CIGRE UK
Data Science and Next Generation Communications in Electricity Networks

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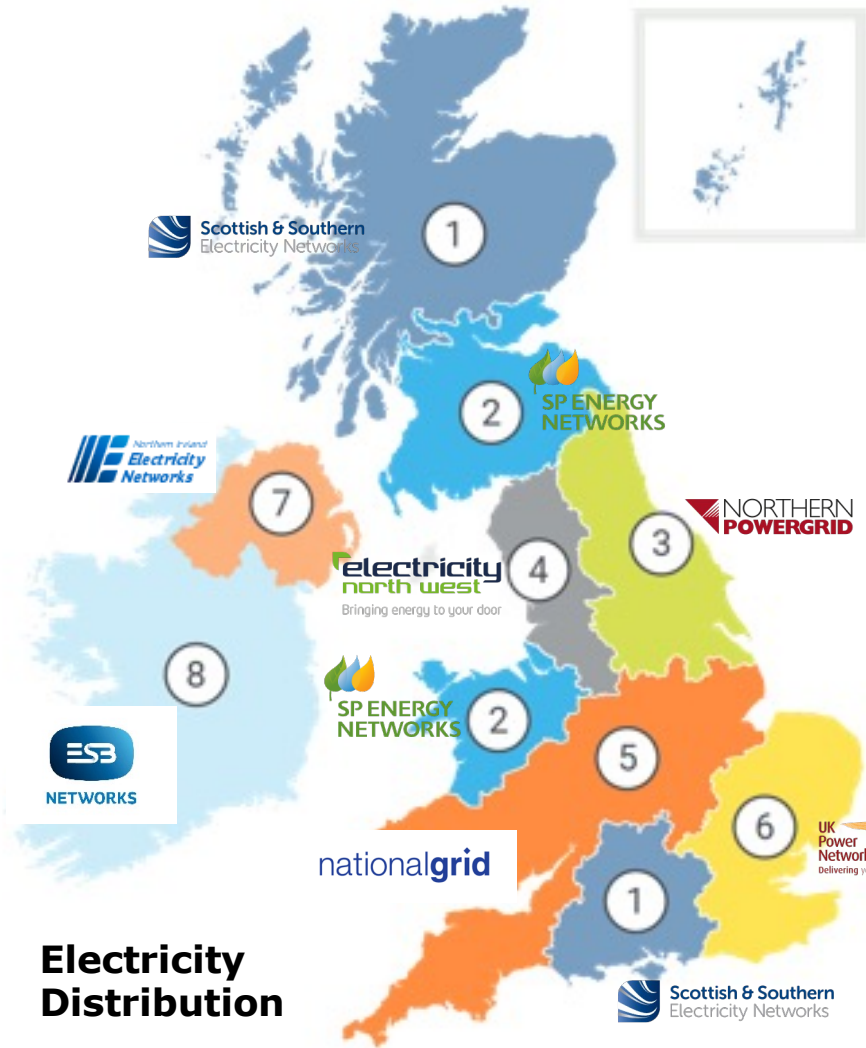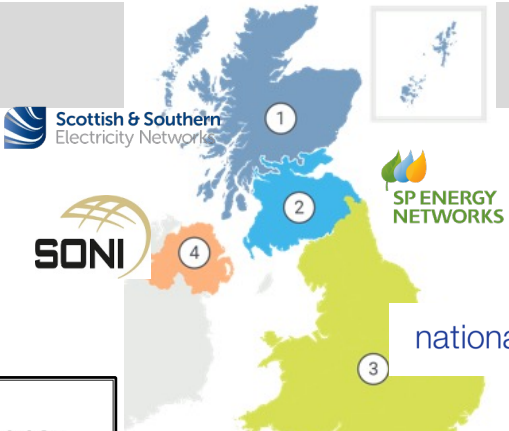Julian.Stafford@jrc.co.uk

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JRC Members…

Electricity Transmission

Electricity Distribution

Gas Distribution

Challenges for the Utility Sector…

- *Gas, Water and Electric utilities are all facing demands for increases in connectivity to facilitate digitalisation*

