SUB THEME: OPERATION

OPTIMIZATION OF PRODUCTION EQUIPMENT MAINTENANCE PLANNING TO REDUCE COST IN SUMATERA LIGHT OIL SOUTH OPERATIONS PT XYZ

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Abstract

PT XYZ thru its operations in Sumatera Light Oil (SLO) South has been operating oil & gas production since 1940's. It runs in Mama, Kilo and Papa as the major fields with about 1,200 active producer wells in one production sharing contract (PSC) area. Various technologies have been piloted and implemented since 1970's to boost and sustain the production level, including water flood and chemical injection. The production level reached the peak performance in 1990's and after that steadily declined toward the end of PSC by 2021. Current production level (2015) is around 74,382 Barrel Oil per Day (BOPD) with injected water volume 6.5 million BOPD in average.

Managing mature field with aging facilities has specific challenge in its operational. The change of fluid composition requires more effort & cost to maintain production level. This situation resulted in higher operation and maintenance cost. The actual production has been declining by 4.6% per year from 2011 till 2015 and projected more than 10% per year starting 2016. However, at the other side, the actual maintenance cost increases by 1% - 7% since last 2 years due to resource requirement and anticipating operational complexity. This is highly impacting to the company's revenue generation especially the oil price suddenly went down starting Q3 2014 from the level of $100's to $30's in Q4 2015.

The model of operations/production system is used to frame the business issue and opportunity for maintenance cost reduction. The cost-efficient maintenance process in SLO South is affected by several contributing input factors that are grouped into 3 main elements. They are manpower utilization, contractor optimization and Inventory or spare-part usages, in addition to maintenance strategy as part of transformation.

Focus Group Discussion (FGD) consisted several experts was formed for business solution. Decision analysis using combination of Value Focused Thinking (VFT) and Analytic Hierarchy Process (AHP) methods was used to provide best result. Alternatives were generated using VFT that was streamlined from the fundamental objective that is to reduce maintenance Operating Expenses (OPEX). As result, list of improvements programs is identified and converted into operation plan. The strategy map for SLO Maintenance South tem is developed to guide the organization achieving the target and sustain its success in base business. Maintenance OPEX reduction by $6,175,748 starting 2017 is expected when all improvement initiatives are well implemented and sustained until 2020.

Keywords: Oil & Gas, Equipment Maintenance, Value Focused Thinking (VFT), Analytic Hierarchy Process (AHP), Operation and Production System Model, Strategy Map, Balance Scorecard

INTRODUCTION

Company Profile

XYX globally is the second largest integrated energy company headquartered in the United States and among the largest corporations in the world, based on market capitalization as of Dec 31st, 2014. Supported by 65,000 employees, worldwide net oil-equivalent production in 2014 averaged 2.571 million barrels per day, with about 26 percent of the production coming from the United States and the rest from more than 20 other countries.

XYZ's partnership with the people and the Government of Indonesia can be traced back to 1924, when the company dispatched a geological expedition to the island of Sumatra. XYZ has been Indonesia's largest producer of crude oil which delivers approximately 40% of national production from its operations in Sumatera and Kalimantan with total cumulative oil production of more than 12 billion barrels. To support operation in Indonesia, XYZ employs 6,300 highly-skilled, dedicated employees and more than 30,000 business partner employees to continue delivering safe, efficient and reliable energy on behalf of the countries.

Through its subsidiaries, PT XYZ, the corporation conducts oil and gas operations in Sumatera. It is divided into two main operating units that are based on the type of oil:

1. Heavy Oil Operation (HOO) that produces heavy oil with extensive operations in Delta field and currently using steam injection technology secondary oil recovery program. Oil production from HOO is about 185,000 barrels per day.
2. Sumatera Light Oil Operation (SLO) that produces light oil from the area of operation which consists of the North area in Bravo, Lima fields and South area in Mama, Kilo, and Papa fields. Currently SLO is implementing water injection technology as a secondary oil recovery system and produces around 200,000 barrels of light oil per day.

Sumatera Light Oil (SLO) South Operation

The operation is under Romeo block Production Sharing Contract (PSC) with Government of Indonesia until 2021. Currently SLO South operates 1,200 oil wells and other 2,000 injector wells in production sharing concession or PSC areas totaling around 2,700 square kilometers. To maintain 74,382 barrel per day of oil production (average in 2015), SLO South has been implementing secondary technology of oil recovery using water flood since 1993 where around total 6.5 million barrels of water per day is injected to reservoir at 700 PSI (Pound per Square Inch) and 150 degree Fahrenheit to stimulate oil production.

The production of oil field from Mama and Kilo-Papa is operated by SLO South Operation & Maintenance (O&M) that is led by a manager with responsibility to maintain and operate reliable surface facility for oil production. There are 4 major teams under O&M South that support the manager achieving goals. Each team is led by a Team Manager. They

are Production Kilo-Papa that oversees production wells and plants (gathering stations) from fields Kilo, Papa and Sera, Production Mama South for fields of Mama area 1, 2 and 3, Production Mama North for area 4, 5 and 6 and Maintenance South that is responsible for equipment maintenance of production facility in all field under SLO South.

Maintenance Unit

In exception of gas compressors, Maintenance South is responsible of conducting maintenance of rotating equipment in Mama, Kilo and Papa. The majority of equipment is on-plot, inside gathering station to support oil treating for production such water injections pump, shipping pump, air compressor, fire pump, etc. including supporting electric system (i.e. Motor Control Center or MCC, Circuit Breaker, Transformations, etc.) and instrumentation & control (Programmable Logic Control or PLC, transmitter, controller and many more).

Maintenance South unit is led by a Team Manager and currently employs 52 XYZ company personnel in various sections that is divided by combination of area/ location of work and functional. Each section is coordinated by a team leader of group leader. Following is the table of personnel number by position including the percentage of typical work assignment. Office work is the activities at the office such as completing administrative works, preparation of standard operating procedures, permits, time sheets, reporting and others while field work is the activities conducted at fields for inspection, maintaining equipment, etc.

