Electricity/Gas Network Innovation Competition Screening Submission Pro forma

Notes on completion		
Before completing this form, please refer to the relevant Network Innovation Competition (NIC) Governance Document(s).[1] Please use the default font (Verdana size 10) in your submission. We will only accept the text visible in the text entry areas. The text entry areas are predetermined and should **not** be changed. The full-completed submission should not exceed 10 pages in total. Ofgem will publish all the information contained within this Screening Submission.		
Is the application for the Gas or Electricity NIC?	Gas NIC ☐	Electricity NIC ☒
Cross Industry Project	YES ☐ *If yes, please fill out Cross Industry Projects section*	NO ☒
Funding Licensee(s)		
Western Power Distribution		
Network Licensee Project Partners		
PassivSystems, Northern Powergrid, Scottish and Southern Electricity Networks, Wales & West Utilities and Cadent		
Funding Licensee area(s)		
Western Power Distribution South Wales		
Project Title		
FreeVE		
Project Summary		
Future customers will own a range of Low Carbon Technologies (LCTs) including Electric Vehicles (EVs), Photovoltaic (PV) generation, storage and hybrid heat pumps. Whilst previous projects have developed an understanding of these assets operating independently, The FreeVE project will look to investigate the interactions between these systems when installed together in various combinations. The trial of over 500 domestic and non-domestic customers will develop understanding on the value and impact of coordinated asset control for the customer, networks and wider energy sector. The project will investigate both the technical requirements of such coordination as well as the commercial arrangements required to unlock the associated benefits.		
Estimated Start Date	**Estimated End Date**	
06/01/2020	31/05/2023	
Estimated Project funding		
The Licensee must provide an approximate figure of the total cost of the project and the amount of NIC funding for which it is applying.		
Total Cost of Project **(If Cross Industry Project provide cost split in Cross Industry section)**	£15.88m	**NIC funding requested** £13.5m
Is the Technology Readiness Level (TRL) of the Project at start date between 4 and 8?	YES ☒	NO ☐

[1] https://www.ofgem.gov.uk/publications-and-updates/version-30-network-innovation-competition-governance-documents All capitalised terms used in this document have the meaning given to them in the respective NIC Governance Document.

What is the Problem?

The Licensee must provide a narrative that explains the Problem(s) that the Project is seeking to address.

The wide-scale adoption of electric vehicles, electric heating and local generation in the form of solar PV is recognised as having a major impact on distribution network loads leading to the requirement for increased reinforcement. Numerous projects have explored these factors in isolation to understand demand profiles and potential networks impacts however to date there has not been any trials demonstrating the impact of co-ordination of LCT assets across vectors.

Smart control systems for low carbon assets that aggregate and integrate such loads into the energy system are now emerging. Such systems have the potential to make a significant contribution to the management of distribution networks and the cost optimisation of the broader energy system, but also have the potential to create unexpected consequences through the following of energy price signals. One such example would be high availability of low marginal cost renewable generation at times of high local demand, causing additional demand coming onto capacity constrained distribution networks. If the use of LCT assets is not coordinated it is likely that both the consumer and the networks will suffer poor outcomes. For example, when both heating and transport assets seek to optimise against local PV generation without co-ordination this will result in unnecessary network demand. There is a requirement to study and evidence the impact of domestic and non-domestic customers with LCT assets augmented with smart controls responding to signals for action.

An integrated approach which supports the ability of domestic and non-domestic consumers to offer up demand response services to the Distribution System Operator (DSO) enables a new direct relationship between parties who up until now have utilised the energy retailer as the intermediary. New market arrangements are emerging that incentivise consumers to offer their flexibility to DSOs in order to achieve best value outcomes for future network management. Imperial College research suggests that consumers able to engage for future flexibility markets are likely to half their bills in comparison to non-participating consumers. As these new markets develop it is essential that consumers experiencing vulnerabilities or fuel poverty are not excluded from design considerations. The project seeks to mitigate the risk that negative distributional impacts could arise if these consumers are not considered at the design stage.

What Method(s) will be used?

The Licensee must describe the Method(s) that are being demonstrated or developed. It must also outline how the Method(s) could solve the Problem. The type of Method should be identified where possible eg technical, commercial etc.

