LTIMindtree

Whitepaper

Production Allocation & Its Challenges

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Abstract

Hydrocarbon accounting is the petroleum management process in which every drop of produced hydrocarbon is accounted for and allocated back to the point of extraction from the point of sale. Production allocation is the heart of any hydrocarbon accounting process. It determines the actual amount of hydrocarbons produced from a well or reservoir. The biggest challenge is to allocate the oil or gas back to the wells, which are produced from 2 or more reservoirs. LTIMindtree, with the help of the best industry consultants, can decode this biggest challenge.

Introduction

The O&G industry is the largest sector in the world. In terms of dollar value, it generates an estimated USD 3.3 trillion in revenue annually. Oil and gas are crucial to the global economic framework, especially for its largest producers: USA, Saudi Arabia, Russia, Australia, Qatar (in terms of Liquified Natural Gas (LNG)), Canada, and China. Hydrocarbon accounting is key in measuring the production of hydrocarbons. There are several challenges in measuring and accounting the hydrocarbons accurately. However, the latest technology and robust applications help to mitigate this risk and provide the closest possible accuracy in hydrocarbon accounting.

Production Allocation

Allocation is an ongoing process in the O&G industry where the produced hydrocarbons are allocated from the point of sale back to the point of extraction. The point of sale is usually the selling point (carrier/ truck/ pipeline). The amount of net oil/gas/LNG exported will be back allocated to the wells or reservoir level.

Usually, allocation is done at the well and reservoir level from the point of sale. But we can even try doing it from the finished product, but that is really challenging. If it is possible to achieve then we can allocate a barrel of oil from the finished product level back to the source. Imagine, if we say this liter of petrol is extracted from this well and reservoir, that would be a great achievement.

Also, the future of hydrocarbon accounting is heading towards hydrogen-based production accounting, and companies are in deep research to get it down at the earliest. Leading product companies are already in the

development of robust products which can cater to hydrogen-based production accounting.

Multiple players collaborate in order to distribute costs, revenues, and taxes associated with the development and production of oil and gas fields. The practice of issuing licenses for exploration and production to a partnership of oil companies is one of the incentives for collaboration. Unitisation, or the sharing of production across multiple land properties or oil fields, is another way to improve production efficiency.

Production allocation to wellbore or completion is required for reservoir simulation where the dynamic geological model is history matched and used for production forecasting. In order to manage the production process, detailed results are obtained from allocating wells or even layers of oil or gas.

Allocation results may also feed the operator's internal systems for product sales, accounting, enterprise resource planning, data warehouse, and management reporting. As part of petroleum accounting, allocation, and hydrocarbon accounting provide supporting information to consider business and financial aspects of oil field operations throughout their life cycle.

The allocation feature distributes data, specified at a summary level of a dimension to lower levels. For example, actual sales revenue may be tracked daily, while sales revenue is forecasted quarterly. Allocation is a useful way of distributing quarterly forecasts to the month and day levels.

Onshore well diagram

Why production allocation is essential in the O&G industry?

Oil and gas allocations can serve as the pulse of your field when done properly. In order to support accurate month-end sales allocations, accurate daily measurement values are necessary. It is accomplished by setting accurate daily measurement values, which are the basis for accurate month-end sales allocations.

1.1.1 Monthly data's dependency on daily data

Wells, in a delivery system, experience variations in production throughout the month for a variety of reasons. Based on these variations, it is only possible to accurately assign production and sales value based upon the closest reasonable daily measurement from each source of production.

- For better accuracy, well tests should be conducted at least once a month (and more frequently in higher fluid volume environments) to ensure they are as accurate as possible.
- Well performance is often affected by inefficiencies in pump efficiency and fluid levels.
- Tracking downtime throughout the day (down to the hour) will enable better allocations and better prevention.
- A more precise evaluation of a well's contribution will make improved production management possible.

1.1.2 Smart measurements

It is preferable to make measurements electronically at the wellhead whenever possible, since they are more accurate. The use of electronic and automated production measurement techniques has become more accessible than ever before. This is strongly considered for new production.

1.1.3 Tank measurements using color cuts

Many companies don't realize how valuable color cuts can be for measuring water in tanks. It is important to remember that even simple things, like color-coding a tank when measuring, can provide a lot of insight into actual production, improving the accuracy of month-end processes.

