



Domestic Hydrogen Appliances for Decarbonising Heat in the UK

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September 2019 - World Plumbing Conference

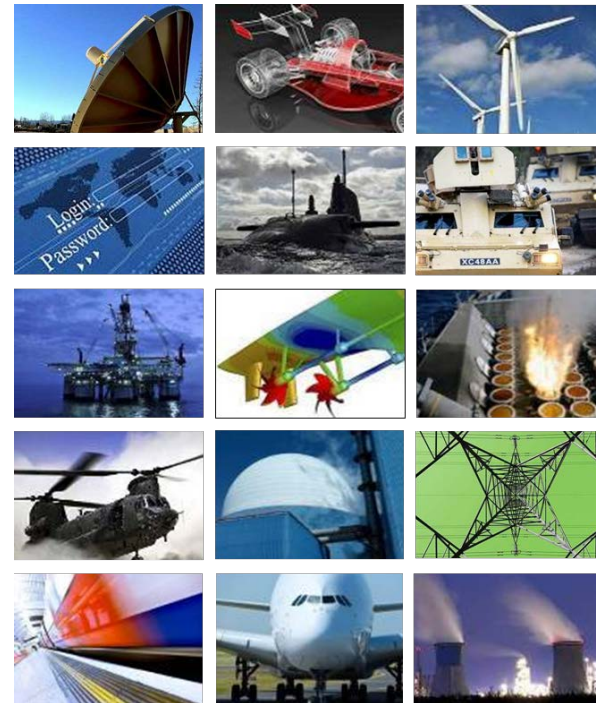
SYSTEMS AND ENGINEERING TECHNOLOGY



1. Why hydrogen?
2. Are hydrogen appliances feasible?
3. Could the UK convert to 100% hydrogen?

Who we are

- ▶ Systems and Engineering Technology Consultancy