A third party led consortium has been formed which will provide both the volumes of assets (hybrid heat pumps, EVs, solar PV) and the technical, commercial and innovation capabilities to develop and deliver a project that will underpin the GB network providers' approach to meeting their customers' needs during the low-carbon heat, power and transport transition, at the lowest cost. The project will seek to integrate low carbon technologies from both domestic and non-domestic customer premises into an existing flexibility platform. Partners from academia and consumer insight will lead the development of the data insight methodology which will be crucial to delivering learning outcomes.

The following workstreams have been identified to deliver project success:
1. Project management;
2. Asset, building and network modelling and simulation;
3. Software and service design, development and testing;
4. Customer recruitment and demonstrator delivery;
5. Consumer, market and technology research;
6. Reporting and dissemination.

The primary research questions are:
1. What is the network/system impact of multiple low carbon asset adoption?

Method(s) continued

2. How much, where and what kind of infrastructure will be required to maintain good consumer services levels for future EVs and heat assets?
3a. How can we minimise customer impact of energy system optimised smart control?
3b. How will customers react to use of optimised control and what will the network impact be?
3c. What commercial levers will consumers respond to from network and other energy system flexibility offers and how can smart controls enhance this?
4. What business models are needed to enable cost effective asset control solutions?

The project is ambitious in scale and scope, targeting in excess of 500 domestic and non-domestic customers with multiple low-carbon heat, power and transport services. The project will recruit domestic and non-domestic consumers in South Wales and Birmingham, working closely with social housing providers, local authorities, commercial service providers and businesses. The project has been structured to be delivered over multiple heating seasons in order to trial the impact of a number of commercial models. The project will target the following five categories of buildings:
1. Private homes, all archetypes;
2. Private and social rented accommodation, all archetypes;
3. High rise multi-occupancy buildings;
4. Council owned properties focussing on schools, offices, care homes;
5. Private businesses focusing on small or medium-sized enterprises.

Underpinning the project will be the data it will generate. Secondary metering data will be collected from each property to understand power consumption by the EV and hybrid heating system and generation from the PV panels. Heat output and net electricity export will also be measured. Where possible, this data will be supplemented with half hourly smart meter data. In addition, sensors will collect data on internal temperature which will be combined with local weather station data on external temperature. Occupancy and service setting data will be collected through a consumer app. During the project, consumer research will collect data on consumer outcomes. All data will be able to be related to physical location on the network and service interactions will be assessed on a number of levels: within property; within network node, and by whole system. The project will also generate derived data from this primary data set, including future demand forecasts that will be compared with actual outcomes to understand system predictability.

New business models can, through smart control, influence the usage patterns of all of the controlled asset groups. The project will explore the impact of existing network Demand Side Response (DSR) schemes on multi-vector, smart controlled services and will investigate optimisation strategies within buildings (behind the meter asset coordination), within network node (community energy schemes that allow asset optimisation at network node level), and at energy system level (optimising against global price and carbon signals). The project will test how effective these schemes are for the different use cases in regards to supporting the distribution networks and balancing demand against the intermittency in low-carbon generation. The system level analysis will consider what data exchange is required between the gas and electricity network operators in order to understand and manage cross-vector dynamics arising from the different control and market strategies.

The consumer facing solutions will test different methodologies for presenting and collecting user data, exploring the new approaches in communicating artificial intelligence derived outcomes across multiple consumer services. This will help understand the optimal and most cost efficient methods for managing heat and transport assets, unlocking the full potential of existing network infrastructure, minimising the need for network upgrades. The project will research user acceptance of the solutions facing the network in different asset combinations, to ensure any barriers to adoption (and therefore benefits realisation) are understood, and where possible, mitigated through further solution refinement. During the consumer research, particular focus will be put on the potential opportunities to assist in the alleviation of fuel poverty through smart controls that create consumer value and communal energy schemes that enable consumers to share in the benefits of the pooled assets in their community.

Funding Commentary

The Licensee must provide a commentary on the accuracy of its funding estimate. If the Project has phases, the Licensee must identify the approximate cost of each phase. Non RIIO-Network Licensees should indicate potential bid costs expenses

The estimated funding for the FreeVE project over the 3 years and 6 months project duration is detailed below:

Project Management – including planning, risk management, health and safety, financial management, communications and intellectual property management. £1,417,500 - £1,732,500 (11%).

