NIA Project Registration and PEA Document

Date of Submission:

*Notes on Completion: Please refer to the NIA Governance Document to assist in the completion of this form. Please use the default font (Calibri font size 10) in your submission. Please ensure all content is contained within the boundaries of the text areas. The full-completed submission should not exceed 10/12 pages in total.*

1. Project Registration

|  |  |  |
| --- | --- | --- |
| Project Title (*This cannot be changed once registered*) |  | Project Reference |
| Consumer Building Blocks Phase 2 |  | NIA2\_NESO078 |
| Funding Licensee(s) |  | Project Start Date |
| NESO |  | September 2024 |
| Nominated Project Contact(s) |  | Project Duration |
| [James Kerr, James Whiteford, Caitlin Bromfield, Rosannah East](mailto:James.Kerr@nationalgrideso.com) |  | 7 months |
| Contact Email Address |  | Project Budget |
| [innovation@nationalgrideso.com](mailto:innovation@nationalgrideso.com) |  | £400,000 |

**Project Summary (125 words limit)**

This project will build on existing consumer building blocks to combine learnings from the first and second Demand Flexibility Service (DFS) and create a more granular set of archetypes for different electrified heating types with a large and recent dataset. We will do this by conducting social research with recent DFS participants to understand consumers interaction with flexibility and apply this to the consumer archetypes.

This project will explore defining more granular archetypes for different electrified low carbon heating types and types of consumers, to reflect the variation in technology mix and consumer behaviour that we are likely to see in the future low carbon domestic heating roll out.

Both updates to the consumer building blocks will ensure they are a more consistent, future-facing and robust set of archetypes.

**Benefits Summary (125 words limit)**

Due to the limitations of the input datasets used in phase one of this project [NIA2\_NGESO026](https://smarter.energynetworks.org/projects/nia2_ngeso026/) , information on how changes in consumer behaviour could impact demand was limited. The further year that DFS has completed as well as the potential to run an additional survey will allow further information to be added to the archetypes from phase 1.

Heat pump demand profile data was previously limited and what is available has not reflected recent performance improvements. Analysing ESC trial data will bring new information into our heat modelling.

Existing profile data is often based on gas boilers and does not represent future demand profiles. This work will be innovative by generating technology and consumer-type demand profiles to enable more accurate modelling of decarbonised heating scenarios.

**Lead Sector**

|  |  |
| --- | --- |
| Electricity Distribution | Gas Distribution |
| Electricity Transmission  X | Gas Transmission |

**Other Sectors**

|  |  |
| --- | --- |
| Electricity Distribution  X | Gas Distribution  X |
| Electricity Transmission | Gas Transmission  X |

**Primary Research Area** *(Please select just one)*

|  |  |
| --- | --- |
| Net zero and the energy system transition | Optimised assets and practices |
| Flexibility and Commercial Evolution  X | Whole Energy System |
| Consumer Vulnerability | Data and Digitalisation |

**Secondary Research Area** *(Please select up to two)*

|  |  |
| --- | --- |
| Net zero and the energy system transition  X | Optimised assets and practices |
| Flexibility and Commercial Evolution | Whole Energy System |
| Consumer Vulnerability | Data and Digitalisation |

**Development steps**

|  |  |
| --- | --- |
| Technology Readiness Level (TRL) at Start  4 | TRL at Completion  5 |

1. Project Details
   1. Problem(s)

This should outline the Problem(s) which is/are being addressed by the Project. This cannot be changed once registered.

**DFS Evaluation and Flexibility Insights**

How consumers react to, think about and participate in flexibility markets is still relatively unknown. Modelling to date has used ‘old’ data that in some cases pre-dates the Covid pandemic. We are interested in linking the Demand Flexibility Service evaluation social research data with the domestic consumer archetypes so that the archetypes contain more information about consumer behaviour, which can feed into modelling work (e.g. in the Future Energy Scenarios modelling). This project will use data and insights from 1000s of active participants of DFS to give an up-to-date picture of consumer participation in flex markets.

**Low carbon heat**

The decarbonisation of domestic and commercial heating is a key challenge to meeting the legislated net zero target, making up nearly 20% of the UK’s carbon emissions. There is a commitment from Government to support domestic decarbonisation, including a target of installing 600,000 heat pumps a year by 2028 and a decision on the future of hydrogen for heating by 2026.

