Reactivation Strategy of Old Oil Wells to Increase Production and Society Welfare

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ABSTRACT

Indonesia has old oil wells that are still potential for reactivation. The efforts undertaken so far are still not optimal, the production is still relatively low, the influence on the environment, and not yet maximally able to provide benefits to the welfare of the community. The obstacles faced are the absence of old wellbore maps that are still potentially reacted, yet no suitable technology has been found for the conditions of old wells that meet HSE standards, but are also relatively inexpensive.

This research is intended to involve old wells that are still potential to reactivate especially in the field of Gabus, then evaluate people's perceptions and attitudes toward the development of old well management, and develop technologies that can be used effectively and efficiently..

The method of SWOT analysis to formulize grand strategy, inventory of potential uses of geoelectric method, modification and development of RIG technology and pumps, development of governance by building stakeholder cooperation, financial analysis by investment feasibility analysis, economic and social studies supported by a public perception and attitude questionnaire. The results focus on four old wells to reactivation, the technology that can be used for exploitation is the mobile RIG ESP and ESP Pump. Manage with the pattern of cooperation between technology provider, BUMD (regional owned enterprise), and society. The results of the feasibility analysis of the business resulted in a feasible conclusion both from the financial, economic and social aspects.

Keywords: Reactivation strategy, RIG ESP, ESP Pump, Old well management

1. INTRODUCTION

The potential of old wells in the State of Indonesia is a thing that has not been optimally utilized, whereas the drastic reduction of oil prices resulted in exploration and exploitation activities decreased so as not to increase reserves and production that continue to experience production decline in Indonesia. The condition of the old well concession right now also some old well field less attention to environmental conditions as a result of conflict with the community around the old well field about environmental pollution, this should be a concern for the parties who will do the old wells.

Therefore, it is necessary to utilize the old wells to increase the production of petroleum in Indonesia. Certainly with the condition of oil prices that come down drastically, the need for an innovation for the management of old wells in Indonesia to be economical and can provide multie ffect to the community around the well field old.

Several regulations have been changed in relation to the management of old wells. Among them is the Regulation of the Minister of Energy and Mineral Resources (ESDM) No. 1 of 2008 which replaces the Decree of the Minister of Mines and Energy No. 1285.K / 30 / M.PE / 1996 concerning the guidelines of petroleum mining concessions on old wells that are not suitable with the development of laws and regulations in the field of oil and gas.

According to the Regulation of the Minister of Energy and Mineral Resources No. 01 of 2008, the definition of the old wells is oil wells drilled before 1970 and once produced and located on unprofitable fields in a working area bound by Cooperation Contracts and not put into operation by the Contractor. The government seeks to optimize petroleum production as well as old wells. The management of old wells is preferred by local companies such as BUMD and KUD, with the aim of improving the welfare of surrounding communities.

Therefore, there needs to be an innovation to optimize the management of old wells. Innovation starts from management concept to technology used for more efficient, effective and economical management.

LPPM UPN "Veteran" Yogyakarta has been doing research & development from 2003 until 2016. This Appropriate Technology Innovation has had operation license and tried to reactivate suspended wells in PT. PERTAMINA EP Asset 4 Field Cepu.

Based on the evaluation of the use of this technology, RIG is still lacking, therefore the researcher performs a modification in order to produce efficient and effective technology for the management of old wells RIG ESP (RIG Efficient Professional Smart) and ESP Pump (Efficient Professional Smart Pump). The research road map is shown in **Figure 1.**

