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CrowdFlex Closure Report

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NESO
National Energy System Operator

CrowdFlex Project Partners

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Contents

Executive Summary

CrowdFlex is a project aimed at understanding and forecasting domestic energy flexibility through large-scale consumer trials, with the goal of establishing domestic flexibility as a reliable resource for system balancing and decarbonisation. The project developed forecasting models and conducted trials across different seasons to inform future business-as-usual (BAU) integration and flexibility service design.

- **Project objectives and scope:** CrowdFlex sought to improve understanding of residential customer behaviour, develop statistical forecasting models; Available Flexibility Model (AFM) and the Expected Delivery Model (EDM), conduct large-scale trials, and create a pathway for rapid BAU adoption of domestic flexibility services. The trials focused on availability and utilisation services across summer and winter periods.
- **Trial design and methodology:** The project used a randomised controlled trial framework with over 107,000 participants in utilisation trials and more than 33,000 in availability trials. Trials tested various incentive structures, notice periods, and behavioural prompts to evaluate demand response and flexibility delivery. Data from smart meters and asset-level metering supported model training.
- **Key trial findings:** Turn-up events elicited stronger responses than turn-down events. Lower incentives produced more flexibility per pound spent, while higher incentives generated greater volumes. Automation increased flexibility delivery by about 30%. Habit formation and motivations such as saving money and supporting a greener grid influenced participation. Escalating payments were more cost-effective in availability trials.
- **Model performance and development:** Both AFM and EDM models forecast domestic flexibility more accurately than naïve forecasts, identifying key factors influencing flexibility across different providers and trial types. Models were designed to meet user needs, including flexibility in regions and integration with existing services.

- **User engagement and feedback:** Early and ongoing engagement with potential users shaped model features and usability, leading to distinct models for availability and expected delivery. Users requested export functions and preferred flexibility in forecast regions. Some desired features, such as long-term forecasts and integration of distribution network constraints, were not feasible within project timelines.
- **Business-as-usual transition:** A roadmap outlines short-term (2026–2027), medium-term (2027–2030), and long-term (post-2030) goals for integrating the models into NESO's operational environment and the Volta programme. This includes IT integration, data sourcing, expanded functionality, and full integration with demand forecasting models.
- **Economic and environmental benefits:** Updated cost-benefit analysis estimates net present values growing from negative £5.0m in year 1 to £337.7m by year 10, driven by improved forecasting and increased domestic flexibility deployment. The models could reduce thermal generation needs, contributing to cumulative CO2 emissions savings of 3.4 MtCO2eq over ten years.
- **Project risks and mitigation:** Key risks included partner withdrawals, data availability challenges, and technical limitations. Mitigations involved sourcing alternative suppliers, scheduling handover meetings, close collaboration with data providers, and technical workarounds.
- **Communication and stakeholder engagement:** The project employed diverse communication channels including websites, newsletters, social media, conferences, and direct stakeholder meetings to promote transparency and avoid duplication. Collaboration with external organisations informed consumer engagement strategies.

Cathy Fraser, CrowdFlex Project Sponsor, NESO

"CrowdFlex is a pioneering innovation project that has led the way in domestic flexibility by gathering valuable data and insights through first of their kind large-scale consumer trials. This new knowledge, together with the advanced forecasting models developed, are vital to unlock the full potential of domestic flexibility and represent a major step in our efforts to deliver a clean power system and reduce energy bills for consumers across GB."

1. Project Summary

Background

CrowdFlex began to address the challenge of how NESO, Flexibility Service Providers and DSOs can better understand residential customer behaviour and make the best use of domestic flexibility as a service. NESO has a very limited pool of information about residential customers and how best to access this potential source of demand side services. The project aimed to establish domestic flexibility as a novel, reliable flexibility resource of national significance, competing alongside BaU alternatives and accelerating decarbonisation. NESO's existing flexibility services, Demand Flexibility Service (DFS) and the Local Constraint Market (LCM) have both provided some insights, but more is needed to ensure NESO can develop robust services in the future.

The objective of the project was to produce insights and build forecasting models of domestic demand and flexibility, informed by large-scale consumer trials, to establish domestic flexibility as a more reliable resource and inform new product design.

Scope

CrowdFlex Scope:

- developing statistical approaches for forecasting and procuring domestic flexibility.
- developing two models; the Availability Flexibility Model (AFM) and the Expected Delivery Model (EDM).
- conducting large-scale domestic customer trials to enable model development and provide a greater understanding of domestic flexibility's potential and technical capabilities.
- establishing a pathway to rapidly accelerate domestic flexibility to Business as Usual (BAU), following the project's completion.

The trials have been wholly focussed on domestic customers and have included a series of summer and winter trials covering availability and utilisation services. The data from the trials fed into the AFM & EDM and the models have then been used by services providers, NESO and DSOs. For more details on the users involved in the design of the models please see Section 8. User Needs.

2. Knowledge creation and dissemination

Knowledge capture is an integral part of innovation projects. The project had a distinct set of learning criteria and objectives that the team had to focus on achieving as set out in **Table 1 Key learning objectives**. In addition, there is, of course, new learning that is intrinsic to projects like CrowdFlex and this is the learning we captured along the way.

Carolina Tortora, Head of AI, Innovation & Sector Digitalisation, NESO

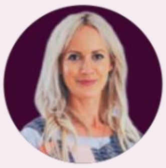
"Our trailblazing CrowdFlex innovation project and the domestic flexibility prediction models we have developed mark a major milestone in establishing consumer flexibility as a reliable grid management resource. The ability to accurately model and predict flexibility is vital for grid operators, to enable them to effectively incorporate the variable nature of renewable energy. CrowdFlex represents a significant step forward on our journey towards the future flexible and digital grid."

Below we set out the learning objectives we had at the outset and the outcomes:

Learning Objective	Outcome
Can simple incentives, reflecting whole system challenges, "reduce complexity, bureaucracy, and barriers to entry" for aggregators to deliver domestic flexibility	Various simple incentives were trialled across one winter and two summers which have provided valuable evidence to support domestic flexibility proposition design for aggregators/DSRSPs. Turn-up and turn-down flexibility has been demonstrated at regional granularity with smart-meter based settlement suited to the market (because that is how settlement occurs) , NESO and DSO demand flexibility services. Establishing these new services in the context of existing business practices should reduce any friction in their general take up.

Can the project successfully trial consumer interventions (financial and informational) targeting different system challenges to clarify consumers' preferences and inform future market designs.	Different payment structures and communications were compared, with participants incentivised to engage with and respond to trial objectives. The measured response to the "events" was thoroughly quantified with participant engagement providing additional insight into attitudes and demographics.
Can the trials prove that residential flexibility reduces bills for consumers.	The trials have quantified the flexibility from "explicit" residential demand response instructions (where explicit is based on actual demand response signals, as opposed to implicit which is based more on Time of Use tariffs) and identified the most cost-effective incentives. Residential flexibility will play a competitive and significant role in system balancing and operation by 2030, reducing system operation and network upgrade costs.
Develop probabilistic modelling of domestic demand and flexibility to improve domestic flexibility forecasting.	CrowdFlex models can forecast domestic flexibility better than a naïve forecast. With similar key model factors across all DSRSPs, trial types and modelling approach it is likely that we've found the 'big hitters' – this will inform future data gathering strategies for flexibility services.
Establish a pathway to rapidly accelerate domestic flexibility to Business as Usual (BAU), following the project's completion.	The long-term value of the CrowdFlex models will come from integration with the Volta programme - powering the new probabilistic scheduling and dispatch optimisers - and the demand forecasts models.

Table 1: Key learning objectives



Sanna Atherton, CrowdFlex Project Lead, NESO

"As we complete the CrowdFlex beta phase, it has been exciting to share the incredibly valuable learnings and insights we have gathered and to see the contribution CrowdFlex is making to the future of flexibility. The pioneering consumer flexibility prediction models have the potential to offer real value to grid operators, helping them operate a cleaner grid, while helping consumers save money on their bills at the same time."

Learnings highlights

Significant learnings have been obtained through the trials workstream, from: engaging with participants with the proposition, the trial communications and follow up surveying; and, from analysis of metering data. In addition, the modelling workstream has provided learnings through the activities of data consent; data management; user engagement (**as summarised in Section 8 User Needs**); and business-as-usual deployment (**as summarised in Section 6 Business as Usual**)

Trial learnings obtained from CrowdFlex can be split into those obtained from investigating the primary goals of the trials, and additional learnings from stretch goals and exploratory analysis. Highlights of these, and models learnings, are summarised in **Table 2 Primary trials learnings** with an extended summary in **Appendix 2 - Extended learnings summary**. More detail can be found in the CrowdFlex reports as signposted in this section under **Key trial reports**.

Work-stream	Sub-trial	Learning Point	Outcome
Trials	Utilisation	How incentive levels influence participation.	Lower £/kWh incentives delivered more flexibility per pound spent, while higher incentives delivered greater volumes, pointing to a trade-off between maximising response and minimising cost. The motivation to save money was the most common motivation.
Trials	Utilisation	How incentive structures influence participation.	Cash, free-electricity and community reward groups all achieved comparable demand response. The free-electricity incentive delivered flexibility at roughly one-third of the cost of the cash incentive and was considered the most enjoyable group, though it is also the one most likely to result in participants losing interest.
Trials	Utilisation	How does participation affect energy consumption outside events?	The size of the response too small relative to baseline demand to confidently say how much is demand creation/destruction.

Work-stream	Sub-trial	Learning Point	Outcome
Trials	Utilisation	The effect of different notice periods on event participation.	Longer notice (>4 hours) resulted in higher response for demand turn-up, though there is mixed evidence over all sub-trials for turn-up and turn-down. Feedback mirrored this mixed response with some participants forgetting events with longer notice and others missing short notice events.
Trials	Availability	How incentive structures influence participation.	All payment structures increased participant engagement (plug-in) over the control group. Escalating payments had either similar or greater effect than flat payments but at a lower cost. Higher escalating payments made no significant increase in plug-in.
Trials	Availability	The impact of increased plug-in on demand response performance.	Increased plug-in resulted in increased demand turn-up but not demand turn-down. Some participants reported concerns, including plugging-in at peak times could increase costs; plugging in too much could reduce battery life.
Trials	Availability	The effect of regular messaging on participation.	Weekly email "nudges" increased plug-in for flat and escalating payment structures. These nudges had more effect on the escalating payment structure which rewarded greater participation.
Trials	Availability	How user app settings impact response performance.	"Ready-by" time (RBT) nudges and payments successfully shifted customers' chosen RBT. The RBT shift did not translate into significant improvements in DTU or DTD, possibly as the shift was too small. Customer familiarity with RBT or similar parameters will be essential to maximising the flexibility from future vehicle-to-grid charge management whilst keeping customers happy.
Models	Both	Can the models predict flexibility?	Both models can forecast domestic flexibility better than a naïve forecast.

Work-stream	Sub-trial	Learning Point	Outcome
Models	Both	Key factors impacting flexibility forecasts	Factors were similar across all DSRSPs, trial types and modelling approaches – it is likely that we've found the 'big hitters' – this can inform future data gathering strategies for flexibility services.

Table 2: Primary trials learnings

Key trial reports

Detail on all the insights can be found in the various CrowdFlex reports with the key ones listed in **table 3 Key trial reports**. Trial reporting was split into:

- **Response analysis** - analysis of operational data from trial participants and hardware, performed by Centre for Net Zero (CNZ).
- **Customer feedback** - surveying of participants and analysis, performed by Centre for Sustainable Energy (CSE).

Trial type	Season	Response analysis	Customer feedback
Utilisation	Winter 2025/26	Utilisation Trial Winter	Winter Utilisation Trial Customer Feedback
Utilisation	Summer 2026	Utilisation Trial Summer 25	Summer 25 Utilisation Trial Customer Feedback
Availability	Winter 2025/26	Availability trial Winter 2025	Winter Availability Trial Customer Feedback
Availability	Summer 2026	Availability trial Summer 2025	Summer 25 Availability Trial Customer Feedback

Table 3: Key trial reports

These reports are available via the Energy Networks Association portal for CrowdFlex[1] (and the NESO CrowdFlex webpage).

"I do my washing in the early hours or overnight most of the time but sometimes when the laundry is waiting and there's a power move, I say oh, why not? Let me just do it in this one hour, if that's the time. So yeah, I've learned that I can be flexible."

Consumer survey respondent

3. Intellectual Property Rights

Approach to IPR

Background Intellectual Property Rights(IPR) was logged at the outset of the project and additional Restricted IP, this in the main pertained to customer data from the DSRSPs, was also logged. Bespoke Data Sharing Agreements then supported the sharing of that Restricted IP.

The approach taken being further assured for project partners by detailing these items within the Projects collaboration agreement as well.

As part of the project this log was maintained throughout the project lifecycle.

No additional or new Foreground IP was created as part of the project.

Elizabeth Allkins, Director of Future Energy, OVO

"OVO customers are proving that consumer flexibility isn't just possible, it's popular, to help save costs and cut carbon. We're proud to be part of a trial of this kind where innovation insights are already being used by network operators and policy makers to inform market design for a net zero electricity network. The results show that the future is a smarter, fairer energy system where the consumer is at the heart of the solution."

4. Data Access Details

Reports from the CrowdFlex project are currently made available via the Smarter Networks Portal where all project deliverables and outputs are published. Only aggregated data was shared with partners and can be shared with stakeholders. Stakeholder should contact NESO at innovation@neso.energy

5. Trials Approach

Trials Overview

The CrowdFlex Beta project used a multi-stage, data-driven approach to explore how willing people are to change their energy use, how practical this is to deliver in real-world settings, and how different incentives influence behaviour. The programme ran three trials, delivered across Summer 2024, Winter 2024–25, and Summer 2025, with each trial split into two distinct sub-trials focused on Utilisation and Availability.

Trials: key stats

- Two-year beta phase comprising of three seasons of large-scale domestic trials
- 107,000 OVO customers took part in utilisation trials
- 33,000 customers across Ohme and OVO took part in availability trials flexibility trials.

Ahead of each trial, separate design documents were produced for the Utilisation and Availability sub-trials. These documents acted as the trial protocols, setting out the objectives, design, and how the trials would be delivered with partners. After each trial, corresponding results reports were produced for both sub-trials, capturing what happened in practice and presenting the analysis and outcomes. Alongside this, consumer feedback survey reports were produced to reflect participant experience and behavioural insights, broadly aligned to each trial phase.

The trial approach was shaped through early workshops with stakeholders, which helped prioritise the goals and use cases before the trials were designed. Taken together, the design documents, results reports, and consumer feedback outputs provide a complete record of both how the trials were intended to run and what they ultimately demonstrated.

1. Purpose of the Trials

The trials were designed to build practical evidence about domestic flexibility and consumer behaviour. They focused on observing how participants responded to different incentive structures in real-world conditions, and how this translated into actual demand response.

Across the trials, the work explored how factors such as notice periods, event frequency, and the direction of the request (turn-up vs turn-down) influenced participation and the magnitude of the resulting demand response. This helped assess whether flexible demand could be treated as a reasonably dependable resource for supporting the grid, rather than relying on assumed behaviour.

The demand data generated through the trials, based on smart meter and event-level response data, was used to develop and train the Available Flexibility Model (AFM) and Expected Delivery Model (EDM). Together, this evidence supported business-as-usual planning and future model development, alongside continued engagement with NESO model owners and external partners to ensure the insights were interpreted and applied appropriately.

2. Trial Design and Methodological Approach

2.1 Trial Design

The Trials were structured to assess how domestic consumers respond to incentives to either adjust their energy usage (utilisation services) or make assets such as electric vehicles available for grid flexibility (availability services). Both utilisation-based and availability-based payment trials were delivered across three phases:

- Summer 2024 trials ran from May to July 2024 and included a utilisation payment trial alongside a pilot availability payment trial
- Winter 2024–25 Utilisation & Availability payment trials, ran from September 2024 to April 2025
- Summer 2025 Utilisation & Availability payment trials ran from July to September 2025

OVO participated in both the utilisation and availability payment trials across these phases, while Ohme took part in the availability trials only.

Across the Availability and Utilisation trials, participants were placed into different groups to test a range of incentive approaches and delivery methods. These included fixed and escalating payments, per-kWh utilisation incentives, consistency bonuses, exposure to both turn-up and turn-down events, and alternative rewards such as community-based incentives and free electricity. The trials also explored the role of behavioural prompts, different notice periods, and specific behaviours like EV plug-in duration and 'ready-by-time' settings. Results were compared against appropriate control groups to clearly understand which interventions made a difference, helping to show how different approaches affected participation, demand response, and the amount of flexibility delivered.

This design was intended to test how consumers respond to different ways of framing rewards and to quantify both incremental consumption and the potential to shift demand.

All aspects of the trial design—such as the objectives, hypotheses, treatment group allocation, event scheduling, outcome measures, and analytical approach—were set out in the individual trial design documents. Taken together, these documents form the overarching CrowdFlex trial protocol.

2.2 Randomisation & Recruitment

A randomised controlled trial (RCT) framework was used, with participants randomly allocated to different trial arms and assigned to notice-period cohorts (for example, same-day or day-ahead). This ensured that any differences in observed behaviour could be attributed to the interventions themselves, rather than to underlying participant characteristics.

The programme involved large-scale participation across both utilisation and availability payment trials. Over 107,000 OVO customers took part in the utilisation trials, while more than 33,000 OVO and Ohme EV customers were engaged in the availability trials.

David Watson, CEO, Ohme CEO

"The CrowdFlex trials have demonstrated that Ohme's smart EV charging technology has a crucial role to play in domestic flexibility and in reducing energy costs for consumers and the system alike. Our customers showed they are willing and able to shift their plug-in behaviour when incentivised to do so and, crucially, they responded positively to a range of different approaches, from escalating financial payments to simple behavioural nudges. Automated smart charging proved particularly powerful, enabling customers to deliver flexible capacity with minimal effort on their part. CrowdFlex has helped build the evidence base that domestic flexibility could deliver hundreds of millions of pounds in system benefits annually as EV uptake accelerates and Ohme is proud to have contributed to laying that foundation."

2.3 Event Scheduling & Operational Parameters

The trials included repeated weekly turn-up and turn-down events, with some designs also incorporating tests to explore bi-directional flexibility.

Event timing and frequency were pre-specified in the trial design documents, with individual events scheduled based on forecast data and informed by discussions with the Day-Ahead Strategy team within NESO.

2.4 Outcome Measurement & Data Collection

Utilisation metrics include:

- Comparison of treatment demand against control during events
- Comparison of treatment demand against control outside events
- Opt-in levels

Availability metrics include:

- Plug-in
- The response relative to baseline
- App engagement/RBT (ready-by-time) change

Further calculations included price to illustrate costs of response.

Design documents captured the full set of primary, secondary, and exploratory measures.

Energy consumption data was captured through smart meter half-hourly readings in the Utilisation trials, with asset-level metering used in the Availability trials.

Additional insight into customer experience and behaviour was gathered through large-scale surveys, including feedback from over 37,000 participants who took part in satisfaction and behavioural studies during these trials.

