An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation

Connectivity and Decarbonisation

Submissions to Call for Inputs 19/126

Submissions to Call For Inputs

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An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation

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Contents

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13th March 2020

Dear Eoin

RE: Submissions to ComReg 19/126

Firstly, I would like to introduce Bord Gáis Energy as a company as we do not engage regularly with ComReg and I would like to give you the context of our interest in your consultation 19/126.

Bord Gáis Energy (BGE) is part of the Centrica Group operating in Ireland. We are a retail supplier of both electricity and gas to both households and businesses across Ireland. We have a gas fired power station that was built in 2010 to service our entry into the residential electricity market, and it is amongst one of the most efficient and flexible power stations on the Irish electricity system. BGE's business strategy is changing in line with the changing needs and demands of our customers, both of which are being reshaped by climate law and policy.

"The Clean Energy Package"[1] provides a new and clear vision for Europe's energy systems and within that we see the nature of our relationship with our customers changing. The Clean Energy Package is a clear shift for the energy industry in that it transforms the role of the customer from one of simply choosing an energy supplier to one where the customer can essentially become the energy producer and is expected to be a much more active consumer. BGE is developing new technologies to sit within our customers' premises to help them manage this new and active role by helping them to become more self-sufficient in producing, storing and using their energy sources. At a household level we have a purpose built in-home device called 'Hive' to help customers connect all of their IoT enabled technologies, control and then monitor their energy usage seamlessly. For business customers, we use another technology from a sister company 'Restore' to help business not only control their operations and processes but also to enable the aggregation of business energy needs across a number of customers. This gives customers a real opportunity to sell energy to the grid and benefit from any flexibilities they may have in their production schedules or onsite energy production.

BGE's future business plan is very much focused on delivering solutions **within** customer homes and businesses and will be very dependent on the performance and reliability of the communications network that will underpin it all. Without a fast and reliable communications network, customers will not see or receive the benefit of the technologies we will be seeking to deploy at a wide scale level. It is with that in mind, that we respond to your consultation. We very much see electronic communications and the associated networks as being an enabler for the decarbonisation of the electricity, gas and transport sectors. However, as we are not telecom or telecom network providers we do not respond to all of the questions in the consultation but hope our responses to some of your questions are useful in giving you insight from another industry perspective.

Q1: Do you think the above discussed benefits accurately reflect the GHG emissions abatement opportunities which ECN/ECS can facilitate across these four sectors? Can ECN/ECS facilitate significant abatement of GHG emissions in any other sectors?

As outlined in the introduction above, communication networks and services are going to be key to how BGE services its customers and moves away from the traditional carbon intensive energy supply model. Through our Hive and Restore technologies, we will be looking to implement on site generation and

[1] https://ec.europa.eu/energy/en/topics/energy-strategy/clean-energy-all-europeans

storage alongside smart devices to help us inform customers on how best to maximise their energy production, storage and usage. This can be at either an individual or aggregate level across a group of customers. Although the opportunity in this emerging model is great for customers looking to control their energy usage and costs more actively it will require reliable and fail-safe communication networks to enable it. As people look to electrify and automate more of their day to day household needs, such as transport, heat, cooking and cleaning, a disruption to the devices that facilitate and enable this would quickly become catastrophic. For instance, if a disruption was to happen during a night time peak event when energy prices spike, a customer may be exposed to extraordinary costs and would have no way of knowing or altering their behaviour to change the outcome. From a supplier perspective, this would lead to a poor and uncontrollable customer experience. From a customer perspective, it could lead to significant and unpredictable costs. Energy prices typically spike around weather events – they affect demand and available electricity generation, causing prices to rise – and therefore in order for electronic communication networks and services to deliver the benefits of decarbonisation, it must be able to ensure security of communications even during the worst of weather events. Without that security, customers and suppliers will not be able to practically deliver the Smart, energy efficient and decarbonised benefits that are envisioned for the industry.

Q2. Do you think the GHG emissions abatement which may be facilitated by these means is significant? Please provide evidence in support of your response.

With reference to Ireland's Green House Gas (GHG) emissions profile, the largest emitters by sector are Transport, Agriculture, Energy Industries and Residential[2]. Laying that against the Marginal Abatement Curve calculated on behalf of the Department of Communication, Climate Action and Energy (DCCAE) in its Climate Action Plan, the transport and residential sectors (which combined account for 30% of Ireland's GHG emissions) are the areas that are amongst the most expensive to facilitate in reducing emissions. Although the European Commission is looking to 'green' the consumption in these sectors through renewable electricity and gas we also need to drive and enable a complete change in mindset and behaviour of customers in how they travel and in how they use energy in their homes. Without the change in behaviour, the cost of decarbonising these areas could be prohibitive for some and unfair for others. Having reliable communication networks will be pivotal in giving customers the confidence to make the behavioural changes and investments needed to underpin this transition.

In short, although we cannot point to a specific GHG saving, communications to facilitate behavioural change will be critical in decarbonising the hardest to reach and most expensive emissions to abate in the transport and residential sectors.

Q3. Do you think these use cases will have significant implications for networks, for example, in relation to resilience, capacity, latency or energy demand of ECN/ECS?

As provided in the response to question 1 above, BGE is concerned about the ability of the communication networks to facilitate the volume of information that is going to be needed to enable the decarbonisation vision that is being rolled out. We are also concerned about the resilience and security of the communication networks given how dependent businesses and general society is going to become on them. We therefore urge ComReg to work with communication network providers to develop robust requirements that will future proof the network in terms of capacity and contingency during extreme weather and environmental changes.

Q4. What are the enablers and inhibitors (technological, societal, economic or regulatory) of the use cases described in this chapter?

BGE has been deeply involved in the 'National Smart Metering Programme' (NSMP) being rolled out across Ireland. This Programme aims to install and rollout smart meters and the associated systems on a phased basis out to 2024. The success of this Programme and the data flows that it will enable will be key to achieving energy efficiency and decarbonisation ambitions in homes and businesses across Ireland.

[2] http://www.epa.ie/ghg/currentsituation/

Over the past 12 months, the industry (suppliers, networks operators and the regulator) has had to consider in detail the data privacy and protection implications of the Programme. We have engaged extensively with the Office of the Data Protection Commissioner and have had numerous discussions on how best to balance the flow of data needed to inform energy choices with the privacy rights of the customer. Our experience has been that data privacy rights need to be considered and planned for at an early stage where technology and information flows are changing. It will at least have implications for the communication and engagement strategies of any project and may even require legislative changes, depending on the scale of change. We would therefore urge ComReg to engage with the DPC at the earliest possible stage of its plan and strategy to discuss the data privacy implications. In a fast-moving technological world and with all of the potential informational insights, we cannot assume changes in data and data access rights will be acceptable without the need for changes in legislation or processes.

Q5. If the market will not deliver a particular use case, are there specific economic signals which could be used to promote investment in a specific use case?

N/A

Q6. Do you think the impact of rebound effects is likely to have a significant impact on the abatement of GHG emissions which these use cases could deliver?

As outlined above, the energy industry is looking to change how it produces its energy with the ultimate aim of being carbon neutral by 2050. This ambition will be achieved through many different mechanisms. The primary focus is on energy efficiency first, i.e. reduce demand where possible and shift it from the peak at least. The secondary focus is on shifting the carbon intensity of the energy that is used and produced by using wind, solar, low carbon gas and carbon capture and storage. Although the education of customers is key in driving the energy efficiency principle, we will also be reliant on economic signals such as taxes and differentiated time of use charges to drive changes in behaviour and investment decisions. These taxes and charges should curtail the rebound effects referred to from an energy industry perspective. Although the energy will be less carbon intensive, we still want customers to shift behaviour so that the cost of meeting energy demand better aligns with the type of resource we are using to produce that energy (e.g. wind and solar). The same could be true for transport and other sectors where education and financial incentives will work in parallel to permanently change behaviour to positively impact greenhouse gas emissions.

Q7. Are there additional practical challenges which have not been identified?

As outlined in answer to question 4 above, we would urge ComReg to engage with the Office of the Data Commissioners Office at the earliest possible stage to discuss data privacy and protection considerations. Technological developments do not override data privacy law and any changes need to plan for how they will manage the rights of customers with the ambitions for decarbonisation so that customers can maximise the potential benefits to be gained in the transition to a low carbon economy.

Q8. What measures could be taken to reduce the carbon emissions of the sector? Please provide evidence in your response.

N/A

Q9 Do telecoms operators assess their carbon footprint and set targets for reduction? What steps have telecoms operators undertaken to reduce the carbon footprint of their operations?

N/A

Q10 What steps are undertaken by operators to conduct business with equipment vendors that have strategies in place for lower carbon emissions?

N/A

Q11 What are the key drivers of GHG emissions in the telecoms sector in Ireland? Are GHG emissions of the sector expected to increase or decrease in the coming years? Please provide evidence in your response.

N/A

Q12 Several studies have commented on the importance of spreading awareness of the environmental impact of digital services. Do you think such an initiative would be worthwhile in Ireland? Would it be feasible? How might this be achieved?

N/A

Q13 How might regulation of ECN/ECS evolve in response to the challenges of climate change adaptation and mitigation?

N/A

Q14 As weather conditions become more volatile with increased average and peak wind speeds, the loading on towers for operators is increased which in turn decreases the amount of equipment a tower can support. What steps are being taken to compensate for this and to minimise the number of new towers required to compensate for this effect of extreme weather due to climate change?

Please see answer to question 18 below

Q15 What energy saving measures are operators considering, as part of their design and operation of networks, for example, in relation to the powering down of network elements (i.e. DSL/GPON ports, router ports) during periods of inactivity. Similarly, with the advent of 5G technology, the number of frequency bands employed to deliver higher capacities is increasing. Are operators considering, as part of their network design, a means to facilitate turn down of some of these frequencies during non-busy periods when there is little or no demand on the radio resource at any given base station site?

N/A

Q16 To what extent might the lifecycle of network infrastructure be affected by climate adaptation or mitigation considerations?

N/A

Q17 Are operators considering the deployment of renewable energy production (and storage) as part of the network infrastructure?

N/A

Q18 What measures are operators undertaking to enhance the resilience of the physical infrastructure (i.e., poles and ducts) against extreme weather events, lightning and flooding and climate change?

BGE is not a developer of network infrastructure but as outlined in our response to questions 1 and 3 above, we are very aware of our increasing dependence on the stability and resilience of the communications networks to facilitate our business strategy. From an energy perspective we see the difference in the resilience of the gas network, (which is largely underground) compared to the electricity network (which is largely over ground) during extreme weather events. Electricity supplies can be affected by extreme wind, cold and /or snow, whereas the gas network is very rarely impacted. Recognising that there are cost implications to consider when developing a network either above ground or underground, we put forward to the energy regulator that given the expected increase in the electrification of Irish society and the Irish economy, the overall cost of losing electricity supplies is increasing, thereby justifying a need to put more of the infrastructure underground to make it more resilient to extreme weather.

Although we are not as familiar with the dynamics and operations of the communications network, we would urge ComReg to ensure that communication network providers have robust plans to weather proof their existing infrastructure and future investments. Climate adaptation is something that is sometimes overlooked when parties are focused on decarbonisation targets for 2050, but we must consider how to make our energy and communications infrastructure fail safe as our environment changes.

I hope you find the above comments and considerations useful. Please do not hesitate in contacting me if you would like any more information on anything in the above or if you have any questions.

Yours sincerely,

Jill Murray
Director of Regulatory Affairs
Bord Gáis Energy

{by email}

eir

Response to ComReg Call for Inputs: Connectivity and Decarbonisation

ComReg Document 19/126

13 March 2020

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eir recognises the importance of the connectivity sector with regard to its role in enabling decarbonisation and welcomes this opportunity to comment on ComReg's Call for Input.

Response to Consultation

General remarks

1. The telecom sector's use of energy to power its communication networks, data centres, and operations, such as IT systems, call centres and points of distribution is less intensive than utilities or natural resource sectors. It therefore makes a relatively moderate contribution to greenhouse gas emissions. However, communications technology and connectivity play a critical role in transitioning to a more resource-efficient world by addressing the harmful effects of climate change, increasing business resiliency and improving daily lives.

2. As the world becomes increasingly digitalised, the telecommunications sector can be part of the solution. The role of new network technologies in energy saving is as important as the role they can play as enablers in critical vertical sectors, such as smart transportation, cities, industry, energy grids, etc. Collaboration is needed to maximise the potential of the sector to help other sectors reduce their impact as well as to limit the industry's own footprint.

Q1. Do you think the above discussed benefits accurately reflect the GHG emissions abatement opportunities which ECN/ECS can facilitate across these four sectors? Can ECN/ECS facilitate significant abatement of GHG emissions in any other sectors?

3. eir agrees that the discussed benefits capture the majority of GHG emissions abatement opportunities that ECN/ECS can facilitate across the electricity, transport, agriculture and industry sectors. eir considers that the overarching four sectors, as described by ComReg, capture the relevant sectors and opportunities for abatement in Ireland but would add a number of other examples as follows.

4. Within the transport sector, there are a number of specific opportunities with regard to logistics. Connectivity allows for smart logistics through the collection of vehicle data. This can then be used for optimisation of route planning, load optimisation, and improvement of driver behaviour. Smart vehicle or fleet management solutions reduce fuel consumption and associated GHG emissions. In addition, vehicle platooning which allows delivery vehicles to drive in close cooperative formations has the potential to reduce fuel consumption. For the transport sector in general, other opportunities include smart parking apps, which can help drivers find available parking spaces, reducing congestion and GHG emissions and exchange activities such as

finding new owners for unwanted goods or offering unused space for accommodation, which can help to reduce travel emissions or emissions from manufacturing new goods.

5. Investment in telecommunications networks facilitates remote working, which is having a significant and growing impact on the number of passenger miles driven by cars and associated GHG emissions. As well as reducing emissions and improving the lives of individuals who can work from home, this also reduces traffic congestion for others. This benefit accrues to all industries.

Q2. Do you think the GHG emissions abatement which may be facilitated by these means is significant? Please provide evidence in support of your response.

6. eir is of the view that as the world becomes increasingly digitised, the GHG emissions abatement, which may be facilitated by these means, is significant. Operators are already reporting progress on enabling GHG emission reductions through their products and services. For example, AT&T has reported that as at the end of 2018, it had enabled GHG savings equivalent to approximately double the carbon footprint of its operations.[1] Similarly, Telefónica calculated that in 2019 its customers avoided 3.2 MtCO2e through IoT services for fleet management, building energy, video/audio conferences, cloud services and connectivity to promote teleworking. This was 3.3 times the sum of its direct and indirect emissions.[2]

7. Meanwhile, Deutsche Telekom has calculated that the "positive CO2 effects" facilitated for its European customers were 21% higher than its total emissions in 2018 (an enablement factor of 1.21)[3] and BT's "carbon-saving products and services", including teleconferencing and cloud networking, helped customers save 11.7 MtCO2e (equivalent to 2.6 times its own emissions) in FY 18/19.[4]

Q3. Do you think these use cases will have significant implications for networks, for example, in relation to resilience, capacity, latency or energy demand of ECN/ECS?

8. eir considers that these use cases will have significant implications for networks with regard to resilience, capacity and latency. It is anticipated that a number of these applications will be enabled by 5G deployment. 5G brings a number of enhancements over 4G, including high

[1] Progress to 2025 – 10x Goal Update, AT&T, 2019
[2] Integrated Management Report, 2019, Telefónica, 2020
[3] https://www.cr-report.telekom.com/site19/facts-figures/environmental-indicators/enablement-factor#
[4] Digital impact and sustainability report 2018/19, BT Group, 2019

speeds, low latencies, enhanced reliability, lower power consumption and greater terminal device densities. In addition, 5G offers new network management possibilities that could enable a single physical network to support a number of virtual networks with different performance characteristics. It will therefore be important to create a regulatory environment that incentivises fast 5G deployment over the medium term.

9. It is possible that the increasing demand for data and connectivity may have knock-on effects for the energy demand of telecoms networks. However, given the enablement factor of carbon-saving products and services, eir considers that any increase in the emissions of the telecommunications sector will be more than offset by net reductions in other sectors. Despite the ICT sector needing more energy to deliver energy savings, growing use of telecommunications doesn't mean an equivalent increase in carbon emissions. A recent study shows that although there has been a large increase in data traffic globally, emissions per user have dropped from 21.5kg CO2e to 19kg CO2e between 2010 and 2015 worldwide.[5]

10. This is due to operators taking steps to reduce both their direct and indirect emissions, thus reducing the carbon footprint of their networks and mitigating the effect of increasing demand for connectivity and data. eir notes that FTTH and 5G rollout, while enabling industry digitalisation, will also improve efficiency with energy savings and emissions reductions. It is estimated that the carbon emissions of the ICT industry per connection will in fact drop by 80% per connection by 2025.[6]

Practical Considerations

Q4. What are the enablers and inhibitors (technological, societal, economic or regulatory) of the use cases described in this chapter?

11. Higher data rates necessarily require smaller cells and densification of the network. However, pivotal site owners may attain a position of market power, which could be detrimental if high site access costs impede roll-out. It would therefore be useful for ComReg to consider engaging with the government with regard to increasing the supply of sites.

12. In addition, delivering extensive coverage at high data speeds and with robust reliability, with each operator running a separate network would require vast levels of investment. Such

[5] The electricity consumption and operational carbon emissions of ICT network operators 2010-2015, KTH Centre for Sustainable Communications, 2018
[6] GIV 2025 Unfolding the Industry Blueprint of an Intelligent World, Huawei 2018

investment levels would be prohibitive and therefore an increased role for infrastructure sharing is envisaged. This will not only reduce the costs of network deployment where possible but also ensure the best use of limited supporting infrastructure and street furniture. Regulation should seek to of be supportive of such sharing, while ensuring competition and fair access are maintained. ComReg should therefore consider a progressive regime that encourages infrastructure and network sharing in order to facilitate densification of small cell deployment for 5G roll-out.

