

# Flexibility from The Residential Heat Sector

Session 4 – Cluster 2: Flexibility

By Alexandre Canet, 17/05/2024

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 **EDRC**  
Energy Demand  
Research Centre

# The Research Journey



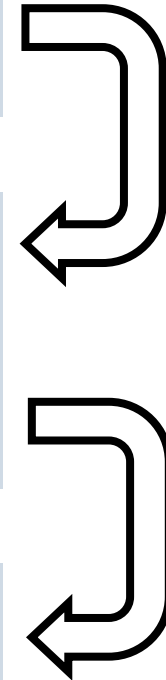
Started with a focus on the residential heat demand of GB



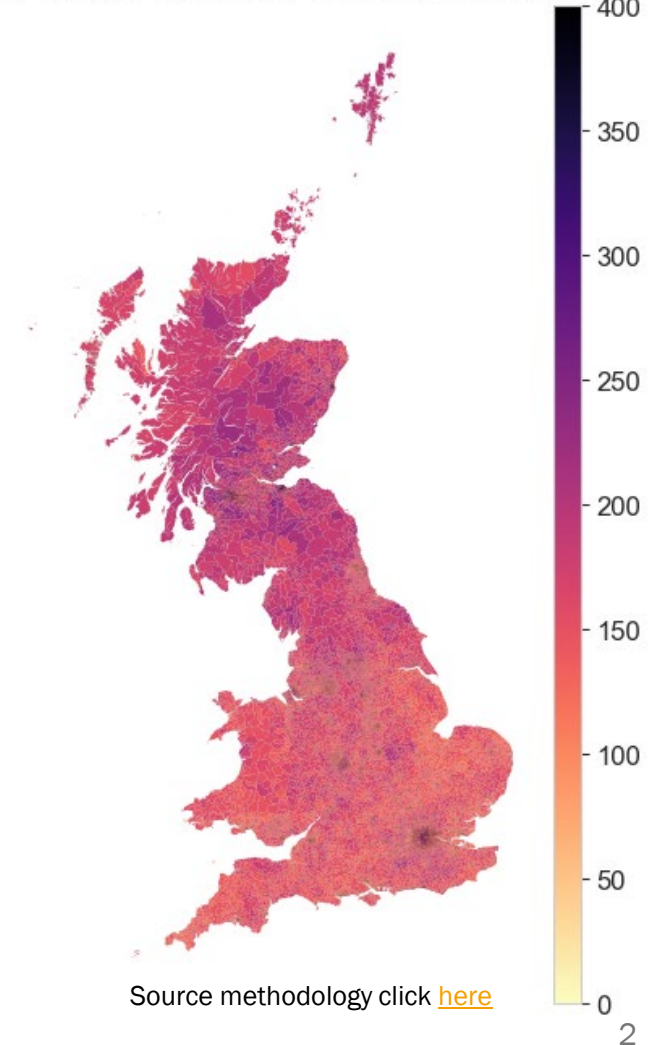
Detailed building stock information



Flexibility from dwellings



Residential heat demand after energy efficiency measures (MWh)



# Residential Heat Demand

**Energy Performance Certificate** HM Government

Coach House, Oakfield Street, CARDIFF, CF24 3RE  
 Dwelling type: Detached house Reference number: 2268-7060-7257-0367-5970  
 Date of assessment: 26 March 2013 Type of assessment: RdSAP, existing dwelling  
 Date of certificate: 26 March 2013 Total floor area: 69 m<sup>2</sup>

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years:	£ 3,033
Over 3 years you could save	£ 711

Estimated energy costs of this home			
	Current costs	Potential costs	Potential future savings
Lighting	£ 168 over 3 years	£ 120 over 3 years	You could save £ 711 over 3 years
Heating	£ 2,589 over 3 years	£ 2,031 over 3 years	
Hot Water	£ 276 over 3 years	£ 171 over 3 years	
<b>Totals</b>	<b>£ 3,033</b>	<b>£ 2,322</b>	

These figures show how much the average household would spend in this property for heating, lighting and hot water and is not based on energy used by individual households. This excludes energy use for running appliances like TVs, computers and cookers, and electricity generated by microgeneration.

