



An Coimisiún um
Rialáil Cumarsáide
Commission for
Communications Regulation

Call For Inputs

Connectivity and Decarbonisation

Call For Inputs

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Contents

1	Introduction	4
2	Connectivity and the Green Agenda	7
3	Impact of the Green Agenda on Electronic Communications	18
4	Next Steps	23
5	Submitting Comments.....	24
	Annex of Questions	25

1 Introduction

Background and Context

- 1 The Commission for Communications Regulation (“**ComReg**”) is the statutory body responsible for the regulation of the electronic communications sector (telecommunications, radio-communications and broadcasting transmission) in the Republic of Ireland. ComReg has a range of functions and objectives in relation to the provision of Electronic Communications Networks and Services (“**ECN**” and “**ECS**”) in accordance with European Union (“**EU**”) and national legislation.¹
- 2 In response to the challenge of climate change, the Irish Government published its “Climate Action Plan 2019”² (“**Climate Action Plan**”) which charts a course towards ambitious decarbonisation targets. The Climate Action Plan recognises that Ireland must step up its commitments to tackle climate disruption and highlights the importance of Government and public bodies taking action to reach Ireland’s decarbonisation goals.
- 3 ComReg has already made efforts to ensure that it facilitates decarbonisation. In acknowledging the key role of Smart Grid as an enabler in the reduction of Greenhouse Gas (“**GHG**”) emissions³, ComReg recently assigned radio spectrum rights of use specifically for the provision of Smart Grid in the recently completed 400 MHz Award process.⁴
- 4 The Climate Action Plan calls for greater action from all public bodies in the response to climate change. Not only should public bodies work towards reducing their own emissions, but the Climate Action Plan calls for public bodies to stimulate action across Irish society.

¹ ComReg also has a remit to regulate the postal sector. However, the focus of this paper is specifically on electronic communications. With regard to climate change and its impact on the postal sector, please see ComReg’s 2020-2022 Postal Strategy Statement (ComReg Document 19/113).

² DCCAE (2019). “Climate Action Plan 2019” <https://www.dccae.gov.ie/en-ie/climate-action/publications/Pages/Climate-Action-Plan.aspx>

³ As noted by the United Nations (“UN”), International Telecommunication Union (“ITU”), the Electrical Power Research Institute (“EPRI”) and the Sustainable Energy Authority of Ireland (“SEAI”), among others. For example, EPRI has estimated that Smart Grid enabled electrical distribution could reduce electrical energy consumption by 5% to 10% and carbon dioxide emissions by 13% to 25%. See Smart Grid Utility Management Systems, Report ITU-R SM.2351-2, 06/17.

⁴ ComReg Document, 19/99

- 5 Responding to climate change is also a top priority at a European level. In December 2019, the European Commission published “The European Green Deal” communication which reset the European Commission’s commitment to tackling climate change.⁵ The communication reaffirms the target of zero net emissions of GHG in Europe in 2050 and notes that the European Commission will propose a “Climate Law” to enshrine this climate neutrality objective in legislation. The European Commission also intends to increase targets for reductions in GHG emissions by 2030 from 40% to at least 50%, compared with 1990 levels. Clearly, there is growing momentum for action on climate change both in Ireland and at a European level.
- 6 In response to the Government’s Climate Action Plan, ComReg is interested in exploring how the electronic communications sector can contribute to achieving these decarbonisation goals. ComReg is also interested in understanding how the sector can reduce its own carbon footprint and how it can adapt to a changing environment.
- 7 A number of regulatory bodies in other jurisdictions have already begun taking action on this topic. For example, ARCEP (the French telecoms regulator) recently published a working document assessing the carbon footprint of the Information and Communications Technology (‘ICT’) sector and is currently seeking evidence from interested parties.⁶ In addition, the Radio Spectrum Policy Group⁷ (‘RSPG’) has included a work item on climate change in its upcoming work programme.⁸
- 8 A range of recent reports have highlighted the potential for various forms of connectivity to enable carbon emission reductions across sectors of the economy (sometimes referred to as “Green ICT”⁹). These reports suggest that the electronic communications sector may be an enabler for decarbonisation. From an increasing use of tele-working and videoconferencing reducing GHG emissions associated with transport, to Internet of Things (‘IoT’) devices improving the efficiency of operations in agriculture or reducing energy consumption in the home, among others.

⁵ European Commission, (2019). “The European Green Deal” https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

⁶ ARCEP (2019). “Digital tech’s carbon footprint” <https://en.arcep.fr/news/press-releases/p/n/future-networks-3.html>

⁷ The Radio Spectrum Policy Group is a high-level advisory group assisting the Commission in the development of radio spectrum policy in the Community. Its members are representatives of Member States and the Commission. See the following link for further information <https://ec.europa.eu/digital-single-market/en/content/radio-spectrum-policy-group-rspg>

⁸ RSPG (2019). “Work Programme for 2020 and Beyond” https://rspg-spectrum.eu/wp-content/uploads/2019/10/RSPG19-029final-RSPG_work_programme_20_and_beyond.pdf

⁹ See for example

ITU (2017). “Green ICT Technologies: How they can help mitigate the effects of climate change” Available at: https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/ICTCC_Session_7_Green%20ICT%20Technologies%20V4.pdf

- 9 At the same time, the electronic communications sector needs to consider its own impact on the environment. While other Irish agencies have a direct remit in this area, ComReg is interested in understanding if more can be done to minimise the carbon footprint of the electronic communications sector.

