

SIF Discovery Round 2 Project Registration

Date of Submission

Jun 2023

Project Reference Number

NPG_SIF_004

Project Registration

Project Title

Resilient Customer Response

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NPG_SIF_004

Project Licensee(s)

Northern Powergrid

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

chris.goodhand@northerpowergrid.com

Project Budget

£138,000.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£118,000.00

Strategy Theme

Supporting consumers in vulnerable situations

Challenge Area

Improving energy system resilience and robustness

Lead Sector

Electricity Distribution

Other Related Sectors

Funding Licensees

NPg - Northern Powergrid (Yorkshire) Plc

Lead Funding Licensee

NPg - Northern Powergrid (Northeast) Limited

Collaborating Networks

Northern Powergrid

Technology Areas

Community Schemes, Distributed Generation, Energy Storage, Network Automation, Photovoltaics, Resilience, Stakeholder Engagement

Equality, Diversity And InclusionSurvey

Yes

Project Summary

In a smarter decentralised energy system, customers are becoming more integrated prosumers who can impact on the network and broader system operation. Historically resilience has meant providing consumers with a guaranteed supply, but future prosumers could have a role in supporting this resilience.

Resilient Customer Response (RCR) aims to unlock the potential for DNOs to use customer's behind-the-meter (BTM) assets and services to support network resilience, and enable networks to prioritise vulnerable customers who are subject to supply loss. RCR will explore the extent to which resilient consumers can support themselves and communities with their BTM assets when the restoration of supply is delayed.

RCR meets the challenge aims by:

- Identifying novel methods and processes for DNOs to access support for improving resilience on low stability networks.
- Using customer BTM assets to provide grid/system support and improved

resilience allowing network investment to be prioritised where needed most.

- Developing a commercial and investment case for incentivising consumers to provide self-resilience.
- Developing new network processes and understanding the network's role to enable coordination of BTM assets to support network resilience and optimise network operations and investment.

Northern Powergrid (lead organisation) is responsible for resiliently supplying 3.9million homes and businesses. RCR will help NPG develop new ways to respond to customers in future events such as Storm Arwen.

LCP Delta (project manager and lead researcher) is a leading European research and consultancy company providing insight into the energy transition, with a particular focus on customers and the interaction of customers with the energy system.

The University of Southampton Sustainable Energy Research Group has internationally recognised expertise in socio-technical aspects of residential low carbon energy systems. Their ongoing research on semi-automated demand response through heat deferral and local storage as well as micro-grids for local energy resilience in East Africa will support RCR.

Energy consumers and prosumers will directly benefit from RCR through improved resilience and potentially value generation. Vulnerable customers will directly benefit by improved prioritisation.

Potential users the RCR solution are electricity DNOs, demand-side response aggregators, private homeowners and potentially energy communities. These users need a clear pathway to deploy resilience from BTM assets including understanding:

- The types of assets suitable and available, and the resilience they can provide
- New commercial arrangements to realise the whole systems value of private assets supporting network resilience.
- The costs and benefits to the people providing the resilience (and those on the PSR side receiving it).

Project Description

Distribution networks have a responsibility for ensuring customers have a reliable and resilient connection, with a particular need for the protection of vulnerable customers from loss of supply. Resilience has traditionally been provided by the network operators, with for example generators deployed in the event of local outages. Recent events such as storm Arwen (which are expected to become more frequent under future climate change scenarios) have demonstrated that network outages can be significant and restoration of services can be challenging.

A key trend in the energy transition is the decentralisation of energy assets, including the widespread deployment of behind the meter assets. This effectively means that customers are part of the energy system, not just a passive connection. The hypothesis of this project is that some customers could provide resilience services to themselves, and potentially the network, through using their behind the meter assets (such as batteries), resulting in greater reliability and reduced investment by network companies (and therefore an indirect cost benefit to all network customers).

Whilst many innovation projects are focussing directly on how vulnerable customers can be supported, this project examines how potentially some of the "least vulnerable" customers can help support network resilience. This approach will help indirectly support vulnerable customers by allowing the network companies to prioritise restoration work on the most vulnerable customers.

This Resilient Customer Response project aims to explore a number of elements of this concept to allow a longer-term trial to be operated. The areas of interest include:

- The types and uptake of relevant behind the meter assets and the technical capability for them to provide resilience services.
- The methods and likelihood of incentivising customers to provide resilience through research into customer responses.
- The cost benefit of different approaches, taking into account the value of lost load, incentive structures, and network cost benefits.
- Recommendations on business models/ propositions to deliver consumer resilience, and the role that network companies need to play to benefit, both operationally and financially.