**Energy Efficiency Rating**

Very energy efficient - lower running costs	Current	Potential	Not energy efficient - higher running costs
(92 plus) A	45	69	G
(75-91) B			
(59-74) C			
(43-58) D			
(27-42) E			
(11-26) F			
(-1) G			

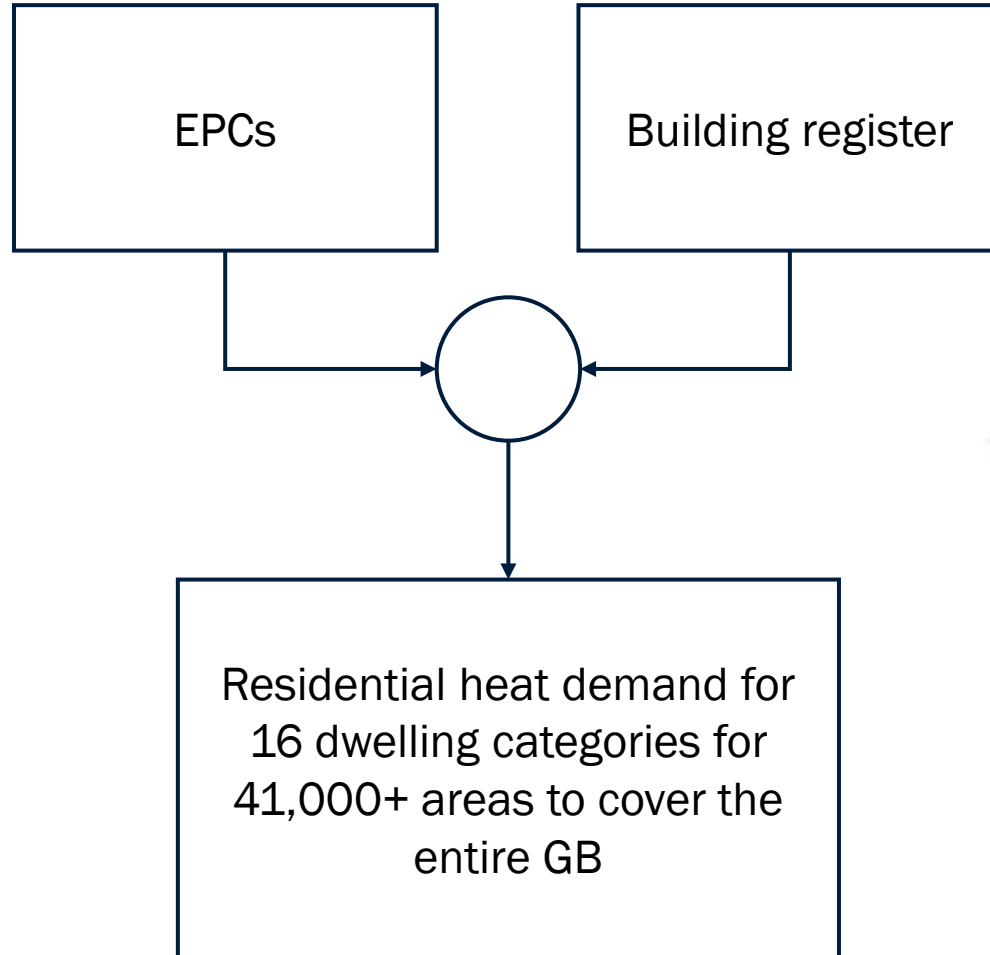
The graph shows the current energy efficiency of your home. The higher the rating the lower your fuel bills are likely to be. The potential rating shows the effect of undertaking the recommendations on page 3. The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60). The EPC rating shown here is based on standard assumptions about occupancy and energy use and may not reflect how energy is consumed by individual occupants.

**Top actions you can take to save money and make your home more efficient**

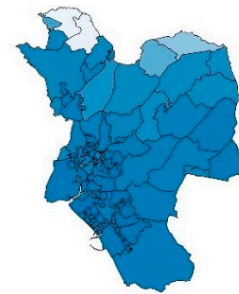
Recommended measures	Indicative cost	Typical savings over 3 years
1 Internal or external wall insulation	£4,000 - £14,000	£ 255
2 Floor insulation	£800 - £1,200	£ 96
3 Low energy lighting for all fixed outlets	£15	£ 39

See page 3 for a full list of recommendations for this property.

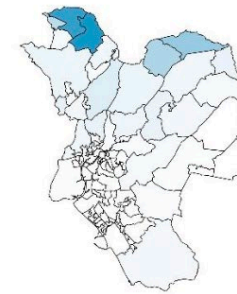
To receive advice on what measures you can take to reduce your energy bills, visit [www.simpleenergyadvice.org.uk](http://www.simpleenergyadvice.org.uk) or call Freephone 0800 444202. The Green Deal may enable you to make your home warmer and cheaper to run.



