FINANCIAL ASSESSMENT OF ALCO ENGINE RESTORATION

Rushandoko Cahyo Saputro[1], Subiakto[1]
School of Business and Management (SBM) – Bandung Institute of Technology (ITB), Indonesia
Email: rcsaputro@gmail.com

Abstract

Crude oil produced from several PT. XYZ fields in Riau will be sent to Gathering Stations and then collected to Dumai storage tank before lifted to Offtakers. It came from domestic and also from International such as Japan, China, Russia and other countries. Shipping pump with 2400 HP capacity and consist of 4 units which used to support daily lifting activities. Crude oil lifting average is around 120 MM BOPY. At the one moment and condition, there is possibility to lift it with 4 unit engine running. Surprisingly in 2015, one-unit shipping pump was damaged. In this thesis, Author firstly do SWOT analysis to take information from an environmental analysis and separate it into internal and external issues. In deeply assessment, Author also assesses the financial aspect by Capital Budgeting analysis and risk management. Furthermore to meet the crude oil demand from buyers and to meet crude oil quotas target as one of Production Sharing Contract of Government Indonesia. By this condition, there are some efforts to put ALCO engine back to run by generating several alternatives. Hopefully the selected alternative will be the best solution with consider contract expiration in 2021.

Keyword: Risk Analysis, financial analysis, Offtakers, NPV, depreciation, SWOT.

INTRODUCTION

PT XYZ was active for over 90 years and operated 90 fields in Sumatra. XYZ Sumatera operates 2 production Sharing Contract areas that consist of Rokan PSC area which expired in August 2021 and Siak PSC area which has been handed over to Goverment in November 2013.

XYZ is searching for new oil and natural gas reserves from central Sumatra to offshore East Kalimantan and continues to innovate with new technologies that are used to sustain and enhance production from existing reservoirs. XYZ is located in scattered Sumatera areas which were placed in four cities i.e. Rumbai, Minas, Duri and Dumai. Crude oil from Sumatra production fields is transported to Dumai through a pipeline system extending some 600 km, and reaches a tank farm with a storage capacity of 5.1 million barrels. From the tank farm, oil is pumped to the Pertamina refinery and oil tankers at Dumai Wharf. Using high-capacity pumps, Dumai Wharf can load four tankers simultaneously.

HydroCarbon Transportation Team is located in scattered area. There are two main stream business in crude oil and gas production. The first is focused on crude oil transportation from Gathering Station (GS) to HCT's storage tank in Duri or directly transferred to Dumai storage tank for north area which counted by primary meter. And then continue to sell it to buyer such as Pertamina UP2, Domestic and International vessel thru 24", 30" and 36" of loading line. Custody Transfer in the oil and gas industry refers to the transactions involving transporting physical substance from one operator to another. This includes the transferring of raw and refined petroleum between tanks and tankers; tankers and ships and other transactions. Custody transfer in fluid measurement is defined as a metering point (location) where the fluid is being measured for sale from one party to another. During custody transfer, accuracy is of great importance to both the company delivering the material and the eventual recipient, when transferring a material.

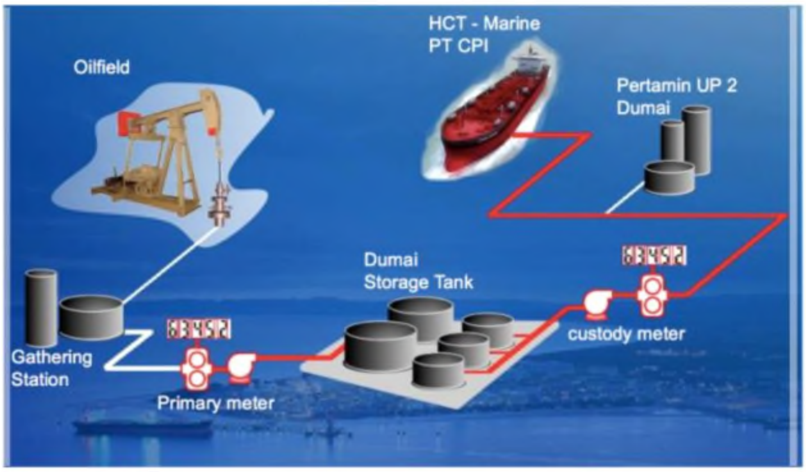

Figure 1.1 Crude Oil Lifting Schematic

The majority of PT. XYZ's Sumatran production in 2014 came from fields in the Rokan PSC. Duri, the largest field, has been using steam flooding technology to improve production since 1985 and is one of the world's largest steam flood developments. In 2014, steam injection was deployed in 70 percent of the field.

In the high demanding of crude oil situation made HCT Dumai as end point of Heavy oil and Light crude oil storages do lifting to Off takers such as PT. Pertamina Unit 2, Domestic and International vessels with yearly average crude oil shipment is 121 MM BOPY with daily average shipping is approximately 2-3 Offtakers per day.

