UNIVERSITY OF CAMBRIDGE | Energy Policy Research Group

Modelling & optimisation of decarbonisation pathways for UK heat sector

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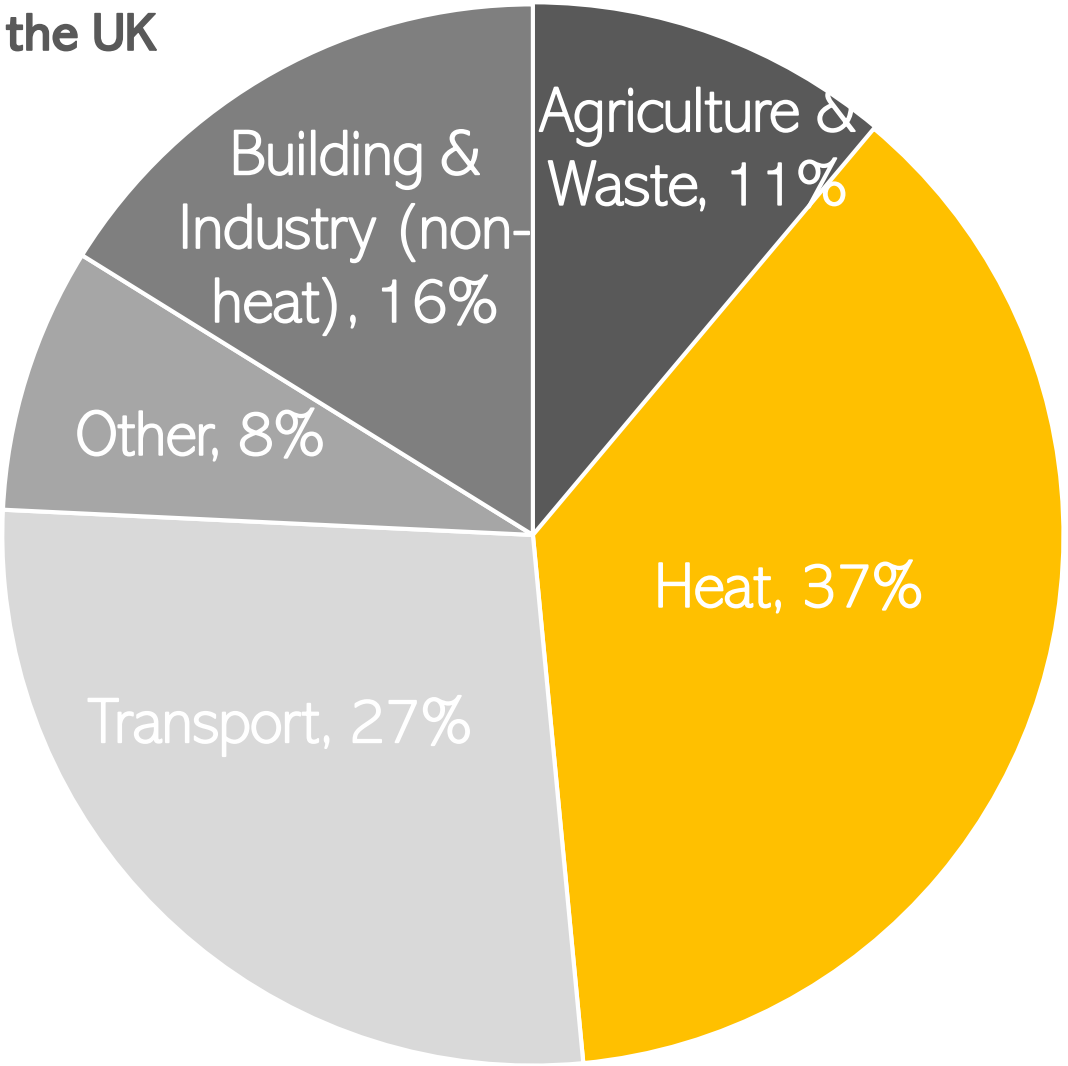
EPRG & CEEPR International Energy Policy Conference
"The Good Fight Against GHG Emissions"
London, 2-3 September 2019

Overview

1. **The UK heat challenge**
   i. Current heating landscape in the UK
   ii. UK heat emissions breakdown
   iii. Timeline of UK policy for heat decarbonisation
   iv. Heat decarbonisation pathways
2. **Modelling the domestic UK heat sector**
   i. Model description
   ii. UK domestic heat demand characteristics
3. **2030 Scenarios & Insights**
   i. The role of carbon budgets on heat
   ii. The value of heat storage technologies
   iii. Market growth diffusion scenarios

The UK heat landscape (I)

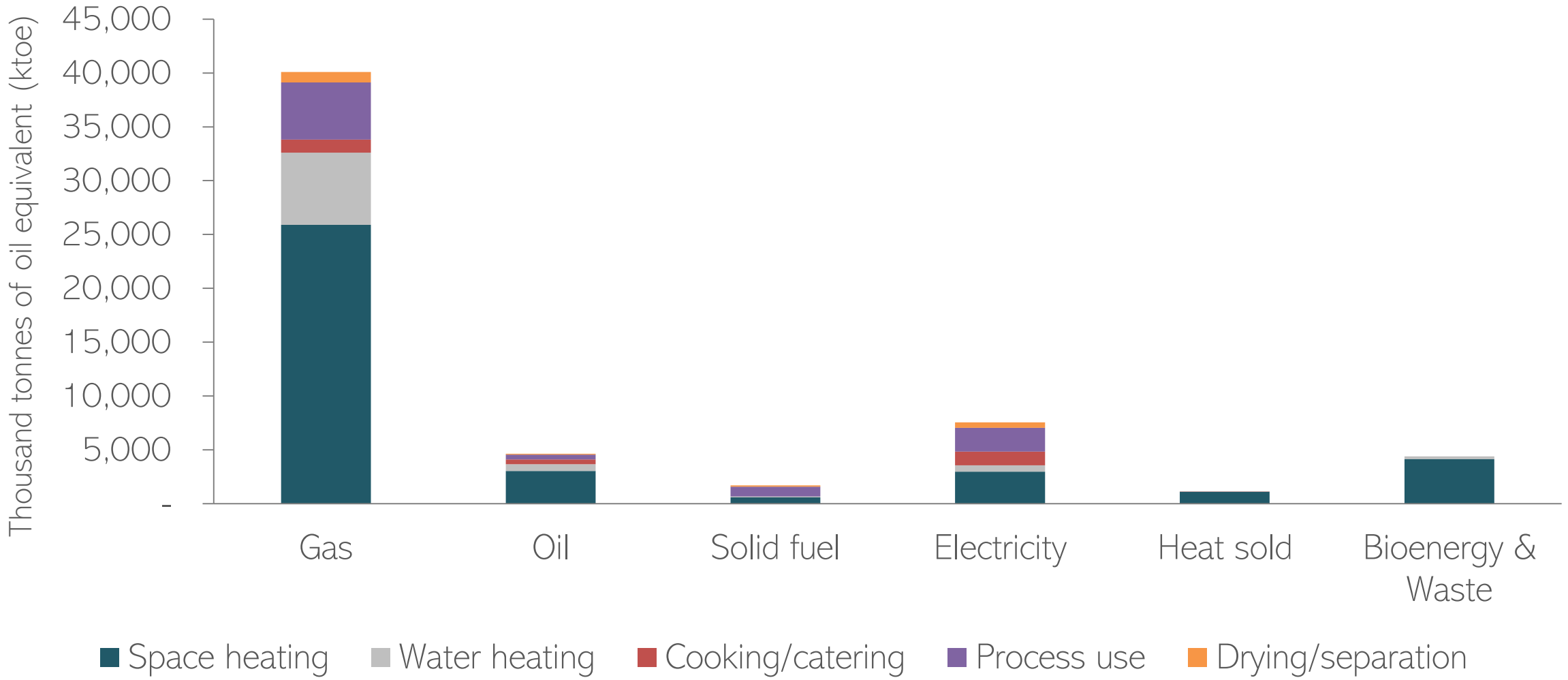
CO_2 emissions in the UK



~170MtCO$_2$e

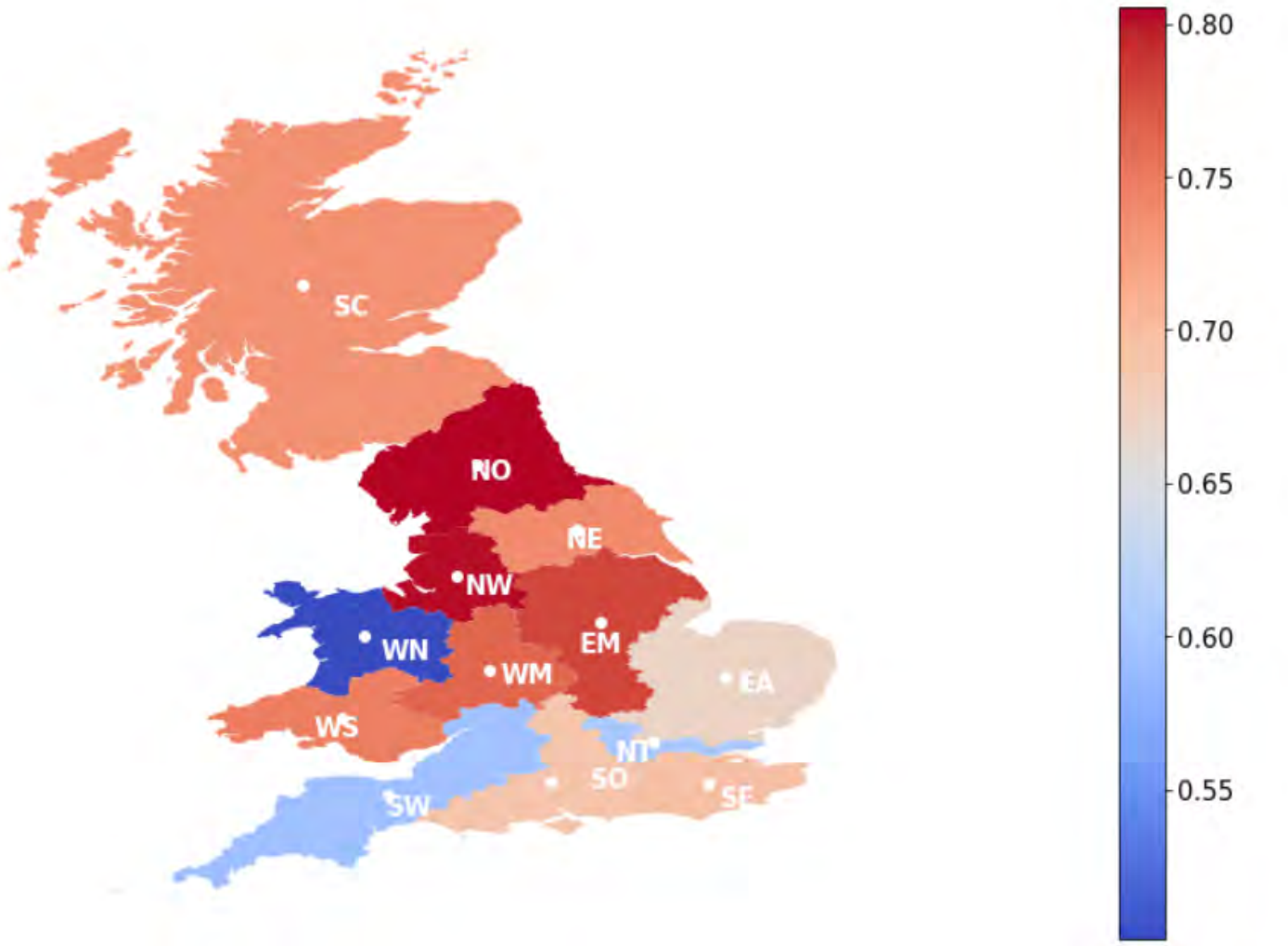
The UK heat landscape (II)

