



# MULTIPHASE FLOW METERING INNOVATIONS IN THE MIDDLE EAST

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**M**ultiphase flow metering has seen a rapid uptake across the Middle East, replacing conventional and more expensive test separators and providing significant CAPEX savings with much improved reservoir management.

Multiphase flow meters that measure individual phase flow rates in a given flow – predominantly oil, water and gas – have been part of the region's oil and gas landscape for over 25 years.

The first commercial Roxar flow meter from Emerson, for example, was launched in the early 1990s. Shortly after, in 2001, the second-generation multiphase meter was launched, packed with a number of

improvements, including – for the first time – measurement of the velocities of both liquid and gas.

This article looks at some of the recent developments in multiphase flow meters and how they are continuing to evolve to meet new challenges.

## Key technology elements behind multiphase flow metres

While multiphase flow meters vary, there are a number of key technology elements that help characterise flow.

Electrical impedance measurements exploit the difference in permittivity of



multiphase components to determine the individual phase fractions of the mixture; gamma ray attenuations – emitted by a nuclear source – distinguish gases from liquids; and differential pressure is measured across a venturi to provide the mass flow rate and determine the velocity of gas and liquid.

Together, these technologies – along with cross-sectional measurements that provide a comprehensive mapping of the flow regimes and advanced signal processing and field electronics – are part of the third-generation Roxar Multiphase Flow Meter.

Today, the meter is used in over 1,500 onshore and offshore installations worldwide, including a number in the Middle East. Examples include TCO in Kazakhstan, which needed highly accurate multiphase metering for reservoir management in challenging high hydrogen sulphide (H2S) conditions.

**Handling complex flow regimes**

Multiphase flow meters today must operate in a wide variety of flow regimes, including bubble, slug, mist, churn, slip and



annular flows. All these different regimes come with widely varying challenges that must be overcome.

In the Middle East, the continued growth

in brownfield oil and gas wells producing over a broad range of process conditions, where more liquid and water are present, contribute to the varying flow regimes, as

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calculations must be included within the meter. With annular flows (high gas fractions), for example, compensation must be incorporated into the gamma and impedance system for accurate measurements.

For rapidly changing slug flows (both water and gas slugs), fast front-end electronics capable of capturing these changes are important. To this end, the third-generation Roxar Multiphase Flow Meter includes high-resolution sensors capable of capturing very small changes in the electrical properties of the multiphase fluid passing through.

■ **New metering advances**

Emerson has continued making further advances over the last 12 months, through the development of a new modular family of multiphase flow meters for more flexible, cost-effective and accurate metering.

A key driver for this innovation is the desire to explore an “all-in-one” multiphase flow meter at the wellhead that shares flow lines and provides continuous wellhead production test data – a concept that has

been explored by ADNOC Onshore.

Rather than being dependent on one technology solution for the lifetime of the well with the risk of failure and increased maintenance, Emerson’s new modular approach is based on different configurations that can be customised according to each application.

For example, Middle East operators can select from a set of modular meters designed for: 1) trending water cut, gas breakthrough and flow rates from a single well installation, 2) generating high accuracy flow rates for oil, gas and water over a broader range of applications in a single well installation, 3) improving meter accuracy and robustness through the addition of a gamma source, and 4) providing flow-back measurements, well testing and allocation metering in both single-well and multi-well applications.

Multiphase flow meters have come a long way since they were introduced to the market over 25 years ago. As can be seen in this article, Middle East operators have much to gain from advancements in multiphase metering.

does the presence of H2S – in Abu Dhabi’s Shah field, for example.

In order to handle these changing flow regimes, a sufficient number of sensors and

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