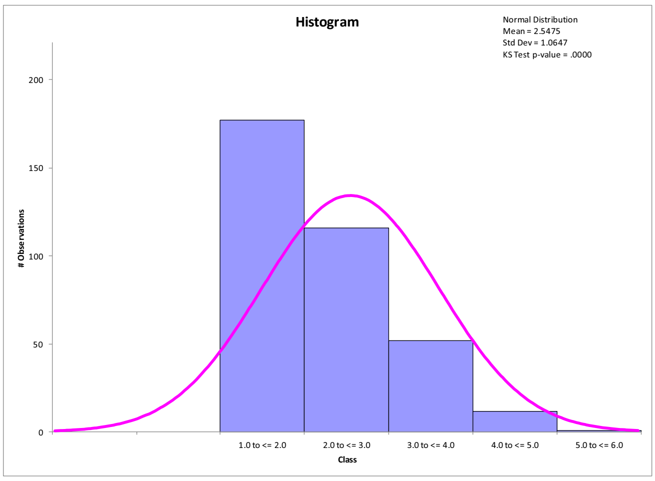

Figure 1.2 Daily Average Shipping

As shown as the graph, there will be over 60 days where more than two-unit pump are being used. It means that shipping pump used for loading to Offtakers with 2.5 shipments per day, with loss on one shipping pump, crude oil lifting operation will have problem.

Shipping pump which driven by diesel engine with capacity 2,400 HP 16-251 type was fabricated by Fairbank Morse as American Locomotive (ALCO) engine in 1958. In doing to support lifting activities in Sumatera Operation, XYZ has been installed four units at Dumai and 2 units at Duri.

In 2014, there is any incident happened during normal lifting activities where one of four units shipping pump at Dumai was stopped running due to overheat, lead to stucked and cracked at several point between crankshaft and engine block. And as the result the upper block engine and crank shaft were worn out.

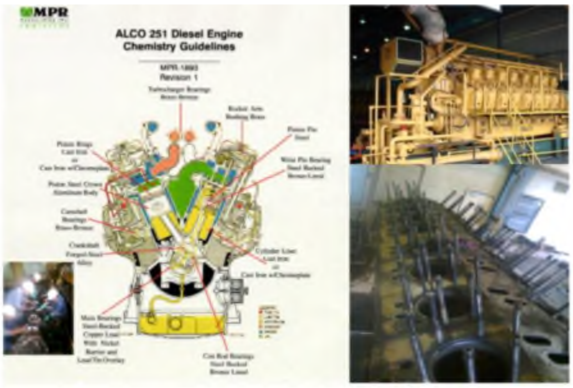

Figure 1.3 ALCO 251 Diesel Engine

Root Cause Analysis (RCA) has been conducted with involving multi team such as Maintenance, Operation and Engineering. The methods to analysis this caused is using ‘Why Tree’. There are three system root cause have been identified, the first is their have not got proper trouble shooting training in detail, the second one is no periodic refreshing training for ALCO engine SOP and the last is original product was not including warning system.

Surprisingly since 2002, there was loosed connection between XYZ and authorized distributor from FairBank Morse to order original parts and as a partner Subject Master Expert (SME) in engine troubleshooting.

Another challenge is to consider Rokan block will be expired in 2021, with limited investment to expand their business in crude oil and gas industry and also depreciation term in Production Sharing Contract (PSC).

Not only losing the authorized contact, but also crude oil production will become decline in year to year (see Figure 1.4)

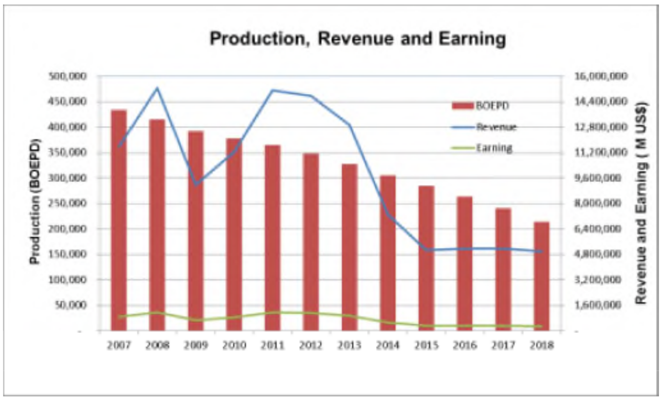

Figure 1.4 Crude Oil Production Profile

In addition number of lifting and total crude oil lifted in recent year tends to decline and will be shown on the graphic in figure 1.5.

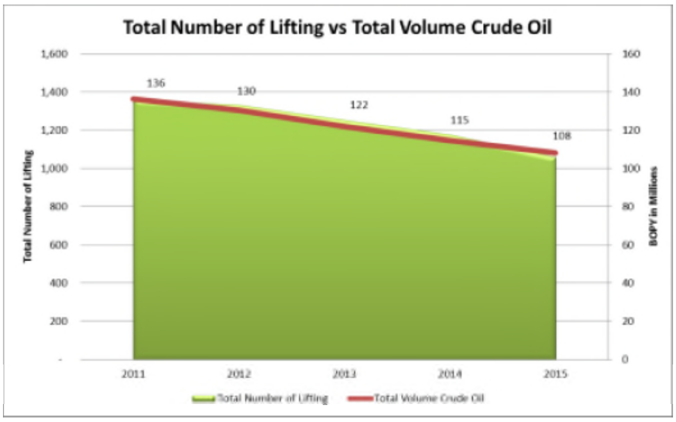

Figure 1.5 Total Number of Lifting vs Total Crude Oil Generated Yearly

Considering the issue explained before, there are several questions which will be answered in this final project.