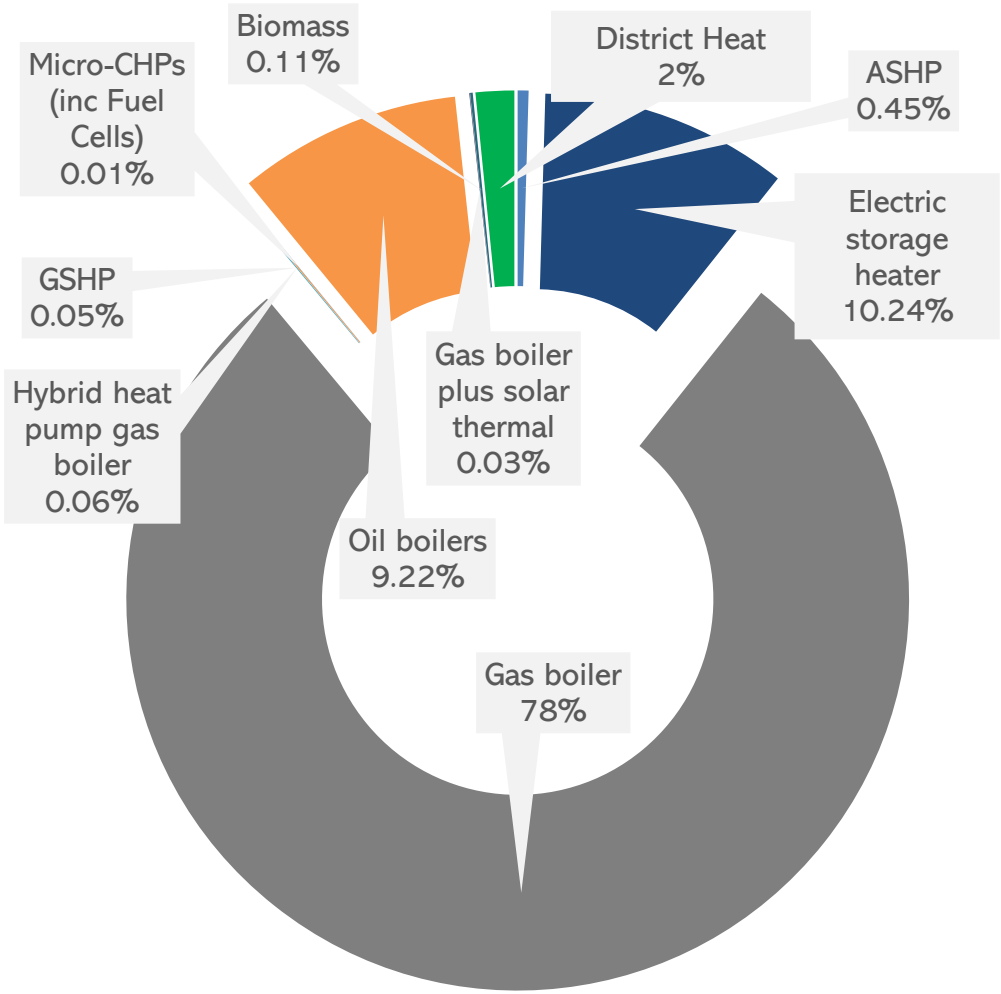
Heat provision by fuel in the UK



The UK heat landscape (III)

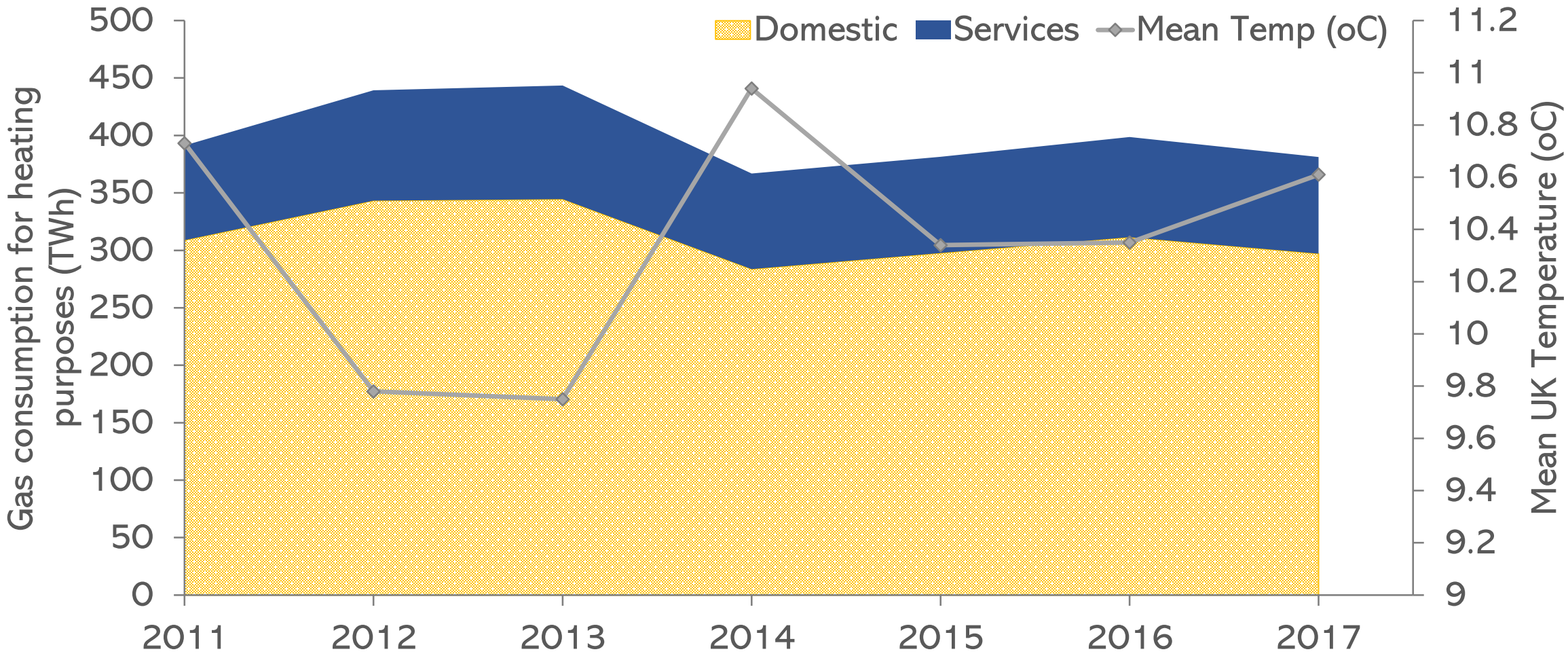
Percentage of gas-fuelled properties in the UK (2018)