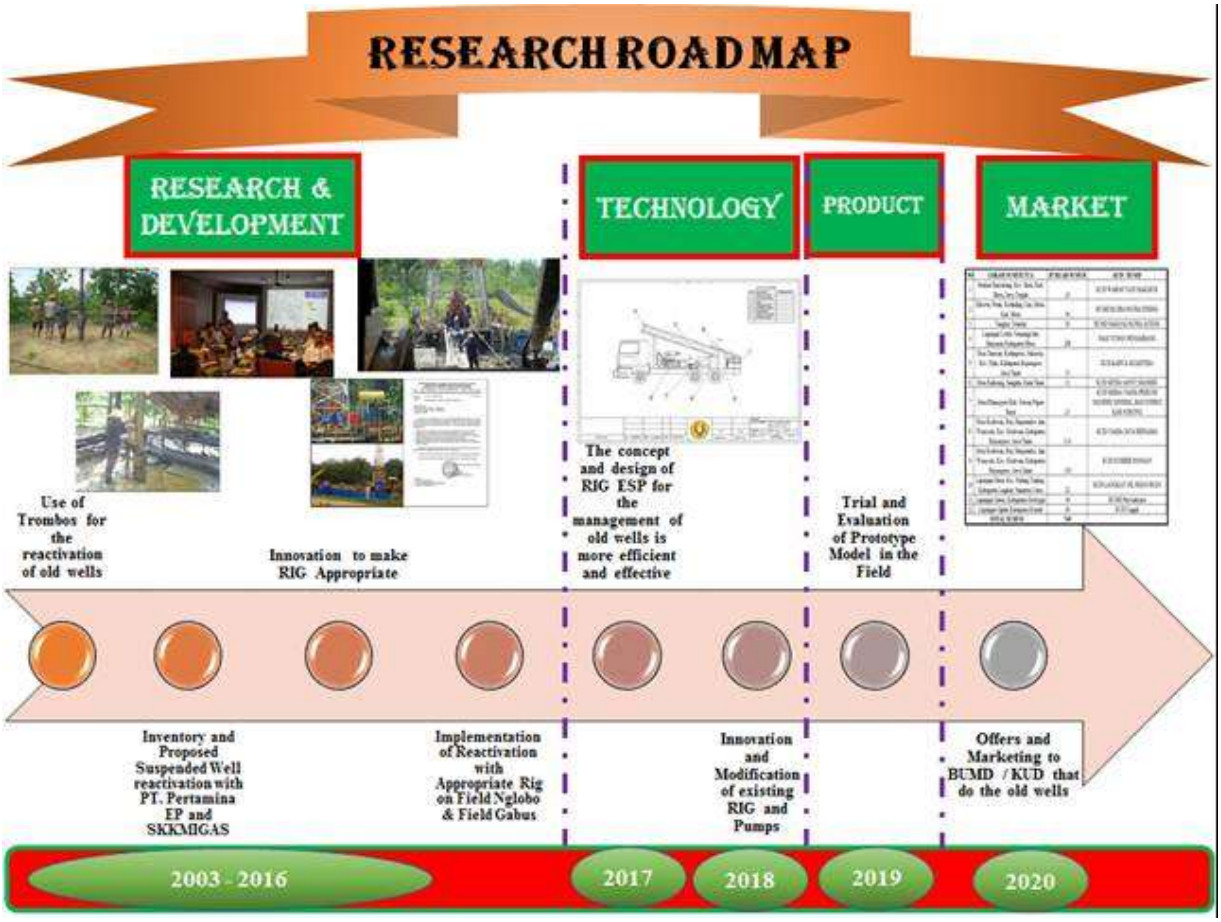

Figure 1. Research Roadmap

2. RESEARCH METHODOLOGY

2.1. Inventory of potential old wells subsurface and surface

Conduct an inventory of technical data of old wells such as surface-visible casing by way of survey to field and doing geoelectric work to get subsurface data.

2.2. Modified Technology

Technology for the Efficiency of Old Wells. The technology in question here is a technology that has been used for re-opening and production of old wells in Indonesia, as already done in Wonocolo field, Ledok field by the community around the old well field.

For the management of old wells can now be divided into two types, which distinguish this type of management is the technology that supports it, namely:

1. Traditional Technology
2. Semi-Traditional Technology

2.3. Management of Old Wells use SWOT

According to Ferrel and Harline (2005), the function of the SWOT Analysis is to obtain information from the analysis of the situation and separate it in the internal issues (strengths and weaknesses) and external issues (opportunities and threats). The SWOT analysis will explain whether the information indicates something which will help the company achieve its goals or provide an indication that there are obstacles to be faced or minimized to meet the desired income.

2.4. Financial of Old Wells

For the exploitation of the old well not the revenue share but the rewards of services provided by PT. Pertamina EP, for the amount of service fee provided for 70% of ICP field (shown in **Figure 2**).