1. Do the engine problem affect to CHEVRON activities ?
2. What efforts need to be done ?
3. What possible risks will appear to the solution ?
4. What kind of recommendation can be given if ALCO engine back to put in service ?

THEORETICAL FRAMEWORK

Since one of four units of ALCO engine at Dumai is already broken due to overheating and lead to some major parts worn out. Nowadays, considering the crude oil demand from Pertamina UP2 and Offtakers is highly, it makes XYZ have to make decision whether ALCO engine will put in service or not. In addition to crude oil production was declined as per forecast for XYZ Sumatera. A SWOT analysis conducts before to understand the business and feed more information to do the problem analysis.

To enrich the information, author is also analysed the Financial analysis by using Net Present Value (NPV) and Depreciation cost until Siak Block end of contract in 2021. And also decision tree will be explained in this thesis. Project risk management is involved with identifying, analysing, and responding to risk so it can prevent the problem happened in the future.

In the end, there is a need for a reliable way to make effective and consistent business decisions or choices to ensure that resources are used effectively.

With the root problem developed, then could be organized some alternative solution. This framework was done to get a better decision making to gain its goal that supports business objectives of HydroCarbon Transportation Operating Unit. The conceptual of this final project is shown as figure 2.1.

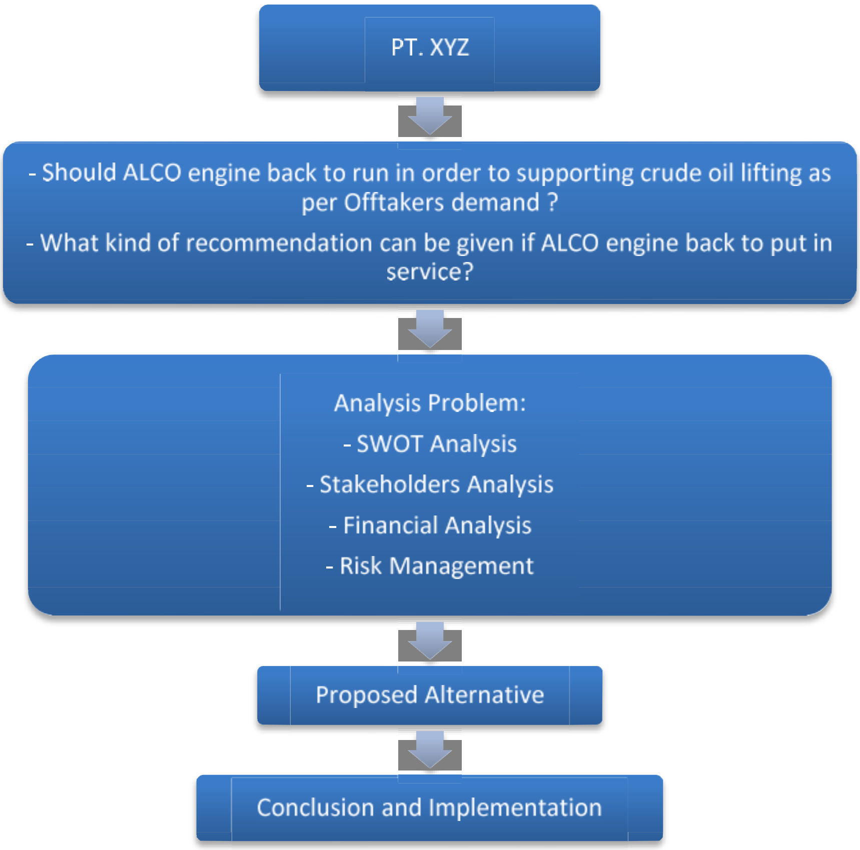

Figure 2.1 Conceptual Framework

	Helpful to achieve the objective	**Harmful** to achieving the objective
Internal Origin Attributes of The Organization	**Strengths:** 1) As a lifting equipment to sell crude oil to Offtakers 2) Standard Operating Procedure to operate ALCO engine is available 3) Preventive maintenance program inspection results are available 4) Safety procedure is available	**Weaknesses:** 1) Aging conventional diesel engine since 1958 2) Lost of Manufacture contact as SME 3) Limited tools analysis 4) Lack of Operation knowledge of ALCO engine
External Origin Attributes of The Environments	Op**portunities:** 1) Supports from stakeholders 2) Increasing reliability and availability of ALCO engine 3) Replace the aging unit with the new one 4) Improve competency of Operator ALCO engine	**Threats:** 1) Expiration of PSC contract 2) Imitation material spare part at market 3) Limited distributor of ALCO engine 4) Crude oil price is going down

Figure 3.1 SWOT Analysis of ALCO engine as lifting equipment

ANALYZE

Based on the demanding of crude oil trending nowadays and from daily average shipping is approximately 2-3 Offtakers per day although this condition is rarely happened. However due to 75% ALCO engine available, it won't' be significant impact to the operations as far as if have good coordination and better vessel arrangement to lift crude oil at Dumai Terminal with Commercial team in order to avoid all the engines running at the same time. Otherwise, it is possible to get claim from Offtakers and possible to loss of production opportunity.

