Using Process Simulation for Hydrocarbon Accounting

Richard Alderson, Managing Director of hydrocarbon accounting software provider, Adept Solutions, describes the reasons for the increasing use of process simulation in hydrocarbon accounting.

In recent years, the oil and gas industry has seen an increased prevalence of infrastructure sharing, involving third-party fields being produced across existing facilities. This arrangement allows the lifetime of the facilities to be extended, while, at the same time, making it viable for smaller fields to be developed. Indeed, when mature facilities are taken over by new owners, the business case often depends on the introduction of third-party revenues.

This has major implications for allocation and hydrocarbon accounting. When production from fields with different equity ownerships is commingled in the processing facility, allocation calculations are used to determine how much of the exported products came from each field, which, in turn, determines the revenues for each set of field owners. This means that field allocation assumes commercial significance (unlike when all fields produced across the facility have the same ownership and tax regime) and, therefore, accurate field allocation becomes more important.

A typical scenario is shown in figure 1.

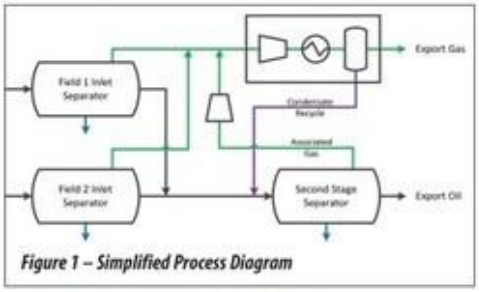

Figure 1 – Simplified Process Diagram

Allocating commingled flows

In this example, each field has a dedicated inlet separator, with commingling occurring thereafter. While each field's oil and gas streams are directly measured at the first stage separators, the unknown factor is the amount of shrinkage or expansion of these streams that occurs between these inlet separators and the export points. The shrinkage or expansion is due firstly to associated gas flashing off the oil as the pressure is reduced in the second stage separator; and, secondly, to liquids condensing from the gas as it is compressed and cooled prior to export. The amount of shrinkage or expansion depends on the characteristics of the fields' fluids and the plant conditions, and can therefore vary significantly between any two fields at any time.

As it is not possible to measure the shrinkage or expansion of each field's fluids directly, the quantities are usually estimated using a process simulation. A model of the plant is constructed using a software simulation package, such as **Aspentech's HYSYS**, and is fed with known production data (flowrates, compositions and plant conditions). The simulation calculates the flow rates of all the required streams on a mass by component basis, allowing each field's contributions to the export streams to be determined, either by simulating each field's production flowing through the plant separately, or by tagging components as belonging to one field or the other.

Simulation packages have been widely used for many years, but have historically not been well integrated with hydrocarbon accounting. Rather than running the simulation for every allocation period, various methods have been used to approximate the results. For example, the simulation may be run for each field over a range of conditions in order to calculate a table of flash factors from which the appropriate value can be selected for a given set of actual conditions. However, this method considers only a small number of the most significant input variables and assumes that all others can be neglected. If this assumption holds true then the results will accurately match the simulation, but if not, then significant errors can occur that may go unnoticed for long periods of time. Given the financial significance of these calculations, this risk is clearly undesirable. For these reasons, more operators now prefer to integrate process simulation directly into the hydrocarbon accounting system and run a full simulation each time the results are required.

Operational challenges

This approach ensures that allocation is as accurate as possible, but presents a number of operational challenges, including:

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- *Providing an IT system capable of integrating with the simulation package and handling the complexities of data and processing that are involved. Systems used for simpler allocation methods may not be suitable.*
- *Making available the expertise to maintain the process model and to recognise and resolve issues that can occur on a daily basis.*
- *Gathering the required data with the necessary accuracy and frequency. The data set is much larger than for a simple volumetric allocation, requiring reliable metering and regular, accurate sampling.*

Summary

For any operator introducing third-party production to existing facilities, allocation is a crucial issue, which determines the revenues of all the parties concerned. Existing allocation methods may no longer be suitable. Process simulation is usually the best method of allocating products accurately, although to use it effectively presents a number of operational challenges. However, operators are increasingly realising how important it is to meet these challenges, as the cost of doing so is small compared to the risks and potential consequences of using a less accurate allocation method.

Adept Solutions, through our partnership with Intertek Metering and Allocation Services, provides software and consultancy to implement and run simulation-based allocation. For more information, go to:

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