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RESEARCH ARTICLE

# Economic Feasibility Analysis of Fishing Job Operation in Well YS13

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**Abstract**

Oil consumption in Indonesia has increased from year to year. However, the increasing demand for oil and natural gas is inversely proportional to oil and gas production, which always declines from year to year. One of the factors causing the decline in production is the well damage. Well YS13 is a well that is damaged in the form of fish in the well. A fishing job is the most appropriate option to solve the problem of the presence of fish in the well because the fish in the well must be removed to continue well production activities or drilling activities. This study aimed to determine the economic feasibility of fishing job activities to be carried out at the YS13 well. The research begins with the preparation of the required data, then calculate the predicted production of the YS13 well with the decline curve method, estimates the cost of the fishing job, and economic fishing time (EFT). And determines the economic feasibility of the fishing job project by calculating profit indicators, namely Net Present Value (NPV), Internal Rate of Return (IRR), and Pay Out Time (POT). The results of calculations using the decline curve method obtained that the total production for 20 months is 4293.52 bbl. The EFT value is 3 days with Ps = 10% and the total cost of fishing is $28.657,70. The economic value of the project with discount rate = 12%, MARR = 12%, NPV = $147.367,20, IRR = 114%, and POT = 1.44. From the results of the calculation of the economic feasibility, the project is considered feasible to be carried out.

**Keywords:** Fishing Job, Decline Curve, Economic Fishing Time (EFT), NPV, IRR.

## 1. Introduction

Oil and gas are indispensable resources for the community in supporting daily activities. Hence, it contributes significantly to the economy and industry of a country and is one of the economic and income supports of the state (Erziyanti, 2019). Oil consumption in Indonesia is increasing year after year. In 2015, oil demand was recorded at 1.5 million barrels of oil a day (bopd), and it grew to 1.6 million bopd in 2016 and 1.7 million bopd in 2017 (Taher, 2019). However, the increasing demand for oil and natural gas is inversely proportional to Indonesian oil and gas production, which has been in decline for the last few years.

The condition of old wells is often the cause of not optimal exploitation activities resulting in a decrease in the amount of production (Utama, 2014). In addition to the condition of old wells, another factor that causes a decrease in production is damage to wells that still have potential (Wibisono, 2018). One of the damages to the well is the presence of fish in the well which hinders well production activities. Fish is material or equipment left in the well: it can be stuck pipe, broken pipe, drill collar, bit, hand tool, cable, etc. (Degeare, 2015).

This fish or equipment left behind needs to be removed to continue the operation to be carried out. Most fish occur during drilling activities, but it is possible for fish to occur in wells that are already operating. Fish in operating wells will certainly hamper production activities which can lead to a decrease in the amount of production. Therefore, the fish in the well should be removed if deemed economically viable. Activities that can be used to remove fish from boreholes are fishing job operations (Lyons and Plisga, 2005).

Well YS13 is a directional well that was completed in 2012 and has a potential production of 20 BOPD. However, in 2014 the ESP (Electric Submersible Pump) circuit broke and was left in the well which caused the production to stop. Therefore, it is necessary to carry out well maintenance to produce the well again. Well maintenance carried out is a fishing job operation to remove a series of ESP left in the well. The fishing job activity is a well maintenance activity that requires a large amount of money due to time and the equipment needed and are inputs to determine if the activity can still be considered profitable (Adkins, 1993).

To determine the economic feasibility of well YS13, maintenance activities will be calculated from the Net Present Value (NPV), Internal Rate of Return (IRR), and Pay Out Time (POT) (Ariyon, Setiawan and Reza, 2020) (William, Kartoatmodjo and Prima, 2017).

## 2. Methods

### 2.1 Fishing Job Operation

Fishing is a technique of removing lost or trapped objects from the wellbore. Fishing job is part of planning in drilling and workover operations (Degeare, 2015).

The factors that cause the occurrence of fish include:

1. mechanical failure such as, pump failure, lifting equipment, subsurface equipment
2. deviation factor, dogleg, and crooked hole
3. human error.

