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RESEARCH ARTICLE

Economic Work Evaluation Of New Zone Behind Pipe Based On Psc Cost Recovery And Gross Split Contract In YL Field

Shamaamah Hajeera [1,]*, Alireza Manouchehr[1], Tania Indah Danastri[1]

[1] Petroleum Engineering Department, Amirkabir University of Technology, Havez Ave, Tehran, Iran.

* Corresponding author : shamaamahhajeera@gmail.com
Tel.:+98-74-019-1488
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Abstract

Oil production in the YL field has decreased, to increase production work was carried out New Zone Behind Pipe (NZBP). For production results to benefit contractors and the government, this project was carried out by grab into account operating and investment costs following the standard cooperation contract system that applies in Indonesia. This study aimed to calculate the economic indicators of NPV, IRR, and POT based on the PSC system cost Recovery and system gross Split. Then determine which contract was feasible more or better by comparing the final results of the economic indicators of PSC contracts and economic indicators of contracts Gross Split. This study produced a comparison based on the system growth Split more wells were considered feasible, namely 6 of the 12 wells studied, with oil production above 2.65 MSTB to 9.71 MSTB, respectively the NPV, IRR, and POT values were 11.90 to 52, 5, 11% to 40%, 0 to 4.22 months. While the PSC system only 5 wells were considered feasible out of 12 wells, with oil production of 1.82 MSTB to 9.71, respectively the NPV, IRR, and POT values were 13.2 to 189.80, 11% to 156%, and 0 to 6.47 months. The system Gross Split was the best cooperation contract system to be applied to the YL field.

Keywords: New Zone Behind Pipe, PSC Cost Recovery, Gross Split, Economic Indicators

1. Introduction

Production wells in the YL field, which have heavy oil characteristics and use a steam injection system, have experienced a decline in oil and gas production. Production rates that have decreased can be increased by doing a workover on the well. Efforts to increase well productivity by changing well conditions to re-optimize the production rate is called workovers (Prasetyawati Umar et al., 2017).

To increase the production of wells that have declined, the New Zone Behind Pipework was carried out. New Zone Behind Pipe is an effort to take advantage of new zones that have prospects for hydrocarbons, in old wells where production rates have decreased. Thus accomplishing NZBP, is expected to increase oil production (Jati et al., 2015). The workover program (Ariyon et al., 2020) in the oil and gas industry is included in the investment budget plan. That's why this work must be planned in such a way as to prevent problems from occurring during operation.

The feasibility of NZBP work is determined by the economics of production results that provide net income or profits that are greater than operational costs incurred for all the needs of the well or field in question. Economic evaluation is carried out based on economic indicators, namely NPV, IRR, and POT using PSC and Grossplit contracts. After carrying out economic calculations then comparing which contract is more feasible for the development of the YL field in the NZBP work..

2. Literature Review

2.1 New Zone Pipe

A very important role in completion is perforation. Perforation is done by making a hole in the casing as a link between the productive layer and the wellbore thus there is fluid flow from the formation to the wellbore (Apolianto & Mucharam, 2012). New Zone Behind Pipe is a work over to perforate a new zone that has never been produced since the beginning of the well's completion, in which the zone has prospects for hydrocarbons. Oil from the newly opened zone will be pure additional reserves in addition to existing production from currently producing formations (Jati et al., 2015)

In the research conducted (Kaesti, 2011) regarding the success of optimizing the re-work of the layer switching carried out in the EYK-02 well which has experienced a decrease in production, the estimated production well is gas. Increased production after KUPL is a success of this work. The results obtained were that before the KUPL gas production was 0.078 MMcfd and after the KUPL gas production increased to 0.687 MMcfd.

2.2 Production Sharing Contract

A Production Sharing Contract is a collaboration carried out between Contractors acting as Operators and the Government of Indonesia which in this case is represented by SKK MIGAS acting as Mineral Right holders or government agents with a production sharing system (Rulandari et al., 2018). The distribution of oil production between the government and contractors is 85%: 15%.

In January 2017, the Indonesian government issued Minister of Energy and Mineral Resources (ESDM) Regulation No. 8 of 2017 concerning Gross Split contracts, but in August 2017 there was a change in regulation from previously by ESDM to Number 52 of 2017 from several changes to the provisions (Ariyon et al., 2020).

