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NIA Project Registration and PEA Document

Date of Submission

Aug 2024

Project Reference Number

NIA_SSEN_0078

Project Registration

Project Title

Demand Diversification Service for LMAs Phase 2 – Commercial Trials

Project Reference Number

NIA_SSEN_0078

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

September 2024

Project Duration

1 year and 6 months

Nominated Project Contact(s)

Brian Wann, Innovation Delivery Manager

Project Budget

£2,059,238.18

Summary

Load Managed Areas (LMAs) were introduced to provide network diversity in response to the introduction of storage heating. However, the industry has matured and LMAs are no longer always fit for purpose as they can restrict consumers' tariff options and their ability to participate in flexibility markets. Alternative market-based methods of diversifying demand are being considered.

Phase 1 of the project conducted desktop simulations and engaged stakeholders to validate the concept of procuring Demand Diversification Services (DDS) from Flexibility Service Providers (FSPs). Phase 2 will finalise the design of and execute the commercial trials of the DDS with FSPs and selected customers. Data collected will be used to model a wider range of network configurations and scenarios to determine if DDS could provide the diversification required for networks.

Nominated Contact Email Address(es)

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Problem Being Solved

LMAs were introduced to provide Distribution Network Operators (DNOs) with load diversification and avoid, reduce or defer the need for network reinforcement as electric storage heating load increased significantly during the 1980s. In Scottish Hydro Electric Power Distribution (SHEPD), this has historically been achieved using a Radio-Teleswitch Service (RTS) to control the charging times of the storage heaters. RTS allowed this new undiversified pre-programmed switched load to be connected without requiring significant network reinforcement using LMA diversification schedules. This had avoided over £700 million in reinforcement costs by 2011 (EA Technology, 2012)1. Whilst these systems have successfully managed demand, they are becoming increasingly incompatible with the current network and wider market operation:

1. LMAs impose mandated demand schedules which limit the ability of consumers and their suppliers to monetise the value of their

schedulable loads.
2. The complexity and restrictions of an LMA reduce the range of tariffs available to affected consumers.
3. The new 5-terminal SMETS2 smart meters provide the same programmable scheduling functionality as the RTS meters that will be retired in June 2025. However, these meters do not support the addition of other loads, e.g. electric vehicle chargers or heat pumps.

To resolve these issues and ensure the network remains within its safe operating limits, this project will investigate new and innovative market mechanisms (DDSs), where FSPs could be contracted to manage schedulable consumer loads within agreed limits. This would also allow suppliers to stack value by utilising the schedulable loads to provide other flexibility services providing this does not undermine the DDS. DDSs will be initially implemented in areas where there is a known network constraint and must maintain at least the existing level of demand diversification provided by the current LMAs while allowing consumers to access new products more easily and from a broader range of FSPs.

Phase One considered two of the barriers to the adoption the demand diversification achieved using a market-based mechanism:

• Technical trials of the metering infrastructure; this was deemed unnecessary as this was being investigated by other parties and its suitability for enabling DDSs will be tested during the Phase 2 commercial trials.
• Scoping new DDS commercial models; this was achieved in April 2024 and the key learnings from a Simulation Workshop held in Phase 1 will be used to design the commercial trials during Phase 2.

There are numerous challenges that need to be addressed before the new DDSs can be introduced to the market, including:

• Will sufficient FSPs (primarily suppliers or aggregators) be willing to participate in DDSs to provide choice and establish viability and enable the LMA notices to be removed?
• Will the coverage and reliability of the Smart Meter network, or standard telecoms networks, be suitable to support technical solutions that interact with consumer meters or smart devices and provide schedule changes or demand data to understand network utilisation?
• Can FSP products or offerings based on behind the meter scheduling solutions provide the level of certainty required for reliable and enduring demand diversification.
• With the possibility of FSPs scheduling loads (existing storage heaters or future low carbon technologies), will DDSs provide the diversification certainty and stability required by DNOs to avoid, reduce or defer network investment counterfactual options?
• What is the appropriate level and location of network monitoring and the refresh rate needed to support FSPs in managing consumer demand and scheduling?
• What is the DDS consumer proposition and how can it be explained to ensure the positive intentions and needs are understood?

If successful, DDSs will allow the continued avoidance, reduction, or deferment of reinforcement. There is also significant potential to replicate this approach to manage network load growth as a result of the rapid uptake of other schedulable assets, e.g. electric vehicles (EVs), home batteries, heat pumps (HPs), which can be scheduled using behind the meter controllers, or network peaks caused by other dynamic tariffs. As such, the DDS solutions could be utilised in a much wider range of network situations to support this growth.

