Work, commute and travel during COVID-19

Prepared for Natural Resources Canada

By Electric Mobility Canada

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Preamble

The COVID-19 crisis has affected the entire planet. From citizens to businesses, from governments to institutions, Canadians have all been affected by this pandemic at various levels.

One of the sectors that has been the most affected by the pandemic is transportation. During the initial lockdown period, vehicle traffic dropped dramatically (on the order of 60%), resulting in improved air quality and clear skies. Traffic jams disappeared, leaving more room for pedestrians and cyclists. Urban citizens became increasingly aware of the link between urban air pollution, vehicles and transportation.

In this context, Electric Mobility Canada (EMC) seized the opportunity to organize a two-day virtual conference on July 7 and 8, 2020. The purpose of this conference was to bring together experts from various backgrounds to discuss the impacts of COVID-19 and the opportunity to plan for post-COVID economic recovery projects and programs in Canada, focusing on electric mobility. The team at EMC was pleased with the quality of the discussion and the high number of participants (> 600).

This report is intended to be a portrait of the impacts of COVID-19 on transport and the environment, as discussed in the virtual conference in July and the state of the sector in September 2020. The content of this report comes from three distinct sources:

- Speakers that attended the conference organized by EMC in July (Theme: Work, commute and travel during and beyond COVID-19);
- A survey sent to EMC members (businesses, not for profit, fleet managers, energy providers, etc.); and,
- Research conducted by the authors of this report, namely
  - Daniel Breton, President and CEO of Electric Mobility Canada
  - Pierre Langlois, Ph.D., electric mobility consultant (www.planglois.com)
  - Pierre Ducharme, President, Marcon-Miratech

This report will provide an overview of the major impacts of the pandemic on transport and the environment. Also, in the introduction, an overview of the present state of the federal government involvement in electric mobility will be given, together with a summary of COVID-19 impacts on various aspects of the society. A section of the introduction is dedicated to the impact on oil demand, given the importance of this sector in the Canadian context.

Introduction

The Government of Canada has set a net zero greenhouse gas emission target for 2050. As one of the means to achieve this goal, the Government of Canada, as well as certain provinces and territories, has enacted various measures to accelerate the transition towards the electrification of transportation for vehicles ranging from light duty to heavy duty.

The Federal Government and Electric Mobility

In 2016, Government of Canada issued the *Pan-Canadian Framework on Clean Growth and Climate Change (PCF)*[1], which provided recommendations for action toward a greener future.

- The PCF includes a concerted strategy to reduce emissions from transportation, organized by 4 main themes:
    - Setting emissions standards and improving efficiency
    - Putting more ZEV on the road
    - Shifting from higher to lower emitting modes, and investing in infrastructure
    - Using cleaner fuels

In December 2017, a 14-member *Generation Energy Council* was announced, with a mandate to advise on how Canada can transition to a reliable, low-carbon economy in the future. Their report was published in June 2018[2]. Recommendations from the **Generation Energy Council Report** for freight transport include:

- By 2030, decouple Canada's freight-related emissions from economic growth;
- By 2030, bring fleet average fuel efficiency in line with best-in-class standards worldwide; and,
- By 2030, achieve a significant shift to rail for long-distance transport.

Recommendations for personal transportation include:

- Vehicle fleet average fuel efficiency is aligned with best-in-class standards; and,
- By 2040, single passenger trips are halved in all medium and large cities by ensuring that Canadians have a sufficient range of transportation options including transit, ride-sharing programs and cycling.

In 2019, the Government of Canada has set ambitious federal zero-emission vehicle (ZEV) targets:

- 10% of all light-duty vehicle sales to be ZEVs by 2025,

[1] http://publications.gc.ca/site/eng/9.828774/publication.html

[2] Generation Energy Council, *Canada's Energy Transition – Getting to Our Future, Together*, June 2018, https://www.nrcan.gc.ca/climate-change/canadas-green-future/generation-energy/20093

- 30% of all light-duty vehicle sales to be ZEVs by 2030, and
- 100% of light-duty vehicle sales to be ZEVs by 2040.

Actions to date

Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative – EVAFIDI. Budgets 2016 and 2017 provided NRCan with a total of $96.4 million (over six years) to support the establishment of a coast-to-coast fast-charging network for EVs, natural gas stations along key freight corridors, and hydrogen stations in metropolitan centres. The program has targets to install 1,000 EV fast-chargers, 21 natural gas refuelling stations and 15 hydrogen stations.

Zero-Emission Vehicle Infrastructure Program – ZEVIP. Budget 2019 provided NRCan with $130M (over five years) for its new Zero-Emission Vehicle Infrastructure Program that will deploy 20,000 new chargers and hydrogen refuelling stations in more focused locations where Canadians live, work and play

Zero-Emission Vehicle Awareness Initiative. In 2019, Natural Resources Canada launched the Zero-Emission Vehicle Awareness Initiative that supports projects that aim to increase awareness of ZEVs, and public charging and refueling infrastructure, through education and capacity-building activities in support of a greater adoption of ZEVs by Canadians.

Greening Freight. NRCan has been supporting the freight industry to reduce emissions for many years, all the while ensuring competitiveness, by reducing fuel consumption and saving on fuel costs, through programs such as the SmartWay Transport Partnership, SmartDriver training and the Green Freight Assessment Program.

Electric Vehicle Infrastructure Demonstration (EVID) Program. Budgets 2016 and 2017 provided NRCan with a total of $76 million (over six years) to support the demonstration of next-generation and innovative electric vehicle (EV) charging infrastructure that address technical and non-technical barriers to the installation, operation and management of EV charging technologies. The last request for proposals in July 2019 also included support for hydrogen refueling infrastructure for medium and heavy-duty vehicles.

iZEV Consumer Incentive Program ($300M /3 years). Budget 2019 provided Transport Canada with $300 million for point of sale incentives for consumers who buy or lease an eligible ZEV. As of September 2020, a total of 56 vehicles are eligible (28 and 28 plug-in hybrids) for the incentives, according to Transport Canada. This includes variants such as range extenders and different model years. As of the end of September 2020, the program had received more than $255 million in claims.

Accelerated Capital Cost Allowance. Budget 2019 proposed a 100-per-cent write-off for zero-emission vehicles to support business adoption.

- Eligible zero-emission vehicles include electric battery, plug-in hybrid (with a battery capacity of at least 15 kWh) or hydrogen fuel cell vehicles, including light, medium- and heavy-duty vehicles purchased by a business.
- The measure applies to eligible vehicles purchased on or after March 19, 2019 and before January 1, 2024. Capital costs for eligible zero-emission passenger vehicles (e.g., cars and SUVs) will be deductible up to a limit of $55,000 plus sales tax.

These investments will be complemented by commitments included in the recent Fall Economic Statement and Canada's strengthened climate plan, A Healthy Environment and a Healthy Economy, which proposes to further accelerate zero-emission vehicle uptake by providing an additional $150 million, starting in 2021-22, for ZEV infrastructure and an additional $287 million in funding for vehicle purchase incentives that will make ZEVs more affordable for Canadians.

Pre-COVID

The federal EV adoption and climate change targets are ambitious, given that greenhouse gas (GHG) emissions from the transport sector currently represents 25% of Canada's total GHG emissions, second only to the oil and gas sector at 26%.

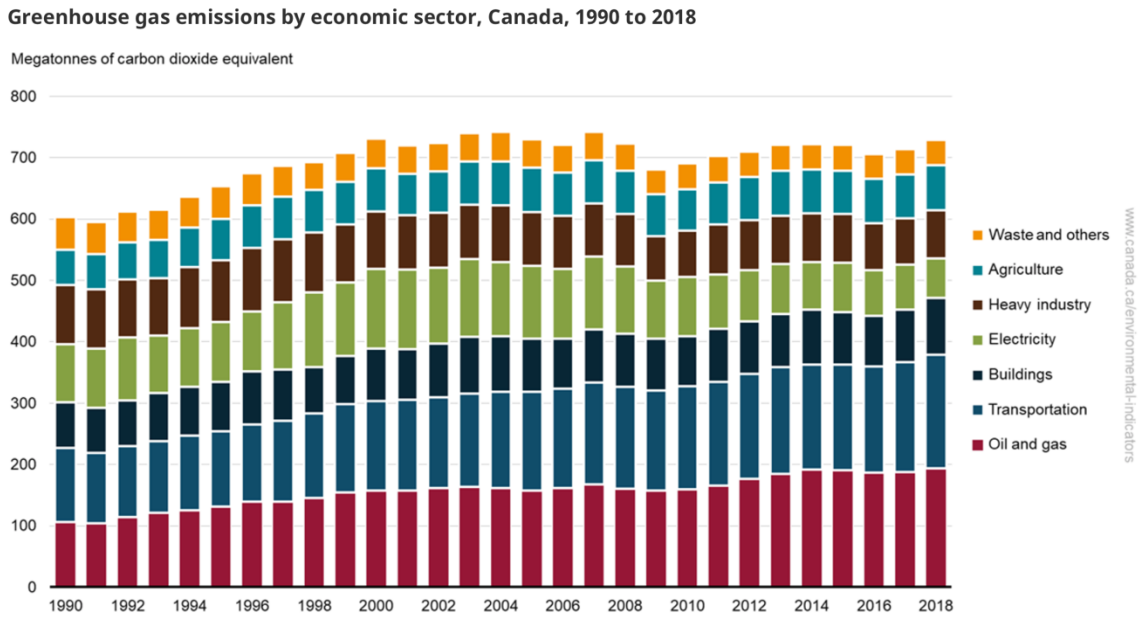

Figure 1: Evolution of greenhouse gas emissions by economic sector in Canada. Source : Government of Canada https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html

Between 2017 and 2018, GHG emissions from the transport sector have gone up 4 %, (from 178.6 to 185.9 Mt CO_2e) which is 50% more than the rise in GHG emissions from the oil and gas sector at 2.8%, (from 188 to 193.2 Mt CO_2e). If these rates are maintained, GHG emissions from the transport sector could soon become the largest source of GHG emissions in Canada out of all sectors of the economy.

According to the International Energy Agency (2019)[3], the fleet of light duty vehicles in Canada emits the most GHG emissions per kilometer globally.

These facts, in combination with the impacts that COVID-19 has had on the way Canadians work, commute and travel, will help determine what needs to be done over the next months and years to reach Canada's targets for EV adoption and in the fight against climate change.

Impacts of the COVID-19 Pandemic

Air Transportation

The closure of the borders resulted in a significant decline in international passenger flights but not air freight transport, as shown in the graph below made from the data of the International Civil Aviation Organization (ICAO). Cargo plane activity increased slightly as early as March, contradicting the assumption that the majority of flights had been grounded by the pandemic.

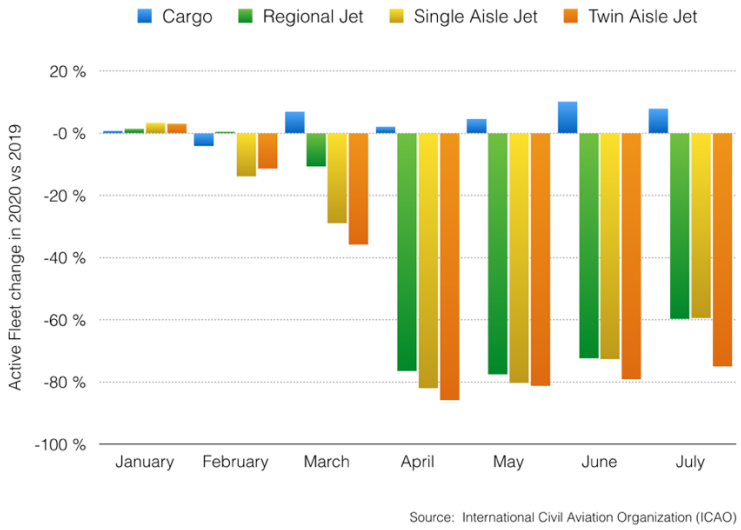

Figure 2: Comparison of the number of civil airplanes in the air between January and July 2020, by category. Source : ICAO, https://data.icao.int/COVID-19/aircraft.htm.

[3] International Energy Agency (IEA), 2019, *Fuel Economy in Major Car Markets: Technology and Policy Drivers 2005-2017*.

