

Heat – a challenge or an opportunity for natural gas?

Professor Nigel Brandon OBE FREng

Director, Sustainable Gas Institute

Director, H₂FC SUPERGEN

Co-Director, ENERGY SuperStore



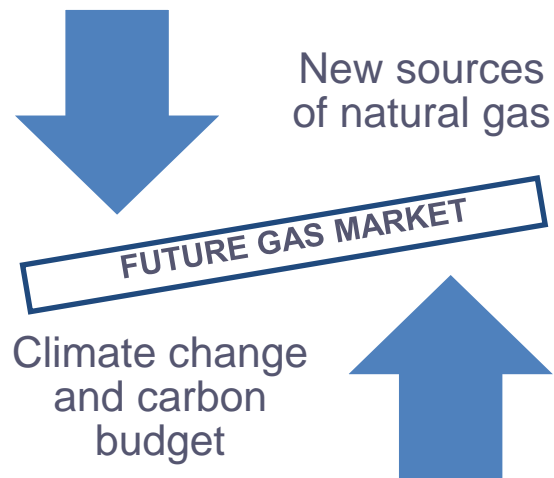
Introduction

- The Sustainable Gas Institute.
- 'Heat' in a UK context.
- Low carbon heating options.
- Natural gas for heat in a low carbon energy system?
- Conclusions

- The Sustainable Gas Institute.
- 'Heat' in a UK context.
- Low carbon heating options.
- Natural gas for heat in a low carbon energy system?
- Conclusions

Aims of the Institute

CHALLENGES



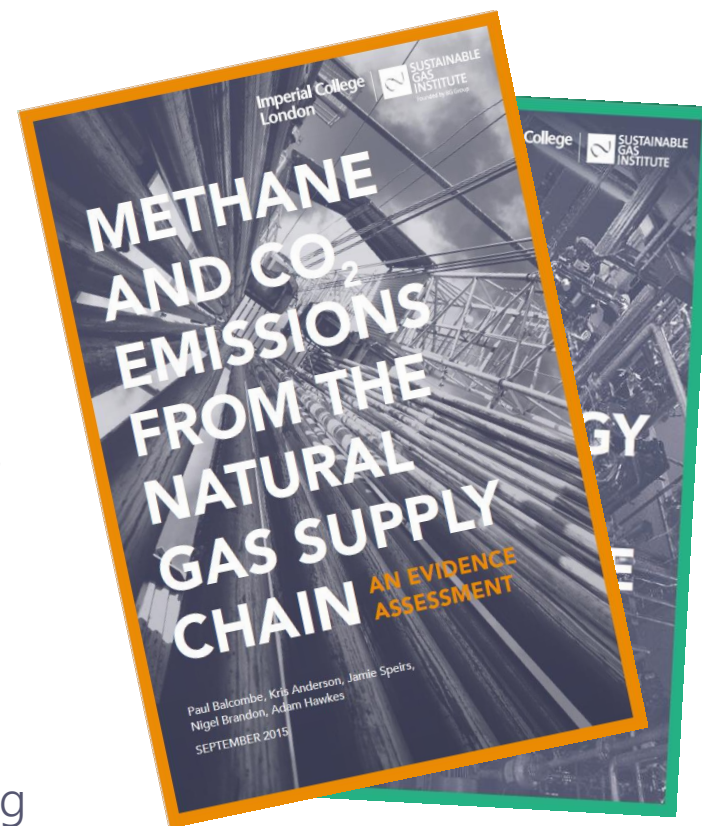
- Examine the **environmental, economic and technological** role of natural gas in the global energy landscape.
- Develop an 'engineering rich' energy systems model that can **explore the role of gas** in current and future energy landscapes.
- Help to advance **technology roadmaps** to support future R&D investment decisions.
- Inform the **debate** about the role of natural gas in the energy system.
- Build a **global centre of excellence** for research, technology and education in natural gas.

SGI White Paper Series

Imperial College
London



- **Evidence-based reviews** targeted at a global audience of policy/decision makers and industry
- Aim to provide clarity to contentious topics in the energy sector and help inform the broader debate around natural gas.
 - A systematic review of the **contemporary evidence base** and **primary analysis** to fill gaps in current knowledge.
 - Each paper begins with a published **scoping note** and reviewed by an **international expert panel** to provide guidance and advice.
 - Published **online** with a short two-page briefing note.