The SWOT analysis is used to analysis the ALCO engine replacement in the HydroCarbon Transportation Unit. The SWOT analysis help to decide if and how should do to response to the lifting trending, managing shipping pump integrity, and deal with changes in the end of PSC contract.

XYZ will deliver crude oil to Offtakers with approximately 122 MM barrel crude oil in yearly average. By this condition, there are many stakeholders will take a part of any decision regarding lifting activities (see Figure 3.2).

For that reason, there are some alternatives have been developed to put ALCO engine back to operation in order to support business continuity. The calculation number in this thesis has been modified.

Stakeholders	Level of Influen ces	Level of Interest	Why they consider a win-their drivers?	What do we need/seek from them	How to engage/gain their support?
GM HCT Operations (Decision Executive)	High	High	• Optimum lifting • Operation Excellence • Reduce OPEX and CAPEX	• Decision on the Operation strategy	• Closely communication and regularly • Gather and provide enough data in order to decide operation strategy
DRB members	High	High	• Optimum lifting • Operation Excellence • Reduce OPEX and CAPEX	• Give valuable input to Decision Executive	• Closely communication and regularly • Gather and provide enough data in order to decide operation strategy
Commercial Team	High	High	• Optimum lifting • Meet GOI quota target	• Manage Lifting schedule	• Closely communication an regularly
CUSA	Low	Mediu m	• Optimum lifting	• Manage Lifting schedule	• Closely communication
SLO	High	High	• Optimum lifting • No Loss of Production Opportunity	• Support on Operation matter • Curtailment process	• Closely communication and regularly
HO	High	High	• Optimum lifting • No Loss of Production Opportunity	• Support on Operation matter • Curtailment process	• Closely communication and regularly

Figure 3.2 Stakeholder Analysis

Alternative #1 Replace with the new one

This alternative is come up from Management to rejuvenate the aging equipment where the ALCO engine was installed since 1958. Thus the preferred analysis is using capital budgeting whether it will be profitable or not. Assume one-unit engine will have opportunity to get the revenue as much as crude oil lifted or COPQ (Cost of Poor Quality) approximately $ 776,780 per year with declining rate 8% per year to year. NPV can be calculated by using Monte Carlo simulation with consider the crude oil price in range $40 - $90/bbls.

Table 3.1 Revenue or COPQ

	2015	2016	2017	2018	2019	2020
COPQ	$ 776,780.82	$ 714,638.35	$ 657,467.29	$ 604,869.90	$ 556,480.31	$ 511,961.89

Table 3.2 Financial Analysis Alternative #1

Assumptions						
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Investment	$ -1,170,085					
Revenue	0	$ -	$ 657,467.29	$ 604,869.90	$ 556,480.31	$ 511,961.89
Base Oil Price	$ 50.70					
Estimated additional production/Mbbls/ year		15,321				
- Expense (excluding depreciation and interest)	$ 1,170,085	$ 1,687,513	$ 217,513	$ 217,513	$ 217,513	$ 217,513
Earning before depreciation, interest, and taxes (EBDIT)	(1,170,085)	(1,687,513)	421,515	370,393	323,361	280,091
- Depreciation		$ 969,165	$ 581,499	$ 348,900	$ 209,340	$ 125,604
Earning before interest, and taxes	(1,170,085)	(2,656,679)	(159,984)	21,494	114,021	154,487
- Taxes (rate, T = 40%)	(468,034.07)	(1,062,671.49)	(63,993)	8,597	45,608	61,795
Net operating profit after taxes	(702,051)	(1,594,007)	(95,990)	12,896	68,413	92,692
+ Depreciation		$ 969,165	$ 581,499	$ 348,900	$ 209,340	$ 125,604
Operating cash flows	(702,051)	(624,842)	485,509	361,796	277,752	218,296
Discount rate	10%					
Year	0	1	2	3	4	5
PV(CF)	(702,051)	(624,842)	485,509	361,796	277,752	218,296
S **PV(CF)**	(702,051)	(568,038)	401,247	271,822	189,709	135,545
		Max	Min	Mean	St Dev	
Oil Price		1.5	0.8	1.14	0.12	0.972
		$ 76.05	$ 40.00			$ 49.28
Project Cost Efficiency		1.2	0.5	0.85	0.12	0.951
Save Margin $15/bbls	$ 15.00	$ 61.05	$ 25.00			$ 36.43
Normal distributed assumed						
Calculate NPV						
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue	$ -	$ -	$ 639,028.84	$ 587,906.53	$ 540,874.01	$ 497,604.09
Operating Cash	$ (667,668.45)	$ (594,240.48)	$ 461,731.40	$ 344,076.94	$ 264,149.49	$ 207,605.03
Net Cash Flow	$ (667,668.45)	$ (540,218.62)	$ 381,596.20	$ 258,510.10	$ 180,417.66	$ 128,906.39
NPV	$ (258,456.73)		Prob to lose		79%	
			(NPV<0)			

Risk Assessment

Based on Risk Matrix guide which the possibility design and operating failure that either contain the hazard or otherwise need to define safe guard to prevent the exposures that can result in harm.

