Imperial College London

SUSTAINABLE GAS INSTITUTE

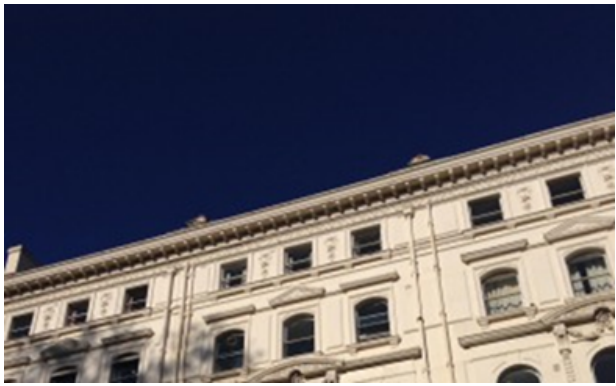
SGI White Paper Series
White Paper 3
Decarbonise or Discard: the future for gas networks in a low carbon world

Jamie Speirs

Overview: Sustainable Gas Institute

Imperial College London | SUSTAINABLE GAS INSTITUTE

- Academic-industry international collaboration **UK and Brazil**
- An international **open innovation** model
- **Hub and spoke** structure enables engagement with a number of research themes
- **Hub** at Imperial College since May 2014
- **First Spoke** - Research Centre in Gas Innovation, University of Sao Paulo since Dec 2015
- Opportunity to leverage value in particular **levy-qualified funding**



SGI White Paper Series

Imperial College London | SUSTAINABLE GAS INSTITUTE

- **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.

www.sustainablegasinstitute.org/white_paper_series/

Scope of project

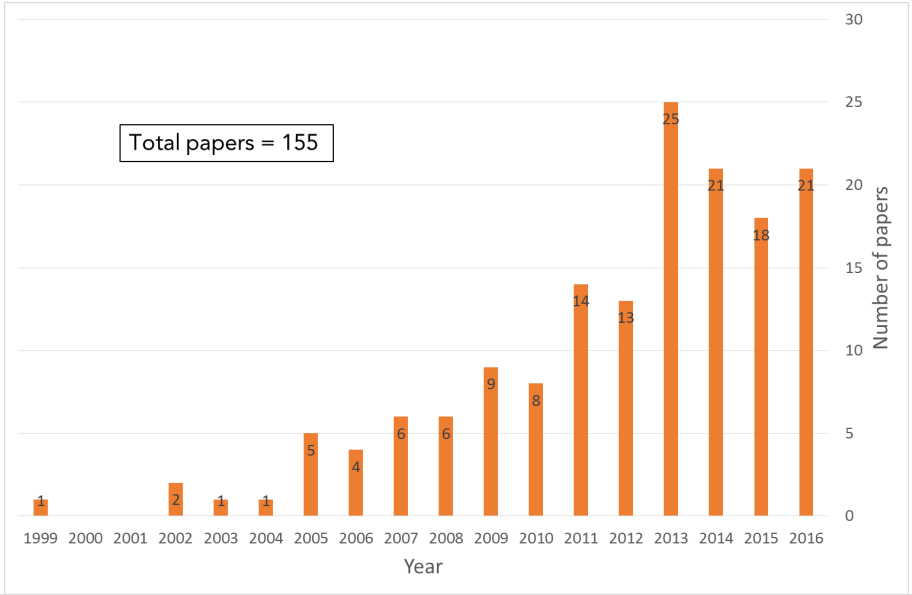
What is the global potential for decarbonisation of domestic and commercial energy end-uses through the repurposing of existing gas network infrastructure?

