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## NIA Project Registration and PEA Document

### Date of Submission

Aug 2023

### Project Reference Number

NIA2\_NGESO043

## Project Registration

### Project Title

Demand Flexibility Service Evaluation

### Project Reference Number

NIA2\_NGESO043

### Project Licensee(s)

National Grid Electricity System Operator

### Project Start

May 2023

### Project Duration

1 year and 0 months

### Nominated Project Contact(s)

James Kerr

### Project Budget

£950,000.00

## Summary

The ground breaking Demand Flexibility Service (DFS) allowed over 1.6 million households and businesses the opportunity to participate in a national flexibility service and be rewarded for the first time. Given the speed that the service was set up and the implications for future flexibility services this project will explore how consumers participated in DFS and crucially the barriers to participation, through 2 phases of work.

1. A social research element (diaries, opinion poll, survey and interviews).
2. Using consenting consumer data, smart meter data will be analysed and linked to the social research.

The findings of this work should inform future iterations of DFS, DSO flexibility services and flexibility service provider offers (suppliers and aggregators).

### Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

## Problem Being Solved

In November 2022 the ESO launched the Demand Flexibility Service (DFS), an enhanced action, to provide an additional tool in the ESO's control room toolbox. The DFS enabled households and businesses to take part in an ESO service for the first time as well as traditional I&C consumers who are familiar with ESO balancing markets.

By the end of the winter over 1.6 million households and businesses had taken part in DFS. Given the speed that the service was stood up and launched, and the number of households that had taken part in a real demand response service for the first time it's important to understand how households have taken part, what the barriers they might have faced taking part and what are the opportunities to improve future flexibility services and propositions to increase participation and consumer confidence.

## **Method(s)**

This project brings together an experienced team of subject matter experts from Centre for Sustainable Energy and Element Energy, with significant experience in consumer analysis. They will work in close collaboration to qualitatively and quantitatively analyse the various data from the Demand Flexibility Service Trials. A comprehensive breakdown of the work packages is listed below:

### **Work package description**

#### **Phase 1**

##### **WP0: Coordination**

WP0 Aims: To ensure the successful delivery of the project within the time and resource constraints and to establish processes for working with and through the approved DFS providers.

- 0.2 Agree participant recruitment process and communications
- 0.3 Agree smart meter data acquisition process and formats
- 0.4 Acquire an initial cut of SM data
- 0.5 Acquire full DFS trial and pre-trial data

##### **WP1: Social Research**

WP1 aims to deliver insights into customer experiences of the trial and understand households' and business owners' motivations to participate, the strategies used, changes over time that can be negative (such as response fatigue) and positive (such as increased flex capability), as well as perceive barriers and benefits. This work package has three strands of work.

- 1.1 Online opinion poll
- 1.2 Qualitative research
- 1.3 Online survey

##### **WP2: Software development**

WP2 aims to deliver a set of tools to support both quantitative and qualitative analysis of the effects of the DFS scheme. Since the volume of data involved is quite large and the work will have some exploratory elements (as we do not yet know the specific queries required to support the analyses), we propose to spend some time developing a bespoke system for this purpose.

- 2.1 System setup
- 2.2 Further development and user support

##### **WP3: Smart meter data analysis**

WP3 aims to deliver quantitative insights into customer responses to the Demand Flexibility Service trials through a series of analyses. The quantitative study will be done for domestic consumers (WP3.1) and micro/small smart meter business consumers (WP3.2).

- 3.1 The above analyses will be done for domestic consumers.
- 3.2 The above analyses will be done for micro/small smart meter business consumers.

##### **WP4: Synthesis & Reporting & Archiving**

WP4 aims to synthesise the insights gained through the evaluation and publish outputs. This work package will involve close collaboration across the teams to ensure the best synthesis of the social research data with the smart meter data analysis. We will also review potential formats in which the data could be made publicly available. This might mean archiving the social research with UK data service, or creating flex demand profiles that can be used in energy systems modelling.

#### **Phase 2**

##### **WP0: Coordination**

WP0 Aims: To ensure the successful delivery of the project within the time and resource constraints and to establish processes for working with and through the approved DFS providers. This will involve participant recruitment and data security, liaison with providers, subcontractors and expert advisors.

