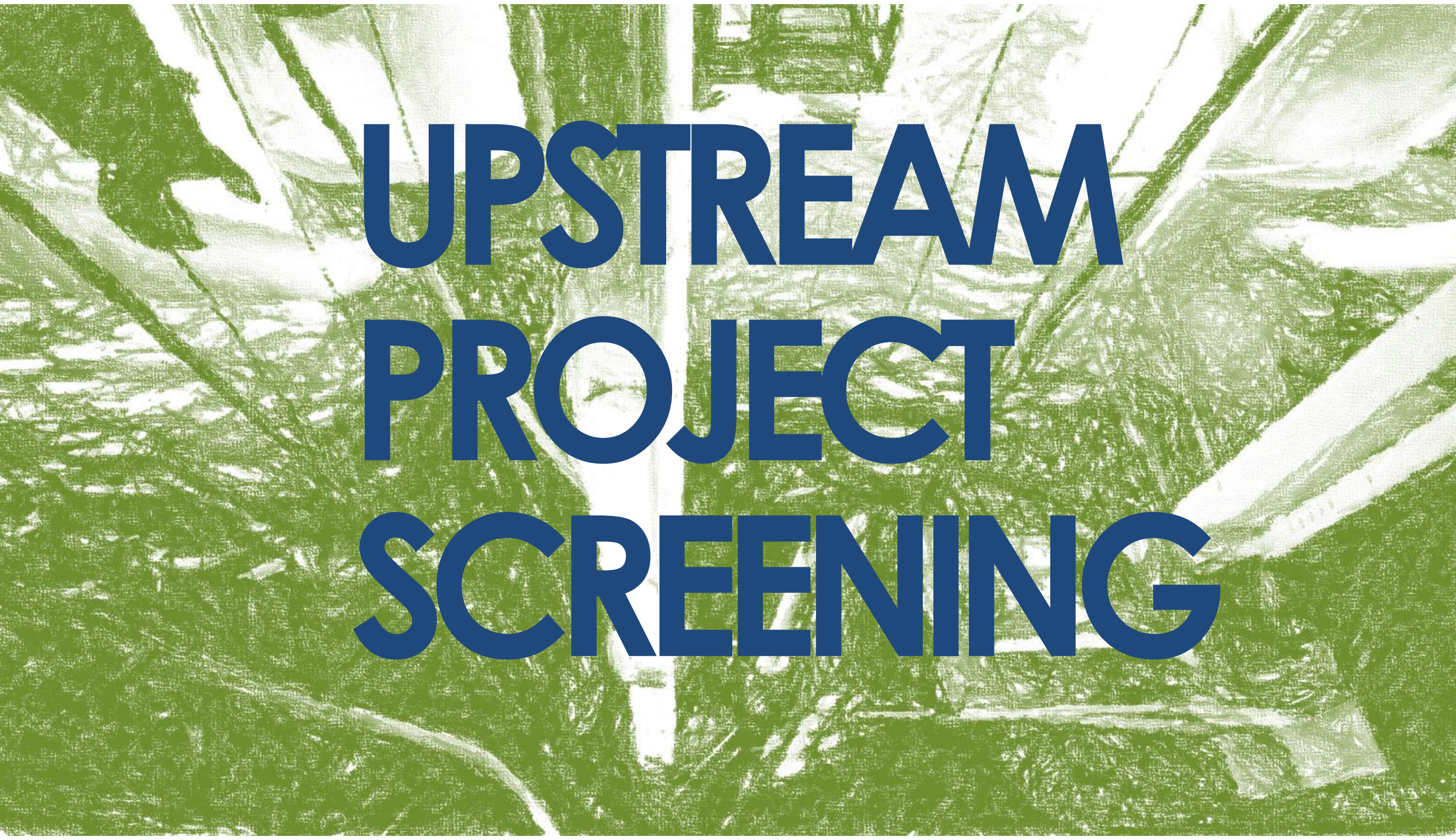

# UPSTREAM PROJECT SCREENING

## ABOUT APTA CONSULTING

APTA provides Financial modelling, Petroleum Economics evaluation & analysis, and Excel training for business modelling and data analysis to range of clients. Our clients range from blue chip to small enterprises and individuals. Our clients have access to high quality, cost effective modelling support delivered by team of experts around the world.