Table 3.3 Risk Assessment Alternative #1

Location: Pump House		Unit:	ALCO Engine				Study Date:	
		P&ID Title:					P&ID Rev. Date:	
Section/Node No.:		Description:	Purchase The New One				CR No:	

WHAT IF ..... ?	POTENTIAL CONSEQUENCES	EXISTING SYSTEMS & PROCEDURES (SAFEGUARDS)	NO.	S	L	R	SHEA	ADDITIONAL CONSIDERATIONS
The existing pump is not matched with new engine due to miss engineering design	Possible loss of production opportunity since the engine downtime is longer than expected. The pump can not be operated and support lifting activities.	Engineering design and guideline, Quality Assurance Check, Constructability review	1	4	4	7	Asset	Manage risk
Too much modification between engine and pump, such as exhaust system, cooling system, etc.	Delay project and possible loss of production opportunity to lifted crude oil to Offtakers. Possible over run budget project.	Engineering design and guideline, Quality Assurance Check, Constructability review, Project Control involvement	2	4	3	6	Asset	Consider to have discussion with SME of the new engine manufacture.
Longer procurement time	Delay project and possible loss of production opportunity to lifted crude oil to Offtakers	Procurement team involvement in early phase, Refer to PTK 007, Monitor procurement progress by regularly engangement Procurement team	3	4	3	6	Asset	Consider to do appropriate selection tender process, whether will use Direct Appointment or Direct Selection or Open Tender.
Operator not familiar with the new engine	Miss operated and possible engine will stopped running well. Possible loss of production opportunity.	Perform training and socialization new SOP in how to operate the new engine.	4	4	3	6	Asset	Consider the new SOP has been socialized to the Operator Pump House.

Alternative #2 Repair the engine with new major parts

Table 3.4 Financial Analysis Alternative #2

Assumptions						
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Investment	$ -1,044,418					
Revenue			$ 657,467.29	$ 604,869.90	$ 556,480.31	$ 511,961.89
Base Oil Price	$ 50.70					
Estimated additional production/Mbbls/ year		15,321				
- Expense (excluding depreciation and interest)	1,044,418	553,735	217,513	217,513	217,513	217,513
Earning before depreciation, interest, and taxes (EBDIT)	(1,044,418)	(553,735)	488,865	432,354	380,365	332,535
- Depreciation		$ 465,387	$ 279,232	$ 167,539	$ 100,524	$ 60,314
Earning before interest, and taxes	(1,044,418)	(1,019,123)	209,632	264,815	279,841	272,221
- Taxes (rate, T = 40%)	(417,767)	(407,649.09)	83,853	105,926	111,937	108,888
Net operating profit after taxes	(626,651)	(611,474)	125,779	158,889	167,905	163,332
+ Depreciation		465,387	279,232	167,539	100,524	60,314
Operating cash flows	(626,651)	(146,086)	405,012	326,428	268,428	223,647
Discount rate	10%					
Year	0	1	2	3	4	5
PV(CF)	(626,651)	(146,086)	405,012	326,428	268,428	223,647
S **PV(CF)**	(626,651)	(132,806)	334,720	245,251	183,340	138,867
		Max	Min	Mean	St Dev	
Oil Price		1.5	0.8	1.14	0.12	1.074
		$ 76.05	$ 40.00			$ 54.47
Project Cost Efficiency		1.2	0.5	0.85	0.12	0.853
Save Margin $15/bbls	$ 15.00	$ 61.05	$ 25.00			$ 37.91
Normal distributed assumed						
Calculate NPV						
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue	$ -	$ -	$ 706,378.03	$ 649,867.79	$ 597,878.37	$ 550,048.10
Operating Cash	$ (534,347.33)	$ (124,568.23)	$ 345,354.92	$ 278,346.64	$ 228,889.87	$ 190,704.15
Net Cash Flow	$ (534,347.33)	$ (113,243.85)	$ 285,417.29	$ 209,125.95	$ 156,334.86	$ 118,412.28
NPV	$ 121,699.20		Prob to lose		3%	
			(NPV<0)			

Risk Assessment

Table 3.5 Risk Assessment Alternative #2

Location: Pump House		Unit:	ALCO Engine	Study Date:	
		P&ID Title:		P&ID Rev. Date:	
Section/Node No.:		Description:	Repair the engine with new major parts	CR No:	

WHAT IF ..... ?	POTENTIAL CONSEQUENCES	EXISTING SYSTEMS & PROCEDURES (SAFEGUARDS)	NO.	S	L	R	SHEA	ADDITIONAL CONSIDERATIONS
Longer procurement time	Delay project and possible loss of production opportunity to lifted crude oil to Offtakers	Involver Procurement team in early phase, Refer to PTK 007, Monitor procurement progress by regularly engangement Procurement team	1	4	3	6	Asset	Consider to do appropriate selection tender process, whether will use Direct Appointment or Direct Selection or Open Tender.
Major parts damage during delivery handling (miss handling)	Parts will be broken and possible loss of production opportunity to lifted crude oil to Offtakers	Follow delivery handling procedure, Use proper equipment or tools	1	4	4	7	Asset	Manage risk

