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.

NIA Project Registration and PEA Document

Date of Submission

Oct 2022

Project Reference Number

NIA_UKPN0086

Project Registration

Project Title

Shift 2.0

Project Reference Number

NIA_UKPN0086

Project Licensee(s)

UK Power Networks

Project Start

October 2022

Project Duration

2 years and 1 month

Nominated Project Contact(s)

innovation@ukpowernetworks.co.uk

Project Budget

£619,300.00

Summary

The rapid uptake of LCTs is likely to cause secondary peaks, herding behaviour and congestion in certain parts of the network. Shift 2.0 will look at the potential for dynamic and locational pricing to address these issues, and how any options can complement flexibility procurement.

Shift 2.0 will:

· Understand the scale and timing of secondary peaks and herding behaviour.

· Investigate the potential for locational and dynamic price signals (both time of use and capacity-based price signals).

· Understand the regulatory, commercial, and technical barriers that would need to be addressed in the design of mechanisms and/or price signals and the enablers, roles, business models and data flows to make dynamic/locational pricing a viable mechanism.

· Further stimulate the development/evolution of market-led customer propositions and business.

Preceding Projects

NIA_UKPN0045 - Shift

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

Rapid uptake of low carbon technologies (LCTs) in homes is required through the 2020s, and management of flexibility will be key to mitigating network impacts, delays to connections, and the potential for reliability issues. Network signals will interact with the wholesale price, and in a world of increasing generation from intermittent renewables and a need to consume energy when it is abundant, the wholesale price will become less predictable, leading to significant changes in the flows in the network. These factors mean that (i) secondary peaks will become more likely, (ii) more flexibility will be needed on the network and (iii) there are potentially uncoordinated signals, e.g. wholesale price response by devices connected to the distribution network causing distribution network constraints.

Greater granularity (in location and time) and dynamism of price signals may be an effective tool to help facilitate and manage these issues. However, uncertainties exist regarding how such signals could be designed and implemented in a way that drives the benefit of deferred reinforcement, protects consumers, and avoids unnecessary complexity and cost.

On-going work into the reform and design of the wholesale market (by BEIS) and distribution charging (by Ofgem, through the distributed use of system charges significant code review) coupled with forecasts for high LCT uptake over the next decade makes it important for us to be assessing implementation options now.

Method(s)

- Analyse when secondary peaks, herding behaviours and conflicting price signals are likely to cause issues on the network, based on various wholesale market developments (including the current pricing regime)
- Based on this analysis, develop options for the design and implementation of mechanisms to address primary and secondary peaks and increase flexibility, including aggregation and locational/dynamic price signals
- Develop options for the technical implementation of mechanisms, through from generation of signals out to their consumption and use by market participants and customers – including what systems and processes would need to be established to support them
- Engage with industry stakeholders to test and refine the purpose of the project and the key questions we are addressing, the theoretical view of price signal and aggregation design, the technical solution options and potential trials design
- Collaborate with market participants to investigate and trial customer propositions and business models to test the effectiveness of the price signals in addressing the challenges outlined
- Gather real-world data to inform network planning and wider industry decision-making regarding the development of roles and responsibilities
- Assess customer and regulatory implications of approaches including equitability/distributional impacts, protections, and ensuring all customers can participate in the energy transition
- For each mechanism, understand its feasibility, effectiveness, distributional impact on customers, cost and complexity to implement, impact on sequencing of dispatch and interaction with wholesale market.

Data & Measurement Quality Statement

All data used within this project is for the purposes described above, and therefore quality will be measured on this basis. The project will follow all data quality rules, logging, and prioritising issues as they arise in line with the approved methodology set out in our Enterprise Data Management Policy, which forms part of the UK Power Networks Integrated Management System.

Data quality will be measured across five dimensions where applicable:

- Accuracy
- Completeness
- Consistency
- Validity
- Uniqueness

Data quality rules for each of the appropriate data quality dimensions above will be set by the project, measuring them closely on a regular basis to identify quality issues.

Data quality issues will be logged in a central location and prioritised using an approved matrix which combines the importance of the issue, and the amount of data affected, this gives an indication of the issue's impact on the project and wider business, considering factors such as:

- The impact on the health and safety of the public and employees
- Whether it may result in a breach of our licence conditions or relevant regulations

- The impact on UK Power Networks' reputation
- The impact on our operations and efficiency
- The financial impact, including project delays and charges from external service providers

The project will then seek support for resolving the issues in priority order. All data and background information will be stored centrally and securely in a project specific Sharepoint folder or in our Enterprise Data Store if required by the wider business in accordance with data protection requirements.

