Summary Report

uZERO TACKLING THE GROWING FUEL POVERTY CRISIS WITH AI

UrbanTide

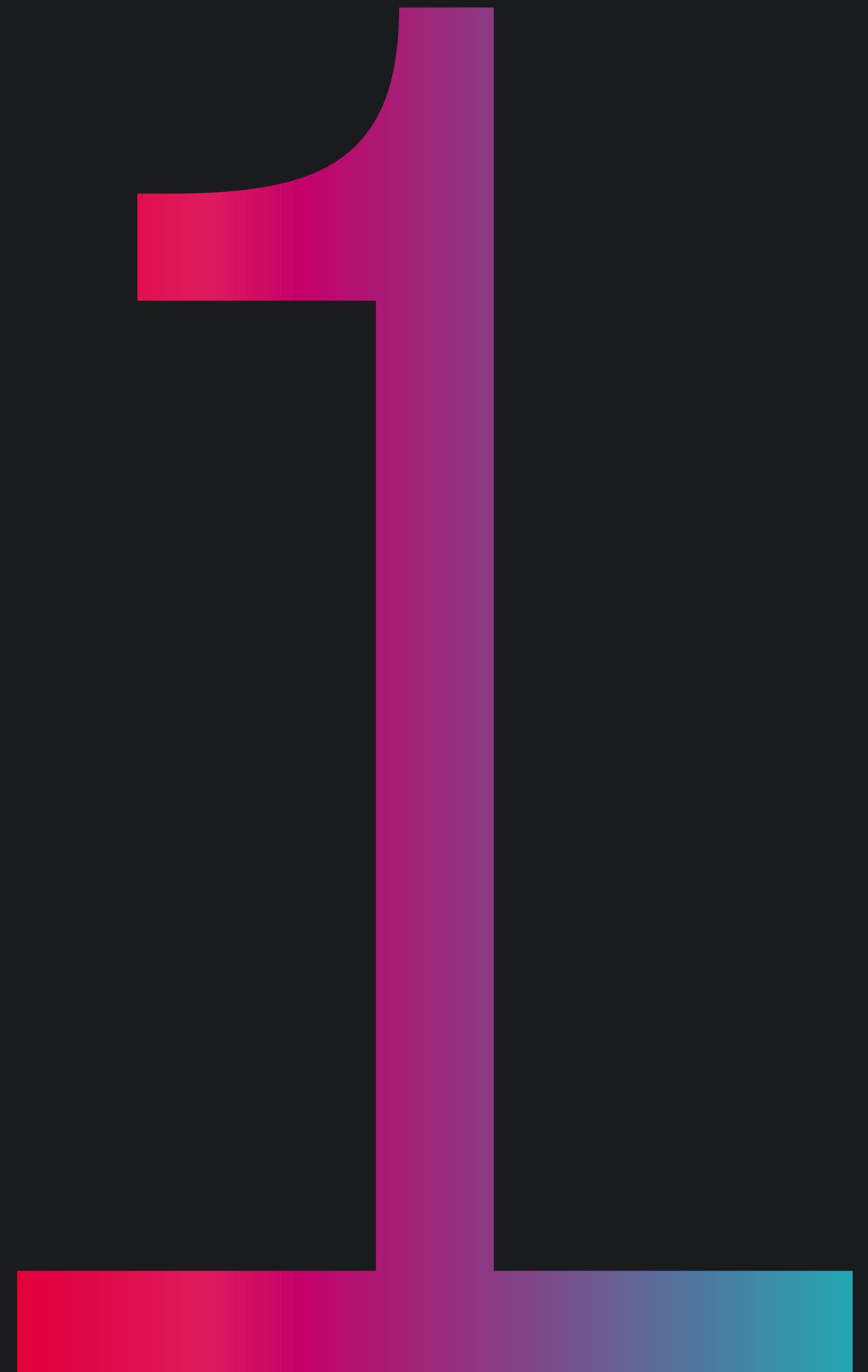# Contents

TACKLING *THE FUEL POVERTY* CRISIS WITH AI

1

6.7 million UK households are expected to experience fuel poverty in 2022/23 – that's around one in four homes in the UK.

As the cost of living crisis intensifies across the UK, identifying households most at risk from fuel poverty will be critical so that organisations can efficiently target support where it's needed most.

UKRI Innovate UK

For the very first time, UrbanTide's uZero is able to combine GB-wide smart meter system data (anonymised by the Data Communications Company) with multiple cross-sector datasets to provide up to date and unique identification on fuel poverty risk.

By combining data and using advanced machine learning, uZero can identify target areas that would benefit most from support and energy-energy-efficiency measures, which will not only reduce fuel poverty but also CO_2 emissions, helping to meet UK Net Zero targets.

This report outlines how uZero will help organisations overcome the barriers that currently prevent them from providing targeted support to fuel-poor households.

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uZero: Tackling the growing fuel poverty crisis with AI is a project led by UrbanTide and funded by UK Research and Innovation (UKRI) and Innovate UK. The project is part of the UKRI '**Modernising Energy Data Applications (MEDApps)**' competition, overseen by the **Prospering from the Energy Revolution** challenge.

This MEDApps project was led by UrbanTide, with support from our consortium members; Data Communications Company (DCC), Greater South East Net Zero Hub, University College London and Connected Places Catapult.

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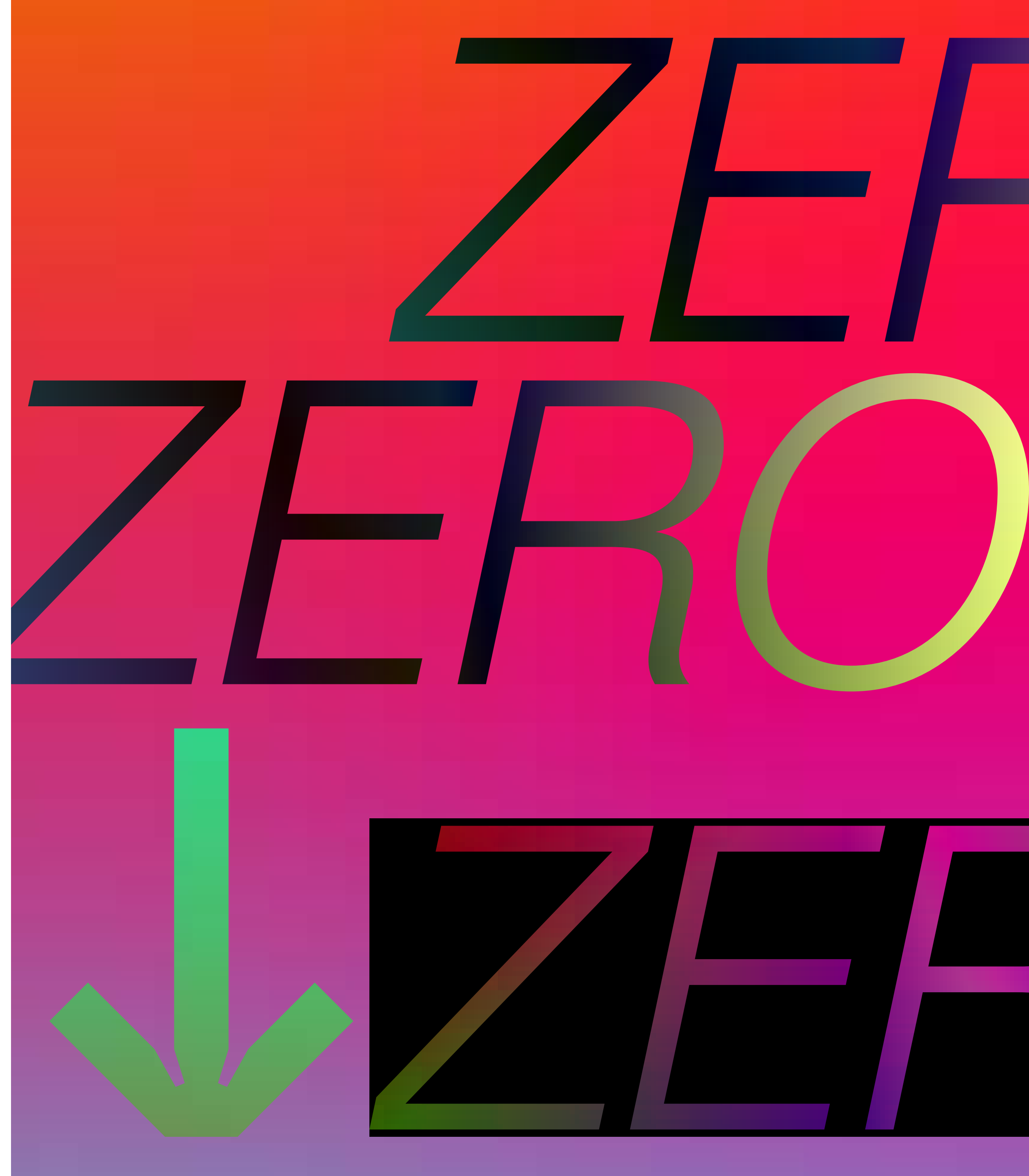
THE GROWING *COST OF LIVING* & FUEL POVERTY CRISIS

Millions of UK households are falling into debt and cutting back on essentials due to soaring energy costs. Struggling households are resorting to extreme coping strategies, rationing their heating to unhealthy levels. This includes only heating one room, wearing coats indoors, 'heat or eat' food rationing and using public places to stay warm.

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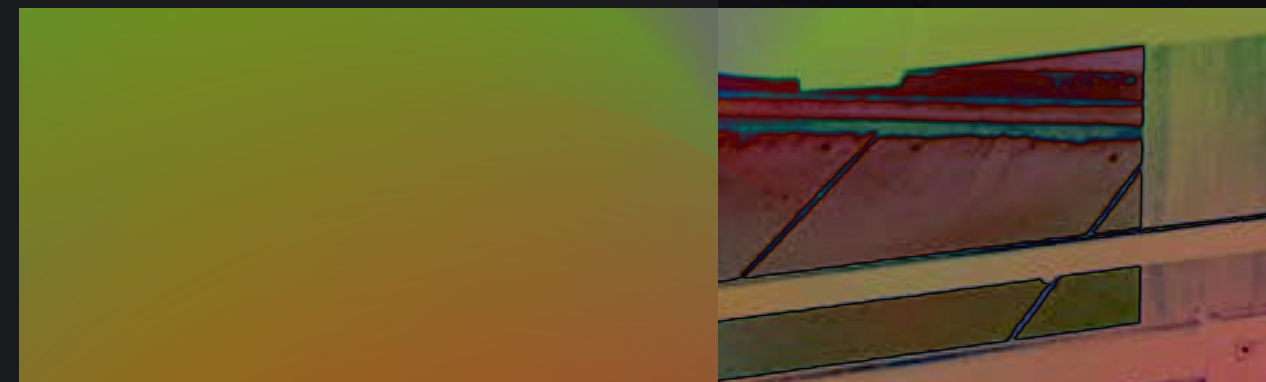
6.7m

This growing cost of living crisis is unprecedented. In October 2021, 4.5 million UK households were in fuel poverty. Now, National Energy Action predicts that for the UK as a whole, this number will reach **6.7 million in 2022/23**.

Despite the seriousness of this issue, organisations involved in supporting fuel-poor households still face significant challenges. Local authorities and their delivery partners, energy suppliers, networks and other organisations all have obligations and targets to help vulnerable households, and with the growing crisis the scale of support needed has increased significantly.

This strengthens the need for targeted prioritisation of the areas and households most in need of energy-efficiency support measures. However, the organisations involved in providing this support continue to face the following data-related barriers:

- The most commonly-used data sources (EPC ratings) are limited, historical and offer an incomplete household view.

- Existing data sources (from official fuel poverty statistics to private sector models) offer limiting levels of granularity.

- In-house teams may lack the systems or data skills (or both) needed to analyse large datasets for insights.

"Tackling fuel poverty feels like a fire-fighting approach at the moment – so little time, no time for real study."

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Tackling fuel poverty with targeted data integration & AI

This report outlines how UrbanTide's innovative data integration and AI solution, uZero, helps organisations overcome these barriers that currently prevent them from providing targeted support to fuel-poor households.

Uniquely, uZero integrates prepayment smart meter system data with other contextual datasets and utilises AI to produce clear locational heatmaps of fuel poverty risk across a given area. This includes household view at different levels, such as Lower Layer Super Output Area (LSOA) and Output Area (OA)[1].

By integrating anonymised smart meter system data with multiple up to date cross-sector datasets,, uZero can support local authorities, housing associations, energy providers and social care providers to target solutions that will save energy, reduce CO_2 and protect the most vulnerable households in the UK.

As part of uZero's extensive development, UrbanTide and Connected Places Catapult hosted a series of focus groups, interviews and surveys with a range of stakeholders who would directly use and benefit from uZero. 44 organisations took part in total, including

local authorities, their retrofit campaign delivery partners, energy suppliers, distribution network operators and net-zero regional hubs.

Through this stage of uZero's development, it was possible to gather a deeper understanding of the current and future use cases and capture feedback on the uZero product development. The key findings are outlined in this report.

[1] Lower Layer Super Output Area (LSOA) contains between 400 and 1,200 houses and Output Area (OA) contains between 40 and 250 houses, according to **ONS geographic levels**.

The project identified five potential benefits of using uZero to tackle fuel poverty

01
Effectively identify areas in fuel poverty

uZero makes it easier to identify areas in or at risk of falling into fuel poverty. This includes "hidden pockets" of households in fuel poverty and higher debt risk that would otherwise escape detection.