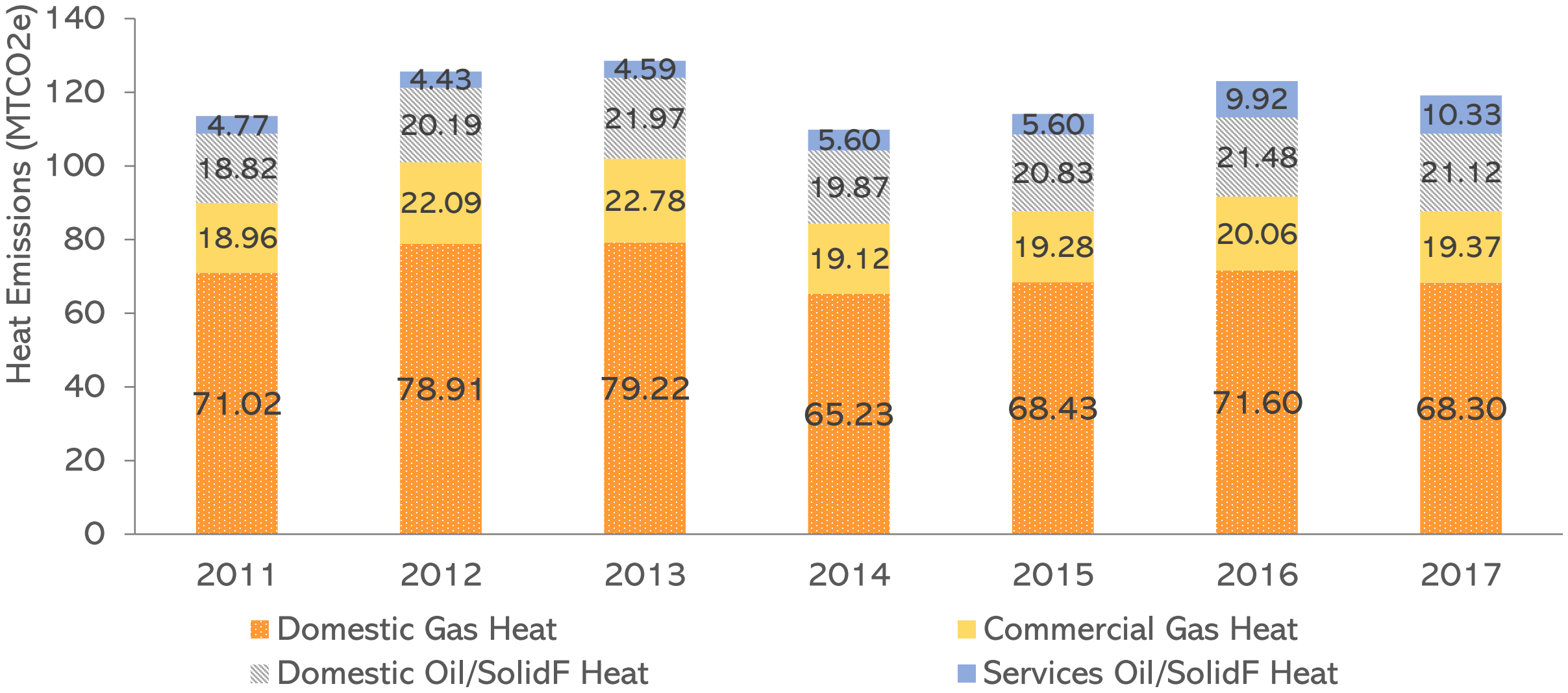


Heating systems share in the UK (2018)

The UK heat landscape (IV)



The UK heat landscape (V)



The time for climate action is running out…

UK policies for heat decarbonisation

Electrification → Hydrogen ?

2009: DECC first report on heat and energy saving strategy.

2011: DECC Introduced RHI and Green Deal.

2013: DECC "The future of heating: Meeting the challenge".

2016: CCC "Next steps for UK Heat Policy" with three main pathways.

2018: NIC "Cost analysis of future heat infrastructure options".

2018: CCC "Hydrogen in a low-carbon economy".

2019: Government's commitment to phase out fossil-fuelled heating in new homes by 2025.

2050

2010: DECC 2050 Pathways analysis report.

2012: DECC "The future of heating: A strategic framework for low carbon heat in the UK".

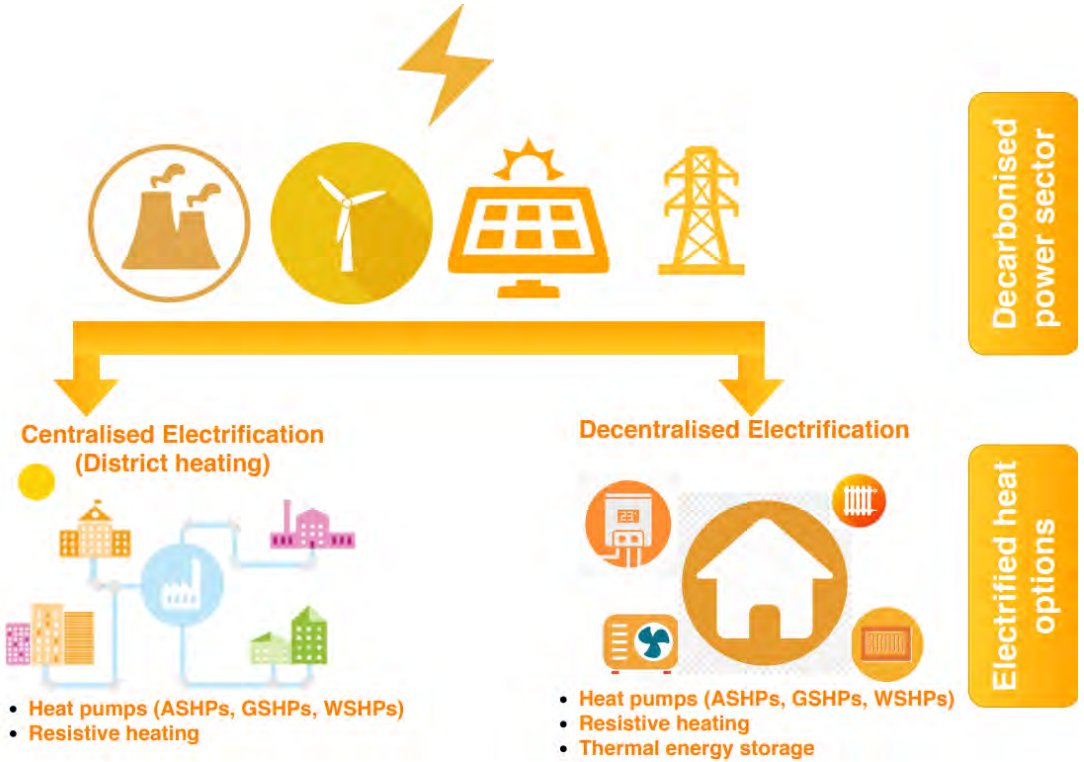
2016: KPMG "2050 Energy Scenarios"

2018: CCC "Analysis of alternative UK heat decarbonisation pathways".

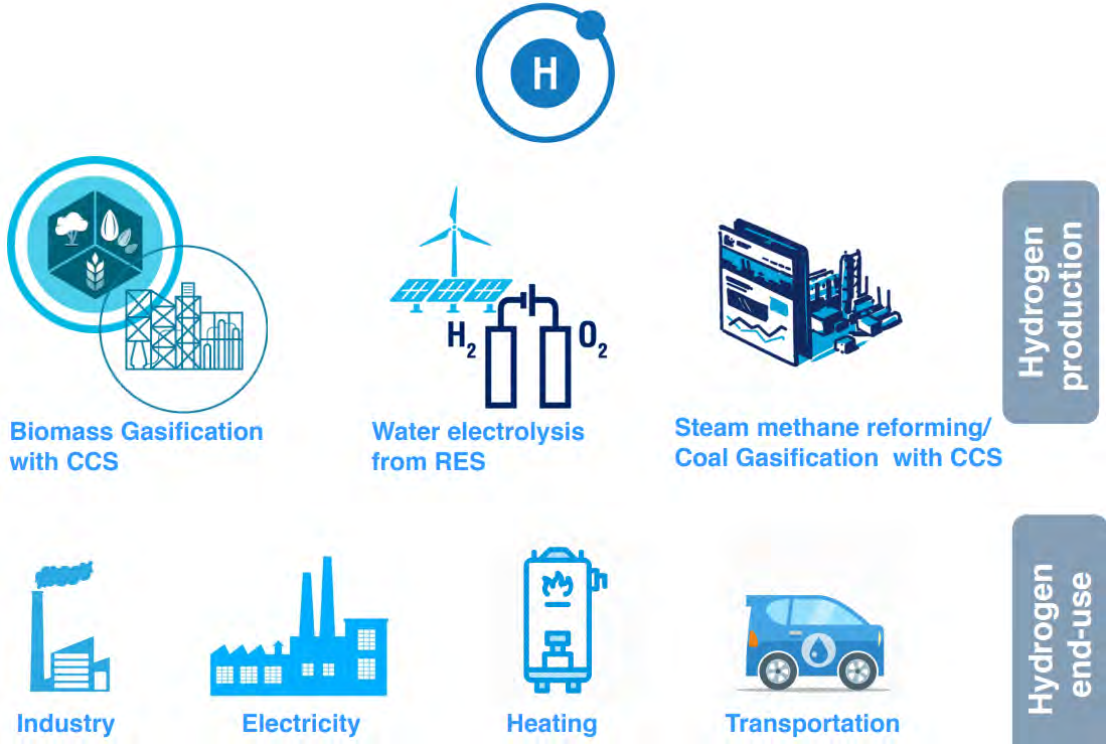
2018: BEIS "Clean Growth-Transforming Heating".

