CATAPULT
Energy Systems

Making the energy transition fair and inclusive

Author: **George Day**, Senior Advisor: Net Zero Policy

Date: November 25

Contents

Acknowledgements:

This paper draws on research and experience from a range of Energy Systems Catapult projects and programmes. The author thanks colleagues from across the Catapult and partners who have shared their expertise.

For further information on our Fair Futures work please use this link: https://es.catapult.org.uk/what-we-do/consumer-insight-and-proposition-design/fair-futures/

To find out more about our Fair Futures work, contact us at fairfutures@es.catapult.org.uk

1. Executive Summary

The Net Zero transition requires transformational change in the UK energy sector. It also provides an opportunity to improve its role in delivering societal goals. The UK's track record in this area is poor – with some of the worst health outcomes in Europe. The path we take to decarbonisation will render current interventions even less effective and make the way we currently conceive 'fuel poverty' less meaningful, in part because the nature of vulnerability will change over time. This paper offers an alternative way of thinking about an inclusive energy transition, centred around the concept of improved 'energy access' across society.

By 'energy access' we mean the ability of all parts of society to reliably use and afford the energy services essential for health and well-being.

We look at the energy sector as one of the key enablers for the health and well-being of all households. We explore how to shape markets so they deliver inclusive, innovative low-carbon offerings, with government interventions targeted to where they can be most effective.

The UK's track record on energy access is poor

The UK has performed poorly on energy access for decades, evidenced most obviously by its relatively high levels of winter excess deaths (among the worst in Europe), lack of progress in improving measures of fuel poverty, along with rising levels of energy debt.

The concept of fuel poverty has been influential in policy development over the past two decades, with much attention and debate focused on its detailed definition and measurement. Arguably there has been less attention to understanding the detailed nature and drivers of the social ills or 'bad outcomes' caused by inadequate energy access.

Policy has attempted to address fuel poverty by means of national interventions (most often in the form of monetary transfers) with top-down eligibility or 'passport' requirements, linked mainly to eligibility for pensions or means-tested benefits. These interventions have been poorly targeted – support does not reach some of those who need it the most – and ineffective at a macro level, failing to improve winter mortality or other measures of 'social ills' (e.g. physical and mental health measures, educational disparities, etc.) associated with insufficient access to energy services.

There has also been much focus on the performance and fairness of the privatised energy sector in delivering a fair deal to households, particularly around retail practices and margins. This has resulted in tightening regulation of the energy retail sector and the imposition of the retail price cap. This heavy-handed approach constrains the scope and incentives for innovation in energy service design and pricing.

Interventions to incentivise and finance the energy transition have been layered on top of wholesale energy markets, creating tensions between the policy objectives of decarbonisation and enabling energy access. For example, domestic gas bills are shielded from carbon pricing but this disincentivises households from switching to low carbon electric heating and cooking. Subsidies for low carbon technologies are funded mainly via

electricity bills, which spreads the costs amongst all households. But the higher upfront cost of low carbon technologies (heat pumps, electric vehicles, solar panels) means that the benefits mostly accrue to wealthier consumers who can fund the capital outlays.

The Net Zero transition will challenge our current approach to energy access

Decarbonising the energy system entails fundamental changes to the physical, commercial and policy systems for delivering energy access. It means that the nature of vulnerability itself is likely to change over time. For example, digital literacy and a smart meter may become prerequisites for access to the cheapest tariffs; and unless the way costs are recovered is changed, an increasingly small number of consumers could be faced with paying for the entirety of the gas system. Even the definition of 'fuel poverty' itself could become less relevant in a world in which most energy costs pay for upfront investment in assets and devices, rather than for daily usage.

But these changes present an opportunity to rethink the paradigm and deliver substantial improvements to the UK's performance on energy access. We need to move from a narrow focus on fuel poverty, which foregrounds statistical measures of affordability, to a people-centred focus on improving energy access. For example, focusing on energy access addresses questions such as whether innovative, low-cost tariffs for flexible electricity use are designed in ways that are inclusive for low income and vulnerable consumers.

A focus on improving energy access would draw attention to the need to understand in more depth the key energy-related social ills, such as cold-related mortality and morbidity, mental health or impacts on children's development and education. It would enable a focus on innovative, inclusive and variegated service design to address those social ills – helping improve the UK's performance in this area, while doing so at a lower cost to bill and taxpayers. Doing so would help to maintain the public support for Net Zero.

We need a new approach to improving energy access

To deliver improved energy access as part of the Net Zero transition requires a coherent economic framework to promote innovation and decarbonisation, along with efficient and targeted interventions to address what cannot be delivered by markets. A holistic approach is needed to encourage collaboration and complementary behaviours across a system of actors including local authorities, energy suppliers, energy network companies, health and social services, NGOs, investors, homeowners and landlords, and consumers of all types.

There are four no-regret enablers that policymakers should use to enable such a holistic approach to improving energy access:

- **Take the long view in policy design** – we need to recognise the centrality of innovation and productivity improvement to the challenge of making energy affordable and universally accessible as we transition to clean energy. This means tackling some difficult long-term issues with clarity, rather than quick fixes. Current examples of where this is relevant include electricity market reform, the allocation of environmental policy costs, and decisions around the future of the gas networks.

Specific measures to target energy access can be layered onto a sound long-term framework for an efficient combination of markets and plans to drive the transition.

- **Harness the power of data** – data from a variety of sources, and digital tools to analyse and harness it, can underpin efficient and responsive targeting of services designed to improve energy access. Policymakers can design and implement better targeted interventions, in-turn unlocking the possibility of pursuing more ambitious policy reforms without fear of unwanted distributional effects that could not be addressed cost-effectively. Current examples of where this is relevant include Automatic Asset Registration (AAR), and access to meta-data from smart meters.
- **Fund local capacity to deliver** – the challenges of energy access and the opportunity to address it vary by place, and so might the best solutions. Government funding should focus on enabling innovative service delivery partnerships – these might encompass local authorities, health service providers, energy network companies and energy suppliers – at local levels. We should stop stigmatising local initiative with the term 'postcode lottery'. A current example of where this is relevant is the question of what the Warm Homes Plan should fund.
- **Trial and learn fast** – the tendency to view innovative solutions with suspiciousness, particularly when it comes to vulnerable consumers, needs to be turned on its head. Designing and testing propositions and policy interventions with low income and vulnerable consumers in a safe real-world environment will increase the success of these new ideas, help develop better ideas and to quantify costs and benefits. A current example of where this is relevant is the debate around introducing a 'social tariff' and what form such a tariff should take.

