



Oxford Smith School
of Enterprise and
the Environment



Policy brief

How can we unlock the scale of the demand-side opportunity to meet the UK's Net Zero commitments?

Summary

- **The scope for UK energy demand reduction is 50% by 2050.** Energy demand in the UK and other developed economies is dominated by transport, buildings and industry. There is now strong evidence that the scope for reducing energy use is very significant, whilst improving quality of life.
- **Demand reduction can deliver concrete energy, economic, health and social improvements, including:** reduced future electricity generation needs from 800 TWh/year to below 500 TWh/year, reducing costs and increasing the feasibility of the transition; growth and jobs with lower import dependence, utilising a wide range of skills, and contributing more to socially just outcomes (in the construction sector alone, industry estimates up to 500,000 new jobs); and, a reduction in physical and mental health problems due to inefficient housing stock, as well as, lower pollution.
- **Specifically, home energy efficiency is central to resolving recurring, short-term affordability crises, coupled to the importance of emissions reduction on the path to zero emissions.** The recent rise in gas prices has had a severe impact on many households, with energy use falling 10% in 2022, due primarily to lower internal temperatures, not better energy efficiency. This partly due to government in 2012 making major cuts to energy supplier obligations and defunding energy advice, resulting in huge cuts in home energy efficiency investment.
- **Delivering a major upgrade in home energy efficiency will require very large investments, effective customer engagement, changes to incentives, supply chain innovation and scaling up.** However, the benefits are proportionately larger. Heat pumps now have the largest potential for energy and carbon savings.
- **We describe a set of policy [steps](#) to unlock the UK's demand-side opportunity, in an outline programme for Government.** This includes legislation to empower local authorities and stakeholders to speed up delivery; outcome-oriented targets rather than technology-specific targets; regulation and standards on acceptable quality that drive business investment to greener options; financial incentives for low-income households as well as those 'able to pay'; aligning supply chain capacity and skills; and, reviving large-scale consumer advice programmes.

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UK energy use will need to change fundamentally if we are to deliver a zero-carbon energy system: energy use will need to be reduced, become more flexible and rely on decarbonised vectors. The potential for demand reduction is very large: an absolute reduction of more than 50% by 2050.

This policy brief, drawing from work of the [Oxford Centre for Research on Energy Demand Solutions \(CREDS\)](#) highlights the scale of the demand-side opportunity in the UK, and what needs to be done in the short and medium term to unlock it. It contains a ‘deeper dive’ into the buildings sector with the following question: **How can we shift the UK building stock to net-zero by 2050 in a cost effective, resilient, acceptable, equitable and practical way, maximising the multiple benefits and minimising unintended consequences?**

Scope for Demand Reduction

Energy demand in the UK, and other developed economies, is dominated by three broad sectors – transport, buildings and industry. There is now strong evidence that the scope for reducing energy use is very significant, whilst improving quality of life. This is true globally, where the scope for demand reduction is estimated to be 40%.¹ This has huge implications for climate policy, and the IPCC concludes that demand side action can reduce emissions 40-70% below baseline.²

In the UK, the scope for energy demand reduction is 50% by 2050³, which would reduce UK per capita energy use to 40 Giga Joule (GJ)/year, well below the current global average of 55 GJ/year, without compromising on quality of life. Government analysis⁴ shows that all plausible scenarios compliant with the net zero goal require significant demand reduction.

The reason that the scope for demand reduction is larger than previously envisaged

by many policy makers is that a variety of measures can contribute, in three broad categories:

- ‘traditional measures’, e.g. insulation, control systems, more efficient engines,
- ‘new measures’ enabled by electrification - electric vehicles and heat pumps, and
- ‘wider systemic changes’ that drive energy demand, notably active travel, public transport and the circular economy.

Demand reduction benefits

The benefits of reducing demand have normally been thought about in terms of emissions reductions and lower customer bills. These are, of course, important, but alone underplay the role of demand reduction. The International Energy Agency (IEA) has led the way in promoting the multiple benefits of energy efficiency.⁵ And the IPCC has concluded that demand side action will do more than supply side changes to deliver the Sustainable Development Goals.⁶ In the UK, demand reduction can help deliver a wide range of energy, economic, health and social improvements. In particular, it is expected to be a critical component of three other goals of the green transition.