##### **WP1: Supplier Engagement**

Within WP1 we will engage with each DFS provider to discuss and agree on the content and format of data to be provided, including availability of data, data formats to ensure anonymity, data transfer between ERM and the ESO and follow ups with providers as required to facilitate data provision. As part of WP1 CSE will also contact social research participants that have consented to being contacted about further research using their smart meter data to link social research findings with processed MPANS.

## **WP2: ESO System Implementation**

For WP2 ERM will develop a database and analytical tools to ingest, store and efficiently process the large dataset of smart meter data. The data will be stored in an appropriate database system and code (most likely Python) will be developed to extract data, perform analysis (based on the analytical methods developed in WP3) and save / store outputs of the analysis.

## **WP3: Smart Meter Data Analysis**

WP3 aims to develop an analysis methodology to draw insights from the DFS participants smart meter data, in order to address key research questions and to inform design of subsequent DFS schemes and other flexibility services, such as Crowdflex. An initial set of research questions that we will seek to investigate through the analysis are set out below:

- Event Analysis
- Flexibility Offered
- Impact of DFS on Participant consumption outside of DFS delivery window
- Predictability
- Effectiveness of DFS design and future recommendations

The analysis methods will be dependent on the extent of data that DFS providers are willing to provide, as we seek to maximise the robust insights that can be drawn from the data available. The analysis will be performed using the software system developed in WP2 and we expect there will be some iteration and additions to the code as the analysis progresses.

Outputs of the analysis of the smart meter participant dataset will be provided by the ESO, produced using common analytical methods (provided by ERM). We will make a comparison of these outputs with those from the main smart meter dataset in order to identify any systematic differences, e.g. that might imply some selection bias in the survey participant group.

## **WP4: ESO Analysis (Technical Analysis)**

In WP4 ERM will support the ESO to perform the analysis on the survey participants' data using the code provided, e.g., ensuring ESO analysts are comfortable running the code and performing any subsequent analysis on the outputs produced. This will take the form of an initial workshop to demonstrate the analysis to the ESO analysts (based on the anonymised data available to ERM) and availability to answer ad hoc questions as they carry out the work.

## **WP5: Reporting**

WP5 will produce a range of project reports summarising the results of the analysis and key insights. Summary reports for each DFS provider which have shared data will be produced on the outputs of the analysis of their customers data. A common template for these summary reports will be agreed in advance, which will be populated with data from each DFS provider. Output datasets will be prepared for publication alongside the final report. These will include only aggregated smart meter data, fully anonymised and not attributable to any particular provider.

In line with the ENA's ENIP document, the risk rating is scored Low.

- TRL Steps = 1 (2 TRL steps)
- Cost = 2 (£950k)
- Suppliers = 1 (2 suppliers)
- Data Assumptions = 2 (Assumptions known but will be defined within project)
- Total = 6 (Low)

## **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 a 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.

## Objective(s)

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.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

The ESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations. Benefits to all consumers are detailed below.

## 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.

## Project Partners and External Funding

Centre for Sustainable Energy (CSE) and Element Energy will be carrying out the work, no external funding required.

## Potential for New Learning

This project will help the ESO and industry to:

- Understand how consumers have engaged with and experienced a live flexibility service – the motivations, barriers, issues and needs.
- Provide large and up to date dataset to inform other innovation projects, industry, policy makers and consumer groups
- Apply learning directly to CrowdFlex and Consumer Building Blocks

## Scale of Project

The project spans twelve months with two project partners. The project consists of:

1. Desk-based research, design and consultation with project partners and stakeholders.
2. Social Research
  - DFS participant diaries
  - Online surveys
  - A nationally representative opinion poll

- Interviews with DFS participants
- Data analysis & reporting

### 3. Smart meter data analysis

- Data analysis
- Linking to social research
- Reporting

## Technology Readiness at Start

TRL3 Proof of Concept

## Technology Readiness at End

TRL5 Pilot Scale

## Geographical Area

The project will be conducted in Great Britain.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

£950,000

## Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

### Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

Please answer **at least one** of the following:

#### How the Project has the potential to facilitate the energy system transition:

The ESO's remit is to provide a safe, reliable, affordable electricity supply. As a central player in the GB electricity system, it is the ESO's role to provide the leadership and guidance for the transition to Net Zero. We are seeking to facilitate a smooth transition through sharing insights and analysis to help industry stakeholders determine the direction of travel and make informed decisions.

