UK Power Networks
Delivering your electricity

Network Innovation Allowance Annual Summary

Progress and results from 2022/23

July 2023

Contents

Foreword

We are in the midst of a period of unprecedented change for the UK's electricity system and its customers. The volume of electric vehicles (EVs) and low carbon technologies such as heat pumps continues to rise. At the same time we are acutely aware of the cost pressures our customers face in the current economic climate, and they rightly expect more of the electricity industry. Customers' attitudes and behaviours are changing as they respond to the rise in energy costs, while the number of people eligible for priority support in the event of a power cut continues to grow.

Over the course of the RIIO-ED1 price control period (2015–2023) we have worked hard to embed innovation in our business, enabling us to deliver more savings than any other network operator. This approach will only continue to grow in strength as we move into RIIO-ED2.

Our corporate vision reflects our role to keep the lights on safely and at the lowest possible cost to our customers. As we enter RIIO-ED2 we are adding a new pillar to that vision, to ensure that nobody is left behind in the transition to Net Zero. We are determined that our network will be an enabler of Net Zero for all, and we will collaborate across industries and sectors to come up with solutions to the challenges we all face.

Changes to the way energy is produced and used will impact customers in ways that are not yet possible to fully understand, so it is vital our strategy remains agile and adaptable to shifting trends and new capabilities. We now have a team solely focusing on developing innovative ways of ensuring no customer is left behind in the journey to Net Zero.

We are evolving our approach to innovation and our strategy now encompasses six pillars:

- Consumer vulnerability
- Net Zero and the energy system transition
- Proactive optimised assets and practices
- Flexibility and commercial evolution
- Data and digitalisation
- Whole energy system.

Our work in the RIIO-ED1 forms a strong foundation for us to build on over the next five years. Innovation is only as strong as the ideas we attract to tackle clear business problem statements. Our team continue to scour the globe for new approaches and ideas that could benefit our customers. Closer to home, our partnership with the Energy Innovation Centre brings access to a network of 3,000 innovators and start-ups.

Collaboration is key for successful innovation and our door is always open for new proposals. If you have an idea or want to collaborate with us, we would be delighted to hear from you. Get in touch at innovation@ukpowernetworks.co.uk

Ian Cameron
Director of Customer Services and Innovation

Partnerships

We collaborate with many organisations to identify opportunities and maximise outcomes for our stakeholders and customers. Collaboration ensures that we have a diverse portfolio of projects and source the best ideas, not only from our industry but also from further afield to help us solve pressing challenges.

Energy Innovation Centre

In 2022/23 we continued partnering with the Energy Innovation Centre (EIC) Partnership to enhance the collaboration across energy network operators and with third parties to accelerate deployment of innovation into business-as-usual (BAU), while also improving how we work with innovators.

The EIC Partnership is continually looking to improve the support provided to innovators and as such, it actively seeks out feedback and suggestions from innovators through the annual Innovator Insights Report and has developed a roadmap of improvements shaped by innovator feedback for 2023[1], which was published at the end of 2022. These recommendations include BAU readiness checks, reviewing terms and conditions, increasing consistency across networks and a new methodology to prioritise industry innovation needs and challenges.

Going forward we will continue to focus on making it easier for innovators to understand the problems we are seeking solutions to, simplifying our procurement processes and increasing the pace for deployment of successful innovations into BAU. This doesn't mean that we will always get it right, but guides our efforts to enhance how we work with our innovation community.

Collaboration

Collaboration is key to successful innovation and has underpinned our success in this space over the RIIO-ED1 period. During this time, we have worked with technology vendors, software start-ups, energy suppliers, vehicle and fleet operators, local public bodies, and Government to name a few. Since 2015, 75% of our Network Innovation Allowance (NIA) funding has been funnelled to third parties, with 26% of projects taking place through direct collaboration with other LNOs, helping to deliver benefits of £425m to UK Power Networks and its customers.

As we aim to unlock innovation and benefits across our communities and energy sectors, the need to work more closely with third parties continues to increase. In addition to the EIC Partnership, this year we have actively explored new partnerships to learn from best practice and identify innovators and solutions globally.

We will continue to make it easier for innovators to participate at each stage of our innovation process:

Problem statements

This year we developed a problem statement framework to allow us to more clearly articulate our business needs to innovators wishing to work with us. During RIIO-ED2 we will publish business challenges regularly.

Idea proposal

We will continue to engage with our innovation community including SMEs through the EIC and other partnerships to co-create project proposals that benefit our customers.

Post idea approval

We will open the doors of our business operations and allow innovators to have direct access to the challenge that they are trying to resolve with the aim of coming up with effective products and solutions.

Delivery

We will ensure that more third parties access our innovation funding, and that we collectively come up with solutions to guarantee wider benefits to our customers and stakeholders.

1. V4.7 - Action Plan Roadmap 2023 (hubspotusercontent-na1.net)

Our Innovation Strategy

2022/23 was a year of change as we closed out RIIO-ED1 and prepared for RIIO-ED2. Our RIIO-ED1 innovation portfolio focused on our three pillars: **Efficient and Effective**, **Net Zero Ready**, and **Future Ready**. However, as the year progressed we started to consider how project ideas would fit into the new NIA governance, where projects must have the potential to facilitate the energy system transition and/or benefit consumers in vulnerable situations.

The challenges we face today span the entire industry and beyond, requiring greater collaboration between parties to tackle them. As a result, we shifted our Innovation Strategy so that our role going forward will be less focused on driving benefits solely within the network, for the benefit of consumers, and more focused on enabling innovation across the industry and delivering social return on investment.

The path to decarbonise transport and heat is not fully clear, and the impact that this transition will have on customers' finances is a great concern for all. Our Innovation Strategy must provide agility to face future uncertainties, leverage other sources of funding and remain open to disruptors. It must maximise the opportunities of seizing benefits across the energy value chain and provide a venue to collectively determine solutions that will unlock and deliver benefits to society.

Finally, these shifts will have significant implications for customers, therefore we recognise the importance of focusing our innovation efforts on ensuring no one is left behind in the energy transition.

Based on the changing needs of our customers, the industry and regulatory framework, we have adopted the industry wide themes of:

- Consumer Vulnerability
- Net Zero and the Energy System Transition
- Proactive Optimised Assets and Practices
- Flexibility and Commercial Evolution
- Data and Digitalisation
- Whole Energy System

Our Innovation Strategy will maintain the highest level of investment – we will invest more than ever before in innovation, including through our own funding – whilst leveraging our innovation culture, processes, frameworks, and experience of deploying innovation into BAU to deliver benefits to our network and customers.

Our RIIO-ED2 innovation themes

Consumer Vulnerability

Our vision of being a respected and trusted corporate citizen and the most socially responsible DNO is ingrained in the fabric of our business. Innovation plays a key part of our Consumer Vulnerability Strategy to deliver value and an excellent service for all our customers, both in normal operations and in the transition to Net Zero.

Our Consumer Vulnerability Strategy was developed through extensive engagement with stakeholders via workshops, bilaterals and webinars. This strategy will guide our BAU activities to ensure that inclusion is delivered by design in all our activities. Based on engagement with stakeholders, we will focus on the following key outcomes

Understanding vulnerability through innovative data analytics
Using the power of data and analytics to inform, share, prioritise and tailor our customer vulnerability approach.
Digital inclusion
We will work with third parties, trusted partners, and communities to proactively provide innovative solutions to reach our hard to reach and digital excluded customers.
Making Net Zero inclusive
We will collaborate to make sure our vulnerable and fuel poor customers will have the best opportunity to participate in the evolving flexibility and DSO market.
Policy
We will proactively participate in, and influence regulatory initiatives to make fairer access to the network, reduce the cost of electrify, and enable local energy markets.

We have a strong track record of innovation projects focusing on fuel poverty, inclusiveness, and fair access to low carbon technologies. We are also focusing on supporting those who may be left behind in the energy system transition within projects such as Socially Green, Social Connect and Power Protect.

Socially Green focuses on qualitatively and quantitatively assessing the needs of our current and future, disadvantaged and vulnerable customers. This aims to help UK Power Networks adapt services to support a sustainable, fair and accessible energy system. In Socially Green we seek to identify different customer segments to understand what support our vulnerable and disadvantaged customers need through the Net Zero transition. We aim to understand this via a comprehensive review of activities in this sector so far, while exploring any gaps identified. This could help us identify key cross-sector partnerships required in the future. The project also includes the development and trial of tailor-made flexible products and engagement mechanisms, delivering inclusive flexibility services specifically designed for hard-to-reach areas. This phase also amins to demonstrate the necessary commercial arrangements required to acquire a societal return on investment once flexibility is successfully secured.

Power Protect aims to support most vulnerable customers by providing a portable power supply in planned and unplanned outage scenarios, where these customers are off supply for an extended period of time. The project will develop and trial a solution to proactively identify vulnerable customers and dispatch batteries. This forecasting solution will enable us to increase our customer safety, reduce operational costs during power outage restoration and ultimately deliver benefits to customers.

Social Connect uses AI and data science techniques to combine UK Power Networks' information and existing fuel poverty insight with smart meter data supplied by households and geographical and socio-economic statistics. The AI system produced by software company UrbanTide will bring these datasets together into one simple dashboard which will give us an accurate picture of who may need support, especially in areas where people are less likely to come forward and ask for help. This work will allow UK Power Networks to support more customers in vulnerable circumstances and provide further opportunities to promote energy efficiency measures which will help customers reduce their energy bills.

Strategic Focus Areas

While the previous sections described how our innovation strategy has evolved and how it is articulated for RIIO-ED2, this report is the last NIA Annual Summary for RIIO-ED1, and is therefore structured based on our RIIO-ED1 themes:

Net Zero Ready

Future Ready

Efficient and Effective

Strategic Focus Areas

Net Zero Ready

Due to world events, the UK economy has slowed, inflation has risen, and household energy bills have soared. Government policy focus has understandably shifted to boosting energy security and increasing electricity generation from renewable sources such as wind and solar, as outlined in the policy white paper, Powering Up Britain[2], which was published in April 2023.

The paper follows the British Energy Security Strategy[3] published in April 2022 and the independent Net Zero Review undertaken by the Former Energy Minister, Chris Skidmore. Whilst wide ranging, the recommendations set out in the minister's Mission Zero[4] report published in January 2023 are targeted at seizing the economic opportunities offered by Net Zero. Electricity networks play an essential role in unlocking these opportunities and informing the fundamental rethink of how power is delivered to consumers.

Customer sentiments and behaviour have also shifted in response to tough economic conditions and high energy bills. For example, applications to connect combined domestic solar and battery storage have increased steeply whilst the growth in EV charge points at home has slowed. Meanwhile, based on our modelling of the barriers customers face, we estimate that 1.58m customers in our regions are at risk of being left behind in the energy transition by 2030. Our RIIO-ED2 business plan sets out seven keys to success over the next five years based on our customers' and stakeholders' priorities. These keys include facilitating decarbonisation at the lowest cost to our customers and being a force for good in the communities we serve. Our staff will be incentivised through a new measure of customer service that will track their experience of connecting low carbon technologies such as EVs, heat pumps, generation and storage systems. Together, these changes signal the increased importance we are placing on Net Zero.

We recognise that aspects of the path to Net Zero cannot be known with certainty. The projects we have selected for our Net Zero Ready focus area demonstrate our engagement with the debate around emerging policy, regulation, technology, market trends, new business models and our own practices.

Optimise Prime is the world's largest trial of commercial EVs, aiming to understand and minimise the impact that electrification of commercial vehicles will have on distribution networks. Working with British Gas, Royal Mail and Uber we studied charging behaviour and investigated flexibility opportunities for return to home, depot based and mixed charging fleets. We tested alternative network connection options to reduce the time and cost it takes to connect as well as providing tools and the data to support fleet managers in the EV transition.

Emerge aims to reduce the time it takes for domestic customers to switch to low carbon technologies and reduce the disruption from multiple home visits. Recognising that a fuse upgrade could be a blocker to the replacement of a gas boiler with a heat pump in an emergency breakdown event, we worked with Octopus Energy to explore what is required to enable appropriate third-party meter operator organisations to undertake fuse upgrades for customers.

CommuniHeat is developing a roadmap to enable rural communities to switch to low carbon heating in a way that ensures comfort, affordability, and a smooth transition. With the village of Barcombe as a case study, CommuniHeat is writing the book on how communities can achieve this transition over the next ten years so we can share our learning with other off-gas communities throughout the UK. We are working in partnership with the people of Barcombe, local community energy group Ovesco, and engineering practice Buro Happold.

NeatHeat is investigating the potential of Zero Emission Boilers (ZEB) as an alternative to carbon-intensive gas boilers in homes where a heat pump is unsuitable due to limited space. The ZEB manufacturers, tepeo, are installing storage-based heating technology in customers' homes whilst OVO Energy are testing whether a first of its kind type of use tariff will incentivise storage heating outside of peak hours. The goal is to understand the impact on the network and customers in terms of disruption, time and cost.

Shift 2.0 was established to explore the potential for dynamic and locational pricing to address secondary peaks, herding behaviour and congestion in certain parts of the network caused by the rapid uptake of low carbon technologies, new electricity tariffs and wider energy market price signals. By understanding the scale and timing of these issues, the appropriate mechanisms and systems can be designed to further stimulate the evolution of market-led customer propositions and business models.

2 https://www.gov.uk/government/publications/powering-up-britain/powering-up-britain

3 https://www.gov.uk/government/publications/british-energy-security-strategy

4 https://www.gov.uk/government/publications/review-of-net-zero

Strategic Focus Areas
Net Zero Ready

Optimise Prime

Background

For the UK to meet its Net Zero target, the EV share of new car and van sales must increase from 25% today to up to 100% by 2030. Commercial vehicles will likely determine the speed of the UK's transition to low carbon transport with businesses buying 55% of new vehicles in 2021[5].

This creates a significant challenge for network operators as there has been limited research into understanding or minimising the network impacts of commercial vehicles going electric. Compared to vehicles used for domestic purposes, commercial EVs are expected to have a much greater impact on the electricity network due to higher energy requirements resulting from higher daily mileage and payloads as well as co-location of multiple EVs at a single site such as a depot.

Optimise Prime is the world's largest trial of commercial EVs. It sought to understand and minimise the impact of the electrification of commercial vehicles on distribution networks. The project brought together partners from leading technology, energy, transport and financing organisations to collaboratively design and trial technical and commercial solutions. These solutions aim to reduce customer costs and enable a faster transition to electric for commercial fleets and private hire vehicle (PHV) operators.

As illustrated in Figure 1, Optimise Prime was built around three workstreams with three fleets. Each of these fleets has specific charging requirements:

- Home charging for British Gas
- Depot charging for Royal Mail
- Mixed charging, a combination of charging at home and on public charging infrastructure, for Uber's PHVs.

Each charging model has its own unique challenges that also translate to specific network challenges.

Figure 1 The Optimise Prime trials

Experience to Date

Optimise Prime started in January 2019 and concluded in February 2023.

