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Hitting the Jackpot: Reaching up to 10000 BBL through *Simson* Idle Well Reactivation Strategy

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ABSTRACT

This study seeks the effective reactivation strategy of the *Simson* idle well in the *Purnomo* oilfield PT Pertamina EP Cepu to produce free-emulsion oil with low costs and technical risks. DCA and Pipesim were used to calculate the production forecast, the precise choke, and the flow coefficient. Due to its remote location, a rig-less and naturally flowing well minimized the cost. A modified choke manifold compliant with the API 6A was installed to control the flow rate from the annulus to the Tank on Site (TOS). The cumulative production in 2023 reached 10.961 bbl with the average BSW at 2%. To avoid water coning, the well should be operated under the critical rate of 60 BFPD. To maintain stable production, the optimum flow coefficient was Cd 0.838 by installing the first 5-mm choke and the second 8.7-mm choke. The average daily production rate by intermittent flow i.e. of 5-hour production and 19-hour shut-in well was 34 blpd, 33 bopd with water cut at 1.64%. By the end of the PSC contract in 2035, the production forecast value using the choke manifold can reach 81 MSTB – 50 MSTB higher than the SRP method.

Keywords: idle well reactivation, flow coefficient, choke manifold

I. INTRODUCTION

Amid high domestic crude oil consumption, several continuous efforts are made to boost crude oil production in Indonesia. With the number of 10,398 idle wells, the government through the Ministry of Energy and Mineral Resources encouraged reactivation of the idle wells that have been inactive for a minimum of six consecutive months to meet the crude oil production target i.e. one million barrels per day by 2030 (Directorate of Oil and Gas, 2022).

As a subsidiary of PT Pertamina EP Cepu – the national oil and gas company, PT Pertamina EP Cepu Zone 14 Papua Field is committed to supporting the goal. Sixty-six crude oil wells sat idle spreading across three fields – 36 (thirty-six) in *Kota*, 23 (thirty-three) in *Selamat*, and 7 (seven) in *Purnomo*. They were shut-in wells temporarily closed due to economic or operational challenges (IOGCC, 1992).

From the economic point of view, nevertheless, the idle wells in the *Purnomo* oilfield seen as having the most potential to be reactivated as they have the lowest cost per barrel (52.45 dollars per barrel). Out of those seven idle wells in the *Purnomo* oilfield, the *Simson* well was the only one producing crude oil and having a minimum of 10 psi. It was a sucker rod pump well that has been temporarily abandoned since 21 June 2021 due to a low production rate of 3.7 barrels of oil per day and emulsions containing fine solid sediment in the produced oil resulting from the previous reactivation program in 2018. Considering these situations, this study was necessarily conducted to figure out the effective reactivation strategy of the *Simson* well that could produce free-emulsion crude oil; hence, a higher production rate to meet the national target could be gained. Furthermore, regarding its remote location, the reactivation strategy was expected to reduce the production cost.

II. METHODS

This study was conducted in six steps as follows:

1. Collecting *Simson* well data.
   The data covered Shut-In Casing Pressure (SICP) showing whether Pressure Well Formation (PWF) was above the hydrostatic pressure of the *Simson* well in order to enable the well flew naturally. In addition, the desired flow rate could be controlled following the well's PWF. The *Simson* well had to be a natural flow and rig-less well; thus, the production cost could be reduced in regard to its remote location
2. Performing a placement tank and flowing test from the annulus to the oil tank.
   It aimed to figure out the Index Productivity Rate (IPR) or Productivity Index (PI) determining the *Simson* well's flow debit, the possibility of the presence of emulsions in the produced oil and the quality of Basic Sediment and Water (BS&W). By doing so, it could be predicted that the produced oil would not affect the quality of crude oil stored in the Main Gathering Station in the future.
3. Calculating the *Simson* well's critical rate during flowing to avoid water coning problems and significant pressure drop so the *Simson* well could flow naturally.
4. Modifying the idle Christmas tree into choke manifold to control the oil flow under a critical rate
5. Monitoring the operation up to 31 Dec 2023 to show a trend of production rate between 2021 to 2023

6. Determining the optimum flow coefficient applying the modified choke manifold was necessary to maintain stable production in the *Simson* well

The Chan Plot diagram was used to analyze the water coning and channeling problem. Pipesim Simulation was run to determine the precise choke and flow coefficient of the *Simson* well. Decline Curve Analysis was used to forecast oil production rate until the Production Sharing Contract (PSC) between *SKK Migas* and PT Pertamina EP ends in 2035.

III. RESULTS AND DISCUSSION

3.1. Identification of Simson Well Reactivation

PT Pertamina EP Region 4 Zona 14 Papua Field has three wells sitting idle spreading across three fields – 36 (thirty six) in *Kota*, 23 (thirty three) in *Selamat* and 7 (seven) in *Purnomo*. They were shut-in wells temporarily closed due to economic or operational challenges. *Kota* Oilfield was the eldest one. It had the biggest cumulative oil production rate yet with the highest water handling problem at a production cost of 92.74 USD/bbl. *Selamat* oilfield faced the most complex challenges since a termination change in 2019. The challenges were its remote location, the low production facilities' integrity due to their age, and its immense production cost of 177.61 USD/bbl.

Table 1. Field Operation Data of PT Pertamina EP Cepu Zona 14 Papua Field

Purnomo Field	Selamat Field	Kota Field
Kais Formation 1800-3000 mss	Kais Formation 700-1100 mss	Kais Formation 110-180 mss
Well status:	Well status:	Well status:
Operation 7 wells	Operation 25 wells	Operation 125 wells
Injection 2 Wells	Injection - Wells	Injection 26 Wells
Suspend 7 wells	Suspend 23 wells	Suspend 36 wells
P/A 11 Wells	P/A 5 Wells	P/A 28 Wells
Type of Production Methode:	Type of Production Methode:	Type of Production Methode:
Gas Lift 2 Wells	Gas Lift 0 Well	Gas Lift 0 Well
ESP 0 Well	ESP 0 Well	ESP 88 Wells
NF 2 Wells	NF 0 Well	NF 0 Wells
SRP 3 Wells	PCP 6 Wells	SRP 37 Wells
	SRP 19 Wells	
Prodution - Reserve:	Prodution - Reserve:	Prodution - Reserve:
Gross/Nett: 19570/357 BPD	Gross/Nett: 4342/98 BPD	Gross/Nett: 123700/531 BPD
Np 29.5 MMSTB	Np 5.1 MMSTB	Np 49.1 MMSTB
RR 1.4 MMSTB	RR 0.71 MMSTB	RR 0.66 MMSTB
Production Cost:	Production Cost:	Production Cost:
54.45 USD/bbl	177.61 USD/bbl	92.74 USD/bbl

The *Purnomo* oilfield faced quite similar challenges as *Selamat* one i.e. its remote location and low production facilities' integrity yet it had a lower production cost at 52.45 USD/bbl. Considering its deep wells, the existing rig with 150 HP was unable to meet the work over demand in this oilfield.

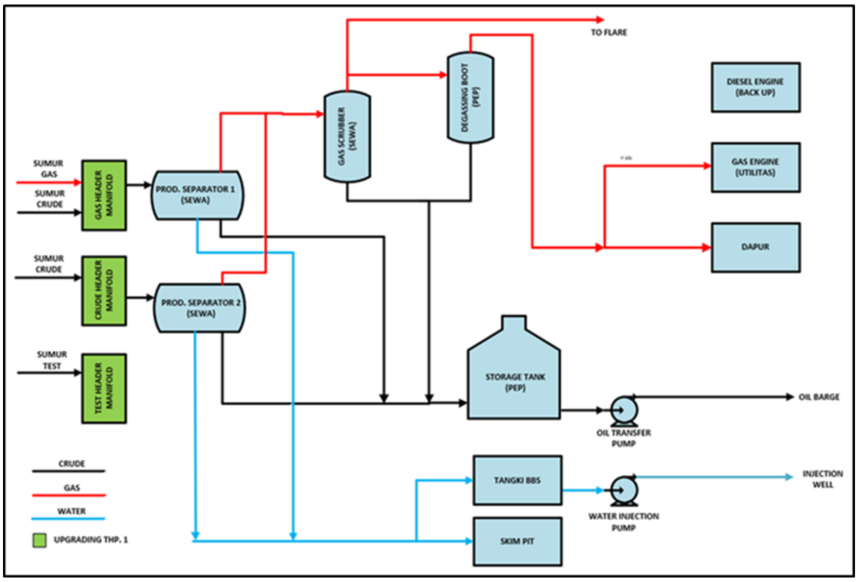


Figure 1. A Flowchart of Existing Production Facilities in Purnomo Oilfield (Widianti at all, 2023)

The production facilities in Purnomo oilfield were partly owned and permanently built by PT Pertamina EP (PEP) and the rest were rented from other parties as shown in Table 2.

