CARBON TRUST

THE ROAD TO ZERO-CARBON GRIDS

Flexibility in Great Britain

23 February 2023

Flexibility in Great Britain report

The report set out to:

- Understand the **role and value** of flexibility in meeting 2050 net zero targets
- Develop a robust **evidence base** to support the continued deployment of flexibility technologies
- Provide **direction** to the market and policy makers on the role of flexibility in a cost-effective transition
- Explore the business models for flexibility and the **requirements** that need to be met to make them deliverable and viable
- Delivered in partnership with Imperial College and supported by a **cross-industry** partner group

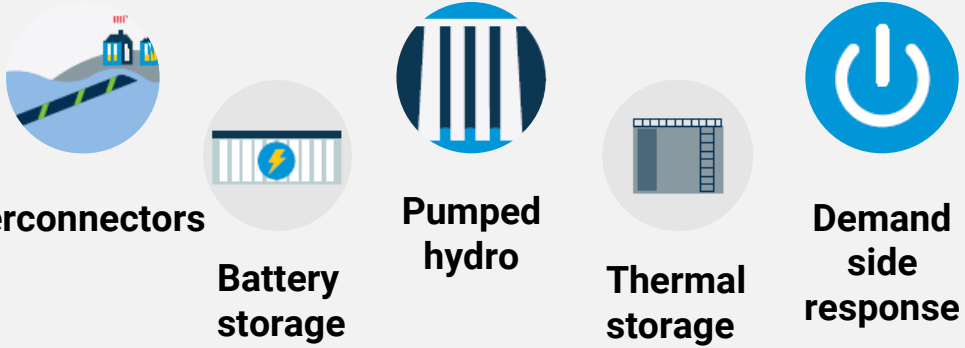
SUPPORTED BY MAYOR OF LONDON

Exploring multiple scenarios allows us to understand the value of flexibility

Three heating pathways were modelled….

Hybrid | Electric | Hydrogen

…with low and high deployment of flexibility



Interconnectors | Battery storage | Pumped hydro | Thermal storage | Demand side response

Sensitivity analysis explored impact of wider system changes..

Impact of hydrogen production route and coupling

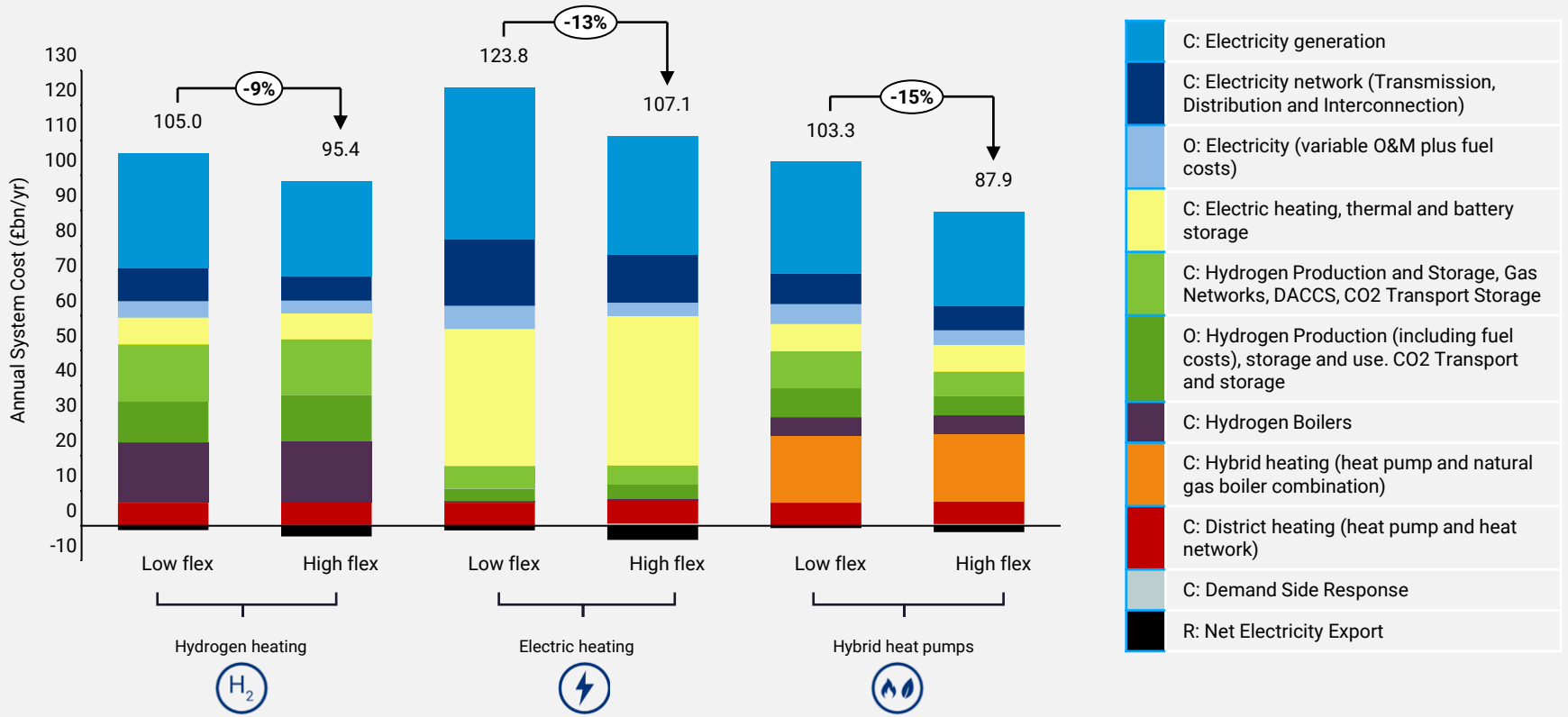
Impact of negative emissions tech availability

