SIF Alpha Project Registration

Date of Submission

Oct 2022

Project Reference Number

10037410

Project Registration

Project Title

Crowdflex: Alpha

Project Reference Number

10037410

Project Licensee(s)

National Grid Electricity System Operator

Project Start

Aug 2022

Project Duration

6 Months

Nominated Project Contact(s)

Dozie Nnabuife dozie.nnabuife@nationalgrideso.com

Project Budget

£606,196.00

Funding Mechanism

SIF Alpha - Round 1

SIF Funding

£499,919.00

Strategy Theme

Flexibility and market evolution

Challenge Area

Whole system integration

Project Summary

CrowdFlex will meet the aims of the SIF Innovation Challenge by establishing domestic flexibility as a novel, reliable flexibility resource of national significance, alongside BAU alternatives in system balancing services, generation capacity or network reinforcement.

- By offering consumers simple and effective incentives, reflecting whole system challenges (e.g. grid responsive tariffs), it will reduce complexity, bureaucracy and barriers to entry for aggregators to deliver domestic flexibility.
- This will improve coordination between networks and other system participants, building on the work of the ENA Open Networks Project.
- By trialling consumer interventions (financial and informational) targeting different system challenges, CrowdFlex will clarify consumers' preferences and inform future market designs.
- Initially, by derating the stochastic portfolio capacity, it will overcome barriers to enable domestic flexibility to participate in deterministic energy markets and flexibility services. In parallel, CrowdFlex will develop innovative approaches that deliver domestic flexibility stochastically improving coordination of emerging innovations across the system.

CrowdFlex will work to address these challenges, offsetting system peak increases, which are projected to increase 19% between 2020-2030 (Consumer Transformation, FES 2021), with an unprecedented resource of domestic flexibility (~7GW turn-down, and >10GW turn-up). ESO and DSOs could use domestic flexibility to address a host of operational challenges, across reserve, energy balancing, addressing network constraints as well as supporting capacity and network investment planning.

Network innovation is central to CrowdFlex. It covers key network load growth challenges as heat and transport decarbonisation, addressing baseline load and flexibility. By trialling fully system transactive tariffs, including load reshaping and system stress events, CrowdFlex will support network planning and investment decisions. Similarly, investigating responsive load management will improve the economics of existing network assets and target future network and system investments.

Discovery confirmed the value of domestic flexibility and improved visibility of baseline demand, and the need to address constraint costs. It identified that portfolios would initially be declared as firm capacities, but a spectrum approach would also mature novel and more valuable stochastic services.

CrowdFlex brings together partners spanning the energy system, best placed to address whole system challenges in the following ways:

- NGESO are the ESO for the entire of GB. They design and procure flexibility services, balance energy following gate closure, and model demand and generation in the FES to plan capacity and network infrastructure investments.
- Octopus are an energy supplier with a focus on renewable energy and offering their customers innovative tariffs and services to encourage the uptake of flexibility.
- CNZ provide world-leading expertise in their modeling capabilities, data science, and consumer engagement work. As CrowdFlex seeks to mature stochastic nature of domestic flexibility, they're expertise will be crucial to model this.
- SSEN and WPD are DSOs with >1GW of combined flexibility services contracted. The DSOs will provide detailed insight into the their needs and steer on how the conflicts between the needs of ESO and DSOs can be avoided/mitigated.
- Ohme are a home EV CPO providing smart charging and flexibility services. They are experts in consumer segmentation and have experience in providing domestic flexibility via EV charging.
- Element Energy are a leading low-carbon energy consultancy. They work across all major low carbon energy sectors, bringing together the different levels of the power system explored in CrowdFlex. They have supported CrowdFlex partners in the previous phases of the project.

CrowdFlex aims to develop novel flexibility services and modelling, and evidence delivery reliability to solve whole system challenges. ESO/DSOs can use this innovation to reduce operational costs and reduce capacity and network investments. The system savings from ESO/DSOs and a proportion of the revenue from flexibility services will be passed down to consumers, reducing their energy bills.

