[Maximum of 15 pages]

Implemental changing of GDU reliability

[Reduction of Gas Loss Opportunity when GDU One Train is stopped]

Starting Date: [01 01 2019]

Completion Date: [30 12 2020]

Number of Team Members: [16]

Category:

- [x] Production and Process
- [ ] Merger & Acquisition (M&A)
- [ ] Exploration

Team Member

No.	ID	Name-Surname	Contribution (Core Team, Major Support, Or On-call Support)	FG	Dept.	Company Name
1	20167	Hein Thiha Thwae	Core Team	PDT	PMO/M	PTTEP
2	20166	Ever Kyaw	Core Team	PDT	PMO/M	PTTEP
3	90706	Anugoon Cumson	Core Team	PDT	PMO/M	PTTEP
4	90846	Kittipong Poota	Core Team	PDT	PMO/M	PTTEP
5	54034	Wetin Thongyoo	On-call Support	PDT	PMO/M	PTTEP
6	23463	Myo Min Htet	On-call Support	PDT	PMO/P	PTTEP
7	23515	Thant Zin	On-call Support	PDT	PMO/P	PTTEP
8	55076	Tasaporn Visawameteekul	On-call Support	PDT	PMO/I	PTTEP
9	52823	Anucha Leelaratsameephanit	On-call Support	PDT	PMO/O	PTTEP
10	40657	Sawian Sri-lamai	Major Support	PDT	PMO/M	PTTEP
11	45815	Phatsawat Thanachirat	Major Support	PDT	PMO/M	PTTEP
12	40532	Jumnongwit Pengsri	Major Support	PDT	PMO/M	PTTEP
13	40479	Chaitat Promyotha	Major Support	PDT	PMO/M	PTTEP

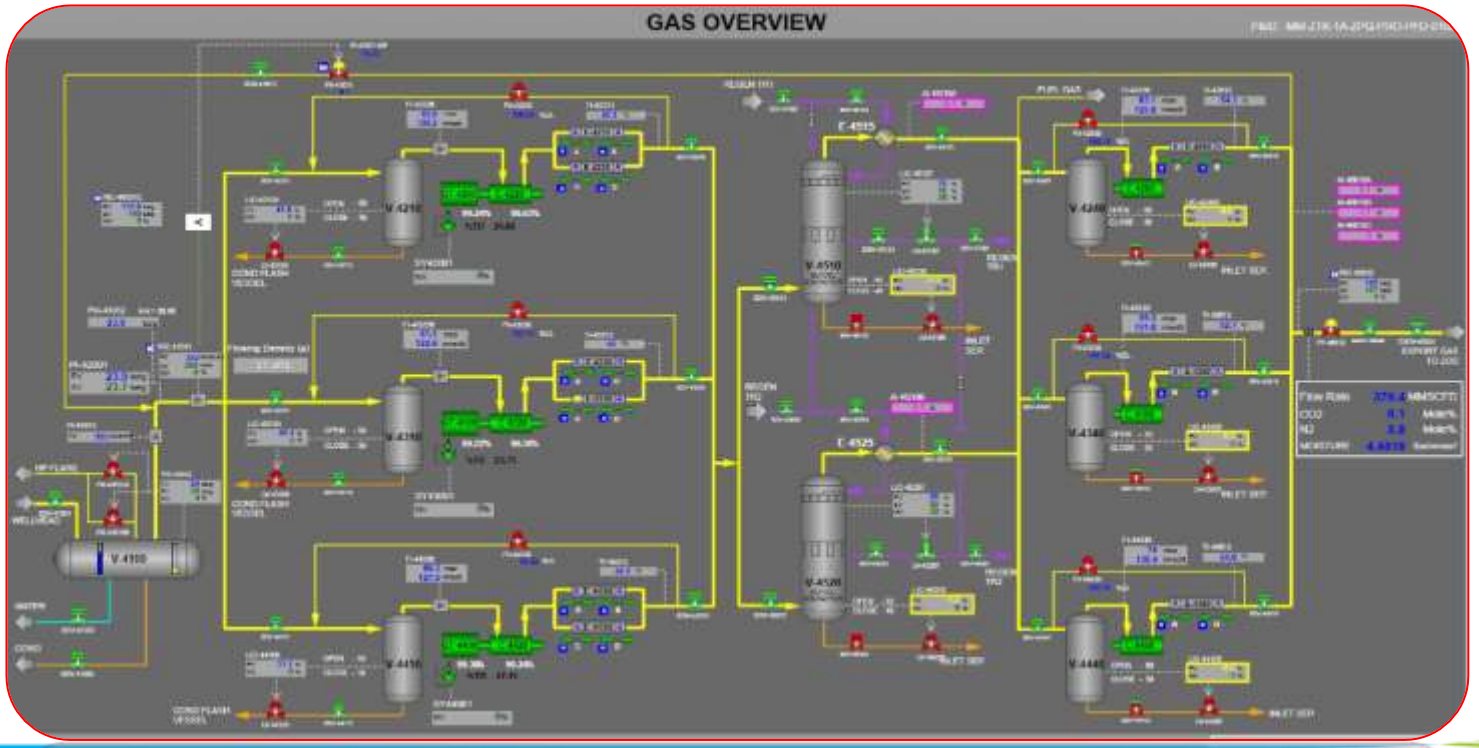
Project Leader Name __Wichan Anawachsiriwong____ext.no. _1415___Mobile phone ___814-1415_