Heat decarbonisation pathways

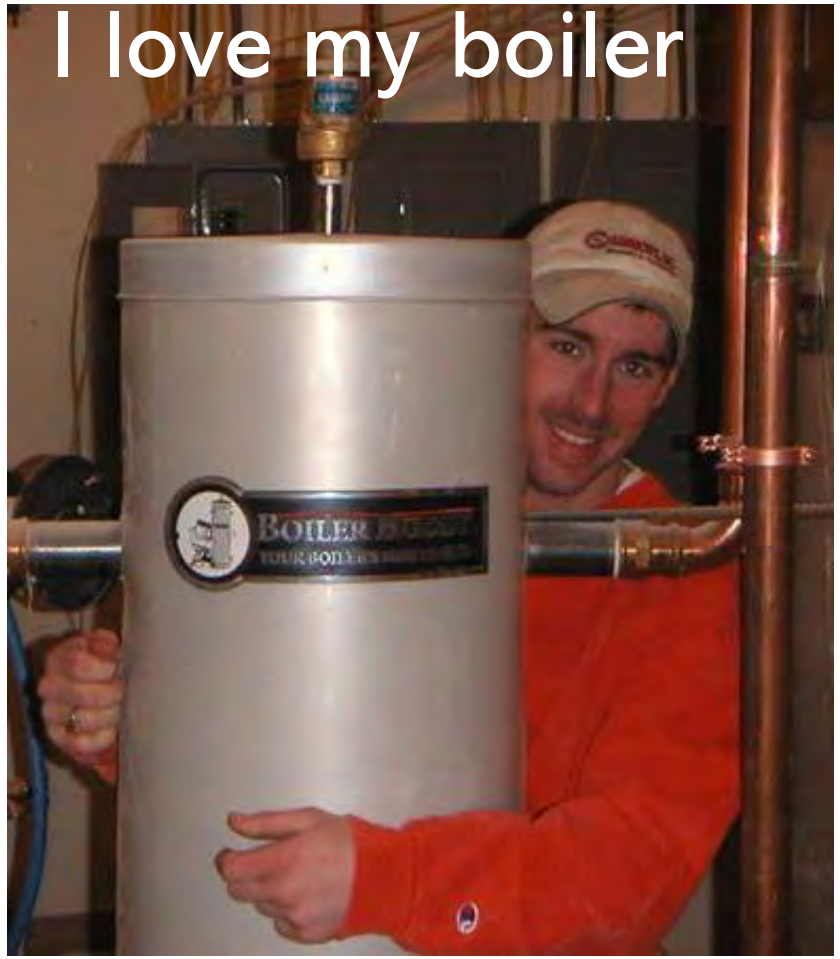
Electrification of heat

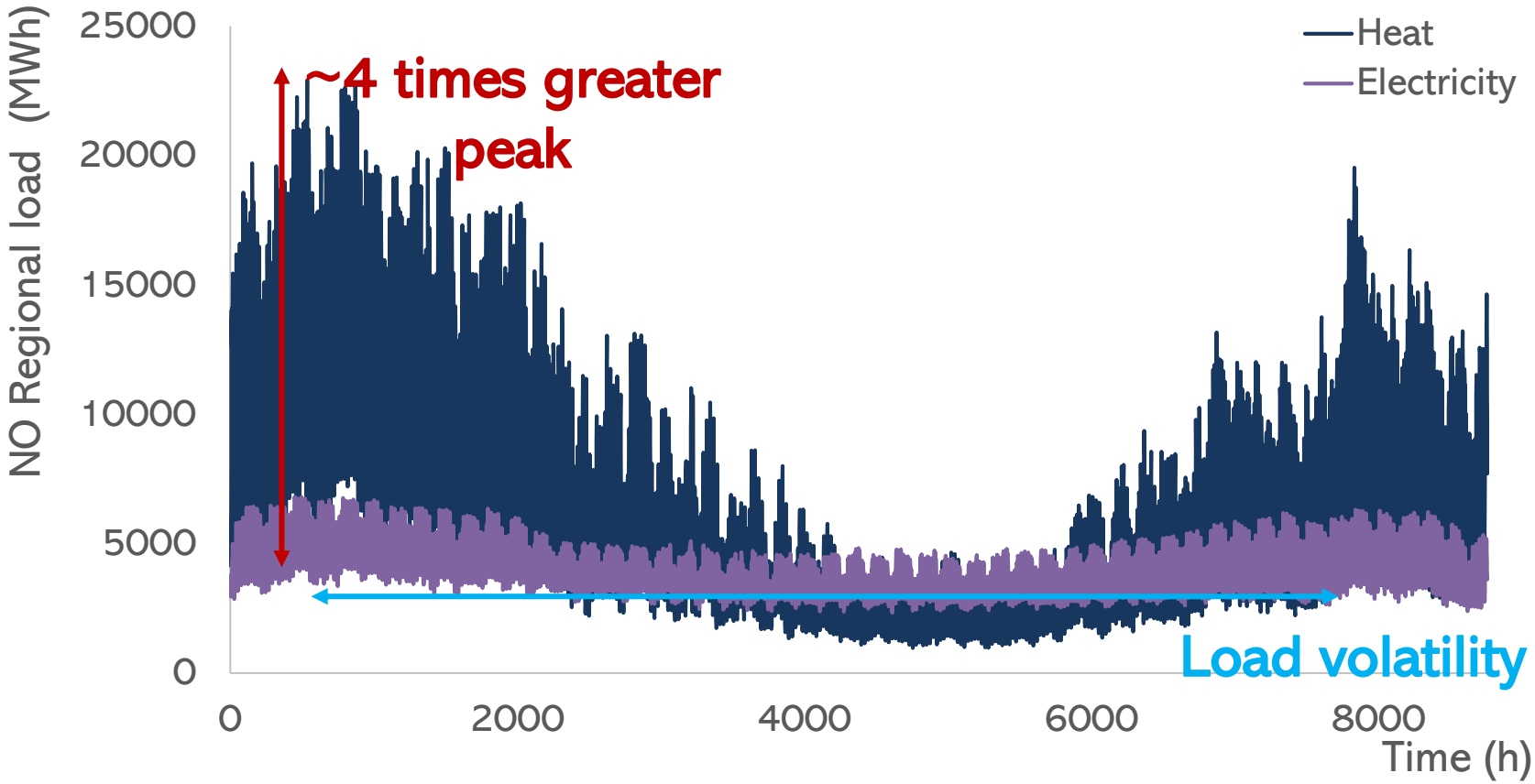


Hydrogen based heat

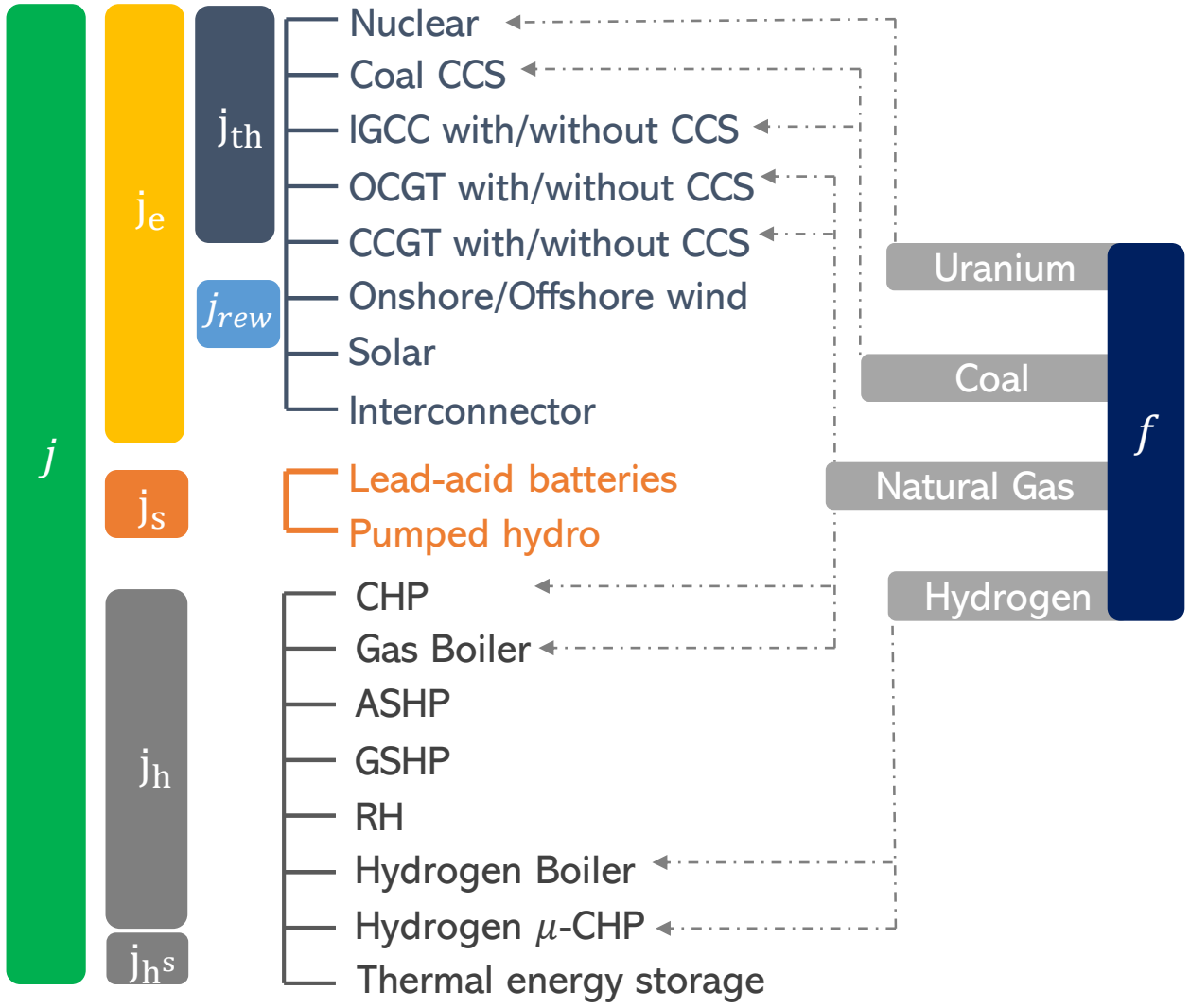


Heat decarbonisation implications

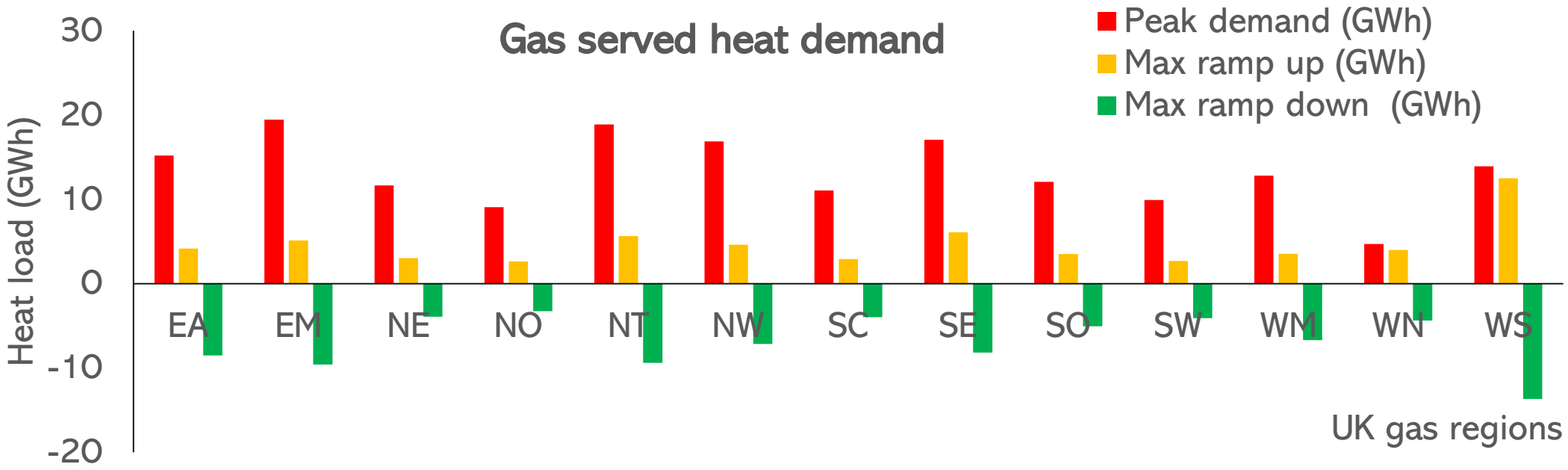


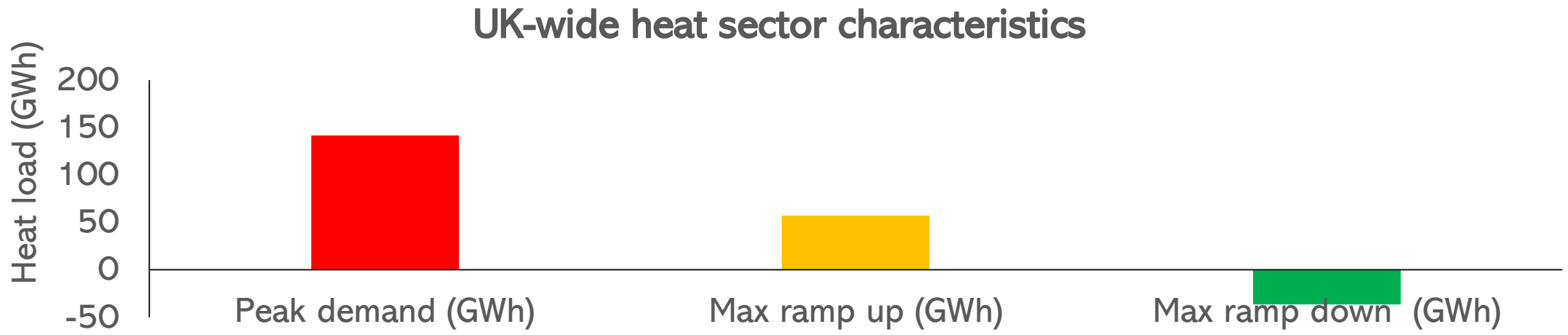


Modelling the domestic UK heat sector



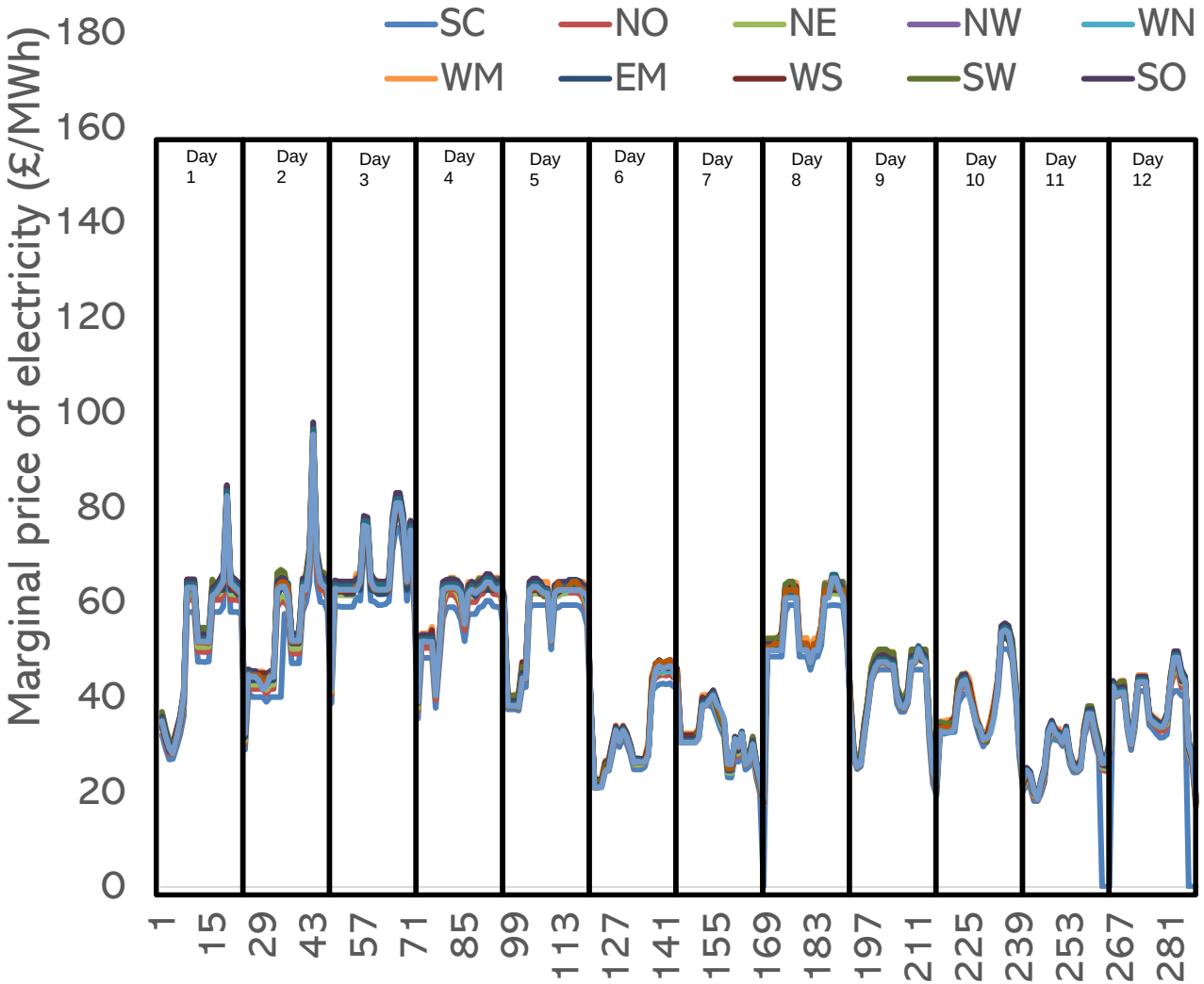
