PROFESSIONAL TECHNICAL PAPER
ONLINE PRESENTATION
24 - 25 OCTOBER 2020

Industry 4.0 Application in Artificial Lift Optimization: A Case Study in Medco E&P, South Sumatra Mature Field

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Abstract. At the beginning of well monitoring and surveillance still depending on manpower. Along with technological advancements and data requirements, Medco E&P proposed to improve quality surveillance method and artificial lift wells optimization using SCADA monitoring. Some of ESP wells were installed with GSM modems to transmit data from wells to SCADA server. In addition, some of SRP wells were installed Rod Pump Controller and GSM modems to transmit data from wells to SCADA server. Both of artificial lift data send to user platform. Real time monitoring method on 15 pilot artificial lift wells giving positive effects on production. Field engineers got the notifications from their email and dashboard if there were problems at wells. They directly focused on problematic wells and solved it. Before using real time monitoring, monthly cumulative loss potential oil of Electrical Submersible Pump wells could get more than 300 BO, but after using real time monitoring monthly cumulative loss potential oil of 10 Electrical Submersible Pump wells under 150 BO. As well as the Sucker Rod Pump wells, the well optimization completed with cumulative oil more than 13,000 BO. This paper presents additive information that provided improvement in reduce operator response times and optimization well effectively and inspire operation initiatives in oil and gas industry.

Keyword: SCADA, Industry 4.0, Well Surveillance

1 Introduction

RMU Block is one of the biggest Medco E&P Block that started producing oil in 1997. There are two major mature fields on RMU Block, KS field and OR field that located in South Sumatra. Major artificial lift in KS field is Electrical Submersible Pump (ESP) and major artificial lift in OR field is Sucker Rod Pump (SRP). Currently 150 active ESP in KS field and 30 active SRP in OR field. The problems in KS and OR fields are the ESP and SRP wells location are wide-spread and some access roads are difficult to pass.

Well monitoring and surveillance in KS and OR field still depending on manpower. Field engineer and operator had to check one by one wells which took a very long time because the location is quite far. At this case, it is necessary to improve well monitoring and surveillance response times by minimalize visit every single well, only focus to problematic well.

There are no Supervisory Control and Acquisition (SCADA) system available in KS and OR field. The advantage of SCADA monitoring has given access to monitoring real-time data from wells to user devices and be able to spend more time analyzing well behaviors and monitoring trends effectively.