Table 2. Production Facilities Status in Purnomo Oilfield (Widianti et al., 2023)

Production Facilities	Qty	Status
Header Manifold • Oil header Manifold, 12", CS, API 5L, Gr. B, 300# • Gas header Manifold, 12", CS, API 5L, Gr. B, 300# • Test Header Manifold, 10", CS, API 5L, Gr. B, 300#	3 unit	PEP
Separator • SPT-005, 86" (OD) x 30' (T/T), Oper. Press. 36 psig 3 phase Horizontal, Design Cap. 25000 blpd • SPT-006, 72" (OD) X 24" (T/T), Oper. Press. 36 psig 3 phase Horizontal, Design Cap. 16500 blpd	2 unit	Rent
Gas Scrubber, SCB-004, 32" (OD) X 8' (T/T)	1 unit	Rent
High Vertical Degassing Boot, PV-DG-01	1 unit	PEP
Compressor Gas Lift, Inlet Pressure, 28 psig Discharge pressure, 1600 psig Operating Flowrate, 2 MMSCFD	2 unit	Rent
Power Generator, GEG, 156 kVA, Actual 110 kVA	1 unit	PEP
Back-up Power Generator, DEG, 156 kVA, Actual 80 kVA	1 unit	PEP
Power Generator u/ WIP • GEG, Cap. 400 HP, Caterpilar G.379 • GEG, Cap. 250 kVA, 380-440 VAC/50 Hz/3 Ph, Kato	2 unit	Rent

FasProd	Qty	Status
Oil Transfer Pump, 40 HP @3500 rpm Disc. Flowrate, 132 GPM (188 boph),	1 unit	PEP
Injection Pump • SLW-P-001A/B, 10000 bwpd, Head 250 ft • SLW-P-002, 10000 bwpd, Head 750 ft	2 Unit	PEP
Oil Storage, Type Horizontal • T-001, 2400 mm x 7000 mm • T-002, 2400 mm x 7000 mm • T-003, 3300 mm x 6700 mm (Rusak)	2 Unit Operation	PEP
Skim Pit		PEP
Square tanks (Total Volume 1000 Bbls)	6 unit	Rent
Oil Barge Harapan Pertamina OBHP IV- Idle Kap. Design, 6000 bbls, Kap. Operasi, 5000 bbls	1 unit	PEP

The production facilities' integrity and tank capacity played an important role in determining the appropriate reactivation strategy in the *Purnomo* oilfield. Facilities of power plants, production water tank, and water injection pump currently have their capacity limit. The idle well reactivation applying a gross-up method was unperformable since it would affect a safety operation. The safest production in these idle wells was by a regular crude oil recovery. Following is the idle wells data in the *Purnomo* oilfield.

Table 3. Data of Idle Well in Purnomo Oilfield

No	Well Name	Status	Last Production	Operation Problem	Well History
1	Purnomo-O1	Suspended	19 Maret 2020, Injection well	Water cut 100%, Tidak ada fasilitas produksi	Incomplete
2	Purnomo A-1x	Suspended	4/21/2020, intermittent recover	Water cut 100%	Incomplete
3	Purnomo D-1x	Suspended	11/4/2023, intermittent recover	Remote area, far from production facilities, and inavailability vessel transportation	Incomplete *)
4	Purnomo E-2x	Suspended	7 Mei 2020, intermittent recover	Well dry after Work over	Incomplete
5	Purnomo- Simson	Suspended	21 Juni 2021, (SRP) & Intermittent recover	- Annulus intermittent recover oil, emulsion problem - Water cut > 99% & oil Production < 5 BOPD - Production line integrity - Fish packer string	Complete
6	Purnomo-B/ O2	Suspended	Intermittent	- Sumur Gas Problem Liquid Loading - Integrity production line	Incomplete
7	Purnomo-1X	Suspended	Intermittent	Remote area, far from production facilities, and inavailability vessel transportation	Incomplete *)

*) Suspended well- After Drilling

Simson well was selected as a pilot idle well to be reactivated based on the screening data of shut-in well pressure in March 2023 and its complete well history data. On 27 March 2023, the trial test and pressure gauge replacement showed annulus pressure by 380 psi and recovery trial to Tank on Site (TOS) for forty-seven minutes by 78 barrels and BSW 0.1%. These numbers indicated that the *Simson* well had the potential to be reactivated as a rig-less and natural flow well. Emulsions were absent as long as the pressure was stable.

Figure 2 showed VLP simulation data as the initial data to continue the well test.

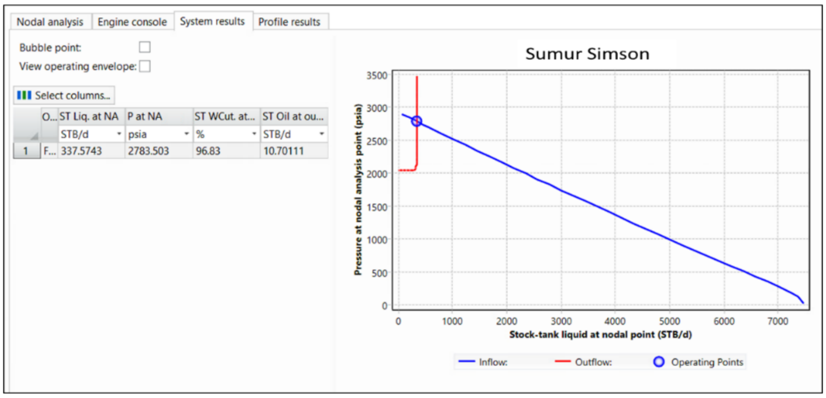


Figure 2. VLP ALS SRP Evaluation Data of Simson Well in 2021

By history, *Simson* well has produced oil since 1977 with OOIP at 1670 MSTB. It had been shut in since June 2021 for economic reasons. Its main problem was a significant rise in water cuts. The water cut rose to 90% in 1977-1979. It had been produced and shut in several times due to the water cut problem (see Figures 3 and 4).

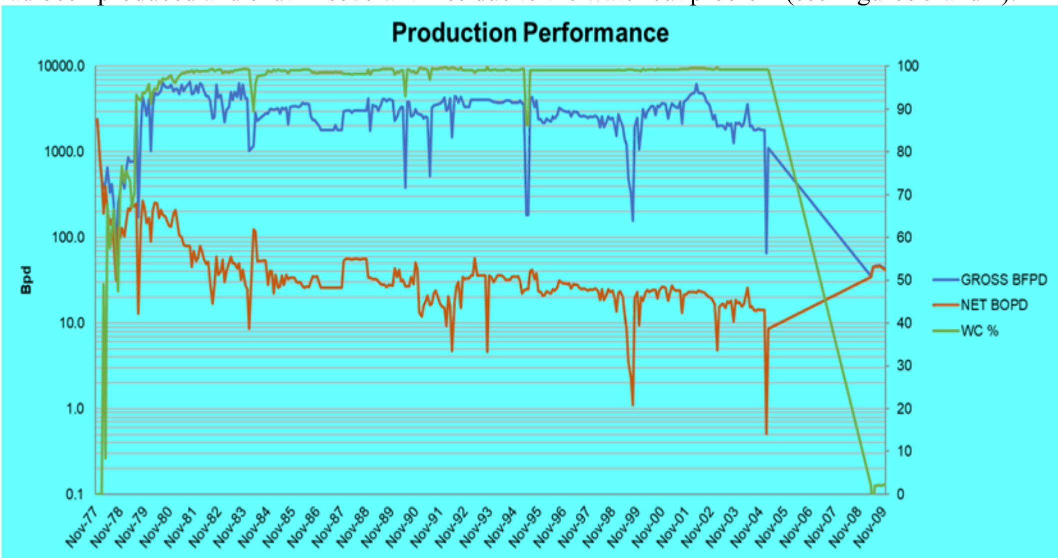


Figure 3. A production profile of Simson well (Purnomo et al., 2024)