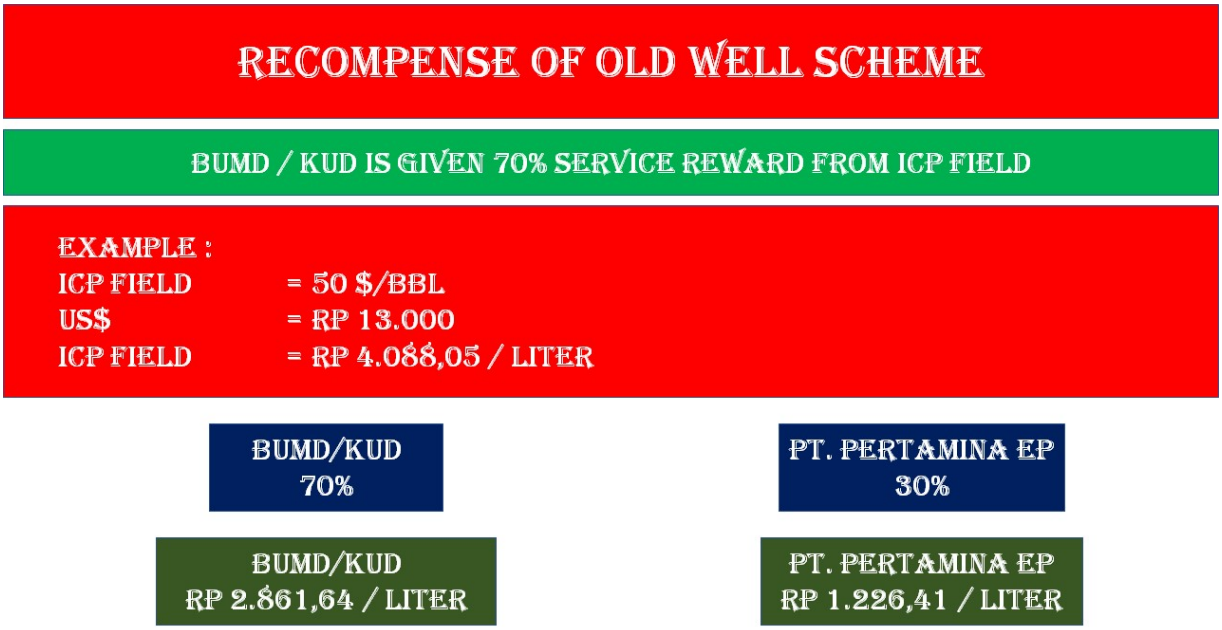

Figure 2. Recompense of Old Well

Based on the analysis of the parties involved, competence / capacity, contribution and compensation will be made some profit-sharing schemes and given examples of calculations.

3. RESULT AND DISCUSSION

3.1. Inventory of potential old wells subsurface and surface

Field Survey of Old Wells. The survey conducted to find out the condition of the old well surfaces and estimate the well wells old well based on existing data. One example of the old well documentation is shown in **Figure 3.**

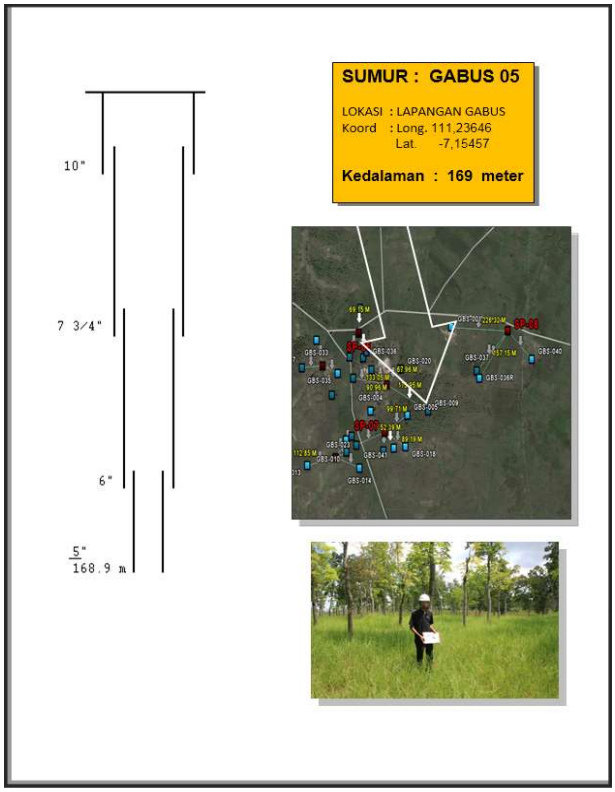

Figure 3. Survey results and cross-section of GBS-05 Wells

The geoelectric activity to know the subsurface condition based on the geoelectric estimation around Gabus Field oil wells obtained the resistivity range of 0.23 - 93.36 Ωm, with an estimated depth of 375 meters. From the obtained resistivity value and based on existing lithologic conditions, it can be interpreted as **Table 1.**

Table 1. Value of Resistivity and Litology

Resistivity Value Ωm	Lithologi
0 - 5	Clay with brackish water (salty)
5 - 10	Clay of sand
10 - 100	Sand clay

From the resistivity columns obtained from the measurement, after being interpreted as lithologically and then correlated between points, so as to show the spread of layers of lithology both vertically and laterally in two dimensions, the correlation results in a subsurface geological section based on resisitivity values.

