PUBLIC CONSULTATION DOCUMENT ON USE OF SPECTRUM FOR MORE EFFICIENT ENERGY PRODUCTION AND DISTRIBUTION

COMMENTS BY THE JOINT RADIO COMPANY LTD, UK

Scope of the Call

The European Commission is launching this public consultation on the use of radio spectrum for smart grids and smart metering, in order to contribute to the preparation of an impact assessment of possible initiatives in this field.

Contributions are welcome from all stakeholders, including from those in the utilities and telecom sectors and regulatory and standardisation agencies. Individual citizens, consumer organisations or any other stakeholders interested in smart grids, including smart metering systems are also invited to express their views.

The closing date for comments is 18 April 2012. Responses are to be sent to the Radio Spectrum Committee Secretariat **(infso-rsc@ec.europa.eu)**. All the contributions will be published on the European Commission's website on radio spectrum policy[1] except where otherwise specified by the respondent.

Background and purpose of the Call

One of the Commission's Europe 2020[2] flagship initiatives is 'A resource-efficient Europe'[3]. In this framework the Commission is now putting forward a series of long-term policy plans in areas such as transport, energy and climate change. The Commission's view is that innovative solutions are required to mobilise investments in energy, transport and information and communication technologies, and that more focus is needed on energy efficiency policies.

A new Radio Spectrum Policy Programme (RSPP) setting out policy orientations and objectives is on the point of being adopted by the European Parliament and Council, based on a Commission proposal. This programme should support the goals and key actions outlined in the Europe 2020 Strategy and the Digital Agenda for Europe[4], which is also one of the Europe 2020 flagship initiatives. The impact assessment accompanying the RSPP proposal concluded that smart energy grids and smart metering systems are potentially an area where EU wide harmonisation of radio spectrum use could bring essential benefits to European consumers. The relevance of spectrum in the context of a sustainable environment, including for smart grids and smart metering, was also raised at the Spectrum Summit in March 2010, and there seems to be wide support and political willingness to develop a common approach at EU level. Other relevant issues in this field are the possibilities to encourage co-investments between utilities and telecom operators as well as the continuity of wireless technologies used in consumer equipment (e.g. smart meters) or in other parts of a smart grid.

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[1] http://ec.europa.eu/information_society/policy/radio_spectrum/index_en.htm
[2] COM(2010)2020, 'Europe 2020 - A strategy for smart, sustainable and inclusive growth', 3.3.2010
[3] COM(2011)21, http://ec.europa.eu/resource-efficient-europe
[4] COM(2010)0245 final/2, 'A Digital Agenda for Europe', 26.8.2010

The draft RSPP text states *inter alia* that the Commission, in cooperation with the Member States, shall conduct studies on saving energy in the use of spectrum in order to contribute to a low-carbon policy, as well as consider making spectrum available for wireless technologies with a potential for improving energy saving and efficiency of other distribution networks, including smart energy grids and smart metering systems. The draft text also refers to water supply networks, but that is outside the scope of this initiative and the specific needs of such networks could be addressed at a later stage.

Smart Grids[5] could be described as an upgraded energy network to which two-way digital communication between supplier and consumer, intelligent metering and monitoring systems have been added. Intelligent metering is usually an inherent part of Smart Grids, which can manage direct interaction and communication among consumers, households or companies, other grid users and energy suppliers. It could also enable consumers to directly control and manage their individual consumption patterns, providing incentives for efficient energy use if combined with time-dependent tariffs for electricity consumption. Improved and more targeted management of the grid translates into a grid that is more secure and cheaper to operate.

The European Council of February 2011 recognised the important role of Smart Grids and invited Member States, in liaison with European standardisation bodies and industry, ‘to accelerate work with a view to adopting technical standards for electric vehicle charging systems by mid-2011 and for smart grids and meters by the end of 2012’. Over the long term, the Commission’s Communication on a 'Roadmap for moving to a competitive low carbon economy in 2050'[6] identifies Smart Grids as a key enabler for a future low-carbon electricity system, facilitating demand-side efficiency, increasing the shares of renewables and distributed generation, and enabling electrification of transport.

The Commission intends to prepare an impact assessment which will assess whether there is a need for an EU wide spectrum harmonisation for smart energy grids and smart metering, to what extent is the currently available spectrum sufficient for smart grid applications, what measures should be taken to satisfy the demand, and whether there are any cases that justify the use of dedicated spectrum. This public consultation is therefore an important follow up step to the Radio Spectrum Policy Programme in order to collect information and stakeholders' views, which will be used as input for Commission's impact assessment and possible subsequent actions.

