

CIGRE UK

Data Science and Next Generation Communications in Electricity Networks

Enhanced Communications Systems – Essential for Energy System Transformation

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Communications and Energy System Transformation

- Energy system transformation forms a key part of the response to the climate emergency.
- Digitalisation will be essential in undertaking this transformation.
- Communications systems are an essential part of the digital infrastructure that is the foundation of digitalisation.

Will communications capabilities be available that will support and enable energy system transformation to achieve Net Zero commitments?

Energy Systems Transformation

- Transformation will be across the whole energy system:
 - Across the value chain – source, conversion, delivery, storage, use
 - Across vectors and sectors – heat, transport, power, business and industry including high consumption industries ...
 - Across infrastructure, technology, business models, markets, innovation, policy, regulation and social engagement
- With perspectives at the home, community, local, regional, national and global levels.
- Critically the interactions, interdependencies and trade-offs between and amongst these parts of the system must be understood, being mindful that these will be changing over time.



Digitalisation is positioned strongly as essential to transformation of the energy system... there is high expectation and intense ambition.

But what about communications?

Energy and Communications

Does this mean “more connectivity” or “new connectivity”?

- ***It does mean more connectivity***
 - **More actors and devices will be connected and exchanging substantially more data and interacting more** ... hundreds or thousands will become many millions or tens of millions or hundreds of millions...
 - It also means that connectivity may be **needed in places where it is not readily available today**
 - ... but why, who, what and when are not sufficiently well understood to be expressed in detail
- ***It doesn't mean new forms of connectivity have to be invented, but...***
 - Connectivity will be **supporting new uses**, some of which will be technically or commercially critical or will be necessary to deliver (good) service to consumers
 - The **attributes of the connectivity may be different**: latency, bandwidth, utilisation, security, reliability, resilience, quality...
 - **New integrations** may be needed
 - ... but why, who, what and when are not sufficiently well understood to be expressed in any detail
- ***And this is not a static situation... needs and requirements will be changing at pace over time***



The energy system will cease to be linear; it will be multi-dimensional and depend upon digitally enabled technologies, operations, services and markets.

Enhanced connectivity will be essential in making this possible and sustainable.

Energy and Communications

Is this a big deal... something that can be sorted relatively quickly with a bit of effort or is it a major national issue?

... it's important, and becoming urgent



Why does it matter?

Security and resilience

Digitalisation of the energy system creates a very substantial and growing reciprocal dependency between digital infrastructure and energy (electrification in particular); when one fails, both will fail unless specific measures are put in place.

Reliability and resilience of communications networks are perceived to be reasonably good, but this perception is not reflective of reality.

The [Government report](#) delivered following Storm Arwen make the need for attention and action clear:



“The volume and scale of power outages highlighted the extent of the interdependencies between the energy and communications sectors and the need to improve resilience.”

This critical dependency is particularly complex in the context of extreme circumstances such as cold start or black start. National Grid Electricity System Operator (NGESO) has undertaken [work](#) focused on this issue:

“Communications networks are dependent upon reliable power sources from energy networks. Just as communications networks are built to a (resilience) budget so are energy networks; this requires the efforts across all the involved stakeholders if good solutions are to be implemented.”

Why does it matter?

Electric Vehicles

The uptake of Electric Vehicles (EV) may provide the first case of significant Low Carbon Technology adoption that has a communications impact. This is recognised in the work of the EV Energy Taskforce in [its most recent report](#). The report states that point solutions will not be sufficient to support charging given the scale of the requirement:

“The charge point infrastructure will therefore not be fully fit-for-purpose without considerable action taken to develop the accompanying communications system architecture that will provide reliable and resilient connectivity. How the geographical distribution of charge points evolves and the differences in configuration of their deployment (single units, clusters etc), will determine the need for a variety of different connectivity services to evolve in parallel, each with their own bandwidth/latency requirements, depending on the nature of the specific data exchange interfaces.”



The report considers the roles of various stakeholders and emphasises the importance of coordinated efforts to assure required outcomes are achieved. It offers as one of its key recommendations:

“Government and Ofcom need to develop a strategy to deliver national data connectivity with an architecture that supports evolving EV charging requirements.”

Why does it matter?