Fishing can be called a risk management strategy. When fishing is successful, the well will be safe and if not, it will suffer a considerable loss (Degeare, 2015). Cost fishing is the cost incurred during fishing job activities carried out. The cost of fishing will be even greater if there is an increase in rig cost due to excessive depth or in more complex wells.

Daily Fishing Cost = equipment cost +rig cost + operator cost (1)

The YS13 well is an off-production well that will be reactivated by carrying out fishing operations to retrieve fish left in the well. To calculate the fishing economy of the YS13 well, the Economic Fishing Time (EFT) parameter is used.

$$EFT = \frac{Ps \times LPO}{DFC} \quad (2)$$

EFT : Economic Fishing Time (days)
Ps : Probability of Success (%)
LPO : Loss Potential Oil ($)
DFC : Daily Fishing Cost ($/day)

In this EFT concept which condisers not only the cost but also the operation's probability of success (Cunha, 1994). In this case, for a well with a probability Ps of a successful fishing job, there will be the following possibilities:

a. do not perform the fishing job and lost potential oil production
b. do the fishing job successfully in a time T and expend DCF.T
c. do the fishing job unsuccessfully during the time T and then abandon the fish and do perforation on other zone

The probability of success is used to determine the time that will be used in a fishing operation. The percentage value of Ps ranges from 5% to 85%. The percentage is obtained from operations that have been carried out previously, although no fishing operation is exactly the same (Kemp, 1986). Loss potential oil is the potential oil that will be produced if a fishing job is carried out, the value used is the cumulative income from the well (Pertamina, 2015). Daily fishing cost is the cost used in fishing operations per day.

## 2.2 Decline Curve Analysis

Production from time to time will cause a decrease in pressure which will cause a decline in the production rate per unit of time. This is due to the limited volume of the oil reservoir. The combination of time, production rate, and cumulative production can be used to determine the remaining reserves and production life of a well or oil and gas field (Lyons, Plisga and Lorenz, 2015). Decline curve analysis is a method used to estimate oil and gas reserves based on production data after a certain time interval (Irwin, 2015).

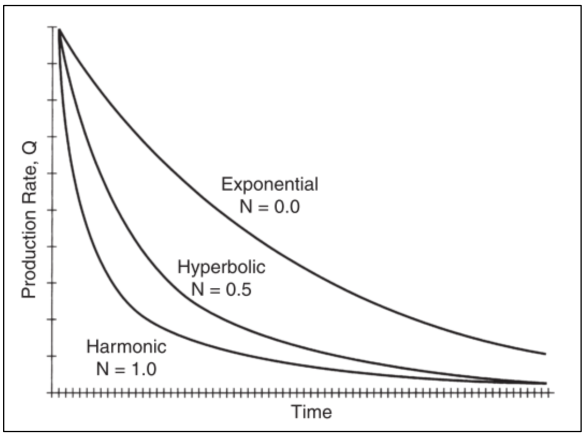


Fig. 1. Decline curve plot

Decline curves are generally divided into three types based on the exponent decline (b):

1. Exponential (b=0) : curve tends to be straight (constant slope)
2. Hyperbolic (0<b<1) : curve tends to be flat
3. Harmonic (b=1) : Steep curve (steep decline from beginning)

### *2.2.1 Trial Error & X2 Chisquare-Test Method*

The trial error & X2 chisquare-test method is a method that estimates the price of production rate (q) assuming various prices of b and determines the smallest difference between q-actual and q-forecast that has been calculated previously (Rukmana and Kristanto, 2011). In addition to the trial error & x2 chisquare-test method, there is also a loss ratio method which is also often used in research.