  - *In order to 'do more with less' (smart / dynamic grids)*

  - *To satisfy obligations placed by regulators*

    - *Minimise Leaks / contamination*

    - *Facilitate the connection of Solar, Wind, EVs and electrification of Heat*

    - *Enable the gradual move from Methane to Green / Blue Hydrogen*

  - *To extend asset life*

  - *To improve customer experience (Customer Minutes Lost)*

  - *To decarbonise in line with UN & UK climate change objectives*

  - *To simultaneously achieve this mass connectivity whilst maintaining cyber security, resilience and cost effective solutions*
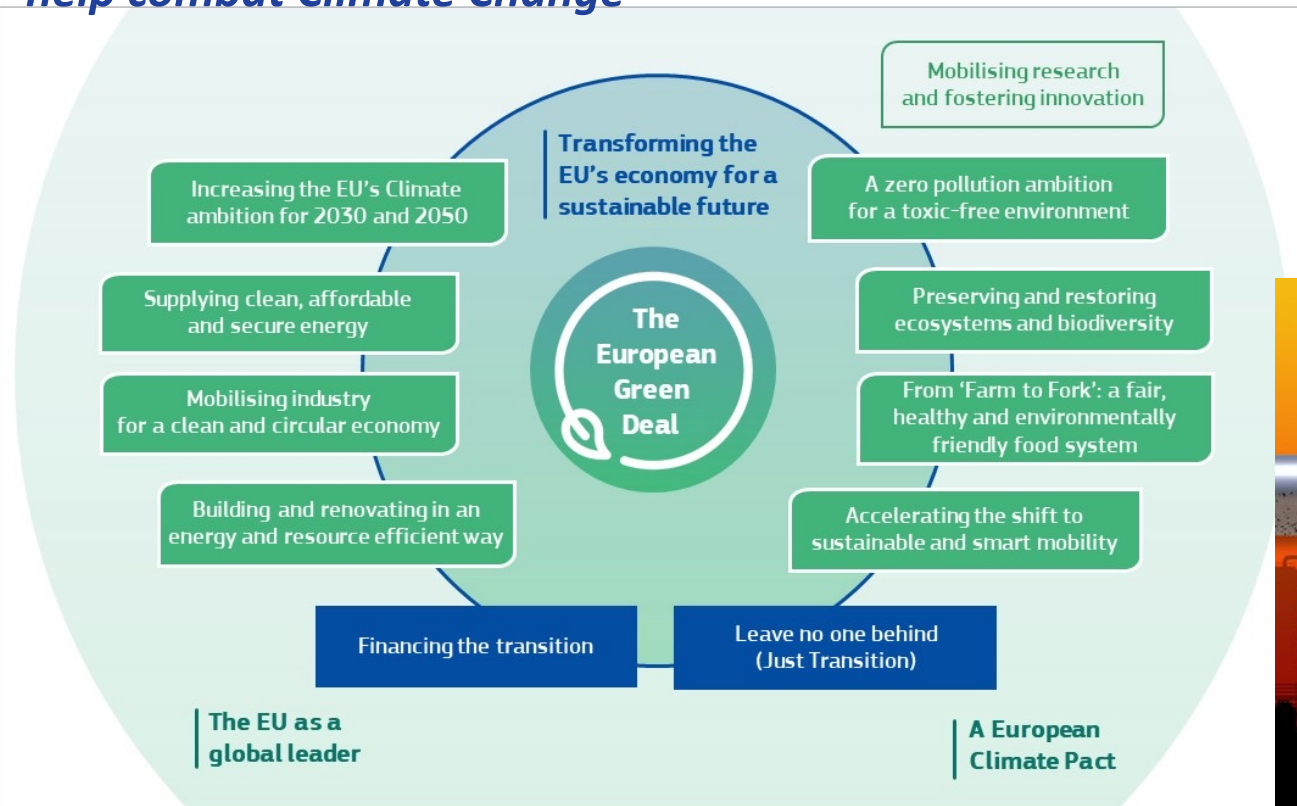
Why is this Presentation Relevant to this Group?

