CENTRE FOR RESEARCH INTO
ENERGY DEMAND SOLUTIONS

Decarbonising Heat: Architecting the System

The CREDS Heat Challenge

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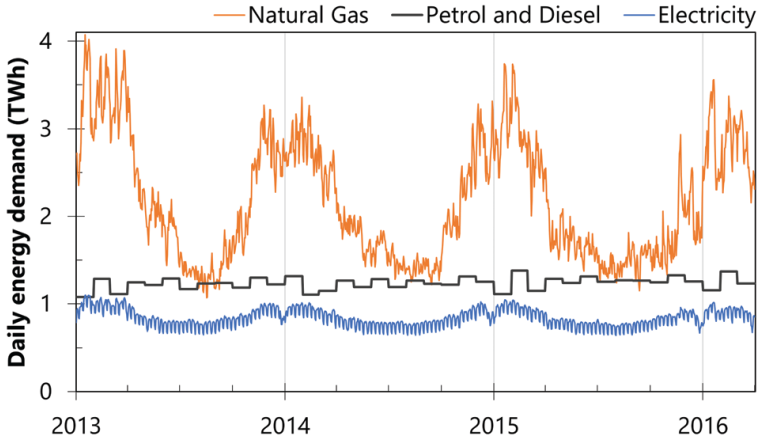
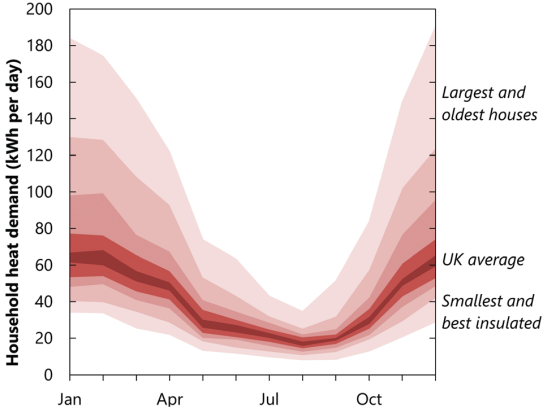




