Your response

Question	Your response
Question 1: Please provide a description of your current use of fixed links (or indicate which of the use types in Table 3.1 best describe your use type)	Confidential? – N *Utilities –National Grid Telecoms utilise fixed links as backhaul from substation and hilltop locations to transport SCADA and mission critical voice services from a range of distributed energy infrastructure back to regional control centres in order to facilitate the real time monitoring and control of the UK's energy infrastructure (i.e. mission critical operational Telecoms of Critical National Infrastructure). Fixed links are also used for connecting directly to bulk supply points and large primary substation for the purpose of diversity and tele-protection services (an extremely low latency application without which electricity networks cannot operate safely) to protect grid transformers and generation supply sites.*
Question 2: What are the factors driving your choice of fixed links over alternative connectivity solutions, and which factors have the biggest impact on your decisions? Is this likely to change in the next 5 years? If so, what do you expect will change?	Confidential? – N *The criteria will be typically driven by cost, flexibility and ease of deployment. The energy industry relies on safe, reliable, resilient and secure communications, which will in turn provides clean, fair and affordable energy for all. Certainty of access to spectrum is therefore critical to the UK energy sector which will enable a cost effective energy transition to net zero.*
Question 3: Is the current spectrum available for fixed links in the UK suitable and sufficient for your needs? If not, what would you change and why? If you believe changes are required, please give specific examples and reasons along with supporting evidence if available.	Confidential? – N *Fixed link spectrum is only just sufficient for current needs of the energy utilities sector. At a time when the communications requirements of the utilities sector are significantly increasing, it is challenging to have had the 26 GHz band removed / excluded, as well as 1.4 GHz and now also a question mark over the future of 6 GHz. Energy network operators are unable to commit investment to fixed links in frequency bands which may be considered for other applications, i.e. IMT at relatively*

	short notice (the Energy Network Operators will typically operate a fixed link for 10 – 20 years). Whilst National Grid Telecoms have recently secured access to the 10.5 GHz band to ensure security of access and flexibility of deployment, some additional spectrum in this band would be extremely useful to make the band more suitable.
Question 4: Is there anything about Ofcom's current framework for authorising fixed links which you consider could be improved?	Confidential? – N *The day to day framework for authorising fixed links is adequate – although there are some instances of unexplained delays to applications being processed and technical details being incorrect. The principal challenge now being encountered is associated with the lack of available channels in the reduced number of suitable frequency bands to address the exacting our needs, potential high TX powers are required to achieve 99.999x% availability – there are increasingly fewer channels of suitable bandwidth (28 or 56 MHz) in the remaining millimetre bands to accommodate such links. In addition, we encourage Ofcom to maintain proactive involvement in any new propagation modelling activity to address the impact of climate change on precipitation models.*
Question 5: How has your use of fixed links changed between 2016 and now? Please provide information on: - Reasons for increase or decrease in the number of your links since 2016; - Changes in the capacity of your links since 2016, including how you have; delivered this capacity change, e.g., different channel bandwidths, different link technology (please specify), etc.	Confidential? – N *There has been an increase in the number of fixed links used since 2015. This is primarily due to the implementation of enhanced digital connectivity required to facilitate Wind and Photovoltaic farms for the UK's net zero targets. This requires greater visibility of devices connected at the periphery of the network – which are most cost effectively supported by fixed links. In addition to the general trend of more fixed links driven by a requirement for greater connectivity, other drivers include* • *Higher bandwidth links required as part of the continued migration from legacy PDH / SDH technology to all IP / Ethernet*

	services (a typical increase in throughput from 4 x MB/s to n x 100 Mb/s accompanied by a 7MHz to 28 MHz RF channel bandwidth requirement); • *Requirement for additional resilience at some sites greater than that possible by using a single fibre or microwave link.*
Question 6: How do you expect your usage to change over the next 5-10 years? Please provide information on: - any increase/decrease in the number of links (by band) and bandwidth expected; - likely changes in geographic distribution of links; - likely changes in distribution of links by frequency band; - likely changes in capacity of links and how you expect to deliver this capacity; - other changes not covered above	Confidential? – N • *The largest increase in fixed links usage is likely to be in the bands below 20 GHz i.e. 18, 15, 13 10.5 and 7.5 GHz. This is due to the suitability of these frequency bands to support the required path lengths typical of our National Grid Electricity Distribution Network whilst simultaneously providing a high degree of link availability (rain fade / atmospheric fade) with antenna sizes that can be accommodated on existing site infrastructure. The typical increase in data throughput is associated with the migration from legacy PDH (8 or 34 Mb/s) to 100 Mb/s or other fractional Gig E speeds;* • *The distribution of links is likely to continue with a bias towards rural and deep-rural areas to support existing systems / technologies;* • *Frequency bands employed in given regions will be partially dictated by suitability to support long path length but also by availability of suitable frequency bands. i.e. the use the highest frequency band which is technically suitable for the bandwidth and availability but if there is no channel availability then a lower band may be employed.* • *Higher capacity links are likely to be achieved by a combination of wider RF channels, more advanced modulation*