02
Provide better targeted support

uZero makes active targeting more efficient and early intervention more effective, providing higher returns on investment when running energy-efficiency campaigns and reduces future burden on other support services.

03
Identify priority areas for retrofitting

In cases where demand for retrofit measures outstrips the time or budget available, uZero xwx help identify where to prioritise delivery for maximum efficiency.

04
Improve uptake of efficiency schemes

uZero can support organisations to improve the uptake of efficiency schemes amongst fuel-poor households, leading to lower energy bills and improved comfort and wellbeing.

05
Create brand new insights

uZero can provide a 'before and after' comparison of the fuel poverty risk that can help organisations and their delivery partners better understand their programme's success in genuinely reducing fuel poverty.

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uZero development: How the project was funded
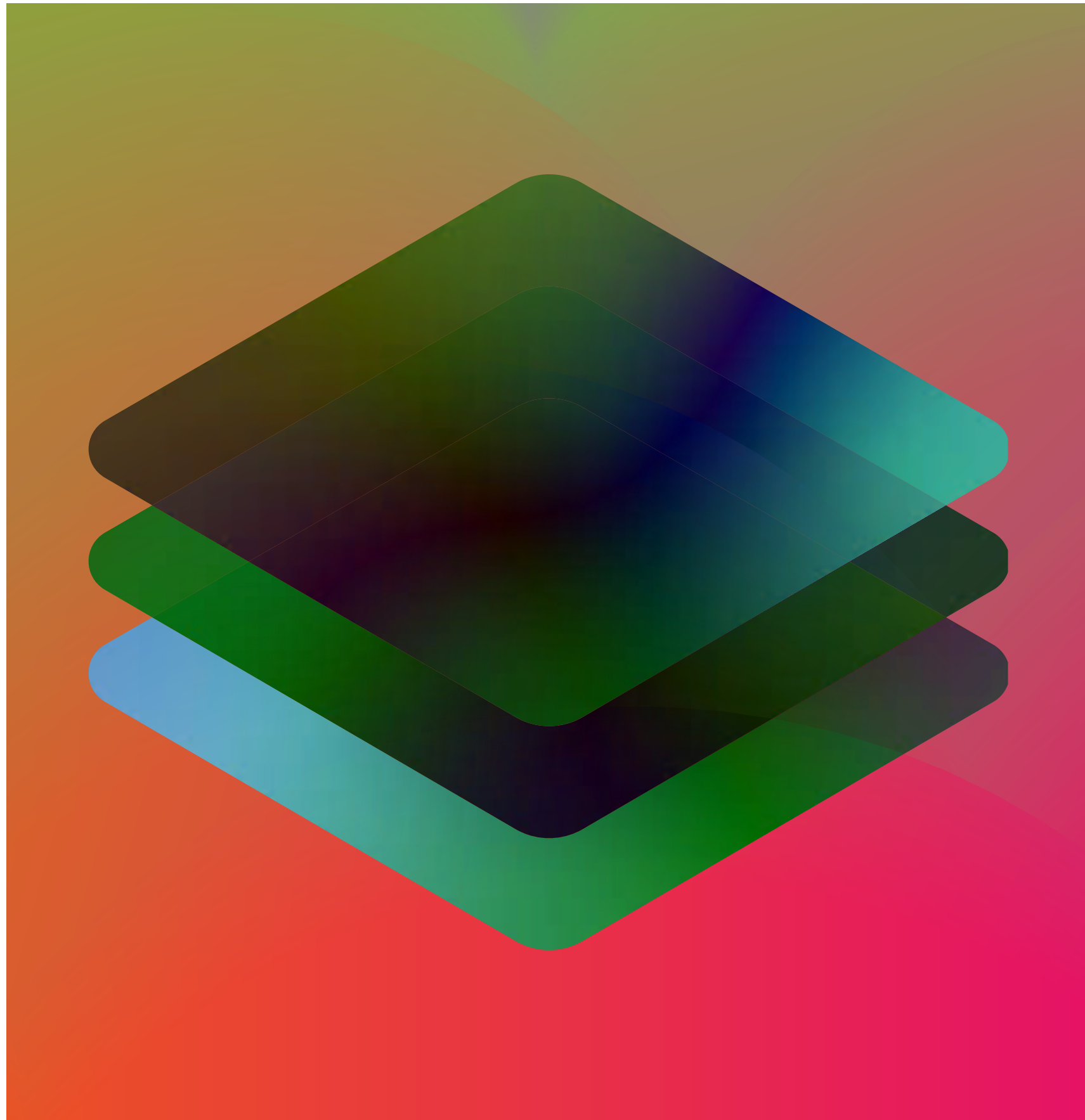
In 2018, UK Research and Innovation (UKRI) announced a £102.5 million **Prospering from the Energy Revolution** programme to accelerate innovation in smart local energy systems. This programme included the '**Modernising Energy Data Applications (MEDApps)**' competition, which awarded funding to a number of innovative energy data projects.

UrbanTide's uZero was one of the selected projects awarded Phase 1 and 2 (Discovery and Beta) funding support. The project's purpose was to prototype a tool for better identifying households at risk of fuel poverty using data integration and AI.

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Development of the AI tool moved forward with support from MEDApps consortium members:

UrbanTide (project lead)
Data science expertise and developer of uZero and the data science insight which powers the solution

University College London (UCL)
Validation of model using their Smart Energy Research Lab

Data Communications Company (DCC)
Provision of anonymised smart meter system data, policy analysis, privacy and regulatory considerations

Connected Places Catapult
Stakeholder engagement and benefits evaluation

Greater South East Net Zero Hub
Government-funded and created to increase public sector capacity to bring forward energy schemes

Beta testing partners
We Beta tested uZero with a number of local authorities and energy networks, including:

Bristol City Council, Wakefield Council, Barnsley Metropolitan Council, Sunderland City Council, South Gloucestershire Council, Nottingham City Council, Hillingdon London, Blackpool Council, Eden District Council, Havering London Borough, Suffolk County Council, Essex County Council, Hastings Borough Council, UK Power Networks, Scottish & Southern Electricity Networks

About the MEDApps consortium

UrbanTide assembled a unique multidisciplinary team of energy and data experts with world-leading capability and a remit to deliver:

UrbanTide are data insights experts on a mission to make a sustainable world with AI. Our innovative data technology enables organisations to unlock data and utilise AI for good. Through data and machine learning, we can accelerate innovation, reduce carbon emissions, decrease energy use and help people live healthier and safer lives.

Data Communications Company operate the smart meter systems secure network across Great Britain and are custodians of the significant volumes of systems data this creates. In support of government policy, DCC wants to enable the use of this system data in a secure, lawful, ethical and equitable way to allow other permitted organisations to analyse it and combine it with other data for the purposes of public good. This would be through agreed governance that is aligned to the regulatory framework and covers data protection and security assurances.

Greater South East Net Zero Hub works with public sector organisations and their stakeholders to support the development and financing of local energy projects. This includes the Green Homes Grant which improved uptake will accelerate us toward net zero targets and help reduce fuel poverty.

Connected Places Catapult drives the adoption of technology and new innovation to create better places. They are experts in design thinking and user research in this space and will lead these aspects of work for the project.

University College London is a world leading academic organisation. Their involvement via the Smart Energy Research Laboratory will bring their extensive expertise on applied data analytics in the field and verify the insights for further algorithm optimisation.

THE *COST OF* LIVING & FUEL POVERTY CRISES

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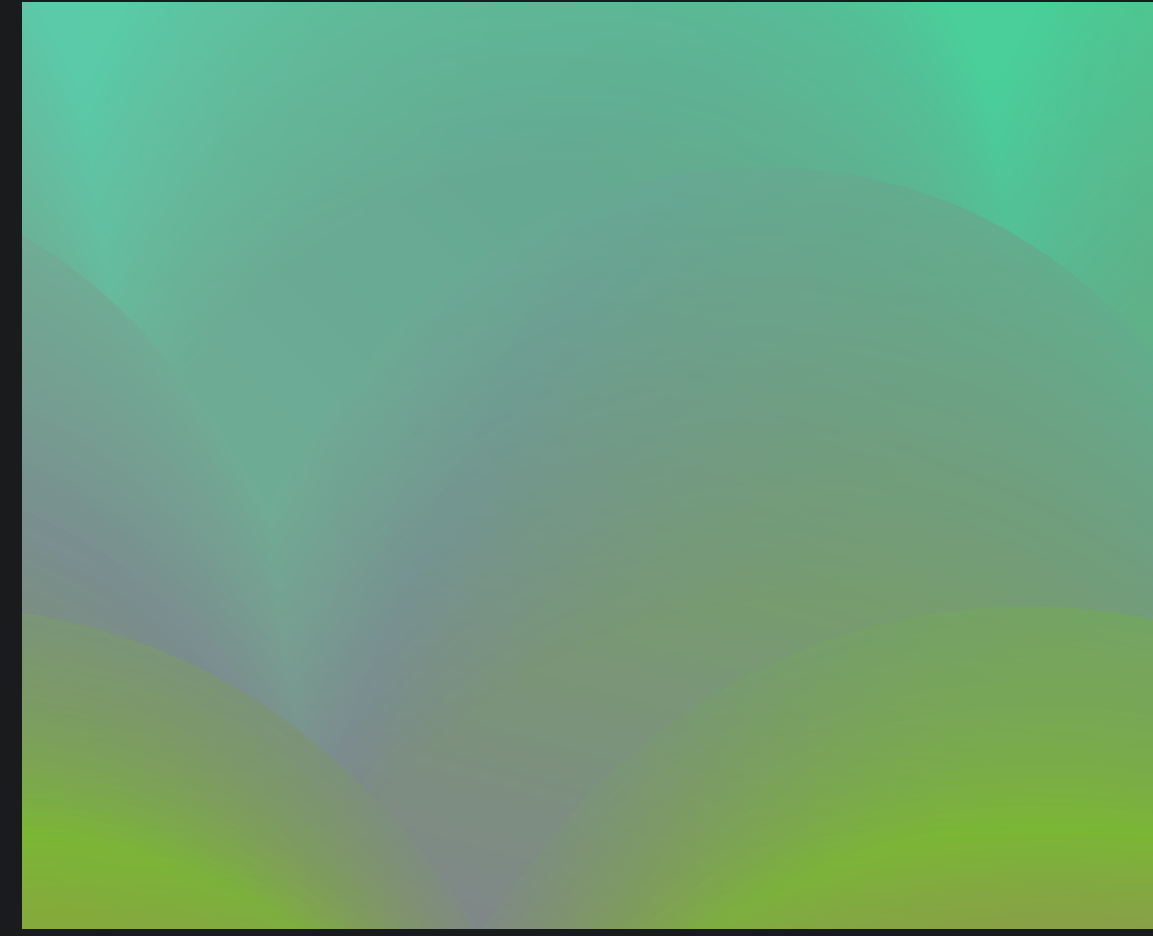
Two major issues have gained traction that have compounded the need for a fuel poverty-focussed data insights tool like uZero:

1. The energy crisis
2. The cost of living crisis

1. THE *ENERGY CRISIS*

From 1st April 2022, Ofgem raised the set limit that energy suppliers are able to charge customers per unit of electricity and gas **(the "price cap") by 54%**. This increased the average annual bill for households on direct debit default tariffs by £693. For those on prepayment meters (the group with the highest likelihood of being fuel poor) the expected increase for an average household is even higher, at £708.

From 1st October 2022, the UK Government then introduced an "Energy Price Guarantee" to protect consumers from spiralling energy prices. This is expected to save the average household £1,000 per year on their energy bills for the next two years. However, a typical household energy bill is still expected to rise from around **£1,971 to £2,500 this winter**. This is a 27% increase since the price cap rise in April 2022 and a **96% increase since winter 2021**.

←Typical houshold bill increase since winter 2021

2. THE COST OF LIVING CRISIS

Inflation has reached a 40-year high in the UK (**10.1% in the Consumer Price Index annual rate as of September 2022**), pushing the nation into a cost of living crisis. While the energy crisis is a key component of the inflation, there are other domestic and global factors at play, including post-COVID surges in demand versus available supply, weather patterns affecting renewable energy generation, geopolitical events in Ukraine, and others. The causes are complex, and the Bank of England does not expect inflation to return to its 2% target for **another two years**.

→ **What does this mean for fuel poverty?** Millions of households are expected to be tipped into fuel poverty as a result of these crises. Analysis by National Energy Action on the energy crisis alone found that on average, households will need to divert an **extra £14.40 each week** towards energy bills — money that they would otherwise have available to spend on other necessities like food.

In their estimates, 2.2 million additional households will enter fuel poverty in 2022, despite the Government's support through the Energy Price Guarantee. This would take the total to approximately **6.7 million households** in fuel poverty — which is around one in four homes in the UK.

How fuel poverty is measured across the UK

Fuel poverty relates to households that must spend a high proportion of their household income to keep their home at a reasonable temperature. According to the latest official data[2], around 13% of households in England were classed as fuel poor, 25% in Scotland, 12% in Wales, and 18% in Northern Ireland.

However, these figures are based on 2020 data, as official data on levels of fuel poverty is published with significant delays. In April 2022, National Energy Action estimated that the number of fuel-poor households in the UK had **grown 50% in just 6 months**.

In England, a household is fuel poor if:

● they are living in a property with an energy efficiency rating of band D, E, F or G.

● when they spend the required amount to heat their home, they are left with a residual income below the official poverty line.

In Scotland, a household is considered fuel poor if:

● after housing costs have been deducted, more than 10% (20% for extreme fuel poverty) of their net income is required to pay for their reasonable fuel needs.