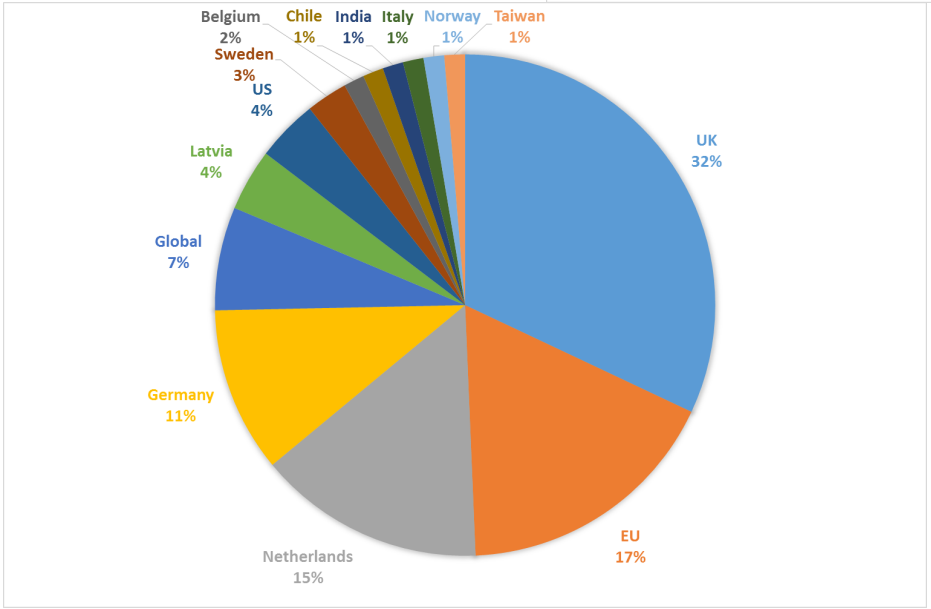
- Global scope with focus on case study regions
- Focus on time period to 2050
- Focus on options commensurate with 2 degree carbon constraint, though will identify the full range of options.
- Focus on the low pressure gas distribution system, assuming that high pressure transmission will be maintained

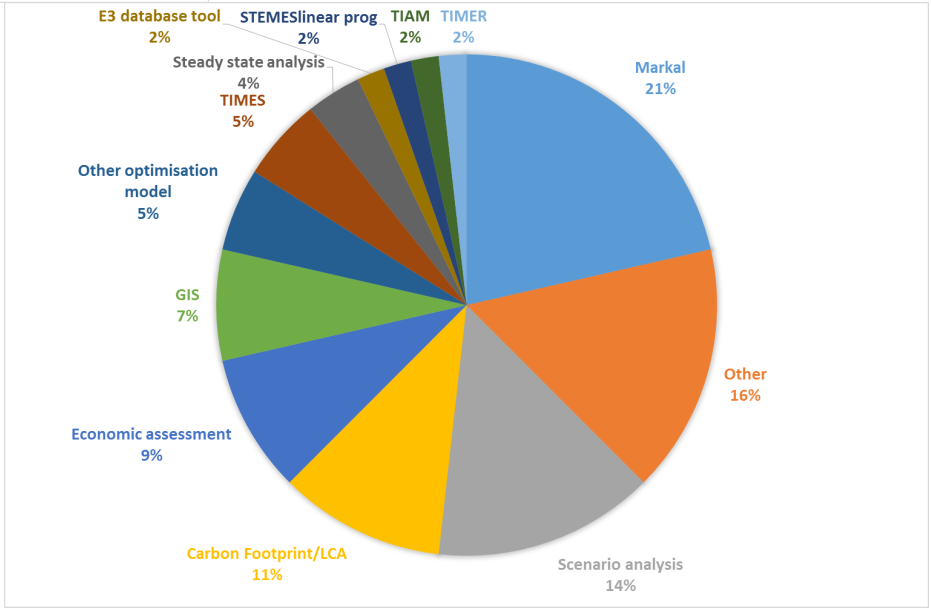
Systematic Review

Imperial College London | SUSTAINABLE GAS INSTITUTE

White Paper 3: Literature search results







Workplan

Imperial College London | SUSTAINABLE GAS INSTITUTE

Task	
1	What is the current state of global gas network infrastructure?
2	What are the alternative uses of existing infrastructure and do they contribute to decarbonisation ambitions?
3	How does the whole-system modelling and scenario literature deal with gas networks?
4	How can the various options be compared to each other and to a counterfactual?
5	What is the role for CCS in the options to decarbonise gas networks?
6	To what extent can gas networks supporting power sector decarbonisation goals?
7	Synthesis and report drafting

