Electricity Network Innovation Competition Screening Submission Pro-forma

Notes on completion
Before completing this form, please refer to the Electricity Network Innovation Competition (NIC) Governance Document. **Please use the default font (Verdana size 10) in your submission, 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 the Screening Submission.**
Funding Licensee
SP Distribution plc.
Network Licence Project Partners
University of St Andrews, DNV GL, Energy Systems Catapult
Funding Licensee area
SP Distribution plc.
Project title
FUSION
Project Summary
The Licensee must provide an approximate Project start and end date.
The energy market in the UK is evolving radically with `**prosumers' increasingly engaged** in generation, flexibility and supply of their own energy. All this activity is having a direct impact upon the operation and design of the network. Distribution Network Operators (DNOs) can make use of this flexibility to **develop a grid modernisation strategy that takes account of the cultural shift in how energy is generated and consumed**; consequently securing the provision of affordable, reliable and safe power within an electrical grid that is dominated by distributed energy resources and multiple fuel technologies. Project FUSION will allow DNOs to make use the inherent flexibility that is available within a region by **implementing a whole system approach across multiple energy vectors (transport, heat, gas electricity).** This will be developed within a fixed frame of network parameters and demonstrate how flexibility across each energy vector can be optimised as part of a services market, to **mitigate network constraints** and provide a **valid alternative to conventional network reinforcement** and enable an **agile market which can accommodate for future uncertainty in regional development.** The project will engage with multiple industry participants and stakeholders **to realise the value of their flexibility** by implementing an open access commercially structured market place which will allow multiple energy users to offer demand or generation services to the DNO to **alleviate network issues in real time** and reduce network losses. The project is estimated to commence in Jan 2018 and be completed by Jan 2023.
Estimated Project funding
The Licensee must provide an approximate figure of the total cost of the project and the NIC funding it is applying for.

Total cost of Project	£7.1m	**NIC funding requested**	£6.4m
Cross Sector Projects only: requested funding from Gas NIC, NIA or second tier LCN Fund?	*If yes, please specify* N/A		

Problem

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

The increasing uptake and penetration of LCTs alongside unforeseen load growth and demand for energy from the transport and heating sectors is driving the **requirement for unexpected network reinforcement** based upon traditional network design rules. To date the **energy vectors have been operated in isolation** meaning DNOs have been unable to unlock the value that can be realised by implementing a **cross vector approach to energy management** and the potential to defer unexpected network reinforcement that would be required under traditional network design rules. Currently, there is no standardised approach to optimise the relationship and integration between **multiple energy vectors** which if left unresolved will **limit the capability of the network to accommodate future LCTs in the absence of significant network reinforcement**.

The problem is emerging across the UK. However, within the **propose trial region of North East Fife**, the local distribution network is **experiencing an unforeseen increase in load growth** and in parts is reaching network limits meaning additional LCTs are experiencing increasing difficulty when connecting to the network. In the absence of an alternative network solution the only available network tool may be **expensive traditional network reinforcement** to satisfy this increasing demand and facilitate the further uptake of additional LCTs.

Furthermore, ambitious plans are already in place to connect a diverse variety of new distributed generation and novel storage technologies within the region, particularly at the University of St Andrews. The University has ambitions to make use of surplus electricity within the region by connecting a **diverse range of energy storage techniques** in the form of batteries, electric vehicles, compressed air, hydrogen, solid oxide fuel cells and Power to Gas as **part of a whole systems approach**. This provides the region with an opportunity to intelligently coordinate these technologies in **real time together with customers, aggregators and generators from across the region to support the distribution network**, increase competition, avoid generation curtailment, and ultimately reduce the network reinforcement that would otherwise be required. This will be achieved by **creating an open access market place for flexibility** by coordinating the diverse variety of generation, storage and demand customers that are available in the region.

To achieve this, the DNO will require sufficient visibility and control in the region to identify network issues in real time, and a new innovative commercial model that brings the whole community together to immediately address these issues and realise the value of the flexibility that will be available within the region.

Method(s)

The Licensee must describe the Method(s) which 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.

Project FUSION **will implement the Universal Smart Energy Framework (USEF) across North East Fife as a new open access market place for flexibility**. The Framework has been developed as an international standard to deliver a universal market for flexibility and has been **successfully trialled in the Netherlands**.

However, the user device interface (UDI) and commercial framework have not been proven within the GB market and consumer context. Therefore, the project will **develop USEF so that it is fit for purpose within the UK.** This includes establishing the interface between USEF and each participant that is active within this flexibility market (network operators, suppliers, aggregators, flexible demand customers) and the commercial arrangements that facilitate a settlement process showing that flexibility products can be delivered reliably as specified and as scheduled.