13. Timely availability of spectrum will also be key. Spectrum auction design should not only focus on raising public revenues but also on market outcomes including investment incentives and diffusion rates. With this in mind, ComReg should rethink the use of allocation mechanisms that use complex auction processes, which only serve to inflate the cost of spectrum.

14. Fibre rollout will be instrumental not only as an enablement technology but also with regard to its role in reducing the footprint of operators. FTTH is 85% more energy efficient than the copper network. In addition, the deployment of fibre will enable the closure of copper facilities, thus allowing for reuse and recycling of much of the equipment. eir notes that it is committed to working in a mutually beneficial manner with ComReg and industry towards network modernisation and considers that ComReg should not adopt an overly prescriptive approach in this regard. In the interim, the regulatory regime for the next number of years will play a crucial role in creating an environment conducive to the continued rollout of FTTH. We would encourage ComReg to ensure that its regulatory approach provides continuing certainty for investors and maintains the correct investment incentives for both incumbents as well as alternative operators. This includes providing a stable migration path from copper network services and supporting initiatives and timeframes for copper switch-off.

Q5. If the market will not deliver a particular use case, are there specific economic signals which could be used to promote investment in a specific use case?

15. The use cases envisaged are quite different from the general connectivity that telecommunications regulators strive to enable. The role of the Regulator is evolving into that of a facilitator, where they are still required to work on enhancing connectivity while also engaging in collaborative regulation to promote the use of ICT in a number of different and diverse sectors such as finance, education, health and agriculture.

16. While eir has made a number of suggestions with regard to how ComReg can continue to enable connectivity i.e. through network sharing, sensible auction design and maintaining

investment incentives, we consider that it may also be worthwhile establishing a cross sectoral regulatory working group to look at the enablement of IoT and connected devices in these sectors. This would allow for sharing of best practice and co-ordinated consumer education. The benefits that these technologies can provide need to be effectively communicated to promote usage. For technological solutions to drive reductions in GHG emissions, users need to understand their benefits and be motivated to use them.

Q6. Do you think the impact of rebound effects is likely to have a significant impact on the abatement of GHG emissions which these use cases could deliver?

17. While eir considers that the abatement opportunities are significant, we are not in a position to quantify the impact of potential rebound effects. eir suggests that it may be useful for ComReg to commission a study in this regard.

Q7. Are there additional practical challenges which have not been identified?

18. eir has nothing further to add.

Carbon Emissions of the Sector

Q8. What measures could be taken to reduce the carbon emissions of the sector? Please provide evidence in your response

19. There are a number of measures which are being taken by industry to reduce the emissions of the sector, which include green energy sourcing, setting realistic and actionable targets for emission reductions and engaging in circular economy targets. For example, eir is taking steps to sign up to the Business in the Community's Low Carbon Pledge and has engaged with a carbon reporting company to carry out baseline reporting on our scope one and two carbon emissions. Following the completion of this work, we will put a plan in place and commit to reducing eir's carbon emissions by 50% by 2030 and will report on our progress annually.

20. In addition, eir signed a three-year contract with SSE Airtricity in 2019 for the supply of green electricity to over 8,000-meter points, including eir's Citywest HQ. eir is also continuing its progression towards becoming a paperless company. We have converted 94,000 customers to paperless billing, thereby saving 2.5 million pages a year and will begin trials to move customers

to digital contracts in retails stores in early 2020. eir will also be reducing printing in core locations with the goal of removing printers in mid-2020.

21. Moreover, eir is reducing waste through the recycling of set-top boxes, which are refurbished for a maximum of 4 years upon their return through ceased or faulty channels, providing they pass functional tests. After 4 years they are harvested for components and or recycled. In this manner, 90% of recovered CPE is reused while the remaining 10% is salvaged for parts and/or recycled.

22. eir notes that it was recertified to the Business Working Responsibly Mark as of October 2019. This is a three-year certification based on the international ISO 26000 and is the only standard for responsible and sustainable business practices in Ireland.

Q9. Do telecoms operators assess their carbon footprint and set targets for reduction? What steps have telecoms operators undertaken to reduce the carbon footprint of their operations?

23. As per our response to Question 8, eir has engaged with a carbon reporting company to carry out baseline reporting on scope one and two carbon emissions and will subsequently take steps towards reducing the company's carbon emissions by 50% by 2030, in line with the Business in the Community's Low Carbon Pledge. As noted by ComReg, a number of operators have signed up to Pledge, thereby committing to the reductions.

Q10. What steps are undertaken by operators to conduct business with equipment vendors that have strategies in place for lower carbon emissions?

24. Operators can, for example establish, sustainable procurement models. This could include the purchase of 'greener' products for example through the secondary or used telecoms market and taking a more sustainable and responsible approach to asset disposal. Operators can also establish minimum standards that suppliers are required to accept.

25. This can allow for the identification of high risk suppliers for specific evaluation of performance and auditing. However, the steps taken to conduct business with equipment vendors that have strategies in place for lower carbon emissions will vary from operator to operator based on business needs.

26. eir is currently establishing a process to determine the sustainability credentials of vendors as well as setting minimum standards for suppliers.

Q11. What are the key drivers of GHG emissions in the telecoms sector in Ireland? Are GHG emissions of the sector expected to increase or decrease in the coming years? Please provide evidence in your response.

27. From the major power plants and cooling systems harnessed by the biggest data centres to the embedded power suppliers required by servers, the telecommunications sector is heavily reliant on power. The key drivers of GHG emission in the telecoms sector in Ireland are therefore likely to be oil combustion for electricity generation and heating and gas combustion. Other drivers could include refrigeration gases as well as commercial fleet fuel and company car fuel.

28. Research from 2018 and based on 2015 data, estimates that the ICT sector's carbon footprint is circa 730 Mt CO2-equivalents or 1.4% of overall global emissions with the sector using 800 TWh or 3.6% of global electricity for its operations.[7]

29. However, GHG emissions of the sector are expected to decrease in the coming years due to operators taking steps to reduce both their direct and indirect emissions. It is estimated that the carbon emissions of the ICT industry per connection will in fact drop by 80% per connection by 2025.[8]

Q12. Several studies have commented on the importance of spreading awareness of the environmental impact of digital services. Do you think such an initiative would be worthwhile in Ireland? Would it be feasible? How might this be achieved?

30. eir considers that such a scheme could be worthwhile in Ireland and potentially feasible. However, we would expect that some research may be required to first establish consumer views and perception in this regard and in order to assess whether there is a need for additional transparency.

31. In addition, we are of the view that any education scheme would require cross sectoral collaboration given the reach of digital services and the numerous stakeholders involved. We

[7] The electricity consumption and operational carbon emissions of ICT network operators 2010-2015, KTH Centre for Sustainable Communications, 2018
[8] GIV 2025 Unfolding the Industry Blueprint of an Intelligent World , Huawei 2018

would suggest that this could fall with within the remit of a cross sectoral regulatory working group to allow for co-ordinated awareness campaigns.

Q13. How might regulation of ECN/ECS evolve in response to the challenges of climate change adaptation and mitigation?

32. eir has raised a number of points earlier in this response but to reiterate, we consider that the following aspects should be the focus of ComReg in this regard;

(i) Engaging with the government to ensure the optimal supply of sites and street furniture for the rollout of new network technologies
(ii) Implementing a progressive regime that actively encourages infrastructure and network sharing
(iii) Auctions and fees should be designed to achieve long-term connectivity targets, rather than to meet short-term budget considerations
(iv) Adopting an approach to network modernisation that is not overly prescriptive but allows for mutually beneficial engagement between stakeholders
(v) Providing continued regulatory certainty for investors and maintaining the correct incentives to promote network investment that enables further improvements in connectivity
(vi) Engaging with other regulators and across sectors to ensure that the benefits, which new connected technologies can provide, are effectively communicated to end-users in order to promote usage and GHG emissions reductions

Resilience and Adaptation

Q14. As weather conditions become more volatile with increased average and peak wind speeds, the loading on towers for operators is increased which in turn decreases the amount of equipment a tower can support. What steps are being taken to compensate for this and to minimise the number of new towers required to compensate for this effect of extreme weather due to climate change?

33. Our experience over the years, including some examples of extreme weather, have illustrated that the mobile network infrastructure is quite resilient, with the majority of outages being related to the continuity of power supply rather than physical storm damage. Structural assessments are carried out when it is proposed to add additional equipment.

34. Appropriate remediation will be undertaken to preserve the integrity of the structure if necessary prior to the installation of the additional equipment. A favourable planning regime is required to minimise the number of new towers. This is both in terms of the height of structures and site location aligned to optimal frequency planning including access to Government resources,

Q15. What energy saving measures are operators considering, as part of their design and operation of networks, for example, in relation to the powering down of network elements (i.e. DSL/GPON ports, router ports) during periods of inactivity. Similarly, with the advent of 5G technology, the number of frequency bands employed to deliver higher capacities is increasing. Are operators considering, as part of their network design, a means to facilitate turn down of some of these frequencies during non-busy periods when there is little or no demand on the radio resource at any given base station site?

35. Such features may be deployed in the network. eir is currently working with its RAN vendor to explore the efficiency and effectiveness of ‘sleep mode’ features.

Q16. To what extent might the lifecycle of network infrastructure be affected by climate adaptation or mitigation considerations?

36. Active equipment has a lifecycle of 5 to 7 years, meaning that there is a regular cycle of new equipment, generally more energy efficient, replacing older equipment. We do not believe that climate adaptation/mitigation will shorten lifecycles for passive infrastructure.

Q17. Are operators considering the deployment of renewable energy production (and storage) as part of the network infrastructure?

37. eir has explored this in the past in respect of mobile RAN sites. The available renewable energy equipment was not able to reliably provide sufficient power for a site to operate off-grid. The assessment also raised concerns regarding site security. We are aware that renewable energy equipment continues to evolve and will keep the potential to deploy cost effective and reliable renewable energy production under review. As noted above, our on-grid energy is supplied from renewable sources.

Q18. What measures are operators undertaking to enhance the resilience of the physical infrastructure (i.e., poles and ducts) against extreme weather events, lightning and flooding and climate change?

38. In our view the duct and pole infrastructure is resilient. The overhead network (poles) is, by its nature more exposed to extreme weather events. However, the ongoing evolution of the fixed access network from copper to fibre cables will enhance resilience of the overhead network. Fibre cable is much lighter than copper cable meaning that the overall weight loading on the overhead network will be reduced when the transition is completed. Fibre cable is not conductive and therefore much less likely to suffer from lightning. We look forward to working constructively with ComReg and Industry to progress fixed network modernisation and ultimately copper switch off in an orderly and timely manner over the coming years.

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

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8th April 2020

Re: Submissions to ComReg 19/126

Dear Mr. O'Connell,

The Environmental Protection Agency (EPA) acknowledges and welcomes the opportunity to respond to the Commission for Communications Regulation's (ComReg) Call for Inputs – Connectivity and Decarbonisation, which aims to explore how the Electronic Communications sector can contribute to achieving the Government's decarbonisation plans across the economy.

The EPA has a wide range of statutory responsibilities in relation to climate change particularly relevant to decarbonisation, energy efficiency and research, innovation and competitiveness. These include:

- National greenhouse gas inventories and projections assessment and reporting
- Coordination of national research on climate change
- Emissions trading regulation
- Secretariat to the Climate Advisory Council
- Secretariat to the National Climate Dialogue
- Intergovernmental climate science support to DCCAE
- State of the environment reporting
- Strategic Environmental Assessment (SEA)
- Resource efficiency and behavioural change
- Advice and assistance to local authorities
- Industrial and chemical regulation

Decarbonisation plans

Figures from the EPA's latest greenhouse gas Inventory[1] and Projections[2] show that Ireland is falling short in terms of lowering our emissions, being climate neutral by mid-century and playing our part in holding the

[1] http://www.epa.ie/pubs/reports/air/airemissions/ghgprovemissions2018/
[2] http://www.epa.ie/pubs/reports/air/airemissions/ghgprojections2018-2040/

increase in the global temperature to well below 2˚C above pre-industrial levels. A strong focus on policy implementation of the measures set out in the 2019 Climate Action Plan will be needed if Ireland is to achieve the 2030 EU Climate and renewable energy targets and national climate commitments for 2050.

EPA Inventory data shows that four sectors make up 82% of Ireland's emissions; Agriculture, Transport, Energy Industries and Residential. The figure below shows the contribution from all sectors to Ireland's greenhouse gas emissions in 2018 (provisional estimates). Further information is available at http://www.epa.ie/ghg/.

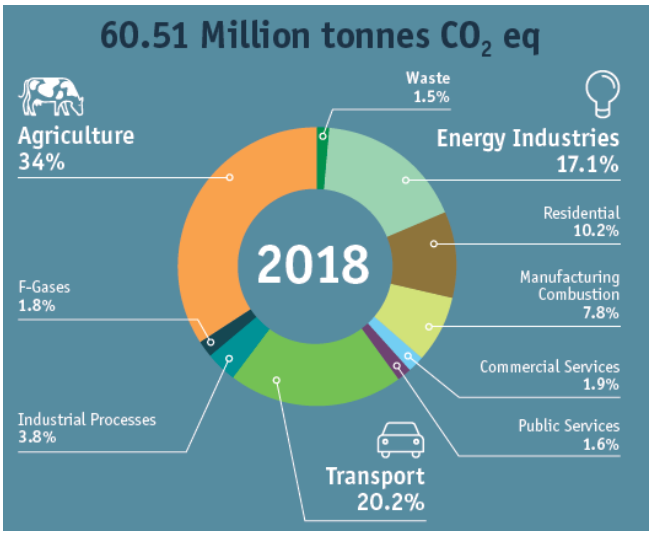

Figure 1 - Ireland's Provisional Greenhouse Gas emissions in 2018

If we are to achieve large-scale emission reductions, then we will need to see significant and sustained emissions reductions in these four sectors, with elimination of fossil energy use for power generation, heating and transport by 2050 at the latest. The scale of the climate challenge is such that all sectors will have to play their part, including realising emissions reductions in other sectors such as Commercial and Public Services and Industry but also introducing emissions removal technologies to achieve sustained large scale negative emissions.

The Call for Inputs document identifies, on a preliminary basis, four key sectors (Electricity, Transport, Agriculture and Industry) in which Electronic Communications Networks and Services may be able to facilitate abatement of GHG emissions to help achieve the Government's Climate Action targets. The EPA recommends that ComReg explores opportunities across all sectors of the economy where abatement of GHG emissions can be facilitated by Electronic Communications Networks and Services, including also for example, the Residential, Commercial and Public Services sectors.

It will be important that projected rising demand in electricity to provide electronic communications services (for example electricity to power data centres) is met by renewable sources where possible.

Resilience and Adaptation

The objective for Government is to enable the transition to a low carbon economy that is to be climate resilient. Climate and weather risks impact existing infrastructure. These impacts and risks are projected to increase in the long term irrespective of the successful implementation of global climate policy. The National Adaptation Framework (NAF) provides the framework for actions to manage the consequences of climate

change through adaptation, with a Communications sector 'Sectoral Adaptation Plan' having been produced under that Framework in 2019.

In its consultation response to the draft National Adaptation Framework, the EPA emphasised the importance of the NAF being developed and implemented in the context of a wider and more integrated approach to achievement of national sustainable development goals. Adaptation should therefore be achieved in a manner that minimises any negative impact on the wider environment and maximises the potential co-benefits for land use planning, human health, biodiversity, water quality, flood risk management and other interrelated areas.

Should you have any queries or require further information in relation to the above please contact the undersigned.

Yours sincerely,

Brian Quirke
Scientific Officer
Office of Environmental Sustainability

Energy for generations

Networks Telecoms, ESB Networks

ESB Networks' response to ComReg's Call for Inputs regarding Connectivity and Decarbonisation (ComReg Document 19/126)

13/03/2020

Contents

1. INTRODUCTION

ESB Networks (ESBN) welcomes the opportunity to respond to the Commission for Communications Regulation (ComReg) Call for Inputs in relation to Connectivity and Decarbonisation.

The electricity industry is undergoing unprecedented change, and the methods by which electricity is produced and consumed are fundamentally altering. Secure, high capacity and high availability telecommunications are fundamental to this change and to the safe and efficient operation of the grid. In Ireland we are already transitioning to a low carbon electricity system, and Ireland is a world leader in the adoption of renewable electricity generation. Through the successful development of our wind industry we now have the third highest wind penetration world-wide.

Radio spectrum is a hugely important natural resource, enabling both critical and non-critical services to be deployed and made available for all citizens. It is a key enabler for the provision of wireless services which in turn generates significant economic, technological, social, environmental and safety benefits. The deployment of smart grid technology using recently awarded radio spectrum from ComReg will enable increased renewable generation onto the electrical network and also to decarbonise our transport and heat systems

ESB Networks is committed to supporting Ireland's target of becoming a low carbon system.

2. INTRODUCTION TO ESB NETWORKS

ESB Networks DAC. (ESBN), a regulated subsidiary within ESB Group, is the licensed operator of the electricity distribution system in the Republic of Ireland. ESBN is responsible for building, operating, maintaining and developing the electricity network and serving all electricity customers in the Republic of Ireland.

