SIF Beta Round 2 Project Registration

Date of Submission

Oct 2024

Project Reference Number

10061361

Initial Project Details

Project Title

Climate Resilience Decision Optimiser (CREDO+)

Project Contact

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Challenge Area

Improving energy system resilience and robustness

Strategy Theme

Consumer vulnerability

Lead Sector

Electricity Distribution

Electricity Transmission

Gas Distribution

Gas Transmission

Project Start Date

01/09/2024

Project Duration (Months)

42

Lead Funding Licensee

UKPN - South Eastern Power Networks Plc

Funding Mechanism

SIF Beta - Round 2

Collaborating Networks

UK Power Networks

Technology Areas

Asset Management

Comms and IT

Measurement

Cyber Security

Modelling

Network Monitoring

Digital Network

Distributed Generation

Overhead Lines

Electricity Transmission Networks

Resilience

Environmental

Fault Management

Project Summary

CReDo+ will develop the Climate Resilience Demonstrator into the Climate Resilience Decision Optimiser digital twin and data sharing platform, enhancing resilience investment planning and reporting. The project will scale the CReDo technology across the electricity and gas sectors to understand infrastructure interdependencies and cascading risk from extreme weather including flooding, extreme heat, and strong winds. Tools will be developed to encode tacit subject matter expert knowledge into new asset risk models, with a risk modelling framework to cascade asset failures through individual networks, between networks, and across sectors including water and telecoms. This will build whole system climate resilience.

Add Preceding Project(s)

10061342 - CREDO+

10061340 - CReDo+ Climate Resilience Demonstrator (extension to new climate risks)

Project Budget

£10,896,603.00

SIF Funding

£9,806,929.00

Project Approaches and Desired Outcomes

Solution statement and solution focus

Due to climate change, extreme weather events are occurring on an increasingly frequent basis and to greater severity, and the UK's infrastructure is not prepared. There is insufficient awareness of the impact of climate change on critical national infrastructure, as agreed by Climate Change Committee and National Infrastructure Committee. More intense and frequent weather extremes are predicted by the Met Office, with winter storms causing flooding, and intense summers causing extreme heat.

The interconnected nature of UK's infrastructure means such weather events can have large ramifications throughout the energy, water and telecoms systems, impacting public health and safety. If one piece of infrastructure fails, this can cause a domino effect with power cuts leading to hospitals being without water or homes without means for communication. In emergency situations, the effect is devastating.
No single organisation is incentivised to take responsibility for resilience across systems and therefore competitive markets would not deliver a solution. This market failure requires a singular organisation to coordinate across multiple organisations and sectors. With crucial data being spread across organisations, network operators, local authorities, and commercial businesses are struggling to incentivise resilience measures beyond their own immediate assets. Simultaneously, existing solely data-driven approaches are limited by sparse historic failure data of rare weather events (e.g. extreme heat) and a lack of digitisation across industries.

CReDo (Climate Resilient Demonstrator) was an innovation-funded project which initiated data collection from key networks to map cascading risk into a digital twin demonstrator.
CReDo+ expands on CReDo by targeting energy sector resilience and aims to scale beyond the demonstrator, delivering the CReDo+ digital twin and data-sharing platform.
This project will encompass major infrastructure operators in the UK. CReDo+ responds to Challenge 3, Scope 2 and will support network licensee users with resilience investment planning and adaptation decision-making in the face of climate change and risks from extreme weather. CReDo+ will improve our understanding of future energy system configurations across core infrastructure and develop solutions to strengthen its robustness.

The core users of CReDo+ are network/infrastructure planners, asset managers, engineers and decision-makers. Learnings from previous phases and input from the Resilience Working Group (RWG) have validated our understanding of their specific concerns.

The Alpha tool shows promise in aiding users to identify where risks would occur but stops short of optimised decision support and identifying impact mitigations through socio-economic and geographical assessments. Beta will enhance its capabilities to further address their needs by:
Map views to visualise connectivity and cascading risk of assets;
Decision support views to identify optimal resilience strategies; and
Dashboard reporting for clear understanding of connected assets.