Method(s) continued

Prior to the network trial the USEF commercial framework will be developed to take account of the market structures and algorithms within the GB market context. This includes the methodologies and safeguards specific to the GB market and regulatory framework to facilitate effective competition in flexible user price submissions and avoid market abuse; as well as demonstrating the safeguards to ensure that 3rd party procurement of flexibility does not result in unacceptable loading on the distribution network.

Once USEF has been adapted and is fit for use within the UK **a network trial will demonstrate how a multi vector approach can provide valuable network flexibility** by incentivising customers to provide the network with the flexibility its requires to alleviate network strain and defer expensive reinforcement. **The trial will coordinate an array of LCTs across North East Fife in real time** in partnership with USEF to show how traditional reinforcement can be avoided by **peak shaving electrical demand by making use alternatives supplies of energy**. For example, the **provision of the gas network to alleviate the peaks in demand caused by the electrification of heat and transport.**

Alongside the project, the local distribution network within North East Fife will be **equipped with adequate monitoring to enable SPD to identify network issue in real time and request the required flexibility** from the USEF market place. This will be a staged approach by identifying priority circuits which include customers and aggregators with the adequate flexibility that can be offered to the DNO.

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. OFTOs should indicate potential bid costs expenses.

Following multiple discussions with our project partners we have identified some of the challenges and effort required to deliver this project. Our estimation of the project cost and breakdown of the funding required at this stage is based upon these initial conversations and previous experience with innovation projects of this nature.

In total we are requested **£7.1m for project FUSION**. Nonetheless the project costs will be refined and detailed during the full submission process.

Specific Requirements (please tick which of the specific requirements this project fulfils)

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 transmission equipment (including control and communications systems software)	
A specific novel operational practice directly related to the operation of the electricity transmission system	✓
A specific novel commercial arrangement	✓

Accelerates the development of a low carbon energy sector & has the potential to deliver net financial benefits to existing and/or future customers

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 demonstrate how an array of LCTs across energy vectors can be coordinated together across a large geographical area to maximise their utilisation and avoid costly losses whilst remaining within network constraints. The project will allow the **carbon reduction benefits of consumer flexibility to become more widely accessible** (and valuable) to energy suppliers, aggregators and network operators. Local flexibility markets have been shown to **accelerate the transition to a more decentralised energy system** and have promoted the use of local renewable energy sources and demand response. USEF is a framework that provides a basis for more consumers at the lower voltage levels to realise **greater value from small scale renewable energy**, storage and demand response technologies. As such, the pool of low carbon energy resources and the efficiency of their use will increase significantly.

The USEF flexibility market place will allow both 11kV and LV customers to realise value by responding to locational cost signals whilst still broadly maintaining the CDCM tariff structure. The new market place for flexibility will promote competitive bidding within the region to deliver flexibility resulting in a network management strategy which is likely to be cheaper for the DNO than traditional reinforcement, providing further financial benefit to the end consumers.

Within North East Fife both demand and distributed generation capacity has grown due to economic growth in both the tourism and education sectors. The aspirations of the local authority, Scottish Government and the University of St Andrew's are aligned and **provide an opportunity to focus on low-carbon, sustainable enterprise and communities**. Due to the topography within North East Fife the region has relatively limited distribution grid capacity centred on two primary substations which are both fully loaded with very little scope for load growth. In addition the 33kV infrastructure supplying these primary substations are lengthy and are now showing signs of age-related deterioration. In order to meet future demand growth, improve resilience and enhance supply security significant investment will be required.

This proposal advocates a different approach to the traditional reinforcement that will be required in the area. By the implementation USEF a more robust and efficient energy management system can be developed in the area **to leverage low carbon power generation and energy storage systems**. These benefits will include but will not be limited to:

- **Deferred or avoided network reinforcement** through the management and balancing of load, generation and storage across vectors.
- Value of **avoided system losses** associated with running highly utilised, high impedance 33kV infrastructure over many kilometres.
- **Additional system flexibility** provided by a flexible interconnector providing "peak-lopping" services when demand between two separate network areas requires additional capacity.
- Higher utilisation of the LCTs connected to the distribution network supplying affordable energy and **directly tackling fuel poverty**.
- Reduced electricity generation costs as there will be **less demand for peaking generation plant.**

Delivers value for money for electricity customers

The Licensee must demonstrate that the Method(s) being trialled can derive benefits and resulting learning that can be attributed to or are applicable to the electricity transmission system.

