International Journal of
Science and Engineering Investigations vol. 7, issue 80, September 2018
ISSN: 2251-8843

Gas Field Project Analysis with Wells and Compressor Investment: Case Study of ID Field

Herianto
[1]Ph.D., Head of Petroleum Engineering Department, University of National Development "Veteran" Yogyakarta
(Herianto_upn_ina@yahoo.com)

***Abstract*-**The business of oil and gas field development project in Indonesia using an economic concept PSC. There are 2 types of standard PSC PSC and PSC namely Gross split. Fiscal regimes become the most important factor to determine the profit-making or not a project to be developed that are represented. Standard PSC forms of cooperation involving the Government and the contractor were the result of gas at 70: 30, while gross split of 52: 48.

Gas field development is based on a gas sales contract with customers using fixed rate cost. On a project of this magnitude on the reservoir X gas reserves of 146 BSCF with a fixed rate of 5 MMSCFD. Scenario development can be done by investing wells and optimization choke with a larger size. Optimization choke provides wellhead pressure-lowering effect and thus require investment compressor. In this paper presented a scenario with a combination of investment and investment wells compressor. In this paper will compare gas field project with standard and gross PSC split which can be a reference for future investors to develop the gas field. With the same amount of tax on gas field project more profitable use standard PSC fiscal regime.

Keywords- *Gas Field Development, Well Indonesian PSC, Indonesian Gross Split*

I. INTRODUCTION

The concept of different oil and gas production which is not only because of its physical properties but also for economic reasons where the gas to be directly sold to consumers while the oil can be stored. [1]

For the development of the gas field, there is a close relationship between the production and marketing phases. Design an optimal development plan for a gas field is always dependent on the pitch parameters such as total reserves of natural gas, well productivity, the rate of gas production and gas sales contract. [2]

In the development field, after the discovery of potential gas reserves, drilling more emphasis on early stage to maximize the flow rate and minimize the cost of the project in the future [3]

To evaluate the economics of oil and gas projects in upstream oil and gas business development planning using the concept PetroEkonomi [4]

In addition to drilling wells may also choke and installation optimization compressor to maintain the rate at a lower cost than drilling. A rate can be set to increase the size of the choke and increase development wells, the pressure can be regulated with a compressor installation. In this paper will discuss a scenario as well as their economic development by investing a combination of compressor and investment wells. [1]

The economic analysis is required when an oil and gas companies have the opportunity to invest in a project and need to determine whether the investment is profitable or vice versa where companies need to see some economic parameters such as cash flow project, the profit or loss, the estimated risk of financial and technical, financing needs (Capex and Opex) [5]

Petroleum Fiscal System (PFS) is the main determinant of investment decisions in the exploration and production (E & P) of oil and gas that can be described as an element of the legislative (government), tax, contract and fiscal underlying the exploration and production operations in a country producing oil and gas [6] ,

Engineer project designers should consider the risks contractors, government revenue and contractors, attract contractors to carry out exploration and development may impact on reserve additions and production targets a country. [7]

There are many factors that affect the outcome of the economic analysis that is royalties, bonuses, cost recovery, profit sharing, income taxes, other fiscal factors (DMO) [5]. Fiscal provisions governing the calculation of royalties and taxes largely predetermined by the laws of a country [8]

The focus of the analysis of the fiscal regime in the oil and gas industry is the distribution of profits between the contractor and the government, some economic indicators are also used [9]. Contractor take is the percentage share of the economic benefits gained by contractors or oil companies. The government takes part remaining. The advantage gained by converting the current value is called Net Present Value (NPV), Cost, Profit to Investment ratio (PIR) and Rate of Return

(ROR) together provide a good measure of the profitability and risk of the investment project [10]

This study aimed to calculate the economics of a gas field development project with a gross model and the standard PSC split that aims to determine which is more profitable and the feasibility of a project to be implemented visits of economic indicators.

