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CAN NORTH AMERICA TRANSFORM FROM A CONVENTIONAL AUTOMAKING HUB TO AN EV POWERHOUSE?

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North America is one of the top auto-producing hubs worldwide, manufacturing around 2 of every 10 cars globally since 1995.[1] Collectively, the three North American economies of Canada, Mexico, and the United States have benefited from enormous growth in auto exports, tripling over the past 25 years to $141.5 billion USD in 2020.[2] Global demand, however, is beginning to shift from the internal combustion engine (ICE) vehicles, which run on fossil fuels, that North America typically produces to electric vehicles (EVs). The existing integrated automotive industry of the region and the trilateral free trade agreement known as the United States–Mexico–Canada Agreement (USMCA) provide a unique opportunity for North America to adapt and innovate in the race toward net-zero transport.

Just last year, worldwide EV sales doubled from 3 million to 6.6 million, making up 9 percent of the overall global car sales market.[3] Looking ahead, BloombergNEF estimates that EV sales will reach 40 percent of the global auto market in 2030 and account for even higher shares in Europe (60 percent), China (59 percent), and the US (44 percent).[4]

If North America does not transition to a sustainable auto industry, it threatens the employment of millions of skilled workers and billions in direct and indirect consumption of goods and services, international trade, and tax revenues. To instead capitalize on the opportunity, the region could harmonize policies and incentives to increase the spectrum of models built to gain market share while actively contributing to decarbonization of the transport sector.[5] The commitment made at the 2021 North American Leaders' Summit to accelerate the transition to sustainable transportation, including a more rapid deployment of electric vehicles, is a step in that direction.[6]

This commentary begins with a look at the state of EV demand, including overall costs, and then turns to the diverse policy routes taken across North America to boost uptake in support of decarbonization targets. It then considers potential opportunities and challenges of greater integration among the three countries through the USMCA framework.

Comparing Overall Costs of Electric and ICE Vehicles

Purchase Price

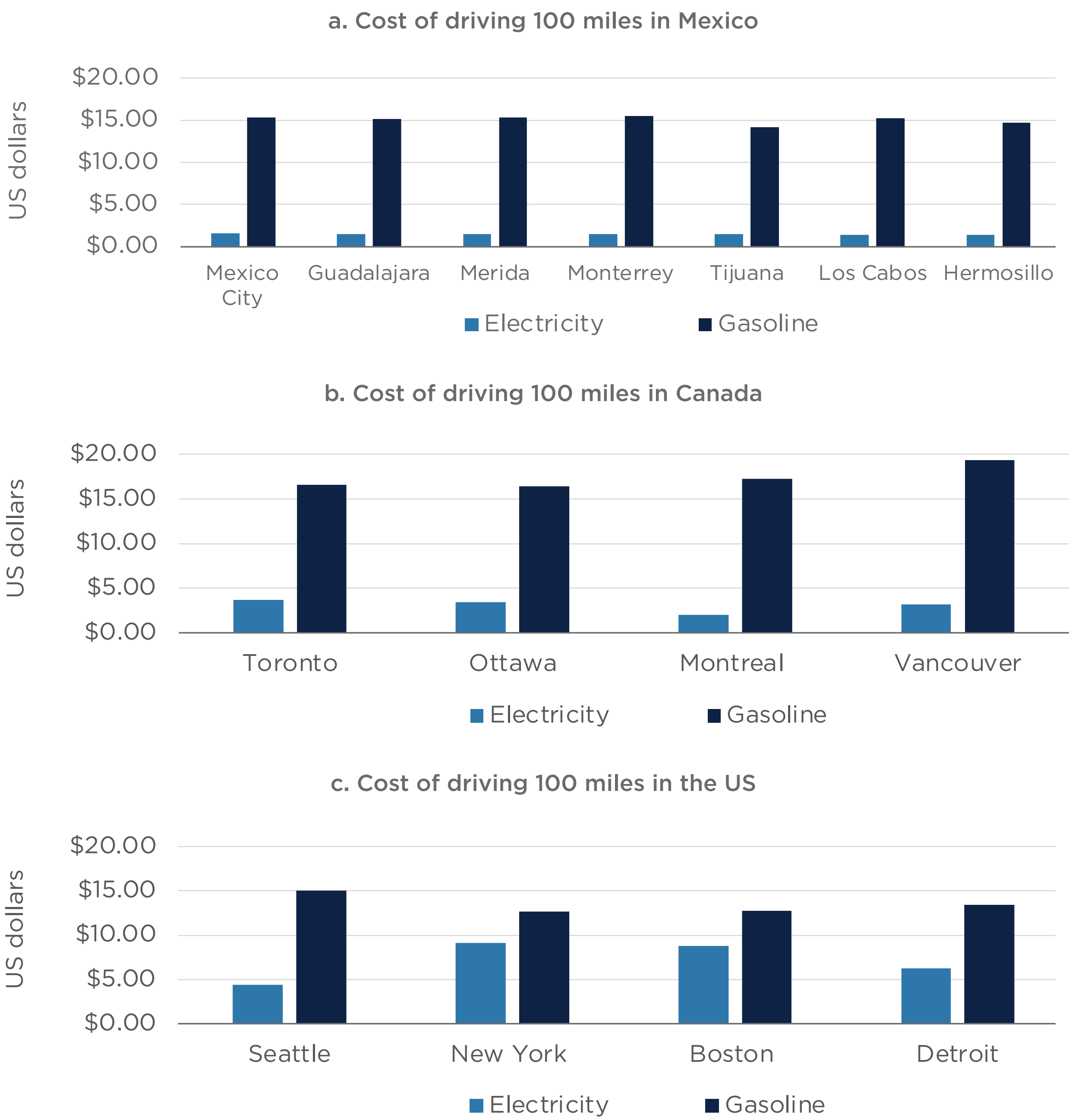
The up-front price attached to electric cars compared with ICE cars remains one of the key challenges to their further adoption. While the initial cost of purchasing an EV is on average higher than that for a similar ICE vehicle, in most North American cities, EVs have a lower total cost when considering acquisition, maintenance, and refueling expenses. Additionally, EVs receive significant policy support in the form of fiscal and financial incentives. As an example, the US federal government offers generous tax credits (up to $7,500 per EV) to accelerate market adoption.[7] Currently, the average price for an EV in the US is $56,437, roughly $10,000 higher than the overall industry average of $46,329.[8] So despite fiscal incentives, the cheapest class of ICE vehicles remains overall less expensive than the cheapest available EV on the market (the Nissan Leaf) in some North American jurisdictions. This leaves wide sections of the population without effective access to EVs, particularly in Mexico, where income is lower and where incentives are more limited than in Canada and the US.