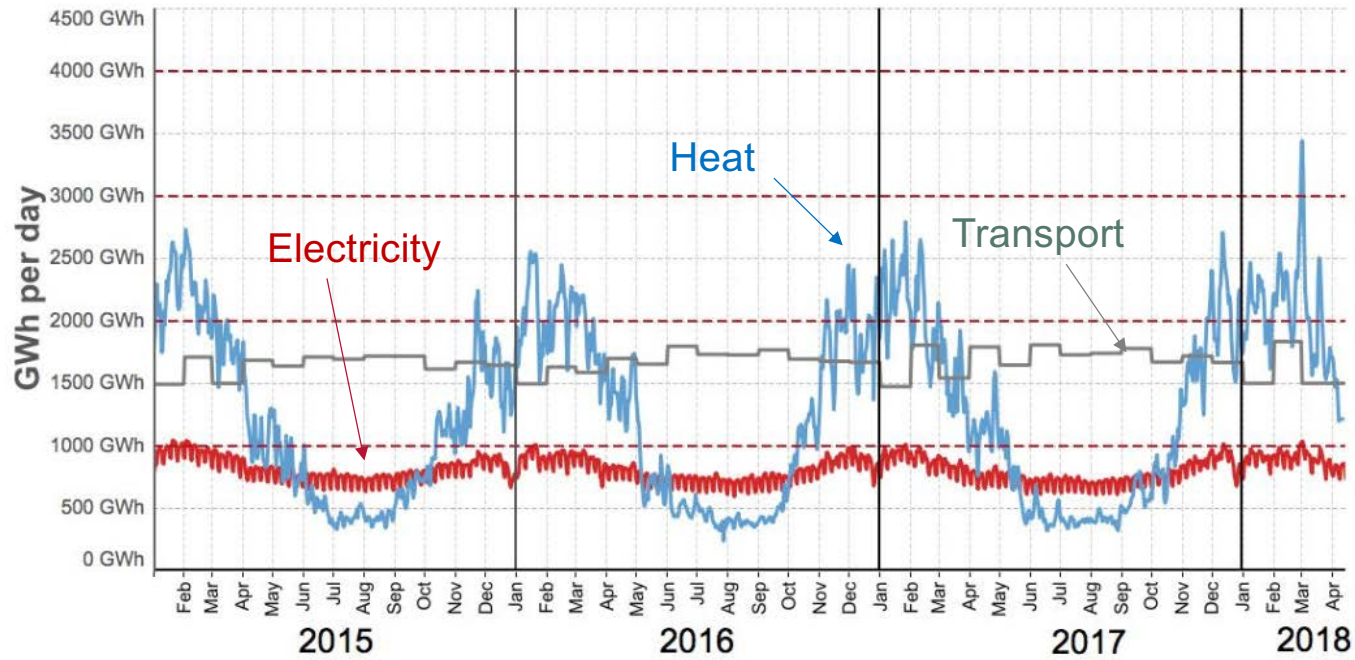


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UK Electricity, Heat and Transport



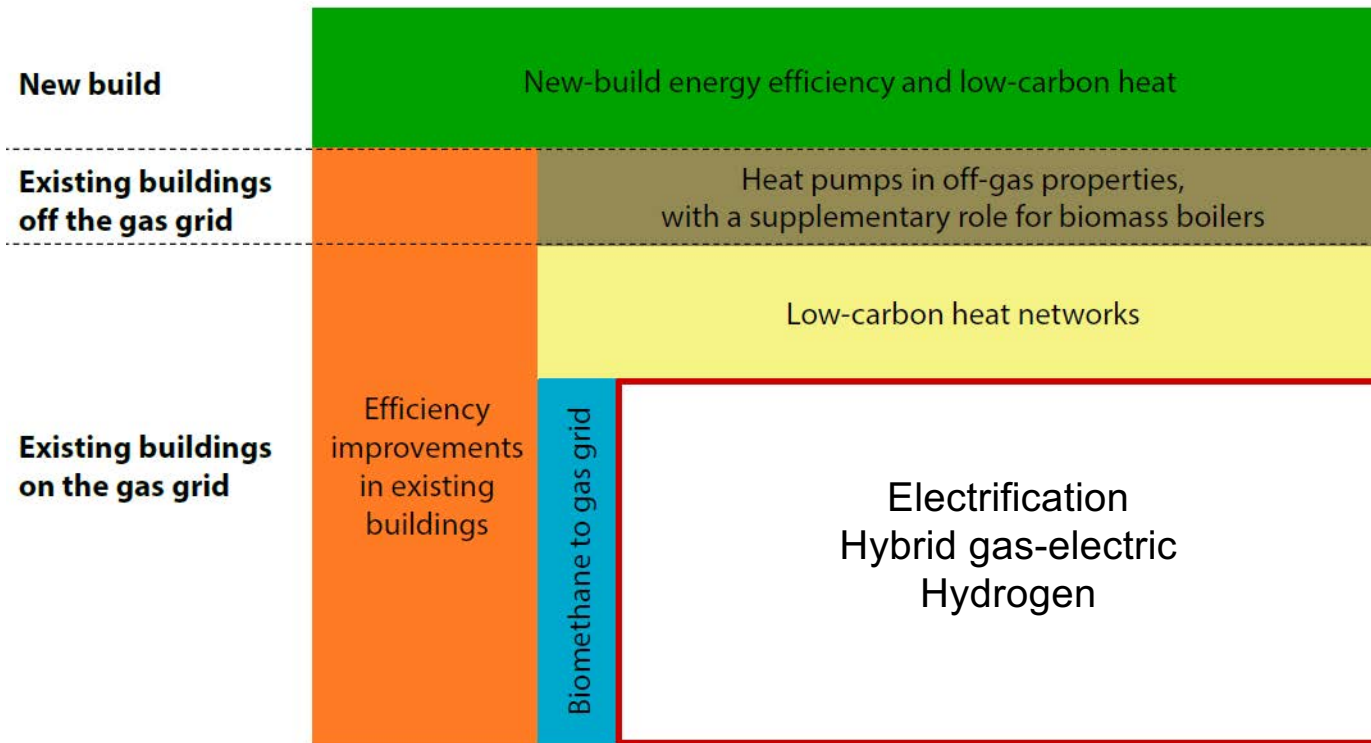
Target Zero by 2050

Data are from National Grid, Elexon and BEIS. Charts are licensed under an Attribution-NoDerivatives 4.0 International license
Charts can be downloaded from <http://bit.ly/energycharts>



