grütter consulting

Country Diagnosis Dominican Republic

Client	AFD
Version	02
Date	28/02/2021
Authors	Verena Arauz, Aixa Henriquez and Jurg Grutter
Revision	Daniel Wunderlin
Contact	Rte. des Esserts 92, 1854 Leysin, Switzerland jgruetter@transport-ghg.com, www.transport-ghg.com

Contents

Abbreviations

AFD	French Development Agency
ASOMOEDO	Dominican Electric Mobility Association
BUR	Biennial Update Report
CCAD	Central American Commission for Environment and Development
CEMP	Punta Cana Energy Consortium - Macao
CIF	Cost, Insurance and Freight
CNCCMDL	Climate Change and Clean Development Mechanism National Council
CNE	National Energy Commission
CNTU	National Center of Unified Carriers
DECCC	Plan for Economic Development Compatible with Climate Change
DIGESETT	General Directorate of Transit Safety and Land Transport)
DGA	General Directorate of Customs
DGII	General Directorate of Internal Taxes
END	National Development Strategy
EV	Electric Vehicle
GHG	Greenhouse Gases
LPG	Liquefied Petroleum Gas
GSD	Greater Santo Domingo
GOR	Relative Organic Gases
GOT	Total Organic Gases
INDC	Intended and Determined Contribution
INTRANT	National Institute of Transit and Land Transport
ITBIS	Tax on the Transfer of Industrialized Goods and Services
MEM	Ministry of Energy and Mines
MICM	Ministry of Industry, Trade and MYPIMES
MIMARENA	Ministry of the Environment and Natural Resources
MOPC	Ministry of Public Works and Communications
MYC	Mobilise Your City
NDC	Nationally Determined Contribution
SDGS	Sustainable Development Goals
WHO	World Health Organization
OMSA	Metropolitan Bus Services Office
OPRET	Office for the Reorganization of Transport
SUMP	Sustainable Urban Mobility Plan
GDP	Gross Domestic Product
UNEP	United Nations Environment Programme
PPM	Parts per million
PPP	Public – Private Partnership
SELA	Latin American and Caribbean Economic System
SIE	Superintendency of Electricity
SITP	Integrated Public Transport System
USAID	United States Agency for International Development

1 Country Brief

The Dominican Republic is an island country that shares the island of Hispaniola with the Republic of Haiti. It is the second largest of the Greater Antilles, preceded by Cuba. The natural boundaries of the country are the Atlantic Ocean to the north, the Caribbean Sea to the south, the Mona Channel to the east, which separates it from the island of Puerto Rico, and to the west, where it borders Haiti. It is a country rich in natural resources and its topography is composed of mountain ranges and ranges that interconnect. It is the second largest and most populated country of the Caribbean islands[1].

The Dominican Republic has a territory that extends up to 48,442 km_2 (Ministry of Tourism of the Dominican Republic, 2020). It is geographically divided into 31 provinces and a National District, and subdivided into three major regions; North, South and East. (SELA, 2020) each of which has its own particular geographic, climatic and socioeconomic characteristics.

According to the World Bank (2020) the GDP of the Dominican Republic as of 2019 was US$88.941 billion. The registered population for 2019 is 10.7 million inhabitants, resulting in a GDP per capita of US$8,282 (World Bank, 2020).

The Dominican Republic has three provinces with more than one million inhabitants: the province of Santo Domingo, with a total population of 2.6 million in 2015, the province of Santiago, in the northern region, with 1 million 17 thousand inhabitants and the province of Distrito Nacional, capital of the country with 1 million 7 thousand. (Embassy of the Dominican Republic in Japan, 2021).

2 Policy Framework

2.1 Climate Change and Environment

According to the first Biennial Update Report (BUR) of 2020, the country's estimated per capita emissions were 3.6 tCO_{2e}. Gross emissions in 2015 of 35 million tCO_{2e} (Government of the Dominican Republic, 2020). The energy sector contributes 62% with 45% from energy industries subsector and 35% from the transport subsector (7.7 million tCO_{2e}). According to the INDC-RD (2015) the aim is to achieve a 25% reduction of base year 2010 emissions by 2030. The INDC-RD Plan is based on the END, the National Climate Change Policy, the Plan for Economic Development Compatible with Climate Change (DECCC) and the National Adaptation Action Plan (PANA-RD). The Dominican Republic has been collecting taxes through CO_2 emissions since 2012 (Law 253-12), which also aims to comply with the commitments made in 2017 when it became a signatory to the Paris Agreement of the United Nations Convention on Climate Change[2].

In December 2020, the Ministry of Environment presented the first official version of the Nationally Determined Contribution (NDC-RD 2020) for the country, in which the Dominican Republic ratifies the pact made with the Paris Agreement for the reduction of GHG emissions. This document establishes the guidelines to be followed in order to develop an action plan against climate change at the national level. According to the updated version of the NDC-RD 2020 (Gobierno de la República Dominicana, 2020) it forecasts that by 2030 there will be a 27% reduction in GHG emissions in relation to Business

[1] https://embadomjp.gob.do/index.php/es/republica-dominicana/geografia-y-clima

[2] https://www.informea.org/en/legislation/resoluci%C3%B3n-no-12217-que-aprueba-el-acuerdo-de-paris-suscrito-por-la-rep%C3%BAblica-dominicana#:~:text=Legislation%20%C2%BB%20Resoluci%C3%B3n%20No.-,122%2F17%20que%20aprueba%20el%20Acuerdo%20de%20Paris%20suscrito%20por,el%209%20de%20mayo%20de

as usual (BAU), which could be achieved through 46 specific mitigation actions distributed among the different sectors of Energy, Industrial Processes, Land Use Activities and Waste Management.

Similarly, the Nationally Determined Contribution-RD 2020 provides for the implementation of a National Action Strategy for Climate Empowerment (ACE) to be achieved through 24 goals within six cross-cutting elements such as gender inclusion, the role of youth, the role of cities, human rights and just transition.

In terms of electric mobility, the NDC-RD 2020 proposes to contribute to the achievement of the global climate change objectives in specific actions detailed below

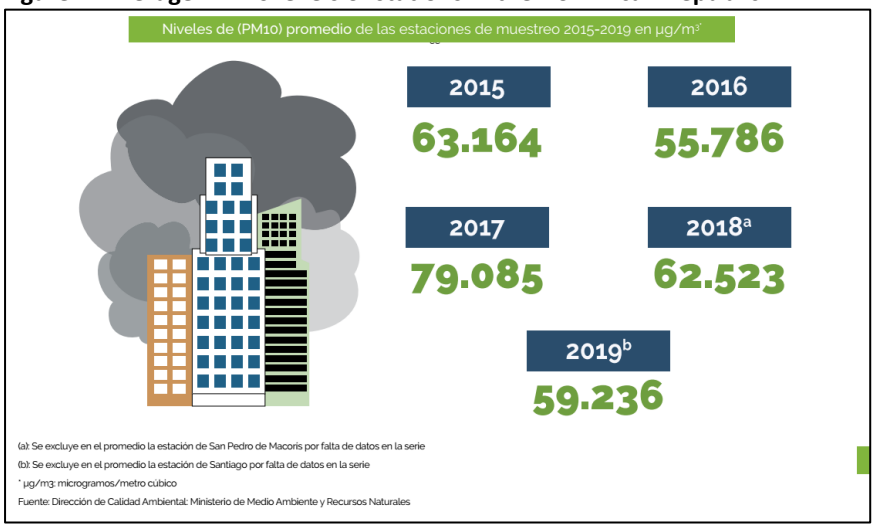
- Electrification of the fleet of diesel buses.
- Renewal of public transport vehicles, such as cabs and "conchos", for electric and hybrid vehicles.
- Introduction of electric buses for school transport service.
- Regulation and creation of policies to encourage the transition to electric and hybrid mobility for private use.

2.2 Air Pollution

It is important to recognize the participation of the World Health Organization (WHO) in the execution of a research project on air quality in the Dominican Republic, which consisted of a monitoring campaign that revealed the existence of some contaminating particles in the air. This study was carried out throughout the year 2020, concluding in August. This project executed by the Ministry of Energy and Mines and other international organizations established that the air quality in the Dominican Republic is above the air pollution limit established by the WHO of 10 $\mu g/m^3$ (annual mean). The evaluation yielded a result of 35.44 $\mu g/m^3$ for $PM_{2.5}$ in the city of Santo Domingo making it the city with the greatest air pollution problem in the country.

Since 2008 and currently, the Ministry of Environment has installed a total of six Particulate Matter Monitoring Stations (PM10), which record emissions weekly throughout the year in different parts of the country. The results of the measurements are summarized in the following graph, where values with high pollution tendencies are observed if we compare them with the recommended maximum value of the WHO (Murillo, 2009).

Figure 1: Average PM 10 levels of stations in the Dominican Republic



Source: Ministry of Environment

There are currently few specific and updated reports on the economic cost of air pollution for the Dominican Republic. However, the World Bank report on the cost of pollution presents global values for each region, so we could place the Dominican Republic within the group of Latin America and the Caribbean that spends up to 2.4% of its GDP in expenses related to total atmospheric pollution, and 1.5% for air pollution. (World Bank, 2016). This report also presents some relevant values for the analysis of the costs of pollution in the Dominican Republic, which more than economic, represent human losses and neonatal deaths. These then represent an absence in the work force that becomes a cost for the nation.

Table 1: Cost of Environmental Pollution by Country

94

	Mean annual ambient $PM_{2.5}$ ($\mu g/m^3$)		Total deaths from air pollution		Total welfare losses (Million 2011 U.S. dollars, PPP-adjusted; % GDP equivalent)		Total forgone labor output (Million 2011 U.S. dollars, PPP-adjusted; % GDP equivalent)	
Economy	1990	2013	1990	2013	1990	2013	1990	2013
Colombia	9.15	12.63	10,635	14,636	6,068 (2.35%)	15,046 (2.58%)	961 (0.37%)	916 (0.16%)
Congo, Dem. Rep.	17.03	18.08	39,416	62,412	2,650 (5.98%)	1,964 (4.02%)	678 (1.53%)	509 (1.04%)
Congo, Rep.	16.76	13.81	2,874	3,393	1,065 (8.49%)	1,400 (5.54%)	130 (1.04%)	153 (0.60%)
Costa Rica	8.08	9.31	593	629	325 (1.44%)	748 (1.14%)	35 (0.16%)	43 (0.07%)
Côte d'Ivoire	19.50	20.30	12,265	16,264	2,524 (6.44%)	2,994 (4.72%)	848 (2.16%)	650 (1.02%)
Croatia	24.89	13.93	3,943	2,716	.. ..	6,392 (7.50%)	.. ..	125 (0.15%)
Cuba	9.49	10.97	3,838	3,052	4,486 (3.10%)	5,603 (2.47%)	178 (0.12%)	124 (0.05%)
Cyprus	20.24	16.46	312	303	843 (6.11%)	988 (3.81%)	21 (0.15%)	20 (0.08%)
Czech Republic	32.83	16.55	12,074	6,640	28,206 (13.76%)	20,521 (6.93%)	600 (0.29%)	339 (0.11%)
Denmark	18.30	11.41	3,880	1,632	13,702 (8.01%)	7,011 (2.94%)	339 (0.20%)	149 (0.06%)
Dominican Republic	11.62	12.49	2,310	3,828	869 (2.27%)	3,792 (3.09%)	169 (0.44%)	232 (0.19%)
Ecuador	8.01	13.91	2,206	3,156	1,246 (1.63%)	2,721 (1.64%)	100 (0.13%)	113 (0.07%)
Egypt, Arab Rep.	35.92	36.41	40,881	39,118	17,802 (5.25%)	31,545 (3.58%)	2,810 (0.83%)	2,367 (0.27%)
El Salvador	10.73	12.92	2,115	2,182	656 (2.76%)	1,306 (2.74%)	89 (0.37%)	85 (0.18%)

The Cost of Air Pollution: Strengthening the Economic Case for Action

Source: World Bank, 2016

It is estimated that about 23% of the total emissions measured in the Dominican Republic are generated by transport alone. In the Criteria Pollutant Emissions Inventory of the Dominican Republic:

2009, measurements were taken on pollutants in different categories, including emissions generated by the transport sector (Murillo, 2009). According to this report the transport sector contributes:

- Nitrogen oxides: 81% of total emissions measured that year corresponded to the transport sector, with diesel trucks accounting for 42%, followed by diesel jeeps and private vehicles, as well as motorcycles.
- PM10: diesel trucks are partly responsible for their emissions into the atmosphere, with a representative 5% of the total accounted for. In addition, there is a direct proportion with the increase in the vehicle fleet over time.

2.3 National Policies for Sustainable Transport

In the 2017 Paris Agreement, the Dominican Republic commits to actions in favor of greenhouse gas emission reductions in order to support the fight against climate change at the global level. To carry out these commitments, the following plans and guidance documents for climate change mitigation referring to the transport sector have been created in the country:

1. Plan for Sustainable Urban Mobility of Greater Santo Domingo (PMUS) (SYSTRA, 2019)
2. National Strategic Plan for Electric Mobility (INTRANT, 2020)

These specific plans on sustainable mobility have been developed by INTRANT in collaboration with other ministries and international entities that support the integral and sustainable transformation of the country's transport sector.

Among the measures that the country has committed to comply with, and that are directly related to the transport sector, are improving the vehicle fleet due to the energy consumption that this sector represents in the country, and improving infrastructure and mass passenger transport services. The country is taking the initiative to include in the transport network new modalities such as trains and cable cars. According to the report DR in 2030: Towards a Cohesive Nation (Godínez & Máttar, 2009) the Dominican Republic must efficiently manage the administration of vehicular traffic, which is why INTRANT was created as the regulatory body of the country's transport sector.

Other measures have consisted of promoting the importation of vehicles through tax incentives, promoting and educating citizens on the importance of using public transport, supporting sustainable transport systems, promoting laws and bills related to electric mobility, among other important steps that will have a positive effect in the medium and long term.

The Dominican Republic is highly dependent on imported fossil fuels. To reduce this dependence, the diversification of the energy mix has been promoted with the installation of important renewable energy projects in recent years. The BUR foresees the installation of more than 1,000 MW in renewable energies (solar, small hydro and wind). The National Energy Commission (CNE) has a National Energy Plan 2010-2025 that contemplates the inclusion of hybrid cars and sets a goal of replacing 10% of the private vehicle fleet plus 100% of public passenger cars, known as "concho", to use clean energy vehicles and buses (Comisión Nacional de Energía, 2010).

The Dominican Republic is a participant in several international agreements related to the environment and its protection. This has represented the creation of a series of local norms in order to pursue the commitments acquired with other nations, such as the following:

- **General Norm for the Application of the CO_2 Emission Tax on Motor Vehicles (Norm 06-12) (DGII)**; which indicates that all imported vehicles are subject to a CO_2 Emission Tax equivalent

to a percentage of the CIF value stated at the DGA, this percentage depends on the emissions level detailed below:
    - For vehicles emitting between 120 and 220g of CO_2/km = 1%
    - For vehicles emitting between 220 and 380g of CO_2/km = 2%
    - For vehicles emitting above 380g of CO_2/km = 3%
- **Law 103-13 on incentives for the importation of non-conventional energy vehicles (DGII)**; which encourages the importation of non-fossil fuel vehicles through the reduction of the 50% of the importation taxes, including the First Registration Tax[3]. In order to be able to benefit from this law, there are some specific requirements that each imported vehicle must meet, such as having a hybrid or fully electric engine with at least 10kW, with regenerative braking and the use of a latest generation battery.
- **Decree No. 671-02: prohibition of the importation of vehicles unfit for circulation in the country of origin**; this statute indicates that this type of vehicles are not allowed to be imported due to Citizen Security, Health and Environmental matters.
- **Environmental Standard for the Control of Emissions of Atmospheric Pollutants from Vehicles (Ministry of Environment)**; which sets the maximum limit permitted of GHG emissions from fossil fuel vehicles in order to preserve the environment and human health.
- **Law No. 63-17 of Mobility, Land Transport, Transit and Road Safety**; this law, which creates the INTRANT, is responsible for the restructure of the sector by regulating all ground transport means and modes and any other action related to mobility, transit and road safety. Furthermore, it provides a legislative framework for INTRANT to create an action plan and transport regulations that promote electric mobility. In view of this, this institution has developed a Strategic Plan 2018-2022 (INTRANT, 2017) where it aims to impact the transport sector, with a focus on public transport, by reducing the pollution caused by the vehicle fleet and improve traffic congestion that represents a major pollutant in the country.

Public transport in the Dominican Republic is composed of state agents and unionized and private actors that are regulated by Law No. 63-17 and ruled by the government institution INTRANT, from which great efforts have been made, in collaboration with national and international organizations, through cooperation agreements in order to promote the use of electric vehicles for public transport, according to strategies and recommendations in both PMUS and National Strategic Plan for Electric Mobility.

Other programs and initiatives that favor the inclusion of electric vehicles in the vehicle fleet are:

- INTRANT is evaluating through the Mobility and Transport Trust Fund (FIMOVIT) the possibility of obtaining investments of various kinds to support the project of modernizing and updating the vehicles of the public transport fleet that currently provides services to citizens.
- A new project announced by the President of the Republic consists of the construction of a series of public parking lot projects which will have electric charger facilities, so that this will serve as a motivation for users of these parking lots to make the switch to electric mobility. This project is called ParqueaT RD, and was officially presented in January 2021[4].

[3] "Impuesto de Primera Placa"; which corresponds to the 17% of the CIF value registered in the DGA.

[4] https://www.diariolibre.com/actualidad/ciudad/gobierno-propone-construccion-de-16-edificios-de-parqueos-en-santo-domingo-DE23725457

2.4 Targets for EVs

At the country level, the objectives presented in INTRANT's National Strategic Plan for Electric Mobility are listed in the following table (INTRANT, 2020).