Alternative #3 Repair the engine with recondition major parts

Table 3.6 Financial Analysis Alternative #3

Assumptions						
Year	2015	2016	2017	2018	2019	2020
Investment	$ -1,077,230					
Revenue		$ 238,212.78	$ 657,467.29	$ 604,869.90	$ 556,480.31	$ 511,961.89
Base Oil Price	$ 50.70					
Estimated additional production/Mbbls/ year		15,321				
- Expense (excluding depreciation and interest)	1,044,418	553,735	217,513	217,513	217,513	217,513
Earning before depreciation, interest, and taxes (EBDIT)	(1,044,418)	(320,313)	426,733	375,193	327,777	284,154
- Depreciation		$ 114,674	$ 298,154	$ 178,892	$ 107,335	$ 64,401
Earning before interest, and taxes	(1,044,418)	(434,987)	128,580	196,301	220,442	219,752
- Taxes (rate, T = 40%)	(417,767)	(173,994.87)	51,432	78,521	88,177	87,901
Net operating profit after taxes	(626,651)	(260,992)	77,148	117,781	132,265	131,851
+ Depreciation		114,674	298,154	178,892	107,335	64,401
Operating cash flows	(626,651)	(146,318)	375,301	296,673	239,600	196,253
Discount rate	10%					
Year	0	1	2	3	4	5
PV(CF)	(626,651)	(146,318)	375,301	296,673	239,600	196,253
S **PV(CF)**	(626,651)	(133,016)	310,166	222,895	163,650	121,857
		Max	Min	Mean	St Dev	
Oil Price		1.5	0.8	1.14	0.12	0.980
		$ 76.05	$ 40.00			$ 49.68
Project Cost Efficiency		1.2	0.5	0.85	0.12	0.884
Save Margin $15/bbls	$ 15.00	$ 61.05	$ 25.00			$ 37.44
Normal distributed assumed						

Calculate NPV						
Year	2015	2016	2017	2018	2019	2020
Revenue	$ -	$ 233,422.64	$ 644,246.48	$ 592,706.76	$ 545,290.22	$ 501,667.00
Operating Cash	$ (553,890.01)	$ (129,328.77)	$ 331,724.82	$ 262,226.01	$ 211,780.09	$ 173,465.63
Net Cash Flow	$ (553,890.01)	$ (117,571.61)	$ 274,152.74	$ 197,014.28	$ 144,648.65	$ 107,708.51
NPV	$ 52,062.57		Prob to lose (NPV<0)		4%	

Risk Assessment

Table 3.7 Risk Assessment Alternative #3

Location: Pump House		Unit: P&ID Title:	ALCO Engine	Study Date: P&ID Rev. Date:	
Section/Node No.:		Description:	Repair the engine with recondition major parts	CR No:	

WHAT IF ..... ?	POTENTIAL CONSEQUENCES	EXISTING SYSTEMS & PROCEDURES (SAFEGUARDS)	NO.	S	L	R	SHEA	ADDITIONAL CONSIDERATIONS
Major parts damage during delivery handling (miss handling)	Parts will be broken and possible loss of production opportunity to lifted crude oil to Offtakers	Follow delivery handling procedure, Use proper equipment or tools	1	4	4	7	Asset	Manage risk
Longer delivery time since the major parts will be repaired at engine manufacture which is located at outside Indonesia	Delay project and possible loss of production opportunity to lifted crude oil to Offtakers	Refer to PTK 007	2	4	5	8	Asset	Manage risk

Alternative #4 Restore the engine with utilizing unused existing major parts

Table 3.8 Financial Analysis Alternative #4

Assumptions						
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Investment	$ 304,513					
Revenue	77678.082	$ 714,638.35	$ 657,467.29	$ 604,869.90	$ 556,480.31	$ 511,961.89
Base Oil Price	$ 50.70					
Estimated additional production/Mbbls/ year		15,321				
- Expense (excluding depreciation and interest)	1,044,418	553,735	217,513	217,513	217,513	217,513
Earning before depreciation, interest, and taxes (EBDIT)	(960,962)	214,063	488,861	432,351	380,362	332,532
- Depreciation						
Earning before interest, and taxes	(960,962)	214,063	488,861	432,351	380,362	332,532
- Taxes (rate, T = 40%)	(384,385)	85,625.25	195,544	172,941	152,145	133,013
Net operating profit after taxes	(576,577)	128,438	293,317	259,411	228,217	199,519
+ Depreciation						
Operating cash flows	(576,577)	128,438	293,317	259,411	228,217	199,519
Discount rate	10%					
Year	0	1	2	3	4	5
PV(CF)	(576,577)	128,438	293,317	259,411	228,217	199,519
S PV(CF)	(576,577)	116,762	242,411	194,899	155,875	123,886
		Max	Min	Mean	St Dev	
Oil Price		1.5	0.8	1.14	0.12	1.074
		$ 76.05	$ 40.00			$ 54.47
Project Cost Efficiency		1.2	0.5	0.85	0.12	0.737
Save Margin $15/bbls	$ 15.00	$ 61.05	$ 25.00			$ 39.64
Normal distributed assumed						
Calculate NPV						
Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Revenue	$ 83,456.35	$ 767,798.45	$ 706,374.58	$ 649,864.61	$ 597,875.44	$ 550,045.41
Operating Cash	$ (425,004.68)	$ 94,673.72	$ 216,208.71	$ 191,216.04	$ 168,222.79	$ 147,068.99
Net Cash Flow	$ (425,004.68)	$ 86,067.01	$ 178,684.88	$ 143,663.44	$ 114,898.43	$ 91,318.27
NPV	$ 189,627.36		Prob to lose (NPV<0)		3%	

