Briefing

Decarbonising heat while addressing fuel poverty

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green alliance...

Summary

To achieve net zero, the UK's housing stock must be decarbonised through improvements to energy efficiency and changes to heating systems. Simultaneously, heating costs need to come down, especially for the least affluent.

This analysis challenges the 'fabric first' approach, showing that heat pumps are up to 44 per cent cheaper than an insulation-only deep retrofit approach, with a cost per tonne of carbon saved that ranges from 6 to 13 times cheaper. The upfront and running costs of heat pumps are predicted to fall over time, as cheap renewables decarbonise electricity. In the short term, we suggest measures to bring down energy bill costs, such as enabling users to avoid peak times for electricity prices.

The government should adopt a heat pump led approach, retain support for the mass uptake of cheap loft and cavity wall insulation, and only pursue deep retrofit for appropriate fuel poor households.

Background

Greenhouse gas emissions from UK housing remain high, with no emissions reductions from the entire heat and buildings sector between 2015 and 2023. Addressing residential heating, according to the Climate Change Committee (CCC) balanced pathway scenario, will account for over 70 per cent of emissions reductions in residential buildings by 2050, yet there is no conclusive government plan to achieve it.[1]

Meanwhile, efforts to retrofit the housing stock are not progressing at the right speed, despite calls from across the board to accelerate rollout to keep fuel poor households warm and bring high bills down.

'Fabric first' is an approach to increasing the energy efficiency of housing which prioritises improvements to insulation. Typical measures include adding insulation to lofts and floors, internal and external wall insulation, improving windows, and adding draught-proofing. This approach to retrofitting the UK's housing stock has typically been prioritised in recent

years, however, innovation in heat pump technology and a lack of cost reduction in deep retrofit measures have changed the balance of what is cost effective, even in poorer households. Well-installed air source heat pumps can now operate at a seasonal coefficient of performance (SCOP) above 3.6 (360 per cent) efficiency. By contrast, even new gas boilers rarely exceed 89 per cent efficiency.

Analysis

To explore the cost effectiveness of heat pumps and deep retrofit options, we compared three scenarios in a typical UK home:[2]

1. **Heat pump**: installation of a heat pump without additional insulation, at a capital cost of £8,000, using a standard electricity tariff.
2. **DeepRetro-A**: a 'fabric first' deep house retrofit using external wall insulation achieving heat savings of 15 per cent with a capital cost of £8,300, with heating provided by a gas boiler.[iii]
3. **DeepRetro-B**: more extensive external wall insulation achieving heat savings of 38.5 per cent with a capital cost of £24,000, and heating provided by a gas boiler.[iv]

Each scenario assumes simple insulation options, such as loft insulation, have already been installed, as low cost, no regret options for suitable property types.

Our analysis found that the total cost over 20 years of installation costs plus energy bills, was up to 44 per cent lower for the heat pump than the other options. Given predicted drops in heat pump prices, this is set to only increase with time. Energy bills, based on today's electricity and gas prices, were cheaper for the retrofit options, but only the deeper, DeepRetro-B, was significantly so, at around £150 cheaper than with a heat pump.

Where heat pumps most excelled was in the cost of carbon savings, where they were six to 13 times cheaper per tonne of carbon abated than either of the retrofit options.

	Heat pump	Avoiding 4-7pm peak	DeepRetro-A	DeepRetro-B
Upfront cost	£8,000		£13,710*	£29,333*
Running cost (per year)	£779	£580	£714	£624
Total cost (20 years)	**£23,580**	**£19,601**	**£27,986**	**£41,806**
£ / tCO_2e (upfront cost)	£206		£2,698	£2,708
£ / tCO_2e (total cost)	£607	£505	£5,507	£3,860

*includes the price of gas boiler installation over 20 years

Reducing the running costs of heat pumps

No matter what the overall savings are, bringing down the cost of energy bills will be central to making any improvement attractive to users, especially those experiencing fuel poverty. High electricity prices are predicted to decline with the decoupling of renewables and wholesale gas prices, which will reduce the running costs of heat pumps over time, but this does not address the short term need for energy bills to come down.

