Response to the RSPG Sub-Group Questionnaire on The Role of Radio Spectrum Policy to Help Combat Climate Change

The Joint Radio Company (JRC) and its Members welcome the opportunity to respond to this consultation from RSPG's sub-group on the role of radio spectrum policy to help combat climate change.

Background and Introduction

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 ensure that the electricity and gas industries can maintain monitoring and control of their remote assets and stay in contact 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 to unmanned sites and plant in remote locations to maintain the integrity of the UK's energy generation, transmission and distribution networks.

JRC supports the European Utility Telecommunications Council's Radio Spectrum Group, and participates in other global utility telecom organisations such as ITU. 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 directly with Ofcom, the ENA's Future Energy Networks Group - 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 notes that the RSPG sub-group intends to compile a report focussing on five key areas–

- i) Implementation and impact of Green Regulatory Measures (Green Deal & ECO Design Directive) into spectrum policy
- ii) Initiatives to reduce the carbon footprint of wireless communication networks and equipment in the EU
- iii) How wireless technologies can help other sectors become more climate friendly
- iv) The use of spectrum for monitoring climate change and collecting data for weather forecasting
- v) Measures to introduce climate change mitigation in spectrum policy and management

JRC notes that the focus of our response addresses questions (i), (iii) and (v), whilst JRC anticipate that responses from other sectors such as the Telco operators / vendor community and meteorological groups will provide valuable input to areas (ii) and (iv).

JRC's Responses to Questions (Non Confidential)

Question 1: How can the wireless technologies contribute to the efforts to reduce the climate impact of your sector?

The reduction in Carbon emissions being prioritised by the Energy Sector will have a significant contribution to minimising climate change and will be dependent on the deployment of many smart devices throughout the energy network to manage and control the contribution of Low Carbon Distributed Energy Resources (DERs), Battery storage facilities and Electric Vehicles (EVs). Each of these smart devices requires a two-way flow of data to function correctly and allow the stability of the Energy Network to be maintained and demand satisfied. Whilst some smart devices will be connected via wired telecommunications solutions it is anticipated that the vast majority will be dependent on wireless solutions which will need to be both operationally robust and resilient in order that energy supply is stable and secure. To this end spectrum access is fundamental to allowing the deployment of wireless technologies, e.g. Private LTE, to afford cost effective and resilient communications to a vast number of devices necessary to enable the smart grid of the future. To fully appreciate the magnitude of the connectivity challenge it is worth reflecting on the existing / historic operational design of the electricity and gas networks (although the description below focusses primarily on Electricity). Essentially, energy has been generated at a relatively small number (Circa 100) of very large centralised plants distributed around each country each with a capacity of (typically) 500 – 2000 MW These plants (often fossil fuel based) are connected to a 'supergrid' through which energy is transmitted via a hierarchy of power lines and transformers to distribution networks and eventually to end users (offices, factories, domestic consumers). To successfully monitor and control the stable operation of these systems, the high end of the power generation and transmission hierarchy has required access to detailed real time data. As a consequence, the middle (distribution) layers of the network and the periphery of the network (where end users are located) has been relatively unimportant from a monitoring and control perspective (with the exception of some very large industrial users of energy – smelting plants for example). In terms of monitoring and control, the most essential parts of the network have been the super grid components and major generating stations (themselves very predictable in their operation) – all equipped with connectivity via extremely robust and diverse communications systems (fibre & microwave). Historically, as long as the Supergrid has been operating correctly with demand and load balanced precisely enough to maintain a grid frequency of 50 Hz, then it has been safe to assume that the distribution elements of the networks will have been functioning normally in most locations for most of the time. In fact, most Energy Network Operators still have zero visibility of the Low Voltage (LV) parts of their networks – apart for some very limited, non-real-time data from smart metering systems. [The gas network architecture follows a similar hierarchical structure – but with pipes, compressors and storage units taking the place of cables and transformers.]

The move away from centralised fossil-fuelled generation effectively turns the existing paradigm upside down. Rather than one way power transmission from a small number of very large, stable, centralised locations out towards the edges of the electricity grid there will in future be a plethora of generating and storage devices connected to the edges of the electricity grid. This will comprise a combination of small, medium and large generators (wind, solar, Biomass, etc.) located throughout each country. Residential PV will be (and is) connected to urban and suburban distribution networks whilst larger PV farms and wind turbines are often located in rural and deep rural areas due to availability of land. Each of these renewable sources by their very nature are far more variable on a minute by minute basis in their availability due to local weather conditions. The addition of distributed battery storage at grid and distribution level (including bi-directional energy flow to EVs) add an additional layer of complexity. It is anticipated that (as a minimum) hundreds of thousands of active devices will be added to the energy grid of all European States in the next ten years (possibly millions or tens of millions). These active devices will comprise not only a wide range of DER, battery storage and EVs but also a growing number of connected assets such as transformers, switch gear and synchro phasers – the vast majority of which are currently invisible to the DNO in terms of real time communication. Similar challenges exist in the gas sector, where an ever-increasing number of installations being added to the periphery of the network can have a significant impact on the stability of its overall operation. There are options to mitigate some of these challenges by a brute force method of simply building additional heavy electrical or gas infrastructure (network reinforcement). However, this approach would only partially solve the issue and would be both hugely expensive and disruptive. The proposed solution is analogous to current developments on congested sections of road and motorway – i.e. using the infrastructure which already exists in a more intelligent, efficient manner – smart motorways, or in this case Smart Grids.