However, overall, air transportation is one of the sectors that has been the most affected by this pandemic and it can be assumed that air traffic will not completely resume in the short term. Air traffic has fallen 92% from 2019. In an editorial in the Edmonton Journal, Janet M. Riopel, president and CEO of the Edmonton Chamber of Commerce and Patrick Sullivan, chair of the Canadian Global Cities Council, said that "next year doesn't look much better, with 2021 passenger traffic numbers projected to be down by two-thirds compared with 2019. Revenue losses are in the billions of dollars across airports, airlines, and NAV Canada. Tens of thousands of jobs have been lost — almost half of the aviation workforce"[4].

The recovery will be slow, especially for large passenger aircraft (shown in orange in Figure 2). The decreased demand is having devastating impacts on jobs in the aviation sector, from aircraft construction and maintenance, to aircraft operations and airport activities.

Road Transportation

The adoption of lockdown measures, during the first months of the pandemic, also caused dramatic reductions in road transportation. For example, in examining the daily number of route requests in Apple Maps database, used to approximate the relative volume of road travel in Canada, it can be seen in Figure 3 that trips by car and by foot were down over 60% from the baseline in April.

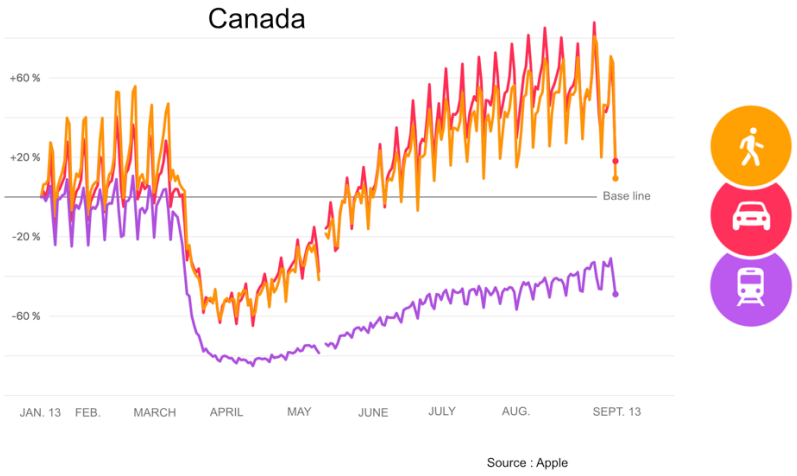

Figure 3: Comparison of the number of route requests in Apple's Maps application. Source: Apple

However, there has been a stark recovery in car and foot traffic since the lifting of the lockdown measures. On the other hand, public transit has not yet fully recovered, with the

[4] Nov 3, 2020, Edmonton Journal : https://edmontonjournal.com/opinion/columnists/opinion-help-the-ailing-air-travel-industry-support-canadas-major-cities

number of users in Canada dropping by 80% in April 2020, and remaining 30% lower than usual in September 2020.

The decline in the use of public transportation could in part be attributed to passengers' worries regarding the potential for viral infection given close proximity in buses, subways and trains. While transit agencies expect the traffic to get eventually back to normal, given the uncertainties surrounding the pandemic, there is a great amount of uncertainty as to when it will happen.

Micro-mobility

Recently, bike retailers have been pleasantly surprised to double or even triple their sales in 2020, compared to previous years[5]. The pandemic appears to have initiated a modal shift from public transit to micro-mobility. Although there is little data available now, the Minnesota Department of Transportation suggests that the number of people cycling and walking has increased by 72% since March 2020[6].

However, there has been some resistance coming from citizens, business owners and some elected officials to transform streets or portions of streets dedicated to cars for the use of bicycles. For instance, in New York, Toronto and Montreal, many businesses are expressing their disapproval with such measures since they consider that these will impact their activities even more in the context of the pandemic.

While there appears to be a trend towards a significant increase in the use of bicycles and electric bicycles for short and medium distance travel, this resistance, combined with Canada's winter climate, makes the evolution of this trend uncertain or at the very least seasonal.

Teleworking

Teleworking, which has been described as an efficient approach for reducing GHG and air pollution related to transport, has reached proportions never seen before the pandemic. Data from *Statistics Canada's Labor Force Survey of August 2020* [7], suggests that in April 2020, 3.4 million more Canadians were working from home and that as of August 2020, 2.5 million Canadians were teleworking. Workers commuting to office buildings realized that they were saving time and money and that they could be as efficient working from

[5] Micah Toll, *Get' em while they' re hot! E-bike and e-motorcycle manufacturers set to triple sales in 2020*, *Electrek blog*, September 10, 2020. See also Annabelle Caillou's article in the newspaper *Le Devoir* of August 24, 2020, entitled Electroshock *in the sale of electric bikes*.

[6] Chris Teale, Cities have seen a cycling surge amid COVID-19. Will the trend stick?, SmartCitiesDive, April 27, 2020 (https://www.smartcitiesdive.com/news/cities-have-seen-a-cycling-surge-amid-covid-19-will-the-trend-stick/576122/).

[7] Statistics Canada, *Labor Force Survey, August 2020*, published September 4, 2020 (https://www150.statcan.gc.ca/n1/daily-quotidien/200904/dq200904a-eng.htm).

home offices, if not more, than working from designated office spaces. On the other hand, employers realized that teleworking works and that they could significantly reduce their floor spaces in doing so, thus realizing important cost reductions.

It seems that there is a continued interest in teleworking as office spaces in Montréal have never been this low; **in September 2020 the office buildings in downtown Montreal would only be occupied by 10%**, according to an article in the newspaper *Le Devoir* [8].

Lower ridership levels on public transport could therefore be partly related to the phenomenon of telework, which stretches over time, especially since trips in major city centers depend heavily on public transportation.

The rapid and widespread implementation of teleworking is forcing commercial property owners to review their business models. This situation affects owners of office towers, and is also impacting shops and businesses and the socio-economic dynamic of every city center. This reality will be closely monitored over the next months.

The Demand for Electricity

Due to the closure of many commercial facilities during the lockdown period, electricity demand was also affected.

According to Global Data, there have been reductions in electricity demand ranging from 6% to 10% in different provinces in Canada, for the period spanning from March 18 to April 28, 2020, as shown in the graph below[9].

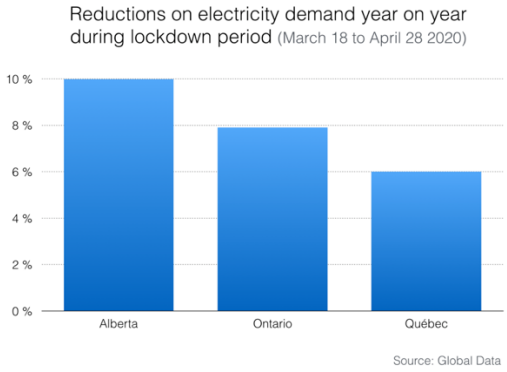

Figure 4: Reductions in electricity demand in 2020 compared to 2019 due to COVID-19 lockdown for three Canadian provinces. The comparative periods run from March 18 to April 28 each year.

In-store and Online Commerce

[8] Jeanne Corriveau, *Montréal presse les employés de revenir au centre-ville*, *Le Devoir,* September 2, 2020.

[9] Global Data, *Canadian electricity demand declines in key provinces in wake of COVID-19 lockdown*, June 16, 2020 (https://www.globaldata.com/canadian-electricity-demand-declines-in-key-provinces-in-wake-of-covid-19-lockdown/).

The retail sector has also undergone significant changes because of the pandemic. The difficulty in physically accessing stores has led to a drop in their sales, but led to record-breaking e-commerce sales.

Statistics Canada has compiled the changes in sales in April 2020 (at the heart of the lockdown) compared to February 2020 (before the lockdown). The results of these changes, by sub-sector are shown below.

Figure 5: Comparison of sales in April 2020 compared to February 2020 in Canada. Source: Statistics Canada (https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00064-eng.htm).

According to Statistics Canada, in April 2019, the market share of e-commerce was 3.8%. In April 2020, it reached 11.4%.

Much of the increase in online sales could persist after the pandemic. While at the moment this has led to an increase of emissions from freight operations, this is also **an opportunity to deploy urban electric delivery trucks,** and some models are manufactured in Canada. In fact, it was reported in September that Amazon purchased ten electric trucks from the Canadian company Lion.

Environment and Climate Change

As mentioned above, the sharp decline in travel from March to May 2020 had positive impacts on air quality in major cities and there was a decrease in GHGs emissions.

In a study led by the World Meteorological Organization (September 2020)[10] **found that by April 2020, GHG emissions decreased by 17% worldwide compared to the 2019 average.** However, the study also notes that the low level of emissions in April 2020 was similar to GHG levels of 2006, meaning that global GHG have increased 17% in the last 15 years.

The pandemic made it clear that the decline of GHG emissions worldwide was minimal despite global and massive measures of lockdown. This suggests that Canada will have to implement titanic efforts to combat the impacts of climate change, especially when considering that GHGs are still on the rise.

According to an article by the Canadian Press (May 2020) on the reduction of pollution in Canadian cities due to COVID-19 lockdown measures[11], researchers in the Air Quality Division at Environment and Climate Change Canada measured significant decreases in nitrogen dioxide (from exhaust pipes) by satellite. In April 2020, the decrease was 40% in Edmonton and Calgary and more than 30% in Toronto and Montreal. The article also mentions the findings of Miriam Diamond, a professor of earth sciences at the University of Toronto:" A couple of months [of reduction] will do us well because we are avoiding air-pollution-related deaths and illness, especially at a time when we are really concerned about the respiratory system."

This is significant because there are 14,600 premature deaths in Canada each year due to air pollution, according to an assessment by Health Canada in 2019 [12].

These findings demonstrate the extent to which transport electrification will have a role to play in the fight against climate change and the reduction of air pollution.

COVID-19 and Demand for Oil

The drastic decline in air and road travel caused by the pandemic, as shown in Figures 2 & 3, caused a considerable decrease in the demand for oil worldwide.

IHS Markit estimates that at the height of the coronavirus disease (COVID-19) global oil demand shrank by a massive 18 million barrels/day in second quarter of 2020. Demand has since seen some recovery.

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[10] World Meteorological Organization and al., *United in Science 2020 – A multi-organization high-level compilation of the latest climate science information*, September 2020. Download here: https://public.wmo.int/en/resources/united_in_science .

[11] Mia Rabson, *COVID-19 economic slowdown has cut air pollution in Canadian cities*, The Canadian Press, relayed by CBC on May 21, 2020 (https://www.cbc.ca/news/politics/covid-air-pollution-cut-1.5579452).

[12] Health Canada, *Health Impacts of Air Pollution in Canada – Estimates of morbidity and premature mortality outcomes - 2019 Report*, 2019 (http://publications.gc.ca/collections/collection_2019/sc-hc/H144-51-2019-eng.pdf).

Knowing that in February 2020, 82 million barrels of oil were sold per day (World Crude Oil Production), the drop of 18 million barrels per day, estimated by IHS Markit, corresponds to **a 22% drop in global demand for oil, at the height of the pandemic**. Correspondingly, the price of oil also dropped and was particularly dramatic for **Canadian crude, which fell below $ 10 per barrel and even saw a negative price** at the peak of the pandemic, as shown below. The price of oil has since recovered.

Figure 6: Drastic fall in price of Western Canadian Select crude in April 2020, due to COVID-19. Source: Oilprice.com (https://oilprice.com/oil-price-charts/block/49).

Drops in the price of oil, due to the forecasted declined demand, is also expected to occur beyond 2030 when the number of electric vehicles (EVs) on the roads is forecast to exceed 20% of the fleet of road vehicles[13]. This prompted Suncor President Mark Little to mention that:

"The shift to electric vehicles and other low carbon technologies could disrupt crude oil demand on a similar scale to the coronavirus pandemic" [14]

Suncor Energy is aware that the future of transportation will be increasingly reliant on electricity. This has motivated the company's collaboration in the implementation of the electric Trans-Canada Highway: since 2018, fast-charging stations have been installed at select Petro-Canada gas stations from coast-to-coast.