Impact of flex tech unavailability

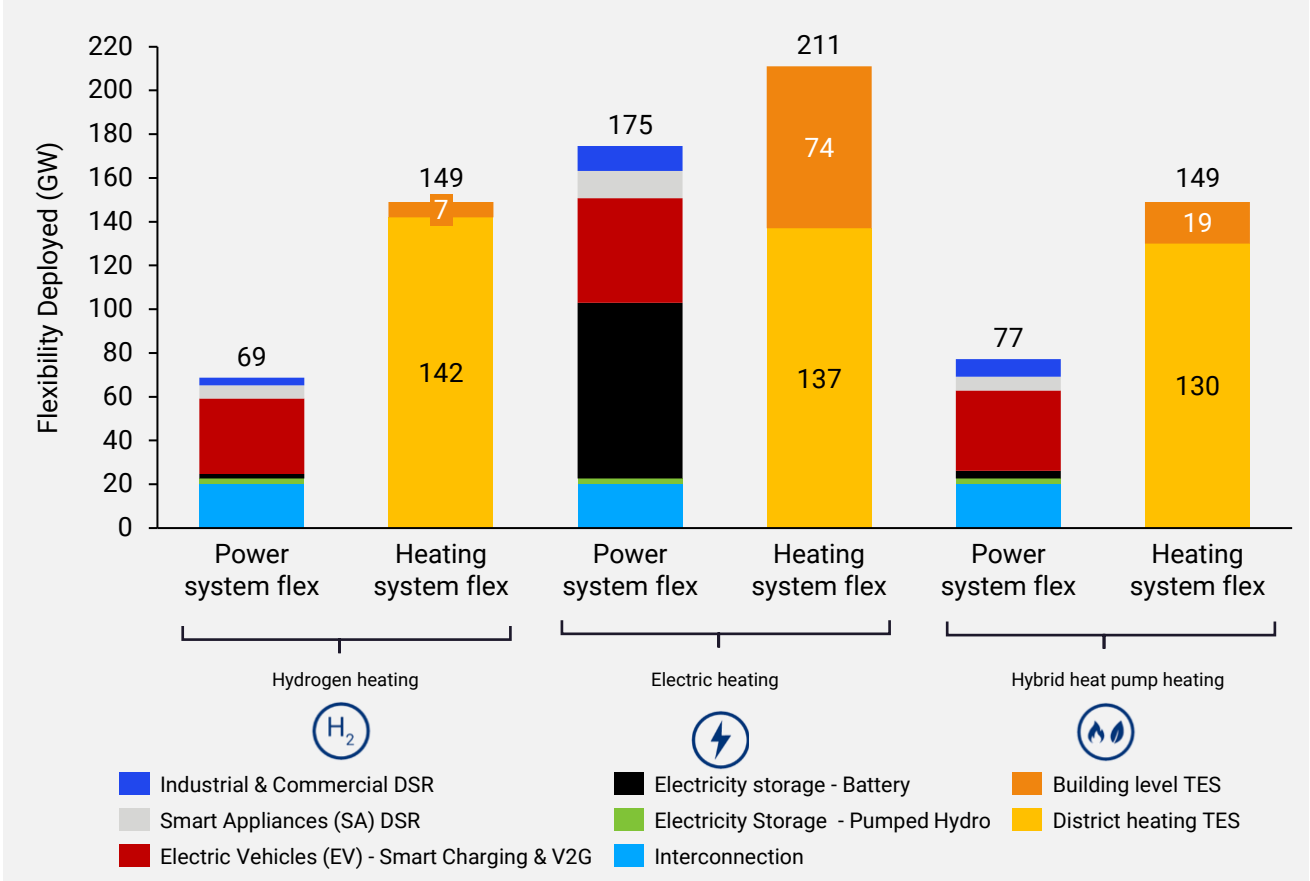
Local vs National Optimisation

Zero vs net negative 2050 carbon targets

Investing in flexibility is a no-regrets decision, generating system costs savings between £10bn – 17bn per year in 2050

