

Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

WORKSHOP NATURALHY

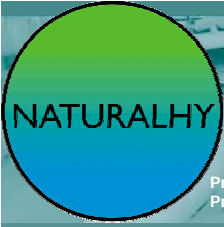
How much hydrogen can natural appliances accept and how do we take hydrogen out of the natural gas network?

Onno Florisson
N.V. Nederlandse Gasunie

(Replaces Costa Komodromos of the University of Warwick)



NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)



NATURALHY

Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

Relevance

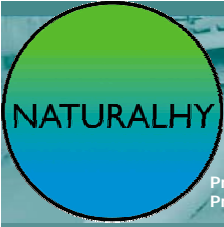
Adding hydrogen to natural gas has an impact on chemical and physical properties of the gas:

Effects the combustion properties

Chemical processes that use natural gas for feedstock



NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)



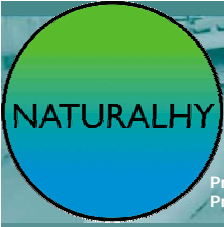
Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

End user appliances

Inventory of available data on the effect of hydrogen addition and assessment of the impact of hydrogen addition on the performance, safety and reliability of current natural gas appliances



NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)



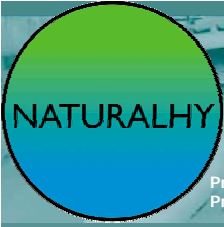
Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

Field trial

DGC & Naturgas Midt-Nord

- Boiler tests (Laboratory and field test)
- Tests being planned (ignition properties, stability, flashback)
- Boiler type chosen (Vaillant VC 127)
- Testing system agreed with manufacturer
- Mixture 23% hydrogen in natural gas





Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

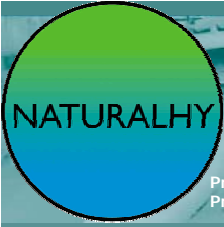
Literature Review

Gasunie Engineering & Technology

Literature review, including existing fundamental know-how on combustion processes with hydrogen

- Predict the effect of H₂/NG mixtures on gas appliances (combustion properties, NO_x formation, stability, corrosion)
Appliances: burners for industrial and domestic heating applications (especially older designs), domestic cookers, industrial radiant burners, stationary engines and turbines.
- Include information gathered in other projects such as the Dutch EET-project "Greening of Gas"





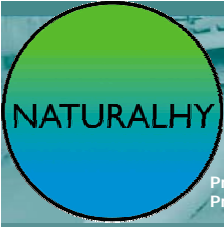
Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

Separation

Establish targets and specifications for permeators for separation of hydrogen at a range of scales to assess the effect on equipment and performance of larger scale operations



NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)



Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

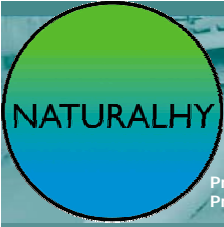
Separation

Issues Considered

- Separation of hydrogen from NG/hydrogen streams at low to medium pressure (ambient to 50bar)
- Scales of operation
- High purity hydrogen (<10ppm CO) for PEM cells
- Options for using lower purity hydrogen (engines etc)
- Performance, durability
- Effect of sulphur and other contaminants
- Lower cost than equivalent scale PSA



NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)



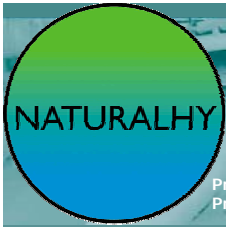
Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

Membranes

3 types of membranes are developed:

- Palladium based membranes on ceramic substrates (University of Warwick)
- Palladium based membranes on metallic support (CETH)
- Polymeric and carbon membranes (NTNU)





Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

Gas quality management

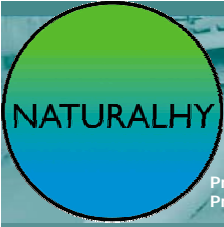
University of Warwick

Strategies to preserve the gas quality in the pipeline after selective withdraw of H₂

Gas transmission and distribution concerns moving gas from A to B, gas quality control and matching the patterns of production and demand



NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)



Preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst
Project Contract No.: SES6/CT/2004/502661

Thank you for your attention

Onno Florisson

N.V. Nederlandse Gasunie

Naturalhy@gasunie.nl



NATURALHY is an Integrated Project funded by the European Commission's Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD)