2017: The year of oil

How the oil price crash affected the global flowmeter market

Flowmeters play a vitally important role in the oil and gas industry. Oil and gas are both measured many times as they move from the wellhead to a gas processing plant or refinery. The output of a gas processing plant includes gases such as nitrogen, oxygen, helium, and carbon dioxide, while major products output from a refinery includes petrol, jet fuel, and heating oil. All these products are measured on multiple occasions as they travel downstream to their ultimate point of use. The movement of hydrocarbons from wellhead to point of distribution can be referred to as the process stream.

Many flowmeter types play a significant role in flow measurement in refineries and gas processing plants. Coriolis, ultrasonic, vortex, and turbine meters measure both gas and liquid flow in in-plant measurement, and flowmeters are also used in blending operations for liquid hydrocarbons. Also, oil and gas are typically measured both as they enter and leave the processing plant. Even though in-plant measurement is not usually custody transfer, highly accurate measurements are required. Different flowmeter types are used at different points along the way.

Three streams

Flow measurement during the process stream is often divided into the three main phases of upstream, midstream, and downstream. Petroleum fluid is drilled and separated into its components in the upstream phase, and sent to a gathering station. From the gathering station, oil and gas are sent to a refinery or gas processing plant, which makes for the midstream phase. After the oil or gas leaves the processing plant, it is sent downstream to its ultimate point of destination.

Upstream Oil and gas typically lie thousands of feet below the Earth's surface. Most scientists agree that oil was formed from the fossil remains of plants and animals over a period of tens or even hundreds of millions of years. To reach this oil, most companies use an oil rig that has a drill to penetrate the ground down to the location of the oil or gas. This drill is in many cases equipped with three sets of steel or diamond-tipped teeth. Such a drill can penetrate through thousands of feet of rocks per day. Once the drill reaches the oil and gas deposit, the process of bringing them to the surface can begin.

The oil well is prepared to bring up the petroleum fluid by lining the wellbore with casing. The wellbore is the vertical hole in the ground created by the drilling bit, while casing is a long metal tube inserted into the wellbore at the depth the drilling company believes that oil can be found. Tubing is placed inside the wellbore to enable the petroleum liquids to come to the surface. Petroleum liquids are usually a combination of crude oil, gas, and water. They are typically brought to the surface due to pressure that is created in the well as a result of drilling fluids that are pumped into the well.

Once the petroleum liquid reaches the surface, it typically goes through a test separator to physically separate the oil, gas, and water. The purpose of a test separator is to separate the fluid into its constituent components for metering and analysing. A flowmeter measures each fluid as it leaves the separator. In many cases, the fluids then passes through a production separator, which separates them for processing purposes. After the production separator, the petroleum liquid may pass through a heater treater. The heater treater breaks oil-water emulsions so that the oil can be accepted by a pipeline or a transporting vehicle. This could be a truck, railcar, or ship.

During the past 20 years, multiphase flowmeters have been developed that can replace the separators that are placed near the top of the well. Instead of having to physically separate the components of petroleum liquids into their component parts for analysis, multiphase meters analyse the content and the flow of oil, water, and gas as it the leaves the well on a real-time basis. This enables operators to better analyse the contents of the reservoir, and to tell when a well is beginning to decline. While multiphase technology is quite expensive, and is still in the development phase, multiphase meters are playing an increasingly important role in the upstream environment.

Midstream In the midstream segment, crude oil or natural gas is carried from the production field to a gas processing plant or to a refinery. Lease automatic custody transfer (LACT) units play a major role in the midstream phase. They receive petroleum liquids from the production separator or heater treater and measure and control the flow of crude oil onto trucks and into pipelines. LACT units measure and track the temperature, American Petroleum Institute (API) gravity, and base sediment and water (BS&W) of the crude oil. BS&W is measured to determine if oil contains too much water. If it does, the custody transfer operation is either adjusted or brought to a halt.

A typical LACT unit contains multiple instruments and devices. These include a flowmeter, a motor and pump, an air eliminator, a sampler system, valves and sealings, and a control panel. An LACT unit is an integrated system of devices that measure and control the delivery of oil to pipelines and trucks. They are generally divided into pipeline LACTs, truck loading LACTs, and truck unloading LACTs.

