EnergyPath Networks in Bury

CATAPULT
Energy Systems

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ETI's Smart Systems and Heat Programme

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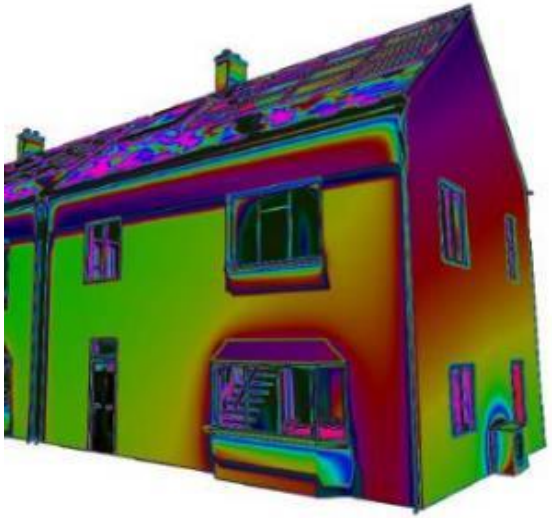

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HITACHI Inspire the Next

"Creating future-proof and economic local heating solutions for the UK"

- Connecting together – the understanding of consumer needs and behaviour with the development and integration of technologies and new business models into…
- Delivering enhanced knowledge amongst industry and public sector
- Resulting in industry and investor confidence to implement from 2020 which enables a UK heat transition

The Energy Systems Catapult will deliver Phase One of the SSH programme as a supplier to the ETI following the transition of the SSH programme team to the Catapult. From 2017 the Catapult will be responsible for delivery of Phase Two of the programme independently of the ETI.

The Purpose of EnergyPath Networks

Strategic, spatial planning to meet future carbon targets in a local area – focusing on decarbonising building energy demands, specifically heat

- Takes a ‘systems’ view
    - What? Where? When?
    - For investments in Buildings, Networks and Energy Production
    - Across Heat, Electricity, Gas

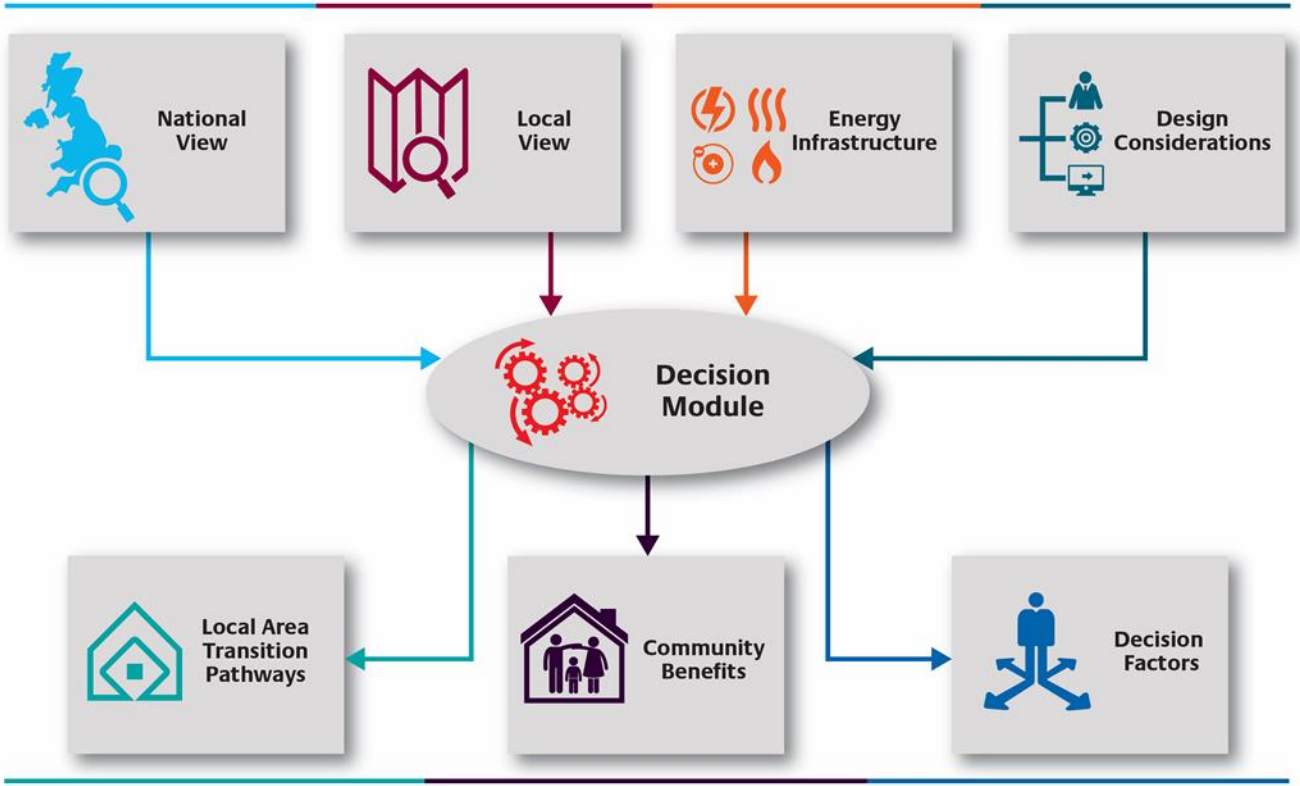
- Supports proactive planning and investment
- Identifies local energy network build and reinforcement
- Aids consensus building - stakeholders and local communities
- Works on a cost to society basis, so without current subsidies and taxes

Why is EPN different?