Scope

The project will first look to understand the change in demand profiles for different customer types over the coming years. It will determine when, and the extent to which, the assumptions currently underpinning reinforcement projections break down. It will then look to design, assess and trial potential measures to mitigate the impact of this need for additional reinforcement. The benefits of such measures would be savings from deferred reinforcement.

Phase 1 will deliver:

- Initial analysis of changing load profiles and their interaction with price profiles
- Scenario development and data collection
- Modelling and CBA
- Write up and options for trial

Phase 2 will deliver:

- Commercial design of products to be trialled
- Trial design

Phase 3 will deliver:

- Partner mobilisation and trial participant recruitment
- Trial delivery and data collection

Phase 4 will deliver:

- Trial analysis and reporting
- Dissemination of trial findings
- Implementation plan for successful products

Objective(s)

- Understand the scale and timing of secondary peaks and herding behaviour
- Investigate the potential for locational and dynamic price signals (both time of use (ToU) and Capacity-based price signals) to be employed at scale to:

a) Better manage within-day flexibility of residential/SME/I&C LCTs on a local level to address constraints – avoiding the risk of secondary peaks and assisting in the management of instances of high renewable generation output

b) Better signal network needs to the market to focus customer acquisition or investment in DER assets where they could be most useful (or least impactful) for the network

c) Increase volumes of flexible resources on the network

- Understand the regulatory, commercial, and technical barriers that would need to be addressed in the design of mechanisms and/or price signals and the enablers, roles, business models, systems and data flows to make dynamic/locational pricing a viable

mechanism.

- Further stimulate the development/evolution of market-led customer propositions and business models to harness and manage flexibility for the benefit of customers.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

A key question to answer as part of the project will look at the customer and distributional impacts of any proposed solutions:

What are the consumer risks and protections required to manage equitability concerns and best enable all consumers to participate in the energy transition?

If the flexibility solutions developed through the project can defer reinforcement and reduce costs to customers, this will benefit all customers through lower bills, including those in vulnerable circumstances. The project will assess and address any fairness concerns from the outset to ensure customers are not left behind or penalised from the products developed and trialled. In addition, this project looks to address local areas of grid constraints, in order to allow more LCTs to connect to the network. This will help avoid customers being left behind in the Net Zero transition.

Success Criteria

The project will be a success if we are able to clearly understand the impact of changing load LCT load profiles and their interaction with wholesale prices and how new flexibility products could mitigate the impact of these on the distribution network. This will be through delivery of:

- An analysis of changing demand profiles that can help predict when secondary peaks and herding behaviour may cause congestion on the distribution network
- A cost-benefit analysis of mitigation options provided by different products
- Commercial design and trialling of mitigation options, with an analysis of the results
- An assessment of system and societal impacts of these options, including an assessment of the impact on vulnerable customers
- An implementation plan for products, successfully demonstrated through the trial
- A dissemination plan to other DNOs to aid in replicability and scalability for successfully demonstrated products

Project Partners and External Funding

Partner organisations to deliver the research and analysis will be identified through a competitive tender process.

Project partners will participate in the design and running of the trials (energy aggregators and suppliers). We will look to include other DNOs in the trials.

There is no additional external funding to this project at this stage.

Potential for New Learning

The project will deliver learnings on:

- The network impact of changing load profiles and their interaction with changing wholesale price profiles
- The potential mitigation options for this using implicit and explicit flexibility options
- Understanding of customer views on different products that could be implemented, gathered through engagement
- Trial results of these options and implementation plans if they are successful
- Distributional impacts of these options, and how to ensure vulnerable customers are protected and/or benefit from them

These learnings will be disseminated through different channels including:

- Publication of clear and accessibly reports on findings and trial results

Events with relevant stakeholders e.g. other DNOs, aggregators, regulator to share learnings

Scale of Project

To ensure that the project provides learning that is relevant to all DNOs, we will engage with a range of stakeholders to assess the options that will be taken to trial. The trial is planned to take place over a full calendar year, in order to get results that are representative and reliable. The trial is likely to focus on key areas of congestion within our network, again in order to ensure that the learnings are relevant to the use case being investigated. This scale of research and engagement is necessary to test the external validity of our findings.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

The trial will take place across all UK Power Networks' licence areas

Revenue Allowed for the RIIO Settlement

There is no revenue allowed for in RIIO-ED1 for this project.

Indicative Total NIA Project Expenditure

The total expenditure that UK Power Networks expects to incur for this project is £619,300 of which £563,000 will be recovered from NIA.