Table 2: Core Targets National E-Mobility Strategy

Axis	Objectives
Legal and Regulatory Framework	- Regulation for the importation of EVs into the country - Regulation for the charging infrastructure - Establishment of standards for Quality, Security and Environmental Protection - Determine the required rates for the charging facilities - Tackle the limitations that installation companies currently face, such as stable power supply or lack of local regulations and standards. - Creation of a Charging Stations Registry for authorization purposes - Establishment of standards for compatibility and interoperability for charging stations with technologies that support data collection - Elaborate an efficiency and security protocol for the technical inspection of EVs - Ensure the correct recycling for the EVs batteries and also the correct management of the hazardous waste generated by these batteries. For this, an elaboration of a national registry is required along with the designation of the institution in charge of it - Establishment of vehicle access regulations for emissions control in urban zones
Charging Infrastructure	- Promote the development of adequate charging infrastructure, in particular those established with renewable energies - Introduce 14,000 charging stations by 2030 and 150,000 by 2050 - Create fiscal and non-fiscal benefits for the installation of the charging infrastructure and the energy sale in an attempt to promote the investment - Study international experiences to provide strategic information in order to analyze different business models for the development of this field
Electric Vehicles	- Achieve a 15% increase of electric vehicles in the vehicle fleet by 2025 and 30% by 2030. - Create fiscal and non-fiscal benefits aimed at the purchase of EVs and its maintenance - Develop e-mobility pilot programs - Compromise the public sector with e-mobility by acquiring EVs for the institutional vehicles fleets
Institutional and Professional Capabilities	- Strengthen the professional and technical capabilities regarding new technologies for e-mobility - Create a technical unit in charge of data collection and management for e-mobility - Study the impact of e-mobility in terms of tax collection for the sale of liquid fuels and examine alternatives to offset this impact - Determine a plan to facilitate customs and fiscal processes in the import of EVs - Encourage the preparation of professionals with technical knowledge in the field - Create a training program for rescue units in case of traffic accidents

Source: Own elaboration based on INTRANT's PENME

3 Transport Sector Characteristics

3.1 Transport Sector Stakeholders Relevant to Electric Mobility

In the Dominican Republic there are different institutions and organizations relevant to the mobility and transport sector:

- **Instituto Nacional de Tránsito y Transporte Terrestre (INTRANT)**: is the governing institution of the sector. The official description[5] of its functions states that is must coordinate with local governments about the planning and regulation of mobility in each territorial area. For the development of its functions, INTRANT is based on Law 176-07 which legislates on the organization, competence, functions and resources of the mayors' offices to offer services which include the regulation of vehicular and pedestrian traffic, the normalization and management of public space, territorial planning, construction of infrastructure and the ordering and regulation of urban public transport. Prior to the constitution of INTRANT as the sole governing body of the transport sector in the country, the management of the sector was segmented into multiple institutions that caused duplication of functions and responsibilities, as well as institutional gaps between one organization and another. These were the Technical Office of Land Transport (OTTT), the General Directorate of Land Transit (DGTT) and the National Transport Development Fund (FONDET), the Taxi Administration and Regulation Council (CART) and the Drivers' Pension Fund. INTRANT was launched on July 1, 2017, thus taking command of the transport sector.
- **Oficina Metropolitana de Servicios de Autobuses (OMSA)***:* is a public company that provides public transport services through buses. It was created in 1997[6] and its general function is to plan and organize the public transport service of state buses, maintain and repair the vehicles in optimal conditions and manage the bus routes designated by INTRANT. OMSA's bus fleet is composed of standard rigid buses of 13 meters long (+500 units) and articulated buses of 22 meters long (80 units); approximately 370 buses are currently operating, around 150 buses need to be replaced and the remaining buses are stranded due to maintenance issues. Each bus normally operates around 180 kilometers per day. The bus fleet operates daily in two shifts, only stopping when in need of preventive maintenance.
- **Office for the Reorganization of Transport (OPRET):** is a public institution that provides rail transport services, it is the public entity in charge of the construction and operation of the Metro of Santo Domingo. Established in Law 63-17[7] and is responsible for ensuring a rail service that contributes to a better quality of life for citizens with mass and sustainable transport.
- **Unidad Ejecutora para la Readecuación de Barrios y Entornos (URBE):** is part of the Ministry of the Presidency[8] (MINPRE) and through urban interventions has motivated the creation of projects to connect marginalized neighborhoods to the transport network of Greater Santo Domingo, such as the first cable car line. It is a multidisciplinary committee that oversees the execution of necessary urban projects.
- **Ministry of Environment and Natural Resources (MIMARENA):** It is the ministry in charge of developing national policies on the environment and natural resources[9], ensuring the

[5] *https://www.intrant.gob.do/index.php/sobre-nosotros/quienes-somos*

[6] http://www.omsa.gob.do/index.php/sobre-nosotros/resena-historica

[7] *https://www.opret.gob.do/SobreNosotros/QuienesSomos*

[8] *https://www.urbe.gob.do/nosotros/quienes-somos.php*

[9] *https://ambiente.gob.do/quienes-somos/*

preservation and sustainable use of the environment and the proper management of natural resources. It elaborates the regulations that protect these resources and ensures the strict application of these rules. It is also the institution in charge of periodically carrying out the surveys that allow the control and monitoring of the sustainable use of resources in the Dominican Republic.

- **Ministry of Energy and Mines (MEM):** In charge of promoting and fostering the development and sustainability of the hydrocarbons sector, promoting energy efficiency and savings, maintaining the energy infrastructure in good condition, promoting the use and development of sustainable, renewable and alternative energies, and developing the energy sector in all its aspects. It was created in 2013 by Law 100-13[10].
- **Ministry of Economy, Planning and Development (MEPyD):** Created in 2006 by Law 496-06[11], its purpose is the general modernization of the State through an optimal system of financial planning, budgeting, accounting, treasury and other factors of economic relevance in governmental management.
- **Ministry of Industry, Commerce and MSMEs (MICM):** Responsible for implementing public policies that promote the productivity and competitiveness of the country's productive industry in a sustainable manner, supporting trade and small and medium-sized enterprises[12].
- **Superintendency of Electricity (SIE):** This is the government agency in charge of overseeing and supervising the correct execution and implementation of the legal and normative regulations that apply to the electricity sector. It also regulates the generation, commercialization and distribution of electricity, as well as electricity tariffs. It was created in 2001 through the General Electricity Law 125-01[13].
- **National Energy Commission (CNE):** Also created by means of the General Electricity Law 125-01 in 2001, it is the entity in charge of guaranteeing compliance with the Incentive Law for the Development of Renewable Energies, Law No. 57-07[14]. Among its functions are the development of projects, policies, regulation of activities related to conventional, renewable and alternative energies, outlining the policies to be followed in the energy sector, and coordinating regulatory projects and legal norms.
- **National Council for Climate Change and Clean Development Mechanisms (CNCCMDL):** Arose as a result of the participation of the Dominican Republic in international agreements such as the UN Sustainable Development Goals[15], this entity is responsible for monitoring and implementing policies, projects and programs that will ensure compliance with the proposed goals to be met by 2030. This institution works in favor of the reduction of greenhouse gas emissions, achieving the mitigation of climate change, promoting clean and sustainable energies, among other functions related to the sustainable development of the global and specific environment of the country.
- **Dominican Electric Mobility Association (ASOMOEDO):** Non-profit organization that promotes the implementation of sustainable and electric transport systems and has had important participation in the working groups for the development of norms and regulations that are currently being debated in the public sector.
- **Ministry of Public Works and Communications (MOPC):** Governmental institution created in 1954 to build, design, supervise, maintain and execute road infrastructure projects, port

[10] *https://mem.gob.do/nosotros/quienes-somos/*
[11] https://mepyd.gob.do/historia/
[12] *https://www.micm.gob.do/nosotros/quienes-somos#*
[13] *https://www.sie.gob.do/sobre-nosotros/quienes-somos*
[14] *https://www.cne.gob.do/sobre-nosotros/quienes-somos/*
[15] *https://cambioclimatico.gob.do/index.php/sobre-nosotros/quienes-somos*

works, in addition to creating the rules and regulations applicable to Design and Construction projects. In terms of transport specifically, it is in charge of placing horizontal and vertical signage nationwide, in addition to currently executing bus terminal projects for intercity transport[16].

Other public stakeholders include:

- The city councils of each municipality in the country
- General Directorate of Customs (DGA)
- General Directorate of Internal Taxes (DGII)
- Ministry of Tourism (MITUR)

Other private stakeholders are:

- **Zero Emission Rd:** Private company dedicated to the importation and commercialization of electric vehicles; moreover, it plays a significant role in the training on the proper use of technologies related to non-conventional energies by providing workshops and seminaries in governmental institutions, private companies and schools and universities. Due to its interest in the development of electric mobility, Zero Emission RD cooperates with the competent institutions by helping shape the existing regulations for a proper implementation of EVs in its different categories in the DR.
- **Asociación de Movilidad Eléctrica Dominicana (ASOMOEDO):** Nonprofit organization created in 2018 with the goal of promoting the electric mobility in the country, integrating public and private efforts in order to create the necessary base that allows the competitive development of the e-mobility market in the Dominican Republic.
- **Giga Auto:** Importers of electric vehicles and scooters, and owners of charging stations infrastructure in the city of Santo Domingo. The company also sells and installs charging stations in domestic and enterprise locations.
- **Consorcio Energético Punta Cana Macao (CEPM)**: Energy generation company located in the East of the country, specifically Punta Cana and Macao. Their service fleet is composed of EVs such as Chevrolet and Hyundai. They have charging infrastructures in the East region of the country and foresee the installation of 500 charging stations for this present year.
- **InterEnergy Systems:** Division of the CEPM, is in charge of importing and installing the charging stations in the country, branded as EverGO charging stations.

Other public transport operators are:

- **Caribe Tour:** Private bus company for urban, interurban, tourist, private and international transport, with over 35 years in the market and a fleet of 700 buses.
- **Metro Servicios Turísticos:** Private bus company for interurban, charter and touristic transport established in 1969.
- **CONATRA**: Public transport provider in Santo Domingo which operates urban and interurban bus routes. CONATRA is a confederation that groups companies and unions. There are many operators, each one owns a small fleet. As part of a PPP, they recently started operating a pilot program in the Núñez de Cáceres Corridor.
- **Central Nacional de Transportistas Unificados (CNTU):** Transport Union in charge of grouping and affiliating small buses or taxi fleet owners. In 2019, CNTU signed an agreement to switch part of its taxi, school minibuses and urban buses fleet to electric vehicles with the assistance

[16] http://www.mopc.gob.do/nosotros/qui%C3%A9nes-somos/

of Zero Emission RD. Its goal is to import around 3,000 units of EVs and to substitute 20% of the fleet in the upcoming years.

- **Apolo Taxi:** Taxi services company stablished for over 40 years in the country with a total fleet of more than 4,000 vehicles, of which 700 are owned by APOLO. Similarly to CNTU, APOLO's fleet consists on the affiliation of small taxi fleet owners.

3.2 Urban Buses

In accordance with the Sustainable Urban Mobility Plan for Greater Santo Domingo (SYSTRA, 2019) collective transport in the province of Santo Domingo is divided into publicly operated buses, and other means of transport such as buses and minibuses belonging to unions and congregated in federations. In order to circulate, these vehicles must have prior authorization from INTRANT. This report presents important points on the prevalence of the use of unofficial buses and minibuses, which represent direct competition to the public bus system, OMSA. As of late January 2021, INTRANT started the implementation of a pilot project in the city of Santo Domingo consisting of the elimination of "concho" vehicles in the Núñez de Cáceres Corridor and introducing 30 buses with Euro III Technology for public transport. These buses operate with the new SD-go card technology, contactless credit or debit cards and the MetroCard, which allows its users to travel between Metro, Cable and Bus without the need to use cash. This plan is under study for the remaining principal corridors of the city and contemplates the creation of new transport companies under the modality of Public-Private Partnerships administered through Trust Funds.[17]

According to the DGII's Vehicle Fleet Statistical Bulletin 2020 (Directorate General of Internal Taxes (DGII), 2020) as of January 7 of the present year, the Dominican Republic had a total of 107,147 buses in the vehicle fleet.

According to the 2018 Annual Energy Consumption of the Ground Transport Vehicle Fleet report, in the classification of Buses we can find the individual amounts according to type of service provided by such vehicles. According to the table extract obtained from said report, the total number of buses accounted for some 101,149 units, of which minibuses and "microbuses" added up to a nationwide total of 11,137 units.

Table 3: Buses National Level

160	OMSA Gran Santo Domingo
1900	Minibús Gran Santo Domingo
2179	Microbús Gran Santo Domingo
2828	Minibús otras provincias
4230	Microbús otras provincias
1,037	Autobús Transporte Público
88,815	Privado y Turístico
101,149	**Autobús**

Source: INTRANT

In 2011, there were 14 public transport federations and 169 private operators (see list below).

[17] https://intrant.gob.do/index.php/noticias/item/690-gobierno-pone-a-circular-corredor-nunez-de-caceres-beneficiara-a-mas-de-10-mil-usuarios-diariamente

Table 4: Public Transport Federations

Federación	No. Unidades	No. Asientos	Edad Flota
CNTU	433	2,197	25
CONACHOF	25	204	20
CONATRA	2,301	12,936	23
FEDOTRANS	1,142	8,440	21
FENACHO	212	1,798	22
FENATRANO	7,461	62,099	22
FENATRAPEGO	1,355	7,162	24
FENTRAUNI	1,072	5,669	24
FETRAPUN	122	1,548	20
MOCHOTRAN	3,723	20,437	24
MUCHOCA	498	3,539	24
NO AFILIADO	103	2,371	22
UNACHOSIN	394	1,970	24
UNATRAFIN	547	4,187	23
TOTAL	**19,388**	**134,557**	**23**

Fuente: Movilidad Urbana de Santo Domingo (Isa J, 2012).

Source: INTRANT

Microbuses in Greater Santo Domingo totaled 2,179 units, and 4,230 units in the interior of the country were registered.

3.3 Taxi and Bus Policy

Since 2000, the Dominican Republic has had an entity in charge of regulating the operation of cabs in the country called the Council for Administration and Regulation of Taxis (CART), however, it showed a deficient activity in the control of the registration of all the cars that provide the service in the country. As of 2013, it was estimated that the CART had officially registered only 3,000 of the 25,000 cabs operating nationwide. INTRANT has created the Taxi Transport Service Regulations, which are currently under review. This regulation identifies the cab service as one of the most used and relevant within the Dominican population.

3.4 Transport Policies for E-Mobility

In the Dominican Republic, in addition to the Law 63 – 17[18], whose objective is to regulate and supervise the affected areas of the transport sector, and to establish a framework for action of the different entities involved in this sector in a comprehensive manner; there are currently two major reports and plans that seek the comprehensive development of the country's transport system. One of them is the National Strategic Plan for Electric Mobility of the Dominican Republic, which seeks to support the transition to a much more sustainable vehicle fleet, promote the use of vehicles that operate on the basis of cleaner and less polluting systems, both for public and private use, and in its different aspects of freight, light, passenger and motorcycle vehicles. This plan includes policies applicable to the Dominican sector, pilot and incentive programs that are possible within the country's socioeconomic environment.

Additionally, as mentioned in chapter 2.3, there is the PMUS (SYSTRA, 2019), which has been based on Law 63-17 and arises as a response to a need of the same law as it represents a total transformation of the country's mobility sector.

[18] Law 63 – 17 on Mobility, Ground Transport, Transit and Road Safety of the Dominican Republic

On the other hand, in spite of these two mayor plans, there is the 2018-2022 Strategic Plan[19] created by INTRANT for institutional purposes and, unlike the PMUS, has a national scope. According to this plan (INTRANT, 2017) INTRANT will work on institutional and legal aspects in different areas that will directly impact the transport sector and mobility in general, in order to make way to a ground transport sector transformed into one that is more worthy of Dominican society and in accordance with the needs of the new times. In this plan, various lines of action have been worked on in the short, medium and immediate term, starting in 2017, which is when this document was published. Once the plan is completed in its analysis and execution phases, it is followed up and evaluated to generate a continuation or approach of the steps to follow in the years after 2022.

One of the main objectives of the INTRANT Plan is to ensure that by 2030 the Dominican Republic becomes *"a model of accessible, efficient and safe mobility",* which seeks to increase the quality of life of citizens and achieve a sustainable and environmentally friendly model for the country.

Among the specific objectives of this plan are to make the Dominican Republic a benchmark for good mass public service that is integrated between different modes of transport, which is a known deficit of the country's urban transport system — to improve coordination between urban development, land use and the capacity and functionality of the country's transport system, in order to achieve sustainable development in mobility. Another objective is to motivate citizen participation in the transformation process of the mobility sector and to achieve efficient and adequate responses to the needs of users in the transport sector. Other objectives include; involves improving the management and use of existing infrastructure, develop policies and strategies to regulate the interurban distribution of goods — which would help in solving the public safety problem that heavy duty vehicles pose since they are constantly present in urban areas, where the infrastructure is not prepared to handle this type of traffic sometimes resulting in fatal accidents and material losses, and finally the plan seeks to comprehensively improve public management to transform mobility in return strengthening government institutions relevant to the country's transport sector.

To achieve these objectives, the plan presents a series of specific actions to be carried out over the years 2018 to 2022, such as social management and general administration of mobility, the creation of a land use plan, the improvement of non-motorized mobility, public and cargo transport, attention to road infrastructure, education in the field of road safety, the use of information technologies to improve mobility systems, and the institutional strengthening of those entities directly involved in the management and control of the Dominican transport system.

As an action strategy, the plan is divided in a three-pronged timeframe, immediate term, which sought to educate the population on the newly created Law No. 63-17. Its scope and implications create a roadmap where the participation of private public transport service providers is regulated and planned, in coordination with them. Some studies and specific interventions would also be worked on in the short and immediate term of implementation of this plan.