The project gathered data from over 8,000 EVs driven for commercial purposes across the three fleet trials. Alongside this, the project trialled the effectiveness of new connection and flexibility services to reduce the need for network reinforcement and therefore lower the cost of the EV transition for all.

We have released the world's largest EV datasets on our Open Data Portal from our trials, which is illustrated in Figure 2 (next page). These datasets will allow the wider electricity, fleet and PHV industries to optimise their vehicle electrification plans while Distribution Network Operators (DNOs), academics and interested parties will be able to utilise the anonymised data created by the project for further research, analysis and forecasting.

We have published detailed results of our trials in Optimise Prime's final report, which includes:

- The use of commercial EV flexibility by DNOs
- Detailed trial findings
- An analysis of EV fleet total cost of ownership
- Fleet behavioural findings
- A step-by-step fleet electrification guide, to help fleets find out where to start their electrification journey, based on the real-life experience of our partners British Gas and Royal Mail switching to EVs.

5 Source: Vehicle licensing statistics: 2021 Vehicle licensing statistics: 2021 - GOV.UK (www.gov.uk)

Strategic Focus Areas
Net Zero Ready

Optimise Prime

Continued

Future Developments

We are implementing the following from our Optimise Prime project:

- The Site Planning Tool is a self-service tool available for our customers who plan to install multiple EV chargers at a site and want to model their optimal energy requirements to save time and cost
- The fleet electrification guide provides step-by-step guidance for fleets to go electric
- We are taking on board key insights on profiled connections and flexibility services to develop our customer solutions further. Figure 3 shows that networks may save nearly £200m across GB by 2040 by putting in place suitable incentives for home-based and depot-based fleets to smart charge
- We are using data on commercial EV charging to improve our network forecasting and make better network investment decisions
- We are transferring our learning on Uber public charging requirements to our Local Area Energy Planning work with local authorities
- All learnings and recommendations for other DNOs to replicate are available in our final report and close down report.

Figure 3: Forecasted benefits from Optimise Prime's smart solutions across GB

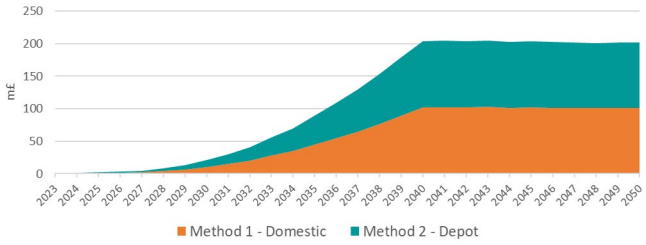
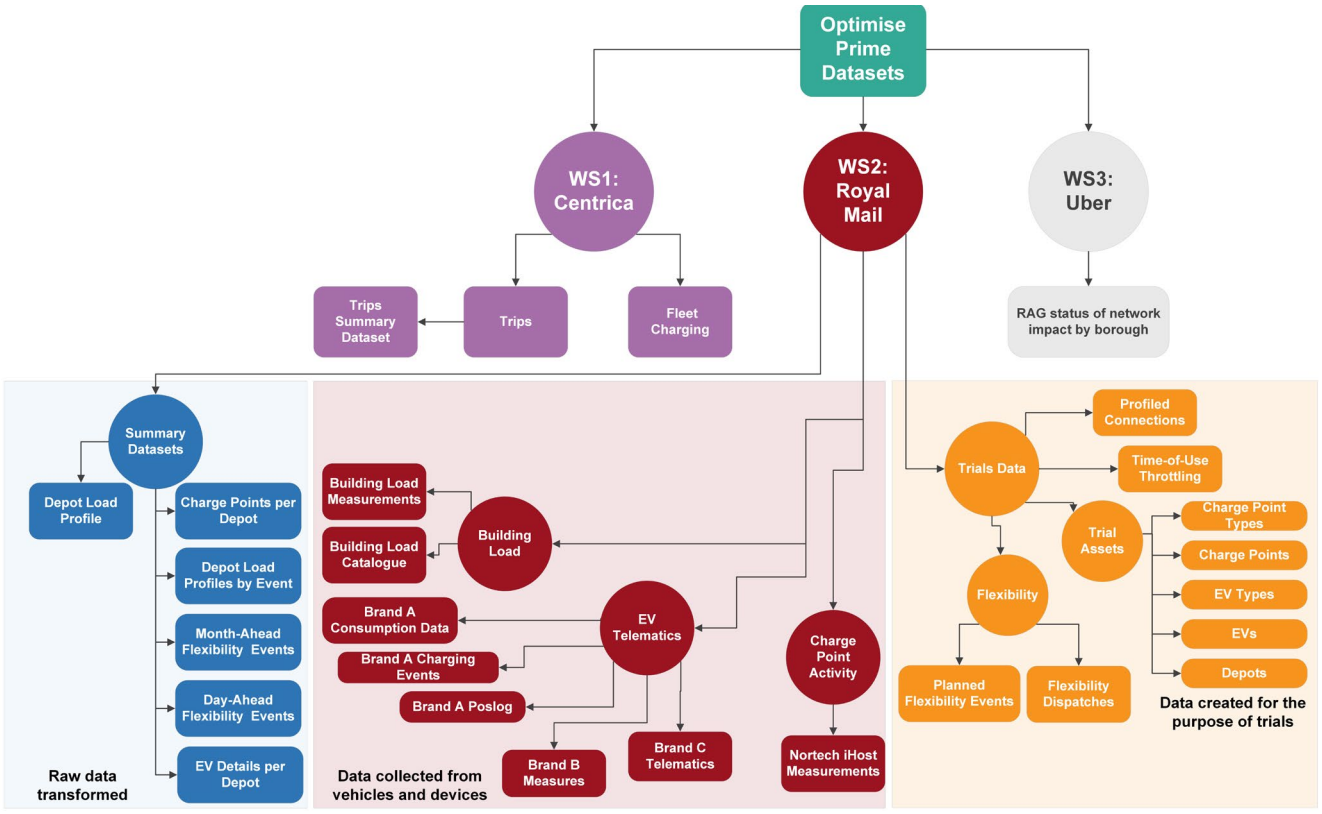


Figure 2: The Optimise Prime datasets



Strategic Focus Areas
Net Zero Ready

Emerge

Background

The decarbonisation of domestic heating systems remains a key focus in the transition to Net Zero. Demand for heat pumps in the UK are expected to accelerate over the RIIO-ED2 period as changes stemming from the UK Government's Heat and Buildings Strategy published in October 2021 are implemented[6].

DNOs are at risk of being a barrier to the uptake of heat pumps with their installation highly dependent on the successful upgrade of domestic supplies. This challenge is further compounded as 80% of domestic boiler replacements occur at the point of failure, presenting a very narrow once in 15-year opportunity for a domestic household to switch to a low carbon alternative. To facilitate the switch, UK Power Networks must upgrade fuses in a timely manner whilst managing increased demand for fuse upgrades from all low carbon technologies.

UK Power Networks partnered with Octopus Energy to deliver Emerge (Emergency Fuse Upgrades). Emerge aimed to reduce the time it takes to switch to low carbon heating and improve the customer journey in response to emergency upgrade events by enabling appropriate third-party meter operator organisations to undertake fuse upgrades for their customers. This was achieved through the provision of training and the introduction of a digital tool to manage the process.

The scope of the Emerge project included:

- Training the project partner and conducting a first set of network trials
- Scoping, creation, development, and trialling of the digital tool with a second set of network trials
- Exploration of:
  - a training and accreditation program accessible for eligible third parties to undertake fuse upgrades
  - a supply register to capture rating and equipment information for domestic properties
- Creation of a training and accreditation programme and supply register depending on the outcomes of the exploration.

Experience to Date

At the conclusion of the Emerge trials, 46 Emerge low carbon technology applications were received, and seven fuse upgrades were completed by Octopus Energy installers on behalf of UK Power Networks. The trials demonstrated that Octopus Energy engineers can safely and correctly upgrade a fuse in certain conditions. Emerge demonstrated that it improves the customer journey for both heat pumps and EV charge point customers. Octopus Energy installers were able to schedule and upgrade the fuse on the same visit as installing the customers low carbon technology and therefore Emerge reduced the average time to upgrade the fuse and the number of visits the customers needed.

A bespoke training programme was created by UK Power Networks' training team, the Emerge project delivery team, and Octopus Energy to ensure Octopus Energy installers could correctly and safely upgrade a fuse in compliance with UK Power Networks' policies and standards. The training programme was reviewed to ensure any gaps or overlaps between the skills and knowledge of Octopus Energy installers and UK Power Networks installers were identified and resolved. 23 MOCOPA-certified Octopus Energy installers attended a one-day training course at UK Power Networks' training facilities. All 23 installers passed a written test and practical assessment and received a certificate that enabled them to be part of Emerge.

Following the first set of live customer trials, a digital product and associated processes were scoped and developed to automate the Emerge end to end processes and enable Emerge to be scaled to many customers and applications. The Emerge digital product was built on UK Power Networks' Smart Connect[7] platform and was tested as part of a second set of live customer trials and worked as designed without defects.

An enduring training and accreditation programme was developed building on the learnings from delivering training to Octopus Energy installers. This can be used in future to upskill any MOCOPA-certified installer to upgrade a fuse correctly and safely in certain circumstances.

6 https://www.gov.uk/government/publications/heat-and-buildings-strategy

7 https://www.ukpowernetworks.co.uk/smart-connect

Strategic Focus Areas
Net Zero Ready

Emerge

Continued

Emerge has led to valuable learnings on the safety, assurance, and training requirements for meter operators to undertake this work on behalf of DNOs such as the type of properties that would be eligible, the documentation required, and the skill gaps that would need to be overcome. Emerge has also led to valuable insight on the type of customers that can benefit from this solution and the maturity of the heat pump market.

Through Emerge we have worked to address the primary network-related barriers facing customers when switching to a heat pump in the event of a boiler breakdown. However, other barriers remain, such as the lengthy and complex process to install a heat pump. The wider industry is seeking to understand and address these barriers.

Figure 4: Octopus Engineer completing Emerge fuse upgrade

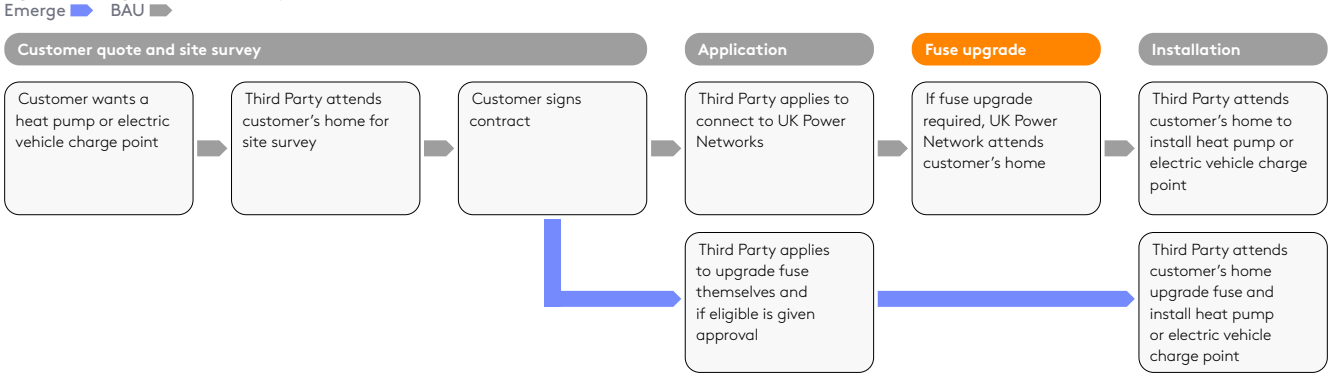
Future Developments

The Emerge trials completed in February 2023. We will continue to build upon and implement the learnings and insights gained through the project. UK Power Networks is in early discussions with other meter operator organisations to take part in a broader trial to:

- Increase the volumes of applications needed to find and test the Emerge method with customers who require an emergency upgrade such as distress boiler events or vulnerable customers
- Explore how to expand the fuse upgrade eligibility criteria to include Paper Insulated Lead Covered service cables and overhead service cables to safely scale the volume of customers that can be part of the trials
- Test and refine the enduring training and accreditation programme developed during the Emerge trials when upskilling and onboarding additional meter operator organisations
- Further develop the operational and commercial framework created by Emerge, addressing and outstanding safety or legal concerns, and validating with the industry.

The learnings and outcomes of Emerge have been disseminated with other DNOs through a virtual learning and sharing session held in March 2023 and have been shared with other meter operators that have shown an interest in participation. The project will continue to engage with other DNOs, meter operators and industry bodies to increase participation in future trials and identify the best pathway for solution developed by Emerge to be rolled out nationwide.

Figure 5: Emerge Customer Journey



Strategic Focus Areas
Net Zero Ready

CommuniHeat

Background

CommuniHeat is developing a roadmap to enable rural communities to switch to low carbon heating in a way that ensures comfort, affordability, and a smooth transition. Using Barcombe as a case study, CommuniHeat is writing the book on how communities can achieve this transition over the next 10 years so we can share our learning with other off-gas communities throughout GB. We are working in partnership with the people of Barcombe, local community energy group Ovesco, and engineering practice Buro Happold. The project is overcoming the difficulties facing off-gas grid communities in their journey to Net Zero carbon emissions by undertaking the following activities:

- Combine local area planning at community level with energy system modelling and techno-economic analysis to understand how Barcombe can move to low carbon heating comfortably and affordably
- Create energy profiles for the whole community, calculating the conversion process of replacing existing heating systems with more efficient electrical heating methods, and then modelling these findings to see how the electricity network could be adapted to accommodate the transition
- Create a digital twin of Barcombe, to enable the recreation of Barcombe as-is which then facilitates the modelling of future decarbonisation scenarios (i.e. uncoordinated vs. coordinated) to identify the optimised decarbonisation pathway for the community.

Experience to Date

The project has concluded its main focus, i.e. to model scenarios based on real community and network data, with a full appraisal of the different technical approaches and their associated costs available to the area to decarbonise in a 'least regrets' methodology.

The reason for this work was firstly to understand the as-is state of Barcombe, in terms of housing stock and local infrastructure, and secondly to assess its capacity to change in response to a variety of potential different scenarios and parameters that Barcombe could face in the coming years. Completing this exercise allowed the project to understand what the optimised pathway of decarbonisation for Barcombe should be.

Once concluded, this work subsequently led to the finalisation of a fully research-based methodology specifically targeting off-gas grid communities. Whilst these specific communities are the primary focus, the methodology could also be applied as a reference point for on-gas grid communities, though with amendment and reprioritisation of some parameters required to be more applicable.

A range of activities were undertaken across the Barcombe community, including home surveys and the installation of home energy monitors. The information captured through these activities proved invaluable in the development of the simulation models used to establish the digital twin of Barcombe parish.

Figure 6: Digital Twin

Strategic Focus Areas
Net Zero Ready

CommuniHeat

Continued

Data collation was instrumental in helping inform the project on the varying heat demands of different types of property archetypes based on factors such as size and occupancy and construction type.