A successful outcome of this concept would mean a more resilient electricity distribution system, with better protection of vulnerable customers during outages, and more cost-efficient use of assets and technology.

Third Party Collaborators

LCP Delta

University of Southampton

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Project Description And Benefits

Applicants Location (not scored)

Northern Powergrid

Northern Powergrid

Lloyds Court

78 Grey Street Newcastle upon Tyne

NE1 6AF

LCP Delta (Formerly Delta Energy and Environment Ltd)

LCP Delta

Lane Clark & Peacock LLP

95 Wigmore Street

London W1U 1DQ

United Kingdom

Southampton University

University of Southampton University Road

Southampton S017 1BJ

United Kingdom

Project Short Description (not scored)

Resilient Customer Response will explore how new categories of customers with behind the meter assets can help themselves and other local network customers by improving resilience in the event of network outages.

Video description

<https://youtu.be/XmljWQXmNP4>

Innovation justification

The problem

Increased reliance upon the electricity networks with electrification, combined with the challenges in operating reliable networks (e.g. more extreme weather events) means that providing a resilient supply for consumers remains a challenge for DNOs. Storm Arwen (November 2021) is a relevant example of an event which is likely to become more common.

Solution and innovation

An untested solution to improve resilience is to make use of the increasing number of BTM energy assets in consumers' homes, s(e.g. batteries, EVs, PV systems, low power systems). These are currently being rapidly deployed and will increase exponentially over the coming years providing a distributed VPP behind the meter.

BTM assets could provide power to consumers in network outage events, providing a level of resilience, and enabling DNOs to prioritise restoration on vulnerable customers. RSR will also explore whether BTM assets can provide local resilience to other (including vulnerable) consumers, enabling the maintenance of essential services (e.g. communications, heating controls, lighting) at a community scale during network supply restoration.

RCR is required because there are no documented examples of using consumer BTM assets to support network resilience in the UK . RCR will draw on relevant existing projects:

- Micro-resilience (NPG) using portable battery storage. RCR provides the bridge between Micro-resilience and developing a consumer-led approach.
- Community DSO (NPG) looking at local network operation models
- RAAS (SSEN) using network connected batteries to provide resilience
- VOLL (ENWL) understanding the value of a resilient connection to different consumers.

The need for funding

Securing resilience from BTM assets is outside the scope of ONO business-as usual activities and current regulation prohibits network operators from exploring, funding and operating them. This innovation project is therefore essential to explore this concept.

Economic and sustainability value against a counterfactual

Costly alternative upgrading/reinforcing the network (e.g. an additional line) still leaves the network exposed to extreme weather events risks and doesn't allow prioritisation of resources during outages. Evidence from storm Arwen demonstrated (NPG findings) the significant impact that large scale events have on customers and the challenges for power restoration. It also showed that customers with BTM assets want to remain more resilient and take control of their energy supply during outages, but that other customers may use higher carbon/ more polluting solutions if the network isn't resilient (e.g. Diesel gensets, fossil fuel or wood burning).

Benefits Part 1

Financial - cost savings per annum on energy bills for consumers
Financial - future reductions in the cost of operating the network
New to market – products, processes, and services
Revenues - creation of new revenue streams
Revenues - improved access to revenues for users of network services

Benefits Part 2

At the discovery phase, RCR will explore a range of direct and indirect benefits to consumers:

- The direct benefit of BTM asset owners being able to provide self-resilience during outages and benefit from incentives.
- The indirect benefit for non-BTM consumers, particularly vulnerable, to have

service restoration prioritised, reducing downtime.

- The community and / or societal benefit of sharing consumer resilience to enable whole communities to manage short outages.
- The indirect benefit of improved network cost efficiency, and therefore lower distribution costs for consumers.
- The indirect benefit of incentivising the deployment of low carbon BTM assets and increasing uptake.
- The indirect benefit of more sustainable restoration of power, and negating the need for fossil generation (such as diesel gensets)

or highly polluting consumer sources (e.g. solid fuel fires).

The Discovery Phase will explore how these benefits can be quantified leading into more detailed analysis at the Alpha and Beta field trial phases. The types of quantification could include:

- The numbers of consumers participating in providing resilience services based on availability of BTM assets and acceptance of services/ incentivisation.
- The activation of consumer resilience measured in number of events, % of overall outages deployed, and the utility provided (e.g. kWh total/ per customer).
- The reduction in time and costs of restoration, and the associated hours and utility benefit to consumers.
- The improvements in restoration time for vulnerable customers enabled by prioritisation of resource.
- The reduction in network operation costs through maximising the use of BTM

assets and reducing the need for network assets.