Based on predicted data showing very small resistivity at depths between 80 meters and 90 meters, it can be interpreted that the possibility at that depth is the contact between oil with brine (OWC_1) shown in **Figure 4.**

The second reservoir layer is a layer of sand of clay with a thickness of more than 250 meters and it is suspected that at a depth between 230 meters to 240 meters there is contact between oil with brine (OWC_2) shown in **Figure 5.**

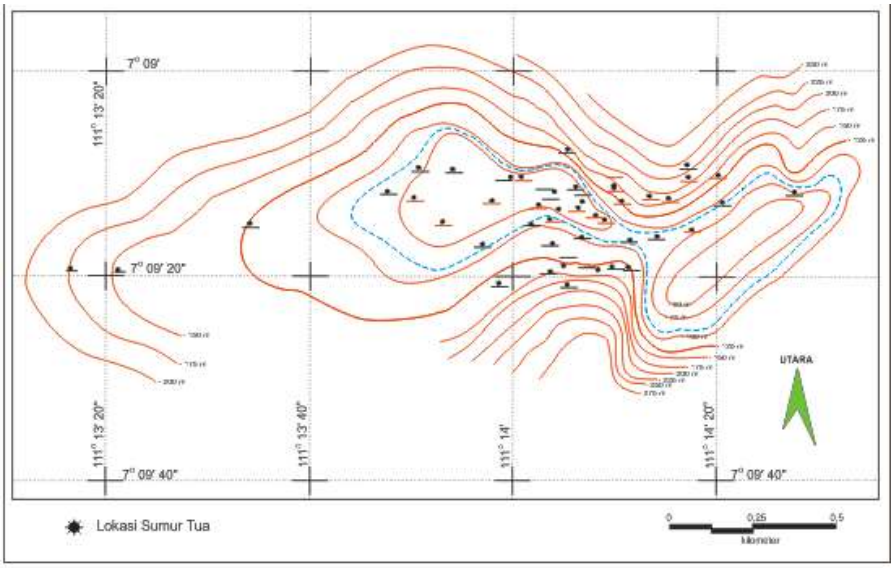

Figure 4. Top Structure of Upper Reservoir

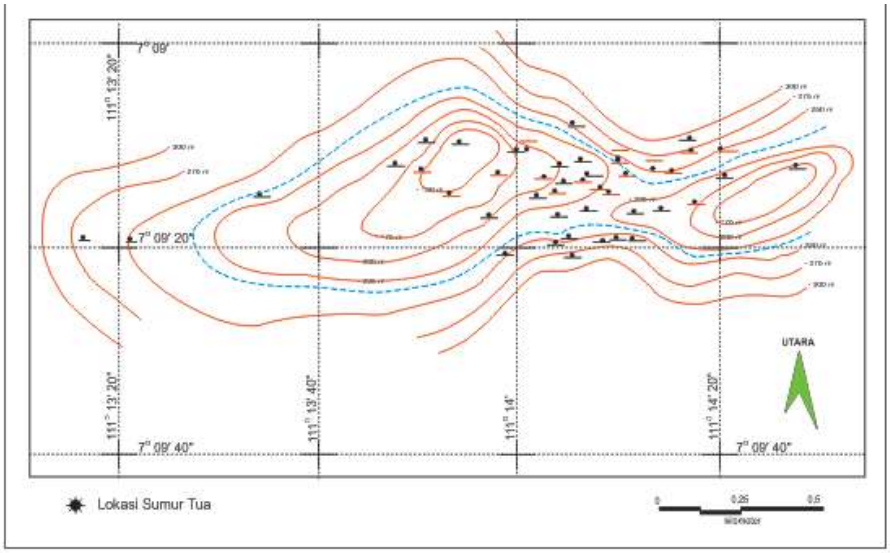

Figure 5. Top Structure of Lower Reservoir

From the potential side based on the Dutch-era map that has been converted. If based on the high final production rate there are two wells GBS-10 and GBS-28 wells (indicated by yellow circle line) in Layer I, but if the result is integrated from the OWC map, the two wells are outside OWC, therefore at this phase of reactivation I we propose an old well in the top structure (indicated by a green circle line). The integration of this evaluation is shown in **Figure 6.**

