Just-in-Time Delivery

Environmental scan of policies and practices

Maddy Ewing

March 2020

Photo: Roberta Franchuk, Pembina Institute

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The Pembina Institute is a national non-partisan think tank that advocates for strong, effective policies to support Canada's clean energy transition. We employ multi-faceted and highly collaborative approaches to change. Producing credible, evidence-based research and analysis, we consult directly with organizations to design and implement clean energy solutions, and convene diverse sets of stakeholders to identify and move toward common solutions.

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Executive summary

Goods distribution is a backbone of the Canadian economy; however, it is also a growing source of emissions. As urbanization, online shopping and the demand for just-in-time deliveries increases, it is expected that more freight vehicles will be on our roads. There is some research that suggests that e-commerce shopping results in lower transportation related greenhouse gas (GHG) emissions than traditional brick and mortar retail shopping due to reductions in vehicle trips. However, these benefits are likely to be eroded particularly when consumers opt for fast delivery resulting in fewer opportunities to consolidate shipments delivered by trucks, perform complementary trips to the physical store to, for instance, return delivered items, or increase the frequency of single item baskets resulting in more individual deliveries by truck. There are three major trends that are changing the landscape of goods distribution in Canada:

1. The increasing popularity of just-in-time delivery
2. Higher volumes of online sales
3. A demand for free shipping

Amidst the fierce competition among businesses to provide the fastest and lowest cost delivery, there are emerging efforts to reduce the carbon footprint of goods distribution that is increasing alongside faster delivery expectations and a higher volume of online sales. To promote this reduction, private and public actors have begun to implement policies and initiatives to encourage delivery methods with lower GHG emissions, whether that be a low impact mode of transport or a longer delivery period. Across North America and Europe, there is a spectrum of existing and proposed corporate initiatives and public policies aimed at encouraging low-carbon delivery methods. They can be placed into one of the following five categories:

1. **Tax policies**: A percentage-based tax rate can be applied to businesses for parcels delivered using carbon-intensive modes of travel. Deliveries made using modes that do not consume fossil energy can be exempt from the tax, therefore promoting the uptake of low-carbon modes of delivery. The rate of taxation can be scaled according to the distance a particular good has travelled from warehouse to final destination.
2. **Carbon offsets**: Corporations can purchase offsets to lower a firm's carbon footprint. Alternatively, they may offer their customers the opportunity to purchase offsets. Offsets indirectly act as an incentive to sway consumers towards lower emitting modes of delivery. As the carbon offset reflects the

quantity of GHG emissions, it will be less expensive to offset a delivery method with a lower carbon intensity.

3. **Consumer incentives and rewards**: Corporate consumer incentives and rewards programs can incentivize consumers to choose low impact delivery methods. Most of the existing corporate incentives work by offering consumers a reduction in price or a reward when they opt for slower delivery methods for non-urgent shipping demands.
4. **Consumer awareness and education campaigns**: Initiatives deployed by both third-party actors, such as news outlets, as well as delivery companies, to bring awareness to consumers on the potential negative externalities and impacts of their chosen delivery methods.
5. **Nudge policies**: The promotion and influence of a preferred behaviour through indirect or nudge policy interventions. Subtle nudges can be employed by both governments and corporations to promote the uptake of less carbon intense delivery methods by setting the greenest shipping option as the default option. In other words, standard shipping could be relabeled as green shipping.

Ultimately, we are at an inflection point and need to reconsider this “race to the bottom”. Free, fast shipping is not only an unsustainable business model for companies, but also poses a threat to our environment. Addressing these changes requires a balanced approach in which we recognize the importance of a reactive goods distribution system, but also provide the necessary mechanisms to successfully limit its negative externalities.

Multiple actors have a role to play in communicating the externalities of free and fast shipping. To reduce the carbon intensity of goods distribution by increasing consumer awareness of the impacts of their delivery choices, we recommend the following actions:

1. **Limit free, fast shipping**: Free shipping is the top priority for the majority of consumers, and speed of delivery is a close second. If consumers are offered free delivery across multiple shipping speeds, they’re inevitably going to choose the fastest option. Companies should consider the cost of externalities when they offer free, fast shipping. By charging for fast delivery, this clearly demonstrates to consumers the added cost of the extra speed. Many e-commerce businesses are already scaling their shipping prices according to speed.
2. **Make low-carbon shipping the default option and make it a highly desirable option**: As evidence suggests that consumers are more likely to

choose default options, businesses should take advantage of this default bias and nudge consumers towards the low-carbon option. Moreover, consumers are highly motivated by free delivery. Though not all companies will be able to offer free delivery, making low-carbon shipping a competitive option is important to consumers.

3. **Educate consumers on the environmental impact of their chosen delivery method at check-out**: A survey of recent trends in e-commerce suggests the majority of consumers think about the environment when making their delivery choices. It is important for businesses, as well as third party actors to provide consumers with credible, targeted information on the environmental impact of various delivery methods. It is, however, important to translate environmental impacts to simple, understandable metrics. For instance, state that a consumer's decision to choose standard as opposed to fast shipping is the equivalent to planting a certain number of trees, or taking a certain number of cars off the road. Alternatively, companies can relabel slow, standard shipping as "green shipping".
4. **Reduce spontaneity and demand for single item baskets by encouraging predictable, consolidated delivery**: Educate consumers on the impact of shipping multiple packages by offering deals on consolidated deliveries. As exemplified by Amazon, businesses can provide consumers with the opportunity to fill their shopping carts over a period of time, and offer consolidated delivery at a lower cost on a scheduled day of the week. Alternatively, companies can offer deals on subscription boxes that can be consolidated in advance and delivered on a specific day. When businesses are able to anticipate consumer demand and needs for goods, they are left with the time to optimize their operations and consolidate shipments. This can cut down on the number of delivery vehicles on the road, as well as the amount of packaging being used.

