Northeast GAS ASSOCIATION
NYSEARCH

Technology Brief

Study on Changing Accuracy & Variability of Therm Zones Affecting Metering of New Gas Supplies

Description: **A study to determine how blending hydrogen into natural gas will change the gas properties that may influence the flow measurement performance of natural gas flow meters.**

Status: **Completing laboratory testing to determine the gas properties and metering characterization is ongoing.**

BENEFITS

RNG injection and hydrogen blending in natural gas networks present a valuable solution for decarbonizing traditional energy systems, including heavy industry, heating, power generation, and transport, while enabling the transition to a low-carbon economy. Accurate measurements of gas composition and flow rates are essential to ensure correct transactions and billings.

This testing will help determine potential measurement errors when introducing hydrogen into the natural gas pipeline. Additionally, natural gas mixed with lower methane content seen in Renewable Natural Gas (RNG) is being tested for gas properties and the impact on energy content. This study will assist in identifying the need for any modifications to the billing process utilized currently by the Local Distribution Companies (LDC).

BACKGROUND

During the NYSEARCH annual brainstorming session in 2021, the members identified the need to understand the impact on the measurement of therm zones with the introduction of different gas supplies like RNG, hydrogen blending, etc. Typical metering technologies used for residential and commercial applications include rotary, turbine, and diaphragm flow meters which all measure the volume displacement of gas. Utilities bill customers on a per-therm basis; the amount of energy contained within the gas.

Natural gas is measured by volume and this volume is then adjusted by applying a factor that reflects the heating value of gas contained in that volume.

The flow rate measured from the gas flow meter in homes and businesses is impacted by the gas composition, temperature of the gas, and pressure of the gas. Accurate measurements of these properties, or reasonable assumptions are required to accurately convert the volumetric flow rate of the blended hydrogen and natural gas to an energy flow rate sold to an LDC customer.

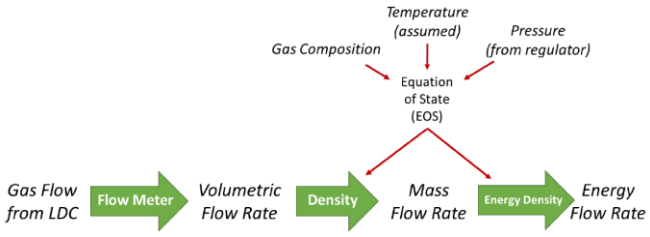

Figure 1: Measuring Natural Gas Energy Rate

TECHNICAL APPROACH

The objective of the project is to characterize the impact of varying hydrogen blends on different types of residential and commercial natural gas meters. The project is gathering the necessary gas property data that is required to calculate a mass flow rate from the residential flow meter output by simulating field conditions using a hydrogen test

loop at the Southwest Research Institute (SwRI) testing facility.
The factors that are required to calculate the total energy that is billable from a metered volume include the flow rate, gas temperature, pressure, gas composition, and the Equation of State (EOS) to determine the gas properties, such as density and energy content.

To understand the gas properties of blended hydrogen, the density of various natural gas and hydrogen blends will be measured and compared with existing equations of state. Hydrogen and natural gas blends of 5% and 20% hydrogen are being tested as well as 5% and 20% hydrogen with RNG. This testing is being accomplished with a high-pressure test cylinder for constant volume and using a highly precise scale with controlled temperature and pressure conditions. The detailed comparison of the standard EOS to the gas compositions assists in the gas metering characteristics testing.

Gas meter characterization testing illustrates the performance of four common residential flow meters (rotary, turbine, diaphragm, and ultrasonic) with hydrogen blended in natural gas. This test helps inform the LDC's as they select meters for their distribution networks in hydrogen blended natural gas grids.

Figure 2: Example of H_2 Blended NG Flow Rig

Each of the four flow meters for testing are being incorporated into the SwRI flow test rig that has been constructed for the project. The rig is designed to provide a homogeneous and steady flow of test gases.

From these tests, the funders of the project are being provided with an extensive evaluation of common natural gas flow meters' performance with hydrogen concentrations up to 20% by volume. Additionally, systematic trends in measurement are being quantified. Also, an analysis of meter performance across the flow range at each concentration is being provided.

PROGRAM STATUS

The testing parameters were established by the funders for the gas properties testing. The four different types of residential and commercial meters were selected and sent to the SwRI testing facility. Additionally, the flow meter testing is utilizing their flow measurement expertise at the Metering Research Facility. SwRI is operating the blowdown rig to produce steady and repeatable flow conditions.

Testing is ongoing and targeted to conclude by the end of 2022.

Highlights

- Evaluates residential and commercial meters selected by funders.
- Assesses how existing natural gas flow meters is affected by blending hydrogen and natural gas.
- Assists in identifying modifications needed for the utility billing process as a result of the presence of hydrogen blends in the gas transported by LDC infrastructure.

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