Presenter Name _____Htet Paing Hein_____ext.no. _1415___Mobile phone ___814-1415_

Presenter Name _____Zayar Linn_____ext.no. _1415___Mobile phone ___814-1415_

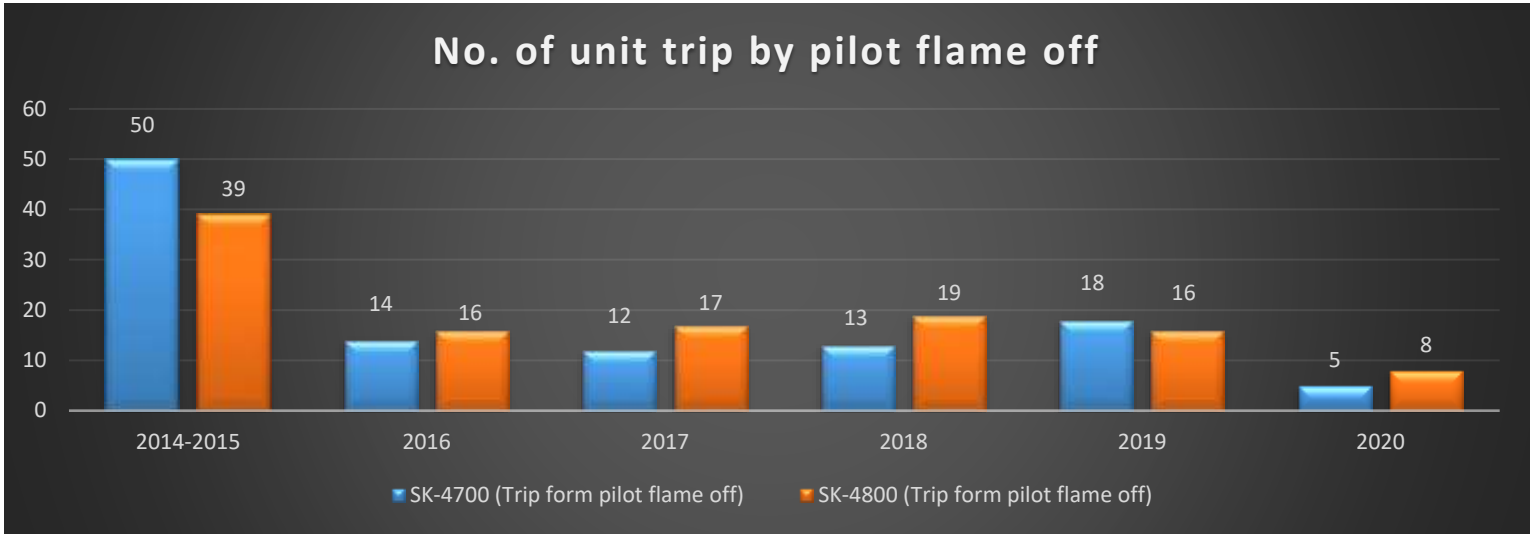
Project Objectives

Introduction : Zawtika gas compression system consists of three (3x33%) trains (GTC-4200, GTC-4300 and GTC-4400) designed to compress gas from inlet separator (V-4100) to the required pressure for exporting to the 28-inch subsea pipeline. It is equipped with two stages of compression with dehydration system (V-4510 and V-4520) in between. The system incorporates 1st and 2nd stage suction scrubbers and 1st and 2nd stages compressor discharge coolers. Gas from 1st stage compressor discharge header is routed to Gas Dehydration Unit (V-4510 and V-4520) to dry the gas to pipeline transport specifications. Dry gas exits through the contactor via a wire mesh mist eliminator to remove any entrained glycol from process gas. Gas from gas dehydration trains is combined into a common 24-inch header and then feeds to 2nd stage compressor section and supplies the required gas to fuel gas conditioning system. After 2nd stage compression, the sales gas is sent to pipeline for export.



Project Objectives (Cont')

Background : One of the vital parts of Gas Dehydration System is Glycol Regeneration which can turn rich glycol into lean glycol. Three major causes of Glycol Regeneration Skids (SK-4700 and SK4800) trips are Pilot flame off, Burner flame off and Combustion air pressure. The recorded number of unit shutdowns are around 214 times from 2014 to 2019. Therefore, GDU downtime improvement has been implemented in 2019 to reduce the number of unit trips. After implementing small alterations at SK-4700 and SK-4800, the unexpected shutdown rate is reduced to around 50% in 2020.



During the past five years from 2014 to 2019, total number of GDU tripped = 214 times.

Objective : To reduce the ionization rods deterioration rate with optimization of fuel gas pressure and to reduce man-hour by elimination of activities during performing Preventive Maintenance are the main targets of this project. Both objectives can also reduce sales gas loss opportunity when one train of GDU stops.

Project Objectives (Cont')

By utilizing Agile Method : Incremental changing step by step and developing over time by making small alterations can be seen at GDU package.

2019

- Submitted IA052 GDU Downtime Improvement during Monsoon Season.
- Submitted IA053: GDU recovery time improvement.
- ZTK-MOD-20005, changing of pressure transmitter (PT) to pressure diff. transmitter (PDT) type.

IA052: GDU Downtime Improvement

IA053: GDU recovery time improvement

Changing of pressure transmitter type from PT to PDT type.

2020

- Ignition rod orientation setup at 12 o'clock experiment + Fuel gas pressure adjustment + PM Optimization (Non-value activity Elimination by lean technique) + Ignition rod re-conditioning.
- ZTK-MOD-19015, Optimize fuel gas pilot supply pressure.

Ignition rod orientation setup

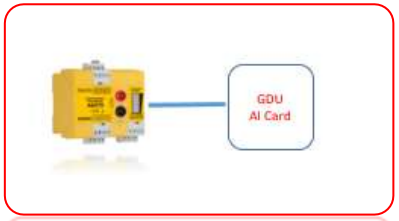
Fuel gas pressure optimization

PM optimization by lean techniques

Ignition rod re-conditioning

2021

- Deeply focus on Digital Transformation to improve ionization monitoring GDU's pilot, by adding additional AAC75 4-20 mA O/P module and can monitor via DCS screen. (WO #500312377 and WO #500314210 reserved for spare controller and cable respectively).
- Trial test new shape ignition rod installation.
- Trial test new design of pilot mixing chamber.
- ZTK-RPIN20027, Study additional UV flame monitoring model D-UV55-10 for pilot flame off.