2.3 Gross Split Contract

A gross split contract is a production-sharing contract based on gross without a cost recovery mechanism thus all costs incurred for operations are fully borne by the contractor. The difference with the previous PSC contract that used a fixed netsplit, that is, the distribution is done net after deducting the operating costs (cost recovery), therefore in this gross split contract the government no longer returns/pays the cost recovery that has been issued by the contractor (Wajong, 2017).

The determination of the work area that is in the hands of the state makes this gross split scheme will not eliminate state control, production capacity, lifting, and profit sharing will also be determined by the state (Pramadika & Satiyawira, 2018). In this contract, the amount of the base split (initial profit sharing) is determined between the government and the contractor, namely, the government's share is 57% and the contractor's share is 43% (for oil) while the split for gas is the government's 52% and the contractor's share is 48% (Ariyon & Dewi, 2018). The division of the contractor split will have additional splits according to the applicable parameters, namely progressive splits and variable splits (Ariyon et al., 2020).

2.4 Economic Indicators

The factor for knowing the profit and loss of a contract is an economic indicator. NPV (Net Present Value), IRR (Internal Rate of Return), and POT (Pay Out Time) are economic indicators used in oil and gas economic calculations (Ariyon, 2013). POT is not related to the time value of money while NPV and IRR are. The advantage of a Cash Flow in the future (Newnan et al., 2004) is called the Time Value of Money

3. Research Method

The methodology used for this final project research is as follows :

1. Study Literature

Literature study is used to solve the problem formulation by looking at previous research.

2. Interview

Interviews will be conducted to get the opinion of experts, petroleum engineers, regarding what costs were incurred for this NZBP work and which wells were successfully executed and which failed.

3. Data Collection

The data collected is NZBP work data carried out in early 2019 to early 2020. The wells carried out by NZBP include 12 wells in the YL field for 1 year the project was studied using production and operating data obtained from the company, the work was carried out for 3 days.

4. Data processing

Process data with case studies that occur in the field with the following stages :

a. Calculating production results before and after NZBP in each well.
b. Calculating cash flow from the PSC Cost Recovery contract, namely Gross Revenue, calculating FTP by removing production results from GR before deducting CR. then ETS is obtained, namely the remaining oil which will be returned to the contractor and the government. Then calculate the DMO and DMO fees if there is an agreement, calculate the contractor's income tax that will be given to the government and put it into the government's cash flow thus the government's net income (FTP, DMO and Tax) is obtained and the contractor's net income after deducting taxes.
c. Calculating cash flow according to the Gross Split contract, namely Gross Revenue, Deductible Expenses, contractor tax profit, government income tax, contractor take and government take.
d. Calculating economic indicators NPV, IRR and POT of both contracts and the sensitivity of the factors that affect the NPV

5. Data analysis

Perform analysis of the data that has been processed, namely comparing the results of calculating the economic indicators of the two contracts , it is known which contract is more profitable for the contractor. And analyze the sensitivity of economic indicators with parameters that affect these wells.

6. Draw conclusions from the results of the Final Project research

4. Results And Discussion

4.1 Data Processing

4.1.1 NZBP Job Cost Data

Investment costs must be known in order to be able to perform calculations and determine the feasibility of a NZBP well. These costs consist of feescapital andnot capital. The following is the investment costs that have been incurred for NZBP work:

Table 1. Cost of NZBP Job

Non Capital Cost	Cost Per QTTY	QTTY	TOTAL
	Cost Of NZBP Job At The Well		
Cost of Rig Rent	$20000	1	$20000
Material Cost	$10000	1	$10000
Company Service Cost	$15000	1	$15000
Cost of Downhole Equipment	$10000	1	$10000
Other Cost	$5000	1	$5000
	Total		$60000

4.1.2 Determination of Oil Prices

The determination of the price of the oil used is obtained from the ICP (Indonesian Crude Price) and the price of this oil varies from time to time. The data used is from February 2019 to May 2020. Oil prices range from $27.79 to $79.12

4.2 Contract Based Analysis PSC Cost Recrovery

4.2.1 Parameter Cash Flow PSC Cost Recovery

Parameters calculated incash flow PSC contract NZBP work for each well consists of: Gross Revenue, First Tranche Petroleum, Escalation Rate, Cost Recovery, Equity to be Split (ETS), Contractor's FTP, Contractor's ETS, Domestic Marketing Obligation (DMO), DMO fee, Net DMO, Contractor Share (CS), Tax,Net Cash Flow (NCF), FTP for the Government, ETS for the Government andGovernment Share *(GS).*