The project will enable energy customers to actively participate in a market place for flexibility allowing them to realise the financial potential associated with their flexibility. Not only will this provide network operators with the flexibility they required to manage their network more efficiently, it will also **enable consumers to make best use of their energy systems and any smart appliances they possess**. The project will **create new incentives and business models for consumers, network operators, suppliers and aggregators increasing competition within the industry.**

Multi-Vector Integration study conducted by the Energy Technologies Institute which considered a case study where "The Electrification of heat with the gas network used to meet peak heat loads" showed that for a city comprising around 280,000 inhabitants residing in 138,000 dwellings a **Smart Multi-Vector approach saves at least £280m** in avoided grid replacement costs compared with a conventional approach by 2050. Extrapolated across the population of Great Britain these savings **could amount to over £50Bn across the GB electricity distribution network.**

Once demonstrated within FUSION this approach could be replicated across the UK representing a significant step change in the industry and how it interacts with its many stakeholders. The project will prove an alternative to traditional network reinforcement by demonstrating how a multi vector approach can support the electricity network at times of strain by peak shaving. This will be particularly valuable due to the ongoing electrification of heat and transport, and the extremely variable demand that will be placed onto the distribution network as a result.

In addition, a distribution market place for flexibility will enable the TSO to make **better use of distribution based flexibility resources for balancing services** at a significantly lower rate than transmission assets, with the savings ultimately passed through to the customer bills.

Demonstrates the Project generates knowledge that can be shared amongst all Network Licensees

The Licensee must explain the learning which it expects the Method(s) it is trialling to deliver. The Licensee must demonstrate that it has a robust methodology in place to capture the learning from the Trial(s).

One of the key objectives of this project is to demonstrate how greater participation and coordination of the many external stakeholders associated with the electricity network can provide valuable flexibility services to network operators. Consequently, the **learnings associated with this project are applicable to DNOs across the UK**. In addition, a trial of the USEF flexibility market place within North East Fife will contribute significantly **towards informing the best approach to a future Distribution System Operator (DSO) model within the UK**, by demonstrating an innovative approach to manage network constraints in a cost effective manner.

The project will use established arrangements for knowledge capture used during previous NIA & NIC projects to support knowledge dissemination during the execution of the project. This approach has been demonstrated during SPENs on-going NIC projects including PHOENIX, VISOR & FITNESS. Key learning outcomes and reports will be published in a dedicated project website and within SPENs innovation webpage.

Finally, the project will conform to the default IPR arrangements set out in the NIC governance document, making the learnings from the project available to DNOs across the UK.

Please tick if the project conforms to the default IPR arrangements set out in the NIC Governance Document?	✓

If the Licensee wishes to deviate from the default requirement for IPR then it must demonstrate how the learning will be disseminated to other 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 arrangements.

The work undertaken as part of this NIC project will adhere to default IPR arrangements. Project partners and suppliers will also comply with the default IPR arrangements as set our within the NIC governance documents. Any deviations, if identified, during the proposal development will be highlighted in the full submission.

How is the project innovative and with an unproven business case where the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness?

Demonstrate why the Licensee has not previously used this Solution (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 trial as part of its normal course of business and why the Solution is not Research.

The **coordination of resources across multiple energy vectors** to make best use of the energy resources that are available for the benefit of the consumers is **considered highly innovative within the UK**. It is no longer feasible to continue to operate the vectors in isolation without investigating how each can support each other as part of a whole system approach to energy management.

Project FUSION will be the first of its kind within the UK to trial and demonstrate a market framework within the commercial, practical and regulatory constraints of the electricity network and supply sectors of the GB market. Consequently, this pilot project within North East Fife will prove extremely valuable if the model is proven to be both feasible and economic and **will inform Ofgem's calls for evidence for the future DSO model within the UK by demonstrating a unproven innovative commercial market approach.**

Project FUSION will deliver this coordination between vectors via the implementation of the USEF open access market place for flexibility services. Again, this is considered highly innovative within the GB market place as there is **currently no standardised approach to access the value of flexibility** for users at all voltage levels on distribution networks and across energy vectors.

However, the project does include an **unproven business case** as a multi vector approach to provide network flexibility to the DNO has **never been demonstrated within the UK** although a number of studies have indicated the considerable benefits associated with the approach. Consequently, NIC funding is critical if the project and the associated benefits are to be realised within a timely manner.