Other oil and gas companies such as Shell, BP and Total are also investing in the electrification of transport and renewable energies, for example by supporting charging infrastructures, wind turbines, and batteries. The natural resources sector continues to be a

[13] L. Mortlock and D. Carcasole, *Canadian electric vehicle transition – the difference between evolution and revolution*, EY report , 2019.
[14] Jeff Lewis, *Suncor CEO Mark Little Says Electric Cars As Big A Threat To Oilsands As Coronavirus* , Huffington Post, June 2, 2020.

vital part of Canada's economy and while we are anticipating a shift towards cleaner use of resources (solar, wind and hydrogen, etc.), clean fuels will still play a vital role in 2050.

Proceedings from EMC's Conference on July 7 and 8, 2020

The conference was divided into eight panel discussions (four per day) and categorized into eight different themes, all of which were related to the impacts of COVID-19 on the environment, peoples' lifestyles, work habits, transportation patterns and one of the theme was specific to the lessons learned. These themes encouraged panel discussions to focus on practical, actionable initiatives to ensure optimal deployment of electric mobility in Canada.

In addition, political representatives from the Canadian federal government were included in these discussions during the conference. The first keynote speaker was the Honorable Seamus O'Regan, Minister of Natural Resources, which opened the conference on July 7th. The Honorable Marc Garneau, Minister of Transport, opened the second day of the conference on July 8th. Ali Ehsassi, Parliamentary Secretary to the Minister of Innovation, Science and Industry interfered at the end of the conference. And finally, the Honorable Jonathan Wilkinson, Minister of Environment and Climate Change, gave an opening statement for the last panel on the impacts of this crisis on the environment.

Each panel discussion was moderated, with each of the panelists giving a brief presentation of their organization's activities, followed by a Q&A session. Questions posed to the panel originated from the moderator or from conference participants via a chat box dedicated to live interactions and reactions.

As mentioned above, this report covers the findings of the impacts of COVID-19. And discussions related to the role of electric mobility in the post-COVID economic recovery, will be part of a second report. Therefore, it has been decided to exclude the content of selected conference panels from this report.

Panel 1

COVID-19 in Our Lives

This chapter will present excerpts of the comments and answers made by the speakers during the first panel of the EMC conference of July 7 and 8, 2020, preceded by backgrounders and a synthesis. This panel was held on the morning of July 7, 2020.

Electric Mobility Canada Board Chair Dan Guatto welcomed participants to the conference. Mr. Guatto is the director of operations and vice president of engineering and operations at Burlington Hydro.

The first panel "COVID-19 in Our Lives" was dedicated to discussing the global consequences of COVID-19 on peoples' lives, businesses' activities, daily transportation and the rise in teleworking.

Daniel Breton, President and CEO of Electric Mobility Canada, moderated this panel.

The three panelists were:

- Dave Reage, Director of Halifax Transit and Vice-Chairman of the Board of Directors of Canadian Urban Transit Association,
- Louis Tremblay, CEO and founder of FLO,
- John Weigelt, Chief Technology Officer at Microsoft Canada.

Backgrounders and synthesis of panel 1

The first panel of the conference focused on a general overview of the impacts of COVID-19, and the following section contains additional information related to the panelists' discussions.

Three central themes emerged from the 1st panel:

1. The importance of eliminating vehicle pollution,
2. A significant weakening of public transport,
3. An increased number of workers and businesses using teleworking, which is expected to persist.

1. The importance of eliminating vehicle pollution

Citizens were pleased to have the opportunity to look at blue skies over big cities and breathe clean air during the confinement. And this is especially true for individuals with respiratory conditions. The introduction of this report contains several interesting additional information on the environmental impacts of COVID-19.

In terms of reducing greenhouse gas (GHG) emissions, it should be reiterated that a study led by the World Meteorological Organization found a 17% reduction in GHG emissions in April 2020 (at the heart of the lockdown) compared to the 2019 average.

Canadians are increasingly aware of the issues related to GHG emissions and climate change For instance, on June 28, 2020, CBC News presented the results of a recent survey on the subject [15].. It is shown that 62% of Canadians consider climate change to be a major crisis and that 64% consider that it is caused by emissions from vehicles and industries. The support of the Canadian population provides an additional argument to electrify our transportation systems.

2. A significant weakening of public transport

In the introduction of this present report, Figure 3 shows that in April 2020, public transit trips had dropped by 80% in Canada, while personal vehicles had dropped about 53% compared to numbers before the lockdown. Suburban trains, subways and buses have therefore been hit extremely hard since the close proximity they impose is incompatible with social distancing measures. By September 2020, public transit ridership levels were still 30% below the baseline, while personal vehicles on the road were up 20% relative to pre-pandemic levels. The continued low ridership levels are an expression of ongoing **concerns about the health and safety of public transit.** How long will these concerns last? It will depend on the recommendations from political and public health leaders, as well as the messages from the media, and of course the evolution and eventual overcoming of the pandemic.

There is also the need to consider telework, which has gained momentum during the pandemic and reduces the need for travel. Considering the rising popularity of teleworking, one could assume a reduction in the use of personal vehicles. However, the increase in the use of personal vehicles post-lockdown, as shown in Figure 3, seems to point to a significant discriminatory effect on public transportation.

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[15] CBC News, *Majority of Canadians and Americans agree on climate change issues*, poll suggests, June 28, 2020 (https://www.cbc.ca/news/canada/british-columbia/majority-agree-canadians-americans-climate-change-poll-1.5630555). See also ADP Canada Co. , *The Future of Work is Flexible: ADP Canada Study*, press release, September 2, 2020, from the Cision website (https://www.newswire.ca/news-releases/the-future-of-work-is-flexible-adp-canada-study-870667518.html).

Another consequence that worth emphasizing is the increased use of electric bikes, whose sales have doubled or even tripled this summer[16] One can also notice a transfer to individual micro-mobility, which is currently difficult to quantify. However, with the arrival of winter conditions, the use of bikes will likely decline.

The decline in revenue will create significant budget deficits for the year 2020, which could be detrimental to the services offered by these companies and delay their efforts to electrify their services. The latter point was reiterated by panelist Dave Reage, Director of *Halifax Transit* and Vice Chairman of the Board of Directors of the Canadian Urban Transit Association, during panel 1.

With the limited information available to us, it is difficult to go any further in analysing the impacts of COVID-19 on public transport. It would be important to conduct surveys and studies to identify issues, trends and solutions to increase the resilience of post-COVID transit systems.

3. An increased number of workers and businesses using teleworking is expected to persist.

One of the most surprising trends that emerged from the pandemic is the feasibility and effectiveness of teleworking on a large scale. According to Statistics Canada [17], among those workers who opted for teleworking during the confinement, only 26% had returned to the premises of their company / organization in August 2020. Consequently, many office buildings in the city centers were still significantly underutilized at the beginning of September 2020.

The widespread adoption of teleworking is evident in an ADP Canada survey[18]; 45% of Canadian workers surveyed would prefer working from home at least 3 days a week. This percentage rises to 61% for young workers, aged 18 to 34.

The future of information-based work, such as planning, design, management, accounting, computer science, studies or writing will be redesigned by this pandemic and the adoption of teleworking. Of course, teleworking cannot apply to every sector of the economy, and workers involved primarily in the primary and secondary industry such as manufacturing, material handling (stores and warehouses, repair shops, deliveries), construction, health care (hospitals, clinics, long-term care centers) and security (police, army), forestry, mining, catering or hospitality sectors, will not be benefitting from this new reality. At first

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[16] Micah Toll, *Get' em while they' re hot! E-bike and e-motorcycle manufacturers set to triple sales in 2020*, *Electrek blog*, September 10, 2020. See also Annabelle Caillou's article in the newspaper *Le Devoir* of August 24, 2020, entitled Electroshock *in the sale of electric bikes*.

[17] Statistics Canada, *Labor Force Survey, August 2020*, published September 4, 2020 (https://www150.statcan.gc.ca/n1/daily-quotidien/200904/dq200904a-eng.htm).

[18] ADP Canada press release, *The Future Work is Flexible: ADP Canada Study*, September 2th, 2020, https://www.newswire.ca/news-releases/the-future-of-work-is-flexible-adp-canada-study-870667518.html .

glance, approximately 30% of all workers and jobs could be done from working at home. A detailed study would be required to confirm the specific numbers more precisely.

M. Louis Tremblay, president and founder of AddEnergie (recharge terminals) provided a powerful testimony on the topic of teleworking that allowed for a better understanding of the credibility and impacts of this new trend on our lives, in such a short time. Mr. Tremblay now intends to allow his employees to benefit from teleworking 50% of the time. And, faced with a shortage of qualified employees, he is also considering hiring personnel located anywhere in North America, since working from home allows for employees to be physically located in several provinces or states. This represents a novel work paradigm.

M. John Weigelt, Microsoft Canada's Chief Technology Officer, points out that effective telecommuting will need a powerful enough communications network. He provided an example of the added demand on one private network where a family might have a child playing a video game in high resolution online, a family member watching Netflix and another family member teleworking on a work-related video-conference. Some infrastructures will need to be updated to the new reality of teleworking.

Highlights from Panel 1

Below is a selection of transcriptions of panelists comments and answers from Panel 1. The sequence of excerpts respects the chronological unfolding of the panel, allowing a better understanding of some statements in their context, i.e. with respect to a previous intervention.

Louis Tremblay (P1)

On the awareness of eliminating pollution from vehicles: "I believe COVID-19 reinforced people's determination to fight climate change collectively. We got the opportunity to appreciate what improved air quality can look like all over the world. How beautiful the skies will be when all the smog is gone. During this unique period, we have been able to witness what life is like when car induced pollution is completely removed."

Dave Reage (P1)

On public transport: "By the end of March, bus systems were generally down 60 to 70 percent of regular service and 80 percent of full service for a commuter rail straight down to 60 to 70 percent. I should say many transit systems had to enforce load limits on both buses and trains meaning some passengers could not be accommodated. Farebox revenues

generally dropped to zero percent because of reduced ridership and most systems went to rear door boarding to minimize the interaction between the employees and passengers (...)"

"(...)So through this crisis, four hundred million dollars per month were lost in fare revenues until ridership recovers and also within that, 1.2 billion dollars in urgent funds requests as some systems are facing liquidity issues within the next six months. We've been collaborating with FCM (Federation of Canadian Municipalities) on this and they also identified in their report to the federal government the need for operating funding for municipalities."

John Weigelt (P1)

On digital tools in companies: "The CEO of Microsoft worldwide has indicated that we've seen years of digital transformation in months as we've helped organizations move more towards the use of technology for their business. We have seen a move towards e-learning, virtual visits, teleworking, almost dropping the e from those types of things, no longer e-learning it is now just learning. As organizations settled in, they start to innovate in how they deliver their solutions, for example to look at retail, you can now buy online and pick up in-store."

"Now we've committed to sustainability at Microsoft where we've committed to being carbon negative by 2030 which puts us on a path to reclaim all the historical carbon that we've emitted since the creation of our company. We also see quantum computing coming to help solve some of these tough problems. So, as we look to reopen our communities, let's make sure that we continue this digital transformation and start to identify those projects that build out the shovel-ready infrastructure that we can then use for that sustainable future."

Dave Reage (P1)

On electric buses: "I think the reality is, as was mentioned earlier, climate change is not going away, the benefits of electric vehicles are not going away and perhaps most importantly the political drive and desire for electric vehicles in the transit industry is not going away. You know what will be the interesting thing as we go forward is really the funding piece of it, and you know a lot of the municipalities have been hit quite hard, transit systems have been hit quite hard, so really I think the key to keep going forward and make sure we can continue down that path of electrification is going to be that significant funding programs are continuing at both the federal and provincial levels because municipalities wouldn't be able to go at it alone anyway."

John Weigelt (P1)

On restaurants and shops: "It's been really intriguing to watch the expansion of e-commerce retailing. Perhaps the most exciting place was in the restaurant industry where the restaurants that are used to in-person type activities moving towards the takeout delivery model… the lesson there for other businesses is that there's a lot of stuff that we're going to maintain after COVID-19."

