A Framework for the Fiscal Impact of Electromobility

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Inter-American Development Bank

Infrastructure Sector

Energy Division

DISCUSSION PAPER Nº

IDB-DP-930

January 2022

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http://www.iadb.org

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Discussion paper and policy options for countries in the Latin America and the Caribbean region to manage the fiscal impact of the deployment of electromobility program.

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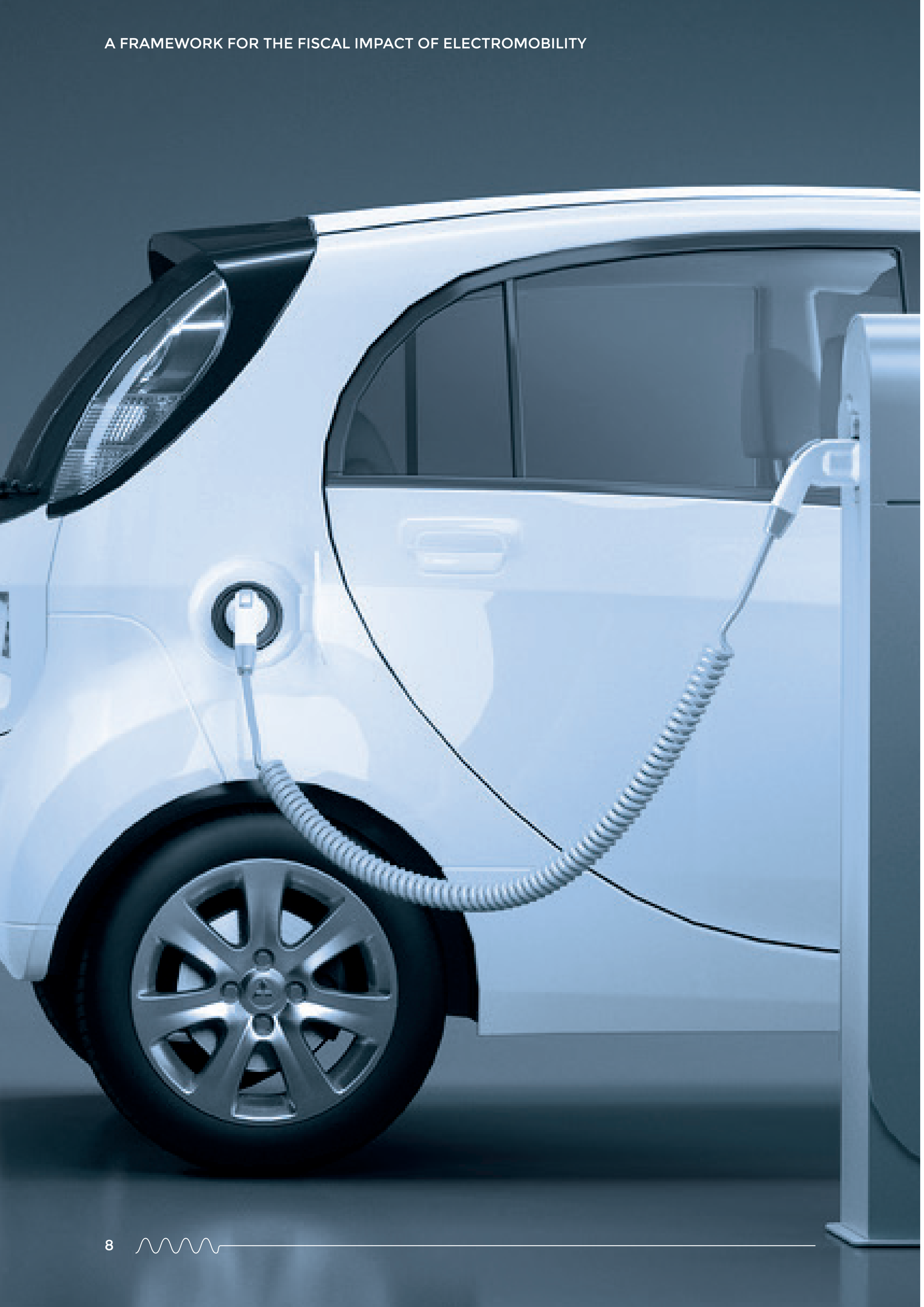

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Acknowledgements

This document has been prepared under the coordination of Marcelino Madrigal and under the direction of Agustin Aguerre, Ariel Yepez, and Nestor Roa, in collaboration with several divisions of the Inter-American Development Bank such as the Energy, Transport, Climate Change, Fiscal Management, and Research. The authors would like to express their sincere appreciation for the revisions and contributions from Adrien Vogt-Schilb, Alberto Daniel Barreix, Alejandra Anahi Caldo, Benoit Lefevre, Bridget Lynn Hoffman, Edwin Orlando Mejia Reyes, Huascar Eguino, Juan Pablo Benitez Gonzales, Juan Roberto Paredes, Luis Alejandro Alejos Marroquin, Marcela Cristina Jaramillo Gil, Michelle Carvalho Metanias Hallack, Raul Rodriguez Molina, and Roberto Gabriel Aiello. The design of the document was developed by Alejandro De Los Santos from Delosantos Design.

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Preface

Over the last years, the Inter-American Development Bank (IDB) has been expanding its electromobility activities in the Latin America and Caribbean (LAC) region due to high demand from countries and cities. For us at the Bank, we consider electromobility a multi-disciplinary topic: it combines aspects of energy, transport, climate change mitigation, innovation and technology, and fiscal management. Just over the last 3 years, the Bank has supported LAC countries in more than 70 requests for support in activities such as technical and pre-feasibility studies, development of new business models, definition of technical standards, modernization of the regulatory frameworks, and financing programs.

These activities are consistent with the IDB Vision 2025 – Reinvest in the Americas which is the IDB's Group blueprint for achieving economic and social development in LAC in 2021-2025 based on five priority areas: (i) **regional integration** activities to strengthen value chains, improve processes, and support regionalization; (ii) the **digital economy,** to catalyze public- and private-sector investments to improve connectivity and deploy digital tools; (iii) support **small- and medium-enterprises** (SMEs), promoting productive financing for SMEs and financial inclusion; (iv) **gender and diversity** by mainstreaming gender-based business and being a leader in ensuring financial access and opportunities for all marginalized groups; and (v) **climate change action,** to design and use innovative financing tools to leverage private sector investment and promote climate-resilience development.

This publication has been developed under the my coordination as leader of the electromobility initiative at the IDB, and has the support of the regional technical cooperation (TC) RG-T3539 (Incentive Program and Support for the Transition to Electromobility in Latin America and the Caribbean) led by Alejandra Anahi Caldo, and which is available at: https://www.iadb.org/en/project/RG-T3539. The TC is part of Regional Public Good (RPG) and has the objective to strengthen the instruments of public policy and regulation for the correct adoption of electromobility in order to enhance its benefits in both public and private transportation developing clear institutional frameworks and greater synergy between the transportation and energy sectors. As an RPG deliverable, this document aims at generating knowledge and synergies, and reducing information asymmetries for the adoption of electromobility in the region. In particular, the TC has focused its attention on Paraguay, Ecuador, and Panama, as these three countries are rapidly advancing in the implementation of electromobility activities and have large potential for reaching the benefits of electrifying their transportation systems.

This publication of *A Framework for the Fiscal Impacts of Electromobility* is a result of dialogues that the Bank have been conducting with the countries in the region, as there is a growing interest on what could eventually be the impact on government revenues in the short- and long-term from the deployment of electric vehicles (EVs). This is based on the fact that some countries in the LAC region rely on fuels taxes on gasoline and diesel as part of their fiscal revenues. The study has reviewed these implications on countries where EVs have experienced significant growth and have achieved large penetration, a situation which the LAC region is not there yet.

The review indicates that – as expected – the impact on the short term is limited due to the small shares of the new vehicles purchased compared to the stock of vehicles. This impact primarily comprises the costs of providing incentives to offset the purchasing costs of EVs, when necessary. In the long term, the analysis indicates that countries should adjust their fiscal framework, as those that are highly dependent on government fuel tax revenues could be affected by lower consumption of gasoline and diesel. It is worth mentioning that, regardless of the introduction of EVs, this effect of lower tax collection has been happening already due to the improvements in fuel efficiency of vehicles over the years. This is when innovation is introduced, as there have been identified alternative taxation regimes to offset for the possible reduction in government revenues. These innovations are led by advances in technology and digitalization and include, for example, charging per distance traveled, where the vehicle pays for the number of miles traveled and not for the type of fuel used. This is the area where there will be several new opportunities for the private sector to participate and let its entrepreneurship flourish.

In addition to the environmental, climate, and energy security benefits, the study also highlights that this is an opportunity for countries to revisit their fiscal regimes, in addition to fuel taxation regimes, to ensure that this transition is fair and equitable for everyone, particularly those who are most vulnerable. Lastly, the study reinforces the importance to introduce mechanisms to get the prices right and eliminate distortions on price formation of energy products.

I hope you enjoy this reading and consider this as a first publication on the subject of fiscal impacts of electromobility. Moving forward, other publications will be developed and made available so that the LAC region can advance its electromobility activities that can deliver important benefits for the region.

Marcelino Madrigal
January 2022

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Acronyms

AMI	Advanced metering infrastructure
ARCONEL	Electricity Regulation and Control Agency of Ecuador, in Spanish
BAU	Business-as-usual
BAU-EM	Business-as-usual with electromobility strategy
BEV	Battery electric vehicle
BRT	Bus Rapid Transit
CAGR	Compound annual growth rate
CBA	Cost-benefit analysis
CCLIP	Conditional Credit Line for Investment Projects
CFE	Federal Commission of Electricity, in Spanish
CFN	Corporación Financiera Nacional of Ecuador, in Spanish
CNG	Compressed natural gas
CO_2	Carbon dioxide
COP	Conference of the Parties
CPMF	Provisional Contribution on Financial Transactions, in Portuguese
CTF	Clean Technology Fund
DAC	High Residential Consumer, in Spanish
DBC	Distance-based charges
DOT	Department of Transportation of Oregon
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	Energy Information Agency
ETS	Emission trading system
EV	Electric vehicle
FCEV	Fuel cell electric vehicle
GDP	Gross Domestic Product
GHG	Greenhouse gases
GJ	Gigajoules
GNSS	Global Navigation Satellite System
GPS	Global positioning system
HEV	Hybrid electric vehicle
HGV	Heavy goods vehicle
HOV	High-occupancy vehicle
ICCT	International Council on Clean Transportation
ICE	Internal combustion engine
IDB	Inter-American Development Bank
IEA	International Energy Agency
IMF	International Monetary Fund
ITF	International Transport Forum
LAC	Latin American and the Caribbean
LEZ	Low Emission Zones

MOU	Memorandum of understanding
MPG	Miles per gallon
MSET	Ministry of Science, Energy, and Technology of Jamaica
MTOP	Ministry of Transportation and Public Works, in Spanish
MTOP	Ministry of Transportation and Public Works of Ecuador
NDC	Nationally Determined Contributions
NOx	Nitrogen oxides
OBU	On-board unit
OECD	Organization for Economic Co-operation and Development
PHEV	Plug-in hybrid electric vehicle
PV	Photovoltaic
RENOVA	Vehicle Renewable Plan (in Ecuador)
RIF	Road improvement fee
RUC	Road user charging
SAF	Sustainable aviation fuel
SDS	Sustainable Development Scenario
SPS	Stated Policies Scenario
TAG	Transport Analysis Guidance
TCO	Total cost of ownership
TIF	Transportation improvement fee
ULEZ	Ultra-Low Emission Zones
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value-added tax
VMT	Vehicle-Miles Travelled
WHO	World Health Organization
ZEBRA	Zero Emission Bus Rapid-deployment Accelerator
ZEV	Zero-emission vehicles

Executive Summary

This document provides a framework with principles and guidelines to help Latin American and the Caribbean (LAC) countries anticipate and mitigate the fiscal impacts evolving from the electrification of the transportation sector. The utilization of the framework must be accompanied by detailed fiscal analysis specific to each country to determine the best fiscal policies and instruments. The fiscal impact of electromobility is a multidisciplinary subject as it includes the infrastructure sectors of transportation and energy, the fiscal and economic, social, and climate change areas. Therefore, this is a first document to lay out a framework of connecting these sectors which can be followed with focused analysis. The key messages of this document are:

1. **The electrification of the transportation sector will continue to grow internationally and in LAC driven by the desire to decarbonize** the sector aiming at: (i) reducing carbon dioxide (CO_2) emissions and mitigating climate change as the transportation sector is one of the largest emitters; (ii) improving air quality and reducing noise pollution in large cities; (iii) achieving better quality of services in public transportation, in particular urban buses; and (iv) improving the energy security of countries by reducing the importation of petroleum products. The electrification of the transportation sector is also an important component of the countries' international climate commitments and Nationally Determined Contributions (NDCs).

2. **Electric vehicle (EV) penetration will increase steadily in the LAC region, starting from a very low base.** In 2020 there were 10 million EVs in the world, just under 1% of the total number of internal combustion engine (ICE) vehicles. In LAC, the share of private EVs is less than 0.05% of total private fleet and the share of electric buses is about 2% of the total buses in public transportation. This penetration pattern, however, may change steadily in the next decade. According to the International Energy Agency (IEA), to fulfil future demand in transport while reducing emissions consistent with the 2 °C target, the global number of EVs needs to increase to 50 million in 2025 and to 140 million in 2030, representing an annual growth rate of 30%. This increase would be driven by the reduction in the acquisition cost of EVs due to advances in technology, a drop in the price of batteries, and the introduction of public policies.

3. **The dependency of LAC countries on revenues from taxing the consumption of diesel and gasoline in the transportation sector is smaller than the OECD and African countries.** On a relative basis and based primarily on the methodology used by the Organization for Economic Co-operation and Development (OECD), taxes on fuels in LAC

represent 1.11% of Gross Domestic Product (GDP). This ratio is less than 2.00% in OECD countries and slightly lower than 1.20% in Africa. In LAC however, there is a wide variance in this dependency from the highest in Guyana and Honduras to the lowest in Belize. In 2018 total taxation over GDP in LAC was 23.1% versus 34.3% in the OECD countries, illustrating that the LAC region has opportunities to improve the tax base and the efficiency of its fuel taxing system while reinforcing the policy goals of decarbonizing the economy and implementing green recovery strategies.

4. **The introduction of electromobility can impact the government revenues in two ways.** In the short term, these are related to the fiscal costs of promoting EVs. These costs are low and will be bound in time as in next 5 to 10 years – depending on each country's conditions – as total cost of ownership (TCO) of EVs will be equal to or less than that of ICE. The main issue is related to the acquisition costs of EVs, which are higher than those of ICE since the former have lower maintenance and fuel costs. In the long-term, revenues from fuel taxes will need to be reevaluated in the LAC region, due to the reduction in consumption of gasoline and diesel, and their associated impact on government revenues. This is relevant considering the fragile situation of fiscal debt in the region. Due to the COVID-19 pandemic, gross public debt in LAC may raise up to 83% of GDP in 2022 from 57% of GDP in 2019, higher than the 44% of GDP registered during 2008-2009 global financial crises. LAC countries therefore need to safeguard its fiscal revenues and consider innovative approaches more than ever.

5. **The reduction in government revenues is already occurring naturally due to energy efficiency in the transportation sector.** Due to advances in technology or the introduction of regulatory standards, vehicles have become more efficient over time, driving more miles for the same gallon. In some cases, this improvement is already reducing gasoline and diesel consumption, and thus the government revenues from fuel, requiring the development of alternative forms of taxation to mitigate the loss in revenues. For example, gasoline consumption in the European Union (EU) peaked around 20 years ago, and it has been on steady decline since then.

6. **Getting the fuel price right is needed to accelerate decarbonization.** Reforming fuel subsidies in the LAC region can contribute to get the prices right and establish a level playing field among fuel technologies, which will accelerate the decarbonization and reduce the fiscal pressure. These are important conditions in the EV promotion phase as subsidies in some countries consume a large share of public expenditures. Fuel subsidies in transportation make it more difficult to achieve a level playing field with EVs during the promotion phase, but in the medium and long term, the reduction in demand for gasoline and diesel may reduce the fiscal burden of subsidies for countries. Getting the electricity prices right is also important, despite the subsidies on electricity being usually much lower than on fuel for road transport.

7. **Against this backdrop, countries are introducing strategies for the electrification of the transportation sector and designing fiscal instruments to manage its transition to become cleaner and more efficient.** The short-term fiscal strategies to promote EVs are described in Chapter 4, and the use of feebates has been considered a promising option due to its revenue-neutrality characteristics. In addition, countries are also using other options to finance the transition. For example, Chile issued the first sovereign green bond in the American Continent in the amount of US$1.4 billion to finance its low carbon transition. Part of it can be used to finance transition to low carbon transport. Green bonds can be an instrument to support the first phase of EV promotion, hence supporting the transition.

8. **In the long term, governments have a menu of options to mitigate the impact stemming from the reduction in fuel taxes.** The menu of fiscal options includes: (i) adjusting the gasoline and diesel taxes that are already in place in LAC countries considering these are below the OECD taxing levels; (ii) introducing different taxation on use and purchasing of vehicles (e.g., acquisition, registration, excise costs or import taxes); (iii) differentiating road use charges as per their environmental performance (e.g., congestion and road charges); (iv) introducing distance based charge (i.e., charging by the vehicle miles travelled and not the type of fuel used); and (v) adjusting electricity tariffs applicable specifically to EVs. Each instrument has pros on cons in matters such as easiness of collection, revenue limitations, link with externalities, and social progressivity.

9. **The private sector can plan an important role to reduce fiscal pressure for capital investments such as in charging stations for electromobility.** Other measures available to governments to promote the electrification of the transportation sector is to enable reforms to attract private sector investors in infrastructure. In addition to the capital investments, the private sector can bring innovation, technologies, skills, and new business models, in turn developing a conducive ecosystem and value-chain that can lead to economic growth.

10. **Electromobility adoption should be seen as part of a broader mobility strategy with a stable approach, and as an opportunity for countries to reform their tax model.** The general tax structure, sensitive social spending commitments and sector policies shape the budgetary pressure

on mobility in each country. Revenue neutrality (offsetting losses in some instruments with revenues from other instruments) is important but having more efficient and equitable taxes is also a priority. In the LAC region, electromobility is an opportunity to reform the tax revenue system associated with transportation (and in some cases the electricity sector), based on the principle of tying levies to externalities which in turn will provide the right incentives to consumers to move toward less polluting fuels.

This publication frames the discussion on the different fiscal policies available to countries to manage the fiscal impact of electromobility programs. It provides a menu of options for a decarbonized transportation system with a framework of policy options with international and regional case studies on how countries are managing this transition.

The publication is comprised of six chapters. Chapter 1 provides an international outlook of electromobility, followed by Chapter 2 which presents an overview of the transportation-related fiscal situation in LAC. Chapter 3, 4 and 5 are the core of the document, presenting respectively a fiscal framework, the short-term and long-term fiscal impacts with corresponding policy options. Finally, Chapter 6 sums-up these options and presents areas of further development. All sections present actual examples of how countries – within LAC and internationally – are managing the fiscal impacts of electromobility.

01.

Global outlook of electromobility

This Chapter summarizes the current situation of electromobility in the world, and in particular the growth in the adoption of electric vehicles (EVs) in the Latin America and Caribbean (LAC) region. The Chapter presents how EVs are gradually becoming more affordable and will reach price parity with internal combustion engine (ICE) cars in the next years driven by technology advances. A few scenarios are also presented to illustrate the growth in EV sales over time.

1.1 Electric vehicles adoption worldwide

Activities toward the electrification of the transportation sector are increasing in multiple countries mostly driven by the need of: (i) decarbonizing the sector and mitigate climate change; (ii) improving air quality in cities and urban centers; (iii) achieving better quality of services in public transportation; and (iv) improving energy security of countries with less imports of petroleum products. The electrification of the transportation sector is also an important component of region's commitments towards the Paris Climate Agreement, as 75% of the Nationally Determined Contributions (NDCs) identify transportation as a source of greenhouse gases (GHG) emission reduction and three NDCs specify targets to reduce GHG emissions in countries (IDB, 2020).

Since the Paris Agreement, several countries, regional governments, cities, automobile manufactures, fleet owners and operators, and investors with significant shareholdings in automotive manufacturing have elaborated public declarations regarding the adoption of zero-emission vehicles (ZEV). For example, at the COP26 in Glasgow, several countries and leading automakers have signed a pledge to phase out gasoline and diesel-powered motor vehicles by 2040 and replace them by electric cars and trucks (UNFCCC, 2021). The signatures from LAC include Chile, Dominican Republic, El Salvador, Mexico, Paraguay, Uruguay, and the cities of Buenos Aires, La Paz and Sao Paulo. It should be recognized that some of the countries that signed the pledge have even more ambitious targets, for example, pledging to phase-out new gasoline and diesel cars by 2035. The pledge includes agreements toward the new opportunities for clean growth, green jobs, and public health benefits from improving air quality; and that the transition could boost energy security and help balance electricity grids as part of the transition to clean power. It also commits the signatories to supporting a global, equitable and just transition so that no country or community is left behind.

At COP26 Transport Day, a memorandum of understanding (MOU) was signed by 15 countries and vehicle manufacturers to work together toward 100% zero-emission new truck and bus sales by 2040, with an interim goal of 30% zero-emission new vehicle sales by 2030 (Smith & Schouten, 2021). Traditionally, the medium- and heavy-duty vehicles were seen as difficult to decarbonize, but the situation has changed with the advances of technology and reduction in costs. According to Dr. Façanha, CALSTART's Global Director[1], freight trucks and buses globally represent about 4% of the on-road fleet globally but are responsible for 36% of GHG emissions, and over 70% of nitrogen oxides (NOx) emissions that contribute to local air pollution. This makes trucks and buses a very effective target for fast decarbonization.

CURRENT FIGURES

In 2020, there were more than 10 million EVs (all type of powertrains) in the world (IEA, 2021). This represents a 43% increase over 2019 and 716% over 2015. Despite the impressive growth, the share of EVs represents only 1% of the total vehicle fleet; this participation continues to growth at an accelerated pace despite the COVID-19 pandemic; for example, in 2017 there were just about 3 million EVs. From the 10 million EVs in the world, 4.5 million are in China, 3.2 million in Europe, 1.7 million in the United States, 0.7 million in the rest of the world; in LAC there were around 25,000 EVs. On a country level and relative scale, Norway reached the highest stock share of EV with 17% of total fleet in 2020, followed by Iceland with 6.2%, Sweden with 3.6%, and the Netherlands with 3.2%. In the LAC region, current penetration is very low, but growing at an accelerated pace. LAC leaders, such as Chile and Mexico, have shares of around 0.05%.

[1] CALSTART is a national nonprofit consortium with offices in New York, Michigan, Colorado and California and partners worldwide, and works with nearly 300-member company and agency innovators to build a prosperous, efficient, and clean high-tech transportation industry.

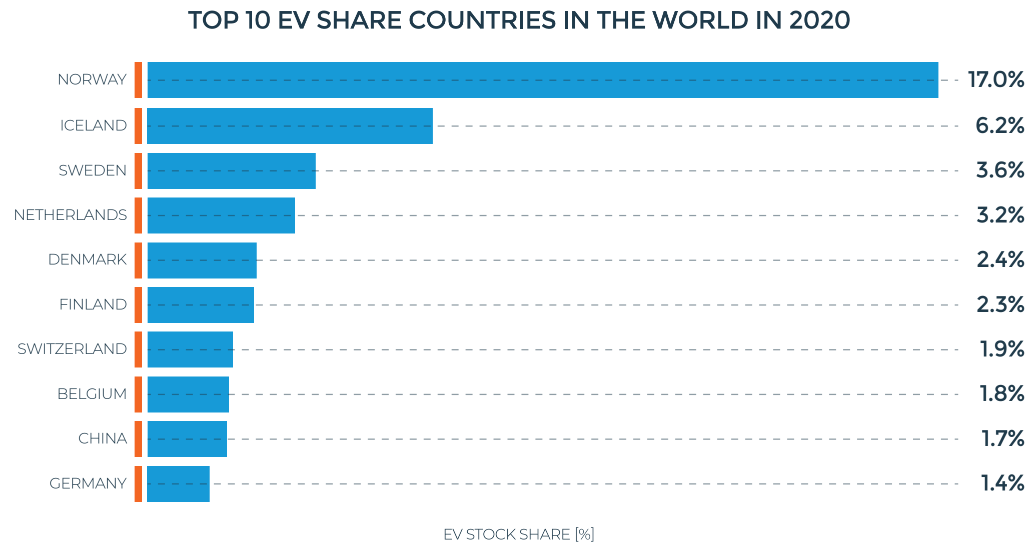

Figure 1: Stock share of EVs by countries in 2020
Source: (IEA, 2021)

Figure 1 illustrates that on a relative basis, and even over a short period of time, countries that have established EVs as a priority and introduced incentives (i.e., Nordic countries and Netherlands) have experienced the highest penetration of EVs and the highest sales shares. A similar conclusion can be reached within countries, for example, California has reached a higher market share of 8.1% (CNCDA, 2021), greater than the average of 2% in the United States. Chapter 4 of this document presents the different types of incentives used by countries and their importance in fostering the deployment of EVs.

UNDERSTANDING VEHICLE OWNERSHIP PATTERNS

Vehicle penetration is closely related with Gross Domestic Product (GDP) per capita. All over the world, mobility of people is associated with increasing economic output and higher standards of living. As incomes grow, people travel more for business and leisure activities than they have in the past. This relationship holds true for industrialized, as well as for emerging economies. People in countries with higher levels of economic development tend to travel more than those in countries with lower levels. Correspondingly, within countries people with higher incomes tend to travel more than those with lower incomes. However, this increase is not unlimited since after a period of accelerated growth from economic development, the number of vehicles gets "saturated" and penetration turns constant. A report from the RAND Corporation (Ecola, Rohr, Zmud, Kuhnimhof, & Phleps, 2014) estimates that this inflection point of saturation is when countries reach a GDP per capita of

US$20,000 using international purchasing power calculations.

However, GDP per capita in LAC countries is far from this limit of saturation as several of the countries are in the range between US$8,000 to US$12,000, and car ownership rates are low. In general, LAC countries have penetration rates lower than 350 vehicles per 1,000 inhabitants, despite having a high variance within the region. For example, Mexico and Brazil have respectively 343 vehicles and 213 vehicles per 1,000 inhabitants, while the mean penetration in Central and South American countries is 181 vehicles per 1,000 inhabitants. In this context, the LAC region has just a fraction of the penetration rates of the United States (836 vehicles per 1000 inhabitants), Canada (656 vehicles per 1000 inhabitants), or Western Europe (620 vehicles per 1000) (Davis & Boundy, 2021). The firm Wood Mackenzie (Wood Mackenzie, 2019) mentions that compared to other regions, current vehicle penetration on average in LAC is very low (130 vehicles/1000 inhabitants). However, moving forward, this penetration is expected to reach ~190 vehicles/1000 inhabitants by 2040, driven by increments in income per capita. This represents a growth increase of more than 45% on a per capita base and much higher on absolute base.

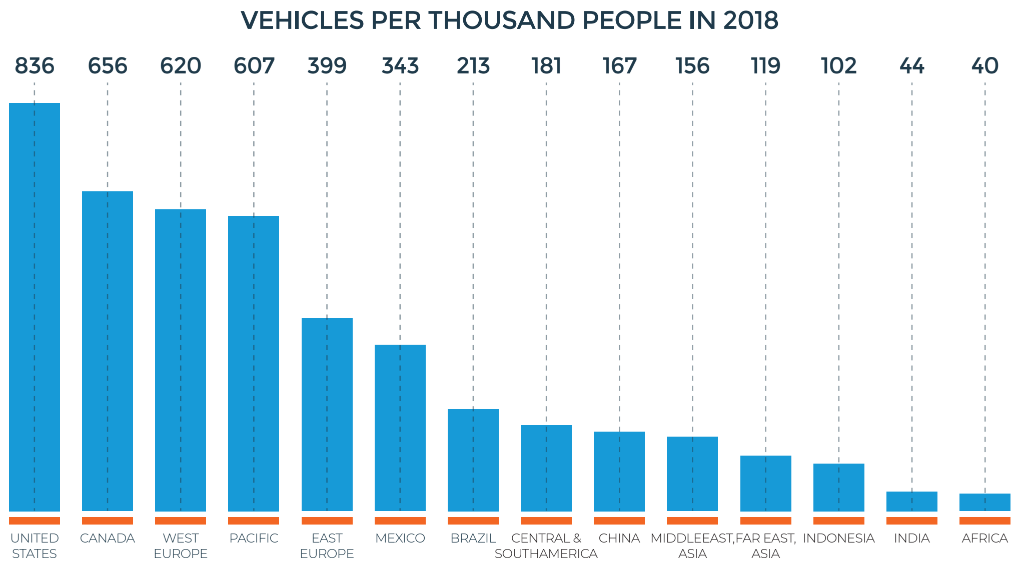

Figure 2: Motor Vehicles per 1,000 people in selected country/regions
Source: Transport Energy Data Book Ed. 39 (Davis & Boundy, 2021)

Therefore, as countries advance their economic development, car ownership will increase up to the saturation levels, despite the efforts being made to increase public transportation options. The LAC region is however distant from this inflection point. Countries have hence the important role to consider what are the adequate incentives to develop sustainable forms of private and public transportation options to cope with the added demand, considering the consumer behavior related to vehicles and the new forms of transportation

such as carsharing and micro-mobility. Personal cars are usually – after the primary residence – the most expensive purchase individuals will make in their lives. Moreover, this decision has long lasting effects, as cars have a long tail with an average useful life between 12-15 years with advanced economies closer to the lower end. For example, the average age of passenger car in the United States is 11.9 years, in the European Union is 10.7, while in Peru is 15.5 (BBVA Research, 2010).