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 project aims to facilitate more LCTs and therefore the energy system transition, by ensuring that the network is ready for their rapid uptake. It will help in the development of new proposition and approaches for flexibility services and smart charging, therefore developing the offering of the DSO and making LCTs more attractive to customers. This will also reduce the potential for reliability and quality issues related to new LCTs and reduce costs to maintain the network. Due to this increased capacity and lower reinforcement needs, quicker and lower cost LCT connections will be possible.

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)

The estimated savings over the course of RIIO ED2 are £16.64m (NPV).

Please provide a calculation of the expected benefits the Solution

The benefits come from CO2 emission reductions and air quality improvements from an additional uptake of EVs.

We assume that without Shift 2.0, secondary peaks and herding behaviour in response to wholesale price signals reduces the diversity of EVs on our network. This would result in fewer EVs being able to be connected to our network, and so lower uptake of EVs.

We assume that this would mean that the number of EVs would fall to our low scenario (Steady Progression DFES).

Shift 2.0 will develop a project to avoid this situation and therefore allow the number of EVs reach our target scenario (Consumer Transformation DFES).

The expected benefits are therefore calculated as follows:

- Costs: cost to deliver the project in 2022, and cost to implement the solution annually in ED2 = £6.03m (NPV)

- Benefits: Additional EVs (Consumer transformation predicted volumes – Steady progression predicted volumes) * £ carbon savings per EV + Additional EVs (Consumer transformation predicted volumes – Steady progression predicted volumes) * £ air quality damage cost avoided per EV = £22.68m (NPV)

- Net benefits = £16.64m (NPV)

- £ carbon savings per EV = CO2 reduction per EV relative to a petrol or diesel car, in kg * carbon price, in £/t

- £ air quality damage cost avoided = p/litre damage cost of petrol or diesel car * annual consumption in litres

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

The method is very replicable across GB. If one or many of the options trialled can be implemented to provide flexibility services in UK Power Networks' area, this could be replicated across all other DNOs in similar areas of congestion. The implementation plan deliverable of the project will help with this. We have already engaged with other DNOs on the project and will continue to do so through to ensure replicability.

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

Assuming UK Power Networks has one third of UK customers, the GB-wide benefits would therefore be around £29m.

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 initial analysis will help all DNOs to understand when secondary peaks and herding behaviour are most likely to cause issues on distribution networks.

The trial will provide evidence that will help DNOs to assess which ones are appropriate to be implemented into their suite of flexibility products and offerings.

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.

We have undertaken:

• a review of the ENA Smarter Networks Portal;

• initial engagement with stakeholders and DNOs; and

• a search for publications.

We have not found a similar project that has looked at the analysis and trial we are hoping to run. While there are projects that have looked at smart charging and flexibility services (including the precursor to this project, Shift), there are no projects that have looked specifically at secondary peaks, herding and the potential for implicit flexibility (i.e. delivered by DNO price signals rather than procured flexibility services). Shift 2.0 is therefore a build on Shift.

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

A previous NIA project, Shift, found that customers respond to price signals but that this could lead to issues with secondary peaks, but it did not investigate how these could be addressed. Since Shift concluded, there has been a lot of change in the price of electricity for customers, and more is expected with the Review of Electricity Market Arrangements (REMA) being undertaken by BEIS. This has brought to the forefront the need to address potential clustering/herding of LCTs on our network in a way that has not been needed before.

Relevant Foreground IPR

The default IPR position will be applied. The Relevant Foreground IPR generated in the project will be the network analysis and implementation plan. Both these outputs will require the use of existing UK Power Networks Background IPR.

Data Access Details

To view UK Power Networks' Innovation Data Sharing Policy, please visit here.

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

We have a BAU flexibility product where flexibility services are procured on a 6-monthly basis. This Is meeting our current flexibility needs, however we believe more will be needed with further uptake of LCTs. A better of understanding on what this would look like, what the impacts would be and how it would be implemented is needed.

Due to the risk involved in the project and the uncertainty around the benefits that will be delivered, these activities would not form part of our business as usual activities. In order to progress an innovative project which carries significant risk in implementation, additional innovation funding is required as a stimulus.

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

As noted in the NIA guidance, certain projects are speculative in nature and yield uncertain commercial returns. This is the case for this project, where new commercial arrangements will be trialled. The NIA funding will enable UK Power Networks to undertake a project which has commercial and operational risks associated with it, in terms of a lack of certainty on results.

This project has been approved by a senior member of staff

☑ Yes