25/04/2021
Submission on Ōtautahi Christchurch Climate Strategy

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Yes - We would like the opportunity to speak to the hearings panel about the STANZ submission.

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Introduction
The Safer Technology Aotearoa New Zealand Society (STANZ) was created in 2020 to help inform, educate and advocate in the public interest including, but not exclusively, to policy makers, regulatory bodies, educationalists, the medical and scientific community as well as local, regional and central government, about the safe use of technology.[1]

STANZ in general agrees with the goals outlined in the Ōtautahi Christchurch Climate Strategy 2021 for Christchurch. However, STANZ wants to make the central point that under Goal 3 and Programme 6 that the move away from resource intensive and high greenhouse emission industries needs to include digital and wireless technology which includes Information and Communication Technology (ICT), Cloud computing and wireless communications through the 4G and increasingly 5G systems cell phone transmitter technology, mobile smart phone use and the infrastructure and data centers required to run them (both locally and globally). Just when we need to be moving as a society to reduce greenhouse gas emissions this sector of the economy is massively increasing its requirements for energy outstripping the growth in renewable energy sources with it being reliant on increasing numbers of coal fired power stations in other countries e.g., China.

STANZ recommends that the CCC needs to take seriously the ICT, Cloud computing and mobile communications systems massively increasing energy requirements and increasing greenhouse gas footprint. The CCC needs to develop a plan that moves toward economic transformation and innovation that is part of a sustainable climate future for Christchurch that does not include mobile wireless 4G/5G systems.

STANZ recommends that the most energy efficient ICT system is a wired system that is not reliant on energy intensive wireless transmissions like 4G and 5G (and eventually 6G). Wired ICT systems are also faster and more secure.

STANZ outlines in this report why smart phones reliant on 4G and 5G (and 6G) mobile phones are resource intensive and high emission technologies that are incompatible with a goal for a climate sustainable society. The smartest mobile phone communication system for the future is to move to so-called “dumb phones” (e.g., Nokia) that only need the existing 2G/3G system which require much

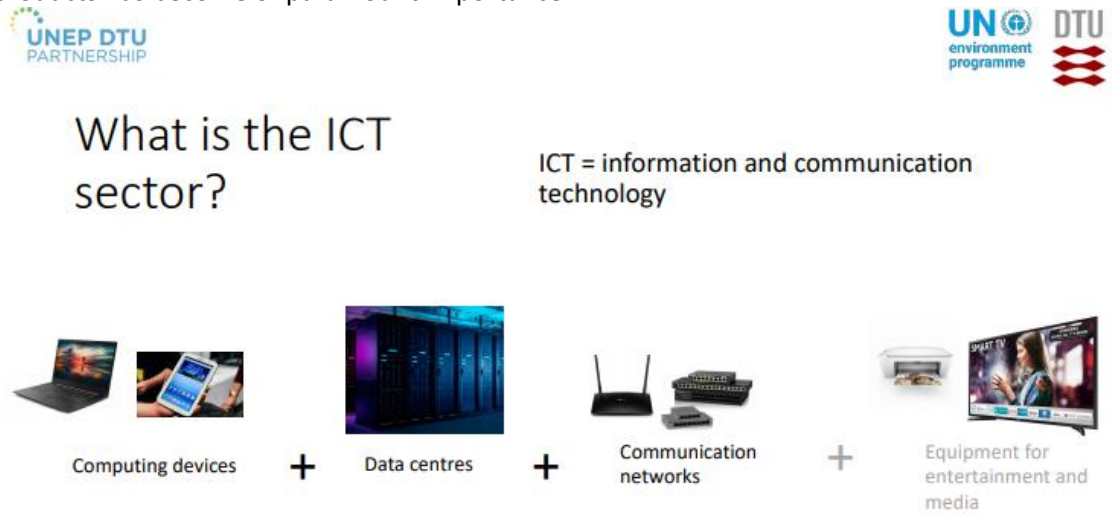
[1] https://www.safertechnology.co.nz/about/

less energy than the 4G, 5G and eventually 6G systems. This would also reduce emissions from globally located cloud computer centres required to provide computing services that smartphones need to work both locally and globally.

STANZ agrees with the French High Council on Climate report that the 5G system will increase greenhouse gas emissions. [2] STANZ recommends that the CCC opposes the increasing rollout and use of use of 4G and 5G mobile phone systems as to such time they can be proven safe for the climate, people and the environment.