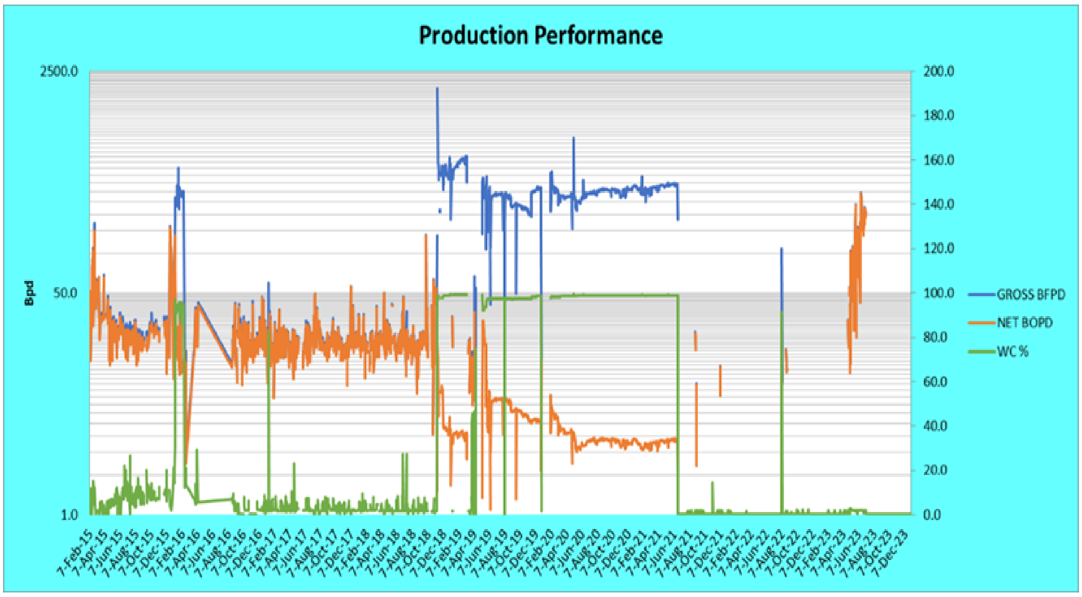


Figure 4. A production profile of Simson well (Purnomo et al., 2024)

Based on the well history data, Simson well had several challenges as follows.

1. It had a left production string i.e. artificial lift sucker rod pump (SRP). Hence, the possible production was through the annulus.
2. The production facilities were more than five kilometers away. The power supply for the sucker rod pump production operation utilized an onsite diesel engine generator (DEG). The necessary daily average fuel consumption of DEG was 113 liters. The production rate before shut-in was 3.4 BOPD. This well had not been produced since 21 June 2021 due to economic reasons.
3. The production pipe inspection data were taken in 2021 (Amiharja & Nata, 2021). The results revealed the pipes' remaining life (RL) was 13.5 years. However, the pipes were externally wrecked and their length was unable to reach the header manifold of the Main Gathering Station of the *Purnomo* oilfield. The risk of pipe leak was taken into consideration for performing an inspection, maintenance and further investment in new pipes; thus, an environmental damage could be prevented and an appropriately safe production operation could be applied.

Figure 5. Simson idle well in March 2023 (Purnomo et al., 2023)

Based on before-idle production observation data, if SRP was active, the annulus must have been fully closed since it was potentially flowing the crude oil. However, the produced oil contained sediment fine solid, and emulsions problem. Crude oil emulsions affected the quality of basic sediment water (BSW) and potentially degraded the quality of crude oil sales in the Main Gathering Station due to an absence of emulsions treatment process in the *Purnomo* oilfield.

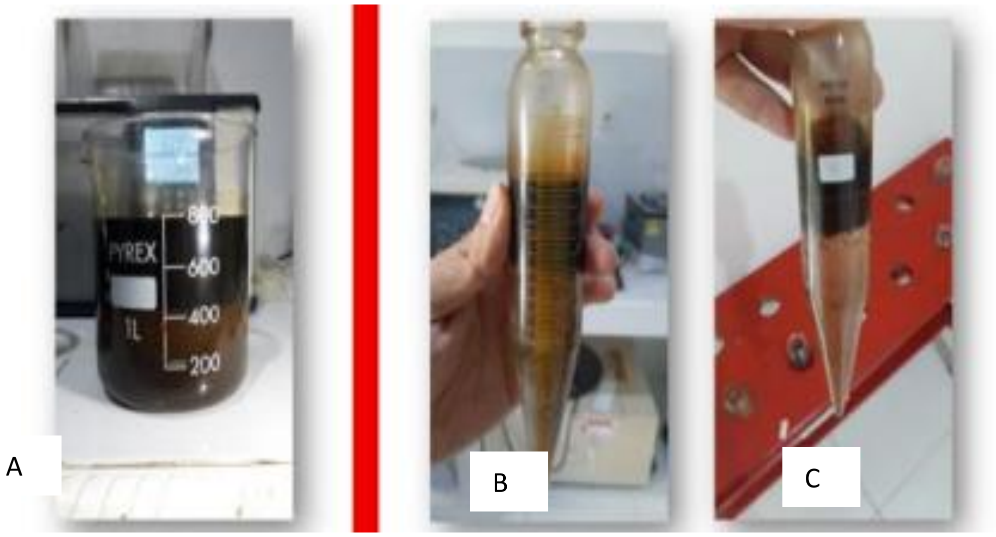


Figure 6. A: Oil in room temperature, B: Oil in water bath heating at 60 degrees celcius, C: Oil after centrifuge treatment

Table 4. Recover Oil Annulus Production Problems in Simson well in 2021 (Purnomo et al., 2023)

No.	Sumur	Tanggal Test	Uji Produksi hari ini			Low / Gain	Uji Sebelumnya			Gas	Metode Produksi
			Gross Bfpd	Nett Bopd	KA %		Gross Bfpd	Nett Bopd	KA %	Mscfd	PUMP (In)
1	SLW-A2	21-Jun-21	18,371.918	109.081	99.4	-4.2	18,085.166	113.296	99.4		Gas Lift
2	SLW-A7	21-Jun-21	1,696.538	13.233	99.2	-0.2	1,720.513	13.420	99.2		Gas Lift
3	SLW-C2X	21-Jun-21	187.592	132.628	29.3	0.0	187.639	132.661	29.3	220	SA / 36/64"
4	Recover SLW-C2X	20-Jun-21	-	-	-	-12.0	12.244	12.016	1.9		
5	SLW-E1	29-May-21	483.084	29.635	93.9	0.0	483.084	29.635	93.9	0	SRP
6	Recover SLW-E1	21-Jun-21	48.041	48.041	-	48.0	-	-	-	-	
7	SLW-F1X	21-Jun-21	182.818	2.011	98.9	-1.8	344.636	3.791	98.9		SRP
8	SLW-N1X	21-Jun-21	32.812	23.562	28.2	0.0	32.823	23.570	28.2	560	SA / 5 mm
9	Skimpit	21-Jun-21	6.912	6.783	1.9	-24.6	31.385	31.385	-		
Gross			21,009.715	364.974	98.3	5.2	20,897.490	359.774	98.3	780	

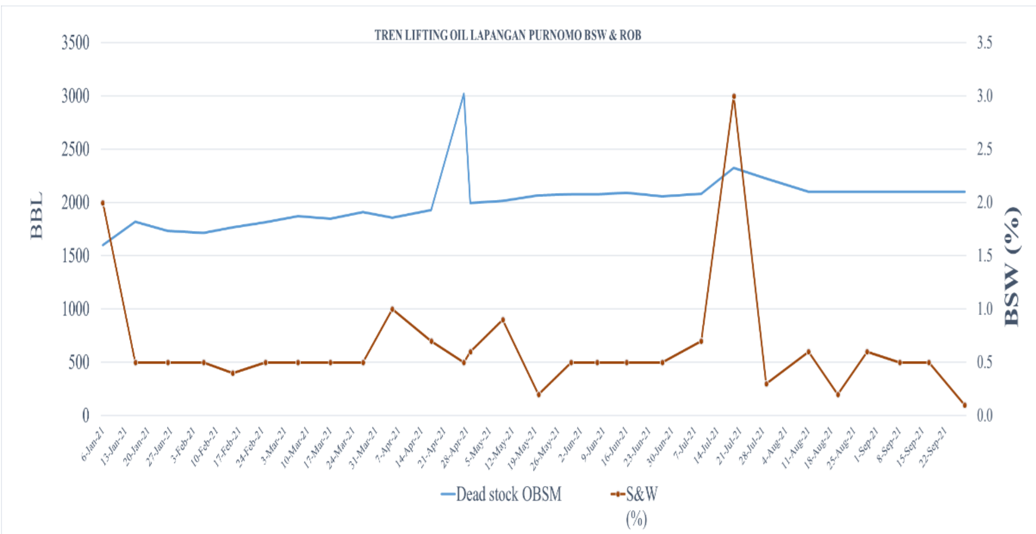


Figure 7. Lifting Quality Degradation Impacts in Purnomo Oilfield in 2021 (Purnomo et al., 2023)

Fine solid sediments were indicated as an impact of previous reactivation program in 2018. At the moment, there were fish i.e. a packer and a production string (Figure 8) which were left broken when the work over was performed. Nevertheless, if the work over was re-performed, the existing rig only had 150 HP and could not provide sufficient fishing tools. Thus, adequate investment and time were required to execute the work over program in the *Simson* well

In response to those problems, an effective production method applying low cost and low technical risks (Nnanna dan Ezekwugo, 2020)was necessary to do in the *Simson* well. Moreover, it should be able to elevate the crude oil production rate with the oil quality containing BSW >5% which was manageable by the Main Gathering Station of the *Purnomo* oilfield. With several shortcomings in the *Purnomo* oilfield and an absence of the Christmas tree in the *Simson* well, modifying idle equipment of the Christmas tree into a choke manifold was seen as a possible solution to optimize the oil production. Therefore, in 2023 the modified wellhead choke (Christmas tree) was prepared and installed in Simson well to flow and to control the fluid flow rate from the annulus to the Tank On Site (TOS). The utilization of Christmas tree was in complied with the API 6A standard for operational safety.