It is to be noted that all the responses to this public consultation will be published unless an input or a specific part of it is requested to be confidential by the contributor.

[5] COM(2011)202 of 12 April 2011 on Smart Grids: from innovation to deployment

[6] COM(2011) 112/4

Annex
Questions for the public consultation on the use of Spectrum for more efficient energy production and distribution

The below questions are grouped in four categories:

A) smart grid system and services related questions;
B) communications / data transfer related questions;
C) spectrum and interoperability related questions;
D) wireless technologies related questions.

Please note that all the responses will be made public, unless a contributor is clearly stating that certain parts of the inputs are to be regarded confidential.

It is also to be noted that there is no need to provide an answer to each and every question.

A) Smart Grid system and services

1. What are the specific security and resilience requirements for ICT infrastructures and services within smart grid systems, if any?

Specific security & resilience requirements are:
**** Independent of mains electricity supply for 72 hours for critical services (UK requirement): must be able to prove such resilience.***
**** Guaranteed access to network – not susceptible to denial of service attacks, especially if resources shared with public networks.***
**** Guaranteed availability, service level and time-to-repair [Not simply compensation for failure to meet specific performance levels.]***
**** Able to comply with nationally imposed government cyber-security and integrity requirements.***
**** guaranteed redundant routing, capable of demonstrating redundancy.***

2. Which services would you regard as "mission-critical" in the context of smart energy grids, and why? What justification, if any, is there for designating dedicated or exclusive spectrum for a specific service?

'Mission-critical' services in the UK are generally defined as:
**** voice communications to operational staff for safety and emergency power restoration***
**** teleprotection (Protection and blocking systems)***
**** Primary SCADA (ie SCADA services which are continuously scanned)***
**** At present, there are differing positions on whether Distribution Automation, secondary SCADA (ie report by exception points on the network) and demand management are 'mission critical': however, as distribution companies come to rely on these services increasingly to balance the network, they will become 'mission critical'.***
**** There is too little video currently deployed to be considered.***
**** Dynamic asset ratings, as they develop are likely to become 'mission critical' as the electricity network comes to depend on such a manner of operation.***

***** As the proportion of power supplied by intermittent renewable sources increases, there is concern that networks will become less stable, or even unstable. This will put a premium on real time communications services, but the mechanisms by which this will be achieved are not yet fully understood.**
***** As the number of demand-managed load increases on the distribution network – for example heat pumps and electric cars, how to restore power after an outage becomes a problem as the load pick-up may exceed the ability of the distribution network to deliver the instantaneous power required.**
***** Generally, new telecom services are often ‘proved’ using non-resilient private or public services, but as utilities become dependent on the provision of such data, they become ‘mission critical’. This can be illustrated in the way that public safety used to operate without ubiquitous radio voice communications, but today these are ‘mission critical’ services; and a similar situation has evolved for railways for signalling.**

3. Which kind of ICT infrastructure (powerline communications / PLC, cable, optical fibre, wireless network, point-to-point wireless connections, mesh network, or a combination of some of these) would be the most suitable to support the critical services in smart grids from your point of view, and why?

The ICT infrastructure is likely to a combination of powerline, fibre and radio, using both private and public networks in the latter two cases. For radio, a diverse range of technologies will be employed – point-to-point, point-to-multi-point, mesh and mobile radio.

Radio technology has a vital role to play as it can be deployed quickly to support energy policy objectives, and provides communications in situations where fixed lines have been damaged, often interrupting both power supply and telecommunications cables. Radio can also be the most cost effective solution in many cases.

In a situation where the end consumer has little choice but to obtain electrical power from a regulated utility, it is important to minimise costs to end users, especially the fuel-poor.

4. How big a portion of the "mission-critical" communications in smart grids can be handled via fixed connections (e.g. with help of PLC, cable, optical fiber) at the moment / in the medium term / in the long term?

In the longer term, more communications are likely to be carried on fibre bearers as utilities install more fibre as they renew power lines; but since the growth in communications requirements will exceed the rate at which new fibre is rolled out, it is likely that the percentage of communications carried by radio will increase.

Whatever role fixed communications play in the utility telecoms networks of the future, radio will still have a large part to play for maintaining resilience, diversity and rapidly deployable communications.

5. Who can provide, operate and manage the necessary ICT infrastructure/platform supporting the critical services – utilities, telecom operators, third parties or …?

Commercial considerations will also play a large part in determining the mix of self-provided and commercially provided telecommunications services; but it is likely that in view of the increasing criticality of communications to the stability of electricity networks, some organisations will not wish to contract out services upon which the viability of their business depends.

6. What kind of new generic services (tele-control, real time monitoring and management, …) do you expect to emerge with the roll-out of the Smart grid, and what are the expected ICT requirements for such new generic services?

The essential difference between the legacy grid and a 'smart grid' is that the original design of electricity networks was for one way flows of power from a few centralised sources of power to a diverse community of users. A 'smart grid' has to accommodate two ways flows of power with a massively distributed network of both supply and demand-side management. This can only be managed with a massive increase in real-time monitoring and control. There will therefore be a growing requirement for time critical teleprotection services.

Experiments are currently under way whereby utility infrastructure is given dynamic ratings rather than based on a worse case scenario. This enables the infrastructure to accommodate more capacity without wholesale renewal of assets, which, apart from the cost, would take decades to implement. However, as the networks become more dependent on assets operating closer to their physical limits, the data supporting this mode of operation becomes 'mission critical'.

Real time ratings projects are likely to be local in scope, needing to communicate between multiple nodes within a few kilometres to tens of kilometres of each other in order to collect data and calculate ratings. Most commercial communications networks (especially mobile phone based ones) are centralised and return everything back to a central node preventing outer nodes from communicating directly with each other. This creates a single point of failure, places unnecessarily onerous requirements on long distance communication paths, and generally undermines resilience principles.

In addition, new technologies such as synchrophasors, operating in real-time, will be needed to maintain the stability of the grid unless the historic principle of reliable electricity supplies (99.999% availability) is replaced by local energy sources and microgrids.

7. Have you encountered problems or risks potentially hindering the deployment of smart grids, for example linked to network and information security or data privacy?

Where public data services have been used, network access cannot be guaranteed, and the services are not resilient against loss of mains electrical power.

Smart Grid services have also only been introduced recently, so longevity of the technology has not been tested.

The normal development path is to introduce, develop and prove new techniques using public networks when the service is not mission critical, but to progressively migrate to private networks as the service comes to be relied upon, and therefore mission critical.

B) Communications / data transfer

8. What are the specific data transfer related (or communications related in general) requirements for the "mission-critical" applications in terms of resiliency, latency, data security/privacy, coverage, and (data) bandwidth?

**** Resilience: UK requirement is independence of mains electrical power for 72 hours for critical voice, telemetry and telecontrol to aid restoration in case of wide-area outages.***
**** Availability: 99% up to 99.999%***
**** Latency: 6mS up to 1000mS***
**** Security: Redundant routing, not susceptible to denial of service attacks, guaranteed network access at all times, encryption and authentication.***
**** Data rates from 600 baud to 64k bits at end points, aggregated to 2 MBits/s as data is concentrated higher up in the network (middle mile as described in IEEE smart grid model); and possibly 2 MBits/s to end points if video is required for security and remote diagnostics, and/or remote firmware upgrade and debug data download.***
**** 100% coverage of desired end-points on network.***
**** Provable and testable characteristics.***

9. Based on the above requirements, which communication needs could not be handled by commercial telecommunication networks (e.g. from resiliency, latency, coverage, data speed/amount, data security/privacy points of view)? Why?

It may be important to distinguish between a 'public' network and a 'commercial' network. Public networks are in general subject to greater regulatory constraints, for example 'net neutrality' policies where all data must be treated equally; and obligations on telecoms providers not to discriminate between customers. This limits the ability of a public network operator to offer preferential access to utilities. However, a 'commercial' network operator may provide a 'private' network, thereby able to offer premium services to one customer in preference to another.

Public networks find it difficult/impossible to demonstrate and maintain redundant routing and power independence.

Public operators view geographic coverage from an investment perspective, evaluating the opportunity cost of extending the network in one area compared to others. It is therefore possible that some geographic areas will never obtain the connectivity required by a utility as investment resources are always limited and may provide better returns in other areas.

10. In view of the previous question, where would fully owned or fully controlled networks / data connections by utilities be a necessity, and where would it be sufficient to have partly owned, or shared, infrastructure for the purposes of wired and/or wireless communications?

It is difficult to provide a generalised answer, but in a competitive and regulated utility market, some electricity network operators may consider self-provided and operated networks enable them to innovate more quickly and provide greater public benefits than if they have to wait for telecoms networks to address specialist utility requirements as they do not have the same incentive to improve energy efficiency.