Project Description

CrowdFlex is a study to understand the role domestic flexibility can play in addressing the system challenge of decarbonisation. As more VRE and LCTs are added to the network, it will become increasingly difficult to balance supply and demand. Domestic flexibility provides a huge opportunity during this transition to build a smart flexible energy system by enabling consumers to act as a new source of flexibility. CrowdFlex explores how domestic flexibility can be utilised to align demand to generation, improve coordination across the network, reduce stress on the system, while reducing consumer energy bills via new tariffs and incentives. The objective of CrowdFlex is to establish domestic flexibility as a reliable energy and grid management resource, providing it alongside BAU solutions such as network reinforcement or new thermal capacity.

Currently, flexibility services are procured deterministically, contracting a firm capacity, reflecting the operation of large thermal generators. However, domestic flexibility is inherently stochastic. Therefore, to participate in flexibility services, declaring a firm capacity means a derating of its potential flexibility capacity. This leads to lost flexibility and the need to over procure to ensure delivery. CrowdFlex will investigate the potential advantages of moving to a novel innovative method of procuring flexibility stochastically, via a Probability Distribution Function. This will be reflected in a spectrum approach to flexibility services. CrowdFlex will investigate how domestic flexibility can be rolled-out in the near term through deterministic flexibility services, helping accelerate decarbonisation and minimising costs, while also develop pathways to introduce stochastically procured flexibility services, unlocking more value for the whole system.

CrowdFlex aims to conduct a large-scale trial in parallel to developing a methodology to model domestic flexibility. A trial will be essential to fully understand the potential of domestic flexibility and its technical capability to deliver flexibility services. A model of domestic demand and flexibility is necessary to forecast baseline demand and the availability of assets to offer flexibility services. This will be part of the VirtualES ecosystem, improving demand-side visibility and so the operational and planning activities of ESO and DNOs.

If successful, CrowdFlex has the potential to deliver value across the energy system. Enabling ESO and DNOs to utilise domestic flexibility to reduce operational costs (namely constraints, reserve, and energy balancing) and capacity and network reinforcement investments. This will lower consumer bills and support the deployment of VRE and uptake of LCTs, accelerating whole system decarbonisation.

Add Preceding Projects

NIA2_NGESO001 - CrowdFlex

10027180 - CrowdFlex: Discovery

Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

Project Approaches And Desired Outcomes

Innovation Justification

CrowdFlex addresses several Whole System challenges; as more variable renewable energy (VRE) generation comes online, the power system must develop the residential sector as a large and deep source of flexibility. Similarly, domestic flexibility is vital to limit the adverse impacts of the rollout of low carbon technologies (LCTs). Without this nascent but large resource, supply and demand side challenges would require uneconomic generation capacity and network investments, significantly raising consumer bills. Domestic flexibility could reduce the energy sector's reliance on large-scale thermal generation during peak times, times of low VRE generation, and for flexibility services. By accounting for households on ToU tariffs with reduced demand in the evening peak into network planning, TSOs and DSOs can plan their investments more intelligently, minimizing unnecessary upgrades.

CrowdFlex will innovate the energy system by accelerating the transition of flexibility away from large, individual, generating assets to small, aggregated, demand side assets, removing the barriers to enable aggregated assets of a stochastic nature to enter deterministic flexibility services. It will develop digital forecasting tools for domestic demand and flexibility to permit all stakeholders to more accurately determine system needs improving existing network operation. CrowdFlex will clarify how to incentivise domestic flexibility most effectively. CrowdFlex will also design an approach for the development of new flexibility services that procure flexibility stochastically, via a Probability Distribution Function (PDF). This would be completely novel and require close collaboration with system operators.

CrowdFlex:Discovery was preceded by CrowdFlex:NIA and the Domestic Reserve Scarcity trial (DRS), which measured the technical potential of domestic flexibility and the expected turn-out based on Octopus' customer base. CrowdFlex:NIA demonstrated that consumers could be influenced by financial incentives, reducing their demand during the evening peak following a switch to a ToU tariff and the ability to provide a one-off response to information remedies. DRS collected useful data on consumer response to financial incentives and information remedies, which will feed into the design of the CrowdFlex trial. It examined 5-10 events over a short period, without knowledge of the technology participating and only considering the needs of ESO, without coordination with DSOs. Neither study demonstrated the ability to solve "whole system issues", by delivering flexibility services, or whether flexibility can be procured on a commercially viable basis. CrowdFlex: Alpha and Trial will plan and carry out a trial to prove the viability of domestic flexibility for a range of system needs, including new stochastic flexibility services, meeting the needs of ESO and DSOs, not yet considered in any related project.