ESB Networks is responsible for developing, maintaining and operating the electricity distribution network. The distribution network includes all distribution stations, overhead electricity lines, poles and underground cables used to bring power to more than 2 million domestic, commercial and industrial customers connected to the electricity network nationwide. ESBN also develops and maintains the high voltage transmission network in Ireland on behalf of the Transmission System Operator (TSO) EirGrid.

Secure telecommunications is vital to the safe and efficient operation of the grid. The electricity network depends heavily on having high quality and high availability communications infrastructure (meeting specifications for back up; redundancy; resilience; low delay and jitter). ESBN deploys and operates extensive fixed and wireless telecommunications infrastructure to provide ESB Networks and EirGrid with necessary real time information for operational purposes (i.e. to control and monitor the distribution and transmission networks). Such critical communication cannot always be provided by public communications networks, as these networks do not satisfy the network requirements. Radio spectrum is a fundamental component of ESB Networks' existing safe and resilient narrowband network.

The levels of renewable generation to be connected to the distribution and transmission networks is set to increase significantly by 2030, approximately adding 12,000MW of wind and solar generation. Generation of renewable (particularly wind) energy can be unpredictable, with quantum of energy generated and available at any time depending greatly on prevailing

atmospheric conditions. Another unpredictable and increasing energy source is solar energy. There has been and continues to be significant investment in solar energy in Ireland[1], which is also a low-carbon energy source. Solar energy will contribute increasing amounts of energy to the Grid in the future[2]. Both of these energy sources create the opportunity for 'active electricity customers'[3] to participate in the energy market.

Safe, efficient and reliable integration of this amount of wind and solar power on the electricity network requires much more sophisticated and real time telecommunications infrastructure. To meet these challenges ESBN will deploy a purpose built smart grid network.

3. COMMENTARY

ComReg has asked 18 questions in its Call for Input. Please find below ESBN's response to each of these questions.

Use Cases (Electricity, Transport, Agriculture and Industry)

Q1. Do you think the above discussed benefits accurately reflect the GHG emissions abatement opportunities which ECN/ECS can facilitate across these four sectors? Can ECN/ECS facilitate significant abatement of GHG emissions in any other sectors?

A1. Being the Distribution System Operator (DSO) for the ROI, ESBN is well positioned to provide commentary on the accuracy of ComReg's analysis regarding the Electricity use case. ESBN agrees with ComReg that ICT greatly enables the delivery of a more efficient electrical network resulting in a reduction of GHG emissions. The EU Clean Energy Package sets out the role of digitalisation of the electricity system, as critical to delivering a secure, low carbon system.

ESBN commends ComReg's award process regarding spectrum in the 400 MHz band specifically for Smart Grid. The radio spectrum (as licensed in November 2019) will enable ESBN deploy a purpose-built mission critical communications network. This communications network will provide significant benefits, including

- providing "visibility" (real time monitoring) of Low Voltage (LV) network so that ESBN can quickly and securely accommodate electric heating and transport, as well as microgeneration, at a local level nationwide;
- facilitating the integration of more renewable energy, by making it possible for ESBN to actively manage the electricity system using remote control, along with system monitoring forecasting and analytics;
- Enabling more efficient management of peak loads and increases the reliability and uptime of the electrical network;

[1] http://www.irishbuildingmagazine.ie/2016/02/01/kingspan-completes-the-largest-solar-pv-project-in-ireland/

[2] http://www.irishtimes.com/business/energy-and-resources/future-looks-bright-for-irish-solar-power-1.2507134

[3] Large amount of small generating units feeding a smart grid that can both supply power to consumers and take it back from them.

- Increased levels of remote monitoring, automation and control, so that when storms hit, we can bring power back more quickly and safely;

- Providing the real time information and signals needed to support customers and energy service providers make more use of renewable energy when it is on the system.

This Smart Grid telecommunications network will enable ESBN to operate a more efficient, reliable and sustainable electrical network whilst reducing GHG emissions.

ESBN will also make Smart Grid services available to EirGrid and Ervia (constituted of Irish Water and Gas Networks Ireland). ESBN plans to use this spectrum to deliver smart grid services which enable electricity market participants deliver new services in the electricity wholesale and energy services markets. ESBN considers that the Smart Grid network will enable all of these organisations to reduce their GHG emissions as a result.

ESBN agrees with ComReg that Smart Metering has the potential to reduce GHG emissions in a variety of ways. In their publication CRU17324, CRU outline how consumer trials of smart meters in Ireland and the enablement of Time of Usage pricing showed a reduction of 10 – 12 % in peak load usage and an overall reduction of approximately 3% of usage. This in turn would generate a reduction in GHG emissions, particularly at peak load where the least efficient sources of energy are required to be utilised to meet demand.

ESBN would emphasise the role that low voltage visibility and other smart grid services will have on the pace and security with which electric vehicles can be adopted in Ireland

ESBN has reviewed ComReg's analysis on other use cases (Transport, Agriculture and Industry) and agrees with ComReg's analysis that there is great potential to reduce GHG emissions in these areas. ESBN is encouraged that ComReg is discussing the reduction of GHG emissions from a broad perspective (i.e. not just electricity) as other use cases make significant contributions to emissions[4]. Cross sectoral convergence is at the heart of delivering a decentralised, digitalised and decarbonised society.

ESBN believes that technology will have a role to play in reducing GHG emissions in other ways. ESBN's Digital Strategy has already incorporated technological solutions to increase efficiencies and reduce GHG emissions, with more initiatives planned for execution over the coming years. ESBN's Digital Strategy is outlined in Figure 1 below.

[4] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/co2/

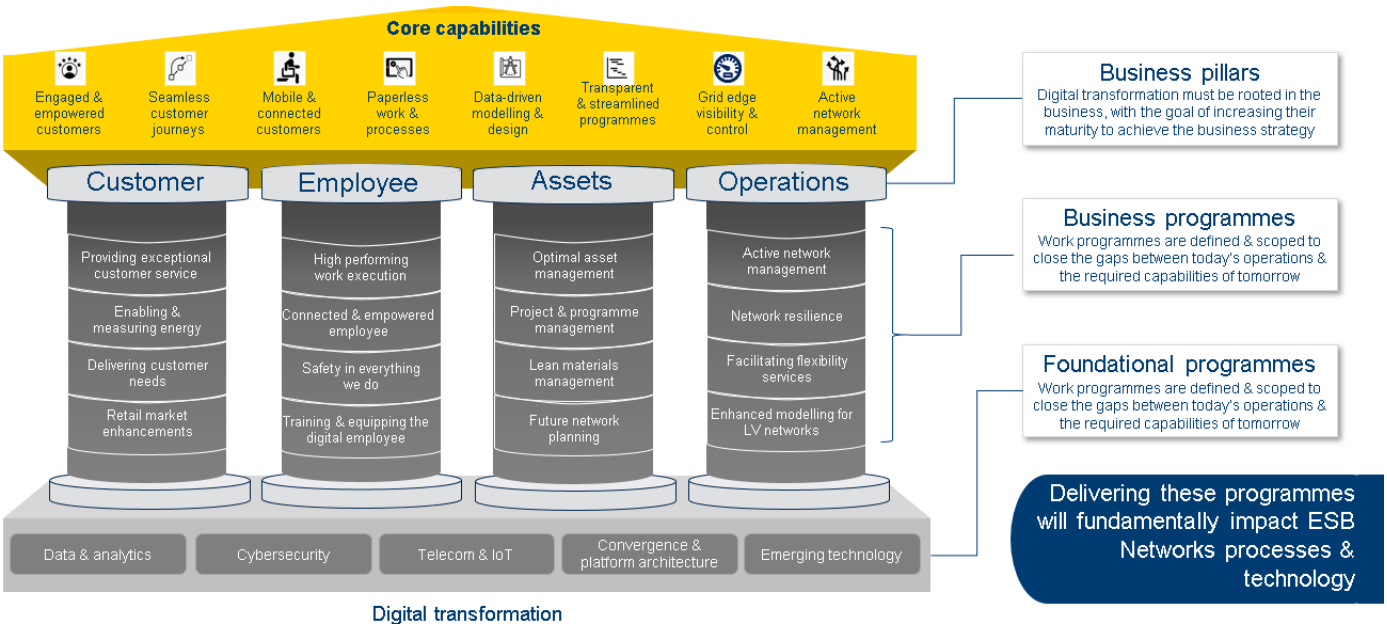

Figure 1: ESBN's Digital Strategy

Technology will enable ESBN and others to reduce requirement for staff to drive and carry out a range of tasks which can be automated by technology. This concept carries true for a wide range of industries apart from ESBN.

Q2. Do you think the GHG emissions abatement which may be facilitated by these means is significant? Please provide evidence in support of your response.

ESBN believes that there is significant opportunity to reduce emissions based on the use cases listed by ComReg. Technology is a key enabler in reducing GHG emissions. It is difficult to estimate the achievable abatement across society as a whole, however ESBN can confirm that Ireland's ability to achieve the GHG emissions associated with the Climate Action Plan rely on our ability to deliver infrastructural solutions which heavily involve the use of smart grid spectrum.

ESBN believes that the abatement achievable due to the deployment of Smart Grid and Smart Metering is significant. Smart Grid will allow for more visibility of the electrical network. This allows for greater management of both capacity and reliability of the electricity infrastructure, the integration of more renewable energy and more low carbon demand technologies (electric vehicles, electric heating solutions) and better use of this renewable energy. Currently, approximately 35% of total electricity in Ireland is derived by renewable sources. ESBN and EirGrid have a target of 70% renewable energy to meet by 2030. To achieve this target and greatly reduce GHG emissions, more data, visibility and control is required. ComReg through its release of spectrum for Smart Grid has greatly aided ESBN and EirGrid meet this target. ESBN agrees with the estimated benefit.

As outlined in response to Question 1, consumer trials of smart meters in Ireland showed a 12% reduction in peak load and an overall reduction of 3% of energy consumption. This will greatly reduce the GHG emissions, particularly during peak load. There are other "uncosted" benefits inherent in the provision of Smart Meter data to Stakeholders in the Industry; Customers, DSO, TSO, Suppliers, Aggregators and other groups. Invariably, the realised

benefit and reduction in emissions will be driven by actual consumer behaviour as opposed to predicted behaviour as estimated in the CRU document.

Not only will EVs reduce GHG emissions, they will allow for more efficient usage of the available electricity. It is anticipated that EV owners will charge their cars over night when the loading on the electrical network is at its lowest. Using the spare available capacity at these times will return even greater GHG emissions reductions.

ESBN commissioned Poyry to carry out research in this area. Figure 2 presents the reduction in CO2 emissions in the 'Baseline' scenario. These reductions reflect the targets of the Climate Action Plan in the period to 2030, and the CO2 emission reduction from the electricity sector which will help to meet the 2050 economy wide net zero CO2 emissions target. Without any adoption of Low Carbon Technologies (LCTs), total Irish energy sector CO2 emissions in the Baseline scenario would increase by 20% between 2020 and 2050. Switching to EVs from ICE cars and replacing fossil fuel boilers with heat pumps avoids a significant proportion of these emissions (as shown). These emissions savings rely on investment in the network over the relevant periods being consistent with meeting the Climate Action Plan targets and subsequent successive targets.

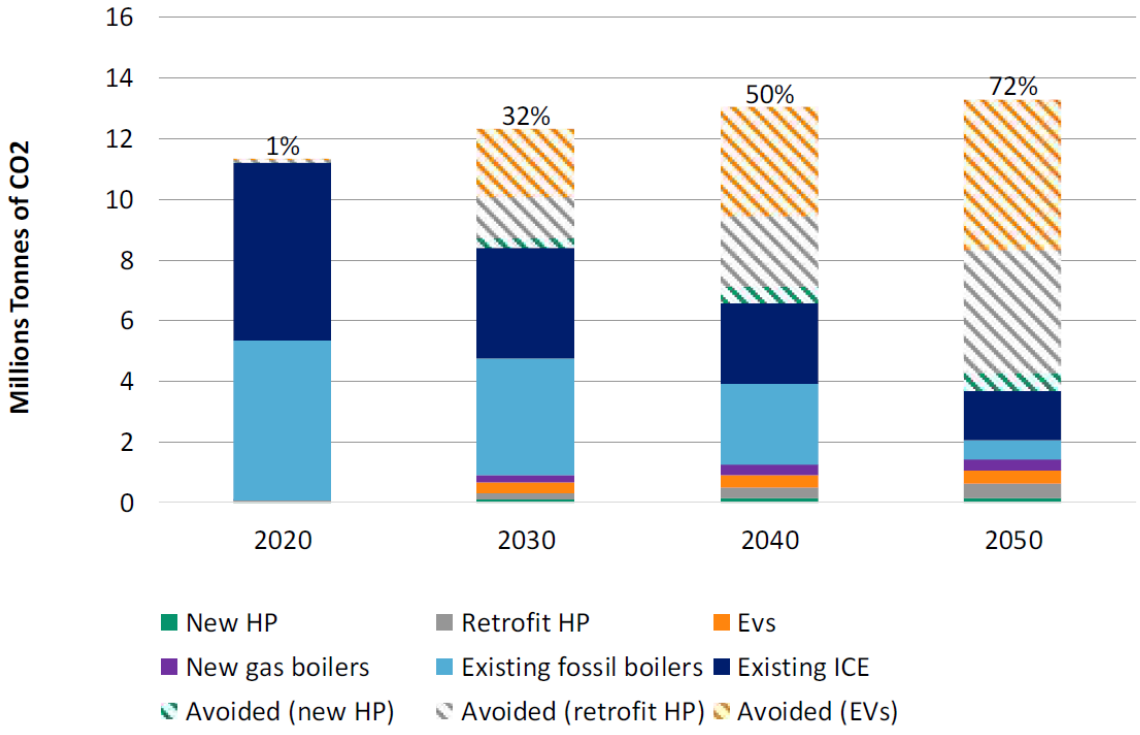

Figure 2: Potential reduction in emissions owing to technology.

Q3. Do you think these use cases will have significant implications for networks, for example, in relation to resilience, capacity, latency or energy demand of ECN/ECS?

It is not possible to give an accurate response to this question given the lack of information on service requirements and volumes of each Use Case.

ESBN is confident that the available spectrum for Smart Grid and the network it will deploy will satisfy the requirements of ESBN, EirGrid and Ervia.

Regarding other use cases listed by ComReg, ESBN at a high level considers the volumes and service requirements to be relatively modest and should be easily accommodated using existing available third party networks and their future iterations.

Smart Metering requires a reliable service with widescale coverage. Smart Metering needs to have next day balance calculations for all Smart Meters. Smart Metering data provides opportunities to identify 'bottlenecks' on the network caused by impact of electrification of heat and transport.

Practical Considerations

Q4. What are the enablers and inhibitors (technological, societal, economic or regulatory) of the use cases described in this chapter?

A4. ESBN again commends ComReg on enabling Smart Grid through its regulatory role. Spectrum is a key enabler of this solution. In addition, ESBN is reliant on CRU approval of its PR5 investment and operational proposals for funds to enable the investment which deliver reduction in GHG emissions. Technology exists which supports the deployment of this network, therefore ESBN is satisfied that Smart Grid has enablers and no known blockers.

A potential societal limitation for Smart Metering is the unknown actual user behaviour and how decisions may be informed or change based on the information Smart Meters provides. An awareness campaign may be required to informs users of cost and environmental gains that can be achieved by using Smart Meter data.

With EVs the enabler is societal acceptance and buy-in to the optimum functionality of operating the network. EVs may require government intervention to further incentivise purchase of EVs.

Q5. If the market will not deliver a particular use case, are there specific economic signals which could be used to promote investment in a specific use case?

ESBN recognises that the take up of EVs is not on schedule to meet government targets[5]. ESBN believes that more needs to be done to make EVs an attractive financial proposition at time of purchase as it would appear that consumers are more motivated by lower upfront costs as opposed to lower running costs. Incentives regarding cost of charging and reduced tolls are already implemented. Further incentives such as allowing EVs to use bus lanes may increase take up.

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[5] https://www.irishtimes.com/life-and-style/motors/climate-plan-1m-electric-cars-by-2030-does-not-look-realistic-1.3929310

Q6. Do you think the impact of rebound effects is likely to have a significant impact on the abatement of GHG emissions which these use cases could deliver?

Rebound effects may have an impact on the gains that can be realised across all use cases. It is difficult to predict to what degree these rebound effects will affect the reduction in GHG emissions. The rebound effect impact will vary per service in each use case. ESBN does not consider that there will be much if any rebound effect in the electricity use case.

Smart Metering is likely to drive a similar usage, but shifting the time of usage, lowering peak load and enabling a significant reduction in GHG emissions. Smart Metering data will assist the DSO and TSO in providing solutions to 'bottlenecks' that will inevitably develop on the network as a result of widespread electrification of heat and transport. This data will also assist in implementing lower cost wireless solutions to these 'bottlenecks' that traditionally would require capital intensive solution.

Q7. Are there additional practical challenges which have not been identified?

Given the spread of population in Ireland, it is necessary to use wireless technology in a lot of instances. Network availability and coverage are issues for any service user. Users want access to services at low cost, always on and widespread, yet this costs service providers. An issue can result whereby a service cannot get access to resilient service in locations as it is not viable for service providers. ComReg are proposing to address potentially coverage issues with the release or 700 MHz and proposed intervention where required.

Carbon Emissions of the Sector

Q8. What measures could be taken to reduce the carbon emissions of the sector? Please provide evidence in your response

A8. ESBN considers there to be potential for the telecommunications industry to reduce emissions. ESBN plans its technology and networks in the most efficient environmentally friendly manner. In addition, ESBN continues to deploy technological solutions which enables reduction of physical visits needed to sites/assets by staff hence reducing vehicle emissions. For example, ESBN remotely manages its switch mode power supplies (SMPS) for its telecommunications network.