1. Introduction

1.1 Economic importance of freight

Goods distribution is a backbone of the Canadian economy. Any business that has a supply chain depends on freight and nearly everything we purchase as consumers has to be delivered to its final point of sale. In 2017, Canada's for-hire trucking industry moved more than 66.5 million shipments weighing over 816 million tonnes across 40 billion kilometers.[1] Rail carriers moved nearly 312 million tonnes of goods in 2017.[2]

Freight provides a notable contribution to Canada's gross domestic product (GDP): in 2018, transportation and warehousing contributed to 4.5% of Canada's GDP. The sector is also an important source of employment: 920,800 people were employed in transportation and warehousing in 2015 in Canada, up 2.7% since 2017.[3] Ultimately, goods distribution plays an important role in Canada's economy; not only does it unite consumers with the goods they've ordered, but it's also responsible for providing Canadians with jobs and contributing to Canada's overall GDP.

1.2 GHG and air pollutant emissions from freight

A number of distinct vehicle types are involved in the movement of goods in Canada. While airplanes, marine vessels, trains or tractor trailers are responsible for goods movement across regions, smaller step vans or utility vans are responsible for delivering goods in the last mile. Each of these vehicles play a vital role in the distribution of goods within Canada. However, they are also a growing source of emissions. Between 1990 and 2016, GHG emissions from freight trucks (including light-, medium- and heavy-duty freight trucks) doubled, and they are now responsible for nearly one half of on-road transportation emissions (see Figure 1).[4]

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[1] Statistics Canada, "Table 23-10-0219-01 Trucking Commodity Industry Activities," 2019. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310021901

[2] Statistics Canada, "Rail Transportation, 2017," *The Daily*, April 8, 2019. https://www150.statcan.gc.ca/n1/en/daily-quotidien/190408/dq190408b-eng.pdf?st=Be3Mtxld

[3] Transport Canada, *Transportation in Canada 2018: Overview Report*, 7. https://www.tc.gc.ca/documents/Transportation_in_Canada_2018.pdf

[4] Natural Resources Canada, "Table 8: GHG Emissions by Transportation Mode," *Comprehensive Energy Use Database*.

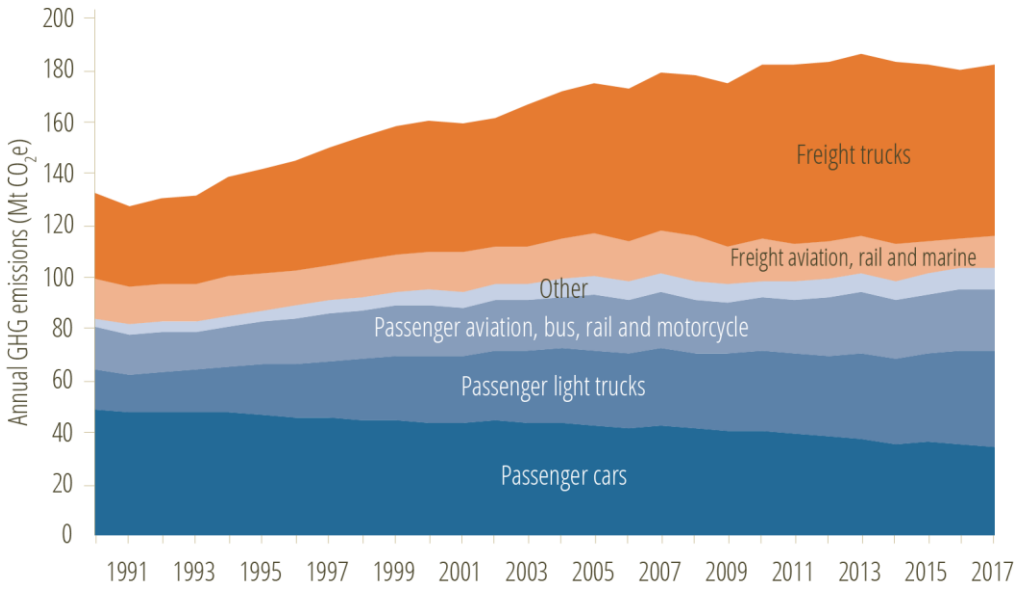

Figure 1. Canadian transportation sector GHG emissions.

Data Source: Natural Resources Canada[5]

Moreover, heavy-duty trucks are a leading source of criteria air contaminants that can contribute to the formation of smog and localized air pollution that can be harmful to human health.[6] A recent study conducted by the Southern Ontario Centre for Atmospheric Aerosol Research (SOCAAR) highlighted the disproportionately large impact of heavy-duty trucks on local air pollution.[7] The study found that concentrations of air pollutant emissions depend more on the proportion of large trucks on the road than the total traffic volume. While the goods movement sector is an important component of the Canadian economy, growing freight activities have major implications on both climate change, as well as the quality of life of Canadians, if they are not adequately managed and planned for.

http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=tran&juris=ca&rn=8&page=0

[5] "Table 8: GHG Emissions by Transportation Mode"

[6] Environment Canada "Air pollutants – Criteria Air Contaminants," 2017.

https://www.ec.gc.ca/air/default.asp?lang=En&n=7C43740B-1

[7] Southern Ontario Centre for Atmospheric Aerosol Research, *Near-Road Air Pollution Pilot Study* (2019). https://www.socaar.utoronto.ca/wp-content/uploads/2019/10/SOCAAR-Near-Road-Air-Pollution-Pilot-Study-Summary-Report-Fall-2019-web-Final.pdf