1 EA Technologies (2012) A Study of the Benefits of the Radio Teleswitch System and the Consequences of Replacement in the SHEPD Licence Area

Method(s)

Phase 2 will investigate the feasibility of whether DDSs incentivise FSPs to deliver at least the existing level of diversification provided by the LMA regulations. It will also determine if DDSs can increase network utilisation and defer, reduce or avoid the need for reinforcement in network areas forecast to be constrained. Two DDS mechanisms were discussed with stakeholders during the first phase of the project:

• **Allocated Capacity (AC)** – each FSP has an allocated capacity based on the number of consumers in their local portfolio and their demand. FSPs commit to ensure their local demand portfolio remains below the AC in return for a Service Payment. The risk to the network is minimal and there are clear FSP responsibilities.

• **Dynamic Congestion Response (DCR)** – each FSP responds to real-time network loading signals and is incentivised to use their consumers' schedulable loads during Settlement Periods (SPs) with a low DCR price (low load factor) and avoid SPs with a high DCR price (high load factor). Network utilisation and the risk to the network are the highest of all DDS models but there are clear incentives for the FSPs to keep aggregate demand within network capacity.

A third mechanism was introduced during Phase 1:

• **Default Schedule** – this replicates the mandated demand schedules of the LMAs and the level of existing diversification. It is

designed to be an interim measure until there is a critical mass of FSPs providing AC and DCR. FSPs will be compensated for maintaining the schedules set by the DNO and, depending on network utilisation, will be able to use their schedulable loads to provide other flexibility services as long as they do not conflict with the default schedule.

Data Quality Statement (DQS):
The project will be delivered under the NIA Governance in line with Ofgem, Energy Networks Association (ENA) and SSEN internal policies. Data produced as part of this project will be subject to quality assurance to ensure the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored in our internal systems with appropriate backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Measurement Quality Statement (MQS):
The methodology used in this project will be subject to supplier quality assurance regimes and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and assessments will also be clearly documented in the relevant deliverables and final project report made available for review.

Scope

If the proposed DDS models are anywhere near as successful and enduring as the diversity provided by RTS then they can be expected to provide the same level of benefits, that is £1 billion of reinforcement costs deferred over the next 40 years.

Phase 2 will refine the DDS models introduced in Phase 1 and conduct commercial trials with FSPs to validate that:

• The basis of estimating the value of providing a DDS to the network is robust and can be used when pricing a Business as Usual (BaU) service – initially based on the reinforcement cost for the network assets that are constrained.
• The value for providing a DDS will incentivise FSPs to provide a service that delivers a reliable and enduring demand diversification.
• FSPs can offer products or tariffs based on DDS that provide greater choice for consumers and the opportunity to financially benefit from providing the DNO with demand diversification.
• DDS will enable the creation of competitive markets in the areas where they are introduced.
• The proposed commercial terms are fit for purpose when implemented as a BaU service – creating new service types that fall under the Open Networks Flexibility Service Agreement.

These will be achieved through three workstreams:

Field Trials
The viability of each DDS will be tested over a minimum of 11 months to establish if parties react as expected, whether the service is capable of delivering the required level of diversification and if there are any unintended consequences. Each DDS will be tested under a variety of conditions to establish how to best set up the DDS as a BaU service, e.g. establishing AC based on the number of consumers in their local portfolio and their demand. Participating FSPs will be required to recruit a number of their customers with smart meters (for settlement) and schedulable loads to participate in the trial. The Field Trials will also uncover if there are any technology requirements essential to the deployment of each of DDS as a BaU service, e.g. sharing of real-time networking monitoring for the DCR model.

Virtual Networks
One of the potential downsides of recruiting consumers is finding a critical mass in an area of the network to provide realistic feedback on whether DDS can have a meaningful impact on the diversity in that part of the network. To overcome this, the project will work with the Power Networks Distribution Centre (PNDC) and the Energy Systems Catapult Living Laboratory (LL) to model virtual networks using real world data captured from the LL participants. This will enable multiple network configurations to be analysed with a variety of types of load and levels of DDS penetration.

Analysis, Insights and Final Report
The outcomes of the field trials and virtual network workstreams will be evaluated with a particular focus on the implications for the future design of BaU DDSs and how these will compare with the cost to reinforce constrained parts of the network. The outcome of both workstreams will also influence a route map for introducing DDS as a BaU service.