The “cost of entry” can be lowered by developing targeted financial options through a coordinated bulk procurement effort with cities that provides public and private purchasers access to better prices. This can be complemented with preferential rate loans for small businesses with intensive vehicle use (e.g., delivery, logistics, and taxis).

Fuel Costs

Refueling EVs is between about 3 and 10 times cheaper than refueling ICE vehicles across North America. Using the US Environmental Protection Agency’s (EPA’s) calculation method,[9] the authors computed 100 miles of range for the average EV and ICE vehicles across major North American cities. Refueling ICE vehicles can be more than 10 times more expensive than recharging EVs in the Mexican city of Monterrey, whereas in Vancouver that gap is six times more expensive for ICE vehicles (see Figure 1). In the US, recharging an EV is also less expensive, albeit with greater variation among cities due to a larger difference in electricity prices across cities than is found in Canada or Mexico. While in Seattle driving 100 miles in an EV is three times cheaper than doing it in an ICE vehicle, in New York City it is only 30 percent less expensive.[10]

Figure 1: Cost of refueling EVs and ICE vehicles driven 100 miles in major North American cities



Source: Authors' analysis of publicly available data from the three countries: Statistics Canada, US Energy Information Administration (EIA), and the Comisión Federal de Electricidad.[11]

Battery Costs

The cost of lithium batteries decreased more than tenfold between 2011 and 2021.[12] This trend is projected to continue and would be a main driver in further decreasing EV prices, making them more accessible to wider sections of the population.[13] That said, the continued effects of the COVID-19 pandemic and the Russian invasion of Ukraine have led to lithium prices increasing more than sevenfold between early 2021 and May 2022. This was mostly caused by disrupted bulk shipments and limited workforce availability following pandemic restrictions, as well as structural underinvestment in new supply capacity since prices collapsed in 2018.[14] Similarly, other indispensable minerals like cobalt and nickel have almost doubled in price during this period, creating a recent overall increase in the cost of EV batteries and an unprecedented level of uncertainty that poses a great challenge to the industry globally in the short term.[15] The International Energy Agency has seen a rise in investment in the supply of these minerals, which could contribute to a less volatile market in the long term.[16]

Policy Targets That Spur Demand and Production

A wide variety of policies and incentives for EVs have been enacted across North America, from mandates for a minimum percentage of auto sales being EVs to tax holidays for purchasing vehicles, for both retail and commercial fleets, to infrastructure investments (see Table 1).