Adding additional AAC75 module

New shapes of ignition rod

New design of pilot mixing chamber

UV flame model D-UV55-10

Project Summary

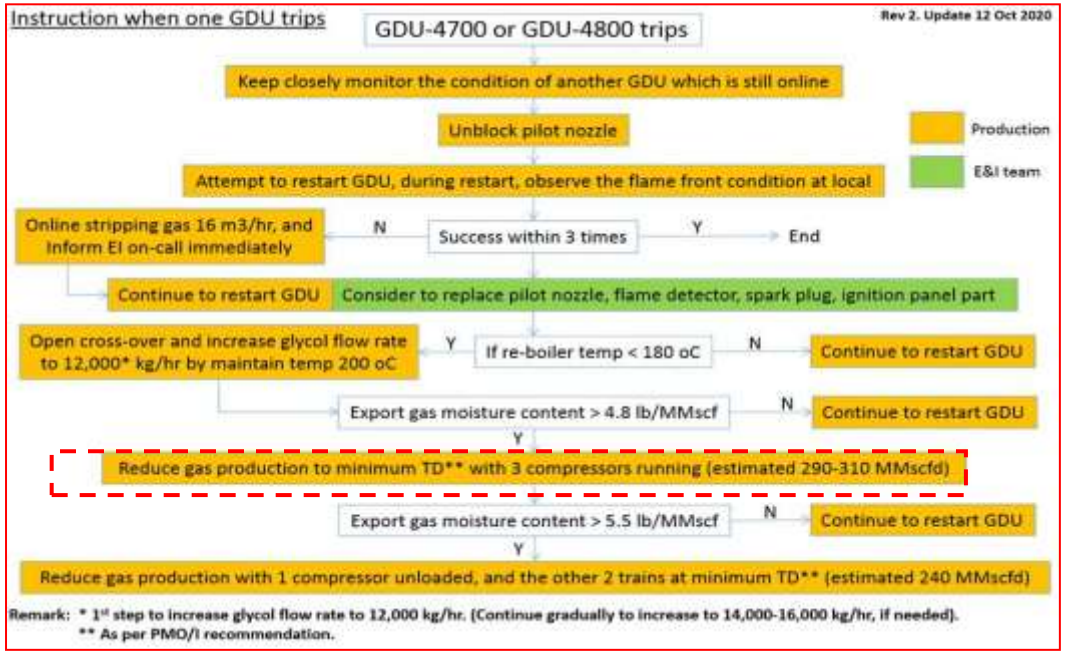
Situation : Zawtika offshore platform handles the moisture content of sale gas specification by Gas Dehydration Package (GDU-4700 and GDU-4800). GDU package shutdown leads to increasing of moisture content in export gas more than sales gas specification at ZOC (metering station). Daily contractual quantity that is committed to deliver is ≈345 MMscfd. Based on equipment design, reduction of export gas to ≈300 MMscfd is needed to be done in the event of one GDU train stopping. In regarding this scenario, when one train of GDU shutdown, gas production is reduced to ≈300 MMscfd with 3 compressors running; consequently, opportunity loss will be ≈45 MMscfd. Every year the GDU will be periodically stopped according to 4MPM fire tube heater activities.

Table 4-11 : Glycol Contractor

Item	Glycol Contractor
Tag no.	V-4510/4520 (2x60%)
Type	TEG dehydration
Design gas capacity/equipment (MMscfd)	252 (280 NOTE 2)
Operating pressure (barg)	50 - 63
Operating temperature (°C)	43 - 47
Mechanical design pressure (barg)	75 / FV
Mechanical design temperature (°C)	115 / -29
Water content in feed (lb/MMscf)	93 -106 (NOTE 1)
Dehydration specification (water/gas, lb/MMscf)	5 (7 NOTE 2)
Equipment rating	ANSI 600#
Material of construction	CS + SS316L internal cladding, SS316L for internals

NOTE: 1. Water content after free water knock out in Inlet scrubber section.
2. One compressor stopped running scenario i.e. the maximum flow of 280 MMscfd (not including internal leakage). Design for two compressors running and one glycol dehydration unit running, but specification of 7 lb/MMscf.