- *Rapid evolution ('Paradigm shift') in the way utility networks are monitored and managed. __BUT__ this coincides with a perfect storm of related issues -*

  - *Removal of legacy connectivity tools – PSTN, 2G & 3G, Paknet shutdown*

  - *Proprietary systems are not scalable to future challenges (volume and long term vendor support)*

  - *Many legacy technology solutions are only just compliant from a cyber perspective and many will struggle to meet future NIS 2 directives*

  - *Energy Pricing crisis*

  - *Skills shortage – too few new entrants to the industry and a problematic demographic*

  - *Reduced short list of available vendors due to geo-political supply chain issues*

  - *Out of support PDH and SDH products*

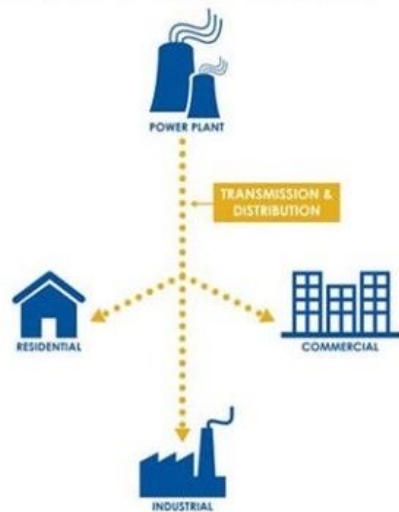# Motivation for Enhanced Connectivity of Utility Assets...

Carbon Neutral Aspirations the main driver

*Role of Radio Spectrum Policy and digitalisation to help combat Climate Change*

The European Green Deal diagram:

- Mobilising research and fostering innovation
- A zero pollution ambition for a toxic-free environment
- Increasing the EU's Climate ambition for 2030 and 2050
- Transforming the EU's economy for a sustainable future
- Supplying clean, affordable and secure energy
- Preserving and restoring ecosystems and biodiversity
- Mobilising industry for a clean and circular economy
- From 'Farm to Fork': a fair, healthy and environmentally friendly food system
- Building and renovating in an energy and resource efficient way
- Accelerating the shift to sustainable and smart mobility
- Financing the transition
- Leave no one behind (Just Transition)
- The EU as a global leader
- A European Climate Pact

The European Green Deal

Motivation for Enhanced Connectivity of Utility Assets (Electricity)…

"Passive" – Top Down

- Large Generation – limited in number

- <u>Almost no visibility of the edges of the network</u>

"Active" – Dynamic
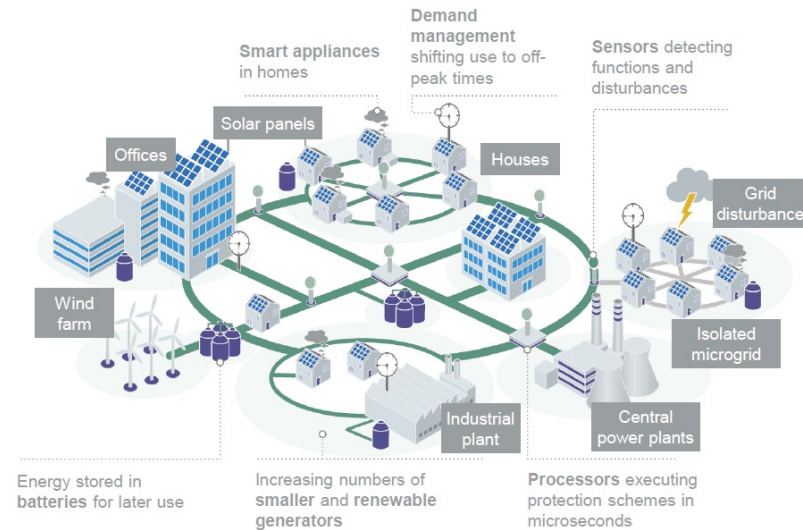
Transmission
DERs
Smart Grid
Prosumer

- Limited Large generation – Extensive Local Generation + Storage

- Focus on balancing demand and availability through the transition to embedded generation and alternative gases

Utilities – Probably the Earliest Adopters of IOT !