Energy security. The impacts of the gas crisis on the UK have been significantly exacerbated by the cuts to energy efficiency programmes since 2012. Going forward, scenarios in which energy demand reduction is prioritised can reduce electricity generation requirements from 800 Terawatt-hours (TWh)/year to below 500 TWh/year,⁷ reducing costs and increasing the feasibility of the transition.

Growth and jobs. Investment in demand reduction is widely spread across the UK, with lower import

dependence than supply side measures. Insulation, heating installation, public transport and recycling create jobs in local communities, utilise a wide range of skills, and therefore contribute more to socially just outcomes. The scale of employment created is significant. In the construction sector alone, industry estimates up to 500,000 new jobs.⁸

Improved health. Energy efficient buildings are more thermally comfortable (in winter and summer) and have fewer problems with damp and mould, leading to substantial reductions in cardio-vascular disease and better mental health. Fossil fuel combustion for heating and transport is the major source of air pollution, which can be hugely reduced by a combination of electrification and demand reduction. Increased use of walking, cycling and public transport will improve road safety.

Energy efficiency in homes

Homes are the largest user of heat in the economy. The UK housing stock is the oldest in Europe. Its efficiency was amongst the worst in 2000, but is now fairly typical⁹ thanks to the major improvements in boiler efficiency and insulation in the decade from 2003. Insulation rates collapsed in 2013¹⁰ and have still not recovered.

The recent rise in gas prices has had a severe impact on many households, with energy use falling 10% in 2022,¹¹ due primarily to lower internal temperatures, not better energy efficiency. Behaviour change to reduce internal temperatures is an opportunity where homes are heated to a temperature above the World Health Organisation (WHO) recommendation of 18 degrees Celsius, but many homes are under-heated, posing risks of ill health. Energy advice needs to address behaviour change with great care, especially in the context of the

cost-of-living crisis.

Despite huge growth in the number of electricity using devices in homes in recent decades, home electricity use has fallen due to major efficiency improvements.

Given the long-lifetime of homes, their contribution to UK emissions, the low rates of retrofit and multiple barriers to investment, decarbonisation of homes is a major challenge.

History

The history of UK home energy efficiency policy is well-documented.¹² Since the first government programmes of loft insulation during the 1974 oil crisis, there have been repeated cycles of policy interest and investment, creating high uncertainty and lack of confidence in long term policy in the supply chain.

The largest programmes were undertaken by the last Labour Government following the 2002 Energy Review, 2003 Energy White Paper and 2004 Energy Efficiency Strategy. Key policies included mandatory condensing boilers and double glazing at the point of renewal, insulation incentives (free for households on benefits) through energy supplier obligations (CERT), EU product standards and strong local advice programmes.

In 2012 the Coalition Government made major cuts to energy supplier obligations and defunded energy advice, resulting in the huge cuts observed in home energy efficiency investment.

New context

The new context for home energy efficiency is the short-term affordability crisis, coupled to the importance of emissions reduction on the path to zero emissions

from housing. The latter is important because it fundamentally changes the desired end point for home heating. Net zero requires the use of zero-carbon heating in every building. Fabric improvement can only be additional to heat decarbonisation not an alternative to it.

The dominant technology to decarbonise heat will be electric heat pumps supplied with zero-carbon electricity.¹³ Heat pumps combine the use of a rapidly decarbonising energy input (electricity) with a hugely improved energy efficiency. The latter is crucial, as the scale of increased electricity use would otherwise overwhelm the power system. Some large heat pumps will be deployed on large district systems; most will be at the scale of the individual building. Rates of heat pump deployment in the UK lag behind much of Europe, which threatens the UK position as a clean energy leader.

Insulation improvement can reduce heat pump operating costs, both by reducing heat demand and enabling improved heat pump efficiency. Improved insulation, with better shading and ventilation, can also help address the risks of summer overheating in some buildings. The optimum level of fabric improvement to achieve this will differ very significantly from building to building depending on the scope for cost effective improvement. Heat pump installation also often requires new radiators and/or hot water tanks.

At the level of the whole building stock, the scope for overall efficiency improvement is still large.¹⁴ Amongst individual homes there is a huge diversity. Many can now be decarbonised using a heat pump without further insulation;¹⁵ in others, significant insulation improvement is still a priority.

Decarbonisation is not the only goal building retrofit policy. Residential buildings are homes: they need to be healthy, comfortable and affordable. Decarbonisation policy needs to support these goals. Even with heat pumps

installed, better insulation will reduce bills, increase comfort, improve climate resilience and reduce risks of damp and mould.