The calculation procedure for this method is as follows (Rukmana and Kristanto, 2011):

a. Create a tab that contains: time (t), $q_{actual}$, $q_{forecast}$ and Di with various prices b, and X2
b. Assume the value of b is from 0 to 1 (b = 0 for exponential, b = 0.1 – 0.9 for hyperbolic, b = 1 for harmonic)
c. Calculate $D_i$ with equations:
   a) b = 0

$$Di = \frac{\ln\left(\frac{q_i}{q_t}\right)}{t_t} \quad (3)$$

   b) b = 0.1 – 0.9

$$Di = \frac{\left({}^{q_i}/_{q_t}\right)^b - 1}{b.t_t} \quad (4)$$

   c) b = 1

$$Di = \frac{\left(\frac{q_i}{q_t}\right) - 1}{t_t} \quad (5)$$

d. Calculate $q_{forecast}$ with equations:
   a) b = 0

$$Di = q_n e^{-d_{i.}t} \quad (6)$$

   b) b = 0.1 – 0.9

$$Di = q_i(1 + bD_i t)^{-1/b} \quad (7)$$

   c) b = 1

$$Di = q_i(1 + D_i t)^{-1} \quad (8)$$

   The value of $q_i$ = $q_{actual}$, the value of $D_i$ is obtained from step 3 and the value of t = dt
e. Calculate the $X^2$ equation (difference between actual and forecast) using the chisquare-test equation:

$$X^2 = \Sigma\left[\frac{(fi - Fi)^2}{Fi}\right] \quad (9)$$

   where :
   fi = observation data (actual) data points being analyzed
   Fi = expected data (estimate)
f. Repeat the calculation procedure in steps 3 to 5 to calculate the next steps.
g. Determine ∑ the smallest value of $X^2$. The smallest value of ∑ $X^2$ shows the most suitable curve to

represent the data points being analyzed with the price of:

a) Exponential decline : b= 0
b) Hyperbolic decline : b = 0.1 – 0.9
c) Harmonic decline : b = 1

### 2.3 Economic Feasibility

Oil and gas activities carried out in the oil and gas industry must be carried out with precise calculations so that the potential for financial loss are minimized. For this reason, it is necessary to carry out an economic analysis of the activities (Rahman and Damayanti, 2021). This analysis will determine whether the activity is feasible or not. The economic analysis carried out is to calculate the feasibility parameter for oil and gas activities, namely the Net Present Value (NPV), Internal Rate of Return (IRR), dan Pay Out Time (POT) (Novrianti, 2017).

*2.3.1 Net Present Value (NPV)*

NPV is a method of calculating net value at the present time. The present time in question is the initial time of calculation in year 0 in the calculation of investment cash flow (Drs. M. Giatman, 2006). NPV is used to assess the feasibility of a project. If the NPV is positive, then the project is worth doing, because it will provide benefits (Shereih, 2017).

$$\mathrm{NPV} = \mathrm{NFC}_0 + \frac{\mathrm{NFC}_1}{(1+i)^1} + \frac{\mathrm{NFC}_2}{(1+i)^2} + \cdots + \frac{\mathrm{NFC}_n}{(1+i)^n} \qquad (10)$$

$NFC_0$ = cash flow year-0
$NFC_n$ = cash flow year-n
i = discount rate

*2.3.2 Internal Rate of Return (IRR)*

IRR or Internal Rate of Return is the interest price that causes the value of cash inflow to be equal to cash outflow if this cash flow is discounted for a certain time (Fiqri, 2013). IRR can be interpreted as the interest rate that causes NPV = 0 (Shereih, 2017). The value of the IRR can be expressed in the following equation:

$$\mathrm{IRR} = i_1 + \left(\frac{\mathrm{NPV}_1}{\mathrm{NPV}_1 - \mathrm{NPV}_2}\right) \times (i_2 - i_1) \qquad (11)$$

$NPV_1$ = Net Present Value (+)
$NPV_2$ = Net Present Value (0)
$i_1$ = discount rate (NPV (+))
$i_2$ = discount rate (NPV (0))

*2.3.3 Pay Out Time (POT)*

*Pay out time (POT) is the time required to return capital or investment* (Sari, 2011). POT is calculated to find out how long it will take for the investment to be returned (Drs. M. Giatman, 2006). The POT value can be expressed in the following equation:

$$POT = n_1 + (n_2 - n_1)\left(\frac{Cumulative\ NCF_1}{(Cumulative\ NCF_1 + Cumulative\ NFC_2)}\right) \qquad (12)$$