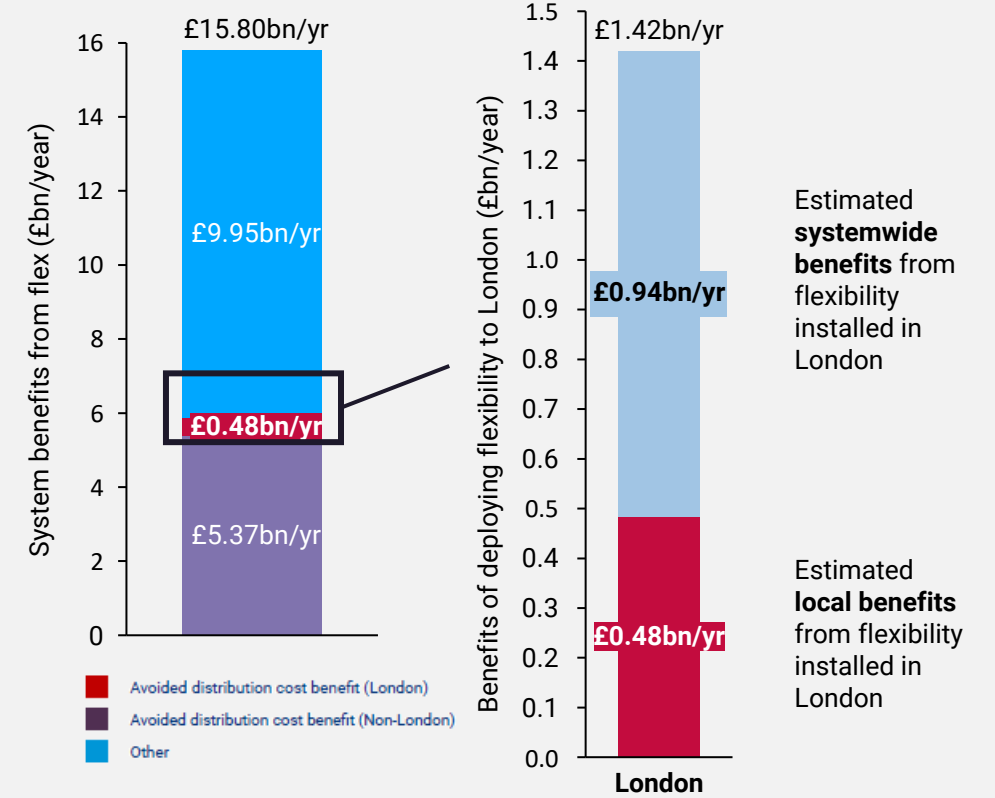


All scenarios deploy a portfolio of flexibility technologies across supply and demand



- A significant proportion of flexibility across all scenarios is embedded within the operation of heating and transport solutions, and appliances
- This flexibility decouples supply of electricity for heating from demand and enables demand for EVs and appliances to be shifted within a day
- Demand side flexibility, from domestic and non-domestic DSR and the flexibility provided by electric vehicles, reduces system costs by up to £5bn/yr

Flexibility is deployed more locally in 2050 and delivers significant value nationally



- The IWES model can apportion costs and savings to different regions.
- Investing in flexibility within the Greater London region delivers £1.42bn/yr savings in 2050
- One-third of this benefit is realised locally as a reduction in distribution network investment
- However, two-thirds of it is actually felt as wider system benefits which may not be recognised at a local level
- This highlights the importance of recognising and rewarding system wide impacts in local decision making

We have used the IWES model to extract the distribution network investment cost at regional level and apportion all other investment costs by region (based on population)

There are a number of key aspects to deliver a smart, flexible energy system

		Domestic DSR	Non-domestic DSR	EVs	TES	Electricity storage	H2 Electrolysers
	Potential 2050 need	6-12GW	3-11GW	35-48GW	800-900GW	5-83GW	1-19GW
	Indicative 2030 target	1GW	1-3GW	2-3GW	GW	5-18GW	1GW
Enablers	Enabling infrastructure						
	Regulatory environment						
	Stakeholder acceptance						
	Level of political support						
Business model	Availability of funding						
	Willingness to pay						
	Financial performance						
	Market opportunities						
Capability to deliver	Resource availability						
	Technical performance / TRL						
	Supply chain and skills						
	Maturity of company landscape						

A smart and flexible system can only be enabled by **digitalisation** of the energy system

An **evolving regulatory environment** combined with potentially low financial gains in the long term creates challenges for business model development

Consumer engagement on flexibility beyond just commercial value is a critical aspect to scaling up flexibility technology deployment

Flexibility should be integrated into enabling infrastructure including low carbon heat and transport solutions from the start

Continued efforts for **new technology development** and innovation focussed on cross vector integration critical to a cost effective transition

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Thank you

https://publications.carbontrust.com/flex-gb/analysis/

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