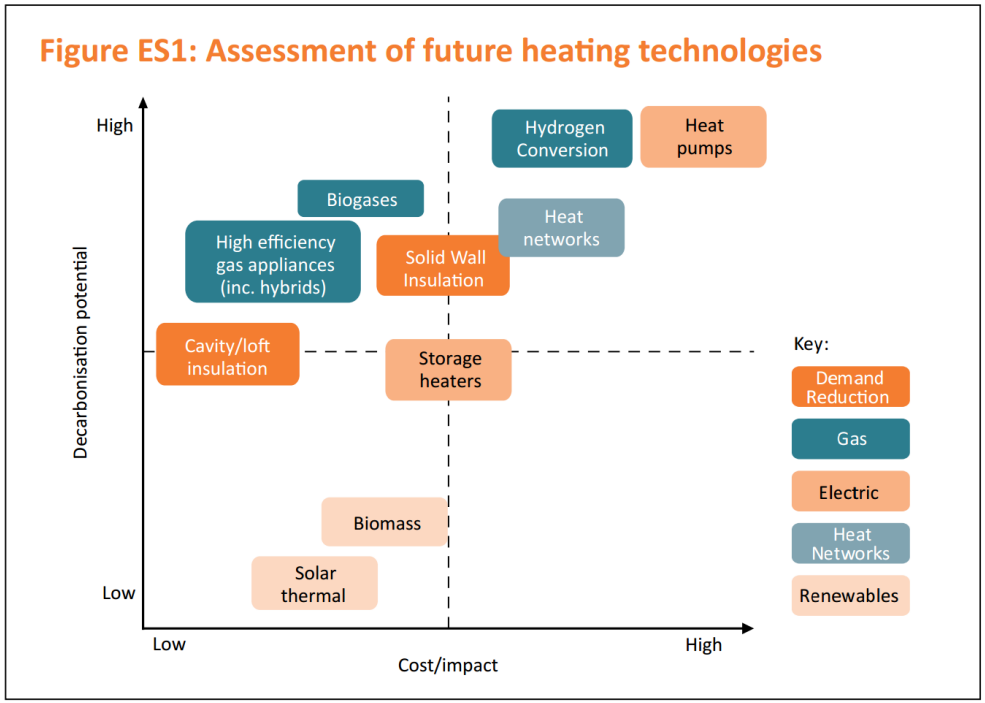
Options for gas network repurposing

Imperial College London | SUSTAINABLE GAS INSTITUTE

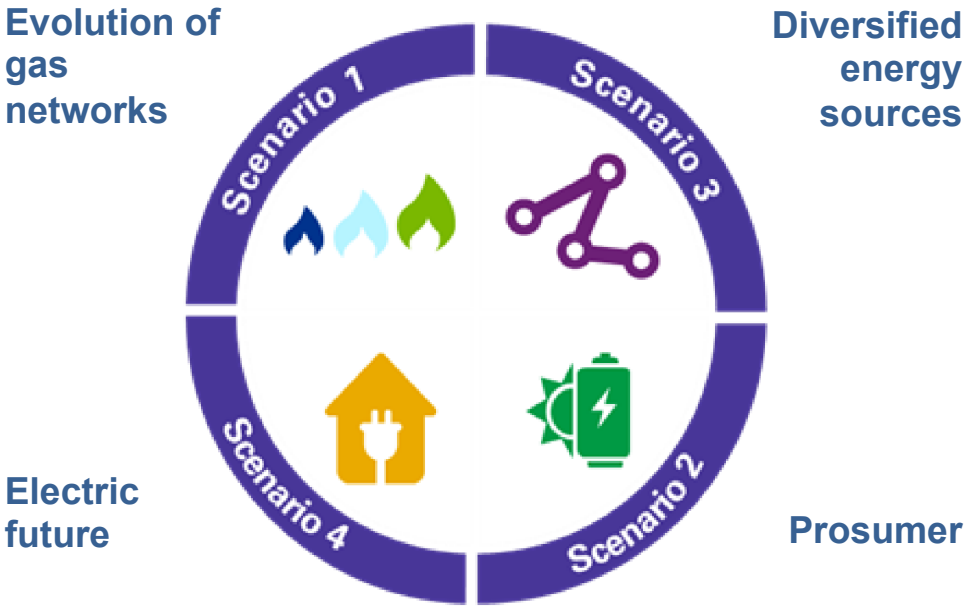
- Strand and dismantle and electrify heat instead
- Supply natural gas as currently (BAU) or bio-methane
- Supply natural gas only to customers with limited alternatives
- Blend limited quantities of low carbon gas (H2 of Biomethane)
- Convert the existing low pressure network to supply hydrogen
- Supply natural gas to hybrid heat pumps
