



2° ELECTROMOBILITY REPORT



2025

**The consolidation of a State Policy:
Santiago as a global leader**

January, 2026





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INTRODUCTION



A CONSOLIDATED PUBLIC TRANSPORT SYSTEM

1. Electromobility as a State Policy

A. Letters from Authorities



JUAN CARLOS MUÑOZ ABOGABIR
Ministro de Transportes y Telecomunicaciones



It is with great pride, after almost four years at the helm of this Ministry, that I present the second edition of the RED System Electromobility Report, a document that consolidates recent progress and outlines the challenges that will guide the transformation of public transportation in our country. Chile has embraced electromobility as a State policy, understood not only as a technological innovation but also as a cross-cutting commitment to sustainable development, environmental justice, and the quality of life for all. This vision, built steadily over the last decade, has enabled numerous institutions, regional governments, municipalities, companies, and communities to move forward in a coordinated manner toward a cleaner, more efficient, and more resilient transportation system.

The results achieved in the RED Movilidad system clearly reflect this effort. Currently, Santiago has 3,849 electric buses in operation, and 1,344 new units were added in 2025 alone—the highest annual figure recorded to date. This progress solidifies our capital city's position as the one with the most electric buses outside of China and allows us to project that, by March 2026, the system will reach approximately 4,400 electric buses, equivalent to 68% of the operational fleet. Beyond the numbers, these advances translate into cleaner, quieter, more comfortable, and more reliable transportation for millions of people. Furthermore, they contribute to creating better urban environments, becoming distinctive icons of each city.

Electromobility has also been a concrete tool for advancing territorial equity. Historically underserved municipalities such as Lo Espejo, Puente Alto, Maipú, and El Bosque will end the current administration with more than 90% of their fleet operating under the RED standard, reducing historical gaps in access to quality public transportation and directly improving the quality of life of their residents. This process demonstrates that the energy transition can be not only an environmental policy but also a social policy.

The results achieved by 2025 clearly demonstrate the concrete impacts of this initiative. In terms of noise, the massive incorporation of electric buses has generated

significant noise reductions on the city's main avenues. On the Alameda corridor, reductions of up to 64% have been recorded, and up to 54% on the Santa Rosa corridor. Regarding air emissions, the progress has been equally significant. Between 2018 and 2025, local emissions of pollutants decreased by 93.6% for nitrogen oxides (NOx) and by 74.4% for fine particulate matter (PM2.5), some of the most harmful emissions for people, as a result of the progressive replacement of diesel fleets with electric buses.

The fleet replacement has been accompanied by a structural transformation of the system's depots. By the end of 2025, RED Movilidad has 73 bus depots, 45 of which are already electric depots, representing 61% of the total, distributed across 15 municipalities in Greater Santiago. In the last four years alone, 35 new electric bus depots have been built, representing a 350% increase and laying the foundation for robust, safe, and sustainable electric operation in the long term.

Today, the depots and RED buses are considered Good Neighbours. A prime example is the Diego Portales electric bus depot in the La Florida district, which has been operating with a 100% electric fleet since October 2025. This has allowed us to evaluate noise reduction, air quality improvement, and community perception through specialized studies presented in this report. These studies show a 60% reduction in noise at the depot and a 33.5% reduction in particulate matter emissions, resulting in a better quality of life for drivers and residents. Today, residents have a positive assessment of the depot, improving the relationship between public transportation operations and their communities.

In parallel, over the past four years, eleven regions have already begun deploying their electromobility fleets, playing a decisive role in this transformation. Today, more than 330 electric buses are operating in cities such as Arica, Iquique, Antofagasta, Copiapó, Coquimbo-La Serena, Valparaíso-Viña del Mar, Colina, Rancagua-Machalí, Concepción, Temuco, and Puerto Montt, confirming that electromobility is no longer limited to the capital. By adhering to the RED bus standard, we ensure that the fleet in each of these cities is equivalent to the one operating in Santiago. Each regional implementation has involved specific lessons learned in terms of infrastructure, operation, and local management, strengthening a public

policy that recognizes the country's territorial diversity. All this progress is based on Chile's environmental commitments, within the framework of its Nationally Determined Contributions (NDCs) and the National Electromobility Strategy, which sets the goal that by 2035 only vehicles with zero local emissions will be sold. The electrification of public transport is one of the most effective tools not only for advancing the decarbonization of our cities and seriously addressing the challenges of climate change, but also for making them better places to live.

This report details a path built collectively across three administrations. Its results reflect the work of hundreds of people and institutions that have contributed to consolidating electromobility as a pillar of the country's development. We reaffirm our commitment to continue driving this agenda with determination, transparency, and a long-term vision, convinced that a cleaner, more modern, and more equitable Chile is possible when transport is put at the service of people and the future we want to build.



PAOLA TAPIA SALAS
Directora de Transporte Público Metropolitano

Urban Mobility as a Social Investment.

As the Metropolitan Public Transport Authority (DTPM), we have led the advancement of urban public transport in Santiago, Chile, building with a sense of urgency and efficiency a resilient, sustainable, and people-centred system capable of responding to current demands and projecting quality mobility for future generations.

During this administration, we have consolidated electromobility as a State policy, grounding it in the strengthening of urban mobility as a social investment. Indeed, the pillars supporting this public policy are a solid and robust legal and financial framework that, with economic stability and fiscal responsibility, has promoted investment; an innovative contractual scheme, under a governance model that includes public and private participation; and environmental sustainability as an international commitment to mitigating climate change and contributing to our country's decarbonization process by 2050.

In these years, we consolidated a strategic approach to electromobility that included the sustained and historic expansion of the electric fleet, establishing Santiago as the city with the most electric buses after Chinese cities. Thus, we also finalized the development of much-needed charging infrastructure, the strengthening of technical capabilities, and the improvement of planning and operational processes. This installed capacity constitutes one of the most significant legacies in terms of added value for the period and a key public asset for sustaining and deepening the transformation of the system in the coming years.

The results achieved in 2025 clearly demonstrate the concrete impacts of the Metropolitan Public Transport Authority's management, including the implementation, on an unprecedented scale, of the first public tender in over 17 years in our capital, incorporating a new fleet and electric bus depots. Based on the analysis of this process, studies, market consultation, a citizen participation

process called "What Moves You?", and an unprecedented consultation with bus manufacturers, we developed a complete second tender and award process in 11 months, significantly reducing timelines and providing greater certainty to the market.

The results were compelling: 86 bids from nine operators, five manufacturers, and four financial institutions, a competition that translated into an estimated annual savings of USD \$60 million. Following the established model, a third bidding process, currently underway, was launched to continue fleet renewal and generate further savings for the system.

As with any public policy, its results are constantly monitored and evaluated. However, in a commitment to industry, academia, and civil society, as well as to other countries that have begun or will begin their journey toward electromobility, we have prepared this second report, which details the evolution of this technology's adoption, expansion, savings, and challenges over the past eight years.

These environmental advances have had direct and measurable impacts on people's health, an issue also addressed in this report with previously unpublished data from estimates prepared jointly with the Environmental Health Department of the Ministry of Health. These show that the sustained decrease in fine particulate matter concentrations in the Metropolitan Region has prevented a significant number of premature deaths.

We therefore share the results of the State policy on electromobility, reflecting a vision from the management that understands sustainability and resilience as central pillars of public policy, and which seeks to prepare the transportation system to face future scenarios of uncertainty, whether due to variations in demand, environmental requirements, or critical events.

Electromobility is now a defining feature of the city of Santiago, as is the presence of more than 2,000 female drivers, developing a more humane and modern public

transportation system that has made our city a global benchmark in mobility.

We deeply appreciate the commitment of the DTPM teams, the companies, the Ministry, and all the institutions that have been part of this process. The 2025 results allow us to confidently affirm that we are moving towards more resilient and dignified mobility for everyone.