1.2 Adoption and outlook of electric vehicles in LAC

Similar to the international experience, LAC countries are promoting electromobility to achieve several compelling objectives such as to reduce oil imports and fuel subsidies, reduce morbidity and mortality due to urban air and noise pollution, meet sustainability targets (carbon neutrality) and in a few cases promote national industry policies (manufacture of vehicles, parts, and batteries). Many cities in LAC exhibit air pollution levels well above the thresholds set by the World Health Organization (WHO) (López & Galarza, 2016), which impose very high mortality and morbidity costs. Regarding fine particles, even though the WHO has set a maximum threshold of 10 micrograms per cubic meter (μg/m3), the pollution levels of some capital cities in LAC are (FSR, 2020): Brasilia (54 μg/m3), La Paz (44 μg/m3), Lima (39 μg/m3), La Habana (35 μg/m3), Santiago (29 μg/m3) and Ciudad de Mexico (22 μg/m3). Electromobility represents therefore an opportunity to reduce health costs in LAC cities and is one of the key adoption drivers.

In this context, several countries in the region (Costa Rica, Chile, Peru, Colombia, and Uruguay) have already established national plans to decarbonize and reach carbon neutrality by 2050 and the transportation sector, in particular public transportation, can make important contributions to this goal.

According to E-Bus Radar (E-bus Radar, 2021), in October 2021, there were 2,482 electric buses in LAC, of which 900 are trolleybuses, 1,244 standard battery buses between 12 and 15 meters long, 326 battery-powered Midi from 8 to 11 meters, and 12 articulated battery/fuel cell bus of more than 18 meters long. The number of electric buses of 2,482 has more than tripled the number in 2017 (728) but it represents just 2.75% of a total of 90,406 units of public transportation registered in the cities on the platform. Adoption levels of EV in the region are not high yet. The number of electric buses in three countries (1,537 in Chile, Mexico, and Brazil) represent 78% of the current electric bus fleet in the LAC region.

ELECTRIC VEHICLES IN LAC METRO AREAS

EVs continue to increase its participation in the urban mass transport systems in LAC. In the next few years, the impulse to electric mobility will come from initiatives of the administrations of the big cities, supported by clean energy national strategies. Santiago de Chile, for example, imported 100 buses in 2018 with the main purpose of reducing environmental pollution and already has around 700 electric buses in operation in 2020. Chile's electrification strategy aims to ensure that all transportation and 40% of private vehicles will be electric in 2050. Mexico City has programmed the entry of 500 public transport vehicles in the short term. Colombia set a goal of acquiring 100% electric or zero-emission public vehicles for mass transit by 2035 and has indicated its intention of leading the deployment of EVs in LAC. The city of Bogotá has announced in early 2021 the conclusion of a public bidding process of more than 1,000 electric buses to de delivered in 2021 and 2022. Other cities in LAC countries, including Guayaquil, Medellín, and Panama City, are increasing the fleet of electric buses (IDB & DDPLAC, 2019). Costa Rica predicts that by 2050, public transport should meet most of the demand in metropolitan areas and non-motorized modes (including cycling) should increase its contribution to 10% of mobility by 2050.

Box 1: Electric vehicles in LAC metro areas

A FRAMEWORK FOR THE FISCAL IMPACT OF ELECTROMOBILITY

In contrast with the growth in public transportation, private adoption of EVs in LAC has been slow to date. According to (Frost & Sullivan, 2020) in 2018 only about 23,400 hybrid electric vehicles (HEVs) and 3,700 battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) were commercialized in LAC. By 2025, the HEV market is expected to reach 114,700 units at a compound annual growth rate (CAGR) of 25.5%, PHEV will top 20,300 units at a CAGR of 36%, and BEV will reach more than 23,300 units at a CAGR of 49.6%. Due the potential market size and strategies developed, the following outlook for EV adoption in LAC countries is foreseen (Frost & Sullivan, 2020): (i) Chile will be an attractive hybrid and EV market from 2020 to 2025 due to the collaboration between the private and public sectors; (ii) Brazil has a huge potential for technologies such as flex-hybrids; (iii) Mexico and Brazil are the largest markets in absolute figures, while Colombia and Chile will be the fastest growing; and (iv) Uruguay and Ecuador have announced incentives and financing programs to promote e-bus adoption in local fleets and have some of the largest penetration rates of hybrid technologies over the total market.

1.3 Electromobility early adoption and technological change

On the technical side, the early adoption of EVs has so far been characterized by high upfront and acquisition costs, limited range of distance per charge, and long battery recharge times. To cope with these drawbacks, countries have provided incentives on the purchase costs and/or operating expenses, but this promotion strategy has been limited to countries with high per capita income or those that have committed substantial public funds to change the fleet (e.g., China). Only in 2020, globally US$28 billion was invested in public and private EV companies, according to data from CB Insights (MarketWatch, 2021).This has not been the case in LAC countries as a sustainable flow of investment is still required for the full deployment of EVs.

However, this situation may change soon. Accelerated adoption of EVs will ramp up once the total cost of ownership (TCO) is less than the corresponding cost of ICE vehicles. It is expected that this price parity may take place in the next years, around 2025-2030. This will eliminate the need for public incentives or subsidies of all kinds, and at that moment, EVs will face an unprecedented uptick. The swift reduction in the costs for electric and hybrid vehicles covers the entire spectrum, from light cars to heavy transportation vehicles. Moreover, interurban transport (long-haul) and transport (heavy duty) vehicles could compete favorably in price with ICE vehicles after 2040. A study by Deloitte (Deloitte, 2019) indicates a “tipping point” between 2022 and 2024 for vehicles in the United Kingdom when the costs of owing an EV will equal that of owning a gas or diesel vehicle. Therefore, with the TCO no longer a barrier to purchase, in general, EVs will gradually become a more realistic, viable option for any new car buyer.

An important driver of the cost reduction of EVs over time is advances in technology and reduction in the cost of batteries. According to BloombergNEF, batteries accounted for more than half (57%) of the production costs of an EV in 2015. These costs are coming down, for example, lithium-ion battery pack prices were on average US$668/kWh in 2013, while in 2020 were around US$137/kWh, and it is expected that by 2023 they will be close to US$100/kWh (BloombergNEF, 2020). It is expected that the levelized cost of battery packs will reach US$58/kWh by 2030, but there is uncertainty on how the industry will reduce prices even further from US$100/kWh. In similar terms, according to (Kah, 2019) the costs of batteries must drop to less than US$100/kWh for EVs to be competitive with ICE vehicles. This analysis also shows the results of studies and surveys that forecast the year in which this milestone would be met, whose median is the year 2025. Several studies converge to the situation where in the next 5 to 10 years EVs will reach cost parity with ICE vehicles, however, this will depend on the individual conditions of each country.

Another reason driving the penetration of EV is related to climate change mitigation from the decarbonization of the transportation sector. GHG emissions per km traveled depend on several factors such as the type of fuel, vehicle efficiency, and the mix of primary sources of electricity generation. In the United States, the average passenger ICE vehicle emits from its tailpipe around 404 grams of CO_2 per mile (EPA, 2021). Even though most of the electricity in the United States is thermal generation, the average direct emissions of EVs are of the order of 100 gram per mile, lower than ICE and hybrid cars. As a region, the LAC countries have the greenest electricity generation matrix in the world with large participation of renewable energy sources such as hydropower, wind, and solar energy. In turn, the LAC region has therefore a great opportunity to use this generation to supply clear electricity to the transportation sector in a sustainable manner.

TECHNOLOGY CHANGES AND ALTERNATIVE FUELS

Technology improvements in electromobility are advancing at an accelerated pace. Countries are considering policies for zero or near-zero emissions which includes electric mobility; and another of this example is the use of hydrogen in fuel cell electric vehicle (FCEV) for mobility. Hydrogen can play an important role in energy transition, and for this reason it is receiving considerable attention. However, not all hydrogen is created equal, it is usually classified in three types: (i) green hydrogen which is the cleanest producing zero emissions usually producing electrolysis with renewable energy such as wind and solar; (ii) gray hydrogen which uses fossil fuels such as oil and gas and emit CO_2

as they combust; and (iii) blue hydrogen that can meet certain low-carbon thresholds, either produced by nuclear energy or by gray hydrogen but using carbon capture technologies to reduce the release of CO_2.

Unlike BEVs, which require a longer time to charge and can have driving range limitations, a FCEV does not have these limitations as hydrogen can be pumped directly into the vehicle's tank and can travel longer distances with a full tank (ranging from 200 to 300 miles). The higher the power required (such as trucks or buses) and the distance to be covered, the greater the benefit of using FCEVs instead of BEVs. The potential growing use of hydrogen in the transport sector, as well as the foreseen greater penetration of EVs in general, illustrates that the current taxes associated with the existing types of fuels (i.e., gasoline and diesel paid at the pump) will gradually be disconnected from road use and from the countries' tax revenues. Therefore, regardless of the new technology that will prevail in the future, there is a high risk if governments continue to rely their tax revenues on the traditional consumption of gasoline and diesel.

This document uses the acronym of ICE almost as an equivalent of cars with engines using gasoline and/or diesel (fossil fuels). However, eliminating the use of fossil fuels is different from eliminating ICE cars as these latter vehicles can also be fueled with biofuels[2] which are renewable energy sources and considered more sustainable compared to fossil fuels, and they also use an ICE. Thus, a ban on the use of fossil fuels could create incentives for the use of biofuels such as ethanol and methanol, but a ban on ICE cars would create incentives for the use EVs and have an indirect – and negative – impact on the use of biofuels. In this context, most of the countries that are introducing decarbonization initiatives in the transportation sector are using the concept of banning or reducing the use of fossil fuels rather than banning or reducing the use of ICE vehicles.

Lastly, this document has focused on the taxation in the use of oil products such as gasoline and diesel in road transportation. However, oil products are also used in the aviation sector which has a specific tax treatment depending on the nature of the flights. In most countries, international flights (cargo freight or passengers) are exempt of value-added tax (VAT) or subject to a full refund of VAT. This is because most of the fuel is used during the international flight and there is an international convention that regulates it. Nevertheless, aviation fuels used for domestic commercial flights is subject to the standard VAT rate in all Organization for Economic Co-operation and Development (OECD) countries (except in the United States), except for Colombia where it is subject to a reduced VAT rate of 5%. For example, in Mexico aviation fuels for

[2] The development of biofuels as an alternative renewable energy source compared to the use of fossil fuels has been extensively reviewed about its trade-off of benefits and impacts. This document does not elaborate on these trade-offs as it focuses on the fiscal impacts of the deployment of EVs.

international flights is exempt, but for domestic flights it incurs a 16% VAT tax (OECD, 2021). Most of the OECD countries exempt aviation fuels from excise duties for commercial international and domestic flights; the exception is for non-commercial and pleasure flights, which are taxed in some countries.

Taxation of aviation fuels is also relevant to the government revenues as the airline industry is experimenting other types of fuels not related to fossil fuels to decarbonize the industry. For example, on December 1, 2021, United Airlines operated an unprecedented flight with an aircraft with passengers using 100% sustainable aviation fuel (SAF), an alternative fuel made from non-petroleum feedstocks and 100% renewable (United Airlines, 2021). SAF has nearly 80% less GHG emissions on a lifecycle basis compared to conventional jet fuel. SAF can be used on its own or mixed with conventional fuel and is compatible with other aircraft fleets. This case illustrates that notwithstanding the focus of this publication on road transportation, as part of the electrification of transport trend, countries will have to also review their tax regimes on other uses of fossil fuels such as aviation fuels or on new products such as hydrogen for fuel cell electric vehicle.

1.4 Scenarios for electric vehicles adoption

As electromobility activities continue to growth in every country, this section presents the medium- and long-term scenarios from three organizations to illustrate the alternative growth trajectories.

INTERNATIONAL ENERGY AGENCY (IEA)

The IEA (IEA, 2020) has developed two penetration scenarios for electromobility in the world for all types of vehicles (BEV, PHEV, buses, and trucks). In the Stated Policies Scenario (SPS), the policies approved in international conventions on energy and technology issues are followed. In the SPS scenario, the global number of EVs would increase from 8 million in 2019 to 50 million in 2025 and close to 140 million in 2030, which implies an annual growth rate of 30%. According to this projection, the percentage of EVs in the world would reach 7% in 2030. Sales of EVs would reach 14 million in 2025, and 25 million in 2030 (10% and 16% of all vehicle sales in those years). In the Sustainable Development Scenario (SDS), measures are adopted to achieve the emission targets agreed in international climate change agreements. The SDS scenario is more aggressive: a global stock of 80 million EVs would be reached in 2025, and 245 million vehicles in 2030.

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COLUMBIA UNIVERSITY

(Kah, 2019) from Columbia University proposes scenarios combining the interaction of various drivers (population and economic growth, cost of batteries, percentages of electromobility within total vehicles, demand for transportation fuels, demand global fossil fuel) and conducted interviews with different stakeholders. From all projections, governments are the most conservative group, followed by oil companies. The forecasts in this report are somewhat scattered in the sense that since it estimates that EVs will reach 20% of the total vehicle fleet between 2022 and 2035, approximately. Despite this variability, all forecasts converge to the assumption that to achieve a sustainable and low carbon scenario, EVs need to reach close to 100% of vehicles sold in 2050.

DELOITTE

(Deloitte, 2019) anticipates that annual global sales of EVs will increase from 2 million in 2018, to 12 million in 2020 and 21 million in 2030, mainly driven by the reduction of the costs of batteries. EVs could represent 20% of the entire vehicle fleet by 2030 and 32% of the total market share for new cars. Deloitte's forecast for different EV technologies is close to the conservative IEA's SPS and (Kah, 2019) forecasts for 2030.

Deloitte however mentions that beyond 2030, one of the key factors in sustaining the growth of the previous decade would be the implementation of charging infrastructure, which requires large capital investments. The ability of countries to mobilize private and public investments to deploy the charging infrastructure will be the main determinant in defining the share between EVs and ICEs in each country. The study indicates also that government intervention continues to play an important role in driving EV sales, as demonstrated in the cases of Norway and Netherlands. The widespread adoption of EVs is a necessary step toward achieving climate change goals, such as those of the 2015 Paris Agreement.

Moving forward, with the acceleration of electromobility activities in the LAC region, several countries are considering the fiscal implications of this trend. The next Chapter presents the fiscal situation in the LAC region, with focus on the government revenues from the consumption of gasoline and diesel taxes.

02.

Fiscal impacts related to mobility in LAC

As stated in the previous Chapter, the electrification of the transportation sector has been accelerating and, as in the rest of the world, high levels of penetration of EVs are expected in LAC in the future. Given this, countries must prepare on various fronts to face this coming situation. One of these fronts could be the fiscal impact since electromobility may affect public finances, both in tax revenues and public spending, depending on the characteristics of each country.

Considering the tax revenues, the impacts of electromobility may come from several fronts. For most countries in the LAC region, the main impact will be on tax revenues related to fuel consumption since they tend to tax fuel consumption with several taxes, such as the fuel excise tax, the VAT, import duties and, in the case of some countries, carbon taxes or other environmental fees. In addition to these taxes related to fuel consumption, other tax revenues may be impacted, including taxes on the income from companies in the sector. Finally, the lower demand for fuels would also lead to a reduction in royalty income from hydrocarbon exploitation, as well as the income of public companies related to the sale of fuels and/or hydrocarbon extraction. This document presents the first type of impact, the tax revenues related to fuel consumption, as the upstream and midstream activities in the oil and gas sector are not covered here.

On the side of public spending, the long-term effects of electromobility could come mainly from changes in energy subsidies. In the long term, the total amount of fuel subsidies will be reduced as a consequence of lower consumption of oil products. On the other hand, expenditures in electricity subsidies may be increased in some countries as a consequence of the greater electricity demand that the electrification of the transportation sector will bring and the eventual electricity subsidy in a given country.

In order to measure the possible long-term direct impacts[3] that electromobility may have on public finances, this Chapter selectively presents the public revenues related to mobility currently available in LAC countries, as well as subsidies for fuels and electricity.

This Chapter is organized into four sections. The first one is related to tax revenues at risk due to the dynamics of electromobility. The second section discusses the impacts on public spending, quantifying energy subsidies in the region and analyzing how the transition will affect these expenditures in the medium term. The third section combines the results of the previous two sections to consider the net effects on public finances. Finally, the last section presents general comments and emphasizes the policy measures available to overcome the identified fiscal challenges.

2.1 Tax revenues related to mobility in LAC

Measuring a country's tax revenues related to the production and consumption of fuels is a complex task, since countries typically do not present disaggregated and detailed information[4], for this reason most studies on this subject are based on the analysis of tax revenues from excise taxes on fuels other petroleum derivatives, which are usually well-identified in public accounts. In this document we use the methodology followed by (Conte, Rasteletti, & Muñoz, 2022) to consider the main type of fuel-related taxes, such as, excise taxes, environmental, on imports, and in some cases the VAT (or sales tax). Nevertheless, this approach does not consider other industry-related business taxes.

In LAC[5], on average, revenues from taxes on fuels represented an amount equivalent to 1.11% of GDP or 5.28% of total revenues in 2018. This figure is relatively low when compared to the collection of these taxes in OECD countries, but similar to those of Africa, and higher than those of Asia. In 2018 and using data from the OECD, the breakdown of the 1.11% environmental taxes in LAC was: (i) energy 0.64%; (ii) transport 0.38%; (iii) pollution 0.02%; and (iv) resources 0.01%. The description of these categories is presented in Box 2. In 2019, the revenue from taxes on fuels in LAC was very similar and represented an amount equivalent to 1.2% of GDP and 5.7% of total revenues.

Table 1: Tax revenues from taxes on fuels 2018

	% OF GDP	% OF TOTAL REVENUES
EUROPE	2.0%	5.5%
AFRICA	1.2%	7.3%
ASIA	1.0%	4.8%
LAC	1.1%	5.3%

Source: (Conte, Rasteletti, & Muñoz, 2022)

Although, on average, the collection of fuel-related taxes is relatively low in the region, it is important to highlight that the collection amounts by country are very heterogeneous (see next chart). Thus, while in Guyana and Honduras the collection in 2018 represented more than 2% of GDP and close to 10% of total revenues, while in Panama this figure did not exceed 0.3% of GDP or 2% of its total revenues. This heterogeneity is also observed when the share of these taxes in the total income of the countries is analyzed. While in the Dominican Republic these taxes represented more than 10% of total government revenues in 2018, in the case of Panama, Ecuador, Trinidad & Tobago, and Belize these revenues represented less than 2% of government tax revenues.

As the next chart shows, for several countries in the region, the relative importance of the collection of taxes on fuels was on average limited. Thus, for countries located in the lower left quadrant of this graph, taxes on fuels did not represent a significant source of income, neither in relative terms of GDP nor in relative terms in total revenues. In these cases, the tax collection efforts to cover the direct loss of revenues derived from electromobility would be relatively lower. However, for other LAC countries the impacts could be important, such as, among others, the cases of Honduras, Costa Rica, and the Dominican Republic.

[3] The analysis presented in this work discusses the possible direct and "first round" effects of electromobility on fuel taxes and subsidies. This implies that the effects on taxes of companies and individuals are not considered, as well as general equilibrium effects that occur in economies due to electromobility. These indirect and general equilibrium effects may quantitatively imply important changes in economic activity, which would affect revenues and public spending. Quantifying these effects requires the specification of general equilibrium economic models, a task that is beyond the scope of this Chapter.

[4] This section was built with the tax information collected by different sources: (i) Revenues Statistics of the OECD available at https://stats.oecd.org/; (ii) Policy Instruments for the Environment" (PINE) database of the OECD; and (iii) Carbon Pricing dashboard of the World Bank. With this, a unified base of fuel taxes has been created, which allows collecting statistics in 101 countries between 1994 and 2019. The main types of taxes covered are excise fuel tax, carbon/environmental taxes, taxes on imports and, in some cases, the VAT or sales tax.

[5] For more details about the individual prices and taxes of fuel products and electricity in LAC, please see joint publication of OLADE and IDB Precios de la Energía en America Latina y el Caribe (Informe Annual)

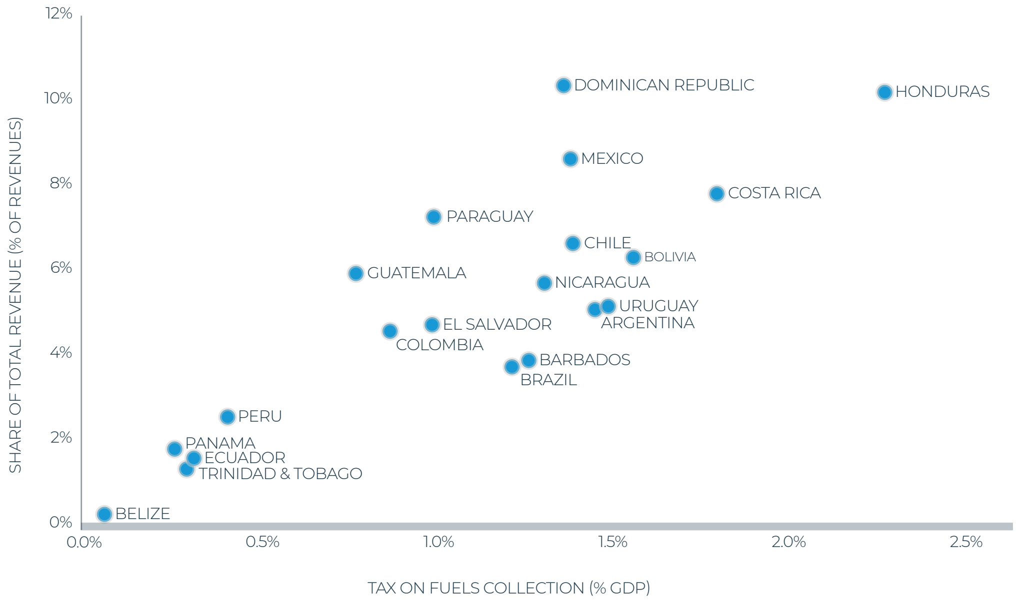

Figure 3: Share of total revenue vs tax on fuels collection by country

Source: Source: (Conte, Rasteletti, & Muñoz, 2022)

2.2 Fuel and electricity subsidies spending in LAC

As mentioned earlier, depending on individual countries, electromobility can have an impact on public spending, with the effects on energy subsidies probably the main impact in the long term.

Although energy subsidies in the region are high, it is important to note that deployment of electromobility will affect fuel and electricity subsidies in opposite ways. In the case of fuel subsidies, the amounts will be reduced gradually over time, provided that fuel consumption will decrease due to the change in the number of ICE vehicles. This would then represent a fiscal relief for those countries that allocate significant resources to subsidize fuels in the transportation sector.

In the case of electricity subsidies, the deployment of electromobility could imply increases in the amounts of these subsidies, if there were no changes in the existing public policies in countries that subsidize these, thus generating greater fiscal pressure. However, this study does not perform calculations on electricity subsidies due to the lack of updated data and that these are not the primary objective of this study. According to data from the Inter-American Development Bank (IDB), in 2015 these subsidies averaged 0.5% of GDP (Izquierdo, Pessino, & Vuletin, 2018). Although these subsidies vary widely across countries, on average more than four-fifths of the energy subsidies leak out to nonpoor households. The magnitude of this inefficiency demonstrates at the same time the large opportunities for improvement. Lastly, and on an international scale, electricity subsidies are usually smaller than subsidies in oil products in the transportation sector.

The situation of LAC countries regarding fuel subsidies is highly varied. As shown in Figure 4, there are countries where subsidies are, on average, high in the period analyzed, such as in Bolivia and Ecuador. On the other hand, for countries like Panama, Brazil, Argentina, and Barbados, both subsidies are low.

From the perspective of electromobility deployment, the countries that fiscally would benefit the most are those that currently have high subsidies on gasoline or diesel.

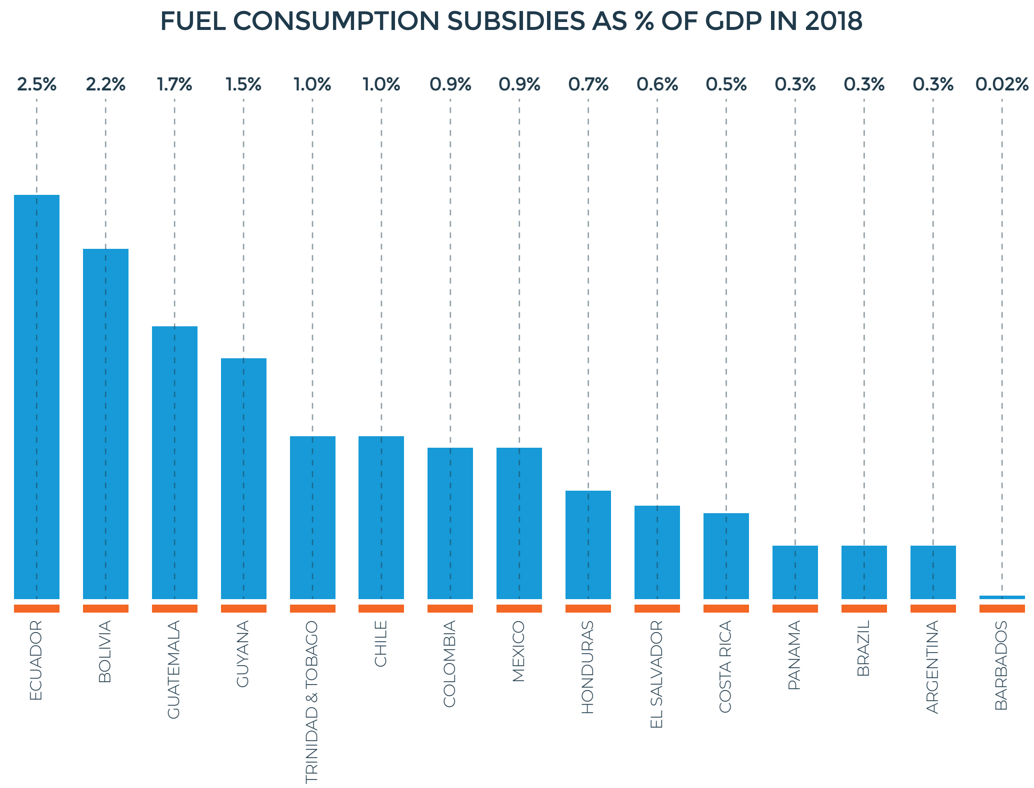

Figure 4: Energy Subsidies to GDP ratio by country[6]
Source: Estimates of (Conte, Rasteletti, & Muñoz, 2022) based on datafrom (Coady, Parry, Le, & Shang, 2019)

2.3 Long-term balance of benefits and costs

Considering the analysis of the possible effects of electromobility on public

[6] The data presented excludes Venezuela for being an atypical case in LAC and the difficulties to obtain updated reliable data.

income and spending carried out in the two previous sections, it is important to contrast these, in order to have a notion of the possible net fiscal effect. A first approximation of this effect can be obtained by comparing the improvements in fiscal balances derived from the elimination of fuel subsidies, with the deterioration of fiscal balances as a consequence of the elimination of excise taxes on fuels. Clearly this is a rudimentary approach, since it does not consider all the income that would be affected or the impact on electricity subsidies. However, it is a useful initial indicator, as it provides insight into the possible orders of magnitude of the fiscal impact and highlights a comparative analysis among the countries in the region using a standard methodology for comparison.

As shown in Figure 5, in the absence of other fiscal measures, there are some countries for which electromobility might have a negative long-term fiscal impact – if no other measures are introduced – such as the cases of Honduras, Costa Rica, and the Dominican Republic, which are countries where tax revenues from fuel consumption are relatively high, and subsidies are relatively low. There is another group of countries such as Bolivia, Ecuador, and El Salvador, where the fiscal impact could be positive and quantitatively significant. This is because they currently have high subsidies and low taxes on fuels. In general terms, the average net fiscal effect for the countries considered would be -0.5%% of GDP. This result indicates the net effect of an extreme (and theoretical) situation of eliminating all fuel revenues and subsidies would almost offset each other at regional level, but not necessarily at country level. However, this is a mere example and an unsophisticated analysis to illustrate the concept and the magnitude of the revenues and subsidies. The following chart illustrates the difference between the tax revenues from gasoline and diesel compared to the estimates of subsidies of these same products. The electricity taxes and/or subsidies are not included.

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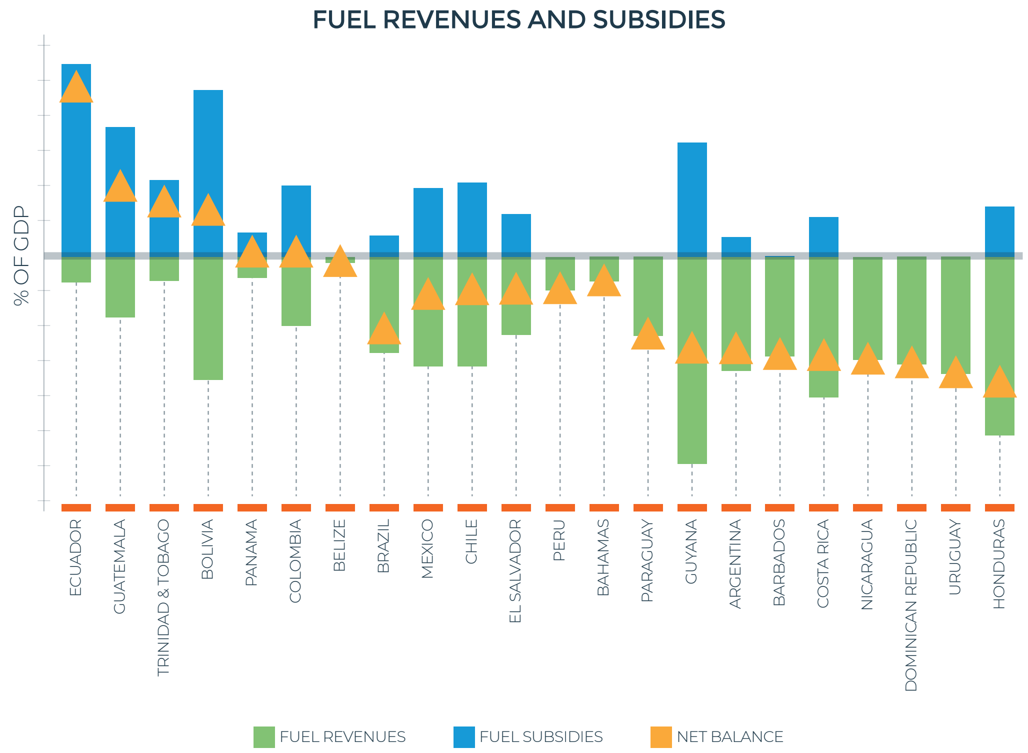

Figure 5: Fuel revenues and subsidies in selected LAC countries
Source: (Conte, Rasteletti, & Muñoz, 2022)

2.4 Recent developments and opportunities

The simple calculations presented in the previous section indicate that although for some countries electromobility could have a negative fiscal impact if no other policy measures are introduced, for most countries in the region this impact would be relatively low. This is due to the fact that some countries in the region do not have elevated excise taxes on fuels or, at the same time, have taxes and subsidies on fuel consumption.