POT = Pay out time
$NFC_1$ = Net cash flow 1
$NFC_2$ = Net cash flow 2
$n_1$ = year when cumulative NCF is negative (-)
$n_2$ = year when cumulative NCF is positive (+)

## 3. Results

### 3.1 Production Forecast

Determination of the type of decline curve with the Trial-Error method is carried out by calculating the estimated production rate at various exponential decline values (b), namely from b = 0 to b = 1. The $X^2$ Chi-Square method is used to determine the decline curve that best fits the q vs t graph in the previous Trial-Error method. From the production data used in the calculation of this method, it is found that the most suitable type of decline curve is the exponential type with b = 0 and the decline rate value = 0.14086.

Table 1. Trial-Error & X2 Chi-Square Tabulation

| Time | Month | Q (BOPD) | Exponential | | Hyperbolic | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **b =** | 0 | **b =** | 0.1 | **b =** | 0.2 | **b =** | 0.3 | **b =** | 0.4 |
| | | | **Di =** | 0.14086 | **Di =** | 0.15685 | **Di =** | 0.17531 | **Di =** | 0.19665 | **Di =** | 0.2214 |
| | | | **qo** | X2 | **qo** | X2 | **qo** | X2 | **qo** | X2 | **qo** | X2 |
| 1 | 01-21 | 1138 | 988.55 | 0.15 | 974.06 | 0.17 | 957.96 | 0.19 | 940.15 | 0.21 | 920.54 | 0.24 |
| 2 | 02-21 | 985 | 742.95 | 0.33 | 723.05 | 0.36 | 701.69 | 0.40 | 678.97 | 0.45 | 655.03 | 0.50 |
| 3 | 03-21 | 1240 | 812.83 | 0.53 | 783.13 | 0.58 | 752.24 | 0.65 | 720.49 | 0.72 | 688.20 | 0.80 |
| 4 | 04-21 | 2241 | 1275.90 | 0.76 | 1219.69 | 0.84 | 1162.88 | 0.93 | 1106.16 | 1.03 | 1050.22 | 1.13 |
| 5 | 05-21 | 1030 | 509.31 | 1.02 | 484.13 | 1.13 | 459.32 | 1.24 | 435.17 | 1.37 | 411.95 | 1.50 |
| 6 | 06-21 | 1033 | 443.74 | 1.33 | 420.31 | 1.46 | 397.74 | 1.60 | 376.26 | 1.75 | 356.03 | 1.90 |
| 7 | 07-21 | 1270 | 473.69 | 1.68 | 448.02 | 1.83 | 423.78 | 2.00 | 401.13 | 2.17 | 380.18 | 2.34 |
| 8 | 08-21 | 1216 | 393.91 | 2.09 | 372.76 | 2.26 | 353.13 | 2.44 | 335.09 | 2.63 | 318.63 | 2.82 |
| 9 | 09-21 | 1149 | 323.30 | 2.55 | 306.69 | 2.75 | 291.51 | 2.94 | 277.75 | 3.14 | 265.33 | 3.33 |
| 10 | 10-21 | 1041 | 254.38 | 3.09 | 242.36 | 3.29 | 231.53 | 3.49 | 221.80 | 3.69 | 213.12 | 3.88 |
| 11 | 11-21 | 1022 | 217.02 | 3.71 | 208.05 | 3.91 | 200.05 | 4.11 | 192.94 | 4.30 | 186.63 | 4.48 |
| 12 | 12-21 | 570 | 105.17 | 4.42 | 101.63 | 4.61 | 98.50 | 4.79 | 95.74 | 4.96 | 93.31 | 5.11 |
| 13 | 01-22 | 598 | 95.84 | 5.24 | 93.52 | 5.40 | 91.48 | 5.54 | 89.69 | 5.67 | 88.12 | 5.79 |
| 14 | 02-22 | 655 | 91.10 | 6.19 | 89.92 | 6.28 | 88.89 | 6.37 | 87.98 | 6.44 | 87.19 | 6.51 |
| 15 | 03-22 | 138 | 16.63 | 7.27 | 16.63 | 7.27 | 16.63 | 7.27 | 16.63 | 7.27 | 16.63 | 7.27 |
| | Σ | | | 40.35 | | 42.14 | | 43.96 | | 45.78 | | 47.60 |