	schemes and possibly employment of XPIC technology. • *The ongoing migration of links away from 26 GHz will also act as a driver towards alternative frequency bands.* • *Enabling the 'Net Zero' transition; A fundamental change to operational design and architecture of the energy network, from a centralised model to a distributed model, will be the prime driver for a significant increase in the number of fixed links and hence future fixed links spectrum needs this is also driven by the anticipated deployment of a Private LTE network for enhanced operational control. Noting Ofcom's recent work to establish spectrum options for such a solution[1].*
Question 7: Which of the developments listed above are expected to have the biggest impact on your use of fixed links? Are there other developments to be aware of that have not been listed? Please explain the reasons for your answer.	Confidential? – N *The anticipated allocation of dedicated spectrum for a private LTE network will be the single largest element to the increase in the number of fixed links from a backhaul perspective. Many additional links will be required with a minimum capacity of 100 Mb/s per link (possibly n x 100 MB/s) It is anticipated that the topology / architecture to be deployed in the backhaul layer will comprise rings of microwave links terminating at fibre connected core sites.*
Question 7a: Are you considering using NGSO satellites to provide backhaul for your network? If so, please provides details of the capacity requirements/expectations and the locations where delivery of this type of backhaul would be likely.	Confidential? –N *National Grid Telecoms are not considering NGSO solutions as backhaul. Latency, Security measures which include NIS and TSA are contributory factors. The technology remains immature / unstable[2] and there is no certainty around its suitability for use in critical national*

[1] Ofcom CFI and statement,
[2] Telegraph article specific to OneWeb

	infrastructure applications from either a technical, commercial or geo-political perspective.
Question 8: If you already use alternative transport options for delivering your services, please: - Provide an indication of the proportion of your services delivered over fixed links vs each alternative that you currently use. Is this proportion likely to change over the next 5-10 years? Is so please provide details; - Explain how your business rationale for use of fixed links vs alternative connectivity solutions is changing over time; - If possible, provide examples of your decision-making process for recently deployed connections	Confidential? – N *National Grid Telecoms use a combination of private, self-owned fibre connectivity, 3rd party fibre connectivity and privately operated fixed links. The major requirement for new connectivity is expected to be in areas which are unlikely to be cost effectively served by further private or publicly funded fibre optic connectivity (the exception to this would be the relatively infrequent addition of new overhead or underground power lines – where the incremental cost of installing a new fibre optic cable is very small). As a result, we expect a large proportion of the connectivity to embedded / distributed energy network assets to be dependent upon fixed links, either directly or by a private LTE network whose backhaul would be reliant on those fixed links. In the case or a small number of large network sites (primary substations for instance) there would be potential for a dedicated microwave link to serve just that site. In the case of the largest number of distributed assets, these would be connected by an LTE network with the local serving base station being connected to the core network by microwave link.*
Question 9: Which of the listed technologies are you already using or do you plan to use in the future? For each that you are using/plan to use, please explain: - the current extent of your use, whether you expect to expand or shrink your use over the next 5-10 years, and how availability of these capabilities might impact your choice to deploy fixed links vs an alternative.	Confidential? – N *We are currently utilising XPIC and relatively high modulation (128 and 256 QAM). Many of the other solutions such as ACM, ATPC, W, D and E band and BCA do not necessarily fit with the operational requirements of our network due to specific performance criteria, i.e. extremely high*

Estimates of numbers or percentage of links deployed with each capability now and in the future would be valuable. We are particularly interested in feedback on future use of BCA.	*availability, long path lengths and long duration product life cycles.* *We recognise that BCA, W & D bands etc. may be very useful for consumer grade 'reasonable efforts' connectivity but they are not aligned with the mandatory operational requirements of the energy industry.*
Question 9a: If you plan to use BCA would you plan to use this primarily for new links, up-grades to existing links or a mix? What factors affect your decision to deploy (or not deploy) BCA today? Please provide whatever detail you can	Confidential? – N *As noted above the dynamic nature of BCA and the risk of instability resulting from the failure of different carriers at different times due to changes to propagation conditions would not be compatible with the operational requirements of our distribution energy network.*
Question 10: Do you have a need for W and D bands for fixed links use (or alternative uses)? If so, in what timescale? Please provide further details, including any evidence you have to support your response**.**	Confidential? – N *Due to the short range capability (<2 km) of W & D bands, they do not lend themselves to the typical link distances most frequently required. The exception being where short, high bandwidth links are deployed locally on an operational site to connect assets.*
Question 11: Do you expect to apply for new fixed links in the upper 6 GHz band in the fu-ture, and if so, in which geographical areas? What are the reasons for choosing this band over other available bands or alternative tech-nologies? Is there a technical reason why you would choose the upper 6 GHz band?	Confidential? – N *National Grid Telecoms tried to avoid use of the 6GHz band due to the relatively small amount of hardware choice available, large antennas and small number of channels available. Typically we would only choose to use 6GHz (Lower or Upper) when channel availability in 13 GHz or 7.5 GHz was an issue due to lack of channels or a TX Hi Lo clash. Moreover, the uncertainty over the future of U6 GHz (for IMT or Wi-Fi use) is a further disincentive to deploy in the U 6 GHz, although it may be necessary as a last resort to deploy a small number of fixed links where no other options are available.*

Question 12: Are there other international developments that you are aware of that could affect availability and utility of fixed links in the next 5-10 years?	Confidential? – N *We would encourage Ofcom to track global developments around Europe on smart grid evolution and its relevance to achieving the UK's net zero objectives. Enhanced Operational Telecommunications capability and specifically private LTE deployments are a major enabler certain for European Energy Network operators.* *There are also significant developments connected with future 5G and 6G capabilities for the utility sector which are underway within 3GPP.* *Items proposed at WRC 23 for inclusion at the next WRC (27) exploring the potential for the introduction of IMT systems in two additional fixed link frequency bands (7.5 and 15GHz bands) which would significantly impact incumbent users. These two bands are used by National Grid Telecoms and would lead to a reduction in the relevant bands available within the context of increased need for fixed link spectrum from the sector to deliver the 'Net Zero' transition.*

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