● after further adjustments are made to deduct childcare costs and any benefits received for a disability or care need, their remaining income is insufficient to maintain an acceptable standard of living (defined as being at least 90% of the UK Minimum Income Standard (MIS)).

In Wales, a household is defined as being in fuel poverty if:

● they would have to spend more than 10% of their income on maintaining a satisfactory heating regime.

In Northern Ireland, a household is considered fuel poor if:

● in order to maintain a satisfactory level of heating (21°C in the main living room and 18°C in other occupied rooms), it is required to spend in excess of 10% of its household income on all fuel use.

[2] As of October 2022.

Fuel poverty support schemes: growth and challenges

A number of schemes are available to help alleviate fuel poverty in the UK, such as:

- **Energy Company Obligation (ECO)**
  Where obligated energy suppliers install energy efficiency measures (such as insulation and boiler replacement) in eligible homes (those of low income, fuel poor, and vulnerable households). The scheme is paid for by a levy on consumer bills.

- **Energy Price Guarantee (EPG)**
  From 1st October 2022, the Government's Energy Price Guarantee replaces the energy price cap, instead limiting the price suppliers can charge customers for units of gas. Under these plans, a typical UK household will pay no more than £2,500 a year on their energy bill for the next 6 months (reduced from the **previous commitment of two years**). This involves temporarily removing green levies (worth around £150) from household bills.

- **Energy Bills Support Scheme**
  In September 2022, the Government announced that most homes in the UK will get a £400 non-repayable discount on their electricity bills to help with rising costs. The grant will be provided in six monthly instalments, from October 2022 to March 2023.

- **Energy Efficiency Taskforce (EETF)**
  The government announced in its 2022 Autumn Statement that an extra £6bn would be made available (on top of the existing £6.6bn already pledged) from 2025 to 2028 to reduce energy consumption from buildings and industry by 15% by 2030. A new Energy Efficiency Taskforce (EETF) will be responsible for delivering long-term energy efficiency across the UK economy.

- **Home Upgrade Grant (England only)**
  A £300 million scheme to fund delivering energy-saving upgrades such as draught proofing, cavity-wall and loft insulation to homes in England. The fund is managed by local authorities.

- **Social Housing Decarbonisation Fund (SHDF)**
  The Government has proposed a £3.8bn Social Housing Decarbonisation Fund over a 10-year period to improve the energy performance of social-rented homes.

- **Sustainable Warmth Competition**
  The Sustainable Warmth Competition awarded around £500 million in funding to local authorities to help them upgrade energy inefficient homes of low-income households in England.

- **Other social schemes**
  For example, the Winter Fuel Payments, Cold Weather Payments, and the Warm Home Discount Scheme, which helps vulnerable households with their energy payments. As fuel poverty is devolved, there are also additional measures available in Scotland, Wales, and Northern Ireland, as well as specific measures in certain local authorities

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Challenges with these support schemes

When attempting to identify fuel-poor households, organisations are hampered by challenges that result in low conversion rates (the rate at which targeted homes go on to receive retrofit support).

Some of the main challenges they face in actively targeting households are as follows:

1. Poor availability of up-to-date and granular data

- Outdated data:
  Annually-updated databases provide lower-quality analysis and even centrally-published reports operate using historical data.

- Inconsistent data granularity:
  Existing databases used to identify households in fuel poverty operate at varying levels of granularity (from Lower Layer Super Output Area (approx 650 houses) down to household level with EPC datasets). Finding the optimal granularity of insights to drive effective targeting processes can be a challenge and a time-consuming process.

- Inaccuracy of data:
  Some models suggest that identifying households based on EPC rating D or below can lead to almost half of identified households not actually being in fuel poverty (for example, older buildings that have a high household income).

2. Absence of a comprehensive methodology

It's not always possible to aggregate the current set of databases used by organisations (which may include energy ratings of buildings (EPC), Index of Multiple Deprivation (IMD) data, gas/electricity consumption data, etc.) because these all refer to different aspects of a house and its occupants. Therefore, organisations need a comprehensive methodology to manage the different levels of data granularity.

TACKLING *FUEL POVERTY* WITH TARGETED DATA INTEGRATION

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UrbanTide's uZero is a powerful AI and data insights platform that, for the very first time, combines anonymised GB-wide smart meter system data with multiple cross-sector datasets to provide new and unique intelligence on fuel poverty risk identification.
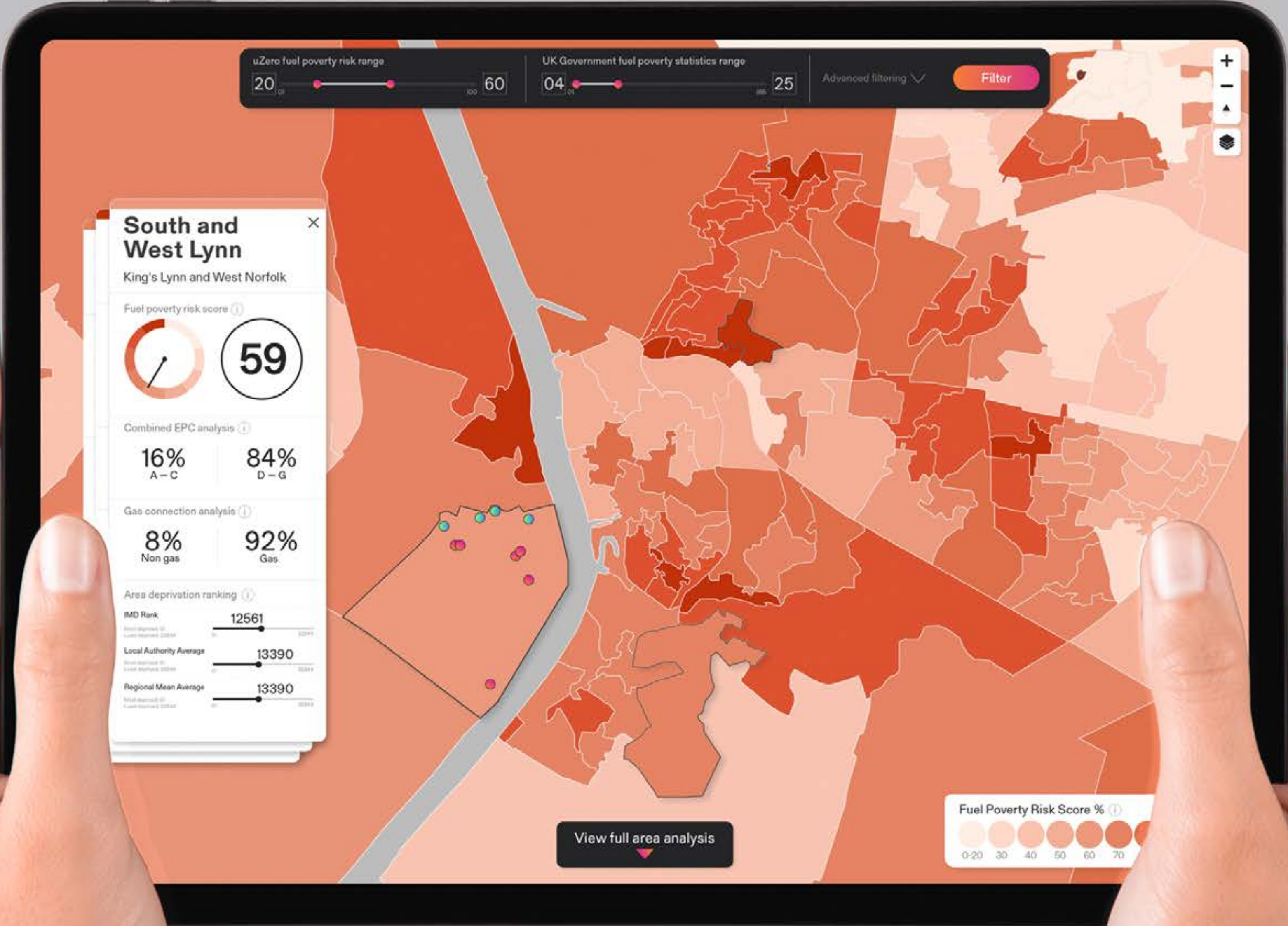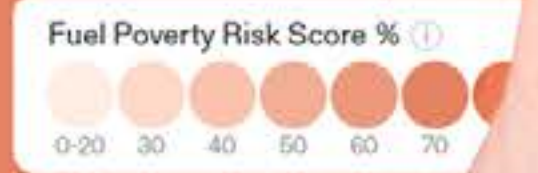
By combining data and using advanced machine learning, uZero gives organisations the information they need to clearly identify and effectively target areas that would benefit most from energy-efficiency measures.

uZero is integrated into uSmart – UrbanTide's growing data innovation platform – and is available as a Software-as-a-Service (SaaS) product. This can be procured directly from UK Government frameworks or as part of a larger innovation or energy-efficiency programme.
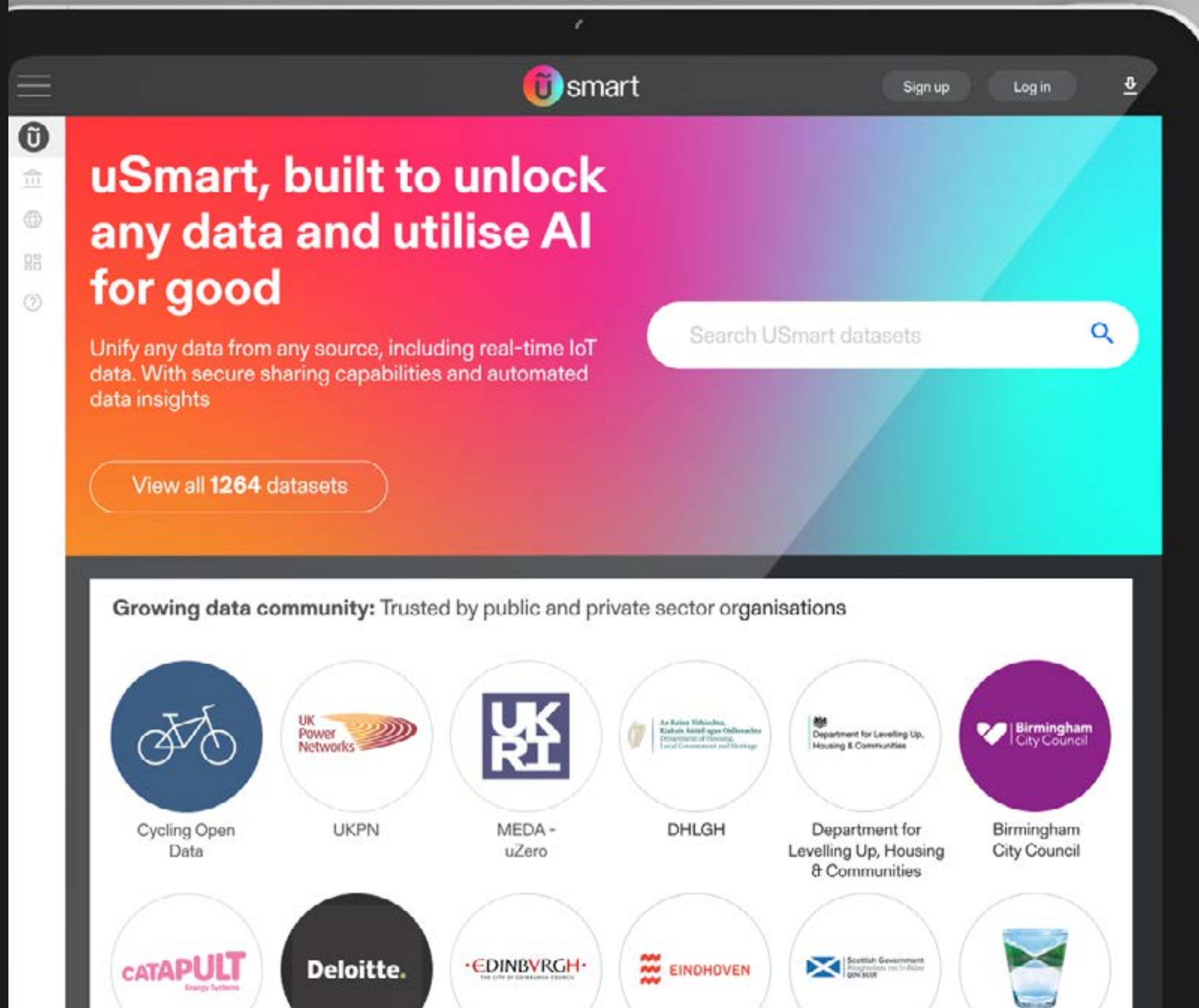
← uSmart Platform
↑ Previous Page: uZero