B. Electromobility: a State Policy

→ 1. RED Movilidad: a resilient and transformative system

Electromobility in public transport in Chile has emerged as a concrete response to international commitments to mitigate climate change and the need to improve the quality and sustainability of urban services. Following the ratification of the Paris Agreement, the country defined specific goals in its Long-Term Climate Strategy, establishing that all new additions to urban public transport must be zero-emission by 2035 and that, by 2040, regional systems must operate entirely with clean technologies.

To advance these goals, the State has consolidated a regulatory and financial framework that allows for the implementation of large-scale electromobility projects. Among the most relevant instruments is Law No. 20,378, published in September 2009, which creates a national subsidy for paid public passenger transport and other complementary regulations, such as Law No. 18,696, published in March 1988, which establishes, among other things, the basic rules for the bidding processes for the use of public transport system routes, as well as its complementary services; Law No. 18,059, published in October 1981, which assigns the Ministry of Transport and Telecommunications (MTT) the status of national governing body for transit and assigns it powers; and Supreme Decree No. 212, processed in October 1992, which grants the MTT broad powers to intervene in and regulate public transportation nationwide.

In parallel, policies such as the 2018 Energy Policy 2050 and its 2022 update, the First National Electromobility Strategy of 2017 and the new National Electromobility Strategy of 2022, Law No. 21,305 on Energy Efficiency of 2021, Law No. 21,505 on Storage and Electromobility of 2022, the 2025 Sectoral Plan for Mitigation and Adaptation to Climate Change in the transport sector and the 2022 Sustainable Mobility Policy. They have guided the adoption of clean technologies in urban transport. This set of instruments, developed by different administrations, has provided continuity and coherence to electromobility, consolidating it as a long-term state policy.

In this context, the RED Movilidad System emerges as the leading example of electromobility worldwide. Starting in 2017, when the first electromobility strategy was created and the first electric buses were incorporated, the process

began with the first road usage tender that included electric buses. This was followed by the 2019 bus supply and operation tender process, as well as those carried out in 2023 and 2025 (hereinafter referred to as the 2023 and 2025 Tenders, respectively). These processes, which for the first time established the obligation to incorporate 100% electric buses into the entire fleet, along with the construction of the necessary charging infrastructure, introduced various elements that contributed to the objective of strengthening sustainability, reducing barriers to entry, and fostering participation and competition.

Thus, the provision of the fleet and its respective charging infrastructure was based on a provisioning model that allows for the acquisition and management of assets, defining them as assets of the concession and guaranteeing the full payment of fleet instalments. The availability of depots and electric bus depots was also reinforced by third parties, especially through the public company Desarrollo País, which acquires and makes available the land necessary for operation.

All of the above is under a sustainable scheme based on the national subsidy for public transport created by law, which guarantees the long-term financing of the System, in conjunction with the fares paid by users. This structure guarantees service continuity, independent of the operator, mitigates financial and operational risks, improves efficiency, and ensures the responsible use of public resources.

The year 2025 marks a decisive stage in the evolution of the RED Movilidad System, consolidating the implementation of contracts derived from the 2023 Tender and advancing the awarding of the 2025 Tender, aimed at strengthening the system's operational resilience and risk management. While the 2023 Tender established a homogeneous technical standard in terms of comfort, energy efficiency, and safety, the 2025 Tender expands upon these achievements by incorporating integrated energy backup management and greater participation of women drivers in operations.

This process of technical and contractual consolidation has had direct effects on the system's economic efficiency. Both tenders have been fundamental in consolidating electromobility within the system, enabling a significant

reduction in operating and investment costs. In particular, a 66% decrease in energy consumption per-bus and a 44% decrease in fleet maintenance costs were observed, efficiencies that were passed on to price through the competitive process developed in 2023.

Furthermore, compared to 2017, the acquisition price of buses has fallen by 49%, with the 2023 tender achieving an additional 19% reduction compared to the values observed in previous renewal processes. Regarding infrastructure, depot costs decreased by 40% per square meter, and charging infrastructure saw a 17% reduction compared to the values recorded in the 2019 tender. Taken together, these efficiencies reflect a more efficient use of public resources, generating significant savings for the system.

During this period, the implementation of the new contracts has generated significant learning among the various stakeholders in the electromobility ecosystem, reflecting the maturity achieved in the management of the electric fleet and in public-private coordination. The operation of the more than 3,849 electric buses that the RED Movilidad System will have by the end of 2025, representing 58% of the total fleet, has demonstrated high stability and adaptability to contingencies, as well as a smooth transition between outgoing and incoming operating companies.

This has been possible thanks to the implementation of energy backup protocols, transition plans, intelligent charging management systems, and ongoing coordination with operating and distribution companies. These measures have ensured the availability and reliability of the service, defining 2025 as a key year in the consolidation towards an electric and resilient public transportation system.



2. About this report

This Second Electromobility Report presents the main results achieved by the Metropolitan Public Transport Authority (DTPM) during 2025, integrating historical data from 2022 to 2025, as well as background information illustrating the evolution of the implementation, operation, and sustainability of electric public transport in Santiago. Its purpose is to communicate the technical, environmental, social, and economic results associated with this transformation, in accordance with the principles of transparency, accountability, and access to public

information, as established by the Transparency Law and international treaties such as the Escazú Agreement.

The information was built upon a robust data governance framework developed by the DTPM during the current administration. This framework has enabled the consolidation, standardization, and collaborative sharing of data from various departments, including strategy and contract management, citizen engagement, finance and economic analysis, planning, intelligent transportation systems, and operations and maintenance, among others, which form the structural basis of this report.

This internal database is complemented by specific studies and inter-institutional collaboration, integrating information from concessionaires and operators of the RED System, the Ministry of Environment, the Ministry of Energy, the Ministry of Health, the Superintendency of Electricity and Fuels, the National Energy Commission, freight and ancillary service operators, and external collaborating organizations, strengthening the consistency and robustness of the analysis.

The report also incorporates the results of 26 interviews with key stakeholders in the electromobility ecosystem, from both the public and private sectors, providing insights into the challenges and lessons learned during the implementation of the 2023 tender. In addition, it includes field studies and technical estimates aimed at measuring the impact of electromobility on various dimensions of sustainability, ensuring the traceability and comparability of data at the national and international levels.

The report also links its findings to the Sustainable Development Goals (SDGs), particularly SDGs 7 (Affordable and Clean Energy), 9 (Industry, Innovation and Infrastructure), 11 (Sustainable Cities and Communities), and 13 (Climate Action), as well as other goals related to health and well-being, gender equality, decent work, and responsible production, reflecting the cross-cutting and integrated nature of electromobility as a public policy.

The experience of Santiago de Chile offers valuable information for expanding the model to other regions of the country and for its application in urban contexts in Latin America and around the world. The lessons learned and indicators derived from recent tenders serve as a reference for defining technical parameters, financial schemes and replicable management protocols, contributing to strengthening the planning and sustainability of electric public transport systems.