Table I-1 Maintenance Job Position and Typical Assignment

Position	No of Personnel	Typical Assignment	
		Office Work	Field Work
Team Manager	1	90%	10%
Team Leader	3	80%	20%
Group Leader	7	60%	40%
Planner	2	60%	40%
Materialman	2	100%	0%
Data Management	2	100%	0%
Analyst	7	50%	50%
Facility Representative	4	50%	50%
Senior Technician	16	20%	80%
Technician	8	10%	90%
Grand Total	**52**		

In addition to 52 XYZ personnel, Maintenance South also gets support from 25 to 34 man-powers from contractors with various disciplines. They are under Operation Maintenance Support & Services (OMSS) contract that is established in SLO South for certain period of time. Most of contract man powers are working with Work Unit Rate (WUR) as stipulated in the contract agreement.

Business Issue

SLO South has been operating oil & gas production seven decades. As common mature field behavior, there is natural production decline as impact of change fluid composition and reservoir pressure after being exploited for a number of years. The use of enhanced technology beyond water flood to recover more oil is not always generating results as expected and sometime sounds un-economical. Various technologies have been piloted and implemented since 1970's to boost and sustain the production level, including water flood and chemical injection. The production level reached the peak performance in 1990's and after that steadily declined toward the end of PSC by 2021.

At the other hand, secondary production system like in SLO South operations demands huge investments in both capital and operation expenditures because to process fluids from production wells it requires additional surface production equipment such as water injection facilities, including the injection pump complete with electrical systems, instrumentation and control, as well as piping system and finally injector wells. Managing mature field with aging facilities also creates another challenge in operation. The change of fluid composition requires more effort & cost to maintain production level. This situation resulted in higher operation and maintenance cost.

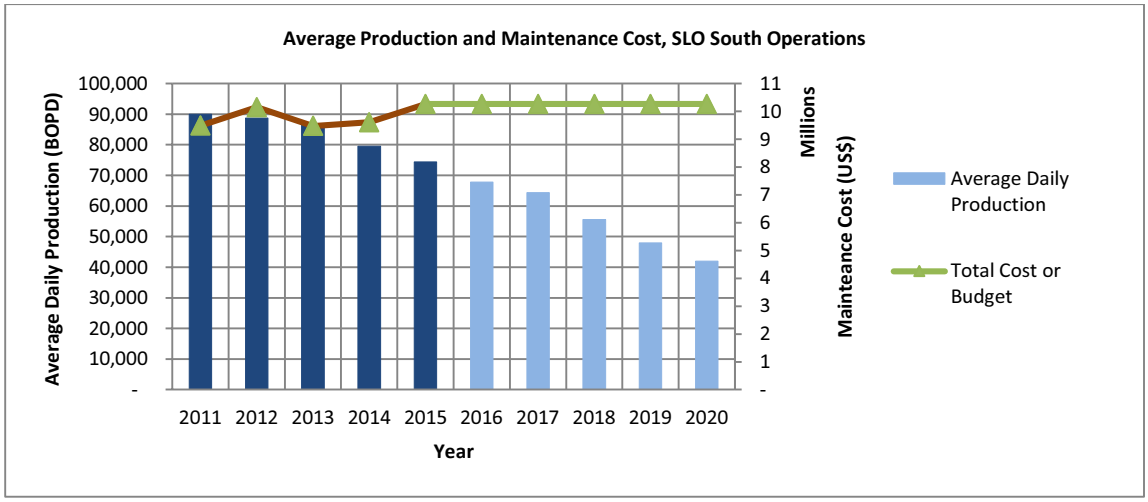

Figure I-1 Trending of Average Daily Production and Maintenance Cost

From the Figure I-1, it is showing that production declines by 5-8% per year till 2017 and goes beyond 10% starting 2018. However, at the other side, the actual maintenance cost increases by 1% - 7% since last 2 years due to resource requirement and anticipating operational complexity. At beginning, the declining of production had no significant impact to the revenue and profit earning of company since the trend of world oil price was relatively high in the last 17 years. However, it became a major issue for most oil companies when the oil price suddenly went down starting Q3 2014 from the level of $100's to $30's in Q4 2015.

This challenging condition mandates most oil & gas companies including PT XYZ to seek opportunities and area of improvement where cost saving that be obtained for the company to sustain in low oil price period. During budgeting cycle for the year of 2016 – 2020, PT XYZ Management set the rule that the budget for upcoming year can't be greater

than actual cost running year, unless there is any significant impact to Health, Environment and Safety (HES) issues. They also urge all team including Maintenance team to identify potential opportunity for optimization and cost reduction by Maintenance South. The goal is to have high equipment reliability which can be translated to minimum loss production opportunity caused by facility down and ultimately to maintain production level as per its production capacity.

BUSINESS ISSUE EXPLORATION

Conceptual Framework

Jacobs, F.R. and Chase, R.B. (2014) define efficiency as a measure of how well we do things. Efficiency is about "doing thing right" where from the resources point of view, efficiency is strongly related to the utilization of resources and mainly has on the input of productivity ratio. Practically it means that it achieves particular tasks in the most valuable and effective way with minimum possible wasteful ways. Joseph G. Monks (2004) also defines Operations Management as the process whereby resources, flowing within a defined system, are combined and transformed by a controlled manner to add value in accordance with policies communicated by management. The definition of the operations Management contains following keywords: Resources, Systems, transformation and value-added activities. Resources are the human, material and capital inputs to the production process. Human resources are the key assets of an organization. As the technology advances, a large proportion of human input is in planning and controlling activities. By using the intellectual capabilities of people, managers can multiply the value of their employees into by many times. Material resources are the physical facilities and materials such as plant equipment, inventories and supplies. These are the major assets of an organization. Systems are the arrangement of components designed to achieve objectives according to the plan.

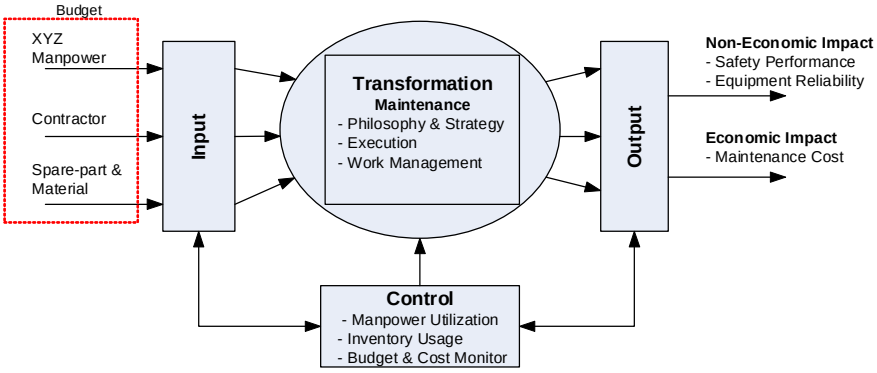

Figure II-1 Model of Operation/ Production System
Source: Kumar, S.A. and Suresh, N. (2009), Operations Management, p11

Maintenance activities of surface production facility in SLO can be described in the model for operations/production system as illustrated in the Figure II-1. The activity converts the resources needed for maintenance into the reliability of production facility by following

work management process. The required input is man-power or technicians that can be internal company labor and contractor performing maintenance works. The next inputs are spare-part or material used to replace broken unit of production asset and maintenance budget or funds to pay all resources required for the activities.