> *"We're running quite a tight ship, and everything that's off is off or being sensibly used and it is easier to Power Up."*
>
> **Consumer survey respondent**

2.5 Analytical Approach

Each trial used a pre-specified analytical strategy as documented in its design document, typically including:

- Baseline construction,
- Regression-based or difference-in-difference estimators,
- Assessment of heterogeneity across incentive structures and participant profiles.

Rationale for the Chosen Approach

CrowdFlex used a progressive optimisation approach, where insights from early trials were used to shape and improve the design of later trials. This allowed the team to:

- Adjust incentive structures as learning emerged.
- Refine trial windows over time (for example, testing peak versus off-peak events)
- Incorporate emerging behavioural trends to improve the accuracy of the models.

This iterative approach was important for building models that better reflect real-world behaviour, including:

- Seasonal differences in consumer response
- Asset-specific behaviours, such as EV charging patterns
- Differences in how customers respond to turn-up versus turn-down events.

This flexibility-first approach enabled learning to be generated across a range of system conditions and seasons, providing robust inputs to NESO modelling and supporting future business-as-usual integration.

Integration with Project Outcomes

The trials formed the backbone of both the modelling work and the insights brought together in the final project outputs. While each individual trial produced its own detailed technical findings, the real value at a project level came from pulling those results together—spotting patterns across trials and translating them into what they mean in practice for future flexibility services and how the system is operated.

Taken as a whole, the trial portfolio supports the project's assessment of readiness for business-as-usual delivery, plans for handing models into BAU, and public-facing knowledge dissemination activities.

Financial incentives are proven to be effective in stimulating flexibility, with turn-up events generating a stronger response.

Key Learnings from the Trials

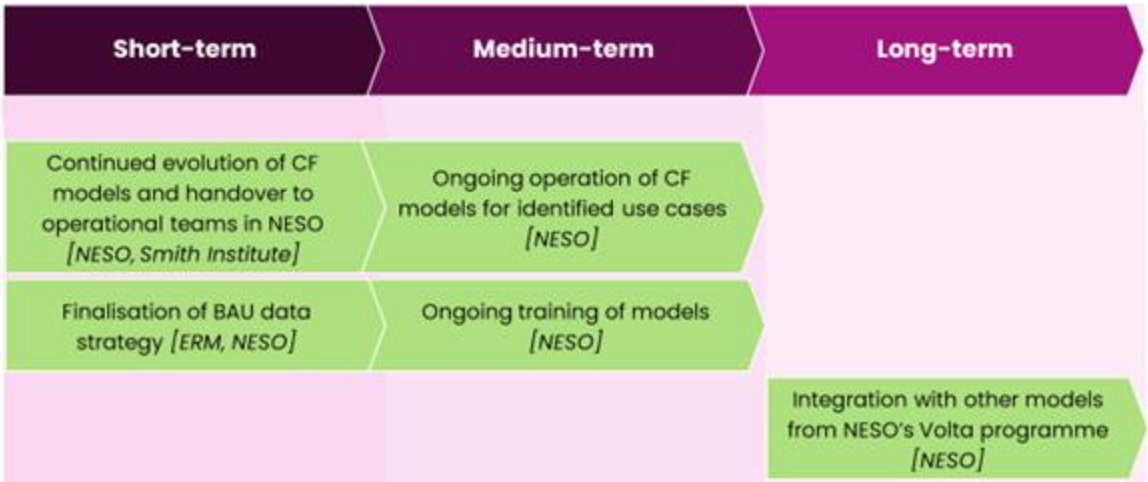
- Across both utilisation and availability trials, turn-up events consistently prompted stronger responses than turn-down events.
- In the availability trials, 64% of EV participants said they plugged in their vehicle more often during the trial than they did beforehand.
- Most flexibility was still delivered manually, with 80% of utilisation trial participants relying on manual shifting. However, automation enabled participants to shift around 30% more electricity on average, showing clear potential to enhance participation.
- Evidence of habit formation increased over time. In the utilisation trials, motivation linked to habit-building rose from 22% in the first survey to 39% in the latest, while 73% of availability trial participants said flexibility had become part of their regular routine.
- The strongest motivation for taking part in utilisation trials remained saving money (69%), followed by supporting a greener grid (46%) and interest in the challenge (46%).
- Customers were price-sensitive, delivering higher responses when incentives were more generous. However, lower incentives were often more cost-effective per kWh of flexibility, highlighting a trade-off between total response and value for money.
- In the availability trials, escalating payments generally performed better than flat payments, delivering flexibility more efficiently in terms of cost per kWh.

Trial data directly supported the development of the AFM and EDM forecasting models, strengthening confidence in scaling domestic flexibility into business-as-usual operations.

6. Business as Usual

The insights from the user engagement conducted during the project are the starting point for goals of the BAU transition of the models.

The long-term value of the CrowdFlex models will come from integration with the Volta programme - powering the new probabilistic scheduling and dispatch optimisers - and the demand forecasts models. To achieve those benefits a transition roadmap that outlines short-term (2026 – 2027), medium-term (2027 – 2030), and long-term (2030 onwards) goals has been produced.



The short-term goals are aimed at moving the models from their current stage (AFM – MVP, EDM – proof of concept) to software that is fully set up and running in a NESO environment. This will require alignment with NESO security standards and general software engineering best practices as well as backup routines and update and maintenance schedules.

New sources for model input data will need to be identified. Guided by the findings of ERM's assessment of future model input data, the models will benefit from being retrained on data that is available to NESO now, from existing flex services and forecasts, and the results evaluated.

The models have been handed over to the Day Ahead Strategy (DAS) team, who lead on the IT integration and operational data sourcing work.

Once completed, this will allow the models to be used to support margin modelling and alongside DFS as first use cases and so give users a way of experiencing the models value as well as identifying any further changes that need to be made to the functionality.

The next stage (medium-term) will see the models' functionality expanded to unlock further use cases.

Commonly used trading zones spanning multiple GSPs will be defined and the models trained to forecast for those specifically. This will help the Trading team to integrate flexibility forecasts into their decision making.

The medium-term will also see the integration with the demand forecasting model. This will likely happen initially on a 'manual' basis first, using the export function of the model dashboard.

New input data sources will keep on being identified, tested and integrated where improving results. This might be additional data from other innovation projects or data from suppliers for evolving flex services.

In the long term, the models will be a part of the wider NESO forecasting environment, fully integrated with the VOLTA programme and the demand forecasting models. Findings from using the models for several years will have led to a clear specification of the input data needed to achieve the best forecasting results. These specifications will be integrated in service terms for existing and future flexibility services.

The benefits from successfully integrating the CrowdFlex forecasting models into BAU are quantified in the CrowdFlex CBA, presented in *Impacts and Benefits*. It demonstrates the clear benefits available by to NESO by supporting domestic flexibility in the core use cases identified by CrowdFlex. Savings would pass through to consumers electricity bills by reducing BSUoS costs, helping to deliver a lower cost, lower carbon power system.

Josh Visser, Innovation Incubator Senior Manager, NESO

"CrowdFlex is the first large-scale innovation project to be incubated in NESO's incubator function and it's exciting to see this dynamic project reach completion and move towards business-as-usual integration. The achievements and deeper understanding of flexibility gained in CrowdFlex's two-year beta phase have made significant strides forwards for domestic flexibility and its integration into NESO's real time, day-to-day grid operations."

7. Policy, Regulatory and Standards Barriers

Policy, Regulations and standard barriers were monitored as part the of special conditions. CrowdFlex did not have any specific barriers during its lifecycle, and none are expected to prevent the implementation of the findings into BaU.

Barriers that had been highlighted before having mainly been around market distortions that may occur as part of the trials but as the volumes being procured were modest, these distortions did not materialise.

Policies are unimpacted as there are few policies pertaining to the procurement of flexibility services at this stage. We kept a watching brief on developments and are already engaged with the Market Facilitator.

"Yeah, I think it's that making the difference, that's the important part… it's just taking the extra step to do it at a specific hour just shows that you are conscious and you want to do what you can to help the community or to help the planet."

Consumer survey respondent

8. User Needs

During the project a group of potential users for the AFM and the EDM were identified and engaged from the early concept phase through to demonstrations of the model prototypes.

The models: CrowdFlex developed two state-of-the-art domestic flexibility forecasting models for grid operations

- AFM – Available Flexibility Model
- EDM – Expected Delivery Model

Potential users were selected with the most likely use cases in mind, these included Demand Flexibility Service, Local Constraint Management, demand forecasting, constraint and margin management. The group of users engaged with changed over the course of the project as use cases became clearer.

Early user engagement focused on understanding existing workflows and how CrowdFlex models could facilitate use of flexibility.

We learned that there was an interest in using the model for planning several days to one day ahead of flex delivery as well as the need to evaluate a specific amount of flexibility and its likelihood of being delivered in full. This contributed to the decision to develop two distinctly different models rather than just one to accommodate users' needs. One, the AFM, which could be operated without a specific flex target and that would show the general availability of flex. And a second one, the EDM, that could be used with received bids and offers for flexibility and forecast probability of actual delivery as well as the impact of procuring flexibility for a certain period would have on electricity consumption on other times of the day.

Following on from this initial engagement, meetings were held to show implementation progress of the models and get the users' feedback on added features and usability. This allowed to clarify use cases, align feature requests and discuss conflicting wishes.

User feedback ranged from simple usability improvements to more conceptual changes.

UI improvements included displaying half-hourly settlement periods as well as displaying hover-over tooltips the explain each in- and output.

A crucial wish from all users was an export option of the flex forecast. The Smith Institute implemented this function which will allow the output to be used offline and / or as input for other tools.