Modelling and Simulations (National, local and in-home) - design, build, model, analyse the FreeVE trial data. £517,500 – £632,500 (4%).

Service Development and Test –service to manage multiple aggregated low carbon technologies in various combinations and against various market conditions. £2,430,000 - £2,970,00(19%).

Installation and Support - process design, supporting materials, recruitment, survey, installation, commissioning, monitoring, support. £6,669,540 - £8,151,660 (51%).

Research and Dissemination - customer engagement and protection, impact assessment on consumer outcomes, fuel poverty, networks, commercial opportunities, technology, service and market implications, reporting and dissemination. £1,957,500 - £2,392,500 (15%)

These estimates are based on our and the partners' experience in delivering similar technology systems and services, together with people costs based on current rates and estimated work volume and material costs based on current unit costs and estimated volumes. A more detailed cost break down will be built up for the Full Submission Pro-forma (FSP). The project partners will supplement the licensee contribution and plan to make a 10% (PassivSystems 15%) contribution of a minimum of £1.58m. This results in a Network Innovation Competition (NIC) funding requirement of £13.5m. The contributions will include in kind provision of time, resources, data and software, ensuring that the project can proceed at a lower cost than if it was delivered commercially and allowing the project to utilise existing Intellectual Property (IP) and data held by the partners. Full details of partner contributions will be provided at FSP.

The project will require a significant deployment of hybrid heating systems, EVs and associated charging infrastructure, and PV and storage solutions. The project partners have been selected based on their ability to contribute commercially deployed assets that together will form the pool of consumers participating in the project. The majority of heating, PV and battery storage systems will be funded through commercial routes (in the case of heat by making use of renewable heat incentive funding). The majority of charge points and EV costs will be subsidised from the NIC.

Whilst we have confidence in the estimated costings, the rapidly developing nature of the low carbon heat, PV and battery and EV markets means that there are a number of factors that may require future budget revisions and re-allocations: rate of uptake of LCT assets in homes; evolution of asset capabilities for smart control; evolution of local energy market services. The project is working closely with partners to understand and mitigate risks in these areas.

Which specific requirements does the Project fulfil?(Please tick which of the specific requirements this Project fulfils)

	Electricity	**Gas**
A specific piece of new (ie unproven in GB) equipment (including control and/or communications systems and/or software)	☒	☐
A specific novel arrangement or application of existing electricity/gas transmission and/or distribution equipment (including control and communications systems software)	☐	☐
A specific novel operational practice directly related to the operation of the electricity/gas transmission and/or distribution systems	☒	☐
A specific novel commercial arrangement	☒	☐

How does the Project accelerate the development of a low carbon energy sector and have the potential to deliver net financial benefits to existing and/or future customers in the relevant sector?
The Licensee must demonstrate that the Solution has the potential to accelerate the development of the low carbon energy sector in GB and/or deliver wider environmental benefits to GB customers. The Licensee must demonstrate the potential to deliver net financial benefits to existing and/or future customers.

The project will improve DSR availability by identifying which network management strategies and associated local energy market structure and operations will be acceptable to consumers. The project will generate data that will help DSOs understand these complex market interactions and factor them in to their forward infrastructure planning.

The United Kingdom (UK) Committee on Climate Change (CCC) recently reported that energy use in homes accounts for about 14% of UK green-house gas emissions. These emissions need to fall by at least 24% by 2030 from 1990 levels, but are currently off track. Recommended actions include deployment at scale of hybrid heat pumps in buildings on the gas grid (up to 10 million by 2035), encouraging the uptake of EVs and smart charging points. Flexibility measures associated with these assets are identified as having the potential to bring electricity system costs down by £16bn/yr by 2030 or up to £38bn/year by 2050. The project focuses on these primary energy assets and seeks to identify, quantify and demonstrate consumer value through 4 primary channels:

1. Improved return from LCT assets when those assets are controlled in a coordinated manner, increasing value to the consumer from renewable generation and Time of Use tariffs;
2. Support the networks, consumers and supplier of exponential growth of LCT assets that are currently being installed in the UK energy system;
3. New value streams for the consumer from local trading of their demand flexibility, incorporating value from DSO flexibility markets and peer to peer trading;
4. New value streams for the consumer from multi-vector optimisation of the energy system by enabling demand flexibility to trade in capacity, wholesale energy, operating reserve, frequency and imbalance markets.