In the short term, between 2018 and 2020, the education of the population on transport would continue, the plans implemented in the first phase would be implemented, and the public transport massification plan would continue, which also seeks to return control over this important sector to the state.

For the medium term, between 2018 and 2022, the education program and the implementation of administrative and operational measures remain in action, in addition to the continued

[19] INTRANT, Plan Estratégico del Instituto Nacional de Tránsito y Transporte de la República Dominicana (Santo Domingo: 2017).

implementation of major infrastructure works in the different components of the Dominican Republic's mobility sector.

For the province of Santo Domingo, INTRANT developed the first PMUS[20], in 2019, which was financed by the French Development Agency (AFD) with the technical assistance of SYSTRA within the framework of the *MobiliseYourCity* iniciative, introduced by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. This plan aims at projecting the needs of the transport sector within the province of Santo Domingo, and its infrastructure and service requirements, thus enabling timely planning to meet the following needs; efficiently managing the demand for urban transport, generating coherent public policies and creating links between urban development and planning policy and policies concerning transport, provide guidelines and action plans that ensure the feasibility and effectiveness of the plan's expected results. (SYSTRA, 2019).

The SUMP was developed over 16 months of work by a series of actors who were responsible for carrying out the diagnoses, strategies and action plan resulting from the research. Considering all the natural and social conditions that make up this territory, the plan identified the need for a balanced development of the transport network in the metropolitan area of Santo Domingo. One of the goals to be achieved through the plan is to expand the public transport network and coverage supported by methodologies and processes based on sustainability. The plan thus seeks to return the focus of urban management to the user and his or her transport needs.

Another objective of the SUMP is to achieve a paradigm shift in the way the user and the collective behave with respect to the city and to reestablish a bond of mutual respect between the built entity and the person who inhabits it, which is why it is a priority to identify the capabilities and resources of each of the actors involved in the environment. The action plan seeks to achieve greater efficiency through a rational use of resources, identifying the limitations present in the field.

The SUMP is to be implemented over a 5-year period starting in 2025, with a deadline in 2030 to meet the goals set forth in the plan. These tangible goals are divided into three major key points to achieve a substantial improvement in the province's transport sector:

- Creation of a public metropolitan network linked to alternative regulated services. This network will be composed of a mass transit network comprised of systems such as the metro, which has two existing and operating lines, a tram/BRT that is a current project, the cable car, which currently has one line in operation and a second one under construction, and the complementary network, which would be composed of express and secondary buses.
- Improve the connectivity of poorly integrated neighborhoods and municipalities. This phase will consist of intervention in road projects such as the creation of new roads or necessary connections, the adequacy of existing roads, the creation of parking lots, among other projects necessary to improve local connectivity between those areas of the city most affected.
- Improve the efficiency of the transport system as a whole. This phase consists of improving the interconnections between one mode of transport and another, in those important nodal points where more than one type of public transport converges.

A priority also expressed in the SUMP is the importance of complementing transport systems with the improvement of the built urban environment, which allows for optimal and safe movement of citizens, which includes pedestrians. It also encourages the inclusion of non-motorized systems such as the use

[20] Plan de Movilidad Urbana Sostenible del Gran Santo Domingo, SYSTRA (2019)

of bicycles, for which there are already plans being implemented by the different municipalities to prepare public spaces and roads for adequate non-motorized mobility.

In concrete numbers, the SUMP seeks to increase the coverage of the public transport network by 33%, achieve an 8% increase in public transport trips, a reduction of 20 minutes in the average daily time in means of transport, and a reduction of 20% in CO_{2eq} emissions for each year after the completion of implementation of this plan and its action points. This plan allowed the Dominican Republic to join a network of 20 countries and 100 cities that in 2017 committed to achieving the global goal of reducing greenhouse gas emissions from mobile modes of transport.

The execution deadlines of the SUMP have been divided into short (2020), medium (2025) and long (2030) terms to be executed through a construction dynamic that facilitates the implementation of the plan, tied to the identification of a single mobility planning entity, which does not exist today for the territory of the capital city. It is important, as established by the PMUS, to contribute to strengthening the capacities of local actors, promote the modifications of the plan to the public urban mobility policy, and to achieve an effective link with the urban mobility strategy elaborated at the national level by INTRANT, and PEMUS 2017-2022.

The actors involved in the development and creation of this plan corresponded to a diverse cross-section of governmental, administrative and municipal entities, representatives of civil society and international donors interested in the substantial improvement of developing countries.

The SUMP clearly describes the different methods of public transport present in the province:

- **Metro**: currently composed of two operational lines serving the North-South (Line 1) and East-West (Line 2) axis. It was developed by OPRET, inaugurated in 2008 and began operations in 2009.
- **Cable Car**: it was created as a complement to the Metro lines and connects in a north-south direction the sectors of the northeastern outskirts of the city. It is comprised of 4 stations and connects 3 municipalities.
- **Surface transport** system, which is subdivided into three important modalities in the city of Santo Domingo,
    - The **OMSA** an organized bus supply, of a public nature, composed, according to the PMUS, of 330 units, according to the most recent report as of 2020 for the city of Santo Domingo.
    - The **independent bus** supply, made up of drivers' unions that operate minibuses or microbuses, with a presence of 3,000 units in the city.
    - Finally, the "**conchos**", also formed by private unions that operate cars, have a presence of 16,000 units in the territory of Greater Santo Domingo.

Both unionized modalities must be authorized by INTRANT for their operation and only 1% are not affiliated to any union. This unionized system is one that seeks above all else the profitability of its services, and does not allow for a true integration of the mass transport system in the country or the intermodal charging system that is intended to be implemented in the future. INTRANT has determined that a general formalization of the sector should be carried out and the possible inclusion of informal or unionized drivers within the OMSA staff is being discussed. The general idea is to regularize and support the public bus system, which suffers direct competition from conchos and minibuses, and which often offer a redundancy on the routes which affects the good performance and efficiency of the OMSAs. It is also the improvised routes of conchos and minibuses that cause massive

traffic congestion saturating the road network throughout the day, especially in the morning and afternoon rush hours in the city.

In addition to urban transport there are also private school transport operators, whose stops are sometimes located in neuralgic points of the city forcing them to cross from one direction to another in order to move to the outskirts of the city to other provinces of the country because the government does not provide a special network for these purposes. Cab companies by digital platforms also make their appearance as part of the transport system of Greater Santo Domingo, including the Uber platform as reference, in its modalities of light vehicles and motorcycles, included in the years 2015 and 2017 respectively.

Once the various base, central and optimal scenarios of the development plan for the transport sector were presented to the authorities, the main solutions and strategies to be implemented in the various timeframes previously identified were discussed. Mass transit optimization systems were presented as well as the creation of new modes of transport such as BRT or Tramway, all with the purpose of reducing congestion and pollution and offering new alternatives. The possibility of changing and updating the vehicle fleet has been contemplated in accordance with Law 63-17. The adequacy of the transport infrastructure network will be sought, the key points in need of urban interconnection by means of transport have been identified, so these should be solved as a result of the timely implementation of the SUMP. The implementation of an Integrated Public Transport System (SITP) in the province is also one of the main proposals regarding the organization of the bus supply system, which is why the central government is already making efforts to provide OMSA with a greater number of units for circulation and passenger service in the city.

In the medium term, 5 BRT or tramway structure lines shall be implemented to complement the mass transit network that has already been initialized with the SITP buses, directly improving the urban environment through these important interventions. By 2025 the goals to be achieved through the SUMP include the following proposed BRT lines: Avenida Luperón, Avenida Independencia, Avenida 27 de febrero, Avenida Mella and Avenida Ecológica, the latter in Santo Domingo East. In the long term, BRT lines are proposed for Avenida Prolongación 27 de Febrero and Avenida Charles de Gaulle, western section. The inclusion of a streetcar or BRT system in the city of Santo Domingo would represent an important contribution to decongesting the aforementioned roads where part of the major traffic congestion of the capital city is experienced daily, since the flow of people added to a shorter travel time along the roads would result in a great relief for the other transport systems that use the road infrastructure to move around.

In 2018, it was announced by INTRANT, in conjunction with the American Chamber of Commerce, the creation of the first National Scrap Repair Plan of the Dominican Republic, which would be executed in alliance with institutions such as the DGII and the Directorate General of Customs (DGA). This plan promotes the modernization of the country's vehicle fleet, since it has been identified that most of it is older than 15 years, and as established by the Sustainable Urban Mobility Plan (SYSTRA, 2019) the impact and emissions to the environment are directly proportional to the age and deterioration of vehicles in circulation.

Although the Scrappage Plan is still in the process of being prepared by the authorities, the SUMP details objective planning with respect to scrappage: in a base scenario, the creation of regulations and incentives for the purchase of new vehicles are proposed as part of the process of integrating informal public transport vehicles into the city's formal service offer; in a central scenario, the goal of 100% renewal of the current fleet is proposed; and, in an optimal scenario, incentives are provided for users' participatory behavior in environmental policies.

Article 20 of Law 63-17 (Congreso Nacional, 2017) establishes a plan for the renewal of the vehicle fleet using the funds from the application of Paragraph III of Article 20 of Law No. 253-12 (National Congress, 2012) which stipulates a tax charge of RD$2.00 pesos for each gallon of fuel sold, of which 25%, i.e. RD$0.25, must be allocated through the General State Budget for the renewal of the vehicle fleet, specifically for public passenger transport vehicles. Law 63-17 also establishes that these funds collected are to be managed through INTRANT.

Article 83 of Law 63-17 contemplates and defines the cab service by communication or platform, Uber and its peers, to be included in this modality. Since 2015 the company Uber is installed in the Dominican Republic offering its cab and motorcycle transport services through its virtual platform for cell phones. This is the first company in the country to offer the security of real-time tracking via GPS and offering employees the flexibility to offer their services at the time they deem appropriate. Another advantage with which Uber has attracted the Dominican public is to know the price of your trip in advance and the flexibility of payment through various methods such as credit and debit cards or cash, as decided by the passenger. Similarly, the company of Spanish origin Cabify was established in the Dominican Republic in 2016 in order to compete against Uber, however, last October 2020 they have announced the closure of its operations after failing to meet their goals and business expectations in the country. However, while Cabify is making its exit from operations, this same year the arrival of a new virtual mobility platform called Didi was announced. A company of Chinese origin that settles in the country with the promise of providing its users with safe and reliable mobility, while seeking to *"offer new opportunities for growth and entrepreneurship to Dominicans"* (El Día, 2020).

The arrival of these platforms in the Dominican Republic meant a revolution for conventional cabs and 'concho' type car transport which, once their complaints and oppositions against the competition were presented, had no choice but to update their business strategies and market model. For example, some traditional cab companies proceeded to create their applications for cell phones and sought to resemble the new model brought by the competition: GPS tracking, presentation of the cost of the trip in advance, presentation of the driver and vehicle data, as well as its rating in terms of customer service.

3.5 Electric Vehicle Policies Promoted by the Transport Sector

In the Dominican Republic, the National Strategic Plan on Electric Mobility, developed by INTRANT in collaboration with the IDB. The plan was released to the public in 2020. It provides for a short, medium and long-term transformation of the transport sector throughout the country. This plan is aligned with both the UN Sustainable Development Goals (SDGs) 2030 and the Sustainable Development Plan 2030 of the Dominican Republic (Ministerio de Economía, Planificación y Desarrollo , 2012). The plan is aimed at all modes of transport including light, heavy, passenger, logistics and cargo vehicles, and motorcycles.

As background, in 2013 the first law supporting electric mobility was enacted, the Electric Mobility Incentives Law 103-13, which allows the importation of electric vehicles with some benefits to tariff payments, first plate and ITBIS (Tax on the Transfer of Industrialized Goods and Services) reduced by 50% of the regular value of the taxes.

The Dominican Republic is part of the Latin American Sustainable Mobility Alliance and a member of UN Environment and *Latam Mobility*, key organizations that have supported electric mobility initiatives in the country.

Various initiatives of private origin have been gradually motivating government action to establish a consolidated plan for planning and strategy for electric mobility in the country. Such is the example of the Dominican Electric Mobility Association (ASOMOEDO) created in 2018 and whose mission is to promote and encourage the development of this sector in the country. Through the efforts of the non-profit organization, it has managed to integrate the public and private sectors to achieve foundations that allow the development of electric mobility by promoting a sustainable and competitive market.

The Dominican Republic's Strategic Plan for Electric Mobility is based on four fundamental axes:

1. The legal and regulatory framework, which seeks, in the first instance, to gather information at the institutional level to identify their current status, establish tariffs for the services that merit it, and overcome the deficiencies of the installers.
2. Infrastructure, which promotes optimal access to existing and future charging stations, a diversity of electric vehicle charger options, assessing demand and establishing the necessary resources to strengthen the networks.
3. Electric vehicles, which seeks to increase the number of electric vehicles over several time periods and gradually towards a target of 30% of the vehicle fleet by 2030.
4. Institutional and professional capabilities, with the aim of laying the necessary foundations to respond to the diverse needs that may arise in the area of electric mobility.

The objectives pursued by INTRANT's electric mobility strategy are to achieve the massification of the collective use of renewable energy vehicles, so as to reduce GHG emissions while decreasing the import of petroleum-based fuels. A second objective refers to the promotion of the participation of new actors through the elimination of regulatory obstacles that affect this process by working hand in hand with legislative entities to adapt existing laws or promote the implementation of new regulations, as the case may be. Providing the population with charger infrastructure is another of the goals that this plan seeks to achieve, also looking for this infrastructure to have the characteristics of sustainability that the rest of the electric system has promoted. Coordinating institutions and mutual support among them, motivating dialogue and taking advantage of the capabilities of the public and private sectors becomes the fifth objective to be achieved by this plan. As a last objective, to promote the impulse to technological transformation to finally fulfill the introduction of electric vehicles for both the public and private sectors.

The specific goals for each of the axes pursued through the plan are divided into some specific short-term actions, to be fulfilled between 2020 and 2022, and medium-term actions, to be fulfilled between 2023 and 2025. Among these goals are those aimed at the regulatory framework, which include goals such as the resolution requiring the formal registration of charging stations, tariff schedules for electric vehicles, and defining the technical inspection and road safety protocols relevant to electric vehicles. In the medium term, other goals are outlined such as the definition of regulations for the labeling of electric vehicles, the management of waste from electric vehicles, the creation of regulations regarding construction aspects, and the municipal decree establishing restrictions on traditional combustion vehicles.

Regarding the axis that will work on professional and institutional capacities, some of the short-term goals are the creation of an inter-ministerial committee, as well as a technical unit to carry out surveys of relevant information on electric mobility in the country, and training of rescue units to handle incidents involving electric vehicles. In the medium term, a plan will be pursued to reduce processing times for the import management of electric vehicles, and finally to introduce in the academy programs aimed at relevant skills in electric mobility.

A the strategic plan has clear short and medium term goals of introducing 30% of official vehicles by 2030, while the private sector is targeting 10% of the vehicle fleet. Public buses will also make up 30% of the national fleet in electric mode, and private company vehicles will account for 10% of the total by that year. The goal in terms of charging infrastructure is to establish 14 thousand charger units of different characteristics nationwide.

The goals for the year 2050 would mean 100% of the vehicle fleet for government use, 70% for the private sector, 100% for public buses, 50% for private sector freight vehicles and some 150,000 charger units throughout the national territory of the Dominican Republic.

The stakeholders identified as relevant for the electric mobility project in the Dominican Republic have been grouped into the two main sectors, the public sector and the public-private sector, as shown in the table below.

Table 5: Relevant E-Mobility Actors

Public Sector	Public-Private Sector
Ministry of Energy and Mines / National Energy Commission	Electricity Generators
Ministry of Tourism	Electricity Distributors
Ministry of Public Works	Commercial Banking
Ministry of Planning and Development	Trade Associations
Ministry of Environment	Vehicle Marketing Companies
INTRANT	FIMOVIT
Ministry of Public Administration	
Dominican Institute of Quality	

Source: INTRANT

Article 9 of Law No. 63-17 on Mobility, Land Transport and Road Safety of the Dominican Republic provides that INTRANT will be in charge of drafting policies on mobility.

As has been presented, the Dominican Republic has had Law 103-13 on Incentives for the Importation of Non-Conventional Energy Vehicles since 2013. However, in August 2020, representatives of the Dominican Congress received from entities such as Zero Emission RD and ASOMOEDO the request to review the correct application of this law because the tax benefit granted to electric vehicles that are imported are then taxed by the DGII as luxury vehicles [21] (Gómez, 2020) This means that, for the buyer, the economic benefit that could mean buying an electric vehicle, is dismissed by having to pay a higher tax burden for this *impasse*. Although the law has existed since 2013, it is from 2018 when it begins to further encourage the application in imports, so these drawbacks are kept in talks between the parties to reach an agreement that will benefit and further promote electric mobility in the Dominican Republic. In comparison, a conventional vehicle increases its value by 56% thanks to import taxes, contrary to the 28% that is stipulated for electric vehicles, however, electric vehicles remain in a higher price range for the reasons stated above.

At present, although it is part of the DR's Strategic Plan on Electric Mobility, a tariff has not been formally established to regularize charges at recharging points (INTRANT, 2020), with prices that correspond to real costs and further motivate the switch to electric mobility when compared to traditional fuels.

[21] https://www.eldinero.com.do/114324/republica-dominicana-tiene-alrededor-de-1327-unidades-de-vehiculos-electricos/#:~:text=From%20your%20side%2C%20the%20president,1%2C327%20units%20in%20the%20streets.

Among the efforts that have been made in recent years are the financing facilities for alternative energy vehicles. Commercial banks offered, as of May 2020, six-year term loans with an interest rate of 8.76%, with the customer contributing 20% as the initial amount of the vehicle's value. It is now common to find vehicle sales fairs that encourage and accommodate users in the purchase of alternative energy vehicles such as electric vehicles.