EnergyPath Networks is unique in combining four aspects of energy system planning in a single tool:

- A multi-vector approach which allows trade-offs between energy vectors / networks to be understood.
- The ability to understand the spatial relationships between buildings and the networks that serve them so that costs and benefits correctly represent the area being analysed.
- Use of an optimisation process to compare a large number of combinations of options (over 17,000 building pathways in Newcastle)
- Optimisation for multiple analysis areas within the study area and for 4 separate time periods out to 2050.

Introduction to EPN



Outputs for Bury

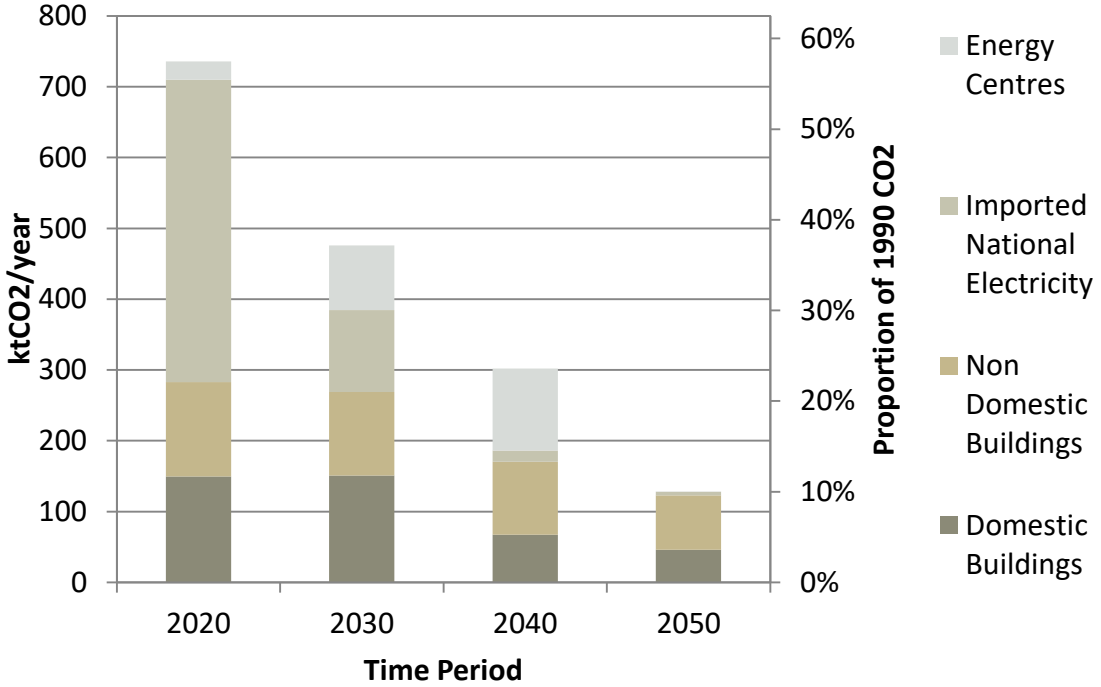
- Our work is an iterative process, constantly improving and refining based on stakeholder feedback, model improvements and new datasets
- The next few slides show some example outputs from Bury
- These are from the mid stage of the project and do not necessarily reflect final results.
- We have done further modelling with some improvements to data and tighter carbon targets.
- We are currently working to produce and gain consensus on a local energy strategy for Bury, based on the findings of this work.

Future System - Carbon

As an example, reducing Bury's 2050 in scope emissions to **128kT** CO_2 would give a **90%** reduction on in scope 1990 level.

The remaining in scope 2050 CO_2 emission is modelled to consist of:

- **76 kT** from non domestic buildings
- **46 kT** from domestic buildings
- **5 kT** in the grid electricity