The modelling suite that was established, utilising publicly available data including Energy Performance Certificate (EPC) data, enabled an analytical assessment which demonstrated that whilst publicly available data is sufficient to develop an initial picture of the community, it is insufficient to establish what the community options are and how the network impact of heat decarbonisation could be mitigated.

The survey process was designed to ensure a sufficient level of detail could be achieved whilst not overburdening customers. A data extraction process was also designed to include a visualisation approach which significantly enhanced the ability of different stakeholders to access various levels of data and information to be able to make the right decisions and explore options.

Community engagement conducted throughout the lifecycle of the project demonstrated the real challenges faced by a typical customer in reaching their goal to decarbonise. These include a lack of clarity on options, difficulty in accessing finance and the immediate need to conduct network upgrades to facilitate individual households looking to transition to low carbon heating. In response, one of the outputs from the project was the development of a Home Action Plan that was socialised with the residents of Barcombe in Q2 2022 as part of the conclusion of the project to give guidance on the most appropriate steps they can take to begin or continue their path to Net Zero.

Figure 7: Home Action Plan

Following the CommuniHeat project, and as part of Barcombe's continued efforts to decarbonise, residents have gained a better understanding of the considerations required when making the transition to electrified heating. Products like the Home Action Plan have provided a useful starting point for those wishing to change their heating arrangements but are unsure on how best to next proceed. OVESCO also maintains an active role in the community, with a local energy Steering Groupand has launched initiatives such as the Lewes Climate Hub which offers free, impartial advice on energy bills, renewable energy installations, home insulation, energy efficiency and more. Data from CommuniHeat has assisted OVESCO in being able to give advice to residents with a much greater level of confidence than before.

Future Developments

The project concluded in December 2022. Working with our project partners and with local authorities, we are exploring how we can directly address barriers to low carbon heating adoption, improve energy efficiency and install domestic low carbon technologies by demonstrating novel approaches to community-led decarbonisation.

This could include the development of software tools for customers to collectively plan their decarbonisation journeys at individual and community level, which would allow them to optimise domestic heat decarbonisation alongside other domestic or community owned low carbon technologies whilst exploring potential flexibility solutions. These tools would require community engagement and the use of novel financing methods to accelerate heat decarbonisation and enable a co-ordinated approach to network connections and reinforcement, touching the network once.

In addition, we are considering a local, community-owned and managed balancing system demonstration. This could reduce energy costs and network power flows by optimising local energy consumption using domestic and community or privately owned commercial assets. Building on work already done by CommuniHeat, this could be achieved by implementing trials in Barcombe and other communities.

Strategic Focus Areas
Net Zero Ready

NeatHeat

Background

While heat pumps are expected to be a core part of the electrification of heat, a one size fits all approach does not work for heat. Installing heat pumps in homes with limited internal space and no outside space, such as terraced housing, can be challenging. Even in homes where external wall space is available, heat pump installation comes with significant disruption. Radiator replacements and pipework upgrades may make heat pumps an unattractive proposition for customers in such housing archetypes.

This project is investigating the potential of zero emission boilers (ZEBs), specifically smart electrical storage heaters, as an alternative to carbon-intensive gas boilers in areas where a heat pump is unsuitable for the reasons described above. To determine the applicability and implications of using ZEBs at scale, we are using a combination of qualitative customer research, interviews with subject matter experts, and analysis of installations to understand the impact on customers in terms of time, disruption and cost. In parallel, we are undertaking quantitative analysis of data, such as supply point half-hourly consumption and dedicated asset monitoring, to understand the impact on the network.

The project is delivered in partnership with Ovo Energy, an energy retailer initiating a first-of-its-kind "type of use" tariff, charging participants a lower set rate of electricity, no matter when the ZEB is in use. The manufacturer of the ZEBs, tepeo, will lead the installation process and all matters related to the product.

Experience to Date

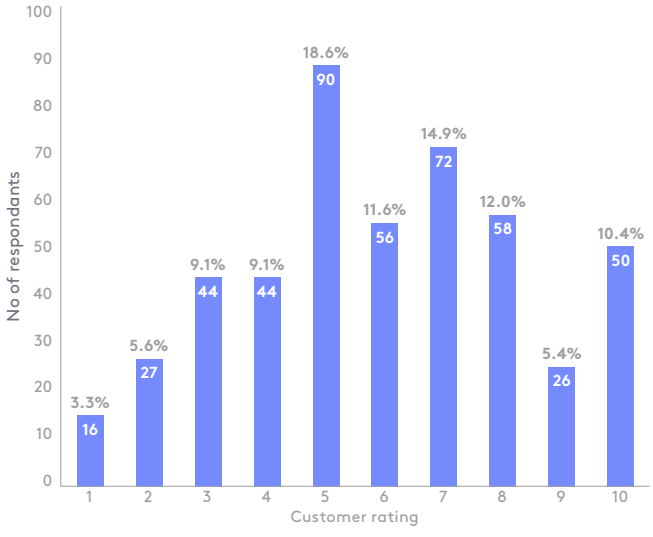
The project is currently in the recruitment and installation phase, with eight installations from our target of thirty completed to date. See Figure 8 for a typical installation. For the first marketing campaign the project partners created a page for the project on their designated websites and sent out a joint press release alongside UK Power Networks. Out of 1,500 sign-ups, only 170 met the eligibility criteria.

As a result, a second, more targeted marketing campaign commenced on 23 January 2023. This campaign aimed to recruit sufficient eligible customers in the project to commence the project trial. To date, the further email campaign has increased the number of signups to 1,700 with an additional 30 eligible customers identified. By increasing the number of eligible customers, we will gain more confidence in achieving the optimal number of installations to gather statistically significant findings.

As part of early customer engagement activities, a survey was launched amongst all participants that registered interest in this trial. 483 respondents were asked how they felt about their current heating system. Figure 9 provides a breakdown of their response where 10 is very dissatisfied with the current heating system. The majority of respondents provided a neutral response of average satisfaction. This can be interpreted as customers not having significant expectations from their heating systems in general. With that said, more than half of the respondents had a negative experience to varying degrees.

Figure 8: Installed ZEB in a customer's home (left of the picture)

Figure 9: Customer rating of their current heating technology (Rating out of 10, number of respondants inside bar)



Strategic Focus Areas
Net Zero Ready

NeatHeat

Continued

When asked to provide additional feedback, below are the key drivers of customer interest in a ZEB:

- Reducing their environmental impact
- Existing system needed replacing
- Operational cost savings
- Trying a new, or more suitable, technology.

Following the first marketing campaign and eight successful installations, we have reflected on key challenges and lessons learned. The most prominent challenge was the significant drop-out rate of participants during the assessment process, which was partly due to some respondents residing outside Great Britain. To address this, the team launched a more targeted campaign with clear selection criteria and increased automation.

Another reason for drop-outs arose from the requirement for customers to switch to Ovo Energy, which posed potential difficulties given the current energy crisis. Consequently, all project communications were carefully considered to ensure customers were fully aware of this requirement and its implications in advance.

Lastly, one customer encountered a further obstacle. They wanted to completely remove the gas supply from their home and fully transition to low carbon technologies. It was discovered that installers were unable to remove the gas meter, and thus a request had to be made for the customer's energy supplier to arrange a visit for its removal. Until then, the customer must continue to pay the standing charge. Moving forward, customers will be informed of this requirement if it applies to their future decarbonisation plans.

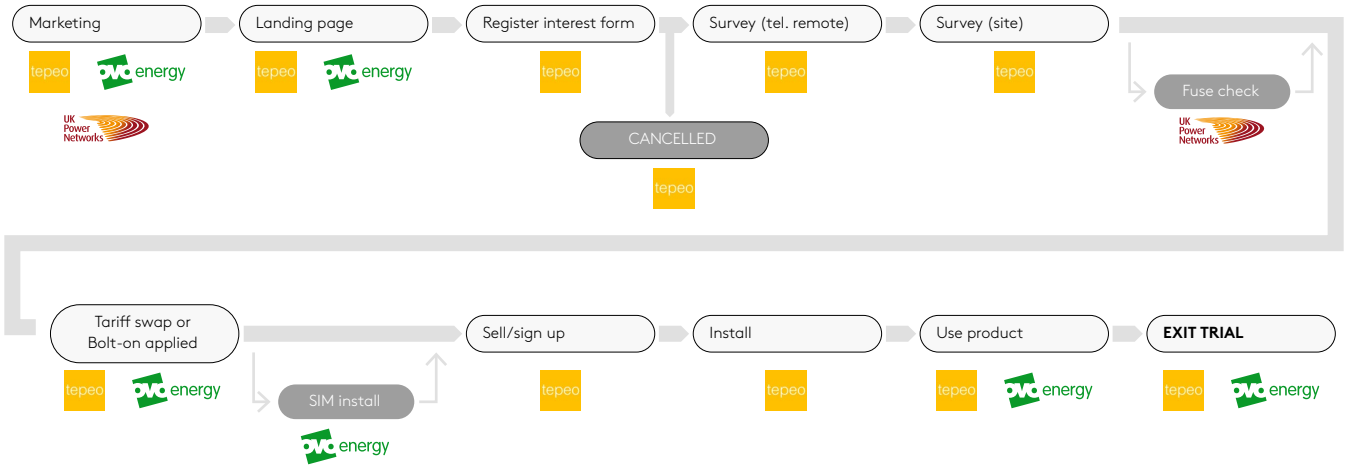
Future Developments

Following the completion of the first eight ZEB installations, our current focus is on securing further customer homes for ZEB installation. The overall customer journey is shown in Figure 10. A number of customers have already progressed beyond the site survey stage and are now in the process of finalising the necessary agreements to begin the installations. We anticipate that our second marketing campaign will result in a lower drop-out rate, given its targeted approach.

After installations are complete, the performance of the ZEBs will be monitored, and their operational data will be collected and analysed. The tepeo and Ovo Energy data teams have already determined the data requirements and developed a data plan. This plan defines the types of data that will be collected from the ZEBs, as well as the method of data collection, handling, and sharing between the project partners. The next steps will be to create a template for the data report and determine the best ways to review and present the data collected by the ZEBs. This step aims to assess the load profile of the ZEBs, their impact on the network, and their ability to provide flexibility through demand-side response.

To ensure that the user experience is captured throughout the customer journey, multiple interviews are planned with all trialists. These interviews have already begun with trialists pre-installation of the ZEBs to capture their current experience. Trialists are also being interviewed after installations and towards the end of the trial to reflect on the overall journey. The stakeholder engagement team at Ovo Energy will analyse the findings, which will be included in the project reports.

Figure 10: NeatHeat trial customer journey



Strategic Focus Areas
Net Zero Ready

Shift 2.0

Background

The rapid uptake of low carbon technologies coupled with new electricity tariffs and wider energy market price signals is likely to cause secondary peaks, herding behaviour and congestion in certain parts of the network. Shift 2.0 was established to look at the potential for dynamic and locational pricing to address these issues, and how any options can complement flexibility procurement.

The project aims to:

- Understand the scale and timing of secondary peaks and herding behaviour
- Investigate the potential for locational and dynamic price signals that could be time of use and/or capacity-based
- Understand the regulatory, commercial, and technical barriers that would need to be addressed in the design of mechanisms and/or price signals
- Determine the enablers, roles, business models and data flows to make dynamic/locational pricing a viable mechanism
- Further stimulate the evolution of market-led customer propositions and business models.

Experience to Date

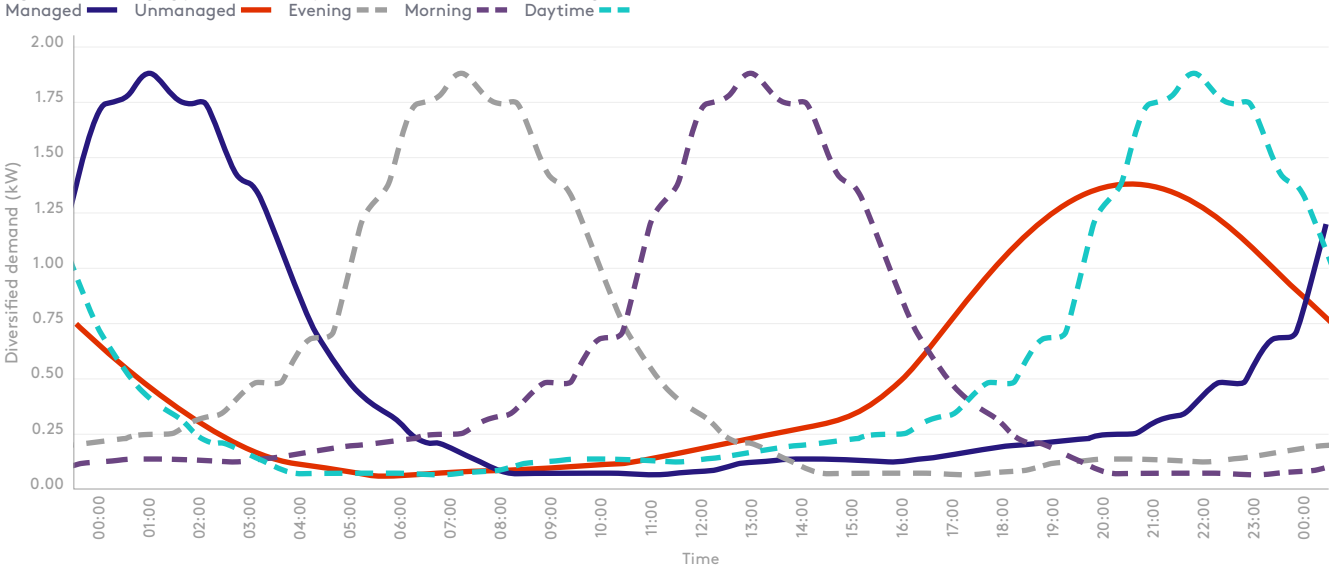
The impact that future wider system incentives may have at the network level is uncertain. This project has set out to investigate these uncertainties and the related risks. We built a forecasting model which replicates the methodology and inputs from our Strategic Forecasting System in a simplified way, to enable more flexible investigation of the impact of adjusting different input profiles. This model allows us to explore what would happen to our forecasted reinforcement needs out to 2050 if day-ahead wholesale prices incentivise customers to charge at different times of day.

We then tested the impact of morning, daytime, and evening low price events on managed charging profiles, based on forecasted wholesale price data from Baringa's price forecasts. The impact assessment suggests that evening low price events are the primary risk, in which managed charging schedules could again begin to interact with the existing household demand peak.

The EV charging profiles used in the model are shown below (Figure 11), and include:

- An unmanaged charging profile – relating to the demand that materialises from EVs which plug in and charge immediately (typically resulting in an evening EV peak)
- An 'original' managed charging profile – relating to the EV demand seen through Project Shift, i.e. with smart charging shifting the demand to the overnight period
- Additional managed charging scenarios – new potential EV charging demand profiles that could be seen in the event of low/zero price events at alternative times of the day.