In doing so, the project will help to build the consumer investment case for decarbonisation of heat and transport, bringing forward the adoption of these technologies and helping to drive de-carbonisation in these critical sectors. The project will identify the barriers to the adoption of the target LCTs and identify potential remedies, be they technological, market, regulatory or policy. The project focus is on near term low carbon solutions that will be adopted during the project timeframe with a view to achieving rapid TRL advancement and exiting the project with solutions and services that can play a meaningful role in LCT market development.

Specifically, the project will generate new IP in the following areas:
- Behind the meter, location and building specific demand and generation forecasting to support network operator forecasting and planning;
- Behind the meter LCT asset optimisation and maximising demand flexibility to improve cost, comfort and carbon. In addition, multiple LCT assets that are integrated and optimised to support network demand management;
- A better customer experience in LCT related energy services, including network to consumer engagement;
- High volume energy interactions in real time to deliver local grid optimisation. To enable network operators to better understand the impact of local grid optimisation;
- 3-tier demand management from consumer through local energy market through to whole energy system.

The project will produce a report which will articulate key recommendations on how to maximise effectiveness of the trialled schemes and minimise end user impacts (seamless scheme integration, level of incentives for customers etc.).

How will the Project deliver value for money for electricity and/or gas customers?

The Licensee must demonstrate that the Method(s) being used can derive benefits. It must also be able to demonstrate that the resulting learning can be attributed or are applicable to the electricity/gas transmission and/or distribution systems.

Smart control and suitable flexibility markets can pass energy system savings through to consumers. Large scale trials are required to monitor and report on the impact of energy usage by customers who have low carbon technologies with smart controls. This data will assist with demonstrating where cost savings can be realised by responding to pricing signals. This relationship is a critical dynamic in making the consumers business case for investment in low carbon assets attractive.

My Electric Avenue estimated the network cost of EVs, at £2.2bn by 2050. Freedom estimated that flexibility from hybrid heating systems could avoid up to £9.3bn of network reinforcement investment annually. To date there has been no trial demonstrations of the additional value that can be created when optimising multiple assets behind the meter. Understanding this dynamic will be important to unlock value for money directly (for example by maximising self-consumption of generation and utilisation of low cost power from variable rate tariffs) and through lowered network costs. This dividend is likely to be magnified if the assets can then be further optimised by network node through a community energy scheme.

Identifying and demonstrating the mechanisms through which this value can be realised will bring forward these markets and ensure that consumer benefit are realised. Initial analysis shows that while individual asset optimisation can reduce reinforcement costs by 40%, coordinated asset optimisation has the potential to deliver an additional 12% cost saving. These costs savings should be passed onto customers through lower use of system charging to all customers. This project is therefore of national significance to the UK: 1.) Addressing the electrification of domestic heat and transport operating in parallel on peak load across the network. 2) Learn how smart controlled integrated electric heat and transport can incentivise consumers. 3.) Compare economic benefit of the use of integrated smart electric heat, EV charging with PV generation to utilise existing infrastructure against network reinforcement.

How will the Project generate knowledge that can be shared amongst all relevant Network Licensees?

The Licensee must explain the learning that it expects the Method(s) to deliver, and how it will be shared. The Licensee must demonstrate that it has a robust methodology in place to capture the learning and how the learning will be disseminated.

The project will, through a comprehensive data gathering exercise covering hybrid heating systems, vehicle chargers, solar PV generation, grid, environmental and socio-economic data, create a world class dataset of the consumer and network impact of the adoption of multiple low carbon technologies. This new data, along with the analysis, insights and solutions from this project will be of value to all the GB DNOs as well as policy makers, local authorities, housing providers and solution providers from across the value chain. Specifically, the project will generate the following learnings of importance to licensees:

• Data on the electricity demand from smartly controlled hybrid heating systems, EVs, and solar panels allowing DNOs to improve the accuracy of their forecasts and optimise future network investments more effectively;

• Analysis of the potential to influence demand at consumer and community level through incentives, including consideration of technical, economic and behavioural issues, allowing DNOs to implement optimal demand response strategies as they transition to DSOs;

• Learnings relating to the effect on the network of implementing a range of smart control methodologies, and how these can be influenced to increase benefits to the network.