Call for Inputs

- 10 The purpose of this Call for Inputs is to enable ComReg to better understand the electronic communications sector's relationship with climate change, including how the sector can assist in facilitating decarbonisation across the economy, how the sector can reduce its own carbon footprint and how it can adapt to a changing environment. A number of questions are posed throughout this document (and compiled in Annex 1). ComReg would welcome evidence and views of interested parties and encourages all stakeholders to respond.
- 11 ComReg intends to use this Call for Inputs to commence a discussion with a range of interested stakeholders, including operators and other Irish agencies (some of whom have direct remit in this area). This Call for Inputs will help inform ComReg's contribution to national strategy and debate that involves the electronic communications sector. ComReg will carefully consider the responses received, and will use them to inform ComReg's own strategy.
- 12 This Call for Inputs proceeds as follows:
- **Chapter 2** briefly discusses the findings of recent reports which estimate how connectivity can help to reduce GHG emissions across sectors. Reflecting on these reports and the Government's Climate Action Plan, this chapter identifies, on a preliminary basis, the areas where it appears the electronic communications sector may be able to facilitate reductions in GHG emissions.
 - **Chapter 3** considers whether there are steps which could be taken by the sector to reduce its own carbon footprint and to improve resilience in the face of climate change.
 - **Chapter 4** provides a brief summary of the document and sets out next steps.
 - **Chapter 5** sets out the process for interested parties to submit responses to this Call for Inputs.
 - **Annex 1** compiles a list of the questions raised throughout the document.

2 Connectivity and the Green Agenda

- 13 As identified in Government's Climate Action Plan, significant efforts are required across all sectors of the economy to reduce GHG emissions in Ireland. The electronic communications sector may have the ability to facilitate reductions in GHG emissions across a range of sectors of the economy.
- 14 The availability and access to ECN/ECS can enable a range of other ICT applications which can provide the opportunity to change the way we live and to enable a low carbon economy. The European Green Deal communication identifies that digital technologies are a critical enabler for attaining sustainability goals in many different sectors.¹⁰ The roll out of advanced mobile and fixed networks and the growth of the IoT, for example, could all assist in facilitating decarbonisation across the economy. For example, the use of smart building automation can facilitate improved energy efficiency and greater use of renewable energy, tele-working can reduce the need to travel while smart grids could improve the efficiency of utility networks.
- 15 In many cases, connectivity enabled by ECN/ECS operators can assist in facilitating the virtual replacement for a physical process which uses considerably less energy (reducing GHG emissions) but still enables people to achieve the same or similar results.¹¹
- 16 A range of reports have explored the potential environmental benefits that the Information and Communications Technology ('ICT') sector could facilitate. Reports have been produced by the Global e-Sustainability Initiative¹² ('GeSI'), the International Telecommunications Union¹³ ('ITU'), the International Energy

¹⁰ European Commission, (2019). "The European Green Deal" https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

¹¹ GeSI (2012). "SMARTer2020: The Role of ICT in Driving a Sustainable Future" Available at: https://www.telenor.com/wp-content/uploads/2014/04/SMARTer-2020-The-Role-of-ICT-in-Driving-a-Sustainable-Future-December-2012_2.pdf

¹² GeSI is an international consortium for the promotion of ICTs and practices that promote sustainable development and growth. GeSI is comprised of diverse and international members and partnerships, representing around 40 of the world's leading ICT companies, 12 global business and multiple international organisations, such as ITU, the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Program (UNEP). See the following link for a full list of GeSI members and partners <https://gesi.org/members>.

GeSI reports include:

GeSI (2019). "Digital with Purpose: Delivering a SMARTer 2030" available at: <https://gesi.org/storage/files/DIGITALWITHPURPOSESummaryWEB.pdf>

GeSI (2015). "SMARTer2030: ICT Solutions for 21st Century Challenges" Available at: http://smarter2030.gesi.org/downloads/Full_report.pdf

¹³ ITU-D, (2017). "Question 6/2: ICT and Climate Change" Available at: <https://www.itu.int/pub/D-STG-SG02.06.1-2017>

ITU, (2013). "The case of Korea: the quantification of GHG reduction effects achieved by ICTs" Available at: https://www.itu.int/dms_pub/itu-t/oth/Ob/11/T0B110000243301PDFE.pdf

ITU, (2015). "Question 24/2: ICT and Climate Change" Available at: https://www.itu.int/dms_pub/itu-d/opb/stg/D-STG-SG02.24-2014-PDF-E.pdf

Agency¹⁴ ('IEA'), the Organisation for Economic Co-operation and Development¹⁵ ('OECD') and McKinsey & Company¹⁶, among others.

- 17 These reports typically attempt to identify key sectors of the economy where the development of ICT applications – enabled by the connectivity provided by ECN/ECS - can facilitate abatement of GHG emissions.
- 18 For example, GeSI's "SMARTer2030" report identifies eight key sectors (Energy, Health, Buildings, Work & Business, Manufacturing, Food, Learning & Mobility and Logistics) which could see significant abatement of GHG emissions due to the development and application of ICT.¹⁷ Similarly, the ITU's Korean Case Study identifies 14 key ICT services which may facilitate decarbonisation.¹⁸
- 19 A number of reports have also attempted to quantify the GHG emissions abatement which ICT can facilitate. The ITU's 2013 Korean case study estimated that the total amount of expected GHG abatement through the 14 identified ICT services in Korea would be approximately 118 million tonnes of carbon dioxide equivalent ('CO₂e'), equivalent to 14.5% of Korea's predicted GHG emissions in 2020.¹⁹ GeSI's SMARTer2030 report estimated that ICT has the potential to enable a 20% reduction of global CO₂ emissions by 2030.²⁰ The report estimates that the potential for GHG emissions abatement facilitated by ICT is nearly 10 times higher than ICT's expected carbon footprint in 2030.

ITU (2017). "Green ICT Technologies: How they can help mitigate the effects of climate change" Available at: https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/ICTCC_Session_7_Green%20ICT%20Technologies%20V4.pdf

ITU, (2011). "Overview and general principles of methodologies for assessing the environmental impact of information and communication technologies" Available at: <https://www.itu.int/rec/T-REC-L.1400-201102-I/en>

ITU, (2015). "Methodology for environmental impact assessment of information and communication technologies at city level" Available at: <https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12431>

¹⁴ IEA, (2019). "Energy Efficiency 2019" https://webstore.iea.org/download/direct/2891?fileName=Energy_Efficiency_2019.pdf

¹⁵ OECD (2009). "Towards Green ICT Strategies: Assessing Policies and Programmes on ICT and the Environment", <http://www.oecd.org/internet/ieconomy/42825130.pdf>

¹⁶ McKinsey & Company (2017). "A strategic approach to climate action in cities—focused acceleration" Available at: <https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/A%20strategic%20approach%20to%20climate%20action%20in%20cities%20focused%20acceleration/Focused-acceleration.ashx>

¹⁷ GeSI (2015). "SMARTer2030: ICT Solutions for 21st Century Challenges" Available at: http://smarter2030.gesi.org/downloads/Full_report.pdf

¹⁸ ITU, (2013). "The case of Korea: the quantification of GHG reduction effects achieved by ICTs" Available at: https://www.itu.int/dms_pub/itu-t/oth/0b/11/T0B110000243301PDFE.pdf

¹⁹ ITU, (2013). "The case of Korea: the quantification of GHG reduction effects achieved by ICTs" Available at: https://www.itu.int/dms_pub/itu-t/oth/0b/11/T0B110000243301PDFE.pdf

²⁰ GeSI (2015). "SMARTer2030: ICT Solutions for 21st Century Challenges" Available at: http://smarter2030.gesi.org/downloads/Full_report.pdf

- 20 Based on a review of these reports, there are a number of key processes by which technology can facilitate reductions in GHG emissions. These processes include the ability to *Connect & Communicate, Monitor & Track, Analyse & Predict* and *Automate & Control*. A number of key technologies provided by ECN/ECS can facilitate these processes. Key technologies offered by ECN/ECS which make decarbonisation possible include Very High Capacity Networks ('**VHCN**') and IoT.
- 21 For example, Smart Building Products (using *IoT* technology) offered by ECN/ECS can allow consumers and businesses to *monitor & track* their energy usage. Through *analysis* of the gathered data, usage can be *controlled* or *automated* to reduce energy consumption and associated carbon emissions.
- 22 Considering the findings of these reports and the Government's Climate Action Plan, ComReg identifies, on a preliminary basis, four key sectors in which ECN/ECS may be able to facilitate abatement of GHG emissions to help achieve the Government's Climate Action Plan targets.
- 23 The four key sectors identified are: Electricity, Transport, Agriculture and Industry. The potential benefits for each of these sectors is briefly discussed below. Following a discussion of the potential benefits, a range of practical considerations are also briefly discussed.
- 24 Importantly, the GHG emissions abatement benefits which can be delivered by each of these four sectors rely upon resilient and high quality connectivity provided by ECN/ECS.

Electricity

- 25 The emergence and widespread adoption of ICT technologies in electricity systems can facilitate a range of opportunities to reduce energy related GHG emissions. The connectivity provided by ECN/ECS is a key enabler of these benefits. By using a network of connected devices, energy systems can be managed more efficiently by collecting, analysing, monitoring and exploiting real-time data.²¹ In particular, Smart Meters, Smart Grid and Smart Buildings can facilitate a range of benefits.

Smart Meter

- 26 Smart meters, which are capable of monitoring energy consumption and transmitting and communicating this information, open up a range of opportunities for reductions in GHG emissions. For example, smart meters may facilitate time of use electricity pricing, actively engaging consumers through demand-side management and microgeneration.²² The Commission for

²¹ Zhou, K., Yang, S. and Shao, Z., (2016). Energy internet: the business perspective. *Applied Energy*, 178, 212-222.

²² CERRE, (2019). "Smart Consumers in the Internet of Energy: Flexibility Markets and Services from Distributed Energy Resources"
https://www.cerre.eu/sites/cerre/files/cerre_smart_consumers_internet_of_energy_november2019_0.pdf

Regulation of Utilities ('**CRU**') has done significant work in this area, including estimating the potential reduction in peak energy consumption which smart meters may deliver in Ireland.²³

Smart Grid

- 27 Smart Grids provide the information to enable two-way data flows between various parts of a utility network. Smart Grid uses intelligent communication networks to bring together monitoring and control functions to enable grid analysis of various aspects of the utility systems.²⁴ Smart Grids have a significantly higher number of elements and sensors compared to the legacy grid. The sensors are used for data acquisition and information exchange between equipment and data centres, facilitating optimisation of delivery in response to demand, while existing utility distribution systems deliver resources uniformly.²⁵
- 28 As a result, Smart Grids can deliver significant reductions in the carbon emissions of energy networks. The Electrical Power Research Institute ('**EPRI**') has estimated that a Smart Grid enabled electrical distribution system could reduce electrical energy consumption by 5% to 10% and carbon dioxide emissions by 13% to 25%.²⁶ The Sustainable Energy Authority of Ireland ('**SEAI**') estimates that by 2050, Smart Grids will see an accumulated reduction in energy related CO₂ emissions of 250 million tonnes.²⁷
- 29 In order to deliver these benefits, a Smart Grid requires reliable and resilient communication infrastructure able to provide real-time secure communications.²⁸ In November 2019, ComReg published the results of the 400 MHz Award and announced that new rights of use would be assigned to ESB Networks DAC in the 400 MHz band for the provision of wireless communications for Smart Grid.²⁹

Smart Buildings and Smart Cities

- 30 As smart devices become more prevalent, they can optimise demand for energy in buildings. For example, data collected by smart devices can be communicated with users, allowing users to monitor their energy use, control building functions such as lighting, cooling or heating, and detect faults or

²³ <https://www.cru.ie/wp-content/uploads/2017/11/CRU17324-Smart-Meter-Upgrade-Cost-Benefit-Analysis-Information-Paper.pdf>

²⁴ ComReg Document, 18/92

²⁵ ComReg Document, 18/92

²⁶ Smart Grid Utility Management Systems, Report ITU-R SM.2351-2, 06/17.

