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Optimization of the drilling campaign in reducing drilling cost in Block A Asset

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Abstract

Drilling requires large costs with a very high risk of work, therefore good and careful planning is needed before it is carried out to obtain effective and efficient results by considering two aspects i.e. engineering and economics. Unstable conditions at the drilling site pose a high risk from the investor's point of view in terms of the total drilling costs that will be incurred in the area. The Platform drilling campaign implemented in Alur Siwah Phase 1 project is part of a project to increase gas recovery so that meets the gas raw materials demand in Aceh and the campaign is conducted using directional drilling technique. A descriptive method was used in the study and the data was gathered from the drilling activity reports during planning to post-drilling. Optimization using a drilling campaign during the drilling for the three wells in Alur Siwah Fase 1 resulted in a drilling cost savings of 26% and also saved execution time about 37 days from planning time.

Keywords: technical aspect, cost aspect, drilling campaign, optimization.

1. Introduction

Drilling operational activities are the most dangerous activities and have a high risk in the processes of oil and gas exploration and exploitation [1]. Drilling activities require large costs with a very high risk of work, for that good and careful planning is needed before this activity is carried out so that effective and efficient results are obtained by considering two aspects, namely engineering aspects and cost aspects. These two aspects must support each other to be implemented during the drilling operation. If a drilling plan is technically supportive, but the cost aspect is not adequate, it will cause the drilling process to not continue until the target has been set. The success of the drilling campaign was discussed in the paper [2] where the optimization of planning and improvisation has had a positive effect on the economy of the Repsol Sinopec Brasil drilling project in the Santos Basin, Brazil over 2 years (2008-2010).

The drilling activity of the Alur Siwah Fase 1 is a Medco Block-A Project in East Aceh Regency located in the middle of the former GAM base area in Aceh Province. This district is socio-politically characterized by post-conflict dynamics that are deeply embedded in psychology, social structure and relations in society. The post-conflict atmosphere and the length of time the community has been in conflict and violent situations have in many ways influenced the pattern of supervision in project management [3].

This unstable condition usually poses a high risk from an investor's point of view in terms of the total drilling costs that will be incurred in the area. Therefore, the main objective of this paper is to provide an overview of the success of cluster drilling activities with the concept of a drilling campaign to ensure the sustainability of future investments, especially in the Blok A Asset area.

The drilling campaign concept is a centralized drilling concept with several drilling wells in one cluster which is usually applied for offshore drilling.

The purpose of this research will be to examine the effectiveness of the actual drilling time and costs compared to the cost and time analysis before the drilling is carried out referring to the predetermined planning. The study of the research focuses on the identification process of drilling activities through the Drilling Campaign, where the process of identifying obstacles and problems during the drilling process from both technical and economic aspects influences the amount of time and cost that can be saved from identification activities.

2. Research Methods

The writing method used is a descriptive method, where for the fulfillment of the data this writing refers to the results of the drilling activity report, both during planning to post-drilling. in the reference [4] explained that the descriptive method is a method that functions to describe or provide an overview of the object under study through data or samples that have been collected as they are.

2.1. Drilling Concept

Drilling is the first and foremost step in the exploration and exploitation of the oil and gas industry. Drilling is one of the oldest technologies on earth and today's technology in this sphere is the introduction of wells by scientists, technicians, and the petroleum industry [5]. Along with technological developments, drilling techniques have developed quite rapidly when compared to the drilling techniques that were first performed. The drilling itself is carried out to make a channel between the

reservoir and the earth's surface so that oil or natural gas can flow due to the difference in pressure on the surface.

The platform drilling campaign carried out in the Alur Siwah Fase 1 project is part of a project to increase a gas recovery to meet the demand for gas raw materials in Aceh under gas sale agreement (PJBG) between PT. Medco E&P Malaka with PT. Pertamina through the pipe Perta Arun Gas (Pertagas). One of the drilling implementation mechanisms that is being implemented is using a directional drilling technique.

2.2 Directional Drilling

Directional drilling is a drilling technique in which the drilling trajectory is deflected following the planned trajectory to reach the predetermined target. The shape of the resulting trajectory is not a vertical trajectory [6]. Directional drilling was chosen for certain reasons, where a condition was found in which not all effective drilling was carried out vertically.

