



APPLICATION REPORT

Oil & Gas

Flow measurement of green hydrogen at a power-2-gas plant (P2G)

- Accurate and consistent information for the grid injection of green gases
- Flow measurement of hydrogen, synthetic methane (SNG), carbon dioxide and natural gas
- Full scope of delivery from one source incl. instrumentation, testing, commissioning and training



1. Background

GRTgaz is one of the leading European operators in natural gas transmission. The company is an innovator in the area of sustainable energy production and distribution. GRTgaz is the project coordinator of the Jupiter 1000 project (www.jupiter1000.eu), which is France's first industrial power-2-gas (P2G) demonstrator with injection into the gas grid, located in Fos-sur-Mer in southern France. This project was supported in particular by the French Agency for Ecological Transition (ADEME), the European Regional Development Fund (ERDF) as well as the administrative region of Provence-Alpes-Côte d'Azur and has been awarded by the Investments for the Future (PIA) programme of the French government.

P2G is a technology that uses electrical power to produce gaseous fuels. In the Jupiter 1000 project, renewable energy is used to produce hydrogen by means of electrolysis of water. This green hydrogen can be applied either as a fuel, an energy carrier or as feedstock, and will play an important role in de-carbonizing the industry and energy sector. In the Jupiter 1000 project the produced green hydrogen is applied in two different ways to de-carbonize the natural gas supply. In the first method the hydrogen is directly injected in the grid and forms a blend of hydrogen and natural gas. In the second method the hydrogen (H_2) is converted into synthetic methane (CH_4) via the methanation process in which it reacts with CO_2 captured at a nearby industrial site. Subsequently the synthetic methane is injected in the natural gas grid.

2. Measurement requirements

JUPITER 1000 is a demonstrator P2G project which combines two electrolysis technologies: PEM (membrane) and alkaline (liquid). In cooperation with several industrial partners, performance tests and plant optimisation analyses are carried out for a minimum of three years. To assess the technical and economic feasibility of injecting H₂ and synthetic CH₄ into the existing gas networks, knowledge about the composition of the products and the efficiency of the different electrolysis processes is of the essence. Therefore, GRTgaz requests accurate, clear and consistent information about the flow rates and compositions of the various gases. Furthermore, low costs of maintenance and operation (OPEX) are required.

3. KROHNE solution

As a main instrument vendor (MIV) and solution provider to the gas industry, KROHNE has designed, built and delivered a tailored package to the customer, including flow metering and flow computing. The process integration, commissioning and on-site training has been provided as well. The measurement of all essential process flows has been covered:

Mass flow measurement of **green hydrogen** from electrolysis and **synthetic natural gas (SNG)** from the methanation process:

- 2 x OPTIMASS 6400 C Coriolis mass flowmeters (½" with 600 lb flanges), ATEX Ex ia certified

Volume flow measurement of **carbon dioxide** captured from industrial flue gases:

- 1 x OPTISWIRL 4200 C Vortex flowmeter with integrated pressure and temperature compensation as well as built-in flow computer for flow calculation to standard conditions; Certified acc. to ATEX Ex ia

Volume flow measurement of **natural gas** from the network:

- 2 x OPTISONIC 7300 C ultrasonic flowmeters (4" and 6" with 600 lbs flanges), ATEX Ex ia certified