In the case of countries with positive impacts of electromobility on fuel-related income and subsidies, it is important to note that many of these countries are hydrocarbon producers. Thus, although the net effects of gasoline or diesel would be positive, global revenues related to hydrocarbon upstream activities could be reduced, as a consequence of the more general processes of decarbonization of their economies.

For those countries where the fiscal impact of electromobility is high, the next few years will be opportune to advance in fiscal reforms to cover these gaps. This is due to the fact that the economic crisis caused by the COVID-19 pandemic is affecting and will strongly impact the region in the near future. According to estimates from the International Monetary Fund (IMF), the region's GDP has declined 7.0% in 2020 following a 0.1% growth in 2019 and moving forward the growth is expected to be 6.3% in 2021 (IMF, 2021).

To face the economic crisis derived from the pandemic, LAC countries announced support measures that averaged 4.7% of GDP (Pineda, Pessino, & Rasteletti, 2020). This increase in public spending, in addition to the reduction in income due to lower economic activity, generated important fiscal deficits and a public debt expected to reach 79.3% of GDP, this is eleven percentage points above the value from the previous year. To ensure the sustainability of their public finances, countries will need to introduce fiscal reforms, so this could be the right context to also make adjustments that consider the long-term impacts of electromobility.

Although LAC countries have been making efforts to increase tax collection, there is still room to increase it since, on average, they collect 11 percentage points of GDP less than what is observed on average in OECD countries. In 2019, for example, unweighted average tax-to-GDP ratio in 26 countries in LAC was 22.9% (excluding Venezuela due to data availability issues), while in the 37 OECD member countries was 33.8%. There is also some wide variance within LAC: the countries with the highest tax-to-GDP are Cuba (42%), Barbados and Brazil (each with 33.1%), and those with lowest tax-to-GDP ratio are Guatemala (13.1%), the Dominican Republic (13.5%) and Paraguay (13.9%).

This relatively low tax collection in the region is explained by deficiencies in tax design, which reduce the tax bases and generate collection losses, known as tax expenditures. As shown in Figure 6, considering only VAT, corporate income taxes and personal income taxes, the total tax collection represents 11.4% of GDP and the tax expenditures represent 3% of GDP for a typical country in the region. Additionally, the region also has significant deficiencies in the administration of tax collection, which allow high levels of evasion. The tax evasion for a typical country is, on average, 6.1% of GDP.

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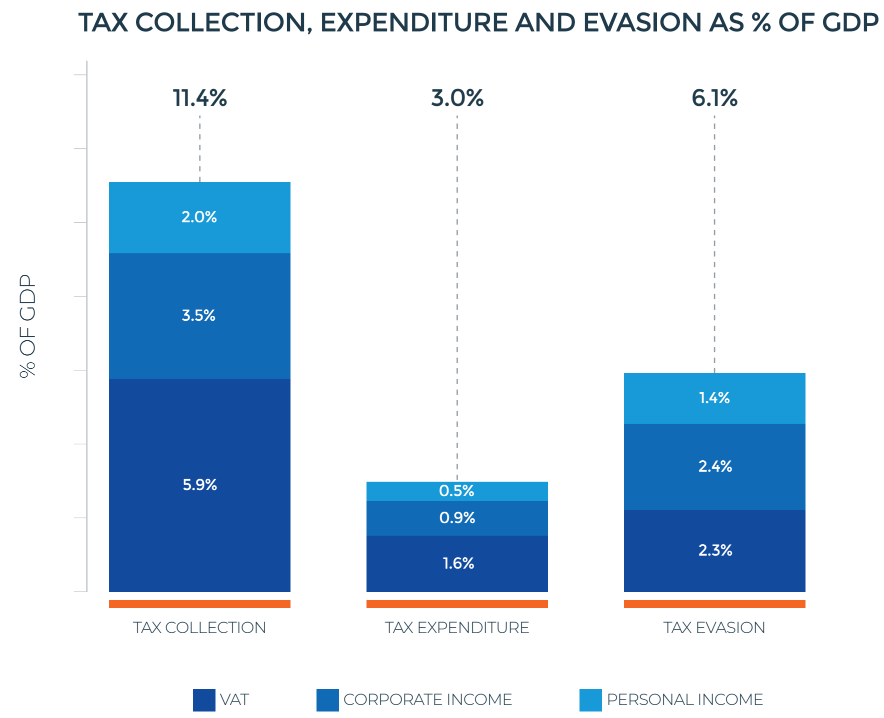

Figure 6: Collection, tax expenses and evasion of main taxes
Source: Estimations of IDB's Fiscal Management Division[7]

[7] Based on input-output matrices of each country and tax-gap methodology.

ENVIRONMENTAL REVENUES: TAXONOMY AND COMPONENTS

This section presents a taxonomy and quantification of environmental revenues in LAC with the most up-to-date records of 2018. Environmental revenue is a subset of the countries' general tax revenue and is defined as a tax based on a physical unit (or a proxy of a physical unit) of something that has a specific and proven harmful impact on the environment, regardless of whether the tax is intended to change behavior or is applied for another purpose.

Although environment-related tax revenue cannot be identified in the standard OECD tax revenue classification, it can be identified through the detailed list of specific taxes included for most countries within this classification. Value added taxes (VAT), land taxes, and taxes that should be treated as rents on sub-soil assets are excluded from environmental-related taxes.

This document presents four types of environmental taxes, consistent with the taxonomy used by the OECD. In addition to these, countries also have other types of indirect taxes such as taxes on production or payroll applicable to the value chain of production or assembly of vehicles, but for simplicity these are not included as environmental taxes.

$$Environmental\ revenues\ (c)_t\ = \sum(Energy +\ transportation + pollution + resources)_t$$

where c represents the country and t the specific year:

Box 2: Taxonomy and components of environmental revenues

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Energy use: includes fuel taxes and subsidies (special taxes on gasoline and diesel), carbon taxes and subsidies for electricity consumption for transportation. Therefore, it includes fuels for transport purposes and energy products for stationary purposes. They currently represent an important part of the tax revenues of the countries.

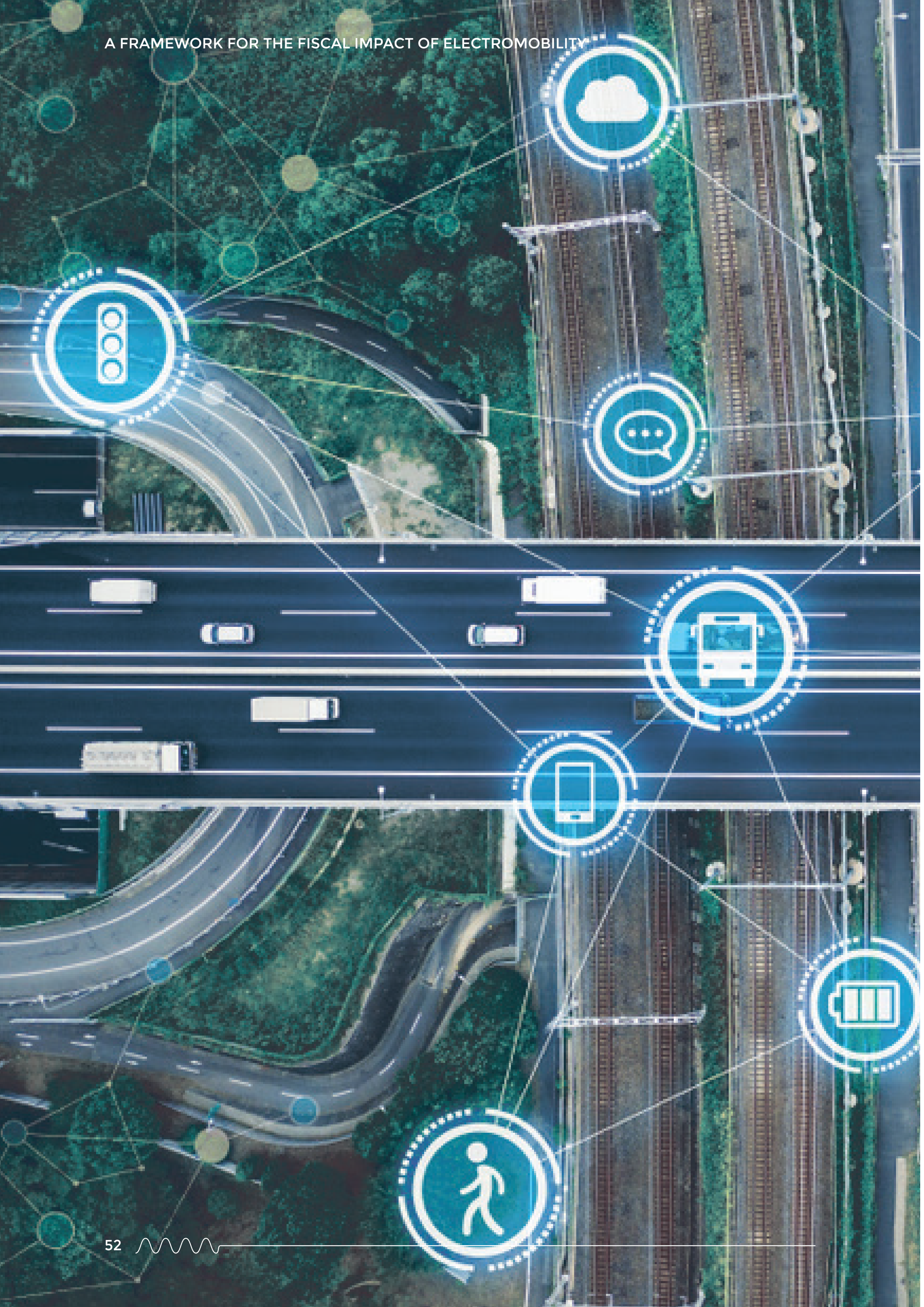
- Transportation related: includes taxes related to the ownership and use of motor vehicles (excluding fuels) such as tolls, distance traveled, congestion, and road damage charges. It also includes the use of vehicles and the stock related to taxes or incentives that differ by type of vehicle, technology, energy efficiency and environmental standards, and one-off taxes such as import r annual road taxes.
- Pollution taxes refer to taxes on SOX and NOX emissions to air and water, taxes on ozone-depleting substances, charges on wastewater discharge, and taxes on packaging, for example, and
- Resource taxes related to taxes on water extraction, forest products, excavation taxes, and mining royalties, for example as these deplete natural resources. Taxes designed to capture the resource rent from the extraction of natural resources should be excluded as rents are considered not taxes but part of a wider category called property income.

For a detailed definition of these categories as well as the accounting rules and principles, please see their full description at: Environmental taxes: A statistical guide (2013 edition) by Eurostat Manuals and Guidelines.

Box 2: Taxonomy and components of environmental revenues

03.

A framework to consider the fiscal impacts of electric vehicles



The gradual increase in electromobility activities in a country can led to two different impacts on government revenues. The first one can arise in the short term from the incentives a country may introduce to foster the acceleration of electromobility activities until EVs acquisition costs reach cost-parity with ICE vehicles. A second one can arise in the medium-to-long term from lower government revenues due to the reduction in consumption of fossil fuels –gasoline and diesel– in the transportation sector. In this second impact, one consideration is that in some countries the reduction in the consumption of fossil fuels could have a positive impact on government revenues in countries that are subsidizing the consumption of gasoline and diesel. This impact could be the opposite if governments are subsidizing electricity and there are no specific tariffs for the transportation sector.

This document has already presented the benefits of electromobility (e.g., cleaner air, lower CO_2 emissions, better quality of service in public transportation, and improved energy security) and these are the main reasons countries in the LAC region are accelerating the deployment of electromobility activities. This Chapter presents a conceptual framework of how government authorities can consider the impacts of lower revenues caused by the deployment of electromobility initiatives, while Chapters 4 and 5 present the specific policy options available to countries.

3.1. Timeframe considerations for the impact on government revenues

The growth of electrification of transportation will likely follow the adoption of innovation and technology model or the Bass model (S-shaped curve, Bass diffusion of innovation model) presented in Figure 7. The Bass model illustrates how new products are adopted and uses a mathematical theory to describe the diffusion of frequently purchased products and from sociology and consumer behavior, how word of mouth is applied to sales of new products (Bass's

Basement Research Institute, 2021)[8]. The timeframe can be divided in three different phases (the early adoption, take-off, and saturation) and different policy options should be used in each of these phases. The specific duration of each phase depends on each country context.

MODEL FOR THE ADOPTION OF INNOVATION AND TECHNOLOGY

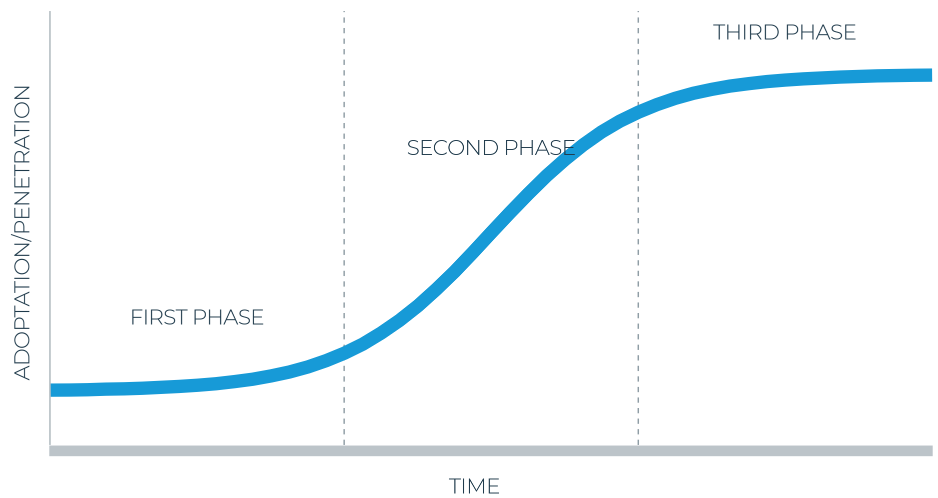


Figure 7: Introduction of innovation according to the Bass model

As illustrated in Figure 8, this S-shaped curve was the case in the adoption of other technologies in households of the United States such as: electric power, automobile, landline telephone, cellular phone, and household appliances such as the electric stove and the refrigerator.

These technologies follow a three-phase approach of: (i) an early adoption phase where the technology is not available or accessible to everyone, and when the growth is small and at a slow pace. This phase is followed by (ii) a period of rapid growth called the take-off phase with a significant increase in sales as the standards become established, which in turn attracts competition. In the long-run the (iii) the consolidation (or saturation) phase where there is a cool-off period with very small growth, and the technology gets stable at high penetration. An alternative to this phase is when technology is replaced by a new one, for example, the decrease in use of landline telephones replaced by mobile phones.

[8] It is also known as Gompertz model.

SHARE OF US HOUSEHOLDS ADOPTING SPECIFIC TECHNOLOGY

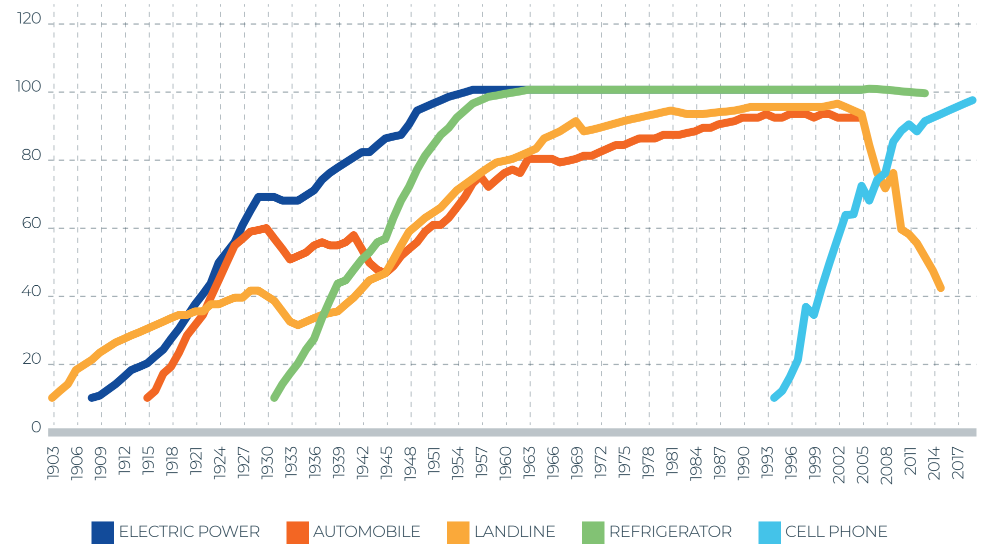


Figure 8: Technology adoption by households in the United States

Source: (Visual Capitalist, 2020)

In the case of the implementation of electromobility, the impact on government revenues in the three phases (the early adoption, take-off, and saturation) can be described as follows.

- In the early adoption phase, the short-term fiscal impact of electromobility is limited due to the small share of EVs in the total car fleet. In LAC, for example, it is less than 1% of new car sales. In this regard, small adjustments in the current tax regimes already in place in a country are enough to cover the initial incentives. The early adoption phase usually kick starts with the introduction of an electromobility strategy and action plan and can last 5 to 10 years depending on the country. The incentives are the main governmental costs in this phase, and they are usually small due to the low penetration. To offset these incentives, small adjustments in policies and tax regimes that are already in place can work in the short term in LAC due to the reduced costs or disturbance compared to the current regimes.

- The intermediate take-off phase is when there is fast adoption of electromobility activities in a country. There are still no countries in the LAC region at this phase, and even internationally there are very few. One of the countries with higher penetration of EVs is Norway where in 2020 EVs (including BEV and PHEV) represented about three quarters of new vehicle sales. In this phase of EVs deployment, incentives are gradually reduced or eliminated. For example, to offset the initial revenue loss from lower gasoline and diesel consumption, California introduced a small increase in the registration of new vehicles. In this context, the takeoff phase is the time in which countries must begin to review their tax and revenue streams related to the transportation system and to introduce tax reforms that are sustainable on the long term. In this phase, countries can introduce small tax adjustments as technology advances and new types of revenues become more acceptable.

- However, in the long term, more structural reforms must be put in place as countries develop their policy roadmaps. In this phase, incentives are fully eliminated (as technology has evolved and acquisition costs are competitive) and the government costs are the reduction of taxes on gasoline and diesel. Chapter 5 identifies the policy options available to government authorities to compensate for the loss of revenue, but which would require advance planning to restructure existing tax regimes in the transportation sector, and eventually in the electricity sector. The size and magnitude of this restructuring will depend on the fiscal strategies and the dependency on fuel taxes. The policy options of decarbonization need also to be integrated to a broader set of fiscal policy reforms a country needs to introduce.

3.2. The scenarios

An important consideration that authorities should take into account in advance is to understand the fiscal impact of the electrification of the transportation sector and seek policy options that mitigate the eventual reduction in revenues in a given period (e.g., in the short, medium, and long term) or during all timescales. However, this depends on the fiscal situation of each country and its priorities with other sectors such as education and health; this policy decision is country specific. Therefore, countries should develop a detailed fiscal impact analysis for each circumstance that identifies and quantifies existing and future fiscal gaps in the transportation sector. This analysis will review the existing revenue stream from the transportation sector and assess the impact on costs incurred, and revenues received by the government due to future incentives, fees, or taxes.

To illustrate the impact on government revenues, Figure 9 presents a conceptual model, developed for this work, on the way in which these revenues can evolve over time in a country and for different scenarios. Since most countries are developing decarbonization strategies up to 2040 or 2050, this figure identifies three possible scenarios over a period of roughly 30 years. Countries must then analyze and quantify these scenarios, which are:

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- The **business as usual (BAU)** scenario reflects that no action is taken by governments, but gradually over time, these revenues will naturally tend to decrease due to two reasons: (i) as vehicles become more efficient (driving more miles per liter of gasoline or requiring less gasoline for the same distance); and (ii) the natural increase of electrification of transportation due to reduction in prices from advance in technologies will also reduce the consumption of gasoline and diesel. Both factors would mainly impact the long-term revenues that the government currently receives from gasoline and diesel consumption. In this scenario, the country does not introduce incentives (such as tax exemptions) to deploy EVs in the short-term neither does it introduce new policies to offset fuel revenues in the long-term.

- **The business as usual with electromobility strategy (BAU-EM)** scenario contemplates the option that governments introduce incentives for the deployment of EVs but do not develop new policy options to offset the eventual long-term reduction in revenues from gasoline and diesel taxes. This scenario is a more pessimistic situation compared to the BAU since in the short-term these financial incentives can impact government costs, and the deployment of electromobility activities can accelerate the reduction of gasoline and diesel revenues if no offsetting mechanisms are put in place. This scenario, however, is not likely to happen as countries should develop a long-term fiscal strategy to electromobility activities.

- The **policy offset** scenario indicates government will adjust or introduce policy measures within the transportation or other sectors that will partly or totally mitigate the reduction in long-term revenue losses. In this scenario, and on average over a period, it is possible that there will be no losses in the government intake due to the new fiscal measures introduced. There are two other variants for this scenario, the first one is a **partial policy offset** scenario, where the reduction in revenue is mitigated with the introduction of new regimes but there is still a loss from the BAU scenario. This may be the case when the introduction of new fiscal measures may become socially regressive, or there are difficulties in the ease of adjusting or introducing new tax regimes. The second variant is that these new fiscal measures are introduced in an aggressive manner, illustrated in Figure 9 as **bold policy offset,** leading to an increase in the government revenues, eventually exceeding the BAU. In this variation, the recently introduced activities and services related to electromobility present an opportunity to increase tax revenues in a country.

Figure 9 illustrates government revenues, establishing a starting base equal to

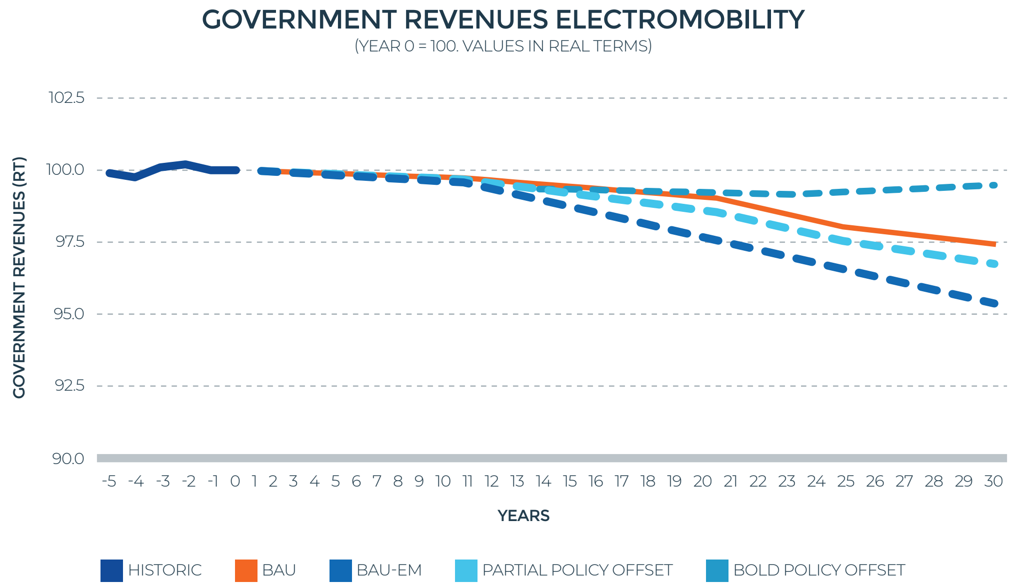

Figure 9: Government revenue model due to electromobility

Source: Own elaboration

This analysis and modelling of the fiscal impact focus strictly on government revenues from the electrification of transportation systems. However, more broadly, countries need to consider other impacts of electromobility on the overall economy (e.g., economic growth, changes in employment or level of business activity) and monetary conditions (e.g., inflation). This analysis should be carried-out by countries, generally with input-output economic models that represent the interdependencies between the sectors of a national economy in an integrated manner. These can be obtained using a partial general equilibrium (typical supply and demand that do not consider feedback from related market) or a more sophisticated general equilibrium model that considers an entire economy.

These models must also consider uncertainties. Since these economic models are based on multiple input variables and assumptions that need to be considered over a long period of time, they will deliver multiple results based on changes in the assumptions. The dispersion of the results based on the uncertainties of the inputs and the methodological challenges such as the possible multicollinearity between variables illustrate the importance of having a robust model to evaluate government's revenues in the long term and the sensitivity of the results.

[9] The chart can also be expressed in other indicators such as a percentage of GDP, but this would not change the concepts and scenarios presented.

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CASE STUDY IN ITALY, SLOVENIA, AND BRITAIN

Italy

A study by (Cambridge Econometrics, 2018) has estimated the reduction in revenues from fuel taxes in Italy due to the electrification of the transportation sector, illustrating the concept of general equilibrium modelling. The study concluded that in the reference case, with the main scenario of electromobility, government revenues from fuel taxes on total government revenues would be reduced from 2.7% to 2.3%. This reduction would be partially offset by higher income, VAT and social securities that would be generated by the additional activity in the Italian economy. The remaining gap could then be addressed by other tax changes, including those targeted specifically in the transportation sector to car drivers. The study identifies some of the transitional challenges such as the needed funding of €465 million per year by 2030 to implement a rapid charging infrastructure. In addition to these quantitative impacts, the study highlights the important benefits on energy security as Italy would replace high volume of fossil fuel imports with domestically produced electricity and hydrogen fuel to be used in the transport system.

Slovenia

A recent study by the OECD International Transport Forum (ITF) analyzed the fiscal impacts of decarbonization of the transportation sector in Slovenia (OECD/ITF, 2019). In 2016, the excise duty and carbon taxes on fossil fuels used in road transport represented 14.6% of the total tax revenue of the central government. The study examined Slovenia's transportation sector in a 2 °C scenario when alternative fuel scenarios (such as the use of BEVs and PHEVs) in passenger cars increase from 2% in 2017, to 25% in 2030 and 62% in 2050. The modelling exercise in a BAU scenario indicates that revenues from road transport taxes would be 13% lower in 2050 compared to 2017 level (this includes taxes on fuel use, vehicle registration or ownership, and road use). Revenues from excise taxes from passenger cars would decrease by 56% due to increased fuel efficiency and adoption of alternative fuel technologies. In this context, the study quantifies the BAU of government revenues in Slovenia and presents a menu of policy options to mitigate these potential reductions.

Box 3: Case study Italy, Slovenia, and Britain

CASE STUDY IN ITALY, SLOVENIA, AND BRITAIN

Britain

A similar study (Lord & Palmou, 2021) has reviewed the impact on the current revenues in Britain from the growing deployment of EVs which could increase from the current 100,000 to 3 million by 2025, and 25 million by 2035. Considering that the current revenues from car usage are based on taxing fossil fuels, the study mentions that in the absence of reforms in the existing taxation regimes, it is envisaged 3 consequences: (i) congestion would rapidly get worse; (ii) annual fuel duty revenues would plummet, requiring tax rises elsewhere; and (iii) unfairness and inequality would rise as those who drive new EVs or BEVs would pay less, while the remaining drivers using gasoline and diesel would become responsible for the making-up the difference. The study sends a message that “doing nothing” is not an option, and it argues that road pricing is the preferred way forward, as it becomes a unique opportunity to address externalities such as the real social costs of driving, from air pollution to congestion. In the current taxation regime, the study mentions that (excluding the externalities) fuel duty and Vehicle Excise Duty (VED) raise around £35 billion for the Treasury each year. Moving forward, tax revenues from car usage could fall by around £10 billion by 2030, £20 billion by 2035, and £30 billion by 2040 with the deployment of BEVs. The study presents alternative offsetting mechanisms but indicates that road pricing (with different options and parameters) is the preferred solution. The study presents next steps toward implementing a model for road charging in Britain.

Box 3: Case study Italy, Slovenia, and Britain

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3.3. Equity considerations

Another consideration deals with equity and fairness considerations that arise from the different impacts of the electrification of the transportation sector, since the gains and losses may not be equitably distributed among the participants in a society. When reviewing these impacts, policy makers should consider the trade-offs between efficiency and equity of the fiscal policies, the distributional aspects. This is important as eventual subsidies to EVs can be regressive as the healthy part of the society are the ones more likely to purchase EVs. When these become too regressive –when the tax burden decreases with income– and are unavoidable, the impact on low-income households or vulnerable groups adversely affected by policy interventions must be compensated through social programs or other well-established mechanisms. In addition, this is where a strategy for improving public transportation needs to be introduced simultaneously.

These concepts are consistent with the term of a *Just Transition*[10] (Morena, Krause, & Stevis, 2020), a term that refers to policy interventions that aim to change the current economic structure to one that is low-carbon, socially and environmentally friendly. The Just Transition promotes sustainable development as well as protecting the workers’ right to decent work, green jobs, and social protection for those who bear the brunt of the transition. A mix of just transition policies is needed to reduce the adverse impacts of decarbonization on workers, firms, and communities to ensure that the transition is fair and inclusive for all. Since 2006 the Just Transition has been promoted at the Conference of the Parties (COPs) and the United Nations Framework Convention on Climate Change (UNFCCC).