Domestic flexibility will struggle to make a large-scale impact without being utilized to its full potential via CrowdFlex. Delivering innovations in domestic flexibility will reduce consumer bills by redirecting system operational and network and capacity investment savings back to consumers. The impact of not understanding the full potential of domestic flexibility would lead to continued reliance on large, more carbon-intensive flexible assets, especially during peak times and for flexibility services such as the capacity market. It will inevitably reduce the speed of grid decarbonization, delaying the roll out of LCTs, as the TSO and DSOs complete large and expensive network upgrades.

Until the capability of this nascent resource is proven, it is unlikely to attract significant investment and cannot be funded by the price control mechanism. Similarly, proof of the capability of the asset class is needed, so that ESO/DSO can develop tools and services that can fully exploit and monetise it. To prove domestic flexibility could provide a reliable service, a large-scale trial is needed and innovation funding is required to support this.

Benefits

The domestic flexibility resource unlocked through CrowdFlex would generate value across the power system, both operationally as well as through more efficient strategic planning. These savings across the ESO, DSO and energy markets, represent multiple components of consumers electricity bills. By including ESO, DSO and an energy supplier, the project can leverage whole system savings and has a route to passing these savings onto customers.

Following Discovery, we have updated our CBA model. This update includes amending the potential revenue streams to account for services that were originally excluded from consideration, but following discussions with the NGESO and the DNOs, should be included. Savings include wholesale arbitrage, reduced balancing costs, reserve, congestion management, and network and capacity investment avoidance costs. We believe our CBA is conservative, and there is significant upside, for example to reduce ESO Constraint costs.

The potential revenue streams of domestic flexibility through existing energy markets and flexibility services are as follows:

- Redispatch avoidance - £105/kW/yr (Element Energy analysis based on FES 2021),
- Wholesale arbitrage - £85/kW/yr (daily 4h price spread based on 2021 data),
- DNO network reinforcement - £64/kW/yr (Element Energy analysis),
- Balancing Mechanism - £47/kW/yr (Element Energy analysis),
- TSO reinforcement avoidance - £37/kW/yr (Element Energy analysis based on FES 2020/21),
- Capacity Market - £12/kW/yr (2021 T-4 clearing price; a conservative value lower than Cost Of New Entrant),
- Operating Reserve - £1.4/kW/yr (Element Energy analysis).

Before Discovery, CrowdFlex:NIA outlined the technical potential of domestic flexibility. The outputs from NIA were applied to the updated revenue streams from Alpha and extrapolated to model the uptake of domestic flexibility following the trial. With 60% of GB EV-owning households participating in domestic flexibility, as CrowdFlex becomes BAU, the value of flexibility could be worth £1.25Bn/yr to the end consumer across GB when the cost of providing flexibility services is accounted for. This includes £3.8Bn of avoided DN reinforcement and £2.2Bn of avoided transmission network reinforcement investments between 2024-2050. Such value far outweighs the estimated £10-15M trial cost to establish a domestic flexibility resource. If initially 100,000 customers begin participating in domestic flexibility in 2024, growing out to 2050, The potential IRR of CrowdFlex is 324%.

CrowdFlex will help accelerate decarbonization, reducing the need for VRE dispatch to be compensated with thermal generation on the other side of constraints and will reduce peak demand met with thermal generation. This equates to 4.6MtCO2eq/year of avoided CO2 emissions, assuming peak demand is met with additional OCGTs. In addition, CrowdFlex will relieve load from the DN encouraging the uptake of LCTs. These factors will play a crucial role in shifting the grid to a decentralized smart energy system, vital if National Grid ESO are to achieve zero carbon operation by 2025 and a decarbonized grid by 2035 as well as the Government's ambition for Net Zero by 2050.

Passing all these system savings onto customers has the potential to reduce consumer electricity bills by up to 11% and reduce CO2 emissions related to their electricity use by 17%. This equates to approximately £137 in bill savings and 0.25tCO2eq of avoided emissions per consumer per year. Over a 20-year lifetime of a household, this could lead to bill savings of £2,750 and an emission avoidance of 5.3tCO2eq.