Users also advised on how they wanted the probability quantiles to be displayed. Originally, those were shown in the 'mathematically' correct order, which meant that they didn't take into account the desired outcome. This would have meant that the 5% quantile for turn-up would have displayed the safest assumption - only 5% likelihood not to achieve that value. For turn-down, the opposite would have been true - here 5% would have represented the high-risk assumption as only in 5% of cases that amount would be realised.

While the Control Room wanted to be able to see flex forecasts on a GSP level, the teams involved in trading were interested in bespoke combinations of GSPs as that is what their trading decisions are based on. This at first seemed like an unresolvable conceptual conflict. Over several rounds of conversation, a solution was agreed that allowed to specify predefined regions which the models were then trained on in addition to the original GSP approach. In the UI a drop-down field was added that allows to choose the region a user wants to generate a flex forecast for.

For the EDM, the original concept was to evaluate individual bids and offers. During our user engagement we learned that this wasn't going to be useful given that in most cases a combination of bids/ offers from different flex providers were procured and therefore it was necessary to assess the likelihood of delivery of the total procured amount. The Smith Institute implemented a proof-of-concept solution that combines bids / offers from both participating DSRSPs to integrate the desired functionality for further development.

Inevitably, there were user wishes that could not be fulfilled, because of limited project timescales or because they deviated too far from the project idea. Among those were a need for long-term flex forecasts (several months to years ahead). The models were not designed with those timescales in mind, and the available data wouldn't have allowed to test whether they would deliver valuable outputs.

Some constraint management tasks, like outage planning, would require forecasting a series of flex events (for example turn-down between 5 and 6pm every day of one week). The trials did not test a setup like this, so there was no data the model could have used for training on this specific use case.

For the existing flexibility services DFS and LCM, users expressed the need for a way for DNO information to be integrated into the models. This was mainly around constraints on the DNOs' networks that would prevent flex units in certain locations/ postcodes to participate in a flex service. DNOs agreed that this would be a useful feature, but the project timelines did not allow for this to be implemented.

9. Impacts and Benefits

CrowdFlex has demonstrated how domestic consumer-led flexibility can deliver material whole-system benefits while supporting the transition to a net zero power system. By growing the scale and sophistication of consumer-led flexibility, transmission and distribution system operators can reduce system operational costs, mitigate or delay generation capacity and network investments, and accelerate decarbonisation. The original CrowdFlex cost-benefit analysis (CBA) demonstrated that growing domestic flexibility to a resource of national significance could deliver **£472m of direct and indirect system benefits annually after 10 years**. Leveraging this source of flexibility could also reduce the need for thermal generation, equivalent to **cumulative CO2 emissions savings of 6.3 MtCO2eq** over the same period.

Following delivery of the programme, the CrowdFlex CBA has been updated to explicitly reflect the impact of improved forecasting of domestic flexibility. This update isolates the benefits associated with building and implementing the Available Flexibility Model (AFM) and Expected Delivery Model (EDM), which represent the primary analytical outputs of the CrowdFlex programme. Therefore, the CBA assumes that the implementation of flexibility forecasting models has no impact on the total volume of domestic flexibility delivered to the system, only that they improve NESO's ability to forecast delivery and plan system balancing actions accordingly. It is expected that the CrowdFlex learnings will inform future flexibility service design by NESO and DSOs, as well as support flexibility service providers in the development of consumer propositions. This update does not account for these wider co benefits of the CrowdFlex learnings.

The CBA suggests that implementing the CrowdFlex forecasting models results in NPVs of **(£2.6m)**, **£14.8m**, **£46.6m**, and **£218.2m** in years 1, 3, 5, and 10 (2036) respectively. This reflects the cost of the trial, a capital-expenditure heavy implementation of £3.8m over two years following completion of CrowdFlex, followed by an annual cost of ownership and operation of that grows as the model use matures.

The revenue, costs and resulting NPV is summarised in Figure 1 below.

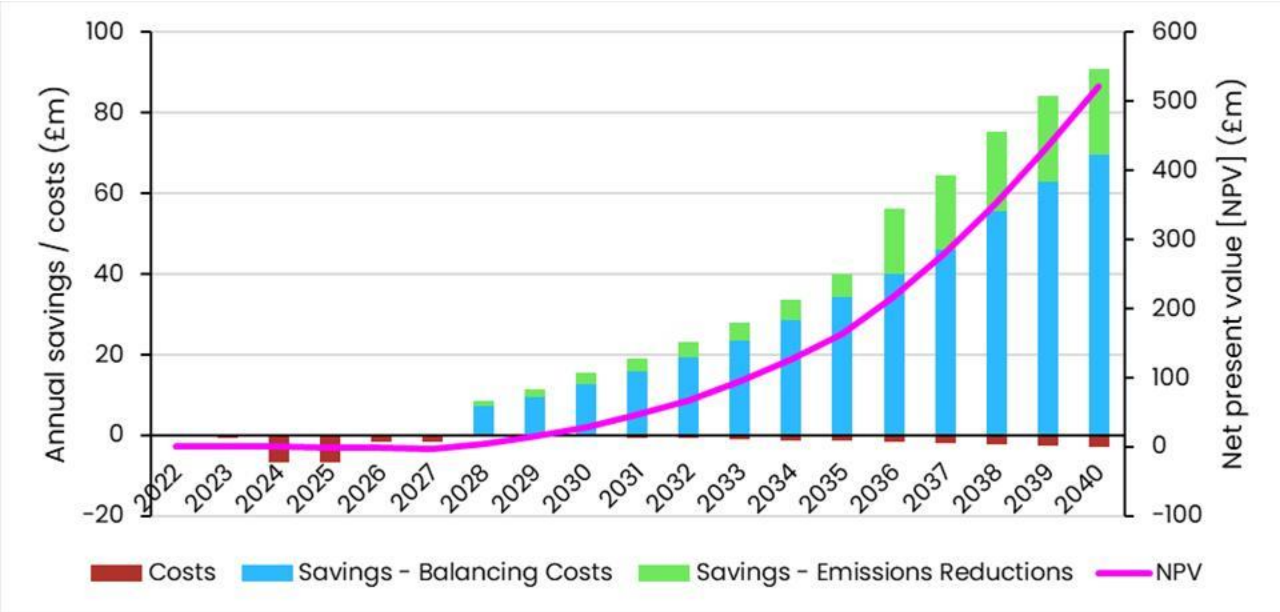


Figure 1: Annual savings, costs, and resulting NPV of CrowdFlex cost benefit analysis.

The benefits in the CrowdFlex CBA are derived from improved forecasting. This enables NESO to plan system balancing actions at lower cost, reducing the extent to which the system is left short or long due to the stochastic nature of domestic flexibility. By 2030, this equates to a possible annual saving of **£17.2m**, rising to up to **£133.7m** by 2040. The increasing benefits in the CBA are largely driven by:

1. Growth in the volume of domestic flexibility available to and deployed by NESO as EV and heat pump uptake accelerates.
2. Improvements in modelling performance over time. This grows as a) consumer-led flexibility becomes increasingly automated, improving predictability and b) the model is retrained with larger BAU datasets[1].

Use of the CrowdFlex forecasting models is dependent on their successful implementation with NESO systems and processes following the conclusion with CrowdFlex. The central scenario for the CBA assumes that the model is fully operational from 2028. Sensitivities have been run to illustrate the impact of a delayed implementation into BAU.

1. [1] The CBA takes the conservative assumption that performance improves by 50% over the 10 years following CrowdFlex.

Figure 2 shows the decrease in 10-year (2036) NPV as a result of a 2-year (2030), 4-year (2032), and 6-year (2034) delay in model implementation.

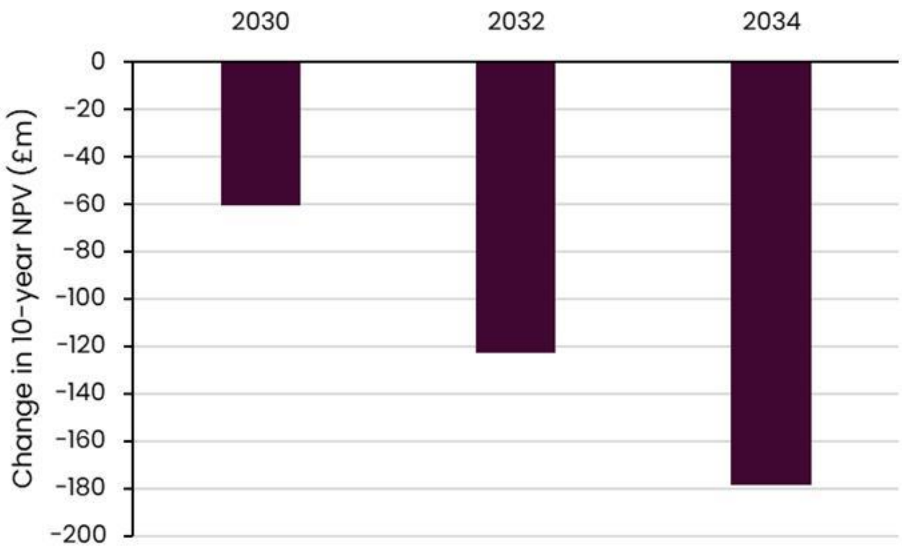


Figure 2: Change in 10-year (2036) NPV of delaying the implementation of CrowdFlex forecasting models vs. central scenario (2028).

In addition to the economic benefits, implementation of the CrowdFlex models could support power system decarbonisation, reducing the need for thermal generation to support variable renewable energy dispatch and provide energy balancing. Two opportunities for are modelled in the CrowdFlex CBA:

1. Reducing the need to ramp-up/down open-cycle gas turbines by improving forecasting on periods when the system is left short,
2. Supporting the grid in periods of renewable oversupply by improving forecasting when they system is left long.