Heating type is one of the key factors that determines a household domestic energy demand profile. In future, there will be a variety of different heating options available and the ability to model low carbon heating demand profiles accurately will be key to inform pathway modelling, network planning and policy.

Existing pathway modelling has been largely based on gas boiler profiles and is therefore not fully reflective of the different technologies that will be deployed to meet net zero.

There has previously been little heat pump profile data available and the data that is available does not reflect more recent performance improvements. Analysing data from the ESC’s ‘electrification of heat’ demonstration will bring new information about heat pump profiles. Alongside this, analysis of available data for other electrified heating types (such as direct electric or electric storage) will help to model future demand profiles for these heating types.

* 1. Method(s)

This section should set out the Method or Methods that will be used in order to provide a Solution to the Problem. The type of Method should be identified where possible, eg technical or commercial.

For RIIO-2 projects, apart from projects involving specific novel commercial arrangement(s), this section should also include a Measurement Quality Statement and Data Quality Statement. [You can find more information here](https://nationalgridplc.sharepoint.com/:w:/s/GRP-INT-UK-ESOInnovation/EUHa8ywhnJ9EmaRDlEXTOGcBR-ixyoa2Nd9onfMs66xdsw?e=fefb74).

A partnership led by Centre for Sustainable Energy (CSE) and ERM, will explore the implications of the latest Demand Flexibility Service to understand consumer experiences and apply learnings on demand flexibility to the consumer archetypes. Alongside this, CSE will develop a more granular set of archetypes for low carbon domestic heating, including consideration of demand flexibility. CSE and ERM will do this using the following approach:

* **WP1: DFS Consumer Evaluation**

As in the 2022-23 evaluation, a customer feedback survey will be designed to address agreed research questions. The survey will be shared with participants by their DFS Provider. A key difference to last year will be the expansion of the survey to include eligible non-domestic consumers (i.e., micro/ small businesses with smart meters and industrial and commercial businesses). Two separate surveys will be designed, bespoke to the domestic or non-domestic audiences, but these will be hosted by the same survey company or on the same in-house survey software and delivered in the same way to customers. We will seek expert QA of the questions.

For the domestic evaluation, 20 interviews are also proposed to delve deeper into the experience households that represent particular groups or topics of interest. We also propose to undertake interviews with non-domestic sector participants – in this case the focus will be on refining the survey prior to launching with the full group, hence the interviews will be performed in the early project stages. We have allowed for up to 20 interviews, to get a spread across sectors and organisation sizes.

* **WP2: Nationally Representative Opinion Survey & Heat insights Scoping**

The DFS survey data is not a representative sample of every household that took part in the DFS and not a representative sample of the GB population. To address this issue, we propose to conduct a nationally representative opinion survey with questions that can allow us to classify the respondents into one of the archetypes, and enhance our knowledge about demand flexibility ability/behaviour.

Building on the existing set of domestic consumer building blocks developed by CSE, further analysis of available data and models will be conducted in order to deliver a more granular set of archetypes for different electrified technology and consumer types. WP2 will include scoping for this piece of work, including a review of existing data.

* **WP3: Enhancing Consumer Archetypes**

We will classify domestic respondents from the DFS evaluation survey 22-23 and the new domestic survey respondents for 23-24 into the domestic consumer archetypes, calculate the distribution of certain survey responses, and conduct exploratory analysis to understand the flexibility strategies (e.g. load shifting, peak shaving, or no response) of different types of consumer.

For the non-domestic evaluation, we will classify respondents into the non-domestic proto-archetypes, analyse the results of the survey and use the outcomes to update the offer attribute matrix, which will return a revised archetype grouping.

These insights on demand flexibility will then be added to the consumer archetypes.

For the low carbon heat archetype enhancement, this may include desk-based analysis of heat pump data (including hybrids) to produce demand profiles linked to a range of ambient weather conditions for each consumer archetype, as well as how demand flexibility uptake might be considered. For other electrified heating types this would include desk-based analysis of other low carbon heating types (electric storage, direct electric etc) and modelling where needed, to produce archetypes to the same specification as for heat pumps.

* **WP4: Reporting, Dissemination & Archiving**

WP4 will involve close collaboration across the teams to synthesise the insights gained through the evaluation and the update to the archetypes. A customer evaluation report for DFS 23-24 will be produced for publication. For the updated archetypes a short summary report and new data tables will be produced. We will also explore options for securely archiving the data for future research purposes.

For the low carbon heat work, CSE will develop a tool and/or set of archetypes which take account of both consumer type and low carbon heating type. CSE will produce a report on their approach and methodology.