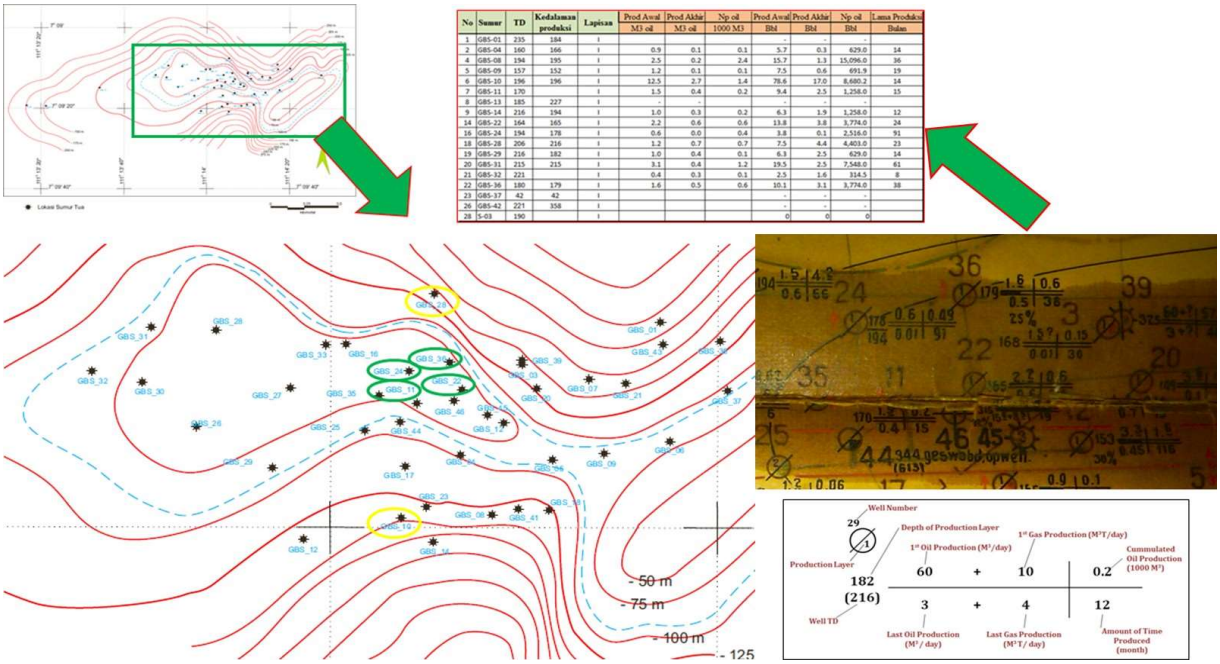

Figure 6. Integration of data for evaluation of potential old wells

3.2. Modified Technology

The development of technology use for the management of old wells is shown in **Figure 7.**

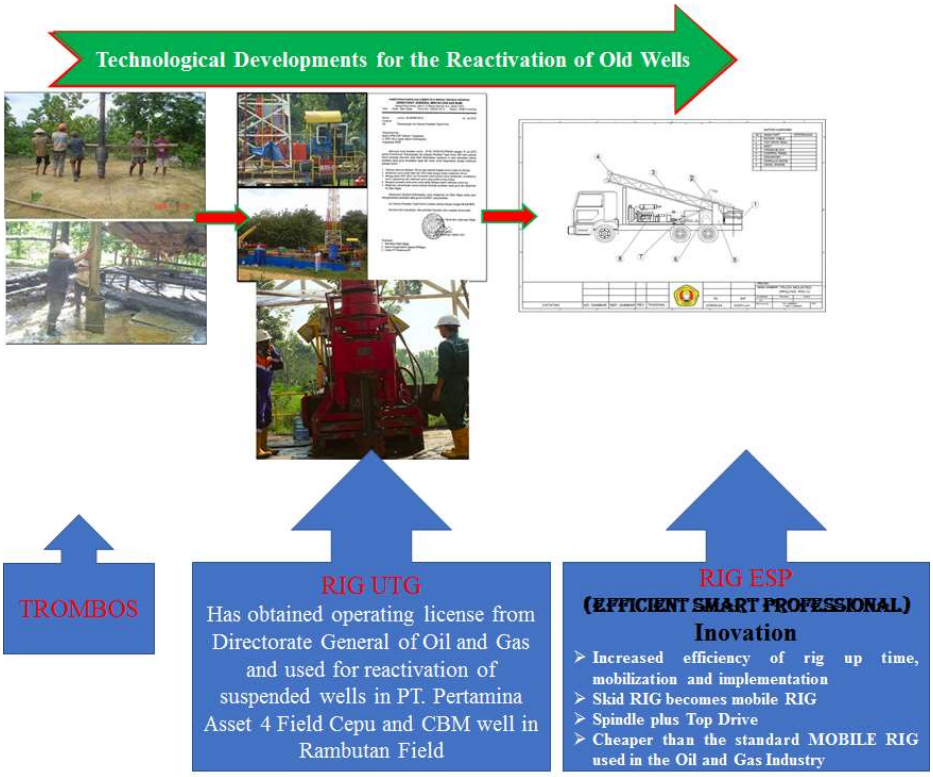

Figure 7. Technological developments for the management of old wells

ESP RIG Design and ESP Pump. This activity is the result of innovation researchers who see the potential of old wells but because the technology used to make the old well less effective, efficient and economical. The ESP RIG design results are shown in **Figure 8.**

Figure 8. ESP RIG Design

3.3. Management of Old Wells use SWOT

The strategy of this study using SWOT Matrix is shown in **Figure 9**.