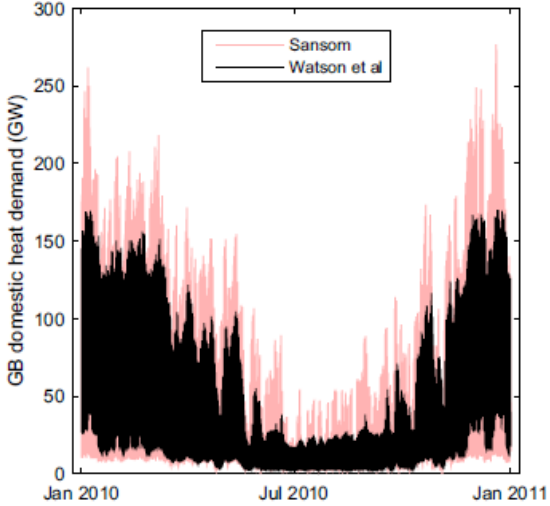


Figure 2

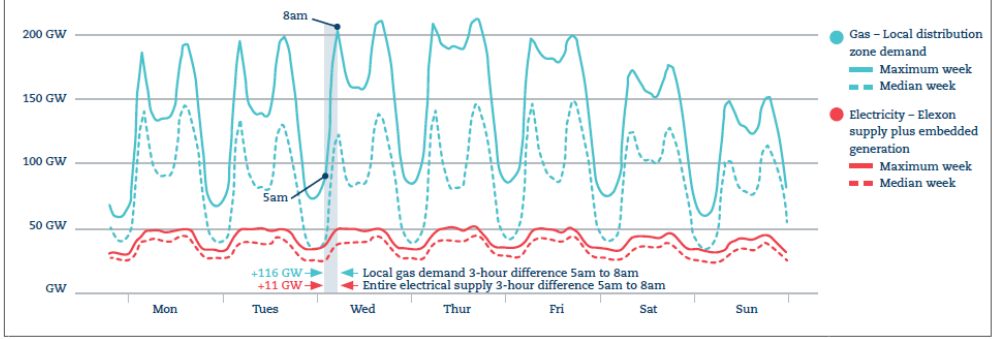