- Electric, Gas and Water Utilities used 'Intranet of Things' long before the term IOT was thought of …

  - Utilities have had remote control and monitoring of thousands of assets for almost 100 years

  - Utility sector primary use of connectivity has always been for 'things' rather people

  - Historic systems were typically

    - Operated in isolation (air-gapped)

    - Proprietary in nature (wired and wireless)

    - Not interoperable

    - Subject to significant vendor lock in and obsolescence issues

    - Expected to remain in service for 20 – 30 years

- However, this long standing status quo is changing rapidly…

Huge Increase in need for connectivity…

- **Increase in data rate per device of 100 x**

- **Increase in device numbers from 100,000 > 100 Millions**

- **All must meet strict cyber security requirements (Critical National Infrastructure)**

- **Massively increased attack surface**

- **Extensive coverage required utilising a mixture of all connectivity formats**

  - **Terrestrial Wireless**

  - **Fibre**

  - **Satellite**

  - **Copper**

- **Long term vendor support required**

- **Harsh environment (Dust, Vibration, Humidity, Temperature and EM Fields)**

- **Autonomous Power Operation – 72 – 96 hours**

What is EUTC? *(European Utilities Telecom Council)*

- Representing technical and regulatory interests of Electric, Gas and Water Utilities – critical national infrastructure.

- Membership driven – with major utilities, from large and small countries including Spain, France, Netherlands, Germany, Portugal, Ireland and UK.

- Engaging with stakeholders including vendors and operators to ensure alignment of new products, standards and spectrum allocations with utility requirements.

- Responding to consultations from the European Commission, Energy and Telecom Regulators and National Administrations about digitalisation of the energy sector.

- Interacting with European Parliament and Policy Groups.
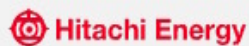
Close Working Partnership Between Key Players -
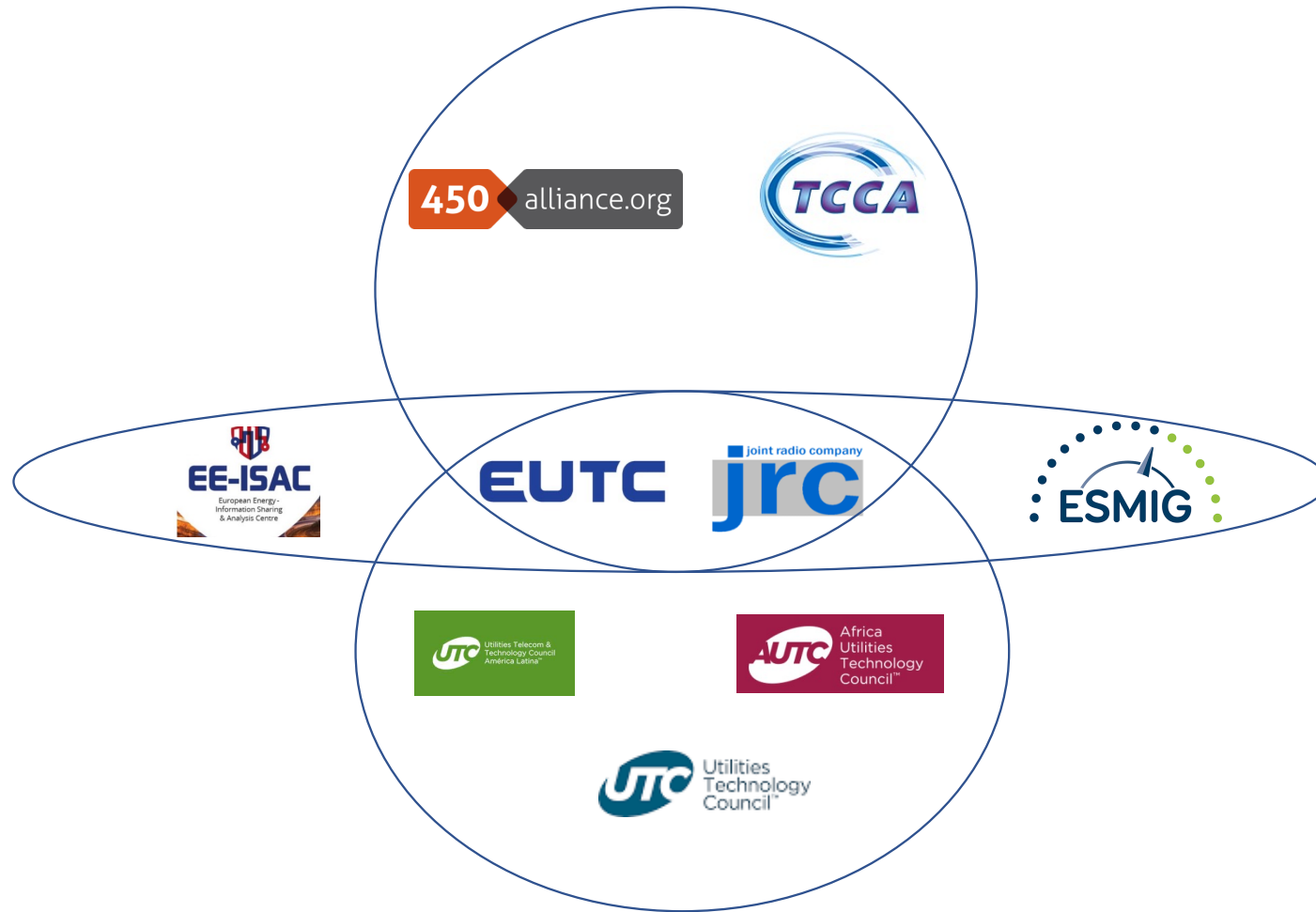
Why so many interactions and MOUs?