PassivSystems, the lead project partner, brings with them extensive experience in smart control strategies and analysing and sharing rich datasets. In addition expert academic and specialist consultant partners will analyse and report on the findings of the project and the applicability to the wider energy system and support the development of commercial business cases.

Does the Project conform to the default Intellectual Property Rights (IPR) arrangements set out in the NIC Governance Document?	YES ☒	NO ☐

By selecting NO, the Licensee is indicating that it wishes to deviate from the default requirements for IPR. If this is the case, it must demonstrate how the learning will be disseminated to other relevant Licensees and how value for money will be ensured. The Licensee must also outline the proposed alternative arrangements and justify why the arrangements are more suitable than the default IPR arrangements.

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How does the project demonstrate it is innovative (ie not business as usual) and has an unproven business case, that the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness?

Demonstrate why the Licensee has not previously used this Method (including where the Solution involves commercial arrangements) and why NIC funding is required to undertake it. This must include why the Licensee would not run the Project as part of its business as usual and why the Solution is not Research.

This project is the first large scale, multi-vector data driven commercial trial of low carbon heat, transport and generation technologies to test demand forecasting, optimisation and DSR trading strategies behind the meter, aggregated at community level, and aggregated at energy system level. It will provide unique insights into methods of modelling and predicting future distribution network loads in such complex consumer driven demand markets.

The project is innovative due to:
• Its investigation of multi-vector solutions across heat, power and transport in both domestic and commercial settings;
• It building on the learning of previous projects to explore more complex demand interactions;
• A plan to trial solutions that not only benefit the network, but improve the user experience and commercial viability of LCTs in order to accelerate the adoption such technologies;
• and its recognition of the potential for unequal outcomes across socio-economic groups and its exploration of opportunities to ensure those in fuel poverty are able to access future benefits.

The activities that are proposed in this project fall outside of the usual day-to-day activities of the network licensee, requiring additional funding, for the following reasons: The project will need to trial a number of as yet unproven solutions, such as multi-vector, multi-asset demand response, presenting a risk to the DNO if behavioural barriers prove difficult to overcome; The project is complex, involving the monitoring and control of interacting LCTs in different settings and the management of the resulting information, requiring active involvement of multiple stakeholders; and The project was proposed by and is intended to be led by a third party.

How were project Partners, external resourcing/funding identified, and what are their respective roles in the Project?

The Licensee must provide evidence of how Project Partners were identified and selected, including details of the process that has been followed, and the rationale for selecting partners and ideas for the Project.

The Licensee should provide details of any Project Partners who will be actively involved in the Project and are prepared to devote time, resources and/or funding to the Project. If the Licensee has not identified any specific Project Partners, it should provide details of the type of Project Partners it wishes to attract to the Project.

The project has evolved from the extensive analysis and dissemination work undertaken by WPD and PassivSystems during the delivery of the Freedom Project, which identified the considerable benefits of smart control and multi-vector solutions in delivering decarbonisation of heat into homes. PassivSystems developed the project proposal and shared this with WPD to explore how the Freedom legacy might be built upon. This analysis was also supported by Wales & West Utilities, also a Freedom project Partner, who funded through an NIA project an analysis of the potential to exploit hybrid heating technologies in non-domestic buildings, the findings of which have been incorporated into this project. PassivSystems has identified academic and consultancy Partners who are leading experts in their field who were able to evidence the required skills, knowledge and experience to deliver the project. Commercial Partners have been selected from organisations that PassivSystems has identified as being active in the near term low carbon heat and transport markets that are able to bring leading technologies, supply chains and established customer bases in support of the project.

The project aims to engage with key project partners to support the delivery of the project. The following key project partner specialisms have been identified to deliver project success:
1. Whole system network modelling, network modelling, commercialisation strategies, market and policy recommendations, local decarbonisation planning;
2. Local energy trading system design and modelling, Microeconomic modelling and simulation;
3. Consumer engagement design, engagement implementation (including recruitment), consumer protection, consumer research;
4. Smart control design and development; trading platform design and development.

Partners will be confirmed by the FSP stage.