²⁷ <https://www.seai.ie/publications/Smartgrid-Roadmap.pdf>

²⁸ Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.

²⁹ ComReg Document, 19/99

abnormalities early – all remotely.³⁰ This can facilitate the reduction in energy demand in buildings and associated GHG emissions.

- 31 Smart technologies can be applied more broadly across society to improve quality of life, for example, through the creation of Smart Cities (or Smart Sustainable Cities³¹ ('SSC')).
- 32 ICT can enable the aggregation and analysis of data across an SSC to understand how the city is functioning in terms of resource consumption and services to improve efficiency and reduce GHG emissions. For example, intelligent transport systems can optimise and improve urban mobility.³²
- 33 Work is already ongoing in Ireland to promote the development of SSCs. For example, Dublin City Council's ('DCC') Smart Dublin is an initiative of the four Dublin Local Authorities to engage with smart technology providers, researchers and citizens to solve city challenges and improve city life.³³

Electrical Vehicles ('EV') providing storage capacity

- 34 In addition, smart charging can also serve to alleviate pressure on energy networks. Cars, including EVs, typically spend about 95% of their lifetime parked.³⁴ These idle periods, combined with battery storage capacity and smart charging technology could make EVs an attractive flexibility solution for the power system. Each EV could effectively become grid-connected, enabling flexible demand or even acting as a storage unit with the potential to provide a broad range of services to the system.³⁵ Electricity sourced from EVs could provide flexibility and balancing services when needed.³⁶ This would be particularly useful in a system like Ireland's with an increasingly high share of variable renewable energy.
- 35 There are a range of ways in which connectivity provided by ECN/ECS can assist in facilitating the decarbonisation of the electricity sector. The widespread accessibility of VHCN and smart devices (via IoT) can allow consumers to

³⁰ GeSI (2015). "SMARTer2030: ICT Solutions for 21st Century Challenges"
http://smarter2030.gesi.org/downloads/Full_report.pdf

³¹ The ITU defines a Smart Sustainable City ('SSC') as an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects. See <https://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx>

³² <https://www.itu.int/en/ITU-T/ssc/Pages/info-ssc.aspx>

³³ <http://www.dublincity.ie/SmartDublin> See <https://smartdublin.ie/>

³⁴ (IRENA) 2019. "Smart Charging for Electric Vehicles" International Renewable Energy Agency https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_EV_smart_charging_2019_summary.pdf?la=en&hash=8A4B9AB5BAB3F2341B366271DCA6FF7EE802AED4

³⁵ (IRENA) 2019. "Smart Charging for Electric Vehicles" International Renewable Energy Agency https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_EV_smart_charging_2019_summary.pdf?la=en&hash=8A4B9AB5BAB3F2341B366271DCA6FF7EE802AED4

³⁶ CERRE (2019). "Electric Vehicles Roll Out in Europe: Towards an Improved Regulatory Regime"
https://www.cerre.eu/sites/cerre/files/cerre_2019_electricvehicles_energyregulation.pdf

better *monitor, analyse* and *control* their energy usage, reducing GHG emissions. These benefits create opportunities for consumers, businesses and for cities more broadly. These benefits could serve to aid Ireland achieving renewable energy targets and empowering the consumer.

Transport

- 36 The widespread availability and access to VHCN can assist in facilitating reductions in GHG emissions associated with the transport sector in a range of ways. A number of these are discussed below:

Virtual Replacement (tele-working/videoconferencing/e-commerce/e-health)

- 37 In many cases, connectivity provided by ECN/ECS can facilitate the virtual replacement for a physical process which uses considerably less energy (reducing GHG emissions) but still enables people to achieve the same or similar ends.³⁷ In the presence of VHCN, workers may have the opportunity to work remotely (or tele-work). Staff can stay home and work efficiently while avoiding the need to travel.
- 38 The Government's Climate Action Plan estimates that for each new remote worker, an estimated average net saving of up to 10 kWh per day will be achieved, reducing commuter transport energy use and carbon emissions. Similarly, availability of better online conferencing and collaboration tools will reduce the need for business travel and the associated carbon emissions.³⁸
- 39 Given that transport contributes around 20% of Irish CO₂ emissions in Ireland³⁹, growth in the use of teleworking and videoconferencing could be a way to significantly reduce GHG emissions. Previous estimates have suggested that teleworking and videoconferencing could replace between 5% and 20% of global business travel.⁴⁰
- 40 This not only applies in the case of work, but can similarly apply in the case of e-Learning, e-commerce, e-banking and e-Health, as patients, customers and students can avoid the need to travel.
- 41 However, when considering these benefits, it is important to also consider so-called "rebound effects". If improvements in technology increase efficiency and reduce costs for consumers, consumers may choose to increase

³⁷ GeSI (2015). "SMARTer2030: ICT Solutions for 21st Century Challenges"
http://smarter2030.gesi.org/downloads/Full_report.pdf

³⁸ DCCAE, (2019). "Climate Action Plan 2019" https://www.dccae.gov.ie/en-ie/climate-action/publications/Documents/16/Climate_Action_Plan_2019.pdf

³⁹ EPA (2019). "Provisional Greenhouse Gas Emissions 1990-2018"
http://www.epa.ie/pubs/reports/air/airemissions/ghgprovemissions2018/Report_GHG%201990-2018%20Provisional%20Inventory%20October%202019.pdf

⁴⁰ ITU (2017). "Green ICT Technologies: How they can help mitigate the effects of climate change" Available at:
https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/ICTCC_Session_7_Green%20ICT%20Technologies%20V4.pdf

consumption.⁴¹ This may ultimately reduce the overall reduction in GHG emissions facilitated by the use of digital services. This is discussed in further detail below.