II. CONCEPT ECONOMICS PSC MODEL STANDARD OIL AND GROSS SPLIT

In calculating the economics of the project required a cash flow analysis. Cash flow is a picture of the final cash flow that can be obtained and government contractors. The amount of Net Cash Flow (NCF) is a Total Contractor Share (TCS) after deducting total expenses (expenditure). Expenditure includes the cost of the investment (capital and non-capital) and operating costs. The elements required in the calculation of Net Cash Flow (NCF), among others:

- Gross Revenue
- Investment
- operating Cost
- Escalation Rate
- First Tranche Petroleum (FTP) *
- cost Recovery*
- Equity to be Split (ETS)
- Division of Revenue (Share)
- Domestic Marketing Obligation (DMO)*
- Taxable Income (TI)
- tax
- expenditure
- Net Contractor Share (NCS)
- Total Contractor Share (TCS)

*) Only in the standard PSC

A. *PSC Standard Economic Concept*

In the standard PSC contract size of government and the contractor's share of gas at 70: 30 before deducting taxes. The amount of tax that should be paid to the government by 40%, besides there are FTP and DMO are submitted to the government. But for standard PSC investment costs borne by the government in the form of cost recovery. Fiscal standard PSC regime in Indonesia is shown by the schematic in Figure1.

B. *Gross Split Economics Concept*

The main difference with the gross ordinary PSC split is that the oil share of gross production is no cost recovery from the government. Base split between the government and the contractor is at 57:43 to 52:48 for the oil and gas. PSC split in gross, the risk for contracting associated costs are higher because there is no cost recovery. The contractor should be more selective and efficient. But there is an advantage of this mechanism which is the contractor does not have to seek approval for the budget to SKK Migas. It provides the bureaucracy and the opportunities easier and time efficient. Fiscal Gross Split Indonesian regime with the scheme shown in Figure 2.

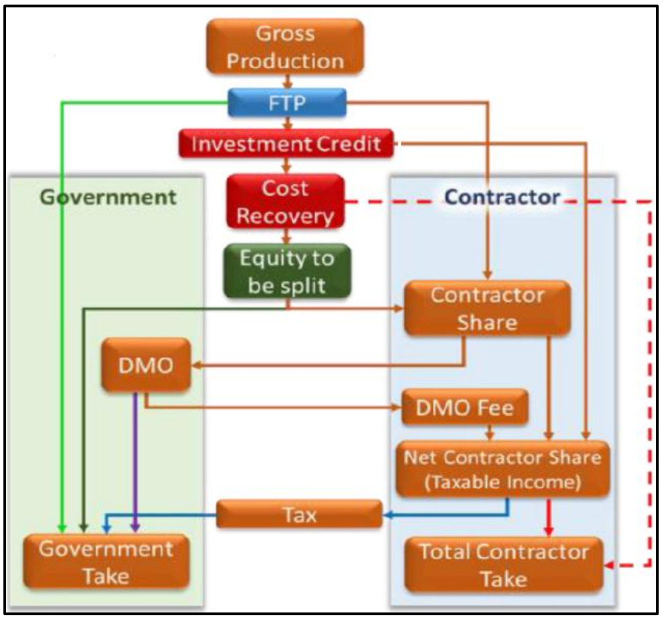

Figure 1. Fiscal Regime PSC Standards (Daniel H, 2017)