Figure 11: EV charging profiles. Dashed profiles indicate time-shifted managed demand



Strategic Focus Areas
Net Zero Ready

Shift 2.0

Continued

The modelled effect over the next five years is an increase in low voltage network exceedances by c.40% compared to UK Power Networks' current forecast. For the subsequent five years and beyond, the network exceedances more than double. This initial model also showed that applying simple regional smart charging incentives will drive higher exceedance volumes in areas that are dominated by Profile Class 2 households, which exhibit higher overnight demand.

Under current market arrangements, the incremental wholesale savings available to customers who respond to evening low wholesale price events by shifting load overnight is small as the overnight prices also tend to be small, and these evening low price events occur only on a handful of days per year. However, there are other areas of wider system value that also influence smart charging schedules, e.g. supplier intra-day imbalance positions, balancing services, and grid carbon intensity. Managing charging around these is assumed to be of higher value to customers.

Engagement with smart charging providers has confirmed that their current propositions would likely respond to changes in the day-ahead wholesale price, and indeed are already scheduling smart charging demand to coincide with the evening system peak in some instances driven by these wider pricing signals.

Figure 12 summarises the key factors affecting flexibility versus reinforcement decisions for networks, considering what customers are willing to accept to deliver flexibility services at the distribution level.

Figure 12: Factors affecting flex VS reinforcement decision for networks

	REINFORCEMENT		FLEXIBILITY
	Value of reinforcement deferral incentives to customers	VS	Customer benefit of using network capacity to access other markets
	Reinforcement Deferral Value The £ saving per year for a given substation deferral	VS	**Wholesale Energy Cost Savings**
	Idealised Flexibility Need The kW/kWh needed to address the exceedance	VS	**Excess renewables proxies**
DSO LEVERS TO INCREASE FLEX PAYMENT VALUE	**Procurement Efficiency** kWh bought vs kWh needed	VS	**System Services**
DSO LEVERS TO INCREASE FLEX PAYMENT VALUE	**Cost to Serve Efficiency** Reducing the transaction costs for DSOs per kW/kWh	VS	**System Services**

Future Developments

There is an opportunity for the DSO to mitigate the network exceedance risks through leveraging flexibility for network reinforcement deferral, whilst ensuring best value for consumers. Mechanisms can be more or less granular (i.e. focused on specific locations and time periods only) and dynamic (i.e. signalled only on days and time periods when needed based on real-time awareness of network conditions).

Granular and dynamic flexibility incentives can focus the value of reinforcement deferral on a much smaller number of events and customers and provide suppliers with assurance that calls for flexibility from EVs to manage constraints would be less frequent, and thus easier to respond to when the supplier is also managing imbalance positions or delivering balancing services.

We are now looking into whether to undertake further investigation with smart charging providers, to fully understand the current and future interaction of network flexibility needs with wider system incentives. In addition, uncertainty exists regarding how smart charging providers could respond to more granular and dynamic network flexibility incentives, and therefore innovation will be required across the industry to determine whether network incentives and customer propositions could interact more effectively.

This research has also identified other areas of risk and opportunity that could be explored further through innovation or delivery through BAU:

- Investigating the potential for locational non-dynamic flexibility payments to further mitigate the evening peak risk, as a short-term measure in RIIO-ED2 building on existing flexibility approaches
- Investigating how the implementation of BAU flexibility mechanisms for RIIO-ED2 should be managed to avoid exacerbating the peak at sites with overnight load
- Investigating how customers may change their charging behaviour if offered low-cost daytime destination charging propositions, and how this might affect assets in non-residential areas.

Strategic Focus Areas

Future Ready

The second area of strategic focus for UK Power Networks' innovation portfolio is to deliver projects that help enable a future-ready distribution system that meets the needs of tomorrow's customers. This means meeting our customers' evolving needs, including ensuring that no one is left behind in benefiting from the Net Zero transition as well as covering the provision of new services involving Distributed Energy Resources (DER). Our projects in this area include facilitating the reliable connection of increased DER on to power distribution networks as well as increasing resilience of the Low Voltage (LV) network with greater visibility, monitoring and control.

Within this innovation summary report, we have highlighted four NIA projects and one Network Innovation Competition (NIC) project in our Future Ready portfolio.

Collaborative Local Energy Optimisation (CLEO) project will provide core planning datasets via an online, self-service energy planning tool to support the planning process for our local authorities, helping them make the best choices for their communities. This local area energy planning self-service tool will allow local authorities to layer local input such as decarbonisation strategies and action plans, local market trends, social inclusion policies and transport plans upon our network infrastructure data to develop options for their communities.

High Voltage (HV) Auto Quote project will provide a self-service connection that offers customers enquiring about connections between 300 kVA and 1 MVA. Furthermore, it aims to provide budget estimates for connections from 1 MVA to 2.5 MVA and will codify the tacit logic used in HV quotes to enable this automation. It will also include the development of logic to assess the cost of traffic management. This innovation project will perform the necessary analysis and change to put connection offer requests in the hands of the consumer, allowing them to see the cost of different options interactively, reducing time to deliver connection offers and improving service delivery.

Our View project is investigating the benefits of using video-aided technologies to enhance customer service delivery and the safety of field staff. This will allow customers to initiate video calls with our agents when reporting problems allowing the potential for faster resolution and improving customer satisfaction. It will also allow our task force to benefit from technologies such as Artificial Intelligence (AI) when completing risk assessments which improve the overall process and safety. Once successful, the solution can be integrated into existing workflows to optimise processes and maximise the benefits to both our customers and the task force.

Social Connect project is helping to accelerate the identification of customers in, or at risk of entering fuel poverty. The project is currently developing an innovative AI tool, modelled using the best available data, including Smart Meter System data to enhance our understanding of fuel poverty across our licence areas. This work will enable UK Power Networks to support more customers in vulnerable circumstances and provide further opportunities to promote energy efficiency as a way to reduce energy bills.

Constellation is a NIC funded project led by UK Power Networks and delivered in partnership with ABB, GE, University of Strathclyde's Power Network Demonstration Centre (PNDC), Siemens and Vodafone. The project aims to demonstrate how protection and control solutions located locally within DNO substations can be used to facilitate the connection of more DER on to power distribution networks. It also includes a smart service that de-risks the likelihood of sudden and widespread DER curtailment and/or disconnection. This world first innovation initiative is essential to facilitating Net Zero through enhancing the core of the distribution network: substations. It will introduce a first of its kind local intelligence at the substation level that complements existing functionality, in a sustainably cost-efficient manner for our customers.

Strategic Focus Areas
Future Ready

Collaborative Local Energy Optimisation (CLEO)

Background

Around 100 of the 127 Local Authorities (LAs) in the UK Power Networks region have declared a climate emergency, and over 300 across the UK have done the same. More than half (66 of the 100) of these have set an accelerated target to achieve Net Zero by 2030. Ofgem has set the expectation that local plans should be used to inform network planning and justify capital investment. Each LA has different needs; understanding their needs and what plans would best suit the customers and communities in that area is a complex, time consuming and resource intensive process.

Many LAs lack the expertise and experience to be able to identify, assess or consider the energy and technology impact on their development plans and vice versa. An effective Local Area Energy Plan (LAEP) requires integration of various data sources and balancing of various dependencies and constraints to achieve Net Zero goals. Not only do LAs lack the resources and expertise to build LAEPs to meet evolving industry standards, but they also face difficulties in assessing the impact that the energy plans have on social equality and lack the capacity to engage effectively with other local, regional, and national energy system stakeholders.

UK Power Networks has built a team that will engage with all 127 local planning authorities on their climate plans each year of RIIO-ED2, offering a three-tiered support service utilising a framework to assess and develop action plans and deliver investments where a prescribed level of certainty is achieved in period.

This team and the LAs they serve will require the tools and data to perform this activity and collaborate effectively.

The project aims to provide a web based geospatial software application free of charge to users. The software will enable Local Energy Planners to use various layers of data to analyse and design ways to decarbonise their areas using low carbon technologies that best suit their constituents' needs. The tool will provide clear visibility of the impact of these plans and help them make informed decisions.

The tool also empowers Local Energy Planners to engage confidently through the process of conducting LAEPs and collaborating with UK Power Networks' Net Zero Team through the tiered assessment framework.

Ultimately the tool will enable the UK Power Networks Net Zero Team to facilitate Local Energy Planners through the process of conducting LAEPs. UK Power Networks will then use the completed and validated LAEPs to improve energy network forecasting over the next 25 years. With more confidence in the forecasting based on robust and validated energy plans, UK Power Networks will be able to act on reinforcing the energy network to support the plans.

Figure 13: Roadmap

Strategic Focus Areas
Future Ready

Collaborative Local Energy Optimisation (CLEO)

Continued

Experience to Date

Following a process of deep user research, the project has defined and validated the user needs and what problems the users are having in their current experience of local area energy planning.

The engagement with LAs, Net Zero Hubs, Community Energy groups and Energy Partners has led to the definition of the high level requirements and low level user stories that if implemented in a web based software application, would address the user needs and problem statements.

Furthermore, data is critical to the success of this software and validation and prioritisation of both the requirements and the data was explored and tested with a variety of the stakeholders.

The functional and date requirements have been used in twofold:

1. To further prototype elements in a web-based tool that will allow users to first hand collaborate and try some of the concepts that they had a hand in designing through the Discovery stage
2. To procure a software vendor through a tender process that will deliver a product that meets the requirements.

The working prototype was launched in March 2023 and includes:

- User sign up process to understand maturity of the LAs
- Signposting to help energy planners depending on where they currently are in their journey
- Energy forecasting comparison tool that allows LAs to submit updates against our forecasted energy scenarios
- Knowledge hub of useful information about Local Area Energy Planning including case studies and completed LAEPs
- Means to engage and book support sessions with the Net Zero team.

Future Developments

The prototype will run throughout Q2 2023 and we will continue to learn and iterate with the well-established LA and LAEP Practitioner User Groups that have been supporting the project to date.

A continual process of testing, learning, and improving is critical to the success of this software and embodying the principles of collaboration throughout.

During Q2, the software vendor will also be onboarded and commence the development and release that will include the data modelling, visualisation and optioneering components of the software.

Figure 14: Prototype Landing Page

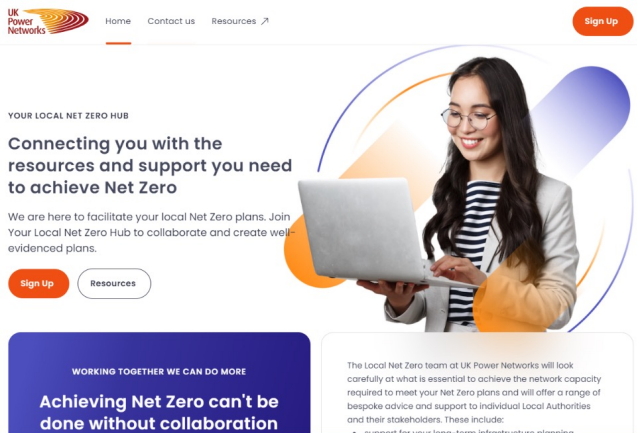


Figure 15: Sign Up questionnaire

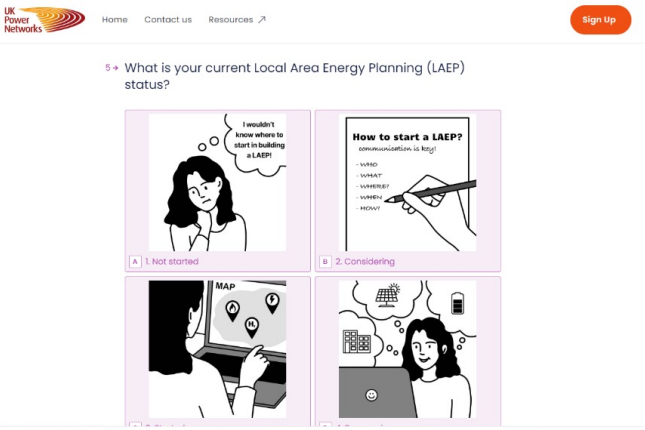
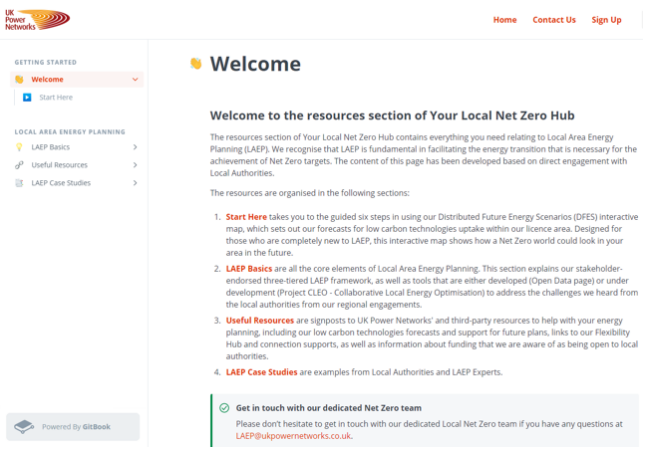


Figure 16: Knowledge Hub



Strategic Focus Areas
Future Ready

High Voltage (HV) Autoquote

Background

Providing formal offers to customers for new HV connections requires UK Power Networks to undertake several manual activities which can take weeks to complete, such as a site visit where appropriate. Ultimately the connection offer may not be accepted by the customer and at present only 26% of the connection offers are currently accepted. The number of connection requests is anticipated to grow by at least 40% by 2028. Under current processes, this increase in volumes would require a significant increase in work to maintain our current performance and level of customer service.

UK Power Networks has partnered with EA Technology to deliver HV Autoquote, building on EA Technology's AutoDesign product for LV budget estimates. This project takes the solution to the next level, offering formal connection offers rather than budget estimates. Innovation in topics such as traffic management costing is required to bridge the gap between estimates and firm offers.

HV Autoquote aims to improve the customer service for HV connection requests by developing an online self-serve tool for budget estimates (between 300 kVA and 2.5 MVA) and formal connection offers (between 300 kVA and 1 MVA) that will reduce the time to quote from weeks to minutes, enable a larger volume of customer quotes to be delivered, and provide better transparency of the quoting and connections process.

Experience to Date

The first phase of the project was a two-month discovery phase from September to November 2022. During the discovery phase, EA Technology worked with UK Power Networks to understand the current connection offer generation processes (data and logic) in detail. EA Technology then developed a high level logical design of HV Autoquote which was assessed and passed by UK Power Networks' Technology Architectural Review Board.

The second phase of the project is a year-long implementation phase which began in December 2022. This started with a more detailed discovery and documentation of the current manual quotation processes, underlying data required and the requirements for integration into UK Power Networks systems.

A customer journey and business process has been mapped out in detail based on the outputs of workshops and received positive feedback from stakeholders. Customer, connection, traffic management and substation input questions have also been drafted and validated, detailing the information that HV Autoquote will require to produce a formal quotation. High level specifications for integration into existing UK Power Networks systems later this year have been developed and agreed with the relevant stakeholders.