CReDo+ enhances the resilience planning process, by considering whole systems impact and climate change to optimise decision making, network planning and reinforcement. It goes beyond existing sole data-driven methods by utilising a hybrid approach with elicitation of core knowledge from subject matter experts. We will prepare CReDo+ for BAU by iterative testing with DNOs and other sectors, working closely with decision-makers in utilities and the regulator to define enhanced resilience planning processes and deliver greater resilience more efficiently.
The originator project, CReDo is funded by Connected Places Catapult's Innovate UK core grant. CReDo also receives complementary funding from Ofwat's Water Breakthrough Challenge 3 Catalyst Stream to assess the impact of extreme heat on water assets. Together with this Ofgem SIF project, this enables an understanding of interdependencies and shared learnings across sectors. Knowledge sharing with other SIF projects, including NIMBUS (SSEN), Predict4Resilience (SPEN), Scenarios for Extreme events (NGESO), and WELLNESS (NGET) meant we were able to ensure innovation projects complemented each other rather than overlapped

Innovation justification

Networks and other national infrastructure operators are currently not incentivised to plan beyond their immediate assets. Additionally, current energy network data is often insufficient to provide the cross-network insights that enable cost-effective targeting of resilience budgets or to meet the Regulator's strategies for whole system planning. CReDo+ addresses Challenge 3, improving the UK's energy system resilience and robustness by enabling network licensee users to plan for the efficient rollout of new infrastructure in the face of growing risks from a changing climate.

Key innovative aspects include:
First-of-its-kind digital twin providing whole-system view of network connectivity and cascading risks, powered by interoperable technologies and enabled by new data sharing infrastructure;
Integrated economic modelling will overcome the challenges of costing resilience against a range of extreme weather and time horizons, and help realise the direct, indirect, societal, and environmental benefits of adaptation to cascading failure with cost-benefit analysis decision intelligence tools that will be codesigned with planners, asset managers, and engineers;
Connected asset risk modelling encoding tacit knowledge from subject matter experts to understand current and future risks, and Bayesian inference is used to combine and validate with historic fault data;
Risk models will be created using a pioneering Digital Elicitation Tool, with training provided to upskill network experts on use and quantifying risk; and
Interoperable "plug-n-play" capability to integrate existing technologies, such as Predict4Resilience wind risk models.

The CReDo+ Resilience Working Group (RWG) established during Alpha convened energy network organisations to promote, challenge and refine Beta . Working in the open with key stakeholders, we held workshops to share knowledge on their needs and validated the design hypothesis digital twin, modelling and use cases.

Learnings from Alpha, which shaped Beta

User adoption: Mathematical concepts used for asset modelling, decision support, investment planning are complex and not readily understood by target users. Simplifying messaging increases organisational understanding and drives adoption.
Better predictability to resolve data gaps required for assets and systems: Underpinned by a streamlined approach to expert elicitation interviews and data processing. This will enhance the Bayesian network technology underpinning CReDo+.
Stakeholders involvement is key: Leverage the CReDo+ RWG to share lessons learned and identify emerging insights/opportunities between stakeholders.

The current state of the platform is TRL5 IRL 4, and CRL 5, and it is estimated to be at TRL 7-8, IRL 7, and CRL 7 following successful Beta completion. After Beta, some sectors and aspects of climate resilience will be BAU deployed, but further work will be needed to expand to all energy industry and to include full spectrum of climate events which can occur

To ensure the innovation in Beta improves exponentially, stakeholders from within and outside the energy sector continue to be engaged, including Digital Twin developers (via the Digital Twin Hub), government departments and agencies, including DfT, DEFRA, Climate Change Committee, National Infrastructure Commission, Cabinet Office, EA, Ofwat, along with the water and telecoms industry.

Alignment to SIF
Current regulation and price control mechanisms are focused on resilience planning for each sector individually, i.e. lacks the investment provision for organisations to plan beyond their own resilience needs. Thus, there is no incentive to consider cascading risk and whole system resilience across different sectors within BAU activities.
The size and scale of Beta is appropriate to maximise the learnings and address the innovation challenge and theme

Consideration of counterfactual solutions
The counterfactual is the existing state-of-play; the energy sector currently does not plan for whole system resilience, but rather all players use their own tools to plan for their own network resilience. Details of quantified benefits against the counter factual are included in Q6

Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Financial - cost savings per annum for users of network services

Environmental - carbon reduction – direct CO2 savings per annum

Environmental - carbon reduction – indirect CO2 savings per annum

New to market – products

New to market – processes

New to market - services

Others that are not SIF specific

Impacts and benefits description

Maintaining whole system resilience will be more challenging in the future as the current infrastructure was not designed to cope with extreme weather events.

