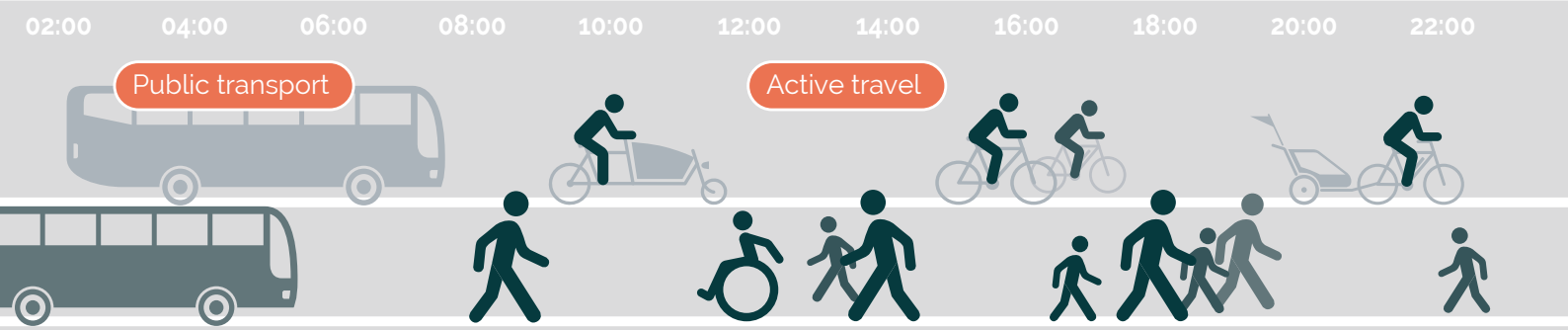
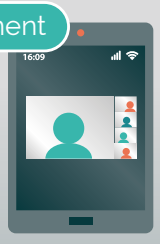
CREDS

# CREDS research findings

Change in daily routine

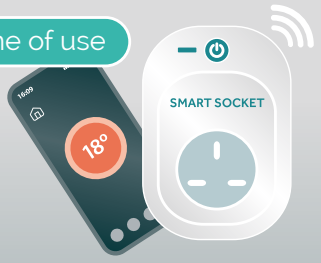



Public engagement



Active citizenship

Control time of use




Circular economy

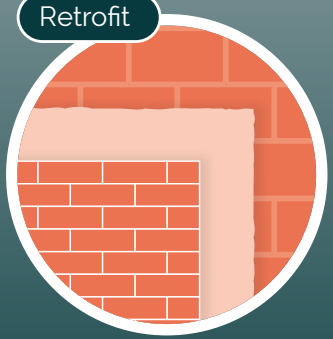
Heat pumps

New skills

Targeted reduction policies

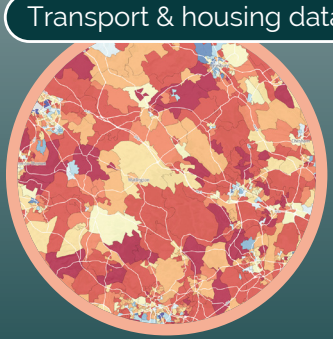
More jobs

Retrofit



Planning regulations

Transport & housing data



# CREDS research findings

We have analysed the research undertaken by CREDS over the past four and a half years. This analysis demonstrates that reductions in energy use are essential for the transition to a net-zero society. In the current energy affordability crisis, urgently achieving a fair low carbon society is more important than ever. Our research findings cover 15 topics framed within 7 broader questions.

## Why do we want to reduce energy use?

Lower energy demand reduces the scale of energy supply decarbonisation needed, and therefore is essential if the UK is to meet its carbon emission reduction goals. It also has significant other benefits.  For energy users lower energy bills are frequently the most obvious benefit. However, reducing energy demand also increases energy system security, and there are wider benefits, notably health improvement due to warmer homes, cleaner air, more active lifestyles and better diets. Investing in saving energy also creates jobs and wealth in local economies.

Reducing the UK's energy demand therefore needs to be at the heart of a fair, affordable and healthy route to net-zero carbon emissions. By reducing the size of the energy system, it can limit the risks and costs of some proposed supply-side solutions such as carbon dioxide removal.

**Find out more:**

Multiple benefits

## How much can we reduce energy use?

There are many well-established ways of improving energy efficiency. They have played a larger role than supply side changes in reducing UK greenhouse gas emissions, although the rate of improvement has declined in the last decade, largely due to weaker policies.

Energy demand can be significantly reduced in all the main energy using sectors. Transport has the highest potential for demand reduction, by combining shifts towards more active travel and public transport modes with a move to high-efficiency electric vehicles. In buildings, the main potential lies in reducing heat demand through high-efficiency heat pumps and improved building fabric. In industry, there is less potential for improved end-use energy efficiency, but a larger potential for energy demand reduction through improving the efficiency with which energy-intensive materials are used.

Overall energy use in the UK could be halved by 2050, whilst enhancing quality of life. This would reduce UK per capita energy use from its current level of 89 GJ/year (2.8 kW) to 40 GJ/year (1.3 kW), which is well below the current global average of 55 GJ/year (1.7 kW), demonstrating the feasibility of a high-welfare, low-energy society, with major implications for sustainable development globally.