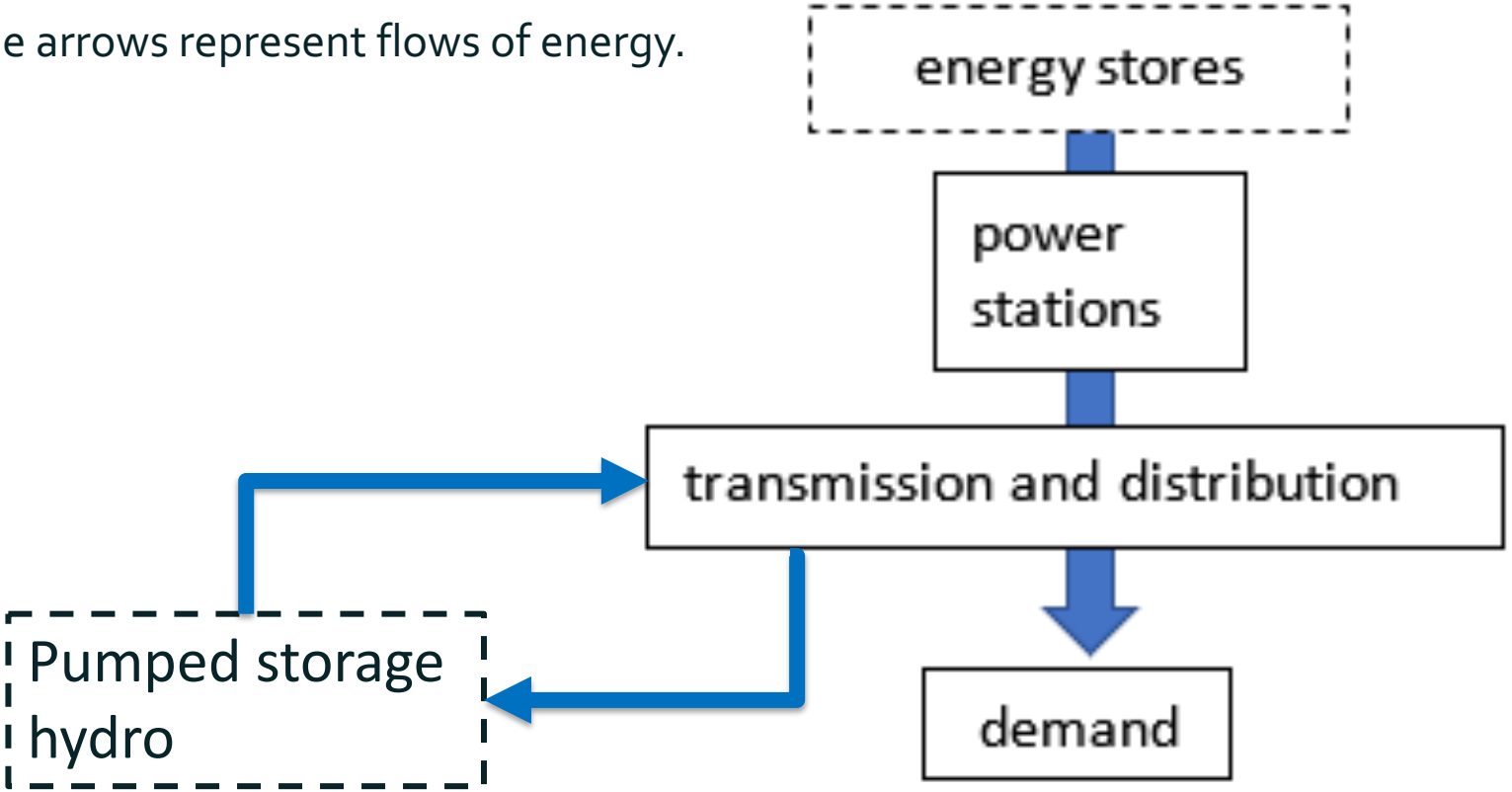
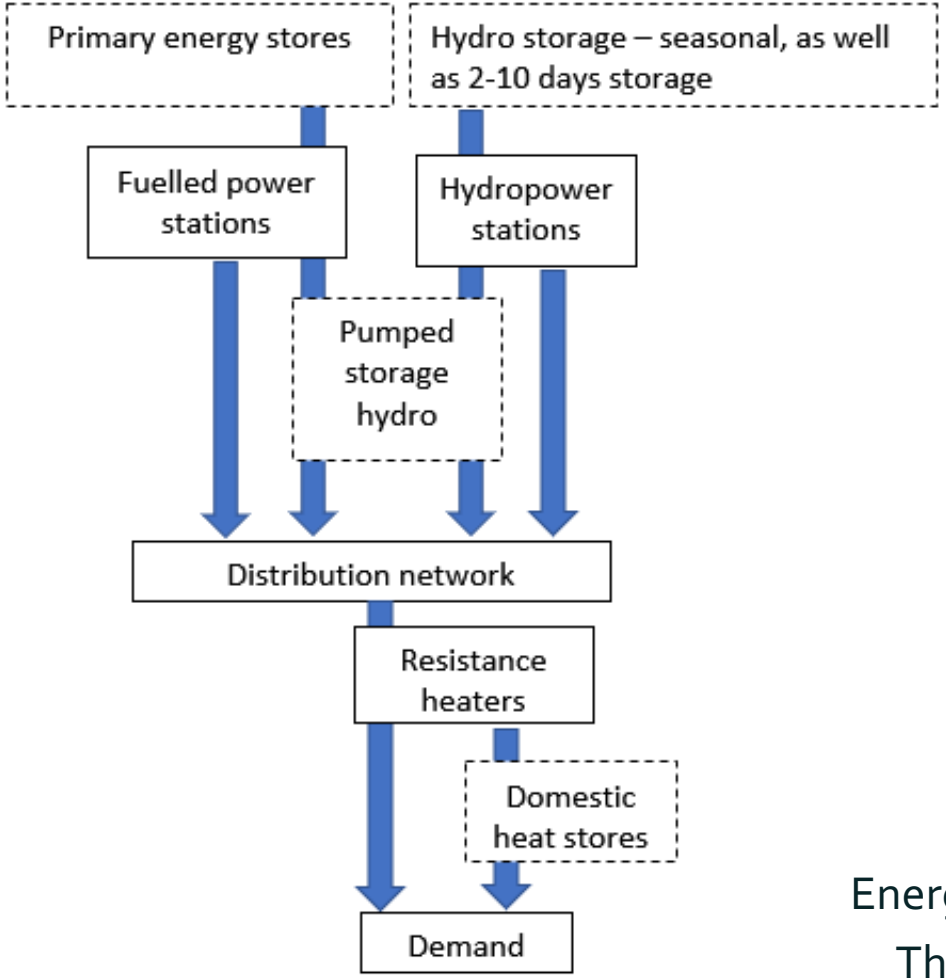