3.4. Broader tax considerations

The last consideration deals with the fact that the fiscal policy options for the electrification of transportation sector cannot be an isolated activity, instead it must be integrated into a more comprehensive long-term fiscal strategy. Historically, taxation in LAC has been seen as a means of generating income to keep the government in business, but a more sustainable and impactful vision is to use taxation as a development tool, altering preferences towards a desired goal such as stimulating development. This can be important in strengthening the quality of the public transportation and improving the quality of air in urban centers. These arguments for the use of taxation as a development tool are emphasized in the book More than Revenue, mentioning that no other

[10] The concept of a “just transition” originated in the 1970s labor movement in North America in response to workers displaced from their work in the process of phasing out polluting industries for the benefit of the environment.

major reform is more important for the sustainable and inclusive growth of the LAC region than the one of the region's fiscal and tax systems (IDB, 2013), which is still pending.

On this matter, Annex 1 discusses Costa Rica´s National Plan of Decarbonization, a key example of how fiscal and sector incentives are put together coherently, and Annex 3 presents an extract from the book More than Revenue, with the main concepts of the important role of taxation in fostering a sustainable development and the principles that countries could follow.

04.

Short-term fiscal impact: incentives, challenges, and policies

Following the model presented earlier, the deployment of electromobility initiatives can have two types of fiscal impacts: (i) in the short term, the impacts may arise from the incentives created by governments to promote electromobility and reduce the initial purchase price and induce consumers to purchase EVs, and (ii) in the long term, the impact may arise from reduced government revenues from lower gasoline and diesel consumption as ICE vehicles are gradually phased out. This chapter presents the short-term fiscal instruments used by authorities as it reviews international –and LAC– experience of countries that have introduced incentives to accelerate the deployment of electromobility.

4.1. Types of Incentives

Choosing the right type of fiscal incentives is important considering there is an extensive list of different types of short-term incentives with different levels of effectiveness. According to (Mock & Yang, 2014); these are: (i) **direct incentive to consumers or manufactures,** defined as a one-time bonus or rebate upon purchase of an EV (defined as a fixed amount that is paid if a certain condition is met); (ii) **financial (or tax) incentives,** defined usually on fiscal terms as a reduced purchase tax (for example elimination or reduction of VAT) or import tax. Other financial incentives are reduction or elimination of annual registration or ownership fees for EVs; (iii) **fuel cost savings,** when drives switch from ICE vehicles to EVs and described as indirect incentive as electricity prices are usually lower than fuel prices as a result of lower taxation or lower energy costs, as well as higher efficiency of EVs; and (iv) **indirect or non-monetary incentives** such as exclusive access to parking spaces, urban centers, or preferred lanes such as those dedicated to high-occupancy vehicles (HOV). These are powerful instruments, particularly in urban centers. Other non-monetary incentives are related to vehicle fleet mandates to more efficient and low-carbon vehicles or updating building codes to ensure that new (or renovated) buildings are already prepared with infrastructure for EV charging stations.

Over time, countries have used one or more of these incentives, and each one has pros on cons on issues such as ease of collection, linkage with the external costs of mobility or pollution, and social progressivity. There is some literature on the effectiveness of each type of incentive, but that assessment is beyond the scope of this document, which is to list them and provide a brief description. This document seeks to recognize that it is not only the fiscal incentives that matter, that other factors such as the price of gasoline and electricity can also influence the decision to purchase EVs . This Chapter focuses on identifying these types of incentives and presenting the international and regional experience. These incentives have had limited fiscal impact as, used in the short term to stimulate the use of EVs, they have offered transition arrangement options to consumers as they are phased out at some point.

Direct incentives for vehicles use have been substantial in developed countries and China (Mock & Yang, 2014) to promote "greener" transportation. In France, for example, vehicles with CO_2 emissions below 20 g/km received a bonus of €7,000 in 2012. In the United Kingdom, users who bought electric or hybrid vehicles with CO_2 emissions below 75 g/km received a bonus of 25% of the cost of the vehicle (approximately £5,000). In the United States, the federal bonus reached US$7,500, and states like California provided additional subsidies of up to US$2,500. Depending on the type of vehicle and battery, China has granted subsidies between €4,200 and €7,200 per vehicle.

Despite these successes, direct vehicle incentives have not in all cases had a clear and direct impact on increasing the share of EVs in some countries. In the United Kingdom, for example, it failed to increase the market share of EVs between 2012 and 2013, even though the subsidy on the value of the vehicle covered almost 50% of its purchase cost. Other factors come into play for adoption, such as perceived range, availability of public chargers, and battery charge times, among others. Moving forward, vehicle incentives will tend to lose ground once EVs ownership costs are lower than ICE vehicles costs, which would happen in about 5 -10 years depending on the country.

Financial (or tax) incentives cover four categories: VAT, one-time purchase/ registration taxes, annual circulation taxes, and taxes on company-owned vehicles (Mock & Yang, 2014):

- The VAT has not been widely used to stimulate the adoption of EVs, except in Norway, where BEVs are exempt from paying it. However, more recently other European countries have introduced temporary or partial VAT exemptions.
- The registration tax in the Netherlands depends on the CO_2 emissions

level and the type of vehicle. With this mechanism, some gasoline vehicles with emissions of 99 g/km receive an incentive of €500, while some hybrid vehicles that use diesel and emit 169 g/km receive incentives for €11,000. In Denmark, exemptions depend on the price of the vehicle and the level of emissions. Buyers of high-end vehicles may cash in registration subsidies larger than €14,000.

- Circulation taxes are of less value than registration taxes and generally follow a complex and heterogeneous pattern. In Germany, annual exemptions are made by CO_2 emissions level and vehicle type, cover 10 years, and can range between 20 and 170 € per year per vehicle. In the Netherlands, the road tax is based on weight, but before 2013, vehicles with emissions below 111 g/km for gasoline or 96 g/km for diesel were exempt from road tax.
- Company-owned vehicles taxes are important in Europe. The model consists of handing over vehicles to employees, covering costs (including fuel costs), in exchange for a lower salary, and the company can deduct the vehicle expenses from income taxes. The employee can use the vehicle for private use and pays a small company tax. In Germany, for example, 62% of vehicles registered in 2012 belonged to companies, and in the Netherlands, 25% of the price of a vehicle is considered part of the owner's income and subject to income tax. In 2013, passenger vehicles with emissions below 50 g/km were exempted from the company-owned vehicle tax.

The approach of setting vehicle taxes or granting subsidies according to their emissions may lead to other problems (Van Dender, 2019): (i) it creates a tension between fiscal and environmental objectives because success in reducing emissions reduces revenues; (ii) when the incentives are set by emission bands, the principle of uniformly stimulating the reduction of emissions can be violated, encouraging the purchase of vehicles that are close to the edge of the band to avoid paying taxes; and (iii) subsidization of cleaner private vehicles is prone to efficiency errors and is socially regressive (beneficiaries of EV subsidies tend to be high income individuals).

INTRODUCING THE FEEBATE

The feebate is a mechanism in which more-efficient vehicles benefit from rebates and less-efficient vehicles are subject to fees. A feebate program establishes a *pivot point* or *benchmark* that distinguishes the rebate from the fee and represents the point where the feebate changes from granting a benefit to charging a fee and achieves a balancing position. The revenues from the fees (associated with less efficient vehicles) support expenditures (i.e., the rebates) in more efficient vehicles and therefor feebates can be considered as a transfer system and not a tax, as the fee paid by the more inefficient vehicles support can be used to be benefit of the more efficient vehicles.

Emissions of CO_2 are usually used as the proxy for determining the efficiency of the vehicles. Feebates when properly designed are revenue neutral and self-funding and can be implemented in a stepwise approach or continuous with a sliding linear scale according to the selected parameter (such as CO_2). Feebate systems are considered one of the best policy options to foster the adoption of low carbon emission vehicles due to its revenue-neutrality and easiness of implementation as it can be integrated into the vehicle's registration methodology for defining the fees. An additional benefit of the feebate is that it can be technology neutral, only focusing on the efficiency. The collection and granting of fees or rebates can be done at the consumer or the manufacturing stages.

INTERNATIONAL EXPERIENCE WITH FEEBATES

The following figure illustrates the use of the feebate in selected countries, according to the level of emissions, and the highlighted red line is a proposal for the introduction of a feebate in Finland in a recent IMF paper of designing fiscal policies for achieving Finland's emission neutrality targets (Parry & Wingender, 2021). The analysis indicates that feebate that progressively shifted new sales to 100 percent EVs by 2035 would reduce road fuel emissions about 50 percent below otherwise projected levels for 2035. Deeper reductions would continue after 2035 as the fleet continued to turn over. Moreover, A complementary reform would be to remove the favorable tax treatment of diesel fuel which would improve economic efficiency and generate, albeit moderate and transitional, emissions and fiscal benefits.

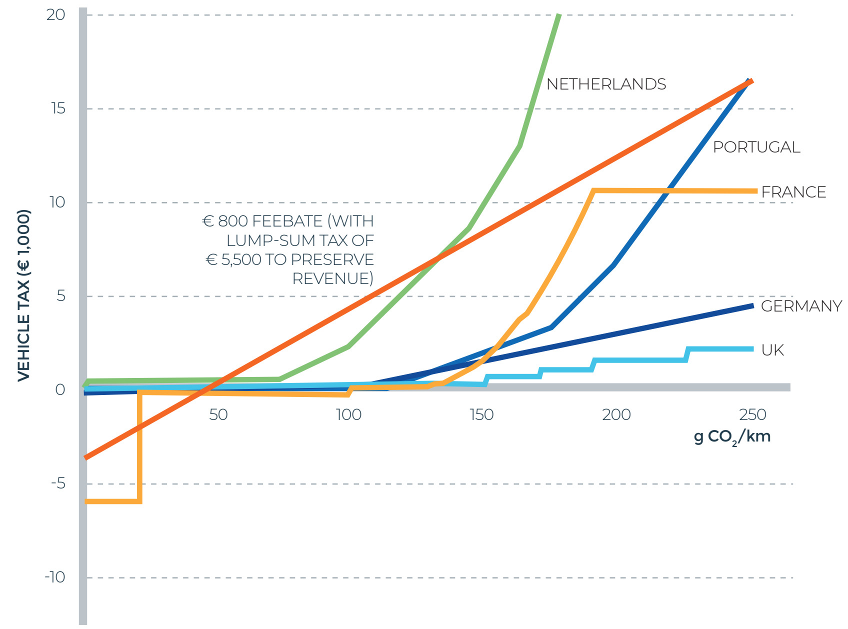

Figure 10: Example in use of feebates in selected countries

Source: Parry and Wingender (2021)

France had a recent experience in the use of vehicle stimuli to promote cleaner vehicle penetration. (Teusch & Braathen, 2019) undertook a thorough ex-post cost benefit analysis of the French Feebate Program for CO_2-efficient motor vehicles introduced in 2008. Regardless of the program specifics, there are areas of attention about the option of reducing the purchase value of private EVs. Under the feebate policy, French consumers purchasing vehicles that did not emit more than 130 grams of CO_2 per km would benefit from a rebate or subsidy of up to €1,000 (for the least polluting non-electric vehicle class, A-). Those consumers purchasing vehicles with emissions of more than 160 grams of CO_2, on the other hand, had to pay a tax of up to €2,600 (for the most polluting vehicle class, G). The objective of the policy was to reduce CO_2 emissions through providing consumers with incentives for the purchase of more fuel-efficient vehicles, while encouraging manufacturers to develop vehicles with lower emissions.

The introduction of the policy delivered an important benefit as it increased the sales of cleaner vehicles. The feebate system led to a decrease in CO_2 emissions (by an estimated 4.8 million tons over vehicles' lifetime), but had indirect impacts on excise tax revenue and VAT revenue:

- Excise tax revenue changed through two channels: (i) fuel tax revenue per km declined as the composition effect implies that cars are more fuel efficient; and (ii) excise revenue increased because of rebound and fleet size effects. In the French case, the composition effect dominated rebound and fleet size effect. The net excise tax effect is almost three times as large as the direct fiscal cost of the feebate.

- The feebate policy affected VAT revenue through two channels: (i) VAT revenue increased due to higher car sales; and (ii) VAT decreased because of lower fuel consumption per km (which is only partly offset by additional road use). In the French case, the former effect dominated somewhat but the net effect is rather small compared to feebate and excise tax effects.

The revenue losses induced by the French feebate was estimated to be more than the estimated value of the climate benefit. The consumer surplus increased by €223 million, but this gain only represented some 15% of the fiscal cost in the baseline specification. The effect on producer surplus for both domestic and foreign producers was positive, as it increased vehicle sales and potentially allowed firms to charge higher margins for clean vehicles. The net effect resulting from the 2008 feebate was negative, and it is estimated to decrease social welfare by €3.3 billion. The feebate model could also have distributional implications. People with a higher income gain more so, in absolute terms, feebate benefits increase monotonically with the income decile (Durrmeyer, 2018). These issues highlight the importance to perform detailed cost-benefit analysis (CBS) for the design of incentives, and these are described later in this chapter.

Other countries that have adopted the use of feebates are Denmark, Germany, Netherlands, Norway, Ontario (Canadian province of) Singapore, and United Kingdom.

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UNDERSTANDING THE BREAKDOWN BETWEEN VAT AND EXCISE TAX, AND THE MAIN PRODUCTS SUBJECT TO EXCISE TAX

This document has made references to VAT and excise taxes, which together with import taxes are the most used in fuel consumption. However, these have different meanings since, as the name implies, VAT is a general tax that is added to the price of goods or services at each stage of production or distribution and is collected at different phases. The amounts to the taxable person are usually deducted from the tax already paid in the previous phase. The excise tax is generally applied to a specific good or service as a selective measure, usually to increase revenues or induce consumer behavior, and it is commonly levied on alcohol products, tobacco, oil products, and sometimes on entertainment. The definition of which one of these two is the most appropriate option is a country specific decision.

Excise taxes are considered Pigouvian taxes after British economist Arthur Pigou introduced the concept of externality (or spill over) problems in 1920, arguing that the government should correct the externalities by taxing the activities that harm the economy and have negative impact on others in a society, but not necessarily the person who does that activity. The consumption of fossil fuels can generate several externalities such as pollution, traffic congestion, noise, accidents, and emissions, and thus a Pigouvian tax can, when properly defined, partially or fully correct the distorting effects of a consumption. Section 5.3 expands on an analysis that estimates the cost of gasoline and diesel if the externalities are considered.

As a reference, in the case of oil products in automotive fuels, our analysis using OECD data indicates that excise tax represents the largest share of the total fuel taxes. For example, using 2019 IEA data from 36 selected OECD countries, average non-weighted excise tax in premium gasoline represented 71% while in automotive diesel represented 67% of the total tax. The analysis indicates also that the data is very heterogeneous across countries, and that on average diesel is taxed at a lower rate than gasoline.

Box 4: VAT and excise taxes

Table 2: Shares of VAT and excise tax by product 2019

TYPE OF TAX	PREMIUM GASOLINE		AUTOMOTIVE DIESEL	
	US$ PER LITER	%	US$ PER LITER	%
VAT	0.232	29%	0.221	33%
EXCISE	0.571	71%	0.446	67%
TOTAL	0.803	100%	0.667	100%

In the LAC region, the excise tax on liquid fuels represents the largest share compared to other items subject to excise tax. The analysis of 14 countries in LAC indicate that the non-weighted average excise tax on liquid fuels and gas represents 48% of the total excise taxes across all products. This amount is about four times bigger than the second largest product that is excise tax over tobacco which has a 12% share. Next in the shares of excise taxes comes alcoholic beverages (7%), beers (6%), motor vehicles (4%), and non-acholic beverages (2%).

Box 4: VAT and excise taxes

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EFFECTIVENESS OF INCENTIVES TO PROMOTE ELECTRIC VEHICLES

Considering the different types of financial and non-financial incentives that have been implemented in different countries, there is a growing amount of literature being published which evaluates the effectiveness and efficiency of these incentives,

A study of incentives implemented in the European Union (Cansino, Sánchez-Braza, & Sanz-Díaz, 2018) concluded that the most important policy instrument to promote the use of EVs are tax and infrastructure measures along with financial incentives for purchasing and supporting research and development (R&D) projects. Despite the scarcity of EV registration data, the available information of this study concluded that higher penetration levels of EVs appear in countries where the registration tax, the ownership tax, or both taxes have developed into a partial green tax by including CO_2 emissions in the calculation of the final invoice. Countries with more intensive use of EVs also finance charging stations to facilitate electromobility. In cases where the automotive industry is relevant at the national level, public funding also supports R&D projects by focusing on EV deployment.

A recent publication (Xue, Zhou, Wu, Wu, & Xu, 2021) had analyzed the key factors that affect market share and adoption of EVs, such as, policies, incentives, and socio-economic factors[11]. The study attempts to identify the key factors behind the uneven penetration of EVs, as some countries in 2019 achieved high market shares (such as Norway with 55.93% and Iceland with 22.6%) while other countries have less than 7% market shares. The analysis has considered data on EV market share and information on policies and incentives in the leading 20 EV markets that represented 90% of the world EV market. The period analyzed was from 2015 to 2019 using a panel regression model. The innovation of this article was to combine incentive policies with socioeconomic factors and use panel data to analyze the actual adoption behavior of the global EV market. The article also presents a review of literature of other studies related to the effectiveness of incentives to promote EVs, therefore making an important contribution to this subject.

The results from this study had shown that the tax reduction policy, charger density, and income have significantly positive effects on the penetration of EVs. First, tax reductions, such as exemption from ownership, had a strong impact on the EV adoption, compared with purchase subsides. Second, charger density could help overcome perceived and actual range barriers for EVs, as the deployment of chargers had demonstrated to be a prerequisite for wide adoption. The mass deployment of EV charging infrastructure plays a crucial

11 Examples of socio-economic factors in this study were household disposable income, gasoline price, and electricity price.

role in the accessibility of chargers and EV electricity demand. Third, household disposable income is one of the most neglected factors among socio-economic factors. The data analyzed showed that household disposable income has the highest coefficient, which means income has a significant positive impact on EV uptake.

4.2. LAC regional experience on incentives to promote electric vehicles

In recent years, the LAC region has also introduced incentives to foster the promotion of electromobility. The review confirms the international experience that countries usually deploy multiple types of incentives as part of an electromobility program, rather than just one. Figure 11 summarizes these instruments in selected countries. Countries are sorted from least (left) to most (right) instruments established. All the countries in the sample have established discounts or exemptions for purchase and VAT discounts, and most of the countries have incentives for EV taxis.

However, the countries differ in enabling the operating conditions of EVs. A first group of countries has introduced VAT and import duty incentives to reduce purchasing costs (which apply to both EV and ICE vehicles, mainly due to free trade agreements). A second group of countries has emphasized the role of preferential financing for EVs, and a third group has taken no actions beyond very small public transportation pilot projects[12].

The Caribbean region is also moving towards the electrification of the transportation sector. Barbados is at the forefront as a country advanced in the use of EVs becoming the top user of EVs per capita in the Caribbean, with over 430 EVs on the island's roads. Barbados has also ambitious plans moving forward, to make all passenger vehicles run on electrify of alternative fuels by 2030 (UNFCCC, 2021).

Other countries are now following the same path (Masson & Pérez, 2021). In the Dominican Republic, the government has reduced duties and registration fees for EVs by 50%, which allowed the number of EVs to increase almost ninefold. Jamaica is also moving into that direction. To support the review and implementation of policies, regulations, and fiscal incentives related to the development of the EV ecosystem, the Jamaican government has established an EV Council chaired by the Ministry of Science, Energy, and Technology (MSET). The EV Council also consists of representatives from other public institutions, the utility, the regulator, and the private sector automobile industry. Trinidad and Tobago, for example, a country that has been using

[12] Appendix A of (Cavallo, Powell, & Serebrisky, 2020) presents the individual country policies to promote EV in LAC.

vehicles fueled by gasoline and compressed natural gas (CNG), has introduced in its Budget 2022 a proposal to become effective by January 1, 2022, that the country will be removing thel custom duties, motor vehicle tax and VAT on the importation of BEVs. The policy is applicable to EVs with an age limit of two years and is consistent with the country's plan to increase the penetration of electric vehicles and reduction of emissions pledged in its NDCs.

TYPE	ARGENTINA	URUGUAY	BRAZIL	PARAGUAY	CHILE	ECUADOR	COLOMBIA	COSTA RICA	MEXICO
EV PURCHASE TAX DISCOUNT / EXEMPTION	■	■	■	■	■	■	■	■	■
EV PURCHASE VAT DISCOUNT / EXEMPTION	■	■	■	■	■	■	■	■	■
DISCOUNT / EXEMPTION OTHER DUTIES		■				■	■	■	■
DISCOUNT / EXEMPTION REGISTRATION OWNERSHIP, OR FEES		■	■			■	■	■	■
PREFERENTIAL ENERGY RATES OR FREE ENERGY	■	■		■	■			■	■
PRIORITY LANES / DISCOUNTS / EXEMPTION USE CHARGES						■	■	■	
PREFERENTIAL PARKING					■	■	■	■	
E-TAXI PROGRAMS		■	■		■	■	■	■	■

Figure 11: Review of incentives for electromobility in selected LAC countries
Source: (Cavallo, Powell, & Serebrisky, 2020)

The vehicle tax structure in LAC is very diverse as there are large differences between countries and between technologies (Gómez-Gélvez, Mojica, Kaul, & Isla, 2016). This indicates that the appropriate type of incentive is a country-specific analysis due to the different composition and levels of taxes between countries. For example: (i) considering the different taxes (i.e., import taxes, value added taxes, and others), Argentina and Brazil collect the highest total taxes on imported EVs, 135% and 89.6%, respectively. (ii) Mexico charges the lowest taxes on all types of vehicles (20% for ICE vehicles and 16% for EVs). and (iii) in the rest of the countries the variations in total taxes are small between countries and between technologies, but there are large variations in the collecting tax instrument. For example, Mexico does collect taxes on vehicles imports, while Argentina has the highest VAT (41% for both EVs and ICE vehicles) and Chile has the lowest VAT (16% for both EVs and ICE vehicles).

In addition to these incentives aimed at consumers, international experience indicates that countries have introduced other types of incentives towards car manufactures. These can be production incentives, tax credits, subsidies for research and development, subsidies for the production and sale of EVs, or even subsidies the development of battery technology. The United States, Germany, China, and Japan have introduced one or more of these incentives on the manufacturing side. Most of the automobile manufacturing in the LAC region is in Mexico and Brazil, accounting for around 95% of LAC production, and as of this writing, this review has not identified large incentive programs for EVs manufacturing in these two countries as their production has been set primarily for ICE vehicles. In the other LAC countries, which are vehicles importers, the situation is very different as a shift towards new technologies such as EVs can occur much faster as new – or used – models become available on the international market.

With the current levels of adoption of EVs in the region (2% of the total buses in public transportation, and less than 0.5% of the total private fleet) and the low rates of motorization, the fiscal impact of promoting EVs in LAC has been modest. At a regional level, these incentives have not impacted government revenues, and this is the same situation as from international experience due to the limited share of EVs. Despite this limited impact, these incentives are important to introduce the concept to countries and establish the minimal conditions for the early adopters to purchase EVs. Annex 2 presents in detail the policies and incentives introduced by a sample of LAC countries to promote EVs, including the laws, plans, and regulations of each country.

IMPORTANCE OF COST-BENEFIT (CBA) ANALYSIS

While the fiscal costs to promote EVs cannot last indefinitely, countries must develop a detailed cost-benefit analysis and a comprehensive future demand model to mitigate the potential fiscal impacts while they are granted, even before EVs achieve cost parity with ICE vehicles costs. The important consideration for countries is to determine: (i) the types of incentives that would be applicable to the country considering its local characteristics, and (ii) the period during which these incentives will be offered and maintained until the moment that EVs reach cost parity with ICE vehicles, which is when incentives should be discontinued. If a country considers it is necessary to undertake EV promotion, it should consider giving the highest priority to urban public transportation as well, making the implementation of electric buses a priority.

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(Teusch & Braathen, 2019) emphasize that cost-benefit analysis (CBA) assessments of environmentally related tax policies are key to provide decision-makers with a broader perspective of social costs and benefits and allows the identification of potential trade-offs among policy objectives. The economic evaluation of replacing ICE vehicles with EVs must consider all the costs and benefits of both alternatives during the lifecycle of assets, including production and final disposal (Laurent & Windisch, 2012). In addition, considering the large uncertainties related to certain assumptions and parameters, these assessments should consider models with alternative scenarios and probabilities of different outcomes such as Monte Carlo simulation analysis. A reference for CBA analysis is from the United Kingdom's Transport Analysis Guidance (TAG) which provides multiple appraisals and modeling values, including historical information and factual reference information. The TAG informs how the transport appraisal process supports the development of investment decisions to support a business case (UK Department for Transport, 2021).

4.3. Options to finance the transition

The deployment of electromobility activities is usually associated with a country's efforts to reduce emissions as part of a broader energy transition program. In this context, countries have available financing mechanisms and instruments to mobilize, in a sustainable and scalable way, resources to achieve the objectives of the national climate change policy and comply with international commitments. These mechanisms can support short- and medium-term decarbonization transitions as part of the early adoption phase, despite having a limited (or no) role in offsetting future long-term public revenues.

Therefore, countries can develop financial instruments and access sources of financing locally or internationally. Countries can also promote enabling reforms to support structuring of attractive investment opportunities for the private sector (for example, on issues related to infrastructure development), as well as the promotion of risk transfer mechanisms (Eguino, Bonilla-Roth, Lopes, & Delgado, 2020). Some of the financing options for the transition are described below, although some of the measures presented in the next Chapter as long-term options could also support the transition.

GREEN BOND INSTRUMENTS.

A green bond is a conventional bond plus a green certificate that can finance the transition. A green certificate is issued by an independent party which includes a well-defined governmental green commitment. The proceeds from the bonds can be partially used for example in an electromobility program which meets certain conditions: (i) they bring collateral benefits, such as reduction of CO_2 and urban air pollutants; and (ii) they reduce budget pressure. For example, financing decarbonization in the transportation sector in the region would generate net benefits of almost US$20 billion by 2050 due to the reduction of the negative health impacts of air pollution, time savings due to the reduction of congestion, fewer accidents, and lower operating costs (IDB & DDPLAC, 2019). A recent study (UNEP & Clear Air Institute, 2019) has found that, for a group of large cities in the region, reducing PM2.5 emissions would save 10,000 lives, with a monetary value of US$32.3 billion.

Some examples include the issuance of sovereign green bonds such as those that Chile introduced in 2019 (Frisari, 2019). With the assistance of the IDB, Chile issued the first sovereign green bond in the Americas for an amount of US$1.4 billion that was well received by international investors. This emission will allow Chile to make the transition to a low-carbon, climate resilience and environmentally sustainable economy. Eligible green expenditures include: (i) tax expenditures (subsidies and tax exemptions); (ii) operational expenditures (funding for state agencies, local authorities and companies instrumental in implementing the country's climate and environmental strategy); (iii) investments in assets (land, energy efficiency, infrastructure, etc.) and maintenance costs for public infrastructure; (iv) intangible assets (research and innovation, human capital and organization); and (v) capital transfers to public or private entities (Ministry of Finance of Chile, 2019).

A recent publication by the IDB (Delgado, Eguino, & Pereira, 2021) has also identified other more sophisticated financing instruments to be used to activities related to transition to a zero-carbon economy. As indicated in the publication, one example is Debt-for-climate swaps: Debt-for-climate swaps consist of the sale of a foreign currency debt to an investor, or forgiveness of a debt by a creditor, in exchange for investment of the debt relief in climate change-related activities. Adjusting the approach could allow debt swaps to provide financing for climate action, including mitigation and adaptation measures. A debt-for-climate swap does not necessarily put more resources at the disposal of a government (especially in the case of highly indebted countries), yet a properly designed swap can create fiscal space to mobilize more domestic savings for climate change-related investments. In LAC, Costa Rica has carried out several debt-for-nature swaps, and in 2020, the 10th call for projects was launched under the U.S.-Costa Rica Debt-for-Nature Swap program (Forever Costa Rica Association, 2020). Several conservation projects are expected to be financed as a result of these swap operations, especially those that include direct actions to mitigate the impact of the COVID-19 pandemic on biodiversity and the livelihoods of communities.

MULTILATERAL AND PRIVATELY FUNDED FACILITIES.

The socially profitable adoption of EVs powered by cheap clean energy will have a positive impact on productivity and will reduce the impacts of carbon and air pollution from ICE-powered transportation. In the short term, and in countries that rely heavily on fuel excise taxes, this option can increase the budgetary pressure. However, the induced economic growth may eventually lead to higher fiscal revenues. Credit facilities can provide bridge loans or guarantees to socially profitable projects with medium- and long-term positive impact on tax collection. (Cárdenas & Guzmán, 2020) bring to attention the proposal by (Pinzón, Robins, & Hugman, 2020) of issuing Sustainable Development Goals-linked bonds, which usually have a lower cost of capital than conventional sovereign bonds.

In addition to the support provided by multilaterals, some initiatives help foster electromobility in the region. For example, the Zero Emission Bus Rapid-deployment Accelerator (ZEBRA) is a P4G Partnership led by the International Council on Clean Transportation (ICCT) and C40 Cities. ZEBRA aims at securing "a public commitment from regional financial institutions to invest US$1 billion in zero-emission electric drive technology in Latin America" to support research financing and business model applications in LAC (Randall, 2020). Since 2020, ZEBRA has engaged bus manufactures in LAC to advance the deployment of electric buses.

INANCING THE TRANSITION OF SUSTAINABLE ELECTRIC TRANSPORTATION IN ECUADOR

In 2008, Ecuador introduced a Vehicle Renewable Plan (RENOVA) with the aim of replacing units in the public and commercial transportation sectors and has adopted national legislation (Energy Efficiency Act) that requires that all urban public transportation vehicles in continental Ecuador to be electric by 2025. This has created a window of opportunity to promote EV adoption and develop innovative business models. To reduce GHG emissions in the transportation sector, the government is working on a regulatory framework to promote the investment and use of EVs by means of technical standards and tax incentives. The Ministry of Transportation and Public Works (MTOP) has been a key player in fostering the sustainable electric transformation in Ecuador as the regulator and supervisor of RENOVA, and the Electricity Regulation and Control Agency (ARCONEL) has introduced differentiated electricity rates for charging electric vehicles.