Private insurance companies now offer specific coverage plans for these vehicles, in addition, the Dominican Republic also has some service centers already authorized to offer maintenance and support to electric vehicles on the market. Of 15 insurance companies present in the country, five offer policies for electric vehicles, and six of them offer basic insurance for electric vehicles.

There is currently no battery management policy in the Dominican Republic, but this section is among the lines of action and objectives that will be worked on through the country's Strategic Plan for Electric Mobility (INTRANT, 2020).

4 Electric Mobility System

Charging Facilities

By the end of 2020, according to an article in El Dinero, Interenergy Systems Dominicana has been responsible for the installation of the 150 charging stations that are currently serving the transport sector and at the same time promoting its technology platform and EverGo brand. These installations have been done hand in hand with Dominican brands and companies that support electric mobility policies in the country. 48 chargers are available to the public generally in commercial or institutional spaces, while an additional 45 have been installed in residential areas. Among the stations considered as open access, there are premises or institutions that provide the charging service free of charge to their customers and employees, such as restaurants, shopping malls, supermarkets, stores, commercial banks, among others. Strategic alliance initiatives seek to achieve the goal of 500 chargers installed throughout the Dominican Republic by the end of 2021.

Map 1: location of EV Chargers

Source: PlugShare

On the other hand, the electric vehicle importer Sertel S.A. and its representation as Zero Emission RD have available to users the sale of chargers for residential purposes for all those who want their own charging point when acquiring an electric vehicle.

Regarding a regulatory framework for recharge service providers, the methodology to manage the rates and charges for this service is still under inter-institutional debate, since it must be defined

whether the charge represents a sale of electricity or if it is a service that uses the raw material of electric energy. In 2019, a draft bill for the energy efficiency law was submitted to Congress, which proposed the standardization of this service in addition to the inclusion of a paragraph where certification by the Dominican Institute of Quality (INDOCAL) is encouraged for the correct calibration of all chargers installed in the territory, as is currently done with conventional fuel dispensers. This draft bill was discarded from the final bill and, to date, these issues are still under discussion between the parties, studying comparable cases of other countries in the region that already have defined regulations for refueling stations and their respective regulation.

According to the Strategic Plan for Electric Mobility, there are no rules or regulations in the country that define the guidelines to be followed by the companies that provide electric charging services, in terms of safety, installation, quality, which can be an obstacle for companies that are motivated to create and import charging points to the national territory. There are international regulations from which the Dominican sector can take the first steps to follow with respect to this issue, and take into account some determining factors such as the interoperability of the service charging platforms, operational safety for users, compatibility of the energy network with the chargers to be imported, power limits, loads and protections of the power lines of the public network.

As for current rates, the PlugShare[22] portal indicates in its real-time charger location map that, in the country, the costs of using the charging stations currently installed vary if it is a fast charger Level 3, costing RD$573.48/hour (USD$11.80/hour) while a fast charger Level 2, costs RD$127.48/hour (USD$2/hour). These hourly rates have been defined by the suppliers, in the absence of an official regulation that establishes the amounts and the format for charging the energy and the service provided to the users. Once these rates are defined and regulated, incentives for the creation of charging infrastructure, charging schedules with preferential prices, and incentives for the generation of electricity through alternative and sustainable systems can also be defined.

EVs in the Domincan Republic

According to the Dominican organization Zero Emission RD, an entity dedicated to the import, support and promotion of electric mobility, as of 2019, the distribution of electric vehicles by type is accounted for as follows; as of 2019, 56 light vehicles, 1 electric truck, and 1 electric tractor had been imported into the Dominican. According to the report, the brands currently present in the Dominican market are Nissan, with its Leaf model being the most common with 70% representation, Hyundai with 15% of the electric vehicle fleet, Tesla, with 12% and Chevrolet and Kia with 2% and 1% respectively. According to data obtained from the Dirección General de Impuestos Internos (DGII), the most popular brands of electric motorcycles are Motoneo, with 70% of the total number of units, TAILG with 15%, Loncin with 12% and other brands with 2%.

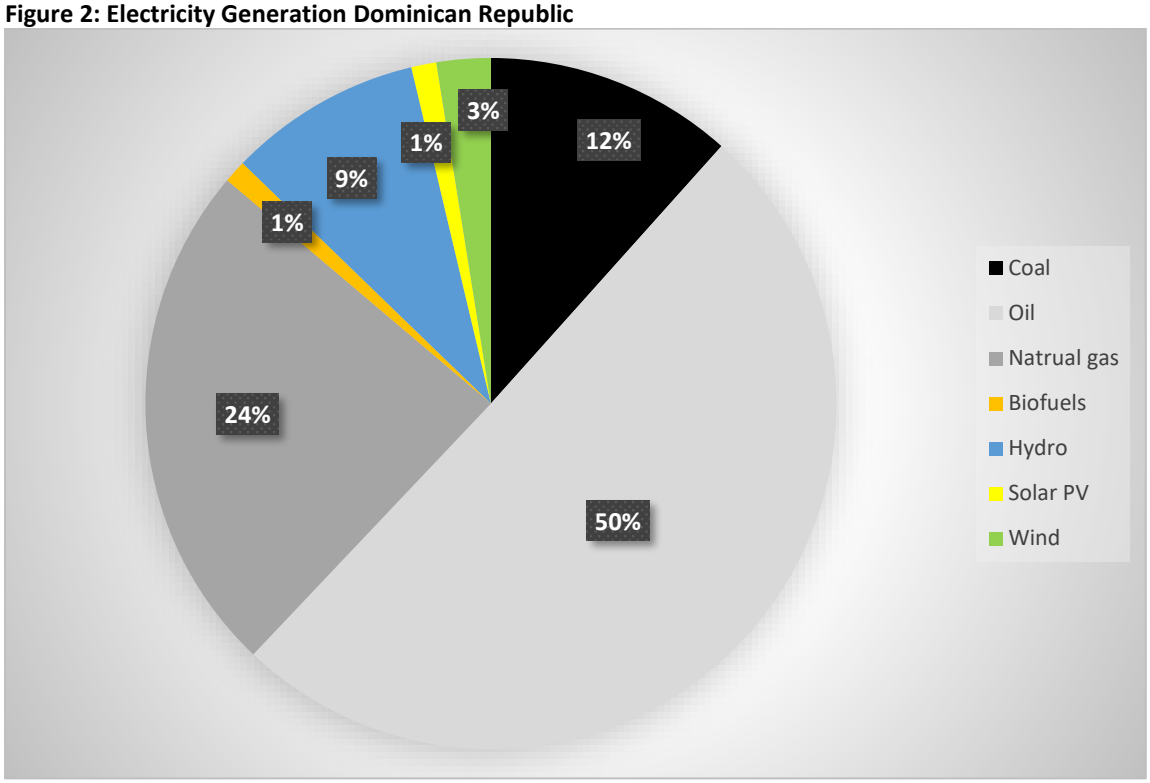
5 Power Sector

5.1 Electricity Generation

In 2018 the share of renewables in total electricity generated was around 15% (see following figure). Oil, natural gas and coal are the main generation sources.

[22] https://www.plugshare.com/location/194490

Figure 2: Electricity Generation Dominican Republic



Source: IEA database

The Dominican Republic has abundant solar and wind resources. 26 Micro-hydropower also offers some remaining potential in certain parts of the country (IRENA, 2016). The projected growth of electricity consumption is estimated at 3.2% annually (Comision Nacional de Energia, 2014) (however, the actual consumption figure of 2018 already surpasses the projected 2020 consumption figure i.e. the growth rate seem sub-estimated).

5.2 Grid Factor

The carbon emission factor of the grid is calculated based on national data. The latest available grid factor is used. The actual grid factor is taken and not the grid factor used by UNFCCC methodologies based primarily on the Combined Margin (CM). The UNFCCC approach using the CM is not applied as former was designed primarily for renewable energy projects trying to capture what type of electricity would be displaced from more GHG intensive means[23]. It is a tool designed for energy supply and not energy demand projects. The CM does not reflect actual GHG emissions of the electric grid and in some cases can be far off actual emissions due (i) non-inclusion of low-cost/must-run (LCMR) resources defined as power plants with low marginal generation costs or dispatched independently of the daily or seasonal load of the grid including primarily hydro, geothermal, wind, low-cost biomass, nuclear and solar generation and (ii) the non-inclusion of CDM projects in the CM. Especially the non-inclusion of LCMR resources result in misleading results.

Following values are used for the grid factor of the Dominican Republic (all year 2018, IEA database):

- Total electricity generation: 19,651 GWh
- Electricity losses: 2,549 GWh
- GHG emissions from electricity generation: 10,995,900 tCO_{2e}

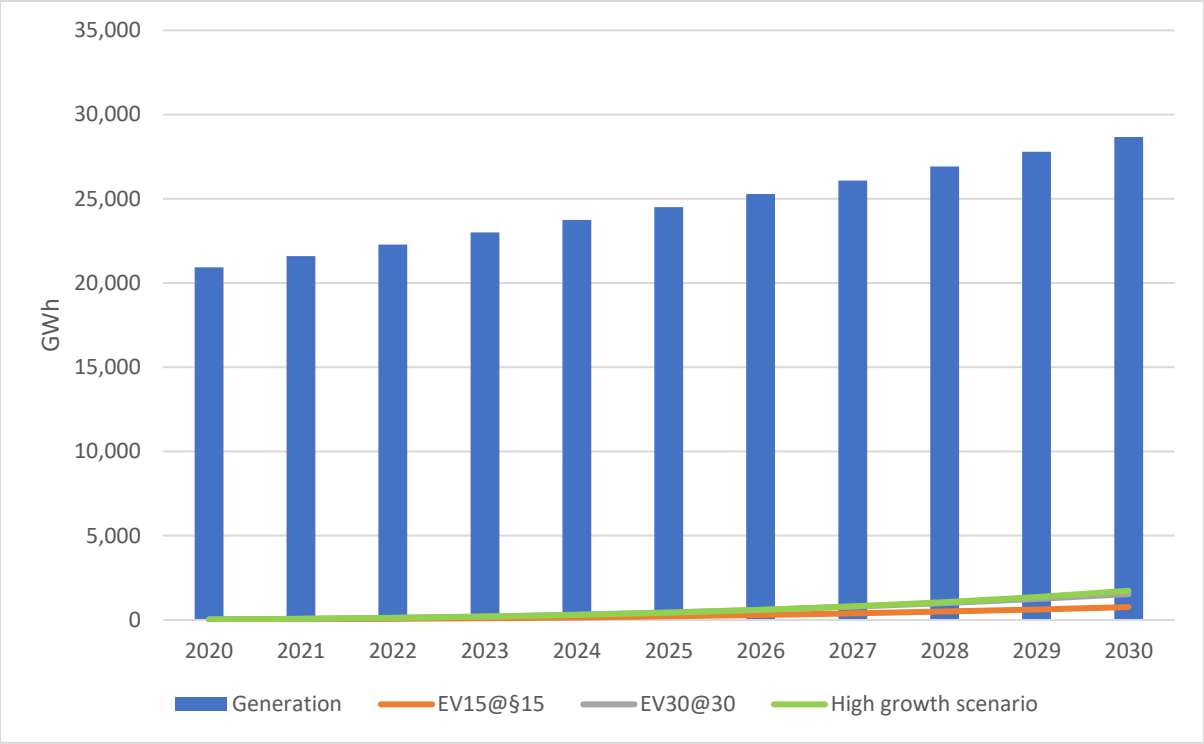
[23] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v6.pdf

The carbon factor of the electricity grid of the Dominican Republic is therefore: **0.643 kgCO_2/kWh**[24].

5.3 Electricity Demand from EVs

The following figure shows the projected electricity demand from EVs based on the three scenarios and the projected electricity consumption of the Dominican Republic.

Figure 3: EV Electricity Demand vs Total Projected Electricity Consumption Dominican Republic 2020-2030



Source: Grutter Consulting

The 2030 electricity demand of EVs represents 3% of projected electricity generation for the EV15@30, 5% for the EV30@30, and 6% for the high growth scenario. Annual consumption increases excluding EVs in the 2020 to 2030 are 3.2%. The EV demand increase is very gradual and thus leaves enough time to the country to plan a production expansion required however only in a decade from

6 Road Transport Emissions

6.1 Introduction

2018 around 4.3 million vehicles were circulating in the country.

The modification of resolution 132-15 of January 6th 2016 establishes a maximum sulfur contents of premium diesel of 15ppm and of regular diesel of 7,000 ppm[25]. Vehicles manufactured prior 2011 have to comply with the vehicle emission standard Euro 2/II and after 2011 with the standard Euro 4/IV[26] with exception of motorcycles for which only the Euro 2 standard is required. PM10 measurements made in Santo Domingo show that WHO annual standards are surpassed (Centro Mario Molina, 2017).

[24] GHG emissions / net production
[25] Resolucion 2016-001.pdf (mic.gob.do)
[26] REGLAMENTO-TÉCNICO-AMBIENTAL-FUENTES-MOVILES.pdf (ambiente.gob.do)

6.2 Road Transport Emissions 2018

The following table shows registered vehicles of the Dominican Republic as of 2018.

Table 6: Registered Vehicles Dominican Republic 2018

Vehicle category	Gasoline	Diesel	LPG	Total
Passenger car incl. Jeeps	795,102	130,308	389,853	1,315,263
Taxi			27,635	27,635
Motorcycle	2,398,511			2,398,511
small bus		4,135	8,040	12,175
standard urban bus		1,197		1,197
Coach/tourist bus		88,815		88,815
LCV	43,203	65,663	21,020	129,886
Truck < 7.5t		206,070		206,070
Truck 7.5-16t		45,741		45,741
Truck 16-32t		45,741		45,741
Truck >32t		20,746		20,746

Source: INTRANT database

No significant number of 3-wheelers operate in the country. Urban buses include basically standard 12m units. The Dominican Republic operates a significant number of LPG vehicles, especially cars, pick-ups, Jeeps and small buses.

The following table summarizes core assumptions on milage and fuel consumption used for calculations[27]. The average vehicle emission standard assumed for 2018 emissions is Euro 2/II in accordance with the national regulations (Euro 4 is only required for vehicles since 2011, which represent less than 50% of vehicles operating in the country)

Table 7: Main Parameters Used for Emission Calculations 2018

Vehicle Category	Fuel Used	Specific fuel consumption (g/km)	Annual mileage (km)
Passenger car	Gasoline	66	10,000
	Diesel	55	10,000
	LPG	57	15,000
Taxi	LPG	57	45,000
Motorcycles	Gasoline	36	5,000
small bus	Diesel	152	30,000
	LPG	196	30,000
standard urban bus	Diesel	405	45,000
Coach / tourist bus	Diesel	247	10,000
LCV	Gasoline	70	20,000
	Diesel	80	20,000
	LPG	57	20,000
Truck < 7.5t	Diesel	101	10,000
Truck 7.5-16t	Diesel	155	10,000
Truck 16-32t	Diesel	210	10,000
Truck >32t	Diesel	251	10,000

Source: Fuel consumption: (EEA, 2020) Tier 2 approach for vehicles > Euro 1/I; distance driven calibrated with total diesel/gasoline/LPG fuel consumed based on INTRANT/BEN. Mileage of vehicles is in certain categories very small which is an indication of a large share of vehicles registered which are not anymore operational or only operational with a very low mileage.

[27] Fuel consumption is the base for calculation of GHG emissions using for tank-to-wheel (TTW) calculations the fuel consumed, Net Calorific Value and the CO_2 Emissions factor and for well-to-wheel (WTW) calculations an upstream mark-up for fuel extraction, refinery and transport plus the GHG emissions caused by Black Carbon.

The following table shows estimated 2018 road transport emissions for the Dominican Republic. The model has been calibrated with actual transport fuel consumed by the country based on BEN with a difference between top-down actual fuel consumption and the modelled bottom-up consumption of ± 2% for gasoline and LPG and 4% for diesel.