SGI White Paper Series

Imperial College
London



- **Evidence-based reviews** targeted at a global audience of policy/decision makers and industry
- Aim to provide clarity to contentious topics in the energy sector and help inform the broader debate around natural gas.
 - A systematic review of the **contemporary evidence base** and **primary analysis** to fill gaps in current knowledge.
 - Each paper begins with a published **scoping note** and reviewed by an **international expert panel** to provide guidance and advice.
 - Published **online** with a short two-page briefing note.



White Paper 3

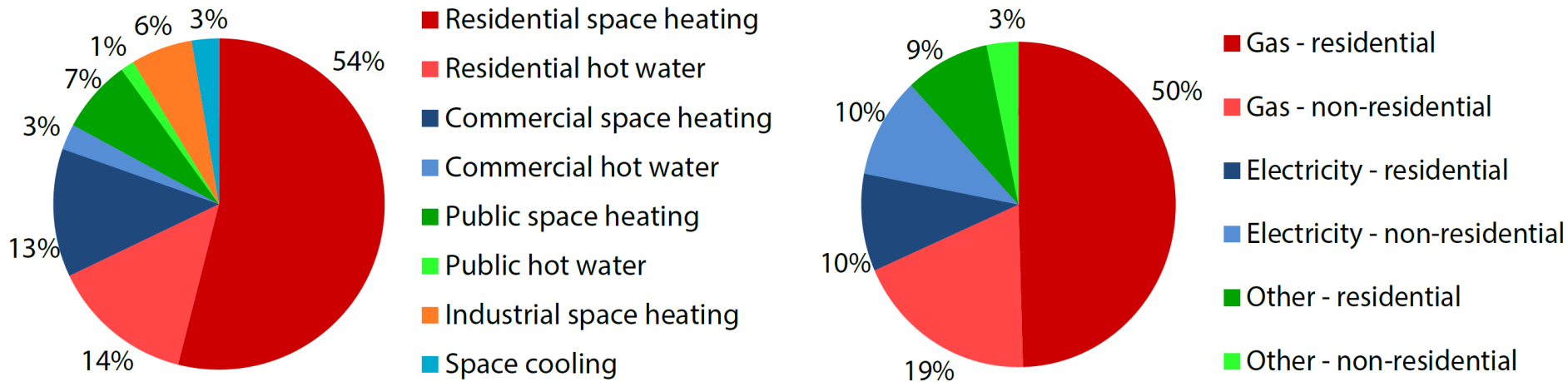
Decarbonise or Discard: the future for gas networks in a low carbon world



- The Sustainable Gas Institute.
- **‘Heat’ in a UK context.**
- Low carbon heating options.
- Natural gas for heat in a low carbon energy system?
- Conclusions

