ABSTRACT
The XY Field is an oil field in the Sunda Basin which was developed since 1981 and has been produced in the Baturaja carbonate layer and Talang Akar sandstone layer. Decreasing the amount of oil production in the reservoir can have a detrimental impact on the company so it is necessary to analyze the remaining reserves of the reservoir. The calculation used to evaluate the remaining reserves use the Volumetric, Material Balance and Decline Curve methods. From the three methods, the results that are close to the reserve of the XY field reservoir are 14 MMSTB. OOIP is obtained from the volumetric method and material balance which is divided into P10, P50 and P90. The reserve OOIP for P10 is 110.8 MMSTB and P90 is 60.34 MMSTB, with the last cumulative production in December 2019 being 9.3 MMSTB, where the economic limit of the field is 46 bbl. / day and the contract will be expired in 2038. From the results of the subsurface analysis, the four infill wells are candidates for infill wells because they have hydrocarbon potential. Then in terms of economics this development scenario is feasible to be developed with NPV reaching 9,140 MUSD, the ROR reaching 41% for PSC and 60% for Gross Split, and increases field recovery factor (RF) up to 56%.

Keywords: Infill Well; Remaining Reserves; Volumetric; Material Balance; Decline Curve

ARTICLE HISTORY
Received : 16 May 2022
Revised : 06 Jun 2022
Accepted : 05 Jul 2022

Correspondences Author:
 dila_stem@esdm.go.id

1. Introduction

Field XY is one of the offshore area that are proven to produce hydrocarbons in the Sunda Basin which located in Sumatra and Java Sea. this basin over the last 25 years has been producing hydrocarbons a total of approximately 800 million barrels, with an average production of 9,000 BOPD. The production is produced from about 21 accumulation potential, with the number of exploratory wells around 200 and a success rate of about 10 % (Wight et al., 1986).

Efforts are made to stabilize and increase the reserves contained in the field is with the addition of wells infill. In an effort to increase oil production that continues to experience a decrease in the level of production, a series of work stimulation, workover, and re-completion has been developed on those wells, however apparently did not give an increase in the rate of production significantly.
Infill well is one way that can be used to improve or maintain the pace of production in an oil field. Especially in the oil field which its production is less than Maximum Efficiency Rate (MER).

2. Materials and Methods
The quantity of the remaining reserve, formation productivity, drainage radius of wells, number of production wells, layout and pattern of production wells that have been developed, are the consideration of the implementation of infill drilling. These considerations are obtained from calculations based on the data of the reservoir and production data obtained during the drilling process or during the process of production is in progress.

The purpose of the infill well is to lift the oil from the reservoir that has not been drained by the existing production wells. Well Spacing need to determine in order to point the number and layout of reservoir drainage radius (re).

Due to the limited data of well testing such as interference well testing and pressure build-up test (PBU) in the XY plane, the spread of rocks facies and geological analysis will be applied to determine the boundaries of the reservoir and a drain radius area. Furthermore, those analysis is useful to determine the location of the infill wells with better reservoir rock characteristic and remaining oil deposits. Figure 1 determines procedures to calculate remaining reserves of XY Field. The Data will be processed with data processing and oil gas commercial software.

![Flow Chart Determination Remaining Reserves of XY Field](image)

3. Results and Discussion
Field XY produces hydrocarbon mostly derived from the Lower Baturaja Formation [BRF] and Talang Akar Formation [TAF]. Figure 2 shows cross-section of the seismic Image which Field XY adjacent and has similar stratigraphy to the Krishna Field. Upper Baturaja is formed on top of the Baturaja Shale, Lower Baturaja, Talang Akar and Basement. In stratigraphy BRS, LBR, TAF pinch out in the area of higher Basement Mela 1 in the area of XY. The deposition UBR found continuously until the region Krishna.
The UBR formation can be seen through the reading of the resistivity log, where the value is higher than the resistivity reading of Gumai shale. The spread of Upper Baturaja on the XY plane can be well described by the attribute sum amplitude.

Based on the observation and description of the reservoir then the carbonate Upper Cover and the Lower Cover has different geometry and facies association. Upper Baturaja is a shelf argillaceous limestone, whereas Lower Baturaja is a reeval platform and Talang Akar is a rework of the sediment.

Figure 2. Cross-Sectional Seismic Field XY Trending North South

The hydrocarbon reserves in the reservoir of XY Field is conducted with volumetric method. It is believed that the method was based on average porosity and hydrocarbon saturation value data.

In the governing the P1 reserve, the parameter of cross-sectional area (A) is determined through the radius of produced Wells. The cross-sectional area (A) of the p1 is 250 meters. However, Wells that out of Net Pay area will be not counted and classified as P2 reserves area. P3 reserves is some reservoir areas beyond the fracture structure and don’t have Well data.

