COST OF DECARBONISING HOUSING

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Introduction

There are two fundamental approaches to decarbonising housing: insulation and electrification.

Deep decarbonisation through insulation measures is likely to be prohibitively expensive because of the difficulty of retrofits to the existing housing stock; costs rise exponentially as further emissions reductions are demanded. A series of studies has found that halving emissions could cost as much as £60,000 per home in small flats, and more in larger homes.[1] Even if costs fall in future, the bill for significant decarbonisation of the housing stock could easily exceed £2 trillion.

Deep decarbonisation through electrification relies on replacing boilers fired by fossil fuels with electric heat pumps. Providing the electricity used comes from renewables, the goal of decarbonisation is delivered, at least in theory. In the UK, emissions-free electricity is supposed to be delivered mainly by offshore windfarms. However, recently installed windfarms deliver very expensive electricity, and it is now clear that the next generation will be no cheaper.[2]

This factsheet describes the results of an attempt to find the cost of decarbonising housing.

General approach

To simplify, we assume a stock of 38 million homes in 2050, all of which require insulation and heat pumps. Although new builds and flats will in practice require different approaches, this is a reasonable first approximation.

Cost of insulation

The pilot projects referred to above allow us to develop a crude formula for the cost of delivering any particular level of decarbonisation through insulation.

This is generous because these projects focused on small homes. A relatively small reduction in costs due to learning is assumed (30%) because retrofit projects are in essence always bespoke, and also because the number of retrofits required will create extraordinary demand for skilled labour, thus inflating prices.

Cost of heat pumps

We assume that air-source heat pumps are always used, at a cost of £9000 each, as compared to a gas-fired boiler at £1500. Many houses would require ground-source heat pumps, which are much more expensive.

In addition, an allowance of £3000 is made for installation of underfloor heating and/or upgraded radiators, which are normally required alongside heat pumps.

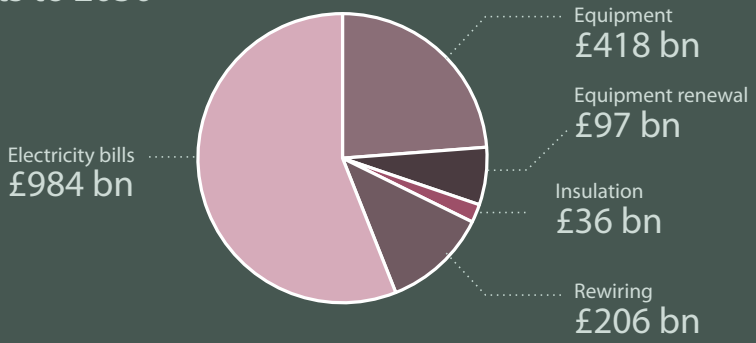
It is assumed that the heat pumps will deliver 2.5 times as much energy in the form of heat that they use to drive the pump. But heat pumps struggle in cold weather so, particularly in Scotland, some homes will also need supplementary heating systems. Again very generously, no allowance has been made for this.

Energy use

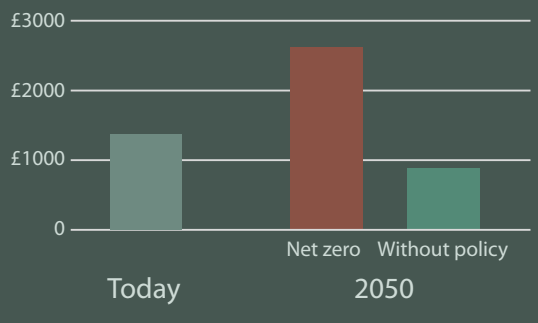
This heat pump 'gain' is offset by two factors: replacing cheap gas (assumed, generously, to hold its price while demand falls) with expensive electricity, and increases in electricity prices as windfarms replace gas turbines.

Electricity prices are based on the system cost modelling of Gibson and Aris,[3] with the difference between system cost and retail price assumed to be static, apart from VAT. This procedure leads to an assumed 88% increase in retail prices by 2050, a figure that

Costs to 2050



Household energy bills



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is probably very conservative. It also needs to be set against a without-policy baseline of electricity prices *falling* at 1% per year (chiefly due to replacement of older gas turbines with newer ones).

Other costs

The factors described above will have knock-on effects.

- Some larger homes will need electric showers as backup, as heat pumps will not heat water sufficiently quickly. We assume this will apply to 50% of homes at a price of £1000 each.
- Homes will need to be rewired and the electricity distribution grid upgraded to cope with increased demand.
- Electricity price increases will also affect non-heat electricity usage.

Results

The cost curve for insulation measures, rising exponentially, means that even with electricity system costs rising at 2.3% per annum, only very limited retrofitting – around £40 billion in total – is likely to prove cost-effective. This work will produce carbon dioxide emissions reductions of less than 10%. That means that most of the work of decarbonisation has to be done by conversion to heat pumps.

Allowing a cost equal to the installation cost of a heat pump system for the 38 million existing homes that may exist by 2050, gives a cost of £456 billion. Adding electric showers in half of them is another £19 billion.

It is important to remember that heat pumps and electric showers, like gas-fired boilers will need to be replaced every 15 years or so. This will cost consumers a further £97 billion by 2050.

To this must be added the £206 billion cost of rewiring homes and the distribution grid to cope with the extra demand.[4]

The total for capital works is therefore £843 billion, or perhaps £757 billion more than it would have been spent without policy interventions.

Using heat pumps reduces energy demand from homes by a factor of 2. They reduce demand for energy for heat by a factor of 2.5, but do not affect demand for lighting and other appliances. This reduction, however, is more than cancelled out by losses from

- switching from cheap gas to electricity
- rising electricity prices.

By 2050, this is costing consumers £66 billion extra per year, or perhaps £984 billion over the period 2020–2049.

Summary

By 2050, consumers have had to pay an extra £1.8 trillion.

	With policy	Before policy	Difference
	£bn	£bn	£bn
Heat pump/boiler	456	57	399
Showers	19	–	19
Replacements	126	29	97
Insulation	36	–	36
Wiring and distribution	206	–	206
Total capital works	843	86	757
Energy costs	1,489	505	984
Total cost	2,368	599	1,769

This amounts to an extra cost of around £46,000 per household. Ongoing energy bills, at £2,613, are around double today's and around triple the no-policy alternative. Consumers will also have to bear the extra ongoing cost of around £450 per year required against heat pump replacement.

This cost estimate will be updated as new information emerges.

Endnotes

1. Kelly M. *Decarbonising Housing: The Net Zero Fantasy*. Report 38, The Global Warming Policy Foundation, 2020.

2. Hughes G. *Wind Power Economics: Rhetoric and reality. Volume I Wind Power Costs in the United Kingdom*. Report, Renewable Energy Foundation, 2020.

3. Gibson C and Aris C. *The Future of GB Electricity Supply: Security, cost and emissions in a net-zero system*. Technical paper 4, The Global Warming Policy Foundation, 2020.

4. Travers M. *The Hidden Cost of Net Zero: Rewiring the UK*. Briefing 48, The Global Warming Policy Foundation, 2020.

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