Model of Operation/ Production System

The transformation process expects an effective maintenance execution and completion that is managed through proper strategy and plan. Hence maintenance strategy plays a vital role to navigate the process of converting resources (input) into objectives (output). The output of maintenance activities is measured through total maintenance cost per barrel oil production within a year as an economic impact. Equipment reliability and safety performance are the metrics of non-economic output. All of them indicate the productivity from maintenance activities which can determine the efficiency of whole process

Business and Maintenance Strategy

Ireland, R.D., Hoskisson, R.E. and Hitt, M.A. (2011) explain that business level strategy is a set of commitments and actions are integrated and coordinated to gain a competitive advantage by leveraging core competencies in specific product markets. As an operator of Production Sharing Contract with Government of Indonesia, PT XYZ business level strategy is cost leadership. The company needs to be efficient in business process and resource optimization to counter high lifting cost while maximizing the production of crude oil.

Collis, D. J. and Rukstad, M. G. (2008) also explain that organizations express priorities best through stated goals and objectives that form a hierarchy of goals, which includes its vision, mission, and strategic objectives. What visions may lack in specificity, they make up for in their ability to evoke powerful and compelling mental images. On the other hand, strategic objectives tend to be more specific and provide a more direct means of determining if the organization is moving toward broader, overall goals. Visions, as one would expect, also have longer time horizons than either mission statements or strategic objectives.

Figure II-2 2016 Sumatera Operations Execution Focus

The vision statement is that "XYZ Remains a Key Long Term Competitor in Indonesia and the Philippines". This vision is translated becoming strategic objectives which then generate Execution Focus Items for all operating groups in Business Unit.

Hunger, D.J. and Wheelen, T.L. (2012) define functional strategy as an approach a functional area that takes to achieve corporate and business unit objectives and strategies by maximizing resource productivity. It is concerned with developing and nurturing a distinctive competence to provide a company or business unit with a competitive advantage. One of the functional strategies is an operations strategy that determines how and where a product or service is to be manufactured, the level of vertical integration in the production process, the deployment of physical resources, and relationships with suppliers.

The Operational Excellence (OE) strategy themes' goals in Maintenance South is to achieve safe & incident-free operations and maintain high equipment reliability & availability by focusing in following activities:

Figure II-3 Operational Excellence Strategic Objectives

Operational excellence (OE) is a critical driver for business success and a key part of enterprise execution strategy. Operational excellence is defined as "the systematic management of process safety, personal safety and health, environment, reliability and efficiency to achieve world-class performance."

Analysis of Business Situation

Maintenance Budget & Expenditure

The budgeting model of PT XYZ separates the costs of people or labor and maintenance service costs that contain spare part and 3rd party contractor's costs. The cost of people/ labor is budgeted and managed in Maintenance department cost center which will be allocated out to work order requesters (most likely Production) while the budget of service costs is stored in Production Operation team which will be used directly when cost of spare part or contractor for maintenance is occurring. The cost of people is fixed which means that the expenses will be carried regardless manpower utilization while the service cost is variable cost, depending on actual expenses on spare-part or contract service required for maintenance.

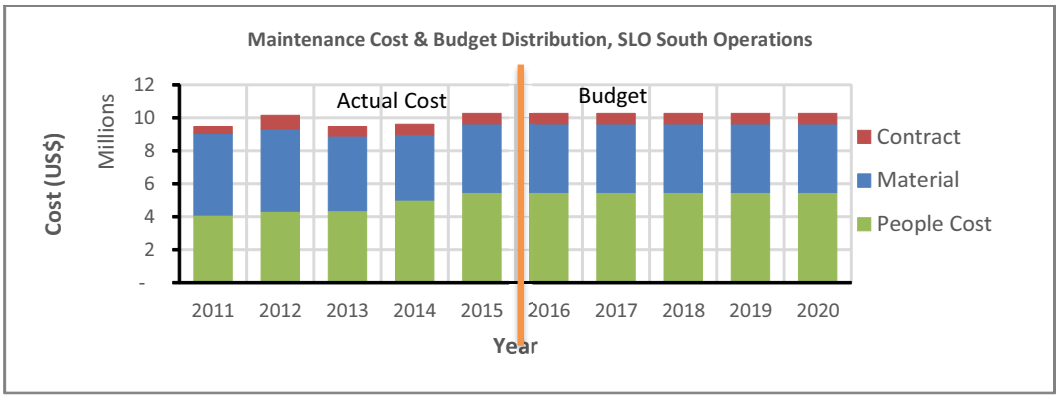

Figure II-4 Maintenance Cost Distribution

There are several issues related with budget preparation and control:

1. The preparation of budget uses the historical spending/ expenditure in previous years to determine activities in following years with the assumption there is no significant changes in maintenance program. There is no special effort to simulate and forecast future needs of manpower based-on regular maintenance program setup in CMMS.
2. The actual spending of people cost between 2011 and 2015 is getting higher. It was around 40% in 2011 but then growing in 2015 become 55.6% of total maintenance expenditure.

Internal Manpower Utilization

Manpower utilization is measured by comparing actual hours of XYZ & contractors spent in equipment maintenance (work order) comparing to their availability in the certain period of time. There are specific conditions that is affecting manpower availability, such as employees' functional discipline, working hours in remote and non-remote locations, daily working hours, public holidays, annual leaves entitlement and trainings.