Table 8: Estimated 2018 Road Transport Emissions

Vehicle category	NO_x	$PM_{2.5}$	CO_2 TTW	CO_2 WTW	Energy in TJ
Passenger car	4,013	218	2,834,240	3,374,339	42,095
Taxi	224	27	211,562	238,384	3,353
Motorcycles	3,802	42	1,325,413	1,586,685	19,126
small bus	156	26	201,258	244,801	4,199
standard urban bus	576	12	69,531	92,455	938
Coach	7,949	147	698,988	945,484	9,433
LCV	470	165	591,961	824,379	8,331
Truck < 7.5t	7,192	126	663,167	889,231	8,950
Truck 7.5-16t	2,516	48	225,902	305,687	3,049
Truck 16-32t	3,618	71	306,060	417,929	4,130
Truck >32t	1,942	40	165,918	227,624	2,239
Total	**32,457**	**920**	**7,294,000**	**9,147,000**	**105,843**

Source: Grutter Consulting; for details of modelling data see Annex 1

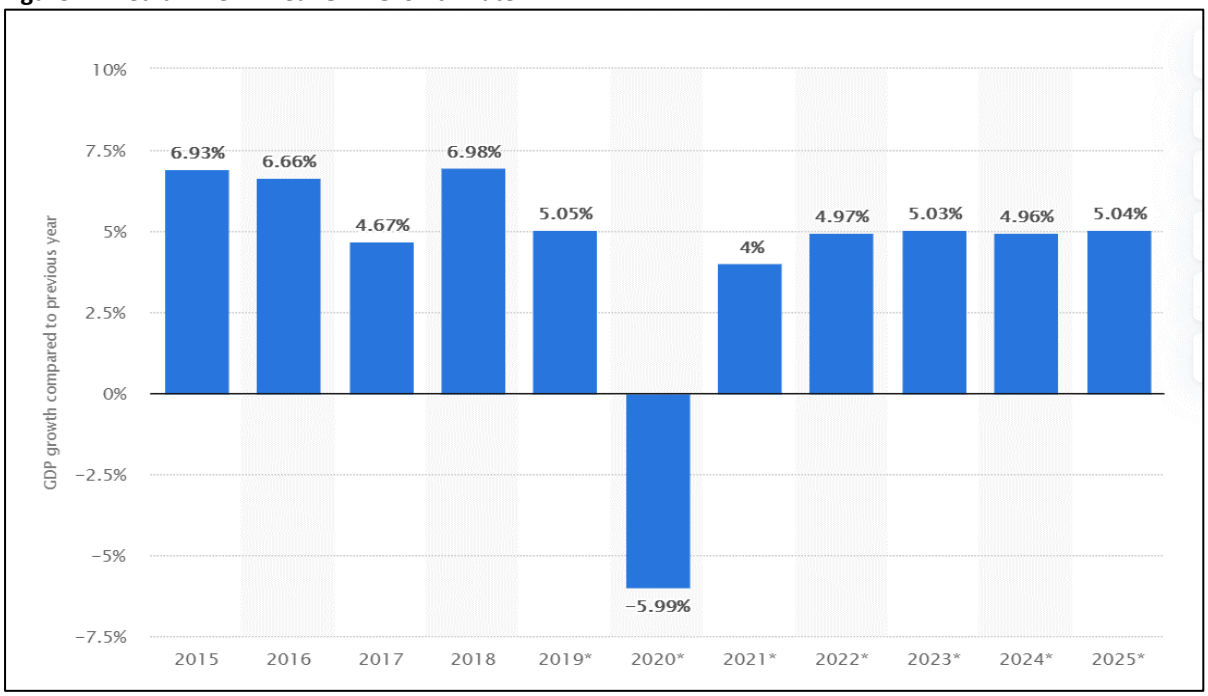
Road transport GHG emissions of the Dominican Republic TTW in 2018 were 7.3 million tCO_{2e}. WTW GHG emissions are 9.1 million tCO_{2e} – these reflect the GHG emissions caused directly and indirectly by the road transport sector of the country. The economic costs of road transport emissions for 2018 are estimated at 560 MUSD of which 370 MUSD due to GHG emissions and the rest due to local pollutants.

Taxis represent in 2018 around 3% of GHG emissions, buses 14% and LCVs 10%. Noteworthy is also that the mentioned commercial vehicles represent 40% of $PM_{2.5}$ and 30% of NO_x emissions of the transport sector due to being primarily diesel vehicles whilst passenger cars and motorcycles used by private persons are predominantly gasoline and LPG powered.

6.3 Projected 2030 Road Transport Emissions

For 2030 projections an elasticity or growth factor per vehicle category was determined. The following graph shows the projected medium-term GDP growth rate in real terms of the Dominican Republic including the recent COVID-19 impact followed by a table showing data relevant for calculation of the projected vehicle numbers in the country.

Figure 4: Medium Term Real GDP Growth Rate



Source: Statista

Table 9: Parameters for Projection of Vehicle Numbers and Emissions

Parameter	Value	Source/Explanation
CAGR population growth 2020-2030	0.7%	ONE projections
CAGR GDP real growth 2019-2030	4.3%	Statista CAGR 2020 to 2025 with assumed constant values 2025 to 2030
CAGR freight transport growth rate	2.0%	Freight intensity of 0.98[28] based on income per capita 2030 (PPP) of 8,280 USD using 2019 data from the World Bank and the real GDP growth rate
CAGR cars, motorcycles, taxis	6.2%	Based on Gomperz function with α of -4.32 and β of -0.000138 with a saturation level of 590 vehicles per 1,000 population[29]
CAGR buses	0.7%	Based on population growth (increased trip numbers but decreasing public transport mode share)

Vehicle growth rates per vehicle category are used to model vehicle numbers for 2030. The average emission level assumed for 2030 is Euro 4/IV. The mileage of vehicles is kept constant. The following table shows projected 2030 road transport emissions of the Dominican Republic.

[28] Freight intensity rates based on groupings realized by (OECD, 2017), table 2-4
[29] Saturation level based on Japanese pattern (Tian, 2014); parameters calculated by Grutter Consulting

Table 10: Projected 2030 Road Transport Emissions

Vehicle category	NO_x	$PM_{2.5}$	CO_2 TTW	CO_2 WTW	Energy in TJ
Passenger car	3,214	115	5,808,362	6,869,859	86,268
Taxi	143	3	433,565	488,534	6,871
Motorcycles	4,768	86	2,716,240	3,251,680	39,195
small bus	738	11	220,006	258,336	3,332
standard urban bus	319	3	69,674	87,535	940
Coach	4,388	34	764,103	963,046	10,312
LCV	1,484	70	750,750	958,141	10,565
Truck < 7.5t	4,286	28	841,056	1,053,198	11,350
Truck 7.5-16t	1,537	9	286,498	358,697	3,866
Truck 16-32t	2,222	14	388,158	486,793	5,238
Truck >32t	1,213	7	210,425	263,582	2,840
Total	**24,312**	**380**	**12,488,837**	**15,039,402**	**180,779**

Source: Grutter Consulting; for details of modelling data see Annex 1

TTW emission from the transport sector are expected to grow under a BAU scenario by more than 70% reaching 12.5 million tCO_2 by 2030 (15 million tCO_{2e} with a WTW approach). Emissions from PM2.5 and NOx are expected to decrease due to higher emission standards. The economic costs of road transport emissions for 2030 are estimated at 700 MUSD of which 600 MUSD due to GHG emissions and the rest due to local pollutants i.e. compared to 2018 the cost of local pollutants is decreased due to reduced emissions whilst the cost of GHG emissions is increasing.

7 EV Scenarios

4 different EV scenarios have been constructed which are contrasted with the BAU scenario:

- EV30@30: The EV30@30 scenario of IEA has as target that 30% of all vehicles sold in 2030 are electric. The scenario is built on newly purchased vehicles (and not the stock of vehicles) in line with IEA scenarios (IEA, 2019). In addition to the IEA also motorcycles and trucks <7.5t are included with the same EV penetration rates.
- EV15@30: The moderate EV scenario is based on the "EV new policies scenario" which has as target for 2030 15% instead of 30% EV share. The same approach is used as for EV30@30.
- National scenario based on national EV targets (INTRANT, 2020).
- EV “high growth” scenario focusing on the potential for commercial vehicles targeted by the e-mobility fund with an EV target of 100% of new registered vehicles for these categories by 2030. In all other vehicle categories the EV30@30 scenario has been chosen.

The number of vehicles to be newly registered per annum is the sum of additional vehicles (due to vehicle growth) and replacement vehicles. The following table shows the average lifespan of vehicles and the average annual replacement rate of the fleet as used for projections.

Table 11: Assumed Average Lifespan and Replacement Rate per Vehicle Category Dominican Republic

Vehicle category	lifespan in years	% replaced per annum
Passenger car	20	5%
Taxi	20	5%
Motorcycles	10	10%
small bus	20	5%
standard urban bus	20	5%
Coach	20	5%
LCV	20	5%
Truck < 7.5t	20	7%
Truck 7.5-16t	20	7%
Truck 16-32t	20	7%
Truck >32t	20	7%

Source: authors assumption

EV 15@30 and 30@30 Scenarios

The following table shows the modelled share of EVs as total of new registered vehicles from 2020 to 2030.

Table 12: EV Rates of Newly Registered Vehicles

Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
EV15@30	3%	3%	4%	5%	7%	9%	10%	11%	12%	14%	15%
EV30@30	5%	6%	8%	11%	14%	18%	20%	22%	24%	27%	30%

Source: Grutter Consulting based on IEA scenarios

EV National Scenario

On a national level absolute EV targets have been formulated for 2030 (and for 2050) (INTRANT, 2020):

- 240,000 electric cars (of which 60,000 public vehicles);
- 312,000 electric motorcycles (of which 145,000 public units);
- 37,000 electric buses;
- 17,000 electric LCVs.

The absolute targets have been translated into annual shares of sales of EVs maintaining the absolute target as of 2030. The following table shows how the absolute target was transformed to annual vehicle sales share targets.

Table 13: Calculated EV Rates of Newly Registered Vehicles for National EV Targets

Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cars	0%	0%	1%	2%	5%	10%	12%	14%	16%	18%	20%
Motorcycles	0%	0%	1%	2%	3%	4%	6%	8%	10%	12%	14%
Buses	0%	0%	5%	30%	60%	90%	100%	100%	100%	100%	100%
LCVs	0%	0%	1%	2%	5%	8%	12%	17%	25%	35%	50%

Source: Grutter Consulting based on (INTRANT, 2020); for buses applied to “coach units”

EV High Growth Scenario

The share of newly registered EVs for the selected vehicle categories in the high growth scenario is shown below.

Table 14: Share of EVs of Newly Registered Vehicles "High Growth Scenario"

Vehicle Category	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Taxis	0%	4%	4%	8%	14%	22%	32%	45%	61%	79%	100%
Urban Buses	0%	11%	4%	8%	14%	22%	32%	45%	61%	79%	100%
Small buses	0%	8%	4%	8%	14%	22%	32%	45%	61%	79%	100%
LCVs	0%	3%	4%	8%	14%	22%	32%	45%	61%	79%	100%

Source: For urban buses, taxis and LCVs the target is that 100% of new registered buses/taxis/LCVs in 2030 are electric; This takes into consideration that EVs in this segment should be cost-competitive by 2030. No early replacement of vehicles is made i.e. conventional vehicles could still be used until ending their lifespan. The growth curve towards 2030 is based on a power curve with the function y=0.0024*n^2.52 based on the curve of Norway for the last 10 years. Initial experiences are built and cost structures go down. Barriers are removed and financial equivalence will be achieved. The vehicle penetration rates increases then (for new vehicles)

For other vehicle categories no specific scenario is made but the value from EV30@30 is taken.

Scenario Results

The following table shows the results in terms of GHG reduction against the BAU scenario of no EVs as well as the additional electricity consumption due to EVs with the different scenarios. Scenarios do not include electric trucks > 7.5t as no massive penetration of such trucks can be expected.

Table 15: Scenario Results

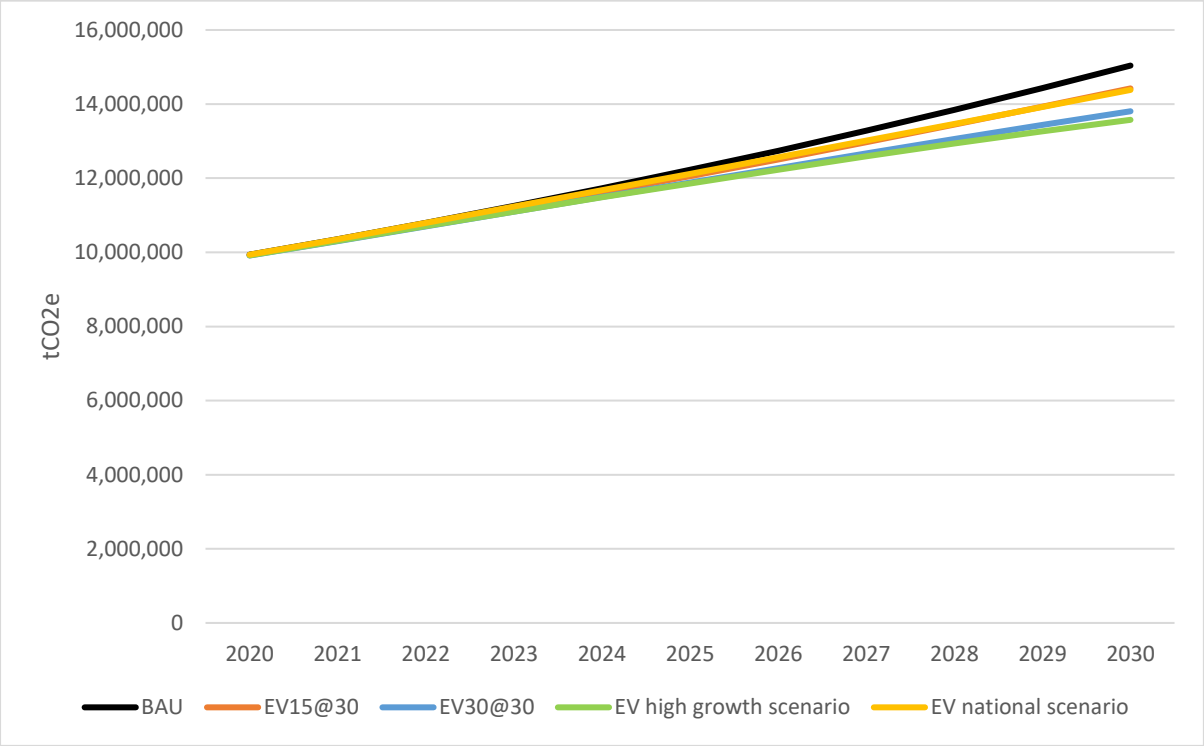
Impact	Scenario	By 2025	By 2030
GHG reduction WTW in tCO_{2e} per annum	IEA 15@30	170,000	620,000
	IEA30@30	340,000	1,230,000
	National scenario	110,000	660,000
	"High growth" scenario	360,000	1,460,000
Electricity demand of EVs in GWh per annum	IEA 15@30	220	770
	IEA30@30	440	1,540
	National scenario	180	910
	"High growth" scenario	440	1,730

Source: Grutter Consulting, see Annex for further details

The growth of electricity demand is discussed in chapter 5.

The most ambitious scenario (EV high growth scenario) would result in a 9% reduction of GHGs relative to the baseline. As of 2030 no scenario results in a trend change allowing to reduce GHG emissions of the road transport sector in 2030 below those of 2018. This is not unsurprising due to the relatively high carbon grid factor of the country. The figure below shows the slow reaction of GHG emission reductions of the sector due to long permanence of vehicles once purchased. The introduction of EVs takes a long time to reduce in absolute terms GHG emissions of the transport sector as vehicle growth still occurs and as vehicle replacement rates are relatively low i.e. it takes time to achieve a large stock and therefore large impact of EVs. This highlights the importance of early actions. Waiting 5-10 years more until the market has evolved without support will result in a 5-10-year time lag of GHG reductions and thus non-attainment of climate targets.

Figure 5: Projected GHG Transport Emissions Ecuador BAU and with EV Scenarios (WTW)



Source: Grutter Consulting

The following tables shows the potential GHG reduction which is possible to achieve for the targeted vehicle sectors.

Table 16: Projected GHG Reductions for Taxis "High Growth Scenario"

Taxis High Potential	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all taxis	31,146	33,065	35,102	37,265	39,561	41,999	44,587	47,334	50,250	53,347	56,634
Replacement taxis	1,467	1,557	1,653	1,755	1,863	1,978	2,100	2,229	2,367	2,513	2,667
Additional new taxis	1,808	1,919	2,037	2,163	2,296	2,438	2,588	2,747	2,917	3,096	3,287
EV taxi fleet new	0	200	141	309	576	969	1,516	2,254	3,220	4,457	5,954
EV taxi fleet stock	0	200	341	651	1,227	2,195	3,712	5,966	9,185	13,643	19,597
EV taxi as % of stock	0%	1%	1%	2%	3%	5%	8%	13%	18%	26%	35%
GHG reduction WTW in tons	0	1,130	1,927	3,675	6,930	12,402	20,968	33,700	51,888	77,068	110,704
Electricity demand GWh	0.0	1.6	2.8	5.3	9.9	17.8	30.1	48.3	74.4	110.5	158.7

Source: Grutter Consulting

Table 17: Projected GHG Reductions for Small Buses "High Growth Scenario"

Small Bus Potential scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	12,357	12,449	12,542	12,635	12,729	12,824	12,920	13,016	13,113	13,211	13,309
Replacement vehicles	613	618	622	627	632	636	641	646	651	656	661
Additional new vehicles	91	92	93	93	94	95	96	96	97	98	98
EV vehicle fleet new	0	50	27	57	101	160	238	336	456	599	759
EV vehicle fleet stock	0	50	77	134	235	395	634	970	1,425	2,024	2,783
EV fleet as % of stock	0%	0%	1%	1%	2%	3%	5%	7%	11%	15%	21%
GHG reduction WTW in tons	0	272	421	730	1,278	2,150	3,447	5,276	7,755	11,013	15,142
Electricity demand GWh	0.0	0.8	1.3	2.3	3.9	6.6	10.6	16.3	23.9	34.0	46.8

Source: Grutter Consulting

Table 18: Projected GHG Reductions for Urban Buses "High Growth Scenario"

Urban bus high growth scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	1,215	1,224	1,233	1,242	1,252	1,261	1,270	1,280	1,289	1,299	1,309
Replacement vehicles	60	61	61	62	62	63	63	64	64	64	65
Additional new vehicles	9	9	9	9	9	9	9	9	10	10	10
EV vehicle fleet new	0	50	3	6	10	16	23	33	45	59	75
EV vehicle fleet stock	0	50	53	58	68	84	107	140	185	244	319
EV fleet as % of stock	0%	4%	4%	5%	5%	7%	8%	11%	14%	19%	24%
GHG reduction WTW in tons	0	1,898	2,000	2,213	2,588	3,187	4,076	5,331	7,032	9,267	12,099
Electricity demand GWh	0.0	2.3	2.4	2.6	3.1	3.8	4.8	6.3	8.3	11.0	14.3

Source: Grutter Consulting

Table 19: Projected GHG Reductions for LCVs "High Growth Scenario"

LCV Potential	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	135,133	137,836	140,593	143,405	146,273	149,198	152,182	155,226	158,330	161,497	164,727
Replacement vehicles	6,624	6,757	6,892	7,030	7,170	7,314	7,460	7,609	7,761	7,917	8,075
Additional new vehicles	2,650	2,703	2,757	2,812	2,868	2,925	2,984	3,044	3,105	3,167	3,230
EV vehicle fleet new	0	50	369	777	1,391	2,246	3,378	4,825	6,622	8,808	11,305
EV vehicle fleet stock	0	50	419	1,196	2,587	4,833	8,211	13,036	19,658	28,466	39,770
EV fleet as % of stock	0%	0%	0%	1%	2%	3%	5%	8%	12%	18%	24%
GHG reduction WTW in tons	0	127	1,067	3,045	6,586	12,303	20,904	33,186	50,043	72,466	101,245
Electricity demand GWh	0.0	0.2	1.7	4.8	10.3	19.3	32.8	52.1	78.6	113.9	159.1

Source: Grutter Consulting

The following table shows key figures for the potential EV scenario in terms of number of electric vehicles, the GHG impact and the vehicle investment volume.