1. **Information & Communication Technology Carbon Emissions**

The CCC climate change strategy needs to address a key component of the modern economy in the form of the digital and wireless economy (or ICT - Information & Communication Technology) and its growing greenhouse gas emissions profile. Both the production and use of ICT equipment has a tremendous impact on our environment in terms of the raw materials required to make them and the energy consumption to power them both locally and globally. Not to mention its end-of-life disposal costs and risks of pollution. The amount of electricity consumed by the ICT sector make this a major contributor to the current and future levels of carbon and greenhouse gas emissions with alarming forecasts if measures are not taken to reverse its effects. As the volume and variety of ICT devices in usage has grown, controlling the costs and environmental impact associated with these products has become of paramount importance.[3]



In a recent United Nations Environmental Program (UNEP) report on Greenhouse Gas Emissions in the ICT sector it notes that there are ways of assessing carbon impacts from ICT, websites, and mobile phone apps. [4]

[2] https://www.hautconseilclimat.fr/en/
[3] https://ictfootprint.eu/
[4] https://c2e2.unepdtu.org/wp-content/uploads/sites/3/2020/03/greenhouse-gas-emissions-in-the-ict-sector.pdf

UNEP DTU PARTNERSHIP

UN environment programme DTU

Tools for measuring carbon impacts

Commercial or Free	Name of the tool	Objective	More about the tool
Free	Ecoindex	Measure the carbon footprint of websites	www.ecoindex.fr
Free	Self-assessment tool	To obtain the approx. climate change and primary energy footprint of an ICT-based organization	www.ictfootprint.eu
Commercial	CO2 neutral website	Calculate CO2 emissions from website and reduce a similar amount of CO2 through climate projects	www.co2neutralwebsite.com
Commercial	CAST Green IT index	Measure software's environmental effect based on how efficiently it carry out intended actions, and how robust it is	www.castsoftware.com
Commercial	Greenspector	Performance measuring tool for mobile apps	www.greenspector.com
Commercial	Ecochain	Activity-based footprinting at the product, company, and value chain level	www.ecochain.com

The key points from the UNEP report show that:
• Trends in the ICT sector are heading in the direction of turning the sector into a significant contributor to global GHG emissions.
• A call for optimizing the ICT sector for energy efficiency – UN Environment's United for Efficiency.
• A call for more estimates of the GHG impacts of ICT devices and ICT solutions, with open, transparent data.
• A call for prioritizing sustainable human-computer interaction: "sustainability through design", and "sustainability in design".

It has been estimated that ICT related CO_2 emissions *"from 2012 to 2015 went from emitting 6 million tons of CO_2 to 30 million tons. In other words, CO_2 production quintupled in just 3 years, which was equivalent to adding 5 million cars on the roads. Up to 90% of this consumption was attributable to wireless communication network technologies!"*[5]

On top of this it is estimated that the energy consumption of ICT is increasing by 9% every year. Because digital technologies are recognized as essential for economic and social development, digitalization appears as an absolute need for all countries and companies. It is also considered as a way to reduce energy consumption in many sectors. However, direct environmental impacts as well as indirect environmental impacts (rebound effects) related to the growing use of ICT are constantly underestimated. Currently the ICT industry is resource intensive and growing in its greenhouse emissions all the time.

1.1 An increasingly energy-gulping digital world
The fast expansion of ICT leads to a rapid increase of its direct energy footprint. This footprint includes the energy used for the production and the use of ICT equipment (servers, networks, terminals). This direct footprint has been increasing by 9% per year. Compared to 2010 the direct energy consumption generated by 1 euro invested in digital technologies has increased by 37%. The energy intensity of the ICT sector is growing by 4% per year, in stark contrast to the trend of global

[5] https://ehtrust.org/wp-content/uploads/Wireless-Technologies-Ethical-Risk-Analysis-Working-Paper-2021.pdf

GDP's energy intensity evolution, which is declining by 1.8% per year. The explosion of video uses (Skype, streaming, etc.) and the increased consumption of frequently renewed digital equipment are the main drivers of this inflation.

Andrae & Edler of Huawei Technologies, On Global Electricity Usage of Communication Technology: Trends to 2030 Challenges 2015 estimates that in the worst-case scenario, that ICT electricity usage could contribute up to 23% of the globally released greenhouse gas emissions by 2030. [6]

And these figures are from before the Covid-19 Pandemic which has driven a massive increase in the use of video calls, remote working from home and online streaming of entertainment e.g., Netflix etc.