1.3 E-commerce and delivery trends

As urbanization, online shopping and the demand for just-in-time deliveries increases, it is expected that more freight vehicles will be on our roads, contributing not only to emissions, but also to traffic congestion, noise and air pollution, and competition for curbside space. There is evidence to suggest that e-commerce has a lower carbon footprint than traditional brick and mortar retail shopping.[8] For one, the carbon footprint of an online retail site is notably lower than that of a physical store.[9] Furthermore, consolidated delivery can eliminate the multiple trips that would have otherwise been made by individual shoppers travelling to a physical store. The carbon footprint of goods distribution, however, is dependent on a multitude of factors such as the consumer's proximity to the fulfillment centre, number of items per order, packaging, complementary consumer trips and the choice and speed of delivery method.[10,11] The GHG emission benefits of e-commerce are likely to be eroded particularly when consumers opt for fast delivery resulting in fewer opportunities to consolidate shipments delivered by trucks, perform complementary trips to the physical store to, for instance, return delivered items, or increase the frequency of single item baskets resulting in more individual deliveries by truck.[12,13]

We've identified three major trends that are changing the landscape of goods distribution in Canada: the increasing popularity of just-in-time shipping demands, higher volumes of online sales, and a lack of willingness to pay for shipping.

1.3.1 Just-in-time delivery trends

Goods distribution is becoming increasingly fast-paced and reactive. More and more, retailers and consumers are operating using a just-in-time philosophy whereby goods aren't ordered or received until absolutely necessary. Expectations for fast shipping

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[8] Dimitri Weideli, Edgar E. Blanco, Naoufel Cheikhrouhou and Anthony Craig, *Environmental Analysis of US Online Shopping* (2013), 4-6. http://ctl.mit.edu/sites/ctl.mit.edu/files/library/public/Dimitri-Weideli-Environmental-Analysis-of-US-Online-Shopping_0.pdf

[9] Ibid.

[10] Ibid.

[11] Patricia van Loon, Lieven Deketele, Joost Dewaele, Alan McKinnon and Christine Rutherford, "A Comparative Analysis of Carbon Emissions From Online Retailing of Fast Moving Consumer Goods," *Journal of Cleaner Production* 106 (2015), 481-484.

[12] Andy Murdock, "The Environmental Cost of Free 2-Day Shipping," *Vox* (2017). https://www.vox.com/2017/11/17/16670080/environmental-cost-free-two-day-shipping

[13] *Environmental Analysis of US Online Shopping*, 4-5.

shifted from three or four days in 2015 to just two days in 2016.[14] And businesses aren't hesitating to meet or even exceed these expectations: standard shipping speed for purchases on Amazon Prime recently dropped down to one day,[15] and within three weeks of Amazon's announcement, Walmart announced its plans for next-day delivery.[16] Furthermore, FedEx and UPS have announced that ground service would be extended from six to seven days a week.[17] The competition for fast delivery is also prominent in grocery delivery with companies like Longo's offering same-day delivery on orders placed before noon.[18] Walmart,[19] Inabuggy[20] and Instacart[21] each offer grocery delivery to your door in as little as one hour. Ultimately, consumers are demanding near constant delivery: 54% of respondents in a recent survey identified fast delivery as either their highest or second highest priority when making online purchases.[22] Moreover, these rising expectations are not limited to the business-to-consumer (B2C) portion of the supply chain; those on the receiving end of business-to-business (B2B) transactions are also demanding the same standard in order to meet their just-in-time operational needs.[23]

Though the just-in-time practice may be a means of optimization or convenience for the customer, it threatens the GHG emission benefits of consolidated goods distribution. In these cases, retailers are forced to quickly respond to customer demands and are left with less time to optimize their delivery practices and ensure that each truck leaves with a full truckload on a well-planned route. To remain competitive and

[14] Deloitte, *The Future of Freight: How New Technology and New Thinking Can Transform How Goods Are Moved* (2017), 6. https://www2.deloitte.com/us/en/insights/focus/future-of-mobility/future-of-freight-simplifying-last-mile-logistics.html

[15] "Prime Free One Day," *The Amazon Blog* (2019). https://blog.aboutamazon.com/amazon-prime/prime-free-one-day

[16] Marc Lore, "Free NextDay Delivery Without a Membership Fee," *Walmart* (2019). https://corporate.walmart.com/newsroom/2019/05/14/free-nextday-delivery-without-a-membership-fee

[17] Emma Cosgrove, "Are We Heading Toward 24/7 Logistics Services Or Are We Already There?" *Supply Chain Dive*, July 11, 2019. https://www.supplychaindive.com/news/247-logistics-services-ecommerce/558246/

[18] "Grocery Gateway by Longos," Longos. https://www.grocerygateway.com/store/groceryGateway/en/

[19] Ashley Newport, "Walmart Launches Brand New (and Super Fast) Delivery Service in Mississauga," *Insauga*, October 10, 2019. https://www.insauga.com/walmart-launches-brand-new-and-super-fast-delivery-service-in-mississauga

[20] "Inabuggy." https://www.inabuggy.com/

[21] "Instacart." https://www.instacart.ca/?country_switch=1

[22] Metapack, *2018 State of Ecommerce Delivery*, 6. https://content.metapack.com/acton/fs/blocks/showLandingPage/a/29620/p/p-0071/t/page/fm/0

[23] *The Future of Freight: How New Technology and New Thinking Can Transform How Goods Are Moved*, 6.

customer-oriented, businesses optimize their shipping operations for time rather than fully loaded vehicles. However, GHG emissions from goods distribution tend to be reduced when shipments are consolidated and delivered less frequently albeit during an anticipated time horizon.[24] Additionally, short time frames for goods distribution are forcing a shift to higher emitting modes of transport, such as air. UPS recently added 11 planes to its fleet in order to keep up with a recent surge in next-day and two-day deliveries.[25]

A just-in-time philosophy also has impacts on order consolidation. Items may be stored in warehouses or retail stores at separate locations making it difficult to ship multiple items in the same package under time constraints.[26] Thus, individual items from multi-item shopping baskets may be shipped separately. Not only does this reduce the number of consolidated deliveries and potentially increase the number of delivery vehicles on the road, but this practice also leads to increased packaging and its associated GHG emissions. Accordingly, cardboard packaging can be responsible for up to one quarter of GHG emissions stemming from the delivery of an item.[27]