Table 1: Sustainable Development Goals contained in this report

SDG	Sections of the report	Main topic
3 GOOD HEALTH AND WELL-BEING 	<ul style="list-style-type: none"> Public health impacts: cleaner air and improved well-being Quieter cities: reduced urban noise 	Reduction of MP _{2.5} , NO _x and urban noise; reduction of respiratory and cardiovascular risks; improvements in well-being and quality of life of users and exposed communities.
5 GENDER EQUALITY 	<ul style="list-style-type: none"> Urban infrastructure with a gender perspective Women Drivers Program 2023 and 2025 tenders: inclusion of women drivers 	Promoting female participation in driving, improving working conditions, and designing safe and accessible bus stops and depots with a gender focus.
7 AFFORDABLE AND CLEAN ENERGY 	<ul style="list-style-type: none"> Charging infrastructure and standardization Smart charging network: energy management to support operations Energy sources and renewable supply 	Use of renewable electricity, energy efficiency, smart demand management and alignment with the national energy transition.
8 DECENT WORK AND ECONOMIC GROWTH 	<ul style="list-style-type: none"> Human capital and green jobs in electromobility Working conditions and training in operating companies Reliability, maintenance, and telemetry 	Generation of green jobs, improvement of working conditions, technical training, increased productivity and reduction of operational costs.
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	<ul style="list-style-type: none"> Electric bus depots: the backbone of the electric bus system Infrastructure for electromobility: resilience and energy management Telemetry, intelligent monitoring, and predictive maintenance 	Development of critical infrastructure, technological innovation, digitization, technical standards and strengthening of industrial capabilities.
11 SUSTAINABLE CITIES AND COMMUNITIES 	<ul style="list-style-type: none"> Network infrastructure and its contribution to urban transformation Electric bus depots and urban transformation Priority lanes and safe stopping points 	lean, accessible and resilient public transport; reduction of urban externalities; strengthening of territorial equity and the quality of public space.
12 RESPONSIBLE CONSUMPTION AND PRODUCTION 	<ul style="list-style-type: none"> Fleet energy efficiency Waste management and water consumption at depots Battery management and asset lifecycle management 	Efficient use of resources, reduction of energy consumption per km, responsible waste management and optimization of the life cycle of buses and batteries.
13 CLIMATE ACTION 	<ul style="list-style-type: none"> Energy consumption and GHG reduction Local and global emissions from public transport System resilience to contingencies 	Climate change mitigation, GHG emissions reduction, adaptation through energy resilience and service continuity.



Year 2015 **Chile bets on the future**

Chile presents its climate commitments (NDCs), agreeing to reduce its emissions by 30% by 2030. Electromobility is integrated as part of public transport and the National Energy Policy 2050.

Year 2016 **Regulatory strengthening for cleaner transport**

The Santiago Prevention and Decontamination Plan (PPDA) of the Ministry of the Environment require Euro VI emission standards for new buses starting in 2018, laying the regulatory groundwork for the incorporation of cleaner technologies in public transport.

Year 2017 **Initial trials of electric buses and other technologies**

Pilot trials begin with two electric buses, ten Euro VI diesel buses, and one double-decker bus, all featuring high comfort standards, including air conditioning, USB ports, cushioned seats, and safe driver's cabins. That same year, the first National Electromobility Strategy is launched, paving the way for cleaner and more modern public transportation.

Year 2018 **First massive leap**

100 Metbus electric buses, powered by Enel, begin operating in seven districts of the city. Additionally, the first two smart electric charging depots are inaugurated in Maipú and Peñalolén, with more than 120 charging stations.

Year 2019 **Transantiago is transforming into RED Movilidad.**

288 electric buses and 613 Euro VI diesel buses with high comfort standards are being added, distinguished by their red and grey colour scheme and the inclusion of air conditioning, USB ports, Wi-Fi, padded seats, and safe driver cabins, changing the travel experience. Furthermore, a new bidding model is being implemented with the publication of two sets of tenders: one for the Supply of Buses and another for the Operation, separating the operation of the transport system from the acquisition and maintenance of the vehicles.

Year 2020 **Chile aims for carbon neutrality by 2050**

Chile updates its climate commitments (NDCs) and will replace more than 1,300 Euro 3 diesel buses with 836 electric and 393 Euro VI buses.



Year
20
21

Climate goals: 100% zero-emission buses

The updated National Electromobility Strategy stipulates that, by 2035, 100% of new additions to the public transport fleet will be zero-emission vehicles, and by 2040, the entire fleet will utilize zero-emission technology. Contracts for the supply of buses have been signed, with three winning companies set to provide 991 electric buses and 646 Euro VI diesel buses between 2022 and 2023.

Year
20
22

Preparing for Expansion

- Road Use Concession Contracts are signed with the transport companies RBU, STU, and Metropól, which are awarded the operation of 153 routes. The "Red Avanzamos Contigo" (RED Moving Forward Together) Campaign is launched to coordinate and inform the public, in conjunction with the municipalities, about the gradual implementation of the new buses and awarded transport services.

- A framework collaboration agreement is signed between the Ministry of Transport and Telecommunications, the Ministry of Energy, the Ministry of the Environment, and third parties for the development of pilot programs for hydrogen buses in Santiago's public transport system.

- The Anti-Evasion Plan is launched, implementing a comprehensive strategy to reduce fare evasion, strengthening oversight and control within the RED Movilidad system.

- In December 2022, the implementation of the contracts begins with the incorporation of a new fleet and an unprecedented transfer of buses and depots.

Year
20
23

Historical acceleration

- Between December 2022 and May 2023, 1,637 new buses (electric and diesel) were deployed, and 14 electric bus depots were opened.

- An unprecedented citizen participation process, "What Moves You?", was conducted to inform the new 2023 Operation and Supply Tender, updating the information generated during the 2016 participation process.

- The first 100% electric tender (Operation and Supply No. 002/2023) was published, which includes the introduction of 1,200 electric buses and 20 electric bus depots by 2025.

- The first double-decker electric buses in Latin America arrived for the Pan American Games, along with the 555 service, which connected to the airport for the first time.

- Electromobility reduces noise in the Alameda by 44% and fine particulate matter (PM2.5) by 52.8% and CO2eq by 22.3% compared to 2019.

- The Ministry of Transport and Telecommunications published a Roadmap for the advancement of electromobility in Chile, a 5-pillar strategy to 2026 aimed at expanding electromobility throughout the country.

Year
20
24

More buses, more trust

- 214 electric buses are added to the fleet, reaching 2,505 electric buses by 2024: 1 out of every 3 buses in the RED System is electric.

- The second service to the airport is launched, connecting the La Cisterna Intermodal Station with the Airport.

- Operation and Supply contracts No. 002/2023 are signed with the transportation companies Voy Santiago, Gran Américas, and Consorcio Conecta to add 1,267 electric buses and enable the operation of 20 electric bus depots by 2025.

- Pilot programs are developed for new onboard technologies focused on improving driving safety and providing real-time information on bus operation. These pilot programs helped define advancements in fleet specifications.

- Public trust reaches 56%, the highest level in a decade, according to CADEM Survey No. 568.

Year
20
25

Chile, World Leader in Electromobility

- Public Tender No. 001/2025 for the Use of Public Roads, a 100% zero-emissions concession, is published. This tender includes the introduction of new electric buses and is projected to be awarded during the first quarter of 2026.

- Implementation begins for the Operation and Supply Tender No. 002/2023, a year marked by modernization with the start of operations of 1,344 new electric buses, reaching a total of 3,849, equivalent to 58% of the RED Movilidad System fleet, and 45 electric bus depots that support their operation.

- Double-decker electric buses and new brands of electric buses are incorporated, expanding the technological offering, strengthening competition, and adapting the fleet to different demand and operational contexts. - The first electric articulated buses in the region begin operation.

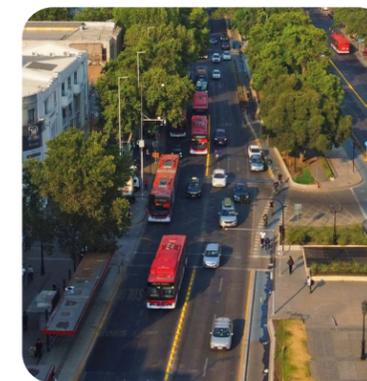
- Construction begins on the first four public electric bus depots through the public company Desarrollo País, consolidating a new infrastructure model for the system.

- Strategic alliances are progressing for the pilot program of green hydrogen buses in public transportation with institutions such as the Ministry of Energy, GIZ, Reborn Electric, and HydroHaul.

- RED Movilidad is consolidated as a Citizen Brand, entering the CADEM national ranking and standing out for its environmental commitment and contribution to quality of life.

- Chile consolidates its position as a global leader, becoming the second country with the most electric buses in the world after China.

