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BROADBAND USE AND ENERGY EFFICIENCY: FACILITATING EMISSIONS REDUCTIONS

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Fixed and mobile broadband internet connect the digital economy. Without them, we could not access the information, services, and markets we depend on and use everyday.

Along with being a powerful economic driver, broadband use and the associated digital economy have also had a substantial positive social impact, such as enhancing the delivery of public services like health care and education.[1] What's more, the contributions of the digital economy to increased efficiencies and reduced energy consumption have translated into positive environmental impacts, including reduced greenhouse gas (GHG) emissions.[2]

Given these benefits of the digital economy, facilitated by broadband internet and wireless mobility, it would be advisable for governments to re-examine the burdensome regulatory framework and public policies that stifle investment and innovation in this area. For example, the mandated sharing of networks at below-market prices dampens the incentives for larger companies to make significant infrastructure investments, and also reduces the incentives for these smaller companies to invest in their own competing networks.[3]

In particular, if Canada's federal government wants to hit its ambitious 2030 emission targets—amounting to reductions of between 287 and 324 megatonnes (Mt) of CO_2 equivalent, based on 2019 emission levels[4]—it will need all the help it can get from the telecom sector.

IMPROVED EFFICIENCY AND REDUCED ENERGY CONSUMPTION

Thanks to broadband deployment and use, information and communications technologies (ICT) and other digital technologies can contribute to a more efficient use of energy by reducing the amount of energy needed to deliver a product or service, eliminating wasteful energy consumption, or changing behaviours that affect consumption.[5] When energy is used more efficiently, energy consumption is reduced, as are GHG emissions, for a given output.

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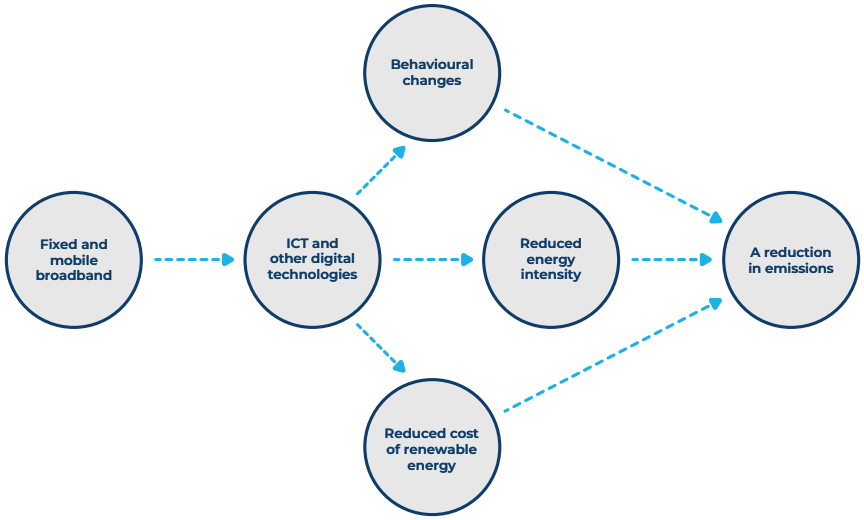
Energy is used more efficiently, for example, when a product's design, production, use, or end-of-life treatment is optimized.[6] Other examples of improved efficiency include decreasing the demand for transportation, among other lifestyle changes; improving industrial processes; and changing the way public services are accessed and delivered.[7] In addition, digital technologies have been shown to potentially decrease the relative cost of renewable energy production. All of these contribute to a reduction in emissions for a given output (see Figure 1).