The flowmeter is one of the most important components of an LACT unit. Positive displacement (PD) meters have traditionally dominated the market for flowmeters on LACT units, but more recently, Coriolis meters are being specified in place of PD meters. Coriolis meters are highly accurate, and do not place an obstruction in the flowstream. FMC Technologies is a dominant supplier of PD meters for LACT units, while Emerson Micro Motion, Endress+Hauser, and ABB are companies that are widely used for Coriolis meters.

Once oil or gas enters a pipeline or is carried by truck, rail, or ship, there are often a number of custody transfer points along the way. For natural gas, the amount of gas is measured as it enters the pipeline, and it may be measured

at multiple points in transit. Natural gas is also measured as it enters a gas processing plant. The market for custody transfer of natural gas is dominated by Elster, Emerson Daniel, and Sick.

The path of crude oil in the midstream segment is parallel to that of natural gas. Crude oil is measured as it enters pipelines or is loaded onto rail cars or trucks. In some case, it is taken to storage locations, while in others the final destination will be a refinery. PD and turbine flowmeters are widely used in these measurements, though Coriolis flowmeters are beginning to have an impact as well. Crude oil is also measured as it enters a refinery.

Flowmeters also play an important role in leak detection in pipelines. Though there are multiple methods of leak detection, some not involving flowmeters, ultrasonic flowmeters are widely used for these applications. In some locations, companies lose oil not just from leaks but also by theft. Leak detection is extremely important, since companies may face stiff penalties if they are found to be responsible for pipeline leaks.

Rendering of a Graylon LACT unit

Downstream gas Once natural gas leaves a gas processing plant, it enters the downstream phase where it is typically again measured multiple times before reaching its point of use. Natural gas is measured as it leaves the processing plant and usually goes to a utility company in charge of gas distribution. Large pipelines, often from 20" to 42" in diameter, carry the natural gas, sometimes for hundreds or thousands of miles. The gas is measured each time it changes ownership. Ultrasonic, turbine, and DP flowmeters are the most commonly used devices for these custody transfer measurements.

Once natural gas reaches its point of use, a local utility company delivers it to commercial and industrial buildings, and to individual homes. This is often called fiscal or utility measurement, although it is somewhat like custody transfer measurement. While much natural gas is transported downstream by pipeline, some is distributed in the form of compressed natural gas (CNG) or liquefied natural gas (LNG). Natural gas is transformed into LNG when it has to be transported over long distances and no pipelines are available.

LNG is typically transported by ship from the Middle East and Europe to Australia, India, China, Japan, and other Asian countries, many of which have relatively small amounts of oil and gas, though some such as China are very rich in coal. Some Asian countries cannot receive natural gas by pipeline because they are islands. Flowmeters measure the natural gas as it is liquefied, and measure it again as it is regasified at the point of delivery and transferred into pipelines.

Downstream oil Crude oil is refined into a variety of petroleum products, including petrol, heating oil, diesel fuel, kerosene, and others. These products are carried by pipeline, barge, truck, tanker, and railcar to a storage area or to their point of use. This may involve multiple flow measurement points, although the volume of oil in storage tanks is sometimes determined by level measurement rather than by flowmeters. Petroleum liquids are measured as they leave the refinery, and they then are often transported via pipeline to a terminal that contains storage tanks where they remain until they are ready for the next step in the distribution process.

Once refined products are ready for delivery, they are usually delivered by truck, rail, or pipeline. Trucks carry petrol to stations and heating oil to businesses and to individual homes, where flowmeters are used to measure the amount of oil delivered. This is measured by a fuel dispensing system that typically contains a flowmeter, a pump, a control system, and usually a printer so that the results of the transaction can be recorded. PD meters have traditionally dominated this market. However, more recently Coriolis meters have begun displacing PD meters in fuel dispensing systems. In the US, the market is dominated by Liquid Controls (IDEX).

Impacts of oil price downturn

From 2011 to 2014, oil prices stayed generally within the $80 to $100 per barrel range (€73-€91). Then oil prices began declining in August 2014, and continued the downward spiral until they bottomed out at just above $26 per barrel in February 2016. Many analysts attribute this decline to the additional supply brought online by the technology of hydraulic fracturing, or fracking. Most of this technology has been used in the US, although it is also now being employed in other countries.