4.2.2 Result of Contract Economic Indicator CalculationPSC Cost Recovery

Table 2. Indicator of Economy and Feasibility Based on PSC System

Well Name	MSTB	NPV *Contractor* ($M)	IRR	POT (*Months*)	*Result*
A1	7,45	41,10	Na	0	Feasible
A2	0,26	-42,18	-23%	12	Not Feasible
A3	3,99	19,50	40%	1,89	Feasible
A4	5,13	26,77	71%	1,8	Feasible
A5	9,71	52,25	Na	0	Feasible
A6	2,63	11,90	11%	4,22	Feasible
A7	1,57	2,66	2%	8,36	Feasible
A8	0,93	-19,19	-9%	12	Not Feasible
A9	0,31	-41,07	-23%	12	Not Feasible
A10	1,82	5,79	4%	6,17	Not Feasible
A11	0,61	-30,87	-15%	12	Not Feasible
A12	0,90	-15,56	-7%	12	Not Feasible

After determining the distribution of the split between the contractor and the government then calculates the parameter of the gross cash flow split. The parameters calculated in the NZBP Gross Split contract work cash flow consist of Gross Revenue, Operating costs, Deductible expenses, Contractor Take and Government Take then made in table form to make it easier to understand.

The results of the analysis for the below wells show that wells A1, A3, A4, A5, A6 meet the eligibility standards and the rest are wells that are not feasible, namely A2, A7, A8, A9, A10, A11 and A12.

4.3 Analysis Results

4.3.1 Determining Split Before Tax

The determination of the split between the government and the contractor is influenced by the variable split and the progressive split. Then determine the contractor's initial base split set by (Regulation of the Minister of Energy and Mineral Resources of the Republic of Indonesia No. 52 of 2017 concerning Changes to the Gross Split Production Sharing Contract, 2017) is 43%, then from the variable and progressive split components the contractor will receive an additional split according to the characteristics of each well. The addition of the split is 20% for the variable component and the addition of the progressive component of the split is 15%.

After getting the variable split and progressive split values, then determine the amount of the split before tax between the contractor and the government. The formula used to calculate the split before tax is :

$$Contractor = base\ split + variable\ split + progressive\ split \ldots\ldots\ldots\ldots..(35)$$

$$Contractor\ Split = 43\% + 20\% + 15\%$$

$$\boldsymbol{Contactor\ Split} = \mathbf{78}\ \%$$

Based on the results of the calculation above, it is obtained that the split for contractors is 78% and the split for the government is 22%. The calculation of the contractor and government split can be seen in Appendix 5. After obtaining the contractor and government split, then calculate the cash flow parameters for 12 wells 4.3.2 Gross Split Cash Flow Parameters

After determining the distribution of the split between the contractor and the government then calculates the parameter of the gross cash flow split. The parameters calculated in the NZBP Gross Split contract work cash flow consist of Gross Revenue, Operating costs, Deductible expenses, Contractor Take and Government Take.

4.3.2 Parameter *Cash Flow Gross Split*

After calculating the cash flow then calculating the NPV, IRR and POT based on the gross split contract.

The feasibility analysis has been carried out on these wells based on the gross split contract. According to (Ariyon & Dewi, 2018) a well with feasible criteria, namely having a positive NPV, an IRR value of more than 10%, and a low or fast POT, and vice versa for those that are not feasible. The results of the analysis for the above wells show that wells A1, A3, A4, A5, A6, and A10 meet the feasibility standards and the rest are wells that are not feasible, namely A2, A7, A8, A9, A11, and A12. In total, 6 wells are declared feasible.

Thus it can be concluded that the Gross Split contract is a better oil and gas cooperation contract than the PSC contract because using the Gross Split calculation can produce a total of 6 feasible wells, while the PSC is only slightly different from the Gross Split, namely 5 feasible wells.