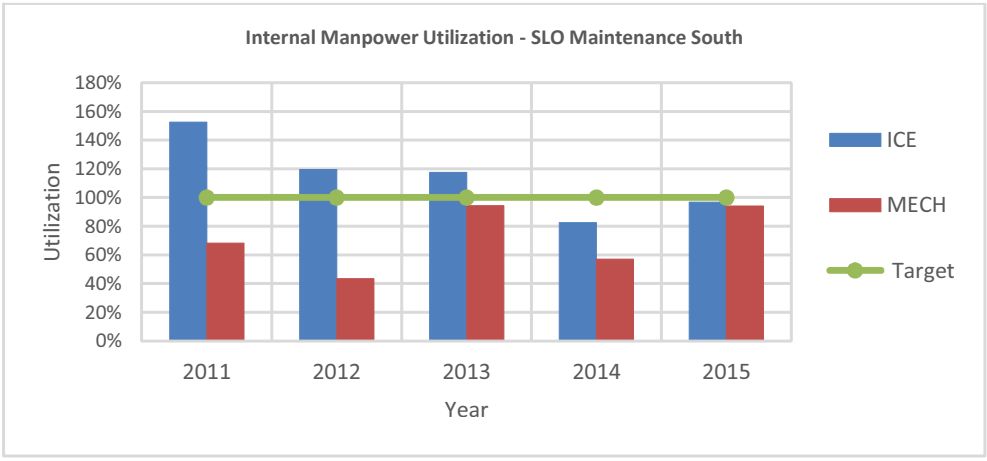

Figure II-5 Internal Manpower Utilization

There are several issues that related with manpower utilization:

1. From the historical trending, it shows that the utilization is fluctuated every year for both Mechanical (MECH) and Instrument Control & Electrical (ICE). Personnel movement

such as employee transfer to other department or retirement was minimum however the required hours for maintenance activities were not at the same level every year which contributed to the fluctuation.

2. The average utilization of Instrument Control & Electrical personnel is 113% while Mechanical is 71%. There is an opportunity to either improve utilization of Mechanical personnel or optimize the idle hours for other productive activities.
3. Based on projected number of hours to complete both preventive and corrective work orders in Mama and Kilo-Papa for each discipline, there is an opportunity to improve manpower utilization, especially the mechanical crew.

Contract Utilization

Different with people cost that is fixed and come from XYZ personnel and other overhead costs, the contract service cost is based on actual service performed by the contractors. There are a number of unit rates stipulated in the contract for each type of service provided by the contractors.

There are several opportunities that can explored with the contractors:

1. Some of the contractors have been working in PT XYZ facilities for a number of years and having experiences with field operations and equipment maintenance. The personnel can be optimized to handle low and medium risk activities with limited supervision from Internal PT XYZ personnel
2. The utilization of contract service for Maintenance is around 10% to 16% of total manpower cost. There is opportunity to optimize more contractors to reduce overall manpower cost without degrading maintenance work quality that will be affecting to equipment availability and reliability.

Inventory and Spare-part Usage

Spare-part is one of important things required for equipment maintenance, especially for rotating equipment that can be worn-out in normal operation for certain period of time. The availability of critical inventory must be maintained properly to ensure that the spare-part is available when needed for replacement, otherwise it will be directly impacting to equipment downtime or availability and can be generating loss production. From the table II-1, it shows that 58% of spare-part budget is consumed by Water Injection Facility.

Table II-1 The Usage of Spare-part for Maintenance

Spare-part Cost by Equipment (USD)	Year					Grand Total
	2011	2012	2013	2014	2015	
Water Injection Pump	3,071,790	1,997,653	2,040,143	2,801,695	3,195,825	13,107,105
Small Pump	744,579	842,952	700,595	319,899	260,904	2,868,930
Instrument & PLC	195,407	322,209	284,935	121,675	166,415	1,090,641
Well & Pipe	196,744	507,763	388,612	181,084	127,421	1,401,625
Air Compressor	149,346	289,133	182,549	101,307	104,551	826,886
Other	109,922	259,198	242,984	101,186	77,625	790,914
Metering	138,960	241,011	193,831	92,685	63,722	730,208
Pumping Unit	127,076	249,475	208,762	71,841	47,771	704,925
Cooler	103,200	136,240	137,126	94,431	62,940	533,938
Tank	103,774	146,691	155,337	77,246	54,366	537,413
Grand Total	4,940,798	4,992,326	4,534,874	3,963,050	4,161,539	22,592,586

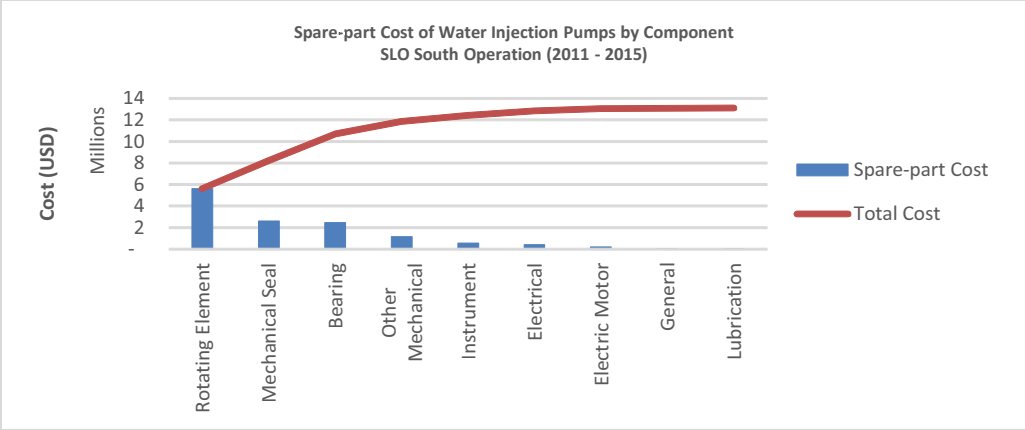

Figure II-6 WIP Spare-part Cost Pareto

1. 90% of spare-part need used in Water Injection Pumps is for mechanical components. They are rotating element, mechanical seals, bearings and other mechanical component such as rings, coupling, deflectors, gasket, etc. They cost around 12 million USD for 5 years.
2. Most of mechanical components were purchased from the Manufacturer. There is an opportunity to review the decision of getting quality spare-part in very competitive price. This way can be one alternative to reduce OPEX from spare-part expenditure for equipment maintenance.