Glycol Contractor specification

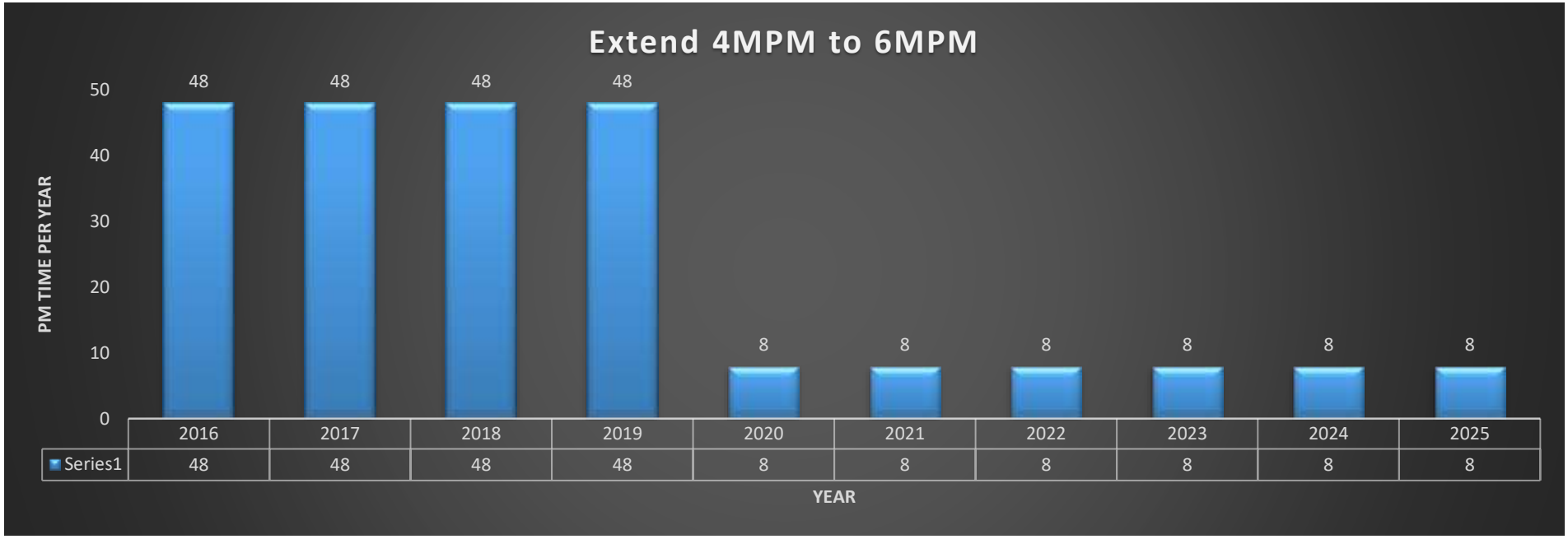


Instruction when