- Services 555 and 444 to Santiago Airport are consolidated as a public, economical, and sustainable alternative, exceeding 6 million trips and registering sustained demand growth. - In 2025, 1,368 billion transactions were reached, increasing 28.8% compared to 2022.



C. Foundations of Electromobility

In accordance with the Chilean government's 2015 commitment to reduce emissions by 30% by 2030 in its first Nationally Determined Contribution (NDC) submission, the incorporation of the first two electric buses into Santiago's public transportation system in 2017 marked a foundational milestone for RED Movilidad.

These buses allowed for the evaluation, under real-world conditions, of their operational capacity considering Santiago's specific characteristics (topography, density, peak demand), as well as the electrical system's ability to supply and deliver the necessary energy for charging. Simultaneously, they enabled the observation of operational and maintenance benefits, along with the passenger experience of traveling on a modern, quiet, and comfortable fleet.

Their operation laid the groundwork for planning, gradually but decisively, the incorporation of this type of fleet on a much larger scale. Today, eight years later, the RED Movilidad System has established itself as a global benchmark for its early adoption of a sustainable, low- and zero-emission fleet, boasting the world's largest electric bus fleet outside of Chinese cities, and launching the largest 100% electric tender process for a single city in the Western world in 2023. This chapter highlights key aspects that enabled progress along this path and the consolidation of electromobility in Chile.

➔ 1. Legal and financial keys: foundations of electromobility in RED Movilidad

a) Key Legal Elements

The transformation of public transportation in Chile has been made possible by a legal and financial framework that combines economic stability, public oversight, and environmental sustainability. Since the enactment of Law No. 20,378, which created a National Public Transportation Subsidy in 2009, the country has had a permanent instrument that ensures the system's financing, provides certainty to the industry, and allows for long-term investment planning. This subsidy has become the foundation of a model capable of incorporating clean technologies, reducing operational risks, and guaranteeing service continuity.

This law establishes a subsidy that is adjusted annually in the national budget law and creates a Panel of Experts, an autonomous technical body responsible for reviewing fare adjustments quarterly to safeguard the system's financial sustainability. These adjustments can be made to maintain the real value of the fare or to define a fare level that allows the system to be financed. In operational terms, the transfer and use of the subsidy is authorized every two weeks by decree, following review by the Comptroller General of the Republic, ensuring legality, traceability, and transparency in the payment flow.

Furthermore, the system's revenues, comprised of those derived from fares and the subsidy, are managed by the Transantiago Financial Administrator (AFT), which operates them as an autonomous and independent fund separate from the managing unit. Within this framework, the Ministry of Transport and Telecommunications (MTT) instructs and coordinates payments to the operating companies according to established standards.

This framework is complemented by additional regulations, such as Law No. 18,696, which establishes, among other things, the basic rules for bidding processes for the use of public transportation routes; Law No. 18,059, which designates the Ministry of Transport and Telecommunications as the national governing body for transit and defines its powers; and Supreme Decree No. 212, which grants the Ministry of Transport and Telecommunications the authority to regulate operations, define technical standards, and establish concession conditions for urban public transportation. These regulations provide contractual flexibility through two instruments: the Concession for Supply and Operation, awarded through public bidding, and the Specific Operating Conditions, applied when continuity of service is required while a new bidding process is underway. Both mechanisms establish equivalent obligations and regulate aspects such as fleet composition, vehicle technical specifications, and operating and maintenance standards.

b) Key Financial Elements

The design of Santiago's public transportation business model is based on three fundamental pillars: a subsidy that guarantees financing, the reduction of barriers to entry to foster competition, and the mitigation of financial risks through a contractual structure that provides certainty. The system's main financial element is its permanent subsidy, established by law, which constitutes a social investment provided by the State that ensures financial sustainability. As part of the system's revenue, it complements the resources derived from fares, reducing exposure to demand fluctuations and mitigating associated risks. Furthermore, its legal backing provides long-term certainty, incentivizing investment and contributing to the reduction of interest rates and financial costs.

On the other hand, the State's acquisition of depots, through the State-owned company Desarrollo País, has been fundamental in eliminating entry barriers into the system. Within a model that separates service operation from asset ownership, the Ministry makes all the necessary real estate available to operating companies, without requiring them to already own land or make investments to acquire it after the services are awarded. This creates a strong incentive for participation, with direct effects on competition levels and the resulting prices.

Finally, based on the subsidy and the separation between operation and assets, Santiago has developed a fleet and freight infrastructure provision model that allows the State to maintain control over essential assets and ensure the system's continuity, even in the event of operator changes. Through the Fleet and Infrastructure Management (AFT) model, the system implements centralized financial management that guarantees full payment for assets throughout their useful life, reducing financial risks and providing stability to the system.

Its structure is based on a provision contract that defines two main characteristics: fleet (or infrastructure) quotas and the category of assets subject to the concession. These supply contracts allow operators to access the necessary assets, such as electric buses and charging infrastructure, subject to approval by the Ministry of Transport and Telecommunications (MTT), ensuring compliance with technical and financial standards and fostering competition.

They always define a fleet (or infrastructure) quota, which corresponds to a fixed monthly payment intended to cover capital amortization and the financial costs associated with acquiring the assets. This quota, managed by the AFT (Transportation Fund Administrator), is transferred directly to the asset financiers, preventing late payments and guaranteeing operational continuity. This mechanism decouples financial management from operations, providing certainty for investors and stability to the system.

For its part, the concept of assets subject to concession, regulated in Article 3 nonies of Law No. 18,696, establishes that all assets essential for providing the service remain linked to the system. This allows assets with remaining useful life to be automatically transferred to the new operator upon contract termination, ensuring continuity of service and protection of public assets, as well as full payment of instalments until the end of the useful life.

This legal and financial framework has been essential for the implementation of electromobility, enabling the incorporation of 100% electric fleets and the construction of electric vehicle depots. Furthermore, it has facilitated the entry of new financial and technological players, reducing investment barriers and attracting private capital under clear and predictable rules.

Together, these tools consolidate a replicable and efficient model, aligned with the State's sustainability and fiscal responsibility objectives. Thanks to this framework, Santiago now boasts one of the largest electric vehicle fleets in the world and a governance structure that balances public and private participation, promotes technological innovation, and guarantees that the environmental and social benefits of electromobility endure over time.



→ 2. Bus Supply and Operation Tenders: competitive design and results

a) 2017 Process: prototype of a new model

In 2017, based on the powers that allow the Ministry of Transportation and Telecommunications (MTT) to tender the use of roads in cases of congestion, environmental degradation, or road safety conditions, and given the approaching expiration of four concession contracts in 2018, the first bidding documents with a structural focus on sustainability were drawn up, including a proposal for 90 electric buses. Although this process was not awarded in March 2018 after 13 bids were submitted, it was a pioneering step in the development of the current model.

First, it explicitly structured the separation between capital and operations. The Provision Contract, entered by the operating company for the use and enjoyment of the assets necessary to provide services and approved by the Ministry, was refined, and the legal framework for assets subject to the concession, created in 2015, was strengthened. This combination ensured that buses and depots could be transferred to the new operator in the event of contract termination, safeguarding the continuity of service.

Secondly, for the first time, the State directly assumed the management and acquisition of depots, establishing the precedent for what would later become the electric bus depots as strategic infrastructure for the system. This implied recognizing bus yards not only as private facilities but also as key components of public transportation policy. Thus, the first nine depots were acquired by the Metropolitan SERVIU (Housing and Urban Development Service), becoming the first public depots in the system.

Finally, the 2017 process reoriented incentives and indicators towards service quality and environmental sustainability. The payment formula was modified so that supply, in terms of kilometres, fleet size, and standards, would carry more weight than demand, consistent with international evidence showing that supply-driven systems are more stable and predictable.

