THE APPLICATION OF CAPITAL BUDGETING MODEL FOR COST EFFICIENCY IN DISTRIBUTION PIPELINE: CASE STUDY IN GREENLAND INTERNATIONAL INDUSTRIAL CENTER (GIIC) AREA - BLOCK B

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ABSTRACT

Oil and gas sectors contribution to Indonesia's revenue has declined from 14.11% in 2014 to 4.46% in 2015. There are several challenges facing the oil and gas sector, including the decrease in resources and the increase in operational cost. Moreover, in 2017, the Indonesia natural gas industry is subjected to new Government regulations from the Ministry of Energy and Mineral Resources (MEMR), which regulate: the price, revenue cap, IRR cap, and transparency. PT Perusahaan Gas Negara Tbk (PGN), a subsidiary of one state-owned company that specialized in the natural gas transportation and distribution in Indonesia, also has experienced some challenges in 2016 whether caused by internal or external factors which affected to its business performance. The revenue of PGN has decreased from USD 2,896 million in 2014 to USD 2,571 million in 2015 and to USD 2,499 million in 2016. Furthermore, PGN should conduct internal efficiency. In 2016, PGN has an option to install alternative materials, polyethylene pipeline or polyamide pipeline, to replace steel pipeline, the existing pipeline material. This study is expected to suggest in choosing and deciding which options will contribute the highest cost efficiency for PGN by using new gas pipeline material whether to use polyethylene pipeline (PE) or polyamide pipeline (PA) as an alternative to replace the existing steel pipeline for developing the future projects. The project location object for the study is in Greenland International Industrial Center (GIIC) Area-Block B, Karawang, West Java and primary data were collected in year 2016. The capital budgeting model used to analyze data and indicators are Payback Period (PP), Return on Investment (ROI), Net Present Value (NPV), Profitability Index (PI), Discounted Payback Period (DPP), and Internal Rate of Return (IRR). The finding shows that PE is more efficient than PA and is able to be implemented in GIIC Area-Block B, Karawang project if the gas pressure requirement is less than 10 barg.

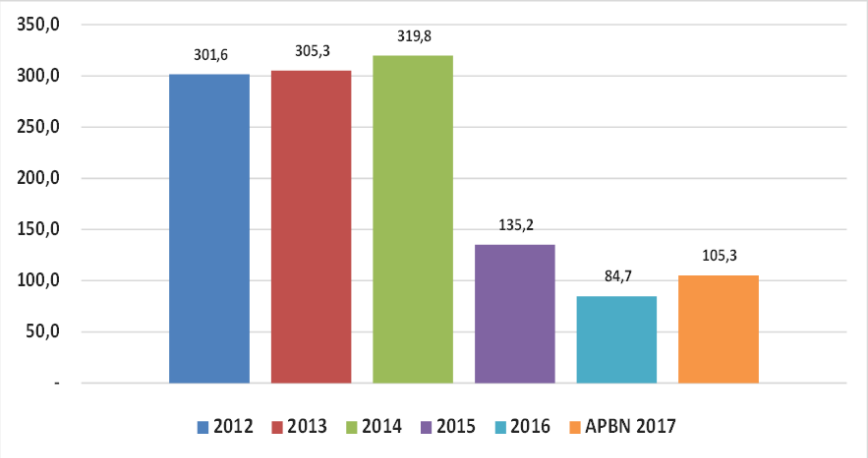
Keywords: Capital Budgeting; Cost Efficiency; Distribution Pipeline

1. INTRODUCTION

Indonesia's oil and gas sector has been a strong pillar of the country's economy. This income from oil and gas sector has provided more than 15% in average of the revenue for the government and has supported for 280.000 jobs in this country (Dolya, Sastry, Tamboto, & Rahman, 2017). Even though oil and gas have been a promising business in the few decade, nowadays the trend is decreasing.

However, since 2015 the oil and gas industry, both in Indonesia and globally, has experienced several challenges within the last five years. In Indonesia, the oil and gas revenue has declined roughly 13% on average in the last 5 years, mainly caused by crude oil price fluctuation. The oil and gas sector's contribution to the country revenues has decreased significantly along with the decline in reserves and production. Thus, revenue from the oil and gas industry decreased by almost 80% from IDR 216.9 trillion in 2014: 14% of state revenues, to IDR 78.2 trillion in 2015: 4.46% of state revenues; and to IDR 44.9 trillion in 2016: 2.8% of state revenues (Ministry of Finance Indonesia, 2016).