To track the benefits of CrowdFlex throughout CrowdFlex:Alpha, Trial and beyond, several metrics will be monitored.

- Per household metrics: Revenue £/year per asset type. Volume activated kWh/year. Diversified peak reduction kW/house (avg).
- Specific metrics: £/kW/year and £/kWh/year to compare to BAU technologies and GB potential.
- Asset declaration metrics: Derating value; statistical metrics for PDF declaration.

Risks And Issues

The appendix includes a risk register, some examples are below:

- the number of dimensions required for a trial and the need to rationalise these – managed by applying techniques already used by consortium members in previous trials.
- the tension between delivering early revenues while maturing the stochastic approach to flexibility that places proper value on the asset – our "spectrum" approach to service provision helps manage this.
- The stage of development of the VirtualES – which provides an opportunity to shape and refine VirtualES to meet the needs of domestic flexibility.
- Process for service stacking to solve whole system issues is still not mature – a WP dedicated to this and leveraging prior work is included.
- The stochastic nature of the asset will impact derating for determination of capacity – the spectrum approach to service provision mitigates this, as well as the impact of regulatory approval that might be required to mature this service.
- Trial project will involve homeowner data, and there is a risk of this being released/used in unapproved way – consortium is well experienced in handling consumer information and complying with GDPR regulations.
- Alpha phase may require in person meetings – but progress on NIA, DRS, and Discovery projects primarily through virtual meetings means any travel based emissions will be kept to a minimum.
- As energy prices are always a concern – our project will work to reduce these, we rate the level of political risk as low.

We will update the risk register regularly and treat this as a live document. We plan to have bi-weekly PM meetings where potential risks are discussed, and ongoing risks are updated. The consortium has experience of working together and has a sound approach to sharing risk concerns as a means of addressing them.

We expect that our risk management approach set out above will ensure that we can reduce both the likelihood and impact of all risks.

Our highly innovative and game-changing project, is built on foundations of strong experience and delivery; with examples including CrowdFlex:NIA and Domestic Reserve Scarcity trials. As a result, we are confident that we can aim high, manage risks as they emerge and deliver on our ambitious work programme.

The spectrum approach to exploring a range of deterministic and statistical service improves confidence in the services and revenues available to domestic flexibility in the near term, ensuring it can be rolled out quickly and effectively to provide flexibility. It also lays out a long-term pathway to introduce a stochastic approach to flexibility, which would provide system savings for all stakeholders for procuring and providing services via a PDF approach

No significant IP barriers are foreseen in this phase. Our work programme ensures that contained within each WP are Partners bringing their own background IP and developing foreground IP.

Individual end-customer data will not be used. We propose an IP approach like the CrowdFlex:NIA project. For customer 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. When developing a baseline approach that can be accessed by third party aggregators and system operators we propose a federated learning approach, which will allow parties access to the aggregated data of consumers while following GDPR.

Project Plans And Milestones

Project Plans And Milestones

CrowdFlex has the resources required to develop and carry out a trial on domestic flexibility because the consortium represents the interests of stakeholders from across the power system: ESO, DSO, suppliers, LCT technology providers, consumer focused groups, and experienced analysts/modellers. The consortium includes experts with decades of experience working in the residential energy/flexibility sectors, and with recent experience of scoping and delivering trials of residential consumer flexibility.

Alpha will have dedicated work packages to identify knowledge gaps and opportunities to exploit. This spans: a strategic view of energy system needs; novel services that exploit the stochastic nature of domestic flexibility; operational and revenue modelling; consumer segmentation and behaviour; hardware/software requirements.

The criterial for successful outcomes for CrowdFlex are:

- It clarifies how to cost effectively incentivise domestic flexibility, improve accuracy of predicting response, and removes market barriers to providing a novel and deep asset class to solve existing and future Power System challenges.
- It will encourage the development of commercially-driven incentives that drive large-scale participation of domestic assets across multiple flexibility services.
- Domestic flexibility would be considered alongside BAU solutions such as network reinforcement or new thermal generation capacity, creating savings across the power system.

