SIF Project Registration

Date of Submission

Mar 2022

Project Reference Number

10027180

Project Registration

Project Title

CrowdFlex: Discovery

Project Reference Number

10027180

Project Licensee(s)

National Energy System Operator

Project Start

April 2022

Project Duration

2 Months

Nominated Project Contact(s)

Nina Klein

Project Budget

£206,829.00

Project Summary

CrowdFlex aims to establish residential flexibility as a reliable energy and grid management resource, establishing it alongside business as usual solutions such as network reinforcement or new thermal capacity, using system operational principles to develop a new digital service. CrowdFlex builds on a significant first phase, https://smarter.energynetworks.org/projects/nia2_ngeso001/, which sized the market opportunity and the viability of consumer response.

Preceding Projects

NIA2_NGESO001 - CrowdFlex

Third Party Collaborators

Octopus Energy

Ohme Technologies Ltd

Nominated Contact Email Address(es)

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Problem Being Solved

- Predicting the current and future needs for domestic energy provision for heat, power, and transport, and how flexibility can reprofile these to support the power system. Building on CrowdFlex:NIA (which focused on residential loads and EV demand), this Project will also explore residential heat. CrowdFlex:Trial will assess how the impact of EV charging, heat pumps, and other emerging low carbon technologies on customers electricity bills can be reduced when consumers participate in domestic flexibility.
- Coordinating energy transmission, distribution, and system operation. CrowdFlex partners represent stakeholders across the power system. CrowdFlex aims to develop commercial frameworks to allow the ESO and DNOs to coordinate their needs and transmit them to consumers via effective tariffs.
- Planning future policy, regulatory conditions, and market designs to support whole system approaches. CrowdFlex will identify the market design of flexibility services that coordinate the needs of the ESO and DNOs, while lowering consumers' energy bills. CrowdFlex will align demand to variable renewable energy generation, reducing stress on the transmission and distribution networks.
- Maximising efficiency in large-scale network and system investments by taking a whole systems view across generation and demand side changes linked to decarbonisation. Domestic flexibility will improve the efficiency of existing investments, deferring or avoiding investment in new network and generation capacity. These savings can be transmitted to consumers, reducing energy bills.

Project Approaches And Desired Outcomes

The Big Idea

CrowdFlex:Discovery will define the system requirements, vital metrics and clear hypotheses to be explored in a subsequent, large-scale consumer trial, to establish residential flexibility as a reliable energy and grid management resource. CrowdFlex meets the following SIF aims:

- Through a large-scale trial, we will understand consumers preferences informing future market designs, supporting optimisation across networks and infrastructures.
- Via transactive grid tariffs, we will reduce barriers to entry, empowering domestic consumers to transform the power system.
- Develop designs of commercial frameworks and tariffs coordinating the needsof stakeholders, reducing duplication and complexity in system services.
- Our broad partnership will support improved coordination of emerging innovations across all system stakeholders, from ESO to customer.
- WPD and SSEN participation will ensure strong coordination betweennetworks and other system participants.

CrowdFlex will clarify the role domestic flexibility can play in addressing the system challenge of decarbonisation. It will (a) Clarify the technical potential, repeatability and cost of domestic flexibility; b) Use this to design robust domestic flexibility services that coordinate the needs of stakeholders to support the powersystem and help consumers reduce energy bills and carbon emissions.

CrowdFlex:Discovery will build on CrowdFlex:NIA, which had access to a uniquedataset of households' electricity loads to investigate response to incentives andinformation remedies to elicit flexibility. Using the Agile Tariff, developed byOctopus, and EV behavioural data from Ohme, among other mechanisms,CrowdFlex:NIA proved that domestic flexibility could be a resource of nationalsignificance (7GW demand turn down, and \>10GW up by 2030). CrowdFlex:Discovery will capture the requirements of the ESO and DNOs; identify key technology and consumer behaviour parameters for a trial; and evaluate howthe statistical nature of the resource translates into reliable modelling and robustcommercial frameworks. CrowdFlex will provide data to inform the Virtual EnergySystem (VES), https://www.nationalgrideso.com/virtual-energy-system(https://www.nationalgrideso.com/virtual-energy-system), and the design of consumer-centric digital services to support all levels of the energy system, improvecoordination between the ESO and DNOs, reduce consumer bills and carbonemissions.

No significant IP barriers are foreseen in this phase as end-customer data will not be used. We propose an IP approach like the CrowdFlex:NIA project. Forcustomer data protection, background IP was all aggregated customer statistics. Analysis was performed on aggregated datasets, forming foreground/resultant IP.

This protected customers and fulfilled our obligations, as well as making the key results available as foreground IP.

Innovation Justification

CrowdFlex:Discovery builds on CrowdFlex:NIA, which reviewed preceding projects that explored residential flexibility (see appendix for full details). All of those projects have been trials, where customers are exposed to simulated tests.Trial outcomes may not translate well to a widespread rollout using routine, market mechanisms.

In contrast, CrowdFlex:NIA gained insights on real-time price signals applied to customers via a standard market product, the innovative Agile tariff. It analysed historical household and EV data, from Octopus and Ohme customers, responding to tariff switches and one-off demand turn up/down interventions. Extrapolating the results to Great Britain in 2030, indicated a potential to decrease the GB system demand peak by 10%, or increase demand by a much larger figure.

CrowdFlex:NIA's outcomes were aligned with much of the previous work:

- Customers are highly willing to provide flexibility through EVs,
- Smart charging is vital to avoid new evening peaks,
- Turn-up potential from new low carbon technologies (LCT) is far greater thanturn down potential arising from existing household loads.

