Promas 83X

Innovations Dominate Flow Measurement Market

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When flowmeters are used to measure flow, they measure one of a number of fluid types. One common way to divide up fluid types is between liquid, gas and steam. These types can be further subdivided. Types of liquid include oil, water and industrial liquids. Types of gas include natural gas, industrial gases and greenhouses gases. However, each of these types can be broken down into more specific gases. For example, types of industrial gases include oxygen, nitrogen, hydrogen and carbon dioxide. Steam is often divided into wet, saturated and superheated.

Gas flow measurement has become increasingly important with rising oil prices. Natural gas has not undergone the same price increases as oil. Natural gas is cleaner and also less expensive than oil. And increasingly, natural gas is seen as a long-term bridge to renewable fuels. This is because natural gas is more plentiful than oil and new technologies make it possible to extract natural gas from locations where it was formerly not possible to obtain the natural gas. As a result of new drilling technologies and new natural gas finds, the world has sufficient natural gas for the next 100 years or more.

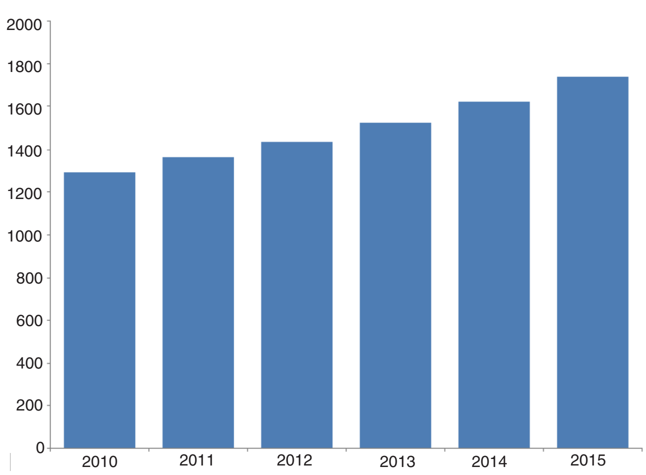
Even though natural gas is still a fossil fuel, it does not have the same environmental impact as oil or coal. This is important today because renewable sources of energy such as solar and wind power are still in their early stages of development. They remain attractive but still expensive alternatives to fossil fuels. This will change over time as more R&D is done and the technology improves. Until then, natural gas will remain an attractive alternative to other fossil fuels and to renewable forms of energy.

Oil And Gas Measurement

As is the case with many flowmeter industries and applications, flow measurement in the oil and gas industry is a battleground between new-technology flowmeters and traditional technology meters. The main types of flowmeters used for oil and gas measurement include Coriolis, ultrasonic, vortex and thermal. Among traditional technology flowmeters, differential pressure (DP), positive displacement and turbine flowmeters do the bulk of the measurement.

While advantages and disadvantages differ with the technology, new-technology flowmeters generally have less pressure drop, higher reliability and lower maintenance than traditional meters. Traditional flowmeters typically have moving parts and require more maintenance than new-technology meters. In many cases, however, traditional meters have the advantage in installed base.

A great deal of change has been occurring in the flowmeter markets in the past few years as suppliers respond to end-user requirements and to shifting market needs. This is especially true in oil and gas measurement. Higher oil prices have meant that end-users are looking for higher accuracy and greater reliability in their flowmeters used to measure oil flow. And even though natural gas prices have remained relatively stable, increased demand for natural gas has generated greater demand for flowmeters that reliably and accurately measure natural gas, especially in measurement of gas flow in large pipelines.



Total Shipments of All Gas Flowmeters Worldwide (Millions of Dollars)

Coriolis Flowmeters

The impact of changing needs in the oil and gas industry has had an especially pronounced impact on the Coriolis flowmeter market. Rheonik (now owned by GE Measurement) used to be the only company that offered Coriolis flowmeters in line sizes above six inches. In the past several years, Endress+Hauser, Micro Motion and KROHNE have entered this market with 8-, 10- and 12-inch Coriolis flowmeters. This is a major switch for the Coriolis flowmeter market since Coriolis flowmeters of two inches and less used to account for 90% of the revenues in this market. These percentages are changing as the larger, high-priced Coriolis make their presence felt. Many of these large Coriolis meters are priced at $50,000 and up, so they are not cheap, but they are highly accurate and very reliable.

