European Commission

IPHE

Hydrogen - A Competitive Energy Storage Medium To Enable the Large Scale Integration of Renewable Energies

Seville, 15-16 November 2012

Economic benefits of delivering hydrogen using the UK gas network

Overall Objectives and Budget

The aim of this project is to understand whether hydrogen can be economically delivered using the UK low-pressure gas network in the future. The gas network delivers energy for heating to 84% of UK homes but previous studies of UK decarbonisation pathways have suggested that it should be decommissioned if the UK is to achieve the 80% reduction in CO2 emissions mandated by the UK Climate Change Act 2008.

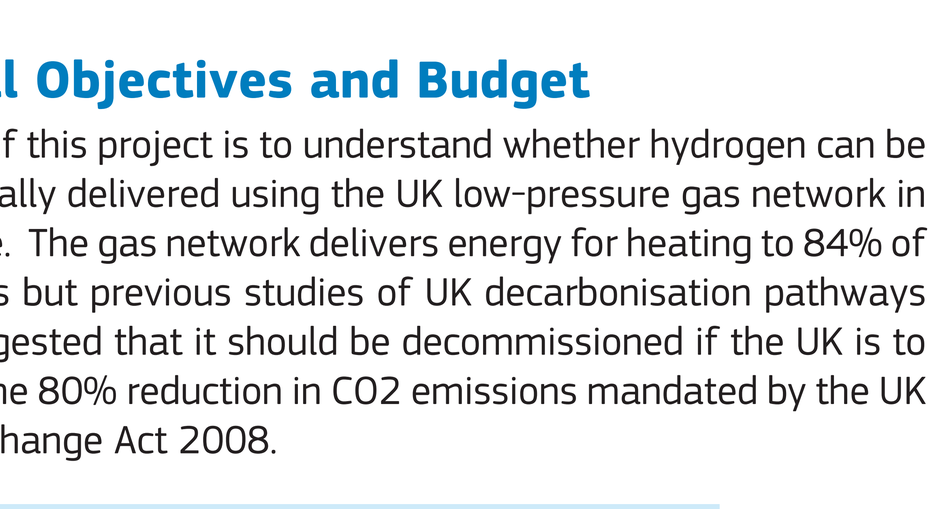
Options are to inject hydrogen into the natural gas or to convert the network to deliver only hydrogen.

Options

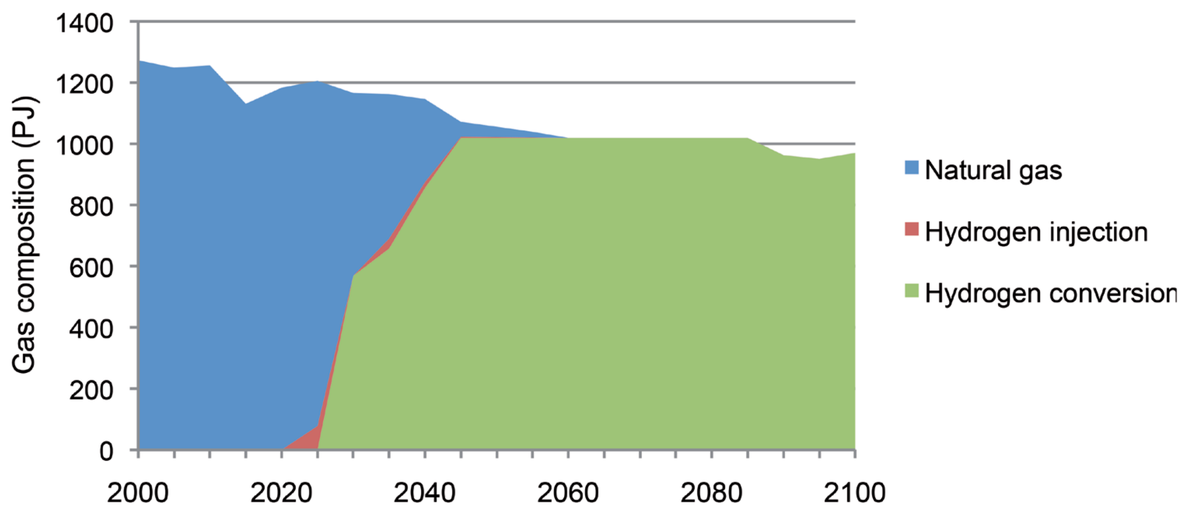
We have examined two options. The first option is to inject small quantities of hydrogen into the gas network for delivery in a natural gas mix. This option uses the gas network as a storage medium when there is excess generation from intermittent renewables and also partially decarbonises the delivered gas. The second option is to convert the gas network to deliver 100% hydrogen for use in fuel cells or micro-CHP as an alternative to electric heating.

Results

From an economic perspective, hydrogen injection is only appropriate as a niche technology linked to intermittent renewables in the short-term. In the period 2030 to 2040, hydrogen injection is a transition technology to reduce CO2 emissions but is produced from fossil fuels with CCS rather than electricity, which is too expensive (Figure 1). By 2050, the carbon content of natural gas is too high and the only viable option for the gas network is conversion to hydrogen. Heating from 2050 is supplied by micro-CHP, air heat pumps and electric boilers (Figure 2), with the balance between these technologies depending on their capital costs. The gas network provides an important hydrogen storage facility in the energy system.



Residential and service heating demand fulfilment by technology. After the gas network conversion is completed, the only heating fuels are electricity and hydrogen.



Composition of the natural gas delivered to the residential and service sectors (PJ)

Future Work

We are examining the technical feasibility and cost of converting the gas network to deliver hydrogen. Safety, leakage rates and the capacity of the gas network to satisfy peak demand are our major concerns. We are also examining how the gas network might be used in conjunction with large-scale inter-seasonal storage of hydrogen in the UK energy system.

Conclusions

The gas network could potentially be used to store and deliver hydrogen for residential consumption in a future low-carbon energy system in the UK.

Project Overview

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- Not applicable
- 09/11 to 12/14
- Not applicable

UK-SHEC SUPERGEN EPSRC Pioneering research and skills UCL