The CBA considered three options for energy-water-telecoms climate resilience investment planning solutions relative to counterfactual:
Counterfactual pre-innovation baseline: network operators invest in resilience across their own networks with no consideration for cascading impacts or strong understanding of climate change
Option 1: blanket investment with high budget
Option 2: CReDo+ cross-network digital twin
Option 3: siloed individual-network digital twins
The CBA found that Option 2 could generate significant positive financial returns (£4.4bn NPV at GB level to 2080) on optimising mitigation investments against future extreme weather. CReDo+ reduces technology development costs with a combined solution relative to Option 3 and provides added de-siloing benefits.
Based on asset and cost data provided by networks in the Alpha pilot the following net-benefits scaled to UKPN's region (based on a flooding and extreme heat use case) have been estimated:
Financial – cost of operating network, cost savings for customers and network users
Direct benefits of £745m to 2080 from:
Reduction in costs of repair and restoration damages due to resilience planning
Capital resilience measures (e.g. structural characteristics, equipment level)
Reduction in cost of temporary operational measures (e.g. backup generators, forced ventilation)
Societal benefits of £887m to 2080 with:
£248m customer benefits through Customer interruptions (CI) and customer minutes lost (CMLs) reductions
£384m water and telecoms interruptions, including those from power outage cascades
£254m direct water and telecoms outages as a result of electricity network failures
Environmental - carbon reduction – direct and indirect CO2 savings per annum
The resilience investments, containment and repair measures available for each asset have associated carbon emissions (e.g. concrete installation, running back-up generators). Although not present in the current prototypes and models, carbon data is something that could be added to CReDo+'s model in future, which would enable views of reductions in emissions for different investment selections.
New to market – products, processes, and services
UKPN pioneered confidential asset data sharing with network partners using a data exploration licence, was first of its kind. It demonstrates execution of such a contract is possible and establishing trust across networks is essential.
Others not specific to SIF
Costs generated by failure of wastewater assets in the Anglian Water network (£15.9m reduction versus counterfactual), considering:
Pollution incidents and compliance failures by Wastewater Treatment Facilities
Sewage pumping station failures cause sewage overflows (internal and external).
Other non-quantified benefits address big-picture goals like economic prosperity, social cohesion, and environmental sustainability.
Societal welfare: an overall improvement in infrastructure resilience and service delivery contributes to enhanced societal well-being. Schools can remain open while essential services such as water supply and sanitation remain operational, safeguarding public health.
Enhanced decision-making: CReDo+ aids decision-makers in making better, faster decisions, improving risk anticipation and

mitigation, efficient resource allocation, and identifying opportunities for robust long-term strategies.
Climate change resilience: Improving sector resilience by mitigating the risks of extreme weather events and fostering widespread innovation in green technologies.
Energy sector stability: Reducing downtime risks and minimising costs, enhancing confidence among stakeholders.
Public health and safety: Identifying assets at high risk of cascading failure so that decision-makers can ensure that hospitals and emergency services can provide continuity of care during extreme weather events, reducing the risk of adverse health outcomes for vulnerable populations. Similarly, enhanced safety protocols and communication systems for field workers can improve their ability to respond effectively to emergencies, minimising the risk of injuries.
Further benefits include better reporting through Adaptation Reporting Power (ARP) and other resilience reporting to Ofgem, DEFRA, and other agencies, potentially attracting additional resilience investments.

Teams and resources

The Beta phase consortium continues to leverage Alpha's skills and knowledge.

UK Power Networks (UKPN)
Skills: UK's largest electricity distributor delivering power to 8.5 million homes and businesses across London, the East and Southeast of England, with a proven track record of delivering benefits through innovation, having delivered over £400m savings from innovation in ED1.
Expertise: Quality of supply analysis, benefits measurement, project management, risk management, stakeholder engagement, and data access.
Role: Overall Project Lead and management. Provide SMI input to understanding why assets fail, used to improve failure prediction models and support the business case and benefits analysis.
Connected Places Catapult (CPC)
Skills: The UK's innovation accelerator for cities, transport, and places. The lead organisation for CReDo development, experienced in identifying market failures and convening stakeholders to solve them.
Expertise: Technical leadership, data science, stakeholder engagement, business case & impact assessment.
Role: Technical and product strategy, asset & system modelling, business case development, cost-benefit analysis, engagement & dissemination.
The Science and Technology Facilities Council (STFC)
Skills: A multidisciplinary government agency responsible for the UK's strategic engineering and scientific research assets, including data centres.
Expertise: The Data Analytics Facility for National Infrastructure (DAFNI) brings together data, computing resources and expertise to accelerate UK infrastructure research, including hosting CReDo. STFC Hartree Centre research focuses on industrial innovation and software engineering.
Role: Develop digital infrastructure for the digital twin platform. Software engineering and data science to develop the digital elicitation tool.
CMCL
Skills: SME tackling cross-domain interoperability challenges spanning energy, infrastructure, chemicals and materials.
Expertise: Semantic computing, including knowledge graph-based solutions, enables data interoperability and distributed digital twins
Role: Development of CReDo digital twin platform, ensuring interoperability, consistency and integrity. Data handling, integration, visualisation and demonstration.
Additional project partners have been selected to cover a range of electricity transmission, distribution, and gas distribution, ultimately leading to successful whole system testing, scaling, and adoption of CReDo+ across the sector.
National Grid ESO (NGESO): The UK's Electricity System Operator. Responsible for balancing electricity supply and demand, developing markets and advising on network investments. .
National Gas: own and operate the national gas network, delivering energy to where it is needed in every part of the country.
Cadent Gas: Owns and operates four of the eight UK gas distribution networks.
SP Manweb: representing SP Energy Networks, a DNO/TNO that manages infrastructure that delivers electricity from the national transmission system to end-users.
The University of Edinburgh leading centre for applying decision analysis methodology to energy systems. Working on Bayesian risk modelling and decision intelligence.
Core roles for all: User research engagement and data exploration, advising impact of extreme weather on infrastructure, providing data and testing for MVP development.
We are also supporting wider SIF resilience projects, including WELLNESS with NGET, who have agreed to support CReDo+ with data sharing and expert interviews.

