



# APPLICATION REPORT Chemical

## Flow measurement for billing of a hydrogen/natural gas mixture

- Custody transfer flow measurement of a gas mixture with hydrogen (H<sub>2</sub>) and methane (CH<sub>4</sub>)
- Re-use of existing natural gas pipeline for H<sub>2</sub> transport between industrial sites
- Decrease in energy consumption of 0.15 PJ, 10,000 metric tons CO<sub>2</sub> per year saved

### 1. Background

In their effort to achieve a climate neutral industry, Dow Benelux is an active partner in the Smart Delta Resources (SDR) partnership in a collaboration with other companies in the Flemish-Dutch Schelde-Delta. One project of this initiative comprises the supply of hydrogen produced in Dow's cracking plants. In this way, the hydrogen is made available as a raw material for other industrial sites in the region, following the "Green Deal on Hydrogen" that was signed for the region in 2016.

### 2. Measurement requirements

As an efficient, safe and sustainable way of hydrogen transportation, a previously existing 12 km / 7.4 mi long underground transport pipeline for natural gas has been reinstated for hydrogen supply. Around 4 kilotons of H<sub>2</sub> can be provided every year as part of a gas mixture of hydrogen and methane. This allows energy consumption costs to be initially cut by 0.15 petajoules (PJ) per year or roughly the annual gas consumption of 3,000 households, which in turn translates into a reduction in carbon emissions of 10,000 metric tons. And there is still future potential for further emission cuts.

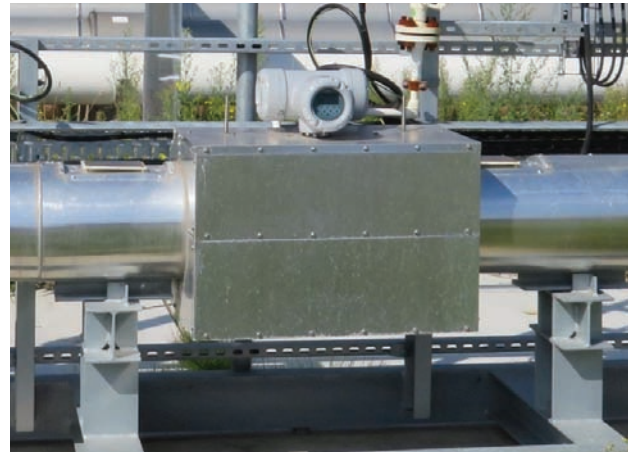
As the gas measurement is subject to billing between buyer and producer, a certified and calibrated custody transfer flowmeter was required for the pipeline. Given that hydrogen has an 8 times lower density than natural gas, the process instrument had to be designed accordingly and supplied with gaskets and fittings in line with these requirements. The pipeline is operated around 30 bar / 435 psi. To keep operational costs at a minimum, pressure loss of the flowmeter was demanded to be as low as possible. It was also of the essence that the flowmeter featured enhanced diagnostics for predictive maintenance.

## 3. KROHNE solution

As an experienced vendor of process instrumentation for custody transfer flow measurement of gases and gas mixtures with up to 100% hydrogen, KROHNE became the preferred supplier in this project. The ALTOSONIC V12 ultrasonic gas flowmeter turned out to be the flowmeter of choice for this hydrogen application. This KROHNE device is a 12-chord ultrasonic gas flowmeter for custody transfer (CT) of natural gas, hydrogen, or different gas mixtures. It was in fact the first ultrasonic gas flowmeter to achieve the OIML R137 Class 0.5. The flowmeter met the essential requirements of the client in terms of custody transfer approvals, wetted materials, extensive diagnostic features, calibration, and pressure loss.

The ALTOSONIC V12 was installed as a 6" insulated meter into the hydrogen/methane transfer pipeline that was previously in use for natural gas. Offering a wide range of ultrasonic transducer materials, KROHNE recommended the epoxy-based version. This transducer type perfectly fits applications with hydrogen as it provides excellent acoustic features and is not prone to hydrogen embrittlement at elevated temperatures as compared to titanium transducers. The gas flowmeter comes with enhanced diagnostics. Among others, it features a vertical diagnostic path that detects contamination on the bottom of the measuring tube (bottom-fouling detection). In this way, it can give a precise view into the flowmeter, allowing the client to carry out predictive maintenance.

In close cooperation with a calibration lab, KROHNE also solved the challenge associated with custody transfer calibration procedures for hydrogen applications. As there has not been any commercial lab for calibration of flowmeters with hydrogen so far, a similar Reynolds number range was selected at the lab to get as close as possible to operational conditions. The  $H_2/CH_4$  ratio required a 3 times lower pressure to be used in the lab as compared to operational conditions. The meter has been calibrated at six flow rates and is certified according to MID-002.



MID certified ultrasonic custody transfer flow measurement of a hydrogen/methane mixture

## 4. Customer benefits

The client benefits from reliable and accurate custody transfer flow measurement in accordance with the MID MI-002. The transport and supply of the hydrogen/methane mixture can now be properly invoiced and billed. Thanks to its diagnostic path to detect contamination, the reliable and accurate KROHNE flowmeter enables self-monitoring, making process optimization possible.

## 5. Product used

### ALTOSONIC V12

- Ultrasonic flowmeter for custody transfer (CT) measurement of gases
- 12-chord meter, for high accuracy flow metering of natural gas
- CT: OIML R137 (class 0.5), MI-002, AGA9 etc.
- Many variants, extensive CBM diagnostics free of charge
- Flange: DN100...1600 / 4...64"; max. PN450 / ASME CI 2500



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