Flexibility

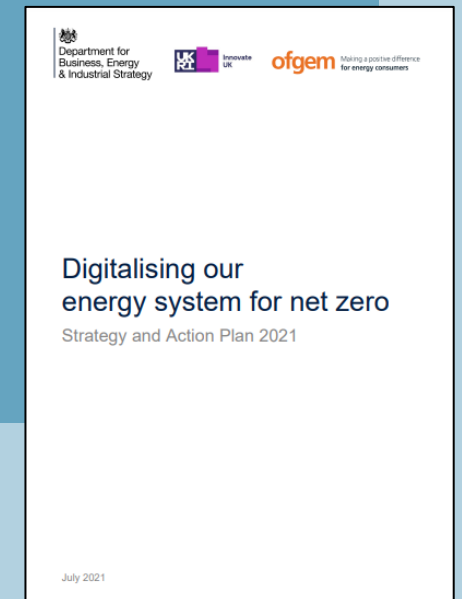
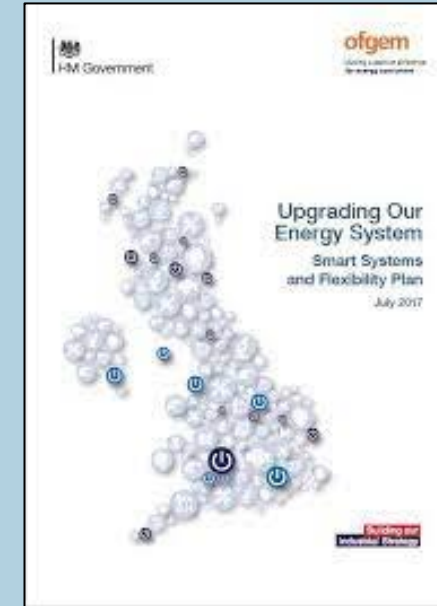
Flexibility is seen as playing a critical role in the future energy system centred on aligning demand with supply.

Flexibility relies heavily on digitalisation. Two primary perspectives are provided in the Government's [Smart System and Flexibility Plan](#) and the related [Energy Digitalisation Strategy and Action Plan](#).

“Our future net zero energy system will comprise millions of assets – including solar panels, electric vehicles, heat pumps and batteries. These will need to be optimised, primarily through open and transparent markets, across our transmission and distribution networks, and coordinated with other sectors such as transport. We also need to unleash innovation across the sector, including in the low carbon services offered to consumers. This will only be possible by harnessing the power of data across a digitalised energy system.”

Harnessing the power of data across a digitalised energy system will not be possible without the right communications systems and infrastructure being in place.

These plans for flexibility delivery do not explicitly acknowledge the role of communications systems as an enabler. This suggests there is a need for study to ensure that other actions are in place elsewhere to deliver what will be needed.



Why does it matter?

Visibility

Network visibility made possible by monitoring will be necessary to permit operation of the much more complex, distributed energy system, and will be key to enabling new services and business models.

Operational telecommunications for future networks will be substantially different in terms of scale and capacity than those of today. The Energy Network Association (ENA) Strategic Telecommunications Group (STG) and the Joint Radio Company (JRC) have investigated the emerging requirements and have published their [findings](#).

“Existing communications network arrangements do not have the capacity needed to connect all the devices associated with the transformation to a Distribution System Operator (DSO) or deployment of smart grids. The increase in connectivity and data requirements is starting to grow through RIIO ED1 and is forecast to grow exponentially through the period 2020 to 2030, as new forms of customer technology are connected, and electricity network flexibility is implemented.”



The new types of operational functions that will be performed are not the only requirement.

“Investment will also be necessary to ensure that the telecommunications infrastructure meets the resilience and reliability requirements necessary for the operation of critical national infrastructure such as the electricity networks. Making the appropriate strategic choices now will avoid an unnecessarily piecemeal approach to the overall investment required in the communication systems and associated operational telecoms developments.”

Conclusions

Will communications capabilities be available that will support and enable energy system transformation to achieve Net Zero commitments?

There is **very significant risk that communications capabilities will not be available** in the form, with the anticipated levels of security and resilience, within the timescales or at a cost that will support and enable energy system transformation to achieve Net Zero commitments. Much is being taken for granted which is disguising how best to respond to the need.

How to Move Forward

- **Option 1:** Do nothing and rely on the communications sector's own direction of travel aligning with needs as they emerge.
- **Option 2:** Do nothing and react with urgent measures when these are demanded.
- **Option 3:** Deliver specific measures to address anticipated requirements, accepting that these may not take a strategic or systematic perspective.
- **Option 4:** Proactively evaluate the need in a strategic and systematic way, engaging with the right stakeholders to align interests and coordinate efforts; this will mean dependencies are identified and managed, and a coherent path that will serve the energy, digital and communications communities can be prepared.



However...

There is no strategic plan...

... and no one is accountable for ensuring that suitable communications are available to support the energy system and its transformation.



An Analogy?

- We focussed on offshore wind to decarbonise electricity generation...
 - ... without an aligned focus on network infrastructure
 - ... leading to a situation today where infrastructure delivery is a barrier to power system decarbonisation on the journey to Net Zero
- In the same way a focus on digitalisation
 - ... without commensurate attention on communications systems
 - ... could result in connectivity becoming a barrier to energy system transformation.



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