Proceeding Book of ***The 6th ICMEM 2021****, 11-13 August 2021, Bandung, Indonesia*
ISBN*: 978-623-92201-2-9*

Multi-Criteria Decision Making for Selecting Cost Reduction Project to Substitute the Compression Cost in PLN Muara Karang

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Abstract - **There is a potential decrease in profits of PT. Perusahaan Gas Negara Tbk (PGN) after the company carried out the government's assignment to implement ministerial decree No.89 and No.91. One of the root causes required strategic decision making in the form of selecting a cost reduction project to substitute the Compressor fee. To overcome this problem, it is necessary to apply Multi-Criteria Decision Making (MCDM) in project selection. The Analytic Hierarchy Process (AHP) approach was chosen in project selection by looking at the benefits of AHP compared to other methods.**

AHP is done by applying pairwise comparisons to give weight to the 10 selected sub-criteria. The next process is continued by quantifying alternative parameters. The last step is to calculate the priority index by multiplying each sub-criteria weight by the respective rating for each alternative. Taking into account the results of the calculation for the six alternatives, it is recommended that PGN carry out a negotiation process (alternative #5 and Alternative #6) that provides the greatest benefit and zero Capex. However, alternative #1 (extend the pipeline 3 km) must also be started in parallel so that if the negotiation fails, PGN still get Incremental profit from cost reduction.

Keywords - **Analytic Hierarchy Process (AHP), MCDM, Project Selection, Cost Reduction**

I. INTRODUCTION

The business environment is becoming more regulated, where the government determines the buying and selling price of natural gas. There is a potential decrease in the profit of PT. Perusahaan Gas Negara Tbk (PGN) after the company carried out government assignments to implement Ministerial Decrees No.89 and No.91. PGN experienced a decrease in gross margin of $0.6/mmbtu or 23% of the previous gross margin. PGN strives to maintain profit by making efficiency, especially in reducing operation costs. Reducing operational costs for power plant customers is the focus. Power plant customers are included in the Ministerial Decrees No. 91, high gas consumption and small number of customers.

The purpose of this paper is to present findings in applying Analytical Hierarchy Process (AHP) method to formulize a prioritization model for selecting cost reduction project. There are six alternatives of cost reduction project in PLN Muara Karang to be prioritized as follow: extend the Ringline 1 Pipeline for 3 km (Alternative #1), integrate PGN's Ringline 1 Pipe (CP9) with the Muara Karang - Muara Tawar (MKMT) Transmission Gas Pipeline (Alternative #2), Use Pertagas Compressor (Alternative #3), Continue Existing Compressor Lessor (Alternative #4), negotiated with PLN so that MW will be charged a compressor fee (Alternative #5), negotiated with PLN so that PGN can swap supply of piped gas and LNG gas (Alternative #6).

Several papers have discussed the prioritization consideration in Investment Portfolio Prioritization In PT Krakatau Steel [1], project selection Model [2]-[3], From this literature, there are insight about which criteria should be considered in Project Selection. These literature is helpful when coducting Focus Group Discussion to determine which criteria and sub criteria should be included in model. various methodologies in multi-criteria decision making [4]-[6]. These literatures consist of example and guideline how to use Analytic Hierarchy Process. The Analytic Hierarchy Process (AHP) approach was chosen in prioritizing projects by looking at the advantages of AHP compared to other MCDM.

II. METHODOLOGY

The development process of Cost Reduction Project prioritization model starts from define the objective then set up team that related function in company as the Expert as shown in Figure 1. After the team was formed, a Focus group discussion (FGD) was held to determine the criteria and sub-criteria that should be included in the AHP model. In addition to establishing criteria, the identification of available alternatives was also carried out. The next process is carried out in parallel, namely data collection for each alternative and pairwise implementation to determine the weight of each criterion and sub-criteria.

On data collection for each alternative, invite related divisions in some FGD to get data according to the predetermined criteria and sub criteria. The data is then divided into 2 groups, namely quantitative data, and qualitative data. The quantitative data is then processed with a quantitative rating, while the qualitative data is quantified using the pairwise comparison method. The data generated in this process is a score for each parameter in each alternative that has been normalized.