1.3.2 Higher volumes of online sales

Higher volumes of online sales pose a threat to the GHG emission benefits of e-commerce and consolidated goods distribution, particularly when coupled with the rising pace of deliveries. Increased connectivity and the emergence of more sophisticated e-commerce platforms has led to more online shopping. Between 2016 and 2018, the average number of online purchases made by Canadians grew by 58%.[28] In fact, more Canadians are satisfied with online shopping (77%) than with traditional brick-and-mortar shopping (59%).[29]

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[24] Johannes Igl and Florian Kellner, "Exploring Greenhouse Gas Reduction Opportunities for Retailers in Fast Moving Consumer Goods Distribution Networks," *Transportation Research Part D: Transport and Environment* 50 (2017), 63-65.

[25] David Koenig, "Demand for Fast, Online Delivery Drives UPS 3Q," *Canadian Business*, October 22, 2019. https://www.canadianbusiness.com/business-news/demand-for-fast-online-delivery-drives-ups-3q/

[26] Amazon, "About Shipping Preferences." https://www.amazon.ca/gp/help/customer/display.html?nodeId=201910450

[27] "A Comparative Analysis of Carbon Emissions From Online Retailing of Fast Moving Consumer Goods"

[28] Canada Post, *The 2019 Canadian E-Commerce Benchmark Report* (2019), 4. https://www.canadapost.ca/assets/pdf/2019_ecomm_benchmark_report-en.pdf

[29] UPS, *UPS Pulse of the Online Shopper Study: Global Study Executive Summary* (2018), 4. https://www.ups.com/assets/resources/media/knowledge-center/ups-pulse-of-the-online-shopper.PDF

However, the share of e-commerce sales as a percentage of total retail sales is still relatively low in Canada. Statistics Canada estimates that Canadian e-commerce retail sales represented only 3% of Canadian retail sales in 2018.[30] While in-store retail sales grew by an average of 4% per year between 2013 and 2017, e-commerce sales grew by an average of 20% per year over the same period.[31] If the growth in share of e-commerce sales continues along its current trajectory, the current goods distribution challenges will only be further exacerbated. As such, there is a need to better plan and manage freight distribution across Canada in reaction to this anticipated growth.

1.3.3 Demand for free shipping

Even as customers' expectations for fast delivery increases, their willingness to pay for it has fallen — 62% of consumers expect free delivery for everyday purchases.[32] Some e-commerce sites are now offering free shipping on expedited deliveries. For instance, Amazon offers its Prime members free two-day shipping, as well as free same-day and one-day delivery on eligible items.[33] As certain actors set the standard for fast, free and flexible delivery, there is increasing pressure for other online retailers to provide this same level of service. This pressure and competition is likely to lead to higher environmental impacts, and thus, it is crucial for all actors involved in e-commerce and goods distribution to determine how negative environmental externalities can be mitigated.

[30] Statistics Canada, "Canadian E-Commerce: Measuring Domestic vs. Cross-Border E-Commerce," 2019. https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2019067-eng.htm

[31] Statistics Canada, "Table 20-10-0064-01 Annual Retail Trade Survey, Sales by Method and Type of Store (x 1,000)," 2019. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2010006401

[32] *2018 State of Ecommerce Delivery*, 7.

[33] "About Amazon Prime," *Amazon*. https://www.amazon.ca/gp/help/customer/display.html?nodeId=201025460

2. Improving consumer awareness of the externalities of just-in-time delivery

Amidst the fierce competition among businesses to provide the fastest and lowest cost delivery, there are emerging efforts to reduce the carbon footprint of goods distribution that is increasing alongside faster delivery expectations and higher volumes of online sales. To promote this reduction, various actors have begun to implement policies and initiatives to encourage delivery methods with lower GHG emissions, whether that be a low impact mode of transport or a longer delivery period.

Retailers, e-commerce platforms, third party logistics providers, government, and research institutes each have a role to play in influencing consumer behaviour with respect to chosen delivery methods. While third party logistics providers may be responsible for adopting low-carbon modes of delivery, retailers and e-commerce platforms are responsible for offering and incentivizing these modes. Similarly, government has a role to play in identifying and incentivizing optimal low-carbon modes of delivery. Meanwhile, research institutes can play a role in analyzing various delivery models to identify what those optimal modes may be.

In general, existing policies and initiatives aimed at encouraging low-carbon delivery methods can be placed into one of four categories: tax policies, carbon offsets, consumer incentives and rewards or consumer education and awareness campaigns. Others have also proposed employing subtle suggestions to "nudge" consumers towards lower impact shipping methods. If successfully implemented, these policies and initiatives could play a role in making goods distribution more efficient and less carbon intensive.

2.1 Tax policies

To date, France has been the only jurisdiction to put forward a proposal to tax goods purchased on e-commerce sites. The proposal has been submitted by the French Senate and if accepted, would result in a percentage-based tax rate that is scaled to the

distance a particular good has travelled from warehouse to final destination (see Table 1).[34]

Goods will be taxed 1% of their final price for delivery distances less than 50 km, 1.5% for distances between 50 to 80 km and 2% for distances greater than 80 km with a minimum tax of €1.00 per online order. The initial proposal of the tax was not percentage-based and had a minimum tax of €3.00 per online order with an additional €0.50 per km travelled.[35] Though the proposed tax does not reflect speed of delivery, it takes into consideration the mode of travel. In particular, deliveries made using modes that do not consume fossil energy would be exempt from the tax.[36] This would include, for instance, electric vehicles, hydrogen fuel cell vehicles, internal combustion engine vehicles operating using biofuels, and active modes of transportation, such as cargo cycles. Though the tax would be charged annually to the e-commerce site, the Finance Committee of the Senate has expressed concern that the cost of the tax would be easily passed on to consumers and would lead to inequalities across regions.[37]

[34] Senate of France, *Proposition de Loi Portant Pacte National de Revitalisation des Centres-Villes et Centres-Bourgs*, June 14, 2018, Article 27, 45. https://www.senat.fr/leg/tas17-125.pdf

[35] Senate of France, *Proposition de Loi Portant Pacte National de Revitalisation des Centres-Villes et Centres-Bourgs*, April 20, 2018, Article 27, 93-94. https://www.senat.fr/leg/ppl17-460.pdf

[36] Ibid.