In addition, explicit incentives were incorporated for low- and zero-emission fleets. At least one service per unit had to be low or zero emissions; higher scores and a longer concession period were awarded when the bid included zero-emission buses (up to 10 years instead of 8); and differentiated useful lives were established for each technology: 10 years for diesel buses, 12 for gas and hybrid buses, and 14 years or 1.2 million kilometres for electric buses.

Although it was never fully implemented, this model introduced a substantial change in the logic of participation for operating companies, proposing a new scheme with lower barriers to entry, decoupling the terms of the contracts for the provision of goods and for operation, and enabling mechanisms for the transfer of

assets between concessionaires. This reduced financial risks, fostered competition, and ensured that the essential assets for the service remained within the system.

b) 2019-2022 Tender Process

Following the 2017 process, a new scheme was designed that captured its spirit, but through two complementary tenders: one for bus supply (LSB) and another for the operation concession (LUV). The process lasted more than three years and reinforced the separation between capital and operation: operators had to select their fleet from a list resulting from the supply process.

After three years of work, 16 bids were received for the operation tender and 23 for bus supply; contracts were awarded for the acquisition of 992 electric buses and 648 Euro VI diesel buses from three manufacturers (Foton, Mercedes-Benz/CAIO, Volvo/Marcopolo), and these were awarded to three operators (RBU, STU, and Metropol) across six service units.

The incentives for a sustainable fleet were made more specific. A longer concession period (from 5 to 7 years) was provided if at least 50% of the proposed fleet was electric (a goal achieved by three service units); a differentiated useful life: 1,000,000 km or 10 years for diesel, 1,400,000 km or 14 years for electric; and the supplier's obligation to carry out, at its own expense, a battery replacement when the range fell below the minimum required.

c) Red Avanzamos Contigo: implementation on an unprecedented scale

The rollout of this new model, which involved changing operators, transferring depots and buses, incorporating a new fleet, and building the first electric bus depots, was planned during 2022 and implemented over a period of six months, between December 2022 and May 2023.

To support this process, the user information campaign "Red Avanzamos Contigo" (We Move Forward Network with You) was developed, which included a joint communication plan with municipalities, municipal associations, Carabineros (Chilean police), operating companies, and services under the Ministry of Energy, aimed at informing the public about the transition in a gradual and transparent manner.

The implementation modified approximately 40% of the system, with changes to 153 services, 40 adjustments to the Operating Program, and the creation of 9 new routes. During this same period, 1,600 new buses were added, 992 of which were electric, and 18 depots were transferred, 13 of them electric depots, located in 10 districts of the city (La Pintana, Huechuraba, Peñalolén, Renca, Puente Alto,

Quilicura, Maipú, Pudahuel, Las Condes, and Lo Prado). At the beginning of 2023, as a result of this process, two out of every three buses in the system became sustainable

and met the Red standard, consolidating a qualitative leap in fleet modernization and marking a milestone in the system's history.



d) 2023 Tender Process: Consecration of the supply model and first 100% electric tender

Based on lessons learned from processes developed between 2017 and 2023, external studies, process analyses, and market consultation, new tender specifications were developed, which included two key strategic processes:

a) A citizen participation process called "What Moves You?" updated citizen input, incorporating universal accessibility and a gender perspective across all sectors. This process involved 15,300 people from Greater Santiago through surveys, community dialogues in 20 municipalities, and 10 thematic workshops with stakeholder groups. These workshops included people with disabilities, older adults, caregivers, migrants, students, children and adolescents, drivers, and mobility and gender specialists, highlighting specific needs related to safety, accessibility, and caregiving.

b) An unprecedented industry consultation comprised over 90 inquiries divided into four sections, allowing for the collection of up-to-date information on technological advancements in zero-emission bus fleets and infrastructure. Twelve national and international companies from the sector participated in the process, addressing key aspects such as range, batteries, charging management, costs, safety, and technological innovations. A webinar was also held with approximately 60 market participants.

Among the results of this consultation, the following stand out: lower maintenance costs, reduced fleet downtime, and energy savings of up to 15% associated with efficient driving, along with a significant reduction in pollutant emissions. Furthermore, low battery degradation was observed after 10 years of operation, along with the development of second-life battery projects for energy storage, which can be integrated with renewable energy sources. Advances in safety and comfort were also highlighted, incorporating electrical monitoring, battery protection, and technologies aimed at improving the safety, accessibility, and experience of users and drivers. Based on all the above, the bidding model was redesigned, seeking to maintain the advantages of separating capital from operations, while incorporating new mechanisms to strengthen competition in all areas and accelerate decision-making.

This meant that the 2023 bidding model established the joint submission of bids between the operator, fleet provider, financier, and freight infrastructure provider, as was the case in the 2017 model. To maintain the separation between operations and assets, the provision contract was reinstated for both the fleet and the freight infrastructure, defining them as assets that can be transferred between operators and establishing the respective monthly instalments to be paid independently,

directly from the AFT, without being subject to operational indicators or risks associated with demand.

The collaborative work between stakeholders (operators, fleet and infrastructure providers, and financiers) allowed for the capture of all the complementary skills and expertise that exist between units in each area. This contributed to the development of bids free from uncertainty, by understanding all aspects related to performance, maintenance, battery cycles, and other factors, which could then be incorporated into price calculations and the generation of competitive offers. Furthermore, from the suppliers' and financiers' perspectives, the project provided certainty from the outset regarding the scale of the business, the ability to adapt their bids to the currency that would yield the best returns, and eliminated the uncertainty associated with the extended timelines of two consecutive bidding processes.

The process was completed in 11 months, from the call for tenders to the award, significantly reducing the timeframe compared to the previous cycle and providing greater certainty to the market by shortening the period of tied-up capital.

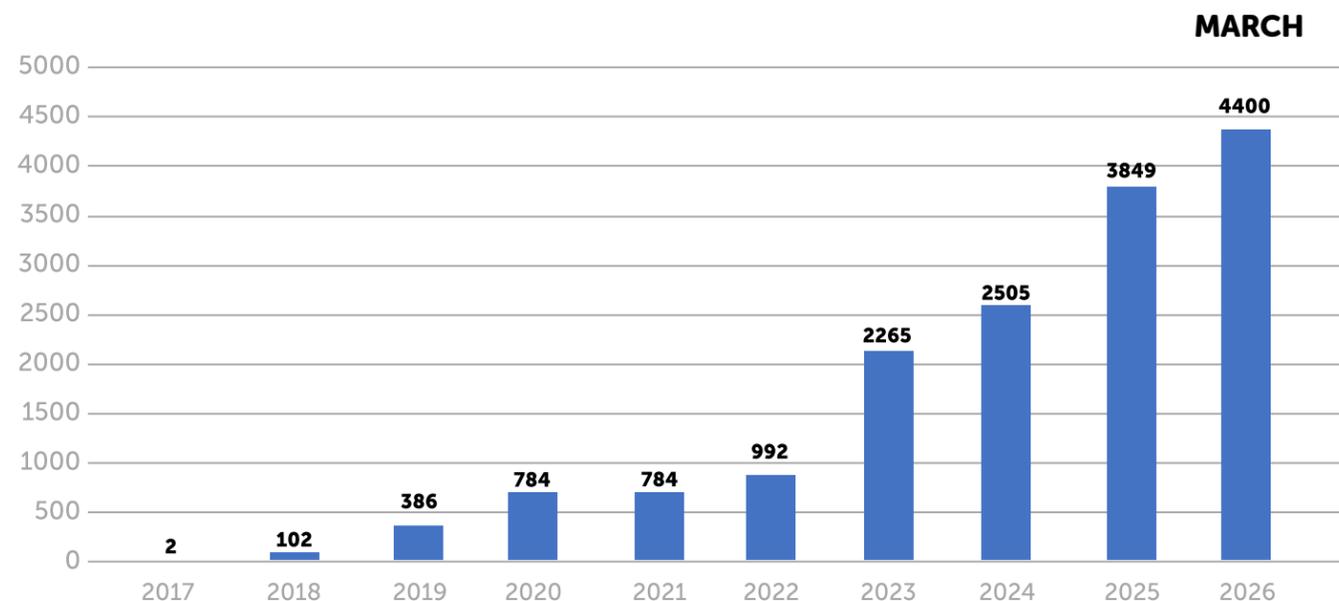
The results were conclusive. Eighty-six bids were submitted for the five Service Units tendered, with the participation of nine operators from Chile, Colombia, France, Mexico, Spain, and Argentina; five manufacturers based in China; four financial institutions from Chile, the United States, Colombia, and Brazil; and two charging infrastructure providers from Chile and Italy. Participation increased fivefold compared to the 2019 process, with an average of 17 bids per Unit, and resulted in the awarding of the contract for the acquisition of 1,267 new electric buses.