HV Autoquote has extracted, transformed, and loaded the necessary input data to complete an HV electrical assessment on a sample area of UK Power Networks' network. This is the first step in deploying a heatmap that will display a geospatial view of UK Power Networks' regions overlayed with its network and indicate where there is capacity and stability for a customer to connect.

Customer feedback sessions took place in February with a mix of HV customers and applicants including consultancies, bus operators, property developers and Independent Connection Providers. They provided feedback on the customer journey, data input questions and other topics which helped to inform the design and requirements of HV Autoquote.

Strategic Focus Areas
Future Ready

High Voltage (HV) Autoquote

Continued

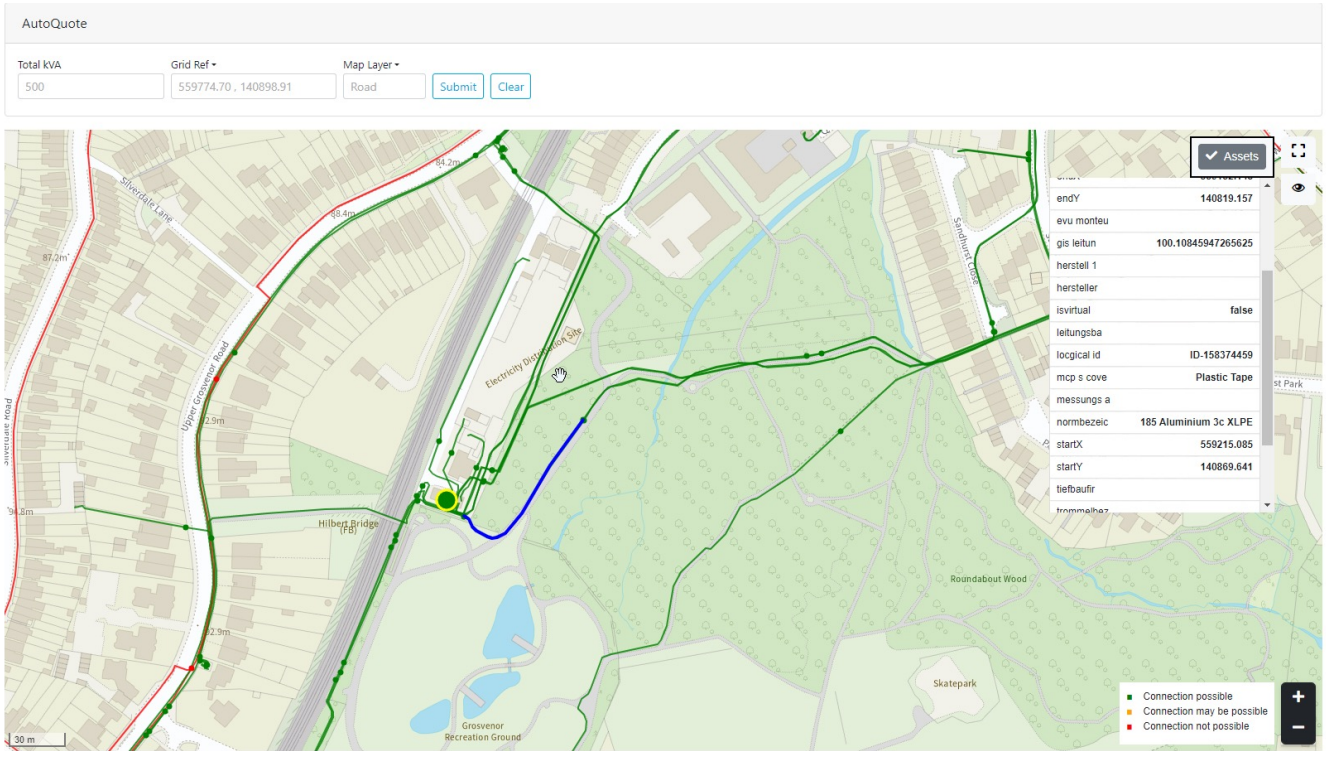
Future Developments

The Autoquote tool and logic will be built and integrated into the existing suite of UK Power Networks' systems and processes. The following activities are required:

1. Finalise the HV Autoquote customer journey and business processes, and develop and implement the solution into UK Power Networks' existing customer journeys
2. Codify the logic and data used to make connection offer decisions, including automating traffic management cost calculations and comparing the accuracy of the HV Autoquote quotation to a quotation via current manual methods
3. Identify the requirements for integration into enterprise systems and develop and implement the solution
4. Build and test the HV Autoquote interface and tool which will allow customers to drop an asset on a map and draw a cable route to a point on UK Power Networks' network that has been electrically assessed
5. Define a product roadmap for future enhancements
6. Identify processes and procedures required for deployment of HV Autoquote as BAU and opportunities to scale the solution beyond UK Power Networks' licence areas.

Following launch we will continuously ask for feedback from the users of the tool to allow us to continuously improve it.

Figure 17: User Interface – Sample Network



Strategic Focus Areas
Future Ready

Our View

Background

Customer Services

Often customers who call UK Power Networks due to a problem with their electricity supply do not have the knowledge or skills to provide the relevant information for customer service agents to determine the nature of the issue. Simple visual assessments can help determine whether the issue relates to the network owned and operated by UK Power Networks or the customer's own internal electrical wiring. When customers cannot provide this information, UK Power Networks' agents find themselves unable to help as they cannot fully understand where the problem lies.

In addition, customers call through to report overhead lines that are down, sagging or hanging very low due to environmental impacts. The information provided by these callers is not usually sufficient to identify if the incident affects assets belonging to UK Power Networks or those belonging to telecoms providers.

Safety

The safety of UK Power Networks' customers and employees is of the utmost importance. As part of UK Power Networks' vision to be an Employer of Choice, we keep our employees safe at work by continuously assessing all site hazards before and while the work is carried out.

Currently, all field staff responsible for putting people to work carry out pre-site assessments and all field employees carry out a point of work assessment at the start of each day or shift change for all works done on-site. This process documents the working conditions on-site and if any conditions were to change, e.g. weather conditions or additional people on site. The point of work assessment is reviewed to ensure no further significant hazards have been introduced due to such changes.

Both processes are followed by completing paper-based pre-work and point of work assessments. It is essential to the safety of all employees (and members of the public) that these assessments are completed and appropriate controls are put in place to manage any risks identified during these activities.

However, the existing processes have some limitations, especially since visual record-keeping can be limited and challenging to implement. Having a visual representation of the site throughout the job lifecycle would greatly benefit our teams. This will aid in determining changes and potential issues which may arise over time. Additionally, safety audits can gain valuable insights by accessing assessments that include videos and photographs, as they would add a real-life discussion point for any topics. These assessments would also capture any behavioural exchanges and procedural drifts which reduces the overall risk to our employees.

Experience to Date

Throughout the current trial taking place with the UK Power Networks customer services team and safety teams, we have found that customers using the video solution find the experience with the advisor seamless and easy to navigate while performing safety checks. This allows the advisor to understand if the power cut is due to a fault on our network or if it is related to the customer's internal electrical network meaning they need to contact their supplier or an electrician.

The project trial has provided positive feedback from the customer service agent's perspective, allowing them to deliver improved user experience and options to provide better support when dealing with power cut calls. The trial has avoided unnecessary engineer visits to customer properties by identifying instances where the fault is due to the customer's internal electrical network

Strategic Focus Areas
Future Ready

Our View

Continued

Future Developments

To identify how the solution could enhance customer service and increase safety levels within our networks, the project aims to achieve the following:

- Assess a new workflow for providing customer service and completing safety assessments
- Evaluate the benefits of using video-aided technologies in providing customer service
- Trialling the proposed solutions with customers, agents, and field staff to ensure their effectiveness
- Enhance the AI capabilities of the solution to detect industry-specific hazards
- Provide exportable insights and data for auditing and training purposes
- Investigate the possibility of a fully integrated and automated workflow of the solution throughout the customer journey.

The learning and insight gained from the trial will be used to progress the project into phase 2 which will integrate the solution into UK Power Networks' call handling and dispatch systems to allow engineers to view the video taken with the call agent the customer and assess the work required for a job before arriving to carry out the work. The insights gained from this project will continue to build on current processes and enhance customer experience when reporting any issues.

Figure 18: Our View process flow

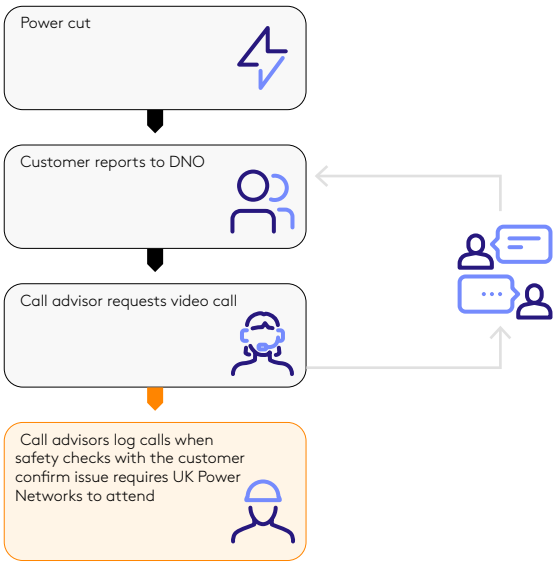


Figure 19: Our View mobile view

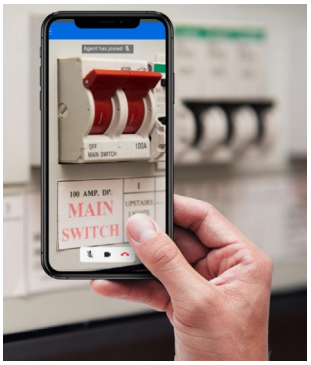
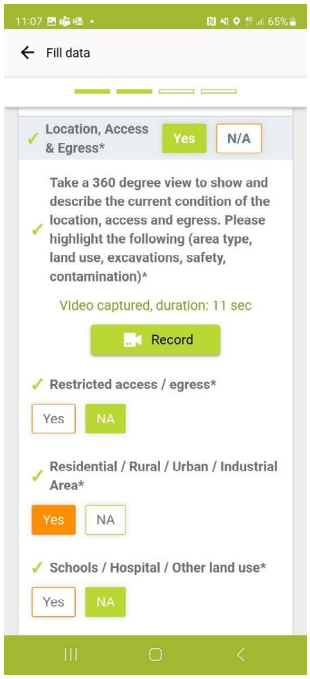


Figure 20: Our View safety assessment mobile view



Strategic Focus Areas
Future Ready

Social Connect

Background

Fuel poverty in England is measured by using the Low-Income Low Energy Efficiency (LILEE) indicator. Under the LILEE indicator, a household is classified as fuel poor:

- Low energy efficiency This includes all households with a Fuel Poverty Energy Efficiency Rating of band D or below
- Low income This includes all households whose residual household income would be below the official poverty line if they were to spend their modelled energy costs.

Tackling fuel poverty is one of the four strategic focus areas of our Social Sustainability programme. Keeping this in mind, we have introduced Social Connect—a collaborative initiative involving the Energy Systems Catapult (ESC) and UrbanTide. Social Connect is working on an innovative method to identify customers at risk of fuel poverty, enabling UK Power Networks to offer more effective support to vulnerable individuals.

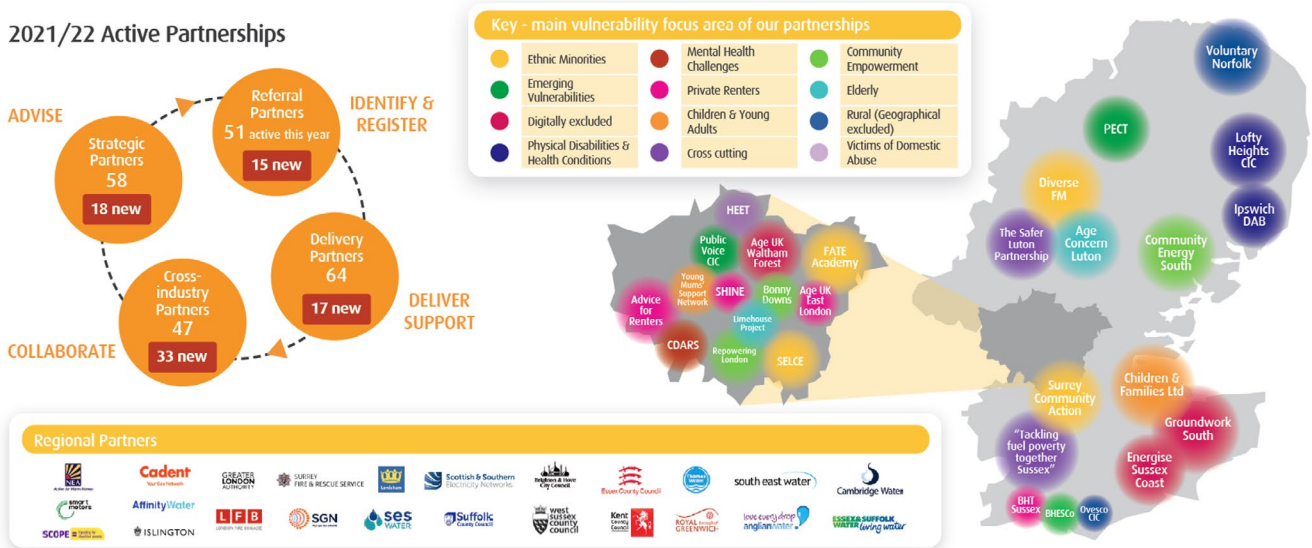
Currently, we collaborate with local trusted organisations to provide personalised assistance, including valuable guidance on reducing fuel bills. Through the new approach developed by Social Connect, we will extend personalise support to up to 100,000 vulnerable customers each year.

Experience to Date

During the data discovery phase, undertaken in the last quarter of 2021, an extensive analysis of available datasets was conducted to identify fuel poverty, which was then integrated with the Smart Meter System Metadata from the Data Communications Company.

The evaluation affirmed the viability of deploying novel approaches to identify fuel poverty. One such method involved utilising machine learning techniques on the Smart Meter System Metadata and overlaying it with other publicly available data to proactively identify customers experiencing fuel poverty. These indicators and support processes were tested in alignment with UK Power Networks' strategic focus.

Figure 22: 2021/22 Active Partnerships



Strategic Focus Areas
Future Ready

Social Connect

Continued

Our work on fuel poverty indicators highlights that identifying those in fuel poverty can be challenging. This is because a number of people constantly move in and out of fuel poverty, e.g. due to seasonality or changing circumstances, such as a change in employment status or health. Some people are also more willing to disclose they are struggling with circumstances that contribute to fuel poverty, but others, including older people, may not.

The number of fuel poor customers paying by direct debit (1.8m) is twice that of customers paying by prepayment meter (870,000), however, the rate of fuel poverty for prepayment meter consumers (29%) is three times higher than the rate of fuel poverty for direct debit consumers (10%). Further to this, fuel debt is often one of many debts and can indicate other financial difficulties. Bringing together behavioural and attitudinal data with housing and household data can help organisations to identify fuel poor households and make targeted interventions.