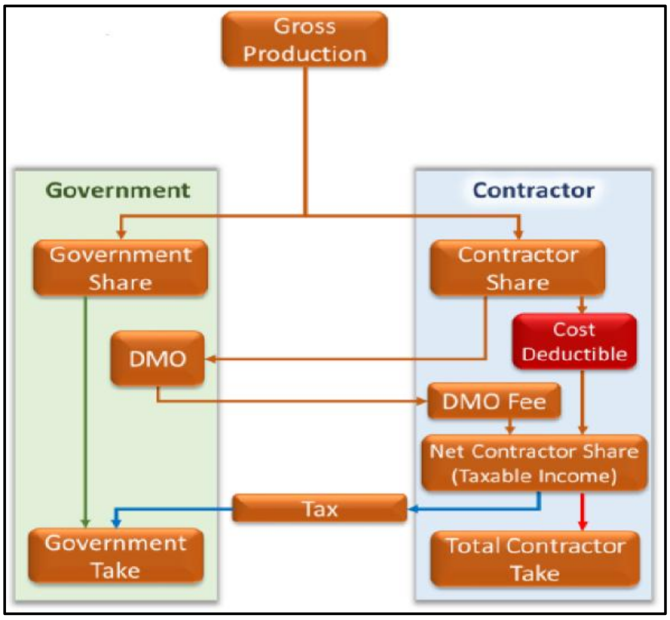

Figure 2. Fiscal Regime Gross Split (Daniel H, 2017)

Summary of regulatory standards and fiscal regimes gross PSC split is shown in Table I below:

TABLE I. INDONESIA FISCAL REGIMES SUMMARY

Parameter	PSC Standard	Gross Split
FTP	20%	none
cost Recovery	POD base	none
tax	40%	40%
Share Government: Contractor	80%: 20% (Oil) 70%: 30% (Gas)	57%: 43% (Oil) 52%: 48% (Gas) variable Split progressive Split
DMO	25%	25%

C. *Analysis of Economic Indicators*

The Output from the economic analysis is economic indicators such as Net Present Value, Rate of Return, Pay Out Time, Profit Investment Ratio, Discounted Investment Profit Ratio can be used as the basis for the selection of a field development scenarios.

Net Present Value (NPV). Value stream of cash flows is calculated using a discount rate determined. A higher NPV means that the value of investing in today's dollars higher. In general, who has a greater proportion of income at the beginning of the end will have a higher NPV.

$$NPV = \sum_{t=1}^{n} CF_o + \frac{CF_n}{(1+r)^n} \quad (1)$$

Rate of Return (ROR). The interest rate that makes the NPV equal to the NPV Net Income Investments. Higher ROR provides a higher return on investment. ROR typically compared with bank interest. ROR should be higher than bank interest plus a risk premium. Normally every company has a limit on the minimum value of the desired ROR expressed in MARR (Minimum Attractive Rate of Return). A project is considered feasible if ROR is greater than bank interest or greater than the MARR.

$$0 = \sum_{t=1}^{n} CF_o + \frac{CF_n}{(1+ROR)^n} \quad (2)$$

Profit to Investment Ratio (PIR). Profit to investment ratio is the ratio of net profit to total investment. PIR higher means higher profits

$$PIR = \frac{\text{Total Undiscounted Net Cashflow}}{\text{Investasi}} \quad (3)$$

Discounted Profit to Investment Ratio (DPIR):

$$DPIR = \frac{\text{Total Discounted Net Cashflow}}{\text{Investasi}} \quad (4)$$

Pay Out Time (POT). Payout Time is the length of time required to collect the gross income equal to the gross investment. POT lower is better investment because the contractor can recover their investments more quickly and also provide more security.

III. METHODOLOGY

The methodology used in this study are the stages:

1. Field data collection on field development plans, including the prediction of production, work programs, and schedule with the investment scenario and investment compressor wells.
2. The calculation of the government's cash flow, the contractor and the contractor with the PSC and the fiscal regime Gross Split
3. Analysis and interpretation of economic indicators of economic outcomes.