ISBN*: 978-623-92201-2-9*

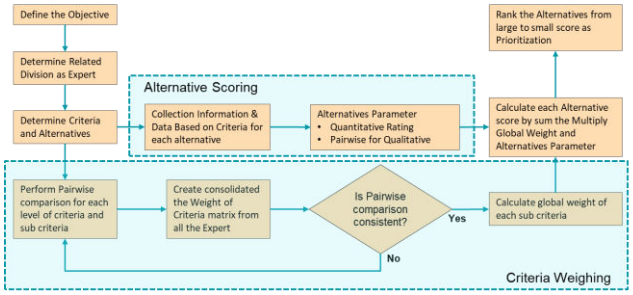

Fig. 1 AHP Approach on Cost Reduction Project Prioritization

In another process, the determination of the weight for each criterion begins with filling out the pairwise comparison form by all experts from related divisions in Table 1. then the data from each expert is consolidated using a weighted geometric mean use the questionnaire that was developed based on the AHP template by Goepel[7]. in this process an expert with a higher position has a greater influence. The next most crucial process is to validate whether each comparison on the main criteria and sub criteria is consistent. if there is a group of criteria that are not consistent yet, it is necessary to repeat pairwise comparison to experts who are not consistent.

TABLE 1
THE EXPERTS OF PRIORITIZATION CRITERIA

No	Job Position	Weight	Number of Respondent
1	Group Head	4	2
2	Division Head	3	3
3	Advisor	2	4
4	Sr. Analyst or Analyst	1	5

After finding that the main criteria and sub criteria are consistent, the global weight of each sub-criterion can be calculated by multiplying the weights in the main criteria and the weights in the sub criteria. The next step is the final calculation of the AHP process, which is to calculate the score for each alternative by multiplying the global weight of all sub-criteria with normalized alternative parameters. the multiplication result is added for each alternative as the final score. The score for each alternative is then ranked from the largest to the smallest as the project priority to be selected.

III. RESULTS

The priority of cost reduction project selection was decided on four main criteria: Financial Feasibility, Implementation Time, Strategic Alignment and Risk. Financial Feasibility is broken down to Capital Expenditure (Capex), Net Present Value (NPV), internal rate of return (IRR), and Payback Period (PBP) [8] - [9]. there are no sub-criteria for Implementation time. Strategic Alignment is measured by Future Demand Capability and Utilization level of Pertagas Assets in all alternatives. Lastly, the risk factor consists of Investment Risk, Operational Risk and Commercial Risks. Pairwise comparison from multiple experts was used to determine the appropriate weight for each criteria and sub-criteria, the result is shown in Table 2.

The result of the weight is shown in Table 2 with NPV of Cost Reduction, Capex and Future Demand Capability are being the most preferred sub-criteria by the experts. Operational Risk, Pertagas Asset Utilization and Commercial Risk are being the least preferred sub-criteria by the experts. This result means that the most preferred criteria will greatly affect the final calculation and the least preferred criteria will have little effect on the final calculation.

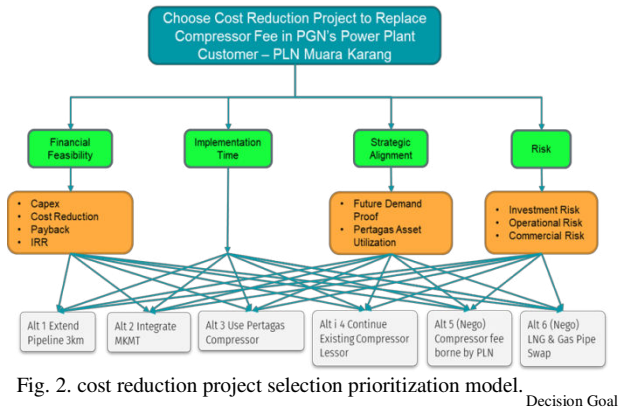

Fig. 2. cost reduction project selection prioritization model.

Quantitative rating technique was used to quantify the value of sub-criteria. the quantification process is carried out by classifying the sub-criteria parameters in 5 groups with a range of 20 to 100. Then from the values that have been obtained the parameters are normalized by the total number of parameters in the sub-criteria for all alternatives. there are several sub-criteria that can be directly normalized without having to be classified first. For sub-criteria, whose parameters are qualitative, the pairwise comparison process is used to obtain numerical values.