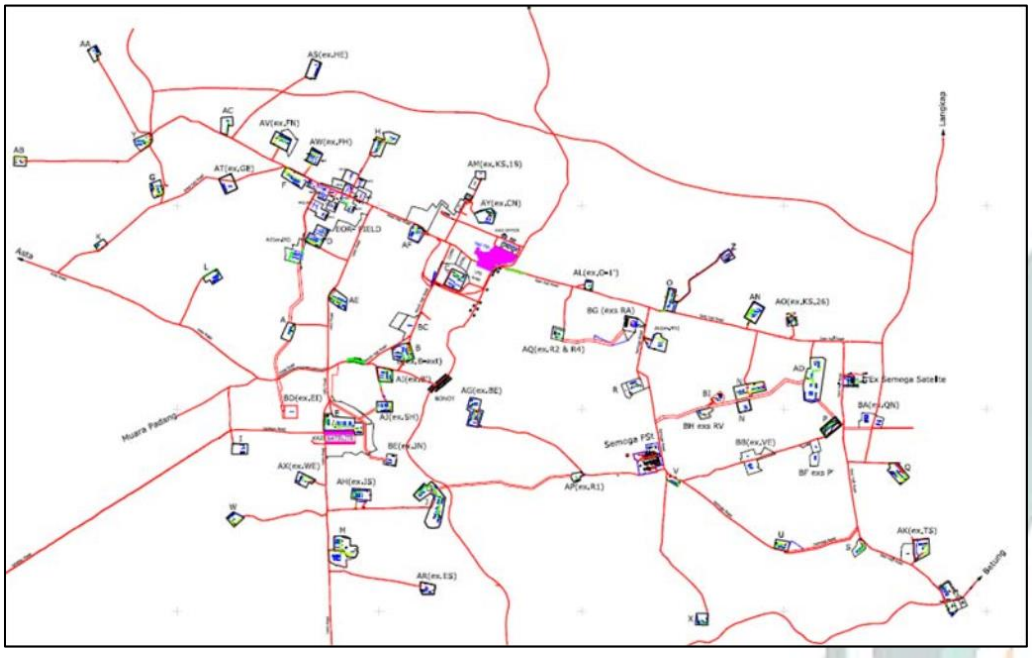

Figure 1. KS Field Map Location

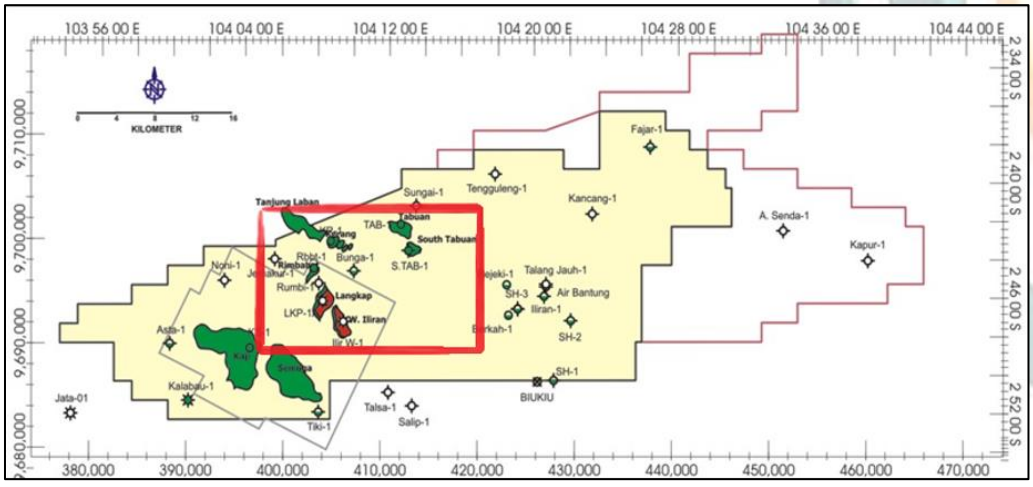

Figure 2. OR Field Map Location

This paper tells the case of how SCADA monitoring evolve well surveillance operations by reduce well downtime, reduce loss potential oil and maximize wells optimization.

2 Methodology

2.1 Industry 4.0

Industry 4.0 represents a new step in the industrial revolution. Via Internet of Things, access to real-time data and growing trend towards automation that can analyze problems effectively. Industry 4.0 improve business owners control and understand every aspect of operation. The technologies allows them to gain efficiencies on multiple levels, create end-to-end information across the value chain, improve processes and control instant data to boost production.

2.2 Application in Mature Field

Along with technological advancements and data requirements in oil and gas industry, Medco E&P proposed to improve quality surveillance method and artificial lift wells optimization by utilizing SCADA monitoring. SCADA monitoring in KS and OR field using GSM signal to transfer data from well to user devices. The GSM signal cover most of well location.
ESP with installed modem transmit raw data from well to GSM Communication, GSM Communication transmit data to SCADA server to processes the big data and then to user devices with unique interfaces. As well as the SRP well, SRP with installed Rod Pump Controller (RPC) transmit raw data from well to GSM Communication, GSM Communication transmit data to SCADA server to processes the big data and then to user devices with unique and understandable interfaces.