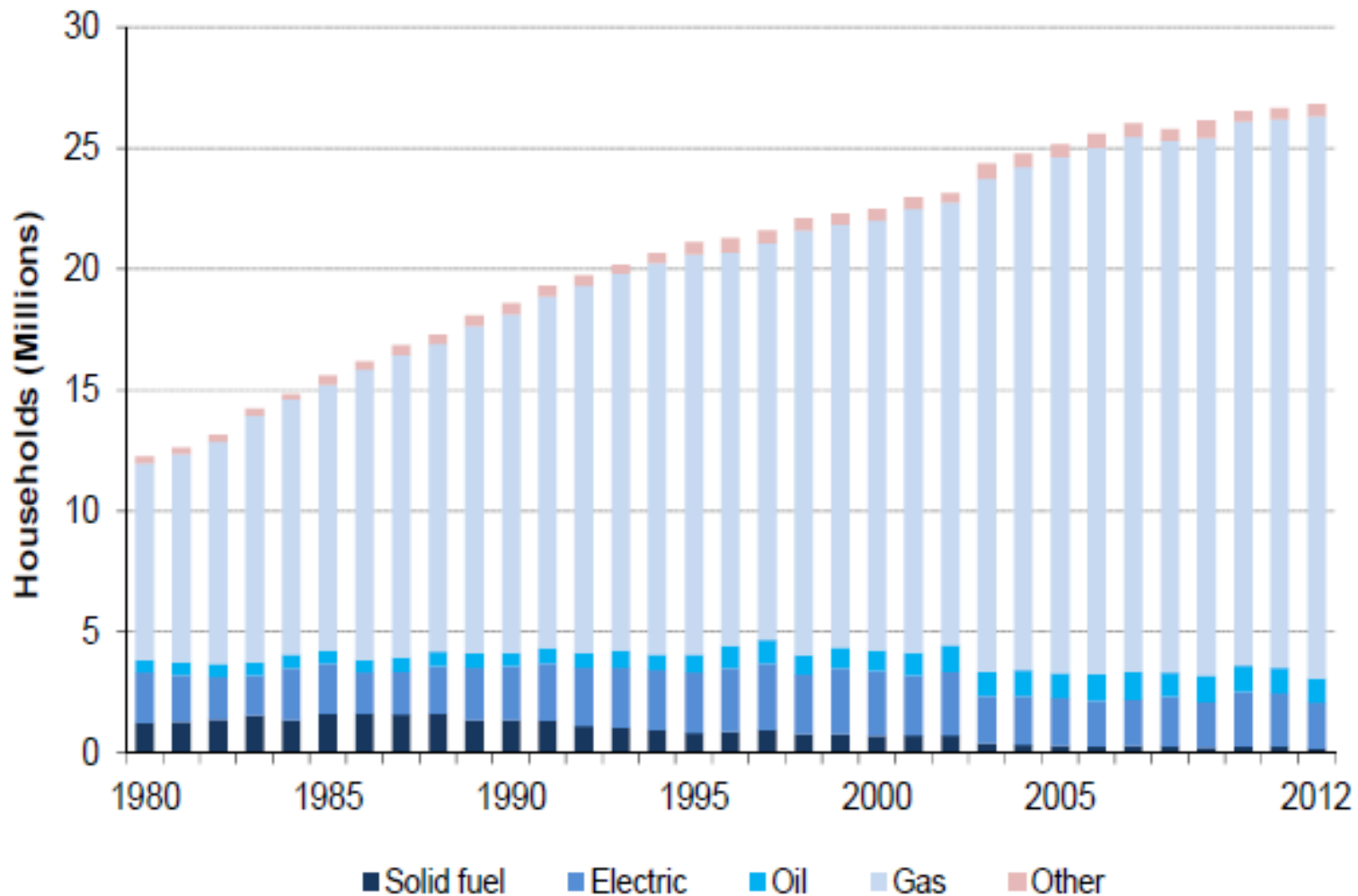
Heat in a UK context

Figure 1.1. UK heating emissions by source and fuel type (2013)



- Heating and hot water for UK buildings make up 40% of our energy consumption and 20% of our GHG emissions.
- Of the total of 906 TWh of natural gas consumed in the UK in 2011, 52% was used to provide heat for buildings and industry.
- GHG emissions need to fall towards zero post 2050. Ultimately this means heat to building being delivered in non-hydrocarbon form such as electricity, hot water through heat networks, and/or hydrogen (CCC, 2016).