- Overlaps between all of these groups

  - User requirements & Sharing workload

  - Ownership

  - Global Ecosystem

  - Cyber Security

  - Leverage individual strengths of each group

  - Government requirements / obligations

  - Larger market if volumes combine – resulting in a healthy supplier base and economy of scale

  - All require electricity supply to operate

  - Intersection of all mission critical users – blue light, transport, utilities and connectivity of the general public

Spectrum Allocation Success for Utilities…
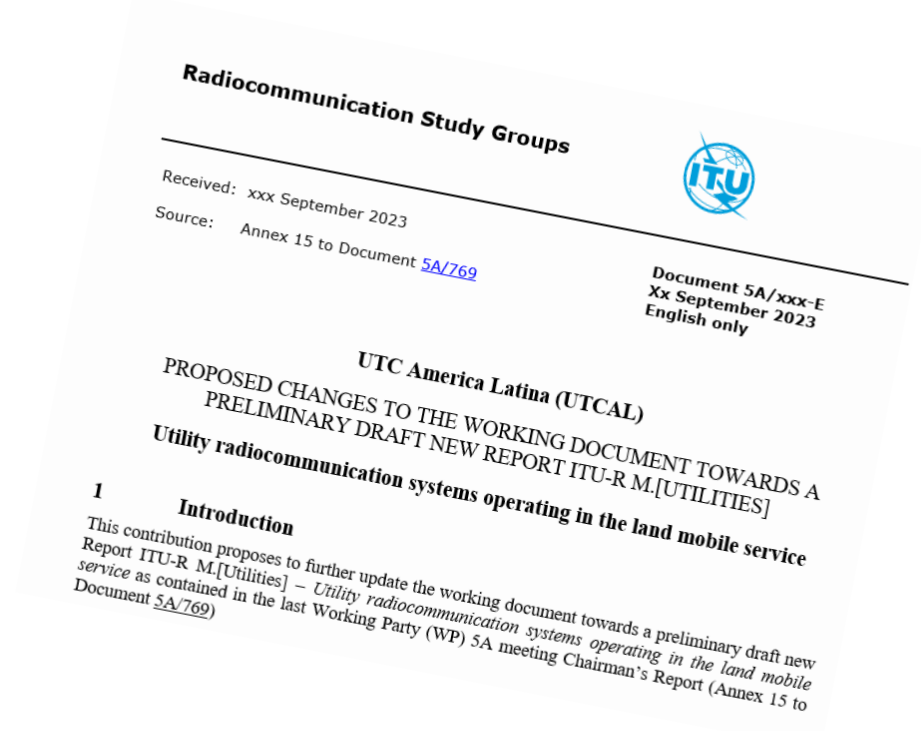
Ireland (2019)

Germany (2021)

Spain (2021)

Poland (2019)

Radiocommunication Study Groups

Received: xxx September 2023

Source: Annex 15 to Document 5A/769

Document 5A/xxx-E
Xx September 2023
English only

UTC America Latina (UTCAL)

PROPOSED CHANGES TO THE WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW REPORT ITU-R M.[UTILITIES]