The following is the result of calculating economic indicators using a gross split contract :

Table 3. Indicator of Economy and Feasibility of NZBP Well Based on Gross Split System

Well Name	MSTB	NPV Contractor ($M)	IRR	POT (months)	Result
A1	7,45	149,33	NA	0,0	Feasible
A2	0,26	-24,0	-23%	12	Not Feasible
A3	3,99	65,74	105%	1,77	Feasible
A4	5,13	91,00	156%	1,6	Feasible
A5	9,71	189,80	NA	0,00	Feasible
A6	2,63	35,59	26%	4,35	Feasible
A7	1,57	1,67	2%	9,48	Not Feasible
A8	0,93	-12,11	-10%	12	Not Feasible
A9	0,31	-23,45	-23%	12	Not Feasible
A10	1,82	13,2	11%	6,47	Feasible
A11	0,61	-18,18	-16%	12	Not Feasible
A12	0,90	-10,05	-8%	12	Not Feasible

4. 4 Sensitivity Analysis

A sensitivity analysis was carried out to determine the factors that most influenced the work of NZBP in the YL field. The economic indicator whose sensitivity is analyzed is the NPV. Factors that are considered to affect the value of the economic indicators of this PSC system are oil prices, oil production, water production, workover, and lifting costs with an assumed level of sensitivity testing of ±15 %.

4.4.1 Sensitivity of the NPV to the influencing parameters under the PSC contract

1. A1 Well

Table 4. Sensitivity Parameters of PSC Well A1

			NPV		
				Sensitivity	
	No.	Parameters	85%	100% ($M)	115%
A1	1	Oil Production	33,10	41,10	49,10
	2	Water Production	41,47	41,10	40,50
	3	Workover	42,33	41,10	39,88
	4	Lifting Cost	41,76	41,10	40,45
	5	Oil Prices	33,06	41,10	49,15

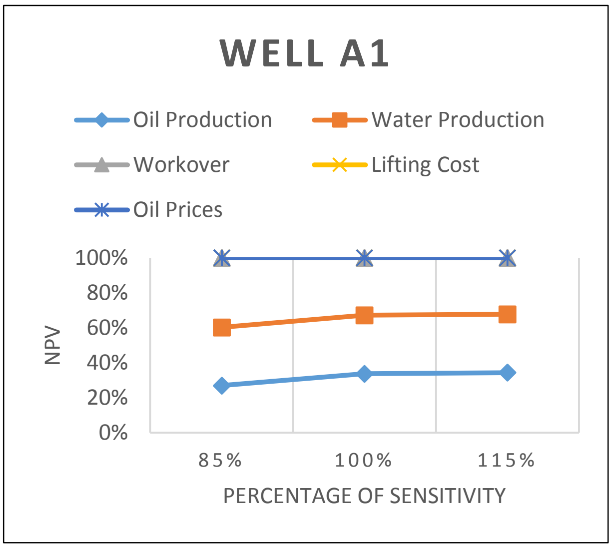

Fig 1. Graph of PSC sensitivity of well A1

2.A3 Well

Table 5. Sensitivity Parameters of PSC Well A3

	No.	Parameters	NPV Sensitivity 85%	100% ($M)	115%
A3	1	Oil Production	15,12	19,5	23,8
	2	Water Production	19,7	19,5	19,2
	3	Workover	19,57	19,5	19,4
	4	Lifting Cost	19,7	19,5	19,2
	5	Oil Prices	15,10	19,5	23,9