It must be noted that improvements in efficiency that reduce the marginal cost of energy services can lead to increased consumption, in what is known as the rebound effect.[8] However, empirical studies show that at the macro-level, as the number of subscriptions to both fixed and mobile broadband services increases, emissions at the country level decrease.[9]

Figure 1

Impact of broadband-enabled ICT and digital technologies on emissions



Note: While the rebound effect can lead to some increased consumption, the net effect appears to be a reduction in emissions.
Sources: Jonathan D. Moyer and Barry B. Hughes, "ICTs: Do they contribute to increased carbon emissions?" *Technological Forecasting and Social Change*, Vol. 79, No. 5, June 2012, pp. 919-920; World Energy Council's Future Energy Leaders, *The role of ICT in energy efficiency management: Household sector*, 2018, pp. 8-9; Kenneth Gillingham, David Rapson, and Gernot Wagner, "The Rebound Effect and Energy Efficiency Policy," Resources for the Future, Discussion Paper, November 2014, p. 18.

Indeed, research shows that the digital economy has a significant inhibitory effect on carbon emissions.[10] A macro-analysis of 181 countries from 2002 to 2020 found that a 10-percentage-point increase in mobile broadband penetration is associated with a 7% reduction of CO_2 emissions per capita.[11] According to one conservative estimate, in the average OECD country, basic and fibre-based broadband connections reduced CO_2 emissions by at least 67 Mt between 2002 and 2019.[12] This is approximately equivalent to Ireland's total annual CO_2 emissions in 2019, or 9% of Canada's in the same year.[13] Thus, over longer periods of time, investments in broadband infrastructure contribute to reduced CO_2 emissions.

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The recent surge in remote working, enabled by broadband and ICT, is an interesting case study, with its displacement of commuter traffic and office use, which reduces energy consumption and emissions.[14] One study estimates that a 10% reduction in traffic congestion would result in the city of Montreal slashing 130,000 tonnes of CO_2 emissions, equivalent to removing 29,000 cars off the road.[15]

Between April 2020 and June 2021, 30% of the Canadian workforce worked remotely, compared to just 4% in 2016.[16] While the increase was due in large part to the pandemic and related public health restrictions, remote working is unlikely to be a short-lived phenomenon. Cost savings, productivity gains, and increased employee satisfaction have led many companies to consider hybrid work arrangements for employees.[17] While remote working could induce other behavioural changes that would increase energy consumption in the home, for instance, the net effect appears to be positive. A 2020 systematic review across a sample of 39 studies concluded that there was positive evidence for energy savings:

up to 15% reduction in overall energy use and up to 80% reduction in CO_2 emissions.[18]

INCOMING 5G NETWORKS WILL FURTHER REDUCE GHG EMISSIONS

Digital connectivity has evolved rapidly over the past two decades, from 3G streaming and videoconferencing to 4G networks which introduced higher bandwidth speeds and HD streaming. Now, incoming 5G networks are expected to deliver connections up to 20 times faster and with up to 100 times the network capacity compared to 4G, in addition to greater reliability and superior security.[19] Moreover, there will be direct increases in the energy efficiency of the networks, and indirect impacts across all sectors that utilize ICT and other digital technologies.

The new 5G networks are more energy efficient than previous forms of network infrastructure when performing the same functions. In fact, energy used in data transmission for a 5G cell site will be just 8% to 15% of what it is currently with a similar 4G cell site.[20] In Canada alone, one study estimated that with a rapid rollout, 5G can enable a reduction of up to 10 Mt of CO_2 equivalent between 2020 and 2030.[21] This is the equivalent of more than 2.8 million passengers flying from Montreal to Perth, Australia, on the other side of the planet.[22]