> "*Behind each byte we have mining and metal processing, oil extraction and petrochemicals, manufacturing and intermediate transports, public works (to bury the cables) and power generation with coal and gas. As a result, the carbon footprint of the global digital system is already 4% of global greenhouse gas emissions, and its energy consumption rises by 9% per year*."
> — Jean-Marc Jancovici, President of The Shift Project, member of the French High Climate Council. [7]

Action Point - 1
The CCC needs to develop a plan that moves toward economic transformation and innovation that is part of a sustainable climate future for Christchurch that does not include mobile wireless 4G/5G systems.

2. 4G, 5G & 6G Driving Massive Increase in Energy Demand

The unbridled energy consumption of our wireless revolution, 4G, 5G (and soon 6G) and the Internet of Things (IOT) is contributing to climate change. 5G requires millions of new cellular antennas called "small cells" - basically shorter/smaller cell towers - to be built in neighbourhoods directly in front of our homes. These 5G antennas are to connect with billions of new wirelessly connected "smart" devices referred to as the Internet of Things. Telecommunication companies are well aware that 4G/5G will increase overall global energy consumption and with-it greenhouse gas emissions.

David Bruno, an expert in electromagnetic pollution, obtained a document from the National Frequencies Authority (ANFR) concerning the installation of an Orange relay antenna site in Marseille. According to him, "the colossal power of 5G antennas is to be feared". He analysed the Orange document and found the 5G relay antennas in the 3400 to 3800 MHz band will by themselves emit electromagnetic radiation twice as strong as the sum of the relay antennas of 2G, 3G and 4G technologies combined and in the near future, people living near relay antennas will be exposed to power density levels in W / m², at least 3 times higher than those of today.[8]

The demand for mobile phone technology is outstripping any increase in efficiency. The energy consumption will rise sharply due to the ever-increasing IOT energy demands at every stage of the lifecycle particularly for 5G equipment, from device manufacture to data centers to wireless data transmissions, and networks. It is estimated that:

[6] https://doi.org/10.3390/challe6010117
[7] https://ehtrust.org/wp-content/uploads/5G-and-Climate-Change-Flyer-EHT.pdf
[8] https://ehtrust.org/climate-change-and-5g/

- 70.2 million “small cell” tower bases will be installed by 2025.
- 500 billion devices are expected to be connected to the Internet by 2030.
- 8.9 billion mobile phone subscriptions worldwide by 2024.
- 60% growth a year in production of wireless peripherals (Wi-Fi/ Bluetooth speakers, appliances, wearables).
- 7-fold increase in mobile data traffic globally projected between 2017 and 2022.
- In economics, the Jevons Paradox is when technological progress increases the efficiency with which a resource is used, however demand and consumption increase as well. Thus- the end result is overall increased use of the resource, despite efficiency gains and with-it increased greenhouse gas emissions.

A typical 5G base station consumes up to twice or more the power of a 4G base station. Energy costs can grow even more at higher frequencies, in order to fuel the higher number of antennas and the denser layer of small cells. In addition, the computer facilities needed to support local processing and new internet of things (IoT) services provided on mobile devices will add to the overall network power usage. Although exact estimates differ by source, the general industry consensus is that 5G will double to triple energy consumption for mobile operators, once the new 5G network installations have been completed.

> “A lurking threat behind the promise of 5G delivering up to 1,000 times as much data as today’s networks is that 5G could also consume up to 1,000 times as much energy.”[9]

In a report released in November 2020 it was estimated that there will be a massive increase in the power needs of the world’s mobile technology with it more than doubling by 2030. This report is a joint study by InterDigital, a mobile and video technology research and development company, and ABI Research, with it focussed particularly on the 5G ecosystem. [10] Among its key points are:

- Over the next 10 years 5G will usher in aggressive growth in energy consumption. In 2020, the overall energy footprint of the global wireless ecosystem, including network infrastructure and end use devices, topped 19.8 million tons oil equivalent (Mtoe) per year. By 2030, consumption is expected to grow to 51.3 Mtoe – a number equivalent to all the energy to be consumed throughout Sweden, or roughly the same amount of energy to be consumed by all the households in the United Kingdom that year.