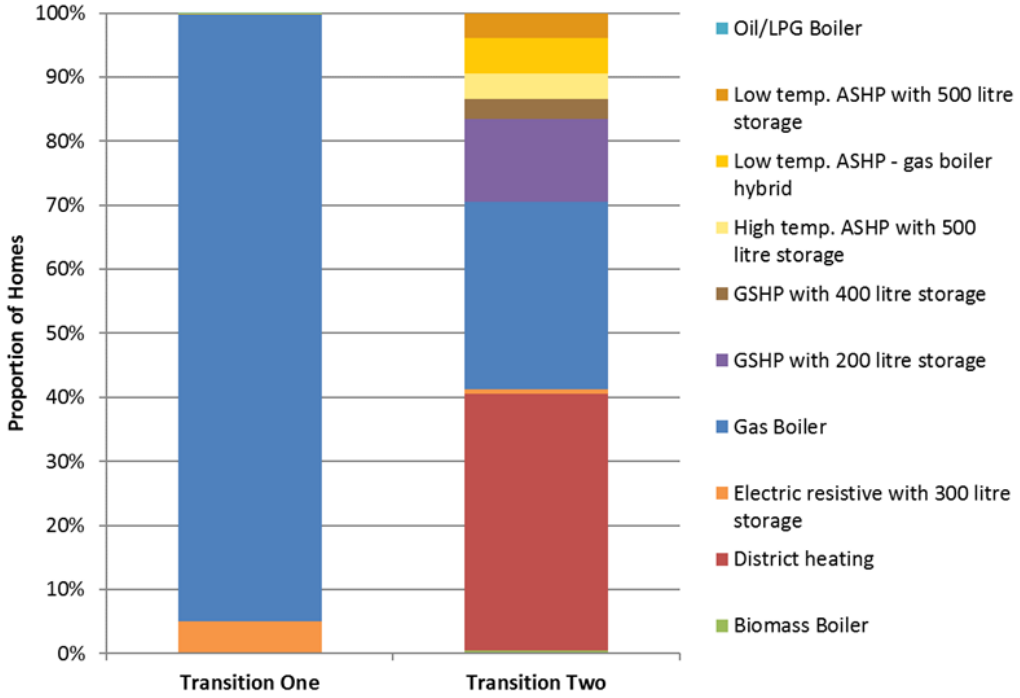


Future System - Domestic

To reach the proposed emission level, domestic heating systems in Bury would have to radically change between now and 2050

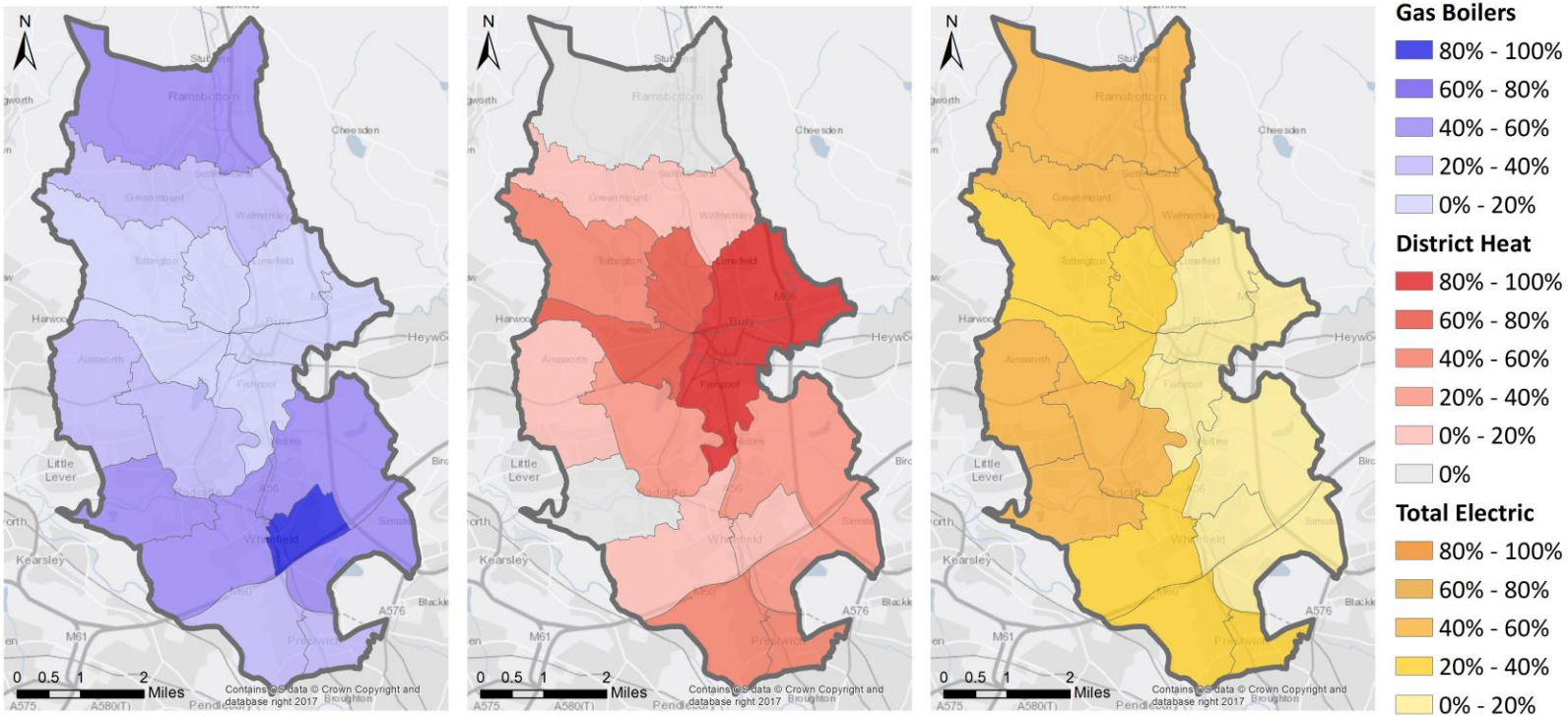
Our modelling suggests the most cost effective pathway would be for:

- **30%** of domestic buildings to stay on gas
- **40%** to switch to district heat
- **30%** to use an electric heat pump option



Domestic Buildings – Transition two

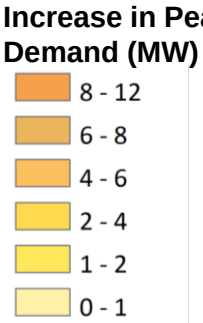
The modelled type of domestic heating systems varies significantly across Bury



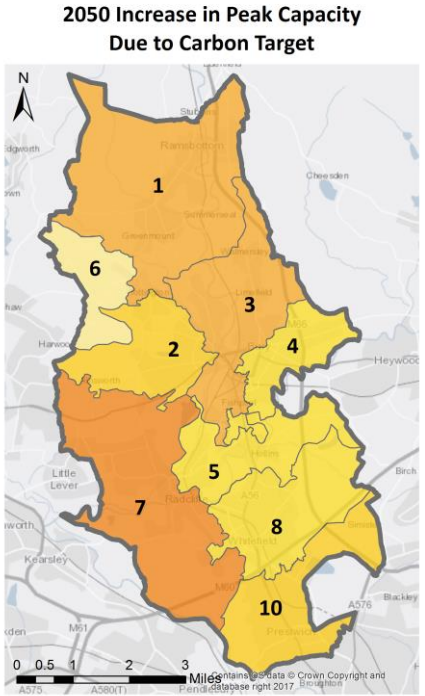
Electricity networks – peak demand

The model shows peak electricity demand in Bury increasing by 22% (from 274 MW to 333 MW) by 2050

- Approximately half of this increase (**10%**, to **301MW**) would occur without the local carbon target
- The increase in peak due to the target would be highest in the area of the Radcliffe primary substation
- This area sees the greatest deployment of domestic electric heat options



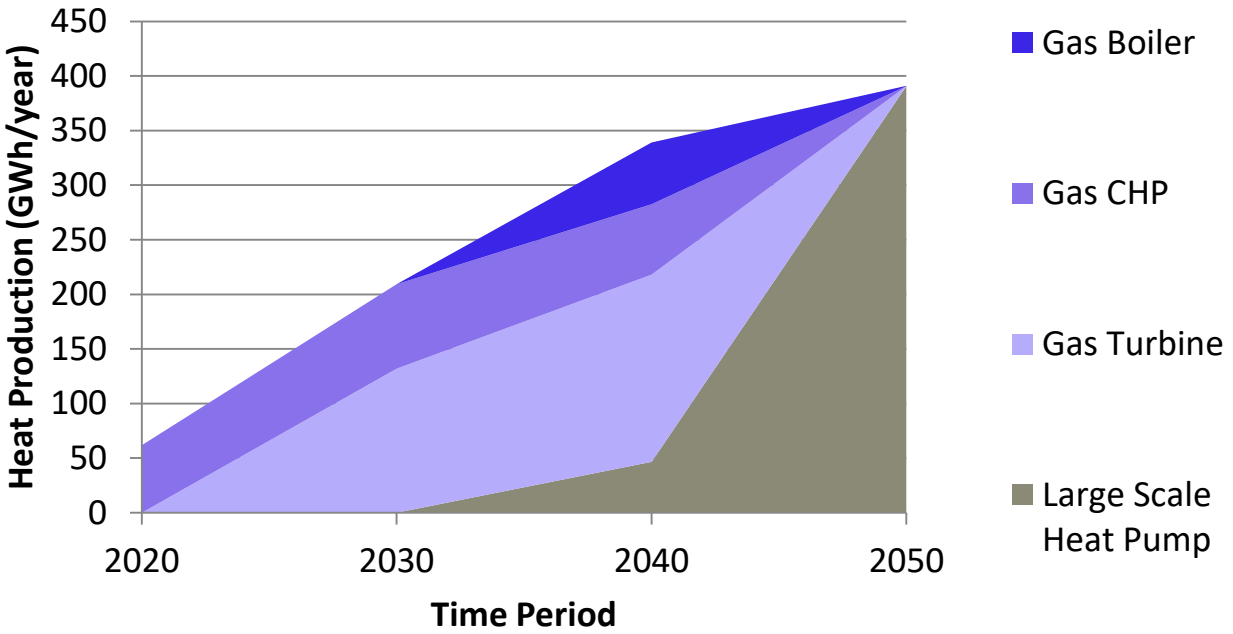
Area	33/11KV Substation
1	Holt St
2	Woolfold
3	Chamberhall
4	Bury Town Centre
5	Dumers Ln
6	Harwood
7	Radcliffe
8	Moss Ln
10	Prestwich