The new technology used, as was done in the concept of drilling in La Ceiba field, Venezuela in 2010 initiated by Schlumberger, has provided a solution to drilling problems, especially in the well depth, temperature and design constraints of previous wells (offset wells). Improvisation is carried out based on various challenges and applications through coordination between the drilling engineering department and various parties involved in this activity to take advantage of the availability of data contained in the drill bit selection database, including logging data and other equipment data in the previous drilling phase. [7].

When it comes to the future of the oil and gas industry, smart drilling will be a new concept that changes the drilling paradigm over the years. This requires a combination of technology and thinking to re-imagine how an oil and gas company can manage and implement a more appropriate approach for the continuity of good well production. The implementation of smart drilling is the latest technology that will provide all important data in real-time without downtime (NPT).[8].

Many factors cause directional or horizontal drilling to be carried out, such as geographic, geological and economic considerations. In the module that discusses the Fundamentals of Drilling Techniques, [9], there is one concept that is the reason for conducting directional or horizontal drilling in the Alur Siwah Fase 1 field, namely Multiple Well Drilling.

2.2.1 Multiple Well Drilling

If a drilling location has a limited area on the surface it is not possible to drill with many wells and different locations. This can be overcome by drilling multiple wells which is a design for drilling at the same site or the same platform for several wells which will be beneficial for cost savings and also maximize the area of the drilling location, usually multiple well drilling is done for offshore drilling.

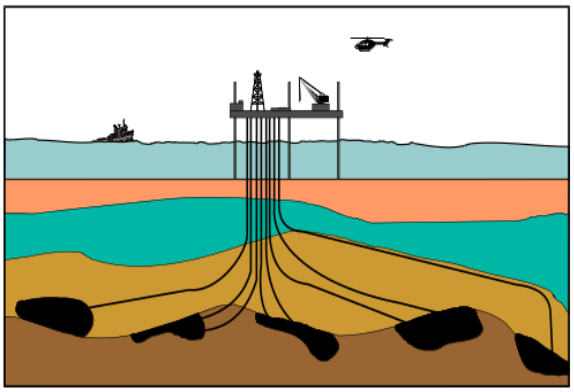


Figure 1. Multiple Well Drilling[9]

3. Results and Discussion

All components of the implementation of drilling operations, both technical and cost (tangible and intangible) are the reference in making decisions on each option, including the selection of drilling with the Drilling Campaign concept, referring to offset wells and costs that have been approved by the Government through Authorization For Expenditures (AFE).

The AS-1A well is the first well to be drilled in the development program in the Alur Siwah field. This well is a replacement for the AS-1 well which was drilled and completed in 1997. The AS-1A well location is still in the same cluster as the AS-2 and AS-3. The AS-1A well was drilled on 12 November 2017 using the Antareja-9 rig with a capacity of 2000 HP. Drilling of 36-inch holes and installation of 30-inch casings was carried out in batch drilling with AS-2 and AS-3 wells using an Auger Rig. AS-1A is a vertical well with a maximum inclination of 1.53° and 1.63°/100ft DLS.

Table 1. AS-1 Well Configuration

No	Casing Pipe Diameter (Inchi)	Type	Depth
1	30	pilling conductor	188 ftMD/TVD
2	20	surface casing	2,215 ftMD/TVD
3	13-3/8	intermediate casing	7,150 ftMD/TVD
4	9-5/8	production casing	9,060 ftMD/TVD
5	7	production liner	9,145 ftMD/TVD
6	6	production liner	9,637 ftMD/TVD
7	4-1/2	super duplex (25Cr80) tubing	Open Hole

Several operational problems occurred during the drilling operation, including the problem with Elmagco (drawworks system) which occurred after the process of installing and cementing the 20-inch casing pipe, causing the rig to standby for 25 days to wait for replacement spare parts to arrive at the site. Other problems faced were gas influx and partial

losses when drilling the 17-1/2-inch hole and problems with the accumulator rig which caused drilling operations to be temporarily suspended and continued with the shift of the rig using the skidding method to the AS-2 well on January 9, 2018, and return to AS-1A on February 4th, 2018. The problem continued when testing the 13-3/8-inch casing pipe which caused the split lock to detach from the 20-3/4-inch Unihead so the operation had to wait for spare parts from the clamp and lock ring to be re-installed.

The AS-1A well completion activity began on March 22, 2018. The well-test activity (testing wells) was carried out using a rig on April 2, 2018, with the production of 22 MMSCFD of gas from the initial target of 20 MMSCFD of gas. The rig was released from well AS-1A on 10 April 2018 and then skidding to continue drilling activities for well AS-2. The AS-1A well's total time was 133 days including drilling, completion and well testing. The actual time used was 31 days longer than the planned one, which was 102 days.