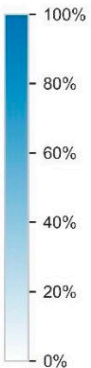
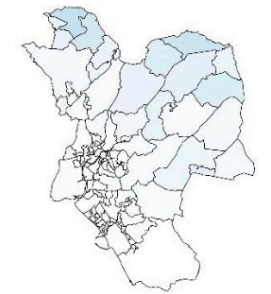
Share of gas boilers by LSOA



Share of oil boilers by LSOA



Share of biomass boilers by LSOA



Figures: Share of current heating systems in dwellings in Neat Port Talbot, UK

# Residential heat demand data

A dataset of the building stock characteristics:

- 16 dwelling categories,
- Location,
- Thermal losses before and after energy efficiency measures,
- Thermal capacity, and,
- Floor area.

# Building characteristics

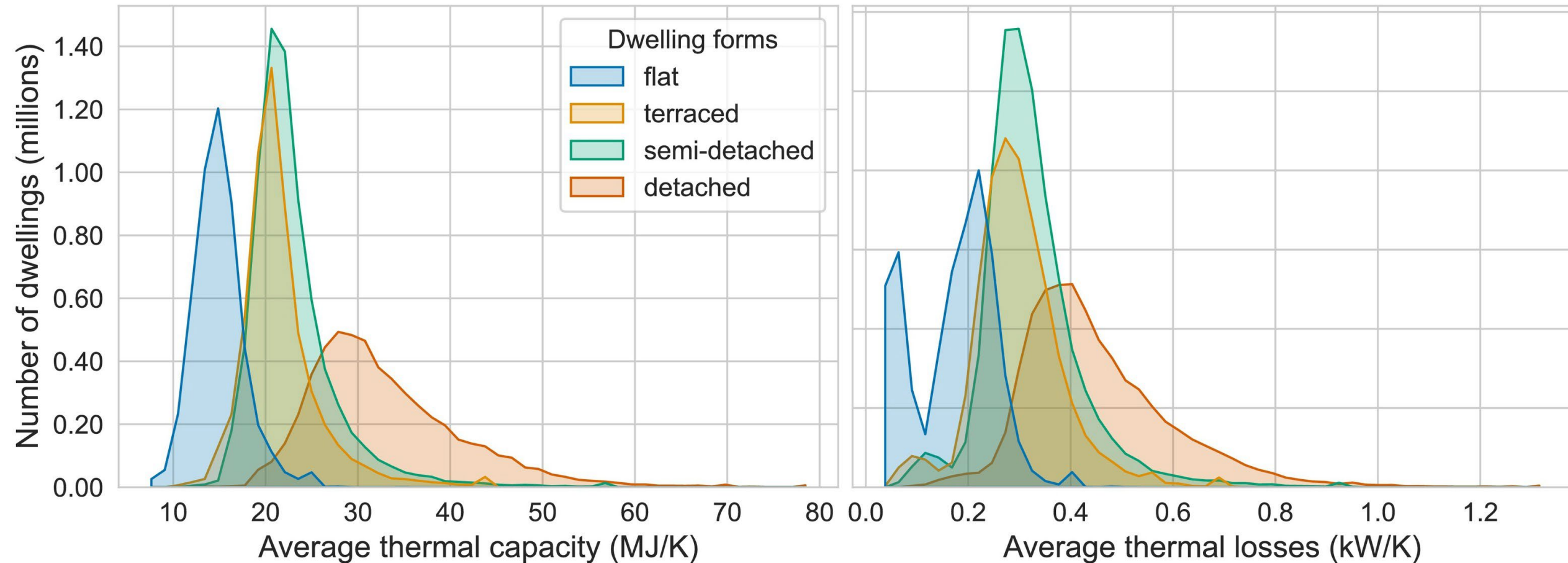


Figure: Distribution of the thermal characteristics of four dwelling forms in England and Wales. The average thermal capacity is based on medium thermal capacity level. The figures were smoothed for visualization purposes by grouping the values into 50 bins. For the link to the paper click [here](#).