IV. DATA ANALYSIS AND CALCULATIONS

A. *Data collection*

Data Engineering:

Gas reserves = 148.18 BSCF

Pressure reservoir = 1380 psia

Surface test data are shown in Table 2:

TABLE II. SURFACE TEST DATA

flow	choke Size	THP
	/ 64 in	psia
1	16	800
2	24	450
3	32	350
4	48	200

Sales line pressure = 300 psia

HP compressor = 500 HP

Gas sales agreement consists of a fixed rate and pressure sales line. Fix the desired rate of 5 MMSCFD with a pressure of 300 psia. By considering technical aspect to meet sales gas production according to the agreement, created a scenario with optimization choke and compressor installation and combined well with the addition of the well as shown in Figure 3.

Production profile for the field ID planned to follow the pattern seen in Figure 3. The development strategy is summarized in a work program with investment and investment compressor wells. To meet the fixed rate 5 MMSCFD in the plan optimization choke when the decline rate has reached a critical point, the effect of optimization choke causing wellhead pressure is getting smaller and is unable to transport the gas to the sales line, it is necessary for investment compressor. Decline initial rate of 13% while the average choke optimization of decline down to 3.6%. If the choke own maximum optimization then continued with investments wells. In 2019 require three production wells, in the implementation of production planning requires a draft of which are tabulated in Work program costs and budgeting in Table III.

Gas production daily average of 5.5 MMSCFD which captured 10% above as gas sales agreement by 5 MMSCFD. Operating cost is calculated each amount of production (US $ / MMBtu), which consists of lifting costs and general and administration. For this calculation it is assumed conversion of the heating value of 1 MSCF = 1 MMBTU. Summary operating cost can be seen in Table IV.