The AS-2 well is the second well drilled in the development well drilling program in the Alur Siwah field. The AS-2 location is still in the same cluster as wells AS-1A and AS-3. The AS-2 well was drilled on 3 November 2017 using the same rig as the AS-1A. The AS-2 well is a directed well with a maximum inclination of 23.56° and 3.23°/100ft DLS.

Table 2. AS-2 Well Configuration

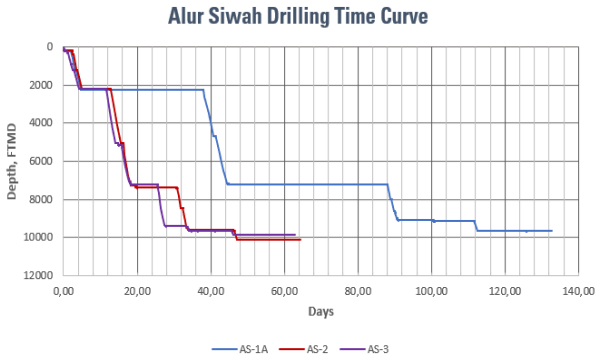
No	Casing Pipe Diameter (Inchi)	Type	Depth
1	30	pilling conductor	188 ftMD/TVD
2	20	surface casing	2,203 ftMD/2,187 ftTVD
3	13-3/8	intermediate casing	7,385 ftMD/7,088 ftTVD
4	9-5/8	production casing	9,536 ftMD/9,123 ftTVD
5	7	production liner	9,622 ftMD/9,204 ftTVD
6	6	production liner	10,140 ftMD/9,637 ftTVD
7	4-1/2	super duplex (25Cr80) tubing	Open Hole

AS-2 well completion activities start on May 5, 2018. The well-test activity (testing wells) was carried out using a rig on May 11, 2018, with a production result of 21.8 MMSCFD of gas from the target of 21.5 MMSCFD of gas. The rig was released from well AS-2 on May 18, 2018, and then moved for drilling activities for well AS-3. The total time used for drilling the AS-2 well only requires 64 days including drilling activities, completion of drilling and well testing, where there is a difference of 32 days faster than the planned time of 96 days. The AS-3 well is the third well drilled in the development well drilling program at Alur Siwah field. The AS-3 site is still within the same cluster as the AS-1A and AS-2 wells. Well AS-3 was drilled with the same rig on October 25, 2017. Well AS-3 is a directional well with a maximum inclination of 10.47° and 3.07°/100ft DLS.

Table 3. AS-3 Well Configuration

No	Casing Pipe Diameter (Inchi)	Tipe	Depth
1	30	pilling conductor	188 ftMD/TVD
2	20	surface casing	2,203 ftMD/2,196 ftTVD
3	13-3/8	intermediate casing	7,220 ftMD/7,080 ftTVD
4	9-5/8	production casing	9,405 ftMD/9,207 ftTVD
5	7	production liner	9,405 ftMD/9,207 ftTVD
6	6	production liner	9,865 ftMD/9,641 ftTVD
7	4-1/2	super duplex (25Cr80) tubing	Open Hole

The AS-3 well completion activity started on 27 June 2018. The well-test activity (well testing) was carried out when there was a rig on 4 July 2018 with gas production of 9 MMSCFD from the target of 21 MMSCFD of gas. The rig was released from well AS-3 on July 13, 2018, and then moved for the next well drilling activity. The time needed to drill the AS-3 well is only 63 days including drilling activities, completion of drilling and well testing. The completion of the drilling of the well was 37 days faster than the technical time planned, which was 100 days.



Gambar 2. Figure 3. Comparison of drilling time AS-1A, AS-2 and AS-3[10]

Many positive things were experienced during the drilling of the three wells, especially those related to the time and cost of drilling. The concept of a drilling campaign technically makes the drilling operation continue to be carried out without having to stop drilling activities if there is a problem with one of the wells in the cluster. This can reduce the risk of loss suffered by investors if the investment fails.

From an economic point of view, the capabilities that have been optimized in the drilling campaign platform have provided cost savings due to using a single cluster, where a significant contribution to cost savings is obtained in the land acquisition process, procurement of goods and services, logistics strategy as well as reducing the mobility of the workers who carry out the activities.