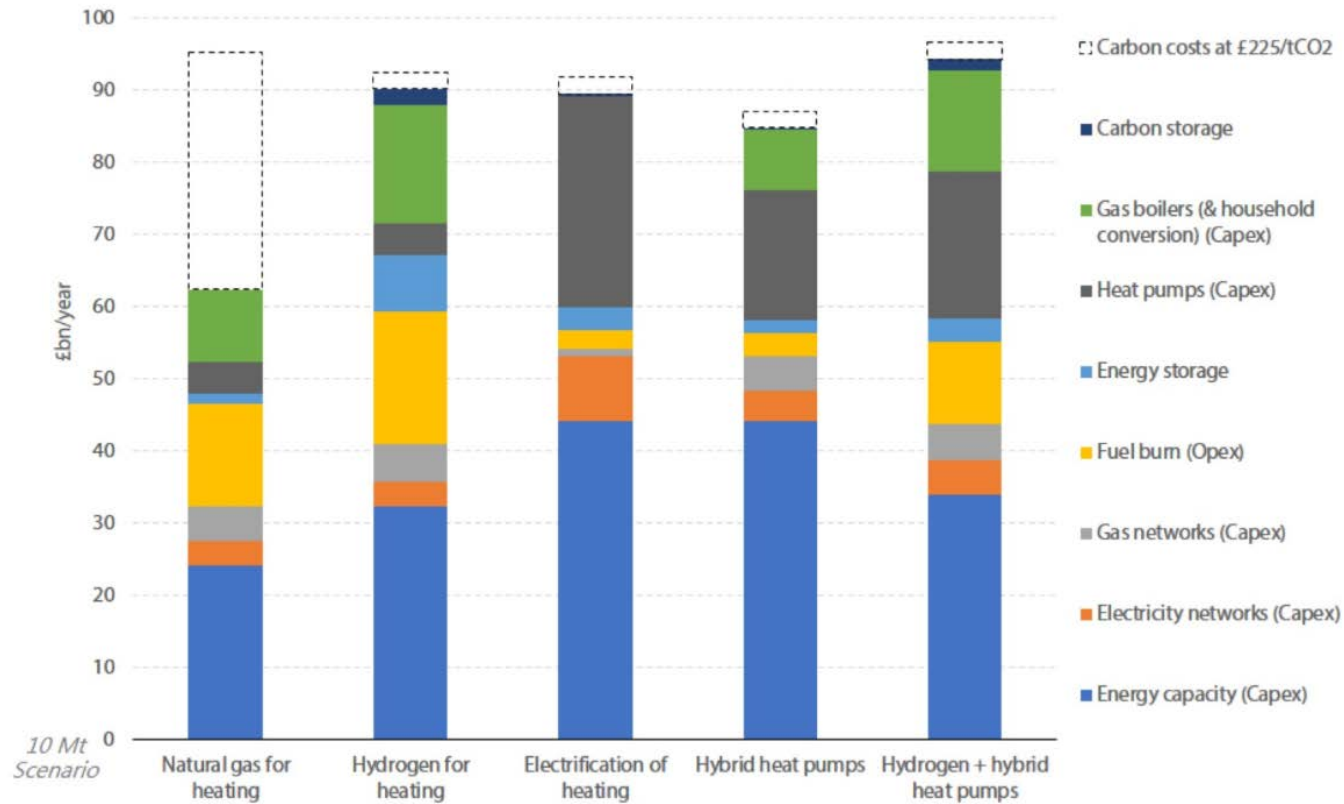
by Dr Grant Wilson grant.wilson@sheffield.ac.uk

Low regrets actions for decarbonising UK heat



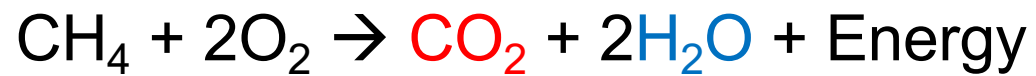
Adapted from *Committee on Climate Change, Next steps for UK heat policy (2016)*