The most recent entry in this field is the Proline Promass 83X/84X Coriolis flowmeter from Endress+Hauser. Endress introduced this meter to the North American market in May 2011. Aimed squarely at the oil and gas, fiscal measurement and high-accuracy oil and gas flow measurement markets, this is the largest Coriolis flowmeter yet at 14 inches. It is available with 12-, 14- and 16-inch flanges, giving it some flexibility in the large line size market. The Promass is the first four-tube Coriolis flowmeter made. Typical applications include pipelines and transfers to and from tanker ships, trucks and railroad cars.

While the new large line size meters break new ground in Coriolis technology, no one has yet figured out how to make these large line size meters any smaller or lighter. The large size and heavy weight of these flowmeters will no doubt limit their adoption rate. On the other hand, Coriolis flowmeters are still the most accurate meter made and users of Coriolis flowmeters have a loyalty to the technology that is unparalleled by users of any other flow technology. In reality, these large line size flowmeters are selling very well and are already having a major impact on the Coriolis flowmeter market.

Ultrasonic Flowmeters

The most important development in ultrasonic flowmeters in the past 10 years has been the development of multipath flowmeters for the custody transfer of natural gas. In 1998, the American Gas Association (AGA) gave its approval to the use of ultrasonic meters for custody transfer applications by issuing AGA-9. Suppliers responded by developing multipath ultrasonic flowmeters that conformed to AGA-9's requirements. Previously, only differential pressure and turbine flowmeters had AGA's approval for custody transfer applications.

For a number of years, Emerson Daniel and Elster-Instromet dominated the market for custody transfer of natural gas. Then FMC Technologies entered the market with its own multipath ultrasonic flowmeter. In the past few years, SICK Engineering has come on strong with a range of ultrasonic flowmeters for custody transfer and other applications. SICK also offers ultrasonic flowmeter solutions for flare gas measurement, where it competes with GE Measurement and Fluenta. KROHNE has also entered the ultrasonic flowmeter market for custody transfer of natural gas.

Elster-Instromet unveiled its Q.Sonic Plus ultrasonic flowmeter, in May 2011. Featuring six paths and up to 16 measurement chords, the Q.Sonic Plus accounts for flow profile, swirl and turbulence through its advanced diagnostic analysis. The multiple paths and enhanced number of measuring chords enables the flowmeter to adjust its measurement to take into account build-up of dirt and grime on the inside of the meter. The Q.Sonic Plus is designed for fiscal metering for natural gas transmission, distribution, storage and production, including custody transfer applications.

Ultrasonic flowmeters also play an important role in custody transfer of oil. Faure Herman (which has been acquired by IDEX Corporation) has developed an 18-path ultrasonic flowmeter for custody transfer of petroleum liquids. And Caldon (now part of Cameron) has an 8-path ultrasonic flowmeter for oil flow measurement.

Just as is the case for Coriolis flowmeters, custody transfer requirements are driving technology developments for ultrasonic flowmeters. End-users are looking for higher accuracy and greater reliability as the value and the volume of the measured fluid increases. In making purchase decisions, end-users consider life cycle costs as well as purchase price. Both ultrasonic and Coriolis flowmeters for custody transfer applications have high initial cost. However, these meters in many cases are worth the initial cost due to their high accuracy, reliability and low maintenance requirements.

Turbine Flowmeters

Turbine flowmeters received AGA approval for use in custody transfer of natural gas in 1981. This report was issued as AGA-7 and was called "Measurement of Natural Gas by Turbine Meters." This report provides equations for both volumetric and mass flow using turbine meters and addresses meter design requirements, installation specifications and meter maintenance checks. AGA-7 was revised and updated in 1996 and 2006.

Turbine flowmeters have several disadvantages versus ultrasonic meters. Their technology requires the presence of a spinning rotor, which is mounted on ball bearings and spins in proportion to flowrate. The presence of the rotor in the flowstream creates pressure drop and makes the meter susceptible to impurities like sand in the fluid. In addition, rotors are moving parts so they are subject to wear and the bearings are also subject to wear. On the other hand, high-end turbine meters can achieve very high accuracy levels and are widely used as flow transfer standards in calibration facilities and metrology stations.