EKSTERNAL / INTERNAL	STRENGHT	WEAKNESS
	1. The potential of a large old well in Indonesia 2.Technology with cheap rental fees 3. Technology that still considers the HSE Aspect 4. Technological innovation works of the Indonesian Nation with high TKDN value 5. Effective and efficient technology for the exploitation of old wells 6. Experienced researcher on the old wells in Indonesia 7. Policies that support BUMD / KUD to do the old wells	1. Power is only 250 hp 2. Too risky to depth of more than 500 m 3. The term of the old well concession contract is only 5 years
OPPORTUNITY 1. Number of old wells that many in Indonesia 2. BUMD / KUD who are interested in doing the old wells 3. The high interest of investors to invest wells old 4. The high interest of the community will be involvement in the exploitation of old wells	**SO STRATEGIC** **1. Optimizing the potential of existing old wells in Indonesia to increase national oil production** **2. Using this Indonesian nation's technology so Investors will invest in the exploitation of old wells** **3. Involve the community in the exploitation of the old wells**	**WO STRATEGIC** **1.Maximize contracts that are only 5 years old by using technology that is in line with the old wells**
THREAT 1. Compete with existing technology at this time 2. Lack of support from the Central Government to BUMD / KUD in terms of funding	**ST STRATEGIC** **1. Seek funding support from Central Government to BUMD / KUD for the exploitation of old wells**	**WT STRATEGIC** **1. Target is only for the exploitation of old wells with a depth of more than 1000 m**

Figure 9. SWOT Matrix

3.4. Financial of Old Wells

Analysis of the parties involved, competence / capacity, contribution and compensation of management of old wells shown in the **Table 2** and **Figure 10**.

Table 2. Management of Old Wells

NO	PARTY INVOLVED	COMPETENCE / CAPACITY	CONTRIBUTION	COMPENSATION
1.	Technology Provider	Technology for reactivation and producing old wells	Renting Technology and HR	Rental costs
2.	BUMD	Has the right to the exploitation of the old well	Business holders who hire technology	Rewards from PT. Pertamina EP
3.	PT. Pertamina EP	Owner of the old well field	Reward the services provided by the product	petroleum products
4.	ESDM	old well regulators	Licensor	increase of national oil production
5.	SKKMIGAS	old well regulators	Licensor	increase of national oil production
6.	Local government	local policy holders	Licensor	PAD
7.	Investors	Provider of funds	Provide investment funds	Profit
8.	Society	Manpower and get to know the condition of the old well field	Manpower	Jobs