1.1.4 Importance of fuel gas data

Fuel measurement from a field is undoubtedly a good practice when running equipment, such as compressors. It is very helpful in preventing equipment and fuel losses to know how efficiently and accurately fuel is being used. When evaluating the true cost of production, simple measurements and accounting for fuel can provide better insights, particularly in fields where gas can be used to optimize various gas lift technologies or sold for resale. It costs money to waste a Thousand Cubic Feet (MCF).

1.1.5 Agile system and its importance

Changes in your delivery system don't always occur at the beginning of the month, unfortunately. As changes occur in the field, your system needs to be able to adapt quickly. Mid-month changes in a delivery system must be accurately tracked daily so that proper sales allocations can be done at the end of the month. While building for a monthly allocation, make sure your allocation system is flexible enough to adapt to those changes.

1.1.6 Good measurement, excellent allocations, and better management of production

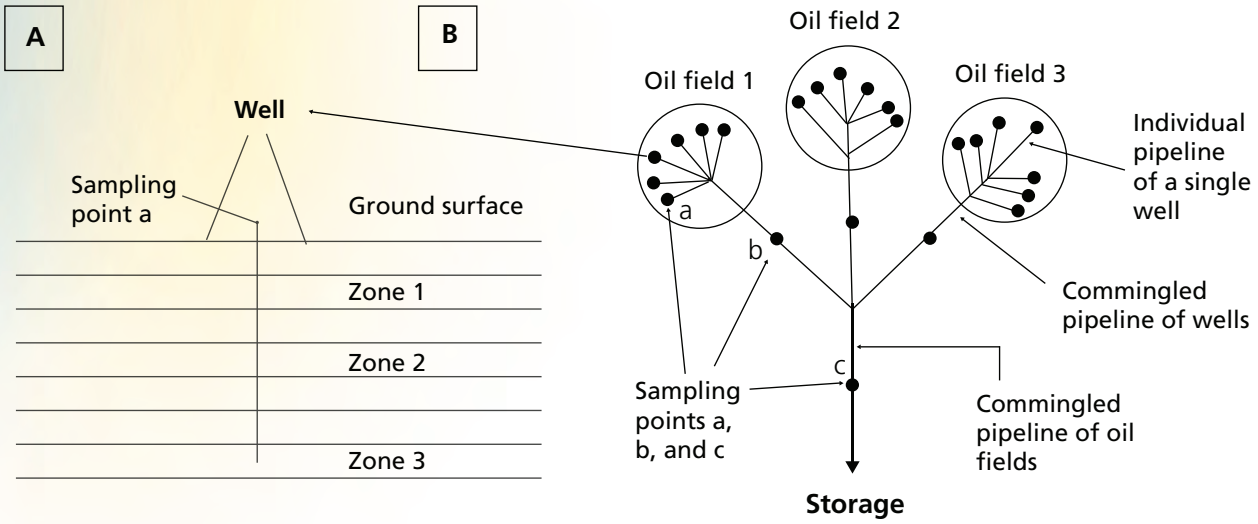
The lack of adequate data from the field is a common problem that occurs when working with O&G companies. This can occur for a variety of reasons. It is common for older fields to have antiquated (or nonexistent) measurement methods. In most cases, however, insufficient well tests are to blame. Many instances can be cited where three year old well tests have been used as the basis for allocation. Using old data for new allocations creates the problem that not only are the allocations misappropriated but also the viability of the well is often masked. Well tests are to be conducted at least once a month in older fields. Downtime calculation across each well is critical in allocation, and hence working hours of each well must be accurately recorded in any production accounting system.

Challenges in production allocation

The key challenge in allocation is for commingled wells, which means that one well is produced from multiple reservoirs. But there is a way to get its percentage production from each reservoir.

The assessment of each individual zonal contribution is crucial for wells producing from mixed zones. The typical method for calculating the downhole contribution of each reservoir is the Production Logging Tool (PLT). More deviated and horizontal wells have been made possible over time thanks to directional drilling's most recent technological improvement. In addition to phase holdups and fluid properties, Pressure-Volume Temperature (PVT), well deviation also affects the fluid flow pattern in a borehole. The transfer of the lighter phase to the well's high side causes the liquid that makes up the dominant heavier phase to be displaced, which causes it to flow downward as production fluid rises in a deviated well. Apparent Down Flow (ADF) is the name given to this drilling occurrence.