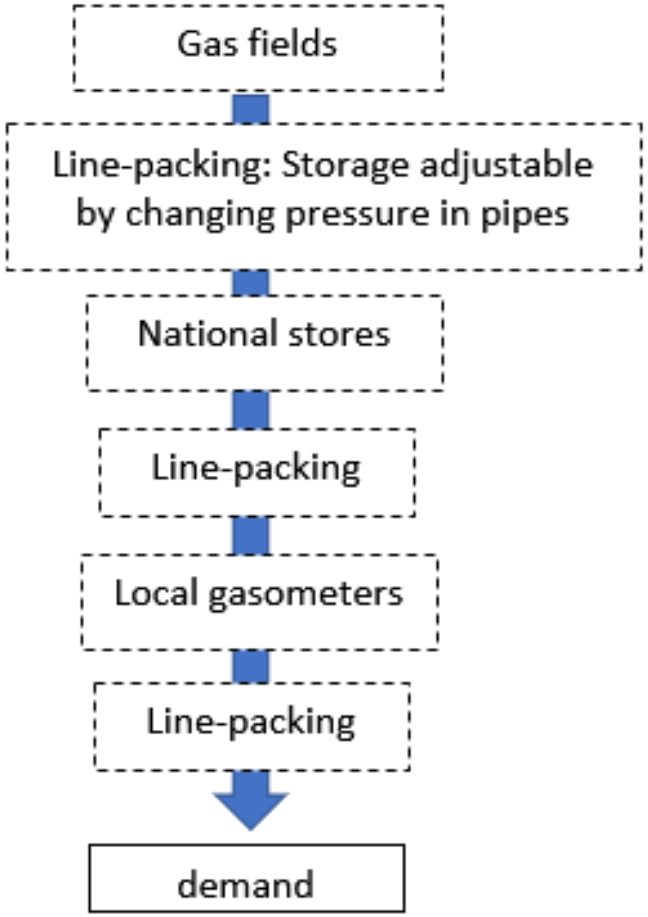
Figure 2: Britain's local gas demand and electrical system supply - median and maximum demand weeks. The week dating 22nd to 28th January is the median demand week for the 2017–2018 heating season. The week dating 26th February to 5th March represents the maximum demand week of the 2017–2018 heating season.

