DCMS Call for Views

5G Trials and Testbeds Programme

5G Network Deployment Pilots: Call for Views

Executive Summary

The Joint Radio Company (JRC) welcomes the opportunity to respond to this call for views and in particular we support the approach from Government to provide funding support to 5G developments to enable future UK competitiveness.

In terms of the three use cases to be explored we endorse the observation that Massive Machine-Type Communications will be directly relevant to the 'Energy' sector in the future and see merit in linking this initiative to the Energy Network's Association Open Networks Project which is seeking to establish sophisticated approaches to electricity Demand Management. In addition, when considering Ultra-Reliable, Low Latency Communications URLLC this also has a direct relevance to the Energy Supply Sector. The energy supply sector currently utilises this capability on a limited scale to control power supplies but in future there will be enhanced need for this capability at all levels of the energy network and as such the amount of active network components needing this type of critical communications capability will likely increase by two orders of magnitude. Furthermore, a key component of enabling URLLC type systems is access to resilient and robust energy supplies and / or having back-up energy present locally. Hence there is a direct relationship between the energy supply industry and future URLLC type solutions from both the Demand and Supply perspectives and we are keen to work with DCMS to establish this aspect as part of future initiatives.

It is worth noting that the 'Energy' sector is currently undertaking trials utilising LTE technology to support increased data traffic flows to enable the future demands of Energy Network Distribution Automation Systems and these existing trials may prove useful when seeking to establish future 5G trials to service the needs of the Energy Networks.

Finally, it is worth noting the emphasis placed by Government on Mobile when describing the 5G initiative and we encourage Government not to overlook the potential for the 5G technology to be deployed in a Fixed Wireless Access context and that this approach should also be considered within the 5G Pilots.

Background

Joint Radio Company Ltd is a wholly owned joint venture between the UK electricity and gas industries specifically created to manage the radio spectrum allocations for these industries used to support operational, safety and emergency communications.

JRC manages blocks of VHF and UHF spectrum for Private Business Radio applications, telemetry & telecontrol services and network operations. JRC created and manages a national cellular plan for co-ordinating frequency assignments for several large radio networks in the UK.

The VHF and UHF frequency allocations managed by JRC support telecommunications networks to keep the electricity and gas industries in touch with their field engineers. These networks provide comprehensive geographical coverage to support installation, maintenance and repair of plant in all weather conditions on 24 hour/365 days per year basis.

JRC's Scanning Telemetry Service is used by radio based Supervisory Control And Data Acquisition (SCADA) networks which control and monitor safety critical gas and electricity industry plant and equipment throughout the country. These networks provide resilient and reliable communications at all times to

unmanned sites and plant in remote locations to maintain the integrity of the UK's energy generation, transmission and distribution.

JRC supports the European Utility Telecommunications Council's Radio Spectrum Group, and participates in other global utility telecom organisations. JRC participates in European Telecommunications Standards Institute (ETSI) working groups developing new radio standards, and European telecommunications regulatory groups and workshops.

JRC also manages microwave fixed link and satellite licences on behalf of the utility sector.

JRC works with the Energy Networks Association's Future Energy Networks Groups assessing ICT implications of Smart Networks, Smart Grids & Smart Meters and is an acknowledged knowledge source for cyber-security in respect of radio networks.

JRC's General Observations on the DCMS Trials and Testbeds Programme

Introduction

UK Energy Networks are undertaking a transition from centralised Energy Generation to a model where energy generation is distributed via a larger and more diverse set of generation points resulting in a shift from a passive to an active grid where energy flows in two directions. This shift to an active and distributed grid demands a greater level of intelligence and interconnectivity (sensors, communications and control) and automation across the entire distribution networks, in order to ensure co-ordination, efficiency, responsiveness, safety and security. Wireless based communication systems have always been a critical component of the Management and Control systems of the UK Energy Networks and with the increasing diversity of energy supply the number of devices that will need to be connected in the network will potentially increase by up to three orders of magnitude with data volumes increasing accordingly. This will be facilitated by a digitisation of the active assets that form the energy networks with a resulting significant expansion in the active communications component needed to facilitate the Management and Control of the networks. To this end, new digital technologies and infrastructure being considered by DCMS will have a profound bearing on the future ability of UK Energy Networks to deliver against Government Policy initiatives, such as establishing the 'low carbon economy.'

Use Cases / Trials

The 'Energy' sector has been exploring innovative communications solutions and the adoption of new technologies, e.g. WiMax and more recently LTE to prepare for the dramatic increase in active network components envisaged with the transition to the 'Smart Energy Grid.' These trials have sort to demonstrate the potential for more dynamic network management of the electricity networks. The initial trial utilised WiMax technology to establish remote monitoring and control of electricity sub-stations to allow for real-time re-configuration of the electricity network whilst also actively managing load reduction and electricity supply from third party distributed generation through the establishment of;

- Dynamic Asset Ratings
- Automated Load Transfer
- Meshed Networks
- In Network Battery Storage Solutions

This WiMax trial served both rural and urban service areas and could act as an ideal potential testbed environment for 5G solutions for industry verticals including the Energy utilities.