Table 1: Policies and incentives for EVs in North America

	Canada	Mexico	US
Financial support	• $400 million CAD for zero-emission vehicle (ZEV) charging stations. • Canada Infrastructure Bank will also invest $500 million CAD in ZEV charging and refueling infrastructure. • $1.7 billion CAD to extend the Incentives for Zero-Emission Vehicles (iZEV).	• No financial incentives or measures have been implemented to date. • Fiscal incentives include the exemption of a tax on the procurement of new vehicles (Impuesto sobre Automóviles Nuevos) as well as the ownership tax.	• $7.5 billion investment in EV charging stations.
EV composition and charging stations	• At least 20% of new light-duty vehicle sales will be zero-emission by 2026, at least 60% by 2030, and 100% by 2035. • Aim for 35% of total medium- and heavy-duty vehicles (MHDVs) sold to be ZEVs by 2030. • Develop an MHDV ZEV regulation to require 100% of MHDV sales to be ZEVs by 2040. • Add 50,000 ZEV chargers to Canada's network.	• All new cars and vans sold by 2040 will be zero-emission. • EVs will account for 30% of total sales by 2030.[17]	• Up to 500,000 charging outlets by 2030. • Executive order to set a nonbinding goal that 50% of new US cars sold will be electric by 2030.

Source: Environment and Climate Change Canada,[18] the White House,[19] Cámara de Diputados,[20] and UK government.[21]

Yet the region could coordinate efforts and benefit from harmonized policies targeted to increasing the adoption of EVs while simultaneously boosting EV production, taking advantage of North America's existing robust automobile industry. In the US, the combined market potential and state-level pledges signal an opportunity to rapidly expand assembly lines, develop EV offerings, and achieve higher market penetration. This potential extends to Canadian and Mexican automakers that have integrated supply chains with the US and each other (some components cross borders several times before becoming a finished product).

Harmonizing policies and incentives from a regional perspective, for both consumption and production, could take several forms, including setting a North American cap on vehicle emissions in urban areas; offering a tax holiday for shared investments in the research, development, and deployment (RD&D) of batteries and for adding mineral processing capacity; creating preferential crossing lanes for EVs at international border crossings; and reducing fees for medium- and heavy-duty (MHD) vehicles crossing international borders.

A common emissions standard in North America would reduce the need to have differentiated trains of production, taking advantage of the economies of scale of having a standardized complying product across the region. Implementing a five-year tax holiday for shared investments in RD&D, including for battery improvements (materials, range, and size), would push innovation, and with new extracting and treating capacity for critical minerals (cobalt, lithium, and nickel), North America would reduce its reliance on other regions for the supply of these commodities. Having dedicated lanes for EV crossings at the borders and reduced fees for MHD EVs will stimulate entry into this market for both freight and passenger buyers and create incentives for automakers to switch production from ICE vehicles to EVs.

The US government is supporting the ambition of 50 percent EV sales by 2030 by planning to build 500,000 charging points (five times the current number) to boost consumer confidence, yet this would require a tantamount effort from the private sector to have a net increase in the existing recharging infrastructure given the projected growth of EVs.[22] According to a Roland Berger report in 2021, both the US and Canada (no data for Mexico were included) are lagging behind Europe in terms of EV charging infrastructure, having fewer than one charging station per 100 km of roadway.[23] Having more convenient locations for reliable chargers would decrease the charging price as well as consumers' anxiety about EV range. It would also allow existing gas stations to diversify their offerings away from fossil fuels as ICE vehicles are phased out.

USMCA: An Opportunity to Coordinate EV Production

Currently, China leads in the production of EVs, at about 50 percent globally, followed by Europe, at 20 percent. North America accounts for roughly 10 percent of all EVs produced (for comparison, it produced 19 percent of all ICE vehicles in 2019).[24] The United States-Mexico-Canada Agreement (USMCA), a commercial treaty that substituted and updated the 1994 North American Free Trade Agreement (NAFTA) and entered into force in July 2020, offers potential opportunities to expand EV manufacturing in North America.[25]