- Connected devices will grow exponentially as enterprises begin widescale deployment of IoT and 5G-enabled devices. This will result in a whopping 37% increase in overall total energy consumption by 2030 and spotlights the importance of device-side energy management to tackle the CO2 emissions associated with mobile devices.

- Communications service providers (CSPs) must deploy an array of new network architectures to support a proliferation of end devices to provide the best 5G user experience. These architectures include a network of millimeter-wave base stations, virtualization radio access network (vRAN), massive multiple input and multiple output (MIMO) antenna with beamforming, carrier aggregation, dynamic spectrum sharing, network slicing, and edge servers and gateways, and will unlock new capabilities, and new

[9] https://ehtrust.org/climate-change-and-5g/
[10] https://www.datacenter-forum.com/datacenter-forum/5g-will-prompt-energy-consumption-to-grow-by-staggering-160-in-10-years

layers of complexity, that result in much higher energy consumption in cellular networks than at present.

- As 5G usurps LTE (4G), energy consumption is expected to increase 61 times between 2020 to 2030 due to the energy demands of powerful network elements like massive MIMO and edge servers, the proliferation of 5G cell sites.

- Power consumption of the 5G network is expected to soar due to active network elements like energy-hungry baseband units, remote radio heads, small cells, and core networks.

It needs to be kept in mind that this massive increase in energy use will not just be limited to the actual running of the 5G infrastructure itself, but will also need to include the actual running of the ICT servers themselves that provide the services demanded by mobile users e.g., Facebook, YouTube, Twitter, Instagram, Google, Skype/Zoom, emails, movie videos on demand, games and music etc. At a time when we should be focussed on using less energy intensive, efficient and sustainable options 4G/5G technology is absolutely the wrong direction to be heading in.

As one physicist has put it:

> *The 5G revolution that the cell phone industry is so proud about is likely to prove to be an ecological disaster that could easily wipe out the Carbon emissions savings of the Paris accord.*[11]

2.1 French High Council on Climate

The French governments High Council on Climate issued a report in December 2020 on CONTROLLING THE CARBON IMPACT OF 5G. It states that 5G will increase greenhouse gas emissions in the next decade and that a moratorium would be preferable as these new frequencies have not been subject to a prior environmental assessment particularly in regard to 5G carbon emissions. It also notes that this should not be a substitute for a full assessment of all the environmental (including the material footprint), health, economic, financial, and social impacts, which should have been carried out beforehand.

For the purposes of this submission, we will just list its first recommendation on the need to clarify climate issues prior to the deployment of new wireless technologies such as 5G (and remember work is going on to develop 6G for 10 years' time which will be even more energy intensive):

> *"Assess new technologies from a climate perspective before deciding on measures accompanying their deployment, in the same way as the economic, financial, social, health and environmental impacts (including the material footprint) of new technologies are evaluated before deciding on any measures accompanying deployment. Such an assessment should have been conducted for 5G before deciding to allocate the necessary frequencies."*

STANZ believes that the CCC should read and follow the recommendations carried in this French report. STANZ also believes that there should be an immediate moratorium on 5G in Aotearoa until such time it has had a thorough and independent assessment of its potential environmental, climate and human health impacts.

[11] https://blogs.timesofisrael.com/the-green-dilemma-of-5g-densification/

The Executive Summary of this report can be found in English here:
https://www.hautconseilclimat.fr/wp-content/uploads/2020/12/hcc_rapports_5g-en.pdf

> "*Behind each byte we have mining and metal processing, oil extraction and petrochemicals, manufacturing and intermediate transports, public works (to bury the cables) and power generation with coal and gas. As a result, the carbon footprint of the global digital system is already 4% of the global greenhouse gas emissions, and it's energy consumption rises by 9% per year*."
>
> – Jean-Marc Jancovici, President of The Shift Project, member of the French High Climate Council

2.2 State of New Hampshire Final Report of the Commission to Study the Environmental and Health Effects of Evolving 5G Technology

STANZ would like to point out to the CCC that other jurisdictions are taking the risks from 5G very seriously and include for reference some information from the State of New Hampshire (USA) report from their Commission to Study the Environmental and Health Effects of Evolving 5G Technology:

> *What the Commission learned early on in its work is that you cannot talk about 5G without talking about the earlier generations 3G and 4G. Then the Commission embraced the concept of the Internet of Things (IoT) which is a world in which all electronic devices communicate via electromagnetic waves. This led to discussion of routers and other internal technologies. The devices receiving and sending signals via electromagnetic waves also became part of the discussion. So as the presentations and discussions went on, the Commission concluded that all things emitting radio frequency (RF) radiation needed to be considered together because of the interaction of all these waves. At the heart of the discussion was the research as to whether non-ionizing radiation causes biological effects on humans as well as other living organisms, either animal or plant. No one argues that ionizing radiation from the high energy and frequency ultraviolet, x-ray, and gamma ray end of the electromagnetic spectrum are a danger to all living things. Of concern to the Commission, and internationally, are the electromagnetic waves in the microwave range of energy and frequency. There is mounting evidence that DNA damage can occur from radiation outside of the ionizing part of the spectrum. We heard arguments on both sides of this issue with many now saying there are findings showing biological effects in this range. This argument gets amplified as [5G] millimeter waves within the microwave range are beginning to be utilized.*

Full report and recommendations here:
http://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf

2.3 5G Satellites and IOT

Currently underway is the deployment of tens of thousands of 5G satellites destined for low earth orbit by various private operators approved by the FCC. MBIE have already given Space X permission to transmit data to and from its satellites in NZ aerospace in the 5G spectrum. However, there has been no assessment of the impact on the climate (let alone on the ozone layer of the planet) from all of the rocket launches it will take to put in place and maintain these satellites. It is estimated that these satellites will last on average about 5 years as their batteries lose capacity to store power from their solar panels. This means that it will require a constant re-placement of the old and defective

satellites creating a treadmill of rockets emitting greenhouse gases and other toxic emissions on a continual basis. These 5G rocket launches will contribute to the:

- depletion of the ozone layer
- pollution from rocket launches (exhaust gases, black carbon, alumina, toxic chemicals)
- vast increase in energy consumption through the actual use of the 5G terrestrial and off-world satellite infrastructure
- climate impacts from manufacturing & disposal of all IOT connected "things" & infrastructure

A low carbon future demands that NZ does not participate in allowing the use of these satellites 5G microwave radio frequency radiation data transmissions in our atmosphere. Here is a list of companies that are actively planning to launch and operate large constellations of satellites in low orbit around the earth. The purpose of these satellite networks is to provide Internet and/or cell phone service everywhere on earth, as well as to facilitate the Internet of Things. All will shoot focused beams of radiation at the earth from phased array antennas.

SpaceX
SpaceX, based in the United States, already has approval to operate 12,000 satellites and has filed applications for 30,000 more. More than 1,300 have already been launched. At least initially, these satellites are for Internet only and will not communicate directly with cell phones. Subscribers will purchase a small rooftop dish and a Wi-Fi router. Beta testing by an estimated 10,000 subscribers in the U.S., Canada, U.K., Germany and New Zealand is already happening.

OneWeb
OneWeb, based in the United Kingdom, has already launched 148 satellites, and plans to begin providing service after it has 250 satellites in orbit. Initial service will be to northern latitude regions, including the UK, Europe, Greenland, Canada, and Alaska.

Telesat
Telesat, based in Canada, has increased its planned number of satellites from 117 to 1,671. It, too, is marketing its service to businesses. Its customers will include cruise ships, airlines, and governments. Telesat intends for its satellites to replace terrestrial fibre networks for long-distance communication.

AST & Science
This company, based in the U.S., is designing its satellites to communicate directly with cell phones. While this company does not plan to have as many satellites as its competitors, the power levels of its communicating beams will be much greater. Its application to the FCC specifies a maximum EIRP (effective radiating power) of up to 79.2 dBW, or more than 83,000,000 watts per beam.

Omnispace
This company, partnering with Lockheed Martin and the U.S. military (maybe even NZ's own RocketLab), is also designing its satellites to communicate directly with cell phones. Its brochure boasts that it will "enable the Internet of Things on a massive new scale. Omnispace has an experimental license from the FCC and has not revealed how many satellites it plans to operate.

Amazon
Amazon's application to operate 3,236 satellites was approved by the FCC last July.

Lynk
Like Omnispace and AST & Science, Lynk is designing its satellites to communicate directly with cell phones. Like AST & Science, Lynk has an experimental license from the FCC and has not revealed how many satellites it plans to operate.