Throughout 2022, project partner UrbanTide gathered key indicative behaviours for people in or entering fuel poverty. This involved identifying accessible datasets to confirm which ones could be used in further development of the Social Connect tool. Subsequent project phases then progressed the design, development and deployment of the first iteration of the Social Connect tool. Figure 23 illustrates the Social Connect tool in use.

Meanwhile, ESC, our second project partner, worked towards two key project objectives:

- Detailing indicative behaviours of people in fuel poverty
- Presenting findings on the output of consumer workshops on future support services.

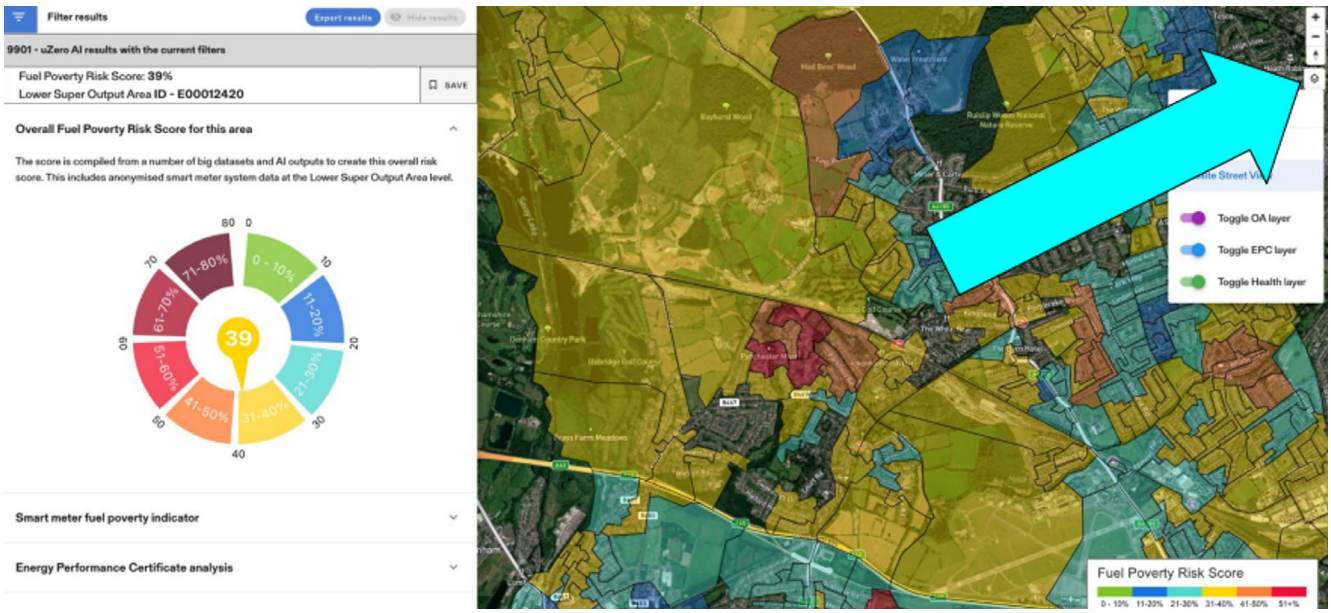
These objectives led to the creation of a comprehensive report, with the primary focus being on:

- Communicating findings from the fuel poverty dataset to project stakeholders, e.g. network operators, community groups
- Summarising indicative fuel poverty behaviours emerging from fuel poverty expert interviews and individuals experiencing fuel poverty
- Setting up proposals for services across short- and long-term timescales
- Receiving feedback from UK Power Networks' support partners and customers.

Future Developments

The project ran until February 2023. The final outputs of the project saw the deployment of the first iteration of the Social Connect tool, Additionally, a webinar was organised to present and communicate the results of an evaluation carried out by the (ESC), which specifically assessed the efficacy of UrbanTide's Social Connect tool.

Figure 23: The Social Connect tool showing a subset of data overlaid on the mapping layer



Strategic Focus Areas
Future Ready

Constellation

Background

Constellation is a NIC funded project led by UK Power Networks and delivered in partnership with ABB, GE, University of Strathclyde's PNDC, Siemens and Vodafone. The project aims to demonstrate how novel protection and control solutions located locally within DNO substations can be used to:

- Facilitate the connection of more DER to power distribution networks
- Protect smart services by de-risking the likelihood of sudden and widespread DER curtailment and/or disconnection.

This world first innovation project is essential to facilitating Net Zero through enhancing the core of the distribution network – substations. It will introduce a first of its kind local intelligence at the substation level that complements existing functionality, in a sustainably cost-efficient manner for our customers.

Problems the project is exploring

Network resilience

As the distribution network increases its reliance on smart services provided by DER, there is a growing risk to network resilience. This is because the loss of a high proportion of generation at the distribution level would reduce system stability and could lead to an increase in disconnection events and potentially widespread power cuts. More specifically, smart services are at risk of being impacted by loss of communication with our central systems or by unnecessary disconnection of DER.

Network capacity

The expected increase in DER required to achieve Net Zero will require significant amount of network capacity to be available in specific areas. However, our existing protection systems can limit the available capacity in some instances. Specifically, the directional overcurrent protection, designed to protect the network from back-feeding faults, limits the amount of distributed generation (DG) that can be connected. Our traditional solution (load blinding) allows the protection to use a pre-calculated power factor to differentiate between network faults and generation/load. In the future, this will result in parts of the network having spare capacity to connect more DER to support our transition to Net Zero due to static protection settings.

Solutions

To overcome the limitations of our existing capabilities and facilitate Net Zero, we need to enhance our local substations by making them more intelligent, digital and interoperable and by enabling secure, scalable communication between them. Constellation achieves this through a flexible and future proofed system for local intelligence working in partnership with central systems, which in turn, enables three solutions:

Local Active Network Management (ANM) Local network control at the substation level to provide resilience to DER operation against loss of communication with the central ANM system. Whenever the central system is unable to communicate with our local network assets, the local intelligence will take over optimisation for that specific DER, substation or area

Wide area protection Provide resilience to DG operation to prevent transient instability events triggering the conventional generator protection

Adaptive protection Dynamically assessed protection settings to enable more capacity for DER connections.

Strategic Focus Areas
Future Ready

Constellation

Continued

Experience to Date

The first phase of the project ran between May 2021 and March 2022 and focused on the design of the Constellation solutions. The second phase was focused on selecting the trial sites. We successfully completed this phase and published our learnings, UK Power Networks Innovation - Constellation.

Overarching trial methodology

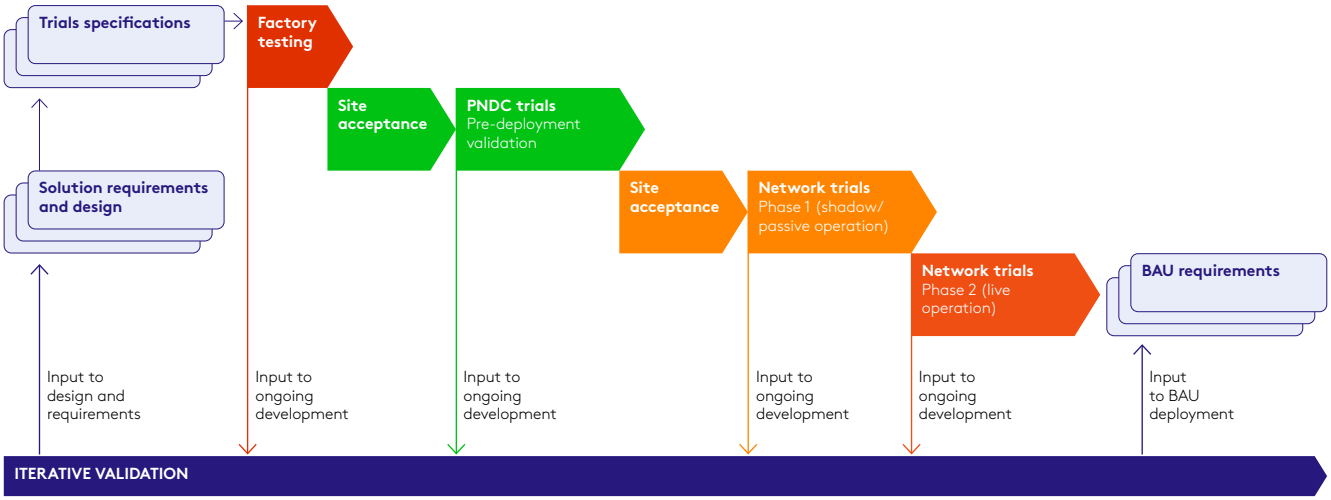
The trial phase of the project is essential to the successful delivery of Constellation and is responsible for de-risking the solutions prior to rollout in BAU. The trials aim to demonstrate the correct operation of the solutions when integrated together on the electricity network to provide benefits for our customers.

To achieve this, the Constellation solutions will be demonstrated through structured testing across project partners' test facilities, the PNDC test environment and the UK Power Networks live network, within the two trial areas chosen during the site selection stage of the project. The stages of the trials are visualised in Figure 24.

Trial phases

The testing commences with the Factory Acceptance Test (FAT) at each of the respective project partners' facilities (indicated in red in Figure 25), where the respective solutions will be individually subjected to rigorous testing. After the FATs, the solutions will be integrated in the PNDC test environment, as visualised in green. There, the solutions' functionality will be extensively tested in a realistic operational environment. Finally, visualised in dark and light orange, the solutions will be deployed on the distribution network at the selected sites for the final phase of the trials. At first, the solutions will be tested passively, without the ability to make changes on the live distribution network. Once sufficient evidence is collected to assess the correct operation, the solutions will be tested actively and will be relied on to protect and control the distribution network.

Figure 24: Constellation trial stages



Strategic Focus Areas
Future Ready

Constellation

Continued

Progress of the trials so far

The testing phase of Constellation begins with each solution's FAT in order to verify that they fulfil the functional requirements. The table below summarises the focus for this testing.

Factory Acceptance Testing

AIMS	APPROACH
Demonstrate that the individual designs are compliant with the relevant UK Power Networks engineering technical specification and test specification documents	Implement a test environment to demonstrate the solution operation
Demonstrate that the solutions are robust and performance is acceptable	Carry out testing as per the approved testing specifications
Demonstrate that the solutions operate correctly in isolation	Perform and validate testing with key experts
Demonstrate that the solutions are ready for the subsequent trial phase	Iterate and update solutions to resolve any major issues before proceeding with the PNDC trial

The FAT was carried out between November 2022 and March 2023. All four FATs were successfully completed and a number of improvements to each solution were identified. At the time of writing, our partners are implementing the improvements to the designs and the learnings from the FATs will be shared in the upcoming Deliverable 3 report.

Future Developments

The key future developments for Constellation in 2023 are:

PNDC trial

This will be the first opportunity to combine all the Constellation solutions on the same platform. The PNDC facilities are set up to mimic the real electricity distribution network using a real-time digital simulator. We intend to use the PNDC trial to demonstrate the functional and non-functional performance and build up confidence in the solutions before they are deployed on the live network

Site works

We are continuing the site works in both trial areas in Maidstone and Thanet. We will deploy IEC 61850 compliant devices and the environment for smart substations. We will then begin the deployment of the novel software and carry out integration testing to ensure all the components are connected.

Strategic Focus Areas

Efficient and Effective

The national Net Zero target is a profound transformation of the energy landscape, leading electricity customers to change the way they use products. A renewed focus on low carbon technologies and digital systems provides our customers the opportunity reduce their bills and to make a positive impact on our environment while addressing issue of climate change.

DNOs are responding to these evolving needs by developing and delivering innovative solutions at an unprecedent pace.

UK Power Networks believes that distribution networks are at the centre of the energy revolution. We want to be one the key protagonists, alongside our customers, for the decarbonisation journey of the country.

The 'Efficient and Effective' strategic focus area represents UK Power Networks' response to the decarbonisation challenge. The key objective is to deliver smart solutions that enable a smooth low carbon transition at lowest possible cost for our customers.

This is achieved by continually enhancing the reliability, availability and performance of our networks, focusing on replacing our existing assets with smarter equipment and introducing digital processes and automation techniques.

Numerous innovation projects are delivered by UK Power Networks in collaboration with external partners with a specific target: to increase network performance by placing innovation at the heart of everyday business as usual activities. Part of our vision at UK Power Networks is to be a respected and trusted corporate citizen. This is reflected in our diverse portfolio of innovation projects that deliver measurable social, environmental and safety benefits through those initiatives, including but not limited to:

Stratus – trialling first of its kind smart transformers in the distribution network to increase the visibility of the LV networks (improved data quality to network engineers), optimise voltage quality and the running arrangement of the distribution network of the future

Power Protect – design and deliver a new generation of service to support vulnerable customers in the event of power outage by using portable battery banks

HV feeder monitoring to pre-empt faults – trialling a data-driven and machine learning based predictive monitoring solution to detect and locate abnormal network disturbances before they materialise into faults

Phase Switch System (PSS) – develop and test an innovative power electronic phase switch system to optimise load balance between substations.

All learnings developed in the RIIO-ED1 regulatory period have been used as a cornerstone for the UK Power Networks RIIO-ED2 innovation plan which aims to enhance our focus on network reliability, availability and performance and ensure a fair low carbon transition that leaves no one behind, all at the lowest possible cost.

Strategic Focus Areas
Efficient and Effective

Stratus

Background

Using state-of-the-art power electronic technologies, the project aims to deploy a number of smart transformers on the network. In their active configuration, these smart transformers can flexibly adapt to make sure power is directed when and where it is needed, balancing load on the network and protecting against multiple kinds of potential faults.

Designed as a direct replacement of a conventional distribution transformer, a smart transformer can be deployed within existing substations and with no change to the existing footprint. Combined with power electronics, autonomy and on-board analytics, the smart tx is capable of dynamic, autonomous voltage regulation and power factor optimisation in real-time. When operating as part of a fleet, the smart tx has the potential to contribute to network stability by providing frequency control through power flow modulation.

The ability to stabilise voltage and resolve local grid constraints will facilitate a higher penetration of distributed energy resources whilst maximising existing electricity network infrastructure. Thanks to its high frequency sensors, combined with onboard processing, the smart tx introduces a data-rich control capability to the edge of the distribution network which contributes significantly to increased visibility of supply and demand behaviour on LV networks.

Experience to Date

In November 2022, the first smart tx (STX1) for NIA trial was deployed in a secondary substation in Uckfield. Five further sites have been identified across the South Eastern Power Networks licence area, with installations planned throughout 2023. During February 2023, STX1 was first energised into standard transformer mode (Passive Mode) with smart controls enabled later (Active Mode). Voltage regulation experiments started at the end of February and continued for subsequent months in collaboration with AmpX and UK Power Networks engineers.