There will be significant re-use of the ENA Flexibility Service Agreements (FSAs), and one of the project outcomes will be new Service Type templates suitable for the DDSs, ensuring alignment with the ENA Open Network Project principles.

Objective(s)

Primary Objective

To design and run commercial trials to establish the feasibility of introducing DDSs as a means of reducing peak demand. If DDSs can provide at least the level of diversification of the existing solution in LMA areas, mandated diversification schedules would no longer be required and the enabling LMA notices could be liberated through a structured programme of moving consumers to non-LMA settlement codes.

Secondary Objectives
To establish:
• What barriers to entry, if any, deter new FSP entrants or prevent consumers from participating in DDSs, e.g. requirement for a smart meter.
• The commercial models that are of interest to FSPs and whether the level of incentive required to ensure the demand is diversified can be justified by the DNO and enable DDS to be procured as a BAU enduring service.
• The engagement of consumers and associated propositions so they contract with FSPs, schedule their Flexibility repeatably, and the FSP can provide accurate demand forecasting with volume sustainability.
• If the products or tariffs offered by FSPs provide greater choice for consumers and the opportunity to financially benefit from providing the DNO with demand diversification.
• The minimum viable market size for a location based on the proportion of flexible load to the total load at a network location.
• The DDS penetration level required to replace the level of diversification from existing LMAs and trigger the removal of an existing LMA and how it is measured.
• Whether the technology and data to settle the DDS delivered by the FSPs in each SP using half-hourly or more frequent metering is available.
• Whether FSPs can respond to DNO signals (forecast or unanticipated network congestion) and if this encourages herding or hunting behaviours.
• If the behaviour of an FSP is different if they are aware they have a dominant position.
• The effect of dominant FSPs and whether they have an unfair advantage.
• How to easily integrate DDSs into BaU operations.
• If there are unintended consequences from the deployment of some DDSs, if any have a higher success rate (and why), and whether multiple DDSs can operate in the same location.
• How DDS can be designed/modified to address significant network growth.

Consumer Vulnerability Impact Assessment

This project will not adversely impact vulnerable consumers. No consumers on the Priority Services Register will be recruited to the active trials. However, approximately 20% of homes that take part in the Living Lab are registered as having “Long term health condition/disability”. The historical data from these homes may be used as baseload data for building virtual networks.

If successful, the project will open up the opportunity for suppliers and aggregators to offer vulnerable customers, particularly those with storage heaters, tariffs and products that allow them to benefit from providing demand diversification for the DNO.

Figure 1

Success Criteria

• Sufficient FSPs contribute to successful trials to understand the pros and cons of the DDSs.
• Confirmation that each of the DDSs is technically feasible.
• Understand the appetite of FSPs to provide a similar BaU service and whether each DDSs is commercially attractive.
• Stakeholder feedback confirms that there is sufficient interest to establish viable markets.
• Next steps for introducing DDS as a BaU service are clearly understood.

Project Partners and External Funding

Actual Partners (confirmed at time of writing)
• Any FSPs participating in the trials. All retail suppliers and aggregators will be approached in the early stages of the trial, where we will explain the project, its objectives, and the benefits to the FSPs in partnering with SSEN during the trials.
• Power Networks Development Centre
• Energy Systems Catapult Living Lab

Potential partners
• National Grid Electricity Distribution

Potential for New Learning

• Capability of SMETS2 infrastructure to support new DDSs.

• End to end process for the DDSs.
• If other flexibility-enabling technologies enable the end-to-end process.
• Unintended consequences from DDS implementation.
• New FSA Service Types.
• Alternative approaches to managing the aspects of the significant rise in demand as GB moves towards Net Zero.

The learnings will be disseminated through the following channels:
• Published to ENA Smarter Networks portal.
• Discussion panel at the ENA Energy Innovation Summit.
• Sharing outcomes on the SSEN Innovation website.

Scale of Project

Removing LMAs requires demonstration of alternative solutions at a scale which enables the understanding of the viability and risks of the solutions, and at a quality suitable for enabling deployment on the SHEPD network. Phase 2 has been designed to produce the required quality level efficiently – in the real environment – while avoiding any risk of overload.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The trial will take place in SHEPD, however the creation of virtual networks using LL participants does not have to be limited to the SHEPD licence area. All relevant consumer data can be incorporated into the virtual networks created by the PNDC.