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Key uZero features
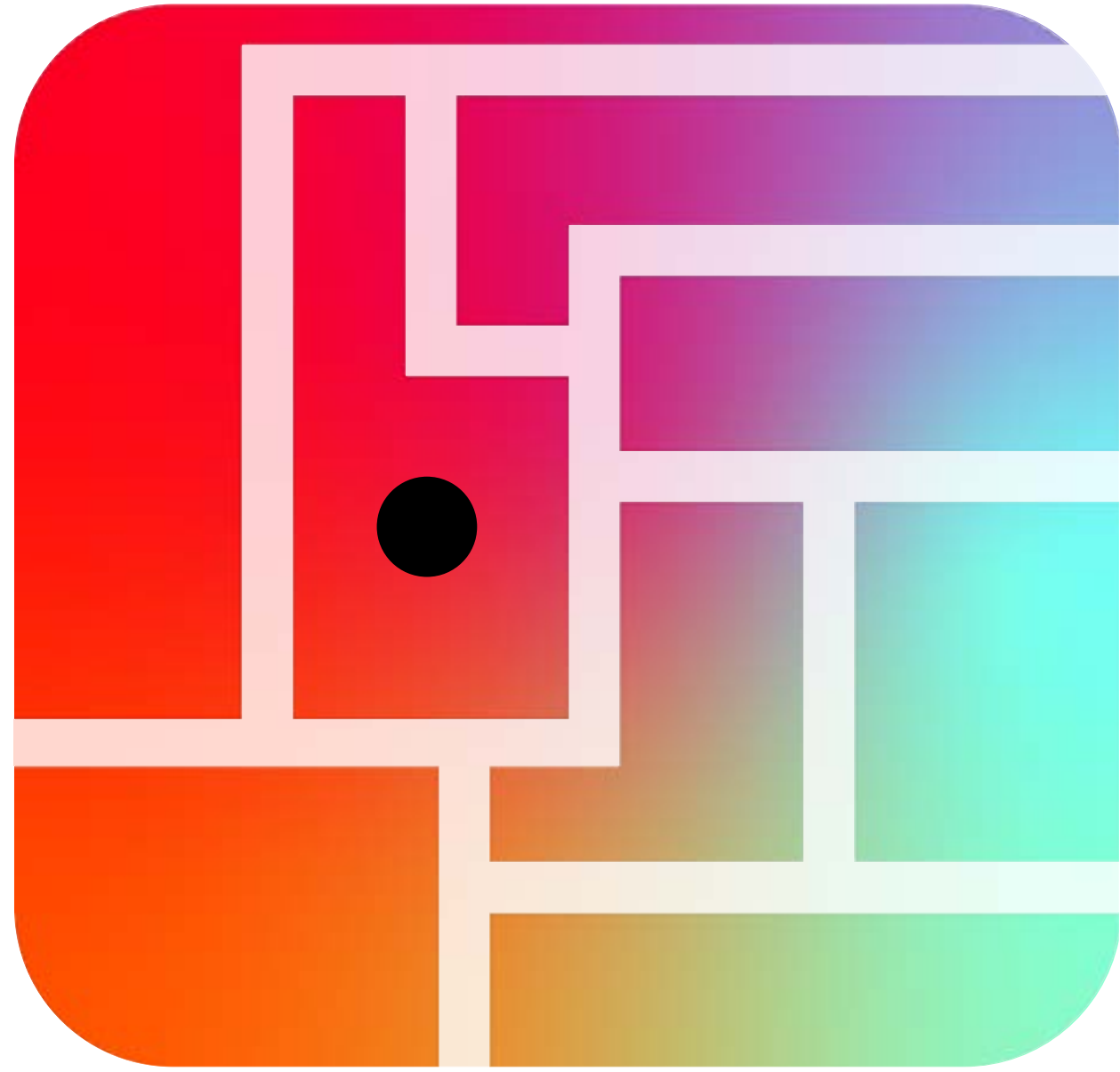
Fuel poverty area mapping

Users are able to view local data in satellite map or street view through a data dashboard securely hosted on the uSmart data innovation platform. uZero presents the probability results on an easy-view heatmap.

Unique data intelligence

uZero provides unique data intelligence by integrating anonymised smart meter system data with multiple cross-sector datasets and indicates areas of highest risk of fuel poverty.
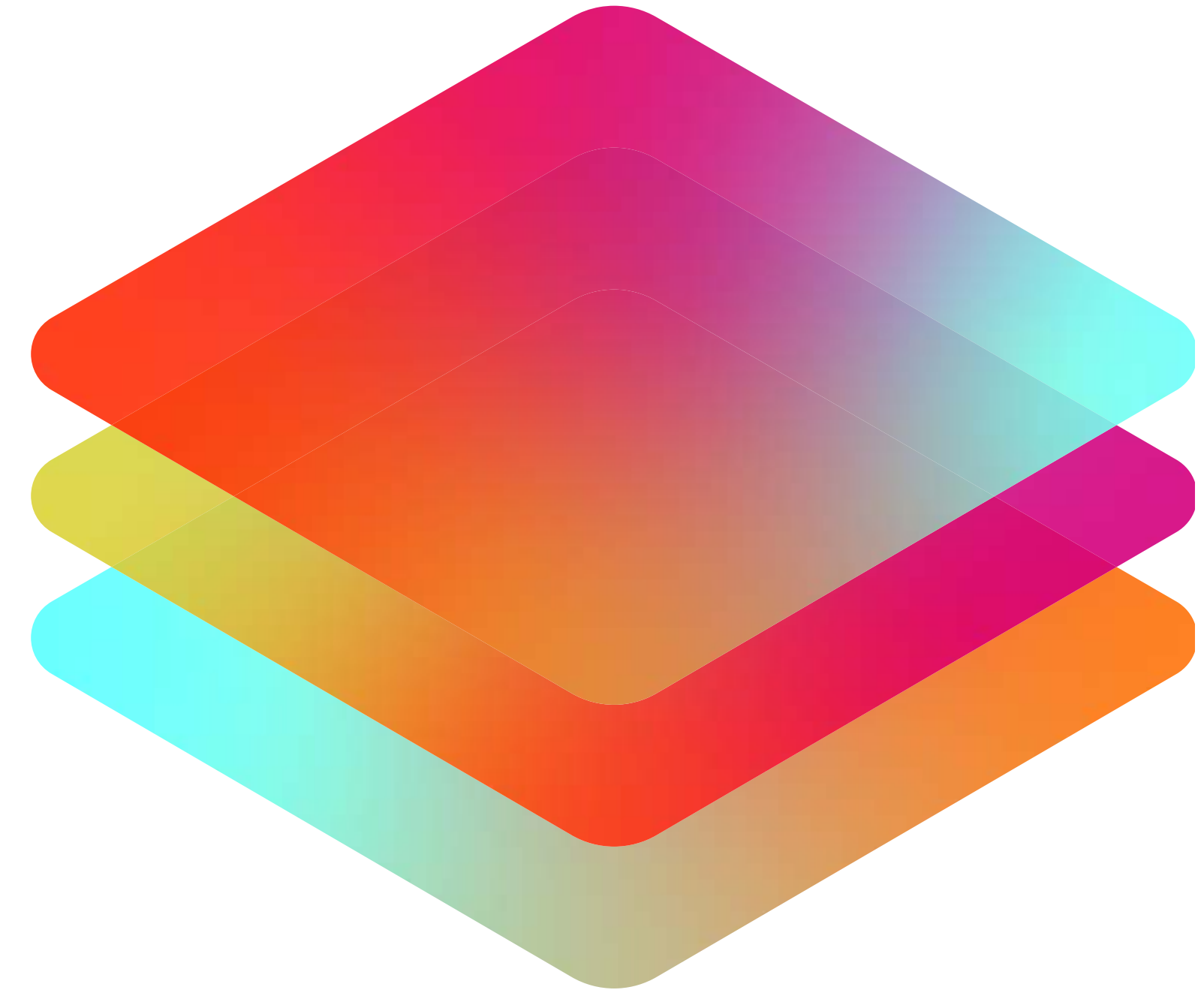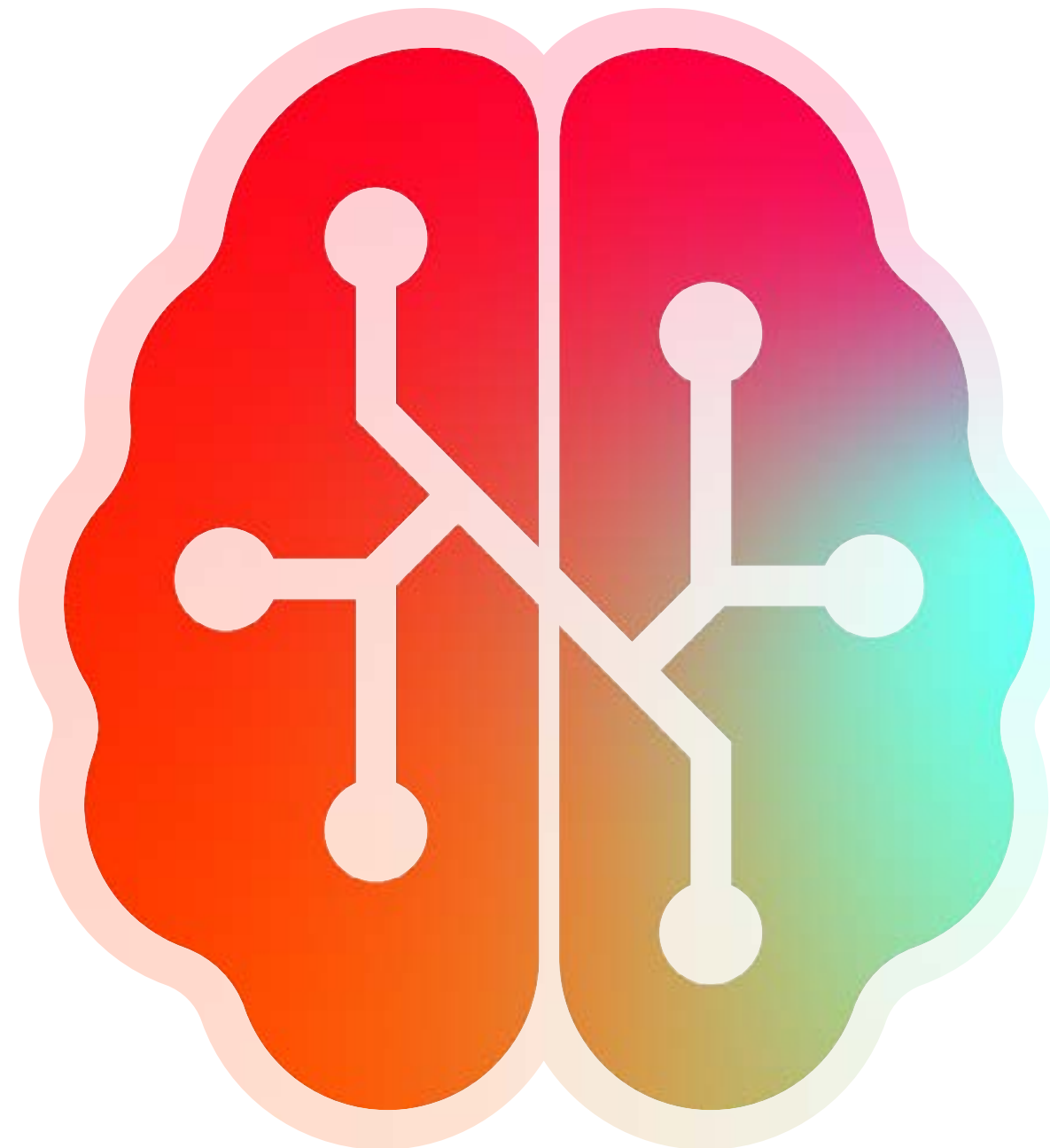
Filter data layering

Users can layer and filter local data across selected areas. They can also export custom layers with APIs and raw data downloads for wider data integration with third-party systems.

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Key uZero features

Fuel poverty risk scoring

uZero's fuel poverty indicator makes fuel poverty prediction possible. The dashboard map view of area-based rankings for fuel poverty is based on a number of key indicators.

Potential carbon savings

AI and advanced machine learning predicts potential carbon savings and remediation costs across targeted areas.
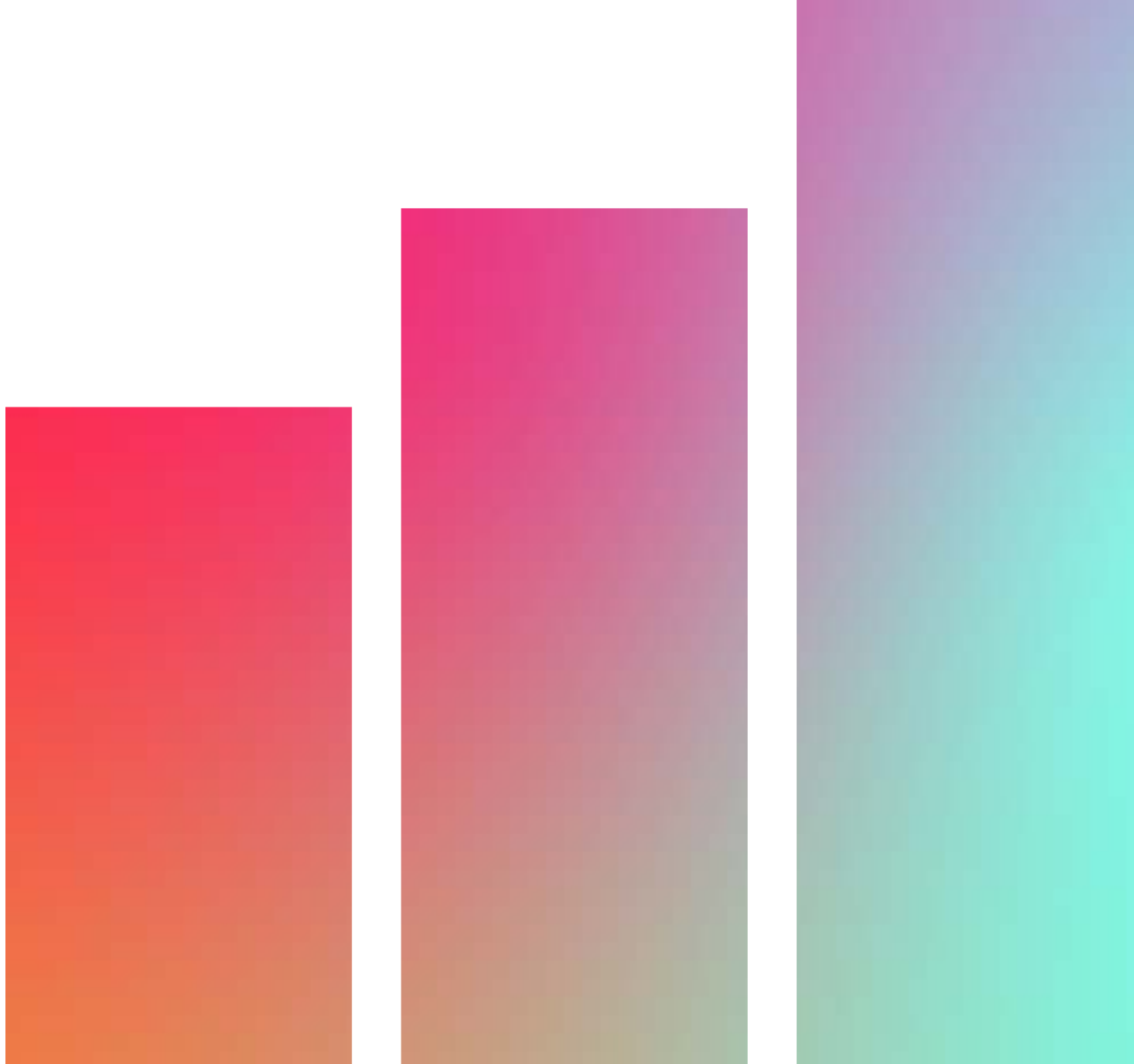
Monitoring impact

uZero enables organisations to assess the impact of targeted energy-efficiency measures over time.

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"I expect [uZero] will be an invaluable 'one-stop shop' in helping us to identify homes experiencing fuel poverty in the future. I also hope that using the tool alongside other information will help us to identify potentially other vulnerable people and households."

Data use and data validation

As a unique fuel poverty identification tool, uZero works by combining multiple cross-sector datasets to create new insights. We worked with the following key stakeholders during uZero's development process to ensure robust data validation and anonymisation.

Data Communications Company (DCC) progressed the the lawful, secure and ethical release of anonymised data for this specific use case. This required DCC to apply rigorous anonymisation and synthesising techniques to enable data to be shared externally.

Data use: DCC

The project is a key strand of DCC's ambition to maximise access to smart meter system data for public interest purposes. The anonymised system data provided relates to the time and date at which messages were sent to and from connected devices across the DCC network (i.e. information about a message rather than its content).

It is important to note that DCC cannot and will not be accessing, processing, or sharing any encrypted message contents. All the system data used is derived from a combination of device IDs and the time-and-date stamps of message transactions, particularly relating to pre-payment devices. The protection of consumer interests has been assured through robust data modification, including anonymisation. Specifically, device IDs have been anonymised and aggregated to groupings of around 600 households on

average. In addition, the time-and-date stamp of transactions has been obfuscated to further ensure that the data is anonymised.

Robust contractual, technical, and operational security measures have been put in place to govern data sharing between DCC, UrbanTide and UCL. Further, external engagement and application of **Energy Data Taskforce** (EDTF) best practice recommendations supported the process in alignment with DCC's own **Data for Good** initiative. Data for Good aims to deliver the best possible outcomes for society, the energy system, energy suppliers and consumers by securely sharing anonymised smart meter system data. This will enable new use cases that deliver public benefit and accelerate decarbonisation.

Data validation:
UCL's Smart Energy Research Lab

As part of the **MEDApps consortium**, UCL's **Smart Energy Research Lab** (SERL) undertook various data validation assessments on uZero's outputs.

The validation involved comparing uZero's results with homes included in a SERL study group – all of which had given complete voluntary permission to use their data. As SERL had these permissions, DCC were able to provide them a pseudonymised linked dataset, which was immediately deleted after use. This meant SERL was able to accurately compare the uZero results for anonymised homes with the SERL fuel poverty result for the same home.

The results of the validation primarily found that the uZero models predicted higher rates of fuel poverty than SERL. This meant that households predicted as fuel poor by uZero were not always considered fuel poor by SERL. However, those identified by SERL as fuel poor were always identified by uZero as displaying fuel-poor characteristics.

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Potential uZero users & beneficiaries

uZero has been designed and developed to support a number of organisations with their efficiency programme delivery. This includes the following organisations and beneficiaries:

Organisations

- **Net Zero hubs**
  Government-funded programmes, created to increase public sector capacity to bring forward energy schemes. Accurate targeting would not only result in higher uptake of energy schemes but would help them strategically match funding support with local authority needs.

- **Local authorities**
  Involved in the implementation of the Government energy strategies via the Local Authority Delivery (LAD) scheme and through various support grants. They are particularly interested in faster, easier and more accurate methods of identifying fuel-poor households to widen retrofit campaigns and increase their social impact.

- **Local authority delivery partners**
  They manage the end-to-end installation and quality inspection of heating, insulation and energy efficiency improvements in the identified households. Accurate targeting and high conversion rates will increase their access to fuel-poor households.

- **Distribution Network Operators (DNOs)**
  Companies that run the regional electricity distribution networks. They will bear the cost of re-enforcement of the network as electrification of heat grows. Decreasing loss of energy by retrofitting will reduce local energy consumption, provide support to vulnerable and fuel poor households and also translates into lower costs for DNOs.

- **Housing providers and associations**
  Housing organisations face a number of challenges due to fuel poverty. For example, bad debt and missed rent payments, additional costs of void properties (empty properties without a tenant), complaints and maintenance of low-energy efficient homes. Fuel-poor identification toolkits like uZero help them target and support vulnerable households to reduce these risks.

- **Energy suppliers**
  Energy Company Obligation (ECO) is a requirement for larger domestic energy suppliers to install heating, insulation or other energy efficiency measures in fuel-poor households. Methods that make it easier to identify fuel-poor households and roll out targeted solutions will reduce cost of delivery and ensure full compliance with the ECO programmes.

- **Department of Levelling Up, Housing and Communities**
  DLUHC leads the way in improved energy-efficiency standards. A tool providing accurate, timely and granular insights would assist in future policy and decision-making.

- **National Health Service (NHS) and Clinical Commissioning Groups (CCG)**
  Reports have placed the annual cost to the NHS of treating illnesses **caused by cold homes at £857 million** and the number of winter deaths caused by cold homes at **around 11,400**. Reductions in fuel poverty will directly reduce these costs and improve community health and wellbeing.

- **Department for Business, Energy and Industrial Strategy**
  Sets out the fuel poverty targets, including minimum household efficiency standards based on historic data sources. uZero has the potential to provide deeper, more accurate insights into fuel poverty.

- **Other Organisations (e.g. Ofgem, Energy Saving Trust)**
  Independent energy regulators and climate solution providers are also interested in solutions to identify and retrofit fuel-poor households as a solution to achieve net zero and support communities.

Beneficiaries

- **Households in fuel poverty**
  Low uptake rates of fuel poverty support suggest fuel-poor households have insufficient access to energy efficiency schemes. Improved targeting with uZero will help them gain advice and financial support that will improve household efficiency. This would result in a reduction in energy bills, reduced health problems and create better homes to live in.

- **Energy efficiency supply chain (retrofit companies)**
  To secure the UK's commitment to net zero by 2050, the nation's notoriously "leaky" and heterogenous housing stock will need some form of retrofit. To achieve this, the current suppliers and supply chain in retrofit solutions will need to scale and upskill. uZero can accelerate the rollout of retrofit solutions and increase supply chains which can benefit from a fuller pipeline and more opportunities in revenues, talent, skills and growth.

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Intended outcomes

01
Accurate targeting

Using data to better target households in energy efficiency campaigns.

02
Measuring success

Using data to show a change in payment behaviour as a result of completed retrofit or other support solutions.

03
Getting buy-in

Using data to demonstrate the prevalence of fuel poverty to get senior buy-in within local authorities.

04
Shaping policy

Providing additional data to inform fuel poverty policy and its effectiveness.

05
Resource intensity

Using data on energy systems to reduce the work of early property checks (physical property surveys and checks).

06
Improved conversions

Marketing to households that are eligible for support means higher success rates as effort could be more effectively targeted to these areas.

Contribution to Sustainable Development Goals

The **17 Sustainability Development Goals** (SDGs) are a collection of interlinked global goals designed to be a "shared blueprint for peace and prosperity for people and the planet, now and into the future". The SDGs were set up in 2015 by the United Nations General Assembly and are intended to be achieved by 2030.

uZero has been designed and developed specifically to help meet these goals and supports 11 out of the 17 SDGs.

United Nations

How uZero meets SDGs

01. No poverty

The NEA estimated that in April 2022, the number of fuel-poor households in the UK grew 50% in just 6 months. As the energy crisis escalates, more households will continue to fall into fuel poverty. It's critical we find new ways to provide adequate support to those who need it.

02. Zero hunger

The current cost of living crisis is forcing households to choose between 'heat or eat'. By improving the efficiency of our homes, we can begin to address this dilemma.

03. Good health and wellbeing

The cost to the NHS of ill health from cold homes is estimated at £2.5 billion per year, whilst children living in inadequately heated households are more than twice as likely to suffer from conditions such as asthma and bronchitis. In the winter of 2018/19, there were an estimated 28,300 excess winter deaths in England and Wales. A large share of these deaths were attributable to living in a cold and damp home.

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07. Affordable and clean energy

Record increase in global gas prices has resulted in Ofgem raising the energy price cap. By targeting and accelerating retrofit programmes across the UK our homes will be less reliant on expensive fossil fuels.

08. Decent work and economic growth

Department for Business, Energy and Industrial Strategy estimates that energy efficiency investment could create between 66,000 and 86,000 new jobs across all UK regions and result in **£4.3 billion of avoided electricity network investment**.

09. Industry, innovation and infrastructure

An increase in the uptake and delivery of retrofitting initiatives would result in significant macroeconomic impact including increases in Gross Value Added (GVA), job creation and a cost reduction to the energy sector through optimised energy infrastructure investment.

10. Reduced inequality

The UK has a very **high level of income inequality** compared to other developed countries. By targeting the most vulnerable homes first with energy-efficiency measures, this ensures households with lower incomes are prioritised, helping to reduce the impact of such inequalities.

11. Sustainable cities and communities

Homes that have poor energy efficiency directly impact the physical and mental health of those living in them. Improving the energy efficiency of the UK housing stock provides an opportunity to reduce inequalities and create sustainable communities.

12. Responsible consumption

Household energy use still accounts for **26% of global CO_2 emissions**. It's critical we decarbonize our home energy systems to reach net zero by 2050.

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13. Climate action

Making homes more efficient and supporting people to reduce their energy bills will help to reduce energy consumption and transition to clean energy with greater efficiency.

17. Partnerships for the goals

Organisational partnerships are essential to the implementation of sustainability goals. By integrating cross-sector data, uZero can provide insights that organisations can use to build partnerships and inform strategy and action.

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RESEARCH
DEVELOPMENT

4

As part of uZero's extensive development, UrbanTide and Connected Places Catapult hosted a series of focus groups, interviews and surveys with a range of stakeholders who would directly use and benefit from uZero.

The research focussed around the following questions: To what extent will uZero...

01.

...enable more accurate strategic targeting (by local authorities, housing providers and Net Zero Hubs) to improve access to efficiency schemes for fuel-poor households, leading to lower energy bills and carbon emissions?

02.

...enable more accurate operational targeting of fuel-poor homes at a more granular level by local authorities and their delivery partners?

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Approach and data collection

- **Semi-structured interviews (90 minutes)** with personnel from a local authority's fuel poverty teams, their delivery partners, Citizens Advice Bureau representatives and the representatives of the project's Net Zero Hub.

- **Surveys** with stakeholders on their current processes and data maturity. Respondents included 44 organisations, including local authorities, their delivery partners, housing associations, delivery network operators, and not-for-profit council support services.

- **Focus groups** with personnel from local authorities' fuel poverty teams, their delivery partners, DNOs and other organisations. Attendees represented seven local authorities and one DNO, split over three 90-minute focus groups. Participants were given logins to explore the tool over several days and/or shown a demo of the tool live in the focus group. Their responses are based on these interactions with the tool.

This assessment focused on:

- Benefits of the tool
- Disbenefits of the tool
- Actions/decisions made as a result of the tool
- Enablers to scaling
- Barriers to scaling
- Any other topics

KEY FINDINGS FROM THE RESEARCH

5

In this section, we share findings from the semi-structured interviews, focus groups and other liaisons with key stakeholders on the two research questions.

Research Question 1: Strategic targeting

Five Net Zero Hubs operate across England, supporting local enterprise partnerships, local authorities and other organisations with investment and practical expertise to deliver successful local energy projects. The Greater South East Net Zero Hub (GSENZH) alone works with 136 local authorities, and plays a strong role in local housing retrofit campaigns.

In the current process, Net Zero Hubs invite Expressions of Interests from local authorities to bid for funding from BEIS. Net Zero Hubs then begin allocating funding amongst the local authorities and organising aspects of the delivery. While the campaign is underway, they may also assist with marketing to increase awareness amongst households of the support they can receive.

A semi-structured interview was conducted with the consortium's Greater South East Net Zero Hub representative. Based on the interviewee's perceptions of the uZero demo and their close familiarity with the tool as a core consortium member, they qualitatively assessed the following question:

To what extent will uZero enable more accurate strategic targeting (by local authorities, housing providers and Net Zero Hubs) to improve access to efficiency schemes for fuel-poor households, leading to lower energy bills and carbon emissions?

Greater South East Net Zero Hub identified four key areas as potential benefits of uZero:

1. **More effective funding allocation**
2. **Higher-impact marketing**
3. **Finding "hidden pockets" of fuel poverty**
4. **Simplicity of use**

These potential benefits and other considerations are explored in more detail on the following pages.

Q1: Four key benefits uZero can provide for Net Zero Hubs

1. More effective funding allocation

Funding allocation is currently based on two datasets:

- The local authorities' population sizes
- The local authorities' fuel poverty rates per BEIS's fuel poverty statistics.

Net Zero Hubs currently spend time analysing the population and BEIS fuel poverty statistics per energy efficiency campaign. If they were able to use a tool that calculates the risk of fuel poverty more accurately and quickly, this could help this process step to be more effective.

"Potentially, the data granularity adds more definition. If you can understand fuel poverty better, you can allocate your money more appropriately and effectively."

→ Net Zero Hub interviewee

2. Higher-impact marketing

Net Zero Hubs often help local authorities to target homes with energy-efficiency marketing campaigns. This can involve anything from identifying households in need to assisting with mail-outs. Some local authorities rely almost exclusively on local knowledge and word of mouth to identify areas of fuel poverty, whereas others have in-house data analytics teams generating bespoke insights.

The interviewee reported that a more granular and timely tool such as uZero could ensure marketing activities are targeted more to areas with the highest household need. The granularity is of key importance here, with an Output Area level of insight being a practical level to target mail outs. Higher accuracy can therefore make targeting more cost-effective by generating higher success rates for any marketing spend.

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3. Finding "hidden pockets" of fuel poverty

Long-standing fuel poverty officers often have good insights built up from their experience, but they won't easily be able to detect the gaps in their knowledge. There are "hidden pockets" of fuel poverty that don't get flagged up in normal community engagement; for example rural homes, elderly residents who are relatively housebound, and householders who don't speak English as their first language.

Even without uZero's algorithms, simply having a view of areas with high proportions of prepayment meters correlates well with fuel poverty. BEIS data shows that households using a prepayment electricity meter are **more likely to be fuel poor (31%)** than those paying by other means such as direct debit (15%). The pattern is similar for gas methods of payment.

The key features of the tool – showing fuel poverty hotspots based on algorithmic signals and extensive data science discovery and validation – were found by interviewees to be unique features that no other current tool offers. The expected benefits of this were cited as two-fold:

- **If uZero flags currently-identified areas as fuel poor, it confirms to the fuel poverty officer that they are on track and operating effectively.**

- **If uZero flags new areas as fuel poor, it helps the fuel poverty officer to engage previously-hidden pockets of fuel poverty.**

4. Simplicity of use

Feedback on the tool also found uZero to have an intuitive and easy-to-use interface. In contrast to raw tabular data in CSV files, the geographical heat map provided a quick and informative view that could be filtered and explored with more data layers.

Research question 2: Operational targeting

For this question in the research, semi-structured interviews, focus groups and other liaisons took place with 44 organisations, including local authorities, delivery partners, network operators and third sector organisations.

Based on several hours experience with the uZero prototype and/or a demo in focus group sessions, those participants qualitatively assessed the question:

To what extent will uZero enable more accurate operational targeting of fuel-poor homes at a more granular level by local authorities and their delivery partners?

Seven interlinked areas were identified as potential benefits from uZero:

1. **More effective identification**
2. **More effective partnerships**
3. **More accurate targeting**
4. **Fewer ineligible households**
5. **Pre-emptive prioritisation**
6. **Demonstrating household impact**
7. **Overall productivity**

These potential benefits and other considerations are explored in more detail on the following pages.

Q2: Seven key benefits of uZero

1.More effective identification with integrated insights

Common geographical boundaries used in data sets for fuel poverty targeting include the below:

- **County level -** The whole county
- **Ward level -** Highly variable: contained between 54 and 15,661 houses in the 2011 census
- **Lower Layer Super Output Area (LSOA) -** Contains between 400 and 1,200 houses according to ONS policy
- **Output Area (OA) -** Can contain between 40 and 250 houses according to ONS policy
- **Post code -** Can contain up to 100 houses (15 houses is typical)
- **Street level -** Varies by street

In group and individual discussions, local authorities revealed that for practical terms, they think along the lines of LSOA level representing c. 650 households and OA representing c. 50 homes.

Some more findings of note:

- **Existing datasets operate at all levels of granularity – with a gap at OA level**
  Some local authorities said the most effective targeting approach is door-stepping, preceded by a letter. Door-stepping occurs at approximately OA level, yet there is a relative lack of data insights at OA level to guide this. uZero can fill that gap.

- **Lack of in-house skills is a barrier to gaining insights from existing datasets**
  Some local authorities and their delivery partners rely almost exclusively on local knowledge and word of mouth to identify areas of fuel poverty; others have in-house data analytics teams generating bespoke insights. More than half (53%) of local authorities surveyed said their digital capabilities relating to identifying houses in fuel poverty as "Basic". uZero's intuitive heatmaps and user interfaces could help overcome such barriers.

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- **Current datasets can give misleading results**
Participants reported concerns in the accuracy of existing datasets. EPC ratings can often be inaccurate, with cases of different assessors giving the same house markedly different ratings. The objective nature of uZero and the analysis from a range of data sources could be expected to provide more accurate insights than variable and subjective measures such as EPC ratings.

Local authorities sometimes don't have the in-house skills to be able to efficiently and effectively analyse the data, and can't match or integrate these datasets beyond "guesstimates".

There are also recognised limitations to the most commonly used datasets:

- EPC ratings are not trusted to be accurate, with anecdotes shared of houses moving up or down a grade purely due to an alternative assessor doing the grading, and of low EPC ratings often correlating with affluent homeowners who simply own old houses.

- Most local authorities rely on BEIS fuel poverty statistics but updates are infrequent.

- Private tools still suffer from the two bullet points directly above, and are costly.

Participants commented that uZero's function as a single place for including several datasets (beyond smart meters) is a positive, as it conducts wider analysis that they would otherwise be unable to do or would have to do manually.

BEIS fuel statistics are published with a significant time lag (e.g. whilst each year's publication makes projections for the year, it is based on data from two years previous).

In comparison, uZero utilises a mix of data sources including smart meter system data which offers much shorter refresh rates and higher frequency data updates. This recency and frequency of data was seen as a valuable addition, especially given the moving nature of fuel poverty in current circumstances, driven by the energy and cost of living crises. Even before these crises, reports mentioned the high level of "churn" (with houses moving in and out of fuel poverty) which can quickly render datasets out of date.

"It's the fact that it's all in one place. A lot of the data I already have access to, but I have to open several different portals – having it in one place where you can automatically overlay different selections is useful and not something that I have access to at the moment."

2. More effective partnerships

Interviewees and focus group participants informed us that partner referrals play a key role in active targeting. Such partners can include health and social services, over 60s groups such as AgeUK, women's groups such The Women's Institute, food banks and other community groups. In West Suffolk, approximately 50% of their engagement with fuel-poor households historically came from partner referrals.

Trusted referrals
Several local authorities referenced the important role that trust and name recognition plays in such referrals. In Nottingham for example, people even consult straight with AgeUK before going to the council because they are a well-trusted organisation in the area.

Richness of information
The information received from partners was said to be much richer than information gathered from self-referrals. Referrals from health partners may include information like age, whether they live alone or with family, whether they have heating, if they've had any injuries in their home, etc.

In contrast, self-referrals required digging for that information and interviewees highlighted that a fair proportion of self-referrals were well above the income cut-off point and seeking unneeded financial support for home improvements.

Additional support
Households struggling with fuel poverty rarely struggle with fuel poverty alone and are in need of other support services (financial planning, befriendment to tackle isolation, social and health services and more). Local authorities reported that partner referrals are almost always fuel poor and vulnerable in other ways. If stronger partner relationships are built that catch more referrals, those households are more likely to receive the additional support that can make a difference to their lives.

Participants commented that being able to see heatmaps of areas in need would allow them to more strategically build partnerships in the right areas. This was said to be valid at LSOA or OA level.

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3. More accurate targeting

Participants agreed that if we can more effectively identify fuel-poor households, this naturally leads to more accurate targeting too.

Door-stepping can lead to success rates of 30-40% (but is an effort-and-cost intensive process) and letters can lead to success rates of 2-10%. In-person events are also effective and can be good for spreading news of the available support by word of mouth.

Improvements in accuracy of targeting could either lower the targeting costs (for the same rate of success) or maintain the targeting costs (and receive a high rate of success).

4. Fewer ineligible households

Participants said that if active targeting is directed to areas with higher likelihood of needing – and being eligible for – the support, then local authorities could expect less ineligible responses. This would also result in less time and resources spent responding to ineligible households via phone calls, emails and letters, etc. Those local authorities who took part estimated that as much as 10-50% of applications are currently ineligible.

5. Pre-emptive prioritisation

The focus groups revealed that under some circumstances, there will be more eligible applicants for support than the campaign's resources (either time or budget) allow. This means they need to make decisions about which households should be prioritised. Often, these decisions are based on vulnerability levels and delivery efficiency (i.e. households local to where the energy efficiency teams are at that point in time will be more likely to receive measures). The focus groups agreed that uZero's heat map view of need could help guide prioritisation. The tool would allow them to pre-emptively assign the retrofit teams to each area in order of likely fuel-poverty prevalence.

"People interact more with a scheme they're being offered if they're offered by trusted intermediaries. With LSOA level insights from a tool, we can identify where to build links with the communities."

↑ Local authority interviewee

6. Demonstrating household impact

Several participants raised that they assess a household's EPC rating before and after receiving energy efficiency measures, but that this is an inadequate measure for determining that household's reduction in fuel poverty.

This raises a crucial question of how energy efficiency campaigns can know – and demonstrate to funders – whether they are being successful at managing this very real social problem.

Local authorities also pointed out that once houses receive energy efficiency measures (and an improved EPC rating) they may no longer meet the official definition of fuel poverty so are no longer eligible for support (e.g. vouchers). Yet in practical terms, these households may still lack the disposable income to heat their home. In the worst cases, the technology installed and/or the behavioural training is inadequate and their costs actually increase. So while they might have moved out of fuel poverty statistics, they remain very much in fuel poverty reality.

By monitoring smart meter system data such as top-up frequency and emergency credit activations, uZero could play an important role by comparing an area's fuel poverty risk before and after the delivery programme.

Participants also raised that if a "public interest" case was made for UK GDPR exemptions, this could provide household-level insight that could detect whether those households were genuinely in a better position following the campaign – something which there are currently few granular studies on.

7. Overall productivity

In general, local authorities said they don't track the effort spent on their energy efficiency campaign process, so found it difficult to provide figures. However, some were able to give high-level estimates on the approximate proportion of their time that they might spend on key steps.
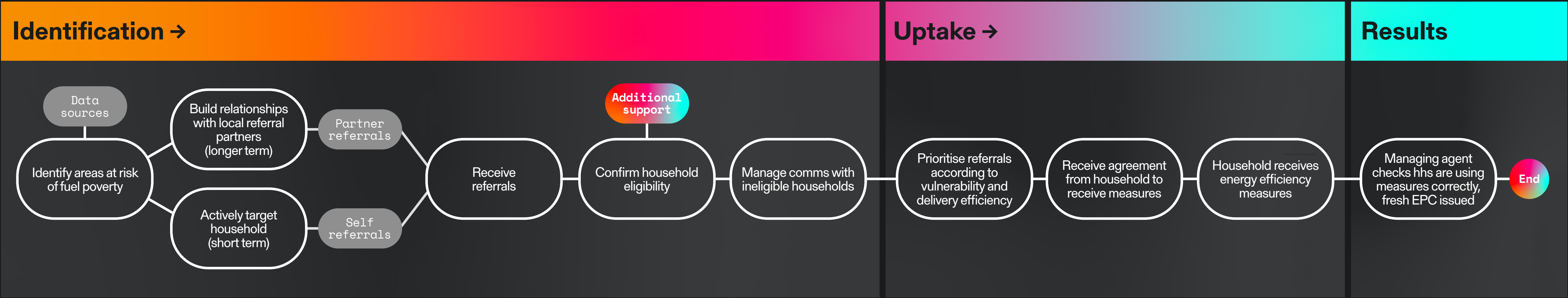
"Even modern dataset methods – if based on flawed information (EPCs, grant databases, etc.) – still need to have local knowledge combined with them to be successful and impactful."