Cooling of equipment in telecommunications cabinets and buildings consumes a reasonable amount of energy, yet it is required to ensure the equipment operates correctly for a long time. Enabling more efficient means of cooling equipment would reduce emissions. Telecommunications equipment vendors manufacturing more efficient operating telecommunications equipment (and manufacturing it in a more environmentally efficient way) could create a significant reduction in emissions. It is necessary for industry, regulators and vendors to collaborate to develop standards for more environmentally friendly equipment as more can be done.

A McKinsey article[6] on the matter of creating greener telecoms networks states that

[6] https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/the-case-for-committing-to-greener-telecom-networks?cid=soc-app

"Energy costs for telecom operators around the world are already high: at the end of 2018, they accounted, on average, for around 5 percent of operating expenditures. In emerging markets, where low grid coverage often means operators must supply their own power with a generator set, energy can account for as much as 7 percent of expenditures".

The same McKinsey article said that "*In current mobile networks…transferring data only consumes around 15 percent of energy…Some 85 percent is wasted because of heat loss in power amplifiers, equipment kept idling when there is no data transmission, and inefficiency in systems such as rectifiers, cooling systems, and battery units.*"

ESBN encourages and works with vendors to develop environmentally friendly telecommunications solutions.

Q9. Do telecoms operators assess their carbon footprint and set targets for reduction? What steps have telecoms operators undertaken to reduce the carbon footprint of their operations?

A9. ESBN assesses its carbon footprint annually across the full spectrum of operational activities and has been doing so since 2006. Metered energy, fleet mileage and expensed business mileage would all form part of this annual analysis for ESBN. Scope 1, Scope 2 and Scope 3 analysis is undertaken and foot printing reports are subjected to independent verification. Carbon foot printing data is used to formulate a response to the global climate reporting tool, CDP. In 2019, ESBN carbon reporting scored a B Management score, just below the top tier A Leadership rank. ESBN includes environmental considerations in procurement and deployment of all equipment. Life cycle costing undertaken as part of the procurement decision making process considers lifetime carbon and energy impact of an asset and this forms part of the decision making process.

Deployment of new technologies invariably results in reduction of emissions as new equipment and technologies are more efficient. ESBN has deployed an operational IP network which has enabled IP Telephony thus allowing the retirement of MD110 exchanges, which has significantly reduced the emissions associated with providing these internal services.

The McKinsey article validates this thought process where it says; *"Energy is the primary source of cost savings when decommissioning legacy networks, for example. A Southeast Asian operator realized a 3 percent saving on its total energy bill when it decommissioned its stand-alone 2G network and moved to a single-RAN architecture, as the legacy 2G equipment, although underused, was more energy intensive. Similarly, migrating to architectures such as cloud-RAN and "clean cloud" data centers can deliver energy savings of more than 10 percent."*

Q10. What steps are undertaken by operators to conduct business with equipment vendors that have strategies in place for lower carbon emissions?

A10.Where relevant, life cycle analysis considers energy and carbon costs as part of the procurement process. ESBN is currently considering the adoption of the DPER Shadow carbon price to factor into investment and procurement decisions.

GHG emissions reduction will be a consideration for ESBN when procuring equipment for its Smart Grid network later this year. As outlined in response to Question 8, it is in the interests of telecoms operators to reduce energy usage where possible to reduce emissions and costs. Retiring equipment and installing new equipment is likely to reduce emissions.

Q11. What are the key drivers of GHG emissions in the telecoms sector in Ireland? Are GHG emissions of the sector expected to increase or decrease in the coming years? Please provide evidence in your response.

ESBN is not aware of the profile of GHG emissions per network and per service and can therefore only offer a limited response on this matter. ESBN telecommunications transmission equipment must be always on, and often requires redundancy (power backup, hot standby etc.) to ensure that the end service is available at all times. The potential for reduction of GHG emissions can therefore be achieved by the deployment of more energy efficient equipment in the future (potential standards equipment must adhere to could be established) and/or for equipment to have capability to be powered primarily from renewable energy. ESBN will always deploy and operate its equipment in the most environmentally friendly manner possible. ESBN continuously evaluate and consider ways in which technology can enable it to reduce GHG emissions.

McKinsey published a table which outlined how technology and different ways of doing things can reduce emissions, see Table 1 below;

Levers	Description	Energy costs addressed, %[2]	Potential cost improvement, %	Energy cost savings, %[3]	Capex[4]	Complexity	Achievable within a year
Smart sleep and shutdowns	Site level: power-amplifier symbol, adaptive power consumption, multiple-input and multiple-output muting	20	10	2	Low	Low	✓
	Multisite level: carrier shutdown, cell shutdown, cross-base-station optimization, cross-radio (3G/4G) optimization	40	15	6	Low	Medium	✓
Internet of Things–enabled energy optimization	Sensors to optimize cooling	25	15	4	Low	Low	✓
	ToU[5]/Smart metering	100	5	5	Low	Low	✓
	Fuel monitoring	5	15	1	Low	Low	
Structural and architectural transformation	2G or legacy shutdowns	3	100	3	Medium	Medium	
	Newer cooling systems, insulation, reflective paints	15	20	3	Medium	Medium	
Strategic and sustainable energy sourcing	Purchase or generate green energy	100	30	30	None	Medium	
	Direct procurement/ competitive sourcing	100	5	5	None	Low	✓

[1]Figures are indicative only and will differ by market and operator, depending on various factors (eg, regulations governing distribution/retailing, green-energy incentives, OEM choice, operator's starting point in energy efficiency). [2]Share of network energy costs addressed. [3]Network energy-cost savings. [4]Capital expenditures. [5]Time of usage.

Table 1: McKinsey outlines power efficiencies that can be enabled.

Q12. Several studies have commented on the importance of spreading awareness of the environmental impact of digital services. Do you think such an initiative would be worthwhile in Ireland? Would it be feasible? How might this be achieved?

A12. ComReg has identified that 80% of GHG emissions from a smart phone are associated with its production and the remaining emissions from its ongoing use. Such emission profile could stand true for a wide range of user devices. Therefore, whilst an awareness campaign for end users may deliver some awareness and efficiencies, there is a much higher benefit when equipment manufactures create technology and devices in a more environmentally friendly manner whilst also enabling such devices to operate in a manner which reduces emissions should the user wish.

ESBN believes that arming consumers with environmental impact of equipment vendors would enable the environmentally conscious to purchase devices with lowest GHG emissions. Such an environmental register would therefore focus vendors strategies to ensure they reduce emissions as much as possible. ESBN therefore advises consideration be given to the creation of such a register therefore empowering consumers with environmental impact of the production of equipment so they can play their part.

Q13. How might regulation of ECN/ECS evolve in response to the challenges of climate change adaptation and mitigation?

A13. ESBN has to date deployed mission critical telecommunications networks to support a highly available and reliable electricity network. ESBN will plan, design and deploy this Smart Grid telecommunications network to have a very high (99.99%+) availability to the benefit of ESBN, EirGrid and Ervia. This network will stand up extremely well during extreme weather events and climate change as its existing telecommunications network does.

ESBN has no comment on what regulation is needed to be provided to other networks.

Resilience and Adaptation

Q14. As weather conditions become more volatile with increased average and peak wind speeds, the loading on towers for operators is increased which in turn decreases the amount of equipment a tower can support. What steps are being taken to compensate for this and to minimise the number of new towers required to compensate for this effect of extreme weather due to climate change?

A14.

ESB Telecoms (ESBT) are a commercial entity owned by the ESB Group who primarily wholesale access to fibre and rent out mast and cabin space to telecommunications providers. ESBT are a service provider to ESBN. ESBT operate a portfolio of 320 radio towers, offering services to both internal and external customers. As a service provider to ESBN, we are aware that ESBT have initiated a major tower strengthening program in 2019 to increase the wind-loading and structural strength of the towers. The engineering analysis performed on the tower also factors in the projected increase in wind speed, due to climate change, using the latest recommendations.

ESBT's analysis of telecoms structures utilises the Irish Annex to the Eurocodes (IRISH NATIONAL ANNEX TO EUROCODE 1:ACTIONS ON STRUCTURES) which is maintained by NSAI. If wind speed requires revision, NSAI would issue it as part of this standard. The wind speeds used were revised during the transition from BS standards to Eurocodes. As ESBT analyse new structures or re analyse existing structures they are brought up to the current standards. Existing structures in many cases can be strengthened as required. In reality the increase of loading due to technology change forces changes on the structures before wind load changes would require the structure to change.

Within the telecommunications industry, the general consensus would be that the number of towers will increase, driven by the need for mobile operators to improve their radio coverage, particularly with the advent of 5G and the increasing use of higher frequencies by mobile operators.

Q15. What energy saving measures are operators considering, as part of their design and operation of networks, for example, in relation to the powering down of network

elements (i.e. DSL/GPON ports, router ports) during periods of inactivity. Similarly, with the advent of 5G technology, the number of frequency bands employed to deliver higher capacities is increasing. Are operators considering, as part of their network design, a means to facilitate turn down of some of these frequencies during non-busy periods when there is little or no demand on the radio resource at any given base station site?

A15. ESBN has licensed spectrum from ComReg for DMR, point to point links, telemetry SCADA and Smart Grid. By its very nature, ESBN's networks are mission critical and are therefore required to be always on. When replacing or deploying new equipment, ESBN aims to use the most environmentally efficient technology option. ESBN has shown in responses to Questions 8, 9 and 11 the existing ways power can be reduced as well as opportunities for technology to enable further reductions.

Q16. To what extent might the lifecycle of network infrastructure be affected by climate adaptation or mitigation considerations?

A16. ESBN receives services from ESBT regarding tower space. With respect to the ESBT's Tower portfolio, the lifecycle of the towers will not be impacted. However, rising wind speeds would suggest that the investment cycle in Towers will shorten, in order to maintain structural integrity & safe operation.

With respect to ESBT's underground fibre duct network, increased investment may be required to stop subsidence based on increasing rainfall levels and to harden the duct infrastructure. We have noticed an increase in fibre ducts being flooded in the Dublin area. The main impact is to increase costs of maintaining the ducts, i.e. ducts need to be pumped dry to access the fibre splice enclosures.

Q17. Are operators considering the deployment of renewable energy production (and storage) as part of the network infrastructure?

A17. ESBT deployed a small wind turbine at a Point of Presence (PoP) site at Kilteel, Co Kildare. The purpose of the trial is to gain a better understanding of how wind generated electricity could make contribution to lowering power consumption and power consumption of the ESBT telecommunication network.

ESBN is trialling the use of hydrogen fuel cells to power equipment at its Cairn Hill radio telecommunications site. This fuel cell is capable of delivering 48VDC to equipment. ESBN will validate performance and consider deploying this solution in further sites.

Q18. What measures are operators undertaking to enhance the resilience of the physical infrastructure (i.e., poles and ducts) against extreme weather events, lightning and flooding and climate change?

A18. The civil design and construction standards of the distribution system aims to ensure its safety and reliability. These standards are developed based on the structural burden of holding up the electricity infrastructure. This burden changes when telecommunications infrastructure is added to the same structures, so ESBN adapts the network to ensure its continued

resilience when telecommunications infrastructure is attached to the existing electricity network. This includes for example additional pole supports to counteract the additional wind loading which poles will be required to withstand with additional fibres between poles.

There are three climate change impacts ESBN have considered here:

1. Increased wind speeds
2. Flooding
3. Wildfires

Increased wind speeds

ESB Networks is exposed to more increase wind intensities and frequencies. ESB Networks has used data from Met Eireann weather stations to analyses wind trends. It shows that the frequency of intense wind, and the duration of intense wind over the past 5 years. The European Environment Agency has some useful guidance available on trends and projected changes in wind speeds[7].

ESB Networks maintain a vast amount of aging infrastructure that is exposed to severe weather and increased wind speeds. These structures are susceptible to storm damage from high winds and falling trees and limbs. Currently, the degree and location of damage is difficult to predict; while ESB Networks generally design structures to support loads from equipment, wind, and ice, data has not historically been available to facilitate designs focused towards fast restoration. However, ESB Networks is working with EPRI in assessing and testing designs for new overhead structures to reduce damage and facilitate hastened repair and restoration.

ESB Networks has carried out resilient structure performance testing and simulated tree strikes at the EPRI Power Delivery Laboratory. The objective of these tests was to collect data regarding the failure modes of each structure type, and measure the forces generated on the conductor. This provides ESB Networks with reasoning to assess how it designs and constructs overhead network during PR5. The key thing for ESBN is adapting the network for faster restoration times in case of impact.

Flooding

ESB Networks have completed studies in relation to flood prone areas. Flood risk assessments to identify asset sites located in flood plains has been undertaken by the ESB Networks GIS Business Support team using data provided by the OPW.

These datasets distinguish COASTAL and the FLUVIAL locations together with predictions under different scenarios i.e. the current likelihood of flooding in a specific location together with projected flooding patterns in the Mid-Range Future Scenario (MRFS) and High-End Future Scenario (HEFS). The datasets also contain a range of flood event probabilities (termed AEP) for which their flood maps have been developed, expressed in terms of Annual Exceedance Probability (AEP).

[7] https://www.eea.europa.eu/data-and-maps/indicators/storms-2/assessment

The parameters and assumptions used for these studies are listed in the table below:

Parameter	MRFS	HEFS
Extreme Rainfall Depths	+ 20%	+ 30%
Peak Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year1	- 0.5 mm / year1
Urbanisation	No General Allowance – Reviewed on Case-by-Case Basis	No General Allowance – Reviewed on Case-by-Case Basis
Forestation	- 1/6 Tp2	- 1/3 Tp2 + 10% SPR3

Table 2 Mid-Range and High-End Future scenarios

ESB Networks is investigating solutions to minimise impact of flooding such as raising electrical equipment, site drainage and mitigation works or station re-location.

Wildfires

Wildfires is another climate change area that ESB Networks are investigating and currently assessing assumptions and scenarios that can be applied. Current assumptions are based on the Forest Fire Danger Notices that are issued during the main wildfire risk season from February through to September by the Forest Service of the Department Agriculture, Food and the Marine. These notices provide forest owners and managers with advance warning of high fire risk weather conditions and permit appropriate readiness measures to be taken in advance of fire outbreaks. Such measures may include the installation of firebreaks, or the removal of dangerous vegetation in proximity to property and critical assets and extend to the undertaking of fire patrols and pre- positioning of fire suppression resources by property managers. Given the volume of the network assets and land ownership and access arrangements these measures are not practical.

ESB Networks planned Timber Cutting Programme and Forestry Corridor Management programmes will have the greatest impact on fire prevention and are a key priority.

As a consequence of climate change there has been increased incidents of dry weather and higher risks of large wildfires is forming the reasoning for wildfire investment. This risk is recognised by The Department of Agriculture, Food and the Marine who are using a Fire Risk Warning System to highlight days with a high risk of wildfires. This system is linked to the European Forest Fire Information System (EFFIS).

ESBT main focus to date is on the Tower portfolio and increasing the wind-loading and strengthening of the tower structures.

ESBT's underground fibre duct network is maintained on an ongoing annual basis. No special measures are currently envisaged for the underground fibre duct network.

4. SUMMARY

ESBN welcomes the opportunity to respond to this Call for Inputs document. ESBN commends ComReg's endeavours to reduce GHG emissions by ECN/ECS and also downstream to industries and users. ESBN will assist ComReg in its endeavours in whatever way possible.

ESBN recognises that technology can provide a wide range of benefits with respect to reduction in GHG emissions and financially for service users. ESBN also recognises that there are opportunities for the Telecoms industry to reduce their own emissions in a number of ways (e.g. optimising equipment configuration, using environmentally efficient equipment) and each operator should take ownership of its responsibility in this regard.

ESBN recommends that ComReg include an environmental impact assessment in every publication so that it is possible for it to be considered in relation to Decisions that will be made. A number of Decisions that ComReg make may have indirect environmental impacts which may not otherwise be considered. Considering potential environmental impacts in every consultation will allow respondents inform ComReg of environmental considerations it may not have been aware about and which ComReg can then factor into its Decision making process.

ENDS

COMREG CONSULATION ON CONNECTIVITY AND DECARBONISATION

SIRO SUBMISSION

Contents

Introduction

SIRO is an ESB/Vodafone joint venture company which is building a 100% fibre-to-the-premises broadband network in 51 regional towns across Ireland. The fibre network is deployed to individual premises using the existing overhead and underground electricity infrastructure. SIRO was launched in 2015 with a phase one plan to cover 500,000 premises in 50 towns across Ireland. The SIRO network currently covers over 320,000 homes and businesses in 45 towns across 21 counties.

SIRO is an open access wholesaler and at this time has partnerships with 16 retailers/operators. Through its 100% fibre network SIRO offers speeds of 1 Gigabit per second to both homes.

Broadband operators like SIRO who currently provide fibre-to-the-building/home connections offer speeds of 1 Gigabit to households, but in the very near future 10 Gigabit will be available for those who want it. Because fibre optic cable connections can up be upgraded to 10 Gigabit and beyond without building new infrastructure, once the cable is laid in an area and a home is connected, it is future-proofed for higher speeds in the decades to come.

Building a future-proofed 100% fibre-optic broadband network will help Irish companies and people to make the changes they want to make in their own lives and work to help tackle climate change. For the individual, there is potential to reduce transport emissions, in particular through facilitating remote working. For companies and the state, many of the ICT use-cases as described in the ComReg document will require widespread 100% fibre networks.

Where use cases require an extensive 5G network, widespread access to fixed line fibre optic networks are essential.