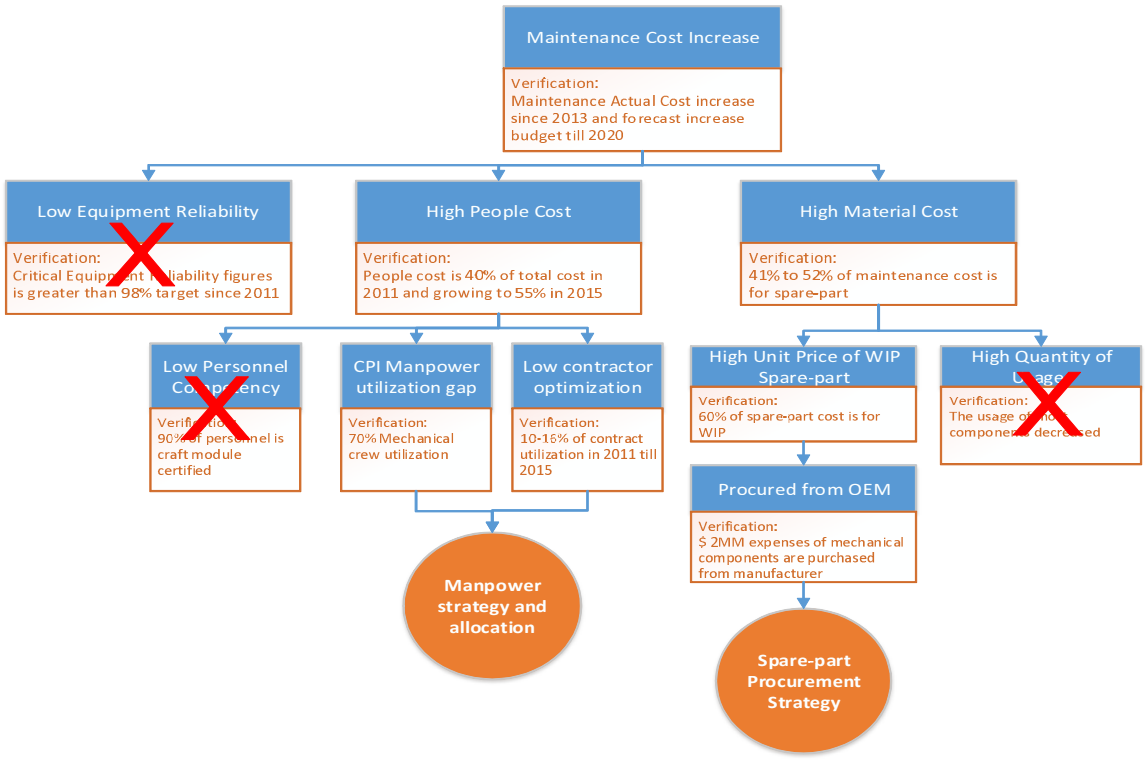

Figure II-7 RCA of Maintenance Cost Increase

Root Cause Analysis

Root cause analysis (RCA) is a systematic process for identifying "root causes" of problems or events and an approach for responding to them. A factor is considered a root cause if removal thereof from the problem-fault-sequence prevents the final undesirable event from recurring; whereas a causal factor is one that affects an event's outcome, but is not a root cause. Though removing a causal factor can benefit an outcome, it does not prevent its recurrence with certainty

BUSINESS SOLUTION

The decision making process use Value-Focused Thinking (VFT) and Analytic Hierarchy Process (AHP) to solve the problem. Both methods support the decision-makers of the problems involving multiple objectives. VFT method generates alternatives and criteria used by AHP to determine the ranking of alternatives. Keeney, R.L. (1996) explains that VFT describes and illustrates concepts and procedures for creating better alternatives for decision problems, identifying decision opportunities more appealing than confronting decision problems. It is articulate and use fundamental values to guide and integrate decision making activities.

For the purpose of exploring the alternatives and provide judgments about the intensity of importance in one alternative against the other, a Focus Group Discussion (FGD) was formed. The participants comprised of senior employees from internal organization with extensive working experience in operation and maintenance of production equipment in SLO South. They are 2 leaders from Operation department, 1 leader and 1 senior analyst from Maintenance department and 1 facility/ reliability engineer from Engineering department. All of them are very familiar with Mama and Kilo-Papa production facility. Specific in spare-part procurement strategy discussion, 1 senior analyst from Inventory Management – Supply Chain Management (SCM) team who familiar with mechanical product was also invited.

Determining Criteria and Alternative

First step of VFT is to define fundamental objective. Starting from here, criteria, decision context and alternatives are determined using VFT method. Mean objectives can have identified to intermediate fundamental objective and criteria.

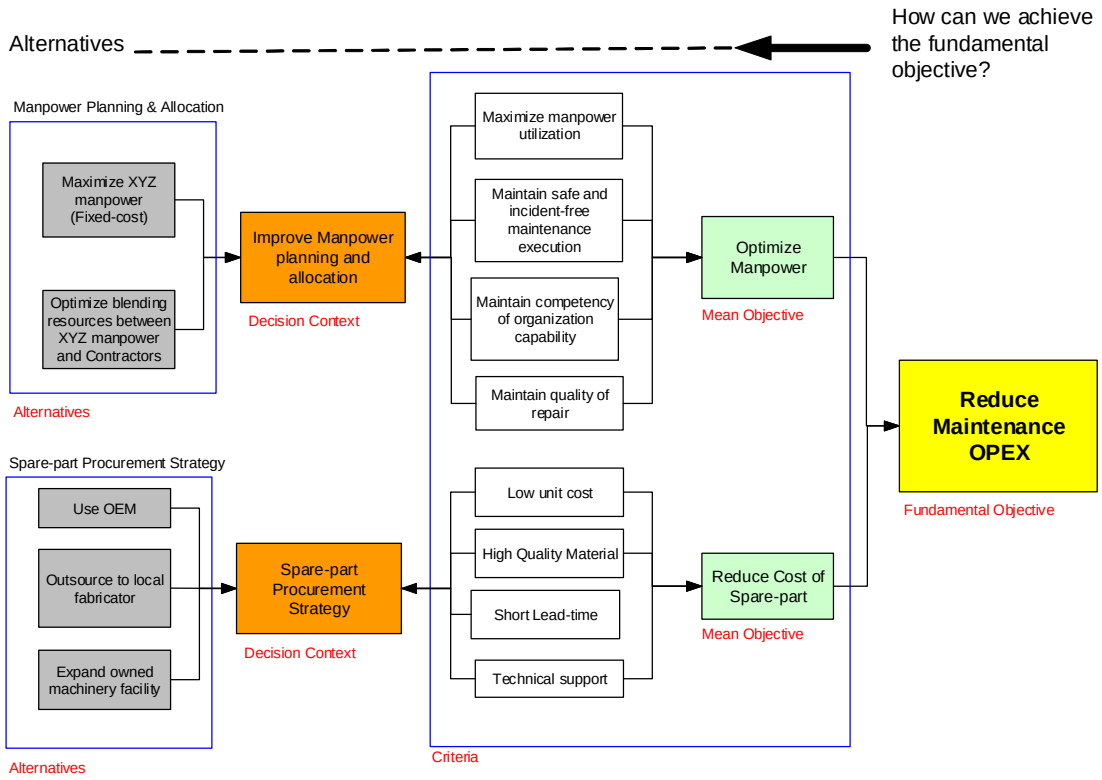

Figure III-1 VFT Diagram of Reducing Maintenance OPEX

According to the business issue exploration and discussion with focus group, following alternatives and criteria are developed as the potential solution to reduce maintenance OPEX.