A policy framework built on these four enablers is the basis to a fair future: characterised by **markets that deliver innovative energy propositions – including tailoring offerings to the needs of consumers in different vulnerable situations – that make it attractive and affordable for people to make low-carbon choices**. Where the market is not able to meet some consumers' needs, this policy framework enables government intervention to be targeted and effective, designed to match the specific needs and circumstances in question.

1. The UK's track record on energy access

This section aims to provide a brief overview of how thinking about the social and economic challenges of access to energy services has developed in the UK since the 1970s.

1.1 The emergence of policy on fuel poverty

Since its inception, the definition and understanding of fuel poverty has evolved, with different countries adopting varied approaches to measuring and addressing the issue. The core idea remains focused on the intersection of low-income, high energy costs, and poor energy efficiency in housing.

The notion of fuel poverty and concern around it as a distinct social challenge grew during the energy price shocks of the 1970s and 80s, as did concerns around the impact of poor energy efficiency on the cost of keeping warm for many households. Dr Brenda Boardman's book 1991 *Fuel Poverty: From Cold Homes to Affordable Warmth* was a key early intellectual contribution in this space, developing the first widely accepted technical definition of fuel poverty (a household who must spend more than 10% of income to achieve an adequate standard of warmth). Boardman's analysis led to researchers and social activists highlighting the connection between cold homes, poor health outcomes, and social inequality[1].

Prior to 1997, under Conservative-led governments, some allowance was made in the welfare system for energy affordability challenges. For example, the supplementary benefit system allowed for additional payments to cover heating costs for certain groups judged to be at risk of struggling to be able afford adequate warmth. A system of cold weather-related payments to benefit recipients was also gradually developed from the mid-1980s. But it was under the Blair Labour government after 1997, that a more strategic national concern with fuel poverty and energy affordability emerged. This was embodied most obviously in the Warm Homes and Energy Conservation Act of 2000 which created a statutory framework obliging the secretary of state to create and implement a Fuel Poverty Strategy.[2]

The legislation specifically created a requirement for a statutory fuel poverty target and this has generally been framed in terms numbers of homes deemed to be fuel poor.

The current target is stated as ensuring that as many fuel poor homes as is reasonably practicable achieve a minimum energy efficiency level of an Energy Performance Certificate (EPC) rating of Band C by 2030. Interim targets are framed in terms of achieving EPC ratings for fuel poor homes by set dates. This approach has driven a strong focus on quantitative modelling of fuel poor homes to estimate progress to delivery of statutory targets. There has, however, been less detailed focus on understanding the underlying causal mechanisms between inadequate access to energy services and social harms such as health, educational or mental wellbeing outcomes and inequalities.

---

[1] Sustainability First (2010), Fuel Poverty: From Cold Homes to Affordable Warmth, report for Ofgem

[2] Warm Homes and Energy Conservation Act 2000

The use of EPCs as a tool to measure fuel poverty comes with its own challenges. To date, EPCs have been based on a single cost-based metric, which relies on underlying data about energy costs which is significantly out of date.[3] The government has committed to reforming EPCs to include a wider range of headline metrics,[4] but EPCs look likely to remain an imperfect tool for targeting policy measures to improve energy access.

1.2 Targeted transfer payments

After the 1997 election the Labour government substantially expanded the use of direct transfer payments or bill rebates as the main intervention to attempt to reduce fuel poverty.

- Cold weather payments – these were made automatic after 1997 (i.e. not requiring separate application) for recipients of means tested benefits, for 7-day periods of low winter temperatures. Payments are currently £25 per week and annual expenditure for 2023-24 was estimated at £29.6 million for England and Wales[5].
- Winter fuel payments (WFP) were introduced on a universal basis for all pensioners in 1997. These now account for most of the expenditure on transfer payments relating to energy bills, yet it has been widely accepted that the expenditure (approximately £2.05bn on a universal basis in 2023-24) is poorly targeted in addressing fuel poverty[6]. The Starmer government's attempts to tighten the criteria for receipt of WFP has, however, met with widespread political opposition. Changes have thus been watered down.
- Warm home discount (WHD) – was introduced in 2011 to help low income and vulnerable consumers with energy bills and takes the form of a one-off annual rebate (currently £150) usually applied automatically to electricity bills for eligible households. Energy suppliers fund the rebate through a levy on all consumers' bills. Eligibility criteria have varied since the scheme's introduction, but they target low-income pensioners and working age households in receipt of means tested benefits. The criteria for working age households have been relaxed for winter 2025-26.

1.3 Interventions to improve energy efficiency

As well as transfer payments, the government has also attempted to tackle fuel poverty by funding or obligating improvements in the energy efficiency of homes occupied by low-income households. The original focus was direct government funded grants for energy efficiency improvements for eligible households. Over the past 15 years this has shifted more to schemes funded by energy suppliers through the Energy Company Obligation (ECO).

---

[3] Energy Performance Certificates (EPCs): the case for change, Energy Systems Catapult blog by Fay Holland, 6 September 2023

[4] Energy Systems Catapult response to DESNZ consultation on Reforms to the Energy Performance of Buildings Regime, 26 February 2025

[5] Department for Work and Pensions (2025), Background and methodology: Cold Weather Payment estimates 2024 to 2025

[6] Department for Work and Pensions (2024), Winter Fuel Payment statistics for winter 2023 to 2024

Period	Focus	Main programme(s)
2000–2012	Direct grants to households or social housing providers	Warm Front, Carbon Emissions Reduction Target (CERT), Decent Homes standard, Community Energy Saving Programme (CESP)
2013–2018	Supplier obligations & market-based approaches	Energy Company Obligation (ECO) 1–2, Green Deal
2018–2025	Shift toward low-income targeting & whole house	ECO3–4, Warm Homes: Local Grant, Housing Upgrade Grant, Warm Homes: Social Housing Fund

Current energy efficiency programmes too often struggle to reach the households that they are designed to help. For example, in 2024-25 the Energy Systems Catapult ('the Catapult') and Scottish Power collaborated on a trial which sought to target access to ECO4 funding for vulnerable households, identifying people whose health is made worse by living in a cold home and offering free home improvement measures via the Warm Home Prescription® service.

Just four out of 42 (9.5%) of the surveyed homes qualified for a fully funded ECO4 retrofit due to misaligned funding rules and the scheme's whole-house approach. The average contribution required from residents was £17,850, making it unaffordable for most vulnerable households. The Catapult's experience was that structure of the scheme incentivises target- and measures-driven delivery over health or consumer-centred outcomes.[7]

[7] Energy Systems Catapult (2025), Making ECO Work for Health

1.4 Tariff structures and social tariffs

Over several years many of those concerned about fuel poverty and energy affordability have focused on the impact of tariff structures, notably the impact of standing charges on affordability for low-income consumers. This has partly reflected concern about how standing charges can contribute to energy debt even when consumers are using very little energy or have self-disconnected.

However, there are tensions and no easy solutions here. For a given level of energy system costs that need to be recovered from consumers, lowering standing charges means higher unit charges which, in turn, provides higher rewards for more affluent consumers who can partially self-supply. It would also exacerbate affordability challenges for larger households or those with non-discretionary use needs. See, for example, Citizen's Advice response to recent Ofgem consultation on this topic.[8]

More recently there has been growing support for the concept of a national social tariff to reinforce or perhaps replace some of the above measures. A variety of advocates have promoted social tariff concepts[9],[10]. Should a national social tariff be adopted it would face familiar challenges around funding (by taxpayers or other bill payers) and eligibility criteria.

1.5 UK Progress

The Committee on Fuel Poverty stated in 2024 that fuel poverty had not reduced in five years, following a decade during which steady progress had reduced by 40% the number of households in fuel poverty.

The Committee states 'We foresee that based on current energy price levels, targeted support to the fuel poor will remain important and necessary for the foreseeable future.'[11]

The Committee has also noted repeatedly that assistance is poorly targeted on those in fuel poverty. In 2021 it stated that only around 20% of the value of assistance under ECO, WHD and WFP reached fuel poor households[12]. Recent difficulties in tightening criteria around receipt of WFP shows how difficult it is for government to introduce reforms to improve targeting efficiency.

[8] Citizens Advice response to Ofgem's Call for Input on standing charges, 2 February 2024
[9] Scottish Government (2025), Social Tariff Working Group: final report – spring 2025
[10] National Energy Action (2023), Ninety-five organisations call for the introduction of a social tariff
[11] Committee on Fuel Poverty (2024), Fuel poverty has not fallen 'to any meaningful extent' in 5 years
[12] Committee on Fuel Poverty (2021), Annual report: 2021

UK performance on indicators relating to fuel poverty and energy access appears to be among the worst performers for similar countries in North and Western Europe.

- Excess winter deaths are higher in the UK than in countries such as Germany, Netherlands or Scandinavia, suggesting a higher health and mortality burden associated with cold homes[13]
- Surveys suggest that the proportion of UK households reporting being unable to keep their homes adequately warm is higher than most other Western and Northern European countries.[14]
- Fuel poverty in the UK appears concentrated in lower income, post-industrial towns[15], with low-income groups having to spend higher proportions of disposable income on heating than in comparable European countries such as Germany or Netherlands. Inequality in energy access across income deciles appears to be sharper in the UK than in most other European countries[16].

[13] E3G (2018), UK has sixth-highest rate of excess winter deaths in Europe
[14] European Statistics on Income and Living Conditions (EU-SILC 2014)
[15] Committee on Fuel Poverty (2024), Annual report 2024
[16] International Monetary Fund working papers (2022), Surging Energy Prices in Europe in the Aftermath of the War: How to Support the Vulnerable and Speed up the Transition Away from Fossil Fuels

2. The challenge and opportunity of the energy transition

Given the specific UK context for energy access, this section unpacks some of the key challenges and opportunities which arise for managing the energy transition.

2.1 Challenges arising from the transition for energy access

2.1.1 Incentivising change without damaging energy access

Delivering the energy transition is a huge societal, engineering and financial challenge for the UK. Much of our housing stock is older than in European peer countries, and the energy efficiency of its fabric requires improvement. Our current heating systems (overwhelmingly gas-reliant) are adapted to the particularities of UK housing stock and housing markets, reflecting our individualistic approach to housing and decision-making. Local government tends to be less powerful and less well-resourced in the UK than in European peer countries, so the framework for managing collective local decision-making is less well-developed.

Current economic incentives promote higher carbon heating choices, and energy for heating is favoured in current tax arrangements (through no carbon price on domestic gas and VAT exemptions for domestic energy).

The government is currently grappling with the difficulties of rebalancing these incentives without damaging public support for the transition to clean energy. Successive governments have committed to addressing the 'spark gap' between the retail price of gas and electricity, specifically with regard to how environmental and social costs are recovered. But specific reform measures have not yet been formally consulted on. Many commentators, suggest that redressing the 'spark gap' will be critical to promote decarbonisation of domestic heat, but that it will also require consideration of further (better) targeted intervention to assist low income and vulnerable households.[17]

2.1.2 Managing the upfront capital costs of change

A key challenge for the energy transition is that it tends to require significant upfront capital investment before the benefits of cleaner, smarter technology can be unlocked. Investing in solar panels, battery storage, or heat pumps is out of reach for many households. For cash-poor lower income households where immediate needs are likely to be most pressing (i.e. with high personal discount rates) this is a particular challenge.

How then can policymakers create policies or markets capable of spreading these investment costs in a socially acceptable way, while also maintaining incentives for efficiency? Past experience with interventions like the ECO scheme and the Green Deal shows how difficult this is, particularly within a wider economic context which continues to favour fossil fuels.

[17] Nesta (2024), Delivering clean heat: a policy plan

Government has intervened to lower the upfront costs of heat pumps, currently offering a £7,500 grant to households replacing a fossil fuel heating system through the Boiler Upgrade Scheme. Funding for low-carbon technology is also available through ECO, the Warm Homes: Social Housing Fund and Warm Homes: Local Grant, subject to eligibility requirements. But access to this assistance is often dependent on either the ability to financially contribute, or other criteria which may exclude many of the most vulnerable.

For low income and vulnerable households, the risk is that energy transition could worsen inequality and raise costs. These households need support and propositions that enable them to make low carbon choices, spread costs and gain immediate benefits from smarter clean energy services. These remain important challenges for policy to address as government develops its Warm Homes Plan.

2.1.3 Understanding what really drives bad outcomes

Much of the social science and analysis of fuel poverty has centred on income-related definitions and modelling progress against quantitative targets. This has tended to come at the expense of building a more detailed understanding of the causation of the bad outcomes that households experience from inadequate access to energy services. This is vital to inform the design of measures and energy services tailored to meet the needs of low income and vulnerable households as they navigate the energy transition.

NGOs and academics have begun to build the evidence base, for example in relation to the links between child health, development and education and cold or damp homes. For example, researchers at the Fuel Poverty Research Network show how children "are being disproportionately affected by the high cost of energy, with an impact on their physical wellbeing, mental health and the dynamics of their home environment"[18].

In relation to health outcomes there is growing awareness of the relationship between cold homes and health outcomes, but there is still much scope to improve understanding. The NICE guideline NG6 Excess Winter Deaths and Health Risks of Cold Homes was published in 2015 and provides guidance on strategies to reduce health risks from cold homes. Work by National Energy Action and Marie Curie reviewed how the recommendations were being implemented in practice and found progress to be patchy[19]. This review also highlighted the specific needs of people with terminal illness.

The impact of different ways of paying for energy on health outcomes is also poorly understood. People from lower income households are more likely to pay for their energy through pre-payment meters or pay on receipt of a bill. This means that they cannot spread higher winter heating costs throughout the year in the same way as Direct Debit customers[20]. Some evidence suggests that pre-payment meters may be associated with higher risks of poor health outcomes.[21]

---

[18] Fuel poverty is rocketing but where are the children in UK energy policy?, Fuel Poverty Research Network
[19] National Energy Action (2023), Taking the Temperature of NG6
[20] Resolution Foundation (2024), Paid in full: The perils facing pre-payment energy customers this winter
[21] Ding X, *et al* (2024), Prepayment meters strongly associated with multiple types of deprivation and emergency respiratory hospital admissions: an observational, cross-sectional study

2.1.4 Designing better policies and better targeting

Successive reports by the Committee on Fuel Poverty raise the issue of the relatively poor targeting of interventions on fuel poor households, within the government's Low Income Low Energy Efficiency definition (while also noting in its 2024 report some shortcomings with that definition)[22]. Even recent policies designed specifically to target low-income households appear to have performed poorly in delivering benefits to targeted groups. The strongest statement by the Committee on Fuel Poverty in relation to the efficiency of targeting came in its 2021 report[23] when it stated "It is unacceptable that out of a current total budget of over £2.55 billion per year allocated to improving energy efficiency and assisting householders to pay their fuel bills, only about £0.4 billion per year is received by fuel poor households".

Energy bills and the cost of delivering Net Zero following the energy crisis of 2021-23 are now highly politically salient. Many more people now struggle with energy bills, but there is little fiscal headroom for the government to address this directly. So we need approaches that are much more efficient and effective at delivering targeted assistance at as low a cost to other tax or billpayers as possible.

Controversy in the past year over Winter Fuel Payments is a good illustration of how difficult it can be to adapt social policy interventions, even when they are objectively inefficient in targeting assistance to those who really need it.

Improving the targeting efficiency and the realisation of benefits by households with energy access needs will be a key challenge. Understanding the detail of low income and vulnerable households' varied needs and the detailed causation mechanisms that link inadequate access to energy services with bad social outcomes will be key to better targeting and design of inclusive energy services.

2.2 Opportunities

2.2.1 Broadening out the definition of energy access

New approaches, technologies and design philosophies can be harnessed to build a more holistic, people-centred approach to the social challenge of ensuring all households are able to access energy services sufficient to maintain health and well-being. Our report on Inclusive Smart Solutions[24] discusses how research based on current and intended future energy behaviours shows that groups displaying a range of socio-economic characteristics are at higher risk of being locked out of a future smart energy system.

We can broaden our approach from the income or cost-related emphasis of fuel poverty definitions and targets. This means focusing more on understanding how to deliver services in ways that meet the varied needs of low income and vulnerable households. Building a broader concept of ***energy access*** provides the opportunity to build a much

[22] Committee on Fuel Poverty (2024), Annual report 2024
[23] Committee on Fuel Poverty (2021), Annual report: 2021
[24] Energy Systems Catapult (2025), Inclusive Smart Solutions: Final Report

richer picture of needs at household level, the causative factors that drive bad outcomes and therefore to more insightful design services or interventions to improve energy access

In our response to the recent review of the Fuel Poverty Strategy,[25] the Catapult suggested that the fuel poverty target should be reframed and broadened to measure progress towards the outcomes and impacts that are needed to achieve a fair and inclusive energy system. Fuel poverty targets should ultimately be set to measure progress to the social impact that government wants its policies to achieve.

For example, framed around:

- Health: a reduction in the number of people with health conditions made worse by the cold admitted to hospital and a reduction in their avoidable mortality (e.g. by adopting a suitable measure of excess winter deaths or cold-related morbidity).
- Debt: a reduction in the proportion of households that are experiencing energy debt.
- Access to energy: a reduction in the proportion of households that are self-disconnecting from energy to manage costs. This could be measured through smart meter data and contacts with energy advice agencies.

To enable achievement of the social impact targets set out above, government would need to adopt new measurements of low income and vulnerable consumers' energy-related outcomes. We think these should build on reformed EPCs, given the role EPCs already play in energy and fuel poverty policy.[26] Specifically:

- Energy Performance: measured using the Fuel Poor Energy Efficiency Rating (FPEER), this would provide continuity with the current fuel poverty target by measuring the proportion of low-income households whose homes achieve energy costs equivalent to the current EPC C, where the EPC rating is based on an updated methodology incorporating *in situ* measurement of energy performance wherever possible.
- Energy affordability: measured using an additional indicator to reflect the impact of energy prices on the ability of low-income households to access energy, which captures all low-income households who are unable to heat their homes rather than only those in energy-inefficient housing.
- Climate impact: using a carbon metric within the EPC, this would measure the proportion of low-income households whose homes achieve a desired standard in terms of carbon emissions attributable to their energy use. This would measure the extent to which low-income households are enabled to participate in the transition to Net Zero.
- Smart readiness: using the proposed Smart Readiness metric in the reformed EPC would measure the proportion of low-income households achieving a desired standard in terms of the ability to participate in demand side flexibility. This matters because it will enable low-income households to access lower energy prices at off-peak times, which are expected to play an increasingly important role in the energy system as we move towards clean power and electrification of heat and transport.

[25] Energy Systems Catapult response to DESNZ's Review of the Fuel Poverty Strategy, 4 April 2025
[26] Energy Systems Catapult (2023), Making Energy Performance Certificates work for Net Zero

Targets and objective dates for each of these outcomes should be set in line with relevant delivery plans and Carbon Budgets. Government can then align regulation and funding programmes with these, measuring the effectiveness of policy in realising these outcomes and impacts.

2.2.2 Data & digitalisation to enable better targeting

The growing digitalisation of the energy system and the adoption of smart meters creates the opportunity to build a richer picture of how households use energy. The Catapult's own Living Lab facility provides a live example of how digital technologies can enable rapid testing of new products and services, accelerating learning and improvement.

The Data Communications Company (DCC) has identified two primary opportunities to address energy access through the smart metering system:[27]

- More dynamic and accurate insight to enable targeted intervention, for example identifying geographic concentrations of fuel poverty which enable energy efficiency schemes to better target their services.
- Direct intervention through the system which could facilitate the introduction of a social tariff for vulnerable consumers.

Joining up data between sectors is also needed to enable better targeting. The Catapult's Warm Home Prescription service works with the NHS and other health agencies to identify people who have health conditions made worse by the cold. However, Integrated Care Boards and NHS Trusts are not required to collect data on health vulnerability to the cold and those that do use a range of formats and criteria. Comprehensive understanding of how many people are at risk from cold homes and where they live is needed to design services to address this.

Better data means improved understanding and quicker feedback, enabling innovative new service designs. The Catapult recommends unlocking smart meter system data to support fuel poor households. Ofgem should give the DCC 'permitted purpose' consent while longer-term regulatory solutions are explored. Industry should work with Ofgem to agree changes to data governance and data legislation responsibilities.[28]

2.2.3 Learning from other sectors

The energy sector is not unique in needing to enable low income and vulnerable individuals to access socially essential services. Policy makers and energy market players would benefit from learning the lessons of these sectors, which range beyond the typical regulated utility sectors that energy is compared to. The two most obvious comparator sectors appear to be health and financial services (section 3.2 below on harnessing the power of digitalisation includes some examples of innovative services from those sectors).

The health sector is an interesting comparator because of its need to focus on variegated and specific needs associated with different conditions, and to enable patients to access

[27] Data Communications Company (2025), Tackling Fuel Poverty through Smart Metering
[28] Energy Systems Catapult (2023), Data for Good: smart meter data access

services and manage their needs themselves (see text box below). The Financial services sector is interesting because while it is a regulated retail market there appears to be more scope and incentive for innovation in service design. Potentially there are lessons for retail energy regulation to be drawn from the experience in financial markets.

Health and fintech examples of inclusive digital innovation

Health sector examples

NHSX was launched in 2019 to drive digital transformation across the NHS, focusing on initiatives in Digital records (electronic patient records, interoperability), Mobile apps, AI and data initiatives, improving cybersecurity, supporting digital health startups and scaling innovation. A range of digital innovations were stimulated during the pandemic including, for example:

Alcuris Ltd Alcuris' Memohub® prolongs the independence of elderly or vulnerable people, enabling them to return to home quicker from hospital. A digital platform collates data from unobtrusive home sensors to provide actionable alerts when behaviour changes, enabling families to intervene and reduce the frequency of professional 'crisis intervention' help.

Vine Health for cancer patients: Vinehealth is a mobile app to support cancer patients and their loved ones during treatment by allowing them to easily track and understand their care, including their symptoms, side effects, appointments and medications by completing a 1-minute daily log.

Beam: a digital platform that supports the homeless and vulnerable. Beam takes referrals from local authorities and homeless charities and ensures goods are funded, delivered and documented.

VideoVisit Ltd: VideoVisit® HOME allows the elderly to communicate with their family members and home care providers through a virtual care tablet designed specifically for the elderly. VideoVisit will measure how this impacts people's feeling of safety and loneliness during self-isolation.

Fintech examples

Snoop – Money Management app aggregates accounts and finds ways for users to save on bills and subscriptions. Tailored for households under financial pressure to optimise spending and spot "bad deals" – very useful for lower-income groups.

Pockit – Prepaid cards and current accounts for the underserved, Pockit offers: Basic current accounts without needing a credit history; access to direct debits; salary payments, government benefits; and cashback on spending.

There are also new approaches to social outcome procurement or commissioning, social impact bonds or place-based commissioning, which could offer potential opportunities for improving social impact in the energy sector.[29] These approaches are untested in the energy sector and further work would be needed to understand how such approaches could best be applied to the problems of energy access.

[29] Gov.UK (2023), Guidance: Social Outcomes Partnerships and the Life Chances Fund

Nonetheless a range of examples and evidence offer potential inspiration for the design of new interventions aimed to improve energy access or to incorporate within a broader place-based or built environment focused intervention. Government could initiate a trial to test the use of these approaches to deliver energy efficiency funding as part of its Warm Homes Plan funding commitment.

2.2.4 User-centred design

This phase of significant change in the energy sector is an opportunity to address the failings of current policy approaches to meet the needs and preferences of low income and vulnerable consumers. To do so requires designing new products and services around these needs and preferences.

The Catapult carried out a review in 2021, resulting in six recommendations to enable ideas to become products and services that increase access to a smart energy market.[30] To address some of these recommendations, the Inclusive Smart Solutions programme[31] aimed to provide a better understanding of the barriers faced by low income and vulnerable consumers in the transition to a smart, flexible energy system and develop innovative solutions to facilitate their participation. This model and the insights it has generated can provide a framework for future innovations to understand and address the needs of low income and vulnerable consumers.

Based on this project and our wider experience of working with low income and vulnerable households around flexibility services, there is a strong case to:

- Encourage or require innovators offering smart solutions to make it clear how the benefits they offer are estimated, for example, by establishing a suitable baseline reflecting realistic consumption of households who ration their energy use and requiring that innovators use this baseline to estimate realistic savings for such households.
- Put in place appropriate safeguards to ensure that low income and vulnerable consumers reducing their consumption at peak times are not put at increased risk. For example, guidance could ensure that essential devices (e.g. medical equipment) are excluded from any automated flexibility responses.
- Develop a regulatory environment that permits innovative retail models, such as those that enable consumers to pay for outcomes they value (such as warm hours rather than kWh) or 'secondary supply' models that allow consumer to access different tariffs for different devices in their homes.[32]
- Develop a system map to help innovators, particularly those new to the energy sector, understand how smart, flexible solutions should be integrated within the energy system. This could highlight the impact of potential policy or regulatory changes, giving innovators visibility of how the system might evolve.

---

[30] Energy Systems Catapult (2021), Project InvoLVe: How can innovation deliver a smart energy system that works for low income and vulnerable consumers?

[31] Energy Systems Catapult (2025), Inclusive Smart Solutions: Final Report

[32] Energy Systems Catapult (2025), Exploring the secondary supplier model

- Enable new asset ownership models so low income and vulnerable consumers can access assets – and the benefits they enable – without owning them.
- Ensure that standards applicable to energy smart devices requires them to be interoperable and accompanied by accessible information for households, so that households can to operate them effectively.