Fibre-to-the-home networks are significantly more energy efficient than those which have copper in their networks. SIRO re-uses the existing ESB network to build its FTTB network. This reuse of existing ducts and poles has significant environmental benefits including avoiding digging, and the manufacture and installation of thousands of new wood poles and many kilometres of heavy duty plastic ducting.

In summary, in order to decarbonise the telecommunications sector and facilitate the use cases outlined in the consultation document, SIRO recommends accelerating the replacement of copper in our fixed broadband networks with full fibre, preventing the laying of new copper networks and fast-tracking the copper switch-off in Ireland.

Section 1: How the sector can assist in facilitating decarbonisation across the economy

1.1 Questions 1 and 2

Question 1: **Do you think the above discussed benefits accurately reflect the GHG emissions abatement opportunities which ECN/ECS can facilitate across these four sectors? Can ECN/ECS facilitate significant abatement of GHG emissions in any other sectors?**

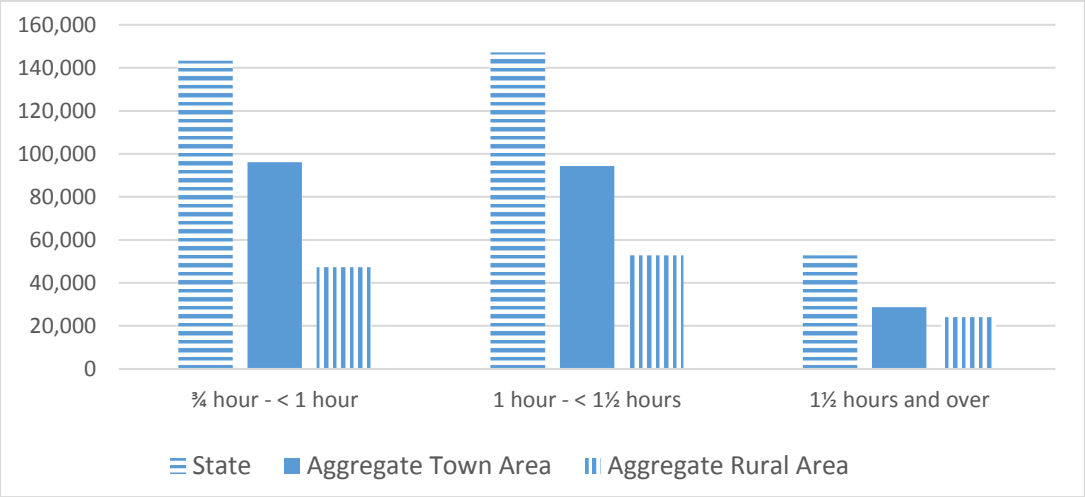
Question 3: **Do you think these use cases will have significant implications for networks, for example, in relation to resilience, capacity, latency or energy demand of ECN/ECS?**

The consultation document lists the following use-cases, Smart Meter, Smart Grid, Smart Buildings and Smart Cities, Electric Vehicles ("EV") providing storage capacity, Virtual replacement (teleworking/ videoconferencing/ e-commerce/ e-health), Traffic Control and Optimisation, Smart Charging, Connected Private Transportation. The SIRO response will focus on the virtual replacement use case.

Use Case: Virtual replacement (teleworking/ videoconferencing/ e-commerce/ e-health)

Representing 20 per cent of emissions in 2018, the transport sector is one of the most difficult sectors to tackle from a policy perspective. A dispersed population and high reliance on the private car means that despite investment in public transport infrastructure in the last decade, emissions have been steadily rising.[1] While the uptake of electric vehicles and increased investment in public transport will provide some measure of reductions, our dispersed population makes it difficult to provide public transport solutions to a large part of the population. Reliance on the private car, reinforced by Ireland's population dispersion, is reflected in rising commuting times, as people are forced to travel more to work or to spend more time in traffic.

Travelling Time to Work 2016: rural and urban areas



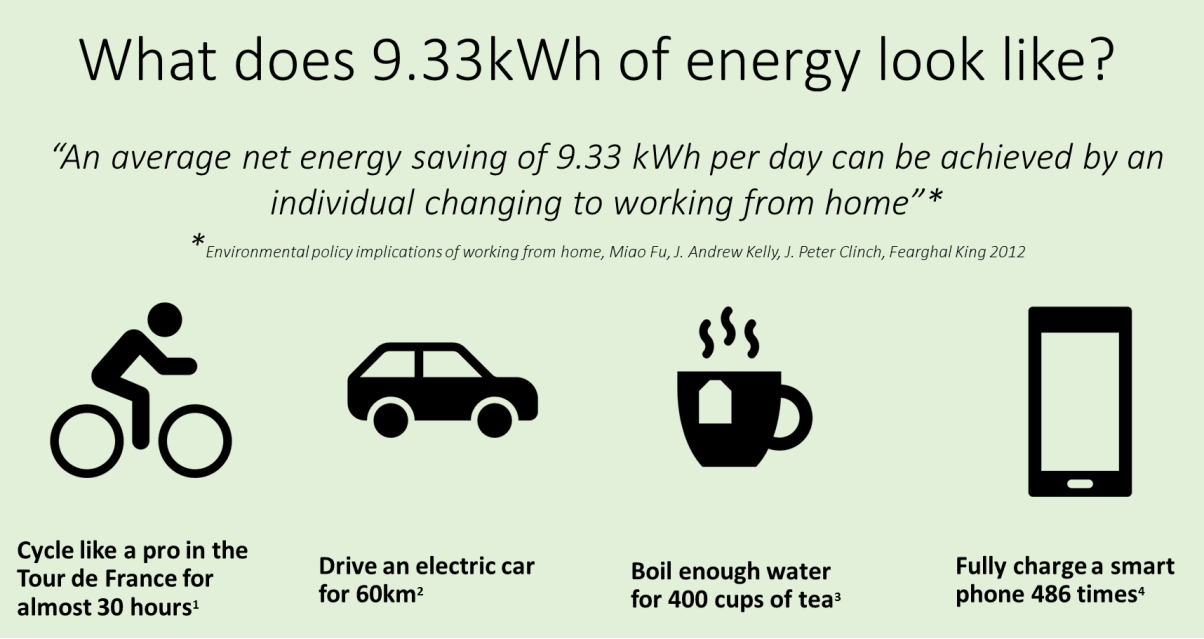
Source: CSO Census 2016

[1] EPA, *National Emissions Inventory*
https://www.epa.ie/climate/emissionsinventoriesandprojections/nationalemissionsinventories/

As can be seen from the chart above, 123,000 people from urban areas and 77,000 from rural areas travel between 1 to 1½ hours to work (CSO, 2016). Nearly 220,000 people from outside County Dublin, Cork City and Galway City commute between 1 to 1½ hours to work and there are fewer public transport options available to those commuters.[2] With improving broadband coverage nationally however, there is scope to increase the number of teleworkers in Ireland, reducing time travelled and transport emissions.

A quantitative analysis using a lifecycle approach conducted by PwC for the FTTH Council North America found that within 6 years of its deployment, a typical FTTH network in the US will have a positive impact on the environment mainly due to the benefits of teleworking.[3]

The extent of reductions in GHG emissions depends on a number of factors, including but not limited to how many days a week workers choose to work from home, the mode of transport they use and distance commuted. Taking these factors into account, a 2012 study found that every new worker at home in Ireland would save a net 9.33kW/h energy per day.[4] To put this into perspective, 9.33kW/h is equivalent to the following:[5]



1. *Thomas De Gendt stage 12 Tour de France 2016, weighted average power output 316W (strava.com)*
2. *Real world experience of a BMW i3 (2016) driver and a Nissan Leaf (2019) driver December 2019*
3. *00.093kW to boil 1L of water for room temperature, cup size 250ml*
4. *iPhone 6 charging measurement of 19.2Wh (macobserver.com)*

[2] CSO, Census 2016

[3] PwC, (2008), 'Developing a Generic Approach for FTTH Solutions using Life Cycle Analysis Methodology to Determine Environmental Benefits of FTTH Deployments in the USA'.

[4] Fu, M., Kelly, A.J., Clinch, J.P, King, F. (2012) 'Environment policy implications of working from home: Modelling the impacts of land-use, infrastructure and socio-demographics'.

[5] There is also the possibility of rebound effects such as possible increase of population outside of urban areas and thus an increase in the number of non-commuter travel which can impact on the energy-savings effects of remote working. See Fu, M., Kelly, A.J., Clinch, J.P, King, F. (2012) 'Environment policy implications of working from home: Modelling the impacts of land-use, infrastructure and socio-demographics'

In the UK, it has been estimated that the nationwide availability of faster broadband could save 1.6 million tonnes of CO_2 emissions per annum due to remote working and a reduction in work travel alone.[6]

However, rebound effects may reduce some of the emission reductions made through increased teleworking. There is some evidence that teleworking may increase tolerance of long distance commuting and thus incentivise commuters to live further away from their place of employment. In these cases the number of trips made is reduced but the distance is increased.[7]

At SIRO, we see building a future-proofed 100% fibre optic network as an important enabler for the transition to a sustainable economy. Our network currently reaches 320,000 homes and businesses across regional Ireland, with over 60,000 customers and growing. As will be discussed in more detail in a number of questions below, FTTH networks themselves are more energy efficient than other access networks and research has shown that per gigabit, widespread adoption of FTTH infrastructure could be responsible for 60 to 88 percent fewer emissions in European countries than the alternatives[8].

Implications for networks

If realised, the use cases listed by the consultation document will put additional pressure on existing telecommunications networks. In a recent paper published by UK wholesale fibre network operator City Fibre on the potential for ICT-enabled carbon reduction solutions, the authors argued that such applications would need to be underpinned by very high capacity networks such as fibre.[9] Without a high-speed, high-quality, low latency and resilient broadband network, these solutions will be difficult to adopt widely. Increased data traffic that will arise from these use cases will put pressure on existing networks.

A 2019 Spanish study forecasting the needs of FTTH networks for the coming decade, estimated that the current PON architectures would be insufficient to deal with the expected 25% rise in residential traffic and that they would need to be upgraded to 10G versions over the next five to eight years and to 25G beyond that.[10]

It has been suggested that the coming decade will see the Yottabyte (One Trillion Terrabytes), which will have an impact on energy consumption.[11]

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[6] SQW (2013), *UK Broadband Impact Study*. Found in WIK Consult (2018), *The Benefits of Ultrafast Broadband*

[7] Evidence from a study in Switzerland: Ravalet, E. and Rérat, P. (2019) 'Teleworking: Decreasing Mobility or Increasing Tolerance of Commuting Distances?' *Built Environment*, Volume 45, Number 4, December 2019, pp. 582-602(21)

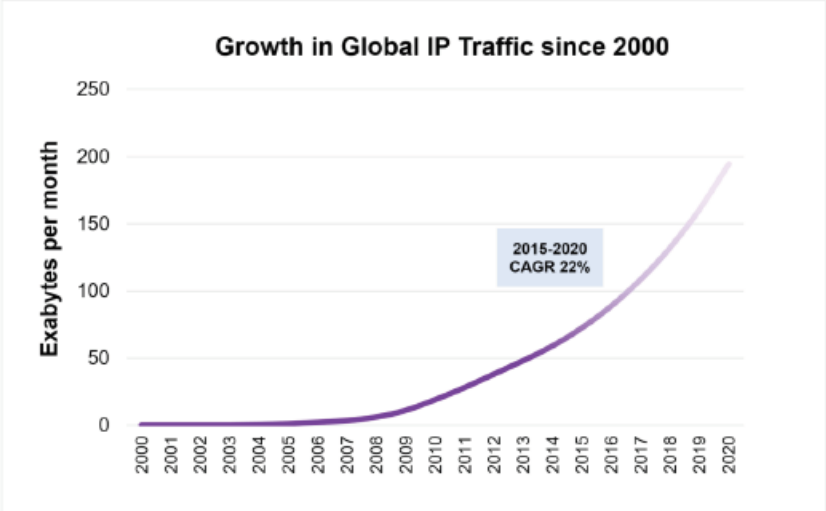
[8] 88% fewer emissions than the mix of copper and cable technologies. Aleksic, S. and Lovric, A, (2011) 'Energy Consumption and Environmental Implications of Wired Access Networks' (2011). American Journal of Engineering and Applied Sciences (AJEAS), Vol. 4 (2011), No. 4; pp. 531 – 539. Telefonica in Spain reported a 60% reduction in energy from a 'copper switch-off of the copper network, WIK Consult (2019), *Copper Switch-Off. A European Benchmark Analysis.*

[9] Carbon Smart, (2018) https://www.cityfibre.com/news/uk-dependence-on-copper-could-be-costing-the-earth/

[10] Hernández, J., Sánchez, R., Martín, I., and Larrabeiti, D. (2019), 'Meeting the Traffic Requirements of Residential Users in the Next Decade with Current FTTH Standards: How Much? How Long?' *IEEE Communications Magazine • June 2019*

[11] Anders S.G., (2017) 'Total Consumer Power Consumption Forecast'. Presentation October 2017

For 5G networks to provide the requisite speed and latency to capitalise on these use cases, operators will need to deploy small cells and hotspots with a coverage of metres, rather than the kilometres covered by 3/4G and these will need to be served by fibre.[12]



Source: Cisco VNI, found in Carbon Smart (2018)

Thus the higher bandwidth requirements will necessitate what is termed the "densification" of an area with an increased number of macro cell sites (can be difficult and expensive) or low-power small cells, making the prevalence of 100% fibre networks to connect these cell sites essential to a future-proofed 5G network.[13]

An FTTH Council Europe white paper in 2019 presented options for the convergence of fibre and 5G networks to promote cost effective development of 5G infrastructure and the minimisation of civil works to deploy new networks.[14] As will be discussed later in the document, the sharing of existing infrastructure has a role to play in the reduction of the environmental, including carbon, footprint of new network builds.

In 2015, Peter Cochran, former chief technologist of BT argued that to realise all the potential of the Internet of Things (IOT), from e-health to smart buildings to logistics and transport, the dominant mode must be very short range supported by FTTH/P, not 3G, 4G or 5G.

> *Today the internet of seven billion devices consumes about 10% of the energy generated. We cannot afford more than 50 billion things on line using today's technology, or indeed 5G. FTTH/FTTP and very short-range, low-power wireless links are the only viable route to a sustainable future. You just can't beat the laws of physics.*[15]

https://www.researchgate.net/publication/320225452

[12] Deloitte, https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-5GReady-the-need-for-deep-fiber-pov.pdf

[13] FTTH Council Europe, (2019) 'Fixed-Mobile Network Convergence The Key Role of Fibre'. See also Ciena, https://www.ciena.com/insights/articles/5G-wireless-needs-fiber-and-lots-of-it_prx.html

[14] FTTH Council Europe, *Op.Cit.*

[15] Cochrane, P. (2016) 'IOT, is it the real thing?', *financialdirector.co.uk*

According to the latest ComReg report[16], there are 162,000 FTTP connections in Ireland and approximately 884,000 V/DSL connections, 372,000 cable connections and 300,000 mobile broadband connections. As of January 2020, there are approximately 700,000 FTTP premises passed. Once National Broadband Ireland has completed its build a further 540, 000 premises will be connected. Were SIRO and other private companies to stop building their fibre networks today, this would leave approximately 760,000 premises without full fibre. Therefore, to enable the use-cases listed in the consultation document, widespread 100% fibre networks as essential to ensuring that Ireland's telecommunications networks can contend with the increased demand.

[16] ComReg (2020), 'Irish Communications Market: Key Data Report – Q4 2019'.

Section 2: How the sector can reduce its own footprint/carbon emissions?

2.1 Questions 8 and 11

Question 8: **What measures could be taken to reduce the carbon emissions of the sector? Please provide evidence in your response.**

Question 11: **What are the key drivers of GHG emissions in the telecoms sector in Ireland? Are GHG emissions of the sector expected to increase or decrease in the coming years? Please provide evidence in your response.**

Since SIRO entered the market in 2015 and announced its plans to build an FTTP network in 50 towns across Ireland, the telecommunications industry in Ireland has seen a shift from copper networks to 100% fibre ones. In the meantime the contract for the National Broadband Plan has been awarded and the resulting network will be an FTTP network. Currently however, the majority of homes in Ireland are still connected to the internet via legacy copper lines (as discussed above). Over time these copper connections have become shorter as operators have brought fibre connectivity closer to the premises.

While FTTP connections boast higher speed and reliability, they also require less maintenance and crucially less energy to maintain the network. This is due to a significant reduction of transmission losses when using fibre instead of copper. Consequently, operators deploying fibre can benefit from a reduction in the number of network nodes and less equipment. There is also the added benefit that operators can benefit from the saving of space previously occupied by copper exchanges, often in highly valued urban areas.