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

TRL Steps = 1 (1 TRL steps)

Cost = 2 (£387k)

Suppliers = 1 (1 supplier)

Data Assumptions = 2

Total = 6 (Low)

* 1. Scope

The scope and objectives of the Project should be clearly defined including the net benefits for consumers (eg financial, environmental, etc). This section should also detail the financial benefits which would directly accrue to the GB Gas Transportation System and/or electricity transmission or distribution.

This project will last approximately 25 weeks and is comprised of 4 work packages, which can be considered in 2 parts.

**Part 1:** **DFS evaluation and flexibility insights**

The project outputs will support two objectives:

* Enable NESO and energy system actors to improve the design and delivery of new flexibility services for domestic and eligible non-domestic consumers.
* Improve future scenario modelling work by providing more information about consumer behaviour in the archetypes.

**Part 2: Low carbon heat archetypes**

This piece of work aims to join-up existing NESO work to create a consistent set of heating profiles for different types of consumers across low carbon heating types. This will improve our modelling for decarbonising heating. This piece of work is dependent on the outcomes of a number of internal pieces of work as input, therefore project scope and approach will be defined further as these projects are concluded.

The analysis in this work package would cover both heat pumps and other electrified heating (such as electric storage and direct electric).

* 1. Objectives

This cannot be changed once registered.

This project aims to:

* Document consumer (both domestic and non-domestic) experiences, motivations, perceived benefits and challenges through the second DFS.
* Summarise the different types of demand flexibility behaviour, understand the limitations of the data, and explore other options to gather insight into demand flexibility behaviour.
* Understand the differences and similarities between DFS participants grouped by the consumer archetype they have been classified into.
* Add detailed information regarding demand flexibility to the consumer archetypes
* Create a set of heating demand profiles for different types of consumers across heat pumps and other electrified heating types.
  1. Consumer Vulnerability Impact Assessment (RIIO-2 projects only)

Details of the expected effects of the Method(s) and Solution(s) upon consumers in vulnerable situations. This must include an assessment of distributional impacts (technical, financial and wellbeing-related). For RIIO-1 projects please add “Not Applicable”

The NESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations. Benefits of this project are summarised in Section 1.

* 1. Success Criteria

Details of how the Funding Licensee will evaluate whether the Project has been successful. This cannot be changed once registered.

The project will be considered successful if the following deliverables are produced and meet the project objectives:

* An evaluation of the second year of DFS
* A national representation of GB consumer sentiment and potential drivers to change behaviour
* Enhanced consumer archetypes that consider likely changes to consumer behaviour
* A strategy for modelling the demand profiles from different types of electrified heating and flexibility and either a set of scalable profiles or a tool for generating such profiles.
  1. Project Partners and External Funding

Details of actual or potential Project Partners and external funding support as appropriate.

A partnership between Centre for sustainable energy and ERM for WP1-4. For low carbon heat the work will be led solely by CSE. No external funding.

* 1. Potential for New Learning

Details of what the parties expect to learn and how the learning will be disseminated.

As part of the proposed plan this project will help with further understanding of:

* Understanding how consumer behaviour may influence detailed scenario modelling and how flexibility offerings could be used to drive benefit for the whole energy system.
* Development of approach to creating demand profiles different types of consumers for electrified heating, including use of modelling or synthetic data where necessary.
  1. Scale of Project

The Funding Licensee should justify the scale of the Project – including the scale of the investment relative to the potential benefits. In particular, it should explain why there would be less potential for new learning if the Project were of a smaller scale.

The project spans 9 months with 2 project partners. The project consists of desk-based research, stakeholder engagement with partner organisations and with consumers, data analysis and disseminations.

* 1. Geographical Area

Details of where the Project will take place. If the Project is a collaboration, the Funding Licensee area(s) in which the Project will take place should be identified.

This project will be conducted in GB.

* 1. Revenue allowed for in the current RIIO settlement

An indication of the funding provided to the network licensee within the current RIIO settlement that is likely to be surplus to requirements as a result of the Project.

None

* 1. Indicative Total NIA Project Expenditure

An indication of the total Allowable NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO1).

An indication of the Total NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO2).

£400,000

1. Project Eligibility Assessment

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).

