



centre for
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energy



economia 

Bristol net zero by 2030: Heat decarbonisation

For:



BRISTOL
ONE CITY

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**WORK IN PROGRESS –
NOT FOR WIDER CIRCULATION**



Bristol net zero gap analysis

Study aims: Describe the changes which need to happen in Bristol to reach net zero greenhouse gases (scopes 1 & 2) by 2030.

Identify the conditions for success which will need to be in place by (or before) 2030 for these changes to prove possible.

Propose near-term actions and initiatives which will be needed to create these conditions.

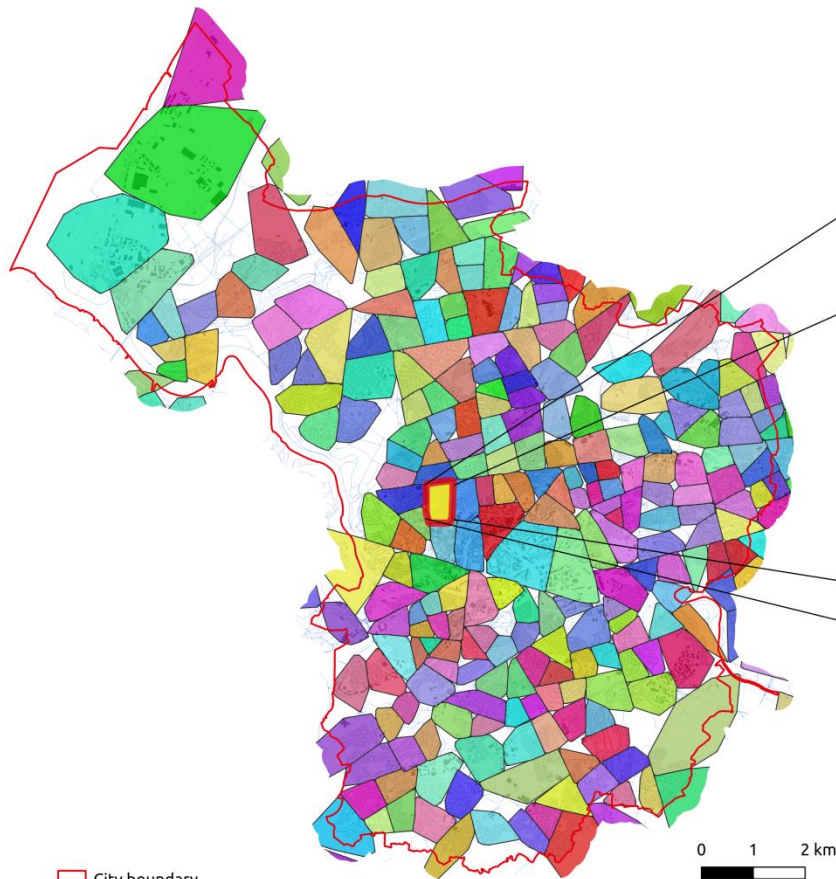


Heating decarbonisation (phasing out gas): Analysis & results I

- Two heating options for decarbonisation by 2030: replace every gas boiler with either connection to district heating network (fed by large heat pumps) or individual building heat pumps
- Retrofit insulation to reduce heat demand (to optimise sizing of heating option)
- Analysis finds least-lifetime-cost solution to decarbonise heat & hot water for every building (from 3D model of each building)
- Solutions are not necessarily 'cost effective' in current conditions (which aren't designed for heat decarbonisation)