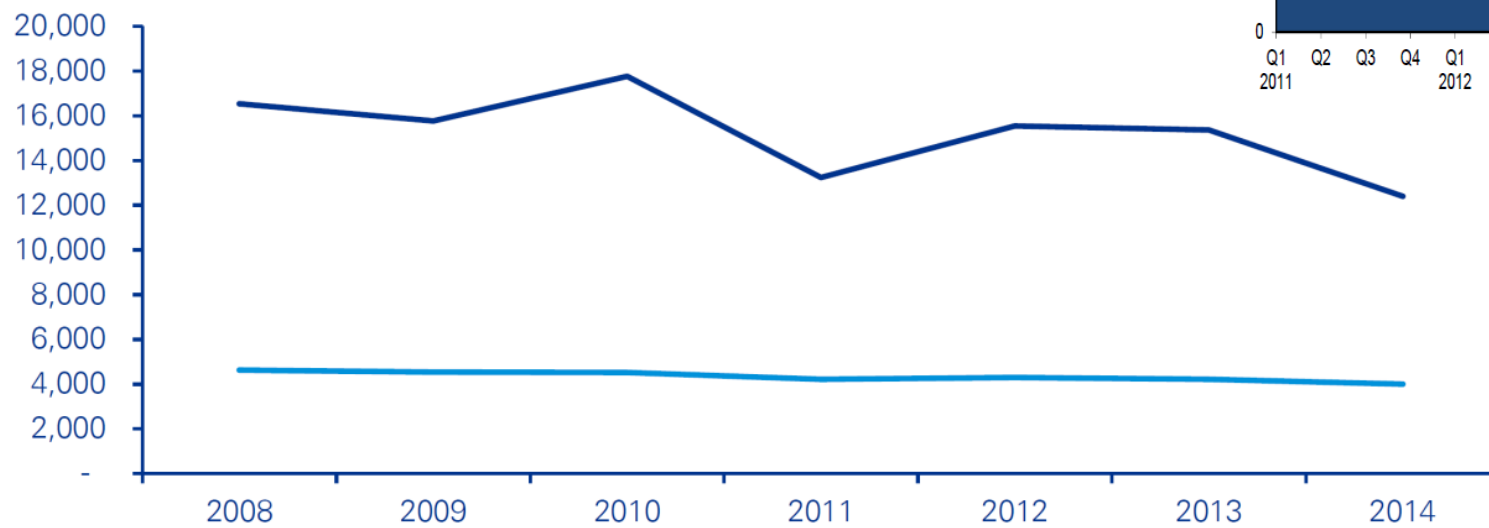
UK residential heating



97% of the UK housing stock has central heating, rising from 58% in 1980.
87% are fuelled by natural gas.

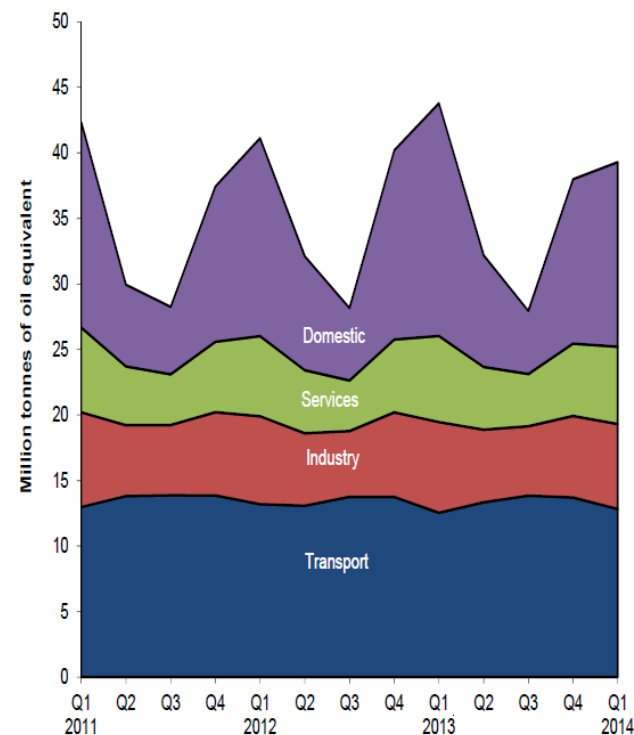
The challenge of heat electrification

UK Final energy consumption (DECC June 2014)



— Average unadjusted electricity consumption (kWh)
— Average unadjusted gas consumption (kWh)