Figure 8. The Installation of Modified Choke Manifold in *Simson* well

After choke manifold was installed, the well was operated regularly. The cumulative production rate up to 31 Dec 2023 hit the jackpot at 10.961 bbl with the average BSW at 2%.

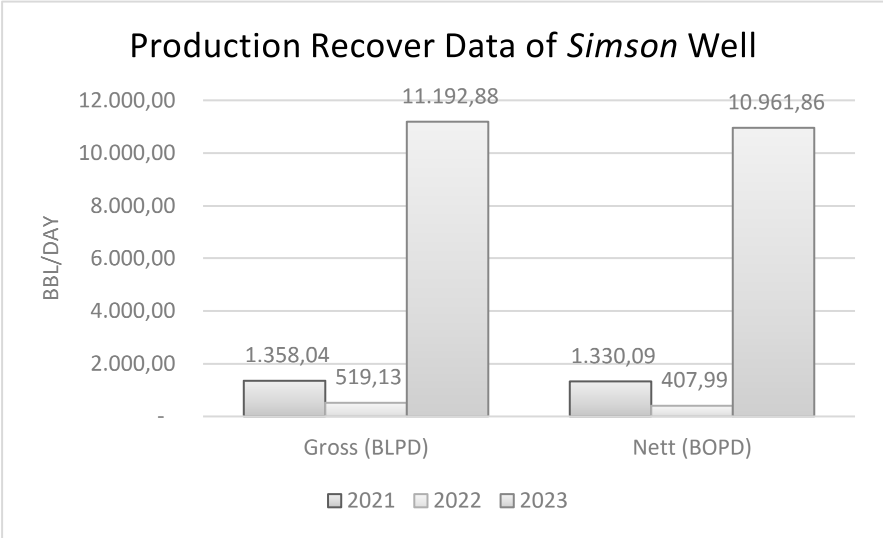


Figure 9. Production Recover of *Simson* Well

This modification resulted in the acceleration of the *Simson* well test without waiting for the provision of the new choke manifold. The next step was conducting a *Simson* well simulation program while estimating the optimum oil production of the *Simson* well. The matching test simulation resulting from the average daily production rate using artificial lift system (ALS) sucker rod pump (SRP) in June 2021 proved that before the reactivation the *Simson* well tended to have a high water cut at 97% simulation (Table 5).

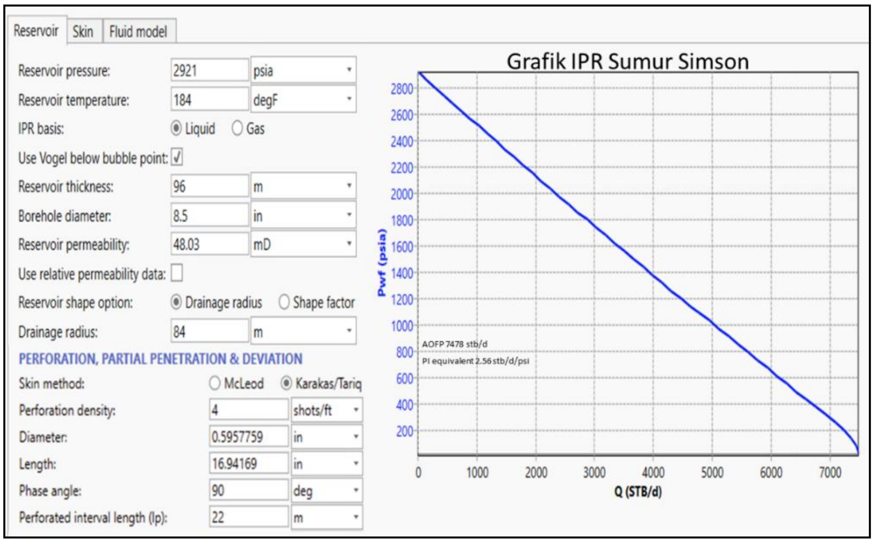


Figure 10. The Index Productivity Rate (IPR) of *Simson* well

Table 5. An Evaluation of Matching Test Simulation Model VLP ALS SRP Using Data of Simson Well's Test

Parameter	Data Test (Jun 2021)	Data Pipesim	Diff
Liquid, blpd	338	337.57	-0.11%
Oil, bopd	10.73	10.70	-0.27%
Water cut, %	96.83	96.83	0.01%

The galat value in the matching test data was near to 0% serving as a sufficient reference for evaluating the *Simson* well. An interpretation analysis of the Chan Plot diagram was then conducted to confirm the water cut rise from the previous matching test data results.

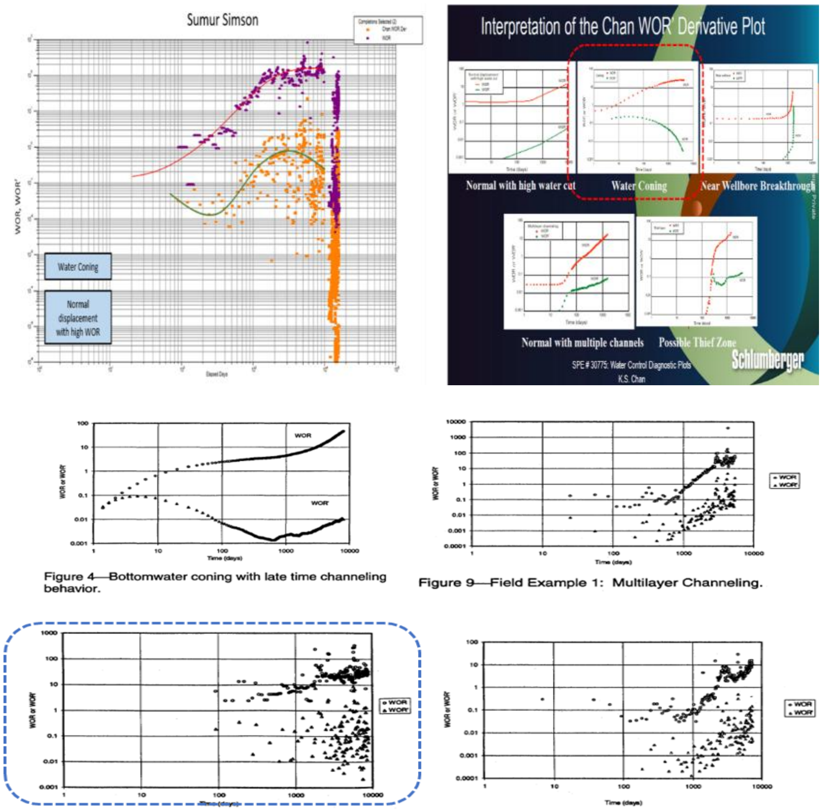
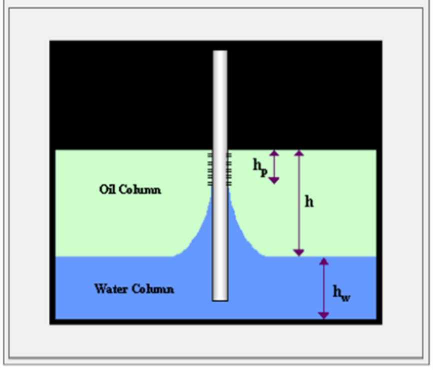


Figure 11. A Diagnostic Chan Plot Interpretation from Simson Well

The Chan Plot analysis of the *Simson* well depicted that water coning was likely to occur since the well naturally had displacement with a high water-oil ratio (WOR) resulting from its reservoir water drive mechanism. Hence, controlling the liquid flow rate under a critical rate was necessarily considered. The next step was calculating the critical oil rate in the *Simson* well. The results of Excel correlation simulation are shown in Figure 12.