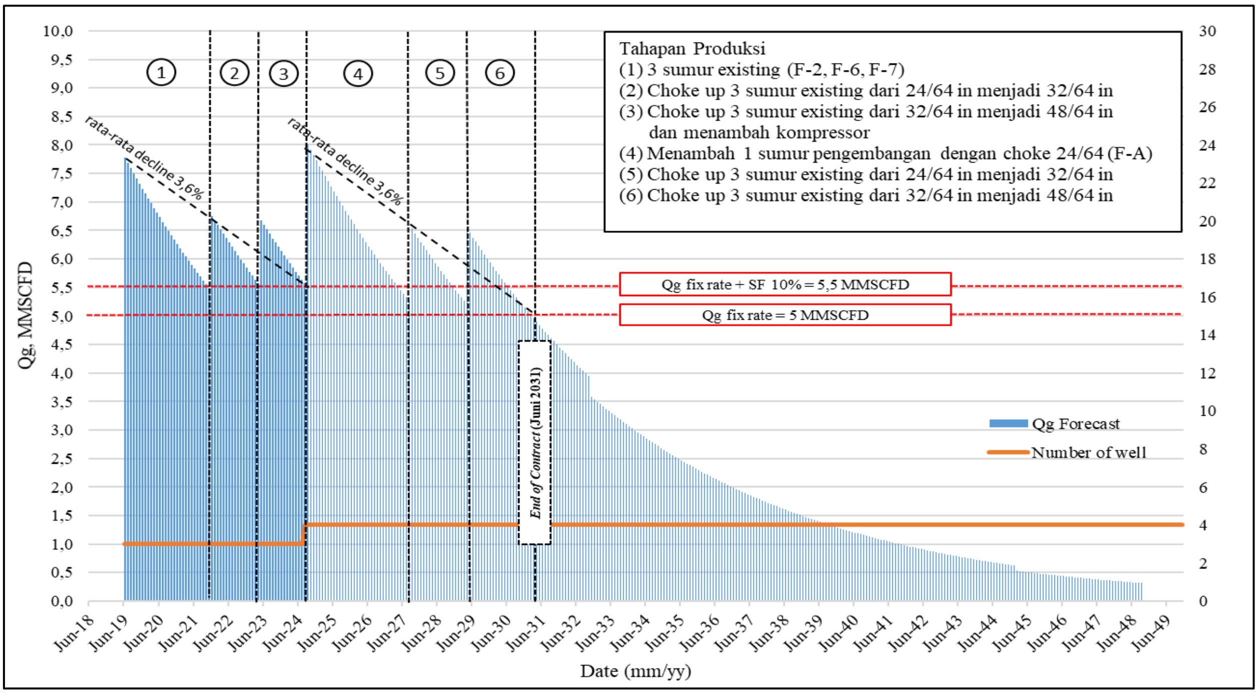

Figure 3. Gas Production Planning Pattern

TABLE III. WORK PROGRAM AND BUDGETING

No.	Description	unit	cost/Unit	Unit to buy	Price	Cap (70%)	Non-Cap (30%)
			MUS $		MUS $	MUS $	MUS $
1	Year-0 (2018)						
	Drilling	well	4,000	3	12,000	8,400	3,600
	piping Installation	per km	100	3	300	210	70
	Surface Facilities	train	3 .000	1	3,000	2,100	900
	GG & R Study	pack	250	1	250	-	250
2	Year-5 (2023)						
	Installation Kompressor 500 HP	train	1000	1	1000	700	300
2	Year 6 (2024)						
	Drilling	well	4,000	1	4,000	2,800	1,200
	piping installation	per km	100	1	100	70	30

TABLE IV. OPERATING COST

No.	Description	Cost / Unit	Cost / Unit	Fixed rate / year	cost
1	lifting Cost	0:35 US $ / MMBtu	350 US $ / MMscf	2007.5 MMscf	MMUSD 702.625 /year
2	General and Administration Cost	0035 US $ / MMBtu (10% Lifting Cost)	35 US $ /MMscf (10% Lifting Cost)	2007.5 MMscf	70,262.5 MMUSD / year
total Cost					772,887.5 MMUSD / year

*) 1 MSCF = 1 MMBTU

B. *Economies analysis*

Economic analysis on the development of the gas field is managed by PT.X INDO who analyzed based system Contractor Contract (PSC) with SKK Migas with system Production Sharing Contract (PSC) and gross standard split. INDO gas field development contracts starting from 2018 until 2033 (15 years old). The contract terms are summarized in Table V.

TABLE V. CONTRACT REQUIREMENT

Parameter	PSC Standard	Gross Split
time Contract	15 years	15 years
discount rate	10% / year	10% / year
The price of gas	6 US $ / MMBTU	6 US $ / MMBTU
GHV	1 MSCF = 1 MMBTU	1 MSCF = 1 MMBTU
Fix Rate	5 MMSCFD	5 MMSCFD
operating Cost	0:35 US $ / MMBTU	0:35 US $ / MMBTU
DMO Fee	25%	25%
Investment Credit	0%	0%
depreciation	DDB 5 years	DDB 5 years
Escalation rate	2%	2%
tax (tax)	40%	40%
Government Share	70%	52%
contractor Share	30%	48%
variable Split		0%
progressive Split		0.25%

1) *Cost*

Costs incurred for the development of this field consists of the investment costs and operational costs. The investment cost consists of the cost of capital (tangible) and non-capital (intangible). Cost of capital is the cost of the investment is used to pay for purchases in the form of goods, while the cost of non-capital investment is an investment cost that is used for payment services. Operational costs consist of the cost of field operations as well as general and administration. The cost of this operation depends on the rate of gas production per year.

The amount of investment prices are tabulated in Table III and Table IV.

2) Indicator Calculation Economies

Step profits indicator calculation is as follows:

a) Calculating the Rate of Return (ROR)

In this field development scenario with PSC standards obtained ROR of 55% greater than the gross split that only 44.75% meaning them favorably with MARR 12%. However ROR bigger is better.

b) Counting profit

NPV @ df = 10% = $\sum_{n=1}^{4} CCF(DF)$

That is, the cumulative values of cash flow to be received in the future are dating (15 years). The greater the NPV, the better.