one GDU Trip

Project Summary (Cont')

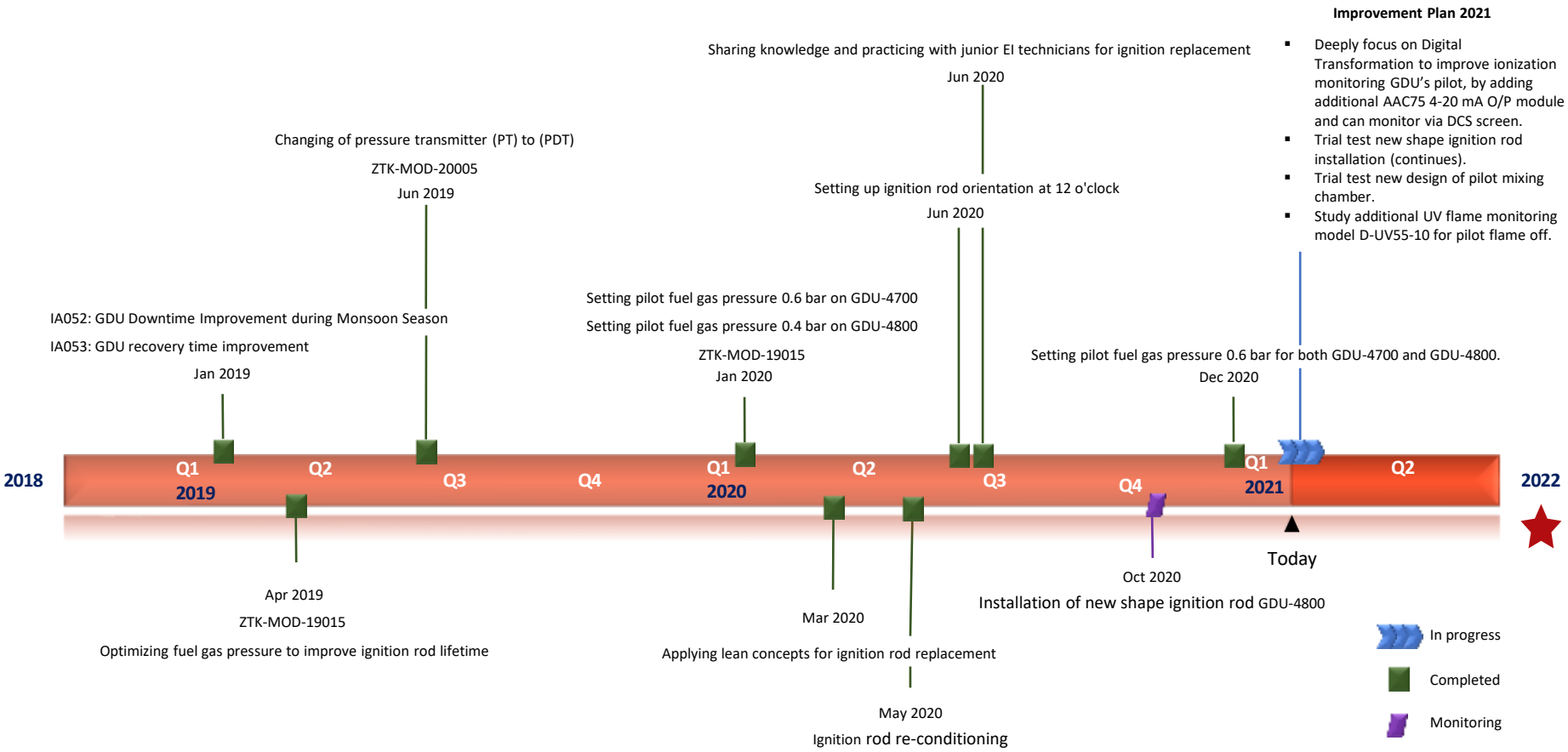
Target :