Table 20: Key Figures Commercial Vehicles EV "High Growth Scenario"

Parameter	Taxis	Small Buses	Urban Buses	LCVs	Total
EV stock year 2025 (share)	2,200 (5%)	400 (3%)	80 (7%)	4,800 (3%)	7,500
EV Stock year 2030 (share)	20,000 (35%)	2,800 (21%)	320 (24%)	40,000 (18%)	62,000
GHG impact year 2025 tCO_2	12,400	2,200	3,200	12,000	30,000
GHG impact year 2030 tCO_2	111,000	15,000	12,000	101,000	239,000
$PM_{2.5}$ reduction year 2030 (tons)	1	2	1	17	21
NO_x reduction year 2030 (tons)	49	154	78	358	640
Savings emission costs in 2030 (MUSD)	5	1	1	8	15
Emissions savings excl. GHG in 230 MUSD	0	1	0	4	5
Vehicle CAPEX 2025 cumulative in MUSD	130	30	18	110	289
Vehicle CAPEX 2030 cumulative in MUSD	418	178	60	832	1,487

Note: Constant real USD of 2020; vehicle values based on 2020 average values and annual reduction rate for each vehicle category based on market trends; see Annex for further details
Source: Grutter Consulting

By implementing this strategy the Dominican Republic would have around 60,000 commercial EVs by 2030 reducing around 240,000 tons of CO_2 per annum. The main impact is from taxis and LCVs. The estimated cumulative vehicle investment required by 2025 is around 290 million USD and 1,490 million USD by 2030. This excludes the investment required for chargers, grid upgrades or other investments e.g. in depot facilities. This is not the incremental investment for EVs relative to the BAU investment for fossil vehicles but the total required vehicle investment i.e. also in absence of an EV strategy a large part of this investment will take place, but in fossil units and not in EVs.

8 Enablers and Barriers

In the Dominican Republic, we have been able to describe a favorable climate for the implementation of electric vehicles and clean energy. Some of the main obstacles encountered in the different sources are:

- The lack of a regulatory framework that covers the entire production and commercialization chain of electric vehicles. This means the lack of definition of incentives and benefits to all those involved in the manufacturing and service process, up to the import and the end user.
- Lack of regulation regarding the charging infrastructure and the billing system for the companies supplying this service. This is due to the fact that the resale of electric energy is prohibited in the country, so it is imperative to define the method of charging the companies.
- The Dominican Republic has compared to other Latin American countries relatively high electricity prices, making usage of EVs less attractive.
- The electricity production is dominated by fossil sources resulting in a relatively high carbon grid factor of the country. EVs still reduce GHG emissions but have less climate impact than in most other Latin American countries.
- The cost of vehicles: The high price of vehicles available in the market, due to the current high import and commercialization prices, is one of the predominant factors for users not to change from a traditional combustion vehicle to an electric one.
- Maintenance of EVs: In the Dominican Republic there are still not enough dealerships approved by the parent companies to offer the necessary services for the maintenance of the vehicles, as well as repairs to any of the parts in case of defects, damage or collisions. There are not many professionals and technicians in the country with the necessary knowledge and experience to provide services to users who require specialized labor in electric vehicle knowledge.
- Electricity Distribution Network: Lack of regulations and policies to incorporate investments for improving electricity distribution networks that supply fast and ultra-fast charging facilities.
- Charging Infrastructure Investment: Incentives for the investment recovery of installing charging stations are non-existent.

Similarly, as presented, the country offers a generalized climate of support for EVs including:

- Existing laws. The various proposals to support sustainability, the tax incentive law, the law to support renewable energies represent an ideal legislative framework to implement any new project in the electric vehicle sector.
- Bills in process. It is also important to highlight the bills or regulatory frameworks that are currently under discussion, both in inter-institutional working groups and in the national congress. Discussions such as battery management, tariff unification and tax incentives and management are decisive in supporting clean energy projects in the transport sector.
- INTRANT Strategic Plan. The fact that the existence and circulation of the INTRANT's Strategic Plan for Electric Mobility has made its appearance in the Dominican Republic demonstrates the political will of more than one sector interested in making a substantial change in the country's land transport system. It has been an effort between parties ranging from the National Energy Commission as a major transformation of multimodal public transport in cities such as Santo Domingo.

References

INDC-RD. (2015). *CONTRIBUCIÓN PREVISTA Y DETERMINADA A NIVEL NACIONAL- INDC-RD.* Santo Domingo : INDC-RD.

Banco Mundial. (2016). *El costo de la Contaminación Atmosférica .* Seattle: World Bank.

Banco Mundial. (2020). *República Dominicana*. Retrieved from Banco Mundial: https://datos.bancomundial.org/pais/republica-dominicana

BID. (2020). *Plan Estrategico Nacional de Movilidad Electrica Republica Dominicana: Material elaborado por el BID para el INTRANT.*

Caraballo, J. (2018). Generación eléctrica RD depende cada vez menos del petróleo. *Diario Libre*.

Centro Mario Molina. (2017). *Campaña de monitoreo de calidad del aire enfocada en el impacto del transporte en Santo Domingo, República Dominicana.*

CEPAL. (2017). *Nueva Agenda Urbana.* Quito: ONU.

Comision Nacional de Energia. (2014). *Prospectiva de la Demanda de Energia de Republica Dominicana 2010-2030.*

Comisión Nacional de Energía. (2010). *el Plan Energético Nacional 2010-2025.* Santo Domingo: Comisión Nacional de Energía.

Congreso Nacional . (2013). *Ley No. 103-13 de incentivo a la importación de vehículos de energía no convencional.* Santo Domingo: Congreso Nacional de la República Dominicana.

Congreso Nacional. (2012). *Ley 253-12.* Santo Domingo: Congreso Nacional.

Congreso Nacional. (2017). *Ley de Movilidad, Transporte Terrestre, Tránsito y Seguridad Vial de la República Dominicana.* Santo Domingo: Congreso Nacional.

Consejo Nacional para el Cambio Climático y Mecanismo de Desarrollo Limpio. (2019*). *Plan de Acción de la NDC de República Dominicana.* Santo Domingo: Presidencia de la República Dominicana.

Diario Libre. (2019). Estadísticas ambientales: cómo está República Dominicana en relación a otros países. *Diario Libre*.

Dirección General de Impuestos Internos (DGII). (2020). *Boletín Estadístico Parque Vehicular 2020.* Santo Domingo : DGII.

EEA. (2020). *Air pollutant emission inventory guidebook 2019.*

El Dinero. (2020, Marzo). *ENGIH 2018: Ingreso promedio en hogares de RD es de RD$38,346*. Retrieved from El Dinero: https://www.eldinero.com.do/100486/engih-2018-ingreso-promedio-en-hogares-es-de-rd38346/#:~:text=El%20ingreso%20promedio%20que%20arroja,promedio%20de%20RD%249%2C710%20pesos.

Electromaps. (2021, 01 17). *Puntos de Recarga Dominican Republic*. Retrieved from Electromaps: https://www.electromaps.com/puntos-de-recarga/dominican-republic

Embajada de la República Dominicana en Japón. (2021). *Geografía y Clima*. Obtenido de Embaja de Republica Dominicana en Japón: https://embadomjp.gob.do/index.php/es/republica-dominicana/geografia-y-clima

Gobierno de la República Dominicana. (2020). *Contribución Nacionalmente Determinada NDC RD-2020.* Santo Domingo: Gobierno de la República Dominicana.

Gobierno de la República Dominicana. (2020). *Primer Informe Bienal de Actualización de la República Dominicana ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático.*

Godínez , V., & Máttar, J. (2009). *La Republica Dominicana en 2030: Hacia una nación cohesionada.* México: ONU-CEPAL.

Godínez, V., & Máttar, J. (2009). *La República Dominicana en 2030: hacia una nación cohesionada.* México: Nacione Unidas.

Gómez, D. (2020). República Dominicana tiene alrededor de 1,327 unidades de vehículos eléctricos. *El Dinero*.

IEA. (2017). *Global EV Outlook 2017.*

IEA. (2019). *Global EV Outlook 2019.*

International Renewable Energy Agency (IRENA). (2016). *Perspectivas de Energías Renovables: República Dominicana* . Santo Domingo : CNE.

INTRANT. (2017). *Ley No.63-17 de Movilidad, Transporte Terrestre, Tránsito y Seguridad Vial en República Dominica.* Santo Domingo: Congreso Nacional.

INTRANT. (2017). *Plan Estratégico del Instituto Nacional de Tránsito y Transporte de la República Dominicana - INTRANT 2018-2022.* Santo Domingo: INTRANT.

INTRANT. (2020). *Memoria de Una Gestión 2017-2020.* Santo Domingo: INTRANT.

INTRANT. (2020). *Plan Estratégico Nacional de Movilidad Eléctrica República Dominicana.* Santo Domingo: BID.

INTRANT. (2021, 01 27). *Gobierno pone a circular Corredor Núñez de Cáceres, beneficiará a más de 10 mil usuarios diariamente*. Retrieved from intrant.gob.do: https://intrant.gob.do/index.php/noticias/item/690-gobierno-pone-a-circular-corredor-nunez-de-caceres-beneficiara-a-mas-de-10-mil-usuarios-diariamente

IRENA. (2016). *Renewable Energy Prospects: Dominican Republic.*

Jiménez, L. (2021, Enero 11). *INTRANT y Uber buscan regulación de taxis*. Retrieved from Hoy.com.do: INTRANT y Uber buscan regulación de taxis

Lizardo, M., & Guzmán, R. M. (2005). *Coordinación de las politicas fiscales y ambientales en la República Dominicana.* Santiago de Chile: Naciones Unidas.

Ministerio de Economía, Planificación y Desarrollo . (2012). *Ley 1-12 Estrategia Nacional de Desarrollo 2030.* Santo Domingo: Ministerio de Economía, Planificación y Desarrollo .

Ministerio de Energía y Minas (MEM). (2020). *AIRE DE SD REGISTRA ALTOS NIVELES DE PARTÍCULAS CONTAMINANTES, POR ENCIMA DE RECOMENDACIONES DE OMS.* Santo Domingo: Ministerio de Energía y Minas.

Ministerio de Energía y Minas. (2005). *Establecimiento de línea base para la economía de combustible de los vehículos ligeros.* Santo Domingo: ONU.

Ministerio de Industria, Comercio y MIPYMES (MICM). (2021, 01 29). Retrieved from Ministerio de Industria, Comercio y MIPYMES (MIC): https://www.micm.gob.do/inicio

Ministerio de la Presidencia. (2017). *Plan Estratégico de Movilidad Urbana (2017-2022).* Santo Domingo: MOPC.

Ministerio de Turismo de la República Dominicana. (2020). *Sobre República Dominicana*. Retrieved from Go Dominican Republic: https://www.godominicanrepublic.com/es/sobre-rd/

Murillo, J. H. (2009). *Inventario de Emisiones de Contaminantes Criterio del Aire de República Dominicana: 2009.* Santo Domingo: Comisión Centroamericana de Ambiente y Desarrollo (CCAD).

Nova, A. (2020). República Dominicana carece de un marco regulatorio que incentive la movilidad eléctrica. *El Dinero*, 1-7.

ONU Medio Ambiente. (2018). *Movilidad eléctrica: Avances en América Latina y el Caribe y Oportunidades para la Colaboración Regional 2018.* Naciones Unidas.

PNUD. (2018). *Financiamiento para la Agenda 2030 en países de renta media: El caso de República Dominicana .* Santo Domingo: ONU.

Sánchez, C. (2019). *Movilidad Eléctrica en la República Dominicana .* Santo Domingo: Zero Emisión RD.

Secretaría de Industria y Comercio. (2001). *Reglamento. Ley Hidrocarburos No. 112-00.* Santo Domingo: Secretaría de Industria y Comercio.

SELA. (2020). *República Dominicana*. Retrieved from Sistema Económico Latinoamericano y del Caribe: http://www.sela.org/es/estados-miembros/republica-dominicana/#:~:text=Organizaci%C3%B3n%20administrativa%3A%2031%20provincias%20y,Plata%2C%20Pedernales%2C%20Peravia%2C%20Puerto

SYSTRA. (2019). *Plan de Movilidad Urbana Sostenible del Gran Santo Domingo.* Paris: MobiliseYourCity.

Vargas, J. (2020). Intrant subastará 13,000 vehículos retenidos. *El Día*.

Vicepresidencia de la República Dominicana. (2017). *Transporte Público y Movilidad Urbana en el Gran Santo Domingo.* Santo Domingo: Vicepresidencia de la República Dominicana.

Wikipedia. (2020, 12 07). *República Dominicana*. Retrieved from Wikipedia: https://es.wikipedia.org/wiki/Rep%C3%BAblica_Dominicana

Annex

Vehicle Data

Vehicle category	gasoline	diesel	LPG	total
Passenger car	795,102	130,308	389,853	1,315,263
Taxi			27,635	27,635
Motorcycle	2,398,511			2,398,511
small bus		4,135	8,040	12,175
standard urban bus		1,197		1,197
coach		88,815		88,815
LCV	43,203	65,663	21,020	129,886
Truck < 7.5t		206,070		206,070
Truck 7.5-16t		45,741		45,741
Truck 16-32t		45,741		45,741
Truck >32t		20,746		20,746
Source: Intrant				4,291,779

Year of data	2018
Country	Dom. Rep.
GDP growth rate	4.3%
take from country values	
Carbon grid factor	0.643
take from country values	
Growth rate freight transport	2.0%
See below	
Bus, coach growth	0.7%
in line with population growth rate	
Passenger car, MC, taxi growth	6.2%

Income Group USD/Capita	Freight Intensity
< 5,000	1.18
5,000-25,000	**0.98**
25,000-50,000	0.87
> 50,000	0.82

Parameters Gompertz for medium income country		
α	-4.32	
β	-0.000138	
vehicl pop 2030	2752073	cars
CAGR	6.2%	
Based on OECD pattern, see source above		
GDP per capita 2019	8282	
GDP per capital 2030	12162	
GDP per capita (current US$) - Ecuador | Data (worldbank.org)		
Projected population 2030	11.253	
Population 2020	10.448	
CAGR	0.7%	

Emissions

All data in tons per annum

2018

Vehicle category	NO_x	$PM_{2.5}$	CO_2 TTW	CO_2 WTW	Energy in TJ
Passenger car	4,013	218	2,834,240	3,374,339	42,095
Taxi	224	27	211,562	238,384	3,353
Motorcycles	3,802	42	1,325,413	1,586,685	19,126
small bus	156	26	201,258	244,801	4,199
standard urban bus	576	12	69,531	92,455	938
coach	7,949	147	698,988	945,484	9,433
LCV	470	165	591,961	824,379	8,331
Truck < 7.5t	7,192	126	663,167	889,231	8,950
Truck 7.5-16t	2,516	48	225,902	305,687	3,049
Truck 16-32t	3,618	71	306,060	417,929	4,130
Truck >32t	1,942	40	165,918	227,624	2,239
Total	**32,457**	**920**	**7,294,000**	**9,147,000**	**105,843**

2030

Vehicle category	NO_x	$PM_{2.5}$	CO_2 TTW	CO_2 WTW	Energy in MJ
Passenger car	3,214	115	5,808,362	6,869,859	86,268
Taxi	143	3	433,565	488,534	6,871
Motorcycles	4,768	86	2,716,240	3,251,680	39,195
small bus	738	11	220,006	258,336	3,332
standard urban bus	319	3	69,674	87,535	940
coach	4,388	34	764,103	963,046	10,312
LCV	1,484	70	750,750	958,141	10,565
Truck < 7.5t	4,286	28	841,056	1,053,198	11,350
Truck 7.5-16t	1,537	9	286,498	358,697	3,866
Truck 16-32t	2,222	14	388,158	486,793	5,238
Truck >32t	1,213	7	210,425	263,582	2,840
Total	**24,312**	**380**	**12,488,837**	**15,039,402**	**180,779**

Emission costs	2018	2030
Pollutants	194	94
GHG	366	602
Total	**560**	**696**

in MUSD of 2019

EV Scenarios

Rate of EVs of newly registered vehicles

Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
S1 EV 15@30	3%	3%	4%	5%	7%	9%	10%	11%	12%	14%	15%
S2 EV30@30	5%	6%	8%	11%	14%	18%	20%	22%	24%	27%	30%

National EV Target

Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cars	0%	0%	1%	2%	5%	10%	12%	14%	16%	18%	20%
Motorcycles	0%	0%	1%	2%	3%	4%	6%	8%	10%	12%	14%
Buses	0%	0%	5%	30%	60%	90%	100%	100%	100%	100%	100%
LCVs	0%	0%	1%	2%	5%	8%	12%	17%	25%	35%	50%

Targets by 2030: 240,000 e-cars (60k public); 312 e-MCs (145k public); 37,000 e-buses; 17,000 e-LCVs (INTRANS, 2020)

High Growth Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Taxis	0%	6%	4%	8%	14%	22%	32%	45%	61%	79%	100%
Urban Buses	0%	72%	4%	8%	14%	22%	32%	45%	61%	79%	100%
Small buses	0%	7%	4%	8%	14%	22%	32%	45%	61%	79%	100%
LCVs	0%	1%	4%	8%	14%	22%	32%	45%	61%	79%	100%

This scenario is only made for the vehicle categories of the program i.e. urban buses, small buses, taxis and LCVs

For urban buses, taxis and LCVs the target is 100% of new registered buses/taxis/LCVs in 2030 are electric; This takes into consideration that Evs in this segment should be cost-competitive by 2030. No early replacement of vehicles is made i.e. conventional vehicles could still be used till ending their lifespan.