TABLE VI. SUMMARY ECONOMIC ANALYSIS

No.	PSC Standard (MMUSD)		Gross Split (MMUSD)	
	gov	con	gov	con
NCF	98.5	59.5	93.7	43.3
NPV	41.4	25.14	38.5	15.2

c) Calculating Pay Out Time (POT)

POT = (Year 1 / (Cum. DCCF2 - DCCF3))

PSC Standard = 2.5 years

Gross Split = 2.7 years

POT or capital period indicate a return of capital for a certain time as shown in Figure 4 and Figure 5. Thus, this scenario can be said to be beneficial for capital back quickly. Summary of economic results on the development of gas fields This ID can be seen in Table 5.

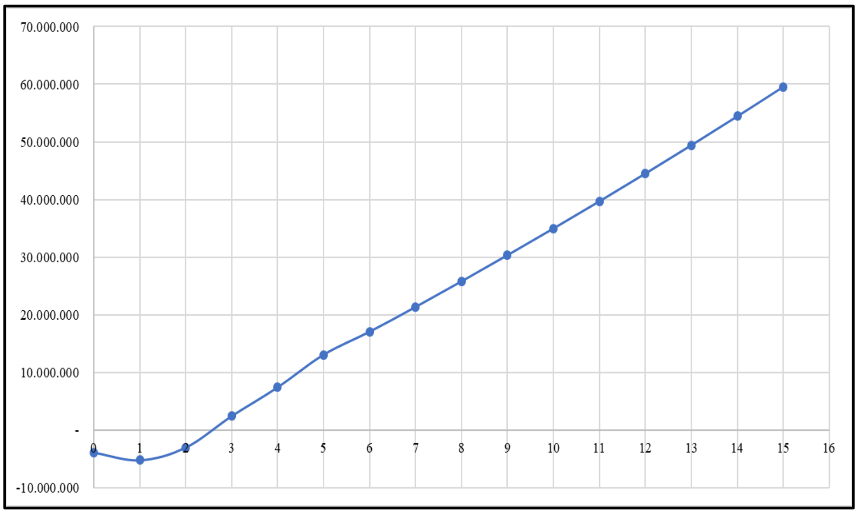

Figure 4. Pay Out Time PSC Standard

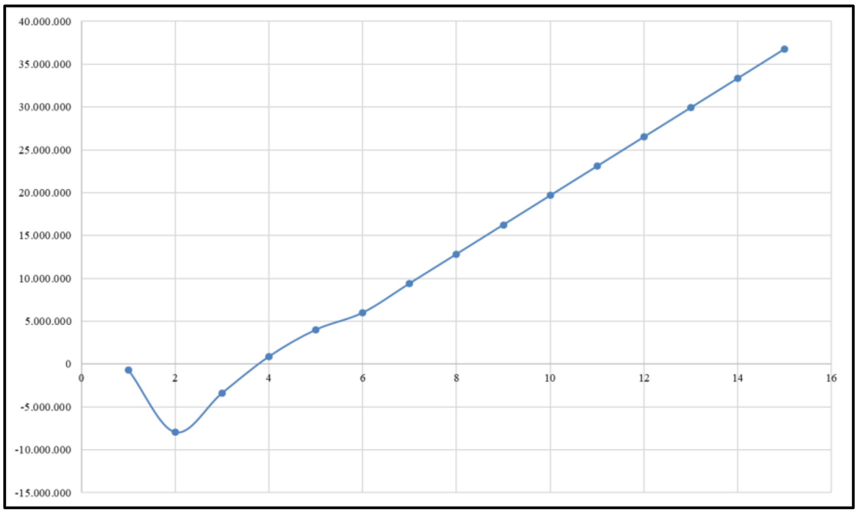

Figure 5. Pay Out Time Gross Split

TABLE VII. SUMMARY ECONOMIC ANALYSIS

Parameter	PSC Standard	Gross Split
gas Production	27.3 BSCF	27.3 BSCF
gas Price	6 US $ / MMBTU	6 US $ / MMBTU
Gross Revenue (100%)	193.15 MMUSD	193.15 MMUSD
Project life	15 year	15 year
Investment	38.4 MMUSD	38.4 MMUSD
Capital	25.5 MMUSD	25.5 MMUSD
Non capital	5 MMUSD	5 MMUSD
operating Cost	12.4 MMUSD	12.4 MMUSD
cost	50.8 MMUSD	50.8 MMUSD
(% Gross Revenue)	22%	22%
Government		
Government Take (NCF)	98.5 MMUSD	93.7 MMUSD
Tax (40%)	20 MMUSD	14.5 MMUSD
Government NPV @ 10%	41.44 MMUSD	38.5 MMUSD
(% Gross Revenue)	51%	61%
Contractor		
Take Contractors (NCF)	59.5 MMUSD	43.3 MMUSD
Contractors NPV @ 10%	25.14 MMUSD	15.2 MMUSD
(% Gross Revenue)	31%	28%
ROR	55%	44.75%
POT	2.5 year	2.7 year
PEAR	195%	30%
DPIR	82%	12%

*) 1 MSCF = 1 MMBTU

V. DISCUSSION

Planning the production profile for the field ID follow the pattern seen in Figure 3. In this development scenario, to meet the fixed rate of 5 MMSCFD in the plan optimization choke when the decline rate has reached a critical point, the effect of optimization choke causing wellhead pressure is getting smaller and is unable to transport gas to the sales line, it is necessary for investment compressor. In 2019 require three production wells, after the decline reached a critical point in 2021 and 2023 did choke up later in 2024 to add one production well and until the end of the production is done choke up back.