Commercial network operators (of both public and private networks) also have different motivations to implement newer technologies, leaving an installed base of legacy equipment unsupported. Examples occur with copper telecoms circuits where commercial operators wish to renew their networks, leaving circuits depending on the unique characteristics of the legacy system isolated; and concerns that mobile operators will refarm 2G spectrum to obtain greater spectrum efficiency from 3G and 4G technologies, leaving those depending on GSM architectures unsupported.

11. What are the synergies between utilities companies and telecom operators in case a shared infrastructure is used

Shared infrastructure might include radio sites and masts, backhaul (especially fibre), cable ducts and tunnels, and utility poles. Utilities might be keen to share infrastructure, but less so services.

C) Spectrum and interoperability

12. Do you see any regulatory or other barriers, in particular in the area of spectrum that would hinder co-investment so as to benefit from the synergies (see Question 11); if you do, what are they?

It is unlikely that the telecoms regulatory structure will allow a telecoms operator to offer priority network access to a utility, and prioritise their data over a network (net neutrality principles); and it is unlikely that energy regulators will allow an electricity company to preferentially restore power to a selected telecoms provider's sites to restore communications to the electricity company's comms network.

However, spectrum sharing is a continuum of options, not a single model. Within the UK, the utilities have a spectrum sharing arrangement through a joint venture company JRC Ltd. JRC licences spectrum from the UK Regulator Ofcom, then 'leases' it amongst its members to obtain optimum spectrum and operational efficiency. This enables electricity generation, transmission and distribution companies to share spectrum with gas transmission and distribution. In areas of particular stress, spectrum can also sometimes be 'exchanged' with water companies who have complementary requirements; and spectrum is also shared in some areas with public transport companies. This results in much more efficient use of spectrum than if it were allocated to single companies using uniform assignment rules, but gives each company certainty over the operation of their own telecoms system.

13. Is there a need for interoperability of certain services or other areas in the context of smart energy grids at European level; what would such services or other areas be

- ***Utilities would benefit from more suppliers, lower cost and greater flexibility if harmonised spectrum and standards were available on a European-wide basis (not just EU, but the whole of CEPT administrations).***
- ***Manufacturers benefit from larger markets.***
- ***There is more opportunity and likelihood of other countries, especially in ITU Region 1, following Europe, creating opportunities for EU companies to exploit their home market and nearby export markets, boosting economies of scale further.***
- ***Harmonising spectrum and standards minimises the risk of cross-border interference and facilitates coordination. [Currently, UK experiences interference into its utility UHF SCADA systems because of conflicting band plans between UK and mainland Europe.]***
- ***Harmonising spectrum and standards for smart grids across Europe creates the potential for a true single market for energy in Europe where utilities could operate across internal borders and design their communications networks for maximum radio spectrum efficiency rather than as currently where national borders may impede efficient network design.***

14. For which services and why would harmonised conditions for the use of spectrum on a shared basis at EU level be needed for the utilities' purposes? Which other spectrum user would you consider to be a good partner for sharing and why?

Spectrum sharing options could be explored, but there may be elements making such sharing difficult, including:

- ***Real-time electricity network management requires continuous monitoring 24/7, diminishing the scope for sharing with another party.***
- ***Utilities need network access during severe weather and disasters, which often coincides with the times when emergency services also need network access.***

15. What would the economic, social and environmental impact be if the use of spectrum on a shared basis was harmonised at European level for the use by the utilities sector in case of:
    a) smart grid applications
    b) smart metering applications

Smart Metering is non-mission critical and therefore has a much greater potential to share spectrum with other users than Smart Grids which are mission critical.

16. Which spectrum ranges would be the most suitable ones for the use of spectrum on a shared basis by different smart grid services in the medium / long term?

Utility spectrum would ideally be a contiguous block of 30 MHz of spectrum between 400 MHz and 1000 MHz. [US has 20 MHz of contiguous spectrum in the 700 MHz band and Canada 30 MHz of spectrum in the 1800 MHz band. However, recognising existing spectrum usage, the urgency of access to spectrum, and that Smart Metering can share spectrum; if suitable and sufficient contiguous spectrum below 1 GHz cannot be made available on a timely basis, a combination of spectrum resources may be the only alternative. This might look something like:

- ***10 MHz of spectrum in 1.5 GHz for the 'middle mile' aggregated back-haul traffic.***
- ***Shared access to 870-876 MHz spectrum for smart metering and non-critical distribution automation.***
- ***2 x 2.5 MHz spectrum somewhere between 400 & 470 MHz for longer range mission critical low data rates.***
- ***Access to VHF spectrum for emergency wide area voice communications and wide area low data rate critical communications into hard-to-reach fixed sites at 2.4 kbits – 64 kbits/s.***

D) Wireless technologies

17. Regarding the use of wireless technologies at different spectrum ranges for transmission of remote readings (distant smart meter locations) or for connections to distant locations of renewable power sources, what are the main technical requirements from the following points of view: coverage, resilience/connection reliability, latency, connection security (privacy of 'sensitive' data), connection bandwidth?