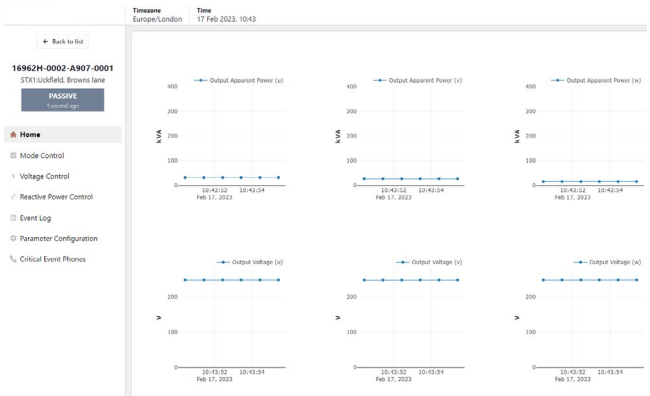
Future Developments

The project has so far installed the first transformer (STX1) targeted within the programme. Subsequent installations will be carried out during 2023 and will see a range of improvements to the design and operation of the smart tx deployed in response to progress with the first units.

Seven additional units are planned by the end of Q1 2024. These consist of five smart transformers operating with the current configuration and two additional units which will be deployed with amended configurations to increase the level of testing into the possible functionality the smart transformers can utilise. All units are due to be installed across the South Eastern Power Networks licence area.

Figure 25: Unit One

Figure 26: Cloud-based smart tx user interface



Strategic Focus Areas
Efficient and Effective

Power Protect

Background

Customers who are medically dependent on electricity are categorised under needs codes 1-4. The needs codes are divided into customers that require the following electrical equipment:

- Nebuliser and apnoea monitor
- Heart, lung and ventilator
- Dialysis, feeding pump and automated medication
- Oxygen concentrator.

As it stands, there are a total of 64,566 households registered on the PSR under one or more of needs codes 1-4, for whom a sustained period of time without power may seriously impact their health conditions.

UK Power Networks' ambition is to deliver industry-leading support that maximises the value delivered to our customers in vulnerable circumstances. Innovative solutions are required to support vulnerable customers during power outages to ensure the delivery of excellent customer service while restoring power, in both planned and unplanned power cut scenarios. To achieve this, we will be collaborating with a leading research institute to understand the need of our targeted customers through surveys, interviews and trials. Power Protect will provide qualitative and quantitative analytics of customer needs as well as assess different types of portable battery solutions to meet our customers' needs.

Experience to Date

The first key deliverable of this project was to conduct research to understand the circumstances, needs, and preferences of our medically dependant customers. This research was carried out by the Research Institute for Disabled Consumers (RiDC). The research piece included a survey of the vulnerable customers registered with the RiDC in Great Britain, followed by a series of in-depth interviews.

The survey was developed through collaboration between the UK Power Networks consumer vulnerability and stakeholder engagement teams and the RiDC. The aims of the survey were to understand:

- Information about respondents' households and the electric medical and/or assistive equipment they have
- Dependency levels on their electric medical and/or assistive equipment in power cuts lasting more than four hours
- Needs, expectations and attitudes toward support and portable electric battery provision in power cuts lasting more than four hours.

A total of 3,500 customers were engaged as part of this survey with a total of 886 complete responses received (refer to Figure 28 for geographics). This helped inform our selection of the participants to take part in the follow-up interviews to further discuss their needs, expectations and challenges if they were to receive a portable battery in a power cut.

The survey consisted of 43 questions and included a mix of multiple-choice and open-ended questions. The findings consist of a mix of quantitative and qualitative insights derived from the survey. The key findings of this survey fell into three themes:

- Medical dependency on electricity of households
- Dependency levels and prioritisation
- Battery solution definition and expectations.

Figure 28 showcases the medical dependencies of our customers which was one of the key highlights of this survey. Developing an understanding of these customer requirements and medical dependencies is essential to ensure that the solution development phase is based on substantial data gathered from the end users.

Strategic Focus Areas
Efficient and Effective

Power Protect

Continued

Future Developments

The next stage of consumer research is to complete interviews with a shortlist of participants. This activity aims to provide more detailed insight into the requirements medically dependent customers have and to assess the requirements or specifications of the proposed battery solution.

In parallel, we are engaging with established and innovative battery suppliers. We have identified multiple suitable solutions that will allow us the support our customers during power cuts. However, further assessments are required to ensure the compatibility of those solutions, especially when paired with potentially sensitive medical equipment.

Lastly, ongoing internal stakeholder engagement will allow us to develop and validate a working process that will be used as a blueprint to provide our eligible customers with batteries. This includes champions from customer services, dispatch, and network operations directorates.

The three activities highlighted above will conclude in a live trial of the selected solutions and business processes. Participants will be selected following the interview stage and key findings will be documented as part of the trial report.

Figure 27: Consumer Research Geographics

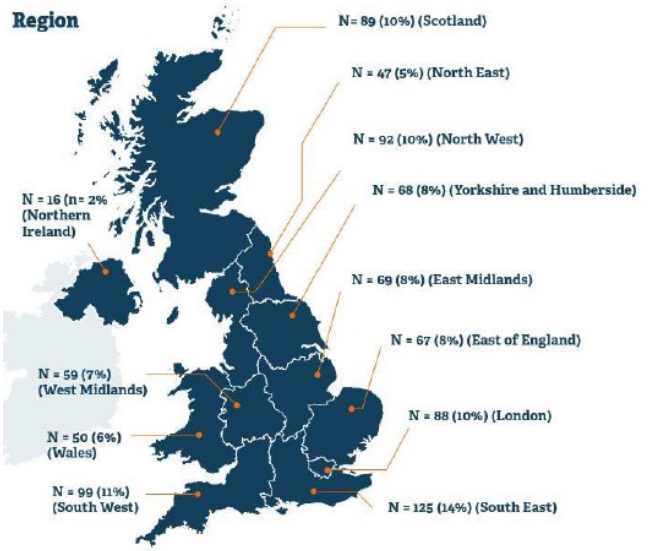
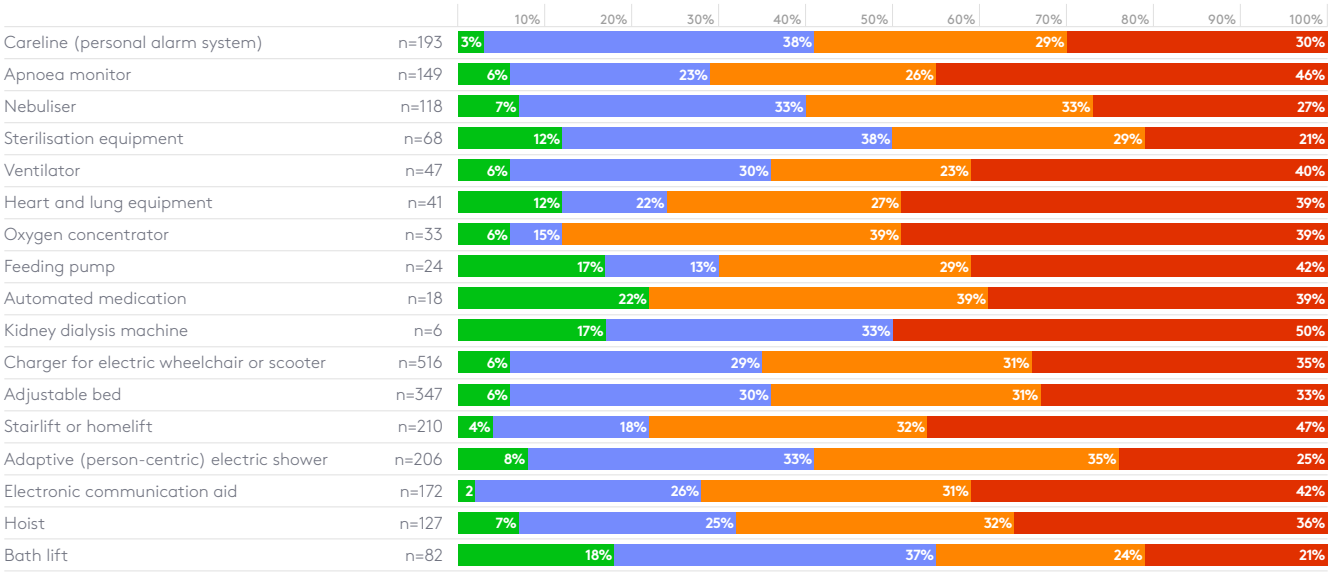


Figure 28: Consumers medical dependency on electricity feedback
I could easily manage without it | It would be inconvenient but I could manage without it | It would be difficult to manage without it | I could not manage without it



Strategic Focus Areas
Efficient and Effective

HV feeder monitoring to pre-empt faults

Background

DNOs experience faults on their electricity distribution networks, which result in Customer Interruptions (CIs) and Customer Minutes Lost (CMLs). Most CIs and CMLs are incurred on the HV network. DNOs implement a number of measures to reduce the CIs and CMLs incurred, for example through switching using remote control and using protection relays to identify faults and minimise impact. However, these measures only address scenarios where the fault has already materialised.

Further improvements in network performance and reduced operating costs could be achieved if DNOs were able to monitor key network characteristics, including voltage and current in real-time, and carry out interventions, e.g. asset or component repairs, before a fault materialises.

Monitoring network characteristics in real-time presents some practical challenges and considerations. For example, we need to understand:

- Typical network characteristics that are identifiable before different types of faults occur;
- How to identify the location of an emerging fault; and
- The operational processes and steps that would need to be followed to successfully pre-empt an emerging fault.

This project trialled the Distribution Fault Anticipation (DFA) solution to monitor feeders to pre-empt faults. The solution consists of a disturbance recorder (Figure 30) used in conjunction with a "master station" as data repository, a network analysis tool (ASPEN Distriview) and Fault Passage Indicators to monitor a selection of HV and 33kV circuits allowing the location of network issues to be identified before they materialised into faults.

Experience to Date

The project successfully concluded in March 2023. UK Power Networks installed 16 DFA units monitoring 13 11kV circuits and three 33kV circuits, one supplying a generator. The units detected many events and the waveforms collected have been analysed by the "master station" identifying likely defect types, e.g. tree branches touching the overhead line, local fauna coming into contact with a transformer, a porcelain insulator beginning to fail. The waveform data has been input into the ASPEN Distriview application which has been able to predict likely defect locations.

We started monitoring 11kV circuits in July 2020. Since then, events have been detected and waveforms have been collected. Some events build up over time before they result in a supply interruption. These events have been analysed in detail allowing the project to predict the area where the fault may occur. The build up to a recent underground cable fault was causing operational staff and control engineers concern as different circuit breaker reclosers were operating. Analysis of the waveforms was able to confirm that the events were caused by the same fault and identified a protection grading issue between two network reclosers, which has now been resolved.

To date, we have waited for the defect to become a permanent fault to confirm the predictions. However, there have been several instances where early indications suggest that the project can deliver early warnings and potential locations before or immediately after an event occurs. For example, the waveform characteristic of a confirmed cable termination failure was compared with a different event that predicted that the cause of the fault was likely to be a cable termination. Figure 31 shows a faulty cable termination.

Future Developments

The final report can be found on the ENA Smarter Networks Portal. Following successes during the project, UK Power Networks has extended use of the DFA solution for the next 12 months and plans to use the learning from the project to test the market for similar or complementary solutions before a longer-term BAU deployment.

Figure 29: DFA disturbance recorder

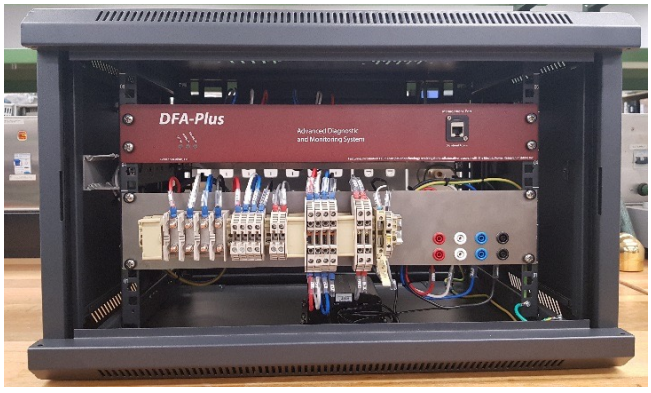


Figure 30: Faulty cable pole termination

Strategic Focus Areas
Efficient and Effective

Phase Switch System (PSS)

Background

National Grid ESO's Future Energy Scenarios forecast that electricity demand will increase significantly between now and 2035; it is expected that most of the new demand will be connected to LV distribution networks. This in turn is likely to cause a larger phase imbalance than currently observed. Domestic load is normally connected to one phase. Once one phase of a transformer or underground cable reaches its maximum rating then LV network reinforcement needs to be considered. The project demonstrated that the Phase Switch System can improve the imbalance between phases and can defer capital investment for several years allowing distribution planners time to consider the most appropriate reinforcement solution.

Experience to Date

The project successfully concluded in March 2023. UK Power Networks installed six phase switch systems in residential areas where clusters of EV chargers were identified to understand the impact of being able to switch customers from one phase to another without a supply interruption. Network studies were carried out to decide the optimum location along the LV feeder for PSS cabinets. Using normal cable jointing techniques, the PSS cabinets (Figure 31) were connected to LV mains cables without having to interrupt customer supplies.

Substation monitors (Figure 32: Substation Monitor) were installed to measure the demand along the whole feeder. Measured demands from the substation and the PSS cabinet were compared to calculate whether there was any benefit to moving downstream customers to a different phase. Each phase is switched to a different position using a combination of power electronics thyristors and contactors whilst maintaining phase rotation. Most of the time customers are supplied via the contactors.

Analysis of the results showed that the PSS can improve the imbalance between the three phases and is able to reduce losses. By improving the imbalance the replacement of a LV cable or transformer can be deferred for several years.

Future Developments

Following the successful conclusion of this project, the final report can be found on the Smarter Networks Portal. As the prototype has demonstrated it can impact the variable effects of EV charging demand, (time of day and days of the week), a commercial product will be developed that is smaller and easier to install.

LV monitoring is becoming more pervasive allowing heavily imbalanced LV feeders with clusters of low carbon technology to be identified. Once identified the LV feeder can be studied to determine the best solution to resolve network issues. If the demand continues to grow, the PSS cabinet will maintain the balance until it becomes necessary to install a new distribution substation. Once installed the PSS cabinet can be recovered, refurbished and reused in other locations.

Figure 31: Phase Switch Cabinet

Figure 32: Substation monitor

Strategic Focus Areas
Efficient and Effective

Active Response

Background

The Active Response project aims to demonstrate active reconfiguration of the network and the use of power electronics to support the growth of low carbon technologies.

The project will deliver two physical smart asset solutions, known as Power Electronic Devices (PEDs), which can provide a range of benefits, including the deferral of costly network reinforcement. These solutions are the second-generation LV Soft Open Point (SOP) and a novel HV Soft Power Bridge (SPB) and will control power flows and voltages on the LV and HV networks respectively. The project will also deliver an advanced optimisation and automation software solution, which will be part of a larger Distributed Energy Resources Management System (DERMS) platform, and will optimise the network configuration through changing the position of open points on the network and the load flow via the SOPs and SPBs.