The growth curve towards 2030 is based on a power curve with the function y=0.0024*n^2.52 based on the curve of Norway for the last 10 years). Initial experiences are built and cost structures go down. Barriers are removed and financial equivalence will be achieved. The vehicle penetration rates increases then (for new vehicles)

Passenger cars S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all cars	1,482,343	1,573,682	1,670,648	1,773,589	1,882,873	1,998,891	2,122,058	2,252,814	2,391,627	2,538,993	2,695,439
Replacement cars	69,815	74,117	78,684	83,532	88,679	94,144	99,945	106,103	112,641	119,581	126,950
Additional new cars	86,037	91,338	96,966	102,941	109,284	116,018	123,167	130,756	138,813	147,366	156,446
EV car fleet new	3,930	5,371	7,340	10,031	13,709	18,735	22,070	26,000	30,630	36,084	42,509
EV car fleet stock	3,930	9,301	16,642	26,673	40,382	59,116	81,187	107,187	137,817	173,901	216,411
EV fleet as % of stock	0%	1%	1%	2%	2%	3%	4%	5%	6%	7%	8%
GHG reduction WTW in tons	4,934	11,676	20,891	33,483	50,692	74,210	101,916	134,555	173,006	218,303	271,666
Electricity demand GWh	7.1	16.7	30.0	48.0	72.7	106.4	146.1	192.9	248.1	313.0	389.5

Passenger cars S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all cars	1,482,343	1,573,682	1,670,648	1,773,589	1,882,873	1,998,891	2,122,058	2,252,814	2,391,627	2,538,993	2,695,439
Replacement cars	69,815	74,117	78,684	83,532	88,679	94,144	99,945	106,103	112,641	119,581	126,950
Additional new cars	86,037	91,338	96,966	102,941	109,284	116,018	123,167	130,756	138,813	147,366	156,446
EV car fleet new	7,861	10,742	14,681	20,062	27,418	37,469	44,141	52,001	61,260	72,168	85,019
EV car fleet stock	7,861	18,603	33,283	53,346	80,763	118,232	162,373	214,374	275,634	347,803	432,821
EV fleet as % of stock	1%	1%	2%	3%	4%	6%	8%	10%	12%	14%	16%
GHG reduction WTW in tons	9,868	23,353	41,782	66,967	101,385	148,420	203,832	269,110	346,011	436,606	543,333
Electricity demand GWh	14.1	33.5	59.9	96.0	145.4	212.8	292.3	385.9	496.1	626.0	779.1

Passenger cars natinal target	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all cars	1,482,343	1,573,682	1,670,648	1,773,589	1,882,873	1,998,891	2,122,058	2,252,814	2,391,627	2,538,993	2,695,439
Replacement cars	69,815	74,117	78,684	83,532	88,679	94,144	99,945	106,103	112,641	119,581	126,950
Additional new cars	86,037	91,338	96,966	102,941	109,284	116,018	123,167	130,756	138,813	147,366	156,446
EV car fleet new	0	0	1,757	3,729	9,898	21,016	26,773	33,160	40,233	48,051	56,679
EV car fleet stock	0	0	1,757	5,486	15,384	36,400	63,174	96,334	136,566	184,617	241,296
EV fleet as % of stock	0%	0%	0%	0%	1%	2%	3%	4%	6%	7%	9%
GHG reduction WTW in tons	0	0	2,205	6,887	19,312	45,694	79,304	120,931	171,436	231,755	302,906
Electricity demand GWh	0.0	0.0	3.2	9.9	27.7	65.5	113.7	173.4	245.8	332.3	434.3

Taxis S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all taxis	31,146	33,065	35,102	37,265	39,561	41,999	44,587	47,334	50,250	53,347	56,634
Replacement taxis	1,467	1,557	1,653	1,755	1,863	1,978	2,100	2,229	2,367	2,513	2,667
Additional new taxis	1,808	1,919	2,037	2,163	2,296	2,438	2,588	2,747	2,917	3,096	3,287
EV taxi fleet new	83	113	154	211	288	394	464	546	644	758	893
EV taxi fleet stock	83	195	350	560	848	1,242	1,706	2,252	2,896	3,654	4,547
EV taxi as % of stock	0%	1%	1%	2%	2%	3%	4%	5%	6%	7%	8%
GHG reduction WTW in tons	466	1,104	1,975	3,166	4,793	7,017	9,636	12,722	16,358	20,640	25,686
Electricity demand GWh	0.7	1.6	2.8	4.5	6.9	10.1	13.8	18.2	23.5	29.6	36.8

Taxis S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all taxis	31,146	33,065	35,102	37,265	39,561	41,999	44,587	47,334	50,250	53,347	56,634
Replacement taxis	1,467	1,557	1,653	1,755	1,863	1,978	2,100	2,229	2,367	2,513	2,667
Additional new taxis	1,808	1,919	2,037	2,163	2,296	2,438	2,588	2,747	2,917	3,096	3,287
EV taxi fleet new	165	226	308	422	576	787	927	1,093	1,287	1,516	1,786
EV taxi fleet stock	165	391	699	1,121	1,697	2,484	3,412	4,504	5,791	7,308	9,094
EV taxi as % of stock	1%	1%	2%	3%	4%	6%	8%	10%	12%	14%	16%
GHG reduction WTW in tons	933	2,208	3,950	6,332	9,586	14,033	19,272	25,444	32,715	41,281	51,372
Electricity demand GWh	1.3	3.2	5.7	9.1	13.7	20.1	27.6	36.5	46.9	59.2	73.7

Taxis High Growth Scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all taxis	31,146	33,065	35,102	37,265	39,561	41,999	44,587	47,334	50,250	53,347	56,634
Replacement taxis	1,467	1,557	1,653	1,755	1,863	1,978	2,100	2,229	2,367	2,513	2,667
Additional new taxis	1,808	1,919	2,037	2,163	2,296	2,438	2,588	2,747	2,917	3,096	3,287
EV taxi fleet new	0	200	141	309	576	969	1,516	2,254	3,220	4,457	5,954
EV taxi fleet stock	0	200	341	651	1,227	2,195	3,712	5,966	9,185	13,643	19,597
EV taxi as % of stock	0%	1%	1%	2%	3%	5%	8%	13%	18%	26%	35%
GHG reduction WTW in tons	0	1,130	1,927	3,675	6,930	12,402	20,968	33,700	51,888	77,068	110,704
Electricity demand GWh	0.0	1.6	2.8	5.3	9.9	17.8	30.1	48.3	74.4	110.5	158.7
E-taxi sales share	0%	6%	4%	8%	14%	22%	32%	45%	61%	79%	100%

Motorcycle S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all MC	2,703,198	2,869,762	3,046,590	3,234,314	3,433,604	3,645,174	3,869,781	4,108,227	4,361,366	4,630,102	4,915,398
Replacement MC	169,753	180,213	191,317	203,106	215,621	228,907	243,012	257,985	273,882	290,758	308,673
Additional new MC	156,897	166,564	176,828	187,723	199,290	211,570	224,607	238,446	253,139	268,737	285,295
EV MC fleet new	8,237	11,257	15,384	21,024	28,732	39,266	46,257	54,494	64,197	75,629	89,095
EV MC fleet stock	8,237	19,495	34,879	55,904	84,636	123,902	170,159	224,653	288,850	364,479	453,574
EV fleet as % of stock	0%	1%	1%	2%	2%	3%	4%	5%	7%	8%	9%
GHG reduction WTW in tons	4,787	11,330	20,270	32,489	49,187	72,007	98,889	130,559	167,868	211,820	263,599
Electricity demand GWh	1.0	2.4	4.4	7.0	10.6	15.5	21.3	28.1	36.1	45.6	56.7

Motorcycle S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all MC	2,703,198	2,869,762	3,046,590	3,234,314	3,433,604	3,645,174	3,869,781	4,108,227	4,361,366	4,630,102	4,915,398
Replacement MC	169,753	180,213	191,317	203,106	215,621	228,907	243,012	257,985	273,882	290,758	308,673
Additional new MC	156,897	166,564	176,828	187,723	199,290	211,570	224,607	238,446	253,139	268,737	285,295
EV MC fleet new	16,475	22,515	30,769	42,049	57,464	78,531	92,515	108,988	128,395	151,257	178,191
EV MC fleet stock	16,475	38,990	69,759	111,807	169,272	247,803	340,318	449,306	577,701	728,958	907,149
EV fleet as % of stock	1%	1%	2%	3%	5%	7%	9%	11%	13%	16%	18%
GHG reduction WTW in tons	9,575	22,659	40,541	64,978	98,374	144,013	197,779	261,118	335,736	423,641	527,198
Electricity demand GWh	2.1	4.9	8.7	14.0	21.2	31.0	42.5	56.2	72.2	91.1	113.4

Motorcycle national target	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all MC	2,703,198	2,869,762	3,046,590	3,234,314	3,433,604	3,645,174	3,869,781	4,108,227	4,361,366	4,630,102	4,915,398
Replacement MC	169,753	180,213	191,317	203,106	215,621	228,907	243,012	257,985	273,882	290,758	308,673
Additional new MC	156,897	166,564	176,828	187,723	199,290	211,570	224,607	238,446	253,139	268,737	285,295
EV MC fleet new	0	0	3,681	7,817	12,447	17,619	28,057	39,715	52,702	67,139	83,156
EV MC fleet stock	0	0	3,681	11,498	23,945	41,564	69,622	109,336	162,038	229,177	312,333
EV fleet as % of stock	0%	0%	0%	0%	1%	1%	2%	3%	4%	5%	6%
GHG reduction WTW in tons	0	0	2,140	6,682	13,916	24,156	40,461	63,542	94,170	133,189	181,515
Electricity demand GWh	0.0	0.0	0.5	1.4	3.0	5.2	8.7	13.7	20.3	28.6	39.0

Small Bus S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	12,357	12,449	12,542	12,635	12,729	12,824	12,920	13,016	13,113	13,211	13,309
Replacement vehicles	613	618	622	627	632	636	641	646	651	656	661
Additional new vehicles	91	92	93	93	94	95	96	96	97	98	98
EV vehicle fleet new	18	23	30	39	50	65	73	81	91	102	114
EV vehicle fleet stock	18	41	71	109	160	225	298	379	470	572	686
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	2%	3%	4%	4%	5%
GHG reduction WTW in tons	97	222	385	596	869	1,224	1,620	2,064	2,559	3,113	3,733
Electricity demand GWh	0.3	0.7	1.2	1.8	2.7	3.8	5.0	6.4	7.9	9.6	11.5

Small Bus S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	12,357	12,449	12,542	12,635	12,729	12,824	12,920	13,016	13,113	13,211	13,309
Replacement vehicles	613	618	622	627	632	636	641	646	651	656	661
Additional new vehicles	91	92	93	93	94	95	96	96	97	98	98
EV vehicle fleet new	36	46	60	78	101	130	146	163	182	204	228
EV vehicle fleet stock	36	82	141	219	319	450	596	759	941	1,144	1,372
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	6%	7%	9%	10%
GHG reduction WTW in tons	193	444	769	1,191	1,738	2,448	3,241	4,127	5,118	6,226	7,465
Electricity demand GWh	0.6	1.4	2.4	3.7	5.4	7.6	10.0	12.7	15.8	19.2	23.1

Small Bus high growth scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	12,357	12,449	12,542	12,635	12,729	12,824	12,920	13,016	13,113	13,211	13,309
Replacement vehicles	613	618	622	627	632	636	641	646	651	656	661
Additional new vehicles	91	92	93	93	94	95	96	96	97	98	98
EV vehicle fleet new	0	50	27	57	101	160	238	336	456	599	759
EV vehicle fleet stock	0	50	77	134	235	395	634	970	1,425	2,024	2,783
EV fleet as % of stock	0%	0%	1%	1%	2%	3%	5%	7%	11%	15%	21%
GHG reduction WTW in tons	0	272	421	730	1,278	2,150	3,447	5,276	7,755	11,013	15,142
Electricity demand GWh	0.0	0.8	1.3	2.3	3.9	6.6	10.6	16.3	23.9	34.0	46.8

Urban bus standard S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	1,215	1,224	1,233	1,242	1,252	1,261	1,270	1,280	1,289	1,299	1,309
Replacement vehicles	60	61	61	62	62	63	63	64	64	64	65
Additional new vehicles	9	9	9	9	9	9	9	9	10	10	10
EV vehicle fleet new	2	2	3	4	5	6	7	8	9	10	11
EV vehicle fleet stock	2	4	7	11	16	22	29	37	46	56	67
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	2%	3%	4%	4%	5%
GHG reduction WTW in tons	66	152	264	409	596	840	1,112	1,416	1,756	2,136	2,561
Electricity demand GWh	0.1	0.2	0.3	0.5	0.7	1.0	1.3	1.7	2.1	2.5	3.0

Urban bus standard S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	1,215	1,224	1,233	1,242	1,252	1,261	1,270	1,280	1,289	1,299	1,309
Replacement vehicles	60	61	61	62	62	63	63	64	64	64	65
Additional new vehicles	9	9	9	9	9	9	9	9	10	10	10
EV vehicle fleet new	3	5	6	8	10	13	14	16	18	20	22
EV vehicle fleet stock	3	8	14	22	31	44	59	75	92	113	135
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	6%	7%	9%	10%
GHG reduction WTW in tons	133	305	528	817	1,192	1,679	2,223	2,831	3,511	4,271	5,121
Electricity demand GWh	0.2	0.4	0.6	1.0	1.4	2.0	2.6	3.4	4.2	5.1	6.1

Urban bus high growth scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	1,215	1,224	1,233	1,242	1,252	1,261	1,270	1,280	1,289	1,299	1,309
Replacement vehicles	60	61	61	62	62	63	63	64	64	64	65
Additional new vehicles	9	9	9	9	9	9	9	9	10	10	10
EV vehicle fleet new	0	50	3	6	10	16	23	33	45	59	75
EV vehicle fleet stock	0	50	53	58	68	84	107	140	185	244	319
EV fleet as % of stock	0%	4%	4%	5%	5%	7%	8%	11%	14%	19%	24%
GHG reduction WTW in tons	0	1,898	2,000	2,213	2,588	3,187	4,076	5,331	7,032	9,267	12,099
Electricity demand GWh	0.0	2.3	2.4	2.6	3.1	3.8	4.8	6.3	8.3	11.0	14.3
Sales share BEBs	0%	72%	4%	8%	14%	22%	32%	45%	61%	79%	100%

Coach S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	90,143	90,815	91,491	92,173	92,860	93,552	94,248	94,951	95,658	96,371	97,089
Replacement vehicles	4,474	4,507	4,541	4,575	4,609	4,643	4,678	4,712	4,748	4,783	4,819
Additional new vehicles	667	672	677	682	687	692	697	702	707	713	718
EV vehicle fleet new	130	168	218	283	367	476	532	594	664	743	830
EV vehicle fleet stock	130	298	516	799	1,165	1,641	2,172	2,767	3,431	4,174	5,005
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	2%	3%	4%	4%	5%
GHG reduction WTW in tons	452	1,039	1,800	2,787	4,066	5,726	7,581	9,655	11,974	14,566	17,464
Electricity demand GWh	1.3	3.0	5.2	8.0	11.7	16.4	21.7	27.7	34.3	41.7	50.0

Coach S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	90,143	90,815	91,491	92,173	92,860	93,552	94,248	94,951	95,658	96,371	97,089
Replacement vehicles	4,474	4,507	4,541	4,575	4,609	4,643	4,678	4,712	4,748	4,783	4,819
Additional new vehicles	667	672	677	682	687	692	697	702	707	713	718
EV vehicle fleet new	259	336	436	566	733	951	1,063	1,189	1,329	1,486	1,661
EV vehicle fleet stock	259	595	1,032	1,597	2,330	3,282	4,345	5,534	6,863	8,348	10,009
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	6%	7%	9%	10%
GHG reduction WTW in tons	905	2,078	3,600	5,573	8,132	11,452	15,162	19,310	23,948	29,133	34,929
Electricity demand GWh	2.6	6.0	10.3	16.0	23.3	32.8	43.4	55.3	68.6	83.5	100.1

Coach national target	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	90,143	90,815	91,491	92,173	92,860	93,552	94,248	94,951	95,658	96,371	97,089
Replacement vehicles	4,474	4,507	4,541	4,575	4,609	4,643	4,678	4,712	4,748	4,783	4,819
Additional new vehicles	667	672	677	682	687	692	697	702	707	713	718
EV vehicle fleet new	0	0	261	1,577	3,177	4,801	5,375	5,415	5,455	5,496	5,536
EV vehicle fleet stock	0	0	261	1,838	5,015	9,816	15,191	20,605	26,060	31,556	37,092
EV fleet as % of stock	0%	0%	0%	2%	5%	10%	16%	22%	27%	33%	38%
GHG reduction WTW in tons	0	0	910	6,413	17,500	34,255	53,010	71,905	90,941	110,119	129,439
Electricity demand GWh	0.0	0.0	2.6	18.4	50.1	98.2	151.9	206.1	260.6	315.6	370.9

