Paper

Economics Evaluation on the Bidding of Oil and Gas Blocks in Indonesia

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Nuzulul Haq

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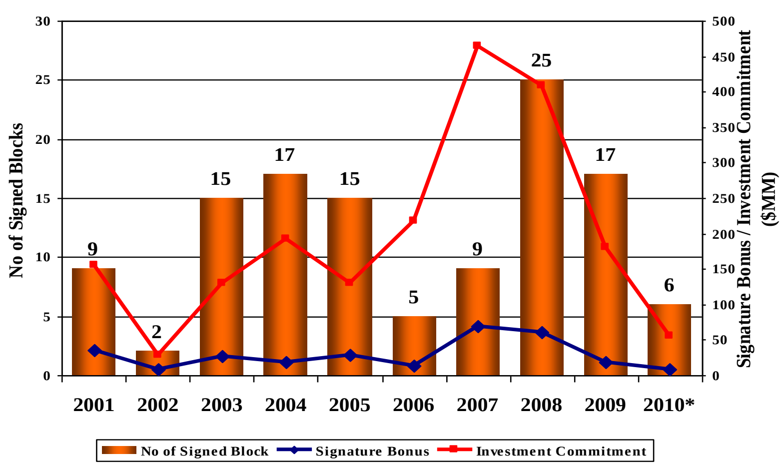
Background

The Indonesian Government has set itself an ambitious target to increase oil and gas production by 2010. The Government recognizes that in order to achieve this goal in an environment of diminishing production from declining mature fields and increasing global competition, it must continue taking steps to improve the fiscal terms available to investors in order to encourage further exploration and investment in Indonesia’s petroleum industry.

Currently, there are two principal mechanisms for awarding blocks in Indonesia, i.e.: Regular Tender and Direct Offer.

In the process of blocks tender, each contractor should submit the competitive bidding proposal to government for winning the block. The parameters that mostly considered by government are the commitment program and amount of signature bonus.

The below figure showed the total amount of signature bonus and firm investment that was committed by tender winners for period 2001 - 2010.



From the bidding process, we sometimes confused what is proper value of the prospect and how we justify the value.

This situation substantiates our belief that investor requires some guidance in determining the total value of signature bonus and commitment program for bidding block in Indonesia.

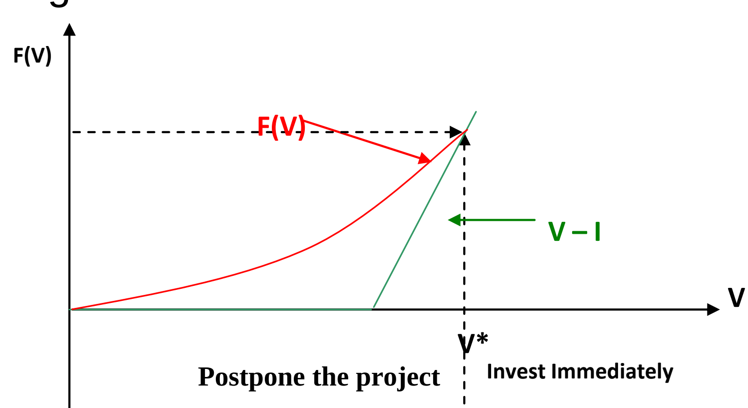
Unexplored Reserve Valuation

Traditionally, the economics evaluation on the unexplored block is based on the combination of Net Present Value (NPV) and Probability of Geological Success (Pg). This approach requires the assumption of production profile and development cost schedule that in some cases, it is very difficult to get from the unexplored blocks.

The criteria for the NPV approach implicitly assume that no possibilities exist for the delay of any investment costs. In this regard investment must be treated as a "Now or Never" decision. However, in practice, investment can be delayed in order to obtain more information on the variables that are to determine project profitability (Pindyck, 1991 and 1995). Therefore, the decision concerning when to invest should compare the project values of an immediate investment and at all possible investment points in the future.