# Flexibility from the Residential Heat Sector



# Research Questions

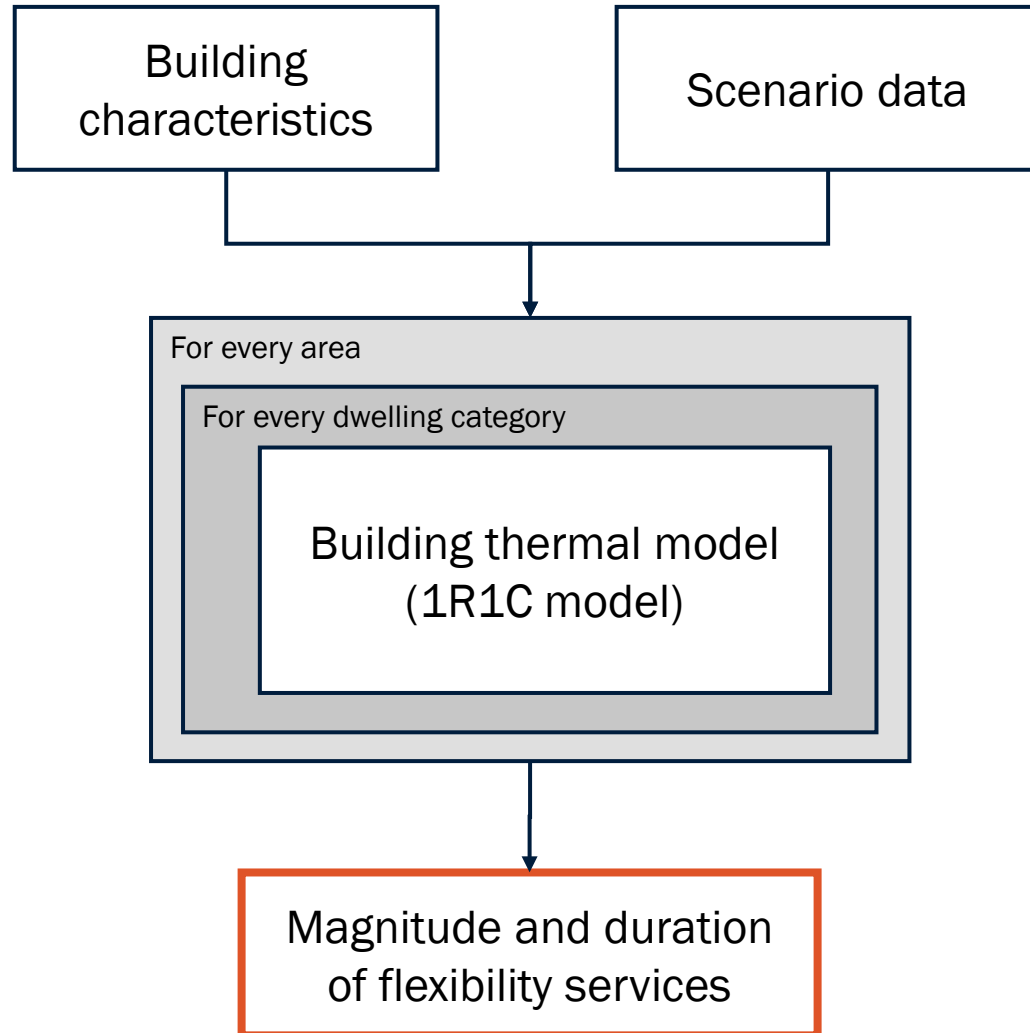


Quantifying the flexibility from the residential heat sector



Impacts of buildings retrofits on the amount of flexibility that can be provided

# Methodology



- By flexibility, we mean for how long can we switch off or switch on the heat pumps before occupants are too cold ( $18^{\circ}\text{C}$ ) or too warm ( $24^{\circ}\text{C}$ ) for different outside air temperatures.
- All dwellings in England and Wales are equipped with heat-pumps,
- Average initial indoor air temperature for all dwellings was  $19^{\circ}\text{C}$ .



# Results

Two flexibility services:

1. Positive flexibility – an increase in the electricity consumption of heat pumps when all heat pumps increase their outputs to their maximum capacity. This provides a demand increase service to the public electricity network.
2. Negative flexibility – a decrease in the electricity consumption of heat pumps when all heat pumps are switched off. This provides a demand reduction service to the public electricity network.