Oil density, rho_o	0.873	gr/cc
Water density, rho_w	1.018	gr/cc
Permeablity horz, kh	48.0	md
Permeablity vert, kv	37.0	md
Oil Column thickness, h	275.6	ft
Perf interval, hp	72.2	ft
Water Column thickness, hw	39.4	Ft
Oil visc, mo	1.717	cp
Oil form vol factor, Bo	1.069	RB/STB
Static press, P'ws	2,921	psi
Flowing press, Pwf	2,682	psi
Mobility Ratio, M	0.70	
Porosity	0.16	Percent
Conate water saturation	0.30	Fraction
Residual oil saturation	0.20	Fraction
Wellbore radius, rw	0.350	ft
Drainage Area	7	Acres
Drainage Radius, re	322	ft
Original Oil in Place, N	1,670,085	STB

Horizontal Well **Vertical Well**



Critical Flow

Craft and Hawkins	237.8	BFPD
Meyer, Gardner and Pirson	60.2	BFPD
Chaperon	201.1	BFPD
Schols	114.0	BFPD
Hoyland	175.4	BFPD
Cheirichi	244.3	BFPD

Figure 12. An Evaluation of Simson Well's Critical Rate

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To prevent water coning or water cut drastic rise, the critical rate of the *Simson* well should be at an average 172 BFPD from these six different correlations. The Meyer, Gardner & Pirson formula i.e. 60.2 BFPD was used as a reference of production optimization of the *Simson* well by applying the choke performance method.

3.2. Flow Coefficient Calculation Analysis and Production Optimization of Simson Well

The *Simson* idle well reactivation had successfully improved the production rate in 2023 yet the well pressure significantly dropped as well. It might be due to the excessive flow rate and its reservoir water drive mechanism. As a further action, the second stage adjustable choke was added. Determining the optimum flow coefficient by applying the modified choke manifold was necessary to maintain stable production in the *Simson* well. The flow coefficient analysis and production optimization of the *Simson* well were performed by analyzing the choke performance simulation and the test validation. The following data were the analysis results.

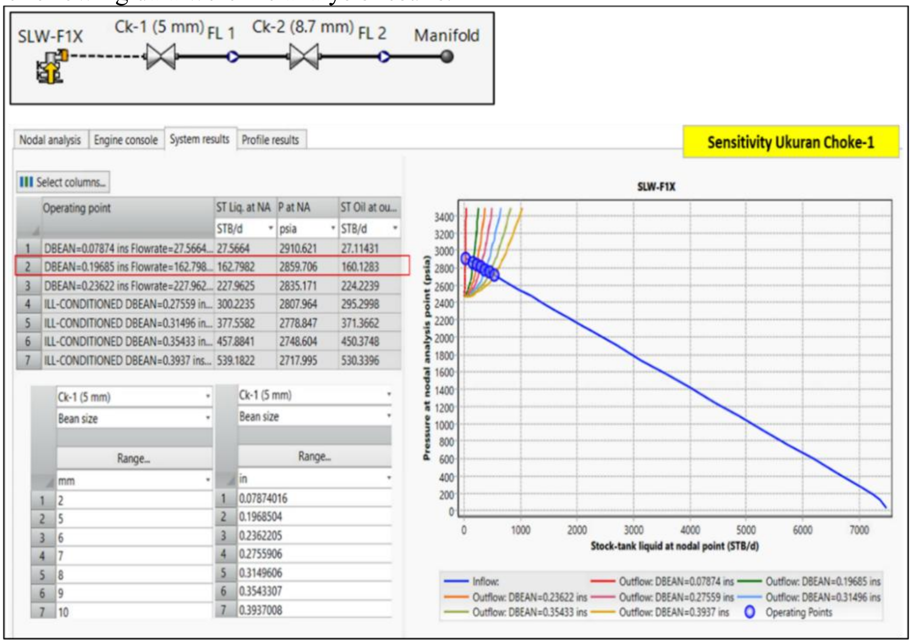

Figure 13. The choke performance simulation by using the modified choke manifold in *Simson* well

The analysis results of the first stage choke performance simulation revealed if the installed choke size was bigger than 5 mm, the produced oil rate (Qo) would be more than the critical rate and the potential risk of water coning could occur based on the average correlation score 6 (<172 BLPD). If the installed choke size was smaller than 5 mm, the produced oil rate (Qo) would not be optimum (low rate) or below the correlation critical statement <60 BLPD.

The analysis results of second stage choke performance simulation depicted that if the installed choke was smaller than 22/64 inch or 8.7 mm, the produced oil rate would not be optimum (low rate). If bigger than 8.7 mm, there was no impact on the flow rate rise (Figure 14). In conclusion, the 5-mm installed choke at the first stage and the 8.7-mm choke at the second one were chosen as a reference to determine the coefficient flow discharge (Cd) in *Simson* well.

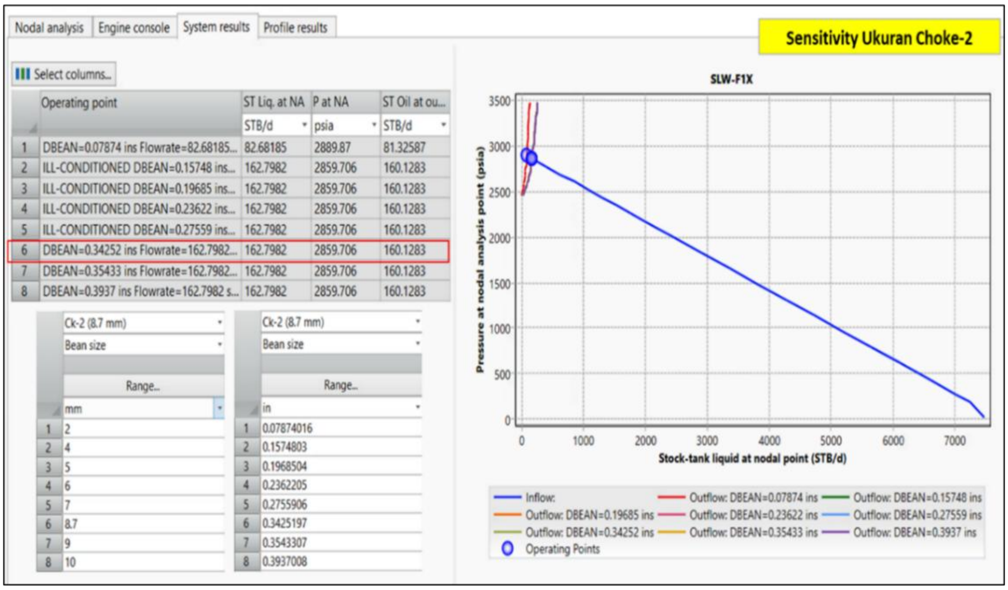

Figure 14. The Analysis of Sensitivity Choke at Stage 2

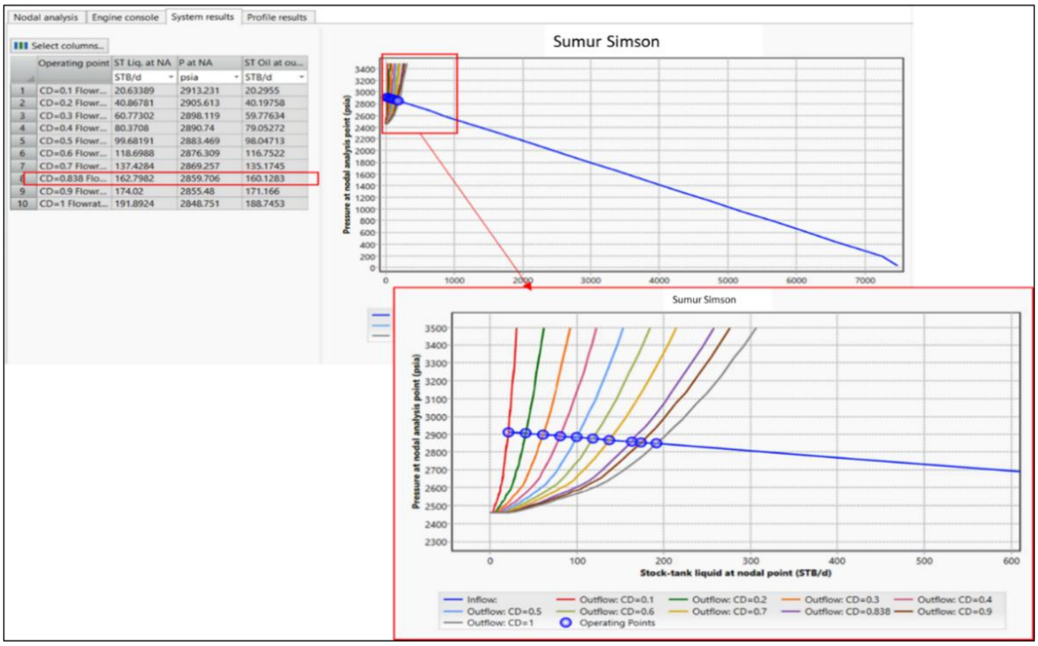

Figure 15. The Simulation of Sensitivity Flow Coefficient (Cd) in Simson Well

The sensitivity simulation value of flow coefficient (Cd) resulted from the choke installation was calculated to estimate the appropriate flow rate which was in line with the data of the *Simson* well test. The Cd simulation showed the flow rate < the average critical rate of the *Simson* well was Cd 0.838 with Q 160.13 STB/D. This value was in line with Guo et al (2017) explaining that the accurate flow coefficient played an important role in the choke manifold planning and operation since it could control the fluid flow rate and pressure. Furthermore, this value was selected as a reference of research and simulation data due to following reasons:

a. The well flow rate < the average critical rate.
b. The lowest available choke was 5mm at the first stage.
c. The flow rate of second stage choke if its size was below 8.77 mm, the flow rate would not be optimum.