The project's outcomes will be fed directly into the design of the Demand Flexibility Service for winter 2023/24. We also expect the associated datasets to provide stakeholders across the industry (DSOs, energy suppliers, consumer groups, regulators and government) with evidence to enhance future flexibility propositions.

The dataset will also enhance the Consumer Building Blocks NIA project by providing additional and up-to-date data for inclusion.

#### How the Project has potential to benefit consumer in vulnerable situations:

N/A

### Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

#### Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)

N/A

#### Please provide a calculation of the expected benefits the Solution

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

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

CrowdFlex Alpha found that the value of flexibility could be worth £1.25Bn/yr to the end consumer across GB when the cost of providing flexibility services is accounted for. This includes £3.8Bn of avoided DN reinforcement and £2.2Bn of avoided transmission network reinforcement investments between 2024-2050.

#### Please provide an estimate of how replicable the Method is across GB

- The project covers the whole of GB where households have participated in DFS.
- The methodology is replicable as the diaries, survey and opinion poll and smart meter data analysis could be rerun at a later date

with an up-to-date dataset.

## Please provide an outline of the costs of rolling out the Method across GB.

No direct costs of rolling out the method across GB are anticipated.

### Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

- A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).
- A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)
- A specific novel operational practice directly related to the operation of the Network Licensees system
- A specific novel commercial arrangement

RIIO-2 Projects

- A specific piece of new equipment (including monitoring, control and communications systems and software)
- A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is unproven
- A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)
- A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology
- A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution
- A specific novel commercial arrangement

### Specific Requirements 4 / 2a

#### Please explain how the learning that will be generated could be used by the relevant Network Licensees

The project's outcomes will be fed directly into the design of the Demand Flexibility Service for winter 2023/24. We also expect the associated datasets to provide stakeholders across the industry (DSOs, energy suppliers, consumer groups, regulators and government) with evidence to enhance future flexibility propositions.

The dataset will also enhance the Consumer Building Blocks NIA project by providing an additional and up to date data for a future refresh. We expect that network companies will utilise the Consumer Building Blocks archetypes and will benefit from up-to-date information on consumer participation in flexibility markets.

#### Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

N/A

#### Is the default IPR position being applied?

- Yes

## Project Eligibility Assessment Part 2

### Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed.

#### Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

Each DFS Provider (Supplier or Aggregator) is expected to carry out their own analysis of how their customers participated in DFS. However by working across multiple DFS Providers, this project will undertake the largest research evaluation of DFS possible.

### **If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.**

N/A

## **Additional Governance And Document Upload**

### **Please identify why the project is innovative and has not been tried before**

- Flexibility is reasonably new topic area that we need to explore further, and we don't yet understand how consumers will embrace participating in flexibility markets.
- This is potentially the largest flexibility 'trial' ever involving new domestic and commercial participants across multiple providers.
- There is significant interest from across the energy industry (and wider) in data and analysis and insights.
- Millions of data lines will need to be analysed in a bespoke secure system.

### **Relevant Foreground IPR**

All relevant reports will be published on the Smarter Networks Portal as available.

### **Data Access Details**

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

1. A request for information via the Smarter Networks Portal at <https://smarter.energynetworks.org>, to contact select a project and click 'Contact Lead Network'. National Grid ESO already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
2. Via the ESO Data Portal [data.nationalgrideso.com](http://data.nationalgrideso.com)
3. Via our Innovation website at [www.nationalgrideso.com/future-energy/innovation](http://www.nationalgrideso.com/future-energy/innovation)
4. Via our managed mailbox [innovation@nationalgrideso.com](mailto:innovation@nationalgrideso.com)

Details on the terms on which such data will be made available by National Grid ESO can be found in our publicly available "Data sharing policy relating to NIC/NIA projects" at <https://www.nationalgrideso.com/document/168191/download>.

### **Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities**

Due to the nature of the project and that it is researching potential future impacts to the grid based largely on assumptions, this does not fall into current BAU.

### **Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks(e.g. commercial, technical, operational or regulatory) associated with the project**

- There are increased risks associated with the availability of required data and a high level of assumptions, which makes this project better suited to NIA.
- The TRL of the overall framework is relatively low. Therefore, innovation funding is more suitable for exploring the project's potential and increasing the TRL before transferring into BAU activities.
- Conducting this project with NIA funding will ensure that the project findings can be shared more widely with other interested network licensees.

### **This project has been approved by a senior member of staff**

Yes