- The increase in LCT deployment and associated decarbonisation driven by the additional Consumer Resilience value (£) and the perceived resilience/ self control benefits.
- Long term planning cost benefits through improvements to network reinforcement investment.
- Direct CO2 and environmental benefits through the reduction in network assets

(gen sets) and consumer assets (fossil back up generation and solid fuel use).

We believe that all of the above benefits should be observable, and mostly quantifiable with the provision of suitable boundary conditions on the analysis.

Project Plans And Milestones

Project Plan and Milestones

RCR will build towards a Beta phase demonstration of demand-side resilience that benefits vulnerable customers, the electricity networks, and the whole energy system.

The Discovery phase of the project will be delivered over the required 3 months period; we will undertake the following work packages:

WP1. State of the Art and Outline Concept (Lead: LCP Delta)

- Research into the current status of RCR taking into account the market for BTM assets and potential growth, current business models and propositions available to customers, current network operation practices around resilience and restoration, and the current regulatory environment.
- Development of the RCR concept describing the types and use of assets, potential operational models, and arrangements for network operators.

WP2. Consumer BTM resilience as a socio-technical service (Lead: Southampton University)

- Research (literature review) into potential frameworks and incentivisation models for enabling customers to actively or automatically deploy BTM assets as a service to the network
- Review of international case studies of BTM 'virtual power plant' systems, local community peer-to-peer energy sharing/redistribution and resilience-driven microgrids for emergency response against these frameworks and models to understand what works and why.

WP3. Economic Potential (Lead: LCP Delta)

- Techno-economic analysis of the potential for BTM assets to provide resilience exploring the type and duration of events, and the maintained loads at both an individual and community level.
- CBA of different uptake and deployment scenarios with quantification of some direct benefits at an individual event level, and extrapolation to NPG licence areas, and GB implementation.

WP4. Engagement (Lead: NPG)

- Review of current and existing network innovation activities and programmes which can support/ input to RCR, and engagement with specific network representatives.
- Mapping of RCR concept against broader network programmes such as Open Networks.

WP5. Summary Reporting (Lead: LCP Delta)

- Summary report drawing together separate WP deliverables, and outlining recommendations and plans for taking RCR to alpha and beta phases.

WP6. Project Management (Lead: LCP Delta)

- Coordination of research and project partners, and responsibility for meeting the 3 month programme.

Regulatory issues are discussed under Q8.

We have included a risk register as part of the management spreadsheet uploaded. Risks are rated on their pre-mitigation level.

Regulatory Barriers (not scored)

The Discovery Phase will identify the range of regulatory issues which may impact on the RCR concept, and these will be explored in more detail at the Alpha phase. The types of issues which we expect to raise and explore include :

- The relationship between the network and the consumer. The RCR approach requires networks to incentivise and in some form, control the resilience offered by consumers in the event of outages or near outages. This could be directly, or involve a range of third parties such as other service providers who act as an intermediary. The incentivisation format could also be more direct (the provision of signals), market driven or exploit social relationships such as gifting and reciprocity.
- Customer connections. The current codes around individual customer connections needs to be explored such that a single consumer can retain power from their BTM assets whilst the LV network is powered down for repairs/ restoration works.
- Network segmentation. If a community level consumer resilience approach is taken (e.g. consumers on a single street LV cable sharing power), then the broader network operation and codes need to be explored to understand if and how it is possible to achieve this.
- Ownership of assets. Whilst we don't anticipate any dedicated resilience components will be necessary, the need for such (e.g. a resilience control system in a consumers home) could raise issues around asset ownership by networks.
- Distribution of value. The RCR approach will enable networks to be more efficient and reduce both investment and operation costs. There needs to be a fair distribution of this value to all consumers whilst sufficiently incentivising resilience providers.
- Sharing of power between consumers. It is not clear how this might fit within existing supply agreements, and how the flow of power would be managed.

Some of these issues are also being explored as part of other projects, especially where community/ local energy approaches are involved. Perhaps the most relevant is Community DSO by NPG (NIA nearing completion, and submitted NIC).