Louis Tremblay (P1)

On the recovery, especially for charging infrastructures: "I would say three ways the government should look at implementing stimulus packages. First, building the charging infrastructure with the deployment of many small projects. So, in multiple locations where stations will be deployed, you can add immediate projects that are small enough to be started quickly with the impacts felt in multiple communities. Second, it involves stations that can be manufactured in Canada and that will give work to contractors and electricians who live in Canada and will spend the money back in their communities. And lastly, we are talking about an investment that makes sense in the long term. The charging stations we are installing today will charge for decades to come. It's anything but money wasted and even if they are moderately used at first their presence might convince some drivers that the infrastructure is there and that will accelerate the adoption of EVs."

John Weigelt (P1)

On telework in rural or remote areas: "We start to look at some of the outbreaks of the virus in our distributed regions or those remote regions. We now have that focus to say; do they necessarily have the infrastructure to support the resilience that's required in this modern economy? And so we do need to recognize that we still have a tremendous amount of communities in Canada that are underserved when it comes to telecommunications... as soon as you start to move out into suburbs things might get a little bit spotty. We were joking a little bit earlier about the kids playing a video game or streaming Netflix... so I think again and reinforce cold-heartedly this idea that we have a distributed workforce and that we need to provide the infrastructure to support that workforce.**"**

Dave Reage (P1)

On rural public transport and micro-mobility: "To function well, traditional transit needs to have a density of people and it needs to have a critical mass of people traveling in the same direction. You know the other thing that is emerging as a result in terms of getting around in rural areas, is the idea of micro transit. So rather than being a bus that comes up every 10 minutes or every 15 minutes, maybe it's a van that you booked on your app and that comes and picks you up in a rural community brings you into an urban bus or train station and then you go on your way from there… one size does not fit all in terms of service provision. So, does that mean that the transit authorities are starting to integrate micro-mobility and different types of mobility so that they can be more flexible? Yes, it

really is an emerging field that emerged just in the past two or three years… it does tend to be more supported by private sector technology types of companies that would collaborate with government and working with municipalities around transit systems rather than the municipalities themselves."

Louis Tremblay (P1)

On the future telework at his company: "Before COVID-19, I intended to double our headquarters in Quebec City this year. Now I am thinking more about how I can utilize that headquarter. How can I have, let us say 50% of the time people working from home, and let's say hundreds of people staying home one week and the other week they go to work. So, it's really different in the way we used to see things and it's aligned with our mission which is to fight against climate change"

"We had a challenge hiring people before the pandemic and we didn't think about the possibility to hire from everywhere in North America and have people working from home, and now it seems possible."

John Weigelt (P1)

On potential de-urbanization and rural development: "We continue to see people coming into the cities and greater density within the cities. What has been intriguing is to watch some of the creative class and the innovators move back into their communities. I was up in Moncton, New Brunswick, talking to a start-up that had moved from Toronto back to Moncton because that's where they grew up and they enjoyed the community and everything the community had to offer… so I do believe that the opportunity exists to keep those communities alive and vibrant and allowing people to work in places that they love and be productive."

Dave Reage (P1)

On urbanization in the future: "I think the urbanization and the move towards urbanization in North America have really been a trend for decades. I don't see it stopping even if you do have people working from home more often, I think the reality is cities, especially larger cities, have become very urbanized. I think that can't change and from that perspective the leadership in cities are still going to play a key role in terms of moving us forward."

John Weigelt (P1)

On setting up satellite locations for co-work in urban planning: "It's a matter of trying to determine where are located the clusters of communities, and make our communities

walkable communities, and we started to see some of the new urban plans doing that. I point towards some of the lands that is reclaimed from the government facilities and putting in construction projects there. So, we see these suburban downtown courts or suburban walkable communities and it is providing those services so that people can get access to them quickly and easily without having to take their own vehicle or other transportation systems. It is a matter of just reimagining those existing solutions and then making sure that the infrastructure is there to support them.''

On teleworking in rural areas: "We start to look at some of the outbreaks of the virus in our distributed regions or those remote regions. We now have that laser focus to say well do they necessarily have the infrastructure to support the resilience that's required in this modern economy and so we do need to recognize that we still have a tremendous amount of Canada that's underserved when it comes to telecommunications… as soon as you start to move out into suburbs things might get a little bit spotty. We were joking a little bit earlier about the kids playing, now call a duty or fortnight or streaming Netflix… so I think again and reinforce cold-heartedly this idea that we have a distributed workforce and we need to provide an infrastructure to support that workforce."

Panel 2 :

From Going to Work to Working from Home

In this second chapter, we will review the discussion presented in the second panel (P2). This panel was focused on the ongoing and upcoming changes in the movement of workers and how these will impact work habits and the transition to electro-mobility and land use planning (city centers, suburbs, and rural regions). Before presenting the panelists excerpts, backgrounders and a synthesis of the verbal exchanges will set the table.

Maxime Charron, CEO of Leading Ahead Energy, was the panel moderator. The three panelists were:

- Chris King, Senior Vice President, Siemens Industry Inc.
- Annie Gilleo, Director, Policy, and Communications, Greenlots
- Gleb Nikiforov, CEO, AutoChargers.ca.

Backgrounders and synthesis of panel 2

Discussions from the second panel highlighted two important issues related to the electrification of transportation and the reduction of GHGs emissions:

1. The need to boost the market penetration of electric trucks and buses
2. The need to optimize the deployment of charging stations

1. The need to boost the market penetration of electric trucks and buses

The market share of e-commerce increased from 3.8% in April 2019 to 11.4% in April 2020, according to Statistics Canada. Electronic commerce has therefore tripled in only one year. This implies an increase in trucking for deliveries. However, the transport of goods by truck (medium and heavy) in Canada in 2018 contributed to 35% of greenhouse gas (GHG) emissions from the transport sector, while the transport of passengers in personal vehicles contributed to 48%, according to data from the Government of Canada and as shown in the graph below. The light passenger truck category includes vans, pickup trucks, and sport utility vehicles (SUVs).

It is worth noting that GHG emissions from the transportation sector account for 25% of all Canadian GHG emissions. Emissions are distributed in various sub-sectors of

transportation in Canada, and in 2018 they were distributed as shown in the graph below, according to data made available on Canada.ca[19] .

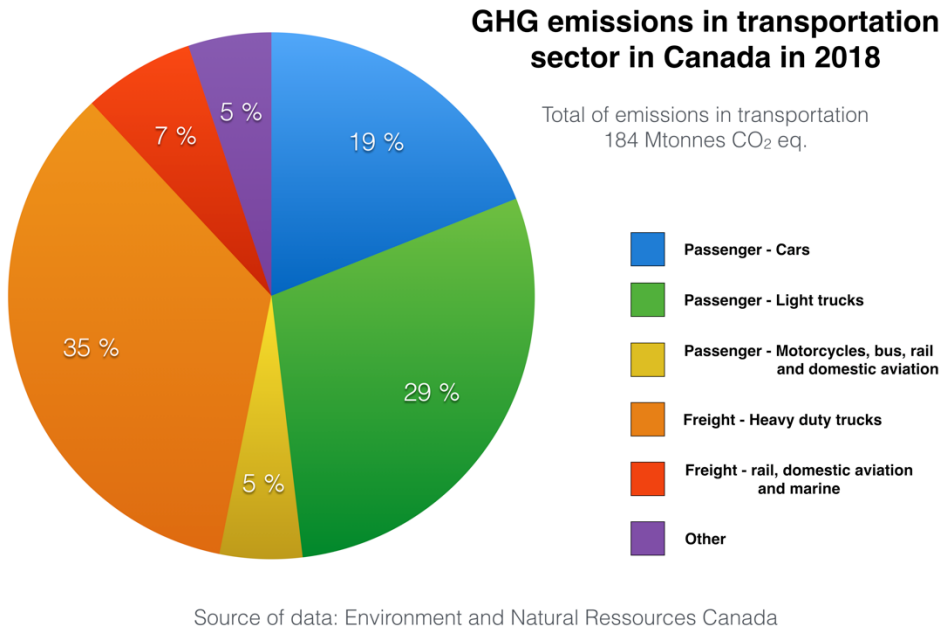

Figure 7: Distribution of greenhouse gas emissions in Canada's transportation sector in 2018, by categories (https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html).

When it comes to freight trucks (medium and heavy), shown in orange on the graph, one can see the importance of electrifying this category of vehicles because their contribution to GHG emissions is almost as important as that of passenger vehicles (cars and light trucks), even if there are fewer freight trucks on the roads.

There are several ways in which industry and governments can support the deployment of electric trucks. Governments could put in place tools (e.g. regulatory) that will obligate heavy-duty vehicle manufacturers to increase the supply of zero emission vehicles in Canada for example by holding them to provide a minimal percentage of electric trucks relative to their total truck offer, a percentage which would increase over time.

California's zero-emission law for light vehicles has been adopted by several states in the United States, the province of Quebec and British Columbia.-In June 2020, the state of California has adopted a law for heavy vehicles, trucks and buses, which is coming in effect

[19] Government of Canada site Canada.ca, Environment and natural resources, Greenhouse gas emissions, tab Economic sectors (https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html).

into 2024 [20]. Initially, the minimum percentage of heavy electric vehicles will be 5% to 9% depending on the vehicle class, then rise to 30% and 50% in 2030. And in 2045, all heavy vehicles sold in the state must be electric.

Such measures would help ensure that diverse models will be available on the market, in sufficient quantities.

A second avenue to assist in the deployment of electric heavy-duty vehicles is for governments to offer **purchase incentives, for several years, until vehicle prices are more competitive**, like what has been done for passenger vehicles.

Another way would be for governments to **help finance the installation of heavy-duty vehicle charging infrastructure**, especially for electric buses, since transportation companies are experiencing financial difficulties due to the pandemic.

2. The need to optimize the deployment of charging stations.

One of the main actions that can drive the adoption of electric vehicles is the need for reliable and widespread charging infrastructure, especially for long trips since most refills are done at home.

For some tenants, it can be difficult to recharge daily. This could be the case of tenants living on the 3rd floor of an apartment block downtown, with no outside outlet available to charge their electric car.

This issue was raised by the panel's moderator, Maxime Charron. Gleb Nikiforov argued that the latest generation of electric cars provide ranges of 500 km, soon 600 km, which will allow people to recharge once a week in future large supercharger stations, much like gasoline-powered cars. But it is not necessarily desirable for everyone who faces this lack of outdoor outlets in their home.

For drivers putting in a lot of annual mileage, approximately 25,000 km or more, that would be understandable. But many car owners travel 10,000 km to 15,000 km per year, translating to an average of 30 to 40 km per day. For them, a large battery of 600 km would constitute non-optimal use of strategic natural resources (to make the battery), non-optimal use of electrical energy (an EV with a heavy battery consumes more energy) and non-optimal use of financial resources (large batteries are expensive).

Another option should be available by 2025. As Elon Musk said on Tesla's Battery Day on September 22, 2020, within three to four years Tesla will be able to store 50% more electrical energy in a battery of the same mass as today's and reach an energy density of 400 Wh/kg (vs 260 Wh/kg in 2020). Add to that the imminent advent of small, light, low-

[20] Reuters News Agency, *California passes landmark mandate for zero emission trucks*, June 25, 2020 (https://www.reuters.com/article/us-california-trucks-electric-idUSKBN23W31N).

consumption electric urban cars (12 kWh / 100 km), and the problem of the lack of an external outlet for recharging can be mitigated.

This type of urban car would be equipped with a small removable 10 kg battery case providing a range of 25 km, in addition to the fixed battery that would allow a range of approximately 200 km. **The removable battery could then be charged at home or work with a regular 120-volt outlet, in 2 to 3 hours,** adding an additional 50 km of autonomy per day without needing an external outlet. If more than 50 km is needed in a day, the fixed battery delivers the energy. The fixed battery can be recharged once a week or every two weeks at a supercharger station, in 15 to 20 minutes since the fixed battery will only have about 25 kWh (this type of car consumes little electricity).

The Importance of Power Management for Recharging

Two panelists, Gleb Nikiforov and Chris King stressed the importance of power management for electric vehicle charging facilities. To prevent an overload of the power grids during peak hours it would be wise to provide variable electricity pricing, depending on the time of use.

Electricity rates for heavy consumers currently consider the energy consumed and the maximum power used in the month. When the threshold is exceeded, energy consumption can be costly for the customer. As instance, fleets of electric vehicles or public stations with several fast-charging stations, could be impacted by this threshold. To manage these scenarios, we anticipate two avenues possible.