* 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:

* + 1. How the Project has the potential to facilitate the energy system transition:

**DFS evaluation and flexibility insights**

Demand flexibility is a key enabler in the energy transition, to lower the costs of net zero by shifting demand to times when energy is cheap and demand is lower. The project outcomes will be fed into our long term scenario modelling and will enhance our understanding of consumer behaviour and therefore could be used as an input into network development processes for future networks as well as identifying improvements that could be used by other organisations within GB who use scenario data to plan electricity and gas networks. In addition, the insights gained through the social research will aid actors across the energy system in the development of flexibility markets and products that consumers want to and are able participate in are fit for purpose.

**Low carbon heat**

Currently, around 78% of UK residents have mains gas heating. In order to meet the 2050 net zero target, domestic heating needs to be decarbonised. There is a commitment from Government to support domestic decarbonisation, including a target of installing 600,000 heat pumps a year by 2028 and a decision on the future of hydrogen for heating by 2026.

Depending on the uptake of different low carbon heating types by 2050, the potential impact on the energy system is extensive. For example, if a number of consumers decide to choose direct electric heating this would increase peak demand substantially relative to heat pumps. The preferences for different low carbon heating solutions is uncertain and heat profiles in NESO are currently based on gas boiler demand profiles. Given that technologies such as flexibly and non-flexibly operated heat pumps, electric storage heaters, direct electric and other electrified heating options operate in a different way and have different impacts on the energy system, it is important to take this into account when modelling future pathways. Daily demand profiles are also substantially impacted by the type of consumer that uses energy (e.g. household size, occupation/work pattern). Combining consumer type with technology type to produce a set of archetypes/demand profiles will enable modelling to take better account of these variables and can enable better decisions for investment and policy.

* + 1. How the Project has potential to benefit consumer in vulnerable situations:

N/A

* 1. 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.

* + 1. Please provide an estimate of the saving if the Problem is solved (RIIO-1 projects only)
    2. Please provide a calculation of the expected benefits the Solution

This is for Development or Demonstration Projects, not required for Research Projects. It should be (Base Cost – Method Cost, Against Agreed Baseline) and include a description of the recipients of the benefits.

Not required as this is a research project.

* + 1. Please provide an estimate of how replicable the Method is across GB

This must be in terms of the number of sites, the sort of site the Method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

This project is comprised of two parts.

* **Part 1: DFS evaluation and flexibility insights**
* **Part 2: Low carbon heat archetypes**

The outputs for part 1 will be shared directly with other network operators as well as being published on the NESO website. This will build on current activities during phase 1 where the outputs were shared and are now being used for further work / innovation.

The output for part 2 will build on phase 1 of the consumer building blocks work to publish a set of archetypes and/or tool for different consumer and low carbon heating types, alongside datasets and methodology where relevant. This will enable wider GB energy participants to use these archetypes in their own modelling processes.

* + 1. Please provide an outline of the costs of rolling out the Method across GB.

Updated consumer building blocks and outputs from parts 1 and 2 will be publicly available, and therefore insights from this work can be used across industry in modelling and analysis.Costs of rolling out should therefore be minimal.

* 1. Requirement 3 / 1 – involve Research, Development or Demonstration
     1. RIIO-1 Projects

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 systems and 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 GB electricity transmission or distribution systems |  |
| A specific novel commercial arrangement |  |

* + 1. RIIO-2 Projects

A RIIO-2 Project must involve the Research, Development or Demonstration of at least one of the following:

|  |  |
| --- | --- |
| 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) | x |
| 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 |  |

* 1. Requirement 4 / 2a – develop new learning

A Project must develop new learning that can be applied by Gas Transporter and/or Electricity Transmission or Electricity Distribution licensees. For RIIO-1 Network Licensees may wish to address challenges specific to their network.

Please answer one of the following:

* + 1. Please explain how the learning that will be generated could be used by relevant Network Licenses

As per phase 1 of the project the intention is to develop the archetypes so the network licensees can use them in scenario development at the regional level. This will lead to strong collaboration if a common language is adopted across the transmission and distribution interface and across vectors.

The low carbon heat element of the project will generate a set of archetypes for different consumer and low carbon heating types, alongside datasets and/or methodology where relevant. This will enable Network Licensees to use these archetypes in their own modelling process, for example as part of energy demand modelling for network planning.

For further benefits see “Benefits Summary” section 1.

* + 1. Or, please describe what specific challenge identified in the Network Licensee’s innovation strategy is being addressed by the Project (RIIO-1 only)
    2. Is the default intellectual Property Rights (IPR) position being applied?