Chart 1.4 Final energy consumption by user





Next steps for UK heat policy

Committee on Climate Change
October 2016

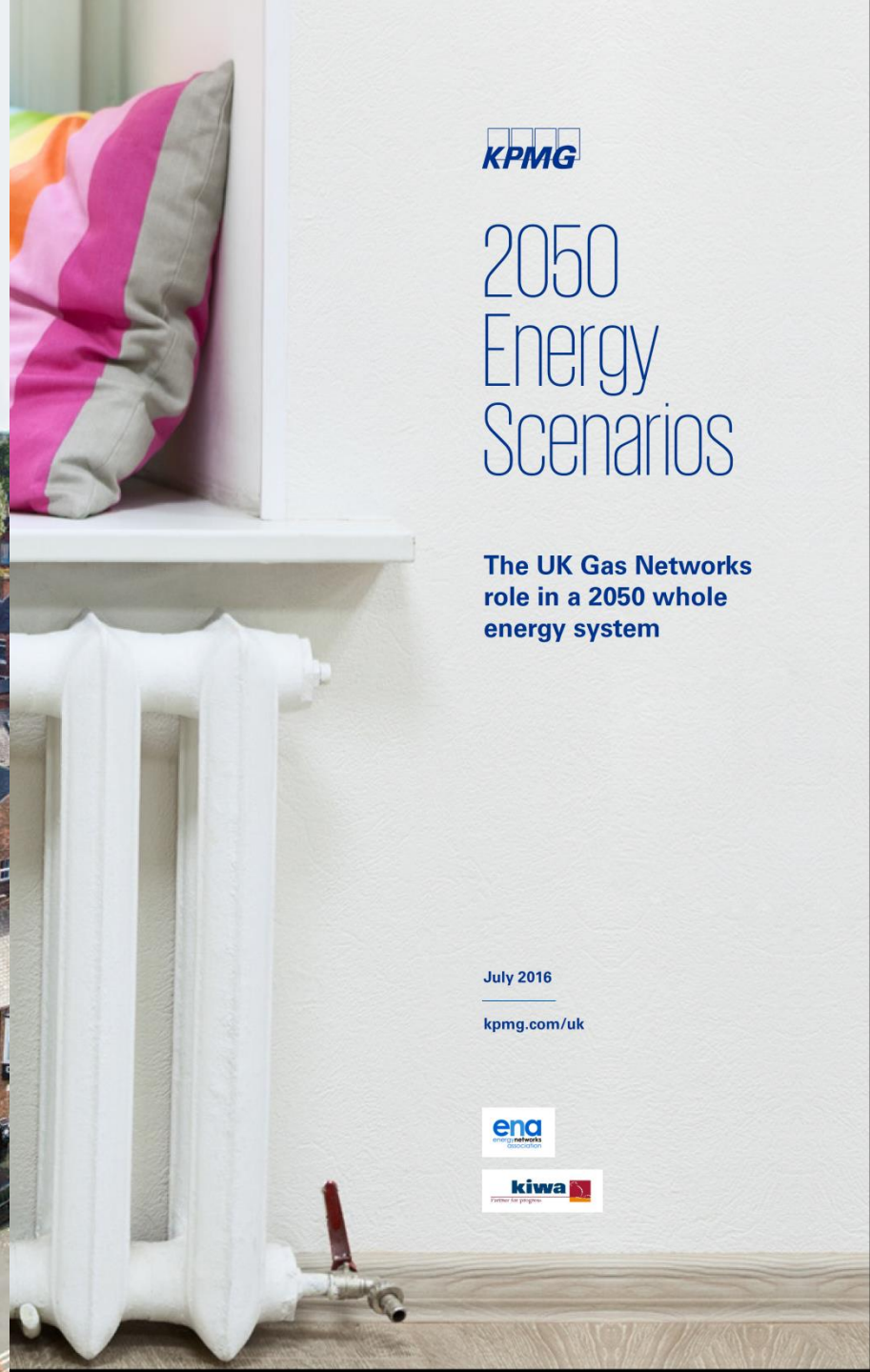


2050 Energy Scenarios

**The UK Gas Networks
role in a 2050 whole
energy system**

July 2016

kpmg.com/uk



Leeds
City
Gate



Too Hot to Handle?

How to decarbonise
domestic heating

Richard Howard and Zoe Bengherbi



Policy Exchange is an independent think tank whose mission is to develop and promote new policy ideas which will foster a free society based on strong communities, personal freedom, limited government, national self-confidence and an enterprise culture. Registered charity no: 1096300.

Policy Exchange is committed to an evidence-based approach to policy development. We work in partnership with academics and other experts and commission major studies involving thorough empirical research of alternative policy outcomes. We believe that the policy experience of other countries offers important lessons for government in the UK. We also believe that government has much to learn from business and the voluntary sector.

Trustees

David Frum (Chairman of the Board), Diana Berry, Candida Gertler, Greta Jones, Edward Lee, Charlotte Metcalf, Krishna Rao, Andrew Roberts, George Robinson, Robert Rosenkranz, Peter Wall, Simon Wolfson.