Table 2. Trial-Error & X2 Chi-Square Tabulation

| Time | Hyperbolic | | | | | | | | | | Harmonic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **b =** | 0.5 | **b =** | 0.6 | **b =** | 0.7 | **b =** | 0.8 | **b =** | 0.9 | **b =** | 1 |
| | **Di =** | 0.25017 | **Di =** | 0.2836635 | **Di =** | 0.322754 | **Di =** | 0.36846 | **Di =** | 0.422 | **Di =** | 0.4849 |
| | **qo** | X2 | **qo** | X2 | **qo** | X2 | **qo** | X2 | **qo** | X2 | **qo** | X2 |
| 1 | 899.10 | 0.27 | 875.81 | 0.30 | 850.74 | 0.34 | 824.02 | 0.38 | 795.83 | 0.43 | 766.47 | 0.48 |
| 2 | 630.06 | 0.56 | 604.31 | 0.63 | 578.09 | 0.70 | 551.73 | 0.78 | 525.57 | 0.87 | 499.93 | 0.97 |
| 3 | 655.79 | 0.89 | 623.66 | 0.99 | 592.21 | 1.09 | 561.81 | 1.21 | 532.76 | 1.33 | 505.31 | 1.45 |
| 4 | 995.75 | 1.25 | 943.34 | 1.38 | 893.50 | 1.51 | 846.61 | 1.65 | 802.92 | 1.79 | 762.54 | 1.94 |
| 5 | 389.89 | 1.64 | 369.14 | 1.79 | 349.83 | 1.94 | 332.01 | 2.10 | 315.68 | 2.26 | 300.81 | 2.42 |
| 6 | 337.18 | 2.06 | 319.77 | 2.23 | 303.82 | 2.40 | 289.31 | 2.57 | 276.16 | 2.74 | 264.31 | 2.91 |
| 7 | 360.96 | 2.52 | 343.45 | 2.70 | 327.60 | 2.88 | 313.31 | 3.05 | 300.48 | 3.23 | 288.98 | 3.39 |
| 8 | 303.72 | 3.00 | 290.28 | 3.19 | 278.21 | 3.37 | 267.42 | 3.55 | 257.78 | 3.72 | 249.17 | 3.88 |
| 9 | 254.20 | 3.52 | 244.24 | 3.70 | 235.36 | 3.88 | 227.45 | 4.05 | 220.42 | 4.21 | 214.16 | 4.36 |
| 10 | 205.38 | 4.07 | 198.51 | 4.24 | 192.41 | 4.41 | 186.99 | 4.56 | 182.18 | 4.71 | 177.91 | 4.85 |
| 11 | 181.04 | 4.64 | 176.10 | 4.80 | 171.72 | 4.95 | 167.85 | 5.09 | 164.41 | 5.22 | 161.36 | 5.33 |
| 12 | 91.16 | 5.25 | 89.26 | 5.39 | 87.59 | 5.51 | 86.11 | 5.62 | 84.79 | 5.72 | 83.63 | 5.82 |
| 13 | 86.74 | 5.90 | 85.52 | 5.99 | 84.45 | 6.08 | 83.50 | 6.16 | 82.66 | 6.24 | 81.91 | 6.30 |
| 14 | 86.49 | 6.57 | 85.88 | 6.62 | 85.34 | 6.67 | 84.86 | 6.71 | 84.44 | 6.75 | 84.06 | 6.79 |
| 15 | 16.63 | 7.27 | 16.63 | 7.27 | 16.63 | 7.27 | 16.63 | 7.27 | 16.63 | 7.27 | 16.63 | 7.27 |
| **Σ** | | 49.42 | | 51.23 | | 53.01 | | 54.77 | | 56.50 | | 58.18 |

The estimated production of the YS13 well is calculated using the exponential decline curve method. Estimated production is calculated from April 1, 2022 – November 1, 2023 (20 months), the YS13 well is capable of producing 4293.52 bbl of oil.