Relative cost of heat decarbonisation options



Source: Net Zero Report, Committee on Climate Change (2019)

Natural Gas



Hydrogen

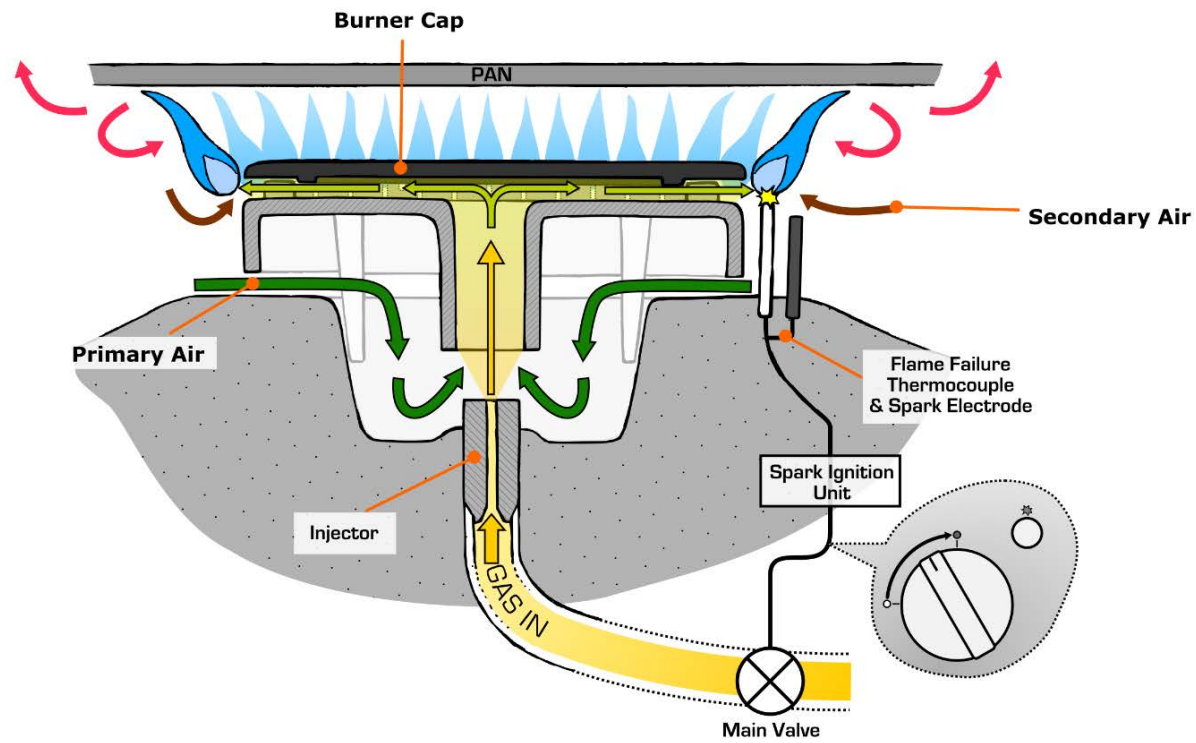