In addition, a separate trial is underway to test the capability of LTE technology to facilitate the critical communication needs of Electricity networks in a 'Smart Grid' future. The trial is designed to establish the potential for LTE to provide the low latency, an example of a URLLC use case, necessary to support the monitoring and control (SCADA) of smart grids as the number of active components in the network increase. In addition, the trial is seeking to demonstrate that LTE has the potentially to offer the appropriate bandwidth and speeds to support the increase in data traffic levels anticipated and in particular actively control sub-stations and offer secure real-time communications to direct field operations activities.

These trials / use cases may act as a practical guide for future 5G MMTC and / or URLLC trials and in so doing play a crucial role in enabling secure and intelligent control, monitoring, co-ordination and automation of the increasingly complex electricity grid. To this end we are keen to support DCMS in determining the role of 5G technology in the 'Smart Energy Grid' of the future.

JRC's Detailed Response to Questions

5G Network Deployment Pilots

Q.1 What should a deployment pilot most usefully cover and why in terms of:

(i) Geographic scale of coverage

(ii) Geographic type, including landscape topography and population density

(iii) Whether a single contiguous geographic or municipal area, multiple related areas or multiple independent areas is most appropriate?

(iv) Timescales over which deployment pilots are delivered?

Response:

Q.1(i) The scale of coverage should in the case of mobile networks seek to establish that the minimum performance characteristics can be supported across a diverse set of coverage scenarios, i.e. dense urban – high demand, rural – low demand and urban – medium demand. In addition, the design of the pilot needs to ensure that the use cases can be fully supported, i.e. health and care services can be delivered both to residential properties as well as care homes and hospitals.

(ii) A diverse set of topographies should be considered taking account of both natural features and man-made clutter. This is particularly important when determining the propagation characteristics of the service and hence the characteristics of service deployment which will influence the economics of the service.

(iii) The areas selected need to offer the opportunity to test the diversity of use cases that might apply to a particular service / application and hence the answer will depend on the characteristics of the service and the typical location of its users. In the event that multiple independent areas are considered within a trial it is crucial that the characteristics of the services are mirrored across these independent locations to ensure meaningful results.

(iv) The duration of the pilots should be established based on two criteria;

1. *Adequate time for the service to be stable and the use case to be proven recognising that there may need to be a period of time for user data to be gathered to ensure the findings are statistically robust.*
2. *The impact of seasonal weather variations on the viability of the service needs to be considered and therefore thought should be given to the timing of the pilots to ensure that seasonal weather impacts are taken account of.*

Q.2 How should deployment pilots incorporate trials of 5G services or use cases? Which use cases would be most appropriate for a network deployment pilot?

Response:

Q.2 To exploit the maximum benefit from deployment pilots it would seem sensible to incorporate 5G use cases where practical. However, in the event that the technology is not fully developed to enable full user testing

then perhaps simulations of traffic flows and operator activity can be implemented as a proxy to measure 5G capability.

The applications being considered for the trial will directly influence the pilot design, i.e. high quality live video based services for general public consumption in the urban context will need to be able to support high bandwidth to the end user. Whereas, if the application were to be a relatively Low Data Low Latency Mission Critical type solution across urban / sub-urban / rural areas which may be deployed as a Heterogeneous Network to guarantee data flows consideration needs to be given to the resilience of the network components, from the point of view of energy supply, core connectivity and cyber security. In addition, there may be merit in trialling decentralised control / automation in the industrial networks being served by 5G.

Q.3 What role can the public-sector play in relation to demand aggregation to support the trials?

Response:

Q.3 No Comment.

Addressing Coverage Challenges through Infrastructure Sharing

Q.4 How could a deployment pilot help to prove the business case for commercial investment through models which go beyond the current infrastructure sharing arrangements? For example, could deployment pilots involve private sector sharing, neutral host provision by the public or private sector, or public/private partnerships?

Response:

Q.4 No Comment.

Q.5 What forms of passive and active infrastructure sharing could usefully be explored through deployment pilots?

Response:

Q.5 No Comment.

Q.6 Should the 5G Testbeds and Trials Programme undertake a network deployment pilot focused on the technologies and deployment methods required economically to deliver coverage, with necessary capacity, to remote and hard to reach locations?

Response:

Q.6 No Comment.

Addressing Deployment Challenges Relating to Planning and Street Works

Q.7 How could network deployment pilots be designed to:

(i) identify and address barriers to deployment relating to planning and process requirements?

(ii) include the provision of public sector assets such as buildings, street furniture and ducts for the deployment of fibre, radio cells and other network equipment?

(iii) develop innovative approaches to the granting of wayleaves and site leases?

(iv) explore how landowners and developers can work in partnership with network providers?