WPD has engaged with DNO/GDNO's to develop the FreeVE project scope to support wider project learnings, ascertain feedback and invite key stakeholders to form part of the steering committee. A result of this collaboration activity, the project will be supported by both electricity and gas operators to provide ongoing project steering:

Northern Powergrid, Scottish and Southern Electricity Networks, Wales & West Utilities and Cadent

Alongside funded partners, Birmingham City Council, Bridgend Borough Council and Bristol City Council have been briefed about the project and would like to be involved and support the project. LCT providers have been identified and project scoping has taken place with Nissan and Samsung. Energy suppliers will be engaged with as part of the project to ensure the relevance of all learning.

Will the Project require any derogations or exemptions?

The Licensee should outline if it considers that the Project will require any derogations, exemptions, or changes to the regulatory arrangements.

No.

How will the Project activities impact customers?
The Licensee should outline any planned interaction with customers or customers' premises as part of the Project, and any other direct customer impact (such as amended contractual or charging arrangements, or supply interruptions).
Consumers are fundamental to the project and the project will actively control assets in consumer's buildings in order to deliver consumer and energy system benefits. The asset classes affected are hybrid heating systems, EV charge points and battery storage. In the case of heating systems and battery storage, it is anticipated that the consumer will have acquired the assets outside of the project and the project will apply additional measurement and control measures as required. In the case of EV charge points and EVs, it is anticipated that the project will fund EV charge points and provide rental EVs to create a viable pool of vehicle with which to deliver the project aims. The project will create a detailed Consumer Engagement Plan describing the nature of all consumer interactions and considering consumer communications, data handling, risks and mitigations, complaint handling and project closedown and exit. The expectation is that the consumer will receive enhanced services from participation in the project, but there is a risk that energy bills may rise or that LCT asset related services may be disrupted. In such cases a mechanism will be in place to provide appropriate compensation to the consumer. No supply interruptions as a direct result of the project are anticipated. Consumers will also be asked to participate in consumer feedback studies throughout the term of the project and the obligation to do so will be included in the terms of participation. The project will provide a small financial incentive to encourage participation in these studies.

What funding is being requested from each NIC? (Cross Industry Projects only)
The Licensee must outline funding that is being requested from the Electricity and the Gas NICs and include a justification for the funding split.
N/A

Are there any further details the Licensee considers would support its submission?
As detailed above, the FreeVE project build upon previous and current Ofgem funded project, SoLa Bristol, Freedom and Electric Nation. WPD, PassivSystems, Northern Powergrid, Wales & West Utilities and Cadent and other project partners bring a great deal of experience and learning to the project. As an example, PassivSystems completed the project management of the NIA funded Freedom Project on behalf of WPD and Wales & West Utilities, working with local stakeholders in Bridgend, South Wales to develop innovative smart hybrid heating systems and energy management solutions. Freedom estimated that flexibility from hybrid heating systems could avoid up to £15bn of network reinforcement and generation investment annually. This activity has been highlighted in the recently published CC report titled 'Hydrogen in the low-carbon economy'; CCC has proposed the deployment of 10 million hybrid heat pumps by 2035. The proposed LCT partners have been pioneers in introducing the electrification of heat and EVs to the domestic market. The project also complements a range of other national initiatives, such as the Department for Business, Energy and Industrial Strategy (BEIS) decarbonisation of heat and transport strategy, in addition to further investment planned by BEIS in both electric heating technologies, charging infrastructure and the wider sector. We will place a priority on ensuring that this project is complementary to other activities, both within the electricity industry and the domestic heat and vehicle sector, throughout the detailed design and delivery phases. In doing so we will avoid duplication and ensure the latest developments are integrated in the project throughout its life-cycle in this rapidly evolving field. It is in this wider context that, whilst the focus of this project is to underpin future network planning and investment, to ensure the best value to network customers, the learning will have far reaching implications both in terms of supporting the domestic electric heat and transport transition for different energy ecosystem participants. In terms of collaboration, where appropriate networks have partnered on certain projects, and have agreed to input and share the learning throughout the course of the projects. These projects will help deliver the outputs and some of the keys areas for innovation that were identified in the Electricity Network Innovation Strategy, published on 28th March 2018. As well as aligning with WPD's Innovation Strategy, this project specifically supports trends 1.1, 1.2, 2.1, 2.2, 2.3, 2.5, 3.2, 3.3, 3.8 and 4.1 to 4.9 of the Electricity Network Innovation Strategy.

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