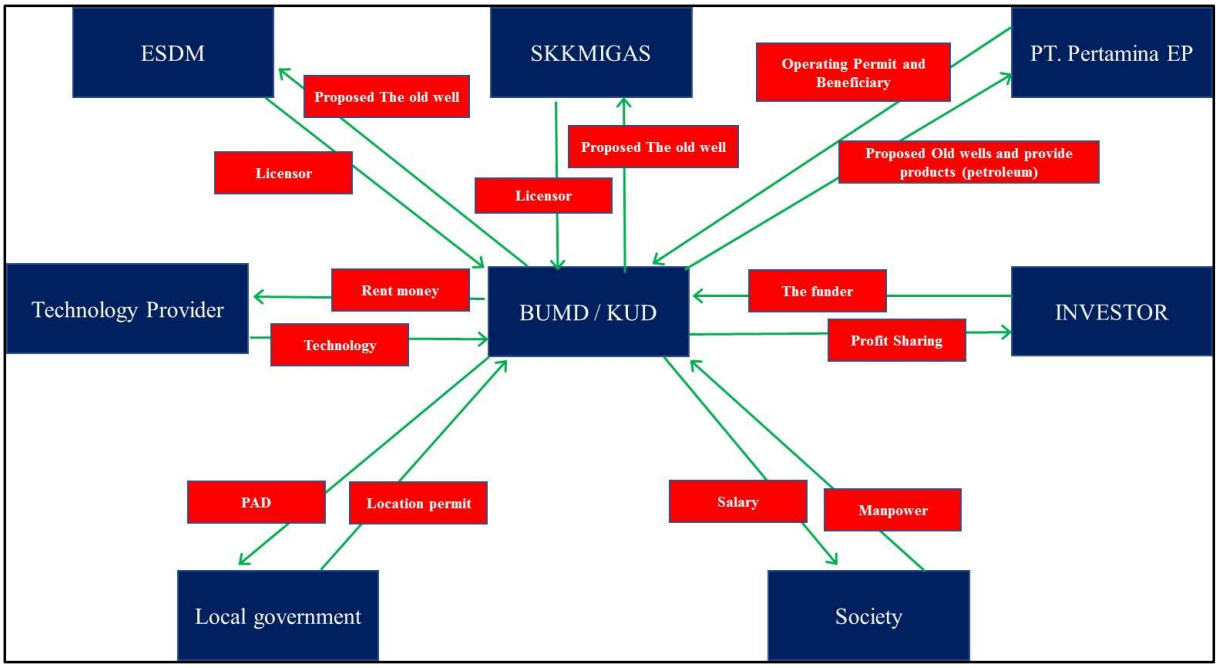

Figure 10. Management of Old Wells

In the calculation of the old well economics can be made some scheme that is the old well concession scheme without the investor and the old well exploitation scheme by using investor (where BUMD / KUD do not do investment but get fee as an example of 10% from which obtained by investor).

The economic calculations use some cost, production and price assumptions as shown in **Table 3.**

Table 3. Cost assumptions, oil production and prices

INVESTATION				
No	**Type**	**Price (Rp)**	**Quantity**	**Total Investment (Rp)**
1	Rent RIG ESP Reactivation	500,000,000	5	2,500,000,000
2	Surface Facilities	150,000,000	1	150,000,000
TOTAL				**2,650,000,000**
RENT TOOL				
No	**Type**	**Rent Price (Rp) / year**	**Quantity**	**Total Rent (Rp)**
1	Genset	180,000,000	2	360,000,000
2	Production Pump ESP Rent	480,000,000	5	2,400,000,000
TOTAL				**2,760,000,000**
OPERATING COSTS				
No	**Type**	**Amount / year**	**Unit price (Rp)**	**Expenses / year (Rp)**
1	BBM, liter	72,000	7,000	504,000,000
2	OLI, liter	2,400	25,000	60,000,000
TOTAL				**564,000,000**

ASSUMPTION			
Number of Wells	=	**5**	**Well**
Share Price Pertamina	=	**30%**	
Share KUD/BUMD Price	=	**70%**	
Decrease in Production	=	**20**	**%/year**
Oil Production	=	**15**	**Bbl/wells/day**
	=	**2,385**	**lt/wells/day**
ICP	=	**60**	**$/Bbl**
$	=	**13,000**	**Rupiah**
Oil Price	=	**4,906**	**Rp/lt**
Oil Prices for KUD/BUMD	=	**3,434**	**Rp/lt**
The cost of transporting oil to cepu	=	**1,000**	**Rp/lt**
Operational Escalation	=	**10**	**%/year**
Discount Factor	=	**10%**	
Overhead office	=	**20%**	

The economic calculation to the economic indicator with the scheme without the investor, is shown in **Figure 11.**

Year	Oil Production (liter)	Gross Revenue (Rp)	The cost of transporting oil to cepu (Rp)	Operational Cost (Rp)	Equipment Rental Fees (Rp)	Total Cost (Rp)
0					2,650,000,000	2,650,000,000
1	4,352,625	14,946,750,000	4,352,625,000	564,000,000	2,760,000,000	7,676,625,000
2	3,482,100	11,957,400,000	3,482,100,000	620,400,000	2,760,000,000	6,862,500,000
3	2,785,680	9,565,920,000	2,785,680,000	682,440,000	2,760,000,000	6,228,120,000
4	2,228,544	7,652,736,000	2,228,544,000	750,684,000	2,760,000,000	5,739,228,000
5	1,782,835	6,122,188,800	1,782,835,200	825,752,400	2,760,000,000	5,368,587,600
TOTAL	**14,631,784**	**50,244,994,800**	**14,631,784,200**	**3,443,276,400**	**16,450,000,000**	**34,525,060,600**