To achieve these primary outcomes there are a number of interim/additional goals:

- ESO will develop their understanding of the stochastic nature of domestic demand and flexibility, and work towards establishing new stochastic services that fully value this asset class.
- CrowdFlex: Alpha will design a trial that will be establish the technical potential, expected turn out and respective services that domestic flexibility can provide.
- Outcomes from CrowdFlex will directly feed into the VirtualES ecosystem, both in terms of structuring the model and the data that can populate it. By doing this, VirtualES will better respond to system needs and commercial imperatives, to improve demand and flexibility visibility on the system.

CrowdFlex: Discovery was successful in delivering the final report on time. We were flexible in accommodating some timeline shifts due to Easter holidays and delivered all outputs on time and to specification. CrowdFlex: Alpha will be project managed in a similar manner to ensure this high level of delivery is maintained.

ESO will serve as overall project manager and EE/OE/CNZ as WP leads. As with Discovery, we will have biweekly project management meetings with key project partners in line with an agile approach to working. This will ensure that all tasks are on track to be delivered on time and offer support where constraints may arise. It will support sharing learnings across WPs to stay focussed on delivering whole system solutions.

CrowdFlex: Alpha has a detailed project plan which defines the deliverable/task lead partner and supporting partners, with responsibility reflecting experience and capabilities. The work programme and effort tables for Alpha have been extensively reviewed by make sure that all WPs are properly resourced and scoped before they commence to ensure timely delivery is possible.

We expect there to be 3 payments aligned with delivery of milestones, as per project plan, see annex

We have submitted our detailed project plan in the appendix.

CNZ have joined the CrowdFlex consortium for Alpha. They provide world-leading expertise with their modeling capabilities, data science, trial design, and consumer engagement work. CNZ is founded by Octopus, who will remain a central part of the consortium as the commercial delivery partner.
Such a consortium strengthens the ability to influence the future design of the energy system, bringing together partners from every level of the energy system. We have a dedicated work package to ensure learnings from Alpha will be shared amongst the industry (WP11).

Regulatory Barriers (Not scored)

The CrowdFlex consortium have identified the regulatory barriers which may hinder the delivery of your Alpha or Beta Phase, and how

they may be addressed to ensure success for the project. For some domestic assets, it is likely there will be a need to meter consumption at an asset level when measuring the response from domestic assets. If so, CrowdFlex will need to identify if MID approved meters are necessary. CrowdFlex will need to calculate whether the need to use MID approved meters is cost prohibitive for domestic flexibility. If so, we may need to explore if a derogation is possible.

Alpha will explore whether sufficient revenue can be extracted from the existing set of flexibility services, or if they underestimate the true value of domestic flexibility. It may be that new services may need to be developed, or that flexibility may need to be declared in a new way, which might require derogation from consumer regulation. For example, while network access is guaranteed to domestic customers, if customers wish to exploit the nascent flexibility of residential assets, this might require limits to be placed on network access, akin to a “fair use” policy.

While ToU tariffs are expected by many stakeholders to be required in a transition to Net Zero, a customer moving to a ToU tariff while persisting in “passive” consumption patterns will likely to be economically disadvantaged. CrowdFlex will be mindful of the need to deliver value while protecting customers who may find it difficult to transition to more agile behaviour.

Similarly, CrowdFlex has laid out how it will address longer term regulatory barriers. Primarily, a new stochastic flexibility service procured as a PDF would not be BAU for ESO in their system operations and would require significant divergence from the current method they use to procure services, as a derated firm capacity. To facilitate this transition, CrowdFlex:Alpha will conduct a deep dive with the ESO/DNOs into why BAU procures a deterministic capacity, whether it is historical or due to regulatory/policy requirements. CrowdFlex will also understand NGESO’s current use of statistical processes, such as determining the volume of ORR required for undersupply or forecasting VRE generation. We accept that in the short term it is likely that flexibility services will remain deterministic, therefore CrowdFlex will explore how stochastic assets such as aggregated domestic flexibility can be collapsed to a derated firm capacity for participation in these services. However, it will lay out an approach to establish a new stochastic flexibility service where flexibility is procured via a PDF to encourage ESO to innovate the way they procure services, providing system savings. In discussion with BEIS and Ofgem on this matter, they highlighted that the legacy performance of deterministic procurement of service made it currently preferable for ESO.