1. Why hydrogen?

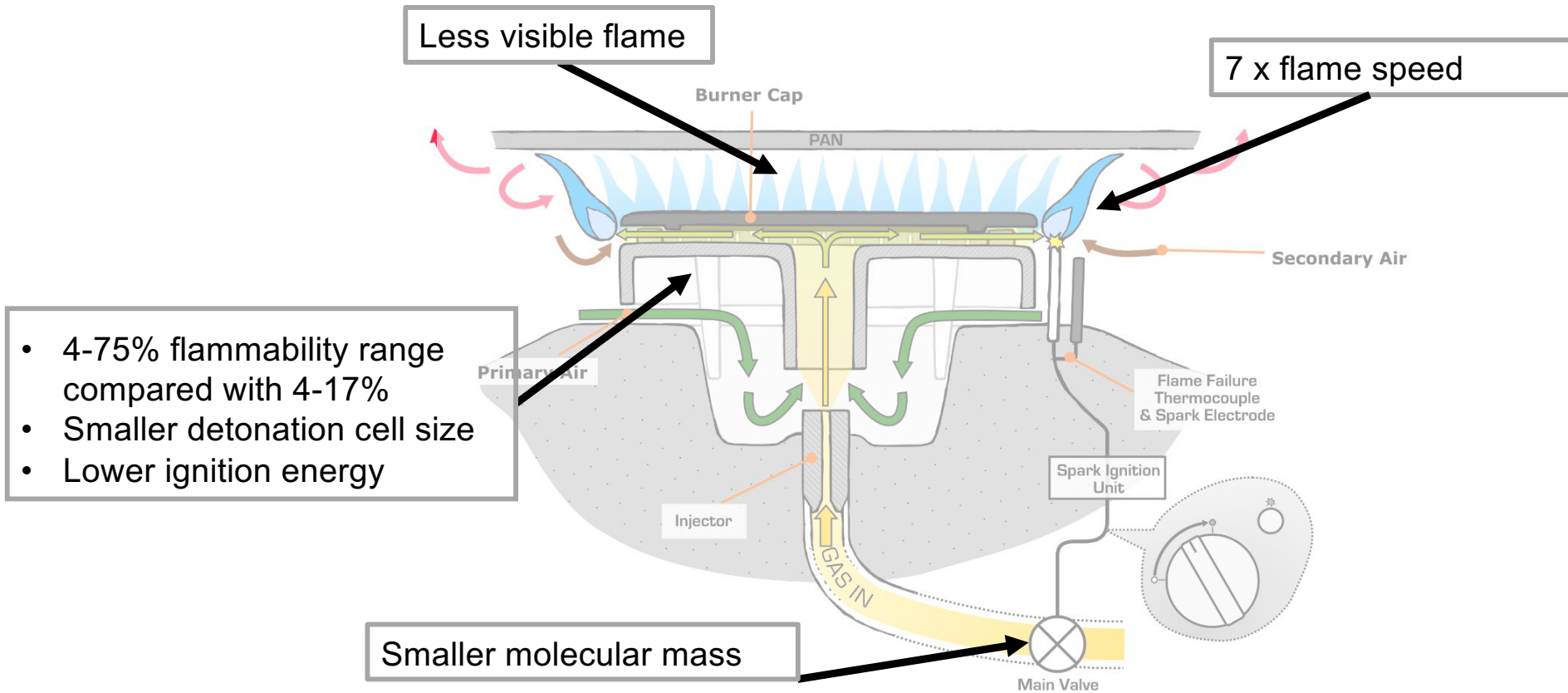
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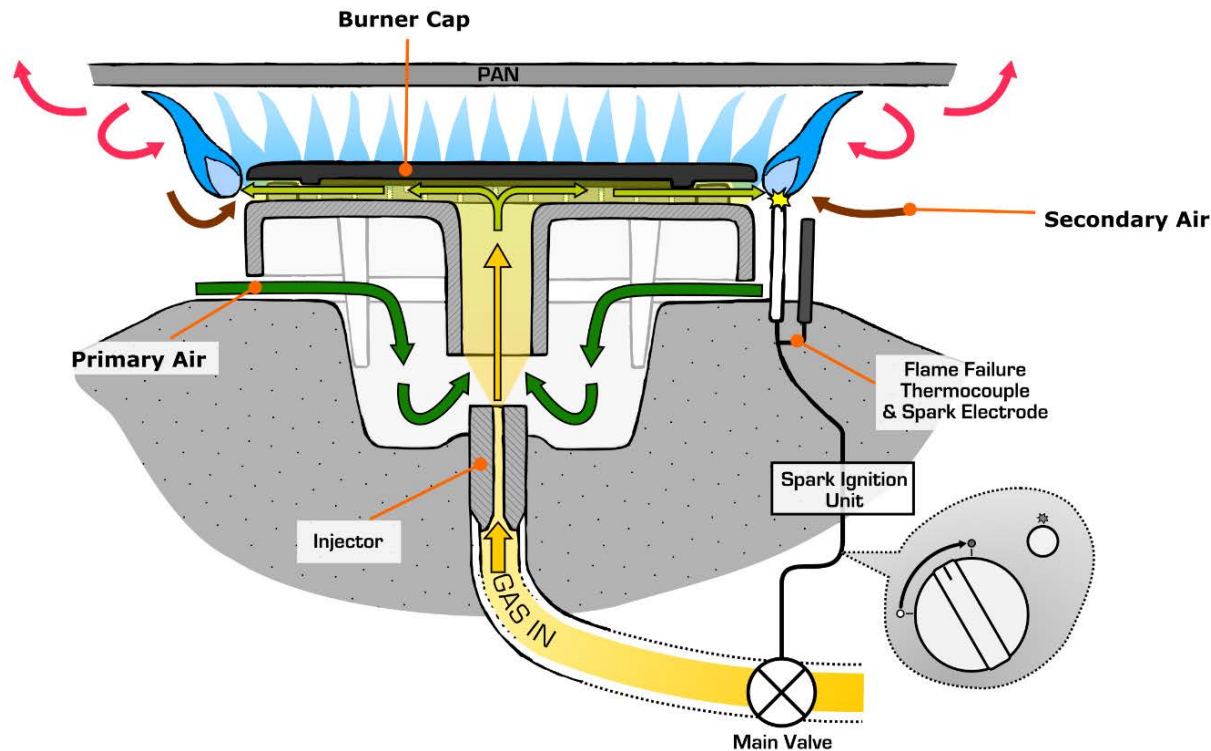
Domestic hob – with natural gas