Utility radiocommunication systems operating in the land mobile service

1   Introduction

This contribution proposes to further update the working document towards a preliminary draft new Report ITU-R M.[Utilities] – *Utility radiocommunication systems operating in the land mobile service* as contained in the last Working Party (WP) 5A meeting Chairman's Report (Annex 15 to Document 5A/769)

- **Advanced trials and consultations under way in France, Brazil, Saudi Arabia, Netherlands and United Kingdom (some specific challenges)…**

Some uses of 410-470 MHz spectrum in Europe

EUTC

cigre United Kingdom

450-470 MHz spectrum held by Norwegian Power & Telecoms Group in 2022

Sweden:2 x 5 MHz LTE system in 450-470 MHz for public safety to which utilities have access.

410-414/420-424 MHz allocated to ESB for LTE Smart Grid in 2019

Denmark:453-457.5/463-467.5 MHz Spectrum awarded for critical communications in 2021

UK: Utilities have narrowband allocation in 450-470 MHz but congested with private & government users: 412-414/422-424 MHz used for smart metering

Utility Connect has 2 x 3 MHz (451.8-454.8/461.8-464.8 MHz) for a CDMA network, currently being converted to LTE. Netherlands consulting on splitting licence into two 1.5MHz channels and licensing one for North Sea LTE Network.

Legacy Utility Tetra network installed by CREOS in 2 x 2MHz in 450-470 MHz

Poland: PGE Systemy LTE 450-470 MHz for electricity network control

Consultation on introducing LTE into 450-470 MHz band

Germany: 451–455.74 MHz / 461–465.74 MHz awarded for LTE utility network in 2021 to 450Connect

Spain: Current use of 400 MHz by military and PPDR: unlikely to change

450-470 MHz spectrum empty and sought by utility E-REDES

Austria: Argonet telco network migrating 2x4.4MHz from CDMA to LTE for exclusive use by utilities
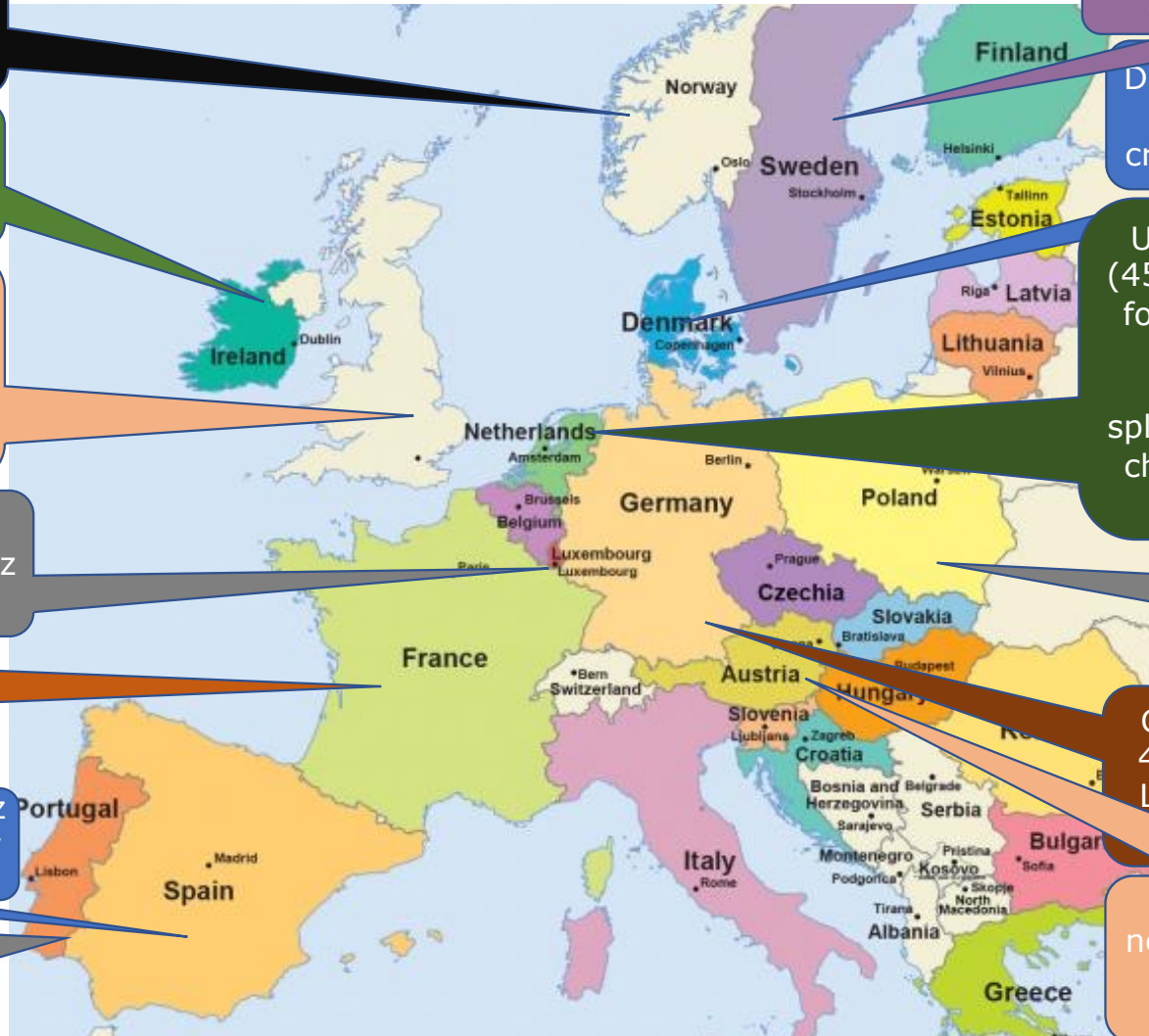
UK Focus – JRC Leading…