Analysis of project economics of this scenario, the gross revenue earned a total of 193.15 MMUS $. Costs amounted to 38.4 capex and opex for MMUS $ MMUS $ 12.4 for a total cost of $ 50.8 MMUS.

With fiscal analysis standard PSC regime which imposes a cost on the government, earned net income (NCF) government that comes from the share, FTP government, DMO and obtained tax amounted to 98.5 MMUSD NPV @ 10% amounting to 41.44 MMUSD. Net revenue (NCF) contractor comes from the share, FTP contractor and reduced by the DMO DMO Fee plus tax amounted to 59.5 MMUS earned $ NPV @ 10% amounting to 25.14 MMUS $.

By analyzing the fiscal regime which imposes a split gross cost to the contractor, earned net income (NCF) government that comes from the share, DMO, and obtained tax amounted to 93.7 MMUSD NPV @ 10% amounting to 38.5 MMUSD. Net revenue (NCF) contractor comes from the share, reduced by the DMO DMO Fee, cost, and obtained 43.3 MMUSD tax NPV @ 10% amounting to 15.2 MMUSD.

Based on the analysis of indicators of economic row for PSC standards and gross splits are obtained ROR (Rate of Return) of 55% and 44.75% which are both profitable with a value greater than the MARR accounting for about 12%, POT (Payout Time) during 2.5 years and 2.7 years, PIR (Profit to investment ratio) of 195% and 30%, and DPIR (Discounted profit to investment ratio) by 82% and 12% (Summary economic calculation results are tabulated in Table VII)

PSC split in gross, the risk for contracting associated costs are higher because there is no cost recovery.

VI. CONCLUSION

Based on the results of research and calculations have been carried out can be concluded as follows:

1. Field development scenario models with wells and compressor investment can affect the performance with difference of 9.4% decline rate from 13% (with existing wells) to 3.6% (with a choke and investment optimization compressor). It can maintain the investment for 5 years thus saving costs.