Risk Assessment

Table 3.9 Risk Assessment Alternative #4

Location: Pump House		Unit:	ALCO Engine					Study Date:	
		P&ID Title:						P&ID Rev. Date:	
Section/Node No.:		Description:	Restore the engine with utilizing unused existing major parts					CR No:	

WHAT IF ..... ?	POTENTIAL CONSEQUENCES	EXISTING SYSTEMS & PROCEDURES (SAFEGUARDS)	NO.	S	L	R	SHEA	ADDITIONAL CONSIDERATIONS
The major parts dimension are out of tollerance.	Possible loss of production opportunity since the engine downtime is longer than expected. The pump can not be operated and support lifting activities.	Engineering design and guideline, Quality Assurance Check, Constructability review	1	4	4	7	Asset	Manage risk
Major parts damage during delivery handling from Duri to Dumai by land transportation (miss handling)	Parts will be broken and possible loss of production opportunity to lifted crude oil to Offtakers	Follow delivery handling procedure, Use proper equipment or tools	2	4	4	7	Asset	Manage risk
The unused existing major parts specification are not matched (shaft bending or etc)	More downtime, Possible loss of production opportunity to lifted crude oil to Offtakers.	Do assessement the engine and refer to engine specification manual book	3	4	5	8	Asset	Manage risk
Reliability of engine will decrease	Need additional maintencance cost, Possible engine suddenly stuck and disturb lifting activities, Loss of Production Opportunity	PM schedule was establised and implemented, SERIP - ORD implementation	4	4	3	6	Asset	Consider to perform PdM task

The financial analysis side is also important to make the right decision. Based on NPV calculation below for each alternative which considering decline rate of crude oil 8% per year. NPV is used to determine the profitability of investment.

The summary of NPV calculation can be shown on the following table:

Table 3.10 NPV summary

I. COST OF PURCHASE NEW ENGINE	$	-169,442
II. COST OF PURCHASE MAJOR PARTS ONLY	$	346,742
III. COST OF RECONDITION MAJOR PARTS	$	269,616
IV. COST OF UTILIZE UNUSED EXISTING MAJOR PARTS	$	666,744

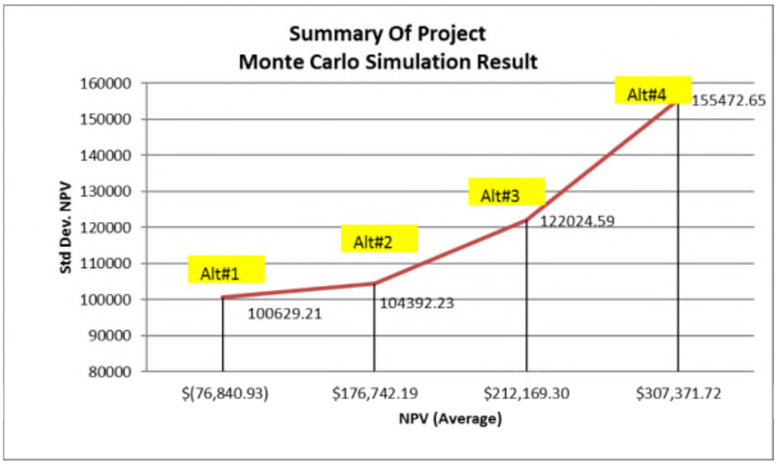

Figure 3.3 SWOT Analysis of ALCO engine as lifting equipment

CONCLUSION AND IMPLEMENTATION PLAN

Business issue that happens in managing integrity of Shipping pump in order to meeting the GOI quotas has been analyzed by financial analysis, monte carlo simulation and risk assessment.

According to the best alternative as per financial assessment above, the selected alternative is restoring the engine with utilizing unused existing major parts which have the highest NPV.

ALCO engine restoration by utilizing unused existing major parts is proposed to be executed which has considered contract expiration in 2021. In other side, refreshing training will be scheduled to shipping pump operator and manage the OEM spare part needs. Hopefully this incident will not happen again in the future. The implementation of this business solution is planned using PDCA cycles that provide with continuous improvement as follows:

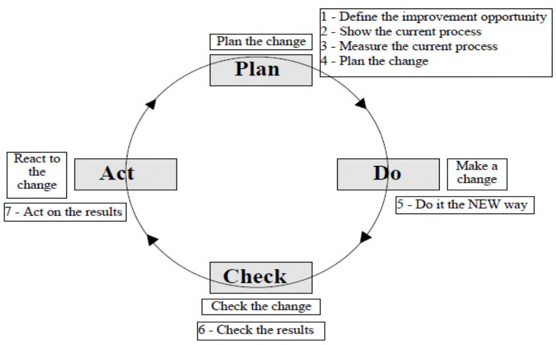

Figure 4.1 PDCA Cycle for Implementing Improvement

1. Plan

   The “Plan” process establishes objectives, targets, controls, processes and procedures for the program to deliver results in accordance with an organization’s overall policies and objectives.

   Some recommendations have been generated by RCA which will be described on the following:

Table 4.1 Planning Phase

What is the improvement being sought?	Objective: Maintain the integrity and availability ALCO engine to prevent the demurrage costs which caused by catastrophic accidents which generated high operational to repair it. With the several considerations, hopefully the ALCO engine will back to run in order to supporting crude oil lifting as per customer demand.