- Use power-to-gas technologies to store excess renewable electricity as gas in the gas distribution network

Comparison of Options

Imperial College London | SUSTAINABLE GAS INSTITUTE



Policy Exchange (2016)



KPMG (2016)

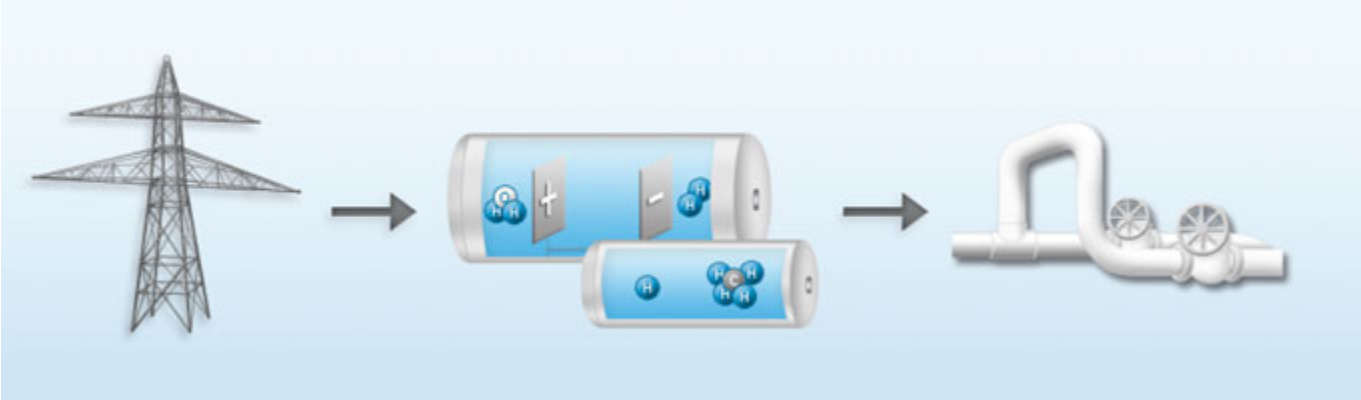
Scenario	R&S emissions in 2050 ($MtCO_2$)	CO_2 marginal in 2050 (£/t)	Change in welfare cost (£bn)
Gas provides 85% of residential heat	44	374	
Gas network is converted to hydrogen	0	271	−56
Gas network is mostly abandoned	13	285	−40

Dodds & McDowell (2013)