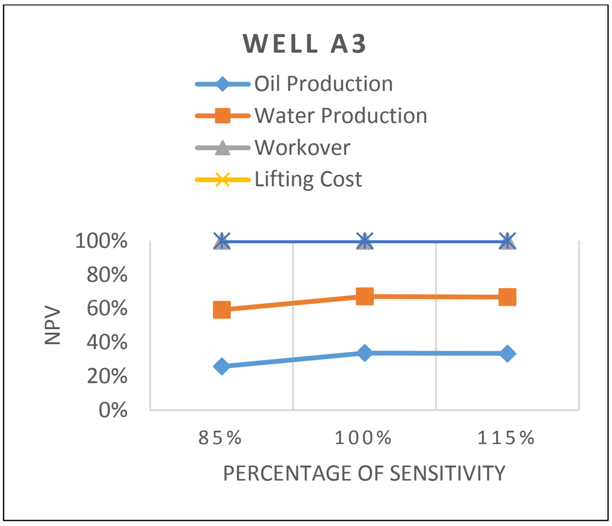

Fig 2. Sensitivity Parameters of PSC Well A3

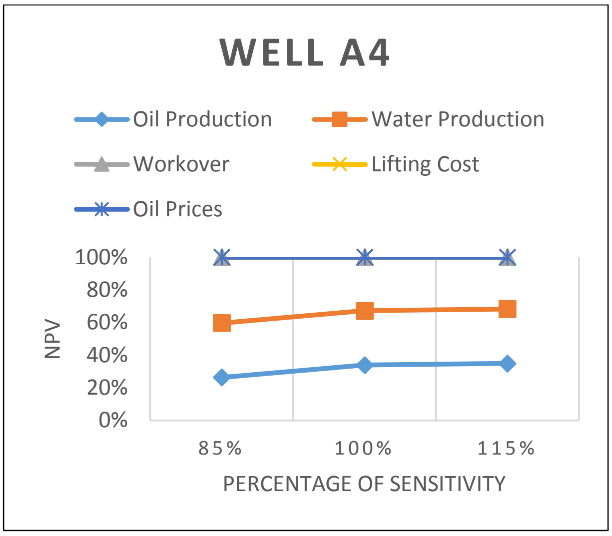

Fig 3. Graph of sensitivity of PSC well A4

3.A4 Well

Table 6. Sensitivity Parameters of PSC Well A4

	No.	Parameters	NPV Sensitivity 85%	100% ($M)	115%
A4	1	Oil Production	21,11	26,77	32,43
	2	Water Production	27,19	26,77	26,35
	3	Workover	28,00	26,77	25,54
	4	Lifting Cost	27,22	26,77	26,32
	5	Oil Prices	21,08	26,77	32,46

4.A5 Well

Table 7. Sensitivity Parameters of PSC Well A5

	No.	Parameters	NPV Sensitivity 85%	100% ($M)	115%
A5	1	Oil Production	42,02	52,25	62,48
	2	Water Production	53,41	52,25	51,09
	3	Workover	50,72	52,25	53,78
	4	Lifting Cost	53,47	52,25	51,03
	5	Oil Prices	41,96	52,25	62,54

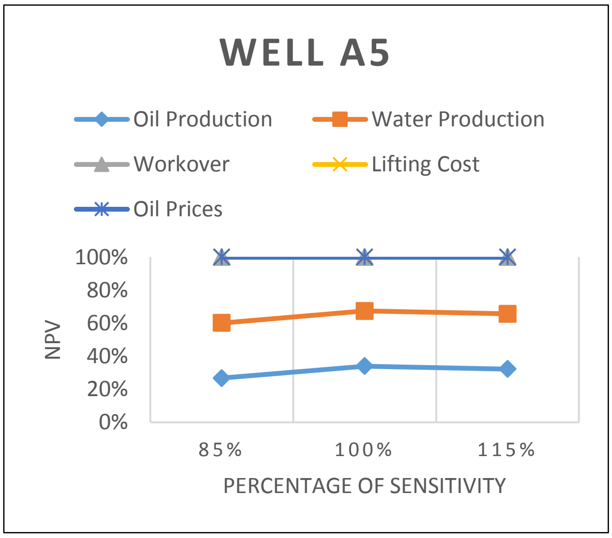

Fig 4. Graph of sensitivity of PSC well A5

5.A6 Well

Table 8. Gross Split Well A6 sensitivity parameter

	No.	Parameters	NPV Sensitivity 85%	100% ($M)	115%
A6	1	Oil Production	25,43	35,59	45,76
	2	Water Production	35,84	35,59	35,35
	3	Workover	40,18	35,59	31,01
	4	Lifting Cost	39,90	35,59	35,29
	5	Oil Prices	25,37	35,59	45,82