[37] Arnaud Bazin, on behalf of the Finance Committee, *Avis Présenté au Nom de la Commission des Finances (1) sur la Proposition de Loi Portant Pacte National de Revitalisation des Centres-Villes and Cetres-Bourgs*, June 5, 2018, 103. https://www.senat.fr/rap/a17-543/a17-5431.pdf

Table 1. Tax-based policies and initiatives aimed at reducing the impact of just-in-time delivery.

Policy/Initiative	Details	Key Actor(s)
France considering tax on e-commerce[38]	The French Senate is considering an annual tax on goods purchased through e-commerce sites. Article 27 states that the tax would be percentage-based and scaled depending on the distance the goods have to travel from warehouse to final destination. There would be a minimum tax of €1.00 per online order. Otherwise, the tax would be set at: • 1% of the price of the good when the distance travelled is <50km, • 1.5% when the distance is between 50 and 80km and • 2% when the distance is >80km. The tax would not apply to deliveries made using modes that do not consume fossil energy, as well as small retailers with annual sales <€50 million and certain local agricultural producers and books.	Government

There is some evidence to suggest that a distance-based tax on trucks transporting goods would only lead to minimal GHG emission benefits and may in fact be counterproductive.[39] In their study on the effect of taxing truck distance in retail transports, Carling et al. find that a tax on truck distance travelled may reduce the demand for goods purchased on e-commerce sites and erode the GHG emission benefits offered by consolidated goods distribution. Ultimately, the authors find that the net effect of taxing truck distance on total GHG emissions is unclear.

2.2 Carbon offsets

Carbon offsets indirectly act as an incentive to sway consumers towards lower emitting modes of delivery. Carbon offsets make use of a reduction in GHG emissions achieved by one party, which are then sold as a credit to another party to compensate for (or offset) their production of GHG emissions. As the carbon offset reflects the quantity of GHG emissions, it will be less expensive to offset a delivery method with a lower carbon intensity. Hence, consumers will be able to identify which delivery modes produce the

[38] Ibid.

[39] Kenneth Carling, Johan Hakansson, Xiangli Meng and Niklas Rudholm, "The Effect on CO_2 Emissions of Taxing Truck Distance in Retail Transports," *Transportation Research Part A* 97 (2017) 54.

lowest GHG emissions. An overview of each of the initiatives related to carbon offsets are provided in Table 2.

Though their customers will not be responsible for the added cost, Etsy was one of the first e-commerce sites to commit to offsetting GHG emissions from delivery.[40] Since Etsy's announcement, UPS has also begun to offer a carbon neutral shipping option driven by carbon offsets.[41] In this case, UPS is passing along the cost to the consumer. If a customer is planning on offsetting the GHG emissions associated with their delivery, it will be less expensive to offset lower-emitting modes. According to one article, fees for carbon offsets offered by UPS will be around 5 cents for ground packages delivered by truck, 20 cents for packages delivered by air and 75 cents for international packages.[42] The carbon offset program offered by UPS is verified by Natural Capital Partners who ensure that carbon credits are additional (i.e., would not have occurred in the absence of financing), legally attributable, measurable, permanent, unique (i.e., only attributed with a single emission reduction) and independently verified.[43] Projects financed through Natural Capital Partners' CarbonNeutral program include renewable energy projects, household emission reduction devices, and forest conservation and restoration.[44] Examples of offset project types include financing water filtration and improved cookstoves in Guatemala,[45] renewable energy projects in India, China and Chile,[46] and rainforest conservation in Brazil and Chile.[47]

In reaction to the increasing popularity of carbon offsets, Cloverly has developed a tool to integrate carbon offsets into a multitude of platforms such as e-commerce sites or ridesharing apps.[48] It can also be integrated with Shopify. To calculate the price of the

[40] Josh Silverman, "Etsy Becomes the First Global eCommerce Company to Completely Offset Carbon Emissions from Shipping," *Etsy News*, February 26, 2019. https://blog.etsy.com/news/2019/on-etsy-every-purchase-makes-a-positive-impact/?utm_medium=editorial_internal&utm_source=etsy_blog&utm_campaign=carbon-neutral

[41] UPS, "UPS Carbon Neutral." https://www.ups.com/ca/en/services/sustainability/sustainable-services/carbon-neutral.page

[42] Freddie Pierce, "What You Need to Know About UPS Green Shipping and Carbon Footprints," *Digital Supply Chain*, Jan 12, 2011. https://www.supplychaindigital.com/logistics/what-you-need-know-about-ups-green-shipping-and-carbon-footprints

[43] Natural Capital Partners, *The CarbonNeutral Protocol* (2019), 32. https://assets.naturalcapitalpartners.com/downloads/The_CarbonNeutral_Protocol_January_2019.pdf

[44] CarbonNeutral, "CarbonNeutral Certification FAQs." https://www.carbonneutral.com/faqs

[45] *The CarbonNeutral Protocol*, 25.

[46] *The CarbonNeutral Protocol*, 30.

[47] Ibid.

[48] Cloverly, "Carbon Offsets on Demand." https://cloverly.com/

carbon offset, the tool takes into account a number of factors including fuel consumption, the distance travelled and the weight of the package being shipped.

Table 2. Carbon offset initiatives employed to reduce the carbon intensity of delivery.