Figure 1. Indonesia's Oil and Gas Revenue



Uraian	2012	2013	2014	2015	2016	Budget 2017
1. Oil and Gas Income Tax	83,5	88,7	87,4	49,7	36,1	35,9
2. Oil and Gas Non Tax Revenue	205,8	203,6	216,9	78,2	44,9	63,7
3. Oil and Gas Other Revenue (DMO)	12,3	12,9	15,5	7,3	3,7	5,7
Total Oil and Gas Revenue	**301,6**	**305,317**	**319,779**	**135,172**	**84,743**	**105,316**

Sources: Ministry of Finance Indonesia 2017

Against a backdrop of global uncertainty, Indonesia's economic growth slowed, the real GDP growth edged down to 5.1 percent in Q1 2018, this number is slightly less than the 5.2 percent in Q4 2017. As global economic growth is projected to slow and trade flows moderate from recent highs, Indonesia's GDP growth is projected to still rise with stronger domestic demand from 5.1 percent in 2017 to 5.2 percent in 2018 (The World Bank, 2018).

PGN, a subsidiary of one state-owned company that specialized in the gas distribution and natural gas industries in Indonesia, is the largest national company engaging in the fields of natural gas transportation/transmission and distribution as well as other supporting businesses, which segment primarily in Indonesia. PGN has built the nation's largest transmission and distribution pipeline network, more than 7,400 km throughout the territory spread across Indonesia. In year 2016, PGN's business performance has experienced some challenges ranging from declining revenue, challenges to providing adequate infrastructure in the market, to the government's plan to implement new regulations in 2017 for natural gas industry in Indonesia.

The revenue of PGN has decreased from USD 2,896 million in 2014 to USD 2,571 million in 2015 and to USD 2,499 million in 2016 (Annual Report 2016, 2016). PGN distribution pipeline mostly adjacent to Industrial Estates which are one of the target segments of PGN with potential sales business. The challenges on providing the adequate infrastructure in Industrial Estates are: industrial estates management demand for cooperation scheme, competition and infrastructure cost. Moreover, in 2017, the Indonesia natural gas industry is subjected to new Government regulations from the Ministry of Energy and Mineral Resources (MEMR), which regulate: the price, revenue cap, IRR cap, and transparency. Specifically, for the gas industry in Indonesia is currently facing the most challenging condition. The Government has issued a regulation on the cost of gas trading in a bid to push the price of gas industry lower, while at the same time giving gas traders and investors a reasonable profit margin. According to a new regulation of policy and/or regulation of Ministry of Energy and Mineral Resources (MEMR) Regulation number 58 year 2017 that now adopts a 7-11 policy that limits the selling cost of gas traders at a maximum of 7% of gas base price and sets an IRR cap of 11% for gas infrastructure projects.

Furthermore, PGN should conduct internal efficiency. Hence, the choices are to use another pipeline material whether to use polyethylene pipeline or polyamide pipeline as an alternative to replace the existing steel pipeline for developing the future projects, which generate the most cost efficiency for the company.

Based on the current market situation and needs, PGN needs to become agile in facing dynamic changes in the gas market with changing regulation and changing business conditions. Refer to the Ministry of Energy and Mineral Resources (MEMR) Regulation Number 58 year 2017, PGN must analyze the impact of this new policy and/or regulation on development of natural gas infrastructure especially in distribution pipeline. Moreover oil and gas business require high capital, high technology, high risks, long-term commitment, but may be high return (Daryanto, 2018).

2. LITERATURE REVIEW

2.1. NATURAL GAS TRANSPORTATION SYSTEM

Pipeline network is one of the modes of transportation to carry gas from its source to energy users. Overall, gas pipelines are an integral part to how the business works in PGN. There are two major types of gas pipelines along the transportation route: gas transmission pipeline and gas distribution pipeline. Gas transmission/transportation is the activity of transporting natural gas owned by shipper from receiving points in the form of a gas field or other source to the delivery point through a high-pressure

transmission pipelines. In this business segment, PGN operates of transmission pipelines to deliver gas owned by shipper and get benefits in the form of toll fees, in which the amount was stipulated by the Downstream Oil and Gas Regulatory Agency (BPH Migas). Distribution/Commerce business segment was the activity of distribution and sale of natural gas to end users for Industries, Power Plants, Commercials and Households by using variety of modes, both pipeline and non-pipeline. In developing distribution network, PGN also used pipe material made from steel or polyethylene plastic with a thickness that has been calculated carefully.