2.2.5 Better technology and outcomes

Low carbon technologies offer the opportunity to improve outcomes for households through smarter, cleaner, more reliable and efficient heating systems, better insulation and indoor air quality management. All of these technologies potentially provide an opportunity to not only decarbonise home energy consumption, but to substantially improve user experiences (e.g. improved controllability) and health outcomes.

For example, one of the innovations tested in the Inclusive Smart Solutions programme was the Homely heat pump controller.[33] Through the trial, Homely enhanced its controller to create a custom version of their smart optimisation technology, specifically adapted for low-income and vulnerable users. The Homely smart optimiser considers multiple factors like home heat loss, weather conditions and energy tariffs to dynamically adjust flow temperatures. Their in-home display will be designed for ease of use, particularly for those less familiar with this type of technology. Adapting products like this to meet the needs of these consumers should increase access to energy by making it easier for households to achieve their desired comfort levels while keeping energy costs manageable.

[33] Energy Systems Catapult (2024), Four UK projects announced to help make benefits of domestic energy flexibility accessible to the widest range of consumers

3. Towards a new approach to improving energy access

In the previous section we noted specific opportunities that can come about from taking a different approach to improving energy access, as part of the transition to Net Zero. In this section we set out four enabling principles for a more people-centred policymaking paradigm focused on improving energy access, and less on statistical definitions of fuel poverty.

This approach would aim to deepen understanding of the key energy-related social ills and stimulate the use of innovative, inclusive and variegated service design to address them. This will help the UK to substantially improve its performance in reducing those social ills, and to achieve that at a lower cost to tax or bill payers.

3.1 Take the long view in policy design

Ensuring all groups of society have good energy access is a long-term challenge. The issues we currently refer to as 'fuel poverty' are embedded in long term societal conditions and structures that extend beyond the structure or level of energy tariffs (e.g. the functioning of housing markets, income inequality, etc.). The way we conceive of and measure fuel poverty leads to a policy focus on short term measures to directly reduce the numbers of households according to specific definitions of fuel poverty[34].

The temptation then is to seek measures such as particular tariffs (e.g. lowering standing charges) or social tariff designs. Such measures can only address a relatively small part of the wider problem of energy access – and they often come at the expense of targeting efficiency and unintended consequences. For example, reducing standing charges can over-reward affluent consumers who take up technologies like solar panels, leaving proportionately more of the system cost burden to be shouldered by less affluent consumers.

As an essential service, energy is always politically salient. Understandably policymakers want to be able to show a clear link between new policy measures and benefits that people can feel – most obviously in their bills. This leads to a focus on policies that intervene directly in energy bills or the costs faced by households. But these interventions are hard to target efficiently at a national level and can have undesirable side effects on the incentives to innovate or the ability of markets to adapt to new challenges.

The energy price cap is a good example of this. The policy arose out of a sense that competition was not delivering good value for households and was the culmination of several interventions to constrain suppliers' behaviour[35]. But recent consultations from both Ofgem and Government imply recognition of risk that over-regulation could

[34] More recently academics have also begun to argue that the language of fuel poverty "implicitly stigmatises people while ignoring structural problems with global energy systems" See: Bouzarovski, S., *et al* (2025), Reframing how we talk about 'energy poverty', *Nat Energy*

[35] Energy Systems Catapult response to Ofgem's Energy system cost allocation and recovery review, 24 September 2025, sets out our thinking on related themes.

constrain innovation,[36] particularly for smarter, more flexible deals that could unlock flexibility or otherwise enable consumers to benefit more from the transition to clean energy.

The energy transition is a long-term challenge, requiring investment in long life assets, so it is important that policy makers take a long view if it is to be delivered efficiently. Energy users have a strong interest in the efficiency of the overall system, which in turn is driven by the success or otherwise of innovation and productivity improvement. This ultimately determines the cost burden they must bear and the affordability of services they rely on.

The temptation to find politically expedient quick fixes needs to be replaced by a recognition of the benefits in long term productivity and innovation that can be unlocked by tackling difficult decisions head on. There are a number of big and difficult challenges that need to be tackled in the years ahead, but it is important that policymakers take a long view. These include electricity market reform, policy cost allocation and recovery and the future approach to recovering the costs of the gas network as it transitions to a very different role in a Net Zero energy system.

In summary, we suggest some principles to guide policy thinking around balancing long term productivity and the challenges of energy access and affordability:

- Recognise that, in the long run, the cost of energy to consumers will be determined by the energy sector's productivity and efficiency.
- Given the transformation required in the energy system to achieve Net Zero, recognise too that innovation will be key to improving energy sector productivity and affordability.
- Recognise that tensions often arise between manipulating charging structures to favour groups who meet various qualifying criteria, and the broader challenge of shaping enduring signals for efficiency, innovation and productivity.
- Recognise the limits of top-down qualifying criteria (e.g. benefits or age-related eligibility) for efficiently targeting measures to address the social ills associated with inadequate energy access.
- Recognise that economic or income indicators on their own are not the only drivers of energy access.
- Aim to create a policy framework that favours long term productivity in the energy transition and maximises the ability to efficiently target assistance to those with specific challenges around energy access.

An example of how we see these principles being operationalised would be our position on locational pricing in the wholesale electricity market,[37] which has recently been ruled out by Government.[38] We see long term reform of markets as being a significant enabler of

[36] Ofgem (2024), Innovation in the energy retail market and DESNZ (2023), Towards a more innovative energy retail market: a call for evidence

[37] Uber-good: making electricity markets fit for Net Zero, Energy Systems Catapult blog by Ben Shafran, 18 July 2023 and REMA is too important to be kicked into the long grass, Energy Systems Catapult blog by Tom Luff and Tim Chapelle, 2 March 2023

[38] DESNZ (2025), REMA: Summer update

innovation and longer-term productivity improvement in the sector. We note concerns about the potential distributional impacts for consumers but consider that interventions to improve energy access are more likely to succeed if they are smartly targeted and designed on social ills, rather than constraining improvements to the technical design of markets.

3.2 Harness the power of digitalisation

An increasing body of experience suggests that we can make much smarter use of data from a variety of sources and through harnessing increased digitalisation of the energy system (e.g. Automatic Asset Registration (AAR)) to underpin efficient and responsive, up to date tracking and targeting of measures to support improved energy access[39].

This could enable policymakers to design and implement more efficiently targeted assistance or support payments to improve energy access. This in-turn could unlock the possibility of pursuing more ambitious innovation and productivity-friendly reforms of energy markets (e.g. to more closely reflect real time physics in market signals) without fear of unwanted distributional effects that could not be addressed cost-effectively.