The policy considerations for longer term implementation of CrowdFlex include those surrounding ToU tariffs, which are a likely tool to incentivise customers. This may extend to incentivising consumer to serve the needs of the DN. The needs of the DN will be highly locational and temporal, therefore the impact of subjecting customers to different ToU tariffs across different locations might have regional impacts. The effect of these regional impacts must be considered, especially on vulnerable and low-income consumers with low flexibility potential. CrowdFlex will need to consider if there are policy/regulatory barriers to introducing locational elements to TOUTs, how they might impact consumers, and if so, what non-TOUT approaches should be considered to incentivise DNO flexibility.

Business As Usual

CrowdFlex aims to develop domestic flexibility as a viable BAU competitor to traditional alternatives, to deliver a reliable, affordable and lower carbon energy system. CrowdFlex will:

- facilitate new statistical approaches to flexibility services, through exploring the stochastic nature of domestic flexibility,
- increase confidence in the reliability of domestic flexibility to meet whole system needs, through a real-world trial,
- enable accurate data-driven service provision, system operation and network planning, through statistical modelling.

As evidenced by the broad CrowdFlex consortium, these project learnings are of interest to actors across the energy sector:

- ESO and DSOs: wanting to design and operate lower cost and lower carbon flexibility services to balance the system and manage network capacities reliably.
- Suppliers and Aggregators: wanting to offer flexibility services which meet system needs and also deliver savings to consumers, support system decarbonization, and earn revenues.

CrowdFlex will support wider adoption by undertaking CBA assessments to make the value case for domestic flexibility and by providing trial evidence and modeling approaches to increase operational confidence in domestic assets. These learnings will be disseminated during the project through specific engagement activities with wider industry stakeholders, especially other DSOs/Suppliers/Aggregators, supported by the CrowdFlex consortium, and through publicly publishing reports and presenting at industry forums.

The BAU adoption approach for ESO and DNOs is to continue to involve markets and operational teams in project design so their interests are addressed. By gathering technical and commercial evidence from trials and modelling, teams can be confident system needs will be reliably and commercially met; seeing the benefits they will want to quickly implement into BAU activities. Through ongoing market development work, they will remove barriers in existing services or develop new technology-neutral services to enable

BAU adoption of domestic flexibility services. They will use existing system operation tools and data interfaces, or scale up new capabilities used in trials, through ongoing system transformation work.

The ESO innovation team successfully delivered £7.3Mn funding across 32 individual projects in 2020-21 and integrated projects into BAU activities, such as a machine learning solar forecast now used in the control room. Project are embedded in the business through a partnership model. CrowdFlex will engage the Market Development and National Control Future Design teams who are responsible for rolling out market/operations developments and can incorporate innovation findings into ongoing transformation work.

The DNO partners are motivated to access domestic flexibility as BAU because this significantly progress this DSO ambitions set out in their DSO Action Plans. Their innovation teams will contribute integration knowledge from past flexibility projects and engage SMEs from the DSO Transition and Flexibility Services teams to ensure new domestic flexibility services aligned with existing processes. Both WPD and SSEN currently use the Flexible Power platform to deliver services, so this will be used for the CrowdFlex trial to ensure domestic flexibility can smoothly transition to BAU.

During the project CrowdFlex will specifically engage policy and regulatory colleagues to identify potential blockers to BAU adoption. Areas of discussion may include statistical-type approaches to services, barriers in current services and incentives for providers to submit forecast data.

Crowdflex plans to use SIF Alpha/Beta funding to prove the pre-commercial case for all partners. BAU implementation in transformation work for ESO and DNOs would require further network innovation funding or Business Plan funding commitments. Suppliers/Aggregators may require further energy innovation funding for technology cost reduction and scale up, but will eventually receive payments for service provision which covers delivery costs, provides revenues and is shared to give consumer savings.

Commercials

Commercialisation

CrowdFlex will mature a large, nascent and underutilised resource of flexibility. By doing this it increases choices for power system and network operators, and massively increases liquidity and options in energy markets.

By driving innovation, the project will improve competition in markets, driving down costs through a new flexibility resource. At its core, CrowdFlex will remove barriers and show how residential customers can actively participate in, and benefit from competitive energy markets.