The project will trial the use of PEDs, switches and ANM software to optimise the HV and LV network. The trials will be broken down into two key methods, **Network Optimise** and **Primary Connect**, as shown in Figure 33 below.

Once Network Optimise and Primary Connect have been trialled successfully in isolation, they will be trialled in combination as the fully integrated Active Response trial.

Experience to Date

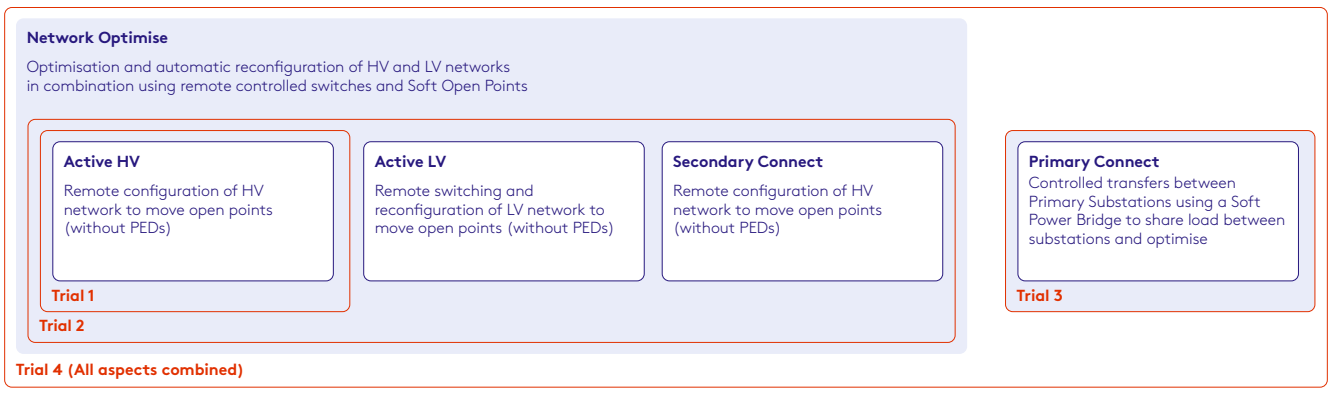
The project has completed the live Active HV trial using project partner GE's Optimal Feeder Reconfiguration (OFR) module in the UK Power Networks Advanced Distribution Management System (ADMS) and demonstrated that automated HV network optimisation can release spare capacity of up to 500kVA (the equivalent of 71 fast chargers (7kW)) within the trial networks. The project is now carrying out the other trials.

Figure 34 (next page) demonstrates example findings between the base case position (i.e. the current Normally Open Points) and the optimal positions, when solving to balance real load.

A number of considerations have been identified for further work to enhance the OFR system for BAU operation and are reported in Deliverable 6, available on our Innovation website.

The project has installed the LV and HV PEDs and remote-controlled switches. Initial commissioning activities have taken place, including documenting the development and acceptance of the approval and operational standards required to install the project equipment onto the network. The project has identified several lessons learnt from these installations and commissioning activities, which have been recorded in the Deliverable 5 document available on our Innovation website.

Figure 33: Active Response Methods



Strategic Focus Areas
Efficient and Effective

Active Response

Continued

Development work has been carried out and completed on the optimisation platform which balances loads across all feeders to reduce the risk of a single feeder becoming overloaded. This development included validation and testing of the HV and LV network Common Information Model and the build and test of the system and communications architecture, including the servers, new Inter-Control Center Communications Protocol (ICCP), subset link – an international standard protocol for communication of real-time data, firewall and anti-virus settings.

Project hardware integration with the ADMS has been completed. This included development work to test the project hardware, such as LV circuit breakers (ALVIN Recloser) and associated monitoring system (VisNet) and the link box switch.

Finally, phase 2 development work of the DPlan planning tool has commenced. This is due to be completed by Q3 2023.

Future Developments

The project will complete trials 2, 3 and 4 and analyse these results. The learnings from these trials will be reported in Deliverable 8 and the associated applicability and benefits will be reported in Deliverable 9 in Q4 2023. These results, along with other learnings, such as lessons learnt from installation and commissioning of the project hardware will be presented in a series of webinars.

The project will complete the enhancement of the modelling tool DPlan to include the Active Response solutions. The business process documentation for all project solutions will also be finalised to enable the successful handover into business operations and BAU rollout.

Figure 34: Base Case configuration vs Optimal configuration as determined by the OFR tool

NOP	Base Case NOPs (23 NOPs)	Real Load Balance OPs (23 OPs)
1	501220 BROKES ROAD, (72) - CONIFER CLOSE tee OAKFIELD LAWN 11kV Gas Sw	501220 BROKES ROAD, (72) - CONIFER CLOSE tee OAKFIELD LAWN 11kV Gas Sw
2	501222 ALMA ROAD, (71) - ALDERS ROAD tee BEVERLEY HEIGHTS 11kV Gas Sw	501222 ALMA ROAD, (72) - CONIFER CLOSE tee GAYTON COURT teed 11kV Gas Sw
3	501224 WATER TOWER MARGERY, (72) - CAA MAST tee MARGERY HALL teed 11kV Gas Sw	501224 WATER TOWER MARGERY, (72) - CAA MAST tee MARGERY HALL teed 11kV Gas Sw
4	501254 GAYTON COURT, (73) - CASTLE GROUNDS tee WARREN ROAD 11kV Gas Sw	501254 GAYTON COURT, (73) - CASTLE GROUNDS tee WARREN ROAD 11kV Gas Sw
5	501260 GREEN LANE, (72) - COLMAN WAY tee PARK ROAD 11kV Oil Sw	501260 GREEN LANE, (72) - COLMAN WAY tee PARK ROAD 11kV Oil Sw
6	501275 SAXONS WAY, (72) - EVESHAM ROAD NORTH tee WEST STREET teed 11kV Oil Sw	501275 SAXONS WAY, (72) - EVESHAM ROAD NORTH tee WEST STREET teed 11kV Oil Sw
7	501290 EVESHAM ROAD NORTH, (71) - SAXONS WAY tee WEST STREET teed 11kV Oil Sw	501290 EVESHAM ROAD NORTH, (71) - SAXONS WAY tee WEST STREET teed 11kV Oil Sw
8	501298 MUTUAL INSURANCE, (72) - WATER AUTHORITY OFFICE 11kV Gas Sw	501298 MUTUAL INSURANCE, (72) - WATER AUTHORITY OFFICE 11kV Gas Sw
9	501305 CHURCH STREET, (72) - HIGH STREET 11kV Gas Sw	501305 CHURCH STREET, (72) - HIGH STREET 11kV Gas Sw
10	501319 BANCROFT ROAD on SWBD2, (75) - HIGH STREET tee SAFEWAYS 11kV Gas Sw	501311 CHARMAN ROAD, (72) - NORTH STREET 11kV Gas Sw
11	501319 BANCROFT ROAD on SWBD2, (76) - BANCROFT COURT 11kV Gas Sw	501319 BANCROFT ROAD on SWBD2, (75) - HIGH STREET tee SAFEWAYS 11kV Gas Sw
12	501327 THE CEDARS, (72) - REIGATE 33/11KV tee 55 REIGATE ROAD 11kV Oil Sw	501319 BANCROFT ROAD on SWBD2, (76) - BANCROFT COURT 11kV Gas Sw
13	501360 ST MARYS ROAD, (72) - CHART LANE tee LYMDEN GARDENS teed 11kV Gas Sw	501327 THE CEDARS, (72) - REIGATE 33/11KV tee 55 REIGATE ROAD 11kV Oil Sw
14	501361 THE CHASE, (72) - CHART LANE tee LYMDEN GARDENS teed 11kV Gas Sw	501360 ST MARYS ROAD, (72) - CHART LANE tee LYMDEN GARDENS teed 11kV Gas Sw
15	501384 SLIPSHATCH ROAD, (71) - SANDCROSS LANE 11kV Gas Sw	501361 THE CHASE, (72) - CHART LANE tee LYMDEN GARDENS teed 11kV Gas Sw
16	501395 NEW CAUSEWAY on SWBD2, (74) - PRICES LANE tee COCKSHOT HILL 11kV Gas Sw	501384 SLIPSHATCH ROAD, (71) - SANDCROSS LANE 11kV Gas Sw
17	501478 LONDON ROAD, (72) - COLLEGE MEDIA/ARTS CENTRE tee RINGWOOD AVENUE 11kV Gas Sw	501395 NEW CAUSEWAY on SWBD1, (71) - WOODHATCH SCHOOL 11kV Gas Sw
18	501494 THE FRENCHES, (73) - LONDON ROAD 73 IDNO tee Pot end 11kV Gas Sw	501478 LONDON ROAD, (72) - COLLEGE MEDIA/ARTS CENTRE tee RINGWOOD AVENUE 11kV Gas Sw
19	501495 BARFIELD COURT, (71) - SAINSBURYS LONDON ROAD tee SAINSBURYS PRINCESS WAY 11kV Gas Sw	501495 BARFIELD COURT, (71) - SAINSBURYS LONDON ROAD tee SAINSBURYS PRINCESS WAY 11kV Gas Sw
20	502404 ARBUTUS ROAD, (72) - HORNBEAM ROAD 11kV Gas Sw	502404 ARBUTUS ROAD, (72) - HORNBEAM ROAD 11kV Gas Sw
21	502491 BELL STREET, (72) - BUS GARAGE SITE 11kV Oil Sw	502491 BELL STREET, (72) - BUS GARAGE SITE 11kV Oil Sw
22	504438 CONGREVE HOUSE, (71) - THE BELFRY NO.1 tee THE BELFRY NO.3 11kV Oil Sw	504438 CONGREVE HOUSE, (71) - THE BELFRY NO.1 tee THE BELFRY NO.3 11kV Oil Sw
23	504836 CLARENDON ROAD, (71) - QUEENSWAY 11kV Oil Sw	504836 CLARENDON ROAD, (71) - QUEENSWAY 11kV Oil Sw

NOPs Removed

OPs Added

25

Figure 35: (a) 2T SOP Installation (b) 3T SOP Installation

Figure 36: SPB Installation

Innovate with us!

We believe that collaboration is key for successful innovation, and our door is always open for new proposals. If you have an idea or want to collaborate with us, we would be delighted to hear from you.

Please get in touch at **innovation@ukpowernetworks.co.uk**

Our Network Innovation Allowance Portfolio

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REFERENCE	PROJECT NAME	RESEARCH AREAS	START	FINISH	BUDGET
NIA_UKPN0033	TransPower	Transition to low carbon future	04/2018	07/2022	£2,143,717.00
NIA_UKPN0047	HV Feeder monitoring to pre-empt faults	Network improvements and system operability	02/2019	03/2023	£2,107,303.78
NIA_UKPN0049	Phase Switch System	Network improvements and system operability	06/2019	03/2023	£1,055,700.00
NIA_UKPN0052	Energy Exchange: Market-Based Curtailment Management	Network improvements and system operability	09/2019	08/2022	£985,800.00
NIA_UKPN0054	EPRI Research Collaboration on Overhead Transmission (P35) and Substations (P37)	Network improvements and system operability	01/2020	07/2023	£924,000.00
NIA_UKPN0057	Circuit See	Network improvements and system operability	02/2020	04/2022	£957,000.00
NIA_UKPN0055	Arc Aid	Safety, health and environment	02/2020	01/2023	£571,000.00
NIA_UKPN0059	Miles better fault location	Network improvements and system operability	05/2020	05/2023	£1,838,000.00
NIA_UKPN0060	White Van Plan	Customer and stakeholder focus	07/2020	10/2022	£604,000.00
NIA_UKPN0063	Charge Collective	Transition to low carbon future	08/2020	12/2022	£843,640.00
NIA_UKPN0062	Radio Teleprotection	Network improvements and system operability	08/2020	08/2023	£438,000.00
NIA_UKPN0066	CommuniHeat	Transition to low carbon future	10/2020	12/2022	£919,688.00
NIA_UKPN0065	Cleaner Engines	Customer and stakeholder focus	10/2020	03/2023	£433,000.00
NIA_UKPN0067	GIS temperature monitoring	Network improvements and system operability	11/2020	06/2022	£327,000.00
NIA_UKPN0069	Socially Green	Customer and stakeholder focus	11/2020	07/2023	£925,000.00
NIA_UKPN0068	FutureLink	Network improvements and system operability	11/2020	08/2024	£478,000.00
NIA_UKPN0070	Envision	Network improvements and system operability	12/2020	02/2023	£1,971,000.00

Our Network Innovation Allowance Portfolio

REFERENCE	PROJECT NAME	RESEARCH AREAS	START	FINISH	BUDGET
NIA_UKPN0072	Voyage	Transition to low carbon future	02/2021	06/2022	£248,930.00
NIA_UKPN0071	Smart Cable Guard	New technologies and commercial evolution	02/2021	02/2023	£435,281.00
NIA_UKPN0074	LV Interconnected Pairs	Optimised assets and practices	05/2021	05/2023	£661,000.00
NIA_UKPN0075	Empower	Consumer vulnerability	09/2021	02/2023	£520,000.00
NIA_UKPN0077	Emerge	Net zero and the energy system transition	02/2022	08/2023	£730,733.00
NIA_UKPN0076	Neighbourhood Green	Net zero and the energy system transition	02/2022	02/2024	£818,000.00
NIA_UKPN0078	Right to Heat	Consumer vulnerability	02/2022	04/2025	£952,774.25
NIA_UKPN0079	Collaborative Local Energy Optimisation (CLEO)	Net zero and the energy system transition	03/2022	07/2024	£2,520,000.00
NIA_UKPN0080	Stratus	Net zero and the energy system transition	04/2022	09/2023	£1,356,000.00
NIA_UKPN0082	LV Fault Passage Indicator	Optimised assets and practices	09/2022	06/2023	£75,000.00
NIA_UKPN0081	High Voltage (HV) Auto Quote	Net zero and the energy system transition	09/2022	09/2023	£2,170,410.00
NIA_UKPN0083	NeatHeat	Net zero and the energy system transition	09/2022	06/2024	£473,000.00
NIA_UKPN0085	Automated Tunnel and Shaft inspections	Optimised assets and practices	10/2022	10/2023	£250,000.00
NIA_UKPN0087	Our View	Optimised assets and practices	10/2022	12/2023	£499,000.00
NIA_UKPN0086	Shift 2.0	Net zero and the energy system transition	10/2022	10/2024	£619,300.00
NIA_UKPN0088	Powercast	Supporting consumers in vulnerable situations	11/2022	02/2024	£274,725.00
NIA_UKPN0089	Fluid Cable Care Phase 3	Optimised assets and practice	03/2023	09/2024	£809,433.00
NIA_UKPN0084	Power Protect	Consumer vulnerability	10/2022	05/2024	£246,250.00
NIA_UKPN0071	Smart Cable Guard	ED - New technologies and commercial evolution	02/2021	02/2023	£435,281.00

UK Power Networks

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