Subcontractors
Appropriate subcontractors will be procured through a fair and open procurement process, ensuring both value for money and technical suitability.
Connected Places Catapult will engage:
Climate modelling and weather data experts.
User Interface/Experience (UI/UX) development experts.
Data and cyber security experts.
UKPN:
BT, Anglian Water and Thames Water to provide asset data and risk modelling expertise for cross-sector dependencies
Sarah Hayes, data, digitalisation and regulation expert supporting on engagement throughout.
Predict 4 Resilience Wind Model integration: Sia Partners and Glasgow University.
The University of Edinburgh:
Newcastle and Warwick University researchers to support Bayesian risk modelling.
Across the consortium, the project will have access to the required resource, equipment and facilities required. The project partners have a proven track record working at the cutting edge of climate modelling, digital twin and cascading modelling.

Project Plans and Milestones

Project management and delivery

Beta will continue to use agile methodologies (Scrum framework) and Jira (product management software) to manage tasks and dependencies. Development will be managed on Gitlab. Approaches include:
Jira Software used to run the project support to work asynchronously.
Daily 'Digital Stand-ups' enable transparency of progress whilst reducing meeting time.
'MS Teams-first' approach to team communication enables collaboration, immediacy of response and document sharing.
2-Week Sprints based on Scrum Agile with Sprint Planning, Stand-ups, Demo Playback, Retrospectives and Backlog Prioritisation.
The approach was commended by partners at Alpha phase, with playbacks and retrospectives creating psychological safety, equitable representation of all contributors, and a positive and collaborative work culture. The project's structure is grouped into six Work Packages:
WP1: Project Management (UK Power Networks)
Aim: Overarching governance, initiation, and closure, following best practice project management governance to continuously assess strategic, regulatory, financial and operational risks.
WP2: Technical Mobilisation (CPC)
Aim: Establish technical delivery plan and product roadmap, with initial user research with all network partners.
WP3: Minimum Viable Product development and release (CPC)
Aim: Iterative development and release of digital twin platform, including risk modelling, decision intelligence, user interfaces, and digital elicitation tool. Connect network data to secure platform.
User research and testing with network partners UKPN, NGET, NGESO, Cadent Gas, and National Gas.
WP4: Second product release and scaling (CPC)
Aim: Continue iterative development with improved data sharing. Launch UKPN trial. Develop reporting use case.
User research and testing, scaling to new network partners including SPEN-T, SPEN-D, SGN
WP5: Third product release and cross-sector integration (CPC)
Aim: Finalise development of digital twin platform with enhanced data sharing and interoperability, including integration of Predict4Resilience wind modelling capability. Complete UKPN trial, supporting RIIO-ED3 and ARP4 reporting.
User research and testing, scaling to cross-sector with Anglian Water, Thames Water, and BT.
WP6: Dissemination, engagement and route-to-market (CPC)
Aim: Engagement and dissemination to share progress and learnings, including refresh Resilience Working Group with networks. Engage on regulatory change for coordinated resilience investment. Deliver route to market strategy.
Stage Gates
Stage Gate 1 follows M1.3 and sees the MVP being deployed. Core models will be built, and data will be integrated from UKPN and core partners ready for user trials.
Stage Gate 2 follows M1.4 and sees the second release deployed. Data will have been integrated from the partners. Access and hosting frameworks will have been drawn up and finalised. Decision will be made on whether to proceed with advanced federated data sharing infrastructure.
Risks & Risk Management:
The project will exercise best practice project management governance to continuously assess strategic, regulatory, financial and operational risks. The approach to project risk will follow:
An If… Then… statement.
Include a likelihood measure of High, Medium, Low
Include an impact measure of High, Medium, Low
Mitigation Category (Accept, Avoid, Transfer, Reduce)
Key Risks
(R1) Delay in contract signing may result in a late start, mitigated by UKPNs issuing the draft agreement before the funding decision to identify any red flags early, and partners agreeing to use the learnings from Alpha phase contract to accelerate the process.
(R3) Data security and privacy concerns from network operators mitigated by project partners' significant experience in setting up web-based and on-premises secure systems to handle critical, sensitive data.
(R7) System does not deliver expected benefits to end users mitigated by extensive user research and iterative testing through agile methodology to ensure value delivery. Additional engagement of Network Operators through our Resilience Working Group, which will promote, challenge and refine the project.
Impact on customers