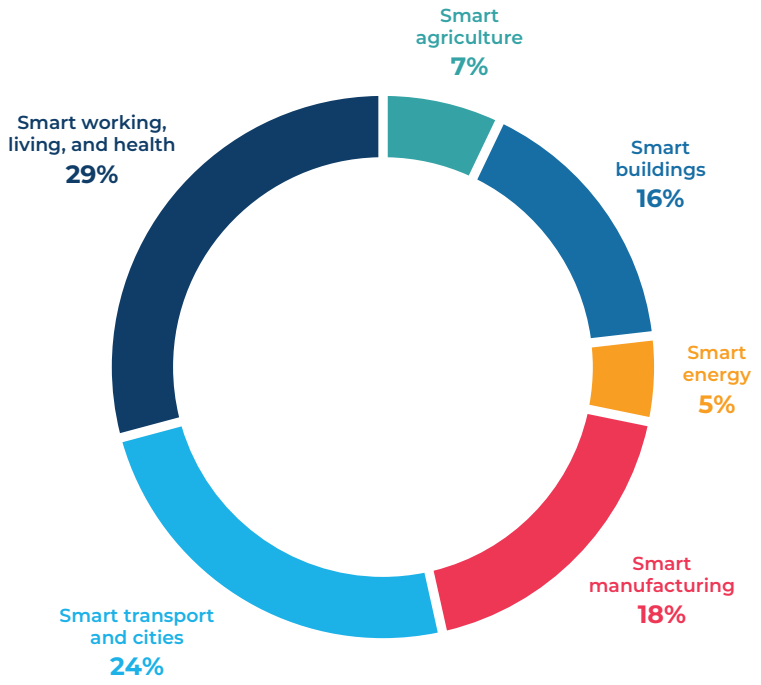
Between April 2020 and June 2021, 30% of the Canadian workforce worked remotely, compared to just 4% in 2016.

There are also indirect improvements to energy efficiency across all sectors facilitated by 5G that will contribute to reduced emissions. The 5G network architecture will facilitate the expansion of the Internet of Things (IoT)—the "fourth industrial revolution"—in which nearly everything will be connected to the internet.[23] Thanks to billions of sensors, intelligent management, and real-time data analytics, sophisticated learning and optimized processes can have very real impacts on energy efficiency and consumption, and therefore on GHG emissions.[24]

Take traffic management, for example. It was estimated in 2016 that from 23% to 45% of metropolitan traffic congestion occurs around intersections due to the static nature of stop signs or traffic lights programmed to remain green or red for set intervals regardless of the flow of traffic.[25] With dynamic functioning, traffic signals can gauge traffic in real time and adjust lights based on volume and patterns, which improves efficiency. Certain North American cities have run such pilot projects as part of their smart transportation initiatives, and results show that smart signals can reduce time spent waiting at an intersection by 40% to 60%.[26] This translates to reduced CO_2 emissions, with a 2022 study estimating that global savings from smart traffic management could reach 205 Mt by 2027.[27]

Figure 2

Indirect carbon emission reductions by category/industry in Canada, 2025



Source: The Canadian Wireless Telecommunications Association and Accenture, *Accelerating 5G in Canada: The Role of 5G in the Fight Against Climate Change*, 2020, p. 22.

There are many other areas where smart technologies, enabled by 5G networks, can increase efficiency: smart working, lifestyle and health applications (enhanced remote working, virtual conferences, etc.), building automation and smart design, more sustainable farming, reduced energy consumption of individual devices, smart grids, and more (see Figure 2).[28] One 2019 study projected that an expedited global rollout of 5G could reduce cumulative carbon emissions by 500 Mt by 2030.[29]

MOVING FORWARD

As a major contributor to Canada's overall economy, the digital economy has fundamentally transformed and reorganized Canadian society. In 2019 alone, GDP associated with the digital economy was over $104 billion,[30] and had grown about 40% faster than total GDP over the previous decade. The rollout of 5G networks and associated technologies is expected to add another $120 billion to Canadian GDP by 2036.[31]

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Every sector of activity in Canada has been tasked with reducing GHG emissions and decarbonizing. The increases in energy efficiency and decreases in energy consumption facilitated by broadband networks and the digital economy are considerable, and there is significant potential for 5G networks to achieve further efficiencies, both directly and indirectly. But maximizing this potential will require the timely deployment of next generation digital infrastructure, which itself will require massive investment. To encourage this, the federal government should provide a transparent and predictable regulatory framework, and eliminate any public policy measures that could dampen private investment or hamper innovation.

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