- Optimization of fuel gas pressure to reduce the deterioration rate for ionization rods including fuel gas consumption.
- Preventive maintenance optimization of GDU Fire Tube Heater by extending PM timeline from 4 months to 6 months.
- Elimination of non-value-added activities from PM Fire Tube Heater and maximizing team performance by utilizing lean techniques. (Reducing no of hours from 8 hours to 2 hours)



Project Summary (Cont')

Action Plan:



Project Summary (Cont')

Result :

- The optimal fuel gas supply pressure sets at 0.6 bar with 50% open air mixing ratio. Based on the test result, the ionization rods deterioration rate is also significantly improved and proposed to raise for PM optimization from 4MPM to 6 MPM.

Original fuel gas at 0.8 Bar after 4 months

Set fuel gas at 0.6 Bar (6 months) during Jan-Jun 20

Set fuel gas at 0.6 Bar (6 months) during Jun 20 to Jan 21

- Resulting 75% activity elimination from base line, the major elimination of activity is setting up ionization rods, installation in pilot fire tube and testing.

Pilot ignition tube complete set (ready to use)

Ignition test at workshop (by using ignition tester)

Set up and installation of ignition rod

1) Benefits to PTTEP

- Estimated Benefits Value Calculation : Zawtika daily contractual production capacity is 345 MMscfd. In case GDU stops 1 train for PM activity that can lead to reduction of production rate to (≈ 300 MMscfd) with 3 compressors running, then production opportunity loss will be (≈45 MMscfd). Extending PM intervals can save 0.41 million USD per year and details can be seen in the following tables.

Cost comparison between 4MPM and 6MPM

4MPM + GDU stop 8hr

Estimate total cost 4M PM , 4E&I+2Operator with 8 Hr.					
		Month 0-4	Month 4-8	Month 9-12	Total Cost (USD)
GDU-4700	Spare part cost	460	460	460	1,380
	Man Hour cost	600	600	600	1,800
	Opportunity loss 8Hr.	100,800	100,800	100,800	302,400
GDU-4800	Spare part cost	460	460	460	1,380
	Man Hour cost	600	600	600	1,800
	Opportunity loss 8Hr.	100,800	100,800	100,800	302,400
Total cost per year					611,160

Vs

6MPM + GDU stop 2hr

Estimate total cost 6M PM and Reduce PM time, 4E&I+2Operator with 2 Hr.				
		Month 0-6	Month 6-12	Total Cost (USD)
GDU-4700	Spare part cost	460	460	920
	Man Hour cost	150	150	300
	Opportunity loss 2Hr.	25,200	25,200	50,400
GDU-4800	Spare part cost	460	460	920
	Man Hour cost	150	150	300
	Opportunity loss 2Hr.	25,200	25,200	50,400
Total cost per year				103,240