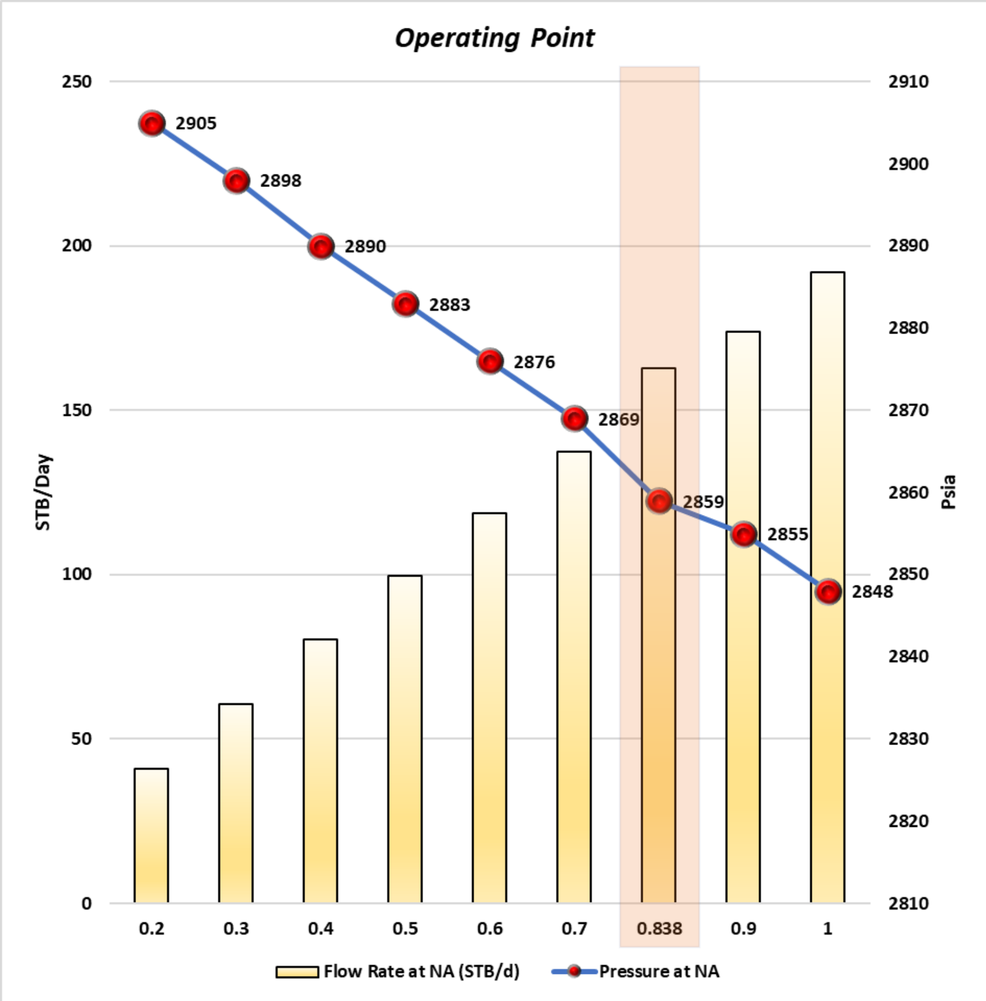

Figure 16. The Operating Point Flow Coefficient of Simson Well

The next step was performing a well-validation test utilizing the modified choke manifold. The validation value was as follows.

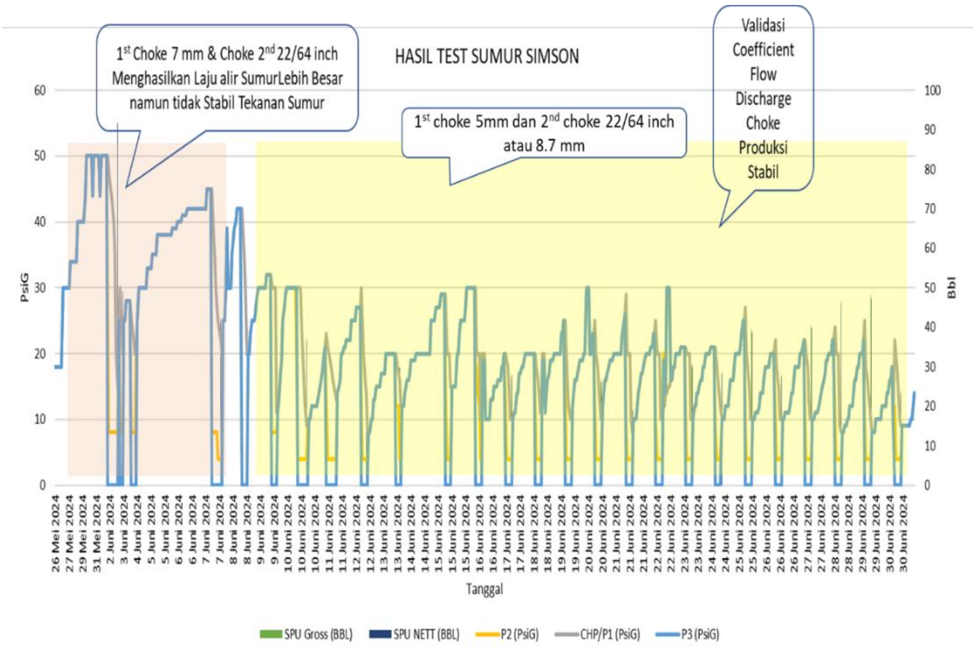

Figure 17. The production test results of *Simson* Well

Based on the validation of the well production test, the first stage choke at 7 mm in size was confirmed to have a significant impact on the oil rate at 92 bbl for five hours. Nevertheless, it resulted in lengthening the well pressure recovery period. The *Simson* well could not produce oil in 24 hours consecutively into Tank On Site (TOS) due to the declined pressure within the parameter of a stable casing pressure as in Figure 17. Therefore, to optimize the production, the *Simson* well was produced based on time or intermittent natural flow.

Table 6. Validation Results of Production Tests of Simson Well

Tanggal	Rate per 5 Jam			Rate per 24 Jam		
	SPU Gross (BBL)	SPU NETT (BBL)	WC %	Ql blpd	Qo, bopd	WC %
2 Juni 2024	92	92	0.31%	441	439	0.31%
3 Juni 2024	49	49	0.27%	236	236	0.27%
4 Juni 2024	26	26	1.91%	125	123	1.91%
7 Juni 2024	42	41	1.91%	203	199	1.91%
8 Juni 2024	43	42	1.91%	207	203	1.91%
9 Juni 2024	38	37	1.91%	182	178	1.91%
10 Juni 2024	37	36	1.91%	178	175	1.91%
11 Juni 2024	22	22	2.10%	107	105	2.10%
12 Juni 2024	21	20	2.10%	100	98	2.10%
13 Juni 2024	30	30	0.30%	144	143	0.30%
15 Juni 2024	26	25	2.10%	123	121	2.10%
16 Juni 2024	27	26	1.91%	129	127	1.91%
17 Juni 2024	28	27	1.81%	134	132	1.81%
18 Juni 2024	22	22	2.06%	107	105	2.06%
19 Juni 2024	20	20	2.10%	98	96	2.10%
20 Juni 2024	27	26	2.07%	129	126	2.07%
21 Juni 2024	19	19	2.07%	92	90	2.07%
22 Juni 2024	27	26	2.07%	128	126	2.07%
23 Juni 2024	31	30	2.07%	147	144	2.07%
24 Juni 2024	29	28	2.07%	137	134	2.07%
25 Juni 2024	39	39	1.91%	190	186	1.91%
26 Juni 2024	28	27	1.91%	134	131	1.91%
27 Juni 2024	41	40	1.91%	195	191	1.91%
28 Juni 2024	47	46	1.89%	224	220	1.89%
29 Juni 2024	48	47	1.91%	231	227	1.91%
30 Juni 2024	24	23	1.91%	114	112	1.91%
Average Rate	**34**	**33**	**1.64%**	**163**	**160**	**1.64%**

These production tests and simulation results proved that the *Simson* well could flow oil naturally with a low rate yet an adequate net produced oil; thus, simple water treatment was required in the Main Gathering Station of the *Purnomo* oilfield. The validation simulation model of flow coefficient towards the matching test gained a galat value at almost 0% (Table 7).