- 42 In addition, these developments can also have knock-on effects. For example, the rise in e-commerce may increase the carbon footprint of the postal sector while decreasing the overall carbon emissions of transport.⁴² Responding to the challenge of increasing levels of e-commerce and its impact on the GHG emissions of the postal sector is considered in ComReg’s Postal Strategy Statement 2020-2022.⁴³

Traffic Control & Optimisation

- 43 Connectivity between cars, roads, lights and control systems allows for the gathering of real-time information on traffic conditions. Traffic control and optimization platforms can use this data to generate insights for drivers to avoid congestion or find the nearest parking spot, reducing time spent on the road and GHG emissions.⁴⁴ The European Green Deal communication also notes the benefits of smart traffic management systems and that the European Commission will help develop smart systems for traffic management through its funding instruments.⁴⁵ Smart Mobility is also considered as part of DCCs Smart Dublin initiative.⁴⁶

Smart Charging

- 44 Through smart charging, Electrical Vehicles (‘EV’) may not start charging as soon as they are plugged in. Rather, charging can be adjusted to specific times, for example, to off-peak times. This may be particularly useful for consumers in the presence of time of use electricity tariffs.⁴⁷ The ability to reduce the cost of

⁴¹ ITU, (2015). “Question 24/2: ICT and Climate Change” Available at: https://www.itu.int/dms_pub/itu-d/opb/stg/D-STG-SG02.24-2014-PDF-E.pdf

⁴² For a more detailed discussion about the positive and negative impacts of e-commerce on GHG emissions, see the following link.

ITU (2017). “Green ICT Technologies: How they can help mitigate the effects of climate change” Available at: https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/ICTCC_Session_7_Green%20ICT%20Technologies%20V4.pdf

⁴³ ComReg Document, 19/113

⁴⁴ GeSI (2015). “SMARTer2030: ICT Solutions for 21st Century Challenges” http://smarter2030.gesi.org/downloads/Full_report.pdf

See an example of in-road IoT sensors being used to optimise parking (‘Park and Joy’) in the following document.

GeSI (2019). “Digital with Purpose: Delivering a SMARTer2030” <https://gesi.org/storage/files/DIGITALWITHPURPOSESummaryWEB.pdf>

⁴⁵ European Commission, (2019). “The European Green Deal” https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

⁴⁶ <https://smartdublin.ie/about/>

⁴⁷ CERRE, (2019). “Smart Consumers in the Internet of Energy: Flexibility Markets and Services from Distributed Energy Resources” https://www.cerre.eu/sites/cerre/files/cerre_smart_consumers_internet_of_energy_november2019_0.pdf

charging may incentivise more consumers to adopt EVs.

Connected Private Transportation

- 45 ICT-enabled car and ride sharing can allow for optimised usage of cars, lowering overall fuel consumption and GHG emissions while also reducing the need for vehicle ownership.⁴⁸
- 46 Improved levels of connectivity provided by VHCN and IoT present a range of opportunities for consumers to reduce carbon emissions associated with transport. From removing the need to travel entirely in the case of tele-working to *monitoring, analysing* and optimising the efficiency of travel in the case of traffic control and optimisation.

Agriculture

- 47 Connectivity provided by ECN/ECS can also assist in facilitating reductions in GHG emissions associated with Agriculture and Land use. The Government's Climate Action Plan notes that there may be limitations to GHG emissions abatement which may be facilitated in the Agricultural sector, given the nature of the sector's GHG emissions. However, the widespread adoption of advanced technologies could go some way to reducing the carbon emissions of the sector.
- 48 As an example, precision agriculture practices using IoT sensors has the ability to lower GHG emissions.⁴⁹ IoT sensors can be used to access real-time data to monitor and optimise land use.
- 49 For example, the Dingle Hub is currently running a farm ambassador pilot project. The project aims to demonstrate that through the use of IoT sensors and cloud computing, real-time, accurate and relevant scientific data can be used to improve the efficiency of farming and reduce associated GHG emissions.⁵⁰
- 50 One area of focus in the project is monitoring soil moisture levels to improve grassland management. By closely monitoring soil moisture levels, farmers could prevent animals from grazing on and damaging land that is too wet for grazing. Better grassland management in autumn will facilitate quicker grass growth in the spring and extend grazing periods. Extended grazing periods can reduce levels of slurry methane and nitrous oxide emissions from storage, reducing the GHG emissions of the farm.⁵¹

⁴⁸ GeSI (2015). "SMARTer2030: ICT Solutions for 21st Century Challenges"
http://smarter2030.gesi.org/downloads/Full_report.pdf

⁴⁹ Precision Agriculture Technologies Positively Contributing to GHG Emissions Mitigation, Farm Productivity and Economics. Sustainability 2017, 9(8), 1339 <https://ec.europa.eu/jrc/en/publication/precision-agriculture-technologies-positively-contributing-ghg-emissions-mitigation-farm>

⁵⁰ <https://dinglehub.com/projects-archive/precision-farming/>

⁵¹ <https://www.teagasc.ie/media/website/publications/2019/Bord-Bia-Beef-Carbon-Navigator-LR4.pdf>