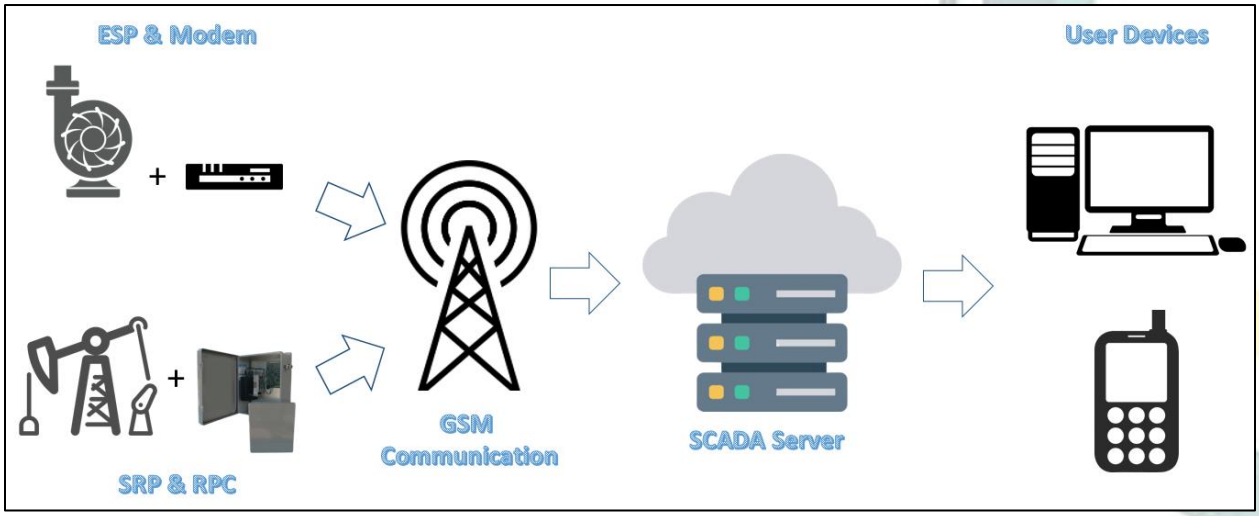

Figure 3. SCADA Monitoring Flow Path

For ESP, the transmitted data includes these following parameters:

1. Motor current
2. Voltage
3. Pump intake pressure
4. Frequency
5. Motor status

For SRP, the transmitted data includes these following parameters:

1. Dynacards
2. Stroke per minute
3. Stroke length
4. Gearbox load
5. Sucker rod load
6. Balance/Unbalance condition
7. Pump fillage

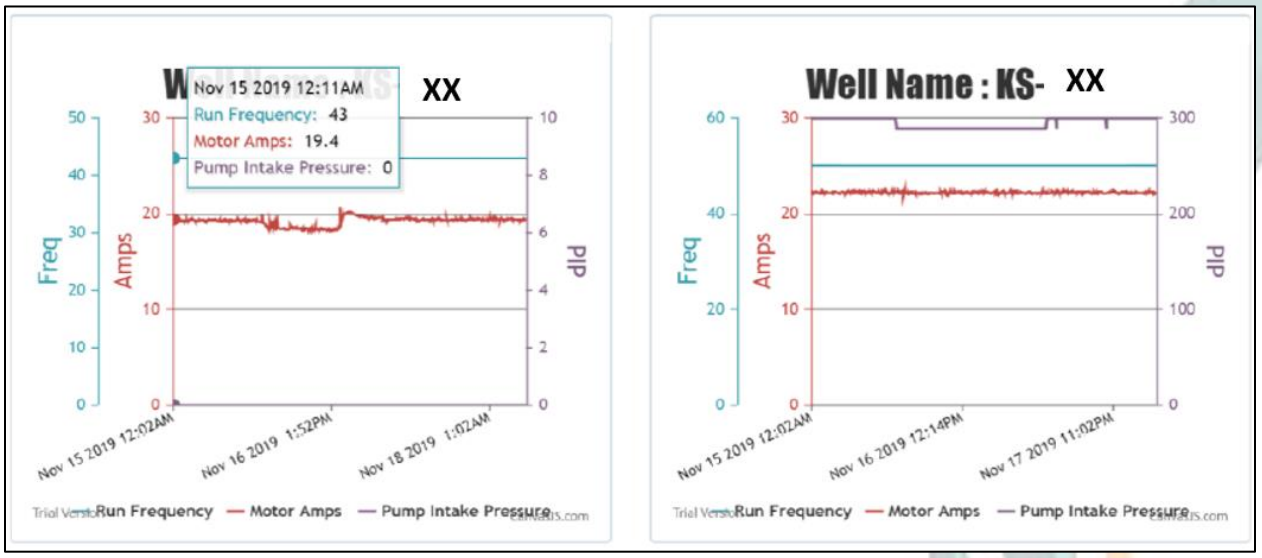

Figure 4. ESP SCADA Graphical Trending

Figure 5. SRP SCADA Dynacard

2.3 Management by Exception

Management by exception is tool to monitor any abnormal condition well behavior when analyzing and diagnosing big data. The system provides well alarms and shutdown notification to field crew when vital parameters down. Field crew can take immediate action to solve the problem that effect to decreasing loss potential oil.

