The new energy management policy: Indonesian PSC-gross-split applied on steam flooding project

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Abstract. "SIPY" oil field has been producing oil using steam flooding technology since 1992 under the PSC-Cost-Recovery policy. In 2021, the contract will be finished, and a new agreement must be submitted to the Indonesian government. There are two applied fiscal policies on oil and gas management: PSC-Cost-Recovery and PSC-Gross-Split (introduced in 2017 as the new energy management plan). The contractor must choose between PSC-Cost-Recovery and PSC-Gross-split which makes more profit. The aim of this research is to determine the best oil and gas contract policy for the contractor. The methods are calculating contractor cash flow and comparing the Profitability Indexes. The results of this study are (1) Net Present Values for the PSC-Cost-Recovery and the PSC-Gross-Split are 15 MMUSS and 61 MMUSS$, respectively; and (2) Internal Rate of Return values for the PSC-Cost-Recovery and PSC-Gross-Split are 10% and 11%, respectively. The conclusion is that the Net Present Value and Internal Rate of Return of PSC-Gross-Split are greater than those of PSC-Cost-Recovery, but in Pay Out Time of PSC-Gross-split is longer than Pay Out Time in PSC-Cost-Recovery. Thus, the new energy management policy will be more attractive than PSC-Cost-Recovery.

Keywords: new energy management policy, oil steam flooding, PSC-Gross-Split

1. Introduction
Oil field "SIPY" is a reservoir structure located in the middle of Sumatra, approximately 120 kilo meters to the north of Pekanbaru and about 75 kilo meters south of Dumai Administrative City in Riau Province. This oil field stretches from the north to the south, having a symmetrical shape with an estimated width of 10 kilo meters from the west to east as well as 18 kilo meters length from the north to south [1]. This "SIPY" field was discovered in 1958, and its production began in 1958 along with the completion of the drainage channel construction from "SIPY" Field to Dumai harbour. The field has an Original Oil In Place of 6,827 MMBBL and an estimated cumulative production in 2021 of 2,116 MMBBL or about 31% of the total Original Oil in Place. The estimated ultimate recovery (EUR) is 60% for Steam Flooding. The maximum oil production that can be taken is 4,096 MMBBL, while the estimated remaining reserves that can be acquired until the year of 2021 is 1,980 MMBL [1].

The PSC Recovery agreement of this field will be expired in 2021, but the contractor still have an opportunities to propose a new period of contract extension. Referring to researchers [5] the contractor may choose a contract management policy on the field to extend the old agreement. The contractor may apply for a contract extension before two years or at the earliest ten years prior to the expiry date according to the ESDM Minister Regulation No. 15 of 2015.
Recently in Indonesia are experiencing various of revision and improvement in the regulations, related with the oil and gas industry activity, this kind of situation certainly will impact to the investment atmosphere in the Indonesia oil and gas upstream.

The new regulation is PSC-Gross Split [7]. The Contractor should use this new regulation, in order to propose the contract extension.

This study purpose is to analyze if the Gross Split mechanism is more attractive or equal the old PSC Cost Recovery.

2. Research Method
The calculation of economic aspects related to the new energy management policy of the oil field includes the computations of gross revenue, First Tranche Petroleum, the amount of capital investment that can be returned in the cost recovery scheme, profit sharing in the form of equity to be split, taxes to be paid to the government, Profitability Index (for PSC-Gross-Split there is no First Tranche Petroleum), cost recovery, and different tax to the contractor. Prior to the economic calculations, some supporting data were needed, such as oil price, capital expenditure (CapEx), Operating Expenses (OpEx), cumulative production, as well as tax and revenue split distribution to yield the Profitability Index. In the economic calculation of an oil field, it takes at least three economic indicators to determine whether a field of oil and gas is to be developed, including the NPV, IRR, and POT.

This study needs some data to compute the profitability index. “SIPY” field has a cumulative production of 132 MMBBL until 20 years for the calculation in this research, as well as an average oil price of $50/BBL, an investment of 452 MMUS$, and an operating cost of 2,574 MMUS$. For three years from starting of the project, the oil production is still zero. Yearly oil production of MBBL/year consecutively are : (0,0); (0,0); (0,0); 1,500; 4,600; 5,800; 5,100; 5,400; 7,100; 10,500; 12,100; 12,500; 12,300; 12,000; 12,700; 14,300; 16,100; 19,100; 20,800; and 24,900.