TABLE 2
WEIGHTING OF CRITERIA AND SUB-CRITERIA

Main Criteria	Sub-Criteria	Global Weight	Rank
Financial Feasibility (52.80%)	Capex (22.70%)	11.99 %	3
	NPV Cost Reduction (51.18%)	27.02 %	1
	Payback Period (12.68%)	6.69%	6
	IRR (13.44%)	7.09%	5
Implementation Time (10.66%)	Implementation Time (100%)	10.66 %	4
Strategic Alignment (19.11%)	Future Demand Capability (71.51%)	13.67 %	2
	Pertagas Asset Utilization (28.49%)	5.45%	9
Risk (17.43%)	Investment Risk (37.94%)	6.61%	7
	Operational Risk (27.64%)	4.82%	10
	Commercial Risk (34.42%)	6.00%	8

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Six alternatives were evaluated to test the validity of the model. Extend the Ringline 1 Pipe for 3 km so that the PLN Muara Karang location will be connected to the high-pressure gas network, was the first alternative to be tested. Integrate PGN's Ringline 1 Pipe (CP9) with the Muara Karang-Muara Tawar Transmission Pipe (MKMT) so that there is no additional parallel pipeline with Pertagas Assets, was the second alternative. Next alternative is Replace the existing compressor provider with a compressor service owned by Pertagas. Then for comparison, continue the existing process, namely using AME's compressor Lastly, negotiated with PLN so that MW will be charged a compressor fee and negotiated with PLN so that PGN can swap supply of piped gas and LNG gas were the last two alternatives to be evaluated. The priority illustrated in Figure 3 was obtained after evaluating the alternatives against the quantitative rating and global weight.

IV. DISCUSSION

It can be recommended that PGN conduct Negotiations to Do an LNG Swap as an initial priority in implementing cost reduction projects. If the first negotiation failed, then Negotiation for the Compressor Fee to be paid by PLN can be started. these two alternatives get the highest score in this criterion because there is no Capex needed for both and can get the largest NPV because the compressor costs are gone and there are no replacement costs.

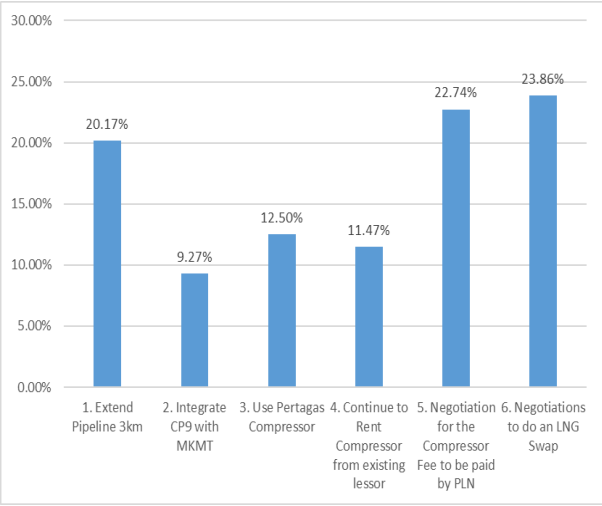

Fig. 3. Prioritization result of six alternatives.

The two alternatives with the highest priority index are alternatives in the form of negotiations so that there is a possibility of success and failure. if within that time limit the results of the negotiations are successful, then there is no need for a project that requires capex, but if the negotiation fails, then the project must be chosen from one of the four remaining alternatives. The next alternative that has the third highest priority index is alternative #1, namely Extend Pipeline 3 Km.

V. CONCLUSION

In determining the priority for selecting cost reduction project, AHP was proposed as an accurate method. The AHP approach was chosen in prioritizing projects by looking at the advantages of AHP compared to other MCDM. For selecting cost reduction project, the criteria and sub-criteria are:

- Financial Feasibility: Capex, NPV Cost Reduction, Payback, and IRR
- Implementation Time without Sub Criteria
- Strategic Alignment: Future Demand Capability and Pertagas Asset Utilization
- Risk: Investment Risk, Operational Risk, and Commercial Risk

The NPV Cost Reduction is the most preferred criteria to the cost reduction project in PGN, followed by Future Demand Capability. On the other hand, the Operational Risk is the least preferred criteria in considering the prioritization, followed by the Pertagas Asset Utilization.

By considering the possibility of the Negotiation to do an LNG Swap and the Negotiation for the Compressor Fee not successful, then in parallel start the procurement of The Extend Pipeline 3km Project. Project construction is carried out when negotiations with PLN are not successful. PGN still get Incremental profit from cost reduction.

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