2.2. GAS PIPELINE MATERIAL

Gas Pipeline is a conduit made from pipes connected end-to-end for long-distance gas transport. Variety of materials have been used to make natural gas pipelines for decades, such as metal pipe and non-metal pipe material. Currently, both steel and plastic materials are used for natural gas distribution pipeline. Material for gas pipeline must be able to maintain the structure of the pipe under certain environmental conditions, chemically in accordance with the fluid being distributed, and meet the requirements according to the application.

Over a half of the total mileage in distribution pipelines is steel and the other third is plastic, primarily Polyethylene (PE). In addition to PE, there is one family of thermoplastic materials, namely the Polyamide 12 (PA 12) materials.

Steel has a long history in gas installation and it is still the only option for real high-pressure gas transportation at 50 bar or higher. Steels are the material of choice when fabricating pipes for the economic transmission of natural gas from remote regions to populated areas where the fuels are exploited in the generation of energy. The American Petroleum Institute (API) provides standards for pipe that are suitable for use in conveying gas, water, and oil in both the oil and natural gas industries. The API 5L specification describes the requirements of chemical composition, tensile test characteristics and impact toughness behavior. Steel pipeline is the most commonly used material because it is easy to install. In gas installations every joint, transition, tee, and other is a critical point. Welding of steel pipes and the quality control of welds are well established. However, steel pipeline has corrosion problems hence it needs corrosion-resistant coatings to protect the pipe surface from corrosion hazards. The corrosion protection is a very cost-effective component in the steel system calculation and in spite of all corrosion protection efforts over the life time rather high maintenance costs have to be carried for the steel networks.

Polyethylene (PE) is a thermoplastic polymer with variable crystalline structure and an extremely large range of applications depending on the particular type. PE pipes are increasingly being used to replace the aging iron and steel pipes in the low-pressure distribution system because of lower construction and maintenance costs. Many kinds of polyethylene are known, with most having the chemical formula: (C2H4)n. Polyethylene is classified by its density and branching. Its mechanical properties depend significantly on variables such as the extent and type of branching, the crystal structure, and the molecular weight. There are several types of polyethylene such as Lower Density Polyethylene (LDPE), Medium Density Polyethylene (MDPE), and High-Density Polyethylene (HDPE). PE100 as the latest development of High Density Polyethylene (HDPE) received the approval for operating pressures up to 10 barg however this comprises only a small share of distribution networks.

Polyamide 12 (PA) is a thermoplastic belonging to the general class of polymers called polyamides. Polyamides are characterized by methylene groups of various lengths joined by amide linkages. Polyamides are named by the number of carbon atoms in the monomer unit. The general formula for polyamides like Polyamide 12 is: [HN(CH2)11CO]n. PA is a high-performance polymer with outstanding mechanical properties and excellent chemical stability. It is the preferred material in many demanding applications, e.g. in the automotive industry for fuel lines of passenger cars or for air brake tubing's in trucks. Compared with polyethylene (HDPE) it has a higher mechanical and impact strength and melting temperature. To make it clear, principally PA is not competing with PE. It is the material of choice for serving the 16 bar networks, where PE is out of discussion. Only if other superior properties of PA are requested PA might interfere in the PE gas supply business. (Lohmar & AG, 2006).

Currently, at the stage of planning and constructing of gas infrastructure, PGN uses steel pipeline material on new industrial customer which should covers general minimum requirements for technical specification of line pipe which is applied in the transmission and distribution natural gas pipeline system and its supporting facilities (Standar Teknis dan Material Pipa Baja, 2018). In certain cases, its resulted in loss potential customer because of long period of ROI or IRR doesn't meet expectation. Hence, in order to maximize project execution time and shortening BEP Period, PGN should create efficiency capex and opex by developing new gas infrastructure with various alternatives of gas pipeline material such as PA or PE.

2.3. BASIC PRINCIPLE OF CAPITAL BUDGETING

The decision of whether to choose and decide new pipeline materials, involves determining the investment rate of return that such the new gas pipeline materials will contribute the highest cost efficiency for PGN. In this study, the use of capital budgeting is important because it creates accountability and measurability.

