

# E&I Research Studentship project proposal 2019

**Project title: Decarbonisation of heat and transport using hydrogen as an energy vector – technology assessment and systems modelling**

**Supervision Team:**

**William Nuttall, School of Engineering & Innovation ([william.nuttall@open.ac.uk](mailto:william.nuttall@open.ac.uk))**

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## Project Highlights:

- Very high levels of UK policy relevance
- Possibility of international travel and research community membership
- Possibility of industrial support (financial and supervisory)

## Project Description:

This project seeks to build upon recent extensive UK assessments of the conversion of domestic and industrial heat demand from hydrogen to natural gas, by considering in greater depth the mobility decarbonisation challenge and various consequential issues arising from national plans.

This project builds upon a body of work by Professors Nuttall and Krishnamurthy. It will use similar research methods to those employed successfully by George Matthew (PhD OU 2018) and currently being pursued by Andy Wilson, Richard Pearson, Madhu Madhavi, Chris Spedding and David Webbe-Wood. These students form a mutually reinforcing community of scholars contributing to the OU's research environment.

The main UK policy action in this space (in 2018 and 2019) relates the active consideration of a possible transition from natural gas to hydrogen as a national pipeline gas, starting with the North of England. The predicted cost of such a shift is of the order of £20 billion for the first phase, but it could, if rolled out nationally, reduce total UK GHG emissions by 258 million Tonnes by 2050 [1]. To place this in context, total UK GHG emissions in 2016 were approximately 600 million Tonnes. Senior policy makers in Whitehall see the potential for a major step change in emissions target progress at a cost that is low when compared to the expenditure required for marginal improvements in electricity decarbonisation. The link to transport and mobility is however not fully thought

through by government (in professor Nuttall's opinion). Much analysis remains to be done.

See later note, for the team's prior hydrogen experience.



**Figure 1:** The Leeds Gateway “h21” proposal for north-east England. (<https://www.northerngasnetworks.co.uk/wp-content/uploads/2017/04/H21-Report-Interactive-PDF-July-2016.compressed.pdf>)

## Research Methods:

Potential research methodologies:

- Technology Assessment
- Technology Road mapping
- Scenario planning
- System Dynamics
- Agent Based Modelling

Techniques associated with management under uncertainty and real options

## Indication of project timeline:

**Year 1:** Literature review of fast moving policy developments relating to hydrogen, especially familiarisation with Professor Nuttall's prior work on hydrogen from fossil fuels (with carbon capture and storage) [Relates to upcoming Springer book]

Consideration of a small scale hydrogen project for which Prof Nuttall is currently seeking industrial support from Cadent (regional UK pipeline Natural gas distributor)

Connect with international and national communities of practice

**Year 2:** Possibly build upon our established links with one or more of:

- SRM Institute of Science and Technology, India
- Worcester Polytechnic Institute MA USA
- Hong Kong University

With possible in-country field work (data gathering)

**Year 3:** Journal publication followed by PhD write up and submission. This approach has proven very helpful and will be especially important noting the looming census date for REF 2021.

We see the potential to involve OU colleagues (such as employed by the OU in Scotland) in these publications. Especially if this could assist the school's 2021 REF submission.

As an interdisciplinary project it is well suited to bringing in colleagues with diverse expertise.

## References

[1] Renewables Now, *Natural gas-to-hydrogen could drive deep decarbonisation in UK* (Nov 23, 2018) <https://renewablesnow.com/news/natural-gas-to-hydrogen-could-drive-deep-decarbonisation-in-uk-634308/>

Relating to lead supervisor prior relevant hydrogen experience:

- WJ Nuttall, BA Glowacki, S Krishnamurthy *Next Steps for Hydrogen*, Institute of Physics Policy Brief, May 2016
- Adetokunboh Bakenne, William Nuttall, Satheesh Krishnamurthy, and Nikolaos Kazantzis, *A Sankey Diagram-Based Insights into the Hydrogen Economy of Today*, International Journal of Hydrogen Energy, Volume 41, Issue 19, 25 May 2016, Pages 7744–7753
- Emma S. Hanley, Bartek A. Glowacki, William J. Nuttall and Nikolaos Kazantzis, Proceedings of the ICE - Energy, *Natural gas – synergies with hydrogen*, **168**, 1, pp. 47-60 (March, 2015) DOI: 10.1680/ener.14.00018
- B.A. Glowacki, W.J. Nuttall, E. Hanley, L. Kennedy, and D. O'Flynn, *Hydrogen Cryomagnetism for Decentralised Energy Management and Superconductivity*, Journal of Superconductivity and Novel Magnetism, DOI: 10.1007/s10948-014-2660-7 11 pages, August 2014

- BA Glowacki and WJ Nuttall, *Hydrogen as a Fuel and as a Coolant – from the superconductivity perspective*, Journal of Energy Science, **1** (1) pp. 15-28 (2010)

## Candidate Applications

- 1000 word cover letter outlining how they are equipped in their educational background and expertise to conduct the research project,
- a CV including contact details of two academic references
- An Open University application form, downloadable from: <http://www.open.ac.uk/postgraduate/research-degrees/how-to-apply/mphil-and-phd-application-process> (Note: This is an Advertised studentship and you do not need to submit a proposal).
- IELTS English Language test scores on application. An average of 6.5 and no less than 6 in anyone of the four components. Applicant should have these results when applying.

Applications should be sent to

[STEM-EI-Research@open.ac.uk](mailto:STEM-EI-Research@open.ac.uk) by 28 February 2019