Industry

- 51 Advances in connectivity are contributing to a revolution in global manufacturing, where the use of ICT can enable connected industrial production.⁵² This is commonly referred to as Industry 4.0 or the Industrial Internet of Things ('IIoT').
- 52 The use of IoT sensors and machine-to-machine ('M2M') communications can transform manufacturing, delivering new levels of monitoring and control of processes, creating smart factories and smart supply chains. Manufacturing processes can be made more efficient, flexible and responsive, transforming how factories operate, improving productivity, reducing energy demand and associated GHG emissions.
- 53 5G deployment in Industry 4.0 applications could result in a step change in manufacturing efficiency which has the potential to facilitate reductions in GHG emissions.⁵³
- 54 The ability to connect IoT devices to *monitor, track, analyse* and *automate or control* industrial processes are all reliant upon reliable and secure connectivity provided by ECN/ECS.
- 55 As noted above, the benefits which can be delivered across these sectors all rely upon ECN/ECS to deliver reliable and high quality connectivity. In the absence of key technologies or reliable services delivered by ECN/ECS, these use cases would be unable to drive efficiencies or reductions in GHG emissions.
- 56 In addition to facilitating abatement of emissions across sectors, these technologies (such as IoT) could also present new opportunities to improve the monitoring of climate conditions, such as air and water pollution levels. By enabling real-time monitoring of conditions, these new technologies can enable better *monitoring* and *tracking, analysis* and predictions of climate conditions.

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?
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.

⁵² UN (2017). "Accelerating Clean Energy Through Industry 4.0: Manufacturing the Next Revolution" United Nations Industrial Development Organisation
https://www.unclearn.org/sites/default/files/inventory/report_accelerating_clean_energy_through_industry_4.0.final.pdf

⁵³ UN (2017). "Accelerating Clean Energy Through Industry 4.0: Manufacturing the Next Revolution" United Nations Industrial Development Organisation
https://www.unclearn.org/sites/default/files/inventory/report_accelerating_clean_energy_through_industry_4.0.final.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?
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Practical Considerations

- 57 A wide range of potential benefits which ECN/ECS could facilitate across sectors have been discussed above. However, there are a range of practical considerations which are required when considering the likelihood of these benefits occurring, potential mitigating factors and potential regulatory challenges.
- 58 Although these use cases may bring efficiencies or reductions in GHG emissions across sectors, the business case for these applications will need to be proven for companies to invest in delivering these benefits. For example, although quality connectivity may facilitate wider use of tele-working, the GHG emissions abatement which is delivered will depend on the number of firms and workers who make use of tele-working.
- 59 Moreover, the benefits which these technologies can provide need to be effectively communicated to promote usage and GHG emissions reductions. For technological solutions to drive reductions in GHG emissions, users need to understand their benefits and be motivated to use them. For example, the introduction of smart meters creates an opportunity for reductions in GHG emissions, but a quality user interface is also required to engage and empower consumers. Similarly, farmers may not engage with precision agriculture unless they understand and trust the benefits which the technology can provide.
- 60 If take-up of these services increases and society becomes more reliant on connectivity, the importance of the resilience of ECN/ECS will also increase.
- 61 Similarly, issues of data security and privacy may also grow in importance. Companies may be concerned that they become more vulnerable to hacking as they digitise their processes and connect all of their machines to a network.⁵⁴ Similarly, Smart City projects such as Waterfront Toronto have come under scrutiny regarding the potential exploitation of consumer personal data.
- 62 In addition, when considering the potential benefits outlined above, it is important to also consider so-called “rebound effects”. If improvements in technology increase efficiency and reduce prices or transaction costs for consumers, they may choose to increase consumption.⁵⁵ For example, if traffic congestion can be reduced due to traffic control and optimisation, it may

⁵⁴ UN (2017). “Accelerating Clean Energy Through Industry 4.0: Manufacturing the Next Revolution” United Nations Industrial Development Organisation
https://www.unclearn.org/sites/default/files/inventory/report_accelerating_clean_energy_through_industry_4.0.final.pdf

⁵⁵ ITU, (2015). “Question 24/2: ICT and Climate Change” Available at: https://www.itu.int/dms_pub/itu-d/opb/stg/D-STG-SG02.24-2014-PDF-E.pdf

encourage more individuals to drive, which may reduce the overall reductions in GHG emissions which are facilitated. GeSI’s SMARTer2030 report estimates that rebound effects could reduce carbon abatement potential by about 11% compared with its headline estimates cited above.⁵⁶

63 Moreover, the increasing demand for data and connectivity may also drive increases in the energy demand of telecoms networks and increase the carbon footprint of the electronic communications sector itself. The following chapter considers the GHG emissions of ECN/ECS and climate adaptation in further detail.

Questions: Practical Challenges	
Q4	What are the enablers and inhibitors (technological, societal, economic or regulatory) of the use cases described in this chapter?
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?
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?
Q7	Are there additional practical challenges which have not been identified?

⁵⁶ GeSI (2015). “SMARTer2030: ICT Solutions for 21st Century Challenges” Available at: http://smarter2030.gesi.org/downloads/Full_report.pdf

3 Impact of the Green Agenda on Electronic Communications

64 Regardless of whether the electronic communications sector is able to facilitate reductions in GHG emissions in other sectors, the sector also needs to consider its own carbon emissions and climate adaptation strategy. This chapter considers first the GHG emissions of the sector and then climate adaptation.