THE ROLE OF HYDROGEN AND FUEL CELLS IN PROVIDING AFFORDABLE, SECURE LOW-CARBON HEAT

A H2FC SUPERGEN White Paper

May 2014



Imperial College
London

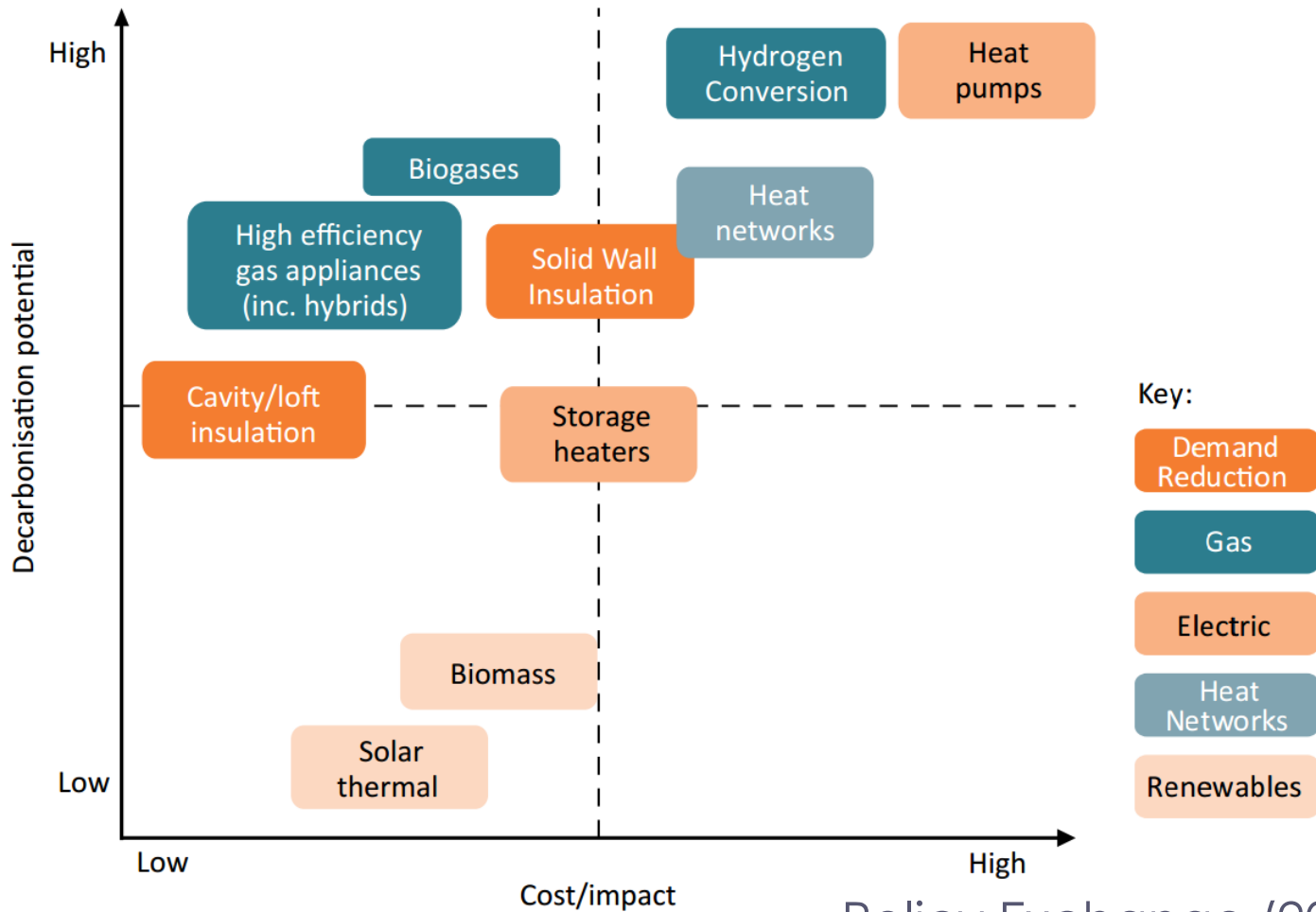
Building a roadmap for heat 2050 scenarios and heat delivery in the UK



- The Sustainable Gas Institute.
- ‘Heat’ in a UK context.
- **Low carbon heating options.**
- Natural gas for heat in a low carbon energy system?
- Conclusions