For public transportation operators, EV technology offers the potential for significant operational savings, particularly for buses, as fuel and maintenance account for a significant portion of annual ICE vehicle costs. Based on a market study (IDB, 2020), despite the high subsidies to hydrocarbons in Ecuador, the energy cost per kilometer of an electric bus is estimated at approximately one third of that of a conventional bus (US$0.05/km vs. US$0.15/km). Similarly, the cost per kilometer for electric taxis is less than a quarter of that of a gasoline taxi (US$0.009/km versus US$0.04/km). Likewise, the maintenance costs of electric buses and taxis are estimated at half of that of an equivalent ICE vehicle (US$0.15/km versus US$0.30/km and US$0.03/km versus US$0.06/km, respectively). Current electricity costs (which are relevant to the charging cost) could locally support the commercial success of EVs if are accompanied by incentives to reduce the cost of capital, such as scrappage payments or the availability of credit at rates and maturities that make investments

Box 5: Sustainable electric transportation in Ecuador

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In this context, Ecuador will increase the financing available for private sector investment in EVs with a US$43 million Conditional Credit Line for Investment Projects (CCLIP) and an initial credit under this arrangement for US$33 million approved by the IDB. The objective of the credit line is to reduce fossil fuel consumption and GHG emissions by encouraging investment in EVs. The first operation of this credit line will promote the financing of private investment in EVs and will encourage the replacement of ICE vehicles. The project will include concessional resources from the Clean Technology Fund (CTF) as well as IDB resources to enable offering long-term credit to finance the acquisition of EVs. In addition, the operation has a gender-inclusive orientation that will benefit women entrepreneurs in the taxi sector. The loans will be channeled through the Corporación Financiera Nacional (CFN, National Financial Corporation), the public development bank that supports private activities in the country (IDB, 2020).

This first operation will also deliver scrappage certificates or bonds to those who, in addition to purchasing an EV, agree to withdraw their ICE cars from circulation, significantly enhancing the environmental benefits of the project. The management of the scrappage bonds will be coordinated by the MTOP. With these actions, the program takes an integral approach to the promotion of EVs. On the one hand, it tackles the issue of financing costs and terms by offering more affordable and longer-term credit to reflect the longer amortization period of EVs. On the other hand, it will foster the retrieval of more polluting vehicles from circulation, stimulating the renewal of Ecuador's automobile fleet. The project expects to finance the purchase of approximately 80 buses and 370 taxis in the country, which will provide a clean public transportation service. In addition, the program has an accompanying non-reimbursable technical cooperation component of approximately US$1 million to help fund the technical, financial, and legal structuring of the projects in support of national and municipal government agencies and transportation operators.

Box 5: Sustainable electric transportation in Ecuador

05.

Medium and long-term fiscal impact: national policy options

Following the initial period of launching the electromobility activities where incentives may be needed to accelerate the deployment, countries need to consider the medium- and long-term impacts on the government revenues. Authorities should review whether compensations and/or new sources of revenues will be found within the transportation sector or, more broadly, in the energy or electricity sectors, or in other economic sectors. Some of these measures can produce results in the short and medium term, but not in the long term. In contrast, other measures are long-lasting and have limited short-term impact but will be important to achieve a steady stream of revenue in the long term.

This Chapter presents these policy options in two dimensions: the first is the sectorial dimension within the transportation sector and then include other economic sectors; and the second is the temporal dimension. The Chapter also presents options for getting the prices right from the review of subsidies.

5.1. Policy options within the transportation sector

Several policy options are available to government authorities within the transportation sector to offset the reduction in government revenues from electromobility. These are often related to road use, vehicle property or ownership, and energy taxes in transportation, which can cope with the technological transition to electric mobility (IEA, 2019). These policy options are not mutually exclusive; they can and should be combined in sequence over a period to obtain the maximum benefit to the country. The best combination of options is a country-specific exercise that needs to be carefully analyzed. The identified policy options are:

OPTION 1: ADJUSTMENT OF EXISTING EXCISE TAXES APPLIED ON PETROLEUM-BASED FUELS.

This adjustment attempts to ensure that the overall amount of revenue generated from fuel taxation does not change over time, even in the presence of a net decrease in amount of fuel use. Eventually, this policy option would lead to excessively high rates with low consumption volumes and can therefore be only applied as a short to medium term measure. This option can be considered a bridge policy, and work in the short-term considering the ease of implementation, as most of the countries in the LAC region already have taxes on the use of gasoline and diesel in the transportation sector. As mentioned earlier , taxes on energy are predominantly raised from excise taxes.

This option is related to a broader carbon tax on fuel consumption. However, depending on the situation in each country, these can be difficult to implement due to the social conditions and regressive social impact, which could disproportionately impact lower income social sectors. In the long-term, it may not be a sustainable solution due to the expected reduction in demand for oil products. On the operational side, there is some ease in using this policy option and, over time, countries have already used this instrument to finance different demands.

INTERNATIONAL EXPERIENCE

For most countries, taxes on the use of fuels (i.e., gasoline and diesel) have been an important source of tax revenues for governments. This is due to the low elasticity (in the short term) between price and fuel consumption. The price elasticity of fuels[13] is less than 1 in absolute value. The main results of (Goodwin, Dargay, & Hanly, 2004) for the group of countries whose data were used to estimate price elasticities are the following: if the price of fossil fuels increases 10% forever: (i) the volume of traffic would decrease 1% in one year, and 3% from year 5; and (ii) the volume of fuel would fall by 2.5% in one year, and by 6% in the long term. The price elasticity, however, may be different among countries, depending on their individual characteristics.

Precisely because of their low-price elasticity, taxes on gasoline and diesel have become the main source of financing for investment and road maintenance. In the United States, for example, about two-thirds of all revenue collected from users (US$100 billion) for road maintenance came from fuel taxes. However, local sales and property taxes have increased their weight in total road financing.

13 Assuming the price of gasoline changes by a certain percentage. The price elasticity of gasoline is the quotient between the percentage change in the quantity demanded due to the price change, and the percentage change in price. This quotient is negative in the case of gasoline and fuels in general. Since the absolute value of the elasticity is less than 1, an increase in prices increases total collection.

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Considering its ease of collection, over time countries have used fuels taxes to finance different activities, in some cases, not related to the development and maintenance of infrastructure.

EXCISE TAX IN THE UNITED STATES

The federal motor fuel excise tax has been levied since 1932. The first levy was 1 cent per gallon and was originally a deficit reduction measure after the Great Depression. In 1941, the rate was increased to 1.5 cents to help finance World War II and was increased again to 2 cents during the Korean War. In 1956, the rate was increased to 3 cents and the Highway Trust Fund was established to finance the new Interstate Highway System. Since then, the rate has multiplied by five to 18.4 cents today (including the 0.1 cent reserved for the Leaking Underground Storage Tank Fund). Some states have levied motor fuel taxes since 1919, and all states (including the then territories Alaska and Hawaii) and the District of Columbia had implemented a motor fuel tax in 1946. The current average state excise tax rate in 2020 is 25.6 cents, but gasoline is taxed at an average rate of 36.4 cents per gallon when other taxes are included.

Box 6: Use of fuel excise tax in the United States
Source: (Boesen, 2020)

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Some governments defend the fuel tax for several reasons: (i) penalizing consumption of gasoline and diesel reduces GHG emissions and local air pollution; (ii) increased travel costs reduce traffic congestion and traffic-related accidents; (iii) fuel taxes generate significant tax revenues (e.g., equivalent to 25% of income taxes in the United Kingdom); and (iv) the low cost and easiness of tax collection. These are important not only at a national level, but also at the city and urban levels. In Europe, fuel taxes can represent half the final price of fuel, on average. In some countries, fuel tax revenues have already started to decline due to improvements in the efficiency of new ICE vehicles or the adoption of new mobility methods (e.g., car sharing, micro-mobility with scooters or bikes).

In general, fuel taxes have not been designed to be efficient economic instruments. (Rietveld & Woudenberg, 2005), for example, find no statistically significant relationship between fuel tax collection and the level of externalities generated by transport in European countries. These authors find that, when government spending as a percentage of GDP increases, fuel taxes increase as they tend to be used to finance public spending and not to correct externalities. Therefore, the authors highlight that the normative literature on pricing externalities has found little support in the realities of transport policies. Later in this chapter it is introduced the concept of optimal tax levels based on externalities. Although fuel taxes can have a pure fiscal component, they must be transparent. The components of pure taxes to correct externalities must be differentiated and calculated with respect to the costs incurred.

OPTION 2: DIFFERENT TAXATION BY VEHICLE TYPE OR EMISSIONS.

This adjustment defines the extent to which vehicle registration, ownership or import taxes are subject to be differentiated rates, as well as those that define the charges applied in annual circulation or import taxes. The LAC region does not have uniform standards on age, engine size or other conditions in the importation of used cars and has large variations between countries and regions. Therefore, adjusting the introduction of emission performances can provide financial incentives for the adoption of vehicles that offer good environmental benefits while adjusting the total amount of revenue they generate. This differentiation can be implemented in the form of feebates as described in chapter 4 as a short- or longer-term policy option.

The different tax regimes based on emissions presents an opportunity for Caribbean or Central American countries that are highly dependent on imported vehicles to establish a benchmark for the import taxes of vehicles. For example, import taxes in some countries are based on the age of a vehicle and not on its emissions profile or environmental performance. This presents a prospect to change the import tax regimes for new and used vehicles. However, special attention should be paid to define the emission band intervals to avoid incentivizing the purchase of vehicles that are close to the edge of the band to avoid paying taxes (Van Dender, 2019).

Following a period of transition when incentives are put in place for EVs, other options need to be introduced to establish a more sustainable and stable revenue flow. An example from some states in the United States can be illustrative to this option. After a period of incentives to introduce EVs, states are creating a special annual registration only fee for EVs, to offset the amount of taxes these vehicles are avoiding paying in fuel taxes compared to all other ICE vehicles. Estimates (Wachs, King, & Weinstein, 2019) indicate that these new registration fees (only applicable to EVs) can replace and even exceed the loss of revenues from fuel taxes. In California, for example, the historical source of revenues has been gasoline and diesel excise and sales taxes. With the state's ambitious target of reaching five million ZEVs by 2030, revenues are gradually shifting to: (i) a transportation improvement fee (TIF) of a fixed amount (e.g., US$25 to US$175 per vehicle per annum) with the amount determined by the value of the vehicle; and (ii) road improvement fee (RIF) of US$100 per ZEV annually. Over time, as government revenues from sales and excise taxes on gasoline and diesel gradually declines, revenues from TIF and RIF increase; and in a high-penetration ZEVs scenario, overall government revenues increase.

OPTION 3: DIFFERENTIATION OF ROAD USE CHARGES APPLIED TO VEHICLES WITH DIFFERENT ENVIRONMENTAL PERFORMANCES.

This option applies to the way infrastructure use is charged (for example, use of tools, preferred lanes for HOVs, or congestion charges) and has become popular in urban centers as less traffic improves health with fewer local air pollutants. The higher the population density, the better results will be obtained in cleaner air from NOx and PM10 emissions. This option can also be considered a bridging policy to charge the entry of high polluting ICE vehicles and the use of Low Emission Zones (LEZ) in urban centers, while in the long term these areas could be left car-free or only accessible to EVs. In relation to the banning of vehicles, the pricing of the use of roads has the advantage of generating revenues that can cover the costs of the scheme and, when there is a surplus, that can be reinvested in the public transportation network of the city to provide residents with better transportation alternatives, which is vital for the success of these policies.

INTERNATIONAL EXPERIENCE

For example, London's Ultra-Low Emission Zones (ULEZ) standards introduced in 2019 are among the most stringent LEZs based on road pricing: Euro 3 for motorbikes, Euro 4 for petrol vehicles, and Euro 6 for diesel and heavy vehicles. The ULEZ applies 24/7 to vehicles that do not meet the emission standards. The London Congestion Charge has generated over £2 billion in revenue since 2003 – around £150M a year – and part of it has been reinvested into London's transportation system. The London Congestion Charging was introduced following several studies and public consultation and led to significant investment in technology and digitalization to introduce an easy method of compliance and payment by the users. In 2018, Madrid's LEZ banned the oldest and most polluting vehicles from the city center, ahead of a planned total ban on private vehicles (except residents) by 2025.

Technology can be an important enabler of road use charges. So far, transport-related instruments have not been implemented because some believe they are regressive, require significant administrative skills, the public is opposed to new taxes, and because fuel taxes are already in place and easy to collect and administer. However, the rapid technological advance of the last decade (for example, digitization, internet of things, and 5G technologies in telecommunications) can help to implement proposals such as those from (Parry & Small, Does Britain or the United States Have the Right Gasoline Tax?, 2005), maintaining the principle that the carbon tax is the only component of the tax that can internalize the problems of climate change. This view is supported by some empirical studies. For example, simulations carried out for Slovenia suggest that distance charges are the most efficient long-term strategy to achieve stable collections (OECD, 2019b), after evaluating three alternatives to counteract the fall in fuel tax revenues: distance charges, carbon taxes and vehicle taxes.

OPTION 4 – DISTANCE-BASED CHARGES (DBC) OR VEHICLE-MILES TRAVELLED (VMT).

DBCs combine taxes applicable to the distance traveled, the types of vehicles and fuels used (key drivers of the transportation systems) and not just the fuel used for driving, which is currently the most widely used methodology. DBCs are well positioned to deal with the rate of use of infrastructure and to generate a steady stream of revenue, as their mechanism could charge for the use of roads and not the type of fuels used. DBC is different from the previous charging mechanism of road use charges, which has a flat fee per vehicle which is valid for a period of time, but the DBC can introduce a variable payment depending on the distance travelled and/or the type of fuel technology used. In this context, DBC provides the appropriate flexibility to be adjusted to local conditions of each country. Recent advances in technology that automatically allow analysis of travel distances of cars have been making DBC a promising solution with a stable flow of revenues in the long-term. Most of the challenges

POTENTIAL OF TRANSPORT-RELATED CHARGES (CAVALLO, POWELL, & SEREBRISKY, 2020)

"Pricing for road use, congestion, curb space, and parking is based on the idea of infrastructure as a service to be paid for through fees that cover the costs of providing it and reflect its value to users. Chiefly, new technologies facilitate applying this concept because they allow for precise pricing responsive to traffic dynamics and adjustable in real time to traffic conditions. Since enhancing the quality of transit systems requires investments that may not always be covered by service earnings, revenues from pricing could be allocated to upgrade transit systems, improving the fairness in resource allocation: subsidies to higher-income private car users are eliminated and the resources are used to improve the quality of pro-poor public transportation. For example, with a congestion charge of US$0.33 per km, Bogotá could raise funding to cover up to 15 percent of the daily costs of the system (Lopez-Ghio, Bocarejo, & Blanco Blanco, 2018)."

Box 7: Potential of transport related charges

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related to DBC are related to public acceptance, privacy considerations, easiness of administration, difficulties for long commuters or rural users, and the effort to revamp the existing charging mechanisms.

The DBC model could have a fixed unit rate based on the distance travelled and a variable portion depending on how many miles a vehicle travel. This rate may be different depending on policy decisions (e.g., different fees for rural and urban vehicles, differentiate the carbon intensity of the vehicles, the weight of the vehicle or the number of axles). However, this is a major change compared to the current fuel rate, which is based on the volume of fuel consumed and not on distance or use of road. The current model implicitly favors the more modern and efficient vehicles that already consume less fuel for the same distance travelled. On the consumer side, there are several ways that DBC could be developed and paid for, for example it could be developed so that it is paid at the pump in existing fuel stations or using technology applications. Either way, it would require a significant change in consumer behavior. The option of implementing a full DBC would require the development of more structural reforms in tax schemes (Elgouacem, Hallandi, Bottai, & Singhi, 2020) and, therefore, should be carefully planned well in advance, and considered as a medium and/or long-term solution.

ILLUSTRATION OF DBC

Figure 12 presents the actual fuel tax cost of fuel consumption for a car to travel 10,000 miles in a year combining two situations: the blue line represents estimated annual gasoline tax in dollars depending on the efficiency of the ICE car, and the red line introduces the concept of a fixed road charge (at US$0.0018 per mile driven) regardless of the efficiency of the vehicle.

It is visible that the most efficient cars are already paying less fuel taxes, as represented by the blue line moving to the right side of the graph (the more efficient cars). This is contrasted with a revenue neutral DBC model where the payment terms would be constant for a fixed distance traveled, regardless of the type of car or the efficiency or technology of the engine. The inflection point in this illustration is approximately 20 miles per gallon (MPG). Using the US$0.018-per-mile charge, cars with efficient levels below 20 MPG (those on the left side of the chart) would pay higher taxes on gasoline excise taxes compared to a fixed DBC, while more efficient cars –which currently pay much less than other cars travelling the same distance– would pay more. In a DBC model, the trend towards more efficient cars and advances in EVs technology would not affect government revenues in the transportation sector. However, countries must be vigilant in having the appropriate standards to continue introducing efficient vehicles.

The DBC flat fee by distance travelled (combined or not with other parameters) would have two impacts: first it will mitigate the reduction of fiscal revenues from the use of more efficient ICE vehicles (a trend which is already happening with the improvements in vehicle standards). Second, it would introduce a fee for distance travelled by EVs, as they are not subject to any fee from fuel use (not represented in the chart as the EVs currently do not pay gasoline or diesel VAT or excise taxes). Therefore, the DBC would introduce a level-playing field between the two technologies (ICE and EVs) for the same distance travelled and would be ready for future potential technologies such as use of hydrogen and fuel cells.

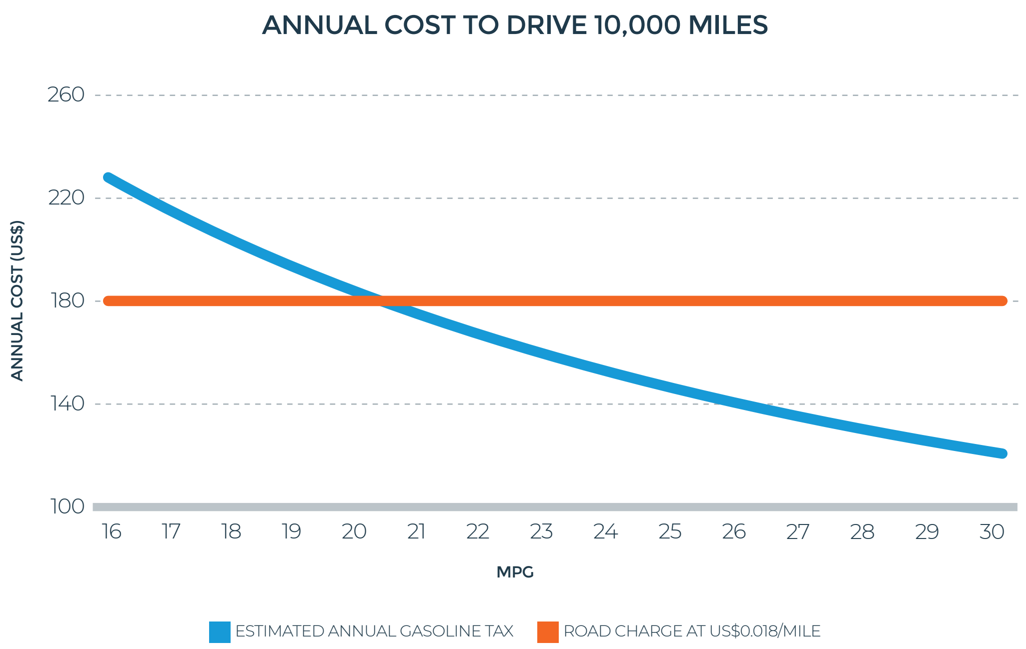

Figure 12: Cost to Drive 10,000 miles, Gasoline Excise Tax vs. Road Charge
Source: (California State Transportation Agency, 2017)

INTERNATIONAL EXPERIENCE

One pilot program of the DBC was carried out by the state of Oregon in the United States in 2015. The state of Oregon was one of the first to implement a voluntary pay-per-mile charge, charging drivers for the amount they drive and not the fuel they consume. Drivers would open an account with the state, pay 1.8 cents per mile driven within the State, which is credited to their account when they pay for gas at the pump (currently, Oregonians pay 36 cents per gallon of fuel to fund road projects). Fuel-powered vehicle drivers can receive a credit for fuel tax and remote emissions testing, and EV drivers are eligible for reduced registration fees. Oregonians can choose from three options and vendors to pay-per-mile, one run by Oregon Department of Transportation (DOT) and two administered by private firms called account managers or providers. Both global positioning system (GPS), which is a vehicle-location technology, and non-GPS options are available (The News Tribune, 2019). Therefore, the OReGO system is an actual pilot example of a new system in which drivers only pay for the miles they drive and is not dependent on fuel for revenue.

The interest in DBC relates not only to passenger cars but also to commercial trucks (Kirk & Levinson, 2016). An example is the implementation of distance charges in Switzerland[14]. The Swiss "road user charging" (RUC) scheme charges trucks for the distance traveled by taking advantage of the European Global Navigation Satellite System (GNSS). The project started in 2001 and has had revenues of €1,420 million in 2014 (GNSS Agency, 2015). Heavy Goods Vehicles (HGV) must install an "on-board unit" (OBU) that measures the distance traveled using the data provided by the vehicle's tachograph and GNSS. The OBU is mounted behind the windshield, so enforcement personnel can observe lights that indicates if the device is operating, and trailer information has been entered. It is automatically switched off by a microwave beacon at the border if the vehicle leaves Switzerland, and it is automatically turned on in the same way when the vehicle re-enters.

Other countries that have included DBC (or RUC or VMT) for the truck system are Austria, Germany, Czech Republic, and New Zealand.

Another example in the use of DBC is from the State of Victoria in Australia (capital Melbourne). Starting on 1 July 2021 a new law required that zero or low emission vehicles (ZLEV) owners declare odometer readings and pay additional registration fees, or risk deregistering their vehicles. The declarations must be supported by evidence, and owners must keep travel and odometer records for 5 years. ZLEV owners would be required to pay a charge based on the total kilometers (km) travelled in the previous registration period, based on odometer declarations, to renew their registration. Starting fees would be 2.5 Australian cents per km for electric or hydrogen vehicles, and 2.0 Australian cents per km for plug-in / fuel hybrid vehicles, increasing annually by CPI at the Minister's discretion. This legislation is different from the ones in London or Singapore, as it does not differentiate based on time of day or location, or the size of the car, but instead on a straightforward charge per mile driven. The State of Victoria is therefore introducing a simple and relatively inexpensive DBC solution even before all the GPS technologies and automated charging mechanisms are available in an effort to accelerate its implementation.

[14] (Elgouacem, Hallandi, Bottai, & Singhi, 2020)

5.2. Policy options in other sectors of the economy

Policy options are also available to government authorities in other sectors of the economy outside the transportation sector. The natural one is the electricity sector, considering that the electricity would be the primary energy source used in EVs. The traditional way in which electricity rates were calculated was based on different types of consumers (generally residential, commercial, industrial, or public sector), but more recently the transportation sector is emerging as a new type of consumer. Other policy option that countries can consider include:

OPTION 5: ADJUST THE ELECTRICITY RATES TO SUPPORT ELECTRIFICATION OF THE TRANSPORTATION SYSTEM.

This option would differentiate the electricity used by traditional users and introduce new types of rates in the transportation sector to charge vehicles. This policy option is likely to progress having different charging rates depending on the time of the day or week and could be done without affecting the rates of the traditional types of consumers (e.g., residential, commercial, or industrial). With the advances in technologies –and considering that currently more than 90% of the charging infrastructure is in households or at work– it is easy to have a dedicated device at home exclusively for the consumption of electricity for vehicles.

Mexico, for example, is one of the countries that made progress in this area (IEA, 2019). The Federal Commission of Electricity (CFE, in Spanish) has been promoting the use of EVs in Mexico by offering preferential electricity rates when exclusive meters are installed for EV charging in households. The electricity rates for households in Mexico corresponds to Level 1 (Level 2 is considered mostly for the commercial sector) and has a cap on the monthly consumption. If the limit is exceeded for one year, the user is considered a High Residential Consumer (DAC, in Spanish) with higher electricity rates. To avoid this, CFE provides a free installation of an exclusive meter for EV charging, which allows higher consumption at Level 1 electricity rate (without increasing to DAC). This metering allows savings in the cost of electricity of approximately 40% for residential users.

These solutions can be combined and converged with the growing trend of utilities moving from providing infrastructure to services. The introduction of mini-grids, advanced metering infrastructure (AMI), battery storage and distributed generation with solar photovoltaic (PV) are converging towards new services in the electricity sector, and therefore, the need to review the rates and taxes of the electricity sector. Some countries have also differentiated rates if the charge is at home or in a commercial establishment.

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The electrification of the transportation sector could also mean new businesses and fiscal revenues. Due to the reduction in the cost of batteries, EVs have the potential to inject electricity into the grid at competitive prices. This sale of electricity to the grid is an economic activity that may subject to taxes, depending on the regulations of each country. The monetization of the re-injections of EV batteries to the grid and the fiscal revenue from this new economic activity can reduce national budgetary pressure.

COMPARING TAXES ON TRANSPORTATION FUELS AND ELECTRICITY

Energy taxes include revenues related to the use of fuels in the transportation and electricity sector. The breakdown of these taxes for both sectors is, in general, not available for LAC countries, but OECD evidence shows that most of these taxes are in the transportation sector, particularly on the use of roads. An analysis of effective energy tax rates in all sectors −mainly in OECD countries, but including few LAC countries− confirms that gasoline and diesel used in road transportation tend to be taxed at much higher rates than other energy carriers such as electricity. According to (OECD, 2019), on average, in the 44 countries analyzed, gasoline is taxed at €5.9 per gigajoules (GJ), diesel is taxed at €5.5 per GJ, and electricity (from natural gas) is taxed at €0.5 per GJ.

This dependence on gasoline and diesel taxes will be affected by increased electrification in the transportation sector. This impact will be more visible in the long term if countries do not proactively introduce new policy measures to mitigate the reduction. As demand for electricity increases and the corresponding demand for fossil fuels declines (for efficiency or technology conversion), countries will need to rethink how to deal with losses in government fuel revenues.

OPTION 6 – CARBON TAXES.

Lastly, policy makers have also available in their fiscal toolbox, the options of carbon taxes or even an emission trading system (ETS). According to the IMF, carbon taxes – charges on the carbon content of fossil fuels – are the single most powerful and efficient tool to reduce domestic fossil fuel CO_2 emissions as it does not only mitigate climate change but also reduce local problems such as air pollution. A carbon pricing can provide across the board incentives to reduce energy use and shift towards cleaner fuels, mobilize a valuable source of new revenue, and be straightforward administered if it builds on fuel tax systems (Parry I. , 2021). It can also be administered at country or subnational level. The case of ETS may be more complex to be implemented, as firms must hold an allowance for each ton of their emissions, and the governments set a cap on total allowances or emissions, where the market trading of allowances establishes the emissions price. ETS may also have higher administrative costs to monitor the emissions and allowances and become impractical for small countries.

Both carbon prices and ETS lead people and firms to shift to greener energy use and there is extensive literature on its international experience and lessons learned. However, these policies can affect the competitiveness and equity considerations of a country. This document does not attempt to present a detailed description of carbon prices or ETS, but rather lists these alternative policy options that countries can consider stabilizing their flow of government revenue over time.

Carbon taxes on domestic fuel consumption can mobilize significant new revenues, ranging from 0.5 to 3% of GPD for G20 countries considering a US$50 per ton in 2030. In particular, the IMF estimates a US$50 carbon tax would generate additional government revenues as percentage of GDP in Argentina, Brazil, and Mexico of 1.3%, 1.1% and 1.8% respectively. A carbon tax would also generate other benefits related to externalities, for example, a US$50 carbon tax would prevent 600,000 premature air pollution deaths in 2030 in the largest emerging economies (Mountford, 2019).

INTERNATIONAL EXPERIENCE

Experience shows that carbon taxes can be a powerful fiscal mechanism that can offset existing taxes and there is extensive literature on this subject.

For example, when the Nordic countries introduced energy taxes, they combined the implementation of carbon taxes with a reduction in income taxes, social security contributions, and pension payments for employers. This shift in labor taxes on fossil fuels ensured that the Nordic countries had enough revenue to maintain high social spending and reduce the impact of higher energy prices on the public (Roth & Laan, 2020). Sweden, for example, has taxed energy for a long time, initially, the main reason for taxation was to increase public revenues, but in 1991 a major tax reform complemented it with taxes on CO_2 and sulfur for environmental considerations. This tax reform reduced the marginal taxes on income produced by capital and labor, the elimination of various tax shelters and broadening the VAT base. The rate cuts in Sweden entailed a reallocation of revenue of approximately 6% of GDP, and the tax return from changes in energy-related taxes amounted to about 1% of GDP, of which, the VAT on energy accounted for the largest share (Genevey, Pachauri, & Tubiana, 2013).

Carbon taxes are usually not an isolated initiative but are part of a broader reform. Some LAC countries have already introduced green tax reforms, including Chile, Mexico, Argentina, and Colombia:

- In 2014, Chile launched a major tax reform that included new taxes related to the environment, which included a tax on the purchase of motor vehicles (introduced in 2015) and collected revenues equal to 0.03% of GDP in 2018. The motor vehicle tax rates depend on energy efficiency and emissions. In addition, at the end of 2017, a tax on pollutant stationary sources was implemented that generated revenues of 0.06% of GDP in 2018.

- In 2014, Mexico introduced a carbon tax that is applied to the sales and imports of fossil fuels according to their carbon content; this increased the proportion of taxed emissions. The carbon tax does not reflect the total costs associated with the carbon in these fuels, but has increased tax revenues since 2015, generating revenue equivalent to 1.2% of GDP in 2015, after a long period of almost a decade of subsidies. Mexico has further increased tax rates on different fossils fuels since then, and over the past five years, this has generated significant revenue for the government.

- In 2017 Argentina introduced a tax reform with an initial value of US$10 per ton of CO_2 in fossil fuels, starting in March 2018 and with the devaluation of the local currency this amount was later reduced in US dollars. It was applied to liquid and solid fossil fuels (natural gas is subject to a separate tax regime with a surcharge at the point of entry in the distribution system, and biofuels is not charged) and impacted all economic sectors covering about 20% of the GHG emissions in Argentina. In 2019, the revenues generated from this carbon tax generated 0.04% of GDP.