Typical requirements:

SMART METERS
98% population coverage
95% availability
1 hour latency
10 seconds power resilience ('last gasp')
Good privacy
10 kbits/s data rate.

SMART GRIDS
99% geographic land mass coverage
99%-99.995% availability
10-1000mS latency
72 hours mains power resilience
Non-blocking guaranteed network access
256 bit AES/DES encryption, authentication, radius servers, firewalled, etc.
Good physical security
2.4 kbits/s – 2 Mbits/s

18. Which kind of wireless technologies and networks would be the most suitable ones for smart grid purposes in the medium / long term? (technology and network topology examples: GSM, UMTS, LTE, LTE Advanced, private mobile radio (PMR) network, Short-range devices, mesh networks / blended networks,…

Utilities are focused on applications, not technologies; but the following is a selection of technologies which may prove successful:

- ***Critical voice: MPT1327, Tetra, P25, DMR, dPMR, CDMA, satellite***
- ***SCADA: as above, plus MPT1411 (OfW49)***
- ***UHF 870-876 MHz Short range devices (ETSI/IEEE specifications)***
- ***1.5 GHz: WiMax, LTE, ETSI standard point-to-point and point-to-multipoint systems.***

19. Do you see a PMR type of network implemented on a shared platform basis - where a (fixed and wireless) network infrastructure could be used for communications and data transfer purposes by several sectors, e.g. by transport, 'blue light users' and utilities - to be a potential solution?

Options can be explored, but

- ***Utilities and 'blue light' services will sometimes both want priority network access at the same time (eg during severe weather)***
- ***Requirements differ between 'blue light' who need wide-area mobile services and utilities who want wide-area fixed coverage.***
- ***European Administrations have differing views on what constitutes 'blue light' (in UK includes the animal rescue service) and utilities (some administrations allow routine power repair operations to use their 'blue light' Tetra services, whereas some administrations only allow emergency power restoration services to use the 'blue light' Tetra service).***

20. How could such a shared PMR network concept fulfil the requirements of "mission-critical" services in terms of resiliency, coverage, data security/privacy and (data) bandwidth?

CEPT Project Team FM49 and the Tetra & Critical Communications Association (TCCA) are investigating the commonality of requirements, but as well as issues raised above, there are major incompatibilities in terms of data security and encryption, bandwidth required and priority access.

And finally:

21. Would you have any additional relevant comments for the purposes of this public consultation?

- ***CEPT and ETSI require mandates associated with M441 and M490 to identify suitable and sufficient spectrum to fulfil these mandates.***
- ***Harmonised European spectrum for smart meters and smart grids will promote a single market for products and energy transmission & distribution.***
- ***EU manufacturers will benefit from a homogeneous EU market.***
- ***EU consumers and citizens will benefit from the lower costs network infrastructure which will translate into lower electricity prices for consumers and more reliable electricity supplies.***
- ***Cross border interference to critical systems will be more easily managed and ultimately reduced.***
- ***A single European market for utility smart grid telecommunications equipment will facilitate EU companies expanding into markets outside Europe as has been the case with GSM and Tetra.***
- ***Early action to identify harmonised spectrum will advance deployment and connection of renewable energy supplies and demand management systems, enhancing security of supply and enabling more rapid reduction in greenhouse gases than would otherwise be the case.***

The Joint Radio Company Ltd (JRC)

A. JRC 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.

B. 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 a number of large radio networks in the UK.

C. 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 throughout the country. The networks provide comprehensive geographical coverage to support the installation, maintenance and repair of plant in all weather conditions on a 24 hour/365 days per year basis.

D. JRC's Scanning Telemetry Service is used by radio based System 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.

E. JRC works with the Energy Networks Association's Future Energy Networks Groups assessing ICT implications of Smart Networks, Smart Grids & Smart Meters.

Adrian Grilli, Managing Director, JRC Ltd
18 April 2012