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

Jun 2021

Project Reference Number

NIA_NGGT0175

Project Registration

Project Title

5G – The art of the possible

Project Reference Number

NIA_NGGT0175

Project Licensee(s)

National Gas Transmission PLC

Project Start

June 2021

Project Duration

0 years and 10 months

Nominated Project Contact(s)

Mathew Currell, Thomas Charton
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Project Budget

£265,016.67

Summary

This project aims to investigate the opportunities that 5G networks can offer with regards to the provision of high bandwidth wireless communication channels as well as location-based services. The project will provide an extensive overview of the current and future capabilities of wireless networks and evaluate potential use cases. Some will be developed in more detail with regards to technical and commercial aspects including a detailed business case. The highest value use cases are expected to be in the area of online asset monitoring and backhaul of system and asset data, however a detailed review will be included in the project. If successful, the project will provide the foundations for follow up projects which are expected to prepare several applications for Business as Usual rollout.

Third Party Collaborators

Digital Catapult

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

The energy network transition will require more agile, flexible and interconnected networks. This will require system- as well as asset-monitoring and dynamic control to adjust networks to changing conditions and optimise the performance of transmission assets. Facilitating this in an affordable way and whilst protecting the interests of consumers is at the centre of our innovation focus.

A key enabler for this will be the delivery of enhanced communications infrastructure to our assets. In many cases we are facing

bandwidth restrictions or even a lack of available communications connections altogether as well as obsolescence issues with existing connections. Providing remote connectivity with sufficient bandwidth and the appropriate resilience in a secure way at an affordable price will need to be an integral part of the energy system transition and digitalisation. We are also experiencing increased demand for mobile communication and location-based services in the context of digitalisation of processes and automation of data flows. 5G networks can offer significant value in this context but a detailed technical and economic assessment of deployment options and use cases will be required to evaluate where energy networks could potentially benefit from a rollout and how this will fit into current and future operational and business networks including IoT.

Method(s)

Method:

The project will be mainly carried out as a desktop-based research project including a small number of site visits to inform the optioneering for wireless communications designs and cost benefit assessments. NGGT and NGET will work with a specialist consultant and will provide detailed domain knowledge and share key use cases. The specialist supplier will carry out the research into how 5G technology can address the highlighted problems and will also include generic designs as well as a technical and economical assessment of a number of use cases.

Data Quality Statement (DQS):

The project will be delivered under the NIA framework in line with OFGEM, ENA and NGGT / NGET internal policy. Data produced as part of this project will be subject to quality assurance to ensure that 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 on our internal sharepoint platform ensuring 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 our supplier’s own quality assurance regime which is currently in the process of ISO 9001 certification. Quality assurance processes and the source of data, measurement processes and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and will be made available for review.

Quality assurance:

The quality assurance process for this work will align with the requirements documented in the Energy Network Innovation Process (ENIP) section 3. Based on the common risk assessment methodology, the project risk category is “low” due to TRL change 2 -> 4, cost<£500k, single supplier and clearly defined assumptions and principles regarding project data and delivery. The chosen quality assurance approach is therefore “Internal Assurance” and will be delivered in line with our internal project quality assurance process.

Scope

As part of this project we are proposing to investigate the opportunities that 5G networks can offer in this context with regards to the provision of high bandwidth wireless communication channels as well as location-based services. The project will provide an extensive overview of the current and future capabilities of wireless networks as well as collect and evaluate potential use cases. Several high value use cases will be developed in more detail with regards to technical and commercial aspects including a detailed business case.

Integration of 5G solutions into operational/IIoT networks and deployment options will also be covered. The project will be delivered in 4 work packages as follows:

Work package 1:

· Overview of current and future capabilities of 5G technology

· Evolution, roadmap and comparison to other alternative technologies

· Deployment options and infrastructure requirements

- 5G applications and integration into IIoT and operational network infrastructure
- Cyber security features and considerations

Work package 2:

- Stakeholder engagement and feedback
- Investigate value levers for energy networks
- Develop long list of use cases

Work package 3:

- Assess and prioritise the long list of use cases
- Select four highest scoring use cases for further detailed analysis

Work package 4:

- For each of the four use cases,
- Develop and design a high-level technical solution
- Develop corresponding specifications
- Carry out cost benefit analyses
- Develop a roadmap for trial and pilot schemes to facilitate future higher TRL work

Objective(s)

This research aims at providing an assessment of the capabilities of current and future wireless networks and how these technologies can be applied by energy networks. Specific emphasis is on 5G and successor technologies as availability improves. The objectives of this work include:

- Detailed assessment of current and expected future performance of wireless networks.
- Analysis of deployment issues in a gas transmission/distribution and electricity transmission/distribution environment.
- Investigate deployment models and infrastructure required for 5G networks
- Review of cybersecurity measures and features
- Development and appraisal of long list of use cases including technical and economic factors
- Identify key value levers for energy networks
- Design of 5G communications solutions/concepts for a number of use cases in terms of technical implementation and detailed business cases ready for follow up development and rollout projects.

This work aims to support energy networks identify opportunities to deliver enhanced consumer value through digitisation and use of 5G and successor technologies.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Financial distributional impact:

The project is expected to support energy networks to deliver communications services at lower cost and enable digitalisation. If these savings are achieved, the financial distributional impact of this project aligns with the simplest case discussed in OFGEM's "Assessing the impact of economic regulation" report. The report confirms that the savings as a percentage of household income are more significant for lower income deciles and therefore the achieved benefits will be particularly valuable to vulnerable consumers. The pricing structure for energy transmission will not be impacted, e.g. benefits delivered as part of this project can be passed on to all consumers including households using a prepayment meter.