Investor will only invest if the investment they intend to make has a sufficient rate of return. However, in addition to the above another factor is the uncertainty and this must be considered when making decisions about projects. This means that there is a "threshold price" and this is an integral part of making an optimal investment. Therefore, as uncertainty increases so does the threshold price and if the value of the project is less than the threshold price then investors will hold off on making their investment.

As shown in the figure (Pindyck, 1991) , the threshold price is the critical value at which it is optimal to invest



Determine value of signature Bonus and Firm Commitment in Bid proposal

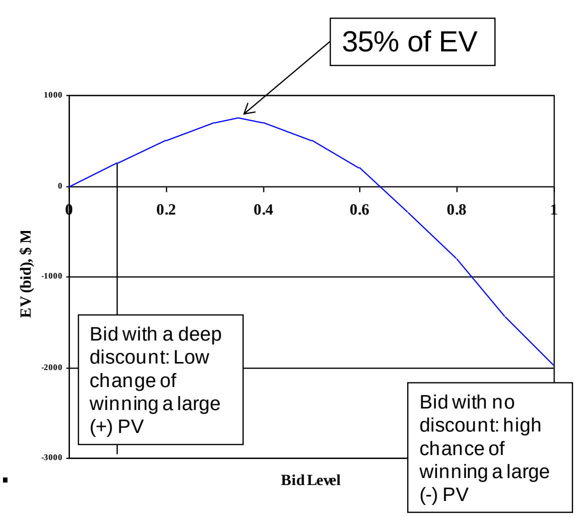
The key principle in the bid strategies is to how add value for company, not just winning the block.

Due to the uncertainty in estimating volume, chance and value, whenever there are many bidders, almost invariably someone will unknowingly overestimate the attractiveness of a block offered under sealed bid and will pay too much for the block ("winner's curse").

Based on the study of three employees of ARCO (Edward Capen, Robert Clapp, and William Campbell) in 1971, in the bidding for offshore drilling right in US, they noticed oil companies seemed to be suffering unexpectedly low rates of return on their investments, often finding much less oil underground than they had hoped.

Based on their observation in ARCO, they suggested that the optimal bid level for balancing these opposing factors was 35% of the EMV of the block as seen in the below figure.

To get the appropriate bid level, we should refer to the level uncertainty in our assessment of the volumes, chance and value of the block. The magnitude of the bid level is proportional to the uncertainty associated with the estimation of value for the prospect or property. As uncertainty increases, increase the depth of discount (low bid level).



Case Study

In this case study, we would evaluate a prospect (block X) that was tendered in Dec 2007. This prospect is estimated a potential gas resource of 5-15 TCF. Term Conditions applied on this prospect is as follows:

- split after tax: 65:35 (oil) and 60:40 (gas)
- minimum signature bonus: $ 5 million

As this prospect is still in the exploration stage, there is uncertain to discover gas. We assumed the probability of geological success (Pg) is 15%.

There are three case scenarios of reserve for this evaluation, i.e.:

1. P90 = 5 TCF (worst case)
2. P50 = 10 TCF (base case)
3. P10 = 15 TCF (best case)

Using the combination of PSS model calculation and a study of Capen et all, we would determine the total value of signature bonus and investment commitment for bid submission on this prospect.

Below is the data assumption

DATA ASSUMPTION	P90	P50	P10
Probable Reserve (mmscf)	5,000	10,000	15,000
Chance of Success	15%	15%	15%
Exploration Lag (year)	3.0	3.0	3.0
Development Cost if Success ($/mmscf)	0.54	0.27	0.18
Development Lag (year)	2.0	2.0	2.0

Exploration Cost Assumption	P90	P50	P10
Chance of Success	0.15	0.15	0.15
% Intangible drilling cost of total exploration cost	0.85	0.85	0.85
Exploration Lag	3.0	3.0	3.0
Value of Exploration Option	0.02	0.07	0.15

Result (1)

Based on the reserve transaction in Indonesia in the end 2007 and early 2008 for the similar block, the transaction was deal in \$0.80/mmscf. This was a sufficiently reliable estimate for developed reserves price. This market value of developed reserve (mvdr) is then discounted for this development lag of 2 years (t) according to:

$$V = mvdr \times e^{-\delta \times t}$$

Using the equation, we found the prospect Value (V) = 0.6/mmscf.