Heat Networks - Technologies

By 2050 the heat in the district heat networks will need to be almost zero carbon

- Future projections of carbon in nationally generated electricity support using it to generate this heat, using large scale electric heat pumps



Sensitivity Analysis

- National energy strategy – ETI's ESME Clockwork / Patchwork scenarios
- Domestic Battery Storage
- Lower carbon hydrogen/gas blend
- Monte Carlo of technology and network costs
- Carbon Max – an earlier, tighter carbon target
- Targeted insulation for fuel poverty
- Changing energy prices
- **Different 2050 carbon targets**

The cost of different carbon targets

1. Without a local carbon target we model Bury achieving a 65% carbon reduction from 1990 by 2050 (for in scope emissions). The greatest possible reduction is modelled to be approx. 96.5%.

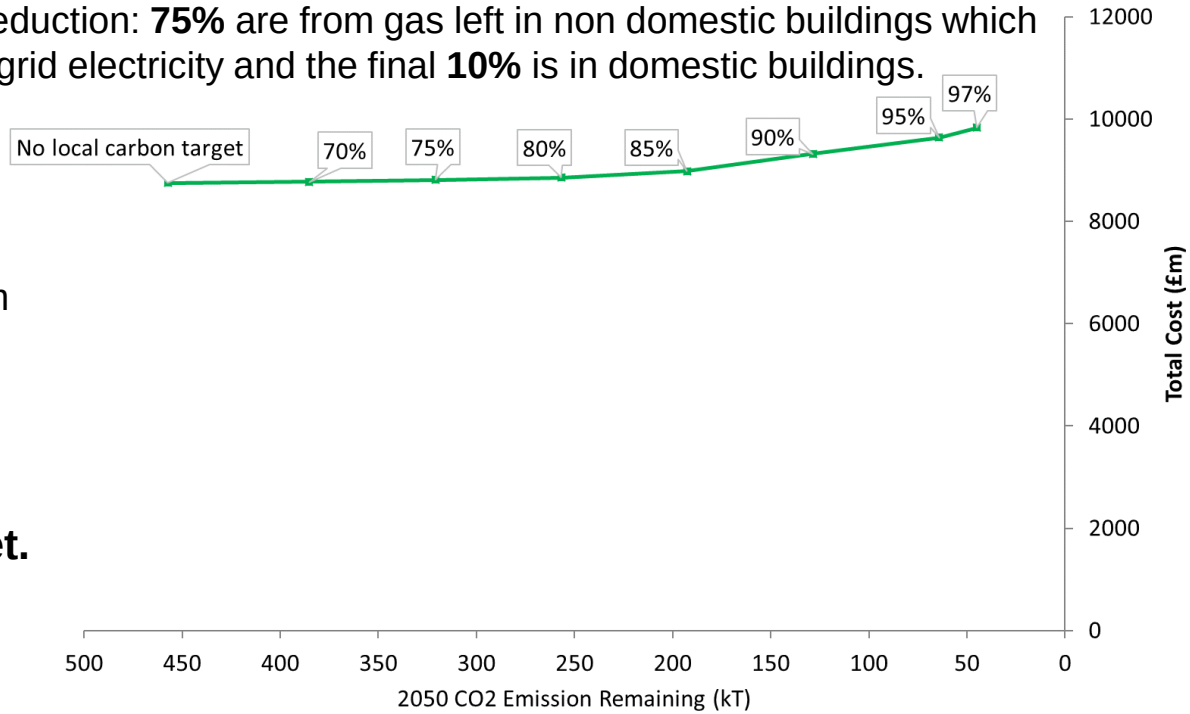
For the remaining emissions in the max reduction: **75%** are from gas left in non domestic buildings which have no low carbon option. **14%** is in the grid electricity and the final **10%** is in domestic buildings.

2. The greater the carbon reduction the greater the cost.

~£1.1b increase between having no local carbon target and achieving the maximum carbon reduction.

