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Natural Gas Measurement Considerations in a Hydrogen Economy

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Historically, oil and gas companies have focused on keeping hydrogen *out* of their pipelines to avoid product contamination, prevent hydrogen embrittlement damage to the steel, and support measurement accuracy. Now, we have an industry-wide shift as part of the "hydrogen economy" to tap into the capabilities of this alternative fuel source.

Why the sudden shift? ESG (Environmental, Social, and Governance) initiatives targeting zero-carbon emissions have become a key driver for many U.S. corporations. While hydrogen-based alternative energy in Europe and Asia may be ahead of North America, our domestic gas industry is now focused on the task at hand. Things are moving quickly to transform the industry through hydrogen utilization.

The timeline for this transition is aggressive. It's clear that the hydrogen economy is coming, and it's coming fast. But, as the "cash register" of the gas industry, will **measurement** be ready? Specifically, are natural gas pipeline operators ready for the measurement impact?

The Big Picture of the "Hydrogen Economy" Transition

At this stage of the transition, companies across the industry are performing extensive research in the following areas:

- Materials compatibility to research which types of steel pipelines can support hydrogen.
- Development of new safety standards.
- Certification of existing equipment for use with hydrogen.
- Creation of new technologies.

There is a lot of research about the individual puzzle pieces of this new picture, but how will those pieces be fitted together? Most of the current focus is on the individual technical and safety details behind introducing hydrogen into our pipelines. However, will measurement be ready when the pieces are finally assembled? Have we started to think about how many of those pieces will involve measurement?

At this stage, the technical aspects of measuring and analyzing natural gas containing hydrogen are fairly well known, the question is: "How will the industry execute this on a commercial scale?"

Accurately measuring and analyzing hydrogen blends at the meter is only part of the challenge facing measurement professionals. The industry must examine the state of natural gas measurement from a perspective much broader than just the meter.

Measurement Challenges with the Hydrogen Economy

As the industry matures its approach to hydrogen in pipelines, it's time to start thinking about measurement issues that affect the cash register. Operators need to walk through three measurement-related actions steps:

1. Understand the implications of equipment changes and pipeline operations changes to your measurement operations.

It's critical that your measurement team be involved in the hydrogen planning discussions from the beginning. Don't wait for the "*we will start flowing on the first of next month*" meeting.

2. Perform a Gap Analysis on existing measurement standards, the installed equipment base, and the existing software systems that collect and process your measurement data.

It's time to ask some questions about whether you have the systems and capabilities to track and report hydrogen in natural gas. We are not finished just because we have volumes and analysis data at the meter. We must address what data needs to pass through related systems? We must be able to consistently produce accurate measurement data and report it properly.

Additionally, your company needs to be prepared to maintain the integrity of measurement data throughout data collection, validation, and processing. You must understand how measurement data should be processed, whether you use a commercial measurement software system, an in-house developed system, or outsource to a third party.

Your company should focus on the following measurement-related areas as part of the Gap Analysis effort:

- Contracts & Tariffs: Language and incorporated references to industry standards.
- Field Measurement Equipment: Inventorying meters, analyzers, and sampling equipment for compatibility.
- Impact of physical characteristics of natural gas as Hydrogen concentration increases: How reduced density, reduced viscosity, and a negative Joule-Thompson coefficient impacts meter equipment, regulation, flow profile development and others.
- The electrical classification of areas and buildings housing measurement equipment.
- Standard Operating Procedures: Revisions to address new/changing equipment and procedures.
- Field Operations: Training; equipment; increased operating cost.
- Polling/Data Collection: Updated data collection templates for each meter type.
- SCADA/Pipeline Control: Updated databases and screens for pipeline controllers; MOC and training.

- Measurement Systems: Calculations for volume and gas composition, validations rules, and reporting.
- Nominations/Scheduling: Data interfaces to real-time and measurement information.
- Accounting: Interface to the measurement system and updates for reporting hydrogen.

3. Identify and address potential issues with contracts, tariffs, and critical customers.

Most existing contracts and tariffs do not mention hydrogen, or if they do, it's treated as a contaminant. This will have to change. The best thing you can do now is to review your current agreements and obligations so that you can be prepared for when that shift hits home.

Customers that may be highly sensitive to quality fluctuations should be identified.

Companies also need to be prepared to adapt their measurement practices and company policies to align with future changes to contracts, tariffs, regulations, and industry standards. Otherwise, you run the risk of future measurement errors, accounting discrepancies, legal disputes, and non-compliance.

Measurement Needs to Take Action Now

While there is still significant research still being conducted into the details of incorporating hydrogen into natural gas pipelines, investors and regulators alike are moving forward with the assumption it will happen sooner instead of later. Puzzle pieces are still scattered across the floor, but order is starting to form and the intensity to move forward is high and measurement needs to join the discussion around the hydrogen economy…or risk being run over.

As the industry continues to finalize how pipelines will operate with hydrogen blends, measurement need to make sure make sure we have a firm plan, along with a timeline that syncs with the ESG drive that is steering our industry. For Measurement, this begins with a thorough gap analysis of your measurement readiness for hydrogen.

- Understand your company’s hydrogen policy.
- Take a close look at existing measurement systems and processes, and what is required to adapt them to likely scenarios.
- Start the discussion about how measurement practices will need to change.
- Review contracts and tariffs to gauge the changes hydrogen necessitates.
- Understand what equipment is required and what delivery\installation timelines will be.
- Begin compiling budgetary numbers for equipment and software system upgrades.

Don’t Let Your Measurement Department be the Holdup

It’s time to start preparing for hydrogen now! Here is why…. Renewable Natural Gas (RNG) has been around under other names since before 2005. Landfill Gas or Digester Gas was mostly consumed at the point of production, so few energy companies were dealing with it. The industry standards committees were mostly hands-off on the subject and tariffs were not modified to acknowledge it.

When RNG was suddenly shifted into the spotlight, many transportation pipelines and distribution companies were caught off-guard and have been struggling to recover. They were either not prepared to handle the challenges, or assumed implementation would be years, not months. Those companies are now struggling with developing quality control specs, analyzer systems, and with how to monitor RNG producers.

When it comes to greener energy, RNG is expected to be a drop in the bucket compared to the impact of hydrogen. The challenges will be greater, but the implementation timelines will likely be rapid.

Measurement should be part of the solution, not part of the problem.

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Resources:

(1) “Hydrogen Blending into Natural Gas Pipeline Infrastructure: Review of the State of Technology” Technical Report NREL/TP-5400-81704 October 2022 from NREL laboratory - U.S. Department of Energy Office of Energy Efficiency & Renewable Energy Operated by the Alliance for Sustainable Energy, LLC

