Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.
Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

NIA Project Close Down Report Document

Date of Submission

Jul 2025

Project Reference Number

NIA2_NGESO043

Project Progress

Project Title

Demand Flexibility Service Evaluation

Project Reference Number

NIA2_NGESO043

Project Start Date

May 2023

Project Duration

1 year and 0 months

Nominated Project Contact(s)

James Kerr

Scope

The project will last approximately twelve months with two project partners. The project will evaluate the DFS using a mixed-methods approach. A programme of social research will deliver insights on customer motivation and experiences, while analysis of smart meter data will provide insight into flexed demand profiles, linking these to household smart energy capabilities where possible.

The social research programme aims to capture households' flexibility strategies and motivations, relevant socio-demographics, smart energy capabilities and any longer-term changes that may have resulted. The social research will use a combination of diaries, interviews, DFS smart meter data, and a post-trial survey to capture this information. The social research will focus on households, but participating SMEs will be included where possible. In addition, a short opinion poll conducted at the start of the evaluation (Jan 2023) will allow us to capture of snapshot of energy behaviours across the UK population during what is already an exceptional period. The social research team will design the research tools and work with approved DFS suppliers to recruit participants. The team aims to document participating customer MPANs to link the social research data to DFS smart meter data.
To carry out the analysis this research project will also design and develop a set of tools needed to support both quantitative and qualitative analysis of the effects of the DFS scheme.

The smart meter qualitative analysis will deliver insights into the DFS scheme through the following analyses, which will be done for domestic consumers: event analysis, flexibility offered, impact outside of DFS delivery window, predictability, effectiveness of DFS design and future recommendations, informing future workstreams.

Objectives

The goal of this research is to understand more about how consumers participated in the Demand Flexibility Service over winter

2022/23. Key areas to explore are:

1. **Awareness:** The level of awareness and understanding consumers have about flex services, and where consumers first came across the offering.
2. **Motivation**: The key drivers behind signing-up (or not signing up) for flex services.
3. **Onboarding & Engagement**: The onboarding experience, consistency of engagement with flex services and key factors which caused drop-offs to occur.
4. **Implementation (logistical)**: The level of ease at which consumers could respond to flex signals, and their knowledge around reducing demand.
5. **Implementation (commercial)**: The impact incentives have on engagement, including the type of incentive used, and how and when it is delivered.
6. **Implementation (comms)**: The impact of varying communication mechanisms on engagement with flex services, including the influence of automation in the process.
7. **Implementation (barriers)**: The key factors behind non-participation or disengagement with the service.
8. **Experience**: The variation in consumer satisfaction with their participation, if participants would engage with flex services in the future, and how engagement could be increased further.
9. **Second-order consequences:** The presence of positive or adverse knock-on effects that can be attributed to participation in flex services.

Success Criteria

The following will be considered when assessing whether the project is successful:

- A representative sample of consumers across multiple DFS Providers has been analysed.
- We understand how consumers have participated including strategies to reduce demand and barriers to participation
- There are clear recommendations following analysis of the data and responses to improve and evolve flexibility services and offers in the future
- Findings from the research directly inform the Demand Flexibility Service for 2023/24.

Performance Compared to the Original Project Aims, Objectives and Success Criteria

Project Summary

The Demand Flexibility Service Evaluation (DFS) project aimed to evaluate the effectiveness of DFS using a mixed-methods approach.

This comprehensive evaluation combined social research insights on customer motivations and experiences with smart meter data analysis to provide a detailed understanding of flexed demand profiles and household smart energy capabilities.

The project was split into two main phases:

Phase 1: Social Research

The social research component aimed to capture households' flexibility strategies, motivations, sociodemographic profiles, smart energy capabilities, and any long-term changes resulting from participation in DFS. This was achieved through a combination of diaries, interviews, DFS smart meter data analysis, and post-trial surveys, supplemented by an opinion poll conducted at the project's outset in January 2023. The research targeted both households and participating SMEs, aiming to link social research data to DFS smart meter data via documented customer MPANs.