In the past, the Organization of Petroleum Exporting Countries (OPEC) has controlled prices by cutting production to keep prices high. However, this time, in a November 2014 meeting, OPEC declined to act. As a result, prices continued their decline from that time until February 2016. Since then, oil prices have recovered to the range of $40 to $50 per barrel. On 28 September, 2016, the OPEC ministers met in Algiers, Algeria, and agreed to a framework of an oil price freeze. The details are to be worked out at its regular meeting on 30 November, 2016. This agreement

An oil field with storage tanks near Houston, Texas. Photo © Flow Research

had the effect of stabilising prices.

The downturn in oil prices had a significant effect on flowmeter companies that supply into the upstream and midstream phases of the oil and gas industry. Many large exploration and production projects were cancelled or postponed, especially subsea projects. However, companies selling into the downstream phase of the business were less affected. The main reason is that the demand for refined petroleum products such as petrol was not affected by the price decline – if anything, it was enhanced. Refineries continued to be supplied with crude oil, whether it was domestic or imported, newly drilled, or from storage. Even though new supply was being reduced, there was plenty of supply available from storage or from imported oil to satisfy refinery needs.

After two years of the oil downturn, there are signs that oil and gas companies are beginning to spend money on new projects again. This is good news for anyone in the oil business, and it is good news for flowmeter companies that supply into the oil and gas process stream. Many signs point to a strong year for oil in 2017, a year that may get dubbed the Year of Oil.

For more information:

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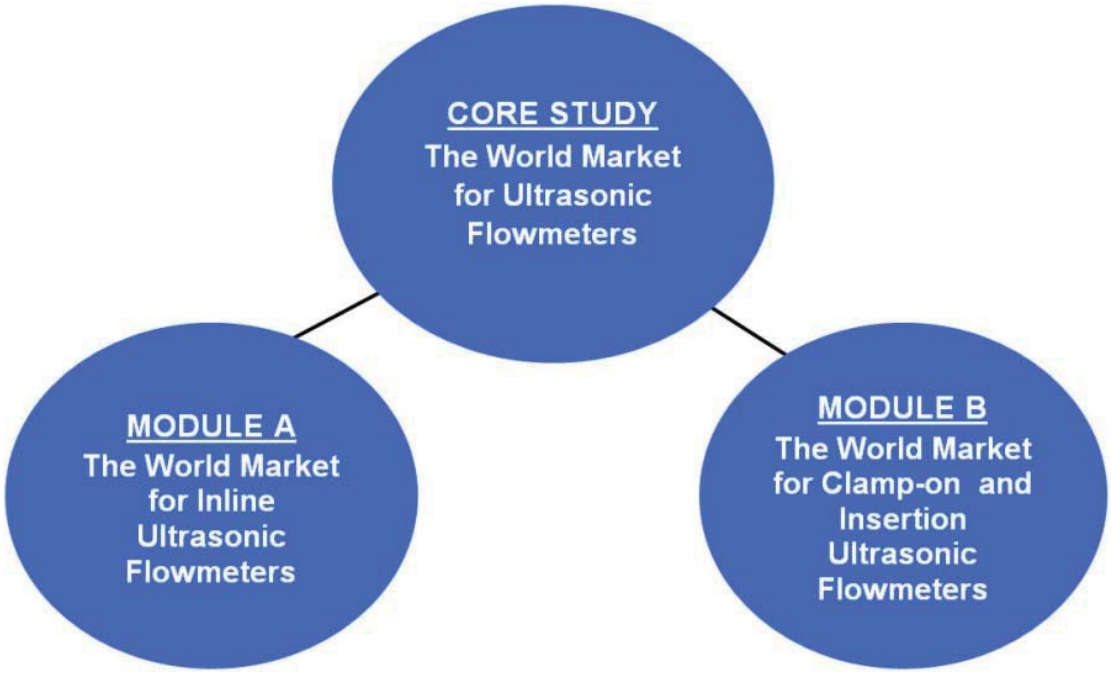

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