(v) explore how innovation and best practice in the design of hardware and other network elements could minimise the impact of network infrastructure on the built environment?

Response:

Q.7 No Comment.

Q.8 What other areas should the Barrier Busting Task Force be looking at?

Response:

Q.8 No Comment.

Collaboration with the Local Full Fibre Networks Programme

Q.9 What opportunities are there for the LFFN Programme and the 5G Testbeds and Trials Programme jointly to fund one or more deployment pilots?

Response:

Q.9 No Comment.

5G Frequency Bands

Q.10 Should deployment pilots focus on any particular frequency bands? If so, what would the likely bandwidth requirements be?

Response

Q.10 A broad range of frequencies should be considered within the pilots to ensure that the diversity of applications / use cases can be fully tested. In the case of 5G for smart grid we emphasise the importance of low frequency spectrum to enable SCADA type solutions to be deployed across all topographies. Whilst higher frequency spectrum could be utilised in a fixed wireless context to facilitate Automatic Network Management in keeping with the acknowledgement by the NIC[1] that local energy networks will require more active management to efficiently manage the dynamics of future energy demand and supply.

Q.11 Are deployment pilots likely to involve the use of fixed term non-operational spectrum licences? If so, how could the long-term sustainability of the deployment be ensured?

[1] National Infrastructure Commission Report Smart Power, published March 2016.

Response:

Q.11 It is likely that fixed term Test and Development licences will be necessary to facilitate pilots where the relevant spectrum bands are utilised by incumbent services subject to appropriate sharing and coexistence arrangements. On the basis that the pilots are intended to explore the economics of supply then clearly the economics of spectrum access will be a key factor when determining whether the system shall remain operational post pilot. To this end we encourage DCMS and Ofcom as part of the trial appraisal process to explore the potential mechanics of spectrum access post pilot, whether that be through sharing and the application of Administrative Incentive Pricing (AIP) or Spectrum Release arrangements and the appropriate timescales that might apply.

Evolving Network Architecture

Q.12 How could network deployment pilots address challenges relating to:

- access to fibre for 5G networks;

- interoperability of new 5G networks and services?

Response:

Q.12 In terms of access to fibre for 5G networks there may be opportunity to utilise private fibre networks such as those deployed in the Transport Sector, e.g. Rail Fibre and Highways Fibre. In addition, radio based networks can also be deployed to facilitate both high speed backhaul and fronthaul to future 5G networks.

From the point of view of interoperability, the pilots should seek to establish how diverse applications may be delivered in parallel within the same transport stream whilst accommodating diverse security, availability and throughput characteristics.

Q.13 What innovative approaches could usefully be explored through a network deployment pilot to:

- civil engineering;

- the supply of power to cell sites;

- more energy efficient technology?

Response:

Q.13 For the supply of power to cell sites the sharing of 11kV poles in rural areas for base stations might facilitate the roll-out of 5G to roads where a power line runs in close proximity. In addition, for urban areas, erecting a 5m pole at 11kV/400V substations could facilitate high bandwidth micro-cell coverage, see figure 1.

In the context of establishing resilient 5G communications solutions local energy storage will be necessary and if this were to be deployed on a sufficiently large scale then this could enable on a secondary basis local energy capacity to balance energy network demands on a dynamic basis.

Where traffic may be intermittent / erratic there is the potential to establish low energy usage sites based on Solar Power and traffic profiling to ensure that the station is only active when appropriate, e.g. outside primary school to facilitate drop-off and pick-up.

Figure 1 5G mast at Surrey University which could be co-located with a local 11kV/400V substation.

Q.14 Could deployment pilots help reduce the commercial risk around 5G by enabling experimentation with cell density?

Response:

Q.14 The principle purpose of deployment pilots should be to establish the economics of service provision which will be subject to experimentation around cell density and the number of active units / proportion of data delivered. This should seek to establish the most cost-effective arrangements for 5G deployment in terms of the range of industry segments / applications that can be served and in so doing reduce the commercial risk associated with 5G deployments which might be undertaken directly by industry.

Approach to Public Funding

Q.15 What is an appropriate amount and timescales for public funding contribution?

Q.16 Given that public funding may be applied to capital expenditure only, how can the ongoing operational costs of deployments be managed?

Q.17 What additional investment and/or contribution-in-kind could private sector organisations make towards 5G network deployment pilots?

Q.18 What sources and approaches to funding should be considered, for example, grant funding, joint venture arrangements, anchor tenants, demand vouchers etc. that could be tested in a network deployment pilot. Would any of these be more appropriate for an urban/suburban or rural network deployment pilot?

Response:

Q.15 – 18 - No Comment

Conclusion

JRC welcomes the DCMS approach to establish 5G technology in the UK and encourages the Department to work with the Energy Utilities to explore the potential role of 5G technology in enabling the 'Smart Energy Future' and also the role that electricity plays in facilitating URLLC services utilising 5G technology.