The capital budgeting model used to analyze data and indicators are Payback Period (PP), Return on Investment (ROI), Net Present Value (NPV), Profitability Index (PI), Discounted Payback Period (DPP), and Internal Rate of Return (IRR).

Capital budgeting, or investment appraisal, is the planning process used to determine whether an organization's long-term investments such as new machinery, replacement of machinery, new plants, new products, and research development projects are worth the funding of cash through the firm's capitalization structure (debt, equity or retained earnings). It is the process of allocating resources for major capital, or investment, expenditures. Capital budgeting has a rich history and sometimes employs

some pretty sophisticated procedures. Fortunately, capital budgeting relies on just a few basic principles. Capital budgeting is very important for corporation. The principles of capital budgeting have been adapted for many other corporate decisions, such as investments in working capital, leasing, mergers and acquisitions, and bond refunding. The valued principles used in capital budgeting are similar to the valuation principles used in security analysis and portfolio management.

Although analysts have vantage point outside the company, their interest in valuation coincides with the capital budgeting focus maximizing shareholder value. Because capital budgeting information is not ordinarily available outside the company, the analyst may attempt to estimate the process, within reason, at least for companies that are not too complex. Further, analysts may be able to appraise the quality of the company's capital budgeting process; for example, on the basis of whether the company has an accounting focus or an economic focus.

2.4. VARIABLES OF CAPITAL BUDGETING MODEL

This study uses variables of capital budgeting criteria decision tools including the techniques according to Hawkins (Anthony, Hawkins, & Merchant, 2010) and Clayman (Clayman, Fridson, & Troughton, 2012).

2.4.1 PAYBACK PERIOD (PP)

Payback period in capital budgeting refers to the period of time required to recoup the funds expended in an investment, or to reach the break-even point. Payback period is the number of years over which the investment outlay will be recovered (paid back) from the cash inflows if the estimates turn out to be correct. If the payback period is equal to, or only slightly less than, the economic life of the project, then the proposal is clearly unacceptable. If the payback period is considerably less than the economic life, then the project begins to look attractive. The formula is as follows:

$$PP = Years\ full\ recovery + \frac{Unrecovered\ cost\ at\ beginning\ of\ last\ year}{Cash\ Flow\ in\ Following\ Year}$$

2.4.2 RETURN ON INVESTMENT (ROI)

Return on Investment is the ratio between the net profit and cost of investment resulting from an investment of some resources. A high ROI means the investment's gains compare favorably to its cost. As a performance measure, ROI is used to evaluate the efficiency of an investment or to compare the efficiencies of several different investments. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment. The result is expressed as a percentage or a ratio. The formula is as follows:

$$ROI = \frac{Accounting\ Profit}{Initial\ Investment}\ x\ 100\%$$

2.4.3 NET PRESENT VALUE (NPV)

Net Present Value (NPV) is a measurement of profit calculated by subtracting the present values (PV) of cash outflows (including initial cost) from the present values of cash inflows over a period of time. Incoming and outgoing cash flows can also be described as benefit and cost cash flows, respectively. The rate at which the cash inflows are discounted is called the requires rate of return, the discount rate, or the hurdle rate. The different between the present value of the cash inflows and the amount of investment is called the net present value (NPV). If the NPV is non-negative amount, the proposal is acceptable. The formula is as follows:

$$NPV = \sum_{t=1} Discount\ Factor\ x\ Net\ Cash\ Flow$$

t = Time when cash inflow or cash outflow is disbursed.
It is assumed that all cash is disbursed at the end of the year.

2.4.4 PROFITABILITY INDEX (PI)

Profitability Index also known as profit investment ratio (PIR) and value investment ratio (VIR), is the ratio of payoff to investment of a proposed project. It is a useful tool for ranking projects because it allows you to quantify the amount of value created per unit of investment. In order to compare two proposals under the NPV method, therefore we must relate the size of the discounted cash inflows to the amount of money risked. This is done simply by dividing the present value of cash inflows by the amount of investment, to give ratio that is called the profitability index. Thus, the project with an NPV of zero has a profitability index 1,0. The preference rule is: The higher the profitability index, the better the project. The formula is as follows:

$$PI = \frac{NPV}{Initial\ Investment}\ x\ 100\%$$

PI = Profitability Index
NPV = Net Present Value

2.4.5 DISCOUNTED PAYBACK PERIOD (DPP)

Discounted Payback Period is the amount of time that it takes (in years) for the initial cost of a project to equal to discounted value of expected cash flows, or the time it takes to break even from an investment. It is the period in which the cumulative net present value of a project equals zero. A more useful and more valid from the payback period is the discounted payback period. In this method, the present value of each year's cash inflows is found, and these are cumulated year by year until they equal or exceed the amount of investment. The year in which this happens is the discounted payback period. A discounted payback period of five years means that the total cash inflows over a five-year period will be large enough to recover the investment and to provide the required return on investment. If the decision maker believes that the economic life will be at least this long, then the proposal is acceptable. The formula is as follows:

$$DPP = Year\ before\ the\ DPP\ period\ occurs + \frac{Cumulative\ cash\ flow\ in\ year\ before\ recovery}{Discounted\ cash\ flow\ in\ year\ after\ recovery}$$

2.4.6 INTERNAL RATE of RETURN (IRR)

Internal Rate of Return (IRR) is a method of calculating rate of return. The term internal refers to the fact that its calculation does not involve external factors, such as inflation or the cost of capital. The higher the IRR, the better the project. When the NPV method is used, the required rate of return must be selected in advance of making the calculations because this rate is used to discount the cashflows in each year. As already pointed out, the choice of an appropriate rate of return is a difficult matter. The Internal Rate of Return (IRR) method avoids this difficulty. It computes the rate of return that equates the present value of the cash inflows with the present value of the investment-the rate that make the NPV equal zero. This rate is called the internal rate of return, or the discounted cash flow (DCF) rate of return. The formula is as follows:

$$IRR = iNPV\ Positive + \frac{NPV\ Positive}{(NPV\ Positive - NPV\ Negative)}\ x\ (iNPV\ Negative - iNPV\ Positive)$$

3. METHODOLOGY

To accomplish this study, the steps are: 1) Study the terms and conditions of Greenland International Industrial Center ("GIIC") Area-Block B project; 2) Calculate the capital budgeting of the project; the results are: Payback Period (PP), Return of Investment (ROI), Net Present Value (NPV), Profitability Index (PI), Discounted Payback Period (DPP), and Internal Rate of Return (IRR) for 20 years period (2017 – 2037); 3) Make decision what option is the most cost efficiency to develop in the future projects whether PA Pipeline or PE Pipeline systems as an alternative to existing steel pipeline for developing the future projects; In this research, the primary data were collected in year 2016.

4. RESULT AND DISCUSSION

Based on the database collected in year 2016 (Database Industrial Estates, 2016), the Capex values needed for GIIC Area-Block B for Steel pipeline, PE pipeline, and PA pipeline are IDR 34,778,092,543, IDR 29,656,766,336, and IDR 32,596,822,744 respectively. While the Opex of year 1 for Steel pipeline, PE pipeline, and PA pipeline are IDR 13,913,857,265, IDR 8,225,651,292, and IDR 10,639,388,167 respectively.

The assumptions used in the calculation of this study are 1) the time period is 20 years from 2017 to 2037; 2) the economic life is 20 years; 3) the depreciation type is double declining combined with straight line at the half-end; 4) the terminal value is 0 (zero); 5) IRR when the NPV value is 0 (zero) and the investment cost using internal financing (PGN); 6) the tax is 25%; 7) the exchange rate of USD 1 = 13,350 IDR; 8) the gas price is 8.57 USD per BBTUD; and 9) the discount rate at the present value = 11%. The results of calculations showed in the Table 1 below.

Table 1. The Result of Capital Budgeting Calculation

Item	Standard Material		Alternative Material			
	Steel Pipeline		PE Pipeline		PA Pipeline	
	Value	Unit	Value	Unit	Value	Unit
Payback Period (PP)	6.14	years	3.52	year	4.87	years

Return on Investment (ROI)	19.32	%	29.96	%	22.16	%
Net Present Value (NPV)	2,387,253,397	IDR	2,648,049,132	IDR	634,768,336	IDR
Profitability Index (PI)	6.86	%	8.93	%	1.95	%
Discounted Payback Period (DPP)	9.26	years	4.57	years	6.85	years
Internal Rate of Return (IRR)	12.46	%	14.34	%	11.57	%