Heating decarbonisation (phasing out gas): Analysis & results II

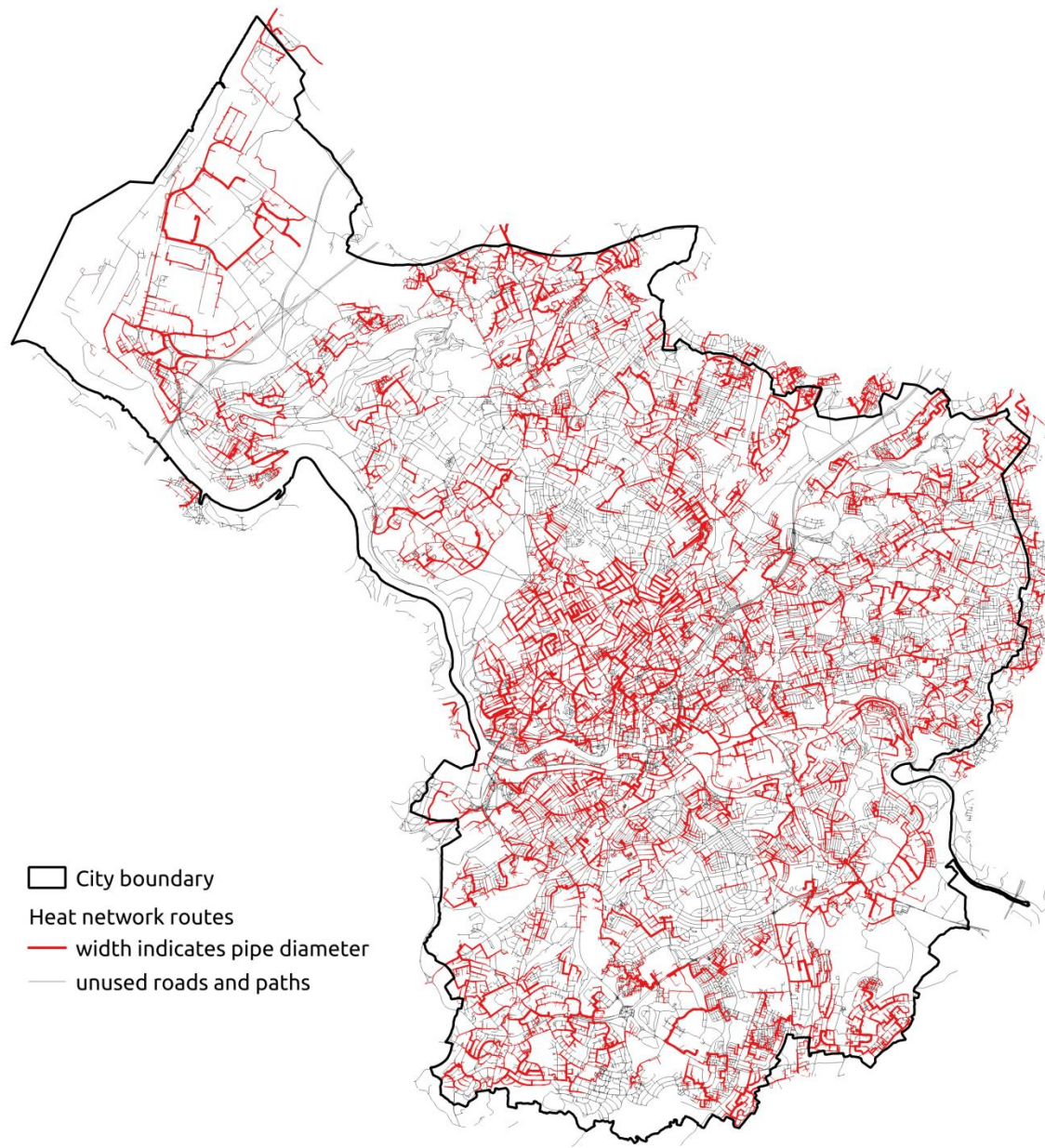
Complexity of optimisation computations
requires analysis on cluster-by-cluster basis



- City boundary
- Buildings
- Roads and paths
- clusters



- Cluster 183
- Network supply locations
- Network in cluster 183
- Networks in other clusters
- Networked demands
- Heat pump demands





Heating decarbonisation (phasing out gas): Analysis & results III

Table 1: Heating & insulation solutions for least cost heat decarbonisation (count by 2030)