Table 3. Forecast Production

| **Time (t)** | **q (BOPD)** | **Np (bbl/month)** |
|---|---|---|
| 1-Apr-22 | 20 | 600.00 |
| 1-May-22 | 17.37 | 521.16 |
| 1-Jun-22 | 15.09 | 452.69 |
| 1-Jul-22 | 13.11 | 393.21 |
| 1-Aug-22 | 11.38 | 341.54 |
| 1-Sep-22 | 9.89 | 296.67 |
| 1-Oct-22 | 8.59 | 257.69 |
| 1-Nov-22 | 7.46 | 223.83 |
| 1-Dec-22 | 6.48 | 194.42 |
| 1-Jan-23 | 5.63 | 168.87 |
| 1-Feb-23 | 4.89 | 146.68 |
| 1-Mar-23 | 4.25 | 127.41 |
| 1-Apr-23 | 3.69 | 110.67 |
| 1-May-23 | 3.20 | 96.13 |
| 1-Jun-23 | 2.78 | 83.50 |
| 1-Jul-23 | 2.42 | 72.53 |
| 1-Aug-23 | 2.10 | 63.00 |
| 1-Sep-23 | 1.82 | 54.72 |
| 1-Oct-23 | 1.58 | 47.53 |
| 1-Nov-23 | 1.38 | 41.28 |

### 3.2 Economic of Fishing

The economic calculation of fishing jobs in the YS13 well is carried out with several parameters, namely production potential of 20 bopd, an oil price of $74.73 per bbl, estimated time of economic production for 13 months, and production cost (ESP rental) of $249.55 per day.

In table 3, the well production and income generated are calculated for 20 months. However, in the 14th month, production was deemed uneconomical because the income was smaller than the cost of production.

Table 4. Production Income

| *Time (month)* | *Production (bopd)* | *Cumulative Production (bbl/month)* | *Income ($)* | *Cumulative Income ($)* |
|---|---|---|---|---|
| 1 | 20 | 600 | $ 44,838.00 | $ 44,838.00 |
| 2 | 17.37 | 521.16 | $ 38,946.58 | $ 83,784.58 |
| 3 | 15.09 | 452.69 | $ 33,829.26 | $ 117,613.85 |
| 4 | 13.11 | 393.21 | $ 29,384.32 | $ 146,998.17 |
| 5 | 11.38 | 341.54 | $ 25,523.42 | $ 172,521.58 |
| 6 | 9.89 | 296.67 | $ 22,169.81 | $ 194,691.39 |
| 7 | 8.59 | 257.69 | $ 19,256.84 | $ 213,948.23 |
| 8 | 7.46 | 223.83 | $ 16,726.62 | $ 230,674.86 |
| 9 | 6.48 | 194.42 | $ 14,528.85 | $ 245,203.71 |
| 10 | 5.63 | 168.87 | $ 12,619.86 | $ 257,823.57 |
| 11 | 4.89 | 146.68 | $ 10,961.69 | $ 268,785.26 |
| 12 | 4.25 | 127.41 | $ 9,521.40 | $ 278,306.66 |
| 13 | 3.69 | 110.67 | $ 8,270.35 | $ 286,577.01 |
| 14 | 3.20 | 96.13 | $ 7,183.68 | $ 293,760.69 |
| 15 | 2.78 | 83.50 | $ 6,239.79 | $ 300,000.49 |
| 16 | 2.42 | 72.53 | $ 5,419.93 | $ 305,420.41 |
| 17 | 2.10 | 63.00 | $ 4,707.78 | $ 310,128.20 |
| 18 | 1.82 | 54.72 | $ 4,089.21 | $ 314,217.41 |
| 19 | 1.58 | 47.53 | $ 3,551.92 | $ 317,769.33 |
| 20 | 1.38 | 41.28 | $ 3,085.22 | $ 320,854.55 |