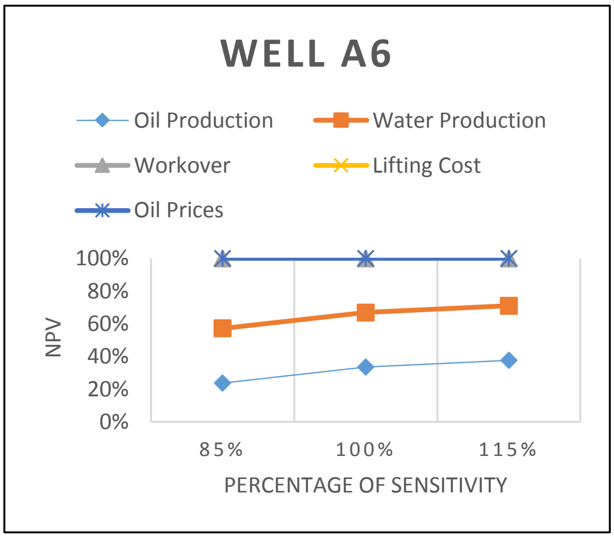

Fig 5. Graph of sensitivity of Gross Split well A6

6.A10 Well

Table 9. Sensitivity Parameters for Well Split Gross A10

			NPV		
			Sensitivity		
	No.	Parameters	85%	100% ($M)	115%
A10	1	Oil Production	6,42	13,18	19,93
	2	Water Production	13,38	13,18	12,98
	3	Workover	17,76	13,18	8,60
	4	Lifting Cost	13,42	13,18	12,94
	5	Oil Prices	6,38	13,18	19,98

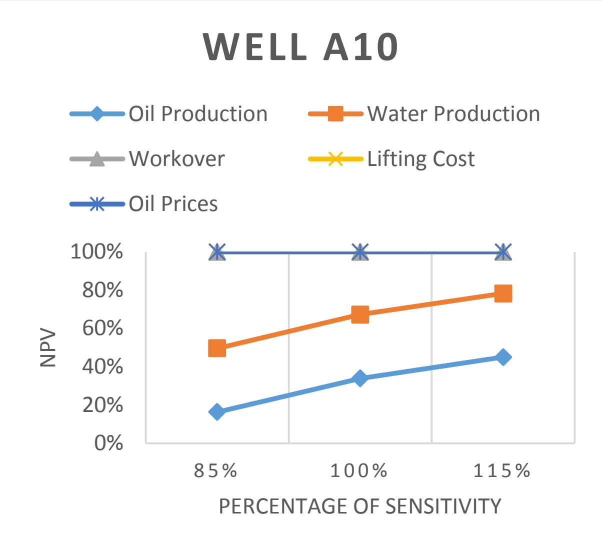

Fig 6. Graph of sensitivity of Gross Split well A10

It is shown in the graph from wells A1, A3. A4. A5, A6, and A10 that oil prices have the greatest slope, meaning that oil prices are a factor that changes the net contractor share. Then the second order factor that influences is the production of oil which has a smaller slope than the oil price or a greater slope than workover costs. Therefore the workover cost is the third factor that is less influential because it has a small slope, is considered less influential, if the workover value is increased or reduced by 15% it will result in a change in the slope that is the smallest compared to oil prices and oil production. From the graphical analysis above, it can be concluded that the factor that has the most influence or is most sensitive to the NPV economic indicator is the oil price.

When oil prices rise, oil production is large and operating costs are small, the right choice is to implement the Gross Split contract system because the project will be more profitable. After all, operating costs are the responsibility of the contractor without any cost recovery, where cost recovery is an operating cost borne by the government. as applied to the Product Sharing Contract Cost Recovery contract

5. Conclusion

From the results of the calculation of economic indicators, namely NPV, POT, and IRR, it is known that the wells declared feasible according to the standard PSC system are wells A1 (NPV = 41.10), A3 (NPV = 19.50), A4 (NPV = 26.77), A5 (NPV = 52.25) and A6 (NPV = 11.90). These wells are considered feasible because they have large and positive NPV values, IRR values greater than the 10% MARR, and POT values that are less than the project life or faster.

Wells declared feasible according to the Gross Split system standards are wells A1 (NPV = 149.3), A3 (NPV = 65.7), A4 (NPV = 91), A5 (NPV = 189.80), A6 (NPV = 35 .59) and A10 (NPV = 13.2). These wells are considered feasible because they have large and positive NPV values, IRR values greater than the 10% MARR, and POT values that are less than the project life or faster.

Based on economic indicators, NZBP's work is more profitable when using a Gross Split contract, because the resulting NPV is higher and the number of feasible NZBP wells is 6 wells compared to using a PSC Cost Recovery contract.

The results of the sensitivity analysis using the PSC and Gross Split systems found that the most influential or most sensitive factor to the NPV economic indicator is the oil price. Oil production and operating costs are the second and third influencing factors

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