- In 2016, Colombia also introduced a carbon tax. The carbon tax is levied on fossil fuels (specifically gasoline, kerosene, jet fuel, diesel fuel and fuel oil) depending on their carbon content. A price of US$5 is applied for each ton of CO_2 produced by the combustion of fossil fuels. Revenues are allocated to a specific fund to address specific environmental issues. Between 2017 and 2019, this tax generated revenues of approximately 0.03% of GDP.

MEXICO: IEPS FOR GASOLINE AND DIESEL AS % OF GDP
2010 - 2020

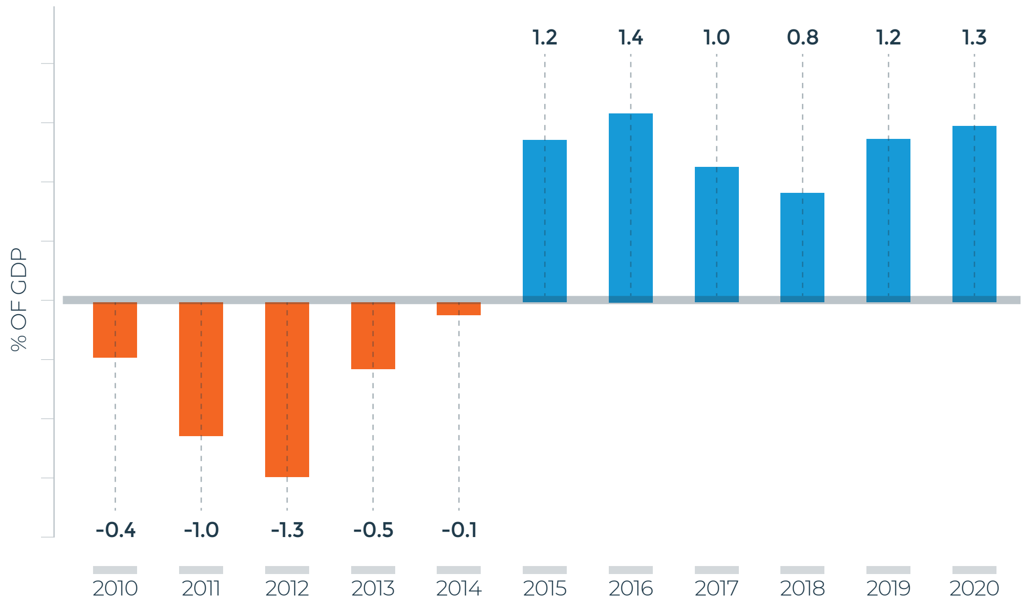

Figure 13: Special tax on production and services (IEPS) for gasoline and diesel in México
Source: (SHCP, 2021)

OTHER OPTIONS

Finally, government authorities also have the possibility of introducing other sources of revenue outside the core transportation and energy sectors to finance their transition towards a low-carbon system. For example, in the 1990s Brazil introduced a special tax regime on financial transactions – a bank debit tax on financial transaction called Provisional Contribution on Financial Transactions (CPMF, in Portuguese) – to finance social, pension and labor benefits, and health protection expenditures. This became an important source of tax revenue for the government and was considered progressive, as it affected those with large sums in the financial system, as the poor have less access to bank accounts. As of 2020 there were eleven countries in LAC with taxes on financial transactions (González, 2021).

In 2018, the average tax-to-GDP ratio in LAC is 23.1%, compared to the OECD average of 34.3%, demonstrating there is room to increase the tax base (ECLAC, 2020). However, the option of seeking revenues in other sectors of the economy should be pursued prudently and consistent with broader reforms of a country's tax system. For this document, the introduction of other sources of revenues outside the core sectors has not been included as policy option as they can create distortions in incentives and generate inefficiencies.

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5.3 Getting the prices right and subsidies considerations

There are multiple studies that indicate how countries subsidize their energy consumption, both in the transportation and electricity sectors. These studies already describe the impacts on various areas such as social and equity, climate, fiscal, and economic. This section is not intended to be a separate analysis of fossil fuel subsidies, but rather it builds on the figures on the size of fossil fuels in LAC presented in Chapter 2 and introduces the concept of subsidy swaps as a mechanism to support the decarbonization of the transportation sector and more broadly getting the prices right to reflect the externalities. The subsidies can also be considered in conjunction with a carbon tax, as the LAC region has wide room to increase fuel taxes (or alternatively reduce fuel subsidies) in a context of relatively low international oil prices (Izquierdo & Pessino, 2021).

OPTION 7: SUBSIDY SWAPS.

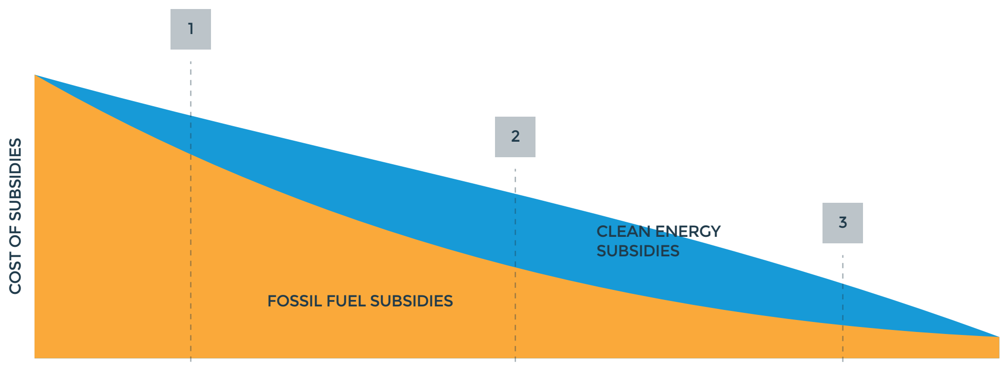
The International Institute for Sustainable Development (IISD) has coined the term "subsidy swap" (Bridle, Sharma, Mostafa, & Geddes, 2019) referring to a wide range of policies that redirect government support in the form of subsidies, from fossil fuels to clean energy. This redirection can be partial or full. This correction is part of the effort of getting the prices right and equitable for everyone. The objective of the subsidy swap is to align subsidy policy with social, economic, and environmental priorities and to promote the transition to clean energy systems. Subsidy swaps can help reduce the fiscal gap when part of the existing fossil fuel subsidies is transferred to other sustainable energy sources and the remainder is saved by reducing government costs.

Consistent with this definition, the Nordic Council of Ministers (Nordic Council of Ministers, 2019) has reaffirmed that "a swap requires not only switching off the carbon subsidies that flow to fossil fuels but a parallel switching on of active support and investment into renewable and energy efficiency services". In this context, they argue that what is needed is a massive swap on a scale similar to that of landlines to mobile telecommunication technologies, from the redistribution of the US$425 billion of top-down and bottom-up subsidies spent on fossil fuels.

Subsidy swaps can be used to eliminate political opposition to any reduction in fuel subsidies stemming from EV adoption. In addition, subsidy swaps will help reduce the equity concerns of fossil fuel subsidies. An IMF global study of fossil fuel subsidies (Coady & Granado, 2010) found that the richest 20% of the population gets 43% of the benefits from fossil fuel subsidies, while the poorest 20% gets only 7%. In fact, the poorest 60% of the population still does not get as much benefit as the richest quintile. The cost of transferring US$1 to the poorest 20% of the population via gasoline subsidies is US$33. More generally, another IMF study (Coady, Parry, Le, & Shang, 2019) estimated that the reform of fossil fuel subsidies would generate, at a global and regional levels, a fiscal gain amounting to US$2.8 trillion, or 3.8% of global GDP.

Savings in government resources derived from the elimination or targeting of fossil fuel subsidies can be directed to any economic sector such as health and social development, but some of them can also be directed to supporting the decarbonization of the transportation sector. This would be consistent with the countries' pledge in their NDCs. The IISD report argues that a well-developed subsidy swap can: (i) expand the fiscal space since in some countries existing fossil fuel subsidies are a large proportion of government budgets; (ii) mitigate the impact of stranded assets, as falling renewable energy generation costs can make expensive fossil fuel-based generation financially unviable; and (iii) capture future reduction in renewable energy costs as these prices increasingly fall below fossil fuels, particularly in the electricity sector, there is a risk that policies that delay a transition to cheaper energy sources could harm economic competitiveness of companies if they are paying the true cost of production.

Figure 14 illustrates the concept of subsidy swaps.



STAGE 1: FOSSIL FUEL SUBSIDIES ARE IN PLACE REDUCING THE PRICE OF FOSSIL DERIVED ENERGY. FOSSIL FUELS ACCOUNT FOR THE MAJORITY OF ENERGY PRODUCED.	STAGE 2: FOSSIL FUEL SUBSIDIES ARE REFORMED. SOME OF THE SAVINGS ARE USED TO REDUCE THE PRICE OF RENEWABLE ENERGY AND PROMOTE ENERGY EFFICIENCY.	STAGE 3: TOTAL SUBSIDIES CONTINUE TO REDUCE. RENEWABLE COST REDUCTIONS MEAN RENEWABLE SUBSIDIES ARE LESS NECESSARY.

Figure 14: Illustration of subsidy swap
Source: (Bridle, Sharma, Mostafa, & Geddes, 2019)

One example of changes in legislation focusing on getting the prices right comes from Uruguay. In 2019, Uruguay enacted Decree number 165/019 introducing

incentives in the public transportation sector for the substitution of diesel buses with new (zero kilometer) electrical buses. The decree has nominated a Technical Commission which will – among other activities – determine the criteria and conditions to get access to this subsidy as well as the specific amount of the subsidies, which is defined as the difference between the acquisition cost of a new electric bus and the diesel bus with similar dimensions, including the financing costs (articles 2, 3 and 12). The subsidy is capped to a maximum ceiling, and its amount would be repaid in equal monthly installments during a period of 7 years (article 13). Moreover, the decree mentions that the buses from these operators that apply to these subsidies will not be eligible to receive the existing subsidy related to the consumption of diesel (article 9). It is envisaged that the electrification of the bus fleet will not only provide more comfort for the users in public transportation with the new buses, but also reduce costs, GHG emissions, and subsidized diesel consumption. The incentive established by the Decree was open to all national public transport operators up to the replacement of about 4% of the total fleet (article 8). A first call for interest was developed in 2019 and 32 electric buses obtained the subsidy.

REFLECTING EXTERNALITIES IN THE FUEL PRICES

There are specific studies that have reviewed the experience of transport-related taxes. (Newbery, 2001) argues that fuel taxes are attractive for internalizing externalities in the transportation system; but that such taxes are very crude because transport externalities vary according to time, location, and type of vehicle. (Parry & Small, 2005) argue that except for the carbon tax, it is better to impose taxes based on items other than fuel, such as local atmospheric emissions and transport-related, which comprise congestion in the peak period, accidents, road damage[15] and distance traveled.

The paper confirms that ideal externality taxes have not been implemented for political, administrative, or other reasons, and it introduces a specific methodology to calculate the optimal level of gasoline price considering the above factors.

The paper also illustrates the application of this methodology for the United States and United Kingdom in the long run. In these two specific examples, the paper concludes that after detailed discussions on the main assumptions and parameters, and under central parameter values, the second-best optimal gasoline tax would be US$1.01/gal for the United States and US$1.34/gal for the United Kingdom. The highest component of this optimal tax would be the

[15] A fraction of pavement damage and deformation increases with the fourth power of the number of axles load of the vehicles. This non-linear relationship would indicate that heavy vehicles, in particular trucks, as part of their "fair share" should pay a significant higher tax than lighter vehicles, a situation that is rarely the case.

"congestion externality" component. At the time the article was published, the United States had a lower tax than the calculation indicates (less than half), and the United Kingdom had an actual higher tax (about double that level).

The methodology of (Parry & Small, 2005) to calculate the optimal level of gasoline taxes has been used in other countries. (Hernández & Antón, 2014) applied the same methodology for Ecuador, El Salvador, and Mexico. While some assumptions and input data need to be updated with more recent values, the illustration is still valid, as they show the breakdown of the optimal tax into the main components and are presented in the next table. The conclusion is that (in 2011) the optimal tax for Mexico, El Salvador, and Ecuador would be respectively 48.2, 28.4, and 31.2 cents per liter. In the case of El Salvador, for example, the country already charges a tax on gasoline estimated at 11 cents per liter, but at that time, its amount was less than half of the optimal tax indicated by the methodology. At that time of the article Ecuador did not have a VAT tax on gasoline.

The main components of the negative externalities part of optimal tax would be the level of accidents, congestion, and travelled distance.

Table 3 Illustration of optimal level of gasoline tax in selected LAC countries

COMPONENTS	MEXICO		EL SALVADOR		ECUADOR	
	CENTS PER LITER [¢]	%	CENTS PER LITER [¢]	%	CENTS PER LITER [¢]	%
FUEL CONTAMINATION	4.6	10%	4.6	16%	4.2	13%
DISTANCE TRAVELLED CONTAMINATION	12.0	25%	9.0	32%	9.3	100%
CONGESTION	11.0	23%	5.2	18%	5.8	19%
LEVEL OF ACCIDENTS	14.2	29%	2.0	7%	1.6	5%
SUB-TOTAL (PIGOUVIAN TAX)	41.8	87%	20.8	73%	20.9	67%
RAMSEY TAX	6.1	13%	7.5	26%	9.9	32%
CONGESTION ON LABOR SUPPLY	0.3	1%	0.1	0%	0.4	1%
OPTIMAL TAX	48.2	100%	28.4	100%	31.2	100%

Source: Adjusted from (Hernández & Antón, 2014)

The model also calculates the sensibilities against different input parameters, and indicates the optimal gasoline tax rate for Mexico, El Salvador, and Ecuador would be respectively in the ranges of 28-90, 20-64, and 21-71 cents per liter for the three countries. This wide range indicates the uncertainties of the estimates of the input parameter, and how sensible the results are to changes in the inputs. Therefore, these results should be taken with caution considering the importance to further refine the inputs with updated amounts and even followed by detailed calculation of values that were not readily available.

Other examples. The same methodology was also applied for two additional countries in LAC in different studies:

- (Antón & Hernández, 2019) estimated the optimal level of gasoline taxes for Guatemala including the externalities and found that the optimal tax level would be 27.5 cents per liter. This amount was higher than the gasoline tax in place in Guatemala at the time of the article. The authors indicate that 40% of the tax would be related to the externality component of congestion. This conclusion is important, as the gradual conversion of the vehicle fleet changes from ICE to EV would probably not impact the congestion levels in Guatemala, reinforcing the notion that EV should also have to pay their fair share of taxes despite not consuming gasoline or diesel, and thus the current tax system has to be adjusted.

- (Parry & Strand, 2010) found, in what was claimed as the first comprehensive study outside the OECD, that the optimal tax for gasoline and diesel in Chile would be respectively US$1.82 and US$1.69 per gallon. In the case of gasoline this amount was 25% larger than the rate prevailing at the time of the study, and the individual components of the optimal tax for gasoline were: 45% traffic accidents, 32% congestion, 20% local tailpipe emissions, and global warming only 4% (using a US$10 per ton of CO_2). In the case of diesel, the amounts were also higher than the prevailing rates at that time, and the main components were: US$0.49 per gallon for congestion, US$0.39 per gallon for road damage, and US$0.34 per gallon for accidents.

NEW BUSINESS MODELS

Chapter 3 has described how innovations are usually introduced and deployed. That section has focused on the technologies and consumer goods, but the experience of electromobility has also demonstrated the opportunity to introduce new business models which can be very effective. This is particularly relevant in public transportation, a sector that can be significantly strengthened in the LAC region to improve quality of service and operate with low carbon fuels. The LAC region has already pioneered the introduction of Bus Rapid Transit (BRT) System and now it is moving to streamline the implementation of electric buses.

Considering that the main challenge to further deploying electric buses is the upfront costs of the new buses, one option is to separate the ownership of the assets to the operations. In Santiago de Chile (IDB & DDPLAC, 2019), the solution was to reform bus concessions, separating fleet ownership from operation. Electric utilities were offered a contract for fleet ownership, which the utilities can manage at low cost, given their large financial capacity, in-house expertise with technical teams and electrical engineers with experience in battery technologies, and the salvage value of used batteries, which can be used to provide ancillary grid services. Utilities then lease out electric buses to transportation companies, which benefit from greater certainty on costs.

06.

Summing-up and areas of further research

6.1. Consolidating the fiscal instruments

The following table summarizes the fiscal policies and instruments described earlier in chapters 4 and 5, being more specific about the temporal dimension of their implementation: (i) the short term (incentives for promotion of EVs) that generally have a limited fiscal impact due to the small penetration of EVs and there is a large stock of ICE vehicles; and (ii) the medium to long-term impact when countries need to identify solutions to offset the reduction in government revenues from existing taxes on gasoline and diesel.

The magnitude of the fiscal impact will depend on the pace of electromobility implementation, the resources allocated to the program, and the existing government dependency on fuel revenues. These are country-specific considerations. These fiscal instruments contrast with the existing system in most of the countries based on taxing the consumption of gasoline and diesel, which has been a convenient and simple way to raise and collect revenues but will not be a sustainable option in the medium to long term when countries move to a low carbon situation.

According to these fiscal policy options and instruments, (Van Dender, 2019) argues that there should be an effort to match these instruments with the desired externalities. This is a country specific government policy decision.

For example, to address road wear and tear (which is unrelated to whether the vehicle is an EV or ICE), the best combination of taxes would be to introduce DBC based on other vehicle characteristics, such as the number of axles and/or weight. The weight of the vehicle (such as trucks) has the greatest impact on the deterioration of the roads. A similar approach is proposed if the goal is to reduce congestion, the best aligned taxes would be congestion charges based on place, location, and time, rather than based on fuel type. In this case, for example, the transition of ICE to EVs would have no significant impact, and investments in mobility and public transportation would be the most

SUMMARY TABLE OF FISCAL INSTRUMENTS

TYPE	SHORT TERM	MEDIUM TO LONGTERM	COMMENTS
Incentive: EV purchase and circulation charge reduction	■		Introduced during take-off phase due to easiness of implementation – it has limited fiscal impact when properly introduced.
Incentive: Discount in electricity tariff	■		Incentive introduced during take-off to increase attractiveness but can be difficult to implement or to remove it later.
Debt: long-term concessional loans or bonds	■		Source of financing can support transition in the short term but should not be used to offset losses in revenues.
Taxes: Fuel taxes (oil-based excise)	■	■	Easy to collect, but not sustainable in longterm due to high unit prices of remaining decreasing volume of oil products.
Taxes: Vehicle tax (e.g., registration or import)	■	■	Can be differentiated by technology or environmental impacts. If a feebate is introduced, it can be revenue-neutral.
Taxes: Road use and congestion charges	■	■	Reduces economic cost of time, helps finance decongestion but requires advanced technical capabilities.
Taxes: Distance based charges or vehicle miles driven		■	Potential to replace existing charging regimes and has several variations (by vehicle type, place, or time) but need advanced technical capabilities.
Taxes: Adjustment of electricity taxes		■	Adjustments in electricity taxes specifically applicable to the transport sector. It has the potential to offset reduction in fuel taxes.
Taxes: Carbon taxes	■	■	Can be set-up in different ways and be adjusted over time to favor transition towards low carbon energy sources.
Get the prices right	■	■	Reduces or eliminates subsidies that are not to benefit the most vulnerable. Opportunities for prices to reflect externalities

Figure 15: Summary table of fiscal policies and instruments
Source: Own elaboration

appropriate solution. However, if the goal is to reduce air pollution or mitigate CO_2 emissions, the best aligned taxes would be taxes based on the type of fuel or taxes on vehicle ownership. In this case, the transition to EV would make an important contribution to reduce CO_2 emissions.

Figure 16 has been adapted from (Van Dender, 2019) to include the dashed lines in order to demonstrate the secondary relationship between the external costs and their drivers, and the inclusion of the level of accidents, which are usually related to the speed limits of the vehicles.

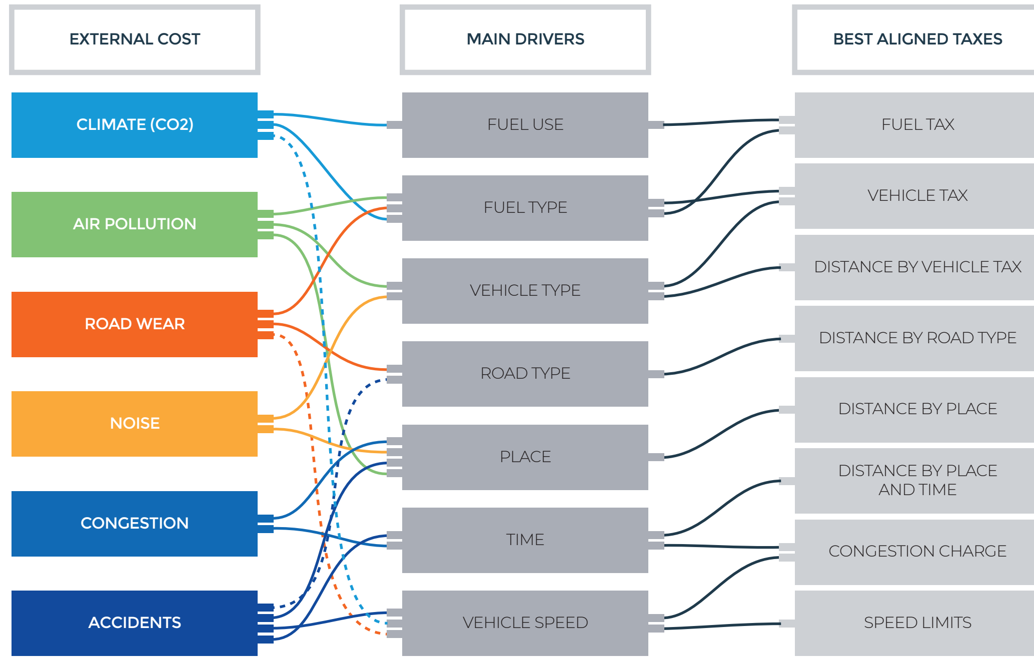


Figure 16: External costs, drivers of external costs, and tax instruments
Source: Adapted from (Van Dender, 2019)

Therefore, the application of each of these fiscal policy instruments will be country-specific, considering its electromobility strategy, the existing dependence on fuels taxes and the goals set to cover externalities, and which ones the country would like to cover. This definition takes us back to the optimal level of taxation defined in Chapter 5 considering the externalities which are reflected in different components and has a detailed methodology for its calculation. Lastly, distributive impacts must also be taken into account so that the transition is equitable and inclusive to benefit the whole of society. This is where the electrification and improvement of public transport plays a very important role.

6.2. Summing-up

This document has discussed the prospects for electromobility in the world and in the region. LAC still has a small penetration of EVs, but a fast adoption rate is expected in the next decade, particularly driven by public bus transportation. This is largely explained by the reduction in TCO of EVs driven by the lower cost of batteries and national and state plans to reduce carbon emissions.

A challenge –and an opportunity– for the countries of the LAC region is to transition to cleaner forms of transportation that deals with the reduction in consumption of gasoline and diesel, but do not erode government revenues. In this context, the LAC region takes note of the trends in gasoline and diesel consumption in other advanced and mature economies, indicating that such consumption has already been stable or declining in these markets.

Figure 16[16] illustrates these trends with the consumption of gasoline in the European Union –EU–, United States –US– and in the countries of South and Central America over the last 40 years. The analysis indicates that gasoline consumption in the EU has peaked in 1998/1999 and has been in steady decline since then. IN 2019 consumption in 2019 was about 60% of the peak consumption. In the case of the US, gasoline consumption has peaked a few years late, in 2005/2006 and from there it was further reduced in the global financial crises in 2008/2009. In the subsequent years it has partly recovered but has been stable since then, with no significant growth. The situation in the selected countries in LAC has followed a different trend, with a balloon and peak in the period 2013/2014 and initiated a small downward trend since then.

The year of 2020 has been removed from the analysis to exclude the effects of COVID-19 in the consumption, as all three regions noticed additional reductions in the consumption of gasoline in 2020 compared to 2019. However, these were due to the pandemic and not to the other structural long-term factors.

[16] The chart has been developed to analyze consumption of gasoline over time and using a single starting base of 100 to understand the increasing or decreasing trend. The three regions however have different consumption levels, and the chart should not be interpreted as the 3 regions having the same consumption volume of gasoline.

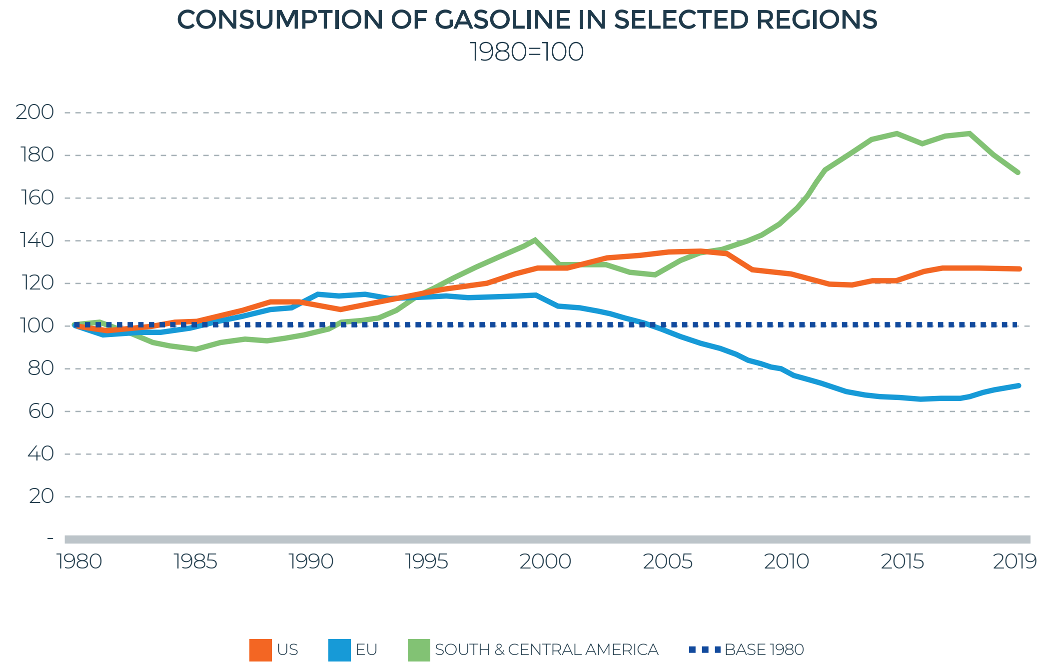


Figure 17: Consumption of gasoline in selected regions 1980-2019

Source: Own analysis using data from (BP, 2020)

Moving forward, the analysis conducted in this document found that countries differ greatly in terms of general tax structure, energy self-sufficiency and balance of payments, weight of fuel taxes in total fiscal revenues, energy subsidies, international commitments to reduce GHG and green development policies, among other visible factors. This situation makes it difficult to recommend cross-cutting measures to achieve revenue neutrality in mobility in a specific country, but some elements are expected to be common to multiple countries.

During the take-off phase, attention is directed to determining the fiscal incentives in the promotion of EVs. This will generally require limited funds as the penetration of EVs is very small. From this initial phase, countries must ensure that the transition is inclusive and benefits all members of society. This document has identified options to meet these demands and, in some cases, the green recovery programs and financial instruments (loans, guarantees, etc.) that can allow the application of incentives and taxes to electromobility. Authorities must ensure that pilots are cost-effective and that incentives are well defined and time bounded. Urban public transportation should be the first candidate to be evaluated for the promotion of electromobility. Getting the prices right is another important action. Communication and outreach campaigns are key in this phase, along with the definition of technical standards, the development of charging infrastructure, and adjustments in the regulatory frameworks of the transportation and electricity sectors.

During the medium to long-term phase of EV adoption, countries should identify the desired pace of electromobility implementation, the different paths, and the corresponding policy solutions to offset the reduction in fuel taxes. This document has presented a menu of options according to the situation of each country, recognizing that each one of them has its own advantages and disadvantages. These should also be adjusted over time as EV penetration increases. Authorities should focus fuel excise taxes on the external costs they impose and foster the use of transport-related taxes (road deterioration, distance travelled, and mostly congestion). This is aligned with the basic principles of public finance, since fuels are an intermediate good and not a final consumer good. Distributive impacts become more important in the medium to long-term considering the renewal of vehicle fleets, including the improvements in the public transportation system. Studies suggest that distance and road damage taxes can increase the tax revenues that are lost on fuel taxes.

The alternatives to anticipate and mitigate the erosion of fiscal revenues due to the adoption of EVs are specific to each country. They depend on factors such as the fiscal system structure, the reliance on fuel excise taxes, the goal of reducing oil imports or promoting clean electricity generation, the ability to meet NDCs to reduce GHG emissions, the goal of reducing air pollution in cities, and binding commitments of social spending in energy subsidies. Even at this level of simplified analysis, the need to address the issue in a broad context becomes apparent, as there are no blanket solution or automatic recommendation for individual countries.

Finally, the fiscal considerations of electromobility should be part of a broader mobility strategy with a durable approach that provides stability to investors. Countries should examine the problem of mobility revenue neutrality in a framework that goes beyond the sectoral level, establishing regular interaction between the transportation, energy, social and environment sector authorities with the fiscal and economic teams. Such a joint review may find alternatives to achieve revenue neutrality or even increase tax revenues over time, recognizing that per capita fuel excise tax revenues may initially increase with the ICE motorization rate, but may later decrease with the acceleration of EV adoption. The importance of coordinating stakeholders across all sectors will be paramount due to the multidisciplinary aspects of electromobility.