The CrowdFlex CBA suggests this is equivalent to cumulative CO2 emissions savings of **65 ktCO2eq**, **102 ktCO2eq**, and **224 ktCO2eq** in years 3, 5, and 10 respectively.

10. Risks, issues, and constraints

The management of project risks has been one of key parts of the project governance. A detailed project log was created to support the management of risks and issues, and regular review meetings were carried out during the duration of the project to ensure the whole team including partners and suppliers were aware of the key issues the project was facing. These were also reported at Project Board meetings and Project Review meetings with UKRI & Ofgem.

Some of the key risks and issues that occurred during the Project are shown in the table 4 below:

Risk/Issue	Mitigation
Octopus confirmed their intention to leave the project	• Source an alternative supplier. • Conduct a full impact assessment with all the project partners
The project is unable to find another supplier to replace Octopus	• Contact as many suppliers as possible. • Utilise existing partners. • Engage Energy UK
The lack of availability of key Business personnel may shorten the timescales for the project team handing over the models to BAU, therefore impacting the quality of the model at the end of the project	• A series of handover meetings are being scheduled to facilitate handover. • Escalated to NESO CIO for monitoring and to provide support if necessary.
The EDM is not delivered in time for utilising the winter trials. This would mean the winter trial data could only be ingested after the trials missing the chance to inform trial design through analysing model output.	• Agree scope, costs and timeline for delivery of the EDM. • Engage BAs to ensure scope meets business needs. • Incorporate data from other NESO projects (DFS, LCM, SAA)
The EDM can't be trained because of the summer 25 trial actuals not passing SI's quality checks. The impact is that the EDM and its output can't be demonstrated to NESO stakeholders which hampers	• SI working closely with OVO and Ohme to resolve data issues. • NESO engagement with 'mock-up EDM' to not lose momentum.

efforts to engage them in BAU transition planning	
NESO and Smith Institute may only have one DSRSP's data in the EDM	• Ohme to confirm whether timescales and resource needed for the EDM data to be provided can be met
OVO were unable to test the Alexa skill in the Summer trials due to technical limitations at OVO environment. The impact is that the project cannot learn customer behaviour from Alexa skill.	• Alternate solution of using a sandbox environment is being explored by OVO. This will allow some testing with few friendly accounts but cannot test in live trials
ERM won't be able to get enough / timely access to current and potential future model data because of willingness to share data and the process being slow	• Accelerate data sharing process where possible. • Explore alternative routes to obtain necessary information

Table 4: Key Risks from the project and mitigations

11. Working in the open

Methods used to communicate publicly about the project

We have used a number of NESO communication channels and methods to engage with stakeholders, work transparently and regularly provide updates and disseminate learnings:

- NESO website news articles and project webpage
- External industry newsletter (10k subscribers)
- NESO LinkedIn (43k followers) and X (34k followers)
- Project updates in the Innovation Summary and Innovation Strategy publications
- Presentations and panel discussions at conferences and university lectures
- Conference stand presence – Energy Innovation Summits and Utility Week
- Participation in forums, such as the SIF Community Forum
- Individual meetings with stakeholders
- End of phase in-person industry event
- Project videos (launch, mid-project and final)
- Podcasts
- End of phase show and tell webinar

Project partners have also carried out their own communications and engagement, issuing press releases, publishing blogs and articles on their websites, social media and conference presentations.

Please see the appendix for example of external communications.

How we collaborated with our stakeholders to promote, invite challenge and refine the project

Over the duration of CrowdFlex we have engaged with a wide range of stakeholders for input and feedback on the project progress, including the Virtual Energy System advisory group. We are keen to work transparently and invite external input as incorporating this wider perspective has contributed to the project's success.

We collaborated with several external organisations on specific work packages, for example Citizens Advice and UK100 helped refine the consumer communications guidelines and consumer survey strategy.

Availability trials survey results

64% of survey respondents taking part in the availability trials plugged their EV in more during the trial than they did before.

As well as promoting the project through the communications channels and methods above, we also encouraged stakeholders to contact the project team directly via the dedicated innovation email inbox.

CrowdFlex was presented by NESO and partners at a number of public industry conferences including Utility Week Live and the Energy Innovation Summit on two occasions. These presentations provided excellent opportunities for discussions and feedback via panels and Q&As or afterwards in-person and via the innovation email inbox.

The project team also met with stakeholders on an individual basis to discuss the project and gave demos of the models as they developed, including with DESNZ and Ofgem. Stakeholders ranged from engaged individuals and organisations, and wider stakeholders such as ENTSO-E (European Network of Transmission System Operators).

The project team engaged across NESO to ensure the wider organisation's needs and expertise was incorporated, with regular meetings and workshops taking place.

Avoiding duplication of efforts and accelerating industry progress on related initiatives

Engagement with interested innovators also helped avoid duplication. When meeting interested stakeholders about CrowdFlex, NESO also encourage innovators to consider proposing new innovation project ideas. This engagement can provide an excellent opportunity to explain the partnering process and provide guidance, for example on related projects.

Taking part in industry events such as the SIF Community Forum also provided a valuable opportunity to avoid duplication of efforts, learn about other parts of the user journey, and to help accelerate each other's progress.

Chloe McLaren Webb, Fair Transition Research Lead, Centre for Sustainable Energy

"Through gathering feedback from over 37,000 trial participants, CrowdFlex has enabled us to get detailed understanding of different households' experiences of flexibility. CSE has been able to analyse the pathways to achieve equitable outcomes for all consumers and have found that flexibility can be inclusive, if the correct support and protections are provided."

Insights gained from stakeholder engagement relevant for future projects

As previously identified by the project through the consumer surveys and interviews, and the results of the trials testing different recruitment messages, consumer communications is an important aspect of engaging customers in domestic flexibility.

The CrowdFlex learnings about this engagement could inform potential research, as this is a rapidly evolving area of communications that will need further research to incorporate learnings over time and as consumers gain more experience of taking part in domestic flexibility. Early engagement with key stakeholders, such as Citizens Advice will be crucial to the success of potential future projects.

Also, as domestic flexibility develops, with industry participants proposing new and exciting initiatives, there could be a need for more clarity between flexibility initiatives and how they interact, to ensure consumers continue to maximise their benefit from flexibility.

"It would be nice to just sign up for all events and be notified when it's happening. When you work shifts and have a family, it's tricky to flex as it doesn't fit in with family schedules."

Consumer survey respondent

12. Costs and Value for Money

Final Project Costs

At the time of submission of this closure report, the CrowdFlex project is in formal financial close-down, with the close-down period scheduled to run to 30 April. Project expenditure has been reviewed against the approved funding profile based on costs incurred and reported to date, and reflects delivery of the agreed project scope, milestones, and outputs.

Financial governance and control arrangements have been applied throughout the project lifecycle. These have included regular monitoring of forecast and actual expenditure, routine partner cost reporting, and systematic validation of invoices against contractual terms. Any variances identified between forecast and actual expenditure have been reviewed with delivery partners and managed through agreed adjustments to invoicing and claims.

At the point of reporting, not all partners have submitted their final invoices and costs. Those outstanding invoices for costs have been identified, formally communicated to the relevant partners, and are being actively managed as part of the project close-down process. Further costs are therefore anticipated during the remaining close-down period, in line with the latest approved Project Direction Change Request (PDCR) and the agreed delivery scope.

Final reconciliation of all partner costs will be completed once all outstanding invoices have been received and reviewed. This will ensure that SIF funding is claimed accurately, and partner contributions are reflected correctly in the final financial position.

Based on anticipated benefits and the total costs for delivery, CrowdFlex has represented good value for money for customers, proving that domestic flexibility can viably contribute to for NESO and DSO services alike. The benefits anticipated at the outset having been validated through the project lifecycle, with the CrowdFlex CBA iterated on as results from the CrowdFlex programme became available. This has informed and supported the development of a roadmap for change within NESO and the implementation of the project outputs.

The adjusted CrowdFlex CBA, presented in *Impacts and Benefits,* includes updated costs for the project over the full SIF process (from Discovery to Beta). It suggests there is a clear value for money from the SIF CrowdFlex funding should the outputs of CrowdFlex be successfully integrated into BAU. The implementation of the CrowdFlex forecasting models result in NPVs of up to (£2.6m), £14.8m, £46.6m, and £218.2m in years 1, 3, 5, and 10 (2036) respectively. This reflects the high initial investment in CrowdFlex, through the SIF funding and BAU implementation, followed by a clear annual benefit of implementation, equal to £17.2m per year by 2030, rising to up to £133.7m per year by 2035.

These increasing benefits are largely driven by growth in the volume of domestic flexibility capacity on the system as EV and heat pump uptake accelerates. It underpins NESO's original motivation behind CrowdFlex – to mature and improve confidence in this nascent and largely untapped resource of flexibility to a resource of national significance. In driving that process, CrowdFlex has delivered outcomes that represent value for money for customers.