The competition demonstrated in the process translated into reductions of between 7% and 15% in fleet quotas compared to previous acquisitions and an estimated annual savings of US\$60 million for the system. In addition, two new operators joined RED Movilidad: Gran Américas, a Colombian company with experience in TransMilenio, for Service Unit 16, and the Conecta Consortium, an alliance between Hualpén (Chile) and two groups with international experience, Avanza (Spain) and ADO (Mexico), for Service Units 17 and 18. The remaining two units were awarded to Voy Santiago.

The implementation process for this tender began in May 2025 and is currently in its final stage. To date, 81% of the electric buses and 75% of the new electric bus depots have been incorporated. Its execution has required close coordination with public and private institutions to plan the transition, adjust operations, and ensure that the new electric fleet integrates seamlessly into the existing system. This deployment and the associated lessons are explored in greater depth in the following section, based on the perspectives of the various stakeholders in the

electromobility ecosystem. This tender, along with the renewal processes, will allow us to reach March 2026 with 4,400 electric buses, representing 68% of the RED Movilidad system.

Figure 1: Electric Fleet Evolution 2017 –2026



Source: Prepared by DTPM (2025)

"La reducción de emisiones lograda por el Sistema RED entre 2018 y 2025 equivale a sacar de circulación cerca de 58.000 autos particulares cada año."

"Más de la mitad de las transacciones en buses ya se realizan en flota eléctrica (54% en diciembre 2025)"

e) 2025 Tender Process: Consolidation of a 100% electric fleet

Given the results of the 2023 bidding process, the 2025 bidding process is conceived as a continuation of the existing model, maintaining the acquisition scheme for 100% electric buses through supply contracts and reinforcing incentives for zero-emission technologies. Key elements are retained, such as maintenance certification by an independent third party, guaranteeing uniform standards; the requirement for a contract with minimum specifications between concessionaires and bus suppliers; and the guarantee of battery autonomy for a defined period.

The technical evaluation of proposals considers various aspects, including experience in passenger bus transport, considering the number of buses and the duration of that experience within the last decade. Higher scores are awarded for experience in urban public transport in Chile, in conurbations, or in metropolitan areas abroad. Furthermore, the experience of bus manufacturers is also evaluated, particularly in the production of buses for urban transport and electric buses; as well as the energy efficiency of the vehicles offered, which is relevant for the operation of the electric fleet. and the average annual personnel expenditure, to incentivize proposals that allocate more resources to operational and maintenance staff.

Meanwhile, the economic evaluation is carried out in two stages: first, the economic value of each bid is determined based on the price per kilometre (PK), the number of buses, the fleet cost (CF), and the fee associated with infrastructure and depots, incorporating a specific payment for charging infrastructure (CIC) that clearly separates the costs of vehicles and charging systems. Then, a relative economic score is assigned considering all technically acceptable bids, ensuring the selection of efficient and competitive proposals.

At the time of writing, the 2025 tender is underway. A total of 63 bids were received from 8 companies for the 2 Service Units included in the tender. This process is the third phase that will allow for the completion of the replacement of the oldest fleet in the committed Service Units and progress toward operation with 100% electric buses. This model, which combines contractual innovation, public-private collaboration, and regulatory flexibility, consolidates electromobility as a structural axis of the system and reinforces incentives for the proper functioning of vehicles, energy efficiency, and the protection of human capital, maintaining Chile as a regional leader in electromobility.



→ 3. Transformation lessons: The implementation of electromobility in the RED Movilidad System

The implementation of electromobility in the RED Movilidad System has marked a turning point in the evolution of public transportation in Santiago. While the initial pilot programs demonstrated that electric buses could operate in the city, this period consolidated the large-scale deployment of electromobility as a public policy, engaging operators, manufacturers, technology companies, energy providers, public agencies, and academia to coordinate their efforts as a true ecosystem. The 26 organizations interviewed for this report allow us to reconstruct this process from the perspective of those who experienced it firsthand, revealing common lessons learned and shared challenges.

a) Transport operators: From pilot to new electric normal

For bus operators, the recent electric expansion cycle marked the definitive shift from experimentation to mass operation. Metbus, a pioneer since 2017, points out that electromobility has ceased to be a “technological novelty” and has become the central focus of its offerings. Companies that incorporated electric buses later, such as Subus, Voy, Vule, RBU, STU, Metropol, Gran Américas, and Consorcio Conecta, emphasize that the system reached this stage with a learning curve already underway, which allowed them to avoid design flaws in their fleets and charging stations.

In all cases, the implementation of electromobility involved reorganizing shifts, redefining maintenance strategies, and revising how services are planned. The transformation forced a shift from a logic centred on supplying diesel buses at scattered service stations to an operation where charging time, available power at each charging station, battery maintenance, and electricity rates have become daily management variables. For planning teams, this meant incorporating new boundary conditions, and for maintenance teams, developing expertise in high-voltage systems, power electronics, and remote diagnostics.

“We started with two buses to learn the ropes, and they ended up scaling up to almost 950, changing the system’s standard.”
*Diego Fuentes,
Planning Manager, Metbus*”

“Electromobility is no longer a pilot project; it’s part of the system’s normality and influences how we plan, maintain, and operate every day.”
*Matías Uribe, Head of Electromobility,
Operations and Studies Division, STU*”

“Our entry into RED coincided with the 100% electric tender. The message is clear: here, electromobility is no longer the exception, it’s the rule of the game.”
*Roberto Cabrera,
Gerente de Mantenimiento,
Conecta Mobility*”

“Our entry into RED coincided with the 100% electric tender. The message is clear: here, electromobility is no longer the exception, it’s the rule of the game.”
*Jaime Trejos,
Maintenance Manager, Conecta Mobility*”

Electromobility also transformed the relationship between workers and their work environment. Drivers highlighted improvements in their well-being, associated with better working conditions, such as reduced noise, less vibration, and improved cabin climate control. Maintenance and yard personnel, meanwhile, observed a reduction in certain tasks related to diesel engines, such as handling oils and filters, along with the emergence of new specializations linked to electrical and digital systems. Companies like Gran Américas and Conecta, recently incorporated into the system, indicate that joining an already established scheme with defined contractual frameworks allowed them to focus on service quality from the outset, without facing the uncertainties inherent in the early stages of the model.

b) Bus manufacturers: construcción del "Estándar RED"

The phased rollout between 2019 and 2023 solidified Chile as a demanding testing ground for electric bus manufacturers. Companies like Foton, Zhongtong, and others describe how they had to adapt their products to meet intensive operating schedules, high peak-hour occupancy, steep inclines, and contractual requirements for battery warranty and lifespan. The combination of large volumes, long-term contracts, and a rigorous technical monitoring system led to the development of a standard for Chile, the "RED Standard," for urban electric buses.

"To be honest, I always say that Chile is the number one country in zero-emission buses in the world, except for China. (Sinceramente, siempre digo que Chile es el país número uno en buses de cero emisiones en el mundo, después de China)."

Cairns Jiang, GM/Global New Energy Bus Director - American Dept, Zhongtong Bus Holding CoGerente de Buses y Vans Foton / Andes Motor

"Chile has one of the highest numbers of zero-emission buses outside of China. This forced us to design solutions specifically tailored to its real-world conditions, not for a laboratory scenario."