Facebook
Facebook is planning to launch a constellation of small, 150-pound satellites, called CubeSats. It too has an experimental license from the FCC and has not revealed how many satellites it plans to operate.

Action Point – 2
STANZ recommends that there be a moratorium on the use and continued roll-out of the 5G system in Christchurch as to such time it can be proven safe for the climate, people and the environment. The CCC needs to lobby central government to help make this a reality.

Action Point – 3
STANZ recommends that the CCC follow a similar process to the French High Council on Climate and assess new mobile phone 4G & 5G technologies from a climate perspective including the economic, financial, social, health and environmental impacts (including the material footprint).

3. Dumb Phones are the Smartest Future for Gen Less

The CCC needs to address the question of what is the best wireless communication technology future that consumes the least energy in order to help meet the Councils climate change goals. The Gen Less TV advertisements ask people to make their own positive choices to help the climate. What they do not highlight is that one of best choices an individual can make is to have a dumb phone not a smart phone.[12]

The massive growth in the mobile phone industry over the past 25 years has led to a massive increase in greenhouse gas emissions to power it. The advent of so-called smart phones from 2007 onwards has seen a massive increase in the consumption of the natural resources to make them and the electrical power to run the Cloud based data processing systems services that people want to use e.g. social media. The 4G system from 2014 onwards has helped facilitate this massive increase in mobile phone data use and this is only expected to increase massively again with the rollout of 5G.[13]

> *"Our energy calculations show that by 2015, wireless cloud will consume up to 43 TWh, compared to only 9.2 TWh in 2012, an increase of 460%. This is an increase in carbon footprint from 6 mega tonnes of CO2 in 2012 to up to 30 mega tonnes of CO2 in 2015, the equivalent of adding 4.9 million cars to the roads. Up to 90% of this consumption is attributable to wireless access network technologies, data centres account for only 9%"*[14]

[12] https://www.androidauthority.com/best-dumb-phones-1117854/
https://genless.govt.nz/

[13] https://www.cesc.kth.se/polopoly_fs/1.647732.1600689929!/ceet_white_paper_wireless_cloud_v2%20(1).pdf

[14] https://ehtrust.org/wp-content/uploads/5G-and-Climate-Change-Flyer-EHT.pdf

Action Point - 4
The CCC need to directly address the fact that so-called wireless mobile technologies are increasingly contributing to global greenhouse gas emissions which cannot be allowed to continue on a business-as-usual model. In order to protect the environment, the CCC needs to do a full life-cycle assessment (environmental, climate and social) analysis of how Christchurch can have wireless communication devices without endangering the climate and environmental and human health in general. STANZ recommends a move to the new "dumb phones" on the 2G/3G systems to help mitigate any risk to the climate while providing for basic mobile communication needs.

In reality the most climate friendly future is not through a society based on an Internet of Things that is mobile and wireless. The most climate friendly future is a digital future that is primarily wired (or fibre) with an absolute minimum of use and exposure to wireless radio frequency radiation. Particularly as wired (fibre) ICT systems require much less energy use to communicate the same amount of data with no risk to human health and the environment.

4. SUMMARY

In summary STANZ has identified that the CCC needs to take into account the fact that the mobile wireless digital economy is resource intensive and a high greenhouse emitting sector of the economy that is unsustainable for the climate. Just when we need to be moving as a society to reduce greenhouse gas emissions the mobile wireless 4G/5G sector of the economy and its supporting ICT and Cloud infrastructure is massively increasing its requirements for energy and massively increasing its greenhouse gas emissions all of which will only make climate change worse. As such, STANZ recommends that the CCC consider taking action on the areas identified by STANZ in this submission:

Action Point - 1
The CCC needs to develop a plan that moves toward economic transformation and innovation that is part of a sustainable climate future for Christchurch that does not include mobile wireless 4G/5G systems.

Action Point – 2
STANZ recommends that there be a moratorium on the use and continued roll-out of the 5G system in Christchurch as to such time it can be proven safe for the climate, people and the environment. The CCC needs to lobby central government to help make this a reality.

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STANZ recommends that the CCC follow a similar process to the French High Council on Climate and assess new mobile phone 4G & 5G technologies from a climate perspective including the economic, financial, social, health and environmental impacts (including the material footprint).