Technical and wellbeing impact:

Based on the recommendations and findings in this research, energy networks may either start adopting 5G services from external providers or will consider the development of private networks. Both will support the availability of high-speed wireless network coverage and availability which will benefit vulnerable consumers who may not have access to direct fibre broadband services.

The consumer impact of any of the methods or solutions developed in this project is not dependent on any of the following factors:

· Dwelling and location (potentially including tenure)

· Readiness for digital technology

· Personal and social factors (for example, households with disabilities and medical conditions, or which speak English as a foreign language)

Energy technology and usage profiles:

As part of the project innovations for gas networks as well as electricity networks are investigated and whilst they may vary in quantity the work does not intend to disadvantage consumers using one energy technology over another.

Success Criteria

The project will be successful if it achieves the objectives set out at the start of the project. In particular, the following outputs will be important when assessing the success of the project:

· Development and dissemination of energy network specific knowledge relating to the deployment of 5G communication networks

· Developing use cases where 5G networks could be used to deliver consumer benefits. This should enable follow up work to either develop these as further innovation or BaU projects.

· Develop detailed standard solutions and CBAs for the most promising use cases

· Enable follow up development/rollout work to apply the learning from the project.

Project Partners and External Funding

This project will be jointly delivered by NGGT and NGET. Both NGGT and NGET will be the joint lead parties with an equal NIA funding split across both business entities, i.e.

NGGT NIA funding: £127,500

NGET NIA funding: £127,500

Potential for New Learning

The outputs of the projects aim to deliver the following new learning:

· Technical capabilities and limitations of 5G and successor technologies in an energy network context

· Comparison to other options for delivery of communications services

· Technical and commercial assessment of deployment options

· Evaluation of the prospects for deployment of a long list of use cases and more detailed insights into costs and benefits for a selected number of shortlisted use cases.

The learning will be disseminated through the reporting via the ENA portal and either ENA or CIGRE dissemination webinars depending on availability and timing.

Scale of Project

This project aims to deliver the key learning to the industry that will enable further development. It is set up as a desktop study with minimal site survey activity and has been reduced to the essential components.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project will be a desktop study with minimal site survey activities. These will be carried out at a suitable NGGT/NGET site in the midlands.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£265,016.67

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 energy system transition will require more agile, flexible and interconnected networks. This will require system- as well as asset-monitoring and dynamic control to adjust networks to changing conditions and optimise the performance of transmission assets. A key enabler for this will be the delivery of an enhanced communications infrastructure to our assets. Dealing with bandwidth restrictions or even a lack of available communications connections altogether as well as obsolescence issues with existing connections will be an important task. This project will help providing remote connectivity with sufficient bandwidth and the appropriate resilience in a secure way at an affordable price and thus will be an integral part of the energy system transition and digitalisation.

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)

N/A

Please provide a calculation of the expected benefits the Solution

This project will be a research project. A detailed CBA for a number of use cases is included in the project.

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

5G networks can be used by all network licensees. The use case selection will be aimed at gas and electricity transmission, however it is expected that the learning will be transferrable to electricity distribution.

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

As part of this work different deployment options will be investigated including the use of service providers, deployment of private networks or any hybrid arrangements. The cost of delivering fully or partially private 5G networks will require a detailed study and will depend on the relevant use cases.

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 learning from this project will prepare the way for a number of potential successor projects. This work includes a discovery phase which will deliver a long list of potential use cases for 5G technology as well as a short list of use cases for the ones most likely to deliver significant benefits. Based on the detailed assessment in this project network licensees will be able to apply the learning as either follow up development projects or even BaU rollout.

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.

Some recent work has been carried out to investigate the application of wireless technologies as part of NIA project NIA_NGTO029 “Assessment of Wireless Technologies in a Substation Environment”. The key focus of this project was on short range communication in a substation environment but some consideration has also been given to 4G data backhaul. However, the technical and commercial aspects of deploying a private network or procuring services on a public network are not discussed in enough detail to enable a detailed assessment of 5G technology.

One specific use case for 5G connectivity has been included in NIA project NIA_NGTO052 “Assessing wearable technology applications for transmission operation and design”. The focus in this project is however on the use of augmented reality technology rather than the telecommunications aspect.

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

The performance, resilience and security requirements for communications services for energy networks have been met by the installation of fibre optic networks, providing high bandwidth, low latency and delays as well as good cyber security. Wireless networks have not been able to meet these requirements in many cases, however improvements delivered with 5G and successor networks may change this for some use cases and will allow more digitalisation and connectivity for equipment as well as improved processes and automation.

Relevant Foreground IPR

N/A

Data Access Details

N/A

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

The application of 5G networks to a number of innovative use cases on energy networks is currently at a low TRL level and the capabilities of current and future networks in the specific context of energy transmission and distribution need to be better understood before use cases and benefits can be assessed. Whilst this is still very much uncertain, the risk associated with this work and the low TRL level result in NIA rather than BaU being the appropriate funding mechanism for this initial research project.

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

Commercial risks:

Some use cases for the rollout of 5G communications on energy networks have been drafted but have not been developed enough to fully understand the commercial risks associated with the corresponding technical solutions. There is little domain specific knowledge on setting up and running private 5G networks which is one of the key outputs of this work.

Technical risks:

The technical solutions applying 5G technologies are at very low TRL level and may encounter major challenges as they are developed to higher TRL. The risk that some of the proposed applications will hit technical challenges that will make them either uneconomic or not technically feasible is significant at this stage, however the benefits that could potentially be delivered are likewise important. This project will help reduce the technical risks by providing an appreciation of the performance of 5G and successor technologies.

Operational risks:

N/A

Regulatory risks:

N/A

This project has been approved by a senior member of staff

☑ Yes