Table III-1 List of Alternatives

Decision Context	Alternative	Logical Reasoning
Manpower Planning and Allocation	Maximize XYZ Manpower	People cost of XYZ manpower is fixed however based on historical trending since 2011 the average utilization of Mechanical crews is 70%. There is opportunity to maximize the utilization so that the requirement of contract service becoming lower and reduce maintenance OPEX by lower contractor cost
	Optimize blending resources between XYZ manpower and contractors	The cost of contractor is much lower comparing to people cost of XYZ manpower. The alternative is to allocate XYZ manpower for corrective maintenance and repair where it requires skill and high competence while the contractors will handle regular preventive maintenance activities at low risk area. Consequently, the surplus XYZ personnel (if any) will be returned to HR for other productive assignment in accordance to staffing strategy. This way the people cost of Maintenance department can be reduced.
Spare-part Procurement Strategy (Mechanical Component)	Use spare-part from Original Equipment Manufacturer (OEM)	The alternative is to keep the current procurement strategy where the spare-part of water injection pumps is bought from OEM mostly located in USA and Europe thru local agent in Indonesia or regional Asia Pacific. From the historical, most of procurement were conducted thru Direct Appointment (DA) to a supplier instead of open tender since the spare-part distribution is managed by sole agent. Renegotiation of unit price needs to be carried to generate cost saving and OPEX reduction
	Outsource to local fabricators	This alternative is based on benchmark to other team such as SLO North where the mechanical spare-part is procured from local fabricator in Indonesia mainly for mechanical seals, bearings and rotating element. From the reference, the cost of spare-part is approx.30% - 40% of the same item procured from OEM

Decision Context	Alternative	Logical Reasoning
	Expand Owned Machinery Facility	Currently XYZ owns and operates the facility of machinery in Delta and Mama. The facility fabricates small and non-complex mechanical component such as bolts, nuts, rings and some more manually made by operator/ machinist. The facility does not support the requirement for high precision and sophisticated component without upgrading it including Computer Numerical Control (CNC) machine. Capital budget of USD 500M - 700M is required for this investment with 9 – 12 month's installation project period. Maintenance OPEX from spare-part can be reduced since most of mechanical components can be refurbished or fabricated in-house.

The most relevant and important criteria that influence the decision problem must be selected and provided to be used by AHP method for determining the best alternative. The following table shows the selected criteria.

Table III-2 List of Decision Criteria

Decision Context	Element	Dimension	Description
Manpower Planning and Allocation	Cost of Manpower	Criteria	The total costs occurred to pay XYZ personnel and contractors. The lower is the better to reduce maintenance OPEX
	Safety Factor	Criteria	Safety performance while executing equipment maintenance is a primary factor in Operation Excellence (OE). The target is maintain safe and incident-free operations
	Personnel Competency	Criteria	Personnel competence to perform complex equipment problem at high-risk facility. Organization Capability is one of important element in Maintenance department that requires specific skills and experience
	Quality of Work	Criteria	Equipment maintenance is performed in high quality result to avoid repetitive failures that impact to reliability and availability
Spare-part Procurement Strategy (Mechanical Component)	Spare-part Cost	Criteria	The unit cost of spare-part including shipment to worksite. Lower unit cost contributes to the OPEX saving.
	Quality	Criteria	The quality of mechanical spare-part as per specification including type of material used, precision of dimension, etc. The high quality spare-part warrants the equipment runtime and reduces repetitive breakdowns that require part replacement
	Lead-time	Criteria	Time that is used from order in place to spare-part delivery at worksite. Lead-time impacts the availability and stock level of spare-part.
	Technical Support	Criteria	Support from vendor/ supplier when purchased spare-part does not meet specification and warranty claim. In many cases, vendor/ technical support supervises the field repair of spare-part that requires special technique of installation. They also receive operational feedbacks from field for product improvement

Selecting Preferred Alternative

Analytic Hierarchy Process (AHP) is one of multi criteria decision making method that was originally developed by Prof. Thomas L. Saaty. It is a method to derive ratio scales from paired comparisons. The input can be obtained from actual measurement such as cost, unit price, lead-time, etc., or from subjective opinion such as quality of work, safety factor and preference. AHP allow some small inconsistency in judgment because human is not always consistent. The ratio scales are derived from the principal Eigen vectors and the consistency index is derived from the principal Eigen value.

Step1: Setup Decision Hierarchy

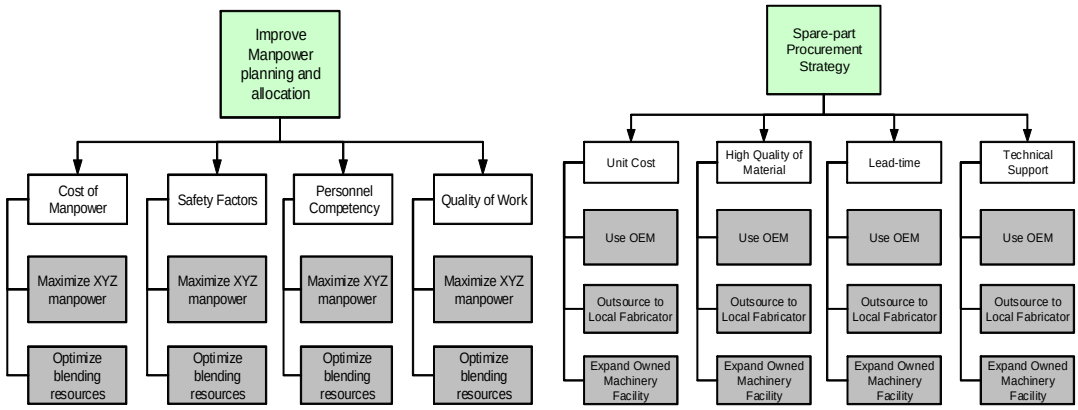

Figure III-2 Decision Hierarchy

Step2: Generating Pairwise Comparison Matrices

To make pairwise comparison, a survey or questionnaire is conducted to get the judgments of the important intensity one element comparing to another element. Five to six experts were interviewed in prioritization process to give opinion or judgments how many times more important or dominant one alternative to another based on a specific criterion, similar technique is applied to give the judgments of sub-criteria and criteria. The experts were given the explanation of the scale of numerical rating and description of criteria of the judgments. Then, they were asked to provide their best knowledge and opinions according to the questionnaires.