Estimate Benefits Value Calculation Reference:

Average gas price at 7 USD/ 1 MMscf, Man hour cost 12.5 USD/hr

Opportunity loss: 45 MMscfd x 960 MMBTU/MMscf x 7 USD/MMBTU x 8 hours/year x 1/24 hours

Man hour cost : 6 Man x 12.5 USD/hr x Working hr

PTTEP Net Benefits : Total benefits x 0.8

PTTEP Net Benefits: 0.41 M.USD/Year

2) Benefit / Cost Ratio

- Total of 12,240 USD (12,000 USD as CAPEX and 240 USD as OPEX, is invested in this project of GDU reliability improvement. The calculated Benefit-Cost Ratio (BCR) is 33.20. The project is expected to generate incremental value.

Description	Qty	Unit	Unit Cost (USD)	Total (USD)
Complete pilot ignition tube with ignition rod Model: TBP-XK-100-S-EI	4	Set	3000	12,000
Ignition tester+ man-hour	1	Set	240	240
Total Cost				12,240
PTTEP Net Benefits (80%)				406,336
Benefit/Cost Ratio				33.20

Benefit / Cost Ratio: 33.20

3) Activity Elimination for PM Optimization

- Activities elimination by using Lean techniques.

Activity	Time (minutes)	Time (minutes)
PTW preparation	10	10
PTW opening	10	10
Pilot tube removal	30	30
Pilot tube cleaning	60	Replace pilot fire tube (complete set).
Pilot MIXER cleaning and inspection	15	
Ignition rod removal	15	
Ignition rod inspection	20	
Ignition rod replacement	180	
Ignition rod insulation test	40	
Ignition rod function test	30	
Pilot tube re-installation	30	30
UV flame monitoring inspection	15	15
Pilot flame monitor signal measurement	15	15
House keeping	10	10
Total time (minute)	480	120

Non-Value Activity Elimination : 75%

4) Knowledge Management

- Conducted Internal knowledge sharing session for GDU ignition rod replacement technique.
- Educating PMO/P on how to unblock pilot fuel nozzles in the case of pilot flame failure during unit start-up.

Maintenance Report

Zawtika offshore production platform

Demonstrate and sharing to production team.

Tag	ZTK-E-4850,ZTK-E-4852		
Equipment	Firetube Fire Heater No.1,Firetube Fire Heater No.2		
Activity Type	Other	Work status	Completed
Date	29 Dec 2019	Task owner	P Way,P Joe,Kong,Jame,Thomas,Zargi
Descipline	Electrical & Instrument		

Detail

-Demonstrated and practiced production team to unblock pilot fuel nozzle.
-Sharing GDU pilot starting sequence.
-Sharing how ignition and ionization rod work.
-Sharing how pilot flame detector work.

Maintenance Report

Zawtika offshore production platform

Tips & Tricks for ZPQ integrity & reliability

Tag	OTHER		
Equipment	OTHER		
Activity Type	Other	Work status	Completed
Date	23 Jun 2020	Task owner	Bo, Group4
Descipline	Electrical & Instrument		

Detail

Topic : Tips & Tricks GDU pilot ignition rod replacement technique

Objective :

-To reduce the down time of GDU

Tips & Tricks short points :

- Bending point and measure point (2.3 cm from the open end of nozzle and plus 0.5 cm for bending point)
- Install ignition rod to upside position.
- the gap between ignition rod tip and surface of the nozzle is 2 mm.
- the ignition rod must be center in the nozzle.

Lessons & Learnt and knowledge sharing with E&I Team and Production Team.

5) Team Collaboration Effort

- Major support form PMO/I & PMO/M, ZTK-MOD-20005 for changing PT-47552 & PT-48552 pressure transmitters from in-line transmitter type to differential pressure transmitter type.
- On-call support PMO/P, ZTK-MOD-19015 for reducing GDU-4700 and GDU-4800 pilot fuel gas supply pressure to prolong pilot ionization rod's service life.
- On-call support PMO/O, ZTK-MOD-20013 for improving GDU pilot flame detector by using UV-type flame detector.

Team Collaboration Effort : Across Dept

End of Presentation

Appendix