Today, the simplest way of lowering bills with a heat pump is to use a time of use tariff and avoid heating at peak time. Using Octopus' 'Agile' tariff and avoiding heating during 4-7pm would save £200 a year, resulting in lower bills than either retrofit option.[v] Doing so would benefit the user of the heat pump, but also other electricity consumers, as peak electricity use is disproportionately expensive: evidence from the US suggests that the 10 per cent of hours with the highest demand account for 40 per cent of the total cost of the power system.[vi]

Bills could be lowered further by exempting heat pump users from government levies, cutting bills by £130, according to E3G.[vii]

Heat pumps plus shallow retrofit are cost effective

Increasing the number of comfortable, healthy, affordable to heat homes in the UK, while achieving rapid decarbonisation, needs an integrated strategy that enhances insulation and changes heating systems. With a fixed capital budget for energy efficiency measures, cost effectiveness in tackling both fuel poverty and decarbonisation is vital.

Our analysis shows that heat pumps offer better value for money and the best cost in relation to the amount of carbon saved. Through policy, the challenges associated with their installation can be mitigated to make them a well-rounded solution to decarbonising the UK's housing stock.

Choosing to prioritise this approach does not remove the need for housing fabric solutions where it is cost effective and addresses health and comfort challenges. However, extending the use of gas boilers, with or without deep retrofit, will not achieve the decarbonisation necessary to meet the country's climate change goals.

Recommendations

- Shallow retrofit, such as loft and cavity wall insulation should be rolled out across all homes in the UK, including continuation of government schemes to insulate poorer, draughty households. This is a no regrets option, with the co-benefit that it enables smaller and cheaper heat pumps to be installed, which reduces the need for disruptive radiator and pipework upgrades.

- Deeper retrofit measures can still be an option where it is cheap to install and essential for health and comfort, or where it will reliably address fuel poverty over its 40 year payback period. For example, social housing is a good candidate for deep retrofit. Models like Energiesprong, which combines deep retrofit with the installation of a heat pump to reduce energy bills and eliminate emissions, are amongst the best approaches for suitable properties in this sector.

- For most British homes, including those occupied by the fuel poor, a heat pump is the most cost effective way to cut carbon and keep a home warm over a twenty year period, so developing a strategy to install heat pumps with low upfront costs should be the priority.

- This strategy should also include measures for reducing the running costs of heat pumps through fiscal measures and providing information and technology solutions to help households avoid peak times for electricity prices.

For more information, contact:

William Carr, policy analyst
wcarr@green-alliance.org.uk

Helena Bennett, head of climate policy
hbennett@green-alliance.org.uk

Endnotes

[1] Sector-summary-Buildings.pdf (theccc.org.uk)
[2] Data for heat pumps (HP) was estimated from the Energy Saving Trust and www.heatpumpmonitor.org, with an upfront cost of £8,000, a coefficient of performance of 3.6, and a life span of 20 years. Gas boiler data was estimated from the Energy Saving Trust, and the Nottingham report (see endnote iv below), with an

upfront cost of £4,000, an efficiency of 89 per cent, and a lifespan of 15 years. Deep retrofit data from UCL (DR-A, see endnote iii below) showed a reduction of heat energy required of 15 per cent at a cost of £8,377. The Nottingham report (DR-B) averaged a reduction of heat energy required of 38.5 per cent at a cost of £24,000. Current electricity, 27.35p/kWh, and gas prices, 6.89p/kWh, were taken from Ofgem figures for the energy price per unit between October and December 2023. Heating needs for an average home were estimated from the gas use for a medium sized household, 11,500kWh, split into 77 per cent for space heating, the rest for hot water heating which is not affected by enhanced insulation.

[iii] UCL, 2020, 'Development for trajectories for residential heat decarbonisation to inform the 6th budget', for the Climate Change Committee https://t.co/413NTr7kKM

[iv] HM Government, 2022, 'Nottingham Retrofit Roadmap', funded by the UK government through the UK Community Renewal Fund, www.nottinghamcedi.org/wp-content/uploads/2022/10/CRF_All_facts_sheets.pdf

[v] Electricity prices based on 'Octopus agile', a widely available electricity tariff (https://energy-stats.uk/octopus-agile-london/). With a yearly averaged price for times outside of the 4-7pm window for the London area of 20.4p/kWh. Should be noted that this tariff requires a smart meter installed in the home, which currently stands at 57% among households, and set to rise to 80% by the end of 2025 (https://www.nao.org.uk/press-releases/update-on-the-rollout-of-smart-meters/).

[vi] https://www.mass.gov/doc/state-of-charge-report/download

[vii] https://www.e3g.org/publications/electricity-levy-rebalancing-make-clean-heat-accessible-to-all-uk-households/