Wired Access Networks (WAN) in Ireland are varied and can be deployed using a range of technologies, configurations and protocols. As broadband is now widely available through a number of methods (FTTH, FTTC, VDSL, DSL, Hybrid Fibre Coaxial (HFX)), the power efficiency of each network has become increasingly analysed. Power usage is one of the key drivers in GHG emissions in the telecommunications sector. The access networks themselves are thought to be responsible for approximately 70% of the total energy consumption of a connection.[17]

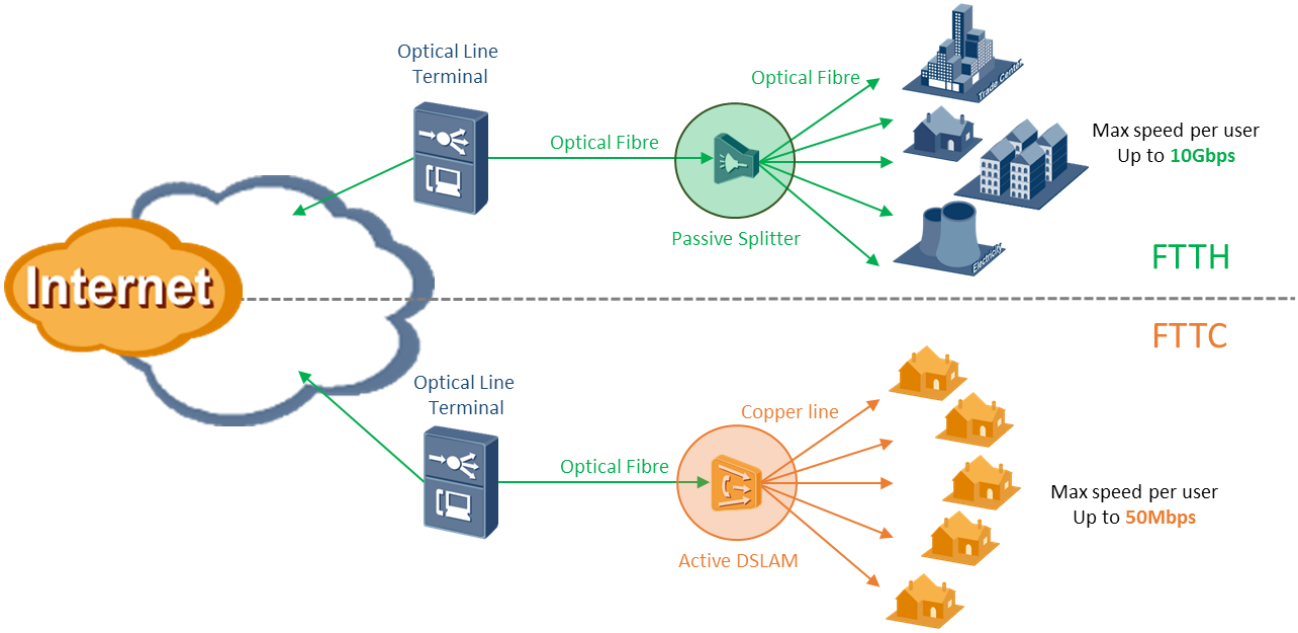
As a general rule of thumb, the energy consumption of a VHCN can be broken down into approximately 60% operations (network usage), and 40% build and maintenance, i.e., installation of network devices 25%, production of components of devices 8-10% and other processes 5%.[18]

[17] Wang, K., Kihl, M., Gavler, A., Du, M., & Lagerstedt, C. (2015). Power Consumption Analysis of FTTH Networks. *10th International Conference on Digital Telecommunications* IARIA.

[18] Coomonte R., Lastres, C., Feijóo, C., and Martín, Á., (2012) 'A simplified energy consumption model for fiber-based Next Generation Access Networks'. *Telematics and Informatics* Volume 29, Issue 4, November 2012, Pages 375-386

FTTH and FTTC networks both utilize fibre backhaul to transport data from the central offices/POPs to the internet. Depending on network architectures, the backhaul for both network types can negate each other. However, there is one significant element that distinguishes FTTC and FTTH from an environmental perspective. This is the use of active or powered devices as the penultimate component in the broadband connection.

Network Topography FTTH and FTTC



Source: SIRO (2020)

Power Consumption

FTTH makes use of passives splitters which require zero power to connect a subscriber. These splitters are capable of connecting 256 or more subscribers to the transport network. Alternatively, a powered DSLAM device which traditionally connect 256 subscribers requires a maximum of 300 Watts of power every hour. Additional requirements to cool and manage DSLAM devices will also contribute to increased power consumption and footprint required to facilitate FTTC cabinets.

Data Rates

The average data rates observed on FTTC are approximately 50Mbps. This is significantly outweighed by the achievable speeds from today's FTTH services (10Gbps). Future technologies will allow FTTH to expand data capacity without any changes to hardware. There will be no need to replace the passive network (i.e. ducts and poles) just to replace electronic cards in the active equipment locations. With fewer nodes (exchanges, cabinets etc.) there is also less travel by maintenance crews looking after them and fewer parts that need replacing.

Recyclables

The ability to increase capacity without replacing hardware means that recycling of equipment is possible to extend the lifespan of FTTH components. Additionally, the footprint required to house a passive splitter (~0.007 *ft3*) is considerably smaller than that of a copper DSLAM (~0.3 *ft3*), increasing the need to use of more non-decaying materials. These material will also require more maintenance where increased "truck rolls" will contribute to the carbon footprint.

Research on the energy efficiency of access networks

A number of studies have examined the energy efficiency of different types of access networks, some of which we are described below:

- A study conducted for the FTTH Council Europe by WIK Consult (2020) on the *Copper Switch Off in the European Union* examined the benefits of moving away from copper to FTTH. One such benefit was the energy usage reduction experienced by operators who have made the switch from copper to 100% fibre. Telefonica Spain reported 60% saving in energy costs and an 85% reduction in space for access technology equipment. A fibre POP is the equivalent of four copper switches. Verizon in the US reported energy savings of 40-60%, real estate/space savings of 60-80%, a 60% reduction in truck rolls and savings of 40-60% in maintenance. Verizon also noted that a fibre network was 70-80% more reliable than a copper one.[19]

- A 2011 paper by Slavisa Aleksic and Ana Lovric investigated the energy consumption and environmental implications of WANs aimed to assess which deployment of WAN was the most energy efficient. The approach was to analyse widely used networks such as DSL and HFX and compare them to GPON and 10-GPON technologies, which at the time were only beginning to be deployed. For optical access, or fibre connections, the researchers considered two different topologies in their research. Point-to-Point (P-to-P) and Point-to-Multipoint (P-to-MP) systems are implemented using direct connections between CPEs (Customer Premises Equipment) and Central Office (CO) equipment through Gbit/s or 10 Gbits/s Ethernet links. In the study, they decided to look at maximum achievable data rates for each technology and to neglect differences in maximum reach i.e. to not take into the account the effect of reducing the data rate with increasing the transmission distance. The researchers noted that an "all-copper" solution, i.e. when electrical signals are transmitted over copper cables directly from the central office to the user premises, would result in a significantly reduced data rates for long distances in case of xDSL and results in a much lower energy efficiency of copper-based access technologies.

  The study concluded that "high-speed optical access technologies providing up to 10GB/s speeds per user have the highest energy efficiency". However, the authors also concluded that 1GPON,

[19] WIK Consulting (2020) *Copper Switch Off in the European Union.* See also press release: https://www.telefonica.com/en/web/press-office/-/telefonica-will-shut-down-one-copper-switchboard-a-day-until-2020

is the most energy efficient option when considering lower access data rates. When comparing copper-based access solutions to fibre based access solutions, they were found to be generally lower in energy efficiency. Copper networks are less reliable than optical ones, are less weather-resistant and are more prone to breaking down. This added maintenance produces more carbon emissions as workers have to travel to the affected areas, often in work vehicles as well as causing disruption to replace the network. Fibre networks required 70-80% less maintenance overall and energy to power.[20]

- A 2015 analysis of energy efficiency in telecommunications networks conducted by Christoph Lange, Dirk Kosiankowski, Dirk von Hugo and Andreas Gladisch,[21] found that for a number of scenarios, "pure fibre-based passive optical access networks" perform better than other access networks and that while "in the newest DSL technology generations, energy efficiency efforts take effect. In case of a paradigm shift to fiber-only passive optical access networks, a significant energy efficiency improvement is achieved—at higher performance capability".[22]

- In a 2011 paper on power consumption in the internet, the authors, (Ricciardi, S., Careglio, D., Santos-Boada, G., Solé-Pareta, J., Fiore, U. and Palmieri, F.), highlighted the possible contribution of access networks to energy efficiency. When other elements are at "state-of-the-art", the last mile accounts for the majority of energy consumption. The energy consumption of copper-based connections, e.g. ADSL and VDSL are sensitive to increased bitrates and energy use increases at scale with the number of subscribers. Replacing copper-based connections with FTTH/P ones both increases the bandwidth and decreases the energy consumption in the internet at the same time. The authors gave figures of 2.8W consumption by a single ADSL link and 0.5W for a GPON link, a saving of 80%, for a higher number of users.[23]

- Baliga, J.Ayre, R. Hinton, K., and Tucker, R.S. published a paper in 2011, which found that there were 88% less greenhouse gas emissions per gigabit with FTTH/B infrastructure compared to other access technologies.[24]

- Following damage from Hurricane Sandy in the North east of the US in late 2012, telecommunications operators decided to replace legacy copper with fibre in preparation for the probability of an increasing serious weather events in the future. A side effect of this decision was the resulting reduction in energy consumption by 40% - 60%, coupled with 70% to 90% increase in reliability.[25]

[20] Aleksic, S. and Lovric, A, (2011) 'Energy Consumption and Environmental Implications of Wired Access Networks'.
[21] Lange, C., Kosiankowski, D., von Hugo, D., and Gladisch, A., (2015) 'Analysis of the energy consumption in telecom operator networks' *Photon Netw Commun* (2015) 30:17–28
[22] Lange, C., *et.al.* p.27
[23] Ricciardi, S., Careglio, D., Santos-Boada, G., Solé-Pareta, J., Fiore, U. and Palmieri, F. (2013) 'Towards an energy-aware Internet: modeling a cross-layer optimization approach.' *Telecommun Syst* (2013) 52:1247–1268
[24] Baliga, J., Ayre R., Hinton K., and Tucker, R., (2011), 'Energy Consumption in Wired and Wireless Access Networks'. *IEEE Communications Magazine*, (June 2011), pp. 70-77
[25] McNaught, C. (2018), 'Next-Gen, Right Now - Strategies to transform the network in the Gigabit era'. *Multi-Channel News*, 29 October 2018

Reducing the environmental footprint of building broadband networks

The Republic of Ireland enacted the Broadband Cost Reduction Regulations (S.I. 391 of 2016) effective from 20 July 2016, which transposed most of the requirements of the Broadband Cost Reduction Directive (2014/61/EU).

The legislation was enacted to enforce measures to reduce cost of deploying high-speed electronic communications networks, and recognised that synergies across sectors may significantly reduce the need for civil works due to the deployment of electronic communications networks and therefore also the social and environmental costs linked to them.

Embedded within the Broadband Cost Reduction legislation was the recognition that national constraints may exist which could affect the objectives of the legislation. Two of the potential areas which the Regulator may be able to influence are:

In-Building Physical Infrastructure: Significant environmental and cost benefits may be accrued in providing mini-ducts during construction of a building, with all new buildings or buildings subject to major renovation being equipped with physical infrastructure and access points, allowing the connection of end-users with high-speed networks. In order to fulfil the vision of the Broadband legislation both the Irish Building Control Regulations and Technical Guidance Documents require updating. ComReg could participate in the Building Control reviews and consider supporting the development of “broadband ready” labels for buildings.

Planning and Development Legislation: While the use of existing physical infrastructure is primary, on occasion the linking of these existing routes require new construction. To ease the roll-out of high-speed broadband across the country ComReg could actively participate in enhancing Section 31 exemptions of the Planning and Development legislation in order to facilitate and gain from both the cost reduction and environmental benefits of high-speed broadband. All such new construction should of course continue to be subject to a minimum of Appropriate Assessments (screening) and construction preventative controls as per current legislation.

2.2 Question 9

Do telecoms operators assess their carbon footprint and set targets for reduction? What steps have telecoms operators undertaken to reduce the carbon footprint of their operations?

Quantifying the carbon footprint of a company’s operations is a difficult undertaking and as discussed in the ComReg consultation document many companies use a third party to help estimate their emissions such as Business in the Community. Many large enterprises and multinationals are also included in the Carbon Disclosure project. Another way of quantifying and improving a company’s environmental footprint is through the use of International Standards (ISOs). Three of the most

popular ISOs for addressing and improving sustainability in telecommunications are ISO 14001, ISO 50001 and ISO 26000. SIRO has achieved ISO 14001, which is an environmental and energy management standards. The National Standards Authority of Ireland (NASI) sets out the broad principles of ISO 14001 as follows:

- "Establish good environmental performance as a strategic objective
- Sustain continual improvement of environmental performance
- Look at your products from 'cradle to grave'
- Reduce waste and pollution
- Analyse, plan, control and monitor all activities that may have an environmental impact
- Comply with legislative and regulatory requirements
- Demonstrate to regulators, stakeholders and other interested third parties that you have an efficient environmental management system."[26]

Relevant actions for this consultation include: "cutting down on waste, lowering energy use, using renewable resources".

While SIRO operates a fibre-to-the-home broadband access network, it is also simultaneously building the network. The company has three main areas which are relevant for estimating it's environmental or carbon footprint, network build, network operations and the administration/head office functions. SIRO is a medium-sized enterprise of 140 employees and in May this year will be five years old. As stated above, SIRO has achieved ISO 14001 and the company has moved on to quantifying its carbon footprint with a view to setting targets. However, as SIRO is at the beginning of this process we do not have most of the figures or statistics ready for use in the consultation. Therefore, we have some general commentary on proposed best practice for network build and some early comments on our carbon footprint and reduction steps.

Corporate carbon emissions are measured in three scopes:

Scope 1: "Direct emissions from owned or controlled sources. (Fuel combustion from company vehicles, fugitive emissions)

Scope 2: "Indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company"

Scope 3: "all other indirect emissions that occur in a company's value chain." (Including employee commuting) [27]

SIRO is currently building in 45 towns across Ireland and is operating a network that covers over 320,000 premises and growing. Scope 1 and 2 addresses the emissions from both the build and the network operations. Scope 3 addresses employee commuting and procured building materials. As discussed above, energy consumption of a VHCN can be broken down into approximately 60% operations (network usage), and 40% build and maintenance, i.e., installation of network devices 25%,

[26] ibid
[27] Carbon Trust, https://www.carbontrust.com/

production of components of devices 8-10% and other processes 5%.[28] A 2012 lifecycle assessment of FTTH networks found the main energy consumption to be "use of home residential gateways, their production, and the use of diesel trucks during engineering civil works and trench deployment."[29] The design, construction and operation of the SIRO national broadband fibre roll-out is on existing ESBN infrastructure (in so far as reasonably practicable). This approach has reduced the environmental life-cycle impact of the build in comparison to an approach which necessitates new infrastructure such as poles, ducting etc.[30]

While the consumption of purchased electricity generally is the largest component of a telecommunications company's carbon footprint, research in 2018 looking at the emissions of four large EU telecoms companies, highlighted the importance of paying attention to Scope 3 emissions, in particular employee commuting. Scope 3 emissions are more difficult calculate and to control, however, they make up a sizeable component of telecommunications GHG emissions.[31]

As discussed above, employee commuting can make up a large share of a telecommunications company's overall carbon footprint. SIRO is currently building across 45 towns in 21 counties in Ireland and the company has a mixture of office-based and field-based staff. While our head office is in Carrickmines Dublin, many of our employees are based in towns across the country from Letterkenny to Tralee, to Galway and Dundalk. SIRO provides the option to work remotely to all those who desire it and whose role allows it. To get an idea of the prevalence of remote working in SIRO and the carbon savings that could be made by a single employee spending one day a week working from home, we recently surveyed the staff.[32] The findings are as follows:

- SIRO staff respondents travel an average of 58km daily to their place of work.
- Those who travel by car travel an average of 62km daily to their place of work.
- 87% of SIRO staff travel to work by private car or company van, with 8% taking public transport and 3% travelling by car share, 2% use other modes such as walking or motorcycle.
- 63% of respondents reported working from home/remotely during the week.

In keeping with the profile of the company, many SIRO employees live outside of Dublin, commuting to the office in Carrickmines from towns and cities such as Roscommon and Cork. Given the location of the office and the distribution of our build sites, it is unsurprising how far the average SIRO employee travels to get to work. Also reflecting our head office location and build sites, the vast majority of SIRO employees travel to work by car.

The company already incentivises use of public transport and cycling through the Government TaxSaver scheme and Cycle to Work scheme respectively, other options to decrease emissions from

[28] Coomonte R., Lastres, C., Feijóo, C., and Martín, Á. (2012) 'A simplified energy consumption model for fiber-based Next Generation Access Networks'. *Telematics and Informatics* Volume 29, Issue 4, November 2012, Pages 375-386
[29] Sherali Zeadally, S., Khan, S. and Chilamkurti, N. (2012) 'Energy-efficient networking: past, present, and future'. *J Supercomput* (2012) 62:1093–1118
[30] Figues on SIRO savings in materials have been submitted to ComReg for the purpose of this consultation.
[31] Radonjič, R and Tompa, S., (2018) 'Carbon footprint calculation in telecommunications companies – The importance and relevance of scope 3 greenhouse gases emissions'. Renewable and Sustainable Energy Reviews 98 (2018) 361–375
[32] The survey was circulated to all 140 staff members and there was a 59% response rate.

travel to work are car sharing and remote working. When asked whether they would be open to car sharing, only 30% of respondents indicated they were and only 3% of people currently car share regularly. Teleworking therefore offers SIRO employees the best opportunity to reduce their commute and the emissions from that commute. From the survey, using an estimate from the IEA of the average GHG emissions from private cars in Ireland of 127g/km, we calculated that on average a SIRO employee working from home one day a week for a year would save approximately 724 kg CO_2 each.[33]

2.3 Question 13

How might regulation of ECN/ECS evolve in response to the challenges of climate change adaptation and mitigation?

Regulations in Electronic Communication Networks and Services in Ireland should evolve to address the challenges faced with regards to growing concerns of climate change. Once such action may to regulate to prevent the laying new copper networks while increasing the efforts in deploying optical based access networks.