Energy Efficiency Campaign process and effort levels (high level)

↓ The graph indicates that the step requiring the most effort for local authorities was identifying household eligibility. Therefore, uZero's fuel poverty heatmaps could substantially reduce the amount of time spent on this key stage of the energy-efficiency campaign process. This could potentially free up resources that could be reallocated to more important activities (for example, conducting further identification or active targeting).
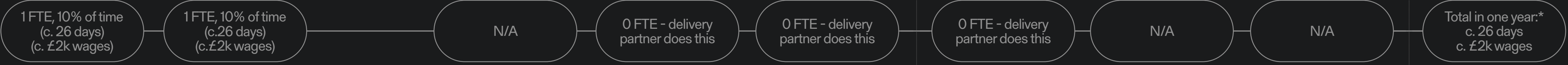
Process

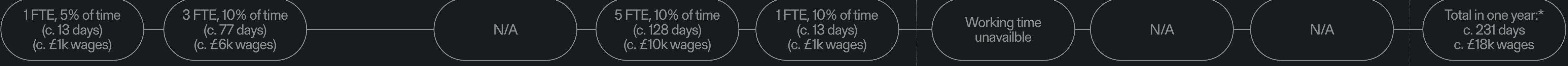**FTE** = Full Time Equivalent
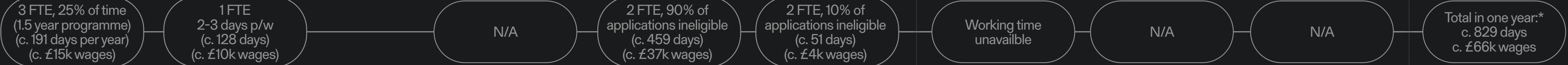**hhs** = Households
LA = Local Authority

Identification →

- Data sources
- Identify areas at risk of fuel poverty
- Build relationships with local referral partners (longer term)
- Actively target household (short term)
- Partner referrals
- Self referrals
- Receive referrals
- Additional support
- Confirm household eligibility
- Manage comms with ineligible households

Uptake →

- Prioritise referrals according to vulnerability and delivery efficiency
- Receive agreement from household to receive measures
- Household receives energy efficiency measures

Results

- Managing agent checks hhs are using measures correctly, fresh EPC issued
- End

Effort by process step

Example LA - least overall effort reported

1 FTE, 10% of time (c. 26 days) (c. £2k wages)	1 FTE, 10% of time (c.26 days) (c.£2k wages)	N/A	0 FTE - delivery partner does this	0 FTE - delivery partner does this	0 FTE - delivery partner does this	N/A	N/A	Total in one year:* c. 26 days c. £2k wages

Example LA - mid-level overall effort reported

1 FTE, 5% of time (c. 13 days) (c. £1k wages)	3 FTE, 10% of time (c. 77 days) (c. £6k wages)	N/A	5 FTE, 10% of time (c. 128 days) (c. £10k wages)	1 FTE, 10% of time (c. 13 days) (c. £1k wages)	Working time unavailble	N/A	N/A	Total in one year:* c. 231 days c. £18k wages

Example LA - maximum overall effort reported

3 FTE, 25% of time (1.5 year programme) (c. 191 days per year) (c. £15k wages)	1 FTE 2-3 days p/w (c. 128 days) (c. £10k wages)	N/A	2 FTE, 90% of applications ineligible (c. 459 days) (c. £37k wages)	2 FTE, 10% of applications ineligible (c. 51 days) (c. £4k wages)	Working time unavailble	N/A	N/A	Total in one year:* c. 829 days c. £66k wages

Challenges to scaling

No significant barriers to scaling were identified during the research, but a few considerations were raised:

Limited remit amongst local authorities on social housing

Some local authorities do not manage social housing, meaning areas identified by uZero that turn out to be social housing estates may need to be targeted with external housing associations. However, this may suggest a role that uZero can explore in helping housing associations with large estates to understand the scale of fuel poverty within their properties.

No "standard" local authority

Fuel poverty team sizes vary widely across local authorities. There's no "standard" local authority - each operates uniquely and within different local contexts. This might require a level of flexibility in terms of uZero features and the level to which users can change inputs, filters, granularity of heatmaps, etc.

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Challenges in detecting fuel poor

Local authorities raised that some people in fuel poverty would not be detected by the system data flags that uZero uses. For example, there are some households who top up often and ensure that they don't go into emergency credit but remain underheating their homes. This is common with elderly householders who may have principles of staying within credit and "self-managing" their own underheating without activating emergency credit.

For this reason, if smart meter system data is not sufficient on its own, then additional datasets may need to be added to derive the most accurate local insights. uZero does already combine additional contextual datasets including DWP Universal Credit data and EPC data to reduce this risk, and further testing with key partners and tracking success rates will help identify other groups that may not originally been spotted.

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Enablers to scaling

Local authorities are developing their data maturity

There's a very large variance across local authorities in terms of data maturity. Some have advanced in-house analytics teams, while others rely on word-of-mouth and local knowledge.

In response to the survey, 47% of respondents assessed their organisation's digital capability as 'intermediate' or 'advanced', whilst 43% classified it as 'basic'. This gives an indication of how valuable intuitive tools like uZero – that combine data sets to provide granular insights – could be.

Additional end-users

The focus groups revealed other important user groups in the energy supply chain who could benefit from uZero.

Local authority MEES teams
Since April 2020, landlords are prohibited from letting properties with an EPC rating below E. Local authorities have MEES (Domestic Minimum Energy Efficiency Standard) teams responsible for identifying houses that fail these MEES standards.

uZero could support MEES teams by:

1. Identifying MEES properties – uZero's ability to identify fuel poor households AND filter for EPC properties rated less than EPC band E was deemed useful for identifying properties failing the MEES regulations.

2. Shifting focus to tenants – Some local authorities want to move awareness-building campaigns to tenants. Tenants can be targeted directly, with tools like uZero informing which areas to target (leaflet drop, etc).

Energy distribution network operators
While Distribution Network Operators (DNOs) don't take part in household energy efficiency campaigns, they do have a keen interest in being able to identify vulnerable households and refer such households to other organisations providing such campaigns. The DNOs' specific roles include identifying candidates for the Priority Service Register (enabling them to receive support in difficult situations) and taking calls from vulnerable customers during power outages in order to provide assistance.

They registered interest in uZero, highlighting that most of their current intel is based on word of mouth and community contacts. A heatmap-

style tool would help them identify houses in need that are currently under the radar. The DNO raised several potential benefits of uZero:

- Identify more of their customer households in fuel poverty and warn them in advance of likely storm-caused power outages.

- Refer vulnerable customers for energy efficiency measures – an activity which DNOs are increasingly keen to engage in. They want to improve their impact here by giving teams in the communities good insights on where to find households in need of support.

Housing associations
Energy efficiency funds such as the Social Housing Decarbonisation Fund run competitive funding rounds for social housing stock. Currently, local authorities can partner with a housing association to bid. In future rounds, housing associations will be able to bid directly.

Complementary process improvements

Messaging and trust
Participants noted that improved identification of households in fuel poverty is only useful if uptake rates are also improved. The messaging that households receive, and that they trust the messenger and the message, was highlighted as equally important.

Householder inclusion
Participants also noted that retrofit designs that are formed inclusively with the householders will be more successful. Retrofits were said to be often "imposed" on households without consulting them. This often results in disengaged householders and technical designs that are sub-optimal because they don't take into account the knowledge of the people who live within the house itself and the role that their behaviours will play in maximising energy efficiency.

Householder support
Participants suggested householders should be supported in how to maximise efficiency with their new retrofit installations.

An example was shared of tenants receiving solar panels but no support on how to use them. After three months, their fuel bill actually increased – they were consuming energy at night, had too many devices operating at the same time etc, and other behaviours that solar power alone is not suited to dealing with. The case did some reputational damage to the retrofit campaign locally, as word of mouth spread that "solar doesn't work".

TRANSFORMING HOW THE UK MANAGES *THE COST OF LIVING CRISIS*

6

This report clearly demonstrates that effectively identifying and targeting fuel-poor households is a significant and rising challenge for those organisations responsible for delivering support.

The major barriers these organisations are currently facing when delivering support are data-related, as the data sources these organisations use are often inaccurate and limiting, and teams lack the in-house resources to analyse the data in a meaningful way.

The feedback gathered in this report strongly suggests that uZero has the potential to help overcome many of these barriers. Through data and AI, they can effectively target and prioritise areas most in need of energy-efficiency measures.

← uZero Platform

5 benefits of using uZero

01
Effectively identify areas in fuel poverty

uZero makes it easier to identify areas in or at risk of falling into fuel poverty. This includes "hidden pockets" of households in fuel poverty and higher debt risk that would otherwise escape detection.

02
Provide better targeted support

uZero makes active targeting more efficient and early intervention more effective, providing higher returns on investment when running energy-efficiency campaigns and reduces future burden on other support services.

03
Identify priority areas for retrofitting

In cases where demand for retrofit measures outstrips the time or budget available, uZero can help identify where to prioritise delivery for maximum efficiency.

04
Improve uptake of efficiency schemes

uZero can support organisations to improve the uptake of efficiency schemes amongst fuel-poor households, leading to lower energy bills and improved comfort and wellbeing.

05
Create brand new insights

uZero can provide a 'before and after' comparison of the fuel poverty risk that can help organisations and their delivery partners better understand their programme's success in genuinely reducing fuel poverty.

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POTENTIAL *IMPACT OF* uZERO BEYOND FUEL POVERTY

Households in fuel poverty are rarely in fuel poverty alone. They often struggle with other issues – for example, **digital poverty** or **water poverty** – and need help beyond retrofitting their house.

If fuel poverty teams are able to better identify households in need of energy-efficiency measures, they will also be able to refer them to other support services and tackle poverty more holistically. Therefore, **the ultimate benefits to householders of being more detectable by tools such as uZero are wider than fuel poverty**. As an indication of the scale, most survey respondents indicated that more than 50% of the households they engage with get referred for other support services.

"I expect this will be an invaluable 'one-stop shop' in helping us to identify homes experiencing (or potentially experiencing) fuel poverty in the future. I also hope that using the tool alongside other information will help us to identify potentially other vulnerable people and households."

In practice, supporting organisations to roll out energy-efficiency measures across the UK means that uZero would also help households reduce their CO_2 emissions. This in turn will help the UK get closer to achieving their net zero target by 2050. By design, uZero also actively contributes to the **Sustainable Development Goals**, set by the UN in 2015.

Efficiently identifying households most at risk from fuel poverty will be critical as the country tackles the impact of the cost of living and energy crises. At UrbanTide, we believe that innovative data technology and powerful AI for Good will be essential to supporting the UK through these difficult times.

The feedback we gathered from stakeholders in this report not only confirms uZero as an invaluable tool but also highlights the need for urgent action. Without an innovative tool like uZero, these organisations are likely to struggle to keep up with rising demand for support, as millions of additional households fall into debt as a result of soaring energy costs. Through data and AI, uZero could potentially transform the way organisations currently manage their resources. More broadly, uZero also demonstrates AI can be used on a global scale to promote energy reduction, reduce household CO_2, and accelerate the transition to net zero by supporting national energy system transformation.

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APPENDIX 7

UK GDPR-related data approval duration

Anonymised smart meter system data is a new area of exploration and must be assured from a security and privacy perspective first. DCC and the other consortium partners champion a strong ethical approach to data use (privacy by design) and are committed to ensuring UK GDPR requirements are fully met at all stages of the project.
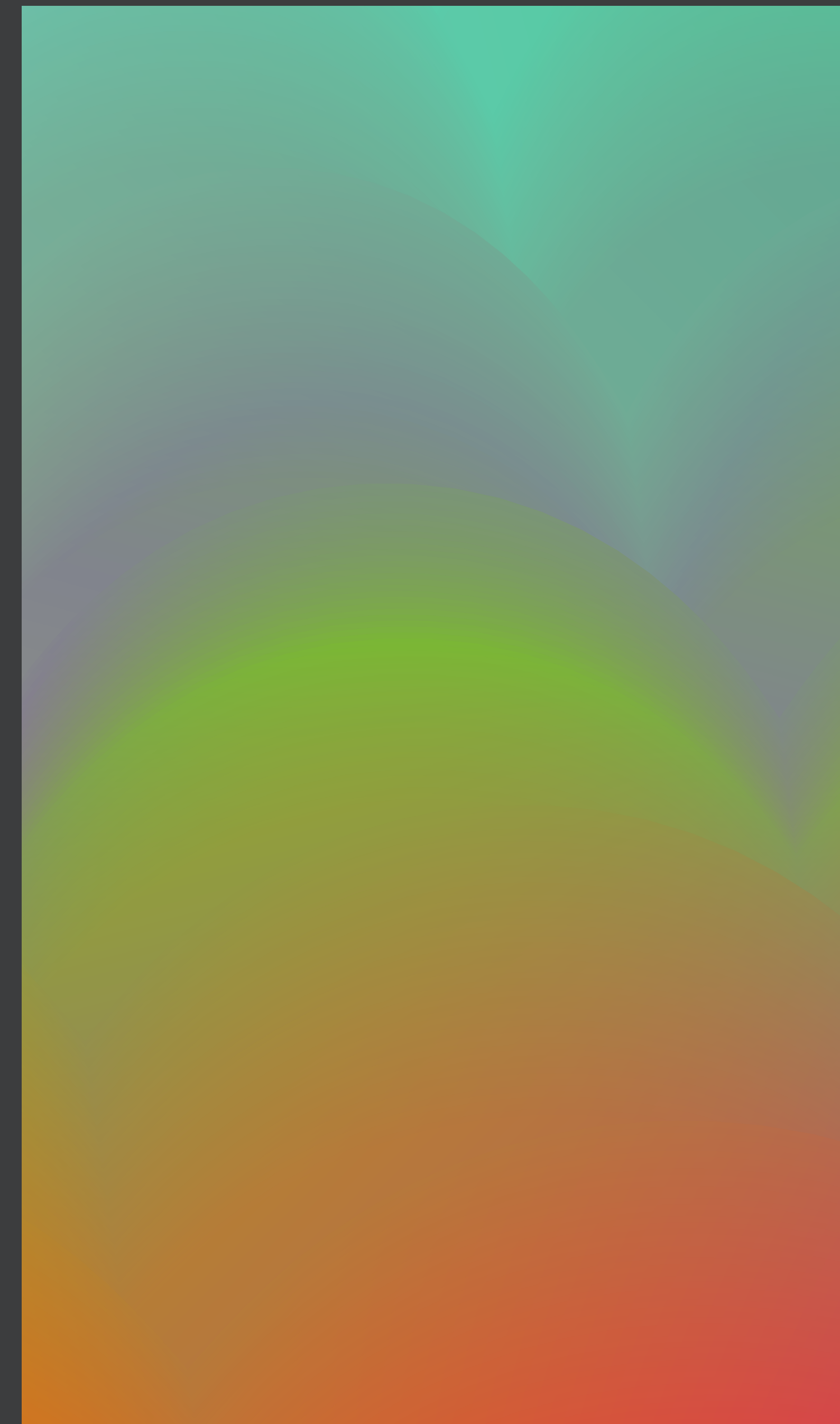
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Recommendation on UK GDPR and regulation

Several local authorities independently shared strongly held views that a 'public interest' and legitimate interest assessment under UK GDPR could be made for exempting fuel poverty campaigns to enable street-level or even household-level targeting.