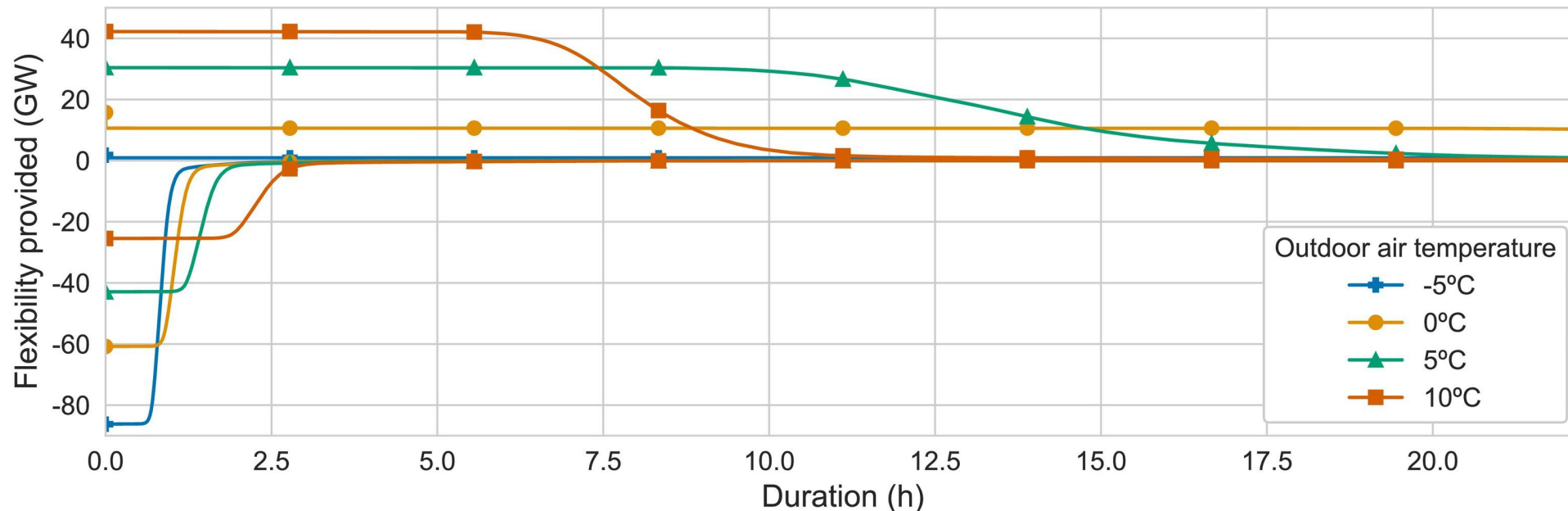


Figure: Estimated magnitude and duration of flexibility services provided when the initial indoor air temperature in dwellings is +19 °C. For the link to the paper click [here](#).

