OIL & GAS

GET HYREADY! - Get prepared for hydrogen added to natural gas

Preparation of engineering guidelines for adding hydrogen to natural gas with acceptable consequences

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HYREADY: What is new?

HYREADY: Next step after NATURALHY, HIPS-NET and others.

Implementation of the outcomes of previous projects into clear engineering guidelines for TSO’s and DSO’s, aiming to support them with preparing their natural gas networks for hydrogen accommodation with acceptable consequences.

TSOs and DSOs get prepared for H_2 accommodation!

It is our **belief** that it is inevitable that the natural gas grids need to become capable of containing a certain percentage of hydrogen, in order

- to accommodate renewable or bio-based gasses that may contain Hydrogen
- to store electricity for shorter or longer periods in the form of Hydrogen (Power-to-gas)
- to reduce the carbon footprint of natural gas.

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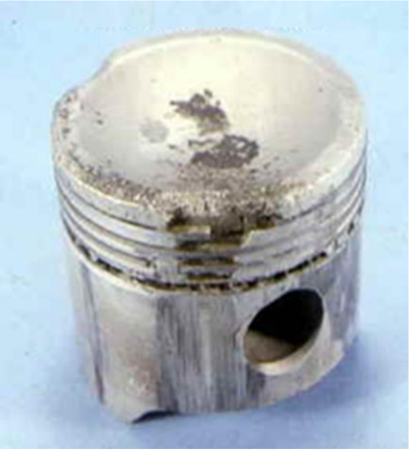
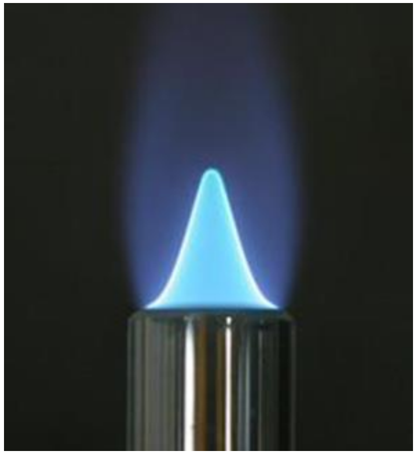
Now, it is time to act!

- Studies show that the existing natural gas system can accommodate a certain percentage of hydrogen added to natural gas…
- However, this does not mean that such accommodation has no consequences nor does it mean that mitigating measures are not necessary
- It is time now to convert the existing knowledge of the impact of hydrogen on the gas system into practical engineering guidelines

Impact of hydrogen added on the natural gas system

- The chemical and physical properties of hydrogen differ importantly from those of natural gas. As natural gas normally does not contain any hydrogen, the natural gas chain is not designed for hydrogen





Examples of the impact of hydrogen addition

- 10%* H_2 added reduces the caloric value by ~7%*

- If more than 10%* H_2 is added to Norwegian natural gas, the methane number drops to 70, and engines designed for this methane number may be seriously damaged.

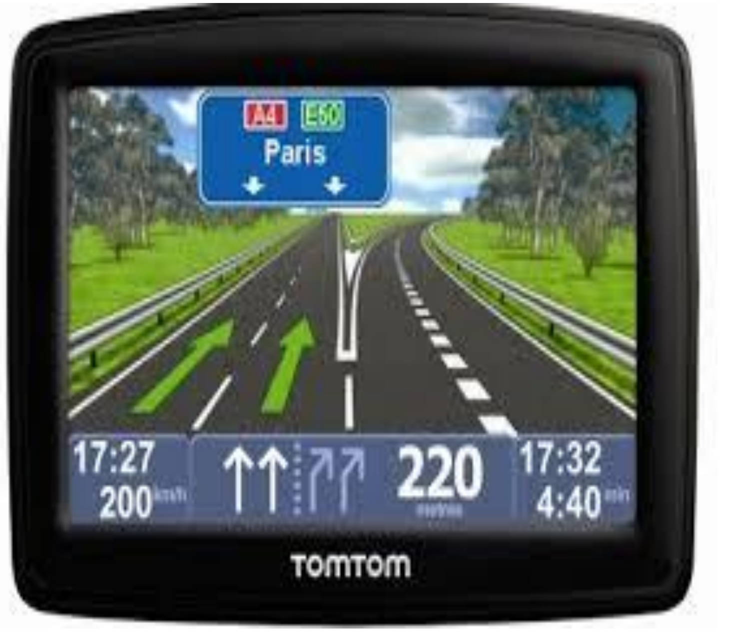
- H_2 can have a significant impact on the fatigue performance of steel and consequently on the lifetime of pipelines operated under fluctuating pressures

- H_2 can permeate through Silicone and PTFE causing leakages of hydrogen which may have consequences for ventilation, electrical equipment and operational.