No planned or potential unplanned supply interruptions
No engagement planned with energy consumers over asset vulnerabilities

Key outputs and dissemination

CReDo+ Beta Phase will deliver:
An interoperable digital twin platform ready for seamless integration with internal systems and other initiatives.
An understanding of infrastructure interdependencies, delineating cascading failures from individual assets to entire sectors, providing a systems-level view for effective risk mitigation.
A tool for resilience investment planning and regulatory reporting, empowering network licensee users with data-driven insights to understand and mitigate climate risks.
Ability to evaluate the benefits of resilience through cost analysis, leveraging integrated economic models, considering interventions and mitigations, informing decision-making driven by user insight.
The expansion of the CReDo programme across sectors and infrastructure types fosters cross-sector collaboration and knowledge sharing to drive climate resilience at a national scale.
Transparent collaboration with other Innovation projects such as Nimbus, Predict4Resilience, Scenario for Extreme Events and WELLNESS.
Key outputs during the Beta phase
Following an initial mobilisation of the project (project kick-off, executing contracts, establishing a steering committee, delivering an inception report), the CReDo+ platform will be developed iteratively, moving from covering UKPN networks to the broader energy sector to cross-sector:
MVP Core release: Initially focusing on UKPN's electricity distribution networks, this phase will mark the platform's core foundational deployment.
Second release: The platform will expand to encompass a broader scope within the energy sector, including electricity transmission and distribution and gas distribution networks.
Third Cross-sector release: The platform will achieve cross-sector coverage, integrating energy, water, and telecoms networks.
Beyond these milestones, deliverables include project reports, technical plans, user requirements documentation, and data exploration outcomes. These will provide critical insights and resources for project management, technical development, and stakeholder engagement.
Quarterly reporting and review meetings to track progress, address challenges, and adjust plans as necessary. (CPC)
Stage-Gate reports evaluating project milestones and readiness for each phase of development. (UKPN)
User requirements documentation specifies the expected functionality and features. (CPC, UKPN)
Development and deployment of CReDo+ Digital Twin technical architecture. (CMCL)
Data exploration outcomes, including insights gained from data discovery and analysis. (CPC)
Deployment and integration of the digital elicitation tool. (STFC)
Infrastructure deployment, data hosting, sharing, cybersecurity and access controls. (STFC)
Decision intelligence tools, including economic models, cost-benefit analysis models, and resilience investment planning algorithms across releases. (CPC)
UI/UX designs, builds and testing for MVP, second release, and third release phases. (CPC, Subcon)
Plug'n'play risk models integration with enterprise systems to support interoperability. (CPC)
Route to market plans outlining strategies for commercialisation and broader adoption. (CPC)
Dissemination activities
Dissemination and engagement activities (CPC, Sarah Hayes (UKPN subcon)) will ensure continued collaboration and transparency in delivering this SIF phase with associated innovation-funded projects. An engagement strategy will include stakeholder mapping, establishment/management of project advisory and working groups, organisation and execution of events, marketing collateral, communication strategy planning, and editorial calendar management.

Dissemination & engagement channels
The visibility and impact of CReDo across sectors will be increased through content creation and promotion across digital communications channels supported by:
The Digital Twin Hub (5200 members representing 2500 cross-sector organisations).
The CReDo+ RWG will continue to promote knowledge sharing, including with other SIF-funded projects. This will underpin collaboration with the wider energy sector.
CreDo SIF Project Advisory Group.
Two events - an MVP Showcase and a Closing Showcase –convening government, industry and academia to promote the project and learnings.
Project Partners using their respective social media and websites.
Outputs will be published on the Smarter Networks Portal and the UKPN innovation website, further disseminated at IUK Show &

Tell events.
Engagement with Ofwat (CReDo water sector project) to support development of data-sharing licenses for cross-sector partners.
Key conferences will be targeted, including Utility Week, Digital Construction Week and others.