# Thermal Mass of Dwellings

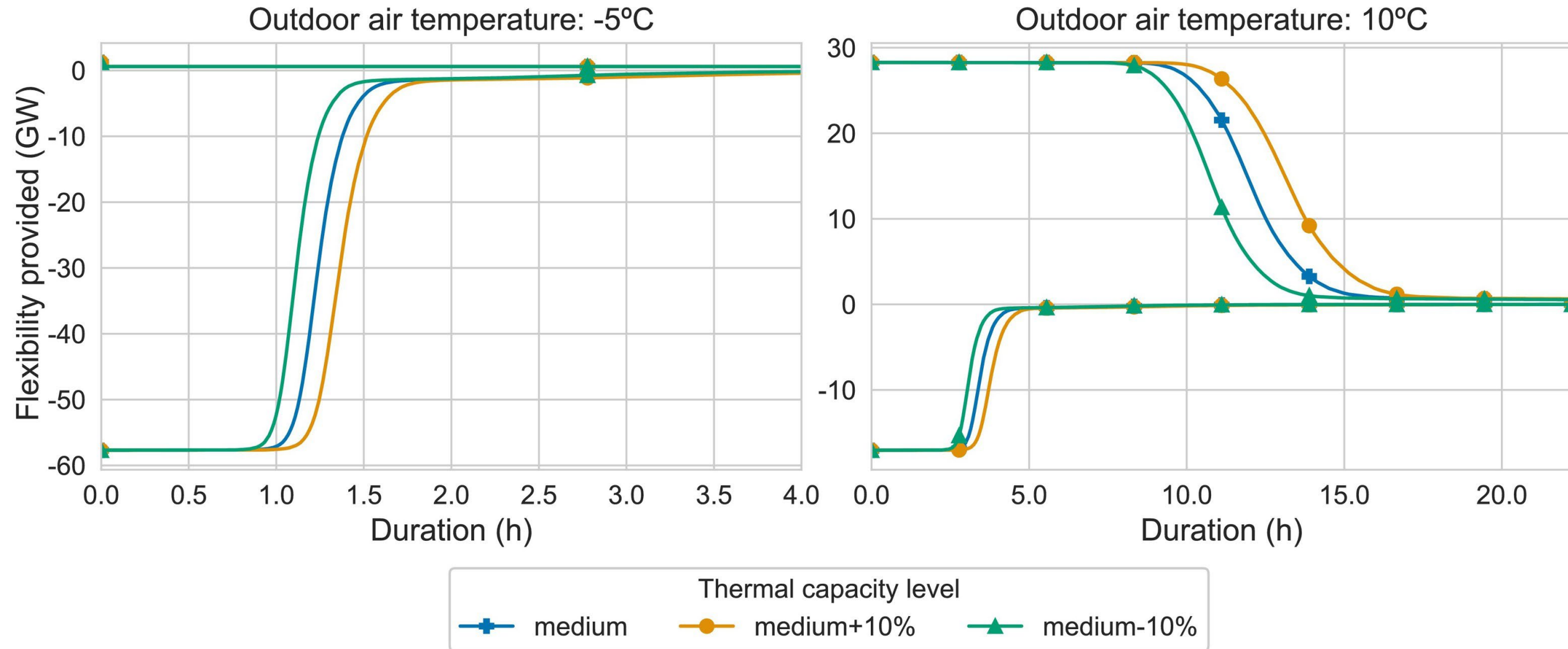


Figure: Impact of thermal capacity of dwellings on the provision of flexibility services. Comparison of the magnitude and duration of flexibility services provided for the England and Wales dwelling stock with different levels of thermal capacity for two outdoor air temperatures. For the link to the paper click [here](#).

# Conclusions



Method to estimate heat demand and flexibility from the residential sector

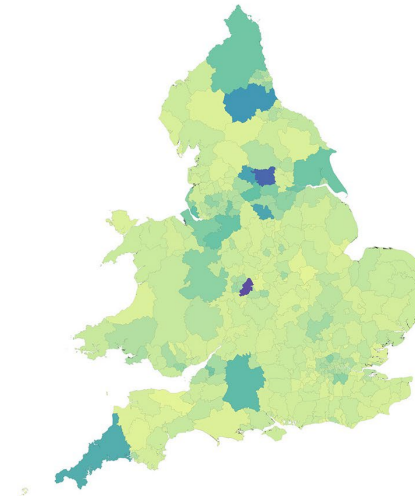


We assessed the technical available flexibility but what is the flexibility considering socio-economic aspects?

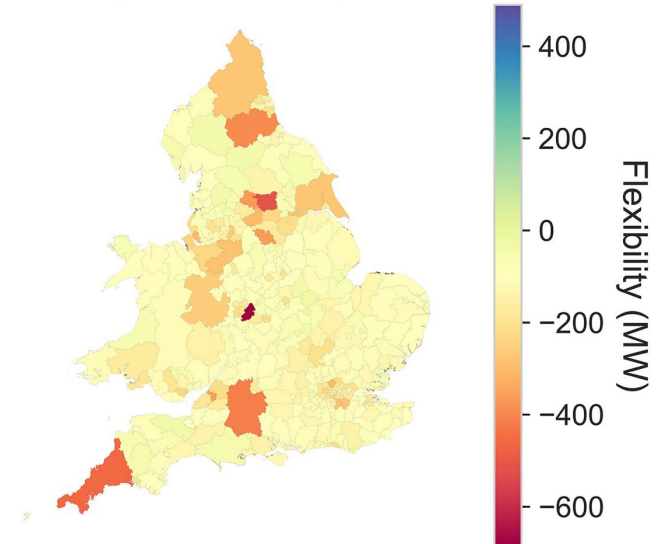


Other work - first estimate of the hourly residential cooling demand in the GB (Work in progress)

Positive flexibility by local authority



Negative flexibility by local authority



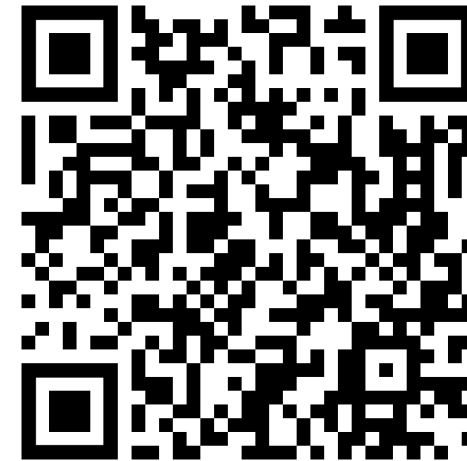
Source: Quantification of flexibility from the thermal mass of residential buildings in England and Wales, Applied Energy, Canet et al.

# Opportunities and Collaborations

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