LCV S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	135,133	137,836	140,593	143,405	146,273	149,198	152,182	155,226	158,330	161,497	164,727
Replacement vehicles	6,624	6,757	6,892	7,030	7,170	7,314	7,460	7,609	7,761	7,917	8,075
Additional new vehicles	2,650	2,703	2,757	2,812	2,868	2,925	2,984	3,044	3,105	3,167	3,230
EV vehicle fleet new	234	307	403	529	695	913	1,033	1,169	1,324	1,498	1,696
EV vehicle fleet stock	234	541	944	1,474	2,169	3,081	4,115	5,284	6,608	8,106	9,801
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	3%	3%	4%	5%	6%
GHG reduction WTW in tons	595	1,377	2,404	3,751	5,521	7,845	10,475	13,452	16,821	20,635	24,952
Electricity demand GWh	0.9	2.2	3.8	5.9	8.7	12.3	16.5	21.1	26.4	32.4	39.2

LCV S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	135,133	137,836	140,593	143,405	146,273	149,198	152,182	155,226	158,330	161,497	164,727
Replacement vehicles	6,624	6,757	6,892	7,030	7,170	7,314	7,460	7,609	7,761	7,917	8,075
Additional new vehicles	2,650	2,703	2,757	2,812	2,868	2,925	2,984	3,044	3,105	3,167	3,230
EV vehicle fleet new	468	614	806	1,059	1,390	1,825	2,066	2,339	2,647	2,996	3,391
EV vehicle fleet stock	468	1,082	1,888	2,947	4,337	6,163	8,229	10,568	13,215	16,211	19,603
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	7%	8%	10%	12%
GHG reduction WTW in tons	1,191	2,754	4,807	7,503	11,042	15,689	20,949	26,903	33,642	41,270	49,903
Electricity demand GWh	1.9	4.3	7.6	11.8	17.3	24.7	32.9	42.3	52.9	64.8	78.4

LCV national target	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	135,133	137,836	140,593	143,405	146,273	149,198	152,182	155,226	158,330	161,497	164,727
Replacement vehicles	6,624	6,757	6,892	7,030	7,170	7,314	7,460	7,609	7,761	7,917	8,075
Additional new vehicles	2,650	2,703	2,757	2,812	2,868	2,925	2,984	3,044	3,105	3,167	3,230
EV vehicle fleet new	0	0	96	197	502	819	1,253	1,811	2,716	3,879	5,652
EV vehicle fleet stock	0	0	96	293	795	1,614	2,868	4,679	7,395	11,274	16,927
EV fleet as % of stock	0%	0%	0%	0%	1%	1%	2%	3%	5%	7%	10%
GHG reduction WTW in tons	0	0	246	747	2,024	4,110	7,300	11,910	18,826	28,701	43,090
Electricity demand GWh	0.0	0.0	0.4	1.2	3.2	6.5	11.5	18.7	29.6	45.1	67.7

LCV high growth scenario	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	135,133	137,836	140,593	143,405	146,273	149,198	152,182	155,226	158,330	161,497	164,727
Replacement vehicles	6,624	6,757	6,892	7,030	7,170	7,314	7,460	7,609	7,761	7,917	8,075
Additional new vehicles	2,650	2,703	2,757	2,812	2,868	2,925	2,984	3,044	3,105	3,167	3,230
EV vehicle fleet new	0	50	369	777	1,391	2,246	3,378	4,825	6,622	8,808	11,305
EV vehicle fleet stock	0	50	419	1,196	2,587	4,833	8,211	13,036	19,658	28,466	39,770
EV fleet as % of stock	0%	0%	0%	1%	2%	3%	5%	8%	12%	18%	24%
GHG reduction WTW in tons	0	127	1,067	3,045	6,586	12,303	20,904	33,186	50,043	72,466	101,245
Electricity demand GWh	0.0	0.2	1.7	4.8	10.3	19.3	32.8	52.1	78.6	113.9	159.1
e-LCV share sales	0%	1%	4%	8%	14%	22%	32%	45%	61%	79%	100%

Truck <7.5t S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	214,395	218,683	223,057	227,518	232,068	236,710	241,444	246,273	251,198	256,222	261,347
Replacement vehicles	10,510	10,720	10,934	11,153	11,376	11,603	11,835	12,072	12,314	12,560	12,811
Additional new vehicles	4,204	4,288	4,374	4,461	4,550	4,641	4,734	4,829	4,925	5,024	5,124
EV vehicle fleet new	371	487	640	840	1,103	1,448	1,639	1,855	2,100	2,377	2,690
EV vehicle fleet stock	371	858	1,498	2,338	3,441	4,889	6,528	8,383	10,483	12,860	15,550
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	3%	3%	4%	5%	6%
GHG reduction WTW in tons	159	368	643	1,004	1,477	2,099	2,803	3,599	4,501	5,521	6,676
Electricity demand GWh	2.1	4.8	8.4	13.1	19.3	27.4	36.6	46.9	58.7	72.0	87.1

Truck <7.5t S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	214,395	218,683	223,057	227,518	232,068	236,710	241,444	246,273	251,198	256,222	261,347
Replacement vehicles	10,510	10,720	10,934	11,153	11,376	11,603	11,835	12,072	12,314	12,560	12,811
Additional new vehicles	4,204	4,288	4,374	4,461	4,550	4,641	4,734	4,829	4,925	5,024	5,124
EV vehicle fleet new	742	974	1,279	1,680	2,206	2,896	3,278	3,711	4,200	4,754	5,381
EV vehicle fleet stock	742	1,716	2,996	4,676	6,882	9,778	13,056	16,766	20,966	25,720	31,101
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	7%	8%	10%	12%
GHG reduction WTW in tons	319	737	1,286	2,007	2,954	4,198	5,605	7,198	9,001	11,042	13,352
Electricity demand GWh	4.2	9.6	16.8	26.2	38.5	54.8	73.1	93.9	117.4	144.0	174.2

Truck 7.5-16t S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	47,588	48,540	49,511	50,501	51,511	52,541	53,592	54,664	55,757	56,873	58,010
Replacement vehicles	2,333	2,379	2,427	2,476	2,525	2,576	2,627	2,680	2,733	2,788	2,844
Additional new vehicles	933	952	971	990	1,010	1,030	1,051	1,072	1,093	1,115	1,137
EV vehicle fleet new	82	108	142	186	245	321	364	412	466	528	597
EV vehicle fleet stock	82	190	332	519	764	1,085	1,449	1,861	2,327	2,854	3,452
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	3%	3%	4%	5%	6%
GHG reduction WTW in tons	86	198	346	540	794	1,128	1,506	1,935	2,419	2,968	3,589
Electricity demand GWh	0.7	1.5	2.7	4.2	6.1	8.7	11.6	14.9	18.6	22.8	27.6

Truck 7.5-16t S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	47,588	48,540	49,511	50,501	51,511	52,541	53,592	54,664	55,757	56,873	58,010
Replacement vehicles	2,333	2,379	2,427	2,476	2,525	2,576	2,627	2,680	2,733	2,788	2,844
Additional new vehicles	933	952	971	990	1,010	1,030	1,051	1,072	1,093	1,115	1,137
EV vehicle fleet new	165	216	284	373	490	643	728	824	932	1,055	1,194
EV vehicle fleet stock	165	381	665	1,038	1,527	2,170	2,898	3,722	4,654	5,709	6,903
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	7%	8%	10%	12%
GHG reduction WTW in tons	171	396	691	1,079	1,588	2,256	3,013	3,869	4,838	5,935	7,177
Electricity demand GWh	1.3	3.0	5.3	8.3	12.2	17.4	23.2	29.8	37.2	45.7	55.2

Truck 16-32t S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	47,588	48,540	49,511	50,501	51,511	52,541	53,592	54,664	55,757	56,873	58,010
Replacement vehicles	2,333	2,379	2,427	2,476	2,525	2,576	2,627	2,680	2,733	2,788	2,844
Additional new vehicles	933	952	971	990	1,010	1,030	1,051	1,072	1,093	1,115	1,137
EV vehicle fleet new	82	108	142	186	245	321	364	412	466	528	597
EV vehicle fleet stock	82	190	332	519	764	1,085	1,449	1,861	2,327	2,854	3,452
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	3%	3%	4%	5%	6%
GHG reduction WTW in tons	56	129	225	351	516	734	980	1,258	1,573	1,930	2,333
Electricity demand GWh	1.0	2.3	4.0	6.2	9.2	13.0	17.4	22.3	27.9	34.3	41.4

Truck 16-32t S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	47,588	48,540	49,511	50,501	51,511	52,541	53,592	54,664	55,757	56,873	58,010
Replacement vehicles	2,333	2,379	2,427	2,476	2,525	2,576	2,627	2,680	2,733	2,788	2,844
Additional new vehicles	933	952	971	990	1,010	1,030	1,051	1,072	1,093	1,115	1,137
EV vehicle fleet new	165	216	284	373	490	643	728	824	932	1,055	1,194
EV vehicle fleet stock	165	381	665	1,038	1,527	2,170	2,898	3,722	4,654	5,709	6,903
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	7%	8%	10%	12%
GHG reduction WTW in tons	111	258	450	702	1,033	1,467	1,959	2,516	3,146	3,859	4,667
Electricity demand GWh	2.0	4.6	8.0	12.5	18.3	26.0	34.8	44.7	55.8	68.5	82.8

Truck >32t S1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	21,584	22,016	22,456	22,905	23,363	23,831	24,307	24,793	25,289	25,795	26,311
Replacement vehicles	1,058	1,079	1,101	1,123	1,145	1,168	1,192	1,215	1,240	1,264	1,290
Additional new vehicles	423	432	440	449	458	467	477	486	496	506	516
EV vehicle fleet new	37	49	64	85	111	146	165	187	211	239	271
EV vehicle fleet stock	37	86	151	235	346	492	657	844	1,055	1,295	1,566
EV fleet as % of stock	0%	0%	1%	1%	1%	2%	3%	3%	4%	5%	6%
GHG reduction WTW in tons	0	-1	-2	-3	-4	-6	-8	-10	-13	-16	-19
Electricity demand GWh	0.6	1.3	2.4	3.7	5.4	7.7	10.3	13.2	16.5	20.2	24.4

Truck >32t S2	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Stock all vehicles	21,584	22,016	22,456	22,905	23,363	23,831	24,307	24,793	25,289	25,795	26,311
Replacement vehicles	1,058	1,079	1,101	1,123	1,145	1,168	1,192	1,215	1,240	1,264	1,290
Additional new vehicles	423	432	440	449	458	467	477	486	496	506	516
EV vehicle fleet new	75	98	129	169	222	292	330	374	423	479	542
EV vehicle fleet stock	75	173	302	471	693	984	1,314	1,688	2,111	2,589	3,131
EV fleet as % of stock	0%	1%	1%	2%	3%	4%	5%	7%	8%	10%	12%
GHG reduction WTW in tons	-1	-2	-4	-6	-8	-12	-16	-21	-26	-32	-38
Electricity demand GWh	1.2	2.7	4.7	7.3	10.8	15.4	20.5	26.3	32.9	40.4	48.8

Default Emissions

Euro 2/II

Vehicle category	Fuel	Fuel consumption	NO_x	$PM_{2.5}$	CO_2 TTW	BC	CO_2 WTW incl. BC	Energy Usage MJ	Annual distance
Passenger Car	gasoline	66	0.255	0.002	203	0	242	2.9	10,000
Passenger Car	diesel	55	0.716	0.055	175	39	255	2.4	10,000
Passenger Car	LPG	57	0.180	0.022	170	0	192	2.7	15,000
Taxi	gasoline	66	0.255	0.002	203	0	242	2.9	45,000
Taxi	diesel	55	0.716	0.055	175	39	255	2.4	45,000
Taxi	LPG	57	0.18	0.02	170	0	192	2.7	45,000
3-wheeler	gasoline	24	0	0.000	75	0	89	1.1	20,000
3-wheeler	diesel	19	0.500	0.050	61	11	86	0.8	20,000
3-wheeler	LPG	32	0.5	0.000	96	0	134	1.5	20,000
Motorcycle	gasoline	36	0.317	0.004	111	1	132	1.6	5,000
Small bus	gasoline	148	0.000	0.000	455	0	541	6.6	30,000
Small bus	diesel	152	0.904	0.163	484	95	691	6.5	30,000
small bus	LPG	196	0.180	0.022	585	0	660	9.3	30,000
Urban standard bus	diesel	405	10.700	0.220	1291	129	1,716	17.4	45,000
Urban standard bus	CNG	515	10.000	0.010	1,545	0	2,155	24.7	45,000
Coach bus	diesel	247	8.950	0.165	787	97	1,065	10.6	10,000
LCV	gasoline	70	0.230	0.002	215	1	256	3.1	20,000
LCV	diesel	80	0.149	0.117	255	84	398	3.4	20,000
LCV	LPG	57	0.180	0.022	170	0	192	3	20,000
Truck < 7.5t	diesel	101	3.490	0.061	322	36	432	4.3	10,000
Truck 7.5-16t	diesel	155	5.500	0.104	494	61	668	6.7	10,000
Truck 16-32t	diesel	210	7.910	0.155	669	91	914	9.0	10,000
Truck >32t	diesel	251	9.360	0.194	800	113	1,097	10.8	10,000

Euro 4/IV

Vehicle category	Fuel	Fuel consumption	NO_x	$PM_{2.5}$	CO_2 TTW	BC	CO_2 WTW incl. BC	Energy Usage MJ	Annual distance
Passenger Car	gasoline	66	0.061	0.001	203	0	241	2.9	10,000
Passenger Car	diesel	55	0.580	0.031	175	25	240	2.4	10,000
Passenger Car	LPG	57	0.056	0.001	170	0	192	2.7	15,000
Taxi	gasoline	66	0.061	0.001	203	0	241	2.9	45,000
Taxi	diesel	55	0.580	0.031	175	25	240	2.4	45,000
Taxi	LPG	57	0.06	0.00	170	0	192	2.7	45,000
3-wheeler	gasoline	24	0.000	0.000	75	0	89	1.1	20,000
3-wheeler	diesel	19	0.500	0.050	61	11	86	0.8	20,000
3-wheeler	CNG	32	0.5000	0.000	96	0	134	1.5	20,000
Motorcycle	gasoline	36	0.194	0.004	111	1	132	1.6	5,000
Small bus	gasoline	148	0.000	0.000	455	0	541	6.6	30,000
Small bus	diesel	152	5.092	0.040	484	27	622	6.5	30,000
small bus	LPG	196	0.180	0.022	585.447	0.000	659.671	9.278	30,000
Urban standard bus	diesel	371	5.420	0.046	1183	31	1,487	16.0	45,000
Urban standard bus	CNG	490	2.500	0.005	1,470	0	2,051	23.5	45,000
Coach bus	diesel	247	4.520	0.035	787	24	992	10.6	10,000
LCV	gasoline	70	0.064	0.001	215	0	256	3.1	20,000
LCV	diesel	80	0.831	0.041	255	32	346	3.4	20,000
LCV	LPG	57	0.06	0.00	170	0	192	2.7	20,000
Truck < 7.5t	diesel	101	1.640	0.011	322	7	403	4.3	10,000
Truck 7.5-16t	diesel	155	2.650	0.016	494	11	618	6.7	10,000
Truck 16-32t	diesel	210	3.830	0.024	669	16	839	9.0	10,000
Truck >32t	diesel	251	4.610	0.027	800	18	1,002	10.8	10,000

Source and Assumptions

Emission factors and fuel consumption EEA, (2020), COPERT Tier 2 except for small buses, 3-wheelers and standard urban buses (standard urban buses based on Tier 3 with 15km/h and 50% load)

car/taxi: medium size

Motorcycle 4-strooke<250cm3, Euro 1 respectively Euro 2

all units g/km

General Parameters			
Parameter	**Value**	**Unit**	**Source**
NCV of diesel	43	MJ/kg	IPCC, 2006, table 1.2
CO_2 emission factor of diesel	74.1	gCO_2/MJ	IPCC, 2006, table 1.4
Density of diesel	0.844	kg/l	IEA, 2005
Well-to-tank mark-up factor diesel	23%		UNFCCC, 2014, Table 3
NCV of CNG	48	MJ/kg	IPCC, 2006, table 1.2
CO_2 emission factor of CNG	56.1	gCO_2/MJ	IPCC, 2006, table 1.4
Density of NG	0.714	kg/m^3	IGU, 2012
Well-to-tank mark-up factor CNG	18%		UNFCCC, 2014, Table 3
Methane slip as % of NG consumption TTW	1.1%		Average low and high value of ICCT, 2015, table 4 for crankcase and tailpipe
Methane slip as % of NG consumption WTW	3.4%		Average low and high value of ICCT, 2015, table 4 for well-to-pump and fuelling station plus TTW slip
NCV of gasoline	44.3	MJ/kg	IPCC, 2006, table 1.2
CO_2 emission factor of gasoline	69.3	gCO_2/MJ	IPCC, 2006, table 1.4
Density of gasoline	0.741	kg/l	IEA, 2005
Well-to-tank mark-up factor gasoline	19%		UNFCCC, 2014, Table 3
GWP_{100} of BC	900		Bond, 2013; see also IPCC, 2013, Table 8.A.6
GWP_{100} of CH_4	28		IPCC, 2013, Table 8.A.
BC fraction Euro 2 gasoline passenger car and LCV	25%		EEA, 2020, tabla 3-92
BC fraction Euro 4 gasoline passenger car and LCV	15%		
BC fraction Euro 2 diesel passenger car and LCV	80%		
BC fraction Euro 4 diesel passenger car and LCV	87%		
BC fraction Euro II HDV	65%		
BC fraction Euro IV HDV	75%		
BC fraction Euro 1 Motorcycle	25%		
BC fraction Euro 2 Mot	25%		
Conversion kWh to MJ	3.6	MJ per kWh	https://home.uni-leipzig.de/energy/energy-fundamentals/03.htm#:~:text=Power%20units%20can%20be%20converted,%3D%203.6%20MJ%20%5B
Battery manufacturing emissions	110	$kgCO_2$/kWh	ICCT, 2018, table 1 (per kWh battery set); average value not taking into account 2nd life usage of batteries