The agreement includes, among others, the following provisions: a definition of regional content for the automobile industry that requires 75 percent of various auto parts be sourced from the US, Mexico, and Canada to support local production; a preference for giving manufacturing opportunities to small and medium enterprises across the region; and a harmonized framework for protection of intellectual property rights and dispute resolution. Some automakers have already made investment decisions under this framework; for example, in April 2022, General Motors (GM) started converting its plant in Ramos Arizpe, Coahuila, Mexico, to focus on EV production, taking advantage of preferential fiscal treatment and lower logistics costs.[26] Similarly, GM envisions converting a plant in Ontario, Canada, to produce all-electric commercial vans.[27]

Expanding EV manufacturing plants in Mexico and Canada would build upon existing trade and business partnerships. Mexico is the sixth-largest auto parts producer worldwide, with an estimated $94.3 billion USD in revenue annually, and it is the second-largest export market for US auto parts.[28] According to the US Department of Commerce, 71 percent of the vehicles produced in Mexico are exported to the US.[29] In Canada, Ford and GM as well as Stellantis, Honda, and Toyota assemble a total of more than 1.4 million vehicles annually.[30] The Canadian government will support further US production in Canada by providing the equivalent of about $0.8 billion USD on top of the $3.1 billion USD that GM and Ford plan to invest in Canada (General Motors plans to invest $1.6 billion USD in its two plants in Ontario[31] and Ford $1.5 billion USD in its plants in Oakville and Windsor[32]).

Recently, Canadian Prime Minister Justin Trudeau reiterated the importance of electric vehicle battery production on making EVs more competitive in the North American market. On March 15, 2021, Trudeau and Premier of Quebec François Legault announced a $100 million CAD (about $78 million USD) investment in automated battery pack assembly in Canada, which is expected to create 150 additional jobs by 2023.[33]

Closely monitoring trade partner activities will help North America develop expertise and strengthen supply chains for EV batteries by segmenting the components of the battery packs so that, for example, one jurisdiction could focus on the thermal interface materials or the communications systems and another could focus on the electrical connectors or the cells. The US could focus on integrating lithium battery production, specializing in cells and electrical connections while allocating more midstream processing of key minerals and other segments of the battery pack (thermal interface materials and contactor and communications systems) to its closest trading partners, Mexico and Canada. Concentrating specialized knowledge and production of key components could create efficiencies, alleviating bottlenecks and reducing production costs.

US lithium battery production currently accounts for 7 percent of global production, with every stage of the global EV battery supply chain dominated by China.[34] In fact, none of the North American economies has major production or reserves of the key minerals for battery production: lithium, cobalt, nickel, and graphite. But increased coordination across North America and with the region’s partners that have reserves of these minerals, including Australia, Brazil, Chile, and Indonesia, can contribute to pooling resources and optimizing existing production and manufacturing infrastructure to continue improving auto industry competitiveness.

And with the opportunity that global goals for decarbonization bring, North American automakers could focus on bigger-picture areas for collaboration, such as phasing in renewable power across all auto industry operations and setting targets to reduce CO_2 content in all auto parts. Promoting the uptake of renewables in industrial sectors would also stimulate investment in the power sector, creating new high-quality long-term jobs there as well.

Challenges to USMCA Integration

Despite existing automotive manufacturing advantages among USMCA trade partners, ample political will would be needed for a fully integrated market to materialize. With US politicians' concerns about losing domestic jobs or depressing wages, this is not an easy task. For example, under a US House of Representatives proposal, "only US-built vehicles with a union workforce" would be eligible for a $12,500 USD credit after 2027.[35] This provision would disincentivize Tesla and Ford from repurposing assembly factories or setting up new facilities in Mexico or Canada. Unsurprisingly, the Canadian and Mexican trade representatives widely protested this announcement. "The interpretation that the United States adopted is inconsistent with USMCA," said Canadian Minister of International Trade Mary Ng in January 2022.[36] Later that same month, Mexico formally requested a dispute settlement panel under the USMCA, alleging unfavorable treatment of Mexican companies, with Canada joining later that month.[37] Mexico's Secretary of Economy Tatiana Clouthier said that the ruling is expected by the third quarter of 2022. However, the restriction proposed in the US House became moot with the passage of the Inflation Reduction Act of 2022, signed into law in August 2022, which expands the credit eligibility from US-only production to North America-manufactured vehicles.[38]

On top of USMCA interpretation disagreements, Mexico's galvanized labor union adds investment uncertainties. On February 3, 2022, employees of a GM plant in Silao, Mexico, voted to set up one of the first collective bargaining agreement negotiations under Mexico's reformed labor law.[39] This is a changed environment for car manufacturers that have historically benefited from lower labor costs in Mexico. With augmented awareness of labor rights and fairer wages among Mexican workers, US manufacturers must incorporate best practices in Mexico and Canada that are on par with US operations. In the longer run, harmonization of labor wages and standards may facilitate easier movement of autoworkers across the three countries and boost product quality.