- *Energy Networks Association Strategic Telecoms Group*

- *Political engagement at multiple levels in collaboration with Instinctif Partners*

- *Gemserv Study of economic rational behind spectrum allocation for private LTE smart grid network*

- *Multiple Ofcom consultation engagements*

- *NGED (WPD) LTE trials in Portishead and Taunton (now on tour – NEC & Liverpool)*

- *NCSC / GCHQ activity around future cyber security challenges*

- *Northern Ireland Initiative*

- *Ongoing meetings with BEIS & DCMS (now DSIT & Department for Energy Security & Net Zero)*

UK Focus – JRC Leading...

Spectrum statement

Policy paper

Spectrum statement

Published 11 April 2023

Spectrum and Net Zero

Spectrum has an important role to play in helping the UK reach our target of Net Zero emissions by 2050. We will work with UKSA, Ofcom and the wider earth and space science community, to ensure the continued availability and appropriate protection of spectrum for climate science, weather and related high impact services. We are also working closely with the Department for Energy Security and Net Zero, Ofcom and Ofgem to assess the energy and wider utility sector's communications requirements and ensure that timely decisions are taken on any resulting spectrum needs.

Assessing the energy sector's communications requirements

Spectrum also plays an important role in enabling the digital connectivity needed for future low carbon energy networks. Reaching Net Zero requires fundamental changes to the way we generate, transport and consume energy. We are moving towards a smarter, more flexible and more integrated energy system which will require significantly enhanced connectivity and digitalization throughout the network to support the coordination, automation and control of energy network assets. This increased connectivity requirement will likely require a variety of telecommunications technologies including fibre, satellites, and public and private mobile networks. Certain communications functions may require enhanced power resilience and reliability. If meeting these or other requirements is best served by private wireless networks, the identification of suitable and sufficient spectrum may be necessary.

We are working closely with the Department for Energy Security and Net Zero, Ofcom and Ofgem to assess the energy (and wider utility) sector's communications requirements and ensure that timely decisions are taken on any resulting spectrum needs.

UK Focus – JRC Leading…
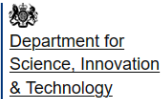
Policy paper
UK Wireless Infrastructure Strategy
Published 11 April 2023

Energy

Telecoms plays an important role in the utility sector, for example, for operational communications, remote monitoring and automated control of an increasing array of critical assets, parameters and functions. Utilities use a mix of communications technologies, including fibre, wireless and satellite. Where wireless connectivity is required they will use public mobile networks where coverage, availability and costs permit. Where high levels of availability, power resilience and low latency are required, utilities tend to use private or self-provided networks.