Table 5. Daily Fishing Job Cost

| | |
|---|---|
| Daily operation cost | $ 4,247.04 |
| Supervise | $ 62.23 |
| BBM | $ 246.84 |
| Fishing Tools | $ 3,500.00 |
| Fishing Jars | $ 2,000.00 |
| Total | $ 10,056.11 |

Table 6. Probability of Success and EFT Well YS13

| **Probability of Success (%)** | **Economic Fishing Time (Days)** |
|---|---|
| 5% | 1 |
| 10% | 3 |
| 15% | 4 |
| 20% | 6 |
| 25% | 7 |
| 30% | 9 |
| 35% | 10 |
| 40% | 11 |
| 45% | 13 |
| 50% | 14 |
| 55% | 16 |
| 60% | 17 |
| 65% | 19 |
| 70% | 20 |
| 75% | 21 |
| 80% | 23 |
| 85% | 24 |

To calculate the economics of fishing jobs, it is necessary to calculate the economic fishing time (EFT). EFT is the time limit for carrying out fishing operations that are still considered economical. To calculate it, daily fishing cost data is needed, as also the probability of success. In table 4, it can be seen the costs needed to carry out fishing operations per day. The EFT calculation is highly dependent on the probability of success (Ps) value. In the fishing operation, the YS13 Ps well is determined at 10% and the EFT is obtained for 3 days. 10% Ps is selected based on estimates of fishing job operators who have carried out fishing operations before. Looking at the condition of the well Ps by 10% is suitable for use. With a duration of 3 days, the fishing operation requires a total cost of $ 28,657.70.

### 3.3 Economic Feasibility

In table 6, it can be seen that the economic parameters of the YS13 well used in the economic feasibility analysis of the YS13 well fishing job are assessed from the NPV, IRR, and POT. IRR value must greater than MARR (Minimum Attractive Rate of Return), the minimum profit an investor expects to make from an investment. Produce the YS13 well, requires production costs in the form of ESP rental with a total of $ 7486.50 per month. The cash flow of the YS13 well can be seen in table 7.

Table 7. Economic Feasibility Parameters

| | |
|---|---|
| Capex | $ 28,657.70 |
| Oil Price | $ 74.73 |
| i (*discount rate*) /year | 12% |
| MARR ( | 12% |
| ESP rent (/day) | $ 249.55 |

#### *3.3.1 Net Present Value (NPV)*

Calculation of NPV in well YS13 using a discount rate (i) of 12% per year or 1% month, the results obtained are NPV = $ 147,367.20 for 12 months. With a positive NPV value, the fishing operation on the YS13 well is considered feasible because it is considered economical.

Table 8. Cash Flow Well YS13

| *Time (month)* | *Np (bbl/month)* | *Cash In* | *Cash Out* | *Net Cash Flow* | *Cumulative NCF* |
|---|---|---|---|---|---|
| 0 | 0 | $ - | $ 28,657.70 | $ (28,657.70) | $ (28,657.70) |
| 1 | 600.00 | $ 44,838.00 | $ 7,486.50 | $ 37,351.50 | $ 8,693.80 |
| 2 | 521.16 | $ 38,946.58 | $ 7,486.50 | $ 31,460.08 | $ 40,153.88 |
| 3 | 452.69 | $ 33,829.26 | $ 7,486.50 | $ 26,342.76 | $ 66,496.64 |
| 4 | 393.21 | $ 29,384.32 | $ 7,486.50 | $ 21,897.82 | $ 88,394.47 |
| 5 | 341.54 | $ 25,523.42 | $ 7,486.50 | $ 18,036.92 | $106,431.38 |
| 6 | 296.67 | $ 22,169.81 | $ 7,486.50 | $ 14,683.31 | $121,114.69 |
| 7 | 257.69 | $ 19,256.84 | $ 7,486.50 | $ 11,770.34 | $132,885.03 |
| 8 | 223.83 | $ 16,726.62 | $ 7,486.50 | $ 9,240.12 | $142,125.15 |
| 9 | 194.42 | $ 14,528.85 | $ 7,486.50 | $ 7,042.35 | $149,167.51 |
| 10 | 168.87 | $ 12,619.86 | $ 7,486.50 | $ 5,133.36 | $154,300.87 |
| 11 | 146.68 | $ 10,961.69 | $ 7,486.50 | $ 3,475.19 | $157,776.06 |
| 12 | 127.41 | $ 9,521.40 | $ 7,486.50 | $ 2,034.90 | $159,810.96 |