Conclusion

Demand for EVs is increasing as concerns about climate change are met with policies making these vehicles more attractive. North American auto producers are beginning to recognize the opportunity and would likely benefit from a collaborative effort among the three countries to build market share. A fair, standard interpretation of USMCA will be crucial if the US, Mexico, and Canada are to become one integrated market where supply chains do not stop at international borders.

North America could add new production of EV batteries across jurisdictions to meet the increasing needs of major EV manufacturers such as Tesla, Ford, and GM by 2030. A coordinated effort from the US, Mexican, and Canadian governments could include a set of policies like tax holidays, credits, expanding auto parts capacity to support EV production, facilitating the repurposing of existing facilities, and promoting joint research and development. If they do so, the three trade partners could more quickly accelerate paths to decarbonization while supporting economic growth.

The potential for building a North American EV powerhouse is substantial. But overcoming the challenges described in this commentary will require close and continuous collaboration and coordination between the public and private sectors and, just as importantly, between Washington, Mexico City, and Ottawa.

Notes

1. "2021 Production Statistics," International Organization of Motor Vehicle Manufacturers, accessed August 4, 2022, https://www.oica.net/category/production-statistics/2021-statistics/.

2. "The Atlas of Economic Complexity," Growth Lab at Harvard University, accessed July 28, 2022, http://www.atlas.cid.harvard.edu.

3. In Canada, total zero-emission vehicles were 5.6 percent of all new cars registered in 2021; see K. Haycock, "Over one in 20 new cars registered in Canada in 2021 were EVs," Electric Autonomy Canada, February 15, 2022, https://electricautonomy.ca/2022/02/15/ihs-markit-zev-adoption-canada-2021/. In the United States, EV sales jumped 83 percent to 434,879, accounting for 3 percent of the total US market; see T. Gul and L. Paoli, "Electric cars fend off supply challenges to more than double global sales – analysis," IEA, January 30, 2022, https://www.iea.org/commentaries/electric-cars-fend-off-supply-challenges-to-more-than-double-global-sales?utm_content=bufferd90dd&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer. EV sales more than doubled in Mexico in 2021, to 1,140, accounting however for less than 1 percent of the total share; see INEGI, "Datos abiertos," 2022, https://www.inegi.org.mx/datosprimarios/iavl/#Datos_abiertos.

4. "Electric Vehicle Outlook 2022," BloombergNEF, https://about.bnef.com/electric-vehicle-outlook/.

5. Despite the overall technology improvements, including in fuel economy, aerodynamics, and weight, greenhouse gas emissions from the transport sector in North America have increased since 1990. Canada's transport sector emitted 124.7 million tons of CO_2 equivalent (CO_2e) in 1990 versus 192.1 million tons of CO_2e in 2018 (a 54 percent surge over the past three decades). Moreover, in per capita terms, emissions grew by 14.3 percent. Something similar happened in Mexico, where emissions from this sector have almost doubled since 1990 (83.5 million tons of CO_2e in 1990 vs. 156.6 million tons of CO_2e in 2018) and in per capita terms grew by 25 percent. The US saw an overall increase of 23 percent in its emissions from transport between 1990 and 2018 (from 1.4 to 1.7 billion tons of CO_2e), although in per capita terms, it observed a marginal improvement (reduction of 4.8 percent). See Hannah Ritchie, Max Roser, and Pablo Rosado, "CO_2 and Greenhouse Gas Emissions," Our World in Data, August 2020, https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions.

6. "Fact Sheet: Key Deliverables for the 2021 North American Leaders' Summit," White House, November 18, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/18/fact-sheet-key-deliverables-for-the-2021-north-american-leaders-summit/.

7. Biden's Build Back Better Act originally proposed a $12,500 USD EV credit, however, the extent of EV tax credits remains a contentious topic within Congress. For now, the maximum available is $7,500 USD. See Scooter Doll, "Here's Every Electric Vehicle That Currently Qualifies for the US Federal Tax Credit," Electrek, July 29, 2022, https://electrek.co/2022/04/15/which-electric-vehicles-still-qualify-for-us-federal-tax-credit/#h-status-of-the-12-500-federal-tax-credit-for-evs.