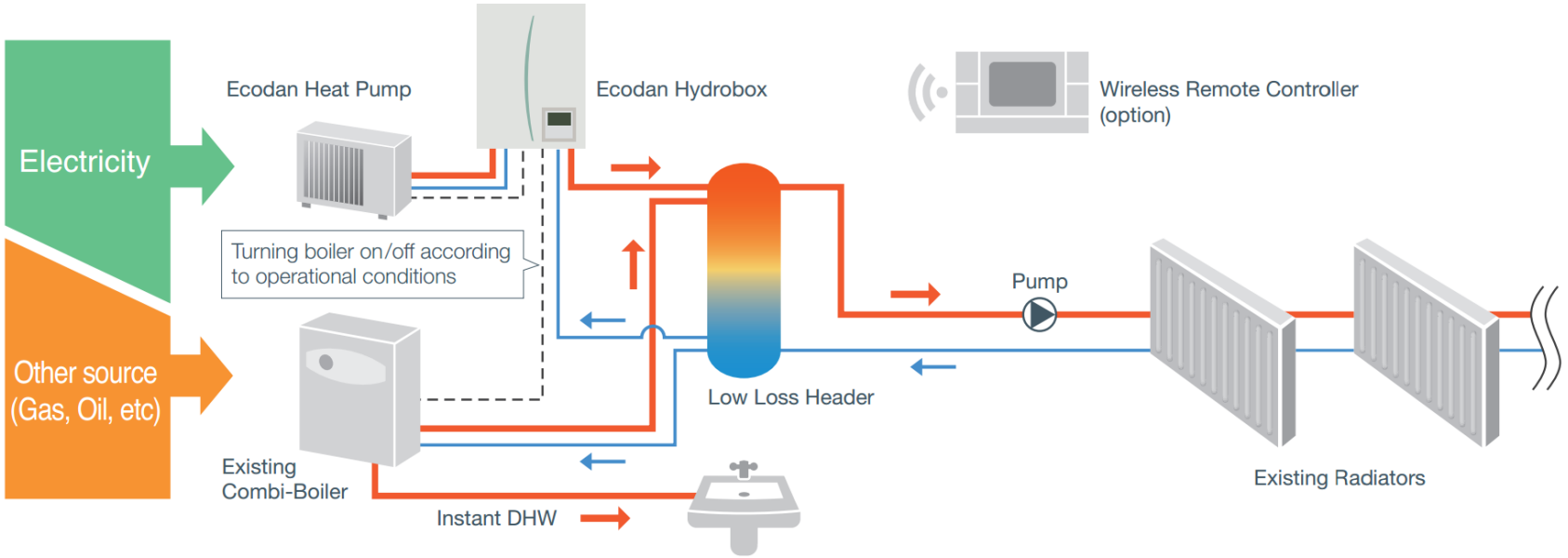
Options for gas to support electricity

Imperial College London | SUSTAINABLE GAS INSTITUTE

Power to Gas



Hybrid Heat Pump Systems



- Research will continue into the new year and report launch aimed at May
- Please contact for more information

Thank You

Dr Jamie Speirs
Research Fellow
Sustainable Gas Institute (SGI)
11 Prince's Gardens
Imperial College London
South Kensington Campus, London SW7 1NA, UK
Tel: +44 (0)2075949760
www.sustainablegasinstitute.org @SGI_London

Why gas networks?

Imperial College London | SUSTAINABLE GAS INSTITUTE

Developing recognition that gas networks may be an important part of decarbonisation pathways

- Mid-2000s back-casting modelling in UK features heat pumps and electrification of heat
- Implication of electric heat is the stranding of gas network infrastructure
- Some research evidence begins to question heat electrification
- Government policy in early 2010s features incentives that include support for electrification of heat
- Progress in electrification of heat slow and Green Deal cancelled in 2015
- Number of reasons suggested for failure including:
  - Aspects of policy design
  - Appraisal optimism in cost estimates, particularly electricity infrastructure
  - Overestimation of consumer acceptance
- Mid-2010s sees a surge in research investigating alternative options for gas network
- Range of other countries also publishing evidence on similar questions