Low carbon heating options

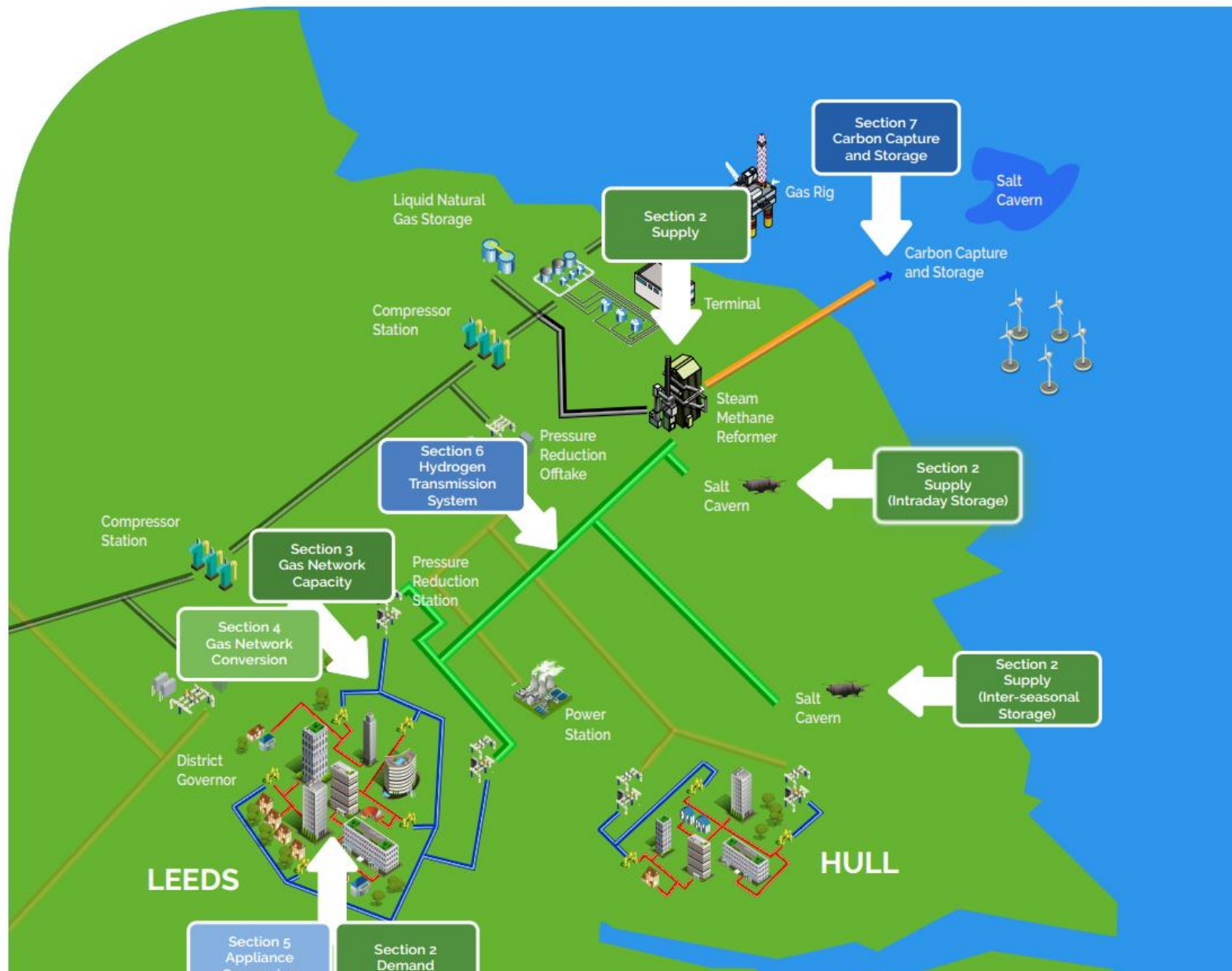
Figure ES1: Assessment of future heating technologies



Policy Exchange (2016)

- The Sustainable Gas Institute.
- 'Heat' in a UK context.
- Low carbon heating options.
- **Natural gas for heat in a low carbon energy system?**
- Conclusions

H21 report



H21 report

- This project demonstrates that it is technically possible to convert to the UK gas network to hydrogen.
- The report concludes that there will be negligible impact on customer's gas bills.
- There will also be minimum change in the form and type of heat delivery from a customer perspective.
- A proven commercial supply chain exists, though further development of some home appliances would be needed.
- The use of hydrogen enables inter-seasonal storage.
- The Iron Mains Replacement Programme has been running since 2002 – the new polyethylene pipes are suitable for transporting 100% hydrogen. It will be complete in 2032.

KPMG – 2050 energy scenarios



	Evolution of Gas	Prosumer	Diversified energy	Electric Future
Practical obstacles	Low/Medium	Very high	Medium/High	High
Incremental cost	£104-122bn	£251-289bn	£156-188bn	£274-318bn
Incremental cost per consumer up to 2050	£4,500-5,000	£11,000-12,500	£6,800-8,000	£12,000-14,000

The majority of customers convert to Hydrogen gas, derived from natural gas with CO₂ permanently stored.