As discussed in questions 8 and 11 above, there has been extensive research into the energy efficiency of fixed networks which find FTTH to be the most energy efficient by 60-80%. 100% fibre networks also require significantly less space than copper networks to deliver the network and less maintenance over time.

More equipment and nodes required by copper networks means more packaging and increased carbon emissions. FTTH has many benefits over copper based networks such as DSL/HFC, not just in terms of access speeds provided and reliability but also in terms of maintenance, energy and equipment thus reducing their environmental impact. By regulating to prevent the laying of new copper networks and focusing efforts on a future-proofed FTTH network, Ireland could significantly reduce its GHG emissions and energy consumption from telecommunications operations. For future builds i.e. homes, premises, apartments, SIRO recommends that building regulations should aim to prevent the building of copper technology and instead enable homes for further FTTH roll out.

The regulator may also consider consulting with the Department of Housing to ensure that the Building Control reviews and consider supporting the development of “broadband ready” labels for buildings

[33] Working 46 weeks a year. Using emissions per km of 127g/km, source International Energy Agency, average emissions for private cars in Ireland 2017. https://www.iea.org/topics/transport/gfei/data/. According to the Irish Bulletin of Vehicle and Driver Statistics 2018, 70% of cars registered by CO_2 emissions are registered at bands under 131g/km and 87% of those registered by CO_2 emissions are registered at bands under 141g/km. 65.8% of the overall passenger car fleet is registered by CO_2 emissions. DTTAS (2019), *Irish Bulletin of Vehicle and Driver Statistics 2018*, https://www.gov.ie/en/press-release/7609bf-bulletin-of-vehicle-and-driver-statistics/?referrer=/press-releases/2018/bulletin-vehicle-and-driver-statistics/

as discussed in question 8 above, thus ensuring that infrastructure for telecommunications has been provided and removing the need for further construction by operators. The regulator could also consult enhancing section 31 exemptions for planning to facilitate the quick and cost effective provision of telecommunications infrastructure, in order to support the use cases outlined in the consultation document.

Section 3: How the sector can adapt to a changing environment / Resilience and adaptation?

3.1 Questions 15 and 17

Question 15: **What energy saving measures are operators considering, as part of their design and operation of networks, for example, in relation to the powering down of network elements (i.e. DSL/GPON ports, router ports) during periods of inactivity.**

Question 17: **Are operators considering the deployment of renewable energy production (and storage) as part of the network infrastructure?**

How can FTTH networks be more sustainable?

Wires-Only Terminations – FTTH traditionally terminate services on an Optical Network Terminal (ONT) in the premises. In order for a subscriber to use internet services, they must connect a wifi router to this ONT. FTTH providers can make use of a combined ONT/Wifi device which will reduce the need for additional power consumption in the premises with less devices to be discarded when a subscriber terminates service.

Sleep Protocols – the exploration of sleep protocols which decrease power consumption when a service is not in use can be employed to improve the consumption of network devices. According to Baliga *et. al.* in their 2011 study, in ADSL and FTTH the customer modem or ONT consumes over 65 percent of the total power in the access network. A recommendation from the study suggested that introducing an automated sleep mode in periods of inactivity in customer premises network could potentially reduce power consumption by 40%.[34]

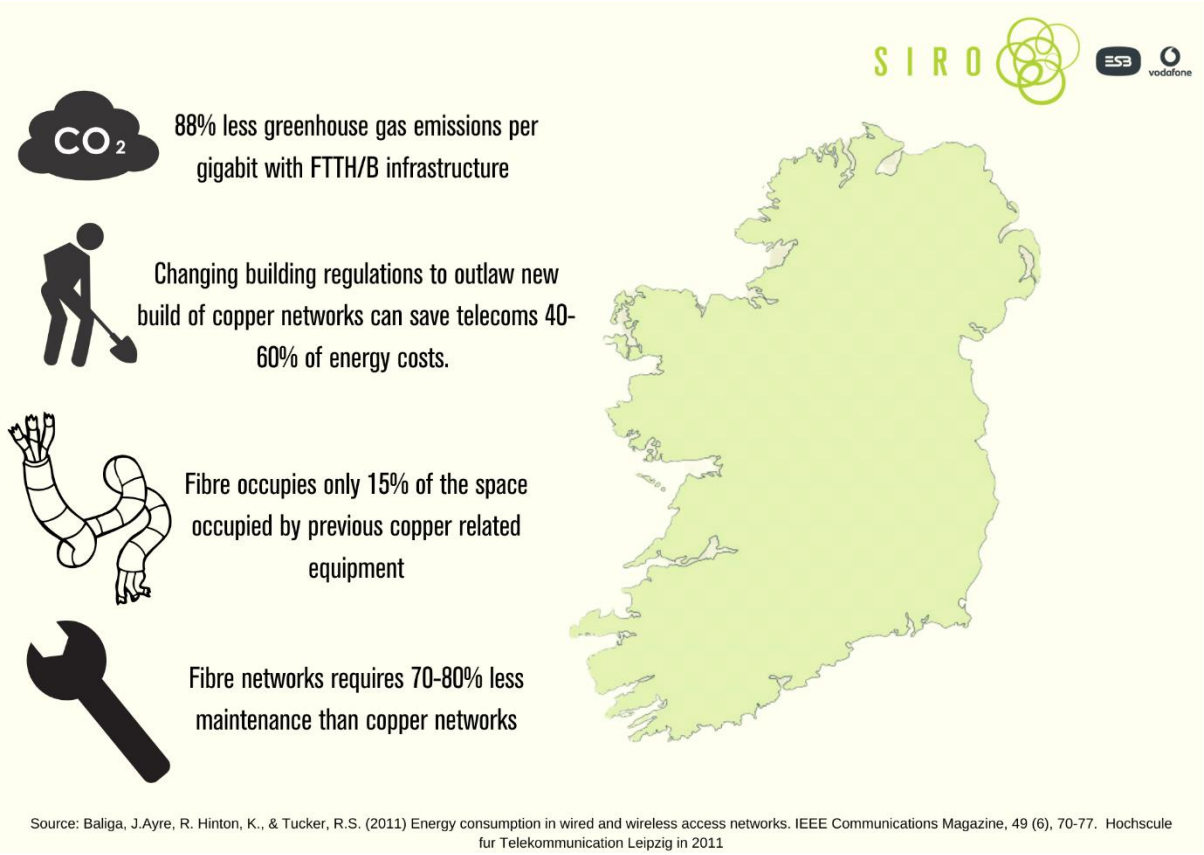
Power Meters – monitoring power consumption in network cabins can produce valuable data that will identify when networks need less power. This could be in certain periods of the day or before services go live on network devices.

Renewable Energy – The transition to renewable energy is not currently cost affective for network providers, however, initiatives to change would make this more appealing. The introduction of Solar Photovoltaic (PV) panels can be used to contribute to the power needs in cabins or release of unused battery power back into the electricity grid can be achieved with government grants to facilitate the change. SIRO plans to undertake a study and trial installation of a Solar PV system at one of our POP installations in 2020 to evaluate the potential for reduced mains power consumption. Early

[34] Baliga *et. al* (2011) See also Wang, K., Kihl, M., Gavler, A., Du, M., & Lagerstedt, C. (2015) and Dixit, A., Lambert, S., Lannoo, B., Colle, D., Pickavet, M., and Demeester P. (2013) 'Towards energy efficiency in optical access Networks' *IEEE ANTS 2013*

information gathering suggests that based on a POP cabin of 3m x 3m roof space, there is an opportunity to generate 1.5 – 2.0kW of electricity based on commercially available products. Site suitability for a candidate is being assessed in early 2020 with a view to deployment and evaluation mid-2020.

Conclusion



The SIRO network build and operations has two distinct advantages, first, the network is built on the existing ESB network, this means that fewer materials (e.g. poles, concrete, plastic etc.) are required to be produced and transported during the build phase. Second, FTTH networks are more energy efficient than copper-based ones and are capable of being upgraded to higher speeds such as 10 Gbps without replacing the passive network. For the benefits of the use-cases listed by the consultation document to be realised in Ireland, we will require ubiquitous FTTH networks, including as part of 5G networks. In order to ensure that FTTH network builds are accelerated and have a lower environmental and carbon footprint, SIRO recommends the following:

- ComReg participate in the Building Control reviews and consider supporting the development of “fibre broadband ready” labels for buildings.
- ComReg actively participate in enhancing Section 31 exemptions of the Planning and Development legislation in order to facilitate and gain from both the cost reduction and environmental benefits of high-speed broadband.
- The laying of any new copper network, or part copper network (e.g. in new developments) should be prevented as a way of accelerating the move to FTTH networks.

Appendix: Acronyms

CO	Central Office
DSL	Digital subscriber line
DSLAM	Digital Subscriber Line Access Multiplexer
FTTC	Fibre to the Cabinet
FTTH	Fibre to the Home
FTTP	Fibre to the Premises
GPON	Gigabit Passive Optical Network
HFX	Hybrid Fibre Coaxial
GHG	Green House Gas
ICT	Information and Communications Technology
IOT	Internet of Things
PON	Passive Optical Network
POP	Point of Presence
POI	Point of Interconnect
P-to-P	Point-to-Point
P-to-MP	Point-to-Multipoint
ONU	Optical Network Unit
WAN	Wired Access Networks
VDSL	Very high speed Digital Subscriber Line
VHCN	Very High Capacity Network

Introduction

The VistaMilk centre is a collaboration between Ireland's leading agriculture and food research organisation (Teagasc) and Ireland's major research centres in sensor-system development (Tyndall), networking and communications (TSSG), and data analytics (UCD-Insight). The overarching objective of the VistaMilk Centre is to generate and deploy innovative basic and applied science and technologies to better understand and monitor the complex interactions across a highly inter-dependent food-production chain. The objective will be achieved by exploring 3 inter-dependent thematic areas (Pasture, Cow and Food) bringing together expertise in the biological sciences, sensor-systems, communications and networking, data analytics, and food processing.
The Marginal Abatement Cost Curve (MACC) developed by Teagasc for farming has created a roadmap to meeting our 2030 targets, however much more is needed if we are to reach Carbon neutrality by 2050. The development of the technologies that will allow us to reach that target will come from research and development that is being carried out today.
A major element of the work being carried out by the VistaMilk project will be to address the challenge of climate change. By combining the knowledge and expertise of the research organisations involved in VistaMilk with the practical experience of industry, a suite of farmer friendly technologies will be developed to help Ireland to reach it's emission goals.

Responses

Q1
With particular reference to the agriculture sector, the benefits listed accurately reflect some of the GHG abatement opportunities, however we believe that there are many other opportunities that will arise from the widespread use of IoT sensors. For example, the development work, currently being carried out on a variety of sensors which could be used to monitor animal behaviour, animal health, soil nutrient levels etc. will increase the performance efficiency of the herd.
Another area of particular interest is the area of soil Carbon, Carbon sequestration and the fluxes occurring in the soil. Through the development of sensors to monitor soil Carbon, it will be possible to determine the levels of Carbon being sequestered and the influence that various management techniques will have on this process.

Q2
The exact potential of these technologies is unknown as many are in the very early stages of development however one example is the area of Carbon sequestration in soil through improved management practices. It is believed that some farms globally may have lost between 50% and 70% of the soil organic Carbon meaning that the sequestration potential of soils means that they could offset up to 7% of global Carbon emissions (Frank et al 2017)

Q3
As sensors and mobile applications become more common on farms, and as the data they are generating becomes ever more crucial to the decisions farmers make, the reliability and capacity of the network will become critical to the sector.
Despite a large amount of work taking place to advance technology in low energy sensors

and to reduce the quantities of data that will need to be transferred through edge computing, there will an increase in the energy requirement of the network. This will be combined with a huge increase in the levels of data that will need to be transferred placing pressure on the network capacity.
If the potential of these technologies is to be maximised, access to high speed broadband will be required on farms across rural Ireland so that farmers will have the opportunity to avail of these developments.

Q4
One of the main enablers to the advance of these use cases will be the development of the technology required so that it is both proportional and affordable. With this in mind, it is critical that the research organisations in this area receive continued and increased support to facilitate the research that will deliver the technological innovations required.
From a deployment point of view, particularly in the agricultural sector, the end user must have trust in both the technology and the network that will facilitate it before there will be widespread uptake of the technological advances. Many of the decision support tools that will be developed, for example, will have to be designed with the farmer in mind. To build trust in the technology, it will be essential that those tasked with educating the farmers, advisors for example, will be provided with the supports required to fulfil the task.

Q5
There is a clear market use for many of the technologies mentioned in both the document and earlier in our response. However, what may impede the market use will be the price point of availing of the technological advances, which may mean that the business case will not stack up for the farmer. In this case, supports through exchequer or European funding, or both may be required to provide the force that would take the technology beyond the tipping point.

Q6
Rebound effects are unlikely to be a factor in the agricultural sector. In the case of sensors used for grassland management or animal health, the aim is to reduce the amount of inputs being used on the farm. As these are a cost to the farmer, and using increased levels of these inputs will not provide any extra profit to the farmer it is unlikely that they will respond by increased use of these inputs.

References

Frank S, Havlík P, Soussana J-F, Levesque A, Valin H et al. 2017. Reducing greenhouse gas emissions in agriculture without compromising food security? Environmental Research Letters

Topic: Vodafone Ireland response – ComReg Call for Inputs: Decarbonisation and Connectivity
Reference: ComReg (19/126)

Date: 13 March 2020

Introduction to Vodafone

Vodafone is Ireland's leading total communications provider with 2.3 million customers and employs over 2,000 people directly and indirectly in Ireland. Vodafone provides a total range of communications solutions including voice, messaging, data and fixed communications to consumers and to small, medium and large businesses. Since 2011, Vodafone has expanded its enterprise division, offering integrated next-generation fixed and mobile solutions in addition to cloud-based platforms, machine-to-machine services and professional ICT support.

In this paper, we provide an outline our position regarding decarbonisation and connectivity, and its importance to our work as a leading provider of connectivity services and management of our network infrastructure.

We also provide responses to the related questions as part of this document.

Vodafone: Decarbonisation and Connectivity

We are focusing on increasing the energy efficiency of our network and services and are moving towards purchasing electricity from renewable sources.

This year, as part of Vodafone's purpose, we have committed to halve our environmental impact by 2025. In order to reflect this in our goals, we have set a target of reducing GHG emissions by 40% by 2025, against a 2017 baseline. We will deliver against this target by improving the energy efficiency of our network and purchasing 100% of the electricity we use from renewable sources.

Vodafone strive to have the highest standards in industry in the area of Energy Management. In 2016, Vodafone Ireland was awarded the ISO50001. Based on ongoing projects arising from ISO50001, Vodafone Ireland project annual savings of 5,626,000 kWh. In 2018, Vodafone secured both ISO14001 & 45001 standards.

Vodafone responses

Use Cases

Q1. Do you think the above discussed benefits accurately reflect the GHG emissions abatement opportunities which ECN/ECS can facilitate across these four sectors? Can ECN/ECS facilitate significant abatement of GHG emissions in any other sectors?

A: The benefits detailed in the uses cases outlined do reflect the potential GHG emissions abatements and reductions available and facilitated by both ECN and ECS.

GSMA (in collaboration with the Carbon Trust) published a report –"The enablement effect: the impact of mobile communications technologies on carbon emission reductions".

The study found that the use of mobile technology enabled a global reduction in Greenhouse Gas (GHG) emissions of around 2,135 million tonnes CO2e last year. The majority of the avoided emissions result from a decrease in electricity, gas, and fuel consumption. Two forms of enablement were assessed; IoT connecting one machine to another **plus** behaviour changes from the personal use of smartphones.

Compared to the global carbon footprint of mobile networks themselves, the level of avoided emissions enabled by mobile communications technologies is 10 times greater –**a tenfold positive impact**. By 2025, estimates based on projections of smartphone users and increases in number of IoT connections could result in **a further doubling of the avoided emissions** enabled by mobile technologies.

Q2. Do you think the GHG emissions abatement which may be facilitated by these means is significant? Please provide evidence in support of your response.

As referenced above, the GSMA Report highlighted that the use of all forms of mobile technology enabled a global reduction in Greenhouse Gas emissions of c. 2,135 million tonnes C02e last year.

The report includes a number of case study examples of enablement, covering six main categories:

–Smart Buildings
–Smart Energy
–Smart Living, Working, and Health
–Smart Transport and Cities
–Smart Agriculture
–Smart Manufacturing

Please find a link below to a full copy of the referenced report:

https://www.gsma.com/betterfuture/wp-content/uploads/2019/12/GSMA_Enablement_Effect.pdf

Q3. Do you think these use cases will have significant implications for networks, for example, in relation to resilience, capacity, latency or energy demand of ECN/ECS?

A: Vodafone IoT has helped its customers reduce their GHG emissions. Our IoT applications help our customers reduce emissions and include:

- **Smart logistics** – IoT technologies embedded in vehicles to optimise route management, vehicle maintenance and driver behaviour, delivering cuts in fuel consumption of up to 30%.

We estimate that over 31% of the more than 85 million IoT connections we operate directly enable customers to reduce their emissions and we expect this proportion to increase over time.

During 2019, the total GHG emissions avoided as a consequence of our IoT technologies and services was 5.9 million tonnes CO2e, which is nearly three times the emissions generated from our own operations.

In 2015, we announced our intention to help our customers reduce their GHG emissions by two tonnes for every one tonne of GHG generated from our operations. We have achieved our original 2015 target, having enabled our customers to avoid 2.1 tonnes of GHG emissions for every one tonne generated from our operations.