Action Point - 4
The CCC need to directly address the fact that so-called wireless mobile technologies are increasingly contributing to global greenhouse gas emissions which cannot be allowed to continue on a business-as-usual model. In order to help protect the climate, the CCC needs to do a full life-cycle assessment (environmental, climate and social) analysis of how Christchurch can have wireless communication devices without endangering the climate and environmental and human health in general. STANZ recommends a move to the new "dumb phones" on the 2G/3G systems to help mitigate any risk to the climate while providing for basic mobile communication needs.

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The Cloud Begins With Coal – Big Data, Big Networks, Infrastructure, And Big Power.
An Overview of the Electricity Used by the Global Digital Ecosystem
https://www.tech-pundit.com/wp-content/uploads/2013/07/Cloud_Begins_With_Coal.pdf

Assessing ICT global Emissions Footprint: Trends to 2040 & Recommendations

Abstract
In light of the concerted efforts to reduce global greenhouse gas emissions (GHGE) per the so-called Paris Agreement, the Information and Communication Industry (ICT) has received little attention as a significant contributor to GHGE and if anything is often highly praised for enabling efficiencies that help reduce other industry sectors footprint. In this paper, we aim at assessing the global carbon footprint of the overall ICT industry, including the contribution from the main consumer devices, the data centers and communication networks, and compare it with the to the total worldwide GHGE. We conduct a detailed and rigorous analysis of the ICT global carbon footprint, including both the production and the operational energy of ICT devices, as well as the operational energy for the supporting ICT infrastructure. We then compare this contribution to the global 2016-level GHGE. We have found that, if unchecked, ICT GHGE relative contribution could grow from roughly 1–1.6% in 2007 to exceed 14% of the 2016-level worldwide GHGE by 2040, accounting for more than half of the current relative contribution of the whole transportation sector. Our study also highlights the contribution of smart phones and shows that by 2020, the footprint of smart phones alone would surpass the individual contribution of desktops, laptops and displays. Finally, we offer some actionable recommendations on how to mitigate and curb the ICT explosive GHGE footprint, through a combination of renewable energy use, tax policies, managerial actions and alternative business models.
https://www.sciencedirect.com/science/article/abs/pii/S095965261733233X

“Lean ICT: Towards Digital Sobriety”: New Report on The Environmental Impact Of ICT

The energy consumption of Information and Communication Technologies (ICT) is increasing by 9% every year. It is possible to limit this growth to 1.5% per year by moving to sober digital practices.

https://theshiftproject.org/en/article/lean-ict-our-new-report/

A Study of the Environmental Impact of Wired and Wireless Local Area Network Access

Abstract:

This paper presents a life cycle assessment of the energy and emission intensity of wired and wireless local area network access. Following a cradle-to-grave approach, the energy consumed and greenhouse gas emissions in the manufacture of Ethernet switches and Wi-Fi access points (including the extraction of raw materials, component manufacturing, assembly, and transportation) as well as during their actual usage are evaluated. The results show that while the manufacturing stage is responsible for a significant fraction of the overall energy consumption, the usage phase accounts for most of the emissions.

https://ieeexplore.ieee.org/document/6490245

On Global Electricity Usage of Communication Technology: Trends to 2030

Abstract

This work presents an estimation of the global electricity usage that can be ascribed to Communication Technology (CT) between 2010 and 2030. The scope is three scenarios for use and production of consumer devices, communication networks and data centers. Three different scenarios, best, expected, and worst, are set up, which include annual numbers of sold devices, data traffic and electricity intensities/efficiencies. The most significant trend, regardless of scenario, is that the proportion of use-stage electricity by consumer devices will decrease and will be transferred to the networks and data centers. Still, it seems like wireless access networks will not be the main driver for electricity use. The analysis shows that for the worst-case scenario, CT could use as much as 51% of global electricity in 2030. This will happen if not enough improvement in electricity efficiency of wireless access networks and fixed access networks/data centers is possible. However, until 2030, globally generated renewable electricity is likely to exceed the electricity demand of all networks and data centers. Nevertheless, the present investigation suggests, for the worst-case scenario, that CT electricity usage could contribute up to 23% of the globally released greenhouse gas emissions in 2030.

https://www.mdpi.com/2078-1547/6/1/117

Le Monde: The deployment of 5G in France is increasingly coming up against ecological concerns

Fierce Wireless "5G base stations use a lot more energy than 4G base stations: MTN" April 3, 2020