Table 7. Data of matching test flow coefficent model evaluation with Cd 0.838

Parameter	Production Test Data	Pipesim Model	Differensial %
Rate liquid (Ql), BLPD	163	162.80	-0.04%
Rate oil (Qo), BLPD	160	160.13	-0.04%
Water cut, (%)	1.64	1.64	0.00%

The evaluation of Simson well's production optimization results implementing the choke performance had enabled to maintain water cut at between 1-2% since June 2024 up to the present (30 September 2024). The average production rate of the *Simson* well by intermittent flow i.e. 5-operation hours and 19-shut in well hours were 34 blpd, 33 bopd, *water cut* 1.64%. The intermittent flow operation had an impact on the well pressure graph which tended to rise from 20 Psig to 60 Psig.

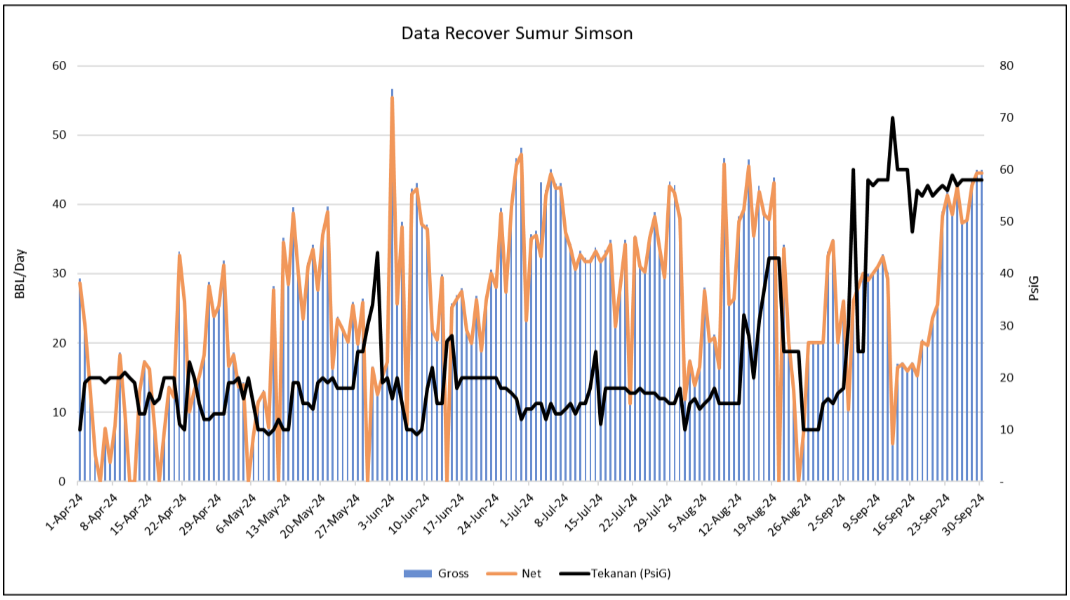

Figure 18. *Simson* Idle Well Oil Production Graph Using the Modified Choke Manifold

The further step was comparing the *Simson* well production forecast as in Table 5 and Table 7 by using Decline Curve Analysis (DCA). The forecast production target when applying intermittent flow method was 10 BOPD while when applying ALS SRP was 3 BOPD. The Production Share Contract (PSC) between SKK MIgas and PT Pertamina EP ends in 2035. Results as follows (Figure 19 up to 21).

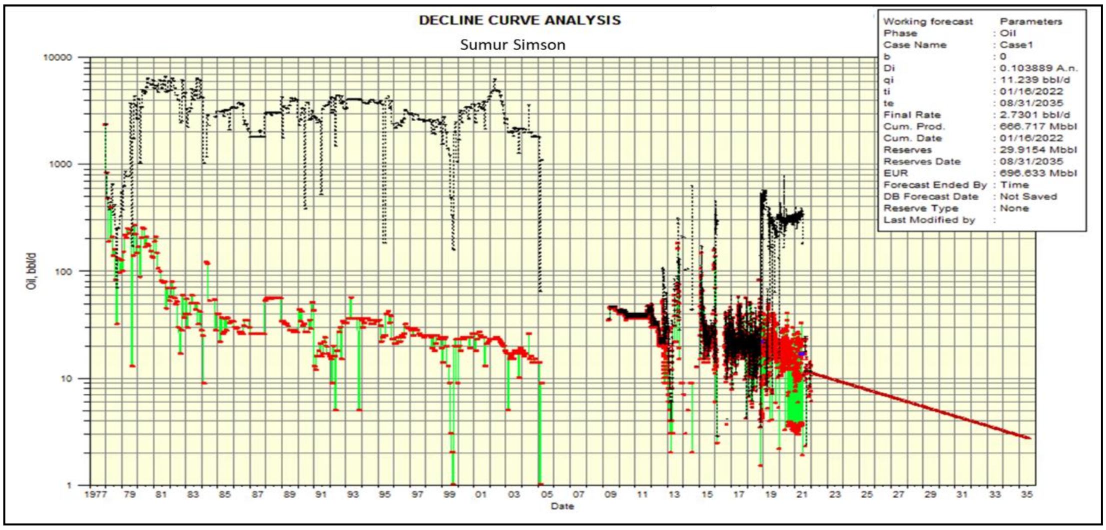

Figure 19. Forecast Production of *Simson* Well Using ALS SRP Method

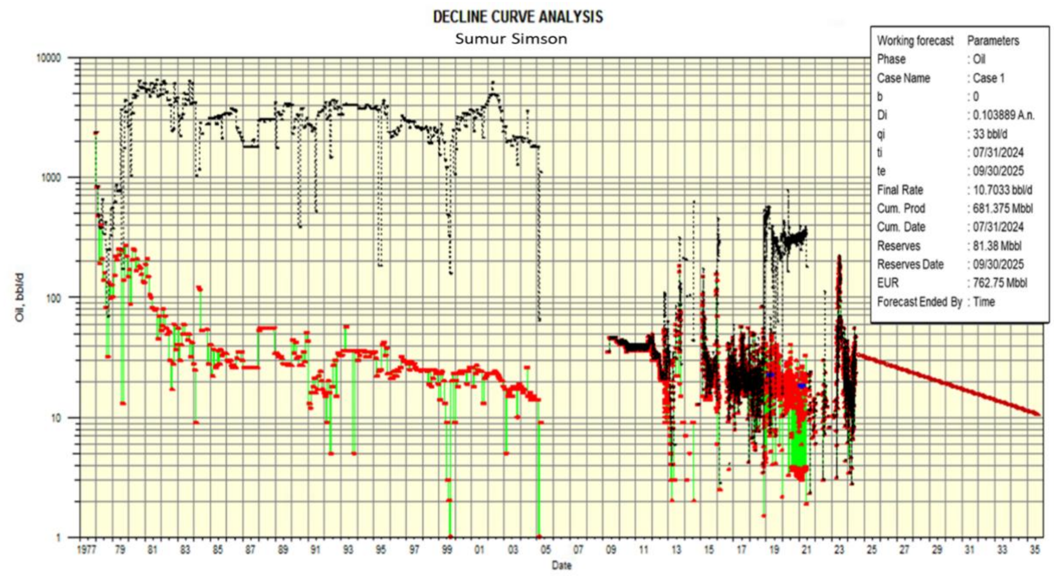

Figure 20. Forecast Production of *Simson* Well with Natural Intermittent Flow Using Choke Manifold

These graph differences explained the forecast production comparison of the *Simson* well i.e.:

1. The well production applying ALS SRP tended to generate a high water cut. As a result, the oil gained by the end of PSC would be 30 MSTB.
2. The well production applying the choke performance offered a low water cut. If the production trends could be maintained, the potential cumulative output by the end of PSC in 2035 would be 81 MSTB.