Rodrigo Sepulveda, Bus and Van Manager, Foton / Andes Motor

Manufacturers highlight three key dimensions of the collaborative learning process with the system: battery range during operation, energy efficiency on high-demand corridors, and quality for passengers and drivers. The evolution of contractual requirements, such as independent third-party maintenance certification and minimum range guarantees, reinforces this logic and aligns incentives: the technologies that perform best in the field are the ones that receive the best conditions to remain in the system.

c) Technology service providers from the isolated bus to the intelligent charging management system

The implementation of electromobility at the level seen in Santiago would not have been possible without the parallel development of planning systems, charging management, and monitoring platforms. Companies like Optibus, Enerlink, Dhemax, and Tracktec emphasize that electromobility forced a shift away from viewing the bus as an isolated unit and toward seeing it as part of an intelligent system where energy, operation, and data are intimately connected.

"Electromobility makes visible something that was always there: the importance of good planning. The difference is that now poor planning is immediately noticeable in charging, range, higher operating costs, and the user experience."

Alvaro Iriarte Sanderson, Regional Director Latam, Optibus

"Power generation depots are, in practice, small energy management centres. If designed well, they allow for the optimization of power, tariffs, and operations, and open the door to future services such as energy storage."

Sebastián Luque, Founder & CEO, Enerlink

For planners, these new platforms and energy management tools allow for the integration of range constraints, charging times, charger availability, and contracted power into service scheduling. The technological platforms have enabled the coordinated management of charging infrastructure, connecting chargers from different brands in a centralized energy management system. Telemetry systems allow for the monitoring of actual consumption, driving styles, and bus availability in near real-time, closing the loop between planning and the effective operation of services.

"We've gone from viewing the bus as an isolated machine to seeing it as a data node. Speed, fuel consumption, load status: all of that now feeds into real-time operational decisions."

Walter Moreno, Commercial Manager, Tracktec

d) Energy providers and distributors: the electricity grid aligns with public transport

From an energy perspective, the widespread adoption of electric public transportation has solidified a shift in scale: electric vehicle depots are becoming major energy demand centres, with contracts with deregulated customers, consumption patterns concentrated during nighttime periods and increasing demands for security and quality of supply. Enel X and Copec Voltex

"The model in Santiago is very good because it provides a lot of peace of mind for the financier: the AFT payments arrive every month, and that's a tremendous guarantee for investing in charging and energy infrastructure for the electric fleet."

Pablo Ugarte, Head of the Public Transportation Segment at RED, Copec Voltex

"Free market energy contracts, financing for charging infrastructure and rolling stock were key to making electromobility competitive. Long-term energy contracts with stable prices and investments backed by government guarantees provide certainty for financiers and operators, helping to expand the electric fleet."

Orlando Meneses, Head of Engineering-Execution & eMobility Chile, Enel Commercial

emphasize that the long-term contract scheme, coupled with centralized financing of fleet fees and the separation between energy costs and infrastructure costs, provides certainty for investing in integrated charging solutions. For the distribution companies (Enel Distribución, Empresa Eléctrica Puente Alto (EEPA), Compañía General

de Electricidad (CGE)), the challenge has been adapting networks designed under a traditional approach to the emergence of large, concentrated demand points. This has involved reinforcing feeders, building new dedicated lines, and anticipating network infrastructure projects based on information provided by the DTPM (Metropolitan Public Transportation Authority) and the operators. The interviews show that early coordination, along with clear

"We have built dedicated lines solely to power electrical depots. The key has been to sit down early with the transportation sector and define together where and when demand will grow."

Hernán Martínez Videla, Planning Department, Enel Distribución

"Each electrical substation is practically a major electrical project. If the planning with the distribution companies and the National Electrical Coordinator isn't done on time, operations simply won't begin."

Cristian Humeres, Commercial Manager, Puente Alto Electric Company (EEPA)

contracts and timelines, have been key factors in avoiding bottlenecks and enabling the electric bus depots within timeframes compatible with the tenders, thus ensuring the timely start of operations for the new electric fleets, the progressive replacement of buses, and an effective improvement in service quality for users.

"For a distributor with a presence in most regions of Chile, electromobility represents a challenge due to the concentration of demand at specific points in the network, but also an opportunity to contribute to the modernization of the country's energy infrastructure and continue improving the quality of service for all its customers."

Oscar Facusse, Commercial Director, Compañía General Eléctrica (CGE)

e) Academia: evidence, training and a long-term perspective

Academia has played a dual role in this process: on the one hand, providing evidence on the environmental and health impacts of electromobility; on the other, adapting human capital development to the new demands of the system. Studies underway at the Pontifical Catholic University of Chile, for example, analyse the effects of switching from diesel to electric buses on respiratory illnesses and emergency care, comparing primary emergency care services (SAPUs) and other local health centres located near electrified routes with those in control areas. This type of analysis seeks to robustly quantify how much of the health benefit can be directly attributed to fleet renewal.

“Chile’s experience in electromobility is so solid that we now teach it in classrooms and serve as an example for other countries. We haven’t had any major implementation failures, which speaks to the careful design of the model.”

Hugo Silva, Professor,
Pontifical Catholic University of Chile

At the same time, academics at the Federico Santa María Technical University emphasize that electromobility has driven the updating of curriculum, thesis projects, and continued education programs in areas such as air quality, power electronics, energy storage, and sustainable transportation systems. The Framework Law on Climate Change and carbon-neutrality goals have acted as catalysts for universities, technical training centres, and professional institutes to incorporate sustainable mobility and electromobility as mandatory subjects in their curricula.

Academia also raises emerging issues that go beyond the standard electric bus: the need to address emissions from abrasive wear (brakes, tires, road surface), the cybersecurity of increasingly connected systems, the second life of batteries, and the potential introduction of green hydrogen buses in specific segments.

“Electric buses reduce particulate matter and NOx, but the challenges don’t end there. We need to make progress on brake and tire emissions, cybersecurity, and the second life of batteries if we want a truly sustainable system.”

Mauricio Osses, Academic,
Federico Santa María Technical University

f) Public institutions: coordination and environmental justice

The public agencies interviewed, including the Superintendency of Electricity and Fuels (SEC), the National Energy Commission (CNE), the National Electric Coordinator, and the Environmental Assessment Service (SEA), agree that electromobility in public transportation has required a new form of intersectoral coordination. The SEC has had to develop specific regulations for electric bus depot infrastructure, reconcile deadlines with safety requirements, and build technical capacity among stakeholders previously unfamiliar with high-power systems. The CNE, for its part, has explicitly incorporated the demand for electric bus depots into transmission planning, while the National

“Our role is to ensure that all this infrastructure operates safely, efficiently, and sustainably. We know the deadlines are demanding, but moving quickly only makes sense if we do it right, with a network that inspires confidence.”

Julio Clavijo, Head of Energy Sustainability,
Superintendency of Electricity and Fuels (SEC)

Electric Coordinator has had to manage open access and connection processes for new facilities within tight deadlines. Furthermore, the working groups from various institutions have developed and built shared knowledge and experience that allows them to better address the challenges associated with electric bus depots. The ongoing exchange of knowledge, the use of a common technical language, and a shared understanding of the energy and transportation sectors have been key to levelling the playing field, reducing gaps, and fostering convergence between disciplines, thus strengthening a comprehensive and coordinated approach to the development of these projects.

The Environmental Assessment Service (SEA) contributes the perspective of environmental and territorial justice. Based on its experience with the first four depots built by the State through the public company Desarrollo País, the Service analysed their classification as bus depots and concluded, after a legal and technical review, that they were electric bus depots that did not require submission to the Environmental Impact Assessment System (SEIA) as such. This difference lies in the fact that, unlike a combustion-engine depot with direct interaction with passengers, these depots significantly reduce local emissions, noise and vibration levels, and do not generate the same negative impacts on surrounding communities.