Project Partners and external resourcing/funding

The Licensee must provide evidence of how Project Partners have been identified and selected, including details of the process that has been followed and the rationale for selecting participants 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 will be delivered by SPEN, University of St Andrews, DNV GL, and the Energy System Catapult in collaboration. However, we envision that many more stakeholders will be required to maximise the effectiveness of the trial and the learnings that are extracted from the project.

The **University of St Andrews** has been redeveloping Eden Campus as an Innovation accelerator. This provides the project will the opportunity to use the University as part of a **test bed to demonstrate how a multi vector approach can deliver the value to customers** as previously discussed. With significant plans to extend the campus facilities the project intends to coordinate the wide range of LCTs that will be available within the area as part of the USEF trial. These LCTs include; Biomass District Heating Scheme, Wind farm, Power to Gas, Electric Vehicles, Hydrogen Vehicles, Compressed Air, Solid Oxide Fuel Cells, Battery Storage etc. There are also plans for a private wire to be installed across two geographically separate parts of the university campus, which will demonstrate how energy demand and supply can be shifted across sites to make best use of the energy available within a region.

DNV GL has played a leading role in setting up the USEF foundation in 2014. The foundation grew out a previous successful project called Power Matching City which lay the ground works for the USEF market place for flexibility. The USEF foundation is made up of a consortium of stakeholders with the intention to facilitate a new market place for flexibility. Everything that has been developed within the foundation is open access and publically available. DNV GL will provide the project with the key experience and expertise required to successfully implement USEF within North East Fife and the UK.

The **Energy Systems Catapult** will look at how a multi-vector approach can avoid the potentially large reinforcement costs in the LV network due to the **domestic electrification of heat** and how it can be **effectively incorporating within a flexibility market**. This includes demonstrating how heat pumps, hybrid heat pumps and heat storage can contribute towards domestic flexibility to a wider market for consumer benefit.

In addition to the project partners identified above there are several groups of key project stakeholders which will be critical to the project. These include **Energy Suppliers, Aggregators & Energy Service Companies, and additional domestic and commercial flexibility electricity users**, all of whom will be active participants within the flexibility market place.

We have been in **regular and transparent contact with other DNOs to investigate opportunities to collaborate** and to ensure that our submissions compliment each other. We will continue to investigate opportunities to collaborate with other DNOs when preparing the full submission proposal (FSP).

Derogations or exemptions

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

Customer impact

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).

Project FUSION will actively engage with a variety of customers to demonstrate the potential value of a flexibility market within North East Fife. This includes a number of large industrial customers that are able to offer demand flexibility to the network operator in response to real time price signals.

An example would be the University of St Andrews itself, who represent a large flexible demand customer and aggregator with a large variety of LCTs. In addition, the project will work together with domestic LV customers to investigate how flexible demand can alleviate the strain on the network due to the electrification of heat and transport. The project will directly benefit these customers by allowing them to realise the value of their inherent flexibility.

Outwith engaging with customers to take part in the USEF flexibility market we envision no interruption in customer supply as a result of the project.

Details of cross sector aspects
The Licensee should complete this box only if this Project forms part of a larger cross sector Project that is seeking funding from multiple competitions (Electricity NIC, Gas NIC or LCN Fund). The Licensee must explain about the Project it will be collaborating with, how it all fits together, and must also add a justification for the funding split.
Project FUSION will look to collaborate with **Scotia Gas Networks** to enable the multi vector approach to energy management. The project will look to collaborate with SGN to prove how the two networks can work together to deliver energy to their customers reliably whilst minimising network reinforcement.

Any further detail the Licensee feels may support its submission
Project FUSION will complement existing investments made in NIA & NIC innovation projects such as UKPNs project TDI 2.0 and WPDs project ENTIRE. FUSION will demonstrate a commercial market arrangement for the provision of network services and managing network constraint. This will directly inform Ofgem's DSO call for evidence. The recent credible study "ETI Multi-Vector integration" can be referenced as a clear demonstration of the business case of utilising a multi vector based approach to avoid reinforcement in the LV network. Government sponsored PPI initiatives such as the ETI Smart Systems and Heat programme, which will capitalise on investments already made in the EnergyPath Network tool, and the Home Energy System Gateway test harness. These are programmes of strategic importance to the UK energy transition to meet the Paris carbon reduction objectives.

Contact name
Anthony Donoghue
Contact Address
SP Energy Networks Ochil House, 10 Technology Avenue, Hamilton International Technology Park, Blantyre, G72 0HT
E-mail
adonoghue@spenergynetworks.co.uk
Direct telephone line
01416146904
Job title
Innovation Engineer