CrowdFlex:NIA highlighted unresolved issues to allow domestic flexibility tobecome a reliable service for the ESO or DNOs. This includes: the technology providing demand turn down, the reliability and repeatability of response at system peak, and the impact of automation. It also included questions about customer behaviour: notice periods, the vector for information, asymmetry of response, and price elasticity of response. Coordination of stakeholder needs via effective tariffsalso needs resolving.

CrowdFlex:NIA showed that domestic flexibility is not yet a business-as-usual(BAU) activity. The reliability and repeatability of response is critical to establishing residential flexibility as a viable BAU option for DNO and ESO. The Agile tariff explored household response to wholesale price variations, but the response to capacity and network limits remains untested. Wholesale price spreads (exploitedby Agile) are insufficient to drive widespread uptake. Balancing services, network avoidance, and capacity benefits will need to be valorised, but this has not been demonstrated to date in domestic flexibility offers.

Funding is required to design and deploy a truly innovative large-scale trial that will prove how domestic flexibility could provide a reliable, system critical energy service. Until this is established, domestic flexibility -- providing the range of system services identified above -- is not BAU and cannot be funded by the price control mechanism. This will be reflected in cost effective offerings to consumers, reducing bills and carbon emissions.

Project Plans And Milestones

Project Plan And Milestones

CrowdFlex:Discovery will be completed in five distinct work packages (WP), each with learning outcomes feeding into a final report in WP5, reporting the findings in an outline specification of the trial. The primary aim of CrowdFlex:Discovery is to outline the specification of a trial to explore the potential and structure of domestic flexibility (with aim of the specification to be designed in detail in the Alpha stage and carried out in the Beta stage of funding). To be successful such a trial will have to draw on the findings from each work package from CrowdFlex:Discovery.

WP1: Capture requirements of ESO & DNOs

Learning Outcomes:

- *List of the requirements the ESO & DNOs have for a digital service that leverages domestic flexibility.*
- *Understanding of howthe service must be coordinated to ensure the needs of the ESO and DNOs align.*

WP2: Identify key trial dimensions, leveraging CrowdFlex:NIA

Learning Outcomes:

- *Deliver the hypotheses to be tested in CrowdFlex:Trial and the dimensions (across technologies, price signals, etc.) which need to be explored do this.*

WP3: Clarify the impacts of the statistical nature of the domestic flexibility

Learning Outcomes:

- *Understanding of the statistical approach required for quantifying domestic flexibility and implications for trial design.*
- *Methodology to incorporate a statistical approach to flexibility into a service provided by energy stakeholders, which are conventionally deterministic.*
- *Structure the reporting of domestic flexibility must have to become an input into the VES.*

WP4: Clarify the services that could allow monetisation of domestic flexibility

Learning Outcomes:

- *Structure of the digital energy service that would leverage domestic flexibility.*
- *Methodology for incorporating such a structure into the design of CrowdFlex:Trial.*

WP5: Outline specification of the trial
Learning Outcomes:

- *Reporting of the findings in CrowdFlex:Discovery.*
- *Outline specification for CrowdFlex:Trial to be detailed in the Alpha stage.*

CrowdFlex:Discovery will have one milestone, which is the delivery of the project report (WP5). This word report will capture the findings from CrowdFlex:Discovery and will provide a high-level specification for a trial. There will be a final project meeting to agree how to take CrowdFlex:Discovery forward to the Alpha stage to realise the vast potential of domestic flexibility for the whole system in the form of a large-scale trial.

Route To Market

CrowdFlex includes stakeholders from across the energy system. This is essential to transition domestic flexibility to business as usual (BAU), ensuring the needs of all parties are coordinated. Stakeholders include:

- ESO: familiar with designing services to balance supply with demand.
- DNOs: focus on ensuring the demands on their networks do not exceed their capacities.
- Suppliers: track records of innovation, offering dynamic tariffs with EV connectivity to customers.

CrowdFlex uses a Whole System perspective to ensure domestic flexibility services align the needs of all parties.

A key learning outcome of the overall CrowdFlex programme is to prove the reliability of the provision of domestic flexibility. This will enable stakeholders to place a value equivalent to that of traditional services and establish domestic flexibility as a viable option under BAU.

A second key learning outcome to allow CrowdFlex to transition to BAU is to develop commercial frameworks that lead to reliable services. The results from the trial quantifying both the technical potential and the statistical nature of flexibility will feed into National Grid ESO's VES. This strategically important modelling asset will allow the ESO to understand and predict domestic loads with greater reliability, higher temporal and spatial resolution. It aims to inform stakeholders how to deploy domestic flexibility services (developed from CrowdFlex) most effectively to benefit all stakeholders in the system.

As a digital service, the techniques developed in CrowdFlex would be readily transferrable to other markets and jurisdictions, facilitating worldwide exploitation. CrowdFlex is led by National Grid ESO. It has the facilities to roll-out this innovative service across GB following the Beta phase, replicating the learnings from partnering with a DNO to all DNO regions. Octopus are a key partner, with track record of innovating in UK and exporting their successes abroad (e.g. Octopus Germany). They can provide key learnings from their previous experiences in facilitating international expansion of innovation.

As the LCT market rapidly grows, so will the opportunity to automate those loads. Ohme's smart charging platform enables direct communication with customers as well as the ability to automate EV loads to ensure customer needs are met while lowering energy bills and emissions. These capabilities are geography-agnostic. This has the potential to further improve the commercial case and reliability of flexibility services and will be explored further in the overall CrowdFlex programme to understand how automation can increase the utilisation of domestic flexibility in a BAU scenario.

Costs

Total Project Costs

206830

SIF Funding

70057

This project has been approved by a senior member of staff

☑ Yes