The project is expected to deliver useful system outcomes without revision to regulation. A spectrum approach will explore deterministic services alongside how novel services could fully value residential flexibility based on the stochastic nature of the asset. Such a novel service would be open to all technologies. Alpha will publish findings, e.g. on service prioritization rules, that will support market entry and increase volume.

The products and services CrowdFlex will create will bring value across the whole energy system, reducing capacity and operational reserve requirements, reducing generation and T&D network costs, and participating in energy markets. CrowdFlex will identify how to remove barriers to residential assets providing flexibility services; hence reducing operational costs, leveraging wholesale arbitrage, mitigating VRE redispatch, and network costs in constrained areas – which benefits ESO/DNOs by enabling the value of residential flexibility to provide whole system response. It will also evaluate the provision of firm flexibility capacity, which will improve system planning and investment decisions. Furthermore, improved baseline demand visibility and access to intraday balancing would reduce the imbalance charges incurred by energy suppliers.

The primary beneficiaries of the outputs from CrowdFlex:Beta will be residential customers who will be able to reduce their energy bills. For Alpha, the Aggregators of domestic assets would be the prime customer of the innovation. Alpha will show what assets they can operate (on behalf of residential customers), what is the services that can be purchased. Aggregators would develop a portfolio of residential demand assets. Responding to the forecasted requirements of the ESO/DSO, they can create a real-time optimised schedule to deliver flexibility services. Aggregators would be paid by ESO/DNO for service delivery, earn revenues from wholesale arbitrage, etc. Aggregators would be responsible for passing on the revenue to consumers, for entering their assets into the domestic flexibility resource. The ESO and DSOs are primary beneficiaries for this innovation. Residential assets represent an enormous and largely untapped latent resource that could reduce system operational and capacity and network investment costs.

Alpha can leverage the lead that the UK has in market based energy services, and apply learnings to other technologies, households, energy services and markets worldwide.

The CrowdFlex consortium recognises the need for diverse partnerships to solve whole system problems. The current consortium has the diverse perspectives required to deliver the planned outcome. Given its importance, we have a dedicated work package to review electrified heating as part of CrowdFlex. If we find including this as a trial technology will be additional to other projects, then CrowdFlex expects to have additional partners join the consortium.

Commercial partners are leveraging revenue from existing businesses (across suppliers, tech providers, and consultancy) to co-invest in maturing residential flexibility via CrowdFlex. Partners also have assets in the form of residential behaviour datasets that will be leveraged, subject to GDPR.

Investment needs templates were not required, as partners are not seeking investment to develop this specific innovation given its early stage and high-risk nature. They plan to use existing investments and R&D budgets, innovation funding, and eventually commercial revenues.

Intellectual Property Rights (Not scored)

The CrowdFlex consortium partners will comply with the default IPR conditions in Chapter 9 of SIF Governance Document. Partners have identified background IP they expect to use in Alpha and possible foreground IP that may arise. Network partners have confirmed that they do not see any IP related constraints or concerns regarding CrowdFlex. Where necessary, legal teams from consortium partners will engage to confirm details of these arrangements prior to beginning the alpha project.

ESO will publish project reports publicly on ENA Smarter Networks Portal. These will not include any commercially sensitive market information or any Critical National Infrastructure sensitive operational information. Where findings in reports are based on ESO data, this data will already be in the public domain and reports will be fully publicly accessible to share learnings widely.

The findings generated will be statistical-type approaches for flexibility, specific insights output from data analysis and literature reviews, a trial design, and a model specification; with IP ownership as set out in Chapter 9. These output findings will be included in the publicly published report.

Where findings in the report are derived from Background IP of project partners, e.g. models, data or technologies, this background IP will not be included in the report or made publicly available in order to protect the IP rights of project partners as set out in Chapter 9.

Costs and Value for Money

All costs are labour needed to deliver project outputs. The team ensured costs are in proportion to the work done, as all partners have allocated costs based on WP content and timelines.