Type of property	District heating	Complex insulation upgrade	% not insulated but suitable*	ASHP (individual building)	Complex insulation upgrade	% not insulated but suitable*
Residential	62,000			93,500		
Non-residential	5,800			1,000		
Total	67,800	4,500 (7%)	18%	94,500	68,500 (72%)	0.1%

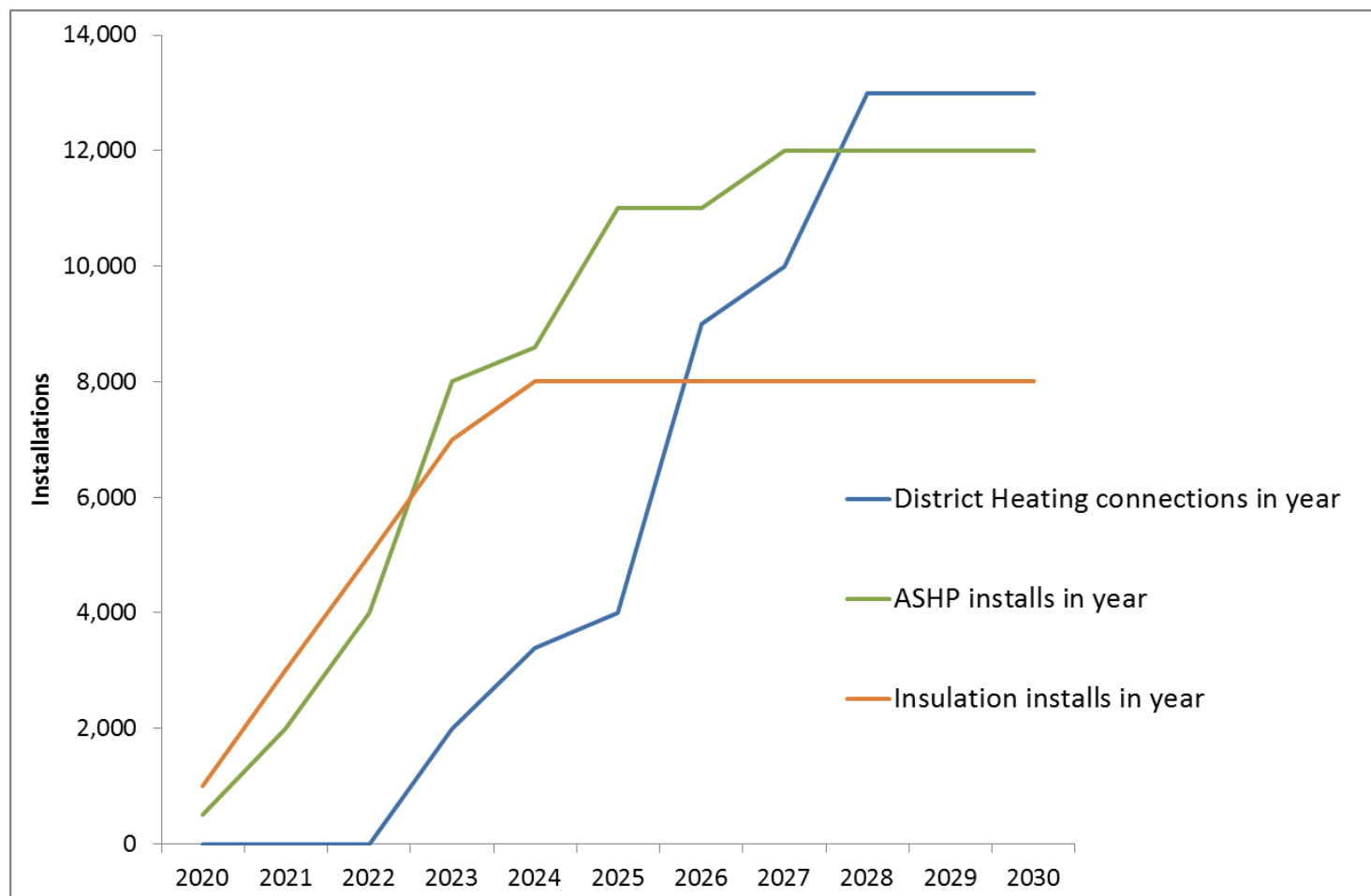
* remainder not suitable for complex insulation