Revenue Allowed for the RIIO Settlement

No revenue has been allowed for this purpose in RIIO-ED2.

Indicative Total NIA Project Expenditure

The project budget is £2,059,238.18

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

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

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

Successful implementation of DDS could enable growth in demand without significant network reinforcement, and this could support the energy transition. It also has the potential to widen participation in flexibility markets which also support the energy transition.

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

DDS is looking to minimise the potential additional complexity and restrictions of the LMAs on the choice of suppliers and tariffs that consumers in these areas can access. Successful implementation of DDS could help increase supply competition in these areas, potentially resulting in a wider range of tariffs for consumers, including those in vulnerable situations, e.g., consumers struggling with fuel poverty. DDS could therefore contribute to ensuring that no customer is left behind in the transition to Net Zero.

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

N/A

Please provide a calculation and/or description of the expected benefits of the solution

In SHEPD, the demand diversification provided by the RTS-managed storage heaters was estimated to have avoided network reinforcement costs of ~£700 million (EA Technologies, 2012)2. The new DDSs are expected to maintain this diversification, thereby continuing to avoid reinforcement; the cost of which would be closer to ~£1 billion at today's prices.. It is also expected that the new DDSs will potentially delay and/or stack on any Load-Related Expenditure planned to reinforce the network

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

While the removal of LMAs is predominantly an issue for the north of Scotland, the need for novel flexibility services is applicable across the GB network as we move towards Net Zero.

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

Early analysis, based on the deferred cost of reinforcing the network and assuming 5% of consumers are providing diversification, suggests that the value of demand diversification is approximately £100 per consumer per annum. Since the reinforcement costs are fixed, if the trials show that a higher percentage of consumers need to provide diversification, the value per consumer may need to drop, i.e., 10% participation results in £50 per consumer per annum. However, this may no longer be commercially attractive to FSPs. Establishing this is one of the objectives of the project.

These costs are based on deferring the upgrade of 270km of low voltage circuits, 44 MVA of ground-mounted and 44.5 MVA of pole-mounted secondary transformers. The value of this is approximately £39 million (or an annualised cost of approximately £1 million) and covers 162,000 consumers. It is assumed that the requirement to upgrade primary substations and high voltage circuits will be driven by larger, strategic considerations.

2 EA Technologies (2012) A Study of the Benefits of the Radio Teleswitch System and the Consequences of Replacement in the SHEPD Licence Area

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

☐ 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

• Capability of SMETS2 infrastructure to support new DDSs.
• End to end process for the DDSs.
• If other flexibility-enabling technologies enable the end-to-end process.
• Unintended consequences from DDS implementation.
• New FSA Service Types.
• Alternative approaches to managing the aspects of the significant rise in demand as GB moves towards Net Zero.

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. Networks must explicitly mention similar projects that they have considered and how these differ.

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

DDS is a new flexibility service that does not exist in the marketplace to provide a minimum level of enduring demand diversification to manage network constraints. Industry alignment will be achieved by reviewing lessons learned from other projects and engaging with other DNOs and ESO through the ENA Open Networks Project.

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

Other DNOs with LMAs have been consulted and are keen to be a project partner.

Additional Governance And Document Upload

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

There are currently no flexibility services that deliver enduring demand diversification that can be applied to any network location, and the following innovative areas will be addressed:

• DDS will deliver an enduring and essential (not optional) service currently unavailable in areas of the network at risk of future constraints.
• Exploring the technologies available to support the higher utilisation and low fee model being proposed.
• New commercial models that incentivise consumers and FSPs to support the roll-out of these services.
• Understand how DDS interacts and stacks with flexibility services procured by the Electricity System Operator (ESO) and DSOs.

Relevant Foreground IPR

There is no relevant IPR expected from the project. However, as we engage with potential FSPs, we will gauge if this position needs to be updated.

Data Access Details

The results of the trials and the associated data (desensitised as necessary) will be made available as part of the final report. SSEN's NIA Data Sharing Policy is available at https://ssen-innovation.co.uk/wp-content/uploads/2022/04/Network-Innovation-Competition-NIC-and-Network-Innovation-Allowance-NIA-Data-Sharing-Procedure-PR-NET-ENG-020.pdf.

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

• DDSs do not exist and needs to be proven before they can be funded as 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

It is unproven and NIA allows us to explore the feasibility of the service.

This project has been approved by a senior member of staff

☑ Yes