A standard PLT has a centralized spinner configuration, and when run in wells experiencing ADF, it will likely cause the spinner to measure an incorrect fluid velocity. Depending on the degree of the holdup of the heavier phase, the spinner may show a reduced or even negative rotation if immersed in the heavier phase fluid. Conversely, the spinner may show faster rotation if it is in the lighter phase fluid. The advanced PLT, with its array of mini spinners and holdup sensors, was developed in part to measure the effects of ADF and was designed to cover the well's cross-section area, giving a more accurate description of the flow behavior; thus, better measurement and understanding of ADF phenomena.



Schematic diagram of oil wells pipeline network

It has been observed from many production logging surveys that were conducted using a standard PLT, where the spinner shows negative readings during the flowing condition, indicating fluid re-circulation (or fluid fallback). However, information from other sensors, such as fluid density identifier and temperature tool, does not support these findings (of fluid re-circulation), which results in inaccurate rate calculation to determine zonal contribution. To overcome this challenge, the advanced PLT can be used to measure the contribution for each zone more accurately, as the effects of ADF are further understood. The calculated production rates from the advanced PLT were found to be more representative despite the presence of ADF in the wells.

Solution

In 2010, we faced the same challenge, and this is how we solved it for one of the US-based O&G giants.

If a well is producing from one reservoir, then the production allocation of oil/gas/water is straightforward. If it has a wellhead meter, then we can easily allocate the hydrocarbons back to the well and the reservoir. If it does not have a wellhead meter, then the allocation will be based upon the Last Accepted Well Test (LAWT) rate.

Case1: Well with wellhead meter producing from a single reservoir

Let us consider, that wells W1 and W2 are producing from reservoir 1 (R1).

Total production on a specific day is 1000 bbl.

W1 has a wellhead meter WM1 reading of 400 bbl.

W2 has a wellhead meter WM2 reading of 600 bbl.

Allocation will be done in this way,

% of W1 production is 400/1000*100 = 40%

% of W2 production is 600/1000*100 = 60%

W1 production from R1 = 40 % of total production = (40/100)*1000 = 400 bbl.

W2 production from R1 = 60 % of total production = (60/100)*1000 = 600 bbl.

Case 2: Well without a wellhead meter producing from a single reservoir

Let us consider wells W1 and W2 are producing from reservoir 1 (R1).

Total production on a specific day is 1000 bbl.

LAWT rate of W1 is 490 bbl and W2 is 510 bbl.

Allocation will be done this way,

% of W1 production is 490/1000*100 = 49%

% of W2 production is 510/1000*100 = 51%

W1 production from R1 = 49 % of total production = (40/100)*1000 = 490 bbl.

W2 production from R1 = 51 % of total production = (60/100)*1000 = 510 bbl.

The actual challenge is when a well is producing from two or more reservoirs. We shall see how to address this kind of challenge.

Case 3: Well producing from multiple reservoirs

The actual % of production from individual reservoirs for a given well will be obtained from the PLT logs, and the same will be configured in any hydrocarbon accounting system. Then the oil/gas/water production will be allocated as per the % obtained as explained below:

Let us consider that well W1 is producing from reservoir 1 (R1) and reservoir 2 (R2).

It is producing 40% from R1 and 60% from R2, as per the PLT logs.

The total production of oil on a given day is 1000 bbl.

Allocation will be done this way,

W1 production from R1 = 40% of 1000 bbl. = 400 bbl.

W1 production from R2 = 60% of 1000 bbl. = 600 bbl.

In a hydrocarbon accounting system, this calculation will be configured, and hence the allocation of wells till the reservoir will be done appropriately.

Conclusion

Production allocation in the O&G industry has been a challenge, and every operator is trying to achieve an allocation factor of 1. But we are not in an ideal world, and it is still not possible to reach this milestone. However, technological advancement and smart software are pushing hard to get an accurate allocation. Soon we will also see a lot of discussions and deep dives into H2 hydrogen-based production accounting, low carbon, and going green.

References

www.totalstream.com

About the author

Muralikrishnan Babu is an accomplished professional with a cross-cultural experience of over 18 years in the Oil and Gas industry. He is highly recognized for providing end-to-end hydrocarbon accounting services, including production support, upgrade of Production Data Management System (PDMS), project management, and leading support transition projects. He has mentored, nurtured, and trained resources pertaining to O&G domain/hydrocarbon accounting tools and helped them grow in their respective areas. He worked extensively in the Indian, Middle Eastern, European, African, and American markets with excellent experience in dealing with people from diverse work cultures.

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