Each of the devices in the smart grid will require a highly reliable and robust telecommunications connection in order that they can function ‘in concert’ with all other smart grid devices (including some autonomous and semi-autonomous operation) to provide a stable energy supply. To connect all of the distributed energy network assets in a smart grid is challenging - especially due to the needs for ubiquitous coverage, power autonomy and solutions which are robust from a cyber security perspective. Whilst existing public networks may have a role to play in non-critical aspects of operation, those system controls that are central to safe and effective delivery of Energy to consumers and enterprise need to be designed and deployed to be robust and resilient to mains power loss, as such it is widely acknowledge that Public Mobile Networks are not sufficiently robust or resilient to address the critical operational telecommunications needs of Energy Network Operators[1].

Furthermore, there is broad agreement between Energy Utilities in the UK and Ireland that the only way to facilitate a cost effective smart grid connectivity solution is via the award of dedicated radio spectrum for mission critical utility smart grid use to facilitate the ‘Net Zero’ future being targeted by the UK Government in the Energy White Paper – Powering our Net Zero Future’, recently published by BEIS[2]

[1] https://op.europa.eu/en/publication-detail/-/publication/246bc6ec-6251-40cb-aab6-748ae316e56d/language-en - Study by SCF concluded that public networks would not be an option for mission critical services

[2] https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

Question 2: Which actions relating to radio spectrum issues and contributing to climate protection are taking place in or being planned for by your sector(s) ? These may be actions based on your own initiative, on the initiative of a group of stakeholders, or adopted as part of National or European Policies.

In the UK, JRC and the Energy Networks Association Strategic Telecoms Group are engaged in detailed discussions with Ofcom and BEIS (The Government Department responsible for Energy Policy) regarding the requirement for dedicated spectrum access for UK utilities. Whilst Ofcom already has a number of VHF and UHF narrow band channels allocated to the UK energy sector via JRC, these channels are too narrow and too few to accommodate the anticipated growth in data traffic and active assets envisaged to enable smart grid capability. Detailed analysis has been undertaken in the UK regarding future data throughput requirements and device numbers. It may be possible to share additional details on this topic with RSPG.

Additionally, four JRC members (major Energy Network Operators) are involved in a combination of advanced field trials and desktop analysis around Private LTE deployment as a connectivity solution for the operational 'Smart Grid' requirements that they will need to deploy to address Government objectives for a 'Net Zero' future. In addition, JRC also collaborates with the European Utilities Telecommunications Council on this important topic. Whilst, in principle JRC and the Energy Network Operators more generally are frequency agnostic in terms of potential dedicated spectrum access, in practical terms there are some pre-requisites –

i) ideally spectrum in the sub 1GHz band is desirable due to the preferable propagation characteristics and coverage alignment with existing utility hilltop site infrastructure.
ii) Spectrum aligned with a globally harmonised product range i.e. 3GPP in order to ensure economy of scale, interoperability and sustainable / extensive eco-system of network and device vendors (and to avoid vendor 'lock in' issues which have plagued many legacy proprietary deployments)

In Ireland, the Communications Regulator (ComReg) awarded a dedicated spectrum allocation in the 400 MHz band to the country's Electricity Distribution Network Operator ESBN in late 2019 to be used specifically and exclusively for the deployment of a national smart grid solution to address the needs of the Electricity, Gas and Water Networks[3,4]. The procurement phase of this project has just commenced. In parallel several other European countries have taken a similar approach –

- **Poland** – November 2019 PGE awarded spectrum in 450-470 MHz band for the purposes of a national smart grid network based on LTE[5];
- **Spain** – July 2020, Spanish Regulator identified the 2.3 GHz band (3GPP band 40) for dedicated use by energy and water smart grids. Award process to be confirmed
- **Germany** - January 2021 German Regulator made available FDD spectrum in 450-470 MHz band for dedicated smart grid use (national LTE network). Several bidders have applied, and spectrum award is anticipated during February 2021[6]; and
- **Portugal** – 2020 Regulator in Lisbon established an auction process for 450-470 MHz spectrum (currently unused). Reserve price was relatively high and no interest was shown other than from power company EDP