Any home energy efficiency programme therefore needs to incorporate both heat decarbonisation and fabric improvement. Both play important roles in the broader goals of green economic activity and employment. And both require major increases in capacity, improvements in quality and increased skills.¹⁶

Strategy

Delivering a major upgrade in home energy efficiency is a complex systems problem.

It requires very large investments, typically £10,000 to £20,000 per house, implying a total UK investment of £30-£60 billion over 20 years.¹⁷ Achieving this will also require effective customer engagement, changes to incentives, supply chain innovation and scaling up. These need to happen together.

There are no policy silver bullets. Energy pricing is a weak lever – impacts are limited because of low elasticities and major adverse distributional consequences. There are different challenges in the three tenures – owner occupation, social housing and the private rented sector. Policy consistency is critical to supply chain and customer confidence. Targeted policy packages are needed. Standards will be critical to providing clarity on the timescales for change, thereby increasing business certainty and reducing risk and costs. Incentives will be needed to boost investment in advance of regulatory requirements and to support low-income households.

Comprehensive training and information programmes will also be essential. Heat pumps now have the largest potential for energy and carbon savings.¹⁸ However, for the reasons set out above, both heat decarbonisation and fabric improvement will be needed, but not uniformly across the housing stock.

Current governance approaches are inadequate. The UK Department for Energy Security and Net Zero (DESNZ) is poorly equipped to run major grant schemes and information programmes. Energy companies are currently incentivised to deliver the more expensive measures which need construction expertise rather than focussing on the low cost measures they delivered effectively up to 2012. Local authorities should have a key role in planning and delivery, rather than competing for small, time limited funding pots. Based on experience under earlier governments and elsewhere, specialist agencies are better placed to deliver large programmes and advice.

The scale and pace at which change can be delivered is limited by the need to consult and engage, and the speed at which supply chains, skills and local delivery capacity can be developed. It will therefore be critical to:

- Ensure that demand, capacity and training develop together,
- Primary legislation, where needed, is introduced early in the parliament, and
- Executive powers and secondary legislation are used where possible.

Recommendations: Outline Programme for Government

Governance Change

Much of what needs to be done quickly can be done within the existing machinery of government. But institutional change will be needed to deliver the scale of programmes required, including:

- New legislation to provide duties, powers and resources for local authorities, working with energy and housing sectors stakeholders, to develop and deliver local area energy plans.
- Creation of dedicated delivery functions within central Government, for example a

specialist agency or task force, to coordinate local delivery.

- Local authorities should be given new powers, devolved funding and a duty to plan for a zero-carbon housing stock in their area as part of local area energy planning.

Targets

To avoid perverse incentives to undertake work that is inappropriate, poor value or does not meet the needs of occupants, strategic targets should be set in terms of outcomes, e.g. 'homes improved', 'bills reduced' and 'carbon saved' rather than technology specific outputs, e.g. 'homes insulated' or 'heat pumps installed'.

Regulation and Standards

Standards provide a baseline for acceptable quality and frame expectations that drive business investment to greener options. These should include:

- Early introduction of net-zero new build standards.
- Announcement of a phase out date for new boiler installations.
- Consultation of long-term standards for existing homes in all tenures.
- Consultation on minimum standards in operation for heat pumps.
- Ending privatised building regulation.
- Commitment to remain aligned with EU product standards and labels.

Financial Incentives

Public expenditure is justified to support low income households where the equity implications of investment would otherwise be unacceptable. It should include:

- Support for low-income owner occupiers, directly or via local authorities, for heat pump installation, associated heating system changes, as well as insulation where this is low cost and/or needed to allow

decarbonisation or bring homes to a good level of thermal comfort at reasonable cost.

- Support for social housing providers to do the same, using the previous Labour Government's mode of the Decent Homes Standard.
- Financial support for able-to pay households will also be needed to deliver increased levels of investment, back to at least pre-2012 levels. This could be delivered with low interest (preferably zero-interest) government-backed loans. There are also fiscal options, including differential Council Tax, differential Stamp Duty and Salary Sacrifice schemes, although these would alone be insufficient.

Similar outcomes are possible through mechanisms involving regulatory routes, including:

- New obligations under existing legislation for major suppliers (Energy Company Obligation),
- Obligations for Distribution Network Operators (DNOs) under the same primary legislation,
- Obligations on the heating supply chain, as previously proposed by the current government through the Clean Heat Market Mechanism.

