

Note #5: Unitization – Are You Determined?

Roddy Irwin – Partner at Rockflow Resources Ltd.

Why would the management of an E&P company direct a subsurface team to spend up to two years working through the technical and commercial aspects of a study that defers production and does not necessarily contribute a single drop of oil or bubble of gas more to in place volumes? This can occur in the oil and gas industry when a field is Unitized and Equity or Tract Participation has to be determined.

Why Unitize

Where an accumulation of oil or gas is shown to cross a boundary from one licence or permit to another, the petroleum reservoirs that cross the boundary are termed “straddling reservoirs”. Unitization ensures that these straddling reservoirs are produced efficiently as a single entity or “Unit”. This is to avoid the old Wild West “law of capture” where petroleum was treated like a rabbit or a pheasant - if it got onto your land it was yours. The obvious benefit of Unitization is that an effective development plan can be applied to exploit the straddling petroleum reservoirs such that hydrocarbon recovery can be maximised and the costs of development minimised. This is achieved by unanimous agreement by the parties either side of the licence boundary to develop the reservoir as a whole in a way that honours petroleum engineering best practice.

The Bad Old Days

In the early days of the oil industry, parties either side of a licence permit would intentionally drill along the line to purloin each other’s share of the oil from a straddling reservoir. This was superbly explained by New Mexico Senator Albert Fall in 1924 who described competitive oilfield drainage as “if you have a milkshake and I have a milkshake and my straw reaches across the room, I’ll end up drinking your milkshake.” which of course inspired the famous ending scene in the 2007 movie “There Will Be Blood”.



Clearly, such competitive production from a single reservoir would be detrimental to its long-term production and has no place in contemporary best practice in field development.

Benefit of Developing Straddling Reservoirs as a Single Unit

If a straddling reservoir was to be developed as a single entity or Unit, this would result in a production strategy that would benefit all parties either side of the boundary. This is achieved by a single optimised cost-efficient development plan which is sensitive to the reservoir static and dynamic properties, avoiding problems like premature water breakthrough or pressure depletion. This would approach a “pareto-optimal” arrangement that leaves no party worse off and ideally all parties will be better off. The state can benefit too, since if production is maximised through efficient development, then tax revenues are also maximised.

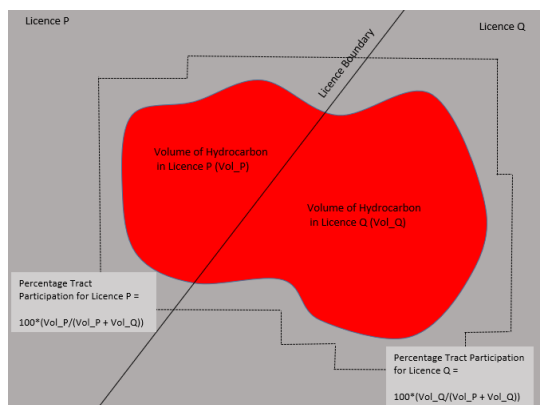
Where a reservoir has been shown to be straddling a boundary by means of drilling, testing or other interpretative methods, then the process of Unitization can be initiated. Before appraisal, a Pre-Unit Agreement (PUA) is commonly drawn up which allows parties with licence permits over the straddling reservoirs to examine the viability of developing the reservoirs as a single unit. At this stage, the parties agree an initial distribution of equity (deemed equity) in order for the field development to proceed efficiently until a Unitization and Unit Operating Agreement (UUOA) is defined and one of the parties is appointed as Unit Operator.

Unitization and Unit Operating Agreement

Unitization only happens once in the life of a field and addresses the activities in a unit area or unit (straddling) reservoirs and usually comes into place before first hydrocarbon production. The UUOA is a contract which describes the obligations and the rights between the parties in the Unit area with the purpose of enabling production of hydrocarbons from the straddling reservoirs as a single effective unit. The UUOA will define the basis for initial tract participation and the basis for subsequent redetermination of tract participation at specified stages in the life of the field.

Tract Participation

Tract participation is the percentage share of the unit area (or unitized straddling reservoirs) in each licence area.



If there is more than one party or owner in a Licence, then the Percentage Unit Interest per party is Percentage Tract Participation X Percentage Licence Working Interest. If a party has Working Interest in more than one licence over the unitized area, then it's overall Unit Interest is the accumulation of all its Unit Interests in its licences.

At the unitization stage, the UUOA will have some outline for the determination of initial equity or tract participation usually in the form of prescriptive technical procedures. By necessity, the Initial Tract Participation is deemed at a point in time where there are limited data from the field. There will usually be a provision for the redetermination of tract participation at a later stage in the life of the field. However, the basis for future redetermination of tract participation is also decided at a point where the field's dataset is still immature at the appraisal stage of field life. These issues can result in a sub-optimal basis for future equity or even ambiguous or dysfunctional technical procedures that potentially result in inequitable outcomes.

Basis for Tract Participation

The basis for both determination of initial tract participation and subsequent redetermination of tract participation should be based on parameters that are not time dependent. The selection of an appropriate basis is driven by the fluid properties and reservoir character. The basis for tract participation can be Static, Dynamic or Hybrid in nature.