Domestic heat demand

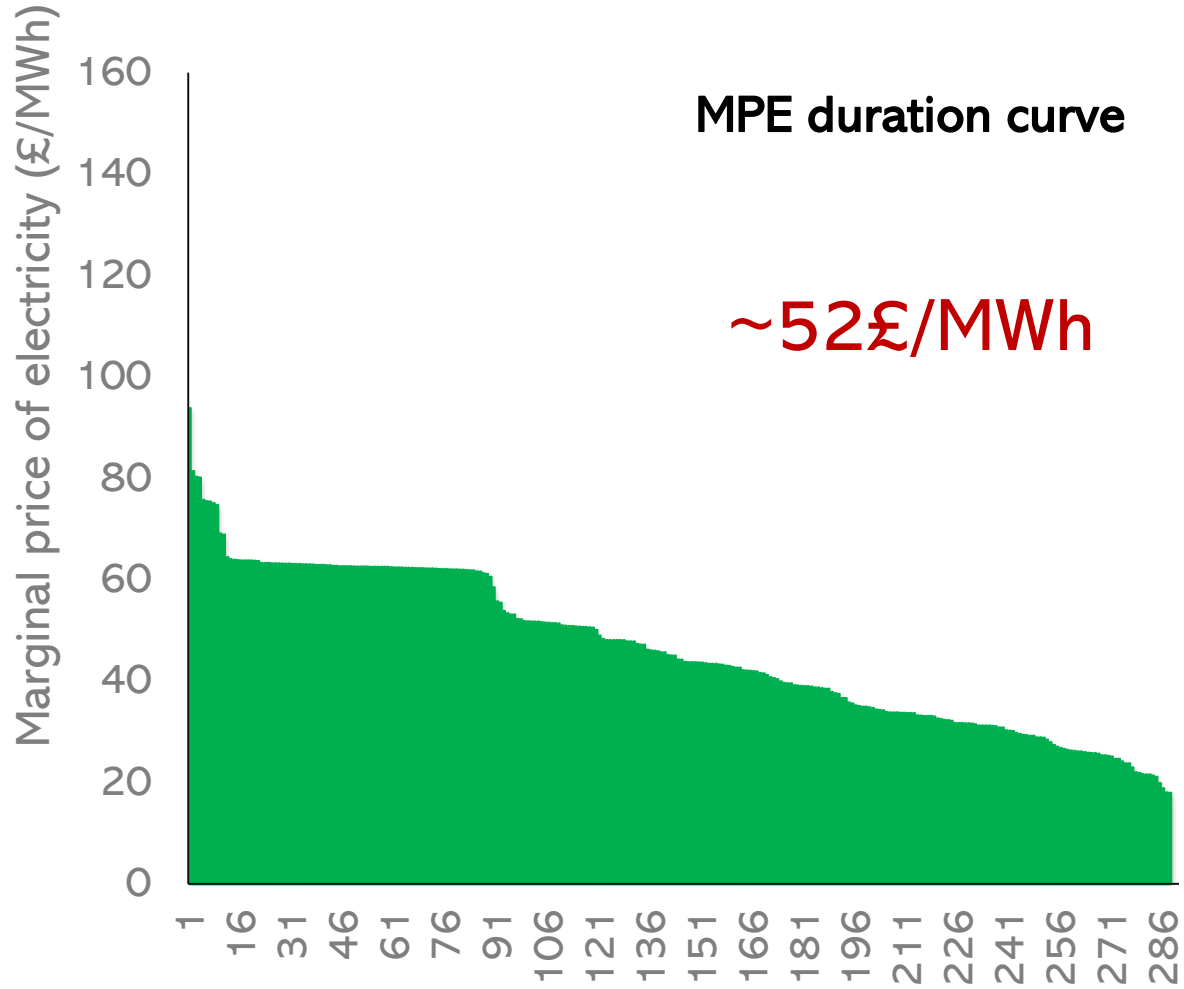




2030 Scenarios & Insights (I)

Single budget driven decarbonisation without heat storage

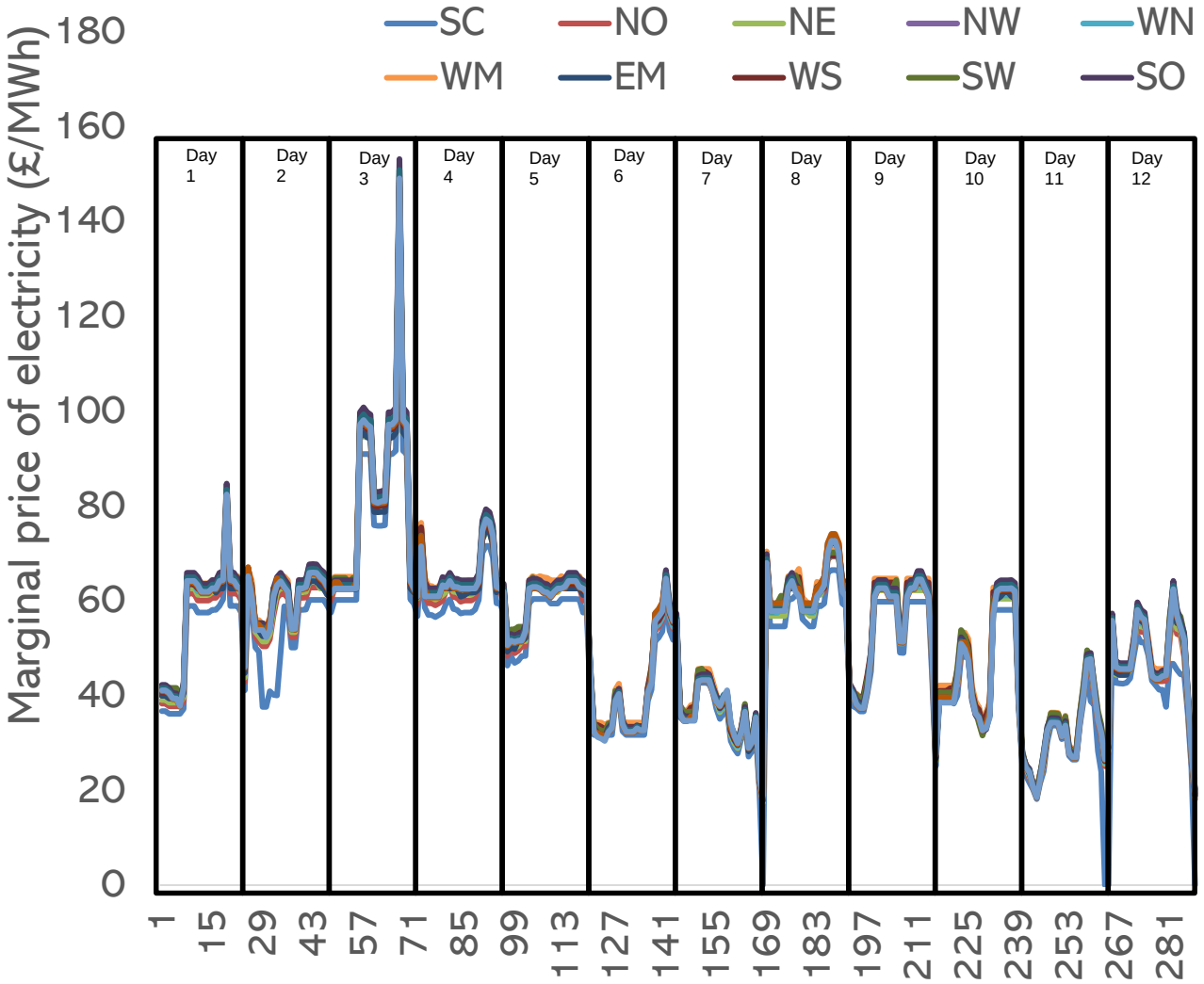


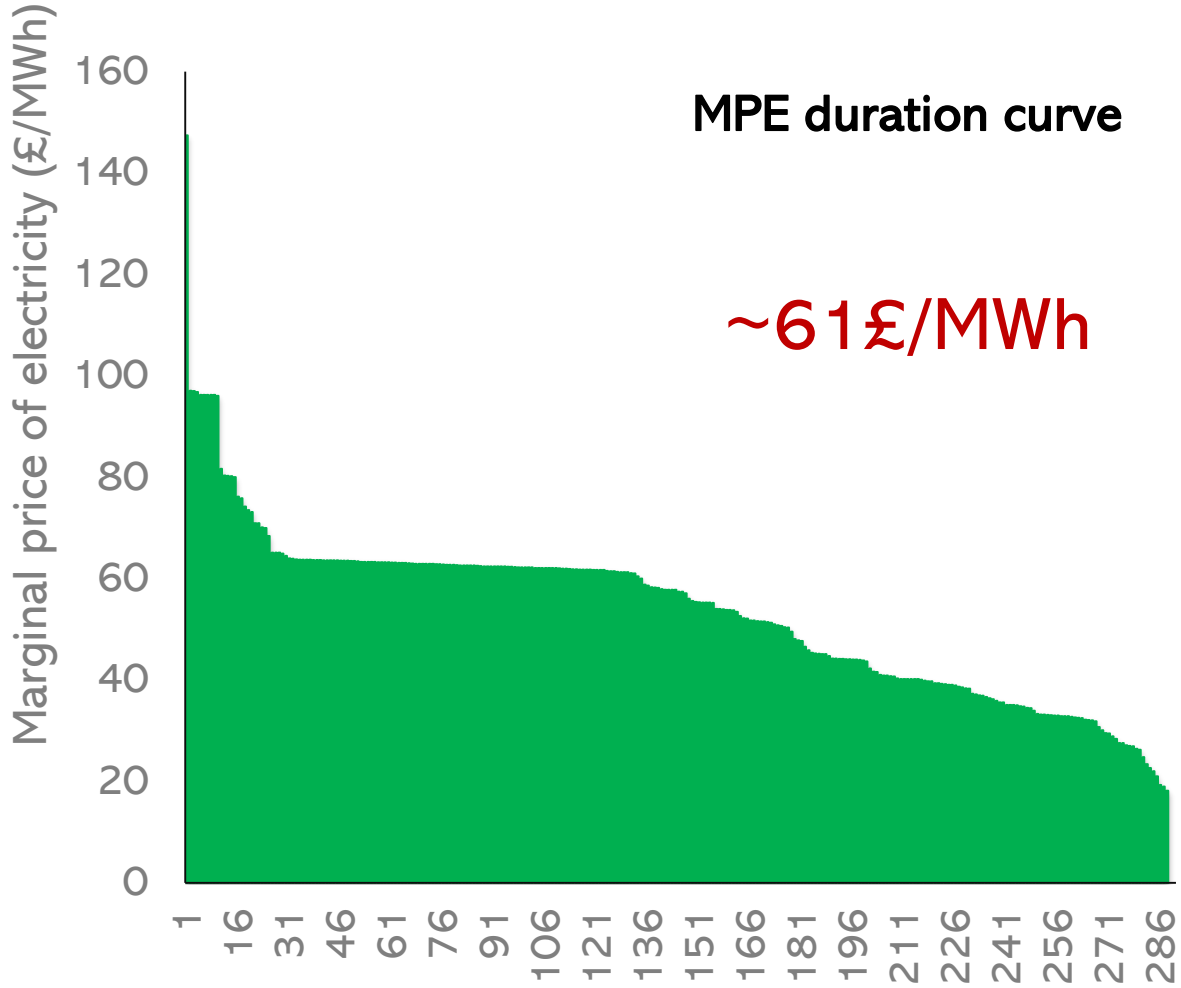


2030 Scenarios & Insights (II)

Separate heat/electricity budgets decarbonisation without heat storage

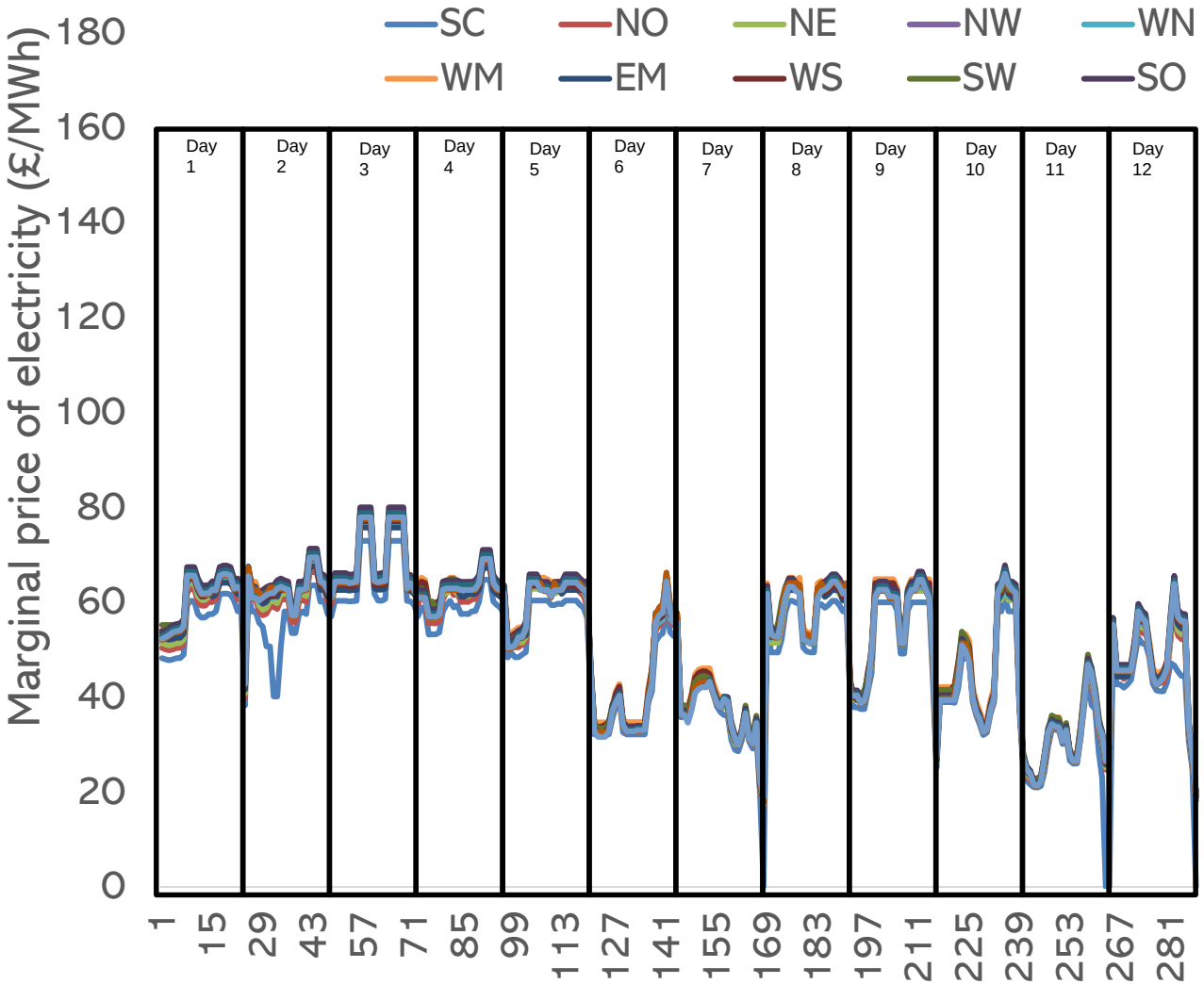