In July 2023 the social research findings were published and presented in a webinar attended by numerous stakeholders. The research engaged over 23,500 participants through online diaries, surveys, and an opinion poll. Although the participant sample was skewed towards older demographics, the insights gathered have been instrumental in understanding consumer motivations and participation strategies. Financial incentives emerged as the primary motivator, with altruistic and social factors also playing significant roles. These insights influenced the design of DFS for the second year, particularly in eliminating the in-day adjustment mechanism.

Phase 2: Software Development & Smart Meter Data Analysis

The smart meter data analysis aimed to provide in-depth insights into the DFS scheme's effectiveness by examining event participation, flexibility offered, impacts outside the DFS delivery window, predictability, and overall design effectiveness.

This work evaluated the household-level response to the first year of the Demand Flexibility service (DFS), launched by NESO in winter 2022/23. We were able to obtain a sample of ~139,000 useable MPANs from domestic customers from Utilita, EDF, and EON who opted-into DFS Y1.

This dataset was cleaned and evaluated against a set of research co-developed questions. These questions delivered quantitative insights into consumer responses to the DFS at a household level, supplementing the system-wide results and reporting published in

August 2023.

Certain metrics, such as household profile or the presence of low-carbon technologies, were then extracted from the cleaned smart meter data and linked to the dataset resulting from the DFS Household engagement survey (undertaken in summer 2023) for the participants that opted in to this further research. The analysis of the linked survey-smart meter data is designed to understand how different types of energy consumers participate in the DFS, and whether certain characteristics of the person or their home correlate to different experiences.
82% of the consumers in our full data sample opted into at least one event and a small number (just over 1%) opted into every event.

Out of the 113,648 consumers who opted-into at least one event, 52% of those consumers reduced their demand relative to the baseline during the event window for those events.

Across events in our sample, the delivered volume per participating consumer (i.e. those who reduced demand during the event) was 0.39 kWh.

In aggregate, the 124 MWh of flexibility delivered across the households and events in our dataset represents just under 4% of the total downturn (3.3 GWh) reported through the DFS over winter 2022/23.

Across the full dataset we saw reduction in demand during the event window for DFS events. The baselining methodology used in DFS Y1, which included an in-day adjustment (removed from subsequent iterations of the service), did often mask consumer intent to reduce demand to some extent.

The in-day adjustment mechanism shifted the baseline based on event day demand during an in-day adjustment window compared to an average baseline. Lower demand during the window resulted in a down-shifted baseline, reducing the measured volume of demand reduction.

77% of customer-events incurred a downshifted baseline, due to consumers reducing their demand before the event. The data suggests that people acted differently from the start of an event day, not just during the event, or during the in-day adjustment window immediately before it. The downshifted baseline will have limited the rewards received by households that made an effort to shift and may have impacted consumer understanding.

To better assess the types of response across the full dataset we separated consumers into different groups based on the delta between their adjusted baseline and the consumption throughout the day of a DFS event.

For many consumers, we found that their actual consumption throughout the day was higher than their adjusted baseline due to the in-day adjustment downshifting their baseline. As discussed elsewhere, this adjustment makes it difficult to unpick consumer behaviour. Despite this, 33% of consumers across events were able to reduce demand relative to the adjusted baseline over the event day.

Across events, we found that anywhere from 78-92% of households have a secondary peak after an event. For 14 of the 18 of the events in our sample, this post-event turn-up in the hour after the event is greater than both the adjusted and unadjusted baselines and outweighs any turn-down during the event.

This indicated that there is a consistent increase in demand in the hour directly after the event regardless of the baseline used, possibly due to customers shifting demand during the event window.

To establish patterns and findings between participant's survey responses and their smart meter demand profiles we undertook group comparisons and outlier analysis.

Comparing those households that that opted in and successfully turned-down with those that opted in but did not actively participate, we found little difference in trial experiences (ease of participation, likelihood of participation), effort (number of events, shifting strategy) and household characteristics.