A FRAMEWORK FOR THE FISCAL IMPACT OF ELECTROMOBILITY

6.3. Areas of further interest

To further develop the ideas presented in the document, the review has identified the following opportunities for future areas of research: (i) develop a **common methodology to quantify and evaluate the fiscal impact of electromobility** in the LAC region. Countries that are at the forefront of this analysis are developing tools and instruments and it would be beneficial to standardize and disseminate these models. This common or standard methodology will also allow consolidation of the results across countries; (ii) analyze in greater depth the **distributive impact** of electromobility so that each policy and instrument developed in the document can be reviewed against the social dimension and the reduction of inequalities, ensuring a just transition for all; and (iii) continue the work to **get the prices right,** with the reduction of fossil fuel subsidies where it is appropriate and evaluating how the fuel prices should reflect the externalities.

To disseminate this material, the following activities could be considered: (i) organize **regional workshops** to discuss the fiscal challenges of electromobility, with participation of the country's fiscal and sectoral authorities (e.g., energy and transportation). These workshops will put the impact of electromobility issue on the public agenda and help identify analytical support activities; (ii) develop and disseminate additional case studies in the region, which will discuss in detail the restrictions and fiscal opportunities of electromobility and present the results to the national authorities. These **case studies** should have a clear quantification for the respective country; (iii) expand use of **financial instruments** to enable a sustainable promotion of electromobility in the context of a green transition; (iv) accelerate work on the enabling environment so that countries have a desirable proposition to **attract private sector investments** to electromobility in areas such as the development of value chain and charging infrastructure.

Driven by natural forces of cost reduction and technological advancement, or by national policies to mitigate climate change, electromobility activities continue to expand internationally and in the LAC region. This document has developed the policy options available to countries to anticipate and mitigate the fiscal aspects of electromobility, and therefore use the electrification of the transportation sector with cleaner and low-carbon sources as an opportunity to enable the energy transition and the sustainable economic development of the countries.

Bibliography

Antón, A., & Hernández, F. (2019). Internalizando externalidades: el impuesto a la gasolina en Guatemala. Revista mexicana de economía y finanzas. doi: https://doi.org/10.21919/remef.v14i1.356

Bass's Basement Research Institute. (2021, October 25). The Bass Model. Retrieved from http://www.bassbasement.org: http://www.bassbasement.org/BassModel/Default.aspx

BBVA Research. (2010). Peru Automobile Market Outlook. Retrieved from https://www.bbvaresearch.com/: https://www.bbvaresearch.com/wp-content/uploads/mult/automobile_market_outlook_peru_tcm348-259266.pdf

BloombergNEF. (2020, December 16). Battery Pack Prices Cited Below $100/kWh for the First Time in 2020, While Market Average Sits at $137/kWh. Retrieved from https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/

Boesen, U. (2020, August). Who Will Pay for the Roads? Retrieved from Tax Foundation: https://files.taxfoundation.org/20200824160626/TaxFoundation_FF7251.pdf

Borba, B. S. (2012). Modelagem integrada da introdução de veículos leves conectáveis à rede elétrica no sistema energético brasileiro. Rio de Janeiro: Universidade Federal do Rio de Janeiro. Retrieved from http://www.ppe.ufrj.br/images/publica%C3%A7%C3%B5es/doutorado/Bruno_Soares_Moreira_Cesar_Borba.pdf

BP. (2020). Statistical Review of World Energy. BP. Retrieved from bp.com/statisticalreview

Bridle, R., Sharma, S., Mostafa, M., & Geddes, A. (2019). Fossil Fuel to Clean Energy Subsidy Swaps: How to pay for an energy revolution. Winnipeg: International Institute for Sustainable Development. Retrieved from https://www.iisd.org/system/files/publications/fossil-fuel-clean-energy-subsidy-swap.pdf

C40 Cities Climate Leadership Group. (2019, March). How to design and implement a clean air or low emission zone. Retrieved from C40 Knowledge Hub: https://www.c40knowledgehub.org/s/article/How-to-design-and-implement-a-clean-air-or-low-emission-zone?language=en_US

California State Transportation Agency. (2017). California Road Charge Pilot Program. CALSTA. Retrieved from https://dot.ca.gov/programs/road-charge/final-report

Cambridge Econometrics. (2018). Low-carbon cars in Italy: A socioeconomic assessment. Retrieved from https://europeanclimate.org/wp-content/uploads/2019/12/low-carbon-cars-in-italy-a-socioeconomic-assessment.pdf

Cansino, J. M., Sánchez-Braza, A., & Sanz-Díaz, T. (2018). Policy Instruments to Promote Electro-Mobility in the EU28: A Comprehensive Review. Sustainability, 10(7), 2507. doi: https://doi.org/10.3390/su10072507

Cárdenas, M., & Guzmán, J. J. (2020, September). Planning a Sustainable Post-Pandemic Recovery in Latin America and the Caribean. Retrieved from Columbia SIPA: Center on Global Energy Policy: https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/LAC_Recovery_CGEP_Commentary_FINAL.pdf

Cavallo, E., Powell, A., & Serebrisky, T. (2020). From Structures to Services: The Path to Better Infrastructure in Latin America and the Caribbean. Washinton, DC: Development in the Americas Report. Retrieved from https://flagships.iadb.org/en/DIA2020/from-structures-to-services

CNCDA. (2021, May). California Auto Outlook: First Quarter 2021. Retrieved from https://www.cncda.org/: https://www.cncda.org/wp-content/uploads/Cal-Covering-1Q-21.pdf

Coady, D., & Granado, J. A. (2010, September 1). The Unequal Benefits of Fuel Subsidies : A Review of Evidence for Developing Countries. IMF Working Papers, p. 23. Retrieved from https://www.imf.org/en/Publications/WP/Issues/2016/12/31/The-Unequal-Benefits-of-Fuel-Subsidies-A-Review-of-Evidence-for-Developing-Countries-24184

Coady, D., Parry, I., Le, N.-P., & Shang, B. (2019, May 2). Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates. IMF WORKING PAPERS, p. 39. Retrieved from https://www.imf.org/en/Publications/WP/Issues/2019/05/02/Global-Fossil-Fuel-Subsidies-Remain-Large-An-Update-Based-on-Country-Level-Estimates-46509

Conte, M., Rasteletti, A., & Muñoz, D. (2022). Impuestos a los Combustibles en la Teoría y en la Práctica. Bogotá: IDB.

Davis, S. C., & Boundy, R. G. (2021). Transportation Energy Data Book Edition 39. Oak Ridge National Laboratory. Retrieved from https://tedb.ornl.gov/wp-content/uploads/2021/02/TEDB_Ed_39.pdf

Delgado, R., Eguino, H., & Pereira, A. L. (2021). Fiscal Policy and Climate Change: Recent Experiences of Finance Ministries in Latin America and the Caribbean. Washington, D.C.: Iner-American Development Bank. doi: http://dx.doi.org/10.18235/0003376

Deloitte. (2019). New markets. New entrants. New challenges. Battery Electric Vehicles. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/manufacturing/deloitte-uk-battery-electric-vehicles.pdf

Diamond, D. (2009). The impact of government incentives for hybrid-electric vehicles: Evidence from US states. Energy Policy, Volume 37(Issue 3), 972-983. doi: https://doi.org/10.1016/j.enpol.2008.09.094

Durrmeyer, I. (2018). Winners and losers: evaluating distributional effects of the French feebate on the automobile market. Economic Journal. Retrieved from http://isisdurrmeyer.wixsite.com/welcome/research

E-bus Radar. (2021). Electric buses in Latin America. Retrieved from https://www.ebusradar.org/en/

ECLAC. (2020, May 20). Latin America and the Caribbean: Tax Revenue Gains under Threat Amid Deteriorating Regional Outlook. Retrieved from Economic Commission for Latin America and the Caribbean: https://www.cepal.org/en/news/latin-america-and-caribbean-tax-revenue-gains-under-threat-amid-deteriorating-regional-outlook

Ecola, L., Rohr, C., Zmud, J., Kuhnimhof, T., & Phleps, P. (2014). The Future of Driving in Developing Countries. Santa Monica, CA: RAND Corporation. Retrieved from https://www.rand.org/pubs/research_reports/RR636.html. Also available in print form.

Eguino, H., Bonilla-Roth, M., Lopes, A., & Delgado, R. (2020, August 12). Inversión pública en descarbonización: oportunidades y estrategias para la recuperación económica. Retrieved from IDB Blogs: Recaudando Bienestar: https://blogs.iadb.org/gestion-fiscal/es/inversion-publica-descarbonizacion-oportunidades-y-estrategias/

Electrek. (2020, July 10). California starts charging EV registration fees up to $175 in July. Retrieved from Electrek: https://electrek.co/2020/07/10/california-starts-charging-ev-registration-fees-up-to-175-in-july/

Elgouacem, A., Hallandi, H., Bottai, E., & Singhi, G. (2020, January 31). The Fiscal implications of the low-carbon transition. OECD Green Growth Papers, p. 46. doi: https://doi.org/10.1787/6cea13aa-en

EPA. (2021). Greenhouse Gas Emissions from a Typical Passenger Vehicle. Retrieved from United States Environmental Protection Agency (EPA): https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle

Forever Costa Rica Association. (2020). Disponibles US$600,000 para financiar proyectos de conservación de la biodiversidad que mitiguen impactos del COVID-19. Retrieved from Forever Costa Rica Association: https://primercanjedeuda.org/

Frisari, G. (2019, August 5). Sovereign Green Bonds: 4 reasons to pay attention in LAC. Retrieved from IDB Blogs: Hablemos de Sostenibilidad y Cambio Climático: https://blogs.iadb.org/sostenibilidad/en/sovereign-green-bonds-5-reasons-to-pay-attention-in-lac/

Frost & Sullivan. (2020, January 15). Electromobility in Latin America: Frost & Sullivan Reveals Key Strategies and Technologies through 2025. Retrieved from https://www.frost.com/news/press-releases/electromobility-in-latin-america-frost-sullivan-reveals-key-strategies-and-technologies-through-2025/

FSR. (2020, February 18). Electromobility in Latin America and the Caribbean. Retrieved from Florence School of Regulation: https://fsr.eui.eu/electromobility-in-latin-america-and-the-caribbean-gearing-up-for-a-revolution/

Genevey, R., Pachauri, R. K., & Tubiana, L. (2013). Reducing Inequalities: A Sustainable Development Challange. AFD.

GNSS Agency. (2015). GNSS Adoption for Road User Charging in Europe. Luxembourg: Publications Office of the European Union. Retrieved from https://www.euspa.europa.eu/system/files/documents/ruc-brochure.pdf

Gómez-Gélvez, J., Mojica, C., Kaul, V., & Isla, L. (2016). La incorporación de los vehículos eléctricos en América Latina. Washington, DC: Banco Interamericano de Desarrollo (BID). Retrieved from https://publications.iadb.org/es/publicacion/17165/la-incorporacion-de-los-vehiculos-electricos-en-america-latina

González, D. (2021, February 1). The Financial Transaction Tax (ITF) in LAC countries. Retrieved from Inter-American Center of Tax Administrations: https://www.ciat.org/ciatblog-the-financial-transaction-tax-itf-in-lac-countries/?lang=en

Goodwin, P., Dargay, J., & Hanly, M. (2004). Elasticities of Road Traffic and Fuel Consumption with Respect to Price and Income: A Review. Transport Reviews, 275-292. doi: https://doi.org/10.1080/0144164042000181725

Hernández, F., & Antón, A. (2014). El impuesto sobre las gasolinas: una aplicación para el Ecuador, El Salvador y México. Santiago de Chile: Naciones Unidas. Retrieved from https://repositorio.cepal.org/bitstream/handle/11362/36778/1/S2013734_es.pdf

IDB & DDPLAC. (2019). Como Llegar a Cero Emisiones Netas: Lecciones de América Latina y el Caribe. Washington D.C.: Banco Interamericano de Desarrollo. Retrieved from https://publications.iadb.org/publications/spanish/document/C%C3%B3mo_llegar_a_cero_emisiones_netas_Lecciones_de_Am%C3%A9rica_Latina_y_el_Caribe.pdf

IDB. (2013). More than Revenues: Taxation as a Development Tool. Washington, DC: Inter-American Development Bank. Retrieved from https://publications.iadb.org/publications/english/document/More-than-Revenue-Taxation-as-a-Development-Tool-(Executive-Summary).pdf

IDB. (2020, May 20). EC-L1268: Financiamiento del Transporte Eléctrico Sostenible en Ecuador. Retrieved from BID Proyectos: https://www.iadb.org/projects/document/EZSHARE-1758156391-2?project=EC-L1268

IDB. (2020, Diciembre 9). Ecuador impulsará inversión del sector privado en vehículos eléctricos con apoyo del BID. Retrieved from Inter-American Development Bank: Comunicados de Prensa: https://www.iadb.org/es/noticias/ecuador-impulsara-inversion-del-sector-privado-en-vehiculos-electricos-con-apoyo-del-bid

IDB. (2020, November). The IDB Group is Driving Electromobility Forward in LAC. NDC Invest Bulletin. doi: http://dx.doi.org/10.18235/0002843

IEA. (2019). Global EV Outlook 2019. Paris: IEA. Retrieved from https://www.iea.org/reports/global-ev-outlook-2019

IEA. (2019, October 18). Preferential Tariffs for Charging Electric Vehicles. Retrieved from iea.org: https://www.iea.org/policies/6939-preferential-tariffs-for-charging-electric-vehicles

IEA. (2020). Global EV Outlook 2020 Entering the decade of electric drive? Retrieved from International Energy Agency: https://www.iea.org/reports/global-ev-outlook-2020

IEA. (2021). Electric Vehicles. Paris: IEA. Retrieved from IEA: https://www.iea.org/reports/electric-vehicles

IMF. (2020). World Economic Outlook Update October 2020. Washington, D.C.: International Monetary Fund.

IMF. (2021). World Economic Outlook Update October 2021. Washington, D.C.: International Monetary Fund.

Izquierdo, A., & Pessino, C. (2021, April 7). A Post COVID-19 Fiscal Strategy for Latin America and the Caribbean. Retrieved from IDB Blogs: Ideas Matter: https://blogs.iadb.org/ideas-matter/en/a-post-covid-19-fiscal-strategy-for-latin-america-and-the-caribbean/

Izquierdo, A., Pessino, C., & Vuletin, G. (2018). Mejor gasto para mejores vidas: cómo América Latina y el Caribe. Washington, D.C.: Inter-American Development Bank.

Kah, M. (2019, December 17). Electric Vehicle Penetration and Its Impact On Global Oil Demand: A Survey of 2019 Forecast Trends. Retrieved from Columbia SIPA Center on Global Energy Policy: https://www.energypolicy.columbia.edu/research/report/electric-vehicle-penetration-and-its-impact-global-oil-demand-survey-2019-forecast-trends

Kirk, R., & Levinson, M. (2016). Mileage-Based Road User Charges. Washington, DC: Congressional Research Service. Retrieved from https://sgp.fas.org/crs/misc/R44540.pdf

Laurent, F., & Windisch, E. (2012). Benefits and costs of electric vehicles for the public finances: integrated valuation model and application to France. ATEC ITS Conference France 2012: Smart mobility: from research to practice. Versailles.

López, G., & Galarza, S. (2016). Movilidad Eléctrica: Oportunidades para Latinoamérica. Retrieved from Euroclima+: https://euroclimaplus.org/seccion-publicaciones/sectores/movilidad-urbana/movilidad-electrica-oportunidades-para-latinoamerica

Lopez-Ghio, R., Bocarejo, J. P., & Blanco Blanco, A. (2018). Políticas de tarificación por congestión: Efectos potenciales y consideraciones para su implementación en Bogotá, Ciudad de México y Santiago. Washington, DC: IDB. doi: http://dx.doi.org/10.18235/0001116

Lord, T., & Palmou, C. (2021, August 31). Avoiding Gridlock Britain. Retrieved from Tony Blair Institute for Global Change: https://institute.global/policy/avoiding-gridlock-britain

MarketWatch. (2021, March 20). In One Chart: The explosion in electric-vehicle funding, valuation and trading. Retrieved from https://www.marketwatch.com/story/in-one-chart-the-explosion-in-electric-vehicle-funding-valuation-and-trading-11615834956

Masson, M., & Pérez, L. (2021, August 16). Electrifying the Caribbean: Plugging in Electric Vehicles. Retrieved from IDB Blogs: Energía para el Futuro: https://blogs.iadb.org/energia/en/electrifying-the-caribbean-plugging-in-electric-vehicles/

Ministry of Finance of Chile. (2019). Republic of Chile Green Bond Framework. Santiago de Chile. Retrieved from https://www.climatebonds.net/files/files/Chile%20Sovereign%20Green%20Bond%20Framework.pdf

Mock, P., & Yang, Z. (2014). Driving Electrification: A Global Comparison Of Fiscal Incentive Policy. Washington DC: The International Council of Clean Transportation (ICCT). Retrieved from https://theicct.org/sites/default/files/publications/ICCT_EV-fiscal-incentives_20140506.pdf

Morena, E., Krause, D., & Stevis, D. (2020). Just Transitions: Social Justice in the Shift Towards a Low-Carbon World. London: Pluto Press.

Mountford, H. (2019, December 2). Carbon pricing: you can't keep a good idea down. Retrieved from Financial Times: https://www.ft.com/content/a5cf96fe-009f-11ea-be59-e49b2a136b8d

Netherlands Enterprise Agency. (2019). Electric vehicles in Mexico. Retrieved from rvo.nl: https://www.rvo.nl/sites/default/files/2019/05/electric-vehicles-in-mexico.pdf

Newbery, D. (2001). Harmonizing Energy Taxes in the EU. Tax Policy in the European Union. The Hague. Retrieved from https://www.econ.cam.ac.uk/people-files/emeritus/dmgn/files/ROTTERDM.PDF

Nordic Council of Ministers. (2019). Fossil Fuel to Clean Energy Subsidy Swaps: How to pay for an energy revolution. Copenhagen: Nordisk Ministerråd. doi: 10.6027/TN2017-537

OECD. (2019). Taxing Energy Use 2019: Using Taxes for Climate Action. Paris: OECD Publishing. doi: https://doi.org/10.1787/058ca239-en

OECD. (2019b). Revenue Statistics in Latin America and the Caribbean 1990 - 2017.

OECD. (2021, December). Consumption Tax Trends 2020 : VAT/GST and Excise Rates, Trends and Policy Issues. Retrieved from OECD iLibrary: https://www.oecd-ilibrary.org/sites/152def2d-en/1/3/4/index.html?itemId=/content/publication/152def2d-en&_csp_=c74456d46ecc7b2f6fd3352bb00363ec&itemIGO=oecd&itemContentType=book#component-d1e52815

OECD/ITF. (2019). Tax Revenue Implications of Decarbonising Road Transport: Scenarios for Slovenia. Paris: OECD Publishing. doi: https://doi.org/10.1787/87b39a2f-en

Parry, I. (2021, September). Five Things to Know about Carbon Pricing. Retrieved from IMF: https://www.imf.org/external/pubs/ft/fandd/2021/09/five-things-to-know-about-carbon-pricing-parry.htm

Parry, I., & Small, K. (2005). Does Britain or the United States Have the Right Gasoline Tax? American Economic Review, 95(4), 1276-1289.

Parry, I., & Strand, J. (2010). International Fuel Tax Assessment: An Application to Chile. Resources for the Future. Retrieved from https://media.rff.org/documents/RFF-DP-10-07.pdf

Parry, I., & Wingender, P. (2021). Fiscal Policies for Achieving Finland's Emission Neutrality Target. Washington, DC: International Monetary Fund.

Pineda, E., Pessino, C., & Rasteletti, A. (2020, April 21). Política y gestión fiscal durante la pandemia y la post-pandemia en América Latina y el Caribe. Retrieved from IDB Blogs: Recaudando Bienestar: https://blogs.iadb.org/gestion-fiscal/es/politica-y-gestion-fiscal

Pinzón, A., Robins, N., & Hugman, M. (2020, May 26). How could sustainable finance help avoid an emerging market sovereign debt crunch? Retrieved from Grantham Research Institute on Climate Change: https://www.lse.ac.uk/granthaminstitute/news/how-could-sustainable-finance-help-avoid-an-emerging-market-sovereign-debt-crunch/

Randall, C. (2020, April 7). ZEBRA to bring electric buses to South America. Retrieved from electrive.com: https://www.electrive.com/2020/04/07/zebra-to-bring-electric-buses-to-south-america/

Rietveld, P., & Woudenberg, S. (2005). Why fuel prices differ. Energy Economics, 27(1), 79-92. doi: https://doi.org/10.1016/j.eneco.2004.10.002

Roth, J., & Laan, T. (2020, July 30). Green Recovery Know-How From the Nordics. Retrieved from International Institute for Sustainable Development: https://www.iisd.org/articles/green-recovery-nordics

SHCP. (2021, November). Ingresos Presupuestarios del Sector Público, Porcentajes del PIB. Secretaría de Hacienda y Crédito Público. Retrieved from http://presto.hacienda.gob.mx/EstoporLayout/estadisticas.jsp

Smith, R., & Schouten, J. (2021, November 10). Landmark Commitment at Cop26: Countries, Subnational Governments, Vehicle Manufacturers and Fleets Target 100% Zero-Emission New Truck And Bus Sales by 2040. Retrieved from Global Drive to Zero: https://globaldrivetozero.org/2021/11/09/landmark-commitment-at-cop26-countries-subnational-governments-vehicle-manufacturers-and-fleets-target-100-zero-emission-new-truck-and-bus-sales-by-2040-10-nov-2021/

Teusch, J., & Braathen, N. (2019). Are environmental tax policies beneficial?: Learning from programme evaluation studies. OECD Environment Working Papers, 28. doi: https://doi.org/10.1787/218df62b-en

The News Tribune. (2019, August 13). Oregon's pay-per-mile program doesn't attract many drivers. Retrieved from The News Tribune: https://www.thenewstribune.com/news/local/article233435497.html

UK Department for Transport. (2021). TAG data book. London: UK Department for Transport. Retrieved from https://www.gov.uk/government/publications/tag-data-book

UNEP & Clear Air Institute. (2019). Metodología para la Evaluación de Beneficios Integrados de Políticas de Movilidad Eléctrica y Resultados. Panamá: Programa de las Naciones Unidas para el Medio Ambiente - Oficina para América Latina y el Caribe.

UNFCCC. (2021). Barbados 2021 Uptade of the First Nationally Determined Contribution. Retrieved from United Nations Climate Change: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Barbados%20First/2021%20Barbados%20NDC%20update%20-%2021%20July%202021.pdf

UNFCCC. (2021, November 10). COP26 Declaration on Accelerating the Transition to 100% Zero Emission Cars and Vans. Retrieved from https://ukcop26.org: https://ukcop26.org/cop26-declaration-on-accelerating-the-transition-to-100-zero-emission-cars-and-vans/

United Airlines. (2021, December 1). United to Become First in Aviation History to Fly Aircraft Full of Passengers Using 100% Sustainable Fuel. Retrieved from united.com: https://www.united.com/en/us/newsroom/announcements/united-to-become-first-in-aviation-history-to-fly-aircraft-full-of-passengers-using-100-sustainable-fuel

Van Dender, K. (2019). Taxing vehicles, fuels, and road use: Opportunities for improving transport tax practice. OECD Taxation Working Papers, 58. doi: https://doi.org/10.1787/e7f1d771-en

Visual Capitalist. (2020). The Rising Speed of Technological Adoption. Retrieved from Visual Capitalist: https://www.visualcapitalist.com/rising-speed-technological-adoption/

Wachs, M., King, H., & Weinstein, A. (2019, July). The Impact of ZEV Adoption on California Transportation Revenue. Retrieved from MINETA Transportation Institute: https://transweb.sjsu.edu/sites/default/files/1850-WP-ZEV-Adoption-California-Transportation-Revenue.pdf

Wood Mackenzie. (2019, September). What does the electric vehicle revolution mean for Latin American refiners? Retrieved from https://www.woodmac.com/: https://www.woodmac.com/news/opinion/what-does-the-electric-vehicle-revolution-mean-for-latin-american-refiners/

Xue, C., Zhou, H., Wu, Q., Wu, X., & Xu, X. (2021, November 30). Impact of Incentive Policies and Other Socio-Economic Factors on Electric Vehicle Market Share: A Panel Data Analysis from the 20 Countries. Sustainability, Volume 13(5), p. 2928. doi: https://doi.org/10.3390/su13052928

ANNEXES.

A framework to consider the fiscal impacts of electric vehicles

ANNEX 01.

Case Study in Costa Rica

In 2019, the President of the Republic of Costa Rica announced his National Decarbonization Plan (NDP) to achieve net zero emissions by 2050 (Government of Costa Rica, 2019). The NDP presents a roadmap with key actions to consolidate decarbonization process of the Costa Rican economy, consistent with the long-term goal of limiting the increase in global average temperature to 1.5 °C above pre-industrial levels. The Plan is based on a cross-cutting 10-axis strategy in decarbonization, including the electrification of the transportation sector and the introduction of a Green Tax Reform. In particular, the Green Tax Reform mentions that it will be necessary to decouple the State's revenues from the sale of gasoline before boosting the massive electrification of the light vehicle fleet. New revenue sources must be identified to replace gasoline and automobile sales, and this must be done with a focus on taxing negative externalities, such as air pollution.

The IDB has been supporting Costa Rica develop this Plan and it has recently coordinated a technical study and forthcoming publication (Zúñiga, Gallardo, Quirós-Tortós, Jaramillo, & Vogt-Schilb, 2021) of the estimated fiscal impact on the electrification of transportation. This section presents the preliminary results of the study that is currently in progress.

The study estimated the impact on government tax revenues from the increased use of public transportation and the electrification of the transportation sector in three sources of revenues: (i) import taxes and duties; (ii) vehicle property taxes; and (iii) taxes on fuel consumption. The study considered a combination of 100 future options and several analytical tools to estimate the fiscal impact over a period of time. Similar to the framework presented in section 3.2 of this document, the Costa Rica study considered three scenarios that are: (i) business as usual (BAU) without introducing the NDP; (ii) introduce the NDP but no fiscal adjustment (i.e., no mitigation option for new policies is made); and (iii) introduce the NDP and also fiscal adjustments with new fiscal policies.

The preliminary results of the study indicate that the implementation of the NDP could have an impact only after 2035. The NDP would generate an average national financial cost of 0.21% of GDP in the medium term (2023-2030) resulting from a negative 0.28% of GDP for households and firms, and a positive 0.07% of GDP for the government. This transition phase would require investments to this transformation and the importation of EV would increase taxes. In the long term (2031-2050), the study estimates a total positive financial benefit of 1.60% of GPD, resulting from a positive 2.20% of GDP for households and firms, and a negative fiscal impact of 0.60% for the government. For the consolidated period 2023-2050, the study indicates an average annual impact of 1.08% of GDP broken down of 1.49% of GDP of positive impact for households and firms, and 0.41% of GDP negative fiscal impact for the government.

However, the above figures only consider the financial impact and they do not consider the social-economic benefits such as reduction in the number of accidents, improvements in air quality, and improvements in productivity due to less congestion. Taking these other benefits into account, the average annual impact of the NDP in Costa Rica is only -0.11% of GDP.

To mitigate these impacts, the study presents ten different options for possible fiscal adjustments, seven of them are already in place in Costa Rica, and three of them that could be introduced (DBC, electricity charging, and hydrogen charging for use in transportation). These options could be introduced in isolation or in combination, although the latter presents more balanced results. The study has analyzed 1,000 different policy options to illustrate their impacts and the possibility of maintaining equitable benefits for households, firms, and the government.

Annex 1. Bibliography

Government of Costa Rica. (2019). National Decarbonization Plan 2018 - 2050. Retrieved from https://cambioclimatico.go.cr/wp-content/uploads/2020/01/NationalDecarbonizationPlan.pdf

Zúñiga, M. R., Gallardo, L. V., Quirós-Tortós, J., Jaramillo, M., & Vogt-Schilb, A. (2021). Impacto fiscal de La descarbonización del transporte en Costa Rica y opciones de política para manejarlo. Washington, D.C.: IDB (Available upon request).

ANNEX 02.

Country policies to promote EV in LAC

The laws, plans, and regulations included in this subsection are not exhaustive but are presented to give an idea of the plans and objectives each country is pursuing so far in electromobility.

ARGENTINA

Executive Decree 331/17 establishes a reduction of import tariffs for PHEVs and BEVs, as well as FCEVs for a maximum of 6,000 units in a period of 36 months. Executive Decree 51/18, which governs electric buses, establishes a reduction in import tariffs of up to 350 units and up to 2,500 chargers with a power greater than or equal to 50kW. Argentina launched its National Electric Mobility Strategy in 2018, which is under construction with the support of UN Environment.

The Clean Mobility Plan 2035 of the city of Buenos Aires has included a pilot project of battery electric buses that will incorporate 8 units of different technologies in different bus lines. The results of this pilot will serve to assess the incorporation of more electric buses in the metropolitan area of Buenos Aires, which has more than 18,000 buses (UN Environment Programme, 2018). In 2016, Argentina purchased 400 electric buses to operate in the main cities of the country (Córdoba, Rosario, Neuquén, Corrientes, Mar del Plata, Lanús, Morón and Tres de Febrero).

BARBADOS

Barbados relies on oil imports for both power generation and transportation (Viscidi, et al., 2019). Higher EV penetration in tandem with higher PV electricity production can reduce the dependence on imported oil, as well as the carbon footprint. In the transportation sector. Barbados spends about US$165,000 per day on oil (the transportation sector accounted for 48% of total energy consumption in 2015), and refined petroleum products cost the country

6.2% of GDP. According to its 2019-2030 National Energy Policy, by 2023 the Barbadian government intends to achieve a 49% nationwide reduction in fossil fuel consumption, which will produce energy savings of US$200-400 million. The government has planned to reach 100% reliance on renewable energy and carbon neutrality by 2030. That year, 100% of buses and government fleets will be EV. The first 33 electric buses were delivered in June 2020.

The government has taken some policies to expand electromobility. Import duties for EVs have been lowered relative to those of ICE vehicles. A transition away from dependence on fuel tax revenues is being evaluated (reducing oil imports will improve current account and foreign exchange reserves, but fuel excise taxes are an important fiscal source). Barbados is a leader in EV adoption in the Caribbean, with around 430 EV. In 2018, 1.28% of new car sales were electric, a share greater than in Canada, for example.