What is the current process?	The selected alternative has been selected. With the several risks management and consideration. So far they have standard operating procedure (SOP) in how to operate the engine of shipping pump but since the organization changed in internal HCT, there is no performed refreshing training to new operator who responsible it, so the new operator have limited knowledge and experiences.
Measure indicator	Number of Worst Actor Identification as part of SERIP (Surface Equipment Reliability and Integrity Procedure) will be tracked in quarterly. Number of Availability of ALCO engine shipping pump is also tracked monthly.
Select change	The proposed change is to utilize unused existing Major parts replacement. Replacement will be planned to execute in Q2 - 2015 until 2016.

2. Do

The ALCO engine replacement will be well planned by several considerations in order to back running the operation to fulfil the customer demand. The following are comprehensive assessment performed:

- Dumai shipping pump availability vs operation usage
- Duri shipping pump capacity review as known as the unused ALCO engine
- Review Engine specification
- Spare part preparation strategy
- Operation and Maintenance Training

Table 4.2 Implementing Phase

Implement the Method	Coordinate with HCT operation Duri regarding Duri's shipping pump capacity review and maintenance team to have detail engine specification ALCO engine at Duri and Dumai. Coordinate with material team to request the OEM parts. Coordinate with Engineering team as SME for project replacement.
Progress plan	Engineering has contacted and discussed with ALCO engine manufacture regarding this issue. Maintenance team has been conducted measurement and verification data of ALCO engine especially for broken parts (crankshaft and bare block) Start to execute the selected project in Q4 2015. Monthly project and backlog monitoring.

3. Check

   From the RCA result there are several action items to be implemented in order to prevent same incident happened in the future. It can be determined in WAIR (Worst Actor Identification Resolution) which is frequently monitoring work order issued regarding ALCO engine problem. The availability and reliability report are also reported and monitored.

Table 4.3 Studying Phase

Evaluate the change	Process: Provide appropriate refresher training for Operator, provide checklist of activities sequence refer to the SOP, Improve interconnected safety pre-starting and shutdown system between priming pump and ALCO engine. Check the load and unload test engine after overhaul to ensure the engine running smoothly. Check the engine condition regularly as the manufacture recommendation. Outcome: percentage of availability and reliability of ALCO engine shipping pump, frequency of ALCO engine problem.

4. Action

   Ensure the measurement and verification for critical parts of ALCO engine are within tolerance before executing the project. Furthermore the spare part management will be improved will help reduce unwanted downtime. And the other important thing is Operator capability will affect directly to reliability. By doing the right operation and maintenance to the ALCO engine until contract expired in 2021 as the PSC to meet the yearly target lifting from Government of Indonesia.

Table 4.4 Action Phase

Adopt or modify the change plan	Collecting lesson learn from RCA and project lock-back.

The PDCA method for this final project detailed as bellow;

Table 4.5 PDCA Method Application

	No	Activities	2015			2016
			Q2	Q3	Q4	Q1
Plan	1	Refreshing Training				
		- Re-develop QSOP and update				
		- Trained new Operator Shipping pump				
	2	Setup the overhaul schedule of ALCO engine				
		- Approved budget				
		- Resources availability				
		- Purchase parts				
Do	3	Do comprehensive assessment to unused parts of ALCO engine				
		- Dumai Shipping pump availability vs operation usage				
		- Duri Shipping pump capacity review				
		- Review engine specification				
	4	Engineering review				
		- Scope of work				
		- Spare part preparation strategy				
		- Cost estimate, material and schedule				
		- Procurement process				
	5	Overhaul the engine				
Check	6	Project milestone				
	7	Unload and Load test engine				
Action	8	Lesson learn and lookback				

REFERENCES

Eden, C. and Ackermann, F., (1998), *Making Strategy: The Journey of Strategic Management*, Sage Publications, London

Helms, Marilyn M. and Nixon, Judy, *Exploring SWOT Analysis,* Journal of Strategy and Management, Vol. 3, No. 3, 2010, 215 – 251.

Kendrick and Saaty, 2007, *Use Analytic Hierarchy Process for Project Selection*, N.p, n.p.

Kepner, Charles H. and Tregoe, Benjamin B., 1997, *The New Rational Manager*, *New Jersey*, Princeton Research Press.

Kessler, Eric H., 2013, SWOT Analysis Framework, *Encyclopedia of Management Theory*, 4-5.

Liz H, 2011, Plan-Do-Check-Act (PDCA) Implementing New Ideas in a Controlled Way, Problem Solving Tools, November 2011. Available from http://www.mindtools.com/pages/article/newPPM_89.htm

Marsh Insurance, 2003, *The 100 Largest Losses 1972 – 2001*, N.p, Marsh's Risk Consulting Practice.

Pinto, Jeffrey K., 2010, *Project Management: Achieving Competitive Advantage*, Second Edition, New York, Pearson Education, Inc.

Paul Goodwin, George Wright, 2010, *Decision Analysis for Management Judgement*, Fourth Edition.

Lawrance J. Gitman, Chad J. Zutter, Principles of Managerial Finance, Thirteenth Edition.

RiskMan2 Integrated Risk Prioritization Matrix User Guide, 2011