3. The cost of the local energy system between now and 2050 is large regardless of a carbon target.

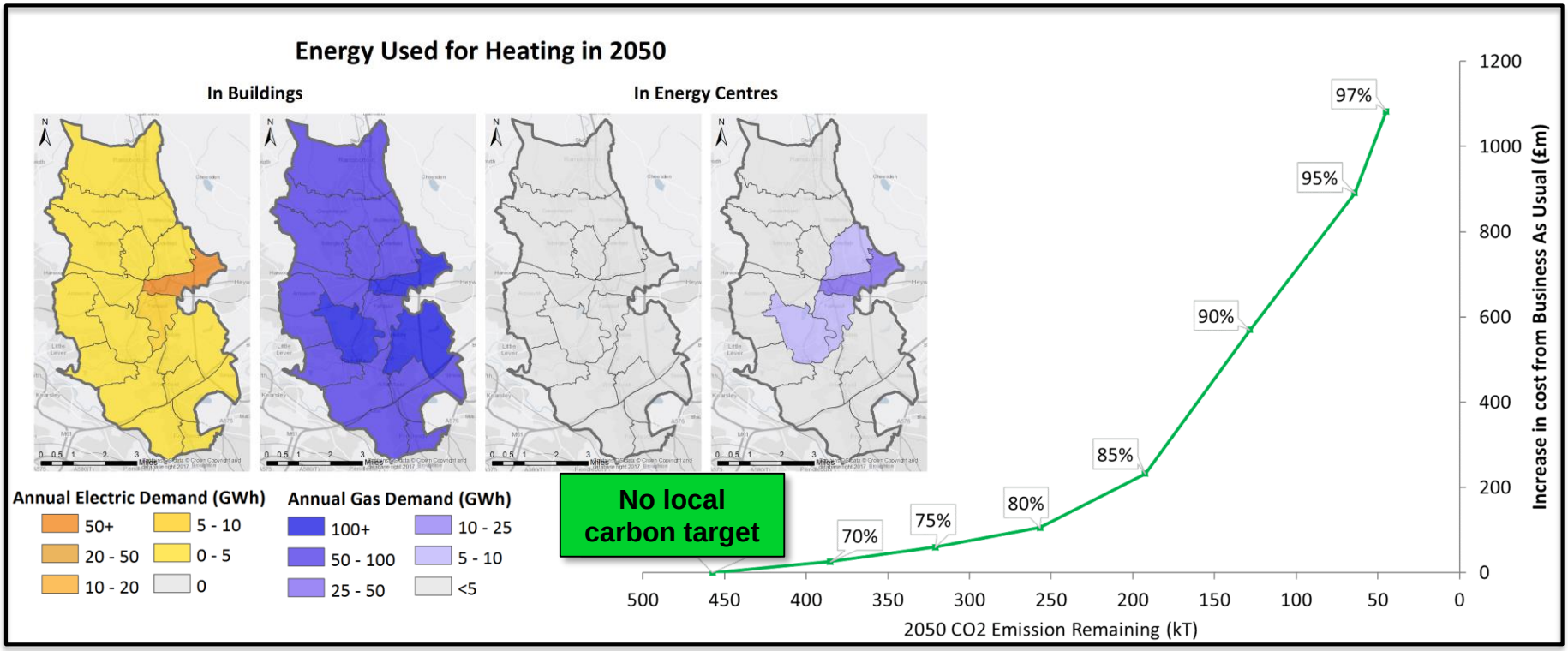
So the additional costs of the target need to be considered in context.



4. With no local carbon target most heat would be provided by gas.

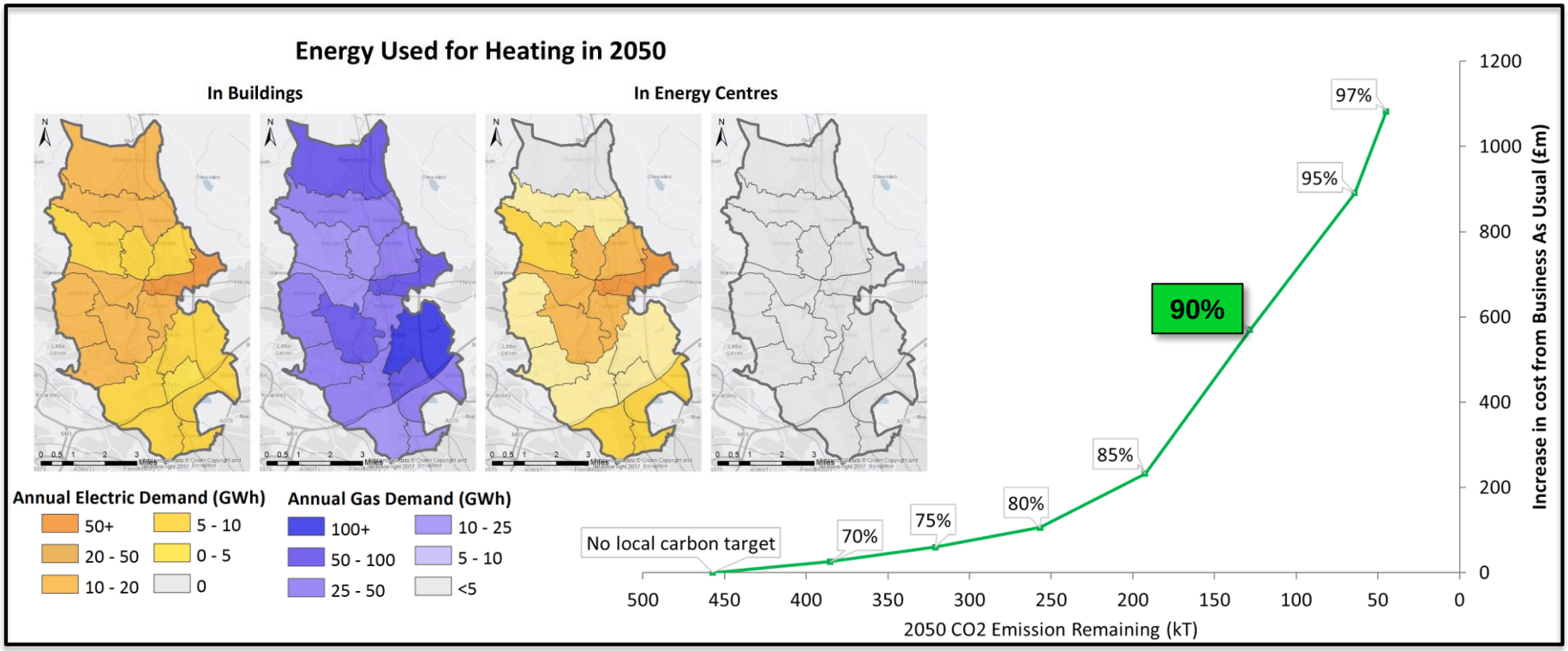
Some electric options in the domestic and non domestic buildings which cannot use gas