BRAZIL

In January 2020, Brazil's Constitution and Justice Commission (CCJ, in Portuguese) approved a bill that bans the sale of new gasoline and diesel-powered cars in the country as of January 2030. After that date, only electric or bioenergy-fueled vehicles will be allowed to be sold. The bill also includes a ban on all gasoline and diesel-powered vehicles from being on roads from 2040. Brazil is a large market for vehicles. According to projections, there will be 54.7 million light-duty vehicles in Brazil in 2026 (Slowik, Araujo, Dallmann, & Façanha, 2018), which represents a 25.4% increase between 2017 and 2016. The adoption of EVs in Brazil is very limited when compared to the estimated fleet of 382,260 buses that circulate throughout the country since the support for EVs has been focused on ad hoc experiments to remove cost and infrastructure barriers.

The evolution of the vehicle fleet in Brazil is determined by the interaction of very strong stakeholders in ethanol production, hydroelectricity generation, domestic and foreign vehicle manufacturers (Marchán & Viscidi, 2015)[17]. In contrast to the small EV fleet, which is all imported, the national market is served mainly by industries installed in Brazil, with imported vehicles representing 11% of vehicle licenses in 2017. More recently, sales of PHEVs and BEVs in Brazil have reached about 2,000 units per month during the first semester of 2020, achieving for the first time a market share of more than 1% of the new vehicles sold in the country (Global Fleet, 2020).

Simulations conducted by (Bitencourt, Abud, Santos, & Borba, 2021) with the Bass technology adoption model, suggest that EV sales in Brazil could reach 20% by 2050. Some market studies forecast that about 15,000 EV units (about 9,300 PHEVs and 5,800 BEVs) are expected to be commercialized in the country

[17] An obstacle to EV adoption in Brazil is the opposition from the country's ethanol fuel program.

by 2025 (Research and Markets, 2020). In São Paulo, the 2018 Climate Law established a goal of zero pollutants from transportation in the state capital within 20 years. EVs are exempt from the annual car ownership tax in the states of Ceará, Maranhão, Pernambuco, Piauí, Rio Grande do Norte, Rio Grande do Sul and Sergipe and enjoy a reduced rate in Mato Grosso do Sul, Rio de Janeiro and São Paulo (Marchán & Viscidi, 2015).

CHILE

This country issued a National Electromobility Strategy made up of strategic axis and lines of action. The lines of action include compulsory purchases of electric buses for urban transportation renovation processes, incentives for electric buses and taxis. Chile introduced a carbon tax in January 2015 to promote the fuel economy of vehicles. The tax applies to new car purchases based on both CO_2 and NOx emissions and must be paid at the time of the purchase, on new light-duty vehicle (LDV) and medium-duty vehicle (MDV) models.

Chile expects to have more than 5 million EVs in 2050. That year, Chile expects that 40% of LDVs and 100% of urban public transportation will be electric. Santiago has launched the first fully electric bus corridor in Latin America following a partnership between a Chinese bus manufacturer and local operators.

The drive for electric buses in Santiago comes from a new quality standard for urban transportation introduced by the Chilean Ministry of Transport in 2018. Santiago has set the target of incorporating 90 fully electric buses to Transantiago and renovating over 6,000 buses from 2018-2030. Urban transportation operators are purchasing purely electric or diesel vehicles complying with the Euro 6 standard. By the end of 2020, Santiago had approximately 800 electric buses in circulation.

COLOMBIA

Law 1964 of 2019 created incentives for public and private electric transportation. Law 1964 reduces taxes on the purchase of EVs, eliminates the VAT for public transportation and reduces this same tax from 19% to 5% for private EVs. In addition, taxes on EVs are capped at 1% of the purchase cost, less than the ICE vehicle tax levels established by Law 488 of 1998, which start at 1.5% for the cheapest vehicles, and they reach 3.5% for the most expensive models. The Law also establishes a 10% discount on mandatory vehicle insurance and grants preferential registration taxes. Batteries for PHEVs and BEVs will have a 0% import duty from 2017 to 2027 that will be raised to 5% from 2027.

Law 1964 of 2019 is part of a National Electromobility Strategy (ENME, in

Spanish), which defines instruments and interventions in regulation, markets, technology, infrastructure, and regional land use. Colombia expects to have 600,000 EVs by 2030 and to have a 100% zero-emission public transportation fleet by 2035. In November 2019, the city of Bogotá allowed the entry of 379 new electric buses in its public transportation system. In 2019, the city of Medellín (the second largest city of Colombia) introduced 64 electric buses in its urban transportation system.

COSTA RICA

Costa Rica has established a National Decarbonization Plan 2018-2050, composed of 10 decarbonization axes. Costa Rica is aiming for a decarbonized economy with net-zero emissions in 2050. The motivation to decrease oil imports, modernize the vehicle fleet and reduce air pollutants is very strong: between 2000 and 2010, the value of oil imports as a percentage of the GDP doubled, diesel represents almost 40% hydrocarbon purchases in Costa Rica, vehicles are 15 years old on average compared to Europe and the United States (which are 7.4 and 11.6 years old, respectively), the Costa Rican freight transport fleet is the oldest among national sub-fleets registered in the Vehicles Technical Revision (RTV, in Spanish) yearbook, with an average of 22 years old (6-year average above the average of all vehicles and higher than in other countries).

During the last six years, the percentage of renewable generation has exceeded 98% of the power supply. These conditions facilitate the transition from the use of hydrocarbons in the transportation sector. The main goals of Decarbonization Axis 1 and 2 for the transportation sector include: (i) in 2035, 30% of the public transportation fleet will be zero-emissions and the electric passenger electric train will be in operation, running 100% on electricity; (ii) in 2050, the public transportation system (buses, taxis, passenger electric train) will operate in an integrated way, replacing private cars as the first option of mobility for the population in the Greater Metropolitan Area (GMA); (iii) in 2050, 85% of the public transportation fleet will be zero-emissions; (iv) by 2025, the growth of the motorcycle fleet will have stabilized and standards will be adopted to shift to a zero-emissions fleet; (v) in 2035, 30% of the light vehicles fleet –private and institutional– will be electric; (vi) in 2050, 95% of the fleet will be zero-emissions.

The Ministry of Finance is currently assessing new financial instruments to decouple fiscal revenues from gasoline sales before boosting the massive electrification of the light vehicle fleet. New sources of revenue must be identified to replace gasoline and vehicle sales, and this must be done with a focus on taxing negative externalities. Costa Rica will launch a Green Tax Reform consistent with a comprehensive analysis of the country's tax structure and define actions that allow the coherence of public policies, considering the distributive costs of the measures.

DOMINICIAN REPUBLIC

The Dominician Republic issued in 2020 a National Strategic Plan for Electric Mobility where specific targets for electromobility were set. Additionaly, its 2010-2025 National Energy Plan identifies a high dependence on imported oil and high energy costs as key drivers of the national energy policy (Viscidi, et al., 2019). In 2017, refined oil imports to the Dominican Republic totaled US$1.67 billion, or 2.2% of GDP. The transportation sector represented 35.6% of total energy consumption. In 2014, the share of renewable energies in total final energy of the Dominican Republic was 16.3%. The Law on Incentives for Renewable Energy of 2007 and its Special Regime mandates a 25% share of generation from renewable energy in 2025. Approximately 2 GW of wind and solar projects will be approved between 2020 and 2021 (compared to the current total installed capacity of around 4.3 GW) will increase the share of renewables in the country's energy mix and is projected to increase by almost 50% over the next few years.

The National Energy Commission (CNE) is developing a regulatory framework for EV charging stations. There is currently some limited government incentives currently exist for electromobility, including a 50% reduction in duties and registration fees for EVs. Some utilities are conducting pilot programs to assess EV feasibility and cost savings and familiarize consumers and companies with the technology.

The number of electric four-wheelers by 2030 could reach 220,000, representing 15% of the total fleet of passenger cars. Electric two and three-wheelers have great potential, especially in congested areas of cities and resorts. Approximately 500,000 of these vehicles can be deployed by 2030 (IRENA, 2016).

ECUADOR

Diesel, gasoline, and LPG subsidies combined cost the taxpayer more than US$1.5 billion a year. Pre-tax energy subsidies represent 7.5% of GDP, of which 7.0% goes to fuels and 0.5% to electricity. Ecuador could reduce the non-oil primary deficit, including fuel subsidies, to 0.3% of GDP by 2021 increasing gasoline prices between 25-75% and more than doubling diesel prices. The air is moderately polluted in Quito and Guayaquil (higher than the maximum limit established for one year by the WHO). Subsidies for fuel and electricity reduce the effectiveness of energy efficiency and renewable energy programs. The National Plan for Good Living 2017-2022 (SENPLADES, 2017) established the target of reaching 60% of the renewable energy generation capacity by 2017, with a focus on hydropower and bioenergy.

Executive Decree 399 of 2018 created the Ministry of Energy and Nonrenewable Natural Resources (MERNNR, in Spanish) by merging the Ministry of

Hydrocarbons, the Ministry of Electricity and Renewable Energy (MEER, in Spanish), the Ministry of Mining, and the Hydrocarbons Secretariat. Ecuador's Coordination Ministry of Production, Employment and Competitiveness (MCPEC, in Spanish) is in charge of proposing a plan for the installation, operation and maintenance of an EV charging network, with the support from the Agency for Regulation and Electrical Control (ARCONEL, in Spanish) and the National Institute for Energy Efficiency and Renewable Energy (INER, in Spanish). The government organization will offer incentive packages to citizens to promote the use and purchase of these electric mobility systems. Resolution 16-2019 makes all EVs exempt from customs duties and taxes starting on June 2019. Preferential financing is one of the policy instruments launched by Ecuador to promote the purchase of EVs (El Comercio, 2019).

BanEcuador will offer loans for light transport cooperatives with interest rates of 9.8% for EVs. The credits range from US$59,100 for fixed assets and up to US$7,000 for working capital. The payment term can vary between two and five years. The National Finance Corporation (CFN, in Spanish) grants loans for the purchase of electric public transportation and charging infrastructure, with and interest rate ranging from 7.5% that can be adjusted every 90 days. Likewise, CFN has stated that the Decentralized Autonomous Governments must implement measures to promote 100% electric mobility. Banco del Pacífico will grant credits for new EVs to authorized dealers, with an interest rate that ranges from 12.50% to 13.50%.

Guayaquil, the most populated city of Ecuador, has 20 electric buses and 50 electric taxis. Guayaquil authorities announced that the transportation sector was eligible for an incentive of US$15,000 to purchase an electric bus or US$4,000 for an electric taxi (Xinhuanet, 2019). A fleet of 30 pure electric e5 taxis circulates in Loja as the largest electric taxi fleet in the country. The project was initiated by the local community and backed by the Ecuadorian government with a tax-free incentive. In 2019, the number of EVs sold in Ecuador amounted to 103 units. This represented a decrease of around 21% in comparison to the number of EVs sold in the previous year.

JAMAICA

Jamaica relies on imports of fossil fuels (9% of its annual GDP, ~US$1.3 billion in 2015) and has a GDP-weighted climate vulnerability index value of 144 out of 192 as determined through a Worldwatch Institute study (Ochs, Konold, Auth, Musolino, & Killeen, 2015). Jamaica has experienced a significant increase (~350,000) in the number of motor vehicles between 2014 to 2017. Light motor cars accounted for 70%, while motorcycles accounted for 8% of the total number of motor vehicles in 2017 (Potopsingh, 2018).

The Ministry of Science, Energy and Technology (MSET) is completing an EV policy and promulgating regulations under the Electricity Act. The IDB is assisting the Government of Jamaica in that regard, developing a strategic framework for electromobility to inform policy and support a transition to BEVs. The EV policy will target public transportation.

The Jamaica Public Service (JPS) has been implementing EV charging stations since the beginning of 2020. EV intervention on an initial small scale can target that 8% (~58,000 motorcycles) nationwide. The MSET is promoting institutional changes, including the liquidation of Petroleum Corporation of Jamaica (PCJ), to allow its main functions to be incorporated into a new division under MSET. In addition, the Ministry of Finance and Public Service is creating a new energy division.

MEXICO

Mexico passed an ambitious climate change law in 2012 and has since pledged to reduce GHG emissions by 40% by 2030. The decarbonization of the country's transportation sector, responsible for 22% of annual emissions, will be essential for Mexico to meet its goals. The Income Tax Law grants higher deductions to investments or leases in PHEVs and BEVs. An additional tax incentive takes the form of a tax credit of 30% on investment made in public power supply facilities for EVs. There is no direct supports for EVs in Mexico, and the tenure payment is only mandatory in 19 states of the republic, some of which have subsidies, so the exemption from this charge does not represent a significant savings for potential EV buyers (Aguilar, 2019). The strongest tax incentive is the ISAN exemption (tax on new vehicles), but this represents only between 8-15% of the cost of the car.

Comisión Federal de Electricidad (CFE), the largest electricity supply company in Mexico, promotes EVs by installing a separate meter to keep the EV user rate within the national rate class. The Federal Law on New Automobiles Taxation exempts vehicles powered by rechargeable electric batteries, as well as PHEV, from the fees related to their sale or importation.

In the Mexico City Metropolitan area, 29% of all daily trips (approximately 6.3 million) are made in private vehicles and 60.6% in low-capacity public transportation concessions, such as minibuses, vans, suburban buses and taxis. Only 8% is carried out in mass public transportation systems (Metro, Metrobus, light train and trolleybus). Mexico City regulation grants benefits for the purchase and use of EVs. PHEVs and BEVs are excluded from the process of vehicle verification, and they can circulate daily without limitation, unlike other urban vehicles subject to "no-circulation" schedules. Parking lots, whether public or privately operated, must include exclusive parking spots for PHEVs and BEVs.

Mexico City also has the EcoTAG, a special type of the prepaid card that is used to travel on urban highways. The EcoTAG is exclusively for owners of PHEVs and BEVs and gives them a 20% discount on the regular rate. The Mexican car industry represents approximately 6% of GDP (Marchán & Viscidi, 2015).

According to CFE, as of July 2019, there were 2,017 charging stations throughout Mexico, almost 20% of them concentrated in the capital. This becomes a bottleneck for the adoption of EV. According to (Netherlands Enterprise Agency, 2019), there are over 500 BEVs and 15,000 PHEVs in Mexico.

PANAMA

The transportation sector in Panama consumed 49.6% of fuels and the country imports all its gasoline and diesel requirements (US$5.62 billion, around 8.6% of GDP). Pre-tax energy subsidies in Panama are 0.8% of GDP, of which 0.3% goes to fuels and 0.5% to electricity. Taxes on goods and services (including fuels) are less than 8% of total fiscal revenue. Air quality in Panama is considered moderately unsafe. The country's average annual concentration of PM2.5 is 11 μg/m^3, which exceeds the recommended maximum of 10 μg/m^3.

The National Energy Plan 2015-2050 of Panama suggests that 70% of the country's energy supply could be renewable after 35 years. The National Electromobility Strategy (ENME, in Spanish) was drafted in 2019 to reduce dependence on refined oil and combustion pollution. As Law 69 of 2012, which granted fiscal incentives to foster the purchase of EVs, did not yield tangible results, the ENME recommends assessing the following fiscal instruments to foster electromobility in the country: tax incentives on consumption, ITBMS (similar to VAT) on imports and ITBMS on sale. The ENME also recommends establishing preferential payments on toll roads and reducing vehicle registration and inspection fees. The ENME suggests identifying financial sources to support the change of public transportation systems and securing banking to support the adoption of private EVs. If the provisions of this national roadmap are fulfilled, the conditions would be enabled to achieve the following goals in the year 2030: (i) 10-20% of private vehicles will be electric; (ii) 25-40% of the private vehicles sold that year will be electric; (iii) 15-35% of the buses will be electric; and (iv) 25-50% of public fleet vehicles will be electric (PNUMA, 2019).

PARAGUAY

In 2019, Paraguay had 2.3 million vehicles. The vehicle penetration rate has increased from 142 per 1000 inhabitants in 2010, to 296 per 1000 inhabitants in 2017. The transportation sector in Paraguay consumes 93% of the all oil-derived products, imported in its entirety. Pre-tax energy subsidies in Paraguay represent 0.1% of GDP, of which 0.0% goes to fuels, and 0.1% to electricity. The air quality in Paraguay is considered moderately unsafe. The country's average annual concentration of PM2.5 is 12 μg/m^3, which exceeds the recommended maximum of 10 μg/m3. There is an excise tax –or "selective consumption tax"– payable at the time of importation or first sale of products, which is 50% on oil products. The National Development Plan 2030 requires the incorporation of 137,013 EVs, which will generate a 20% reduction in the consumption of fossil fuels in private transportation. The country begins with an initial fleet of 360 vehicles (in 2018), reaching about 5,800 in 2020, 27,500 vehicles in 2023, 64,500 in 2026 and 137,013 vehicles by 2030.

The electricity generation in Paraguay comes 100% from hydroelectric plants. The two largest publicly owned generating companies, Itaipú Binacional and Entidad Binacional Yacyretá, are implementing two "green-corridor projects" along the main national highways. These projects include the installation of charging infrastructure for EVs along the corridors. Paraguay established renewable energy targets in its National Development Plan 2014–2030. The country's goal is to reach 60% of renewable energy in total energy consumption by 2030. For the same year, Paraguay aims to reduce the share of fossil fuel in its total energy consumption by 20%.

Law 4.601 of 2012 promoted the imports of EVs with a tax exemption of custom duties and VAT on new and used vehicles. Law 5.183 of 2014 restricted the tax exemption to new BEVs and PHEVs. In 2014, the National Development Plan, the National Energy Policy, and the Energy Efficiency Plan, established goals and targets aimed at implementing nationwide electromobility strategies. Paraguay is currently designing a National Electromobility Strategy. The development of this strategy is financed by the IDB.

According to the Center for Natural Resources, Energy and Development (CRECE, 2020), the current fiscal incentives for electromobility are inefficient and do not register positive effects, in part because they are directed at imports and not at the consumer, and they benefit technologies such as flex hybrid vehicles, which do not provide the same environmental benefits as EVs.

PERU

According to (Astorga, 2020), Peruvian authorities are at the initial stage of encouraging the entry of EVs through specific legislation and other measures to join the global trend of promoting the use of this type of vehicles. In May 2018, the government issued tax measures that included the modification of the excise tax. The latest modification reduced the excise tax applicable to EVs from 10% to 0%.

The Ministry of Energy and Mines (MINEM), the Ministry of Transportation and Communications (MTC) and the Ministry of Economy and Finance (MEF) are working together on a subsidy to incentivize the use of EVs through the issuance of bonds. MINEM is working on regulations related to EVs, the installation of charging stations, rates, and other services related to EVs. The MEF has also approved a decree which eliminates the excise tax for those who renew their car parks with PHEVs or BEVs.

The National Competitiveness and Productivity Plan 2019-30 proposes to carry out decentralized pilot projects by 2021, define technical standards for charging stations by 2025 and to have electric buses operating in Lima, Arequipa, and Trujillo by 2030. The use of EVs in the country is in its early infancy, with only 436 PHEVs and 23 BEVs units imported between 2016 and 2019, according to the Asociación Automotriz del Perú (AAP), which created a committee to accompany the rollout of these units. The Government of Peru has issued 21 proposals to foster EV adoption and charging infrastructure through the Ministerial Resolution RM-250-2019-DM. The IDB has proposed a financing model for public buses in Lima (Ramírez, Lefevre, Fernández-Baca, & Capristán, 2020). These authors evaluate three business models to facilitate the investment of electric buses in Lima, namely commercial financing, partial lease, and full lease.

URUGUAY

The Energy Policy Uruguay 2030 establishes the diversification of the energy matrix, seeking to reduce the country's dependence on oil. Uruguay´s transportation sector represents more than 30% of the total energy consumed in the country. About 70% of the fuel used in Uruguay is diesel, and the transportation sector consumes a third of the country's energy resources. Uruguay spent US$109 million a year on diesel subsidies for public transport in 2018. In 2019, the Uruguayan government regulated Article 349 of Law No. 19.670 where a subsidy is established to support the initial replacement of buses with an ICE by new electric buses in the regular public land collective passenger transport service. With national scope, the new subsidy covers the price difference between a diesel bus and an electric bus of similar dimension; the good results of the subsidy are already beginning to be reported (MIEM, 2021). As of May 2020, the Montevideo transportation system had 30 electric buses in circulation.

Additionally, the government will offer subsidies and benefits to those willing to purchase electric taxis. The taxi license for a BEV will have a US$60,000 subsidy. Additionally, EV owners will be exempt from the 23% import tax on vehicles. Regarding charging infrastructure, the government's stimulus policies will promote the installation of charging facilities with a US$5,000 subsidy for each charging pole installed. In total, a single pure electric taxi in Uruguay will receive the equivalent to US$100,000 in subsidies. The country currently has a total fleet of 5,000 fossil fuel taxis, 60% of which are in Montevideo.

TRINIDAD AND TOBAGO

Trinidad and Tobago's Intended Nationally Determined Contribution (iNDC) has identified an unconditional 30% reduction in GHG emissions by December 31, 2030, in the public transportation sector compared to a business and usual (BAU) scenario using a reference year of 2013. This would be equivalent to one million, seven hundred thousand tons (1,700,000) CO_2e. The country has also identified additional reduction that could lead to a reduction of 15% in total GHG emissions across three sectors (power generation, industry, and transport), to be achieved under certain conditions, which is referred to as conditional contribution. In absolute terms this is an equivalent of one hundred and three million tons (103,000,000) of CO_2e. In the transport sector, the country aims to: (i) create enabling environment; (ii) improve national public transport system; (iii) promote vehicle energy efficiency; fuel efficiency, and fuel switching; (iv) reduce private vehicle use; (v) improve data collection and information sharing systems; and (vi) integrate into National MRV System.

It is against this background that effective January 1, 2022, Trinidad and Tobago will be removing all custom duties, motor vehicle tax and VAT on the import of battery-powered electric vehicles with an age limit on imported used battery-powered electric vehicle of 2 years. This new policy will be subject to review after two years have elapsed. Previously, the country had other incentives for compressed natural gas (CNG) vehicles, such as the CNG Price Reduction (Finance Act 4/2014) and Fiscal incentives for import of CNG vehicles and for the conversion to CNG vehicles (Motor Vehicle Tax Act, Value Added Tax Act, and Corporation Tax Act). In Trinidad and Tobago there is a small VAT for the three different types of unleaded gasoline, domestic kerosene, and auto diesel; however, there is no VAT for CNG. Trinidad and Tobago have initiated its experience with electric buses. The University of Trinidad and Tobago (UTT) has acquired an electric bus as part of a project carried out in partnership with European Union and the national Ministry of Planning. UTT has also set-up a level 3, fast charging station at its Point Lisas Campus.

Annex 2. Bibliography

Aguilar, E. (2019, Octubre 22). Vehículos eléctricos en México avanzan a 'marchas forzadas'. Retrieved from El CEO: https://elceo.com/negocios/vehiculos-electricos-en-mexico-a-marchas-forzadas/

Astorga, A. (2020). Electric Vehicle Regulation and Law in Peru. Retrieved from https://cms.law/: https://cms.law/en/int/expert-guides/cms-expert-guide-to-electric-vehicles/peru

Bitencourt, L., Abud, T., Santos, R., & Borba. (2021). Bass Diffusion Model Adaptation Considering Public Policies to Improve Electric Vehicle Sales—A Brazilian Case Study. Energies. doi: https://doi.org/10.3390/en14175435

CRECE. (2020, April 8). Transición energética: la movilidad eléctrica en Paraguay. Retrieved from www.py.undp.org: https://www.py.undp.org/content/dam/paraguay/docs/INDH%202019-2020/INDH_Cap%206_200328_CC05.pdf

El Comercio. (2019, June 5). Empresas ofrecerán más autos eléctricos en el Ecuador. Retrieved from El Comercio: https://www.elcomercio.com/actualidad/negocios/empresas-oferta-autos-electricos-ecuador.html

Global Fleet. (2020, March 9). Brazil kicks off 2020 in EV mode. Retrieved from https://www.globalfleet.com/en/safety-environment/latin-america/features/brazil-kicks-2020-ev-mode?a=DBL10&t%5B0%5D=Brazil&t%5B1%5D=Latin%20America&t%5B2%5D=FLeet%20LaTAm&t%5B3%5D=electric%20vehicle&t%5B4%5D=BMW&t%5B5%5D=Toyota&curl=1

IRENA. (2016). Renewable Energy Prospects: Dominican Republic. Abu Dhabi: International Renewable Energy Agency (IRENA). Retrieved from https://islands.irena.org/-/media/Files/IRENA/Sids/Publications/Dominican-Republic-_-Renewable-Energy-Prospects.ashx?la=en&hash=9C15CD9A483083A4A9D46E3D0D80545E05BE9CBB

Marchán, E., & Viscidi, L. (2015). Green Transportation: The Outlook for Electric Vehicles in Latin America. Washington DC: The Inter-American Dialogue. Retrieved from https://www.thedialogue.org/wp-content/uploads/2015/10/Green-Transportation-The-Outlook-for-Electric-Vehicles-in-Latin-America.pdf

MIEM. (2021, August 31). Ómnibus eléctricos de Montevideo sustituyeron consumo de 300.000 litros de gasoil durante los primeros seis meses. Retrieved from https://www.gub.uy/ministerio-industria-energia-mineria/: https://www.gub.uy/ministerio-industria-energia-mineria/comunicacion/noticias/omnibus-electricos-montevideo-sustituyeron-consumo-300000-litros-gasoil

Netherlands Enterprise Agency. (2019). Electric vehicles in Mexico. Retrieved from rvo.nl: https://www.rvo.nl/sites/default/files/2019/05/electric-vehicles-in-mexico.pdf

Ochs, A., Konold, M., Auth, K., Musolino, E., & Killeen, P. (2015). Caribbean Sustainable Energy Roadmap and Strategy: Baseline Report and Assessment. Washington, D.C.: Worldwatch Institute. doi: 10.13140/RG.2.1.4351.1922

PNUMA. (2019). Estrategia Nacional de Movilidad Eléctrica de Panamá. Retrieved from movelatam.org: https://movelatam.org/estrategias/panama/

Potopsingh, R. (2018, December 4). Global Fuel Economy Initiative Jamaica: Project Overview. Retrieved from https://www.globalfueleconomy.org/media/597568/rp-unep-gfei-jamaica.pdf

Ramírez, F., Lefevre, B., Fernández-Baca, J., & Capristán, R. (2020). Análisis y diseño de modelos de negocio y mecanismos de financiación para buses eléctricos en Lima, Perú. Washington, D.C.: IDB. doi: http://dx.doi.org/10.18235/0002202

Research and Markets. (2020, January 02). Brazil Electric Vehicle (EV) Market Study 2019-2025. Retrieved from Cision PR Newswire: https://www.prnewswire.com/news-releases/brazil-electric-vehicle-ev-market-study-2019-2025-market-overview-sales--forecasts-charging-infrastructure-new-mobility-services-growth-opportunities--strategic-imperatives-300980503.html

SENPLADES. (2017). Plan Nacional para el Buen Vivir. Quito: Secretaría Nacional de Planificación y Desarrollo. Retrieved from https://www.gobiernoelectronico.gob.ec/wp-content/uploads/downloads/2017/09/Plan-Nacional-para-el-Buen-Vivir-2017-2021.pdf

Slowik, P., Araujo, C., Dallmann, T., & Façanha, C. (2018). International Evaluation of Public Policies for Electromobility in Urban Fleets. Brasilia: Projeto Sistemas de Propulsão Eficiente (PROMOB-e). Retrieved from https://theicct.org/sites/default/files/publications/ICCT_Brazil-Electromobility-EN-01112018.pdf

UN Environment Programme. (2018, August 7). Latin America and the Caribbean hop into electric mobility. Retrieved from unep.org: https://www.unep.org/news-and-stories/story/latin-america-and-caribbean-hop-electric-mobility

Viscidi, L., Graham, N., Madrigal, M., Masson, M., Prado, V., & Cruz, J. (2019). Electrified Islands: The Road to E-Mobility in the Caribbean. Washington, DC: Inter-American Dialogue, Inter-American Development Bank, Organization of American States. Retrieved from https://ecpamericas.org/wp-content/uploads/2020/12/Electrified-Islands-Final-2.pdf

Xinhuanet. (2019, November 9). Ecuador opens its largest electric charging station built by China's BYD. Retrieved from Xinhuanet: http://www.xinhuanet.com/english/2019-11/09/c_138542357.htm

ANNEX 03.

Concepts from the book More than Revenue

The book stresses the need to help convert distortionary, inadequate, and regressive tax systems into allies of economic growth, mobility, and social equality. It also presents five basic principles that countries should adhere to when establishing pro-development tax reforms, which are described below. All of them are applicable to policy options related to the decarbonization of the transportation sector.

- First, reforms must include taxes that favor the poor. The first priority is to improve the progressiveness of the existing tax systems with an income tax that has fewer exemptions, real redistributive capacity, and that preserves the income of the poorest households.
- Second, reforms must establish simpler tax systems with broader tax bases. Most of the region's tax systems are too complex due to a plethora of exemptions and privileges for certain activities, sectors, or groups of taxpayers. The outcome is often taxes that seriously distort resource allocation and result in narrow and fragile tax bases. Shifting to simple, broad-based tax systems that create an environment conducive to innovation and start-ups is one of the surest ways to promote higher productivity growth and a sustainable improvement in the region's welfare and equity.
- Third, tax administrations must be strengthened so that all citizens and businesses meet their tax obligations. Reducing the high rate of tax evasion and creating institutions that guarantee that all economic agents and citizens contribute their part to the collective effort is an essential element of social legitimation and, as such, a requirement for the sustainability of any tax system designed to support development.
- Fourth, institutional agreements and consensuses must be reached to ensure that local governments have the resources needed to act as agents of development. For decentralized spending to be sustainable, the own resources of local governments must be strengthened. Much of the great potential of local revenue is still wasted, especially property taxes.

- Fifth, pro-development tax reforms should build forward-looking tax systems. LAC enjoys an extraordinary endowment of natural resources. However, environmental taxes or the current design of taxes on commodities do not reflect this situation. To adapt the future to reality, tax systems must create incentives for the more efficient use of finite natural resources and take into account the needs of future generations of Latin Americans.

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