Hydrogen hob – with hydrogen



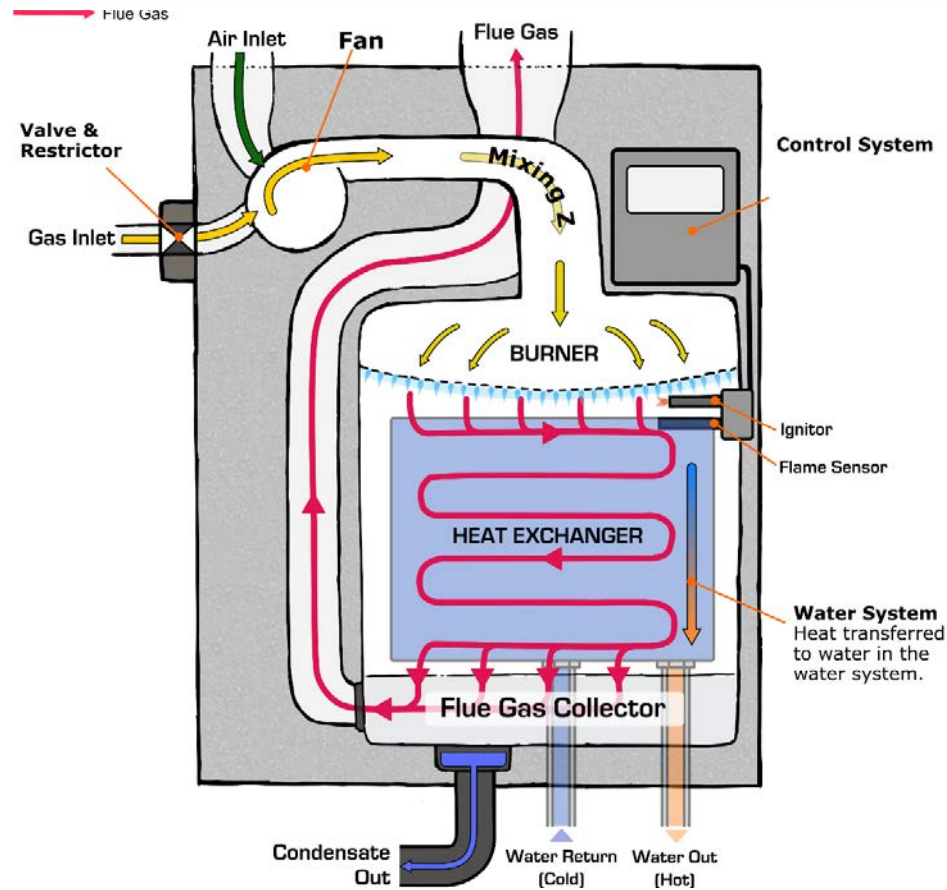
Hydrogen hob – with hydrogen



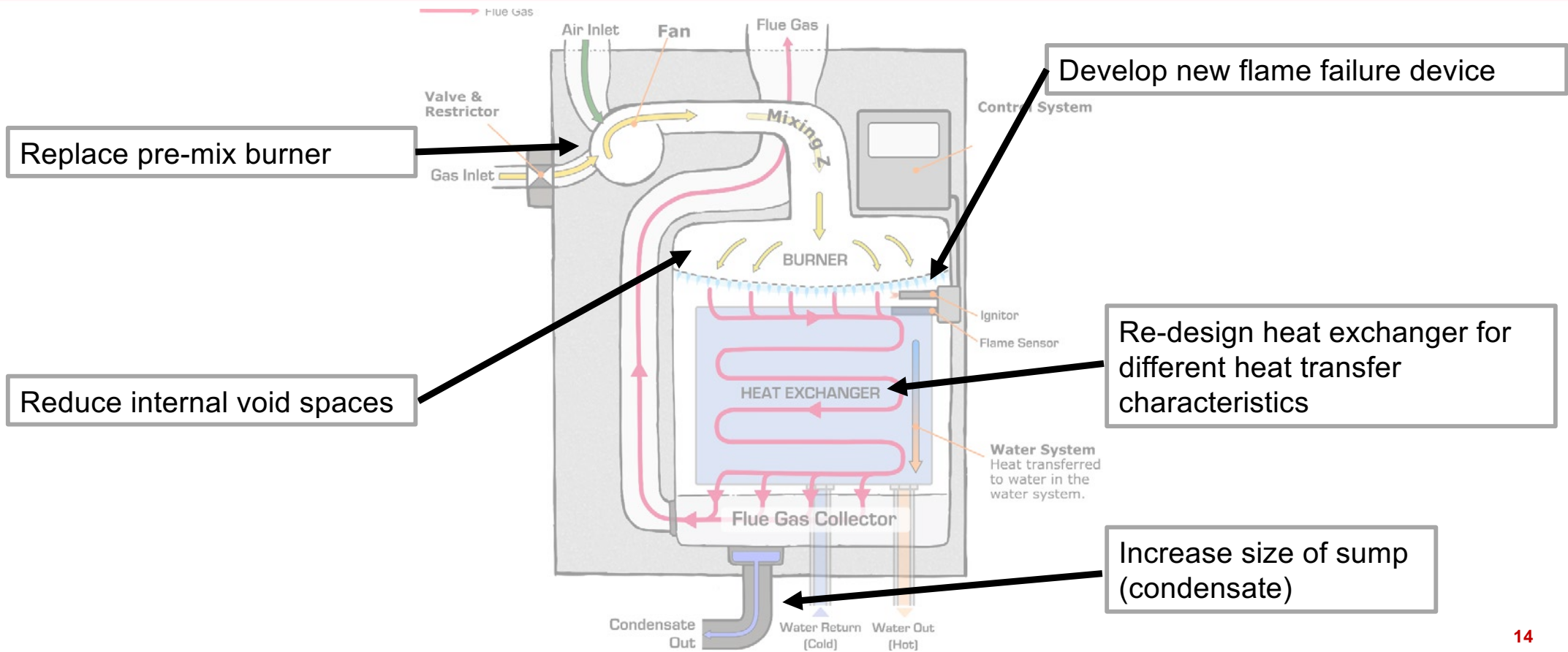
Changes required:

- ▶ Remove primary airflow
- ▶ Reduce internal volume (void space)
- ▶ Ensure controlled ignition
- ▶ Fast acting flame failure device
- ▶ Develop new seals to avoid leakage

Domestic boiler – with natural gas



Domestic boiler – with hydrogen





Nationwide Conversion to Hydrogen

- ▶ **Adaptation of Natural Gas Appliances**
- ▶ **New Hydrogen Appliances**
- ▶ **Hydrogen-Ready appliances**

1. Why hydrogen?

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1967-1977 town gas conversion

- ▶ 14 million homes on gas supply (~18 million homes)
- ▶ 40 million gas appliances
- ▶ 10% of homes with gas central heating (further 30% heated by gas fires)



Now

- ▶ 23 million properties on gas supply (~ 27 million homes)
- ▶ 44 million gas appliances
- ▶ 80% of homes with gas central heating

How long would it take to convert the UK?