Step3: Synthesizing (Determine Best Alternative)

From the calculation, when all Consistency Ratio (CR) is less than 0.10, which means that the expert opinion is within consistency threshold, the process can be continued to calculate the ranking rate of alternatives.

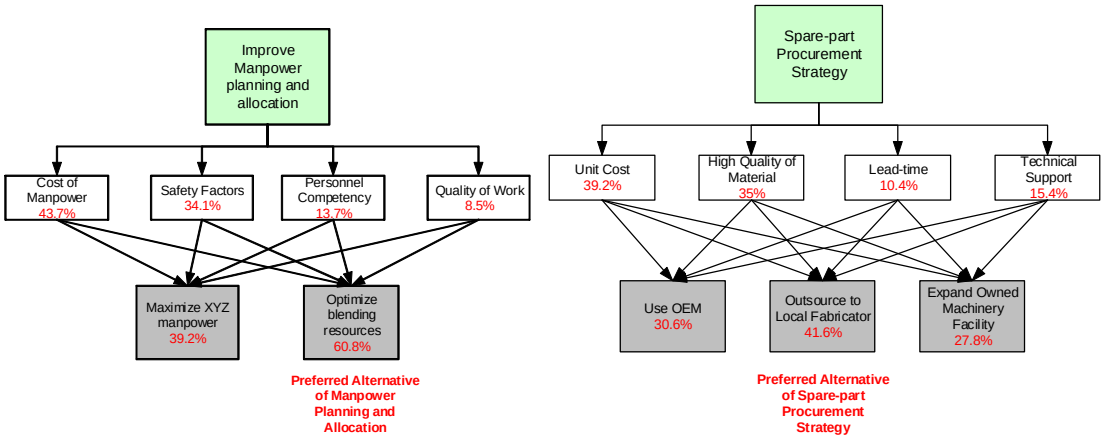

Figure III-3 Proffered Alternative

Operation Plan

Kaplan, R.S. and Norton, D.P. (2008) have mentioned that many organizations have achieved one-time performance breakthroughs without the use of a formal management system. Charismatic leadership and the art of management are powerful and frequently

effective forces. Performance that depends on the power of individual leaders, however, is generally not sustainable over the long term. Unless an organization links its strategy to its governance and operational processes, it won't be able to sustain its successes.

Based on the business exploration and solutions elaborated previously, below is the link between IBU strategic objectives, SMO execution focus items, SLO Maintenance South operation plans and improvement Program which address specific gaps/ issues.

Table III-3 List of Improvement Program

IBU Strategic Objective	SMO Execution Focus Item	SLO Maintenance South Operation Plan	Gap/ Issue	Improvement Program
Strengthen Short Term Financial Performance Extend Long Term Value Delivery Execute Property Transfer Requirements with Excellence Demonstrate company's value to Indonesia to secure our long term future	Execute Incident Free Operations	Maintain Zero Motor Vehicle Crash (MVC), Total Recordable Incident (TRI) and Day Away From Work (DAFW)	The number of near-miss and hazards as reported	Part of Continues Improvement program to address unsafe condition at fields and shops to maintain zero incident
		Compete Contractor Appraisal and Safety Review	Limited availability of leaders to conduct field inspection and validation for contractor safety review	Setup schedule for leadership field inspection. Get support from management
	Protect the Environment & Ensure Compliance	Maintain equipment reliability including Zero Water Discharge facility	Unavailability of critical spare-part for maintenance	Collaborate with SCM for spare-part procurement
			Repetitive equipment failures	Coordinate with Engineer to conduct RCA and Reliability Improvement
	Simplify & Collaborate	Implement Work Order Management as per SERIP	Work Order compliance	Refresh Work Order management process
			Limited usability of KPI/ Dashboard	Improve KPI/ Dashboard
		Maintain Partnership with SCM for Inventory Spare-part Management	Work Order Backlog due to Stock-out	Collaborate with SCM for spare-part procurement. Optimize local fabricator for mechanical component
			Inventory management at satellite godown	Satellite godown optimization
	Improve Cost Efficiency	Optimize Maintenance Cost	Budget preparation for Maintenance	Optimize CMMS to forecast future requirement. Anticipate the change of work program as resulted from RCM study and other initiatives
			XYZ manpower utilization	Refresh manpower planning and allocation. Implement blended resources assignment for cost optimization. Coordinate with HR for staffing strategy
			Maintenance contract optimization	Adjust contracting plan as per manpower allocation strategy

The strategy map is an architecture for integrating the strategies and operations of diverse units and activities scattered throughout organization. It also converts strategic direction statements into measures and targets that can be linked to the management system. A strategy map describes the process of value creation through a series of cause-and-effect linkages among objectives in the four Balanced Scorecard perspectives.