8. Ibid.

9. For gasoline, the US Environmental Protection Agency (EPA) reported that the average new vehicle sold in the US in 2020 had a combined fuel economy rating of 25.7 miles per gallon. Driving 100 miles in that average vehicle would use 3.9 gallons of gas. The average miles per gallon equivalent (MPGe) rating for 2022-model-year EVs sold in the US is about 97 MPGe, so driving 100 miles in that hypothetical average vehicle would use 34.7 kWh of electricity. Hence, on a comparative scale, driving 100 miles would require 3.9 gallons or 34.7 kWh.

10. The authors used publicly available data detailed in endnote 11 to calculate an average annual price for both electricity and gasoline in each of the 15 cities mentioned. Then, the authors, following the equivalence use by the US EPA, calculated the cost of recharging a vehicle driving 100 miles in each city. In one of the mentioned examples, driving 100 miles in an ICE vehicle in New York City costs $12.70 USD, while doing so in Seattle amounts to $15.05 USD. Conversely, driving 100 miles in an EV in New York City is more expensive than doing so in Seattle, since its costs $9.10 USD in the former and $4.36 USD in the latter. However, as seen, refueling an EV is cheaper than refueling an ICE vehicle in both cities, except in Seattle the difference is $10.69 USD while in New York City it is only $3.60 USD.

11. CGEP analysis based on publicly available sources from the three countries:

    Statistics Canada. "Table 18-10-0204-01: Electric Power Selling Price Index, Monthly," Statistics Canada, last modified August 8, 2022, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810020401; "Regular Unleaded Gasoline at Self Service Filling Stations," Statistics Canada, https://www.150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000101; "Petroleum & Other Liquids," US EIA, last modified August 8, 2022, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=emm_epmr_pte_y48se_dpg&f=m; "Average Price of Electricity to Ultimate Customers by End-Use Sector, US EIA, accessed August 8, 2022, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a;

    Calculations for Mexico's electricity rates correspond to the 2022 monthly average of the first bracket of consumption, called by CFE "low-consumption 1-1F rates or *tarifas de bajo consumo* 1-1F." The number of kWh allocated in each rate type varies and is larger in regions with warmer temperature. See "Esquema Tarifario Vigente," Comisión Federal de Electricidad, accesed May 18, 2022, https://app.cfe.mx/Aplicaciones/CCFE/Tarifas/TarifasCRECasa/Casa.aspx; Comisión Reguladora de Energía, "Precios de Gasolinas y

Diésel," accesed May 18, 2022, https://www.gob.mx/cre/documentos/precios-de-gasolinas-y-diesel?state=published.

Note that Mexican electricity rates for residential users are significantly cheaper than gasoline prices; this is due to heavy subsidies for about 89 percent of residential users.

12. "Average Pack Price of Lithium-Ion Batteries and Share of Cathode Material Cost, 2011–2021," IEA, last modified May 20, 2022, https://www.iea.org/data-and-statistics/charts/average-pack-price-of-lithium-ion-batteries-and-share-of-cathode-material-cost-2011-2021.

13. "Global EV Outlook 2022," IEA, May 2022, https://www.iea.org/reports/global-ev-outlook-2022.

14. "Global Supply Chains of EV Batteries," IEA, July 2022, https://www.iea.org/reports/global-supply-chains-of-ev-batteries.

15. "Global EV Outlook 2022," IEA, May 2022, https://www.iea.org/reports/global-ev-outlook-2022.

16. Ibid.

17. Neither of these goals are legally binding, and both of them were determined in international forums. The first goal was agreed to by Mexico in the "COP26 Declaration on Accelerating the Transition to 100% Zero Emission Cars and Vans" and the later one at the EV30@30 at the 11th Clean Energy Ministerial in 2020.

18. "2030 Emissions Reduction Plan—Canada's Next Steps for Clean Air and a Strong Economy," Environment and Climate Change Canada, last modified March 29, 2022, https://www.canada.ca/en/environment-climate-change/news/2022/03/2030-emissions-reduction-plan--canadas-next-steps-for-clean-air-and-a-strong-economy.html.

19. "Fact sheet: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks," White House, August 5, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/.