Table 9. Net Present Value (NPV) Well YS13

| *Time (month)* | *Net Cash Flow* | *PV Factor* | *PV* |
|---|---|---|---|
| 0 | $ (28,657.70) | - | - |
| 1 | $ 37,351.50 | 0.9901 | $ 36,981.68 |
| 2 | $ 31,460.08 | 0.9803 | $ 30,840.20 |
| 3 | $ 26,342.76 | 0.9706 | $ 25,568.02 |
| 4 | $ 21,897.82 | 0.9610 | $ 21,043.38 |
| 5 | $ 18,036.92 | 0.9515 | $ 17,161.51 |
| 6 | $ 14,683.31 | 0.9420 | $ 13,832.34 |
| 7 | $ 11,770.34 | 0.9327 | $ 10,978.41 |
| 8 | $ 9,240.12 | 0.9235 | $ 8,533.10 |
| 9 | $ 7,042.35 | 0.9143 | $ 6,439.10 |
| 10 | $ 5,133.36 | 0.9053 | $ 4,647.16 |
| | *Total PV* | | $ 176,024.90 |
| | **NPV** | | **$ 147,367.20** |

*3.3.2 Internal Rate of Return (IRR)*

The internal rate of return (IRR) of the YS13 well is calculated using Goal Seek in Microsoft Excel so that the NPV value = 0. From the calculations carried out, the IRR value = 114%, which means the project is considered feasible because the IRR is greater than MARR (12 %).

Table 10. Internal Rate of Return (IRR) Well YS13

| *Time (month)* | *Net Cash Flow* | *PV Factor* | *PV* |
|---|---|---|---|
| 0 | $ (28,657.70) | - | - |
| 1 | $ 37,351.50 | 0.4669 | $ 17,438.75 |
| 2 | $ 31,460.08 | 0.2180 | $ 6,857.64 |
| 3 | $ 26,342.76 | 0.1018 | $ 2,680.91 |
| 4 | $ 21,897.82 | 0.0475 | $ 1,040.47 |
| 5 | $ 18,036.92 | 0.0222 | $ 400.13 |
| 6 | $ 14,683.31 | 0.0104 | $ 152.08 |
| 7 | $ 11,770.34 | 0.0048 | $ 56.92 |
| 8 | $ 9,240.12 | 0.0023 | $ 20.86 |
| 9 | $ 7,042.35 | 0.0011 | $ 7.42 |
| 10 | $ 5,133.36 | 0.0005 | $ 2.53 |
| | *Total PV* | | $ 28,657.70 |
| | **NPV** | | **$ (0.00)** |

*3.3.3 Pay Out Time (POT)*

According to calculations already done, the POT of the YS13 well was acquired at 1.44 months. The project is declared feasible and capital refunds can be accomplished in a relatively short period of time.

**4. Conclusions**

Based on research already done it can be concluded that:

1. The production of the YS13 well is capable of producing 4293.52 bbl of oil in the period 1 April 2022 – 1 November 2023 (20 months).
2. The results of the economic analysis of fishing wells YS13 with a probability of success of 10% obtained the EFT value is 3 days and requires a total cost of $ 28,657.70.
3. Economic feasibility analysis on YS13 well with a capital of $ 47,012.59, oil price $ 74.73/bbl, discount rate 12% per year, and production cost (ESP rental) $249.55/day. Obtained an NPV value of $ 147,367.20, an IRR of 114%, and a POT of 1.44 months, which is considered a feasible project to do.

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