15% reduction on heat emissions



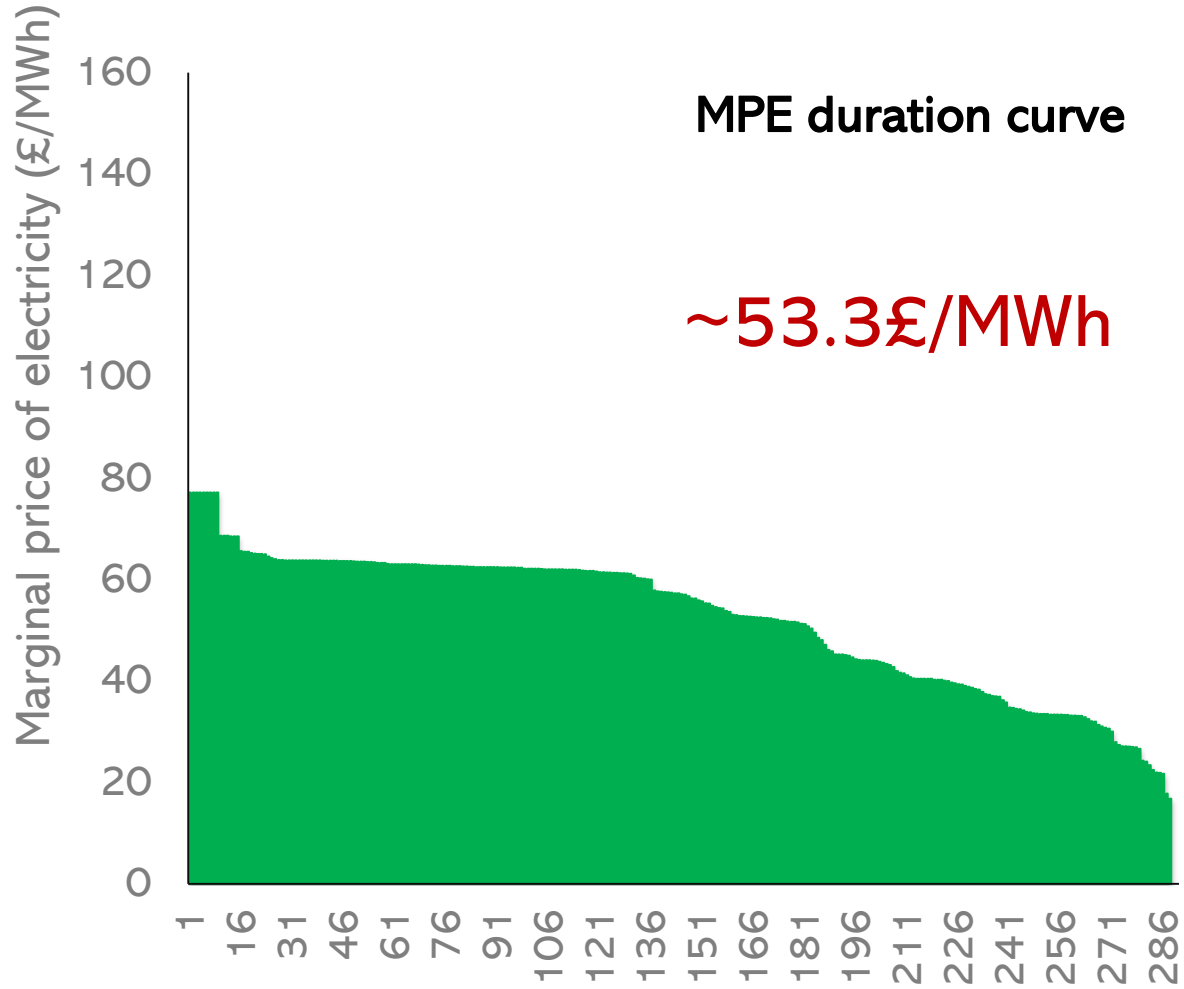


2030 Scenarios & Insights (III)

Separate heat/electricity budgets decarbonisation with heat storage

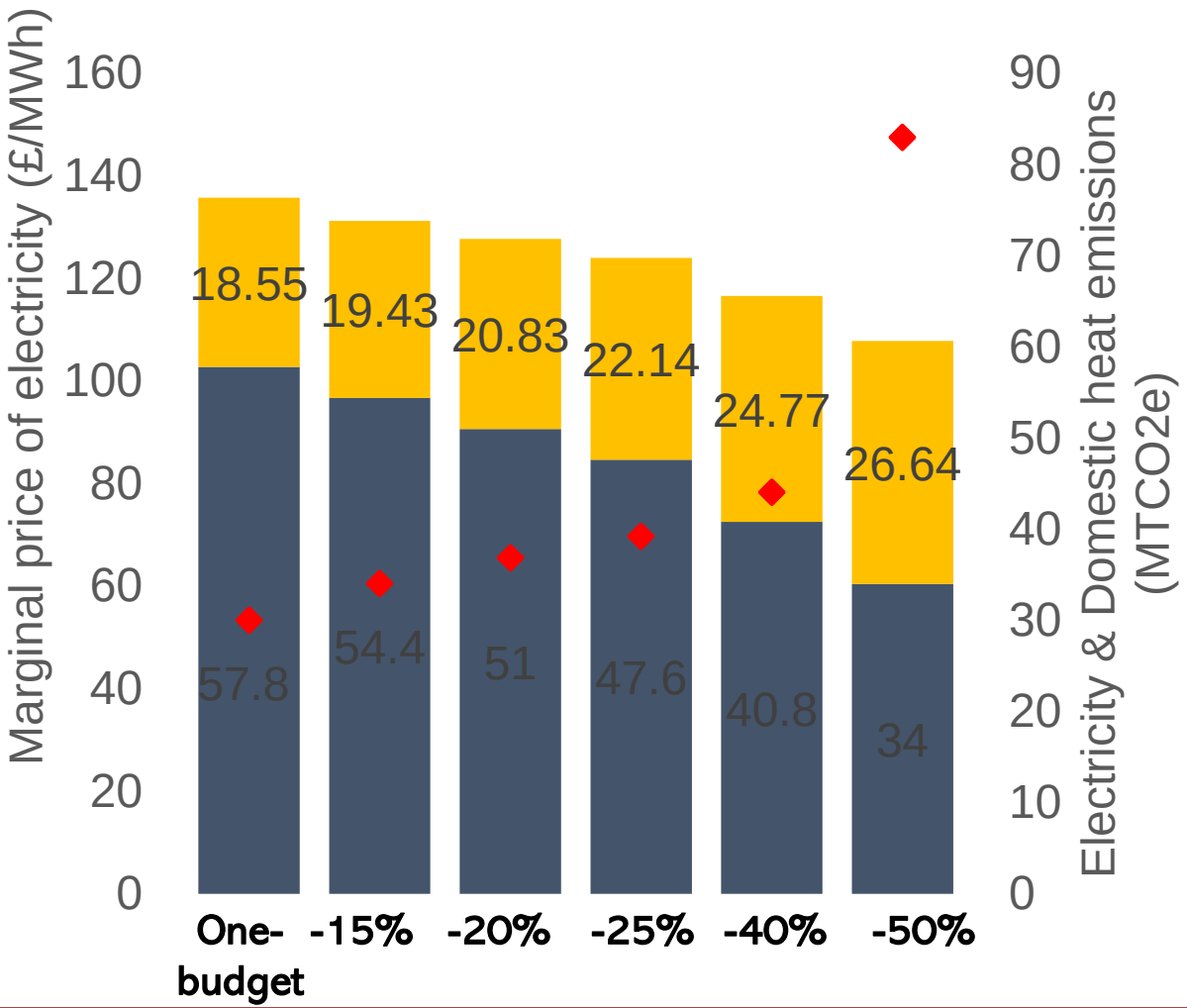


15% reduction on heat emissions

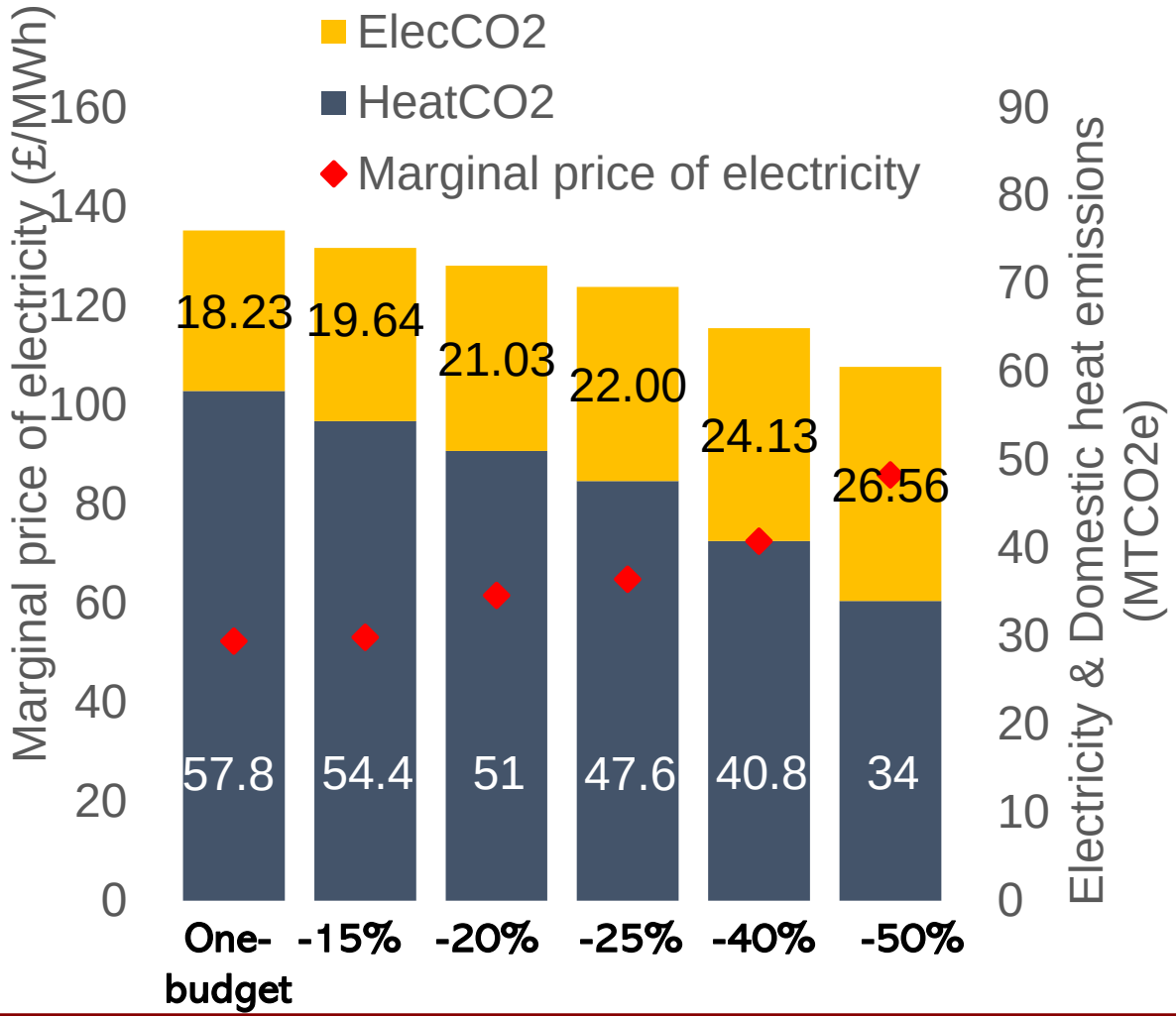


2030 Scenarios & Insights (IV)

Without intraday heat storage



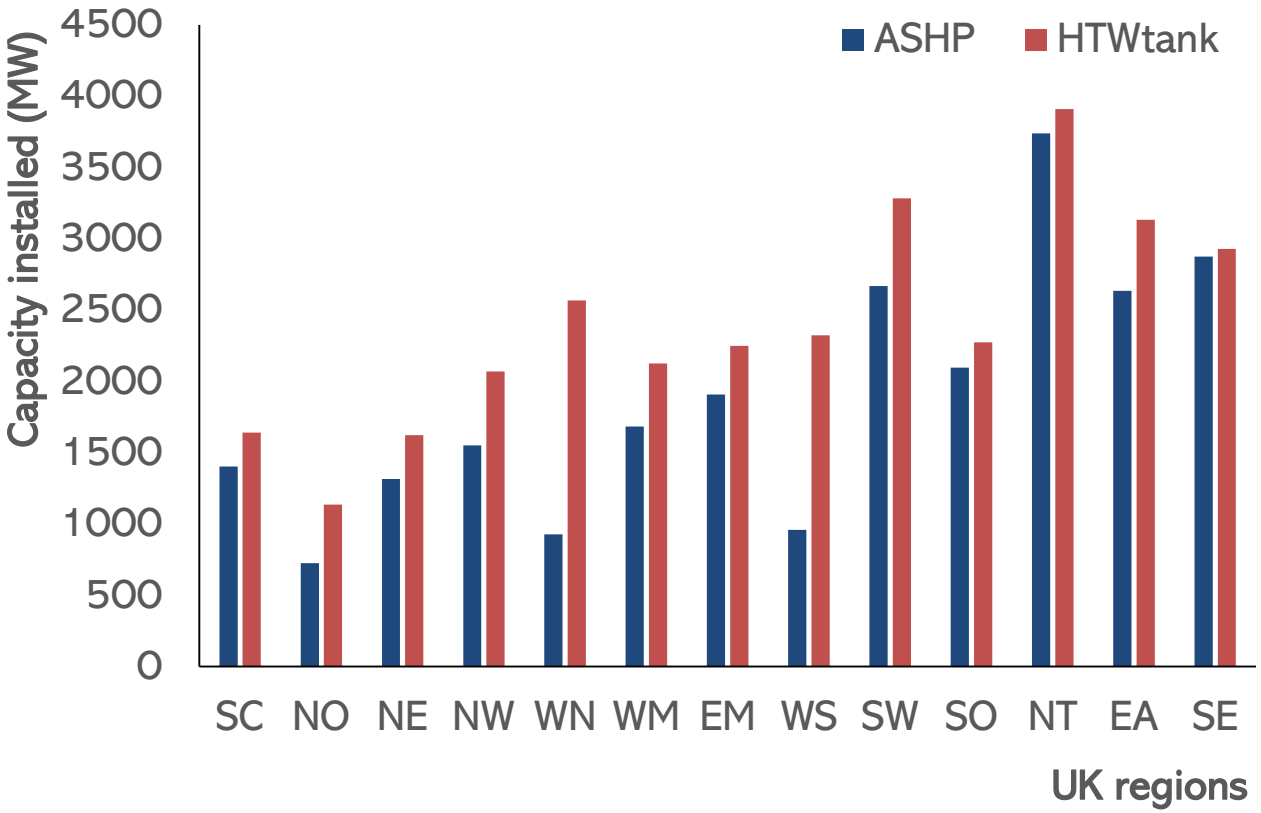