This cannot be changed once registered.

|  |  |
| --- | --- |
| Yes  x | No |

If “no”, the following questions must be answered:

* + - 1. Demonstrate how the learning from the Project can be successfully disseminated to Network Licensees and other interested parties:

N/A

* + - 1. Describe how any potential constraints or costs caused, or resulting from, the imposed IPR arrangements:

N/A

* + - 1. Justify why the proposed IPR arrangements provide value for money for customers:

N/A

* 1. Requirement 5 / 2c – be innovative

A Project must be innovative (ie not a business as usual activity) and have an unproven business case entailing a degree of risk warranting a limited Research, Development or Demonstration Project to demonstrate its effectiveness. This could include Projects which are untested at scale, or in relation to which there are risks, which might prevent the widespread deployment of the equipment, technology or methodology.

* + 1. Why is the project innovative?

RIIO-1 projects must include description of why they have not been tried before.

**DFS evaluation and flexibility insights**

The archetypes were developed in conjunction with the other network companies and this is the first set of DFS data of it’s kind to be incorporated and provide more granular archetypes. The project will provide richer information on emerging flexibility issues which we are only just starting to understand. We can’t rely on previous historic data whilst predicting future consumer behaviour.

**Low carbon heat**

There has previously been little heat pump profile data available and the data that is available does not reflect more recent performance improvements. Analysing data from the ESC’s ‘electrification of heat’ demonstration will bring new information into NESO’s heat modelling. Previous archetyping work has generally focused on building archetypes, whereas in this work we propose to understand how different consumer types impact on demand profiles and the extent to which these can be correlated with building types. Alongside this, analysis of available data for other electrified heating types will help to model future demand profiles for these heating types. Producing demand profiles which take into account both consumer and low carbon heating type is a new and innovative approach, which will enable better future demand and network modelling.

* + 1. Why is the Network Licensee not funding the Project as part of its business as usual activities?

Given the level of innovation associated with this project there are a number of risks that mean we should use NIA funding including:

* As this is a research based project that relies on additional support from partner organisations, it does not fall into current BAU.
* First time development of consumer type and electrified low carbon heating type dependent energy demand profiles using both real data and/or synthetic data to model demand patterns.
  + 1. Why can the Project can only be undertaken with the support of NIA?

This must include a description of the specific risks (e.g. commercial, technical, operational or regulatory) associated with the Project.

Given the level of innovation associated with this project there are a number of risks that mean we should use NIA funding including:

* From an operational perspective if outputs from this project can be used as part of modelling to feed into RIIO ED3 then timelines are very short for a project of this complexity and an expedited funding process such as NIA will be required.
* Whilst we have established an outline methodology for developing low carbon heating demand profiles, there remains risk that it will not be possible to develop a manageable number of profile archetypes, as such there is a residual risk that the outputs cannot be applied within NESO modelling tools. Innovation funding is therefore appropriate given the uncertain outputs.
  1. Requirement 6 / 2d – 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.

* + 1. Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

WP1-4 build on existing work that has been conducted through ENA innovation. The low carbon heat element will review existing literature and available data to help ensure there is no unnecessary duplication.

* + 1. If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

**Relevant Foreground IPR**

*Please provide a list of the relevant foreground IPR that will be generated in the course of the project e.g. reports, models, tools etc*

The deliverable for the DFS Evaluation will be a report detailing the insights from the domestic and non-domestic surveys and interviews including recommendations for future flexibility services, building on the report published from the DFS Evaluation Year 1.

The deliverable for low carbon heat will be a report on a set of archetypes and/or tool for different consumer and low carbon heating types.

**Data Access Details** *(standard NESO response - please do not edit)*

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’. NESO 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 our Innovation website at [Innovation | National Energy System Operator (neso.energy)](https://www.neso.energy/about/innovation)
3. Via our managed mailbox [innovation@nationalgrideso.com](mailto:innovation@nationalgrideso.com)

Details on the terms on which such data will be made available by NESO can be found in our publicly available “Data sharing policy relating to NIC/NIA projects” at [80797503.1 (neso.energy)](https://www.neso.energy/document/168191/download)

1. PEA approval

The senior person (RIIO-1) or senior network manager (RIIO-2) responsible for implementing RIIO-2 NIA Projects must approve the PEA. It must then be published on the Project Registration page of the Smarter Networks Portal.

|  |  |
| --- | --- |
| **Please confirm this project has been approved by a senior member of staff** |  |