Policy/Initiative	Details	Key Actor(s)
UPS offers carbon offsets for shipping[49]	UPS highlights the environmental impact of delivery on their website's "Sustainability Services" page. To counteract the negative impacts of shipping on the environment, the company offers a carbon neutral shipping option. Natural Capital Partners' trademarked program "CarbonNeutral" guarantees the credibility of UPS's carbon neutral shipping program.	Third party logistics provider
Cloverly integrates carbon offsets into platforms like e-commerce sites and ridesharing apps[50]	Pricing reflects fuel consumption and carbon emissions as a result of distance travelled, weight transported, etc. Sample calculations are included on their website. Cloverly is available to add to e-commerce sites, ridesharing apps, etc. Can be used in combination with Shopify.	Business

Though carbon offsets may counteract the negative impacts of a chosen delivery method, they do not eliminate or reduce GHG emissions at the source. Carbon offsets offer more of a reactive as opposed to proactive approach to reducing the GHG emissions of e-commerce and goods distribution.

2.3 Consumer incentives and rewards

Incentive-based policies and initiatives reward consumers for choosing low impact delivery methods. Most of the existing incentives work by offering consumers a reduction in price or a reward when they opt for slower delivery methods. Table 3 outlines each of the incentive-based policies and initiatives geared towards reducing the impact of increasingly fast paced goods delivery.

[49] "UPS Carbon Neutral"

[50] "Carbon Offsets on Demand"

Table 3. Incentive-based policies and initiatives aimed at reducing the impact of just-in-time delivery.

Policy/Initiative	Details	Key Actor(s)
Amazon Day Delivery[51]	Amazon offers consolidated delivery on one day of the week free for Prime members.	Business
Amazon paid customers to choose "no-rush" shipping[52]	Amazon Prime awards customers with a discount or reward when they opt for no-rush shipping.	Business
Sendit Courier offers delivery rates that reflect speed of service[53]	The faster the service, the more expensive it is. A scaled pricing system disincentivizes consumers from opting for rushed deliveries.	Third party logistics provider

Amazon offers its Prime members free shipping when items are consolidated throughout the week and delivered on a single day.[54] According to one survey, 53% of consumers would choose a consolidated delivery over multiple individual deliveries from e-commerce sites, if available.[55] Furthermore, there is evidence to suggest that at least a portion of these responses are environmentally motivated: 35% of consumers surveyed said they view the reduced environmental impact as an important aspect of consolidated delivery.[56]

In addition to incentivizing consolidated deliveries, Amazon also incentivizes slower delivery periods. Customers are awarded with an instant discount or reward when they opt for no-rush shipping on Amazon.[57] While all customers can receive an instant discount, Prime members can also receive rewards for digital products including video streaming, eBooks, music and apps. Prime members can bank these rewards and put them towards future purchases.

Other companies take a scaled approach to incentivizing slower delivery options. Sendit Courier, a Toronto-based bicycle courier company, charges its customers relative to the

[51] Amazon, "Amazon Day Delivery." https://www.amazon.com/b?ie=UTF8&node=17928921011

[52] Amazon, "Earn Rewards or Discounts with FREE No-Rush Shipping." https://www.amazon.com/b?ie=UTF8&node=9433645011

[53] Sendit Courier, "Rates." http://www.senditcourier.ca/rates

[54] "Amazon Day Delivery"

[55] *2018 State of Ecommerce Delivery*, 11.

[56] *2018 State of Ecommerce Delivery*, 30.

[57] "Earn Rewards or Discounts with FREE No-Rush Shipping"

requested speed of their delivery.[58] In other words, the more urgent the delivery, the more expensive it will be. Though Sendit Courier's deliveries are non-emitting regardless of speed, this is a pricing model that can be widely adopted to incentivize lower environmental impact, longer delivery periods. As the delivery period increases, companies are left with more opportunities to consolidate shipments. This can lead to more packages for each delivery vehicle, as well as fewer delivery vehicles on the road.

The majority of consumers are especially motivated by free shipping. 62% of Canadian consumers say free delivery is their top consideration when making purchases on e-commerce sites.[59] E-commerce companies can leverage this preference and incentivize low-carbon delivery methods by only offering free shipping on delivery methods that have a low environmental impact, such as no-rush shipping. By charging for delivery methods with a high environmental impact, such as fast shipping, it is possible that consumers will be dissuaded from choosing these methods.

2.4 Consumer awareness initiatives

Of all the different types of policies and initiatives aimed at educating consumers on the impact of their just-in-time delivery choices, consumer awareness initiatives have been the most numerous to date. Table 4 outlines each of the initiatives that have currently been employed. These initiatives have been deployed by both third party actors, as well as delivery companies.

Preliminary results from a study conducted by researchers at MIT suggests that educating consumers on the environmental impact of their chosen delivery method at checkout leads consumers to choose longer delivery windows, on average.[60] In the study, participants were educated on the carbon footprint of their chosen delivery method in terms of trees and trash. Just over half of respondents were willing to choose a longer delivery period when told that the slower delivery methods would save trees.[61] On average, respondents were willing to wait up to five days for their items.[62] Interestingly, 30% of participants who were not willing to choose a longer delivery

[58] "Rates"

[59] *2018 State of Ecommerce Delivery*, 15.

[60] "'Green Button Project' Consumer Preference for Green last Mile Home Delivery," *MIT Sustainable Logistics Initiative* (2019). https://sustainablelogistics.mit.edu/green-button-project-consumer-preference-for-green-last-mile-home-delivery/

[61] "America's Addiction to Absurdly Fast Shipping has a Hidden Cost"

[62] "'Green Button Project' Consumer Preference for Green last Mile Home Delivery"

period when provided with an economic advantage were willing to wait when educated on the environmental benefit.[63]

Arguably the most wide-reaching awareness initiative is one carried out by Vox in partnership with the University of California. The two organizations teamed up to create a video that highlights the environmental cost of free two-day shipping.[64] The video provides an overview of the increasing demand for fast delivery and the negative consequences it has on the efficiency of operations, including half-full trucks and multi-item baskets being shipped in separate packages. Though the video acknowledges that there are different ways e-commerce companies can shrink their carbon footprint, it targets the role of the consumer and how behaviour can be steered away from fast delivery, when possible. For instance, they suggest offering a "green shipping" option alongside the fast shipping options.