Tungsten carbine, stainless steel and hard carbon are widely used materials for ball bearings in turbine meters. Some companies such as Hoffer Flow Controls and Cox Flow Measurement have turned to ceramic bearings to provide longer bearing life. Other companies use sapphire and ruby bearings and zirconia ceramic shafts to improve turbine meter performance. These technology improvements are important steps towards making turbine flowmeters more reliable. However, pressure drop will always remain an issue for turbine meters. It is impossible to imagine a turbine flowmeter without a rotor, which is required by the technology and placing a rotor in the flowstream causes some loss of pressure.

Elster-Instromet has provided innovative solutions to the turbine flowmeter market. In 2009 the company launched its SM-RI-2 meter as the world's first turbine meter with bi-directional operation, a feature useful for the changing gas metering market. The SM-RI-2's pressure loss can be reduced down to 50% of the conventional SM-RI-X models and the flow capacity has been increased to match the ultrasonic gas meter capacities for the same size.

This new generation of meter also features a TurbinScope diagnostic tool the company considers a breakthrough for examining turbine meter performance under real operating conditions, without removing the meter from the process. It also has an automatic lubrication system controlled by the measured gas quantity and activated by the gas pressure of the pipeline that reduces the need for manual maintenance. The SM-RI-2 is suited for import and export stations, underground gas storage and bi-directional transmission lines.

The Competitive Landscape

Turbine flowmeters are losing market share to ultrasonic meters for custody transfer of natural gas. The primary reasons are the higher accuracy and reliability of ultrasonic flowmeters, along with their reduced maintenance requirements. However, turbine flowmeters have a large installed base and this is helping them maintain their presence in the market.

They can also achieve very high accuracy levels, which is why they are used as standards in flowmeter calibration facilities. As long as suppliers continue to innovate by providing more reliable and long-lasting products, turbine flowmeters will either hold their own or decline only slightly. However, there is more research and development effort going into ultrasonic and Coriolis meters than into turbine meters, so the long-term prospects favor the new-technology meters.

One difference between custody transfer of oil and custody transfer of natural gas is that much of the custody transfer of oil occurs at the distribution end. This occurs when oil is loaded onto trucks, tankers, railcars and airplanes. Coriolis and positive displacement flowmeters handle the bulk of this business. However, the line sizes for these applications are smaller than the line sizes of ultrasonic flowmeters for custody transfer of natural gas, so these meters are less expensive. Oil is measured at many locations, but it is not all custody transfer. Other applications for oil flow measurement include allocation metering, utility/billing and process measurement in a plant.

Other Innovative Solutions

Sometimes when end-users are faced with the dilemma of choosing between two technologies, they may want to consider using two technologies together. Elster-Instromet has implemented a solution in which an ultrasonic meter is used in series with a turbine meter, or vice versa. This provides redundancy and also makes it easier to diagnose problems in the line. Added cost is an obvious disadvantage of this method and the meters need to be installed so as to minimize any impact on flow measurement by the second meter from the flowmeter that is placed first in the series. However, this is a solution some users may wish to consider for high value fluid metering.

Where are the frontiers of flow research today? For Coriolis meters, the most important frontier is in developing large size flowmeters that are neither physically too large or too expensive to be practical. Developing more accurate and reliable flowmeters to measure gas flow is another challenge for Coriolis meters, since gas is less dense than liquid and presents more of a measurement challenge for Coriolis meters. Developing more accurate ultrasonic flowmeters is a challenge and this often is done by creating flowmeters with more paths. However, experts differ on the extent to which adding more paths to multipath ultrasonic meters improves performance.

Companies are also building more diagnostic capability into their meters. This applies to most types of flowmeters, including turbine, ultrasonic, Coriolis and differential pressure. For turbine flowmeters, the frontiers of research include finding more durable materials for ball bearings and rotors. Some companies such as Cox Flow Measurement manufacture dual rotor turbine meters that extend their measurement range and provide enhanced performance. While the fundamentals of turbine flow measurement are unlikely to change, companies are working within those constraints to provide better and more accurate meters.

All these innovative solutions add up to a big advantage for end-users, giving them wider choices among high-quality products that are likely to outlast earlier models. And once a flowmeter technology is chosen, there are many suppliers to choose from. With the cost of oil rising and natural gas more in demand than ever, there could not be a better time for innovative solutions in the flow measurement market. ***P&GJ***

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