Smart Pre-payment – an early example of how digitalisation can improve energy access

One example of how digitalisation has improved energy access for lower income consumers is the advent of smart prepayment. Ten years ago, if you were on a prepayment gas and electricity meter you might have had to go to your corner shop if you had forgotten to top up your key or card.

But with smart prepayment, hundreds of thousands of energy consumers can now top up their prepayment meter on their phone, quickly and easily.[40] The app may also give information to help with budgeting and can certainly give warnings when credit is running out.

This digital innovation – smart prepayment – was introduced by suppliers like Utilita, using innovative technology from meter manufacturer Secure. It's one small but important improvement to energy access, making people's lives better and easier to run, while also reducing the cost to serve for innovative suppliers.

There has been progress in digitally enabled smart controls and tariffs to make flexibility attractive for the able-to-pay segment of consumers, given their higher rate of owning an EV or heat pump (e.g. Octopus' "Intelligent Octopus Go" tariff, or Ovo's "Charge Anytime"

[39] Fawcett, T., *et al* (2024) Using smart energy meter data to design better policy: Prepayment meter customers, fuel poverty and policy targeting in Great Britain, Energy Research & Social Science 116
[40] DESNZ (2025), Smart Meter Statistics in Great Britain: Quarterly Report to end December 2024

plan). The next frontier in digital innovation may well be around propositions that unlock flexibility from low income and vulnerable consumers. Electrification of heating will raise new challenges for designing services for different kinds of consumers (whether vulnerable due to lack of digital access to poor housing stock). There is significant scope to draw on the experience of digital innovations to help people with specific needs or vulnerabilities from other sectors, notably healthcare and fintech (see section 2.2.3).

In future, AAR for low carbon technologies could enable services for low income and vulnerable consumers with particular energy access challenges to adopt them. AAR was initially conceived of by the Energy Data Taskforce[41] and the Energy Digitalisation Taskforce[42], who called for the coordination of asset registration of low carbon technologies connected to distribution networks (such as solar panels, EVs, battery storage and heat pumps, which typically require registration by an installer).

The data from a central asset register could be combined with other datasets – for example, those held by local authorities on social housing – to allow measures targeted on consumers adopting low carbon technologies and who have specific needs around energy access. AAR could be integrated into a system to ensure vulnerable and low-income consumers are able to access financial, digital, and systemic benefits (e.g. smart tariffs) that would otherwise pass them by. It could be the foundation of innovative propositions that target different sources of flexibility more common amongst low income and vulnerable consumers (e.g. storage heaters), which could unlock "load diversity" that is highly valuable to operating the system.

3.3 Fund local capacity to deliver

The challenges of energy access and the opportunity to address it vary by place and so do the best solutions. Government funding (e.g. through the Warm Homes Plan) should focus on enabling innovative service delivery partnerships at local levels. This might encompass local authorities, health service providers, network companies and energy suppliers. Local delivery partnerships could devise their own eligibility processes or criteria to target measures according to local priorities and needs, in place of using top-down 'passport' eligibility criteria linked to age or benefits receipt. Innovation and learning in efficient identification and targeting of assistance could play a key role in improving social outcomes and value for money.

Our work to develop the concept of Warm Homes Prescription is a great example of how we see that innovation can be harnessed and directed to address the social ills related to energy access, making use of existing local capacity to deliver improvements.

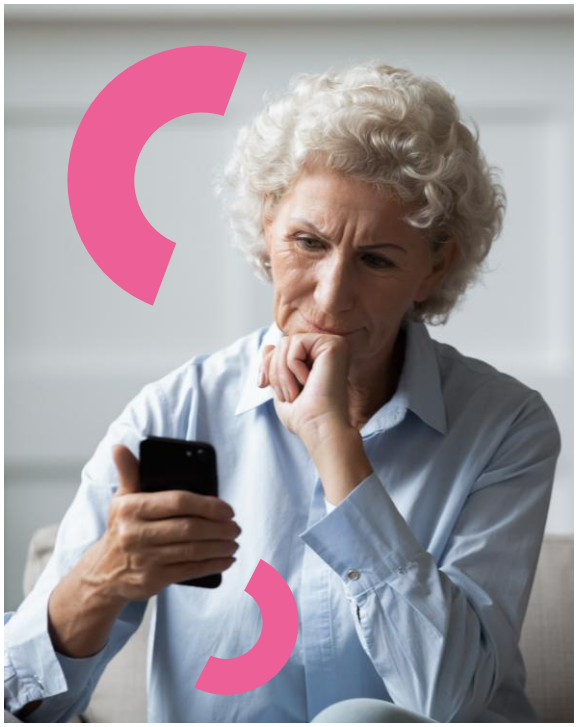
Several trials of Warm Home Prescription have tested different delivery models. Local partnership working has been common to all of them. Health professionals play a vital role in identifying patients who would benefit from the service and enabling them to be contacted. The NHS acts as a trusted messenger, encouraging people to engage with the service – helping to overcome the challenges caused by the public's low trust in energy

[41] Energy Data Taskforce (2019), A strategy for a modern digitalised energy system
[42] Energy Digitalisation Taskforce (2022), Delivering a digitalised energy system

retailers. The local voluntary and community sector assess the needs of the patient and provide support and advice, facilitating energy credit or home retrofit depending on the programme design and need. These pilots show the potential of local partnership delivery to address health-related social ills by improving access to energy[43]. Bringing together health services, energy companies and organisations involved in energy advice in place-based partnerships enables a person-centred approach to improving energy access.

The local partnership approach has the potential to address some of the challenges experienced by existing energy efficiency schemes. For example, ECO schemes have historically had high administration costs associated with finding and engaging with eligible households. Installers delivering the programmes have often had to travel considerable distances to eligible households, increasing costs. Better targeting and place-based partnerships can reduce the costs of delivery by creating economies of scale, as well as enabling services to be tailored more effectively to the needs of local people.

3.4 Trial and learn fast



The tendency to view innovative solutions with suspicion, particularly when it comes to vulnerable consumers, needs to be turned on its head. Testing with consumers in a safe real-world environment can reduce risks, quantify costs and benefits, and help develop better ideas. Given the scale of the energy access needs and the challenges outlined earlier in this report, it is vital that innovators and policymakers or social commissioners are encouraged to focus on the needs of low income and vulnerable households.