Several delivery companies have deployed awareness initiatives in the form of messages on their website. Freightera,[65] Shift Delivery[66] and Cargo Velo[67] each make their customers aware of the reduced impact of deliveries made using low- or non-emitting modes such as cargo cycles or rail, as opposed to trucks. These delivery companies either tend to simply state their deliveries produce zero-emissions,[68] or will state the amount of greenhouse gas emissions (in CO_2eq.) that can be or have been avoided by employing low- or non-emitting modes of delivery.[69,70] Additionally, Freightera and Uber Freight educate their consumers and drivers on the importance of minimizing empty runs and the GHG emissions benefit of consolidated deliveries.[71,72] Ideally, once having been made aware of the reduced environmental impact of certain delivery modes, consumers will feel positive about this choice and continue to choose low- or non-emitting modes in the future.

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[63] Ibid.

[64] "The Environmental Cost of Free 2-Day Shipping"

[65] Freightera, "Green Freight." https://www.freightera.com/en/green-freight

[66] "Shift Delivery." http://www.shiftdelivery.ca/

[67] "Cargo Velo." https://cargovelo.be/nl

[68] Ibid.

[69] "Shift Delivery"

[70] "Green Freight"

[71] Ibid.

[72] Uber Freight, "Load Bundles Bring New Efficiency for Carriers on Uber Freight." https://www.uberfreight.com/blog/Uber-Freight-Load-Bundles

Table 4. Awareness initiatives aimed at reducing the impact of just-in-time delivery.

Initiative	Details	Key Actor(s)
Vox/University of California "The environmental cost of free 2-day shipping" video[73]	Video created by Vox in partnership with the University of California aims to educate consumers of the environmental cost of free two-day shipping. Encourages consumers to consider slower shipping options when fast delivery isn't crucial.	Media/Academia
Educating the consumer on the environmental impact of their chosen shipping method at checkout[74]	In a study conducted by researchers at MIT, more than half of consumers were willing to wait up to approximately 5 days for their deliveries when educated on the environmental impact of their delivery choice at check-out.	Business
Freightera educates consumers on lower GHG emissions of certain transport modes[75]	The Freightera website states that, generally speaking, "the carrier that offers the lowest price will also be most fuel-efficient and use best available emissions reduction technology." Freightera's Green Freight Marketplace allows shippers to see which carriers are participating in emissions reduction programs such as SmartWay or using rail instead of trucking for long haul. An infographic on their website educates consumers of the average CO_2 emissions (g/tonne/km) by mode (truck, train, marine or air) as well as how much each mode contributes to overall GHG emissions. Another infographic educates consumers on the benefits of maximizing loads carried per truck (i.e. reducing empty loads).	Third party logistics provider
Shift Delivery educates consumers on the reduced environmental impact of delivery by cargo bike[76]	Shift Delivery states how many tonnes of CO_2 emissions they have avoided by adopting cargo delivery bikes on their website.	Third party logistics provider
Cargo Velo educates consumers on the reduced environmental impact of delivery by cargo bike[77]	The Belgian company Cargo Velo highlights that deliveries made by cargo bike are CO_2 emissions-free.	Third party logistics provider

[73] "The Environmental Cost of Free 2-Day Shipping"

[74] "'Green Button Project' Consumer Preference for Green last Mile Home Delivery"

[75] "Green Freight"

[76] "Shift Delivery"

[77] "Cargo Velo"

Uber Freight educates consumers on the GHG benefits of load bundling (i.e. booking both a destination and return trip)[78]	Website states that deadhead (i.e. empty) miles account for 20% of miles driven in freight, or 1.5% of U.S. GHG emissions. The company states that load bundles can reduce the number of empty miles compared to self-planned routes thus leading to a reduction in GHG emissions.	Third party logistics provider

2.5 Nudge policies

An initiative that promotes a preferred behaviour through indirect suggestions is often referred to as a "nudge". Nudge theory was popularized in 2008 alongside the release of the book *Nudge: Improving Decisions about Health, Wealth and Happiness* written by Richard Thaler and Cass Sunstein.[79] According to one survey, 77% of consumers are conscious of, or care deeply about the environment when thinking about how they receive their deliveries.[80] Several subtle nudges could be employed to promote the uptake of less carbon intense delivery methods (see Table 5). Though these nudges do not directly educate the consumer, they subconsciously promote a preferred behaviour.

Table 5. Nudge policies and initiatives that can be used to steer customers towards less carbon intense modes of delivery.

Policy/Initiative	Details	Key Actor(s)
Make the green shipping option the default option[81]	Default options and pre-checked boxes on e-commerce sites that require consumers to untick them to opt-out are very influential. This is exemplified in organ donation rates. There are much higher percentages of consent when consumers are required to "opt-out".	Business
Relabel standard shipping as green shipping[82]	Consumers may choose to opt for the green delivery method when given the choice.	Business

[78] "Load Bundles Bring New Efficiency for Carriers on Uber Freight"

[79] Richard Thaler and Cass Sunstein, *Nudge: Improving Decisions About Health, Wealth and Happiness* (New Haven, Connecticut: Yale University Press, 2008).

[80] *2018 State of Ecommerce Delivery*, 7.

[81] Xavier Troussard and René van Bavel, "How Can Behavioural Insights Be Used to Improve EU Policy?" *Intereconomics* 53 (2018), 10.