PARTNER	ACTUAL	BUDGETED	VARIANCE	PERCENTAGE
NESO	£7,386,849	£12,377,150	(£4,990,301)	(40%)
OVO	£3,337,938	£3,353,428	(£15,490)	0%
OHME	£2,578,263	£2,601,928	(£23,665)	(1%)
CNZ	£1,316,035	£1,940,655	(£624,620)	(32%)
SSEN	£115,894	£181,194	(£65,300)	(36%)
NGED	£27,470	£42,372	(£14,902)	(35%)
ERM	£880,890	£879,362	£1,528	0%
AWS	£595,672	£1,233,892	(£638,220)	(52%)
TOTAL	**£16,239,011**	**£22,609,980**	**(£6,370,969)**	**(28%)**

13. Special Conditions

Updates are provided below on the special funding conditions:

Project Conditions	
Condition 1 – SIF Funding	The Funding Party must not spend any SIF Funding until contracts are signed with the Project Partners named for the purpose of completing the Project. **Completed**
Condition 2 – Financial Contribution	The Funding Party must report on the financial contributions made to the Project as set out in its application. Any financial contributions made over and above that stated in its application should also be reported and included within the Project costs template. **Completed**
Condition 3 – Meeting Arrangements	The Funding Party must participate in all meetings related to the Project that they are invited to by Ofgem, UKRI and DESNZ during and after the Beta Phase
Condition 4 – Stage Gate Scoping	The Funding Party must, with support from Innovate UK/UKRI and, where applicable Ofgem, scope the requirements and success criteria for each stage gate within a Project at the quarterly reporting meetings ahead of any stage gate. These will be used to determine what criteria a Project must meet in order to pass a stage gate, and whether any additional information, such as a report, must be produced as part of the stage gate. **Completed**
Condition 5 – Dissemination of annual progress reports	Each of the annual progress reports that the Funding Party publishes in the Beta Phase must, at a minimum, be uploaded to the ENA's Smarter Networks Portal. We also strongly encourage wider

	dissemination of the annual progress report(s) and support from all Project Partners in ensuring it reaches a wide audience. **Completed**
Condition 6 – Impact Monitoring	As part of the end of Project Phase report, the Funding Party must produce a Project Impact Monitoring and Evaluation Plan. This plan must outline how the Project plans to monitor and evaluate the delivery of benefits outlined in the Beta Phase Application following the end of the Beta Phase. The plan must also include the methodology that will be utilised for quantifying and qualifying benefits realisation and how the Funding Party plans to report this to Ofgem 1, 3, 5 & 10 years post-Beta Phase completion. Further details on how to approach the development of this plan may be provided by Ofgem or IUK. **Completed**
Condition 7 – SIF Community Forums	The Funding Party and all Project Partners must make reasonable attempts to attend, participate and/or contribute at SIF Community Forum events occurring during the Project delivery. We anticipate there being approximately one event per year. **Completed**
Condition 8 – Policy, regulatory and standards barriers	The Funding Party must provide verbal updates at each quarterly meeting on any regulatory, policy and standards barriers and any change requirements which may impact delivery of the Beta Phase activities. The Funding Party must also include as an attachment to each of its annual progress report an update on any regulatory, policy and standards barriers which may require derogations and articulation of any proposed regulatory, policy and standards changes which

	would be necessary in deployment. The Funding Party must also provide an as an attachment to its end of Project Phase report a summary of the Project's findings on regulatory, policy and standards barriers, including any considerations for future work, and where applicable, where specific regulatory, policy and standards changes would be required for deployment. **Completed**
Condition 9 – Updated 60 second videos	The Funding Party must provide within the first three months of the Project beginning (i.e. by 1 October 2023) an updated 60-second video. If the Project is greater than two years (longer than 24 months) in length, an updated video must also be provided at the Project's mid-point meeting. All Projects must also provide an updated 60-second video as part of their end of Project phase report. Innovate UK can share its guidance for 60-second videos with the Funding Party, if necessary. **Completed**
Condition 10 – Consumer Engagement	The Funding Party must provide an update as part of each stage gate scoping monitoring meeting on consumer engagement plans. This must include an update on any activities which involve engagement and interaction with energy consumers, and any impact the Project may have on existing or future energy consumers and their premises. **Completed**
Condition 11 – Post-Beta Phase Roadmap	The Funding Party must provide to the monitoring officer by the third quarterly monitoring meeting (i.e. in Q3) a roadmap for activities post-Beta Phase. This can build on the Project's Application question (question 11) and must focus on how and when the proposed solution will become business as usual within your network and

	across the other GB gas or electricity networks. **Completed**
Condition 12 – Commercialisation Strategy	The Funding Party must provide to the monitoring officer by the third quarterly monitoring meeting (i.e. in Q3) a roadmap for activities post-Beta Phase. This can build on the Project's Application question (question 12) and must focus on what considerations have the Project consortium made for the commercialisation of the proposed solution or innovation, and how the Project provides support for non-network partners to move towards commercialisation. **Completed**
Condition 13 - Insights	As part of each of its Beta Phase annual progress report, the Funding Party must provide an attachment which summarises the insights developed by the Project and the flexibility service providers on consumer demographics to date or since its last annual progress report. **Completed**
Condition 14 – Participant Data	The Funding Party must provide an outline report to its monitoring officer ahead of initial trial commencement outlining how the raw participant data gathered by the Project will be made publicly available. We understand that publishing this data in a raw format would not be GDPR compliant without gathering consent from all participants. Where consent is obtained, we expect the raw data to be published. Where consent is not obtained, to ensure GDPR compliance, we expect the Funding Party to aggregate the data to remove personally identifiable information. **Completed**
Condition 15 – CrowdFlex Market Impact	The Funding Party must provide as part of stage gate 1 (set out as Stage Gate 01 in

	the Gantt chart) and ahead of progressing to any trials a presentation clearly illustrating how the CrowdFlex market will interact or complement and/or impact existing markets and the balancing mechanism. This presentation must illustrate these examples for both during trial delivery and for scenarios which may emerge upon Project completion. As part of this, the presentation must explain the potential impacts from CrowdFlex on the Funding Party's business operations and why/how the Funding Party will look to integrate CrowdFlex's approaches and markets into their business operations. **Completed**
Condition 16 – Alignment to License conditions	As part of stage gate 1 (set out as Stage Gate 01 in the Gantt chart) and ahead of progressing to any trials, the Funding Party must provide an explanation summarising how the Project and the data generated by the Project will align with the Funding Party's licence conditions for sharing data and will align with Ofgem's Data Best Practice Guidance. **Completed**

14. Material Changes

During the CrowdFlex Project there were 3 material changes raised with UKRI. Following the Project Direction Change Request process set out by UKRI we submitted these changes which were approved by Ofgem and details of these are shown below:

PDCR Octopus Energy withdrawal from the project - Octopus Energy decided to withdraw from the project and as such it was desirable to try to illicit support from the wider energy retail supplier base to see if they could be replaced. Whilst the project could have proceeded as was without Octopus Energy, having a broader base of consumers maintains the statistical relevance of the sample size. That sample size was an important part of the overarching objectives of the project. The project pursued other DSRSP's to no avail, so the budget was to be allocated to NESO until project end.

In addition, there were proposed changes to key Milestones and Deliverables which needed to be made clearer and some general tidying up of the Project Direction document to provide additional clarity. Funding for Octopus was moved to NESO and changes made to the naming for ERM and NESO within the contract.

The PDCR was approved by Ofgem on the 24th of February 2025

PDCR Ohme Model Data, ERM Implementation Strategy Funding, Additional AFM Sprints

Ohme Issue - OHME are not an energy supplier, it was determined through Model scoping that the capability to provide the data needed for the models, is not within OHME's current capability. Specifically, the provision of customer demand forecasts is a capability that OHME does not use in the same way that an energy supplier would be adept at doing. This issue became known as part of the detailed API specification work undertaken as part of the design work for the model(s). It was therefore necessary to extend OHME's scope slightly. The extended scope would help the Smith Institute analyse energy consumption trends surrounding events and assess the impact on delivered flexibility.

> *"Asking me to move time to say 10am on a specific day is impractical if I have to do a school run with no other option."*
>
> **Availability trials consumer survey respondent**

ERM – reallocation of unspent budget from the trials to fund additional work for ERM as part of WP3 (Implementation Strategy). The scope of the additional work includes the assessment of suitability of data from existing flexibility services for training and running AFM and EDM in a BAU scenario. It also included conducting a gap analysis and expected impact on model performance, as well as recommendations on future data gathering strategies and / or amendments to the models to use existing data. The outcomes will feed into the overall implementation strategy.

AFM Sprints – Reallocation of unspent budget from the trials to fund additional sprints to further develop the AFM. The AFM development was delayed by IT problems on (N)ESO's side (AAE not ready) and data delivery problems by the DSRSPs, which mean that the first complete evaluation of a significant training dataset wasn't possible until now. Originally the AFM sprints were planned to end at the beginning of September which would've left only three more sprints to act on the findings of the evaluation. The change request funded 6 additional sprints (running until 28 November, in line with EDM sprints). These sprints allowed Smith Institute to explore improvements to the AFM core model based on the findings of their evaluation of the summer 24 and winter 24/25 trials. Otherwise only the most basic form of model algorithm (quantile regression model) would have been delivered which had shown mixed forecasting performance.

The PDCR was approved by Ofgem on the 21st of August 2025

PDCR ERM CBA Update, Additional CP30 Scope, Model Handover Support, Dissemination & BaU Transition

ERM CBA Update - This work was in addition to the existing project CBA update requirement. The scope of work covered engagement with NESO & UKRI to fully understand requirements for scope change, understand requirements for the new CBA incl. Reserve, DFS, CP30, CrowdFlex models, etc. It also covered planning and collection of data inputs from within NESO and externally to populate the CBA, building the counterfactual and CrowdFlex scenario models in the Ofgem CBA template. Contextualising, summarising and presenting the CrowdFlex CBA update to the consortium, UKRI, and Ofgem was also included as well as ongoing support to address any UKRI comments.

Additional CBA CP30 Scope - This proposal looked to conduct a gap analysis between the consumer-led flexibility (CLF) modelled in CP30 and the flexibility observed in the CrowdFlex Trials. The work identified which components of CLF in CP30 are relevant to CrowdFlex, quantified flexibility beyond the headline figures in published reports, and provided deeper insight into the nature and application of this flexibility to support a net zero energy system.