Table 2: Total upfront capital investment required for heat decarbonisation scenario

	District heating	ASHPs	Insulation
Total cost of installation (£m)	£1,950m	£580m	£650m
Average cost per property (£)	£29,800	£6,200	£9,000
Average heat demand per property (after insulation, if applied)	25,660 kWh	7,660kWh	-5,500 kWh

Heating decarbonisation (phasing out gas): Analysis & results IV

- Unprecedented rates of installation with some gas boilers being 'scrapped' ahead of time. Electricity network issues to address



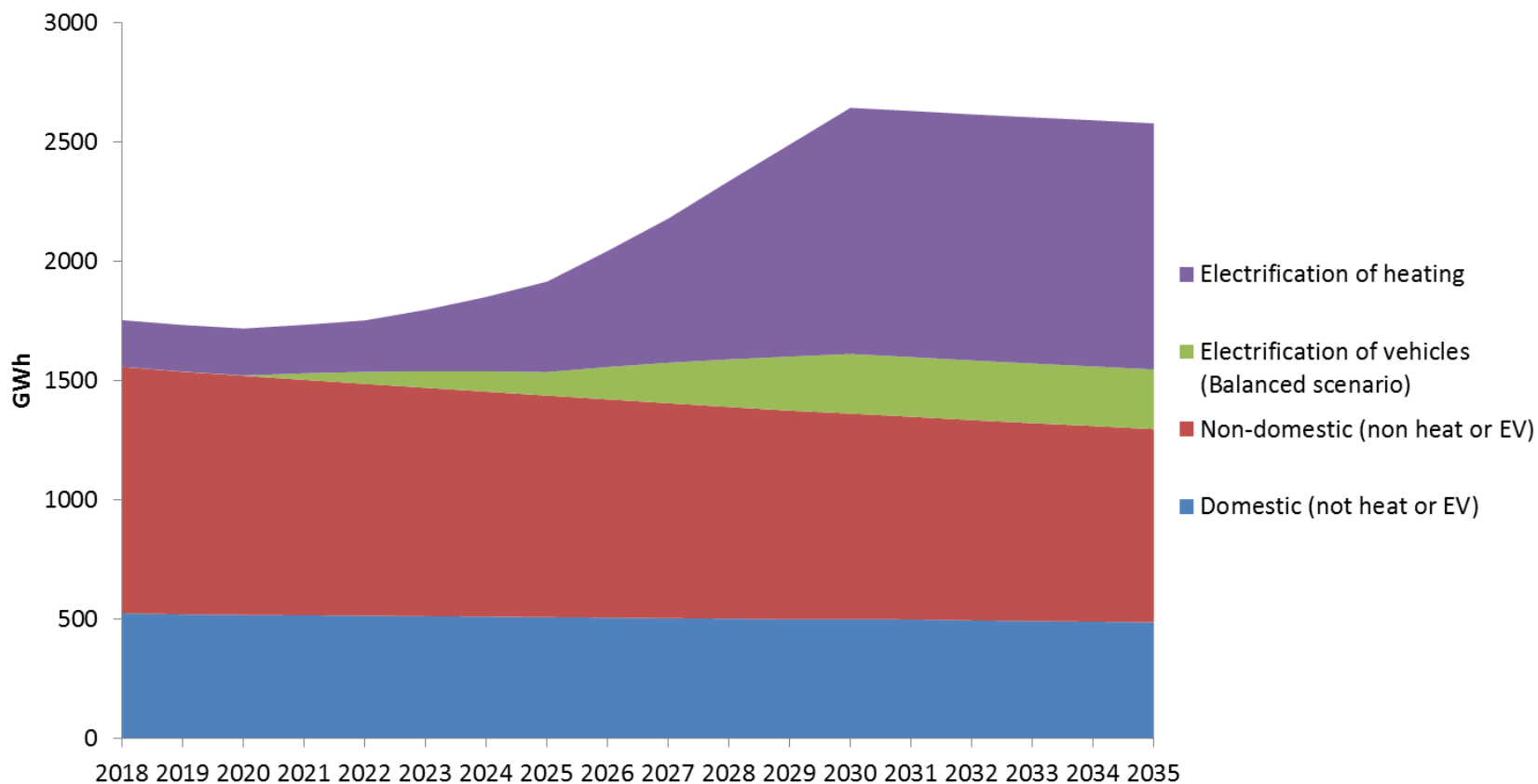


Heating decarbonisation (phasing out gas): Analysis & results: conditions for success

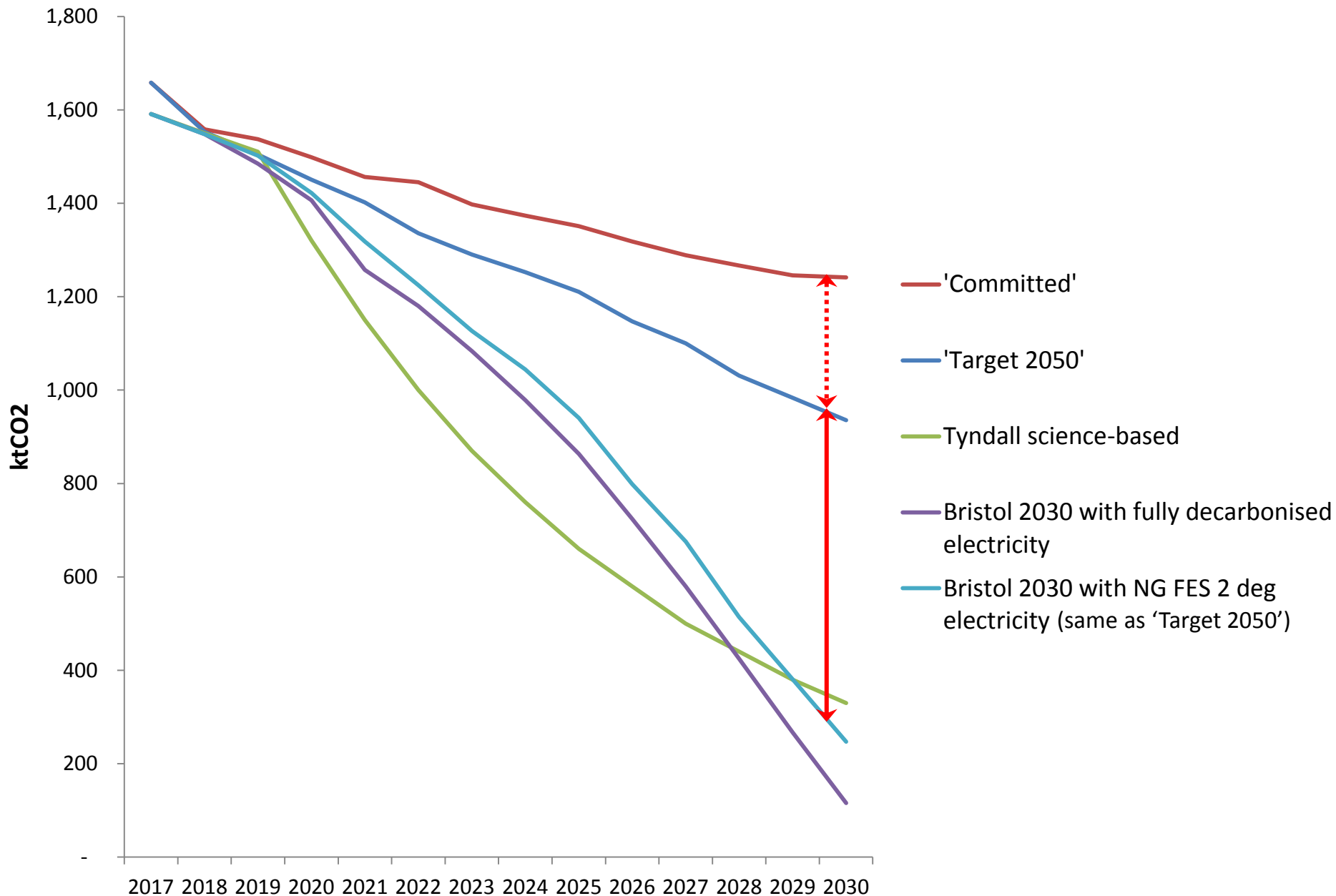
- Funding for investment in heat networks and to address cost differentials with gas
- Planned programme of works across city with major building owners aligning their heat decarbonisation plans
- New powers and regulations to phase out gas boilers, require heat network connections, protect heat consumers, and drive retrofit
- Skills upgrade and training for city's heating engineers and building contractors (c. 70,000 person years of work)
- Redesign of national fuel cost subsidies for vulnerable households
- Upgrade of electricity distribution network ('ahead of schedule')
- Public and business 'end of gas' buy-in programme, led by exemplars, public sector leadership, and evidence of job creation opportunities