GHG Emissions of the Electronic Communications Sector

65 A number of reports have attempted to estimate the carbon footprint of the ICT sector, which includes, but is broader than the GHG emissions of ECN/ECS. Estimates for global carbon footprint of ICT have typically ranged from 3-4% of global GHG emissions.⁵⁷ One recent study estimates that data centres are the biggest GHG emitters in the ICT sector globally, at 45% of the total, followed by communications networks at 24% and smartphones at 11%, accounting for the production and operational energy requirements of ICT.⁵⁸

66 However, ComReg is not aware of estimates specifically regarding the GHG emissions of the electronic communications sector in Ireland. Gathering information about the sources of GHG emissions in the sector may be useful to identify potential solutions to reduce these GHG emissions.

67 Given the continued increase in the demands for data, this may place upward pressure on the energy demands and carbon footprint of networks. A recent report by ARCEP (the French Telecoms regulator) suggests that the energy efficiency improvements of telecoms operators may not be enough to offset the increases in traffic over the long term.⁵⁹

68 In its Climate Action Plan, the Government noted that a rising proportion of Irish electricity demand is powering data centres and that action is required. The Climate Action Plan aims to establish networks in key sectors (such as data

⁵⁷ Belkhir, L. & Elmeligi, A. (2018) "Assessing ICT global emissions footprint: Trends to 2040 & Recommendations" *Journal of Cleaner Production* <http://www.electronicssilent.com/wp-content/uploads/2015/02/ICT-Global-Emissions-Footprint-Online-version.pdf> (estimates 3.5% by 2020 and 14% by 2040)

The Shift Project, (2019). "Lean ICT – Towards Digital Sobriety" https://theshiftproject.org/wp-content/uploads/2019/03/Lean-ICT-Report_The-Shift-Project_2019.pdf (estimates 4% by 2020)

ARCEP (2019) estimates 3%. See <https://www.cullen-international.com/product/documents/countryreport/pdf/?section=6dc81df8-ec41-481b-9714-1d35e5caa5a5&uniqueNumber=B5TEEU20190012&orderBy=country>

⁵⁸ Belkhir, L. & Elmeligi, A. (2018) "Assessing ICT global emissions footprint: Trends to 2040 & Recommendations" *Journal of Cleaner Production* <http://www.electronicssilent.com/wp-content/uploads/2015/02/ICT-Global-Emissions-Footprint-Online-version.pdf>

⁵⁹ ARCEP (2019). "Digital Tech's Carbon Footprint" https://www.arcep.fr/uploads/tx_gspublication/reseaux-du-futur-empreinte-carbone-numerique-juillet2019.pdf

centres) to promote industry-led sectoral plans for decarbonisation.⁶⁰

- 69 The GHG emissions associated with specific complementary devices such as mobile handsets have also been considered. Estimates suggest that the production phase of handsets accounts for the largest proportion of the carbon emissions attributable to mobile handsets (around 80%) across the handsets life cycle.⁶¹ The use phase of a mobile handset represents a much smaller proportion of the carbon emissions attributable to the handset (estimates ranging from 11-17%⁶²) over its entire life cycle.
- 70 In combatting climate change, the electronic communications sector is already making efforts to reduce its carbon footprint. For example, a number of operators have signed up to Business in the Community's Low Carbon Pledge, committing to reducing their direct carbon intensity by 50% by 2030 and to report on their progress on an annual basis.⁶³ Operators also run a variety of schemes that have carbon emissions benefits, such as handset and modem recycling schemes or paperless billing. Indeed, operators are incentivised to reduce energy demand not only to reduce their carbon footprint, but to reduce network operating costs.⁶⁴
- 71 The use of VHCN by ECN/ECS may also serve to reduce the environmental impact of telecoms networks. ARCEP's recent report estimated that full fibre access networks use about a third of the energy use per line compared to an Asymmetric Digital Subscriber Line ('ADSL') using traditional copper networks.⁶⁵
- 72 In its European Green Deal communication, the European Commission notes that it will also consider measures to improve the energy efficiency and circular economy performance of the digital sector, from broadband networks to data centres and ICT devices.⁶⁶
- 73 In addition to rolling out more energy efficient networks, some proposals to

⁶⁰ DCCAE (2019). "Climate Action Plan 2019" <https://www.dccae.gov.ie/en-ie/climate-action/publications/Pages/Climate-Action-Plan.aspx>

⁶¹ See for example "Life Cycle Assessment of a Smartphone" <https://www.ericsson.com/assets/local/publications/conference-papers/life-cycle-assessment-of-a-smartphone.pdf> and https://www.apple.com/environment/pdf/products/iphone/iPhone_XS_Max_PER_sept2018.pdf

⁶² See "Life Cycle Assessment of a Smartphone" <https://www.ericsson.com/assets/local/publications/conference-papers/life-cycle-assessment-of-a-smartphone.pdf> https://www.apple.com/environment/pdf/products/iphone/iPhone_XS_Max_PER_sept2018.pdf and Belkhir, L. & Elmeligi, A. (2018) "Assessing ICT global emissions footprint: Trends to 2040 & Recommendations" Journal of Cleaner Production <http://www.electronicssilentpring.com/wp-content/uploads/2015/02/ICT-Global-Emissions-Footprint-Online-version.pdf>

⁶³ <https://www.bitc.ie/wp-content/uploads/2019/06/Low-Carbon-Pledge-Report-11.06.19.pdf>

⁶⁴ ARCEP (2019). "Digital Tech's Carbon Footprint" https://www.arcep.fr/uploads/tx_gspublication/reseaux-du-futur-empreinte-carbone-numerique-juillet2019.pdf

⁶⁵ <https://www.cullen-international.com/product/documents/countryreport/pdf/?section=6dc81df8-ec41-481b-9714-1d35e5caa5a5&uniqueNumber=B5TEEU20190012&orderBy=country>

⁶⁶ European Commission, (2019). "The European Green Deal" https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

reduce the carbon footprint of the sector have been made.

