Aleksas Murauskas 260718389

ECSE 310 ICT GHG Footprint Paper

The following paper will estimate my weekly Information and Communication Technologies(ICT) Greenhouse Gas(GHG) footprint and compare it to the GHG emissions released by a gasoline powered car. My personal ICT interactions can be broken into two subsets Local and Network.

The Local set is made up of the devices I interact with, namely my Dell Inspiron 15 laptop, One plus 5 smartphone, and Videotron WIFI router. Firstly, my laptop is active roughly 6 hours a day and in in sleep mode the remaining 18 hours. My laptop model uses about 20 Watts while in active mode and about 1 W/s [4]. These values adjusted to kilowatt hours are .02 kWh and .001 kWh respectively. Multiplied by the hours a day they are in their respective mode the values become .12 kWh per day and 0.018 kWh per day, for a total of 0.138 kWh per day and 0.966 kWh a week. My cell phone’s battery has a capacity of 12.70 Wh, and is charged an average of twice a day. The new adjusted value is 0.0889 kWh a week. Lastly, the Videotron Wifi router has an idle consumption of 627 mWh and an active consumption 924mWh[5]. With an average of 12 hours idling and 12 hours in active mode, idle consumes 0.05 kWh and 0.077 kWh a week, at 0.1276 kWh. The Local subset of technology totals at 1.1825 kWh a week.

The Network subset refers to the power consumption of the number of computers in the ICT I interact with in between my local systems and remote servers. This system includes the Core Router, Edge Router, BNG, Ethernet Switch, and Data Centre Switch. The first reading displays each part of the system’s energy consumption per bit operation[6], they respectively follow 8.5, 25.2, 18.3, 21.4, 19.6 for a total of 93 nJ/bit operation. The energy per bit for Wi fi access is also estimated in the document to be 128 nJ/bit, for a total 221 nJ/bit for the network. My Videotron account displays I use roughly 10 gigabytes a day on my personal router, roughly 0.143 gigabytes through smart phone a day, and an estimated gigabyte per day on McGill’s WIFI, summing to 11.143 gigabytes of data a day or 78 gigabytes a week. Multiplying the estimated network cost per bit with the estimated gigabytes of interaction results in 1.37\*10^5 Joules of energy consumed or 0.03819 kWh a week by network interaction.

So now I have the power consumption in kWh for both network and local systems, which adds up to 1.22 kWh. Assuming all parts of the network use Hydro-Quebec’s electricity, which releases 17 grams of GHG per kWh[3], the GHG footprint of my power consumption is estimated to be 20.74 grams of GHG emissions a week.

For comparison I will now estimate the GHG emissions for the average passenger car in a week. The average passenger car GHG emission standard held by the United States in 2019 is 222 grams per miles[1]. The estimation of the miles driven a week for the average driver is 204.96 miles[2]. Multiplying the average GHG emission per mile and the average miles driven results in the weekly GHG emissions per vehicle, results in roughly 45.501 kg emissions of GHG released a week. By this comparison I expend 0.0004558 of the GHG emissions released from the car. My system would need to run for about 2000 weeks to expend the same amount of GHG as a passenger vehicle does in one week.

Sources

[1] <https://fas.org/sgp/crs/misc/R45204.pdf>

[2] <https://www.urban.org/sites/default/files/publication/49536/2000192-American-Driving-Survey.pdf>

[3] <http://www.hydroquebec.com/data/developpement-durable/pdf/ghg-emissions.pdf>

[4] <https://www.researchgate.net/publication/303817773_Good_practices_in_the_use_of_ICT_equipment_for_electricity_savings_at_a_university_campus>

[5]<https://www.researchgate.net/publication/267624438_Power_consumption_of_WLAN_network_elements>

[6] Class reading: Energy Consumption Comparison of Interactive Cloud-Based and Local Applications