Utilities in all of the countries identified above (including UK) have carried out detailed proof of concept trials & field tests. Further afield, energy utilities in Brazil & USA are engaged in discussions with their respective regulators and conducting their own trials of private LTE systems for smart grids. There is also significant work taking place at ITU and 3GPP in relation to radio spectrum allocation and operational telecommunications requirements for smart grids. A product of engagement in 3GPP has been the creation of two new bands – 87 & 88 (410-430 MHz), in recognition of the anticipated demand

[3] https://assets.gov.ie/19240/62af938dce404ed68380e268d7e9a5bb.pdf

[4] https://www.comreg.ie/publication/further-consultation-on-the-release-of-the-410-415-5-420-425-5-mhz-sub-band/

[5] https://www.wirtualnemedia.pl/artykul/pge-zapowiada-przyspieszenie-prac-nad-budowa-sieci-lacznosci-lte-450

[6] www.Bundesnetzagentur.de/450MHz

from utilities who cannot access spectrum in 3GPP band 31 (450-470 MHz) This development has attracted significant interest from a dedicated group within the World Economic Forum, New York[7]

Finally, a major network power loss took place on the UK's electricity grid on 9th August 2019. Detailed technical analysis noted a combination of unfortunate coincidences in terms of lightning strikes, system downtime and off-shore wind energy system loss. However, a lack of sufficient real time data was identified as a potential contributing factor and certainly the restoration of all supplies would have been more effective if robust operational telecommunications system capability had been available across the network[8].

In Summary, throughout the UK, Ireland and the whole of Europe there are extensive Government Policy interventions that are dependent on spectrum access to facilitate smart grid developments and underpin a 'Net Zero' future.

Question 3: How can radio spectrum administration help to reduce the climate impact of your sector?

JRC notes that approx. 80 % of carbon emissions in the EU are directly attributable to energy generation, heating and transportation. The Energy Network Operators are keen to contribute to achieving UN climate change objectives and have already begun to invest significantly in the technological solutions which will enable energy networks to evolve from the established centralised fossil fuel generation model to one that is dependent on distributed renewable energy sources geographically dispersed. However, without visibility and control of a significant number of new smart embedded devices such as distributed energy sources and network control assets (growth expected of at least two – three orders of magnitude) then there will be no mechanism to maintain reliability of supply, carbon reduction and minimise costs. An effective way to facilitate reliable operational communications to monitor and control the majority of the future smart grid will be via wireless technology. A consistent approach to enabling harmonised spectrum access to a modest amount of spectrum for smart grids throughout the EU and UK is essential. Without such access, the potential for the carbon reduction that is targeted from the energy sector and the overall targets set through COP[9]. will be jeopardised. Moreover, the overall reliability and availability of Energy Supply will be compromised.

Question 4: Do you identify any issues involving radio spectrum administration which might prevent combat against climate change, decrease of carbon emissions and reducing energy consumption?

JRC is pleased that this particular topic has moved up the agenda of most spectrum regulators in recent years and is also being addressed by RSPG, ECO, CEPT, ITU [10] etc. Indeed, the progress being made in Ireland, Germany, Poland and Spain is extremely positive. JRC encourages spectrum access for the Energy Sector through policy intervention rather than via an award process / auction [11], unless the award is designed to ensure access to Utility Network Operators as was the case in the Irish award.

> The UK Energy Regulator OFGEM is conducting a regulatory price review for the period 2023-2028 [12]. In their guidance, they have indicated the importance of making adequate

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[7] https://www.weforum.org/reports/future-series-cybersecurity-emerging-technology-and-systemic-risk

[8] https://www.nationalgrideso.com/information-about-great-britains-energy-system-and-electricity-system-operator-eso); specifically https://www.nationalgrideso.com/document/152346/download:

[9] https://ukcop26.org/

[10] https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-SM.2351-1-2016-PDF-E.pdf

[11] https://www.jrc.co.uk/Plugin/Publications/assets/pdf/ICT-The-Socio-economic-value-of-spectrum.pdf

[12] https://www.ofgem.gov.uk/system/files/docs/2020/12/riio_ed2_ssmd_annex_1_delivering_value_for_money_services_for_customers.pdf

investment available for telecommunications and highlight the role which access to spectrum will pay in the future. The specific reference in contained in paragraph 8.145 repeated below:

> "For telecommunications resilience, we believe that it is appropriate to monitor the ongoing developments in relation to the replacement of the public switched telephone network and the need for utility companies to have a proportion of the radio spectrum allocated for their use."

Question 5: Do you have any other comments that you would like to address to RSPG on this topic?

JRC welcomes the opportunity presented by this questionnaire and would welcome further discussion with RSPG as required.