Limited gas fed heat network in the areas around Bury town centre and Radcliffe – **3900** domestic buildings, **640** non domestics connected. Energy centres also used for electricity production.



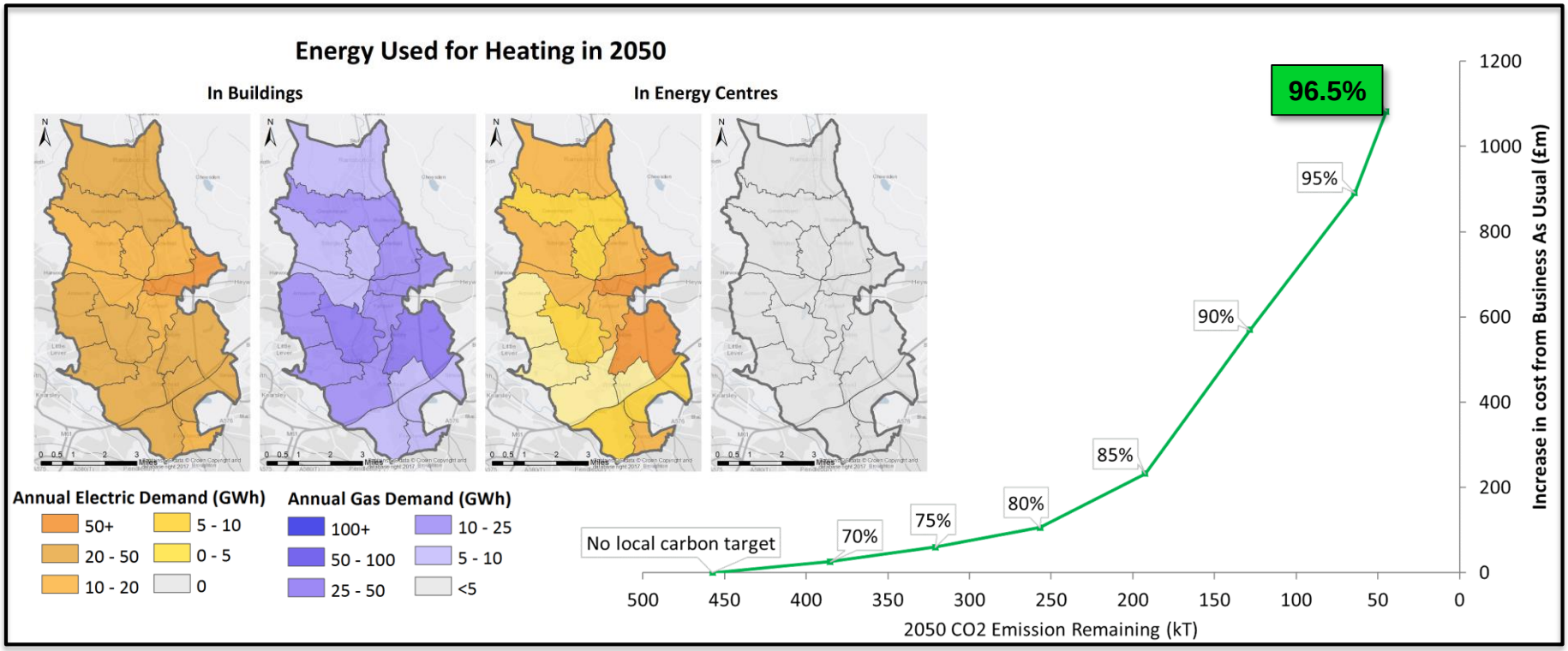
5. By 90% two thirds of domestic buildings have switched to low carbon energy sources.

This is the first point at which you begin to see major uptake of building level electric options - domestic electric heat pumps now provide heat for **28,000** homes. Domestic buildings connected to district heat increases to **38,300**. **1,340** non domestic buildings are also connected.