20. Ley Federal del Impuesto sobre Automóviles Nuevos (2021).

21. "COP26 Declaration on Accelerating the Transition to 100% Zero Emission Cars and Vans" (policy paper, Conference of Parties 26, Glasgow, last modified August 1, 2022), https://www.gov.uk/government/publications/cop26-declaration-zero-emission-cars-and-vans/cop26-declaration-on-accelerating-the-transition-to-100-zero-emission-cars-and-van.

22. "Fact Sheet: The Biden-Harris Electric Vehicle Charging Action Plan," White House, December 13, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/13/fact-sheet-the-biden-harris-electric-vehicle-charging-action-plan/.

23. Bob Zabors, Ron Zheng, Tim Longstaff, and Jan-Philipp Hasenberg, "The Demand for Public EV Charging Stations Is Rising," Roland Berger, November 29, 2021, https://www.rolandberger.com/en/Insights/Publications/EV-Charging-Index-new-trends-affecting-the-

electric-vehicle-charging-industry.html. See Appendix 2 for more details.

24. "Global Supply Chains of EV Batteries," IEA, July 2022, https://www.iea.org/reports/global-supply-chains-of-ev-batteries; "World Motor Vehicle Production, Selected Countries," US Bureau of Transportation Statistics, accessed July 28, 2022, https://www.bts.gov/content/world-motor-vehicle-production-selected-countries.

25. "United States–Mexico–Canada Agreement," Office of the United States Trade Representative, https://ustr.gov/trade-agreements/free-trade-agreements/united-states-mexico-canada-agreement.

26. Kylie Madry, "General Motors to Produce 2024 Chevrolet Blazer EV at Ramos Arizpe in Mexico," Reuters, July 18, 2022, https://www.reuters.com/business/autos-transportation/general-motors-produce-2024-chevrolet-blazer-ev-ramos-arizpe-mexico-2022-07-19/.

27. Nick Lazzaro, "General Motors to Launch Canada's First Commercial Electric Vehicle Hub in Ontario," S&P Global, April 4, 2022, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/040422-general-motors-to-launch-canadas-first-commercial-electric-vehicle-hub-in-ontario.

28. "Automotive Industry," International Trade Administration, last modified September 2, 2021, https://www.trade.gov/country-commercial-guides/mexico-automotive-industry.

29. Ibid. The US Department of Commerce stated that "89 percent of vehicles produced in Mexico are exported, with 80 percent destined for the United States" in the latest publication on the automotive industry, released on September 2, 2021. Given these figures, Mexico produced about 71 percent of vehicles that are exported to the US.

30. "Canadian Automotive Industry," Government of Canada, last modified July 7, 2021, https://www.ic.gc.ca/eic/site/auto-auto.nsf/eng/home.

31. Nathan Gomes, "Canada to invest C$518 million in two GM plants in Ontario," Reuters, April 4, 2022, https://www.reuters.com/business/autos-transportation/canada-invest-c518-million-toward-gms-two-plants-ontario-2022-04-04/.

32. "Ford deal to build electric cars in Oakville comes amid $500M government cash to upgrade plant," CBC News, September 22, 2020, https://www.cbc.ca/news/business/ford-oakville-electric-vehicles-1.5733943.

33. Canada has lithium, graphite, nickel, and copper projects (totaling $2 billion CAD) already in production or under development, representing critical pieces of the critical mineral supply chain needed for electric vehicles.

    See Steve Scherer, "Exclusive: Canada to Invest C$2 Billion on Mineral Strategy for EV Battery Supply Chain," Reuters, April 4, 2022, https://www.reuters.com/business/exclusive-canada-spend-c2-bln-mineral-strategy-ev-battery-supply-chain-2022-04-04/.

34. "Global EV Outlook 2022," IEA, May 2022, https://www.iea.org/reports/global-ev-outlook-2022.

35. Congress, H.R. 5376 Build Back Better Act, Subtitle D: Energy, Part 3—Zero-Emissions Vehicle Infrastructure: Domestic Manufacturing Conversion Grants, H.R. 5376, Sec. 30443, https://www.congress.gov/bill/117th-congress/house-bill/5376/text.

36. "Statement by Minister Ng on the Implementation of Rules of Origin for Automotive Goods under the Canada–United States–Mexico Agreement (CUSMA)," Government of Canada, January 13, 2022, https://www.canada.ca/en/global-affairs/news/2022/01/statement-by-minister-ng-on-the-implementation-of-rules-of-origin-for-automotive-goods-under-the-canada-united-states-mexico-agreement-cusma.html.