*% by volume

Project HYREADY: Objective

- To prepare clear engineering guidelines for TSOs and DSOs to support the preparation of their existing natural gas networks and operations for the injection of H_2 (pure and as a gas component) with acceptable consequences.



Basic principle

A careful approach:

The guideline for change must be based on **known consequences** of the change.

This will ensure decision making by the stakeholders based on **evidence**.

Approach: ‘how-to’ guidelines (1)

HYREADY focuses on:

- The **consequences** of H_2 added to natural gas in an existing specific network and on
- Feasible **counter measures** to mitigate these consequences.

Whether or not consequences are acceptable or counter measures should be taken, is a decision to be taken by the System Operator.

The project concerns **all components** in the natural gas system:

- The high and medium pressure transmission networks
- Distribution grid (incl. PE, PVC and steel pipelines)
- End user in-house infrastructure and appliances (domestic and industrial)
- The hydrogen injection facility.

Approach: ‘how-to’ guidelines (2)

HYREADY distinguishes:

- The **component level**: To which extent are performance and characteristics like leakage, permeation, integrity, accuracy and lifetime affected? To which extent are maintenance and repair procedures, maintenance tools, safety equipment, etc. affected?
- The **system level**: To which extent are e.g. central caloric value determination, network capacity affected?
- The **location level**: To which extent are the installation requirements including safety zoning affected?

Out of scope are: economics, political aspects, public awareness & acceptance.
No tests nor experiments are foreseen within HYREADY.

Breakdown of the natural gas system parts (not limiting)

High and medium pressure transmission system

System level:

- Capacity
- Caloric value determination
- Losses
- Efficiency

Component level:

- Pipelines
- Block valve facilities
- Export stations, M&R and gas delivery stations
- Compressor stations
- Underground Storages
- Measurement equipment

Distribution system

System level:

- Capacity
- Losses

Component level:

- Pipelines
- Pressure regulators
- Valves
- Measurement equipment
- End user delivery facilities

End user facilities

(domestic and industrial)

- Infrastructure
- Appliances (domestic and industrial), including the impact of constant and fluctuating H_2 %
- Gas detection and safety equipment
- Regulations (EU level)

Design of hydrogen injection station

- Different control modes for hydrogen injection

What's in it for participating partners?

- Exclusive access to project results:
  - Guidelines will comprise comprehensive, uniform, impartially prepared and **unequivocal actionable knowledge** which will be shared *exclusively* among partners
  - A *summary* will be available as a public DNV GL Recommended Practice.
- Access to all background information
- Learn from the discussions with other experts
- Obtain a detailed understanding of the Guidelines (and know how to apply them)
- The Guidelines will be kept confidential within the Consortium, and are intended to be processed into public DNV GL Recommended Practices.

Set up of the Guidelines

- We follow the gas system component by component and assess the expected impact of hydrogen added.

We consider:

- Different component types (to be selected),
- The materials from which the components are constructed,
- The operational condition of the components,
- Specific situations and conditions under which the components can be installed (outside, inside, etc. if relevant)
- H_2 % added to natural gas: 2, 5, 10, 20 and 30%

HYREADY Project: Set up

- Energetic approach, led by DNV GL and DBI
- Mobilising knowledge inside and outside the consortium
- No experiments, nor tests: focus on existing knowledge
- Deliverables will be confidential: later on a public high level DNV GL Recommended Practice will be prepared
- Duration: 2 years

HYREADY Project: State of affairs

- The HYREADY programme has been aligned with the potential partners in two meetings
- A proposal has been prepared and distributed among potentially interested parties
- Currently, the parties assess the proposal and make up their minds about participation
- The first signed proposals have been returned
- Expected to start in the next few months
- HYREADY has been presented at the CEN/CENELEC SFEM WG11: no overlap
- New partners are still welcome

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Summary HYREADY project content

Objective: To prepare Guidelines for TSO's and DSO's to support them in preparing their natural gas networks and operations for the injection of H_2 (pure and as a gas component) with acceptable consequences.

Scope: the natural gas chain from the high pressure transmission grid up to and including industrial and domestic end user appliances.

Approach: Guidelines to forecast the consequences of hydrogen injection in a specific natural gas network and to propose feasible counter measures to mitigate unacceptable consequences.

Main deliverable: Engineering guidelines that lay down sound engineering practice and guidance on the measures to be taken to ensure hydrogen injection can be done with acceptable consequences.

Thank you for your attention!

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