Practical Considerations

Q4. What are the enablers and inhibitors (technological, societal, economic or regulatory) of the use cases described in this chapter?

AGRICULTURE USE CASES

Inhibitors

- *Despite the potential of digitization, the agriculture sector is shown to have the lowest digital penetration rate of any other industry[1]. The challenges for uptake in technology include:*
    - *High purchase cost of technology (**Economic**) –Large organisations and commercial farms have higher rates of technology adoption, due to their ability to invest in dedicated innovations and training, reducing investment risk[2]. Lack of technical accessibility and affordability creates a technology gap between commercial and small/mid-sized farms. However, digital technologies can be particularly beneficial for small/mid-sized farms that cannot afford labour but seek ways to bring efficiencies and optimize yield. Yet, financial constraints inhibit small farm-owners to acquire and deploy the use cases described.*
    - *Skills Gap/aging population (**Societal**) -. Currently, under 6% of all European farms are run by farmers younger than 35 while more than 31% of all farmers are older than 65[3]. This intensifies the skills gap as farmers lack access to skills/knowledge to make the most of these technologies.*

Enablers

- ***Technology** itself as an enabler increased efficiency of sector and achieving sustainability goals - Digital technologies have the potential to deliver impact across food value chains by reducing costs, helping farmers make sustainable decisions, improving access to information and markets, and empowering youth in particular. In particular, IoT solutions can also address increasing labour shortages and costs emerging due to an ageing farming population with fewer young farmers joining the industry. Smart farming provides a wealth of value through the use of IoT and smart sensors that are giving farmers valuable information, including soil moisture, nutrient levels, the temperature of produce in storage, and the status of farming equipment[4]. This has the ability to increase the quality, quantity, sustainability and cost effectiveness of agricultural production.*
- ***Regulation –** the agriculture sector and farmer in Europe rely government support for the development of the sector. The EU Common Agriculture Policy is an example of how government can enable the adoption of the use cases described:*
    - *In July 2018, the European Commission proposed a Common Agriculture Policy (CAP) budget of €365 billion for the 2021- 2027 period[5]. Within the proposed CAP budget, €10 billion will be set aside for research and innovation in food, agriculture, rural development and digitization.*

[1] Digital America: A tale of the haves and have mores
[2] Precision agriculture in Europe: Legal, Social and Ethical considerations
[3] Young Farmers in the EU – Structural and economic characteristics
[4] Agriculture is fertile ground for digitization
[5] EU Budget: The CAP after 2020

ELECTRICITY USE CASES

Inhibitors

- ***Technology*** *- The smart building market remains fractured between large multisystem building service companies with bespoke protocols and smaller entrants with standardised or open protocol model reliance. This has created silos around vendors and applications and resulted in high barriers to access data and control. Connectivity options have historically been restricted to short range technologies and building LAN reliance, which has also brought challenges in terms of costs and security. The advent of IoT gateways, edge analytics and the introduction of new LPWA & 5G technologies can bring down the barriers to delivering intelligent buildings going forward.*
- ***Societal*** *– inertia or the entrenchment of behaviour may take time to change, even if there is clear benefit to doing so. Simply rolling out smart meters does not equate to change in consumer behaviours in reducing energy consumption and making informed decisions. Consumers need to be informed how to best to utilise the information smart meters convey to make informed and sustainable choices for their home.*

Enablers

- ***Technology*** *itself as an enabler - across Europe, 75% of buildings are considered energy inefficient, and, depending on the Member State, only 0.4-1.2% of the stock is renovated each year. New disruptive technologies could play an essential role in helping to achieve greater energy efficiency in buildings. The information and control enabled by IoT devices are helping create intelligent buildings that:*
  - *Minimise the energy and associated CO2 needed to run assets and operations*
  - *Optimise the performance, efficiency, and lifespan of physical assets*
  - *Ensure the safety, security, and efficiency of people and processes, and*
  - *Aspire to improve the working and wellness conditions of its inhabitants and users*
- ***Regulation and policies*** *promoting smart metering and smart buildings/cities is a key enabler to push out the use cases into the market for wider adoption. Key examples include:*
  - *Member States are required to ensure the implementation of smart metering under EU energy market legislation in the Third Energy Package. To date, Member States have committed to rolling out close to 200 million smart meters for electricity and 45 million for gas by 2020 at a total potential investment of €45 billion[6]. By 2020, it is expected that almost 72% of European consumers will have a smart meter for electricity while 40% will have one for gas.*
  - *Through the Energy Performance Building Directive, the renovation of existing buildings is expected to lead to significant energy savings while generating other economic, social and environmental benefits[7].*

INDUSTRY USE CASES

Regulation on 5G deployment in Industry 4.0 Applications

Some governments are being heavily lobbied to set aside national spectrum for localised industrial use (as was seen in Germany) on the basis that this is required for future industrial growth - despite leading to inefficient spectrum use. It is important to demonstrate that there are alternative spectrum solutions for industry that are not inefficient.

Business end-users in the industrial sector, as outlined in the use cases, are considering how to implement 5G connectivity, the main technical options are as follow:

[6] Smart Metering deployment in the European Union

[7] Energy performance of buildings directive

- *MNO-provided service – an MNO takes full responsibility for delivering the 5G connectivity service to the business customer. It may involve a solution utilising a public network or a dedicated private network.*
- *Self-managed network – the business takes full responsibility for managing the 5G connectivity solution via its own private network.*
- *Hybrid solutions – the business chooses to manage some aspects of the 5G solution but partners with an MNO and/or Operational Technology company to deliver the full solution.*

The main technical and commercial options in relation to spectrum access include: dedicated licensed spectrum (national or local), leased spectrum, shared spectrum, and unlicensed spectrum. As per our recent 5G industrial spectrum report (https://www.vodafone.com/content/dam/vodcom/files/public-policy/5g-report/an-industrial-5g-spectrum-policy-for-europe.pdf), we commissioned Compass Lexecon to carry out a study (taking into account learnings from the German auction) in which they showed that set-aside policies will lead to a significant consumer welfare loss, reduce the incentive for investment by distorting competition, and inflate the costs of spectrum licences. In particular, the report argues that reservations of that scale in Germany were unjustified and likely to cause consumer harm to society as a whole. Furthermore, there are alternatives (such as Ofcom making non-mobile bands available for shared local licences and facilitating sub-leasing of mobile bands) that achieve a similar result at a much lower societal cost.

The report sets out a three-step framework to assess these types of decisions, namely:
- *Is there a "market failure" to justify considering departing from the accepted market-based approach to spectrum assignment?*
- *Assessment of cost and benefits of reserving spectrum*
- *Assessment of alternative options*

We also commissioned a study by Arthur D Little as part of our report that highlights the different industrial applications that are currently being deployed without spectrum reservation. The study undermines the claim that MNOs are incapable of providing services (e.g. mobile private networks) to meet the evolving requirements of industry and that the only alternative is spectrum reservation.

Q5. If the market will not deliver a particular use case, are there specific economic signals which could be used to promote investment in a specific use case?

- *Focusing in on electricity sector, which is liberalised, giving market signals tend to be a major challenge.*
    - *Government intervention: Reducing risk for investor by guaranteeing long-term prices to reduce the cost of capital could be considered. As an example, through feed-in tariffs, the government can use minimum carbon pricing as a supporting measure. This could be supported until technologies become mature enough where they are able to compete without any intervention (i.e. smart meters, smart grids). This however, may have its challenges included excessive pricing and stifling industry innovation.*

Q6. Do you think the impact of rebound effects is likely to have a significant impact on the abatement of GHG emissions which these use cases could deliver?

If the measures we have outlined within this document are put in place via the use of IoT or other connectivity pathways across all of use cases and sectors, there is a clearly defined set of GHG emission reduction achieved, which we have achieved within our own organisation and on behalf of customers.

Q7. Are there additional practical challenges which have not been identified?

A number of practical challenges have been outlined in the response to question 5.

Carbon Emissions of the Sector

Q8. What measures could be taken to reduce the carbon emissions of the sector? Please provide evidence in your response

A: Ireland is one of the few remaining countries in the Europe, including Greece, Hungary and Spain which are still required to provide physical bills free of charge to customers. Consideration of switching off paper printing and moving toward digital billing will make a positive impact in reducing GHG emissions.

To put this into context, between April and October 2019 Vodafone printed 7.2 million pages for 2 million paper bills during this period. As outlined earlier in our response, Vodafone are committed to reducing our GHG emissions by 50% by 2025, digital billing is an approach which can assist in achieving this objective. To date with our existing customer base we have worked engaged with ComReg on processes to support, as well as targeted campaigns such as auto-dialler, smart classes for 70+, retail store campaign and messaging on our billing and envelopes to raise awareness of the digital billing channel.

A number of initiatives are ongoing with new customers to increase the numbers opting for digital billing, including digital billing performance by channel, retail green champions and changes to our online sales journey.

In addition, we would recommend that consideration be given to the issuing of paper bills to customers either every second month or quarter, which would have a resultant positive impact on the amount of paper required for the billing process. Customers would still be billed on a monthly basis, with the digital format also available to customers, and in our view would support awareness and behavioural change and a greater acceptance of the option of digital billing. A consultation process may need to be initiated between operators, other relevant utilities and respective regulators.

To provide an overview and place such a move toward digital billing by the industry into perspective, every year Vodafone Ireland's paper billing uses over 9 million sheets of A4 per year and 3.3 million envelopes per year which consumes over 530 trees and 4 million litres of water per year. The paper and envelopes would cover the equivalent of the same area as 109 acres or 90 rugby pitches. Vodafone Ireland's current carbon footprint of paper billing annually including paper manufacture, print & transport/distribution is equal to 205 tonnes of C02e.

We currently already hold customer bills digitally, which produce far less CO2. For example, from work carried out by consultants Clearstream Solutions and analysis by our Networks team, digital billing uses approximately 540GB of data per year. Furthermore, the storing, downloading and viewing of bills annually would use a total of 11,500 kWh of energy. All of this activity would equate to 3.7 tonnes of C02e per year. In order to drive such an initiative and move to digital billing platforms, a cross sectoral approach from utilities, financial services & banking to create a hub to drive behaviours to switch off paper and move toward digital billing, with the support of their respective regulatory authorities.

Further measures which should be considered to support reduction include:

- sourcing and implementing more efficient network equipment;
- reducing energy demand by installing lower-energy power and cooling technologies; and
- cutting energy use by decommissioning and upgrading legacy equipment;
- activating energy-saving software features that optimise radio resources and energy consumption to reflect actual voice and data traffic requirements in real time;

Q9. Do telecoms operators assess their carbon footprint and set targets for reduction? What steps have telecoms operators undertaken to reduce the carbon footprint of their operations?

A: Providing communications services requires significant amounts of electricity. Every additional connected device and gigabyte of data transmitted or stored represents a potential increase in energy needs. The telecommunications and information and communications technology (ICT) industry faces a growing GHG emissions challenge as the sector's carbon and energy footprint increases: a recent study estimates that worldwide ICT energy consumption is increasing by around 9% per year.

While the emissions from ICT companies are growing, the services that communications companies provide can make a significant contribution to the reduction of emissions arising from their customers' operations. Through the Internet of Things (IoT), products and processes in the workplace and in the home can become significantly more efficient and reliable. This has a positive impact on energy and GHG emissions, as well as other environmental issues.

This year, as part of Vodafone's purpose, we have committed to halve our environmental impact by 2025. In order to reflect this in our goals, we have increased our GHG emissions target to achieve a 50% reduction by 2025 (previously 40%), against a 2017 baseline. We will deliver against this target by improving the energy efficiency of our network and purchasing 100% of the electricity we use from renewable sources.

We have started work towards our GHG reduction target through increasing focus on a series of energy efficiency programmes across our networks and servers, particularly in power supply and cooling.

Q10. What steps are undertaken by operators to conduct business with equipment vendors that have strategies in place for lower carbon emissions?

A: Regarding energy efficiency and a focus on GHG reduction in network procurement, we work with our equipment vendors to ensure that increased demand and business growth do not result in a similar percentage increase in electricity usage.

Over the last 12 to 18 months, we have:

- made energy efficiency a mandatory requirement in the procurement process for all energy-intensive network and IT products;
- developed more sustainable network technology, including the introduction of machine learning algorithms to optimise the usage of radio resources with minimum energy consumption; and
- evaluated emerging technology, including development of an innovation hub (Green Island) to showcase different technologies that promote sustainability and energy efficiency in radio access sites.

We incorporate power optimisation in design specifications for new infrastructure to ensure that each successive generation of equipment is more energy efficient.

Q11. What are the key drivers of GHG emissions in the telecoms sector in Ireland? Are GHG emissions of the sector expected to increase or decrease in the coming years? Please provide evidence in your response.

A: We are committed to improving the energy efficiency of our base station sites and in our technology (data and switching) centres. Unlike most ICT companies, which tend to have a small number of large data centres, Vodafone has a larger number of smaller technology and base station sites spread across different locations. This means that much of the energy consumed across our businesses is split between multiple sites that consume relatively small amounts of energy. Consequently, optimising our energy consumption is a complex challenge.

We use large numbers of servers and other network equipment, which generate significant amounts of heat during their operation. Cooling technologies are therefore an essential part of our strategy, as too much heat can harm components and lead to network failure.

Our energy consumption has remained largely static this year despite the significant growth in customer numbers and data traffic across the network. It would be our view that this will be reflected across the industry this year and in preceding, leading toward a further reduction as operators implement further energy efficiency measures and GHG reduction programmes.

Q12. Several studies have commented on the importance of spreading awareness of the environmental impact of digital services. Do you think such an initiative would be worthwhile in Ireland? Would it be feasible? How might this be achieved?

A: From a Vodafone perspective a campaign is essential, which should involve companies from across the ICT sector, telecommunications, regulatory authorities and state agencies. Though, the campaign should provide an opportunity to involve all relevant stakeholders to highlight how industry, customers and key stakeholders can work collectively to reduce GHG emissions and environmental impact by making changes to our networks, supply chain, work practices, billing process etc. The campaign could also act as a catalyst to help customer to understand how they can play a role in this process. A first step could be to consider a campaign to move relevant industries from print to digital billing, as outlined earlier. Such a national campaign would only deliver results by industry working with regulatory authorities and central Government.

Q13. How might regulation of ECN/ECS evolve in response to the challenges of climate change adaptation and mitigation?

A: In terms of the regulatory environment, there are a number of factors and impacts to consider; firstly from Vodafone it is our own network, where there will be a need to look at alternative sources of power to reliably run our network which is having to consider ever increasing demands. Some of the alternatives which we have outlined earlier in this response. Secondly, identifying efficiencies in our supply chain processes, such as reducing waste, whilst remaining up to date as technology continues to evolve, and also ensuring the rollout of the digital services economy and market in Ireland, which will underpin decarbonisation across all sectors.

More broadly, there will be a requirement for industry to do more to accurately identify decarbonisation gains in improving connectivity, e.g. connected meters reducing car journeys now needed to read meters. This carbon gain should more than adequately offset any increase in power consumption across telecoms, though there will need to be an agreed set of measures established and estimation methods so that industry can report on a continual basis.

Resilience and Adaptation

Q14. As weather conditions become more volatile with increased average and peak wind speeds, the loading on towers for operators is increased which in turn decreases the amount of equipment a tower can support. What steps are being taken to compensate for this and to minimise the number of new towers required to compensate for this effect of extreme weather due to climate change?

A: The next generation of RRUS are physically smaller and lighter than the previous generations used in network infrastructure.
However our antennas are getting bigger, as we are deploying more technologies overall and we will be moving to all RRU solutions – resulting in no more macro sites. This means more equipment installed on the tower. Overall, there will be a requirement to increase tower loadings in the near future. Furthermore cell density is projected to increase in urban areas to support 5G as I understand it

Q15. What energy saving measures are operators considering, as part of their design and operation of networks, for example, in relation to the powering down of network elements (i.e. DSL/GPON ports, router ports) during periods of inactivity. Similarly, with the advent of 5G technology, the number of frequency bands employed to deliver higher capacities is increasing. Are operators considering, as part of their network design, a means to facilitate turn down of some of these frequencies during non-busy periods when there is little or no demand on the radio resource at any given base station site?

A: Current power saving configurations in operation on the Vodafone radio network are as follows:

- 2G – BCCH Power Savings – All Cells – Night Time Activation
- 3G – Traffic Aware Power Saving on P/T cells – Night Time Activation
- 4G – Cell Sleep Mode Power Saving on L1800 4G Carrier Aggregation Cells – Night Time Activation
- 4G – Micro Sleep Tx Power saving on Cells with Feature Supporting Radios

Q16. To what extent might the lifecycle of network infrastructure be affected by climate adaptation or mitigation considerations?

A: Our supply chain management division is working closely with our network of suppliers to better quantify the environmental impact associated with the production of our network infrastructure equipment. We have implemented some circular economy initiatives and are working on more – equipment being repaired instead of being recycled etc.

Q17. Are operators considering the deployment of renewable energy production (and storage) as part of the network infrastructure?

A: Yes, we already have micro wind and solar deployed in our network. Vodafone are currently planning a large scale solar deployment on our primary data centre. We are working to procure renewable energy directly via a power purchase agreement. We have successfully trialled time shifting of our consumption from day to night rate and will transition to lithium batteries to further enable this. It should also allow for a reduction in consumption during periods of high carbon intensity.

Q18. What measures are operators undertaking to enhance the resilience of the physical infrastructure (i.e., poles and ducts) against extreme weather events, lightning and flooding and climate change?

A: We don't have a large amount of infrastructure of this type but we are working to enhance our resilience to power outages by improving our battery backup & generator capacity and our network diversity. This should help mitigate the impact of such events.

ENDS