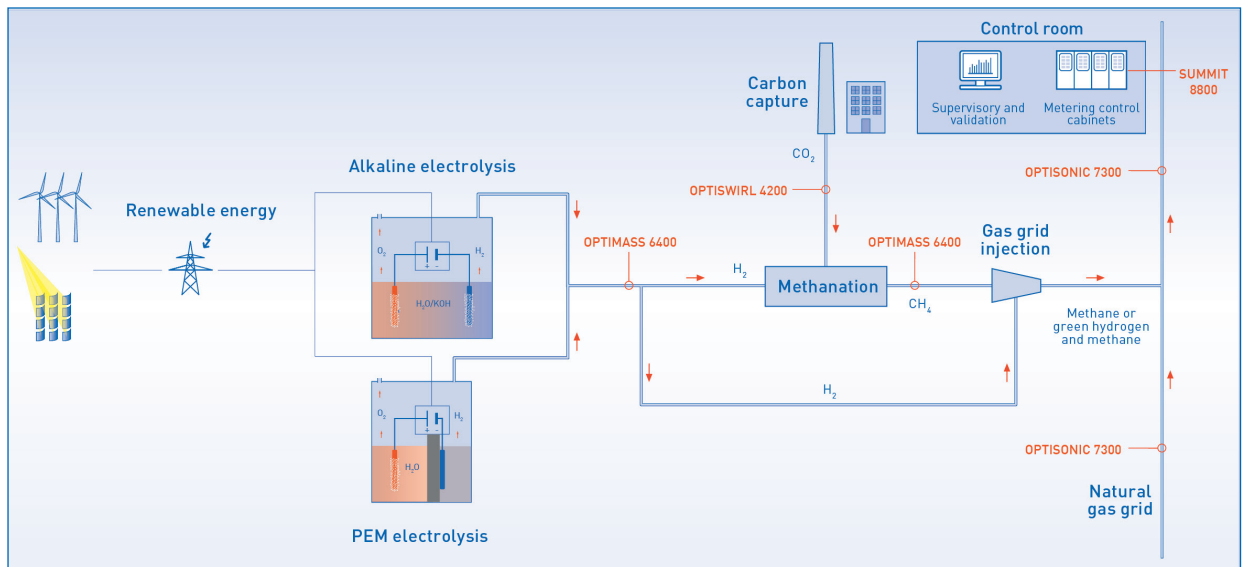


Flow measurement of hydrogen and SNG with the OPTIMASS 6400



OPTISONIC 7300 ultrasonic flowmeter prior to commissioning

All flowmeters are integrated into the existing project infrastructure with its control valves, pumps and gas analysers. The flowmeters for SNG, hydrogen and natural gas are connected to one single SUMMIT 8800 flow computer which enables the customer to set up all four flowmeters independently and without the need for additional KROHNE field service. The highly versatile flow computer is dedicated to the energy calculation of various products and conditions. It comes with Modbus communication protocol (RS 485) as per customer requirement.



Process flow sheet of Jupiter 1000 P2G project with measurement points

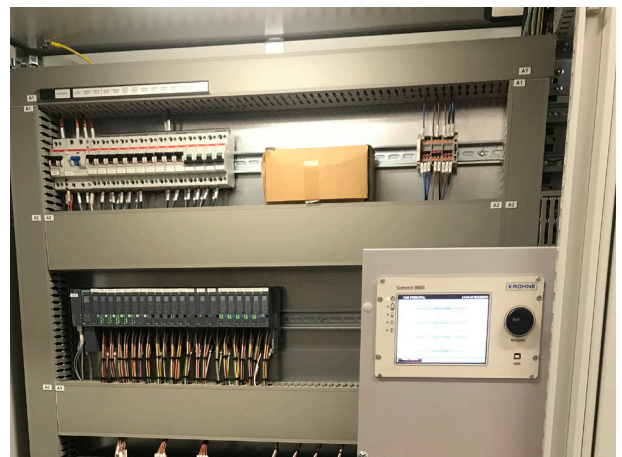
4. Customer benefits

The customer benefits from significantly lower operating costs for the accurate and reliable flow measurement and energy calculation of the produced and transported gases. Maintenance is minimized as the meters have no moving parts. Since the full bore OPTISONIC 7300 is in use, the pressure loss (typically associated with turbine meters) has been minimized, saving on costs for pump and compressor capacities.

Not only OPEX, but also CAPEX has decreased. In fact, there is no need to equip each flowmeter for H₂ and CH₄ with its own flow computer any more, as was the case with the previously used turbine meters and clamp-on devices. The SUMMIT 8800 flow computer is multifunctional and can process the measured values of several meter types simultaneously. The KROHNE project team managed the whole delivery of the complete solution from design to Factory Acceptance Test (FAT) and field integration. By providing all this from one single source, KROHNE fully met the expectations of the customer.



KROHNE Coriolis mass flowmeters installed at P2G demonstrator



SUMMIT 8800 flow computer in control cabinet



OPTISONIC 7300 C: Ultrasonic flow measurement of natural gas from the grid

5. Products used

OPTIMASS 6400 C

- Coriolis mass flowmeter for advanced process applications with hydrogen and other gases and liquids
- Custody transfer: OIML R117, R137, MI-002, MI-005; API, AGA, etc.
- Flange: DN10...300 / ½...12", max. PN 160 / ASME Cl 1500
- SIL 2/3 certification acc. to IEC 61508-2010, up to DN200 / 8"



OPTISONIC 7300 C

- Ultrasonic flowmeter for natural gas, process gas and utility gas applications
- 2-path meter, for standard volume flow metering, independent of media properties
- No maintenance, no pressure loss, large dynamic range
- Flange: DN50...1000 / 2...40", max. PN450 / ASME Cl 2500; also weld-in connections



OPTISWIRL 4200 C

- Vortex flowmeter for utility applications and energy management systems
- For liquids, (wet) gases, saturated and superheated steam (+240°C / +464°F)
- Integrated P+T measurement: direct output of mass, nominal flow, energy, gross/net heat
- Flange: DN15...300 / ½...12"; wafer version: max. DN100 / 4"



SUMMIT 8800

- Flow computer for visualisation of measurements, managing multiple measured values of several meter types simultaneously
- Compliant with all main international standards, such as OIML, ISO, API, AGA, GOST
- Cost effective solution due to modular hard- and software design
- Full colour graphical touch screen for maximum process transparency



Contact

Would you like further information about these or other applications?
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