Commercials

Intellectual Property Rights, Procurement and Contracting (not scored)

Intellectual Property
The parties agree to adopt the default IPR arrangements for this project as set out in Section 9 of the SIF Governance Framework, namely that each Project Partner shall retain all rights in and to its Background IPR and that each Project Partner shall own all Foreground IPR that it independently creates as part of the project. Where IPR is developed jointly, it shall be owned in shares that are in proportion to the work done during its creation. The agreement between the partners around the CReDo solution is that the code is open and published under a permissive licence. We expect the results from this project to benefit the sector at large.
Procurement and Contracting
Several subcontracts will be placed to secure 3rd party input to deliver a successful Beta phase. These include:
By CPC:
Climate modelling and weather data experts. £180k. Years 1 and 2.- Open RFP
User Interface/Experience (UI/UX) development experts. £455k – Open RfP led by CPC, including Dynamic Purchasing System (DPS) issue December '24 to start.
Data and cyber security experts. Advertisement via open RfP £95k (input over 3.5y) issue Dec 2024 to start ASAP.
A Dynamic Purchasing Framework, Dynamic Purchasing Systems (DPS) supports the Catapult in achieving milestones and supporting end clients across three themes:
Innovation Advisory Services;
SME and Academic Engagement;
Marketing and Events.
Tenders are run through the Procontract portal and advertised on websites such as Contracts Finder and Find a Tender.
By UKPN:
BT will provide asset data and risk modelling expertise: £40k
Anglian Water and Thames Water will provide asset data and risk modelling expertise: £30k each. Total £60k.
Sarah Hayes, Data, digitalisation and regulation expert supporting on engagement throughout the project £105k.
Predict 4 Resilience Wind Model integration: Sia Partners and Glasgow University £175k.
These will be procured through single source action to reflect the criticality of their input to the project and their agreement to be involved.

Commercialisation, route to market and business as usual

In previous market analysis, our Cost Benefit Analysis and previous CReDo project shows that there is significant value in CReDo+. There is a clear route to market through the assembled network licensees (initially through two clusters in the Southeast and Scotland), whilst engagement/dissemination activities throughout Beta will bring current and new partners on the journey of development and adoption in Business as Usual.

Commercialisation Plan
Although the scope of the Beta includes considerable work in developing the route to market for CReDo+, the consortium have created an initial commercialisation and scaling plan that encompasses a comprehensive growth strategy to other networks and geographical areas. This aims to bring further public sector users, such as Ofgem, Environmental Agency and Local Authorities. This would mean that the commercialisation model may have to accommodate various types of users and revenue streams and sectors to be sustainable in the long run, hence a form of public-private partnership is being demonstrated through Beta. This plan will be further developed as the project progresses.
Our interoperable solution will be capable of platforming innovation projects, meaning efficiency gains for future innovation funds. Our commercialisation pathway is strong with connections to other sectors, and a natural expansion route with energy dependencies at the core, and feedback benefits to the energy sector as new sectors are onboarded.

Transition to BAU
After completion of the Beta phase:
Year 1 UK Launch: Full launch of CReDo+ (for flooding and extreme heat) across energy, water and telecom sectors and integration as BAU.
Year 2 Network Expansion & Product Enhancement: Expansion of CReDo+ to additional network partners and sectors in the

UK.
Year 3 International Expansion: Expand CReDo+ to overseas markets, building on the successes of the UK.
Further detail is provided in Appendix.

Senior Sponsor Buy-in
Engagement through Discovery and Alpha have already ensured that the key senior decision makers are engaged in the project with the Director of Asset Management being the direct Business Sponsor for Beta. The Head of Asset Strategy and the Head of Network Planning, as well as their teams, guided the proposed scope for Beta and validated the value of the whole system resilience planning approach of CReDo+. In parallel, the Chief Information Officer and his team have been closely involved in the development of the architecture for the secure data transfer which is a fundamental enabler.
Throughout the development of the Beta proposal buy-in was secured from the Director of Finance, Customer Service & Technology and the CEO, as key executives who ensure the integrity and safety of the network.

Outside of UK Power Networks, there is encouraging senior stakeholder support from SP Energy Networks Head of Asset Management and Head of Future Networks.