## APTA OIL & GAS TEAM

APTA's dedicated Oil & Gas modeling team is led by Santosh Singh. Santosh has more than 12 years of industry experience. With a technical background in drilling engineering and further qualification in Finance and Economics, he has worked in a number of major technical and commercial functions and gained extensive experience in economics evaluation, business development and commercial agreements.

Santosh's commercial valuation and analysis experience covers Africa, Asia, and Eurasia to name a few. He has a proven ability in the fiscal regime modelling, investment analysis, and providing high quality support to management for the strategic investment decisions.

SANTOSH SINGH
PRINCIPAL CONSULTANT, OIL & GAS

# PROJECT SCREENING

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When we have to evaluate upstream projects often one of the question asked is does the given project meets a set threshold or the hurdle? Project screening is a process in which we assess whether the minimum required criterion is fulfilled or not. If the economic indicator shows that the project has met the minimum threshold limit, it passes the screening test and therefore can be considered for investment decision. If it fails the screening test, the project is discarded and no further evaluation is carried on it.

One common screening tool in upstream Oil and Gas sector is the IRR. The threshold or the hurdle rate should be set at a level which covers the cost of capital in addition to an allowance for extra margin which can cover both company and project specific risks. For example, if the hurdle rate for IRR is set at 25%, then a project having an IRR say 20% will be rejected and not be acceptable to the management (even if the actual cost of capital of the company is less than 20%).

An investor or a company with no constraints can take on all available projects which meet the screening criteria. But when the investor has certain constraint and he cannot take up all the projects at hand, it is necessary to rank the projects so as to optimize the business.

The optimization can be done by ranking all successful projects that has passed the screening criterion on the basis of the NPV. NPV in such situation be based on company's true cost of capital as this gives the true value of the project.

It is not necessary that a project with the higher IRR will also have higher NPV or vice versa. We should use the NPV Profile to make decision. The NPV based method ranks projects on value only. For holistic decisions, one should also consider other constraints such as: maximum exposure, production limitations, and manpower constraint

For e.g. to compare proposals where maximum exposure is a constraint, the PIR and its exposure-based equivalent PI can be useful. When production or manpower are constraints, ratios such as profit per barrel of production (NPV / PV production) may be more relevant.

# BREAK EVEN

Break even refers to situation when the project just achieves a no profit-no loss situation. Generally, it refers to price, i.e. the minimum price at which the project just recovers all its cost or just pays out but no profit is made. The condition for breakeven is when:

At break-even:

Gross Revenue = Total Costs

Price = Per Barrel Costs

For upstream Oil and Gas project when we talk about it usually implies the price at which the NPV of the project is zero. Since NPV is always based on a discount rate, a break-even price is then always for a particular discount rate.

At break-even:

NPV = 0

Break-even can be thought of from various angles, such as pre-tax break-even price, post-tax break even-price, break-even price in real term, break-even price in nominal term, etc. It depends what the definition of break-even condition is as set by the person asking that question. In case of pre-tax break-even price, we set the PV of Gross Revenue equal to PV of Capex and PV of Opex (we ignored royalty here for sake of simplicity).

PV of (Volume x Price) = PV Capex + PV Opex

Price x PV Production = PV Capex + PV Opex = PV Costs

Price = PV Cost/ PV Production

Thus the break-even price in present value terms is PV of cost per unit of PV of production, on a pre-tax basis. We can also call it pre-tax discounted Break-Even price. The concept of discounting production volume (barrels) is unusual yet some companies do use this concept.

A relationship between the required rate of return and the oil price can be established to quickly show what oil price is required to achieve a target rate of return, or conversely what rate of return will be given by a particular oil price.

We can also think of Break-Even Oil price as the price at which a given economic indicator of interest of a given project equals the minimum required value. This desired economic indicator can be NPV, NCF, IRR or even Reserves size. The break-even oil price estimated using the above then becomes the minimum Oil price above which the project can become economic/profitable.

We have already seen the NPV approach of determining break even Oil price above. The alternative approach is to use IRR for finding the break-even Oil price. Under this approach we establish an Oil price at which the IRR of the project equals the hurdle IRR rate set by the management. We calculate several IRR under several prices and repeat the process until we have an Oil price which gives us the required IRR (= Hurdle rate). In Excel this can be easily solved using Goal Seek functionality. Alternatively we can plot the chart of Oil price and IRR and by interpolating we can arrive the break-even Oil price.