Essentially, the benefits of helping these households in fuel poverty could outweigh the negative consequences of not doing so. If smart meter system data is proven to identify fuel poverty within acceptable levels of accuracy, then uZero may have the potential of drilling down deeper than Output Area and identifying micro clusters and smaller groups of households in fuel poverty that otherwise "slip under the radar".

UrbanTide are well-placed to supply evidence to local authorities or other public bodies for any such future discussions on UK GDPR public interest as well as other exemptions. Such evidence could be drawn from future on-the-ground pilots and real-world trials.

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Data accuracy

During the project, consortium partner UCL worked with UrbanTide on assessing the accuracy of the uZero tool in identifying fuel poverty, by comparing its results against the existing fuel poverty model in UCL's Smart Energy Research Lab (SERL). A high level summary of the research results received from UCL and UrbanTide are included below.

Assumptions used in the UCL research

1. The SERL model is the ground truth for classifying low, medium and high risk of fuel poverty

2. Values of 94 and below for the variable 'uc_ mean' signifies a low risk of fuel poverty, whereas values of higher than 94 signify high (or medium) risk of fuel poverty

3. uZero predicts correctly if those participants classified as low risk are in SERL's fuel poverty low risk category (1), and if those classified as high risk are in SERL's medium or high fuel poverty risk categories (2 and 3).

High level summary of the method used in the UCL research

1. The SERL model provided a dataset of their model participants with a prepayment meter.

2. After filtering out non-classifiable households, this dataset was inputted to uZero.

3. uZero assigned participants a fuel poverty risk category of low risk or high risk.

4. Individual fuel poverty risk categories were rounded down to the nearest ten for statistical disclosure control (SDC) purposes. Therefore whilst the number of households included in the sample findings below is approximately 140, the actual number sampled was higher.

5. The number of true positives (TP), true negatives (TN), false positives (FP) and false negatives (FP) were compared. 'Positive' and 'negative' refer to 'high risk' and 'low risk respectively, and 'true' refers to uZero correctly matching the SERL model's categorisation of risk. Relatedly and as noted above, it is assumed that the SERL fuel poverty risk is the 'true' value.

6. The total 'true' (correct) matches by uZero were calculated as a proportion of the total matches performed, giving an overall accuracy score. In addition, tables, charts and confusion matrices were made to tabulate and visualise the more detailed findings, such as the level of accuracy in each SERL category.

Findings of the UCL research

Given the assumptions above, uZero assigned 90 out of 140 SERL participants correctly, putting its accuracy at 64.3%. To compare, not knowing the percentage share for each of SERL's three categories (low, medium and high risk) and randomly guessing would have been 33.3% accurate (assuming an equal split between those low, medium and high risk categories). A more detailed breakdown of results is shown in Table 1 on the next page.

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Tables

SERL fuel poverty risk	UrbanTide model output	Total classified by uZero*	Percentage of the SERL poverty risk	Correctly identified
1 (Low)	high_risk	30	75%	No
1 (Low)	low_risk	10	25%	Yes
2 (High)	high_risk	60	75%	Yes
2 (High)	low_risk	20	25%	No
3 (High)	high_risk	20	100%	Yes
3 (High)	low_risk	0	0%	No

Table 1: Results of assigning SERL participants with a prepayment meter a fuel poverty risk by uZero, after filtering out non-classifiable households.

* Rounded down to the nearest 10 for statistical disclosure control (SDC).

		uZero model classification		
		High risk	Low risk	
SERL Fuel	High risk	80 (TP)	20 (FN)	100
Poverty Risk	Low risk	30 (TP)	10 (TN)	40
		110	20	140

Table 2: confusion matrix showing the number of uZero true positives (green cell), true negatives (green cell), false positives (pink cell) and false negatives (pink cell).

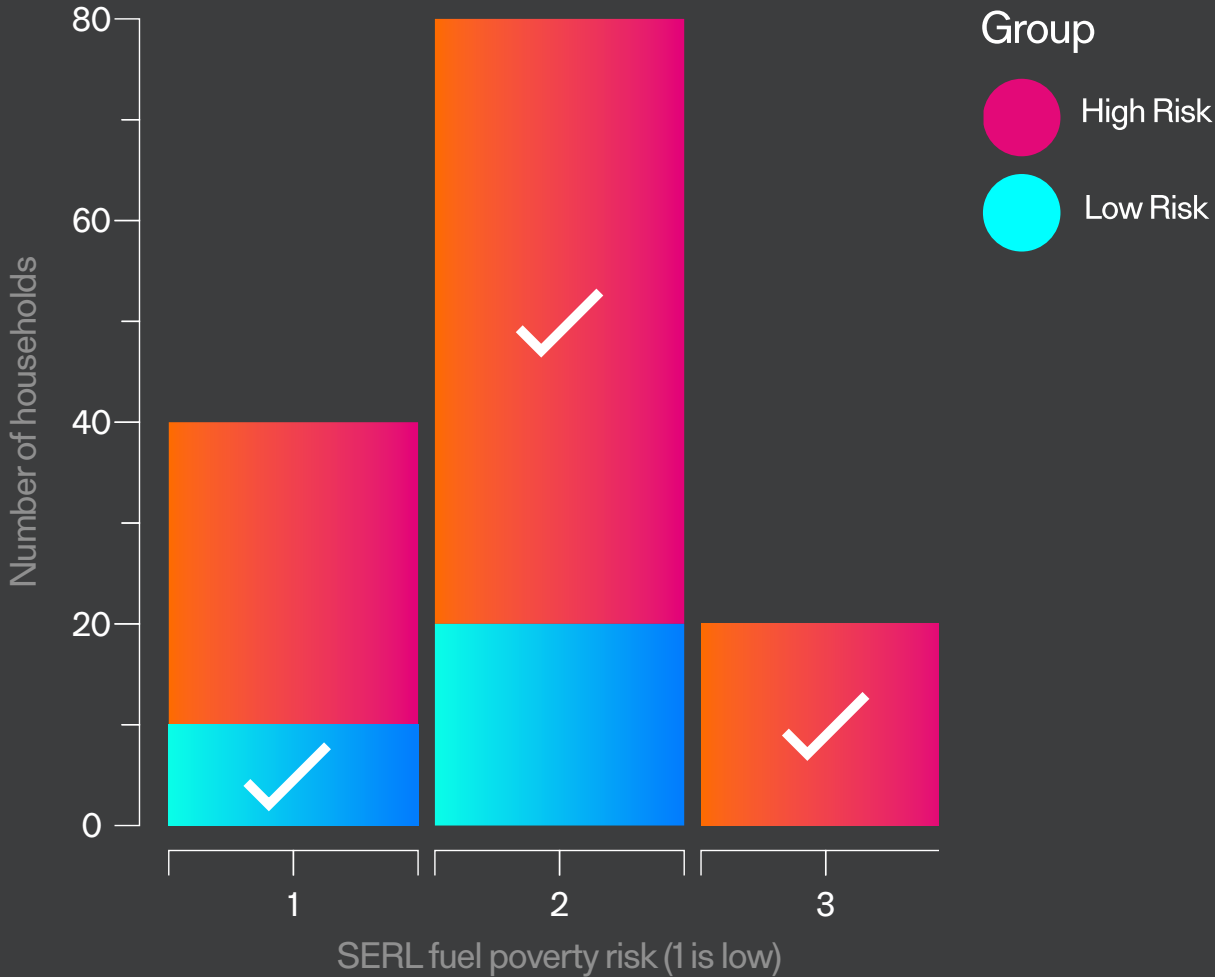* Rounded down to the nearest 10 for statistical disclosure control (SDC).

Figure 1: The number of households in each SERL fuel poverty risk category split by uZero classification (column 3 in Table 3 above). The white ticks indicate correct classification.
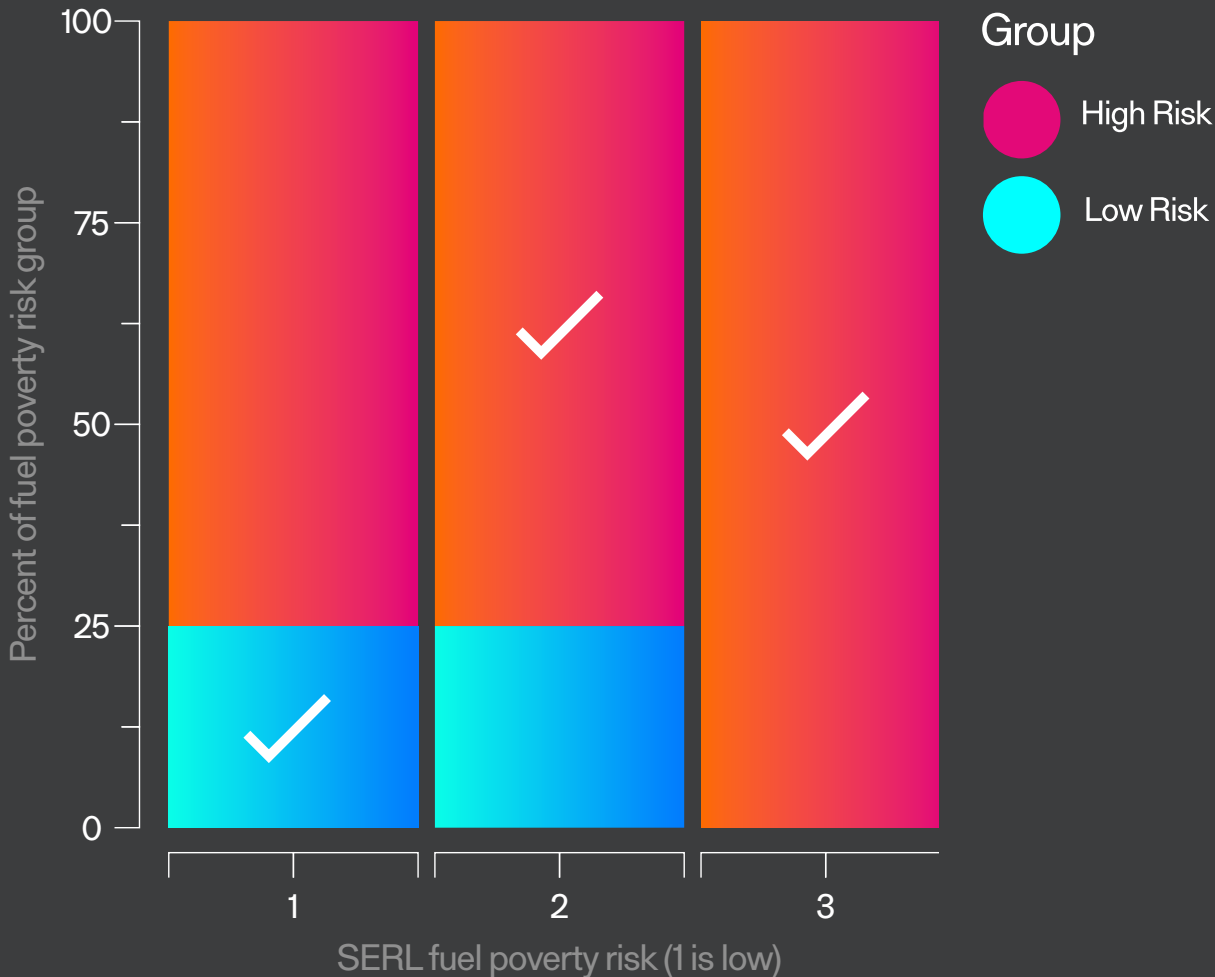

Figure 2: the percentage of each SERL poverty risk category split by uZero classification (column 4 in Table 3 above). The white ticks indicates correct classification.

Resources

NAE Fuel poverty explainer →

NAE 'Lived Experiences of Fuel Poverty' →

Ofgem 'Energy price cap explained' →

Annual Fuel Poverty Statistics in England 2022 (2020 data) →

ONS's 'Climate Change Insights, families and households, UK: August 2022 →

Energy Saving Trust 'Our View for England to 2030' →

The Equality Trust 'The Scale of Economic Inequality in the UK' →

End Fuel Poverty →

NAE 'What is water poverty?' →

Digital Poverty Alliance →

BRE 'The Cost of Poor Housing in England' →

The Data Communications Company 'Data for Good' →

Gov.uk 'Energy Data Taskforce' →

UKRI 'UKRI announces net zero-driven energy data application winners' →

Gov.uk '£102 million to make UK prosper from the energy revolution' →

UKRI 'UKRI announces net zero-driven energy data application winners' →

NEA 'Vulnerable households "left with no choices" as sky rocketing prices hit' →

BBC News 'Energy bill help to be reduced from April, says Jeremy Hunt' →

Ofgem 'Price cap to increase by £693 from April' →

UrbanTide

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