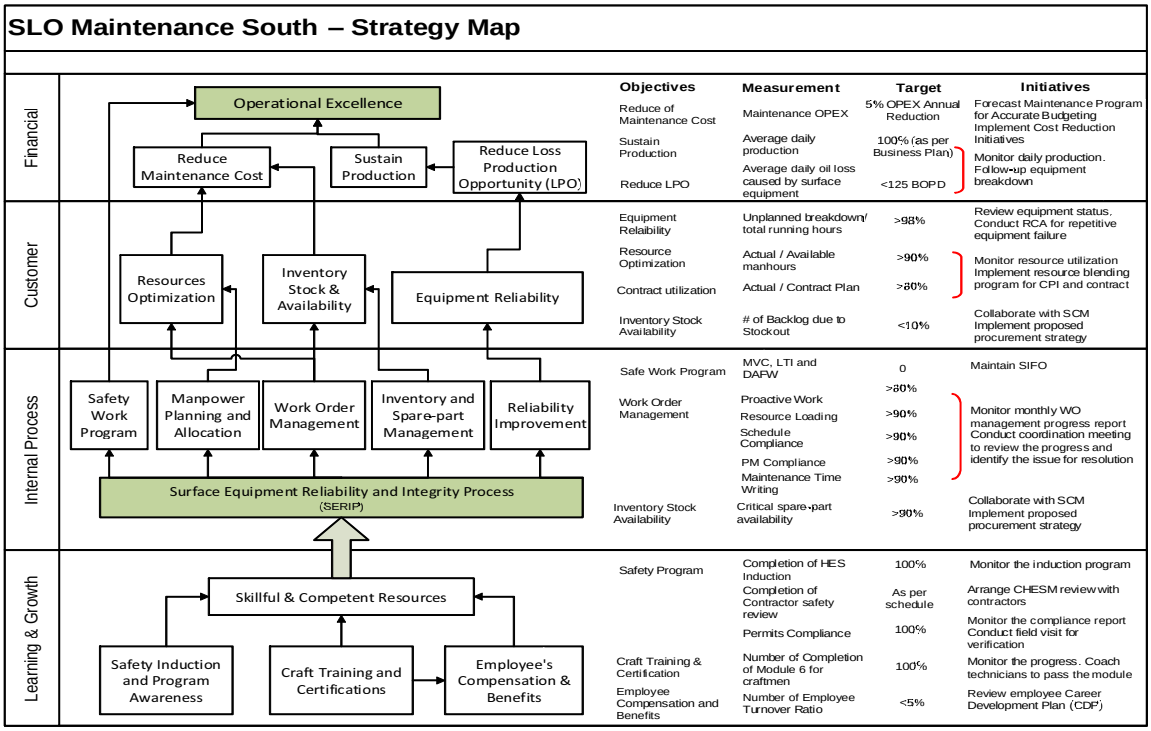

Figure III-6 Strategy Map for SLO Maintenance South

IMPLEMENTATION PLAN

Timeline and Resource Requirement

The Top Management Directed - Staged Improvement Program (Hayes, R. et all, 2005) is chosen to implement improvement program because it allows the organization to establish priorities that reflect its particular competitive strategy and position. The implementation of improvement programs is divided into 4 stages and each stage contains the list of activities placed by priority to perform. It starts with the activities that are considered as quick-win and followed by transition, optimization and lastly sustain.

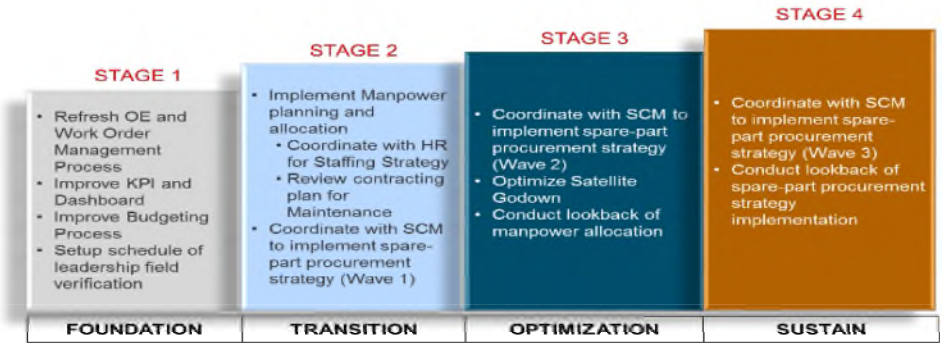

Figure IV-1 Staged Improvement Program

The implementation of improvement program for OPEX reduction requires support from personnel from the existing organization/ department. A special taskforce that consists of Subject Matter Expert (SME) from various teams in existing organization is formed to focus on each improvement program.

Cost and Benefit Analysis

The potential OPEX reduction is obtained from the number of allocated maintenance personnel. Referring to the previous resource plan, there will be a reduction of 15 personnel in Maintenance department since the XYZ manpower will only perform corrective work orders. The cost of contractor will require approx. USD$ 200M more each year to compensate 16,707 man-hours required to complete PM work orders. The reduction from new spare-part fabrication is based on 50% of saving comparing to current strategy by procuring spare-parts from OEM.

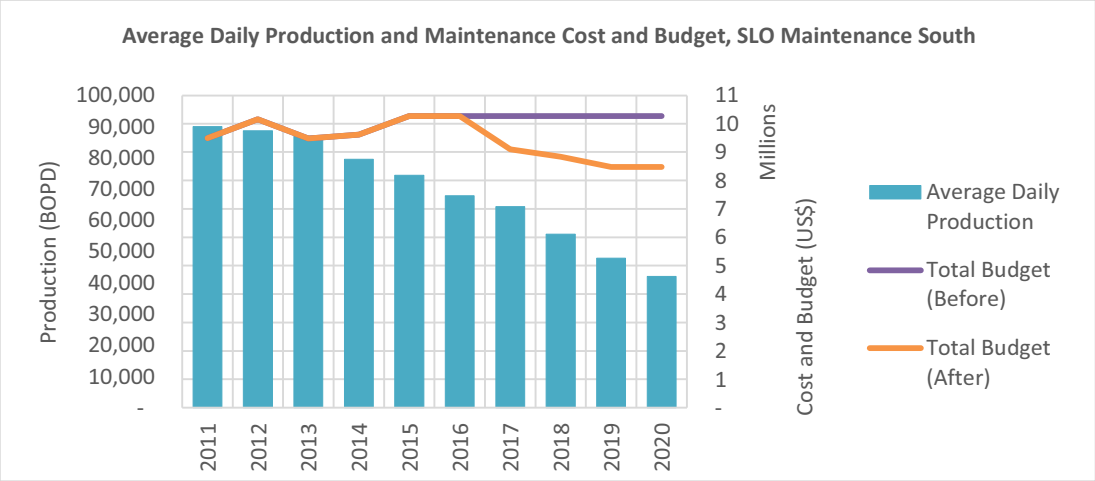

Figure IV-2 Maintenance Cost – Before and After Improvement Program Comparison

Maintenance OPEX reduction by $6,175,748 starting 2017 can be expected when all improvement initiatives are well implemented and sustained until 2020. Therefore, commitment and support from PT XYZ Management, leadership teams and key players are critical for the successful implementation.

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