The first avenue is to provide **smart charging stations that could communicate with each other and the company's energy management system**, to limit the charging power of vehicles that have reached a high state of charge and transfer that power to vehicles with a lower state of charge. Different criteria could also be programmed into the smart charging stations depending on the needs of the consumers.

The second avenue **takes advantage of on the ground energy storage system** (acts as a big battery) that could be recharged during off-peak times. Part of the charging power required could come from the storage system, reducing the demand on the electric network. Of course, such storage systems would be subject to the control of smart charging stations.

Electric Vehicle-to-Grid Exchanges (V2G)

Concerning the capacity to utilize V2G to support power grids, M. Chris King displayed some concerns, noting that the regulatory environment would need to be updated to support V2G and additional infrastructures would be needed, which comes at a cost.

Powerful two-way chargers with wide accessibility (not just at home) would be needed to make a compelling case for V2G. Adding to the fact that the double use of the batteries (powering the electric grid and the car) would decrease the battery life prematurely. The

industry would need batteries with a much longer life capacity. The revenues from V2G for electric vehicle owners is uncertain, but may change over time, when batteries lasting more than a million kilometers become available on the market, and in enough quantity.

Dedicated ground storage systems (e.g. Tesla's Megapack batteries) are increasingly popular in the electric transportation industry because this system reduces the large number of two-way chargers of 5 kW to 10 kW required for the V2G.

On the Profitability of Fast Charging Stations in Rural Regions and the Importance of Government Support.

Gleb Nikiforov expressed his belief that it will take time before the market experience a price drop for fast charging stations. The fast chargers will be less numerous than electric vehicles and consequently will not benefit from the cost reductions of mass production. Also, ultra-fast chargers (i.e. 350 kW chargers) need the support of electric infrastructures powerful enough to supply them. The engineering and utility work associated with the installation and infrastructure can be costly, in the order of several hundred thousand dollars, even a million dollar. These costs are difficult to reduce. **As a result, the profitability of fast charging stations in rural regions can be problematic and would need governments support**.

Interoperability is Essential for Charging Stations

Several panelists mentioned the importance of functional interoperability between various electric charging networks, to provide global accessibility across regions, provinces, and countries. The market for charging stations will be gigantic and the various suppliers should see themselves as partners rather than competitors. There is room for many types of products and companies. And the governments will need to provide and impose standards on the industry.

Level 2 Charging stations near shops and leisure establishments

Annie Gilleo pointed out that one should diversify the accessibility to fast charging stations, one need to plan for the installation of level 2 public stations near shops, gymnasiums, cinemas etc., places where individuals normally spend an hour or more. These terminals can restore a range of 35 km in one hour.

Planning the Charging Infrastructure for Heavy Electric Vehicles

Chris King called on our governments to begin planning regulations and charging infrastructure for heavy electric vehicles, including buses, to increase the air quality in the cities. This is as important for public health as it is for climate change.

Highlights from Panel 2

Below is a selection of transcriptions of panelists comments and answers from Panel 1. The sequence of excerpts respects the chronological unfolding of the panel, allowing a better understanding of some statements in their context, i.e. with respect to a previous intervention.

Gleb Nikiforov (P2)

On charging a vehicle without a charger at his apartment: "Take a look at the example of the city of Montreal. What the city is doing, and they are a leader today in street charging, there is a pilot project that I believe will be running about a hundred level 2 charging stations to be installed on the streets. Keep in mind as well that the battery capacity of the vehicles of the new electric vehicles are becoming larger and larger and there might be a point at which there will be no need to charge your vehicle every day… so we get back to the filling-up of the ice vehicle charger, uh fueling [station]… that's how I believe we will solve the problem with people who would not be able to charge in the garage because they don't have one."

Chris King (P2)

On power management via batteries: "One of the use cases [of batteries] we are seeing a lot of interest for these fleets whether it be a transit fleet or a truck fleet and having on-site storage as part of the depot that enables the control of demand charges and allows load shifting so you can take advantage of peak and off-peak rates."

"**On the V2G side we are a little bit more cautious** I should say, there is a lot that needs to be done, to prepare the vehicles to be able to support it. Markets will need to be able to deal with their regulatory barriers, so that in theory we think **it's a good thing but it's probably going to take some time before it rolls out.**"

Gleb Nikiforov (P2)

When will we see prices drop for fast chargers? "Unlike a gasoline car, an electric car takes a little bit longer at the current stage of development, to get charged right. So, if you look at the current gasoline stations you probably need to make ten times more level-3 charging stations. They will have gasoline stalls today and probably 2,000 more ports of level 2 electrical charging for one gasoline distribution as we have today. In order to achieve that, there should be a return on investment (ROI) for people who chose to install

those systems, it isn't possible at the moment because the technology is very rapidly evolving and this is why the governments are helping companies utilities."

"I don't think it's going in the right direction as we can't afford to install $100,000 units right now, we need to find a better solution as well as we need to understand that even if you put a 350 kilowatt load in the middle of nowhere you need to bring infrastructure to it and that infrastructure might need millions of dollars to be put in place. 90% of the charging outside of home happens on the highway so people don't really need to charge during the day if they drive just a hundred kilometers and their vehicle is capable of storing three or four hundred kilometers in their battery... I think the government should spend a little bit more attention to the new technologies on that market maybe we should look into hydrogen also as a source of power to bring to the site and then convert it on-site to electric power and make more affordable charging as well."

Chris King (P2)

On the importance of planning for the arrival of heavy electric vehicles: "Policy makers and regulators need to start right now to pay attention to the medium and heavy-duty space including transit. Because it is a space that has implications for most people in the country whether you are riding a bus or receiving a delivery. We're starting to see more options now for electrification in the short term and I think there's a real need for some concerted policy effort there."

Gleb Nikiforov (P2)

On the partnership and interoperability of fast chargers: "Any company that provides charged infrastructure products or support or anything to do with the EV charging we are all partners. In this market we are not competitors because the market is going to be huge. For us to collaborate and make sure that our goal, which is basically to let us all breathe cleaner air, better quality air, which can save us about six to eight years of our life when you live in the big city, you lose about six to eight years of your life due to inhaling the exhaust from gasoline and we need to stop that. That's why we're all partners in that and the collaboration is a major key to success and that's why I really embrace it and I think that every EV charge manufacturer must be able to interoperate with others. This is the key to success."

Annie Gilleo (P2)

On level 2 chargers near shops, cinema, etc. "What we need to build out is an ecosystem of charging services so having those very dense urban charging clusters where folks can go specifically to charge up quickly is very important. We must also ensure that there is sufficient level 2 charging infrastructure at the places where people are going to go over the course of their day for other things, while they go at the grocery store or if they go to

the movies again after the pandemic or while they go shopping, so ensuring that there is conveniently placed charging options everywhere. I is going to serve the purpose of enabling people to charge but it's also a really important education tool for spurring easy adoption because it makes people without garages feel comfortable that they're going to have places to charge when they make that purchasing decision."

Gleb Nikiforov (P2)

On government assistance for charging infrastructure: "As you know Canada is a very large country and there are not that many people in the country and we all live close to the border, so we would need probably three or four times more electrical infrastructure than a dense population of let's say some European country, just because of our vast distances... and more people are going to move out of the city and work remotely and just visit the city maybe a week or twice a week, so we're going to see even longer distances covered by our citizens and it is extremely important to make sure that the government is there... we need to be able to reach the point where businesses will be able to buy and operate the charging equipment to make a profit. That would be a turning point in the adoption."

Panel 3 :

COVID-19 and the Evolution of the Commute

This chapter will present excerpts of the comments and answers made by the speakers during the third panel of the EMC conference on July 7 and 8, 2020, preceded by backgrounders and a summary of what was said. This panel was held in the afternoon of July 7.

How will people get back to work when they will have to go back? What means of transportation (personal or collective) are they going to favor? What impact will this crisis have on the electrification of private and public transport? What about air pollution and traffic congestion? These are the concerns of panel 3.

Travis Allan, Vice President of Public Affairs and General Counsel at Flo, was the moderator of this panel. The three panelists were:

- Mohsen Nazem, Director - Research, Data Analytics and Transport Modeling at Exo
- Neetika Sathe, Vice-president, Center for green energies and technologies, Alectra inc.
- Namir Anani, President and CEO of Information and Communications Technology Council

Backgrounders and Synthesis of Panel 3

The verbal exchanges of the Panel 3 can be grouped mainly into three parts:

1. Micro-mobility,
2. Autonomous vehicles, robotaxis and 5G communication,
3. The evolution of urban planning in response to telework.

1. Micro-mobility

Namir Anani stressed the growing importance of micro-mobility. The latter uses vehicles with a weight of less than 500 kg, mainly for urban routes of a few kilometers, at speeds less than 50 km/h. Bikes or electric bikes and electric scooters are also the two main pillars of micro-mobility. The rental companies of these two-wheeled vehicles are booming in an

increasing number of cities. The idea is to reduce congestion and pollution in urban areas and to offer affordable solutions.

However, there are significant challenges including weather conditions (rain, snow) and lack of dedicated runways, not to mention mechanical and theft issues. Bikes and scooters will have to be robust to support this trend.

According to an article published by McKinsey in July 2020, the number of passenger-kilometers of shared micro-mobility decreased from 60% to 70% at the heart of the containment (March to May 2020). Of course, there were fewer people on the roads, but to achieve such a decrease it shows that in times of health crisis people are wary of shared vehicles. As mentioned in the introduction, sales of electric bikes increased by a factor of 3 in 2020 because of the pandemic. Many people seem to have opted for a personal electric bike. And according to McKinsey's article [21], shared micro-mobility is expected to increase by 5% to 10% by 2030.

In Canada, because of the harsh winters, micro-mobility is possible 7 to 9 months per year, depending on the region. It is appreciable to reduce harmful emissions from transportation over such a period, but it may not become a panacea in Canada. There are many places, such as Europe, the Southern regions of the United States, South Asia, etc. where micro-mobility plays or could play an important role.

Electric micro-cars with 3 or 4 wheels (having a mass of 600 kg to 800 kg) that can accommodate 1 to 3 people are emerging. One of these micro-cars is made in Canada. The Solo from Vancouver's ElectraMeccanica, that can carry one passenger, weighs 770 kg. The Uniti One from Sweden is also an example, it weighs 600 kg and can accommodate 3 passengers. These electric micro-cars are cheaper than regular electric cars, provide a highway speed and could be included in what is called micro-mobility. These micro-cars consume little electricity, recharge very quickly (small battery) while protecting against the elements. They take up less space on the roads and require less parking space as well.

It may not be the ideal independent mobility solution, but it is an improvement from the daily commute done by a single person in a large gasoline SUV. In the new transportation landscape within a few years, there will not be a single ideal solution for transporting people sustainably, but rather a wide range of solutions tailored to different situations including public transportation, car sharing, active transport, micro-mobility, personal vehicles and robotaxis.

2. Autonomous vehicles, robotaxis, and 5G communications

[21] Kersten Heineke et al., *The future of micromobility: Ridership and revenue after a crisis*, McKinsey & Company, July 16, 2020 (https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-future-of-micromobility-ridership-and-revenue-after-a-crisis).

Mohsen Nazem is convinced that autonomous electric vehicles will be central to the future of transportation, and Namir Anani warned that the legal environment will need to be updated to provide frameworks for pilot projects with autonomous vehicles.

Electric vehicles (EVs) are much better for the environment than internal combustion vehicles. However, traffic congestion or parking issues and needs with EVs are not addressed. To address these, the number of all the vehicles on the road need to be reduced. Autonomous electric vehicles, used as robotaxis, will allow such a reduction, possibly by a factor of 3 or more eventually. This will mark the beginning of a major shift in paradigm for the transportation of people.

Several studies, including a recent one done by ARK Invest [22], show that subscribing to robotaxi services could reduce the costs of transportation by 3 times compared to the costs associated with the ownership of a personal car. These autonomous vehicles will be in operation 16 to 18 hours a day instead of 1 to 2 hours, which is the case for most personal vehicles. They will travel more than 1 million km instead of 250,000 km compared to the average distance traveled by a personal vehicle. Being driver-less also translates in costs reduction.

