Gas Quality

The effects of hydrogen on Wobbe Index

Joint CEN-ENTSOG Workshop on Wobbe Index and Gross Calorific Value in the European gas value chain

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Storage of surplus of renewable energy

**Sharp growing of renewable power generation**
- Peak power production generates curtailments
- Renewable power is intermittent

**Need for power storage**

**Different technologies available**
- Many of them under development

**Hydrogen is an option**

Why hydrogen?

Allow long term storage and transport of surplus of renewable energy

Hydrogen is an energy vector

Different utilization options:

– Use in hydrogen application: heat, mobility, raw material, ...

– To transform in another fuel: methane, methanol, liquid fuels

– Injection into the natural gas network
Why injecting hydrogen in the natural gas grids?

Source: Enagás, S.A.
Reasons behind injection of hydrogen in the natural gas grid

Allow to use the large storage and transmission capacity of natural gas networks

The natural gas infrastructures already exist and their capillarity along European territory allows connecting almost any production-utilization point

Natural gas infrastructure operators and associations are strongly committed to support the integration of renewable gases in their grids

Contribution to reduce the CO$_2$ footprint of natural gas utilization
Hydrogen main combustion properties vs natural gas (pipeline/LNG origin):

<table>
<thead>
<tr>
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<th>Pipeline NG</th>
<th>LNG</th>
<th>H₂</th>
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<tbody>
<tr>
<td>Hs (MJ/m³)</td>
<td>39.67</td>
<td>41.26</td>
<td>12.10</td>
</tr>
<tr>
<td>WI (MJ/m³)</td>
<td>50.73</td>
<td>52.35</td>
<td>45.88</td>
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<tr>
<td>Rel. Density</td>
<td>0.6114</td>
<td>0.6211</td>
<td>0.0696</td>
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(15°C/15°C conditions)

- Higher combustion velocity
- Higher flame temperature in stoichiometric combustion
Effect of adding hydrogen to natural gas

Pipeline natural gas

LNG

Red area: CBP natural gas specification limits as reference
Effect on gas velocity of mixtures

Source: K. Altfeld & D. Pinchbeck (GERG),
Many gas applications are able to handle mixtures of natural gas and hydrogen without significant problems.

Research has demonstrated that many residential and commercial appliances can handle up to 30% hydrogen without safety concerns.

Industrial applications could handle up to 50% hydrogen without negative impact if proper measurement and control technologies are applied.

Gas turbines and gas engines are probably the most sensitive applications. Manufacturers and researchers are investigating new technologies to address this.
Hydrogen reduces Wobbe index and calorific value of natural gas when mixed with it

- Reduction depends on natural gas composition
- Not only WI/GCV is affected

Acceptable concentrations of hydrogen are different today for different end uses

Many consequences of hydrogen admixtures are qualitatively rather similar to gas natural fluctuations
Thank you!