2. Tax rate imposed on the contractor for the PSC and the gross split which is 40%
3. With a fiscal model of the standard PSC regime, government's net profit after tax and deducted by cost recovery amounted to 98.5 MMUSD NPV MMUSD 41.44 while net profit amounted to 59.5 MMUSD contractor with NPV of 25.14 MMUSD. ROR of 55% and POT period of 2.5 years.
4. With the model split gross fiscal regime, government's net profit after tax and deducted by cost recovery amounted to 93.7 MMUSD with NPV of 38.5 MMUSD while net profit amounted to 43.3 MMUSD contractor with NPV of 15.2 MMUSD. ROR amounted to 44.75% and the POT for 2.7 years
5. When compared to the gains between the standard PSC to gross more favorable split for contractors with a standard PSC fiscal regime for gas field project. This is because the fixed rate pegged at a cost that makes gross revenue each year has remained constant during the production contract. The effect is a constant revenue followed by annual expenditure by the contractors who dependents cost higher due to the escalation so as to make a smaller profit.

REFERENCES

[1] Ikoku, Chi. "Natural Gas Reservoir Engineering". John Wiley and Sons: The Pennsylvania State University, 1984, ISBN 0-471-89482-6. Chp 6 pp.279-311

[2] El-Feky SA "A Combination Gas Field Development model is evaluated with Field Data". SPE 16 937, 1987.

[3] Bennett, PM "Economic Field Development Planning". SPE 9718, 1981.

[4] Pudyantoro, AR "Gas Upstream Project Evaluation and Analysis PetroEkonomi. Jakarta: Petromindo. 2014.

[5] Putrohari RD, Kasyanto A, Suryanto H, Rashid IMA "PSC Term and Condition and its Implementation in Southeast Asia Region :. IPA07-BC-127 2007.

[6] MA Adamu, JA Ajienka and SS Ikiensikmama. "Evaluating the Economic Impact of Fiscal Provisions in the draft Petroleum Industry Bill on Marginal Offshore Oil Field Development". IJSEI vol.4 issue 45, October 2015 pp.39-45

[7] Daniel, Harimurti. "Indonesian Milestone in Production-Sharing Contract in Perscpective of Government Take, Cost Recovery, and Production Target". Paper SPE-187 008-MS.2017.

[8] OO Illedare. "Analyzing the impact of Petroleum Fiscal Arrangement and Contract Terms on Petroleum E & P Economics and the Host Government Take" SPE paper 88 969 2004

[9] Dharmaji, T and Parlindungan, T. "Fiscal regimes Competitiveness Comparison of Oil and Gas Producing Countries in the Asia Pacific Region: Australia, China, India, Indonesia, and Malaysia". SPE Paper 77912.2002.

[10] JB Michael. "A Discussion on the Effect of International Fiscal regimes on Portfolio Selection in Petroleum Industry" SPE 82 011 2003

[11] Livia MM "The Fiscal System Influence on Oil Fields Development and Government Participation". SPE-178 752, 2015.

[12] Government Regulation 79 year 2010

[13] Law of the Republic of Indonesia number 22 year 2001

[14] EP Afriandi and AH Shanni. "Indonesia Wellwork perfromance Management and Evaluation" SPE-176 427-MS, 2015

[15] AZA Faris. "At an Investment Crossroads: Malaysia Versus Indonesia". SPE-176 285-MS, 2015

[16] Ferdian F, Ilyas A, and Mediyanti V. "CBM Development Scenario Optimization for Production Sharing Contract Case Study: Sumbangsel Field, Indonesia". SPE Paper 167 680 2004.

[17] Huffington, Roy M. "Economic Aspects of Successful Indonesian Venture". SPE Paper 7737.1979.

[18] GK Kellas and H Susan. "Risk in Exploration and Production Sharing Contract". SPE 28209, 1994

[19] I Mmakwe and Ajienka JA "Comparative Evaluation of Models for Joint Venture Agreement and Production Sharing Contract Fiscal Regime in Nigeria". SPE 128 886 2009

[20] GM Fachin, "Environmentally Sensitive Contract". SPE 26 027 1993

[21] MoEMR Regulation 52 year 2017.