Gas Prod.</td>
<td>1.67</td>
<td>2.32</td>
<td>2.84</td>
</tr>
<tr>
<td>Oil&amp;Gas Price</td>
<td>1.67</td>
<td>2.32</td>
<td>2.84</td>
</tr>
<tr>
<td>CAPEX</td>
<td>2.31</td>
<td>2.32</td>
<td>2.32</td>
</tr>
<tr>
<td>OPEX</td>
<td>2.25</td>
<td>2.32</td>
<td>2.37</td>
</tr>
</tbody>
</table>
Fig. 3 illustrate the sensitivity analysis of offloading pump project with lease options. The chart shows that the most sensitive parameters for the project NPV are the Oil/Gas production and Oil/Gas price. With all the cases, the lowest NPV is still higher than 0.

![Tornado chart sensitivity for lease case.](image)

Fig. 3. Tornado chart sensitivity for lease case.

Fig. 4 illustrates the simulation result of the NPV based on the parameter sensitivity input using Monte Carlo Simulation. From the summary in Table VII the mean for the NPV in the buy case is 2.04 million $, with the risk of negative NPV being 0 out of 1000 simulations (0%). This data shows that the project can be categorized as very robust economically as the mean NPV is positive and the risk of having a negative NPV is zero.

![Monte Carlo simulation buy case.](image)

Fig. 4. Monte Carlo simulation buy case.

### TABLE VII: MONTE CARLO SIMULATION LEASE CASE

<table>
<thead>
<tr>
<th>Procurement Scheme</th>
<th>Buy Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean NPV (Million $)</td>
<td>2.04</td>
</tr>
<tr>
<td>St Dec NPV (Million $)</td>
<td>0.30</td>
</tr>
<tr>
<td>Median NPV (Million $)</td>
<td>2.01</td>
</tr>
<tr>
<td>Negative NPV Frequency</td>
<td>0</td>
</tr>
<tr>
<td>Probability Negative NPV</td>
<td>0</td>
</tr>
</tbody>
</table>

## V. CONCLUSION

To answer the research question, a set of analyses has been carried out through this research. The business situation analysis was undertaken at the beginning by analyzing the internal and external factors that may affect the project's financial projection in the future. PESTEL analysis suggests that the external political, economic, and social-cultural factors can be considered supportive since Indonesia is still highly dependent on its energy source from oil and gas, which is still being imported. The investment project of additional installation of offloading pump is expected to increase the oil and gas production and help the nation to fulfill its energy demand. From the internal aspect, using the VRIO framework shows that PT ABC has the track record, competencies, and organizational support that can give PT ABC a competitive advantage and support for installing an additional offloading pump.

The discounted cash flow analyses were then performed to evaluate the project's financial feasibility using the two scenarios. The NPV for the buy option is 0.89 million $, and for the lease option, the NPV is 2.32 million $. The IRR in the buy option is 18% and higher than the WACC of 10.6%, while for the lease option, the IRR could not be calculated since the cash flow projection is always positive along the project. The Profitability Index (PI) for the buy option is 1.1 and for the lease option is 1.37. The discounted payback period for the buy option is 5 years, while for the lease option could not be calculated as the cash flow is always positive.

Based on all the parameter that has been analyzed using discounted cash flow analysis, the additional installation of offloading pump scenario is economically feasible, with the lease option showing a better parameter than the buy option. The sensitivity analysis has been performed for both scenarios based on the aspect that is considered will have the most impact on the project if there are changes. The sensitivity parameters are production, price, CAPEX, and OPEX assumption. Based on the sensitivity analysis, the most significant parameter that will impact the project NPV is the effect of change in production and price. In the buy option, the lowest case NPV is estimated at 0.2 million $, with the highest case at 1.40 million $. For the lease case, the lowest case NPV is 1.67 million $, with the highest NPV being 2.84 million $.

Both sensitivity analyses show that with the minimum case, the NPV is still positive, indicating the project is robust, and the option of lease case shows higher NPV in minimum and maximum sensitivity cases.

The Monte Carlo simulation also has been performed using 1000 times iterations. The simulated parameter is the same as used in the sensitivity analysis. In the simulation scenario, the parameters are varied between 75 % to 125 % of the base case scenario. In the buy option, the possibility of having a negative NPV is 7%, while for the lease option, all the simulation still shows positive NPV. Therefore, the Monte Carlo simulation also shows that the lease option shows better economic feasibility than the buy case.

Based on the situation analysis and the financial analysis using discounted cash flow method with sensitivity analysis, it is recommended to the management of PT ABC to execute the project of having an additional offloading pump at Field-B using the lease case scenario.

To ensure that the project's economy is maintained, the parameters that most affect the economy, namely production and price, need to be prepared for mitigation. For production, it is necessary to monitor whether the assumptions used to generate production estimates are still valid; this can be done by testing in several wells. For the mitigation price, it can be done by making a long-term contract with the buyer at an agreed price.
REFERENCES