Steam flooding project is one of enhanced oil recovery method [1], [2], [3]. The implementation of this technique in SPY field will need three years capital and noncapital investment from the beginning of the project. Yearly investment in M$/year are : 319,330; 66,260; and 66,660. The total amount of investment is 452,250 MUS$ for the three years of the early project. Producing oil from the reservoir into the surface will take production cost which estimated 15 US$/BBL of oil. And to protect the environment from all damage and to do the land restoration, some of cost is also needed, which is called Abandon Site Restoration cost (ASR cost). The sum of production cost and Abandon Site Restoration cost is called Operating Cost. Yearly operating cost of M$/year for entirely the steam flooding project, consecutively are : (0,0); (0,0); (0,0); 25,327; 97,153; 186,980; 266,306; 350,133; 459,459; 619,786; 804,113; 994,439; 1181,766; 1364,592; 1557,919; 217,327; 244,327; 533,633; 848,480; and 1224,806. Those data will be the same input for both energy management policy: PSC-Cost-Recovery and PSC-Gross-Split.

Under PSC-Cost-Recovery, the contractor can calculate the cash flow for 17 years on oil production. The revenue distribution splits after tax are 85% for the government and 15% for the contractor. The outcomes of this analysis are Net Present Value, Internal Rate of Return, and Pay Out Time. There are some differences between PSC-Cost-Recovery and PSC-Gross-Split. PSC-Gross-Split has a discrete revenue distribution split and tax. There are no cost recovery and First Tranche Petroleum on PSC-Gross-Split, so the contractor must pay the cost recovery for all their operational costs. The revenue distribution splits for PSC-Gross-Split are 53% for the contractor and 47% for the government since there are additional progressive split and variable split in PSC-Gross-Split.

Following the profitability index result, a sensitivity analysis was conducted for both model managements by changing input data of cumulative production, oil price, investment, and operating cost. Comparison of the output and sensitivity for both models was then carried out to determine the conclusions from the profitability index and sensitivity analysis.

3. Results and Discussion

3.1. PSC-Cost-Recovery Revenue Distribution
The oil production which predicted from the past historical production, the estimated investment, and the estimated production cost, are presented as seen in table below. The revenue come from oil production multiply by oil price. According to the contract term arrangement, the revenue distributed to government and contractor as simple as show in figure 1. Contractor cash flow was calculated from revenue and expenses (all investment and operating cost). Finally, the profit indicator was calculated from the cash flow.

PSC-Cost-Recovery scheme is a little bit complicated in calculation of revenue distribution. It is also need time consumption for Plan of Development approval, Work Program and Budgeting control, Authorization of Expenditure control, which are the implication of cost recovery approval by government.

According to PSC-Cost-Recovery terms and conditions, 20% of the gross revenue will take as cost recovery ceiling. The Parties shall be entitled to take and receive each year 20% of all Petroleum produced and saved ...before any deduction for the recovery of Investment Credit and Operating Cost. Such First Tranche Petroleum shall be shared between government and contractor in accordance with sharing splits. The revenue after FTP can be used for cost recovery. Remaining revenue after FTP and cost recovery, which is called Equity To be Split, or ETS, will be shared between government and contractor in accordance with sharing splits. Contractor share is subject of government tax [4], [6].

For the entire 20 years of the assuming steam flooding project, it will give the revenue in MUS$, consecutively from the start of project : (0,0), (0.0); (0.0); 75,000; 230,000; 290,000; 255,000; 270,000; 355,000; 525,000; 605,000; 625,000; 615,000; 600,000; 635,000; 715,000; 805,000; 955,000; 1,040,000; 1,245,000. The cumulative gross revenue is 9,840,000 MUS$.

The final results for PSC-Cost-Recovery revenue distribution are Gross Revenue of 9,840 MMUS$, Contractor Tax of 44%, First Tranche Petroleum of 1,968 MMUS$ from 20% of Gross Revenue, Cost Recovery of 3,452 MMUS$ from 35% of Gross Revenue, Net Government Take of 5,429 MMUS$ from 55% of Gross Revenue, and Net Contractor Take of 958 MMUS$ from 10% of Gross Revenue (Figure 1).

![Figure 1. Revenue distribution results of PSC-Cost-Recovery.](image)

### 3.2. PSC-Gross-Split Revenue Distribution

PSC-Gross-Split scheme is more simple in calculation of revenue distribution rather than PSC-Cost-Recovery. And there are no time consumption for control of expenses nor cost recovery approval by government.

According to PSC-Gross-Split terms and conditions, 47% of the gross revenue will goes to government, and the remaining 53% of gross revenue is equity of contractor. Contractor have to pay
his profit tax to the government. There are no First Tranche Petroleum (FTP), nor Cost Recovery. All expenses is under contractor self control [5].

The final results for PSC-Gross-Split revenue distribution are: FOR Gross Revenue of 9,840 MMUS$, total Government Take is 5,593 MMUS$ (57% of Gross Revenue), and total Contractor Take is 4247 MMUS$ (43% of Gross Revenue) (see Figure 2).