6. To go from 95% to the modelled 96.5% maximum involves switching more non domestics to a heat network.

6400 non domestic buildings are now connected to a heat network. Some large homes previously on hybrid heat pumps are also connected for the first time. Going from **95%** to **96.5%** costs a similar amount extra as going from a **70%** to **85%** carbon reduction.

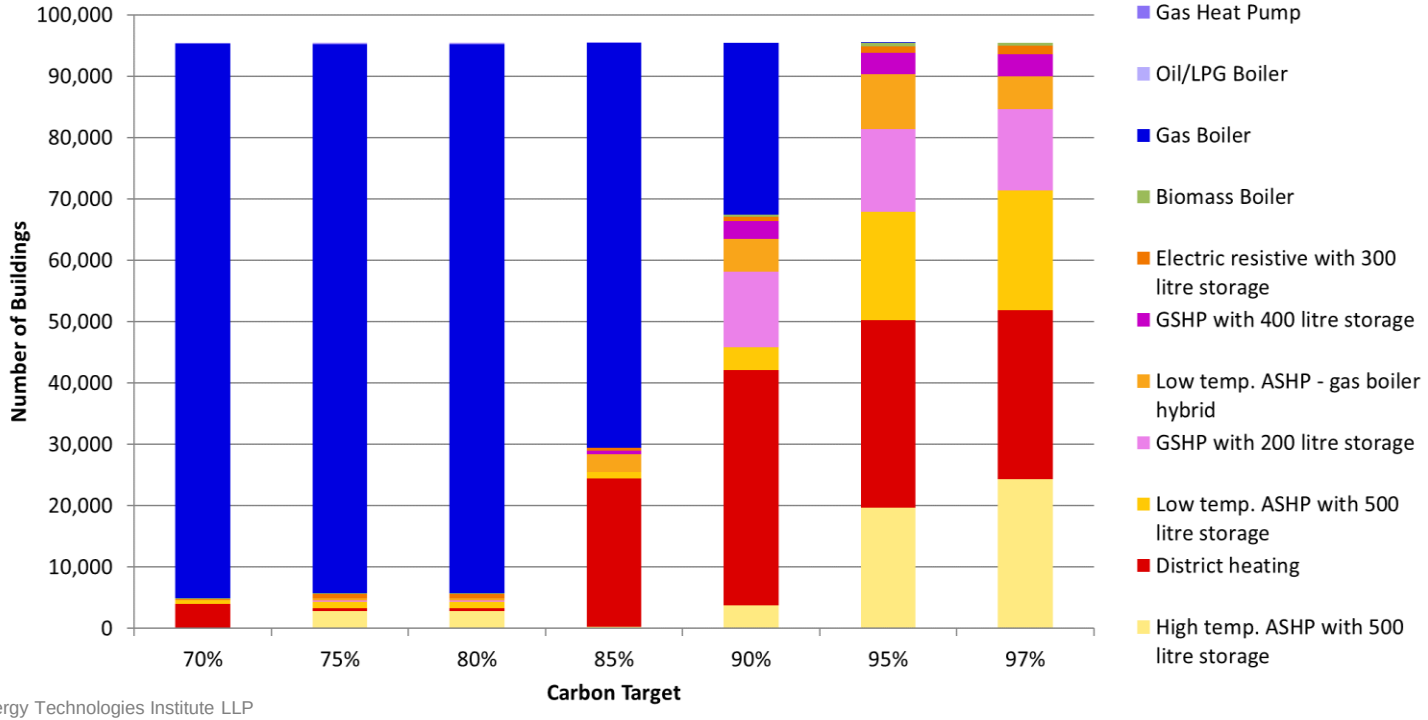


Final domestic heating systems by carbon target

7. As shown, domestic heating systems would need to change significantly at an 85% carbon target and higher.

Carbon target reflects carbon reduction for building energy demands.

This may be an easier sector to decarbonise than others so may require a greater level of reduction, e.g. an 80% reduction in total emissions may require a 90% reduction in the emissions covered by this modelling



Identification of Future Priorities

Using EnergyPath Networks to produce a local area energy strategy, we can help identify priority activities for the future:

1) Low regret deployment which can be executed with high confidence as it has been done before elsewhere.

2) Demonstration where the technologies appear low regret choices, but there are major integration, consumer or commercial unknowns.

3) Data Gathering where the analysis has shown that the results are sensitive to the input assumptions and detailed information is not currently available.

4) Research and Innovation where there may be a game changer but only if certain performance or cost targets can be met.

Learning from Current Projects

- We have undertaken 3 trial projects working with local stakeholders during development of the model
  - Newcastle
  - Bridgend
  - Bury

- They have helped us to test how best to use the approach, and our approach has evolved between projects.

- Who needs to be involved in a local area?
- Which data is essential?
- What are the main data quality issues?
- Which modelling provides the most insight for innovation?

Approaches to the use of EPN in the future would not necessarily be the same as the work to date, but would be guided by what we have learnt

Interested? We would like to hear from you
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