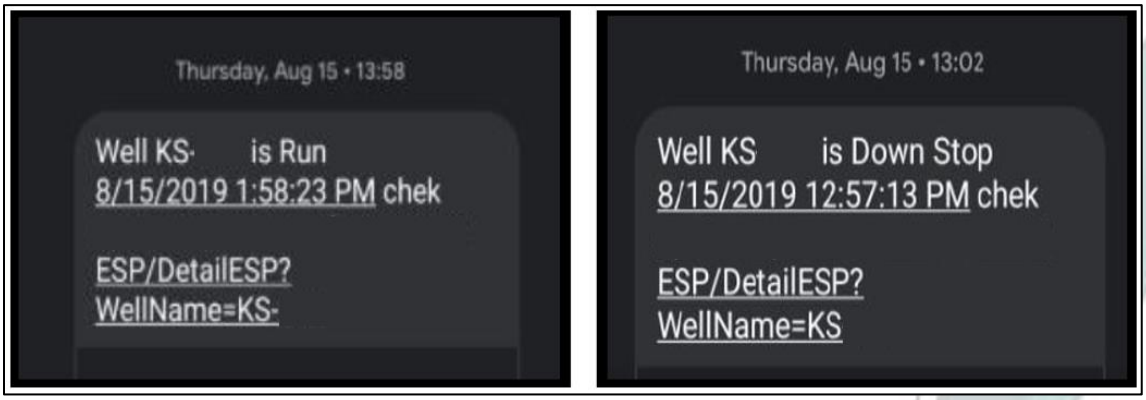

Figure 6. SMS Notification

Figure 7. Email Notification

3 Result

3.1 ESP Real-time Monitoring

By installing modem to 10 pilot ESP wells, field crew can monitoring real-time ESP parameter trends from user devices and diagnose the problems. The result to ESP wells were reduced average loss potential oil from 400 BO per month to under 150 BO per month. Real-time monitoring also reduced average cumulative down duration by 50% per month.