By comparing the outputs of CrowdFlex with the CP30 CLF targets, the project could enable a "like-for-like" assessment of observed versus required flexibility. This then facilitated commentary on the gap between extrapolated observed flexibility to 2030 and the levels required by CP30, alongside discussion of measures to close any gap or ensure CLF delivery.

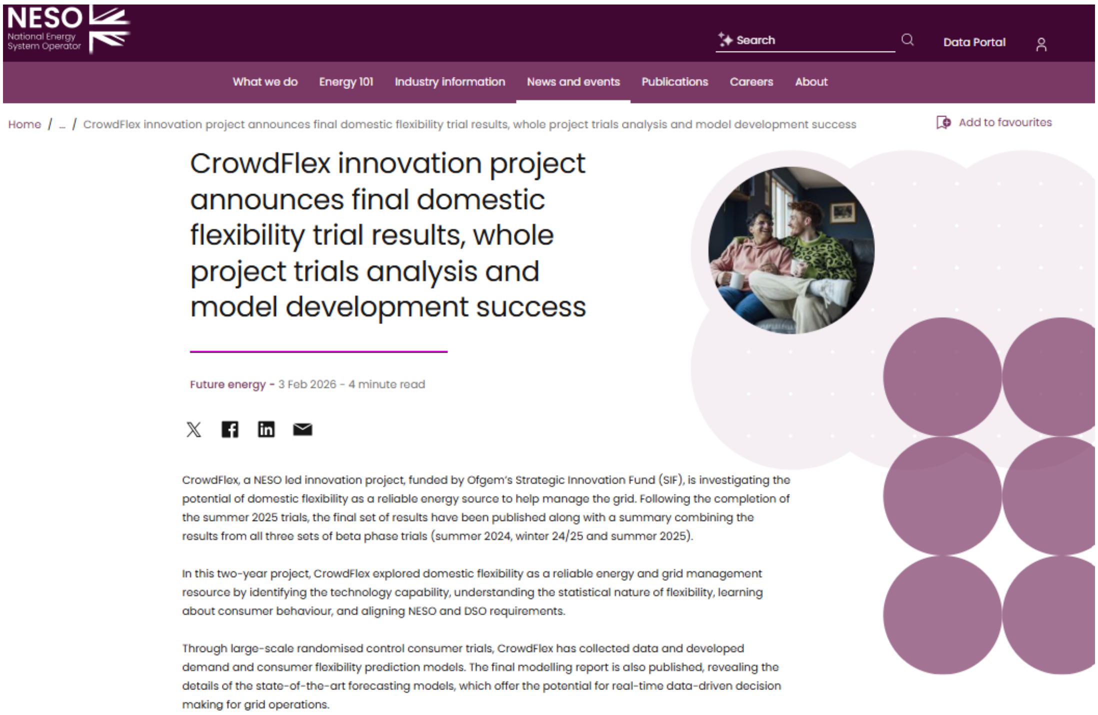
The final output formed part of the report delivered to Ofgem, DESNZ, and UKRI to inform policy development for CP30. The report was published to the wider industry.

Model Handover support – The request was to reallocate unspent budget from the trials to fund technical support from the Smith Institute for setting up the models they developed for CrowdFlex (AFM, EDM) on NESO environments. Support was organised in sprints until the end of April 2026 with NESO to defining goals with SI for each sprint. Support needed included amendments to model code to run on NESO environment, knowledge transfer, additional documentation as well as advise on potential and limits of the models in specific BAU use cases.

Dissemination & BAU Transition - Dissemination input would be required from the partners included in CrowdFlex and form part of the project closure process to meet final deliverables set by UKRI. Partners input on experiences during the project will be invaluable and findings would be shared with external parties and key project stakeholders. If final dissemination and project closure is not completed, then the project will not meet the key deliverables originally agreed with UKRI/Ofgem

The PDCR was approved by Ofgem on the 27th of January 2026

Appendix 1 -External Communications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CrowdFlex innovation project announces final domestic flexibility trial results, whole project trials analysis and model development success

Future energy - 3 Feb 2026 - 4 minute read

CrowdFlex, a NESO led innovation project, funded by Ofgem's Strategic Innovation Fund (SIF), is investigating the potential of domestic flexibility as a reliable energy source to help manage the grid. Following the completion of the summer 2025 trials, the final set of results have been published along with a summary combining the results from all three sets of beta phase trials (summer 2024, winter 24/25 and summer 2025).

In this two-year project, CrowdFlex explored domestic flexibility as a reliable energy and grid management resource by identifying the technology capability, understanding the statistical nature of flexibility, learning about consumer behaviour, and aligning NESO and DSO requirements.

Through large-scale randomised control consumer trials, CrowdFlex has collected data and developed demand and consumer flexibility prediction models. The final modelling report is also published, revealing the details of the state-of-the-art forecasting models, which offer the potential for real-time data-driven decision making for grid operations.


National Energy Syste... · 03/02/2026

Our CrowdFlex innovation project investigated domestic flexibility as a reliable energy and grid management resource. See what motivated over 107,000 @OVOEnergy and 33,000 @OhmeEV and @OVOEnergy customers to take part in different flexibility trial events: bit.ly/4knyRVG

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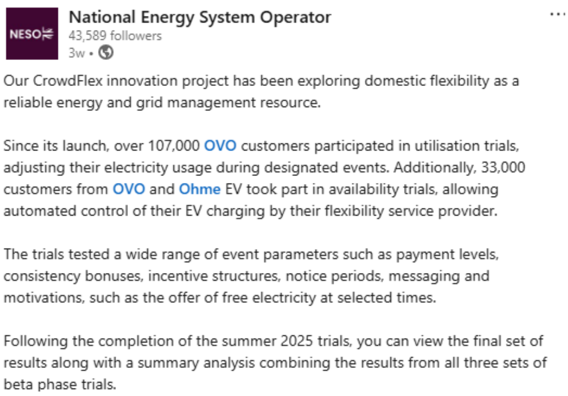

National Energy System Operator

43,589 followers

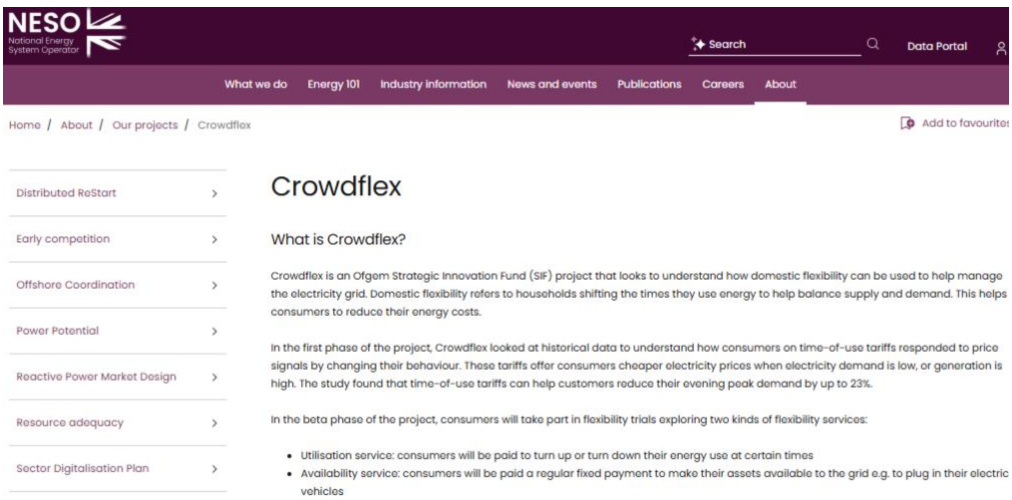
3w •

Our CrowdFlex innovation project has been exploring domestic flexibility as a reliable energy and grid management resource.

Since its launch, over 107,000 OVO customers participated in utilisation trials, adjusting their electricity usage during designated events. Additionally, 33,000 customers from OVO and Ohme EV took part in availability trials, allowing automated control of their EV charging by their flexibility service provider.

The trials tested a wide range of event parameters such as payment levels, consistency bonuses, incentive structures, notice periods, messaging and motivations, such as the offer of free electricity at selected times.

Following the completion of the summer 2025 trials, you can view the final set of results along with a summary analysis combining the results from all three sets of beta phase trials.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Crowdflex

What is Crowdflex?

Crowdflex is an Ofgem Strategic Innovation Fund (SIF) project that looks to understand how domestic flexibility can be used to help manage the electricity grid. Domestic flexibility refers to households shifting the times they use energy to help balance supply and demand. This helps consumers to reduce their energy costs.

In the first phase of the project, Crowdflex looked at historical data to understand how consumers on time-of-use tariffs responded to price signals by changing their behaviour. These tariffs offer consumers cheaper electricity prices when electricity demand is low, or generation is high. The study found that time-of-use tariffs can help customers reduce their evening peak demand by up to 23%.