Electricity distribution network operators (DNOs) in the UK and around the world are undertaking major transformations to meet their net zero targets as well as to meet the increasing challenges of reliability and resilience. Networks are evolving from the traditional distribution landscape, with power flowing from a relatively small number of large electricity generators to the consumer premises, to a more complex one with a much larger set of generators. These changes are increasing the need for monitoring, control, protection and automation across the entire network and thus increasing the overall amount of data which needs to be carried over the supporting telecoms network.

The emergence of 5G could enable useful applications for utilities, particularly when 5G SA is introduced. However, a significant component of the increased connectivity requirement of electricity DNOs is likely to need to be addressed by private wireless networks – particularly to cover critical monitoring, control and teleprotection functions which require high levels of availability and power independence over a number of days. DNOs around the world are in various stages of upgrading their private wireless networks, primarily using 4G now and, potentially, 5G in future.

The digitalisation of energy networks is critical to reaching net zero by 2050 and supporting a smart, flexible energy system. Alongside the Department for Energy Security and Net Zero, and as part of the Energy Digitalisation Strategy, we will continue to encourage collaboration between telecoms and utilities providers to support the digitalisation of the energy sector.

UK Focus – JRC Leading...

Consultation: Exploring future use of the unpaired 2100 MHz (1900 - 1920 MHz) spectrum

Start: 23 March 2023 · Status: Open · End: 25 May 2023

Spectrum for utilities sector

3.23   The unpaired 2100 MHz spectrum may also be considered suitable to support the utilities sector.

3.24   The electricity sector has a requirement for increased operational connectivity throughout the electricity network to support the shift to renewable power generation and the electrification of transport and heating, both of which underpin government objectives to deliver net zero. One of the benefits of this operational connectivity is to help to identify faults on the electricity network and to restore supplies more quickly when there is a fault by avoiding delays associated with sending field staff to sites. The gas and water sectors may also have changing connectivity requirements.

3.25   These future requirements may be best met by the deployment of private wireless networks, for which the availability of suitable and sufficient spectrum may be necessary. Spectrum may be needed to support nationwide coverage and hence would need to be at sufficiently high power to enable this.

3.26   With this in mind, we are currently undertaking a review of the role of spectrum in supporting utilities' future communication needs.[58] Unpaired 2100 MHz spectrum could potentially be one option to support these requirements nationwide. As part of this review, we will publish a document in summer 2023 on a number of spectrum options for utilities' future needs, including unpaired 2100 MHz spectrum.

UK Focus – JRC Leading…

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Home ▸ Consultations ▸ Consultation: Spectrum for the Police Service of Northern Ireland

Consultation: Spectrum for the Police Service of Northern Ireland – Introducing new digital services

Start: 08 September 2022 · Status: Closed · End: 17 November 2022

Ofcom is today proposing to make spectrum available for use by the Police Service of Northern Ireland (PSNI). The spectrum will enable new technology that will modernise the PSNI's communication systems.

The PSNI manages its own radio communications network which supports approximately 20,000 users, including the police, fire and ambulance services.

The existing PSNI network has a limited data capability and cannot match the bandwidth offered by modern mobile communications technology. Therefore, the PSNI is seeking to transition to new technology to enable fast, safe and secure communications for use in live situations and emergencies.

We are proposing to make 2 × 3 MHz of the 700 MHz band (specifically 733 to 736 MHz paired with 788 to 791 MHz) and 2 x 4 MHz in the 800 / 900 MHz bands (specifically 876 to 880 MHz paired with 921 to 925 MHz) available for use by the PSNI. These bands are currently unused in Northern Ireland, and we consider that alternative uses in these bands are unlikely.

Current Advocacy Activities...

- NIE private networks workshop Belfast (March)

- SG Tech event Amsterdam (March)

- EU 5G event – Brussels (March)

- UTCAL annual event Rio (March)

- ITU WP 5A Mexico City

- 3GPP activity – online and in person (Greece, Netherlands,Taiwan)

- 450 MHz Alliance event London 18th & 19th April

- Next generation satellite webinar (April)

- TCCA annual summit (May) Helsinki

- NATO Cyber Security centre of excellence Utility exercise (June) Tallinn

- CIGRE 5G presentation – London (June)

3GPP & Non-Terrestrial Networks…

Thank you for listening !

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