

PhD Confirmation Viva

Presentation

“Improving UK home heating decarbonisation”

By Damon Hart-Davis

2024-09-17

Supervisors: Lirong Liu, Matthew Leach

Contents

- Introduction
- Research Gaps and Aims
- Work to Date
- Plan / Future Work

Introduction

- Climate change is existential
- UK home heating is ~15% of UK's GHGs
- Decarbonising likely awkward and expensive
- ~20M UK homes will retrofit gas to heat pump
- Process needs understanding and +ve impact

Research Gaps

- Retrofit at scale is human, social, political
- Lack of holistic view across theory and practice
- Per Anna Karenina: understanding first?
- User buy-in and understanding (and what happens when absent), and a just transition

Research Aims

What are the practical policies, design rules and end-user guides to get the best outcomes in money, comfort and climate repair outcomes from (UK, wet) heating system retrofits?

How do we best reduce logistical difficulties of such retrofits — in particular is “understanding first” the best approach, else what is?

Heat-pump systems are more complex to operate well than the combustion appliances that they will be replacing, and an extra dimension of grid-interaction is likely to be key also; how do we make it easy and cheap and simple for end users to good results and have agency?

Published Work

To Zone or Not to Zone When Upgrading a Wet Heating System from Gas to Heat Pump for Maximum Climate Impact: A UK View

by **Damon Hart-Davis**  , **Lirong Liu**   and **Matthew Leach** *  

Centre for Environment and Sustainability (CES), University of Surrey, Guildford GU2 7XH, UK

* Author to whom correspondence should be addressed.

Sustainability **2024**, *16*(11), 4710; <https://doi.org/10.3390/su16114710>

Submission received: 19 April 2024 / Revised: 27 May 2024 / Accepted: 28 May 2024 / Published: 31 May 2024

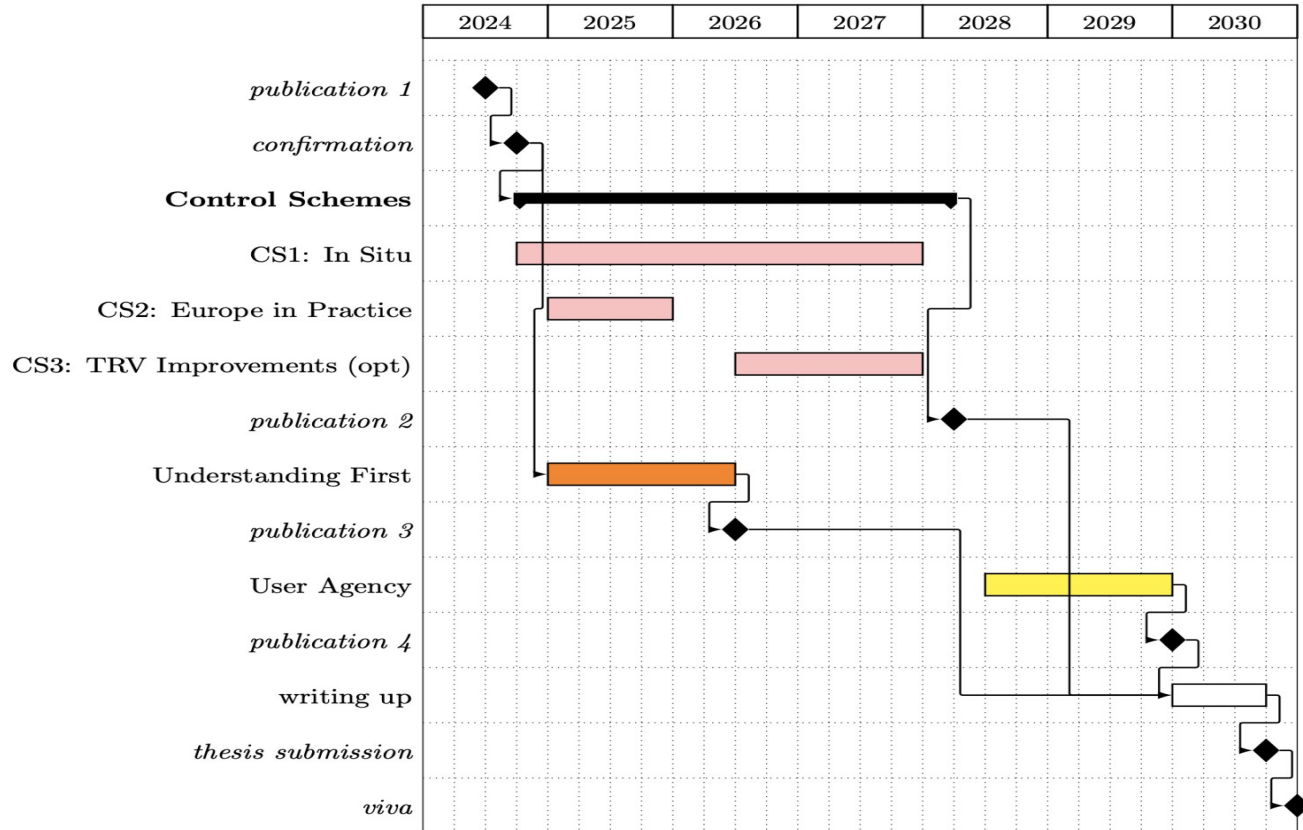
Conclusions

UK heat-pump system installers are unsure if heat pumps and TRVs (and zoning more generally) interact badly, and if TRVs in fact ultimately waste electricity. This work shows, through varying temperature against a decade of external regional temperatures, building archetype, and, critically, the temperature control regime, that this specific industry worry should not in practice be an issue for dwellings with a typical weather compensation control regime, and further that micro-zoning such systems with TRVs will save energy.

Future Work

- Control Schemes (model, physical, review)
 - Multiple strands
- Understanding First (review, model)
- User Agency (review, model, trials)

Time Plan Outline



Plan Notes

- The CS1 work has yet to be negotiated, so is subject to change
- CS3 is optional and only if circumstances allow
- The User Agency work is the most speculative, and furthest from my areas of expertise

Questions for Examiners

- How best to find academic collaborators (most contacts so far have run away!) especially cross-discipline?
- How best to deal with the world changing under this long-duration project?
- What don't I know that I don't know?

Questions for Me

And thank you!

d.hart-davis@surrey.ac.uk