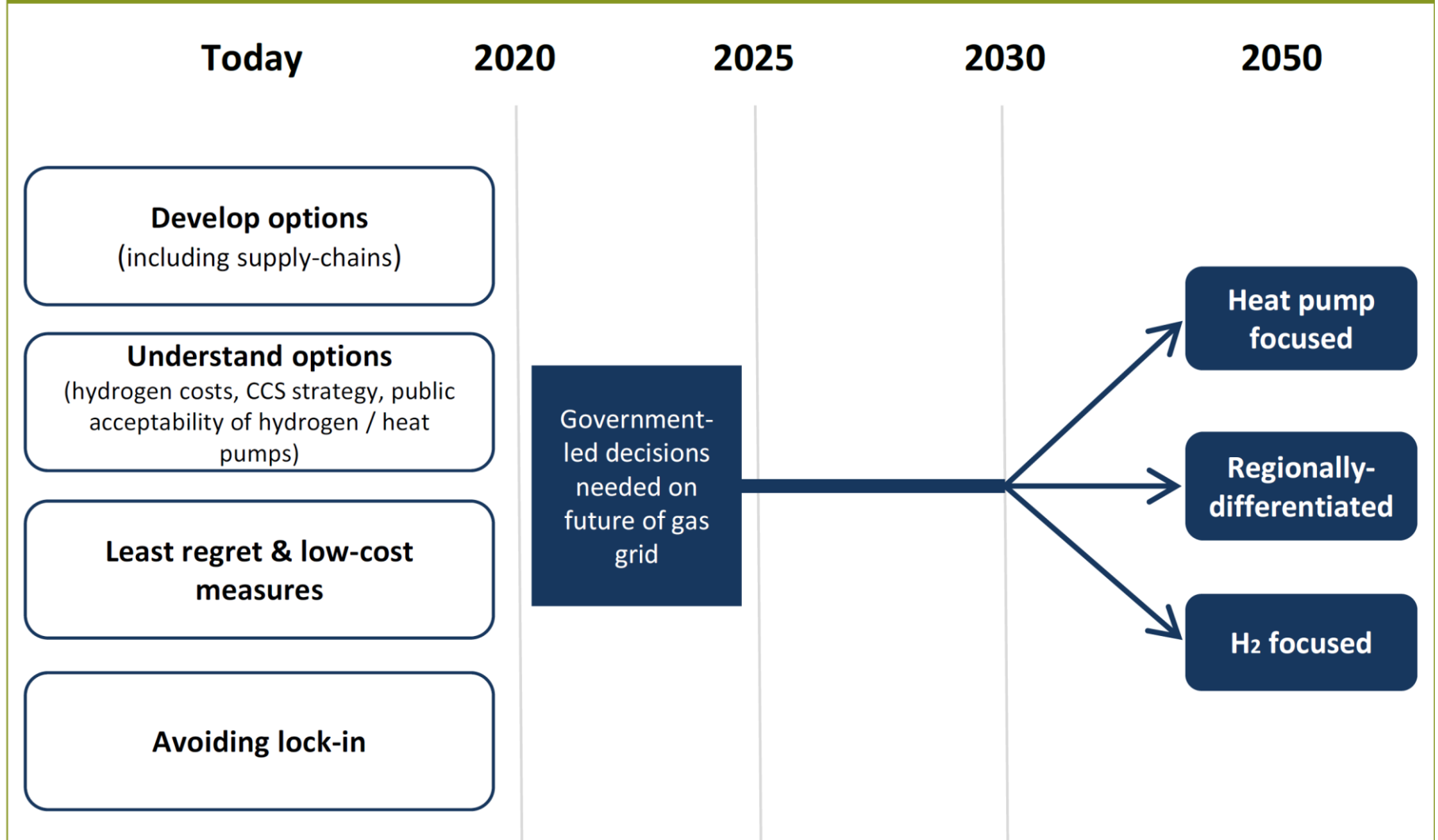
Heat is decarbonised with a mixture of self-generating heat and storage, and electric heating.

Heat is partially decarbonised with a mixture of biomass sourced heat networks, gas and electric heating.

Heat is decarbonised with assumption that power generation is completely decarbonised by 2050.

CCC recommendations

Figure 2.1. The need for strategic decisions in the next Parliament regarding the future of the gas grid



Conclusions

- There must be significant change in the provision of heat in the UK if we are to meet our climate targets.
- This could result in a significant shift in demand for natural gas into the future.
- But options remain in which natural gas continues to play an important role in the delivery of heat, coupled with CCS, with hydrogen then being the delivery molecule to the customer. This would also support the use of hydrogen as a transport fuel.
- This will require a similar programme to the transition from town gas to natural gas from 1967-1977.