Appliances

- ▶ Boilers – 1 day each
- ▶ Fires, hobs and ovens – ½ day each

Gas Appliance	Installed base
Boilers	21.2 million
Fires	10.4 million
Hobs and ovens	12.7 million

52 million person-days

Surveys and pipework updates

There are approximately 23 million gas connected homes in the UK

- ▶ Initial survey – 3 properties per day
- ▶ Property updates (pipework and safety checks) – ½ day per property

Scenario 1: If the conversion was undertaken by the existing Gas Safe workforce of 130,000 (10% of their working time) a transition would take approx. **16 years**

Scenario 2: If a dedicated conversion workforce of 100,000 was developed (50% of their working time) then a conversion could take as little as **4 years**

Key differences to town gas conversion

- ▶ Benefit of hydrogen is not direct to home owner
- ▶ Attitudes to Health and Safety (including perception)
- ▶ Increased complexity of appliances – and more appliance variations
- ▶ Appliance warranties and insurance schemes – e.g. boiler cover
- ▶ Alternative options available – e.g. heat pumps for heating and induction hobs for cooking

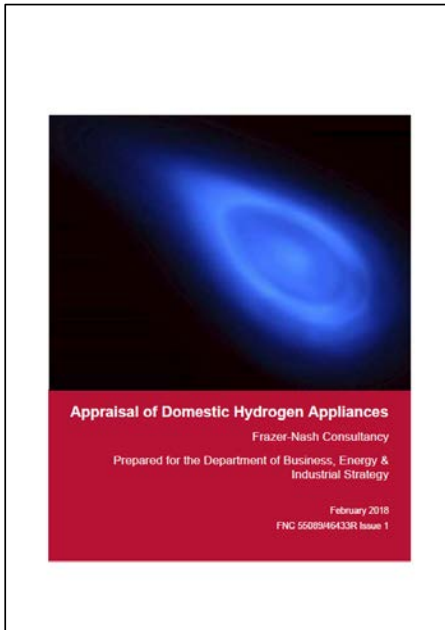
Conclusions

- ▶ Domestic hydrogen appliances are feasible.

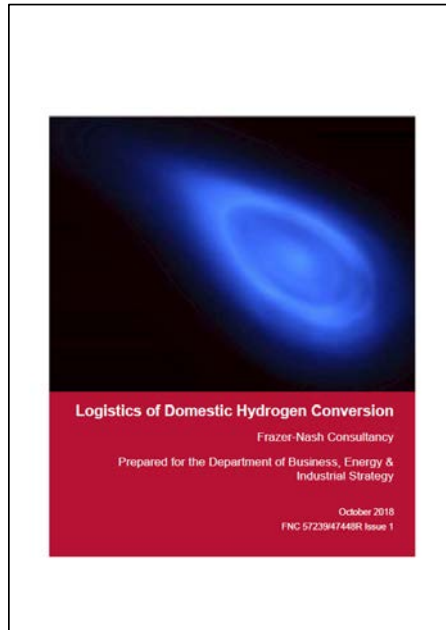
Key issues:

- Demonstrating safety
 - Consumer acceptance
-
- ▶ Appliances could be converted or exchanged at point of conversion – or Hydrogen-Ready appliances could be deployed in advance to ease burden at changeover
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- ▶ Nationwide conversion could take between 4 and 16 years depending on size of taskforce

Further Reading



Search “BEIS hydrogen appliances”



Search “BEIS hydrogen logistics”



The Engineer magazine, February edition



Thankyou

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