![Figure 2. Revenue distribution results of PSC-Gross-Split.](image)

### 3.3. Profitability Indicators Result

For the entire 20 years of the assuming steam flooding project, although the input data are the same for revenue, investment, tax rate, and operating cost, the contractor will have difference cashflow for both PSC-Cost-Recovery and PSC-Gross-Split.

On the side of PSC-Cost-Recovery scheme, the contractor cash flow in MMUS$, consecutively are : (-319.33); (-66.26); (-66.66); 36.92; 119.07; 150.87; 132.32; 60.70; 36.86; 54.71; 63.11; 65.21; 64.16; 62.59; 66.26; 74.66; 84.11; 99.87; 108.79; and 130.32. The cumulative cash flow is 103.96 MMUS$.

On PSC-Gross-Split scheme, the contractor cash flow in MMUS$, consecutively are : (-319.33); (-66.26); (-66.66); 14.42; 28.04; 35.77; 31.26; 33.19; 14.14; 66.04; 76.34; 78.92; 77.63; 75.70; 80.21; 90.51; 102.10; 121.42; 132.37; and 158.77. The cumulative cash flow is (-51.48) MMUS$.

The economic indicator was then calculated from that cash flow. Figure 3 shows the economic output comparison between PSC-Cost-Recovery and PSC-Gross-Split.

Look at the profitability index of NPV, IRR, and POT. On the government side, the new management policy (PSC-Gross-Split) for the petroleum (oil and gas) exploration and exploitation is more attractive than the old one (PSC-Cost-Recovery). On the contractor side, the new management policy (PSC-Gross-Split) for the petroleum (oil and gas) exploration and exploitation is less attractive than the old one (PSC-Cost-Recovery). For this case of steam flooding project, if there is opportunity to choose the type of government management policy, contractor will tend to prefer the PSC-Cost-Recovery, rather than PSC-Gross-Split.

### 3.4. Sensitivity Analysis PSC-Cost-Recovery and PSC-Gross-Split

All data value that used in this project are estimated or predicted data. Of course, those data could be difference in real time the project implementation. It may be under or over estimated value. The impact of all change data input will change the profitability of the project. Sensitivity analysis was performed to figure out the change of project profitability inline with changes of the input data, such as production, investment, and operating cost.
Figure 3. Economic output comparison of PSC-Cost-Recovery vs PSC-Gross-Split.

The result of sensitivity analysis are presented in Figure 4A, Figure 4B, and Figure 4C. Figure 4A is sensitivity NPV and IRR of PSC-Cost-Recovery scheme as function of change in data input of investment, production, oil price, and operating cost. The line of production is the same with line of oil price. Profitability is more sensitive to investment rather than three others variable data input.

Figure 4A. PSC-Cost-Recovery: sensitivity analysis of NPV and IRR

Figure 4B. PSC-Gross-Split: sensitivity analysis of NPV and IRR.

Figure 4B is sensitivity NPV and IRR of PSC-Gross-Split scheme as function of change in data input of investment, production, oil price, and operating cost. The line of production is the same with line of oil price. Profitability is also more sensitive to investment rather than three others variable data input. So that, it is clearly figure out by figure 4, both of the petroleum management policy are the same sensitive to changes of investment.

The new petroleum management policy which represent by “Peraturan Menteri ESDM Republik Indonesia No. 8 Tahun, 2017” is look like tend to not attract the investor or contractor on this steam flooding project. One of the tool to solve this condition is by tax incentive. If the government give tax incentive to the contractor, the project profitability of PSC-Gross-Split scheme management policy would become the same as profitability of PSC-Cost-Recovery scheme management policy (See Figure 4C).

If NPV is important point of profitability, PSC-Gross-Split tax rate should be decrease from 44% to 17%, so the contractor NPV@10% will become 103,962 MMUS$, that is the same with the result of PSC-Cost-Recovery.
If IRR is important point of profitability, PSC-Gross-Split tax rate should be decrease from 44% to 10%, so the contractor IRR will become 13.3%, that is the same with the result of PSC-Cost-Recovery.

![NPV and IRR graphs](image)

**Figure 4C.** PSC-Gross-Split : Sensitivity Analysis of NPV and IRR as changes of Government Tax.

4. Conclusion

Contractor Net Present Value for the PSC-Cost-Recovery is 103,962 MUS$ and for the PSC-Gross-Split is minus 51,479MMUSS. Internal Rate of Return for the PSC-Cost-Recovery is 13.3% and for the PSC-Gross-Split is 8.6%. Contractor Net Present Value and Internal Rate of Return of PSC-Gross-Split are greater than of PSC-Cost-Recovery, but Pay Out Time in PSC-Gross-split is longer than Pay Out Time in PSC-Cost-Recovery. The new energy management policy is considered as less attractive scheme than PSC-Cost-Recovery, for the contractor side.

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