There were no significant differences in the average amount of demand turn-down provided by households between different low carbon technology ownership groups, between vulnerable groups, or between different tenures.

Looking at group differences in average rewards earned per event, we found that those with an EV charger earned significantly more than those without any LCTs.

We found that the incentive offered did have some impact on trial experiences. Those with lower incentives (under £3 kWh) appear to have taken part in fewer events, were more likely to report dissatisfaction with the overall experience (compared to the medium and high incentive groups), and were least likely to report that they would participate again.

Conclusion and Next Steps

The results presented show clear intent to reduce demand across the dataset with 124 MWh of flexibility delivered by the ~139,000 consumers in our sample. This translates to an average reduction of 0.39 kWh across events for each household that was able to reduce demand during the event window.

This is, at times, obscured by the in-day adjustment mechanism which often shifted the household baseline downwards, reducing the measured demand reduction and any rewards received by consumers. The role of the in-day adjustment mechanism is described more fully in the final report.

As a world-first initiative to use domestic flexibility to balance a grid at a national scale, the DFS was expected to encounter initial difficulties with implementation. Following feedback from industry, NESO removed the in-day adjustment mechanism from subsequent iterations of the DFS and the service continues to evolve and mature. The large amount of variation in demand reduction, combined with the baselining method obscuring customer behaviour, means there were few observable group differences or patterns in the survey-linked data subset. Our key findings from the smart meter analysis for DFS Y1 show that consumers were generally able to reduce consumption during the events, despite some evidence of increased consumption outside of the window leading to a secondary peak. However, challenges with in-day baseline adjustments can make it difficult to accurately account for the true extent of demand shifting behaviour.

Response to the DFS: Across the DFS events we saw some evidence of demand creation but on the whole, there is a clearly observed reduction in consumption during DFS events. The in-day-adjustment was also shown to typically downshift the baseline to a level where intention to shift demand during an event could result in either (i) a lower magnitude reduction or possibly (ii) a relative increase in demand depending on the level of baseline shifting observed.

In the survey-linked dataset, there is little difference in trial experiences (ease of participation, likelihood of participation), effort (number of events, shifting strategy) and household characteristics between households that showed turn-up signatures and those that showed turn-down signatures.

Impact of the in-day-adjustment: As the downshifting of consumer baselines must have impacted rewards received, we would expect this to result in negative consumer experiences. However, although it is a small sample in the survey-linked dataset, the group that appear to have encountered these baseline issues still reported that they were extremely likely to take part in the DFS again.

Households that opted-in but did not appear to participate also report positive experiences. A majority reported finding it very easy to participate and a majority said they were very likely to participate again. This suggests that some households participate with a ‘low effort, low reward’ approach in mind. Although they did not appear to shift in many events, they were happy to opt in, and were happy to support research around the DFS by providing their data for this analysis. This approach may shed some light on why only 50% of respondents that received no financial reward at all expressed dissatisfaction in the original feedback survey.

Required Modifications to the Planned Approach During the Course of the Project

The project was originally scheduled for a twelve-month duration but encountered delays due to contractual negotiations and the implementation of enhanced security protocols. The project timeline was extended to ensure that all aspects were thoroughly completed and evaluated due to the potentially sensitive nature of the smart meter and associated meta data that we would be analysing. The core aim of the project remained to assess the effectiveness of DFS through a combination of social research and smart meter data analysis, with a focus on understanding consumer behaviors, flexibility strategies, and the overall impact of the service.

The delay necessitated some modifications to the planned approach, which included securing a data handling environment that met rigorous security standards. This phase included extra time for establishing secure data protocols and completing data collection and analysis. These adjustments were essential to maintain the integrity of the project's findings and ensure that the results effectively guide future flexibility services and innovations.

The project focused on integrating insights from both social research and smart meter data, extending the analysis period, and aligning all efforts to meet the revised schedule and objectives.