Integration Strategy
Addressing system resilience is crucially, and foremost, a coordination problem. As previously mentioned, the market gap around incentivising system-wide resilience requires an independent organisation, to convene across organisations. Therefore, the transition of the CReDo+ solution to BAU will be led by CPC, with the energy system licensees (project partners) as first adopters and a public-private partnership arrangement with CMCL (the developers). An integration plan will be fully scoped out during the Beta phase, although interoperability and extensibility have been factored in throughout the iterations of CReDo
Knowledge Transfer
We will also conduct training sessions and develop user materials across the network partners, with Beta and beyond as more are integrated. We aim to ensure knowledge transfer in using CReDo+ as a tool to ensure maximum efficiency and long-lasting impact of effective resilience planning

Policy, standards and regulations (not scored)

While legal, commercial, and regulatory barriers to data sharing persist across the energy system, we are unaware of any regulatory barriers to sharing the CReDo+ tool with networks and national infrastructure owners. It is a tool that we aim to develop across the industry to help other asset owners develop asset-specific failure models.

A key barrier identified through Discovery and Alpha is the barrier to coordinated cross-organisation and cross-sector investment and the whole system approach to infrastructure interdependencies.

Considering the more extended-term realisation of the benefits of CReDo+, from a policy perspective, it would be valuable for regulators such as Ofgem, Ofwat and Ofcom to coordinate more closely to enable whole system resilience. The National Infrastructure Commission report, Strategic Investment and Public Confidence recommended that regulators adopt climate change and resilience duties and a duty to collaborate. We intend to use CReDo+ Beta as a vehicle for the industry to explore how future price controls could allow for investment designed to deliver system resilience benefits in adjacent sectors to the source of investment and to account for benefits that could accrue to other sectors including water, communications, and transport networks. For example, we intend to demonstrate the value of encouraging whole systems solutions by enabling the water industry to pay to upgrade or defend a substation to give the water assets more resilience.

In promoting collaboration across utility companies, regulators such as Ofgem and Ofwat may need to consider how to fund innovation in cross-sector innovation projects such as CReDo+. Add here

Through the project we established, and will continue, the CReDo+ Resilience Working Group (RWG) attended by 13 energy network licensees and ENA. Led by Sarah Hayes, this group will continue to focus on alignment of resilience standards and metrics, costing resilience, climate and weather data, data sharing, and explore options for policy and regulatory change. These will feed into our proposed work on technical requirements, route to market, and regulatory change.

We are actively engaging through CReDo+ teach-ins with regulation and resilience policy makers including Ofgem's resilience team, ENA, Committee on Climate Change's Adaptation Committee, National Infrastructure Commission, Ofwat, and other stakeholders. This will create feedback loops with our RWG, ensuring alignment to overcome policy, standard and regulatory barriers that will enable a whole-system approach to resilience decision making. Our ongoing collaboration with the water and telecoms sectors, and planned activities with other infrastructure sectors will enhance this effort

Consumer impact and engagement

Direct and Indirect Benefits to Consumers.
Energy bills will be lower in the future than they would be if investment is prioritised towards assets that deliver the highest levels of resilience – the most at-risk assets.
Lower operating costs of the network, relative to the increasing cost of resilience under climate change, will simultaneously translate to lower socialised (Distributed/Transmission Use of System costs (DUoS/TUoS)) costs to the consumer and, hence, lower bills.
Cost savings for energy customers arise from the more efficient investment and lower repair costs. CReDo+ guides decision-makers in selecting the investments that will maximise stability at the lowest price to consumers and with the lowest carbon impact.
CReDo+ will reduce CI (customer incidents) and CML (customer minutes lost) during extreme weather events by predicting failures and informing resilience upgrades.
CReDo+ addresses the diverse requirements of customer segments (vulnerable households or those with accessibility needs) by increasing the resilience of the power network, effectively reducing the risk of outages for customers who may rely on stable power supply for medical equipment (such as power lifts, hoists, mobility and breathing equipment) in their own homes.
More generally, societal welfare can be improved as fewer outages mean that schools, businesses, and essential services can operate as crucial utilities such as power and telecoms are made resilient, thus safeguarding public health and wellbeing

An equitable distribution of benefits among consumers is being ensured through the CReDo+ decision support engine that will offer network resilience mitigation options that consider the balance of social, environmental, carbon, and economic assessments in the recommendations.
Consumers involvement:
CReDo+ has been designed and developed closely aligned with the core themes underpinning UKPN's RIIO ED2 business plan. Themes include delivering a brilliant service, operating a resilient and reliable network, and enabling net zero with the lowest possible bills.
Drawing from the Catapult and UKPN's expertise in human-centred design and research and the combined extensive network of Local Authority stakeholders, the Beta phase will engage with UKPN's DSO Local Net Zero Team, Greater Southeast Net Zero Hub, Local Authority Officers and Community Energy Groups to understand the potential of CReDo+ to support Local Area Energy Planning.
Identifying a coordinated whole system planning approach for critical infrastructure will benefit energy consumers by helping address fuel poverty and its impacts on low-income and vulnerable homeowners.
Activities, including user workshops, will provide a platform for the project to convey the benefits of CReDo+ to other key stakeholders such as asset owners and other operators, undertaking discussion of benefits, impact (or risks) to energy consumers. These activities will support the ongoing development of the CReDo+ evidence base for cross-sector and long-term resilience decision-making for consumer benefit and public good.