The volatility parameter is assumed and taken from the annual standard deviation of rate of change of oil price equal to 34%. Risk free rate is assumed to be 5%.

The first set of results reflects the price per mmscf of the fields at each of their different reserve scenario. The below table reports development options value for each scenario at the end of 2007. As seen in the scenario of P50 and P10 reserve, the prospect value goes above this threshold price it is the optimal time to exercise the option and get to the next stage of development.

	P90	P50	P10
Prospect Value (\$/mmscf)	0.600	0.600	0.600
Value of the Development Option	**P90**	**P50**	**P10**
Threshold Price (V*)	0.641	0.320	0.214
Hold Value (AV^B)	0.181	0.685	1.492
Exercise Value (V-D)	0.179	0.390	0.460
Value of the Development Option	0.181	0.390	0.460

The above result discusses the real option procedure to value undeveloped reserves where exploration has already taken place. We have calculated the value of the undeveloped reserves based on the assumption that we can choose to develop the reserves at any time prior to the expiration of the lease.

Result (2)

Since the prospect of block X is still in the exploration stage, we should incorporate the probability of geological success (Pg) into this valuation by taking the “hold value” from the results of the development options even though this value is higher than the threshold price.

This is the exact position if an exploration program has to be run where oil has to be found first before it can be developed. The reasons why the values of the exploration options are lower than development options are:

1. we have to pay exploration costs
2. we may not be able to exercise development option at what would otherwise be the optimal time
3. we introduce the possibility that exploration might not be successful.

Acquiring the Development Option Value (DOV) is one of the two possible outcomes from an exploration program. The other possibility is a dry hole.

To find the Exploration Option Value (EOV) with exploration period of three years (t), we use the following formula:

$$EOV = Pg \times DOV \times e^{-\delta \times t}$$

Below table shows the result of exploration option value for each scenario.

Exploration Cost Assumption	P90	P50	P10
Chance of Success	0.15	0.15	0.15
% Intangible drilling cost of total exploration cost	0.85	0.85	0.85
Exploration Lag	3.0	3.0	3.0
Value of Exploration Option	0.02	0.07	0.15

Result (3)

To find the maximum amount that should be committed to an exploration program (Cmax), we use the following formula:

$$C_{max} = \frac{EOV}{(1 - \text{contractor share} \times \%\ \text{intangible cost} \times \text{tax})}$$

After we found the total exploration spending, we would multiply a certain bid level. In this case, we applied bid level of 20% as seen the result in the table below. This is the maximum amount paid to this block in terms of signature bonus and exploration investment commitment.

Max. Exploration Cost and Signature Bonus	P90	P50	P10
Max Exploration Cost Spending ($/boe)	0.02	0.09	0.20
Max Exploration Cost Spending ($MM) incl sign bonus	121	911	2,976
Bid Level Applied 20%	24	182	595
If Signature Bonus ($MM)	40	40	40
Commitment Program (Drilling + seismic 2D/3D)	(16)	142	555

If signature bonus is B, we can use equation 10 to calculate investment commitment (I). We can replace Cmax in equation 11, by B + I to find I = [EOV / (1- contractor share x intangible cost x tax)] - B.

Let's say, we use the base case scenario (P50, 10 TCF reserve) as a basis evaluation for bidding this block.

As shown in table 6, if the maximum signature bonus is $ 40 million, the total investment commitment is $ 142 million. The total amount of $ 142 million would be spread for 3 year program for seismic and drilling activity in the bidding proposal.

“PSS model is useful for valuing reserve with limited information”