In the beta phase of the project, consumers will take part in flexibility trials exploring two kinds of flexibility services:

- Utilisation service: consumers will be paid to turn up or turn down their energy use at certain times
- Availability service: consumers will be paid a regular fixed payment to make their assets available to the grid e.g. to plug in their electric vehicles

Appendix 2 - Extended learnings summary

Work-stream	Sub-trial	Learning Point	Outcome
Trials	Availability	How incentive structures influence participation.	All payment structures increased participant engagement (plug-in) over the control group. Escalating payments had either similar or greater effect than flat payments but at a lower cost. Higher escalating payments made no significant increase in plug-in.
Trials	Availability	The impact of increased plug-in on demand response performance.	Increased plug-in resulted in increased demand turn-up but not demand turn-down. Some participants reported concerns, including: plugging-in at peak times could increase costs; plugging in too much could reduce battery life.
Trials	Availability	The effect of regular messaging on participation.	Weekly email “nudges” increased plug-in for flat and escalating payment structures. These nudges had more effect on the escalating payment structure which rewarded greater participation.
Trials	Availability	How user app settings impact response performance.	“Ready-by” time (RBT) nudges and payments successfully shifted customers’ chosen RBT. The RBT shift did not translate into significant improvements in DTU or DTD, possibly as the shift was too small. Customer familiarity with RBT or similar parameters will be essential to maximising the flexibility from future vehicle-to-grid charge management whilst keeping customers happy.
Trials	Availability	Direction	Turn-up events delivered larger effects than turn-down, particularly when compared to the dispatched control group used in the summer '26 trial.
Trials	Utilisation	How does engagement change over time?	No long-term fatigue effect was found in the winter and summer '26 trials. Whilst "saving money" was the biggest motivator, those with environmental motivations reported less loss of interest and felt more that they were making a difference with their

			participation.
Trials	Utilisation	How incentive levels influence participation.	Lower £/kWh incentives delivered more flexibility per pound spent, while higher incentives delivered greater volumes, pointing to a trade-off between maximising response and minimising cost. The motivation to save money was the most common motivation.
Trials	Utilisation	How incentive structures influence participation.	Cash, free-electricity and community reward groups all achieved comparable demand response. The free-electricity incentive delivered flexibility at roughly one-third of the cost of the cash incentive and was considered the most enjoyable group, though it is also the one most likely to result in participants losing interest.
Trials	Utilisation	How does participation affect energy consumption outside events?	The size of the response too small relative to baseline demand to confidently say how much is demand creation/destruction.
Trials	Utilisation	The effect of different notice periods on event participation.	Longer notice (>4 hours) resulted in higher response for demand turn-up, though there is mixed evidence over all sub-trials for turn-up and turn-down. Feedback mirrored this mixed response with some participants forgetting events with longer notice and others missing short notice events.
Trials	Utilisation	Effect of consistency bonus payments	The two Consistency Bonus groups resulted in similar responses to the High incentive group but the additional cost of the Consistency Bonus in the Winter Utilisation trial made the CB groups the most expensive per unit response.
Trials	Utilisation	The long-term effects of participation.	Evidence from the two larger trials suggests no long-term fatigue effect during each trial. Of those reporting a loss of motivation – 50% cited incentives are not worth it. Those getting lower rewards were significantly more likely to be losing interest than those on higher rewards.

Trials	Utilisation	Peak pricing	High value peak events resulted in a 67% increase in demand turn-down. This is evidence that an occasional high response is possible at peak times with the right messaging and reward.
Trials	Utilisation	Duration of demand response events	Domestic DSR can be procured for up to 2 hours at a time without a reduction in performance towards the end of the event.
Trials	Utilisation	SMS event reminders	DSRSP communications can be enhanced with SMS notifications, slightly increasing response, but the cost is likely to outweigh the benefits if applied universally. DSRSPs may choose to use SMS for selected groups of customers for whom the combined social and financial benefits might exceed the cost.
Trials	Utilisation	The impact of individual event opt-in.	Longer notice periods resulted in higher opt-in rates (36%) than 2-hour notice (25%). Some users found per-event opt-in was burdensome.
Trials	Utilisation	Opt-in and baseline accuracy	The summer '26 trial aligned payment calculations with the NESO Demand Flexibility Service terms, paying only opted-in participants with no negative payments for demand shifting in the wrong direction. This resulted in turn-up volumes calculated 48% higher than by comparison with the control group, an improvement over the 168% inflation including those not opted in.
Trials	Utilisation	MPAN-level vs aggregate accuracy of P376 baseline	The 48% inflation for the total opted-in response is reduced to 5% by applying the P376 baseline demand response calculation methodology to the aggregated demand of all participants. DSRSPs reduce their financial exposure from participating in SO services by aligning customer propositions with SO service payment rules. SO service design should balance the support of DSRSPs in offering attractive proposition designs (MPAN-level calculations) with the need to provide technology neutral

			calculation of procured flexibility volumes (Aggregate calculation).
Trials	Utilisation	Multiple incentives	Although some participants were provided incentives that may already shape demand in response to time-of-day market conditions, additional "explicit" flexibility was demonstrated in response to CrowdFlex events and on average at a higher level than other participants.
Trials	Utilisation	Pre-payment (or pay-as-you-go) meter customer participation	Payment system limitations are a barrier to PAYGO customer participation. Turn-up events reduce their pre-paid credit, risking their continuity of supply, before any reward can be paid out. PAYGO customers cannot thus take advantage of turn-up events which would otherwise lower their cost of energy.
Trials	Utilisation	Time of day of events	Turn-down events were mostly scheduled 07:00 to 22:00 with the highest response early evening. Turn-up events showed response all day with 80% higher response daytime than during the day than the night. There was participant confusion when trial event timings are counter-intuitive, e.g.., being asked to turn-up during national demand peak.
Trials	Utilisation	Household technology ownership	Technology ownership had no significant effect on opt-in but certain household technologies significantly increased response, particularly electrical vehicle ownership (+238%) and electric heating (+24%).

Table 5: Extended Trials learnings summary

Work-stream	Sub-trial	Learning Point	Outcome
Models	Both	Can the models predict flexibility?	Both models can forecast domestic flexibility better than a naïve forecast.
Models	Both	Key factors impacting flexibility forecasts	Factors were similar across all DSRSPs, trial types and modelling approaches – it is likely that we've found the 'big hitters' – this can inform future data gathering strategies for flexibility services.
Models	Both	Can CrowdFlex model processes be replicated in business-as-usual?	DSRSPs have implemented demand forecast models, stood up APIs and achieved excellent data quality scores; SI processed tens of millions of data points – good indication that this is possible in a BAU scenario.
Models	Both	How flexible are the models, for example, for different regions, granularity?	Future iterations of the models will need to be tailored to changing energy landscape – the observed behaviour of the models gives reason for optimism that they will be able to cope.
Data sharing	Both	How can DSOs be kept informed regarding CrowdFlex DSR events?	Trial participant locations were shared with DSOs in advance of trials with results broken down by GSP after the trials. GSPs with too few participants were not included in the results sharing. The process was part of a larger data sharing agreement and took longer than expected.
Data sharing	Both	Project partners needed DSRSP data for various analyses.	A spreadsheet of data requests from all parties to deliver outcomes was created, with a final record of agreed sharing. As with locations, it took longer than expected. The approach has been reused for our new SIF project, Powering Wales Renewably, but the process has been brought forward to mobilisation.
Data sharing	Both	Aggregating participants at GSP level	Original granularity of data at GSP level was found to be too inaccurate to provide DNOs with any meaningful view of how their networks may be impacted and undermines

		insufficient for DNOs	any engagement seeking trial events approval.
Data sharing	Both	Data privacy is a challenge for data sharing	Data privacy, GDPR and original data sharing frameworks prohibit direct sharing of customer asset information to DNOs to provide locational visibility to enable bottom-up assessment of distribution network impact from events
Data sharing	Both	DNOs must prioritise safety with information unlocking caution around demand turn-up	Without granular data to confirm location and concentration recruited customers, it can be necessary for DNOs to restrict certain areas from potential recruitment if network issues such as constraints exist and potential CrowdFlex event impact unclear.

Table 6: Extended Models and Data sharing learnings summary

Appendix 3 – Deliverables

Deliverable	Publicly Available	Source	Further info.
CrowdFlex Annual Report Summary	Y	ENA Portal	innovation@neso.energy
CrowdFlex Annual Report-Ofgem Strategic Innovation Fund	Y	ENA Portal	innovation@neso.energy
CrowdFlex Beta SIF Project Direction Material Change Request Decision - Tracked Changes.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Beta_SIF Funding Benefits Map.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Case Study - Electric Heating Users.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Case Study - EV Users with a Disability.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Case Study - Financially Insecure Families.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Case Study - Health and Disability.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Customer Feedback Insights.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Customer Feedback Survey Summer Trial Report.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Customer Feedback_End of Trial Insights.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Executive Summary Availability Payment Trials V1.0.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Executive Summary Utilisation Payment Trials V1.0.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Final Model Report v1.0 (1).pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Report Availability Trial Summer 2025_V1.0.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Report Utilisation Trial Summer 2025_V1.0.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Summer Trial 2025_Customer feedback report Availability_v1.0 (1).pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Summer Trial 2025_Customer feedback report Utilisation_V1.0.pdf	Y	ENA Portal	innovation@neso.energy

CrowdFlex Winter Trial 2024-25 Mid trial customer feedback survey.pdf	Y	ENA Portal	innovation@neso.energy
SIF Beta Project Registration 2023-12-18 12_53.pdf	Y	ENA Portal	innovation@neso.energy
SIF Beta Project Registration 2026-03-27 8_35.pdf	Y	ENA Portal	innovation@neso.energy
Winter 24-25 Availability Trial.pdf	Y	ENA Portal	innovation@neso.energy
Winter 24-25 Customer Feedback Availability.pdf	Y	ENA Portal	innovation@neso.energy
Winter 24-25 Customer Feedback Utilisation.pdf	Y	ENA Portal	innovation@neso.energy
Winter 24-25 Utilisation Trial.pdf	Y	ENA Portal	innovation@neso.energy
Winter Trials Design Summary.pdf	Y	ENA Portal	innovation@neso.energy
CrowdFlex Implementation Strategy	Y	ENA Portal	innovation@neso.energy

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