With intraday heat storage



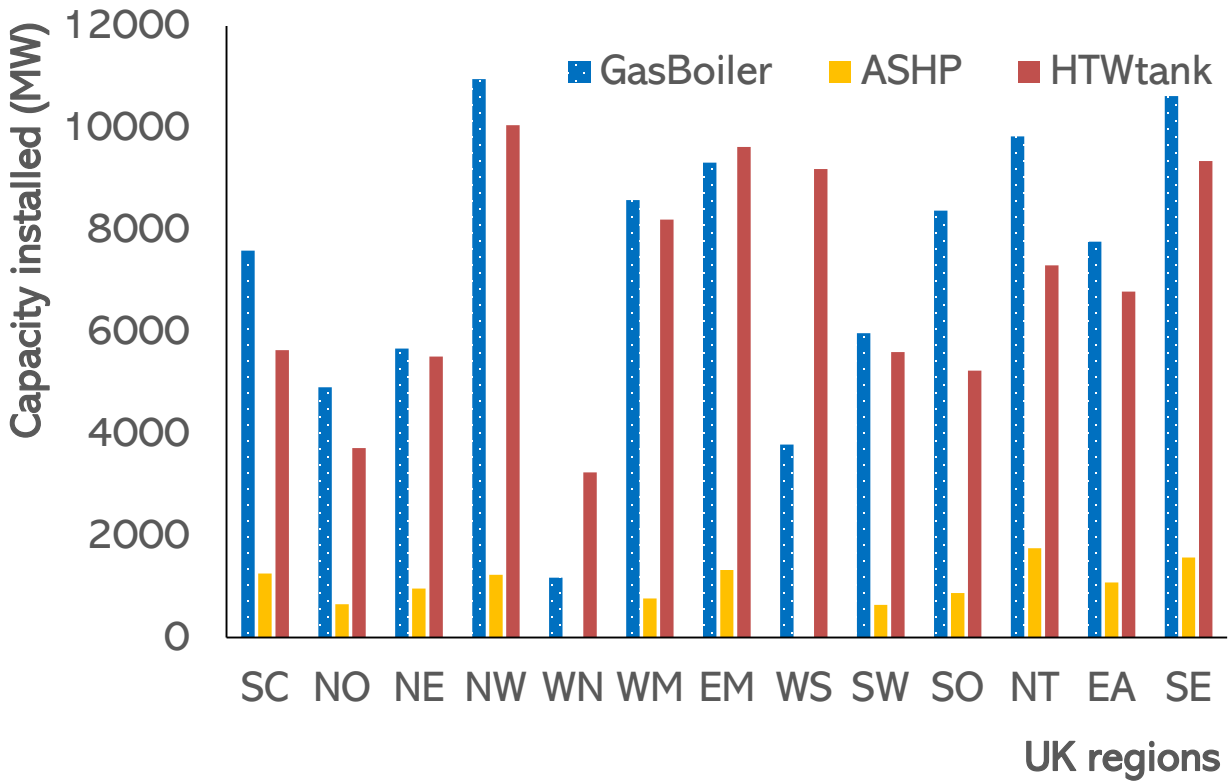
2030 Scenarios & Insights (V)

15% reduction on domestic heat emissions

Off-gas grid heat technologies installed



On-gas grid heat technologies installed



Concluding remarks

Without excessive investments in the electricity grid, **gas** will continue to be the **incumbent heat serving fuel in 2030**

Heat pumps together with **thermal energy storage** technologies are key

Social and geographical characteristics of the regions matter a lot

Need to set **heat budgets** over the remaining policy horizon to guide the transition

Acknowledgements

UKCCS RESEARCH CENTRE

EPSRC
Engineering and Physical Sciences Research Council

Cadent
Your Gas Network

Northern Gas Networks

SGN
Your gas. Our network.

WALES&WEST UTILITIES