*Minimum Economic Reserve* is the volume of commercially recoverable crude from a field which gives us a minimum NPV of greater than zero (when discounted at the company hurdle rate). Fundamentally it gives the lowest possible reserve size which can be profitable to develop under the given fiscal contract, cost and price assumptions.

The methodology to estimate the minimum economic reserve is same as finding the break-even oil price. Only this time the target variable to vary is the reserve size (and thus production profile) instead of Oil (or Gas or both) price. The process is iterative. It requires running several cases with different reserves size (and thus different production profile and associated cost profile) at a given price. The results of the NPV and the reserve sizes are plotted and we can interpolate the minimum economic reserve size.

## UNIT COTS

Unit cots mean cost per barrel of production. This can refer to Capex/barrel of production, Opex/barrel of production or both. This unit cost can be gross or net of tax, discounted or undiscounted. This indicator is useful when:

- ✓ Ranking project on production and not money; when production is constraint
- ✓ Comparing costs of projects of different size
- ✓ Estimating break-even oil price
- ✓ Establishing tariff for sharing facilities etc.
- ✓ Comparing Unit NPV with company's "finding costs"
- ✓ Valuing acquisition/disposal on per barrel basis.

Technical Cost per barrel = (Capex + Opex) / Volume    $/ Bbl
Unit Capex = Capex / Production
Unit Opex = Opex / Production

Basically we divide the total costs by total volume produced to arrive at the unit costs. See the example below: We assumed 10% Royalty rate and 40% tax rate with 200 million barrels in production.

| | Total | | Per Barrel | |
|---|---|---|---|---|
| *Volume(MMBbl)* | 200 | | | |
| | Total | | Per Barrel | |
| *Revenue(MM$)* | 10000 | Revenue ($/Bbl) | 50 | |
| *Royalty(MM$)* | 1000 | Royalty ($/Bbl) | 5 | |
| *Opex(MM$)* | 2000 | Opex ($/Bbl) | 10 | |
| *Capex(MM$)* | 2000 | Capex ($/Bbl) | 10 | |
| *Tax(MM$)* | 2000 | Tax ($/Bbl) | 10 | |
| *NCF(MM$)* | 3000 | NCF ($/Bbl) | 15 | |
| *NPV(MM$)* | 1950 | NPV ($/Bbl) | 9.75 | |

The total unit technical cost in the above = (Capex + Opex)/ Total Barrel
= Capex/Production + Opex/Production
= 10 + 10 = 20 $/Bbl

If we need to incorporate the time value effect on these unit costs then we need to redo the above calculation by first calculating PV of each cash flow item including the PV of production. We used an estimate of 65% to convert normal cash flow into their PV (except for Capex for which we used 80% to convert Capex into PV Capex)

| | | | |
|---|---|---|---|
| *PV Volume (MMBbl)* | 130 | | |
| | Total | Per PV Barrel | |
| *PV Revenue (MM$)* | 6500 | PV Revenue ($/Bbl) | 50 |
| *PV Royalty (MM$)* | 650 | PV Royalty ($/Bbl) | 5 |
| *PV Opex(MM$)* | 1300 | PV Opex ($/Bbl) | 10 |
| *PV Capex (MM$)* | 1600 | PV Capex ($/Bbl) | 12 |
| *PV Tax (MM$)* | 1300 | PV Tax ($/Bbl) | 10 |
| *NPV (MM$)* | 1267.5 | PV NPV ($/Bbl) | 15 |

PV unit Capex = PV Capex/ PV production.

PV unit Opex = PV Opex/ PV production.