Figure 3. The Prospect Area of Field XY Formation Talang Akar [TAF]
Figure 4. The Prospect Area of Field XY Formation Lower Baturaja [LBRF]

Table 1. Volumes calculation Volumetric Method

| Formasi | Volume (Acreft) |
|---------|-----------------|
|         | P10             | P50             | P90             |
| LBR     | 223.317,0       | 179.813,0       | 131.689,0       |
| TAF     | 123.406,0       | 77.856,0        | 47.291,0        |
| TOTAL   | =               |                 |                 |

Table 2. Reserves calculation Volumetric Method

| OOIP (MSTB) | P10       | P50       | P90       |
|-------------|-----------|-----------|-----------|
|             | 86.624,7  | 69.749,5  | 51.082,2  |
|             | 24.221,8  | 15.281,4  | 9.282,2   |
|             | 110.846,5 | 85.030,8  | 60.364,3  |

Table 3. Hydrocarbon fluid Composition

| Component            | %mole | Mw    |
|----------------------|-------|-------|
| Hydrogen Sulfide     | 0     | 34.08 |
| Carbon Dioxide       | 3.17  | 44.01 |
| Nitrogen             | 0.46  | 28.02 |
| Methane              | 33.9  | 16.04 |
| Ethane               | 4.64  | 30.07 |
| Propane              | 3.81  | 44.09 |
| Iso-Butane           | 1.22  | 58.12 |
| N-Butane             | 1.77  | 58.12 |
| Iso-Pentane          | 0.9   | 72.15 |
| N-Pentane            | 1.27  | 72.15 |
| Hexanes              | 2.04  | 86.77 |
| Heptanes Plus        | 46.82 | 100.2 |
| **Total**            | **100**|       |
4. Conclusion

1. Field XY has 14 MMSTB for P90 (Proven Reserve). The Economic Limit per well in the field XY is 5,22 bbl/day.
2. The cumulative production (Np) Field XY is 9.3 MMSTB with 3.7 MMSTB of Remaining Reserve and has 4 more infill Wells.
3. The study of subsurface includes interpretation of geological, petrophysic and geophysic where in the writing of this using the analysis of the interpretation of facies and interpretation of seismic. Facies layer LBR (Lower Baturaja) is divided into Reef, Lagoon, Platform and Slope which is based on the characteristic properties of the rock in the most nice as a reservoir is a type of facies reef. Meanwhile, the facies Talang Akar Formation are divided into Distributary Channel, Intra Distributary Channel, Crivasse Splay-Sediment, and Flood Plain, where the most good as a reservoir is a facies distributary channel and crevasse splay-sediment.
4. Based on this analysis, that the well infill Ana-01 T-02 T-03, and Ana-04 has hydrocarbon potential and the parameters of the economic worth to be developed based on the value of NPV (Net Present Value) reaches 9.140 MUSD as well as ROR reached 41%. From the second scenario development, scenario development that is selected is the addition of the well infill as much as 4 wells because can increase the recovery factor (RF) field to 56%.

References

[1] Ahmed, Tarek, Advanced Reservoir Engineering, Gulf Publishing Company, Houston, Texas, 2005.
[2] Ahmed, Tarek., "Reservoir Engineering Handbook", Gulf Publishing Company, Houston, Texas, 2000.
[3] Allinson, Guy., “Economic of Petroleum Exploration and Production ”, Program Diklat Tim Pengelolaan IWPL Migas Bekerjasama Dengan IAGI, Juni, 1992.
[4] Amyx, J.W., Bass. Jr., D.M., dan Whiting, R.L., "Petroleum Reservoir Engineering", McGraw-Hill Book Company, New York, Toronto, London, 1960.
[5] Arps. J.J.: “Analysis of Decline Curve”, Trans. AIME, Volume 160, 1960.
[6] Batycky, P. 2017. “Material Balance Applied to Dynamic Reservoir Surveillance Patterns”. Society of Petroleum Engineers. California.
[7] Dadang Rukmana, Dedy Kristanto, V. Dedi Cahyoko Aji. 2011 Teknik Reservoir Teori dan Aplikasi. Dadang Rukmana,.2014. Technical Aspect Subsurface.
[8] Data-data Lapangan Pertamina Hulu Energi Offshore South East Sumatra
[9] Gentry, R.W., "Decline Curve Analysis", J.P.T., Januari 1972.
[10] Havlena, D. Odah, A. S. 1963. "The Material Balance as as Equation of a Straight Line". J. Pet Tech. Trans. AIME.
[11] Kanu, Ukwu. 2014. “advancement in Material Balance Analysis”. . Society of Petroleum Engineers. Nigeria
[12] Mian. M.A at al : “Petroleum Engineering Handbook for the Practicing Engineer, Volume 1”, Tulsa, 1992
[13] Permadi, Asep Kurnia, "Diktat Teknik Reservoir 1", Bandung,2014
[14] Peraturan PTK POD SKK Migas.
[15] Rukmana D. at al, "Teknik Reservoir Teori dan Aplikasi", Pohon Cahaya, Yogyakarta, 2011.
[16] Sulistiyono, Thesis “Aplikasi Multi Atribut Seismik Untuk Mengidentifikasi Fasies Paleochannel Formasi Talang Akar Bagian Atas (Studi Kasus Lapangan “HD” Cekungan Sunda)”, Jakarta, 2012.
[17] Thompson, R.S., and Wright, J.D.: “Oil Property Evaluation”,

[80]