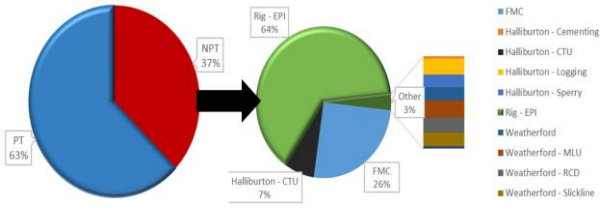


Figure 3. Comparison of PT and NPT well AS-1A [10]

The NPT time has an effect on the completion time of drilling, where each KKKS only tolerates an NPT time of 10-15% [11], while the percentage of NPT time in well AS-1A is based on figure 4. is 37%. The drilling campaign platform has an important impact on anticipating or minimizing NPT so that drilling operations can still be carried out. The decision taken by the investor was to shift the Antareja-9 rig by skidding method to the AS-2 well which is still located in one platform or cluster to ensure the rig remains operational.

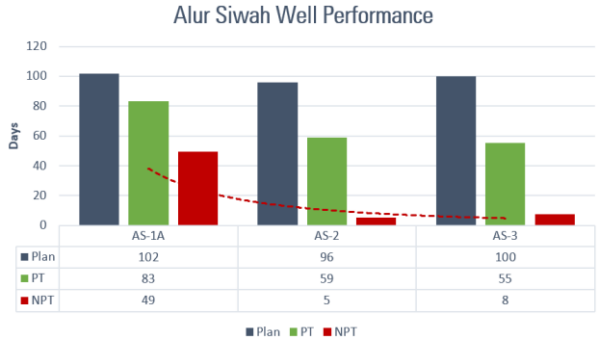


Figure 4. Performance comparison AS-1A, AS-2 and AS-3[10]

The drilling constraints in the AS-1A well that occurred due to Elmagco damage in the drawworks system and several other technical obstacles did not interfere with the drilling performance as shown in Figure 5. This allowed the rig to continue operating so that Non-Productive Time (NPT) could be eliminated.

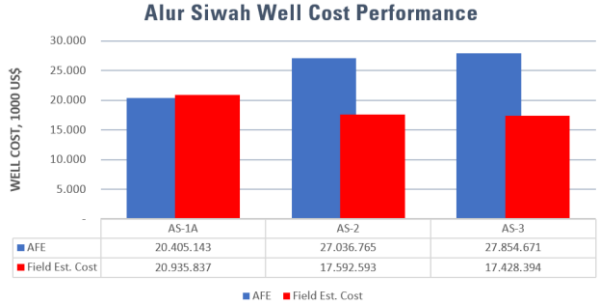


Figure 5. Comparison of costs AS-1A, AS-2 and AS-3[10]

The comparison of the drilling costs in Figure 6. shows that the cost required when drilling the AS-1A well is U$D 20,935,837 where the cost is higher than the initial planned cost of U$D 20,405,143, this is due to problems. technical assistance during drilling and additional costing from intervention activities in the existing AS-1 well (initial well). Improvisation and optimization began to occur at the time of drilling the AS-2 well, where the required cost was only U$D 17,592,593 from the initial planning cost of U$D 27,036,765, this had an impact on savings of US$ D 9,444,172 or 35 %. These savings continued during the drilling of well AS-3, where the cost spent during drilling operations was only US$D 17,428,394 compared to an agreed cost of US$D 27,854,671. Cost optimization was achieved when drilling the AS-3 well as US$ 10,426,277 or a saving of 37% occurred.

4. Conclusions

Drilling operation activities require high costs with a very high risk of work. Therefore, it is necessary to have good and careful planning before drilling activities are carried out so that the results obtained are more efficient and effective. Drilling operations must be carried out properly and correctly so that this activity can be completed according to the planned time and cost, or even faster and more efficiently than planned. However, it is undeniable, in reality there will be many unpredictable problems during the drilling process, such as Elmagco damage in the drawworks system and several other technical problems that do not interfere with drilling performance. Drilling of development wellsAlur Siwah Fase 1 is the most critical field in the development of the working area in Block A because it is the main gas producer to meet the need for gas sales under the Gas Sale and Purchase Agreement (PJBG). Optimization using the drilling campaign concept in the drilling of the Siwah Channel Phase 1 is carried out by identifying planning data using actual data from the drilling process which has a positive impact on the project economy in Block A, which provides an overall savings of U$D 19,339,755 or 26% and provides 37 days time efficiency.

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