Year	Gross Revenue (Rp)	Total Cost (Rp)	Over head Office 20%	Net Cash Flow (Rp)	Cummulative Net Cash Flow (Rp)	Discount Factor	Disc Net Cash flow (Rp)	Cummulative Disc Net Cash Flow (Rp)
0		2,650,000,000		-2,650,000,000	-2,650,000,000	1.00	-2,650,000,000	-2,650,000,000
1	14,946,750,000	7,676,625,000	1,535,325,000	5,734,800,000	3,084,800,000	0.91	5,213,454,545	2,563,454,545
2	11,957,400,000	6,862,500,000	1,372,500,000	3,722,400,000	6,807,200,000	0.83	3,076,363,636	5,639,818,182
3	9,565,920,000	6,228,120,000	1,245,624,000	2,092,176,000	8,899,376,000	0.75	1,571,882,795	7,211,700,977
4	7,652,736,000	5,739,228,000	1,147,845,600	765,662,400	9,665,038,400	0.68	522,957,721	7,734,658,698
5	6,122,188,800	5,368,587,600	1,073,717,520	-320,116,320	9,344,922,080	0.62	-198,767,049	7,535,891,649
TOTAL	**50,244,994,800**	**34,525,060,600**	**6,375,012,120**	**9,344,922,080**			**7,535,891,649**	

ECONOMIC INDICATORS		
NPV	7,535,891,649	Rp
POT	18	Month
IRR	153%	

Figure 11. Economic calculation of the first scheme (without investors)

The economic calculation to the economic indicator with the scheme with the investor, is shown in **Figure 12.**

Year	Oil Production (liter)	Gross Revenue (Rp)	The cost of transporting oil to cepu (Rp)	Operational Cost (Rp)	Equipment Rental Fees (Rp)	BUMD/KUD Fees (10%)	Total Cost (Rp)
0					2,650,000,000		2,650,000,000
1	4,352,625	14,946,750,000	4,352,625,000	564,000,000	2,760,000,000	1,494,675,000	9,171,300,000
2	3,482,100	11,957,400,000	3,482,100,000	620,400,000	2,760,000,000	1,195,740,000	8,058,240,000
3	2,785,680	9,565,920,000	2,785,680,000	682,440,000	2,760,000,000	956,592,000	7,184,712,000
4	2,228,544	7,652,736,000	2,228,544,000	750,684,000	2,760,000,000	765,273,600	6,504,501,600
5	1,782,835	6,122,188,800	1,782,835,200	825,752,400	2,760,000,000	612,218,880	5,980,806,480
TOTAL	**14,631,784**	**50,244,994,800**	**14,631,784,200**	**3,443,276,400**	**16,450,000,000**	**5,024,499,480**	**39,549,560,080**

Year	Gross Revenue (Rp)	Total Cost (Rp)	Over head Office 20%	Net Cash Flow (Rp)	Cummulative Net Cash Flow (Rp)	Discount Factor	Disc Net Cash flow (Rp)	Cummulative Disc Net Cash Flow (Rp)
0		2,650,000,000		-2,650,000,000	-2,650,000,000	1.00	-2,650,000,000	-2,650,000,000
1	14,946,750,000	9,171,300,000	1,834,260,000	3,941,190,000	1,291,190,000	0.91	3,582,900,000	932,900,000
2	11,957,400,000	8,058,240,000	1,611,648,000	2,287,512,000	3,578,702,000	0.83	1,890,505,785	2,823,405,785
3	9,565,920,000	7,184,712,000	1,436,942,400	944,265,600	4,522,967,600	0.75	709,440,721	3,532,846,506
4	7,652,736,000	6,504,501,600	1,300,900,320	-152,665,920	4,370,301,680	0.68	-104,272,878	3,428,573,629
5	6,122,188,800	5,980,806,480	1,196,161,296	-1,054,778,976	3,315,522,704	0.62	-654,934,757	2,773,638,872
TOTAL	**50,244,994,800**	**39,549,560,080**	**7,379,912,016**	**3,315,522,704**			**2,773,638,872**	

ECONOMIC INDICATORS		
NPV	2,773,638,872	Rp
POT	20	Month
IRR	80%	

Figure 12. Economic calculation of the second scheme (with investors)

4. Conclusion

1. Based on data of subsurface and surface analysis results obtained 4 candidate wells are GBS-11, GBS-22, GBS-24 and GBS-36.
2. Based on the mobile ESP RIG design, it is expected to optimize the potential and economics of old wells spread in Indonesia become more attractive to support increase the national oil production and increase too the society welfare around the old wells.
3. Based on the strategy of using SWOT method, it is clear that this technology can be utilized optimally in the exploitation of old wells and the achievement of increasing national oil production.
4. In terms of economics of old wells, two schemes that try to be calculated above all show good results for BUMD / KUD and investors.

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