Value for money

The total project costs for Beta are £10,896,603 with a SIF funding request of £9,806,929. The 10% contribution evidences the commitment of the partners and provides value for money to customers.
For CPC, STFC, and CMCL, the contribution will be covered by the profits from commercially-focused activity rather than using their government funds to support the project. UKPN and other network partners will contribute in-kind through labour.
UKPN
Costs: £1,430,350
SIF Request: £1,287,315
This includes subcontracting budgets:
BT
Costs: £40,000
SIF: £36,000
Anglian Water
Costs: £30,000
SIF: £27,000
Thames Water
Costs: £30,000
SIF £27,000

Sarah Hayes
Costs: £105,000
SIF: 94,500
Sia Partners
Costs: £150,000
SIF: £135,000
Glasgow University
Costs: £25,000
SIF: £22,500
CPC
Costs: £5,295,757
SIF Request: £4,766,169
This includes subcontracting budgets:
Climate Data
Costs: £180,000
SIF: £162,000
UX/UI Development
Costs: £455,001
SIF: £409,500
Cyber Security Expertise
Costs: £95,000
SIF: £85,500

STFC
Costs: £1,256,960
SIF : £1,131,264
CMCL
Costs: £2,152,998
SIF : £1,937,698
National Grid ESO
Costs: £98,986
SIF : £89,087
Cadent Gas
Costs: £99,977
SIF : £89,979
National Gas
Costs: £91,625
SIF : £82,463
SP Manweb (Representing Distribution and Transmission)
Costs: £199,950
SIF : £179,955
University of Edinburgh
Costs: £270,000
SIF : £243,000
This includes subcontracting budgets:
Newcastle University
Costs: £90,000
SIF: £81,000
University of Warwick
Costs: £90,000
SIF: £81,000

The proportional split of partner costs have been agreed across the consortium, and reflect the balance of effort spent during Beta:
UKPN as lead partner have the highest network partner costs due to project management and oversight responsibilities, iteratively trialling the tool with network planning and asset management teams
CPC will supply their full-time core technical and product delivery team who were directly involved in previous phases, bringing over integral expertise surrounding all aspects of the technology stack.
CMCL and STFC have respectively owned technology development of the digital twin and secure data sharing platform since

CReDo's inception. STFC's national facility brings cost savings compared to private cloud infrastructure during innovation. Network partners and subcontractors will provide data, and their subject matter experts attend workshops to feed into development process.
Crucially, the project will leverage existing digital twin demonstrator assets, with £3.6m complementary funding to date, and planned investments over the next 12 months. This includes almost £1m of investment from Ofwat's Water Breakthrough Challenge Catalyst Phase, and a plan for future Transform (Beta-equivalent) funding. SIF investment is essential for progress within the energy sector as the Ofwat funding is specific to the water sector This investment into background thinking and core software has prepared CReDo+ for rapid scaling, and the technology does not have third party license dependencies
CReDo+ brings together a wide array of network and infrastructure owners, who may not otherwise be incentivised to do so. A smaller scope would be inefficient and ultimately more expensive to achieve the final end goal of a whole systems approach to resilience. Similarly, by limiting the scope of climate change impact modelling to flooding, extreme heat and wind, we are able to demonstrate the concept without overspending on modelling a large number of other climate change events.
Our use cases will unlock economic and social value for climate resilience, evidenced by our CBA reporting payback within 6 years, and £16m of financial benefits to UKPN and £54m of customer benefits by 2035. A study by Glasgow City Council supports the value-for-money case for CReDo+, concluding that 'Investments in mitigation and adaptation have benefits that far outweigh their costs', up to £9 of economic return for £1 spent.

Associated Innovation Projects

- (•) Yes (please remember to upload all required documentation)
- ( ) No (please upload your approved ANIP form as an appendix)

Supporting documents

File Upload

SIF Beta Round 2 Project Registration 2024-10-02 4_10 - 93.0 KB

Documents uploaded where applicable?

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