PV Technical Cost per barrel = {PV (Capex) + PV (Opex)} / PV (Production) $/Bbl

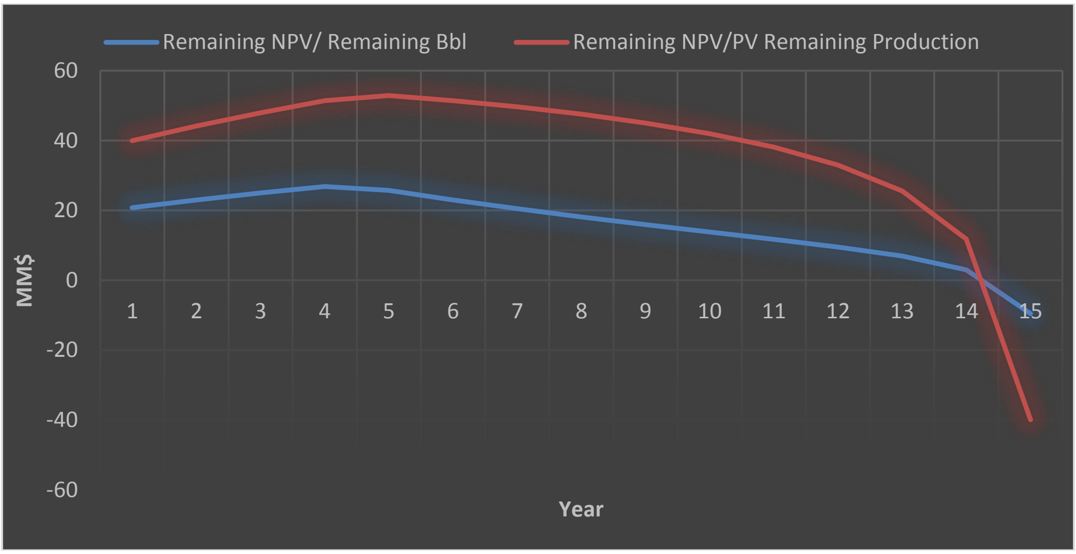
= 12 + 10
= 22 $/Bbl

Notice that the total unit technical cost increased when time value effect is incorporated. Unit Capex increased from 10$/Bbl to 12 $/bbl. Unit NPV increased from 9.75 $/Bbl to 15 $/Bbl. Primarily this is due to the fact that the denominator becomes smaller with the discounting of volume.

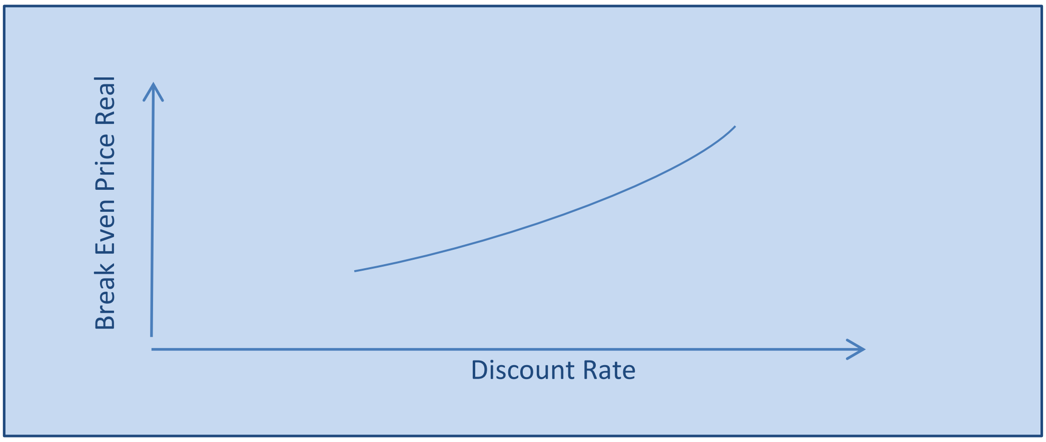
PV unit Capex normally increases with high discount rate. This is because with higher discount rate PV of production is heavily discounted in later part of project life, whereas Capex are mostly incurred in early phase, which is lightly discounted.

PV unit Opex unlike PV unit Capex is not that much impacted by discount rate. It is weighted average and both Opex and production get heavily discounted in tail end, so this indicator does not increase as much as PV unit Capex with increase in discount rate.

Within the same geographical area PV cost/Bbl is a useful indicator for making comparison between projects of different sizes. If the PV costs/Bbl varies significantly then investigation may be required to explain the difference.




The above chart shows the impact of discounting on the Unit NPV. If we do not consider the time value of produced reserves, per barrel NPV looks smaller. But if we discount the production Unit NPV looks much better. In the final year the chart shows negative unit NPV because of abandonments costs.




As we increase the discount rate, the PV unit technical cost will increase. This implies, the break-even price (which should equal the unit technical cost) will also increase with increase in the discount rate.