The longevity of the robotaxis will be ensured by new batteries, announced by Tesla in 2019 and by the Chinese battery manufacturer CATL, in 2020[23]. These new batteries will allow longevity of 1,600,000 km (1,000,000 miles). Tesla also tested the electric motors of their Model 3 over 1,600,000 km and they mentioned that they were still in good condition.

The financial incentives to subscribe to robotaxis is quite high (cost reduced by a third), and people may not be inclined to buy personal cars anymore[24]. And autonomous vehicles offer many advantages. Human errors will be reduced (e.g. fatigue, alcohol and texting while driving, speeding) consequently reducing road accidents. Robotaxis services will allow optional carpooling and the driving patterns will be maximized and energy-efficient, therefore the energy consumption of robotaxis per kilometer will be less. In addition, children, seniors, people suffering from disabilities and people that do not or prefer not to drive will benefit from comfortable and affordable door-to-door transportation. And if people choose not to buy personal vehicles, the number of vehicles on the road will be significantly reduced.

The arrival of autonomous electric microbuses is another trend that can be anticipated. These microbuses could accommodate 8 to 12 passengers, and larger electric and autonomous buses, in lower quantities than today, should also be part of the solution.

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[22] Tasha Keeney, *Autonomous Ridehailing Could Be More Profitable Than We Had Modeled*, site de ARK Invest, February 19, 2020 (https://ark-invest.com/analyst-research/autonomous-ridehailing-fees/).
[23] Steve Hanley, *CATL Says It Has A Million Mile Battery. Is There A Connection To Tesla?*, June 9, 2020, CleanTechnica Blog (https://cleantechnica.com/2020/06/09/catl-says-it-has-a-million-mile-battery-is-there-a-connection-to-tesla/).
[24] James Arbid and Tony Seba, *Rethinking Transportation 2020-2030*, RetninkX report, 2017, https://www.rethinkx.com/transportation .

For the time being, Waymo, a Google sister company, is trying out a robotaxi service in the Phoenix area, as part of a pilot project. The Chinese company AutoX is also experimenting with robotaxis in Shanghai and Shenzhen and plans to expand its services in San Jose, California. Tesla is expected to release the beta version of its fully autonomous Autopilot by the end of 2020 and the company wants to operate a robotaxi service as well, as part of its *Tesla Network*. One can expect to see robotaxis become a reality by 2025 in a growing number of robotaxi climate-friendly cities.

Autonomous vehicles deployed here may be harder to implement in Canadian cities with heavy snowfall. It should take a few more years before we see them fully during the winter. 5G communication and the vehicle environment will allow autonomous vehicles to better position themselves with the help of traffic lights that will transmit information to vehicles, or beacons put in place on main roads as supportive tools for the autonomous driving car system. This is part of the Internet of Things (IoT). Namir Anani stressed the importance of continuing 5G communication work to enable the advent of autonomous vehicles and was supported on this by panelist Mohsen Nazem.

3. The evolution of urban planning in response to telework.

Before the pandemic, there was a global consensus on urban intensification and a tendency to attract workers in the big cities. But after the pandemic, because of the success of telework especially observed in the first months after the pandemic, we anticipate mini-business centers located in the suburbs and in the regions (well equipped with telecommunications) to offer cheaper offices for rent, conference rooms, and various services, and to be made accessible to several companies in the same building.

Highlights from Panel 3

Below is a selection of transcriptions of panelists comments and answers from Panel 3. The sequence of excerpts respects the chronological unfolding of the panel, allowing a better understanding of some statements in their context, i.e. with respect to a previous intervention.

Mohsen Nazem (P3)

On Exo's public transport activities in the Montreal area: "We are the second-largest public transport operator in the Montreal area. Our activities cover 82 municipalities, and we have 241 bus lines, 5 train lines with 58 stations and in 2019, we had a ridership of almost 40 million people. We have a paratransit service as well and we had a ridership of almost 700 thousand trips in 2019. A few months ago, we identified initiatives for the future, one of

them is the acquisition of a fleet of 160 electric buses and another one is in the construction of two new garages to maintain those electrical electric buses and we have different projects with alternative modes like a new micro-transit on-demand service, and a shared electric bike.. Some of our projects are in more advanced stages, while the other ones are still at the beginning"

On the impacts of COVID on public transport: "We are in a global pandemic situation since March 2020 so the cities are shutting down and we ask people not to commute for non-essential needs, also authorities ask people to respect social distancing protocols, working from home, studying and learning from home and now we have more online shopping, etc. All these practices reduce commuting trips, but because the situation is getting better, we are gradually opening up the cities, so we have more and more ridership and people use more public transport services as before. What are the consequences of all that? Until now we have less demand for commuting and what is important to mention is that the regularity of the demand is completely changed. For now, we are not anymore in the situation of having a regular work-oriented transport flow from Monday to Friday with the same trip pattern, and we have less demand for conventional public transit. In some cases, those trips are replaced by private cars and more active modes. The reason is simple; we ask people not to go to crowded places, so people avoid public transport, and also people could use their car more easily because the gas is extremely cheap compared to before the pandemic situation."

On the future of transport: "We should not forget about the climate and ecological crisis that's a lasting crisis. We should develop green economy recovery plans now. Every country and community wants to develop recovery plans. To do so, we should make the right decision, and sometimes hard ones … **we think that the future of the mobility should be integrated, shared and electric and in couple of years, autonomous.**"

Neetika Sathe (P3)

On the activities of Alectra and the importance of resilience: "Alectra is the second largest municipal-owned local distribution company in North America. We serve over a million customers and we have about 1,600 employees. We are noticing in the market for the first time that there is such a heightened need for resiliency and self-sufficiency. It has really been a wake-up call and a reminder of how fragile life is."

On the importance of climate change for Canadians: "A McKinsey study shows that 61% of Canadians now agree that climate change is a key factor. This is a big change from before in terms of awareness about climate change within the average consumers. Now, with COVID-19, we are seeing that people are getting more and more concerned about how to battle and future-proof our lives and our planet. So, this is really fantastic news for us because when we talk about promoting e-mobility then it is easier to promote the benefits to customers."

On the influence of the pandemic on vehicle purchasing: "People are worried about losing their jobs and people are worried about an l-shaped recession or a very sharp V-shaped recession and so they're not too inclined to buy cars right now. But really what we're anticipating in the long term is that EVs are going to come back strong and electric mobility is going to be here to stay as a mainstream energy option transportation option."

Namir Anani (P3)

On transport to work which will become decentralized because of teleworking: "Companies that are already born-digital or digital by default or adopting technologies early have started to look at their employees working from home and those employees as well as starting to look for different measures of commuting, or maybe less reliance, at least for the time being, on public transportation and more on active mobility options, bicycles electric vehicles and others, for short distances trips. The nature of work is changing, and we see more people becoming freelance workers, this trend will be favorable to this proximity-based transportation and it means that people will be moving within their environment and their region."

On the increased role of small towns which will become more active to the detriment of big cities: "55% of the population of the earth is living in cities contributing to 70% of the GDP. A lot of the population is moving to the cities because of the connectivity, the economic prospects, and the urban lifestyle that they provide. However, I think urbanization, and there are more studies that came out recently to provide the latest numbers, is maybe the new casualty of COVID-19. I think there is a whole reflection to have about the impacts the pandemic will impact on urban planning since **the concept of building major cities is shifting towards smaller suburban cities that are connected and able to offer a shorter commute.** Which supports active mobility, electrified mobility and autonomous connected electrified and shared type connectivity transport systems."

On young people peoples who choose not to purchase cars: "We are seeing that, specifically in the Y generation, the millennials, and **the generations who are around *25 years old***. They are certainly reflecting on this with a whole new dimension. The cost of ownership is something that they are concerned about. **They prefer to have shared, local and on-demand mobility than travel long distances and use public transportation**"

On electric vehicles and micro-mobility: "We've seen with some studies in Canada and mainly in Europe, that the demand for micro-mobility has increased quite considerably. The European climate allows for more electric bikes, cycling and active mobility and shared mobility such as shared scooters are becoming a popular option in Europe and Asia. There is a whole new concept about the cost performance of electric vehicles and electric mobility, and it is becoming quite interesting now. Not only because of the confluence of all the environmental concerns. But also, because the cost of running an electric car is cheaper than internal combustion engines, and it reduces pollution and noise pollution, specifically in mega-cities. These are incentivizing individuals to shift toward electric vehicles and micro-mobility."

Mohsen Nazem (P3)

On the advantage of having real-time information for buses: "People want more and more to take decision about traveling from point A to point B based on real-time information in public transportation (i.e. occupation rate). So, We believe the question of accessing the information in real-time it is a big question now, it's a big need now."

Neetika Sathe (P3)

On the role of employers during and after COVID-19: "I can tell you this, all employers want to keep their employees safe and it has been the biggest focus for Alectra. We've had to stop our carpool systems, our charging stations were underused… and as life gets back to normal all, the shifts in the transportation trends will start percolating and affect our employees' commute and the employers will need to react to it. So the questions are; how many people do you want on your premises and how many people want to come back to the office, and how many people are required to physically come back to the office?"

On incentives to retain key personnel, and charging stations: "If the employer does not provide an environment where people can charge their cars then the tension will be a problem because people who will be moving over to EVs are the ones who are pragmatic and thinking it through, and probably, as surveys have shown, a little bit more prone to technology and probably such as data scientist and AI, etc. As an employer, you want to be able to keep your best talent within your organization and providing clean commute benefits will be another way of retaining talent."

Mohsen Nazem (P3)

On social distancing in public transport: "Commuting and public transportation use are still important, and we know that the authorities at the beginning of the pandemic were emphasizing the importance of social distancing. Based on what they asked, social distancing would keep us safe, but we saw in different places of the world that some places respected social distancing but the cases were rising and in other places they didn't respect social distancing and the cases are low. So maybe it's not the real reason, and maybe the reason could be something else. As in public transit, people are still close to each other, but by respecting other practices like wearing a mask, we did not see any case of infection yet."

On the need to meet colleagues in person at work: "The solution is not to keep everyone at home. I think we will lose productivity at work and also we could face mental problems by time. I'm not sure since I'm not an expert of human resource policies, but I think companies should be careful about making long term decisions."

Namir Anani (P3)

On the importance of 5G communications in the future of transport: "I live in Ottawa and there's a lot of snow in the winter no matter what sensory devices these cars will have, ultimately we need the roads to have the infrastructure and IoT to be able to distinguish when a car gets the four-way crossing. We need to get to a point irrespective of the level of communications between the infrastructure and the car, and it is going to be important for connectivity, so IoT is going to play a bigger component and we have to put the right measures into it. I think we have to incentivize these development and road infrastructure and fast track the 5G not only for allowing these cars to operate but also to attract investments."

Neetika Sathe (P3)

On the importance of using electricity providers to plan charging projects: "It's critical to involve the utilities right at the beginning when you're connecting your site so that way you can make sure you minimize costs... If you can integrate the providers in the discussion early enough then they can become your energy ally to help you decide on the right tool and optimize your option solution... I would love for us to be able to provide customized weight basing for EV charging, especially when you are talking about voltage, high-powered fast charging, so that the charging infrastructure owners don't get an extremely high demand. Another way that utilities provider can get involved, and it's right up our alley, is the opportunity to bundle traditional utility solutions with new emerging energy solutions, whether it is battery storage on the side or just bringing solar and storage together, so that we can complete the solutions for the customers and truly be that energy ally that we aspire to be."

Mohsen Nazem (P3)

On the desertification of office towers in the city centers: "I think we should wait and see. We should be open to work from home and be more flexible, but I think that we should not jump quickly to conclusions. Let's say you normally go to the office from 9:00 AM to 5:00 PM every day, but if you want to go from 10:00 AM to 6:00 PM, you have to talk with your manager and go through a formal procedure to be authorized. This could be an example of extreme control and rigidity about working hours . On the other extreme, some are advocating for working from home with complete flexibility on working hours and forgetting about the office towers. I believe that there will be challenges in both of these models, and probably a mixed model could be good, as instance, workers could have the choice to stay at home for couple of days per month or a couple of days per week, depending on the sector and the activities."

Namir Anani (P3)

On the importance of adopting new regulations for autonomous electric vehicles: "If we really want to deploy electric vehicles in Canada we have to change the Highway Code and make sure that the testing is taking place with these autonomous vehicles of the future."