Commercials

Route To Market

Resilient Customer Response will design and demonstrate demand-side resilience as a novel method of securing network resilience, potentially using a market driven approach. The project will de-risk and accelerate the market readiness for BTM resilience in the UK and the core elements of the concept and research are aimed at creating a scalable and adoptable solution which can be exploited by a range of players alongside all network companies. Key points relating to this are:

- The concept uses existing consumer assets (both current and future deployment) and is therefore driven by the rapid market uptake of these types of assets.
- The project will explore the types of business models which can help deliver the concept with a view to maximising the use of existing and emerging forms of customer propositions to enable a solution which is highly scalable, and applicable to a range of customers with different assets and service models. Alongside this it will provide information on the level of incentives which these models may need to provide to consumers.
- The research will increase understanding of the solution and customers, and provide a sound evidence base so that customers and networks have confidence in the solution and its benefits.

In summary to enable BTM resilience to become BaU in the UK, we will identify the appropriate commercial incentives and arrangements that need to be in place and the associated products consumers will need to engage with, alongside the arrangements for networks to engage with these.

At the Discovery phase, the parties conducting the research and analysis are not focussed on commercially exploiting the outcome of the research. For the Alpha and Beta phases, we anticipate that commercial organisations offering products and services will be involved in the research from a demonstration perspective using a procurement-led approach (to provide value for money for the project and enable open innovation), but that the outputs will be open and replicable to enable an open market for RCR provision. These may include the following routes to market for the BTM resilience developed in RCR:

- Retail tariffs and arrangements to incentivise private resilience investment/ HEMS.
- Network implementation/ adoption arrangements
- Services/ propositions to enable the correct level of control and participation.
- Approaches for regulation and policy development to facilitate widespread adoption.

We believe that all the components for RCR are readily available and it could be delivered as BaU following innovation funding.

Intellectual property rights (not scored)

All project partners will comply with Chapter 9 of the SIF Governance document, with a written agreement forming part of each partner collaboration agreement. Details of the background IP and of the proposed foreground IP will be defined and agreed in the project collaboration agreement and NOA.

Relevant foreground IP of the project will be freely shared to provide stakeholders with the information that they need to make informed decisions.

Costs and value for money

Full Discovery costs are £136,560 + expenses, with £116,389 funding request after contributions. No further subcontractor costs are envisaged. These costs use a bottom-up approach for each work package for each partner, and are scrutinised against industry standards.

The following contributions are included:

- NPG 9.4% contribution to overall costs.
- LCP Delta 5% reduction on commercial rates. LCP Delta's capacity as a lead research and analysis partner brings in extensive expertise and LCP Delta will not be commercially exploiting the IP. Costing is therefore on a consulting basis, with no lasting

commercial value for LCP Delta.

- University of Southampton offering 50% of senior academic advisory time at £0 (£2,750 contribution)

Investment in the RCR Discovery phase will develop a strong business case and set out a clear plan to address the risks and barriers at an early stage. This will also deliver value in future phases of the project by providing a robust platform from which informed investment decisions on further research and deployment can be made at Alpha and Beta Phases.

Cost breakdown:

- NPG -- cost £12,800, funding £0
- LCP Delta --cost £92,430, funding £87,808
- Southampton University -- cost £31,330, funding £28,580

The project represents value for money for consumers by leveraging knowledge from industry-leading project partners with experience and learning from previous and current projects, including:

- NPG bring a detailed understanding of their network operation and resilience and restoration experience. This project aims to deliver new approaches and operational procedures which can be relatively quickly integrated into BaU activities following alpha and beta.
- LCP Delta work regularly with innovators from across the customer proposition space and bring an in-depth understanding of how customers buy and use assets under current and future types of business models and services. Through a range of innovation projects (NIA including Community DSO) and working with other players strategically (e.g. network companies, manufacturers, consumer representatives), LCP Delta brings a large amount of insight to RCR.
- University of Southampton -- demand response randomised control trials (e.g. LCNF funded SAVE project); ongoing studies of heat deferral via smartly controlled heat pumps in highly insulated homes (LATENT); socio-technical and socio-economic studies of mini and micro-grids for 'islanded' communities in East Africa (E4D); ongoing collaboration with New Zealand researchers and innovators in the use of BTM virtual power plants for resilience to natural hazards (earthquakes, storms, floods) and distribution network constraints

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

pdf.pdf

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Resilient Customer Response LCP Delta Report FINAL.pdf

WP2-UoS-Literature-Review-Case-Studies-Final-Clean.pdf

RCR_Project_SIF_S&T_080623.pdf

This project has been approved by a senior member of staff

☒ Yes