Lessons Learnt for Future Projects

The project has highlighted several critical lessons regarding the handling of data and the management of extensive data volumes.

One of the key challenges encountered was navigating the complexities of GDPR compliance while ensuring that data handling and analysis met the highest security standards. The necessity for secure data environments and rigorous consent processes significantly extended the project timeline, underscoring the need for early and thorough planning in these areas. Future projects should incorporate

robust data protection strategies from the outset, including clear protocols for managing consent, data anonymisation, and secure storage to mitigate potential delays and ensure compliance.

Additionally, the scale of data generated by the DFS project emphasised the importance of having a well-defined framework for data management and analysis. The sheer volume of data, combined with the need for detailed and accurate evaluation, revealed potential challenges for future projects in this area. To address this, future projects should invest in scalable data processing solutions and consider the integration of advanced data management tools early in the project lifecycle.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

The social research phase, which captured the perspectives of over 23,500 participants, has provided valuable insights into consumer motivations and engagement with flexibility services. The findings have already influenced key design modifications for the DFS, such as the removal of the in-day adjustment mechanism. This early outcome underscores the project's ability to generate actionable insights that can directly impact the development and refinement of flexibility services.

With the smart meter data analysis phase now complete, this has provided comprehensive insights into the effectiveness of DFS in real-world settings. The integration of data from both social research and smart meters has provided a holistic view of how consumers interact with demand for flexibility services. These combined insights are anticipated to support the design of the next generation of flexibility services and tariffs and contribute to more effective energy management strategies.

Data Access

Details on how network or consumption data arising in the course of NIA funded projects can be requested by interested parties, and the terms on which such data will be made available by NESO can be found in our publicly available "Data sharing policy related to NIA projects (and formerly NIC)" and Innovation | National Energy System Operator.

National Energy System Operator already publishes much of the data arising from our NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

Foreground IPR

Report (and associated data): Household engagement with the Demand Flexibility Service 2022/23 - July 2023

Report (and associated data): The Demand Flexibility Service – Smart Meter Data Evaluation – Winter 2022/23

Planned Implementation

The findings of this work have been incorporated into the evolution of the Demand Flexibility Service and wider learnings in the development of flexibility services within NESO. For example, the removal of the in-day adjustment mechanism was a direct result of these findings. CSE (The Centre for Sustainable Energy) have also incorporated findings and learnings into their wider Smart & Fair work programme that looks across the energy market (NESO, DNOs, retail) to ensure that energy consumers are enabled to participate in flexibility services with a fair outcome.

It is hoped that the findings of this work, which has been one of the largest non-commercial evaluations of demand flexibility using real consumption data, will enable NESO, DSOs and importantly energy retailers and flexibility service providers (aggregators) to enhance and evolve their commercial offers. This is particularly important as market-wide half hourly settlement is rolled out, integrating energy flexibility into daily routines.

Net Benefit Statement

The project provided significant insight about real-world experiences of the Demand Flexibility Service. As a result, NESO adjusted the service design to remove a choice that led to an unintended consequence (in-day adjustment). This meant that in subsequent years there would be more of a level-playing field for consumers participating in the service, and NESO of flexibility providers would not over-pay for delivery of the service.

The insights also provide suppliers and flexibility service providers insight into consumer preferences which will allow them to evolve and improve designs for tariffs and flexibility services in the future.

Other Comments

The Project outcomes and results contain confidential information and intellectual property rights that cannot be disclosed in this Report due to their proprietary nature. Should the viewer of this Report (“Viewer”) require further details this may be provided on a case by case basis following consultation of all Publishers. In the event such further information is provided each and any Publisher that owns such confidential information or intellectual property rights shall be entitled to request the Viewer enter into terms that govern the sharing of such confidential information and/ or intellectual property rights including where appropriate formal licence terms or confidentiality provisions. Dependent upon the nature of such request the Publishers may be entitled to request a fee from the Viewer in respect of such confidential information or intellectual property rights.

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