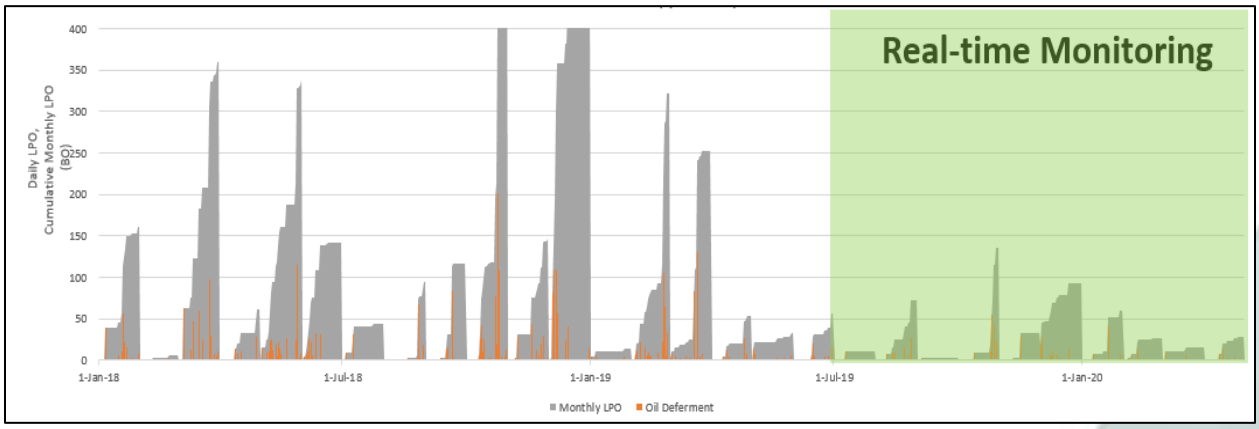

Figure 8. Loss Potential Oil ESP Wells

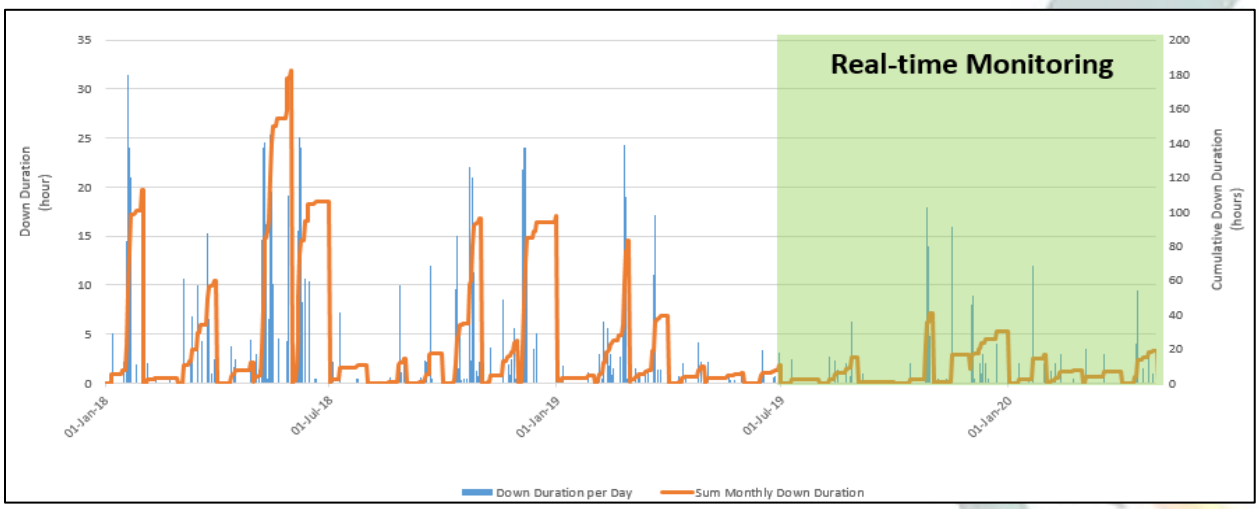

Figure 9. Down Duration ESP Wells

3.2 SRP Real-time Monitoring

By installing RPC to five pilot SRP wells, field crew can monitoring real-time SRP parameter from user devices and identify the optimum settings to achieve best operating pump by optimizing stroke length and stroke per minute three out of five pilots SRP wells. The result to SRP wells optimization completed with cumulative oil more than 13,000 BO.

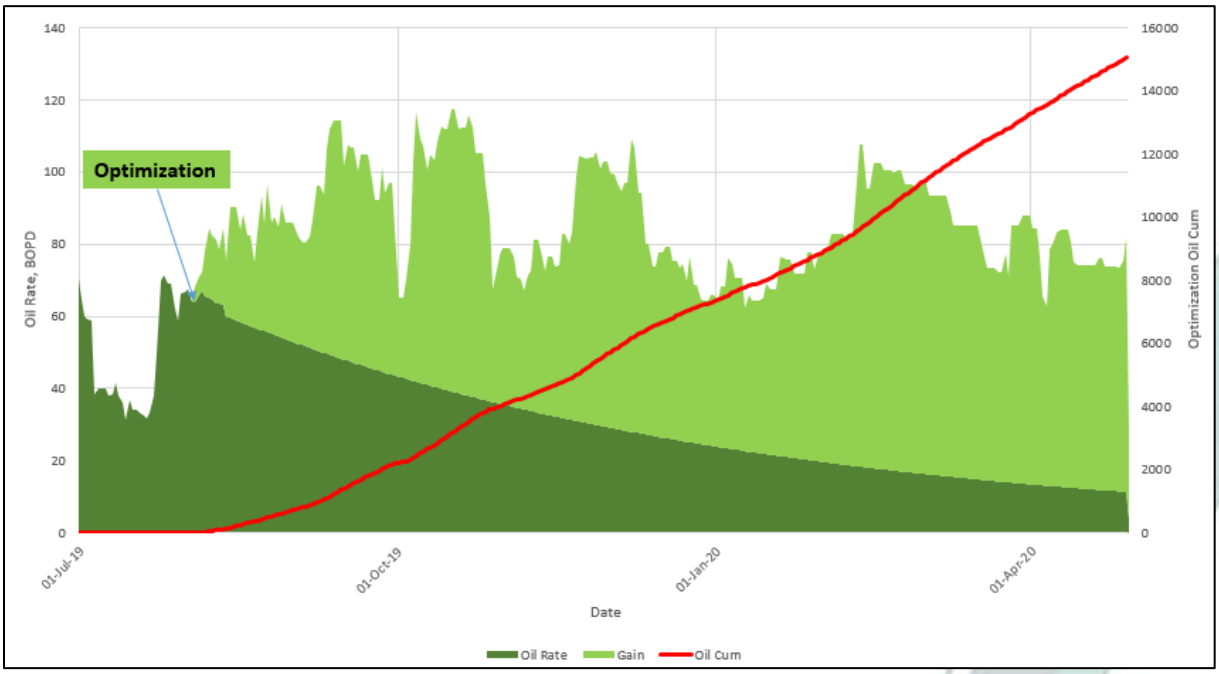

Figure 10. Cumulative Oil SRP Wells

4 Conclusion

SCADA monitoring giving positive effects on production especially for mature field. This advanced technology monitoring showed significant improvement in ESP well surveillance by giving notification of problem wells and field crew can solve the well problems effectively. As well as SRP wells, field crew easily identifying underperforming wells and can optimize to best operating pump setting. In the future, the well data will be a base for big data, machine learning and prediction analysis.

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