The Catapult has been at the forefront of efforts to ensure that innovation in energy services meets the needs of low income and vulnerable households, as well as affluent able-to-pay groups. For example, ESC has already developed guidance[44] on designing and running trials for disabled consumers in collaboration with the Research Institute for Disabled Consumers.

The Catapult has also developed the concept of a Living Lab (see text box) and recruited vulnerable and low-income households to the panel so that their needs can be reflected in innovation trials. The Living Lab is an example of a safe environment for testing innovative new services aimed specifically to meet the needs of low income and vulnerable households.

[43] Energy Systems Catapult (2025), Making ECO Work for Health
[44] Energy Systems Catapult (2022), Trialling with Disabled Consumers: Enabling energy innovation to be inclusive

Energy Systems Catapult's Living Lab

The Living Lab is a community of thousands of households, who are ready to participate in trials of new clean energy innovations. Living Lab households are spread across England, Scotland, Wales and Northern Ireland, and cover a wide variety of tenures, property types and demographics, including vulnerable and fuel poor households.

We capture energy data from homes via mainstream smart meters, smart heating controls, battery storage, solar PV, electric vehicles and chargers, heat meters and more. We can also flex the operation of EV charging and heating systems, to test how these might be used in future energy systems.

The Living Lab can also be combined with network emulation and real-time simulations of future energy system scenarios, to test the network impact of new innovations and test how they would perform under future market conditions, creating a feedback loop between consumer behaviour and system conditions.

Using a trial and learn fast approach with practical real-world testing of propositions and technologies can unlock major improvements in the design of measures or combinations of technology and service interventions to deliver assistance. Some examples of the kinds of questions that could be examined include:

- How could the Warm Home Discount be delivered by suppliers in ways that households value most?
- What are the most cost-effective smart flexibility devices for unlocking savings for households with different needs?
- How can aggregators or suppliers best enable low-income households to benefit from flexibility offerings?
- What is the impact of different designs of 'social tariffs' on different consumer types and their energy use?

3.5 Conclusion

A policy framework built on these four enablers could accelerate progress on energy access, as part of an energy transition that is fairer for all sections of society.

Markets can be shaped to make it attractive and affordable for people to make low-carbon choices and to deliver innovative energy offerings, including tailoring offerings to the needs of consumers in different vulnerable situations.

Where the market does not meet some consumers' needs, policy can then support targeted services and interventions designed to meet those specific needs and circumstances. Those interventions are likely to be more efficient and effective by virtue of making better use of data and local capabilities, and from having been tested in the real-world.

Licence/Disclaimer

Energy Systems Catapult (ESC) Limited Licence for Making the Energy Transition Fair and Inclusive
ESC is making this report available under the following conditions. This is intended to make the Information contained in this report available on a similar basis as under the Open Government Licence, but it is not Crown Copyright: it is owned by ESC. Under such licence, ESC is able to make the Information available under the terms of this licence. You are encouraged to Use and re-Use the Information that is available under this ESC licence freely and flexibly, with only a few conditions.

Using information under this ESC licence
Use by You of the Information indicates your acceptance of the terms and conditions below. ESC grants You a licence to Use the Information subject to the conditions below.

You are free to:

- copy, publish, distribute and transmit the Information
- adapt the Information
- exploit the Information commercially and non-commercially, for example, by combining it with other information, or by including it in your own product or application.

You must, where You do any of the above:

- acknowledge the source of the Information by including the following acknowledgement:
- "Information taken from Making the Energy Transition Fair and Inclusive, by Energy Systems Catapult"
- provide a copy of or a link to this licence
- state that the Information contains copyright information licensed under this ESC Licence.
- acquire and maintain all necessary licences from any third party needed to Use the Information.

These are important conditions of this licence and if You fail to comply with them the rights granted to You under this licence, or any similar licence granted by ESC, will end automatically.

Exemptions
This licence only covers the Information and does not cover:

- personal data in the Information
- trademarks of ESC; and
- any other intellectual property rights, including patents, trademarks, and design rights.

Non-endorsement
This licence does not grant You any right to Use the Information in a way that suggests any official status or that ESC endorses You or your Use of the Information.

Non-warranty and liability
The Information is made available for Use without charge. In downloading the Information, You accept the basis on which ESC makes it available. The Information is licensed 'as is' and ESC excludes all representations, warranties, obligations and liabilities in relation to the Information to the maximum extent permitted by law.

ESC is not liable for any errors or omissions in the Information and shall not be liable for any loss, injury or damage of any kind caused by its Use. This exclusion of liability includes, but is not limited to, any direct, indirect, special, incidental, consequential, punitive, or exemplary damages in each case such as loss of revenue, data, anticipated profits, and lost business. ESC does not guarantee the continued supply of the Information.

Governing law
This licence and any dispute or claim arising out of or in connection with it (including any noncontractual claims or disputes) shall be governed by and construed in accordance with the laws of England and Wales and the parties irrevocably submit to the non-exclusive jurisdiction of the English courts.

Definitions
In this licence, the terms below have the following meanings: 'Information' means information protected by copyright or by database right (for example, literary and artistic works, content, data and source code) offered for Use under the terms of this licence. 'ESC' means Energy Systems Catapult Limited, a company incorporated and registered in England and Wales with company number 8705784 whose registered office is at Cannon House, 7th Floor, The Priory Queensway, Birmingham, B4 6BS. 'Use' means doing any act which is restricted by copyright or database right, whether in the original medium or in any other medium, and includes without limitation distributing, copying, adapting, modifying as may be technically necessary to use it in a different mode or format. 'You' means the natural or legal person, or body of persons corporate or incorporate, acquiring rights under this licence.

Energy Systems Catapult is an independent research and technology organisation. Our mission is to accelerate Net Zero energy innovation.

Launched in 2015 by Innovate UK, the Catapult has built a team of more than 250 people, with a range of technical, engineering, consumer, commercial, incubation, digital, and policy expertise. They draw on sector-leading test facilities, modelling tools, and data collected from our back catalogue of more than 500 research projects.

We use that 'whole energy' system capability to support innovative companies -- small and large – to test, trial and scale their new products and services. Our impact comes when those innovators attract new customers, new investment, and new grants so they can thrive in the future energy system.

Based in Birmingham, Energy Systems Catapult is part of a network of nine world-leading technology and innovation centres, established by Innovate UK. The Catapult Network fosters collaboration between industry, government, research organisations, academia, and many others to transform great ideas into valuable products and services.

Energy Systems Catapult
7th Floor, Cannon House
18 Priory Queensway
Birmingham
B4 6BS

es.catapult.org.uk