Estimating oil and gas volumes using structure contour maps

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The estimation of oil and gas reserves is a completely complex process which involves the integration of geological, geophysical, reservoir and production engineering data.

In order to arrive at the most likely reserves, the reserves are estimated by using deterministic and probabilistic methods as there are various uncertainties that are involved in the estimating the reserves.

In defining the hydrocarbon, Reserves refers to the quantities of oil and gas which can be commercially recovered from a given date forward whereas Resources are the reserves plus additional oil and gas that cannot be produced due to techno-economic factors. In the different stages of a field exploration and developments there are different reserves estimate methods that are generally used at the respective stages. One of the methods which is generally used from when the field is discovered up to when it is abandoned is the Oil and Gas-Len-

Place method at surface conditions.

As usually only some of the oil and gas-in? place can be recovered, therefore the total oil and gas-in-place must be multiplied by a certain recovery factor which depends on the individual field. Moreover, when oil and gas are brought to the surface it shrinks and expands respectively. Therefore if the surface volume of the in-place oil and gas were to be calculated, the Formation Volume Factor which accounts for the shrinkage and expansion factors, should be divided and multiplied respectively for the oil and gas.

From there the formula to estimate the oil and gas reserves are given as: Oil Reserves = Kappa˜snuffboxes ass Reserves = Kappa˜XSgxNGXFVFXRF HP = Oil/Gas pay thickness cap = Porosity So / So = Oil/Gas saturation NIGH = Net to Gross Ratio Puff = Formation Volume Factor for Oil/Gas REF = Recovery Factor for Oil/Gas Apart from the formula, Structure Contour Maps are also utilized to help in calculating the oil and gas reserves. The main objective of this project is to estimate dialectically the oil and gas in place for the Scope field as well as giving initial preliminary broad field development strategy for the Scope field.

The scope field is an offshore field which has gas cap and bottom water. The field is located at a distance of 70 km from the nearest port and is at a water depth of 80 m. So far, four sub-sea completions have been drilled in the region. The scope field has a north-south trending faulted anticline structure which is located over a prominent horst block. Rhea hydrocarbon accumulation consists of mm gas cap, mm oil column with an Infinite aquifer. Furthermore, the hydrocarbon accumulation is within mm thick blanket sand which had been deposited mainly as Barrier Bars which were occasionally cut by distributors Channels.

The tasks for this project are: 1 . Estimate oil-in-place volumes in the 1 P (Proven), UP (Proven + Probable) and UP proven + Probable + Possible) categories based on the SPECIES 1997 guidelines and to estimate gas-in-place volumes in IP (Proven) category. 2. To describe briefly the expected reservoir heterogeneity within the reservoir 3. Indicate preferred platform location to achieve optimum oil production, along with well locations 4. Indicate preferred perforation intervals in four wells 5.

Whether pressure maintenance by Neater or gas injection will be needed during development 6. Whether Gas Cap gas s preferred to be produced along with oil. Methodology Estimating oil- and gas-in-place Estimating the rock volumes A structure contour map for the Scope Field has been given and can be referred to in Appendix 1 . By using this structure contour map, ‘ so-Pay maps were then constructed. The ‘ so-Pay maps were drawn in accordance to each of the categories 11 P, UP or UP).

The ‘ so-pay maps drawn could be referred to in Appendix 2.

For the IP Gas Reserve ‘ so-pay, the ‘ so-Pay value at the Gas-Oil Contact (GO) is zero and it gradually increases to mm at the crest depending on the structural gain (For example, a structure increase of mm increases the ‘ so-Pay by mm). For the IP Oil Reserve ‘ so-pay, the ‘ so-pay value within the entire gas cap is mm and reduces to zero at 1280 ms depending on the structural fall. At 1280 ms is the lowest tested oil. IP category is where there is 90% confidence.

For UP Oil Reserve ‘ so-pay, the Iso- pay value within the entire gas cap is mm and falls to zero at 1300 ms which is at has an ‘ so-pay value of mm in the entire gas cap area and reduces to zero at 1380 ms which is at the last closed contour depending also on the structural fall.

The UP ND UP categories have 50% and 10% confidence associated with them respectively. After the ‘ so-pay contours are constructed, the area between two respective ISO-pay contours is estimated by means of drawing the contours on a tracing paper and by Inspecting the area by means of an underlying graph paper in units of centimeter square (CM).

Once the area between the two ISO-pay contours has been estimated and converted into kilometer-square (km) according to the given scale, the rock mummy is estimated by multiplying the area converted to meter-square (mm) by the average thickness in meters (m) between the two ‘ so-Pay contour values. The above is done for all the IP Gas Reserve ‘ so-pay and the 1 P, UP and UP Oil Reserve ‘ so-pays.

An example of the above is as follows. The diagram above shows the 1 P ISO-pay contour map of the Gas Cap.

Figure 1: IP gas ‘ so-pay contour map As explained before the ISO-pay value ranges from zero to fifteen which depends on the structural gain which was from (1220 to 1205 ms). The three areas are divided into Area A, B and C respectively.

Therefore in order to find the rock volume between the 15 and 10 ISO-pay values (Area B), the area between them is first calculated. This is shown below: Figure 2: Estimating area between ‘ so-pay contours One small box between the ISO-pay contours represents the 1 centimeter-square (1 : mm) box of the graph paper.

Therefore if there are two of the small boxes it means that the area is 2 centimeter-square (2 CM). For Area B it has been estimated that the area is around 15.

5 CM. The average thickness between the two contours is m which gives a value of 12. 5 m. The rock volume is then calculated by multiplying the estimated area converted to kilometer-square (km) according to the scale

and then to meter-square (mm) by the average thickness. The above is then updated for the other contours and other ‘ so-pay maps as well.