Payback period number for Steel pipeline as the standard or the existing pipeline material is 6.14 years, while PE pipeline 3.52 years, and PA pipeline is 4.87 years. Therefore, PE has the shortest payback period. The calculation showed that Return on Investment (ROI) on PE pipeline has the highest than both PA pipeline and Steel pipeline. The number of for Steel pipeline as the standard or the existing pipeline material is 19.32%, while PE pipeline 29.96%, and PA pipeline 22.16%. On Net Present Value (NPV) calculation, both of steel, PE pipeline, and PA pipeline showed positive number which means the investment could be paid back. The NPV numbers for Steel pipeline as the standard or the existing pipeline material is IDR 2,387,253,397, while PE pipeline is IDR 2,648,049,132, and PA pipeline is IDR 634,768,336. Therefore, PE has the highest number of NPV. Calculation of Profitability Index (PI) showed that PE pipeline has the highest number than both PA pipeline and Steel pipeline with the numbers for Steel pipeline, PE pipeline, and PA pipeline are 6.86%, 8.93%, and 1.95% respectively. Calculation for Discounted Payback Period (DPP) showed that investment payback period for PE pipeline is the shortest compare to both PA pipeline and Steel pipeline. The number of DPP for steel pipeline, polyethylene pipeline, and polyamide pipeline are 9.26 years, 4.57 years, and 6.85 years respectively. The result of Internal Rate of Return (IRR) calculation for steel pipeline is 12.46%, polyethylene pipeline is 14,34% and polyamide pipeline are 11.57%. The method to compute IRR is refer to the assumption that NPV number is equal zero. It computes the rate of return that equates the present value of the cash inflows with the present value of the investment-the rate that make the NPV equal zero.

5. LIMITATION

PGN distribution pipeline mostly adjacent to Industrial Estates which are one of the target segments of PGN with potential sales business. Since Bekasi Area is the highest Sales Volume and Revenue of the PGN Areas and is also a red zone area with many populations of Industrial Estates, then in this study will single out the Bekasi Area, especially in Greenland International Industrial Center (GIIC) Block B in Karawang, West Java, as the chosen observed area to analyze it for efficiency improvements in the distribution pipeline. GIIC is one of Industrial Estates whose Sales and Customer Management is carried out by PGN Bekasi Area.

The study has expanded the literature about capital budgeting model in GIICArea-Block B. Revenue is not in the research scope and is not relevant to be compared because the capacity of the 2 options whether Polyethylene (PE) pipeline or Polyamide (PA) pipeline as an alternative to existing steel pipeline for developing the future projects are the same. In the near future, it is suggested to carry out research with many Industrial Estate area to get more generalizes result. Since the focus is only in GIIC Area-Block B, it is worth to explore it on a wider scale and find out if different estate industry area yields the same result. In addition, the study only focuses on financial aspects. Therefore, the research would be better if also includes the non-monetary considerations, such as SWOT, TOWS, and pipeline network analysis.

6. CONCLUSION AND RECOMMENDATION

The purpose of this study is to determine the readiness of PGN to implement the cost reduction strategy based on the feasibility of the project in GIIC Area-Block B based on capital budgeting criteria in terms of Payback Period (PP), Return of Investment (ROI), Net Present Value (NPV), Profitability Index (PI), Discounted Payback Period (DPP), and Internal Rate of Return (IRR) period in 20 years of time frame from 2017 – 2037 for GIIC Area-Block B and also to determine which option, between implementing PE pipeline or PA pipeline, generates the most efficient for the company to develop in future project.

The feasibility of the future projects based on calculation capital budgeting criteria shows that PGN should reduce their cost of Capex and Opex by choosing the most efficient of pipeline material that is Polyethylene Pipeline for developing the future projects in GIIC area. The result showed that Polyethylene Pipeline gives the shortest Payback Period (3.41 years), the highest value of percentage of RoI (33,18%), the highest number of NPV (IDR 10,198,232,570), the highest number of Profitability Index (12.74%), the shortest Discounted Payback Period (4.40 years), and the highest value number of IRR (16.7%). However, PGN should consider any possible future gas pressure requirements of prospective and potential customers in GIIC Area-Block B. Once there is a need of gas pressure which exceeds 10barg, then Polyamide pipeline material can be used as an option for developing the future projects in GIIC Area-Block B, while PE pipeline is the material of choice for serving gas pressure requirement less than 10 barg. Fortunately, based on the gas pressure requirements data at GIIC Area-Block B are less than 10 barg, hence PE pipeline can be applied. Furthermore, considering this project being involved and handled by third parties then PGN must maintain its reputation in the operation of the project.

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