Mohsen Nazem (P3)

On the importance of the 5G network: "I think 5G is particularly important for the future of transportation. Namir talked about the autonomous vehicle, and cloud computing. We observe more interest for on-demand transportation services and the also the need for more real-time information for customers. 5G plays a big role in that, but as we know, 5G is very expensive for the moment, and in more general terms, telecommunication is very expensive in Canada. Maybe we all have an interest to have better prices to assure better accessibility of these services for everyone."

Panel 4 :

Travelling - From Planes to Electric Vehicles

In this chapter, we will review the discussions that were presented in the fourth panel (P4). This panel is concerned about upcoming changes in long-distance travel, vacation, or work. Air travel has declined significantly due to the pandemic, and the recovery is slow (see Figure 2 in the Introduction). Will we see more personal car travel in the future and less air travel? What should be done to facilitate travel supported by personal electric vehicles on highways and secondary roads? The panelists have expressed their views on these questions.

Dan Guatto, Chief Operating Officer and Vice President of Engineering and Operations at Burlington Hydro (and Chairman of the Board of EMC) is the panel moderator. The three panelists were:

- Suzanne Goldberg, Canadian Director of Public Policy, ChargePoint
- Simon-Pierre Rioux, President of the Quebec Electric Vehicle Association
- Ben Sharpe, Senior Researcher and Head of the International Council on Clean Transportation in Canada (ICCT)

Backgrounders and Synthesis of Panel 4

The fourth panel focused on electric and hydrogen trucks and the conditions necessary for ensuring the proper deployment of light electric vehicles and their charging infrastructure, particularly for long distances. Electric boats and planes were also briefly discussed.

The three subsections of this panel are:

1. Urban and long-haul electric trucks,
2. Electric car travel,
3. Electric boats and electric planes.

1. Urban and long-haul electric trucks

Urban electric trucks

The impressive increase in e-commerce during the confinement allowed the market share of e-commerce to triple from April 2019 to April 2020. This new reality will most likely persist, for the most part. This means more urban trucks on the roads for delivery.

Electric trucks available commercially in 2020 are mainly urban or peri-urban delivery trucks, with a range of 150 to 400 km [25]. There are also some garbage and bucket trucks.

Electric heavy trucks for long distances; battery electric and hydrogen-fuel cell

In 2022, Tesla plans to release its tractor for trailer trucks that will provide a range of 800 km at full load at highway speed. The company also plans to set up "mega chargers" for these trucks, capable of giving over 640 km of range in 30 minutes. Other manufacturers should follow also, as the price of batteries goes down.

According to a press release from Toyota on October 5th 2020 [26], Toyota Motor North America and Hino USA have agreed to jointly develop a class 8 fuel cell electric truck for the North American market. The first demonstration vehicle should arrive in 2021 and commercial versions later. No specifications are given yet.

Suzanne Goldberg suggested putting in place regulations to limit truck emissions, taking into account the life cycle of "fuels," which would allow different technologies to be divided between those that meet the standards and those that do not.

The importance of governmental support for electric trucks

Ben Sharpe stressed the importance of having government financial incentives to purchase electric trucks, as well as subsidies to help set up charging infrastructure that will require higher power. These subsidies should be commensurate with the cost differences between an electric truck and a gasoline or diesel truck.

2. Electric car travel

The main obstacles to EV penetration in the market were discussed. Simon-Pierre Rioux, president of the Quebec Electric Vehicle Association (AVÉQ), mentioned the availability of vehicles at local dealerships where there are still long waiting lists. According to him, the second obstacle would be the lack of financial incentives to buy EVs in some provinces, where only the incentive ($5,000) from the federal government is available, whereas in Quebec when adding the provincial rebate, consumers can benefit from support up to 13,000 when purchasing an electric car.
Mr. Rioux does not believe that the autonomy of EVs is a problem at present, since second-generation vehicles have a range of 400 km or more and allow to travel serenely on major roads. The difficulty remains in remote rural areas, where the charging stations are limited.

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[25] Ben Sharpe et al., *Race to zero: How manufacturers are positioned for zero-emission commercial trucks and buses in North America*, report from the International Council on Clean Transportation (ICCT), Environmental Fund and Propulsion Québec, published on October 19, 2020, https://theicct.org/publications/canada-race-to-zero-oct2020

[26] Toyota, *Toyota and Hino to Jointly Develop Class 8 Fuel Cell Electric Truck for North America*, October 5th, 2020, https://global.toyota/en/newsroom/corporate/34009225.html .

It has been pointed out in the previous panels, that the government will have to get involved to subsidize fast-charging stations in rural areas because their profitability will be problematic for several more years given the lower traffic.

Suzanne Goldberg stressed the importance of having good road signs to easily locate public charging stations, as well as the importance of interoperability of charging stations, to travel with peace of mind. She also argued that during the planning phase for charging stations, the accessibility for people with disabilities should be kept in mind. Whether the cable is easy to move or hang up and access is user-friendly for people in wheelchairs.

3. Electric boats and electric planes

Suzanne Goldberg mentioned that a company in British Columbia has developed the world's first all electric commercial aircraft. Harbour Air, North America's largest seaplane airline and magniX, the company powering the electric aviation revolution, today announced the successful flight of **the world's first all-electric commercial aircraft.** The successful flight of the ePlane, a six-passenger DHC-2 de Havilland Beaver magnified by a 750-horsepower (560 kW) magni500 propulsion system, took place on the Fraser River at Harbour Air Seaplanes terminal in Richmond (YVR South) this morning. The plane was piloted by Harbour Air CEO and founder Greg McDougall. This historic flight signifies the start of the third era in aviation – the electric age

With the rapid evolution of the batteries and their lightning, it will be able to make journeys of one hour in 5 to 7 years. For electric boats, LTS Marine stands out in Quebec. They specialize in water sports boats that offer the same performance as gasoline-powered boats. The battery life is three hours, and a charger can be installed at the dock.

Electric boats are already functional because they can carry heavier batteries than airplanes. A particularly interesting niche is electric ferries and short cruise ships. Norway is the leader in this area. Scandlines has put into service a large ferry between Sweden and Denmark, which makes 46 crossings of 4 km per day by recharging in less than 10 minutes at the docks. The ferry can carry more than 100 vehicles and allows 7 million passengers per year to cross the inlet[27]. The extra costs are absorbed in 8 years of operation thanks to fuel and maintenance savings.

Highlights of the Panel 4

Below is a selection of transcriptions of panelists comments and answers from Panel 4. The sequence of excerpts respects the chronological unfolding of the panel, allowing a better understanding of some statements in their context, i.e. with respect to a previous intervention.

[27] Fully Charged, YouTube video *100%ElectricFerry Crossing, May 14th, 2019*.

Suzanne Goldberg (P4)

On the reduction of GHG emissions due to COVID-19: "Air and road travels have decreased dramatically as people are staying at home and working from home and as a result we've seen significant reductions in emissions both air pollution and greenhouse gas reductions especially in Canada's more densely populated centers."

On the reduction of emissions by electric vehicles and on opportunities: "The emissions drop that we saw was a temporary phenomenon related to an unsustainable shift in our driving behavior. Electric mobility can deliver similar results in terms of impacts on our emissions, and on both greenhouse gas emissions and our local air pollution… we have a really important opportunity here to double down on policy and measures in place to support our greenhouse gas reduction goals and zero-emission vehicle goals"

On the reduction of emissions due to the COVID-19 & the need for the deployment of charging stations: "I do want to focus on the driver experience, and the core of how we will support electric mobility in the long run... I will just point this out in three ways. One is improving the way electric vehicle drivers can find charging stations, which now is done with an electric mobility charging app, we need to look at other technologies also such as wearables and Virtual Assistants. The second is making payments more accessible by providing a variety of options but also allowing and enabling driver roaming across networks so that EV drivers can charge wherever they are in Canada regardless of the network. And looking at developing the wide range of partnerships that will support charging deployment where EV drivers go and spend most of their time."

Simon-Pierre Rioux (P4)

On "Diesel Gate" and the limit of combustion engines: "With the recent diesel gate scandal, we have seen that we are at the limit of how clean those engines can be. We need to move into that next phase of electric motors that will output great horse powers use and little energy and be better for the environment"

On the importance of the interoperability of the various charging networks: "If you go from Canada to the US you will always have your credit card to be able to pay up for gas but with an electric car you need to be part of a charging network to pay the charging fees. More and more charging networks are allowing interoperability between them, and it allows drivers to travel without having any trouble and that's something that we've been hoping for as EV drivers."

Ben Sharpe (P4)

On the increase in e-commerce activities and the opportunity for electric trucks: "Let us talk about some statistics from a research from the American Trucking Research Institute done earlier this Spring. They surveyed of several thousand truck drivers at as well as trucking fleets and **the percentage of trips that are less than about a hundred and fifty kilometers has more or less doubled over the past few months** and that's really significant … it opens up an opportunity for electric trucks, battery electric as well as hydrogen fuel cell trucks. Some of the earliest products for the trucking sector are just starting to hit the market and these trucks have a more limited range as compared to their diesel and gasoline counterparts but what's really exciting about these trends towards more short-haul trucking is that it opens things up in terms of opting for electric trucks."

"We're going to have some unique solutions, policy and program interventions to support the electrification of heavy-duty trucks in particular."

Suzanne Goldberg (P4)

On charging stations to facilitate travel: "There's a policy element in terms of helping to facilitate travel by ensuring that we have the opportunity, in the short term, to provide incentives and grants to support the build-out of both fast charging infrastructure along highways and then level 2 charging stations in areas where people with EV drivers are going for longer periods of time."

Ben Sharpe (P4)

On the importance of having many charging stations: "I think the extent to which government can support these companies in terms of lowering the risk, and in terms of providing a much more saturated set of charging options especially in these rural areas, will give people a lot more confidence to be able to take vacations, go to their cabins and do those types of things and not feel like they have to switch over from their EV to their gasoline-powered car."

Simon-Pierre Rioux (P4)

On the use of adequate chargers and the financing options: "I'd like to say that overall the future will be electric, we all know that, but the future is also about extremely fast-charging stations and there will be a time when there's going to be a transition between 50 kilowatts and 100 kilowatts charging and even faster rates with third-generation electric cars coming. So, it is going to be important to be able to figure out which types of chargers we need, and depending on the location, if it is a rural area or a highway stop. And yes, I completely agree with Suzanne that we need more government incentive because the business case is not completely clear as far as fast-charging stations go, they're very expensive and it's a loss leader at one point as it isn't clear that people will benefit from these by stopping over

while dining and being entertained in those areas, while the car is charging. It could take up that kind of costs overall."

Suzanne Goldberg (P4)

On the development of charging stations for people with disabilities: "Good guidelines in California that can be used as a starting point or considerations that need to be taken into account are the size of the parking spot, also looking at the design of charging infrastructure and ensuring that charging infrastructure model can help people who might be in wheelchairs make sure that the cords are accessible and easy to move to their vehicle... we want the experience of going electric to be easy, convenient and safe."

Simon-Pierre Rioux (P4)

On the barriers to electrifying transportation: "I think availability is the first barrier. There are not many dealerships that have electric models if you do not live in BC, Ontario, or Quebec. Second is a lack of incentive. In Quebec, and BC there are provincial and federal incentives that decrease the price of EVs, as instance in Quebec the incentive can go up to $13,000 off the retail price is which is amazing! The range is not so much barrier. I have had cars with a range of 160 kilometers and I have driven 30,000 kilometers per year. With a car that has double and triple that [the range] I can still drive about 35,000 kilometers. So, it is just the time-saving component, as you say, because you don't need to stop on very long hauls and very long trips so much to charge up. But, overall, in Quebec the cars second-generation electric cars are ready, they will fill all your requirements for sure."

Suzanne Goldberg (P4)

On a regulation to limit life cycle emissions to dispose of battery or hydrogen trucks: "From the role of policy and the perspective from that angle, the role of technology- neutral policy and setting goals for emissions reduction, one particular policy comes to mind, the clean fuel standard is a really great tool to look at the full lifecycle emissions from transportation fuel emissions. It is setting the target as to where we want to go from an emissions perspective and letting the community of innovators and businesses compete to provide that solution. But I think where we are looking at what the technology can achieve to best answer the needs. I think another component is to just set real clearly goals on what we want to see from an emissions perspective."