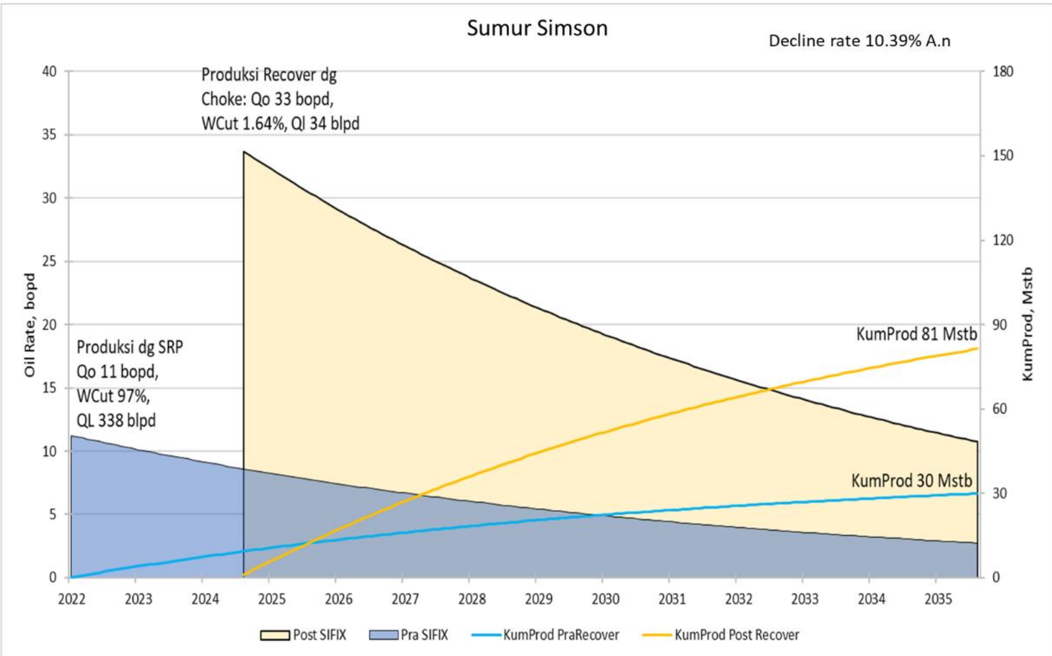

Figure 21. Comparisons of Forecast Production Results of Simson Well Applying ALS SRP versus Natural Intermittent Flow with the Choke Manifold

The production performance of the *Simson* well with natural intermittent flow/periodic recovery of 5-hour production and 19-hour shut-in well was proven to maintain the production rate over the economic limit and below the critical oil rate.

IV. CONCLUSION

As the potential idle well to be reactivated, the *Simson* well face several challenges such as its remote location, inadequate production facilities, oil emulsions, and significant water cut rise. Thus, the effective reactivation strategy of this well had to produce free-emulsion crude oil, reduce production costs, and have low technical risks.

The trial test and pressure gauge replacement on 27 March 2023 depicted that the *Simson* well could be reactivated as a rig-less and natural flow since its annulus pressure was 380 psi and recovery trial to Tank on Site (TOS) for forty-seven minutes was 78 barrel and BSW 0.1%. Emulsions were absent as long as the pressure was stable. A rig-less and naturally flowing well was a strategy to minimize the cost.

To meet the goal of the low cost and technical risks reactivation strategy, the idle Christmas tree was modified into the choke manifold. the modified wellhead choke (Christmas tree) was installed in the *Simson* well to flow and control the fluid flow rate from the annulus to the Tank On Site (TOS). The utilization of Christmas tree complied with the API 6A standard for operational safety. After the choke manifold was installed, the well was operated regularly. The cumulative production rate up to 31 Dec 2023 hit the jackpot at 10.961 bbl with the average BSW at 2%.

Despite the significant increase of the production rate, the pressure dropped considerably caused by the reservoir water drive mechanism. The Chan plot analysis also showed that this mechanism possibly triggered the presence of water coning since the well naturally had displacement with high water-oil ratio (WOR). Hence, controlling the liquid flow rate under a critical rate was necessarily considered. Using the Meyer, Gardner and Pirson formula as a reference, the critical rate of Simson well was 60.2 BFPD.

As a further action, the second stage adjustable choke was added into the modified choke manifold. Determining the optimum flow coefficient by applying the modified choke manifold was necessary to maintain stable production in the *Simson* well. The optimum flow coefficient for the *Simson* well production optimization was Cd 0.838. Added to this, the optimum production method utilizing the choke manifold was by installing the first 5-mm choke and the second 8.7-mm choke. The average daily production rate of Simson well by intermittent flow i.e. 5-operation hours and 19-shut in well hours were 34 blpd, 33 bopd, *water cut* 1.64%. This production rate was already optimum since it was beyond the economic limit of 10 BOPD and below the oil critical rate of 60 BFPD.

The optimum production forecast of the *Simson* well can be achieved if the production can be stable under the critical rate. By the end of the PSC contract in 2035, the production forecast value using the choke manifold can reach 81 MSTB – 51 MSTB higher than using SRP method.

For further research, a correlation between a subsurface pressure and flow rate should be analyzed to determine a precise flow coefficient and choke sizes and investigate whether the flow coefficient is stable for the *Simson* well production.

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REFERENCES

Amiharja, C. & Nata, W. (2021). *Laporan inspeksi dan evaluasi pipa penyalur PT PERTAMINA EP CEPU Zona 14 Papua Field*. Jakarta.

Batohie, G. (2016, June). Mature field rejuvenation by reactivation of idle wells in Petrotrin's Land Acreage. In the SPE Trinidad and Tobago Section Energy Resources Conference (SPE-180792-MS).

Brown, K. E. & Beggs, H. D. (1977). *Artificial lift methods Kermit Brown* (Vol. 1). PennWell Publishing Company.

Chan, K. S., Dowell, S., & Member, S. (1995, October). Water Control Diagnostic Plots. In the SPE Annual Technical Conference and Exhibition (SPE 30775).

Guo, B., Lyons, W.C. & Ghalambor, A. (2007). *Petroleum production engineering: A computer-assisted approach*. Elsiver Science & Technology Books.

Nnanna, E., & Ezekwugo, J. (2020, August). Uptime improvement for selected intermittent oil producers. In the SPE Nigeria Annual International Conference and Exhibition. (SPE-203696-MS).

Purnomo, S., Wahidiansyah, A., Kembayong, D., Zachary, M., Lengkong, F., Ardiansyah, D., Pakanan, D., Mulyadi, & Nugraha, M. (2024). *Risalah Sharing Knowledge-Meningkatkan Produksi Oil dari Idle Well Lapangan Salawati dengan TCT (Tandem Choke Tube) di PT PERTAMINA EP Cepu Zona 14 Papua Field*. Sorong.

Purnomo, S., Wahidiansyah, A. N., Kembayong, D., Lengkong, F., Tripurwanto, R., Reza, H., & Zachary, M. (2023). *Risalah Sharing Knowledge-Penambahan Produksi Minyak Sebesar 9000 BBL melalui Reaktivasi Idle Well (REWEL) SLW F1X di Lapangan Salawati PT. Pertamina EP Cepu Zona 14 Papua Field*. Sorong.

Putra, B. P., & Kiono, B. F. T. (2021). Mengenal Enhanced Oil Recovery (EOR) Sebagai Solusi Meningkatkan Produksi Minyak Indonesia. *Jurnal Energi Baru Dan Terbarukan*, *2*(2), 84–100. https://doi.org/10.14710/jebt.2021.11152

Putra, G. R. (2022). *Pemanfaatan idle well sebagai program kerja reaktivasi dengan metode multi screening dan rencana optimasi sucker rod pump pada lapangan Sangasanga* (Master's thesis). Universitas Pembangunan Nasional Veteran Yogyakarta, Magister Teknik Perminyakan, Fakultas Teknologi Mineral, Indonesia.

Purnomo, S. (2024). *Penentuan flow coefficient menggunakan metode choke performance dalam upaya optimasi produksi sumur Simson di lapangan Purnomo PT Pertamina EP Cepu Zona 14 Papua Field* (Master's thesis). Universitas Pembangunan Nasional Veteran Yogyakarta, Magister Teknik Perminyakan, Fakultas Teknologi Mineral, Indonesia.

Rahuma, K. M., Mohamed, H., Hissein, N., & Giuma, S. (2013). Prediction of Reservoir Performance Applying Decline Curve Analysis. *International Journal of Chemical Engineering and Applications*, 74–77. https://doi.org/10.7763/ijcea.2013.v4.266

Rukmana, D., Kristanto, D., & Aji, V. D. C. (2020). *Teknik reservoir: Teori aan aplikasi*. Yogyakarta, Pohon Cahaya.

Widianti dkk. (2023). *Pre-feasibility study optimasi pengembangan lapangan Salawati kompleks fase 2*. Jakarta.