37. Laura Curtis, "Mexico's Trade Chief Sees Panel Ruling on Car Spat in Six Months," Bloomberg, February 20, 2022, https://www.bloomberg.com/news/articles/2022-02-10/mexico-trade-chief-sees-panel-ruling-on-car-spat-in-six-months.

38. Inflation Reduction Act of 2022, Public Law Number 117–169 (2022), https://www.congress.gov/bill/117th-congress/house-bill/5376/text.

39. Daina Beth Solomon, "'Fed Up' GM Workers in Mexico Pick New Union in Historic Vote," Reuters, February 3, 2022, https://www.reuters.com/business/autos-transportation/gm-workers-mexico-elect-independent-union-historic-labor-vote-2022-02-03/.

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Mr. Beltran has had a distinguished 13-year career in public service in the government of Mexico, including as the longest serving Deputy Secretary of Energy (2012-2018). In this capacity, he led the Ministry´s coordination of Mexico´s National Energy Strategy, policy document that served as the foundation for the energy reform of 2013. He was also on the Board of Directors of Petróleos Mexicanos (Pemex), Mexico´s national oil company and the world´s 10th largest oil producer and was alternate Chairman of the Board of Directors of Comisión Federal de Electricidad (CFE), Mexico´s national power utility and a Global 500 company. Mr. Beltran also chaired the boards of the national laboratories of the energy sector (Mexican Petroleum Institute; National Institute of Electricity and Clean Energies; National Nuclear Research Institute), and presided the board of a billion usd R&D trust funds that created the Mexican Centers for Innovation on Energy (biofuels, CCS, geothermal, ocean, solar, and wind), the largest clean energy technology innovation networks in Latin America, and invested in the biggest talent development effort in the energy sector in the country.

Before serving as Deputy Secretary of Energy, Mr. Beltran held other leadership positions in the Ministry of Energy, including Director-General for Information and Energy Studies and Director for International Negotiations.

Mr. Beltran is currently also a member of the Advisory Board of the Just Transition Initiative (partnership between the Climate Investment Funds and the Center for Strategic and International Studies); a member of the Board of Fundación Por México (NGO focused on providing educational services to underserved communities); a member of the IPS International Association (global news agency); a member of the expert´s network and the Global Futures Council of the World Economic Forum; and a mentor of the Global Women´s Network for the Energy Transition. He is also consulting the Inter-American Development Bank, the Latin American Energy Organization, and the World Bank on issues surrounding the energy transition.

Mr. Beltran is a leading expert in the energy transition, he has been named several times as one of the most influential leaders in the energy sector in Mexico and personality of the year in renewable energy (including in 2018).

He holds a Master's in Public Administration in International Development from Harvard Kennedy School and a Bachelor of Science in Economics from Instituto Tecnológico Autónomo de México (ITAM).

Ivy Kuang was formerly a Departmental Research Assistant at the Center on Global Energy Policy. She is a second-year MPA student at SIPA concentrating in Energy and Environment and specializing in Quantitative Analysis. Ivy brings with her experience in transportation economics, operations, and management consulting.

Diego Rivera Rivota is a Research Associate at the Center on Global Energy Policy at Columbia University. His responsibilities include analyzing energy policy in Latin America, supporting CGEP´s Distinguished Visiting Fellows program and researching natural gas and LNG markets. His previous research has largely focused on energy policy in developing economies, natural gas and LNG markets, and the role of these fuels in the low-carbon energy transition around the world.

Prior to joining CGEP, Diego was a visiting researcher at the Asia Pacific Energy Research Centre (APERC) based in Tokyo, Japan for five years. He was a lead author of the APERC Gas Report and also co-authored several other APEC reports and publications, including the 7th and 8th editions of the APEC Energy Outlook, APERC´s flagship publication. Diego also coordinated cooperative projects related to natural gas, LNG markets, energy security and energy efficiency. He presented APERC´s research extensively across the Asia-Pacific region.

In previous roles, Diego worked on natural gas pipeline and electricity infrastructure development as advisor to the CEO at Mexico's state-owned utility, CFE (Comisión Federal de Electricidad). Prior to this, Diego completed an internship at the Permanent Mission of Mexico to the Organisation for Economic Co-operation and Development (OECD) and worked at Mexico's Office of the President as a junior staffer.

Diego holds a Bachelor's degree in International Relations from the Instituto Tecnológico Autónomo de México (ITAM) and a Master's in public policy with a specialization in Energy and the Former Soviet Union region from Sciences Po Paris. Diego speaks Spanish, English, French, Russian and Portuguese.

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