The costs compare favorably to normal industry rates. Element provided a reduction on commercial rates for innovation work; CNZ are a not-for-profit organization which lowers rates, the ESO and DNOs have benchmarked pay approved by Ofgem and Octopus and Ohme have rates competitive with other innovative businesses. CNZ, added to the Alpha consortium, will be taking forward work Octopus initiated in Discovery. In Alpha, costs are redistributed from Octopus to CNZ, representing better value for money as CNZ is a not-for-profit organization. CNZ's preferred approach is to hire staff for Crowdflex work, however, if this is not entirely possible (e.g. due to part-time roles) contractors may need to be used on a part-time basis.

CrowdFlex aims to develop and test domestic flexibility services and modelling capabilities. Currently there is no clear route to utilize domestic flexibility services at scale. Without innovation funding support ESO and DNOs would continue to focus on traditional sources with a clearer business case. This innovation is required to test approaches which are higher risk but have potential to add value and transform BAU activates. In Crowdflex CBA assessments provide evidence of value and the model and trial provide evidence of delivery results. Therefore, with innovation funding CrowdFlex could progress domestic flexibility to act as a viable and competitive alternative to traditional sources of flexibility within the ESO/DSOs' BAU operations, to generate savings across the system and accelerate energy system decarbonizationTherefore, funding the project represents good value for money for consumers

If CrowdFlex is not taken forward, multiple benefits will not be realized.

- General market reform work would continue, but it would be very unlikely to enable domestic flexibility. It is an inherently different resource (stochastic/distributed), so existing technical/commercial/framework barriers would remain. Without domestic flexibility participating, system balancing and network management costs could increase.
- Modeling to forecast domestic flexibility would be unlikely to be undertaken, as it is not currently a commercial resource. Even it if were, the outputs would remain private to the organization; so the benefits of improved forecasting could not be leveraged by other system actors.

CrowdFlex cannot be funded under BAU as it is not in the ESO and DNO Business Plans and is too high risk for BAU funding. Only once domestic flexibility has been de-risked and proven to be commercially competitive can BAU funding be used. Other innovation funding, such as NIA, is not large enough in scale to fund multiple partners for a large-scale trial as envisaged for Crowdflex Beta. This is why the SIF funding route has been utilized.

Overall, without SIF funding the project could not go forward and SIF funding is the most appropriate route to unlock the value domestic flexibility for the system and consumers, through this innovation project work.

Supporting Documents

Documents Uploaded Where Applicable

Yes

Documents:

SIF Alpha Project Registration 2022-10-18 4_19

CrowdFlex Alpha - Show & Listen - 191022 - FINAL.pdf

CrowdFlex Alpha - D1.1 - Current & future system needs - 31.10.22 - FINAL.pdf

CrowdFlex Alpha - D1.2 - Statistical-type approaches, value, and recommendations - 31.10.22 - FINAL.pdf

CrowdFlex Alpha - D3.1 - Learnings for trial design - 31.10.22 - FINAL.pdf

CrowdFlex Alpha - D2.1 - Priority Consumer Segments and Questions to Trial - 03.11.22 - FINAL.pdf

CrowdFlex Alpha - D2.2 - Delivery approach for consumer engagement for trial - 31.10.22 - FINAL.pdf

CrowdFlex Alpha - D4.1 - CrowdFlex Trial Services - 21.12.22 - FINAL.pdf

CrowdFlex Alpha - D5.1 - High-level functional specification for CrowdFlex trial technologies - 30.12.22 - FINAL.pdf

CrowdFlex Alpha - D6.2 - Plan for Incentives to Trial - 23.12.22 - FINAL.pdf

CrowdFlex Alpha - D8.1 - Use Case Approach and Justification - 23.01.09 - FINAL.pdf

CrowdFlex Alpha - D8.1 - Use Case Approach and Justification - 23.01.09 - FINAL.pdf (1)

CrowdFlex Alpha - D6.1 - Operational Revenues - 23.01.17 - FINAL.pdf

CrowdFlex Alpha - D7.2 - Flexible heat roadmap for trial - 23.01.13 - FINAL.pdf

CrowdFlex Alpha - D7.1 - Trial Specification and Delivery Approach - 23.01.30 - FINAL.pdf

CrowdFlex Alpha - D8.2 - Model Specification and Delivery Plan - 23.01.31 - FINAL.pdf

CrowdFlex Alpha - Lessons Learned.pdf

SIF Alpha Project Registration 2024-02-20 10_56

This project has been approved by a senior member of staff

☑ Yes