The commonly used Static basis is Hydrocarbons Initially in Place (HIIP) which relates to a status before the field is developed and therefore would only be subject to change if more data were acquired during field appraisal which would allow a more certain evaluation of HIIP to be made.

An example of a Dynamic basis is Estimated Ultimate Recovery (EUR) which is strongly dependent on the selected Field Development Plan. A variation of this is Estimated Economic Recovery (EER) which introduces an economic limit of production element which is dependent on estimated forward oil or gas prices.

Where there are trends evident in reservoir quality across the licence boundary, a Hybrid basis may be adopted for tract participation determination. In such cases a weighting factor can be applied. For example, specific weighting factors for each reservoir which are linked to modelled recovery factor can be applied to the hydrocarbon volume estimates on either side of the boundary. These factors which reflect the difference in reservoir quality across the boundary can be based on reservoir simulation models and should be reviewed during the life of the field to ensure their continued relevance at the redetermination of tract participation stage.

Technical Procedures

The Technical Procedures lay out a set of protocols to calculate the parameters required to determine tract participation and the importance of these is doubled since the redetermination of tract participation must follow these too. A common or unit database will also be defined and shared between the parties. These

procedures define the approaches to be followed to quantify the key geological and engineering inputs to the selected basis for tract participation. It is important to have clear and comprehensive definitions that are straightforward to implement. These help to reduce divergence between submittal cases from the various parties and make recourse to arbitration or an Independent Expert for determination less likely. Examples of elements which are commonly not well defined include Fluid Levels (Contacts versus Free Water Levels) Net to Gross ratio (Net Pay versus Net Reservoir Rock) and geological mapping applications (3D geocellular model versus 2D mapping). Each of these elements should be prescribed by as clear and auditable workflows as circumstances and data allow.

Ultimately the available field data should guide the selected petrophysical evaluation and geological mapping methods. This is especially important where data quality differs across the licence boundary (for example in brownfield-greenfield unitization where one side of the boundary may have already been on production while the other side is still at the exploration stage).

Redetermination of Tract Participation

A redetermination of equity or Tract Participation can be initiated at a scheduled date (Trigger Date) or called by one of the parties with interest in the Unit. As a result, any other parties with Unit interests are forced to devote time and resources to the redetermination process to provide their respective submittal cases for tract participation.

A Redetermination Subcommittee with representatives from each party may be established to review the various proposals for tract participation to identify areas of agreement and to try to resolve disputes in determining tract participations.



This 1805 cartoon by James Gillray depicts Napoleon Bonaparte and William Pitt carving up the globe (plum pudding) which is "too small to satisfy such insatiable appetites". This has parallels in equity determination where companies may contrive to maximise their Tract Participation to access a greater share of the profits but this position is also associated with a commensurate share of the liabilities and costs of unit development.

During the determination or redetermination process, divergent estimates of Tract Participation can be due to differing interpretations of inexact technical procedures or the manipulation of parameters to lever a more beneficial estimate of Tract Participation. Other reasons for dispute are where one or other of the parties has selected a modelling method that is not prescribed by the technical procedures, on the grounds that their preferred method is more in line with geological reality or current industry practice.

The Role of the Expert

It is good practice that the UUOA has provision for independent resolution of matters in dispute. Where the UUOA stipulates that recourse may be made to an independent expert, an independent third-party (usually an established petroleum engineering and geoscience consultancy firm) is appointed for a fixed period (commonly 90 days) to, for example:

- Determine the matters in dispute by independent technical work; or
- Provide guidance between the various parties' submission cases to derive an equity split; or
- Make a pendulum decision where one party's submittal case is selected as the basis for tract participation because it is closest to the case calculated by the Expert.

The Expert must be careful to follow the technical procedures to the letter when working out its independent case for tract participation otherwise a disadvantaged party may have grounds for further dispute. It is reasonable to assume that the party which follows the agreed technical procedures most closely in its submittal case for Tract Participation is the one which has the greatest chance of being closest to the Expert's Independent case.

Redetermination of Tract Participation can be a costly and contentious exercise which consumes the internal resources of several E&P companies. This is especially true where the technical procedures are sub-optimal and/or the individual E&P companies lack the in-house experience or resources to create a convincing submittal case in the time frame allowed.

E&P companies often outsource the work which forms the basis of the submittal case for determination of tract participation to an experienced geoscience and petroleum engineering consultancy who can also advise on the best interpretation of technical procedures for their client.

Over the last decade, Rockflow staff have worked on several submittal cases in harmony with clients to provide the most convincing case for determination of tract participation and have separately performed the Independent Expert role in Expert Determination.

Recommended Resources:

Worthington, P.F., 2020, *The Law on Petroleum Unitization*, Elgar Energy law and Practice.

Worthington P.F., 2014, *An Analysis of Protocols for the Calculation of Tract Participation*, First Break Volume 32 – Issue 11, EAGE.



Rockflow Resources Ltd. is an independent technical and management consultancy serving the upstream oil and gas industry. We provide strategic, commercial and technical analysis and advice to oil companies, investors, government agencies and law firms. We work on complex high value client problems where success requires experience, integrity, professional judgment and clear, concise decision-making. Our clients range from start-up companies to the largest multinationals and our international experience spans the globe.