Energy stores are marked with dashed borders.

The blue arrows represent flows of energy.







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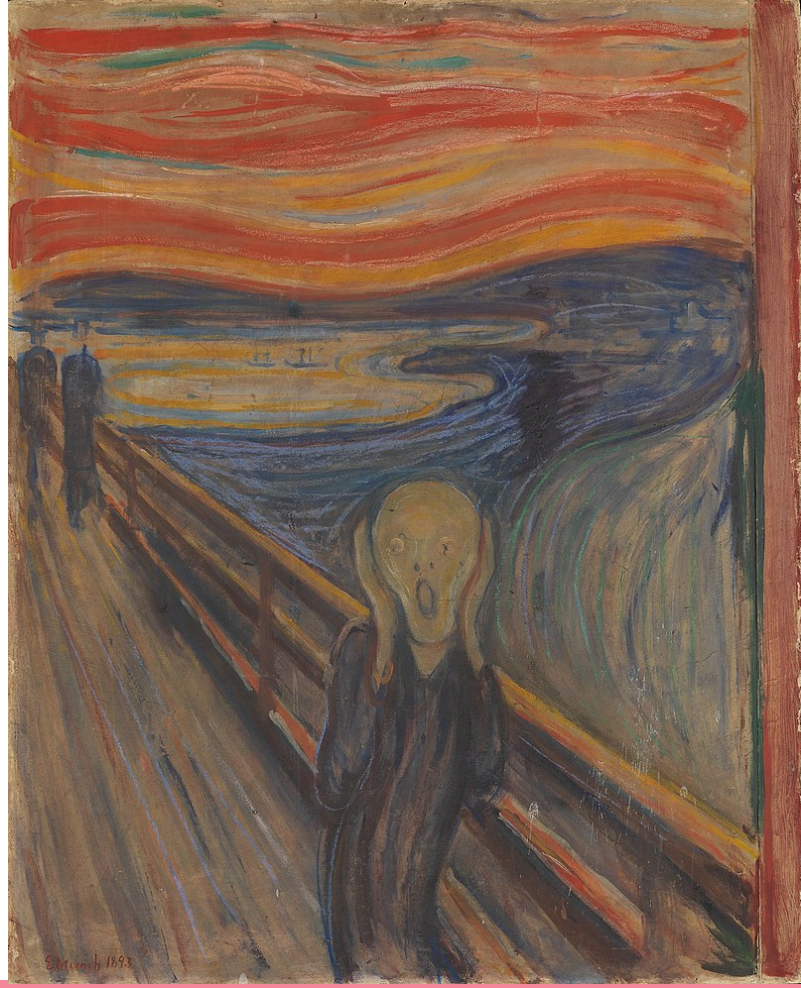
The blue arrows represent flows of energy.

Three point five issues

- Changing our existing heat architecture one customer at a time is likely to be the most inefficient route
- All the alternatives are more expensive than what the customer pays now.
- There are several viable options, each with very high uncertainties over costs. The uncertainties of cost within each option, outweigh the differences in costs between options.

- We have very good reason to believe that all of these things will apply in ten years' time.