Ben Sharpe (P4)

On zero-emission boats and planes: "We in particular haven't been doing too much in the way of commercial aviation or looking at zero-emission options in that sector, but certainly in marine there's lots of interest especially in the hydrogen fuel."

Suzanne Goldberg (P4)

On an incentive in British Columbia for electric aircraft: "BC government and its 2020 budget implemented a new tax credit for electric aviation so there is really a kind of a push. Some companies are making bold statements about their commitment to electric mobility and the government is responding with policy measures to encourage others to do so."

Ben Sharpe (P4)

On the timetable for the deployment of electric or hydrogen trucks: "Some of the early generation delivery trucks are already on the roads. I would expect that we are going to start to see more models across the range of different profiles and truck configurations. But one of the exciting things, from a policy perspective, being here in California and Sacramento our capital, is just a couple of weeks ago, the California Air Resources Board finalized requirements for manufacturers to sell zero mission trucks here in the state. This is an exciting development, the first in the world to require that manufacturers bring these trucks to market and we are really excited at the ICCT to hopefully export these types of regulatory measures to other places. So really in the post-2025 time frame, when we expect this market to really take off and in particular if Canada, and the rest of the world is going to reach its greenhouse gas targets it's really going to require buses and trucks to electrify at a more rapid rate than what was done in in the passenger vehicle space."

Suzanne Goldberg (P4)

On the future of induction charging: "I think will still need to evolve in terms of technology for the vehicle and the chargers, to make that kind of a wide-scale solution for the passenger vehicle segment and any mass scale. It is interesting and exciting that we continue to see new evolutions of the technology hardware while alongside we are developing the software solutions and we can maintain that software solution and that connectedness with a variety of hardware solutions. At this stage, looking at the applications and inductive charging you know maybe a pilot-project but as we moved forward, I mean my crystal ball is probably just as fuzzy as Ben's at this point"

Simon-Pierre Rioux (P4)

On the relevance of being able to reserve a charging station and charging stations for taxi fleets: "It is a complicated issue. A driver that is two minutes away from the charging station would take precedence in charging compared to somebody that just arrived in front of that driver and that did not think about reserving. Unless there are enough charging

stations, and that is what we are hoping as drivers ultimately. Having just one or two fast-charging stations in one location is not good enough, we need to have a more forward-thinking approach. It needs to be 6, 8, 20 charging stations at a time being installed in one location, so that we avoid these problems in the long run… it's about the frustration of the driver arriving at a charging site and finding that there's a waiting line seeing that you have to wait 20, 40 minutes, or 75 minutes before you can charge for 20 minutes… and as we've seen in Montreal as well, with the Taxelco experience, there were very specific charging station and sites reserved for the taxis so there will be some sort of divisions between public charging and fleet charging."

Ben Sharpe (P4)

On the importance of government incentives for electric trucks and the charging infrastructure and the need for planning: "In the US and Canada one of the things that's really impacting the trucking industry is the shortage of drivers. As drivers have been aging, getting new drivers has been a real challenge and because the lifestyle associated with long-hauls means being out for several days. That type of lifestyle is less appealing and it's a lot easier to say okay you're going to be home every night with your family as opposed to off for several days or weeks at a time sleeping in your truck. As I said these first-generation electric trucks while they may have limited range compared to diesel trucks they absolutely can fulfill the needs of this urban or regional type of transport… in and around ports is a place where we expect to see a lot of these in the first wave of electric trucks. We can support these fleets in many ways. Obviously cost is a huge component, this is a no-brainer, bringing down the cost not only of the trucks themselves but infrastructure also, and I think that the government has an important role to play in terms of just making the whole experience of choosing to go electric much more seamless… keep in mind that the large majority of fleets, both in the US and Canada, are either small businesses or owner operators so there are thousands of these small enterprises and as we expect them to electrify over the next five, ten, plus years, I think that the government has a critical role to play not only in education but in terms of thinking about what type of fleets we are going to need."

Simon-Pierre Rioux (P4)

On the location of the fast*charging stations: "There's a Research Chair in Montreal with the Concordia University working on trying to find patterns of traveling between different cities and seeing where traffic goes and where we should have those traffic charging stations. It's a science and I think that the most important part is figuring out where those people are going and where we will need those charging stations in the future."

On Canadian fuel consumption standards that should not follow the new U.S. standards: "In the US, with the EPA being destroyed piece by piece, California has to uphold the law as far as greenhouse gas emissions and fuel standards go. And Quebec has always followed up on what California has been doing. I support that, because the Canadian government has been a follower of what the EPA has been doing as far as fuel standards are concerned,

and since it's being destroyed right now I don't know what our country is going to do overall. We are putting pressure on the federal government and making sure that they will uphold their commitments and make sure that the greenhouse gas emission is a priority for them."

Conclusion

Decongested streets, bluer skies, animals back in cities and less unpleasant odors and noise are the first things citizens have noticed in the beginning of the COVID-19 containment. This is one of the positive aspects of the pandemic, an awareness of the importance of air quality for our quality of life.

As we saw in the introduction, global greenhouse gases have decreased by 17% in the COVID-19 pandemic, motor vehicle traffic has fallen by about 60% and public transit ridership has decreased by about 80% in most major cities. These figures make us realize the enormous efforts that will be required to combat climate change. Needless to say, the deployment of electric vehicles will have to accelerate, and measures/programs that promote their adoption must be continued or put in place.

The other key finding was undoubtedly the discovery that teleworking can not only be very functional, but that it saves time and money for both workers, in terms of expenses and travel time, and employers, in terms of floor space rental and office equipment purchases. This trend is likely to continue and increase in the post-COVID-19 era. There is no doubt that this new way of doing things will have a downward effect on the use of personal and public transport. The situation will have to be closely monitored to establish more precisely the effects on public transport ridership and car use. The area of concern, however, is the low occupancy of downtown office buildings, which was still important in September 2020. This situation argues in favor of a gradual transition to the world of teleworking.

The third major effect of COVID-19 on mobility is less positive. This is the flight of passengers from public transport, which was of the order of 80% at the peak of the pandemic, whereas their use was about 40% less than usual in September 2020. There is no doubt that the close proximity of people in buses, subway trains and trains has not gone hand in hand with social distancing measures. In addition, there is still a health concern among travelers about the virus. The timing of a return to normal is difficult to predict. This situation has deprived the transport companies of very large amounts of money from ticketing, putting them in a very precarious financial situation, as raised by several panelists. This state of affairs is all the more distressing since the investments required for the purchase of electric buses and the installation of infrastructure to recharge them will be significant.

Another sector of activity strongly affected by COVID-19 is e-commerce, which has gone from a market share of 3.8% in April 2019 to 11.4% in April 2020. And it is likely that part of this increase will remain after COVID-19. We will therefore see a greater use of urban and peri-urban trucks. In this regard, several panelists noted that the Canadian industry already includes manufacturers of electric trucks with a range of up to 400 km, and that this would be an opportunity not to be missed.

It's too early to tell what will be the mid to long term effect of COVID-19 on all walks of life and transport in particular but we can already assume that there will be some durable impact.

Next Steps

The observations made in this report, concerning the impacts of COVID-19 on mobility, point to situations that need to be clarified and issues that need to be improved and accelerated. The following are some future actions that would benefit from being considered in this regard.

1. The observed concern of people being too close to each other (for health reasons) and the considerably increased teleworking during the pandemic bring uncertainty as to the use of **public transport** in the coming years. Especially since ridership is still significantly reduced eight months after the start of COVID-19 in Canada.

   Given the importance of public transit for society, more light should be shed on this situation and corrective measures should be taken, if necessary. The first step would be to establish foreseeable trends in order to better manage the resources required by public transportation companies between now and 2030. Consideration should also be given to how vehicles and services could be modified to make them more attractive and better adapted to the new reality that seems to be taking shape.

2. As this report has shown, **teleworking** increased significantly during the pandemic, to the extent that office towers in city centers were left with occupancy rates of less than 20%, also affecting the businesses that served the employees in these buildings.

   This situation indicates that the undeniable environmental benefits of telework (less transportation) are accompanied by economic concerns related to office buildings that are at risk of losing more and more clients. It would be advisable to explore more precisely, in a study, the consequences of telework and ways of mitigating its more delicate aspects, in order to ensure a smooth transition to this new reality.

3. To enter the telework era on the right foot, it will be necessary to **ensure that communication networks are up to the task**. The communication infrastructure will have to be adapted accordingly, which will require governments, in conjunction with telecom companies, to plan all this.

Now, **if there is one thing that stands out as a priority in this report, it is the urgent need to electrify transport where possible** to avoid all the harmful aspects of air pollution on health and quality of life, and to meet Canadian objectives in terms of greenhouse gas reduction. Blue skies, less air pollution in city centers and reduced noise pollution are all phenomena that have been appreciated by the Canadian population from the very first weeks of lockdown. Add to this the fact that the train of intensive industrial development of electric vehicles has started, and our Canadian industry has no interest in missing it. On the contrary, it should be seen as a great opportunity to grow our economy in a greener way. So here are some other actions to be taken in the months and years to come.

4. The first group of actions is definitely **incentives to encourage the purchase of electric vehicles** (EVs). The most important ones are financial assistance from governments to get these new technologies off the ground, as long as the purchase price differential between EVs and gasoline or diesel vehicles is too great. These include rebates on the purchase of EVs, financial assistance for the installation of charging stations at home and at work, and subsidies to set up rapid charging infrastructures. In addition, there are road incentives, such as access to reserved taxi and bus lanes during rush hour, free tolls on highways and bridges, and free parking thanks to a "green plate".

5. The action that goes hand in hand with vehicle purchase incentives is to ensure that EVs will be available in sufficient numbers at dealerships and with a sufficiently varied range of vehicle types and models to cover the needs of motorists. Specifically, this will require the provincial or federal governments to advance measures to increase ZEV supply, by for example requiring manufacturers to set an annual floor for EV sales, increasing each year. The annual floors could follow California's.

6. With regard to the existing automotive industry in Canada, agreements will have to be negotiated with manufacturers to **introduce electric vehicles in Canadian plants**.

7. The **new companies** that have emerged in recent years **around electric mobility** (charging stations, electric trucks and buses, electric boats, electric airplanes, electric micro cars, etc.) also need support. A first way for governments to do this is to order, for example, electric trucks for Canada Post.

8. Another way to help new companies is to issue calls for tenders for the **development of new technologies**, which we know will be required in a few years' time. For example, a mini urban electric car with a battery pack having a removable part to be recharged from a 120-volt electrical outlet inside homes and at work, for those who do not have access to an outlet outside their flat block in the city. This removable part of the battery could take the form of a 12 kg case offering a range of 25 km. The batteries used in electric vehicles today are not light enough but will be in 4 to 5 years. For this project, batteries with a limited number of recharging cycles (300 to 400 cycles) could be used. They are

currently quite light, but do not have sufficient longevity for electric vehicles (>1500 cycles).

9. We should not forget a **promising sector in Canada, related to electric mobility, which is that of batteries**. Canada is very well positioned in terms of the natural resources required (nickel, cobalt, lithium, graphite, aluminum, copper). There are also large laboratories in research institutes and some universities that have been working successfully for a long time on battery chemistries and ways to improve their performance. Moreover, electricity is very clean in several Canadian provinces, which is an asset when it comes to setting up battery plants, since the ecological footprint associated with their manufacture is reduced accordingly. It would therefore be wise to set up a Canadian consortium to develop this sector, up to battery recycling, with financial support.

10. Finally, Canada has shipyards that would be interested in examining the possibility of **building all-electric (including hydrogen) or plug-in hybrid ferries**, as is being done successfully in Scandinavia (see the chapter on Panel 4). Where crossings are less than 5 km at present and more than 10 km in five to ten years, these ferries work wonderfully by charging at the docks in 10 minutes and save enormous amounts of fuel. The greenhouse gas reductions are significant, of course. A feasibility study should be conducted on this possibility.

These are avenues to be explored for the future, in relation to teleworking and electric mobility. These suggestions could be incorporated into a post-COVID economic recovery plan to green the Canadian economy and create quality jobs for the future.