Power demand, distribution & generation: Analysis & results I

- Electricity demand likely to increase by 50% by 2030 with heat and vehicle electrification scenarios
- Local electricity network upgrade and smarter management of demand needs accelerating of current 'schedule' (c. 2040)

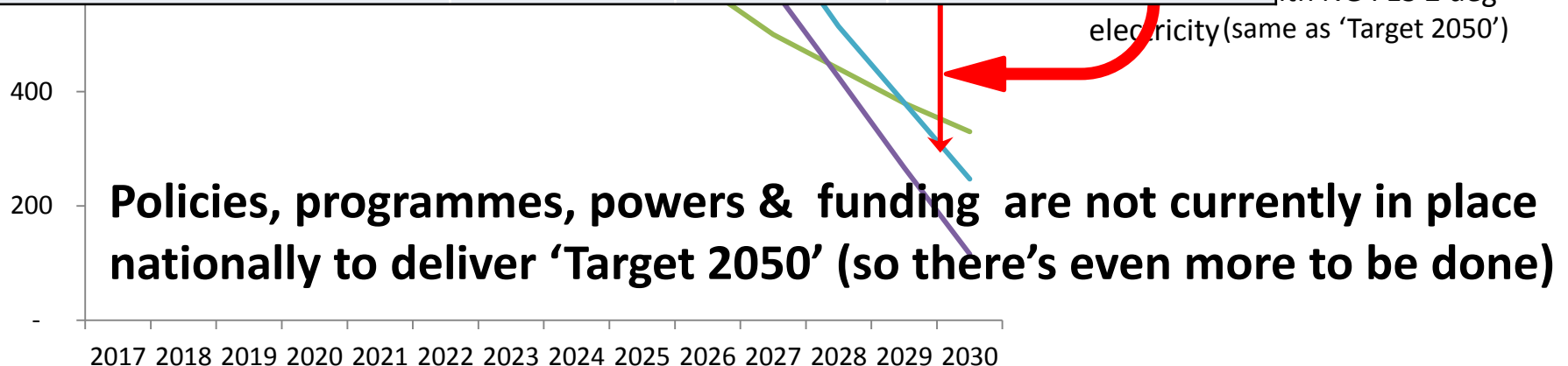


Bristol carbon emission trajectories to 2030



Closing the gap: scaling up for net zero by 2030

Measure	'Target 2050' (by 2030)	'Bristol 2030' (by 2030)	Scale up necessary for net zero by 2030 (cf 2050)
Individual heat pumps	27,000	96,000	3.5
District heating connections	21,000	68,000	3.2
Insulation upgrades (solid wall etc)	73,000	73,000	Same (but still >10 times higher than current rate)
Electric vehicles	57,000	124,000	2.2
Vehicle mileage reduction	-5%	-40%	8
Solar PV installations	c.200MW	>350MW	>1.5





Contact

Simon Roberts, Centre for Sustainable Energy
simon.roberts@cse.org.uk