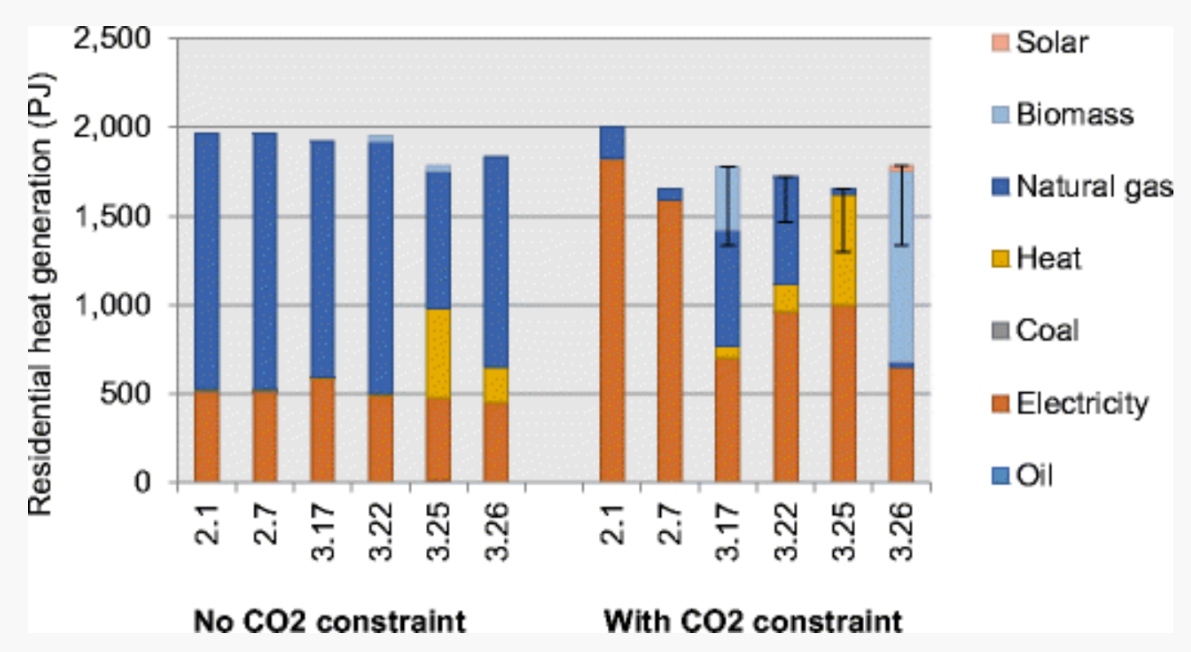


work packages

1. Structured review of existing proposals for heat decarbonisation.
2. Development of energy system models to improve treatment of energy system architecture.
3. Evaluation of social, regulatory and governance implications of findings.
4. Challenge management, integration with other themes within the Centre for Research into Energy Demand Solutions (CREDS), liaison, and communication of findings.

insights from model archaeology

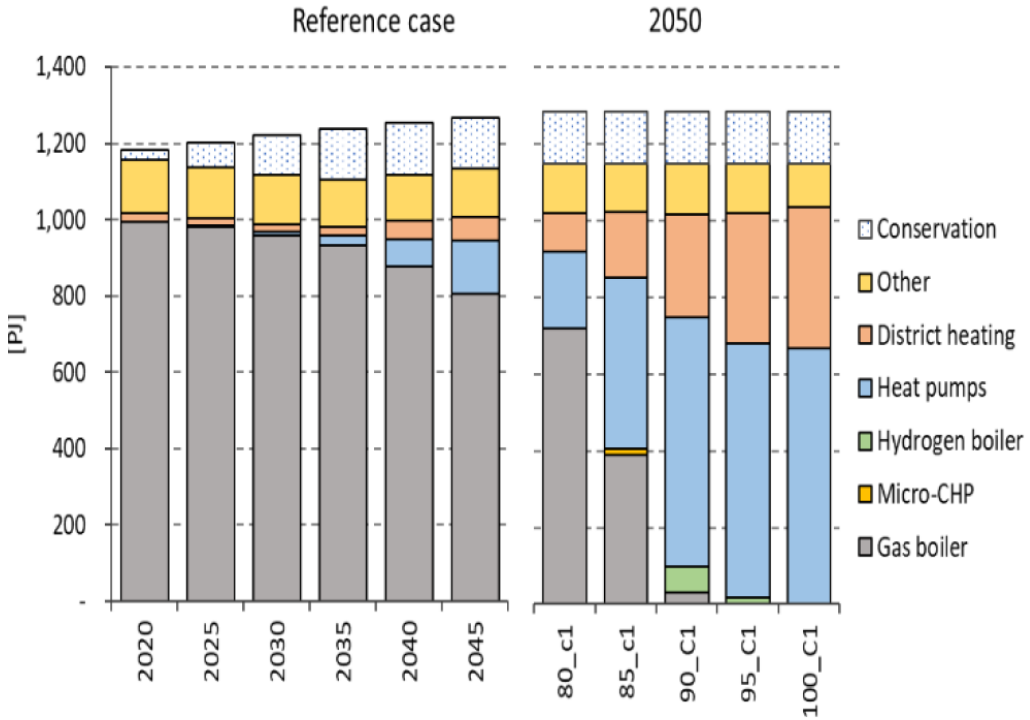
'Model archaeology' as a method to quantitatively examine the balance and evolution of energy system models, through the *ex post* analysis of both model inputs and outputs using a series of metrics (Dodds et al. 2015).