To incentivise the shift away from fossil fuel heating, policy costs should be shifted off electricity and onto gas. This is most likely to be acceptable if and when gas prices fall.

Supply chain capacity and skills

The UK construction sector is generally characterised by low skills and poor quality. This is most extreme in the home retrofit sector, which is dominated by small companies and sole traders. With the exception of safety requirements for gas installation and electrical work, there is no requirement for skills or qualifications related to energy. Training to improve skills is only likely to be

undertaken if linked to expectations that they will be required to install new technology or meet regulatory standards. This should be a priority for the relevant Sector Skills Councils. The goal should be to move to a 'licence to trade' with minimum skills requirements in energy work.¹⁹

Social housing and new build can act as leaders in quality improvement and skills through the scale of programme they control, which are very large compared to individual owner occupier projects. Government should drive this via its funding of social housing and regulation of new build energy performance.

Consumer advice

Large scale programmes can only be delivered with the support of home owners and tenants. This implies a large increase in consumer engagement and advice. This should be a priority for the Government delivery programme. It can draw on the experience of publicly-funded advice by the Energy Saving Trust under the last Labour Government, which was defunded in England by the Coalition Government but still operates in Scotland. The complexity of decisions around heat pump installation and more complex fabric measures also means that home owners need to have confidence in the advice provided by the supply chain. Public funding for retrofit should therefore build on the role of the 'retrofit coordinator' established in the PAS 2035 standard.

The measures above are summarise in Table 1 below, in a 5-10 year outline programme for Government.

Table 1: Unlocking the UK’s demand-side opportunity – recommendations and an outline programme for Government

	Policy Lever	Policy Measures	Commentary
Year 1	Targets	Strategic targets set in terms of outcomes, e.g. ‘homes improved’, ‘bills reduced’ and ‘carbon saved’ rather than technology specific outputs.	Manifesto commitment and ‘first 100 days’ announcement, as part of wider green investment.
Year 1	Regulation and Standards	Standards to provide a baseline and drive business, including: net-zero new build standards. phase out date for boiler installations. long-term standards for existing homes. minimum standards for heat pumps. Alignment with EU product standards and labels. Ending privatised building regulation.	Most can be done under existing legislation, but all require consultation. In many cases, officials will already have outline plans ready. Restoring building regulation to local authorities will require legislation and could form part of a wider package to enable local government climate action.
Years 1 to 5	Financial support for low-income households	Public expenditure to: Support for low-income owner occupiers for heat pump installation and insulation. Support for social housing providers for heat pump and or district heating installation and insulation.	The largest call on public expenditure. Especially critical whilst high energy prices remain in place. Social housing providers have plans on place and can act relatively quickly. Support for low-income owner occupiers exists through the Energy Company Obligation, but the scale of work required cannot all be financed by bill levies. Consultation need on an effective mechanism.
Years 1 to 5	Supply chain capacity and skills	Training to improve skills. Long-term goal of ‘licence to trade’.	Urgent priority to ensure supply chain skills can deliver. Priority for the relevant Sector Skills Councils.
Years 1 to 5	Consumer advice	Rebuild national consumer advice programme. Develop public advice and installer sector skills to address heat pump installation and more complex fabric measures.	Can build on existing scheme in Scotland and EST proposals.

<p>Years 1 to 10</p>	<p>Financial incentives for 'able-to-pay' households</p>	<p>Financial support for able-to pay households via low interest (preferably zero-interest) government-backed loans and or fiscal options. Similar outcomes are possible through mechanisms involving regulatory routes, including: New obligations for major suppliers, Obligations for DNOs, Obligations on the heating supply chain, Shift policy costs from electricity and onto gas.</p>	<p>The largest single call on investment. Multiple options for subsidy have been proposed and could be effective. Given the scale of investment needed most needs to come from outside Government. Regulatory options shift investment obligations onto market actors. Existing primary legislation allows this for suppliers (used in ECO) and DNOs, and therefore this can be done with a single round of consultation. The Clean Heat Market Mechanism would allow investment in heat pumps to move from Government (boiler Upgrade Scheme) to the supply chain. Shifting policy costs when gas wholesale prices fall.</p>
<p>Years 5-10</p>	<p>Governance Change</p>	<p>Institutional change, including: New duties, powers and resources for local authorities. New delivery functions within central Government, e.g. agency or task force.</p>	<p>Not an urgent priority. But seems unlikely that DESNZ can develop the culture and staffing to oversee delivery at the scale needed</p>

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