**Find out more:**

- Transport & mobility
- Buildings & heating
- Industry & materials
- The potential for reducing energy demand

## How can we further reduce energy use?

The scale of the net-zero challenge increases the urgency of energy demand reduction. More fundamental changes will be required: to use zero-carbon energy sources and to address the drivers of energy intensive activities.

Energy use is driven by demand for energy services in other systems of provision – notably for mobility, materials, shelter and comfort, and nutrition. Changes in these systems are therefore critical to changing energy demand. Historically energy service demands have risen, but many of these trends have moderated and can be reversed.

The Covid pandemic has shown major changes are possible, with profound effects on energy use in transport, and smaller effects in buildings and industry. Weekday car traffic remains 10% below pre-pandemic levels, and it seems probable that historic high levels of commuting will never return.

Digitalisation increases the potential for energy saving in three ways: by enabling better control of energy use, by substituting information for material goods and services, and by enabling sharing of material goods. Although there is limited historical evidence, these could lead to significant reductions in energy use, if policy interventions steer digitalisation in these directions.

**Find out more:**

- Learning from the pandemic
- Digitalisation

## How does this fit into the wider energy system?

Energy use interacts with the wider energy system. Wind and solar energy are likely to dominate future energy supply as they are now the cheapest electricity sources. Moving to zero-carbon systems will involve electricity from these sources replacing direct use of fossil fuels. This electrification, in particular through investment in electric vehicles and heat pumps, will enable a huge increase in energy efficiency – reducing final energy demand by up to 40% from this effect alone.

Having more variable sources of electricity means that there will be more need for flexible demand to balance electricity systems. This can be achieved through either localised energy storage or changing the timing of activities. Activity re-timing can use automated systems and/or human agency in real time. In future, the former will predominate. There are major new opportunities for demand response, as heating and transport are electrified.

Building-scale heat pumps, hydrogen technologies and heat networks can all contribute to heat system decarbonisation. Heat pumps, at various scales, will play the key role in heat decarbonisation in most areas of the UK, and this will give a bigger energy efficiency improvement than further improvements in insulation. Major policy, technical, public acceptance and cost challenges remain to be overcome to reach the required deployment rates.

In a high renewable energy system with electric heating, at least 10 TWh storage will be needed. This far exceeds what can be provided by batteries and will require chemical and/or thermal energy storage.

**Find out more:**

Energy systems

Demand flexibility

## What are the main challenges?

Deploying better technology will be important to saving energy and to systems change more generally, but people are critical as well, especially to change at the point of energy use. Changing service demands implies changed lifestyles; and changing end-use technology requires the active support of users. People will need to be supported, advised and/or engaged in various aspects of the transition: as energy users, as citizens and as workers.

Affordable energy services are part of a good quality of life. Currently there are major inequalities in access to warmth and mobility. Higher income groups use more energy, especially for aviation and other long-distance travel, but low-income households use a much higher proportion of their income on household energy. These issues need to be addressed and not exacerbated if the zero-carbon transition is to be a 'just transition'.

**Find out more:**

- Engaging people
- Equity in the zero-carbon energy transition

## What policies are needed?

Strong energy demand reduction policies will be needed to meet these challenges. Current policies and their funding levels are insufficient to achieve this. The scale, multi-level character, engagement needs and interactions of different interventions make net-zero policy making a complex problem. Policy packages including standards, incentives and information are the most effective approach. Institutions designed for energy policy in previous eras are not well-placed to deliver, and therefore governance and institutional arrangements need to be reviewed.

Local government could play a much larger role in driving energy and climate action. The majority of local authorities have declared a climate emergency, set targets and aim to do more. They have key functions, particularly in planning, transport and housing, and in addressing social inequality. However, local authorities currently have only a sub-set of the necessary powers and inadequate resources to ensure delivery. As a result, most targets are not supported by coherent plans.

CREDS has developed a number of innovative tools which can be used to support decision-making.

**Find out more:**

- Governance & policy
- Local action
- Tools & data

## What difference does the energy crisis make?

The immediate energy crisis makes energy services unaffordable to many more households and raises energy security risks. It provides a new driver for energy efficiencies policies to be scaled up and properly financed, across all sectors. However, it does not itself address supply chain capacity and skills deficits. If the worst impacts of high prices are to be avoided, immediate action is required to ensure adequate advice services, and for urgent housing repair and maintenance. Contingency planning for more serious energy security risks should include measures that can rapidly reduce demand, notably information programmes on lower temperature thermostat settings and reduced vehicle speeds, and for Government leadership in these areas.

**Find out more:**

- £ Energy affordability & security crisis

## Reference

This report should be referenced as:

> Eyre, N. (ed). 2022. CREDS research findings. Oxford, UK: Centre for Research into Energy Demand Solutions.

## About CREDS

The Centre for Research in Energy Demand Solutions (CREDS) was established as part of the UK Research and Innovation's Energy Programme in April 2018, with funding of £19.5M over five years. Its mission is to make the UK a leader in understanding the changes in energy demand needed for the transition to a secure and affordable, net-zero society. CREDS has a team of over 140 people based at 24 UK universities

CREDS is funded by UK Research and Innovation, Grant agreement number EP/R035288/1

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