[82] Lydia DePillis, John General and Richa Naik, "America's Addiction to Absurdly Fast Shipping has a Hidden Cost," *CNN Business*, July 25, 2019. https://depts.washington.edu/sctlctr/news-events/in-the-news/americas-addiction-absurdly-fast-shipping-has-hidden-cost

Default options can be surprisingly powerful. Some have suggested making the less carbon intense shipping option the default option, as there is evidence to suggest that consumers are less likely to opt-out of a default option.[83] In a study conducted by Isley et al., consumers were more than two times more likely to purchase carbon offsets for Amazon shipping when it was the default option.[84] If the low-carbon, slower shipping option is the default option, consumers are forced to actively consider whether or not they need to opt for a faster shipping option. The expectation is that fewer consumers would opt-out of the standard delivery, reducing the number of requests for fast delivery.

Others suggest that further benefits could be achieved if standard shipping was relabeled as green shipping.[85] This idea is echoed by Vox in their video aimed at educating consumers on the high environmental cost of two-day delivery.[86] We expect the environmentally conscious consumer, which is expected to be the majority of consumers,[87] will be inclined to choose the green shipping option when it is labelled so plainly.

The majority of consumers are conscious of the environment when they make delivery choices. By employing subtle nudges and leading the consumer towards the preferred alternative, more consumers are expected to choose the low-impact delivery method.

[83] "How Can Behavioural Insights Be Used to Improve EU Policy?" 10.

[84] Steven Isley, Paul Stern, Scott Carmichael, Karum Joseph and Douglas Arent, "Online Purchasing Creates Opportunities to Lower Life Cycle Carbon Footprints of Consumer Products," *Proceedings of the National Academy of Sciences of the United States* 113 (2015), 9781-9782.

[85] "America's Addiction to Absurdly Fast Shipping has a Hidden Cost"

[86] "The Environmental Cost of Free 2-Day Shipping"

[87] *2018 State of Ecommerce Delivery*, 7.

3. Recommendations

The rapid growth in online shopping, paired with just-in-time delivery expectations threaten to erode the GHG emissions benefit of e-commerce and consolidated goods distribution. Ultimately, we are at an inflection point and need to reconsider this "race to the bottom". Free, fast shipping is not only an unsustainable business model for companies, but also poses a threat to our environment. Addressing these changes requires a balanced approach in which we recognize the importance of a reactive goods distribution system, but also provide the necessary mechanisms to successfully limit its negative externalities.

Multiple actors have a role to play in communicating the externalities of free and fast shipping. To reduce the carbon intensity of goods distribution by increasing consumer awareness of the impacts of various delivery choices, we recommend the following actions:

1. **Limit free, fast shipping**: Free shipping is the top priority for the majority of consumers, and speed of delivery is a close second.[88] If consumers are offered free delivery across multiple shipping speeds, they're inevitably going to choose the fastest option. Companies should consider the cost of externalities when they offer free, fast shipping. By charging for fast delivery, this clearly demonstrates to consumers the added cost of the extra speed. Many e-commerce businesses are already scaling their shipping prices according to speed.
2. **Make low-carbon shipping the default option and make it a highly desirable option**: As evidence suggests that consumers are more likely to choose default options,[89] businesses should take advantage of this default bias and nudge consumers towards the low-carbon option. Moreover, consumers are highly motivated by free delivery. Though not all companies will be able to offer free delivery, making low-carbon shipping a competitive option is important to consumers.
3. **Educate consumers on the environmental impact of their chosen delivery method at check-out**: A survey of recent trends in e-commerce suggests the majority of consumers think about the environment when making their delivery

[88] *2018 State of Ecommerce Delivery*, 6, 15.

[89] "How Can Behavioural Insights Be Used to Improve EU Policy?"

choices.[90] It is important for businesses, as well as third party actors to provide consumers with credible, targeted information on the environmental impact of various delivery methods. It is, however, important to translate environmental impacts to simple, understandable metrics. For instance, state that a consumer's decision to choose standard as opposed to fast shipping is the equivalent to planting a certain number of trees, or taking a certain number of cars off the road. Alternatively, companies can relabel slow, standard shipping as "green shipping".

4. **Reduce spontaneity and demand for single item baskets by encouraging predictable, consolidated delivery**: Educate consumers on the impact of shipping multiple packages by offering deals on consolidated deliveries. As exemplified by Amazon, businesses can provide consumers with the opportunity to fill their shopping carts over a period of time, and offer consolidated delivery at a lower cost on a scheduled day of the week. Alternatively, companies can offer deals on subscription boxes that can be consolidated in advance and delivered on a specific day. When businesses are able to anticipate consumer demand and needs for goods, they are left with the time to optimize their operations and consolidate shipments. This can cut down on the number of delivery vehicles on the road, as well as the amount of packaging being used.

Educating consumers on the increased environmental impact of their just-in-time delivery preferences can play a vital role in reducing GHG emissions from goods distribution. While carbon offsets communicate the environmental cost of various delivery methods in monetary terms, these initiatives tend to be reactive, as opposed to proactive in their approach. An environmentally conscious consumer may continue to opt for fast delivery speeds knowing that their impact has been counteracted. Hence, carbon offsets may not be the most effective means to reduce the impacts of just-in-time delivery. Moreover, it is unclear whether or not a tax on e-commerce goods distribution will have a net positive effect on GHG emissions as a result of the policy's negative impact on the shift to e-commerce. Hence, our recommendations focus on influencing consumer behaviour at the point of decision to reduce demand for fast, just-in-time delivery. It is expected that using incentives to promote slower shipping speeds, directly educating consumers on the environmental impacts of various shipping speeds at the point of decision, and subtly nudging consumers towards the low-carbon option could be effective means to curb demand for just-in-time delivery and reduce GHG emissions from goods distribution.

[90] *2018 State of Ecommerce Delivery*, 7.