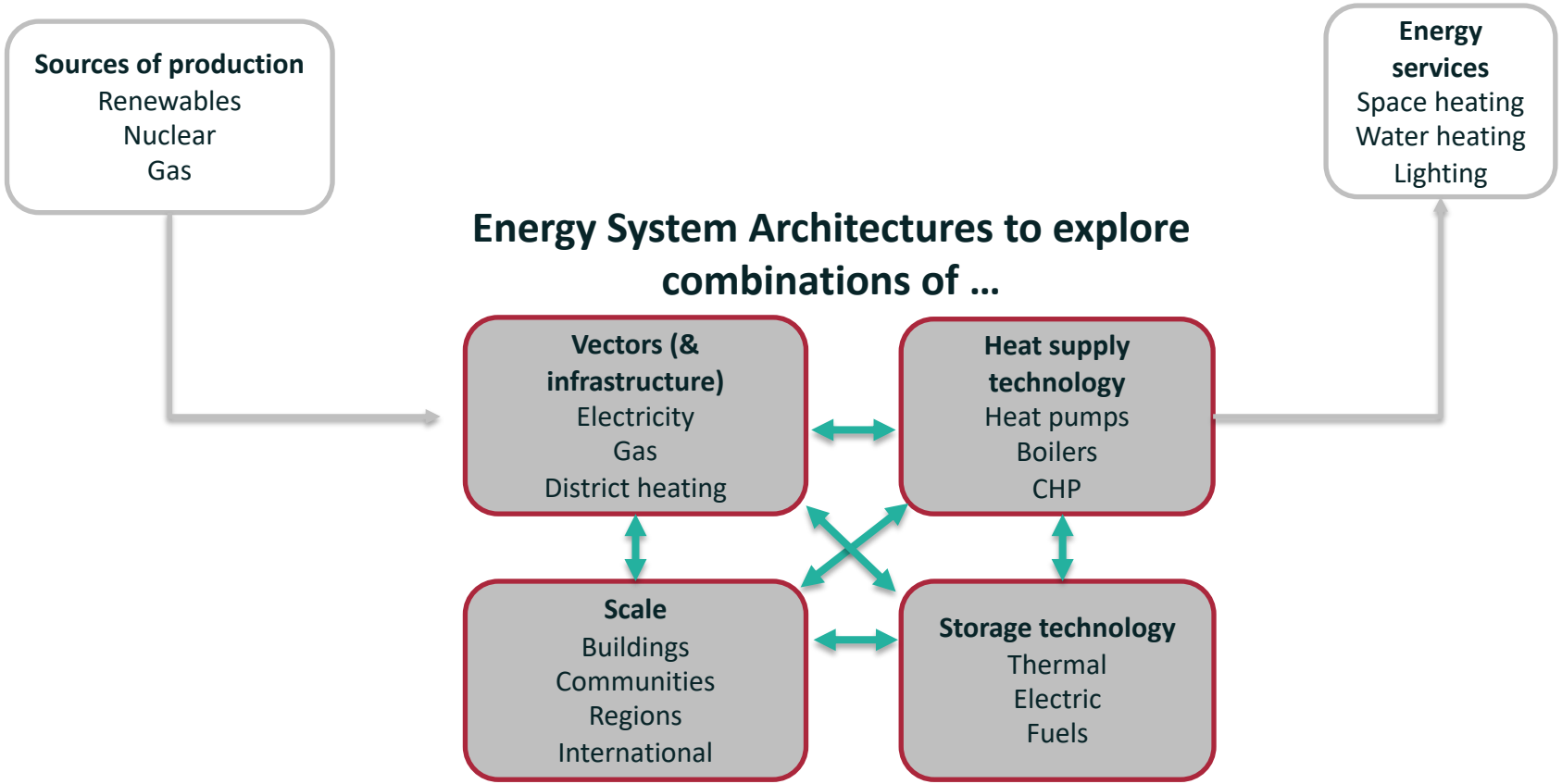


impact of climate ambition

key role of heat pumps in many pathways (Fais et al. 2016; Pye et al. 2015), with deployment strengthening post-2030.

mix of heat technologies is sensitive to climate ambition (and other model constraints).



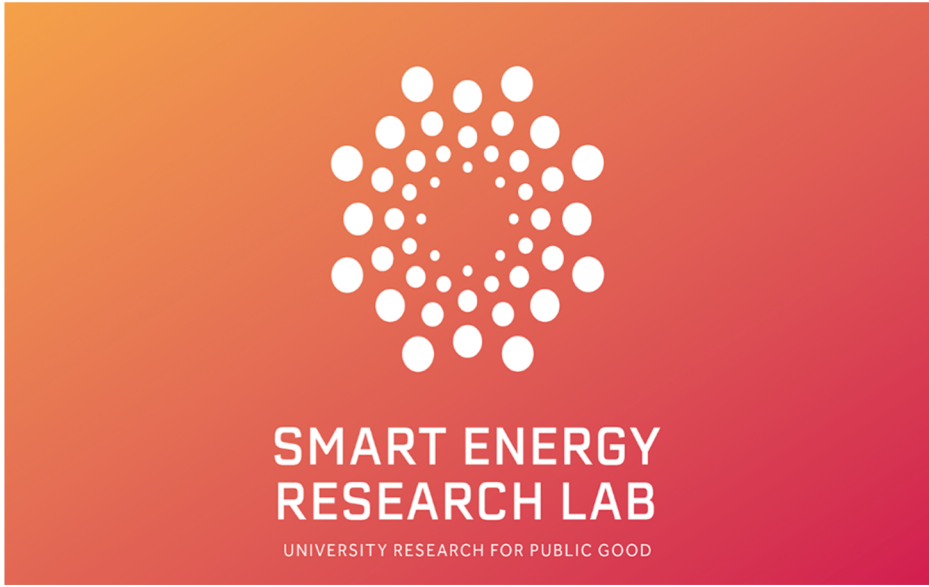

Sources of production
Renewables
Nuclear
Gas
Energy services
Space heating
Water heating
Lighting
Energy System Architectures to explore combinations of …
Vectors (& infrastructure)
Electricity
Gas
District heating
Heat supply technology
Heat pumps
Boilers
CHP
Scale
Buildings
Communities
Regions
International
Storage technology
Thermal
Electric
Fuels

Emerging modelling trends

- Heat decarbonisation models need to:
  - take account of the whole energy system;
  - have high spatio-temporal resolution;
  - account for changing climate;
  - Incorporate better time-series data on existing energy consumption;
  - be used in a way that allows us to capture the option value of enabling technologies – not just predicting the least-cost system, which is a fool's errand;
  - account for trends outside heat provision, including loss of existing storage, growing air-con consumption, and EV charging, that will motivate significant changes to energy system architecture;
  - and better predict future demand, including **peak** heat demand;

Goals of the Smart Energy Research Lab (SERL.ac.uk)

- **A trusted data resource** for researchers to utilize **large-scale, high-resolution, longitudinal energy data**
- An effective mechanism for collecting and **linking energy data with other contextual data**:
  - from national surveys (e.g. EHS)
  - administrative data (e.g. EPCs)
  - individual research projects (e.g. heat pumps, PV, EV etc)
- **Best practice data management** to ensure fit-for-purpose data provisioned to researchers
- **HPC platform** for analyses at scale



Participant Recruitment

Aims

- 1500+ households in the pilot (achieved)
- 10k households by the end of 2020
- Weighted to be representative of GB
- Consent to smart meter data collection and linking with other data
- Complete a survey about household and dwelling