- 74 For example, The Shift Project encouraged greater awareness of the environmental impacts of digital services.⁶⁷ Similarly, ARCEP’s report also suggested that consumers should be better informed about the environmental impact of the devices or services they use. For example, consumers could be informed of the energy savings associated with downloading content over Wi-Fi rather than over a mobile network.⁶⁸ The report also considers whether consumers could also receive standardised information on their devices’ energy consumption or information about whether a device can easily be repaired.⁶⁹
- 75 Transparency on the environmental impact of ECS is also considered in the European Green Deal communication. The European Commission intends to assess the need for more transparency on the environmental impact of ECS, more stringent measures when deploying new networks and the benefits of supporting ‘take-back’ schemes to incentivise people to return their unwanted devices such as mobile phones, tablets and chargers.⁷⁰

Questions: Reducing 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.
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?
Q10	What steps are undertaken by operators to conduct business with equipment vendors that have strategies in place for lower carbon 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.
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?
Q13	How might regulation of ECN/ECS evolve in response to the challenges of climate change adaptation and mitigation?

⁶⁷ The Shift project (2019). “Lean ICT: Towards Digital Sobriety” https://theshiftproject.org/wp-content/uploads/2019/03/Lean-ICT-Report_The-Shift-Project_2019.pdf

⁶⁸ <https://www.cullen-international.com/product/documents/countryreport/pdf/?section=6dc81df8-ec41-481b-9714-1d35e5caa5a5&uniqueNumber=B5TEEU20190012&orderBy=country>

⁶⁹ <https://www.cullen-international.com/product/documents/countryreport/pdf/?section=6dc81df8-ec41-481b-9714-1d35e5caa5a5&uniqueNumber=B5TEEU20190012&orderBy=country>

⁷⁰ European Commission, (2019). “The European Green Deal” https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

Resilience and Adaptation

- 76 In addition to considerations regarding the reduction of the environmental impact of ECN/ECS, the sector will also need to prepare itself for, and respond to, the changes in conditions which climate change will bring.
- 77 In response to these challenges, the Government recently published its first Adaptation Plan for the communications sector (**‘Adaptation Plan’**), prepared under the National Adaptation Framework.⁷¹
- 78 The report acknowledged the risks to the sector associated with more frequent extreme weather events (such as flooding) but also to gradual changes (such as increases in temperature) associated with climate change.
- 79 In particular, overhead fibre and copper lines, underground cables, street cabinets and base stations were identified as being particularly vulnerable to these changes in climate. See the Adaptation Plan for further detail.
- 80 In response to these changes, the sector will need to adapt to ensure that networks remain resilient in the face of more challenging weather conditions. The Adaptation Plan also sets out a number of actions to implement its plan. See the Adaptation Plan for further detail.

Questions: 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?
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?
Q16	To what extent might the lifecycle of network infrastructure be affected by climate adaptation or mitigation considerations?
Q17	Are operators considering the deployment of renewable energy production (and storage) as part of the network infrastructure?

⁷¹ DCCA (2019). “Communications Sector Climate Change Adaptation Plan”
https://www.dcca.gov.ie/documents/Communications_Sector_Climate_Adaptation_Plan.pdf

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?
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4 Next Steps

- 81 As identified in the Government’s Climate Action Plan, significant efforts are required across all sectors of the economy to reduce GHG emissions in Ireland. In response to the Government’s Climate Action Plan, ComReg is interested in exploring how the electronic communications sector can contribute to achieving these decarbonisation goals.
- 82 The purpose of this Call for Inputs is to enable ComReg to better understand the relationship between the electronic communications sector and climate change. ComReg intends to use this Call for Inputs as a basis to commence a discussion with a range of interested stakeholders, including operators and other Irish agencies (some of whom have a direct remit in this area). ComReg is interested in understanding if more can be done by the sector to facilitate reductions in GHG emissions across the economy and minimise the carbon footprint of the electronic communications sector itself.
- 83 Having reviewed the Government’s Climate Action Plan and a range of recent reports which assess the potential for ICT to facilitate reductions in GHG emissions, ComReg considers that connectivity provided by ECN/ECS may be able to contribute toward a number of Government goals. In particular, on a preliminary basis, ComReg considers that opportunities exist in the electricity, transport, agriculture and industry sectors.
- 84 ComReg is also interested in understanding the carbon emissions of the electronic communications sector itself, and the efforts which can be made by the sector to reduce these GHG emissions. At the same time, the sector needs to consider how it will adapt in the face of a changing climate.
- 85 A number of questions are posed throughout this document (and are compiled in Annex 1). ComReg would welcome evidence and views of interested parties. ComReg encourages all stakeholders to respond.
- 86 ComReg looks forward to receiving inputs from all stakeholders. ComReg will carefully consider the responses received, using them to assess whether further actions are necessary and to inform our future strategy. If Government policy issues arise from these responses, we intend to share these submissions with relevant Government departments.

5 Submitting Comments

- 87 ComReg welcomes all written responses from stakeholders by **5pm on Friday 13th March 2020**. It will make the task of analysing responses easier if comments reference the relevant question numbers from this document. In all cases, please provide evidence in support of your views.
- 88 Responses must be submitted in written form (post or email) to the following recipient clearly marked “**Submissions to ComReg 19/126**”:

Eoin O’Connell
Commission for Communications Regulation
One Dockland Central,
1 Guild St.,
North Dock,
Dublin 1.
D01 E4XO
Ireland

Email: eoin.oconnell@comreg.ie

Annex of Questions

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?
- 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.
- 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?

Practical Considerations

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

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

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