“An electric depot significantly reduces noise, vibrations, and emissions for residents compared to a combustion-fueled depot. That, too, is urban environmental justice.”

Arturo Farías, Regional Director, Metropolitan Region,
Environmental Assessment Service (SEA)

Electric Coordinator has had to manage open access and connection processes for new facilities within tight deadlines. Furthermore, the working groups from various institutions have developed and built shared knowledge and experience that allows them to better address the

“Planning ahead is vital for the implementation of electromobility. The collaborative work undertaken focuses on guaranteeing the integrity of the electrical system and providing certainty to the various stakeholders in the process.”

Enrique Cruces, Professional, Planning
Subdepartment, National Energy Commission
(CNE)

“Adding hundreds of megawatts of power in just a few years is no small feat. Planning the transmission system with electromobility in mind allowed us to avoid major bottlenecks.”

Carla Hernández, Deputy Manager of
Interconnection Projects, National Electric
Coordinator

At the same time, the SEA highlights that this new infrastructure can be considered a “harmless industry,” opening the possibility of locating electric vehicle depots in more central areas and diversifying the territorial presence of sustainable public transport. From this perspective, electromobility not only contributes to improving air quality but also to a more equitable redistribution of environmental burdens and benefits in the city.

→ 4. Operative resilience

The rapid growth of the electric vehicle fleet has tested the system's resilience on various levels: from power outages and weather events to the institutional capacity to respond to technical or infrastructure problems. Interviews show that, far from being a weakness, resilience has become one of the main strengths of the Chilean electromobility model.

a) Operators and service continuity

Operators describe a set of protocols and practices that allow them to maintain service continuity even in the event of power outages or failures in the charging infrastructure. Subus, Metbus, Vule, Metropol, Gran Américas, and others recount experiences in which prolonged power cuts at certain depots forced them to use generators, redistribute their fleets, adjust loading levels, and, in some cases, temporarily adjust frequencies or capacity in their bus schedules to cover critical times. Energy planning—which buses are charged, when, and where—has become a natural part of the process, but it is a necessary condition for effective service planning and operation.

"We designed our plans assuming the grid could fail. Backup and coordination between yards allow us to maintain operations even in major contingencies."

Marcelo Cornejo,
Operations Manager, Gran Américas

"When the power goes out, it's no longer a surprise: we know which buses to move, which depot can provide support, and how to prioritize loads so that service doesn't stop."

Rodrigo Carreño,
Deputy Operations Manager, Vule

The contractual design and the requirement for backup systems at each public transport charging centre have been key factors in facilitating these responses. The generators required by the contracts, the ability to move fleets between depots within the same Service Unit, support between depots of different operators, and the flexibility to adjust the operating schedule in the face of extraordinary events have allowed them to maintain service even in adverse circumstances.

b) Energy, distribution and management of electrical contingencies

"Today we know that cutting off power to an electrical depot can paralyze a large part of the transportation network. That's why we treat it as a critical customer in our emergency plans and network design."

Hernán Martínez Videla,
Planning Area, Enel Distribución

Desde la perspectiva de la inyección de energía, las empresas distribuidoras, proveedoras de energía y operadoras de transportes han debido desarrollar protocolos específicos para electroterminales en el contexto de eventos de red. Las entrevistas evidencian que, ante contingencias de magnitud, se establecen prioridades de atención que, aun cuando hoy no siempre estén formalizadas en la normativa como "infraestructura crítica", como personas electrodependientes u hospitales, por ejemplo, reconocen en la práctica la importancia del transporte público eléctrico para la continuidad de la vida urbana.

"At electric vehicle charging stations, we no longer just think about how much they charge, but also how they continue operating when something goes wrong: responsiveness, online monitoring, and emergency plans are all part of the design."

Pablo Ugarte, Commercial Manager, Public Transportation Network, Copec Voltex

Los proveedores de energía e infraestructura de carga señalan que la resiliencia también se juega en el diseño de los sistemas: configuración de redundancias, segmentación de grupos de cargadores, capacidad de operar con potencias reducidas y monitoreo en línea del estado de la infraestructura. Estas decisiones permiten que, en caso de falla de un transformador o un alimentador, no se paralice por completo la operación del terminal, sino que se ajuste temporalmente la capacidad de carga.

c) Regulators and regulatory resilience

Regulatory bodies emphasize that resilience is not limited to physical infrastructure but also requires regulatory frameworks capable of adapting to a changing reality. The SEC has developed specific design and backup criteria for electric depots, defined by regulations as public transport charging centres (CCTP), considering scenarios of failure, earthquakes, or extreme events. The CNE has begun discussing the recognition of electric public transport as critical infrastructure, which would allow for the formalization of priority for supply restoration in the event of major contingencies.

"We designed the electrical depots with emergencies in mind. The idea is that, even with grid problems, the system can continue operating safely."

Julio Clavijo, Head of Energy Sustainability, Superintendency of Electricity and Fuels (SEC)

"There is a consensus that the continued operation of electric vehicle charging stations is fundamental for public transportation. To ensure this, we must use all available regulatory instruments and, if necessary, develop new classifications that reflect the critical nature of this type of energy consumption."

Enrique Cruces, Professional, Planning Subdepartment, National Energy Commission (CNE)

The National Electric Coordinator, for its part, has strengthened its open access and connection processes to accelerate the commissioning of strategic facilities.

The SEA, meanwhile, incorporates an additional dimension by considering environmental and territorial resilience: the possibility of locating electrical depots in more central areas, with low local externalities, contributes to reducing dependence on peripheral depots and, therefore, to diversifying the system's critical infrastructure.

"When an electric vehicle depot is connected, the focus isn't just on day one, but also on how the grid will respond during a major event. That's where prior planning and coordination with the DTPM (National Electricity Coordinator) has made all the difference in accelerating electromobility."

Carla Hernández, Deputy Manager of Interconnection Projects, National Electricity Coordinator

d) Academia and learning for future contingencies

From academia, system resilience is viewed as a continuous learning process. Experiences with outages, localized failures, and coordination difficulties have allowed for the identification of improvements to protocols and procedures, the redesign of certain aspects of contracts, and the inspiration of new lines of research in network modelling, joint transport and energy planning, and systemic risk assessment.

Academics emphasize that resilience also involves diversifying technologies, strengthening cybersecurity and data management training, and continuing to monitor the environmental impacts associated with non-exhaustive emission sources. They point out that electromobility must be understood as part of a broader system of critical urban infrastructure, where transport, energy, telecommunications, and basic services interact with one another.

"Electromobility has already shown that it can be sustained in adverse scenarios. The next step is to better integrate transportation, energy, and data into city planning."

Hugo Silva, Professor, Pontifical Catholic University of Chile

Demand

7,4
Million inhabitants

5,5
Million users

958
Million anual trips

5
Million daily transactions on an average workday

Infraestructure

12.000
Stops

73
Depots

45
Electric bus depots by December 2025

55
Electric bus depots by March 2026

3.204
Km length of the road network covered by buses

494
Km of priority lanes for public transport and emergency vehicles (includes segregated lanes, exclusive lanes and bus-only lanes)

Supply - Metro and Trains

7
Metro lines

149
km of Metro railways

20
km of Suburban railways

143
Metro stations

10
Train station

8
Modal interchange stations

Human Capital

+18.000
Drivers

2.323
Women drivers

+2.500
People make up the maintenance staff

Supply - Buses

+6.600
Muses base operative fleet

3.849
Electric buses – 58% electric fleet by December 2025

4.400
tric buses – 68% electric fleet by March 2026

412
Bus routes

10
Complementary service companies (AFT, Charging network, fleet management, bus supply)

9
Transport concession companies (in addition to Metro and Train)



INNOVATION 

**THAT MOVES
PEOPLE**

Red

INNOVACION
QA OK

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II. Innovation that moves people

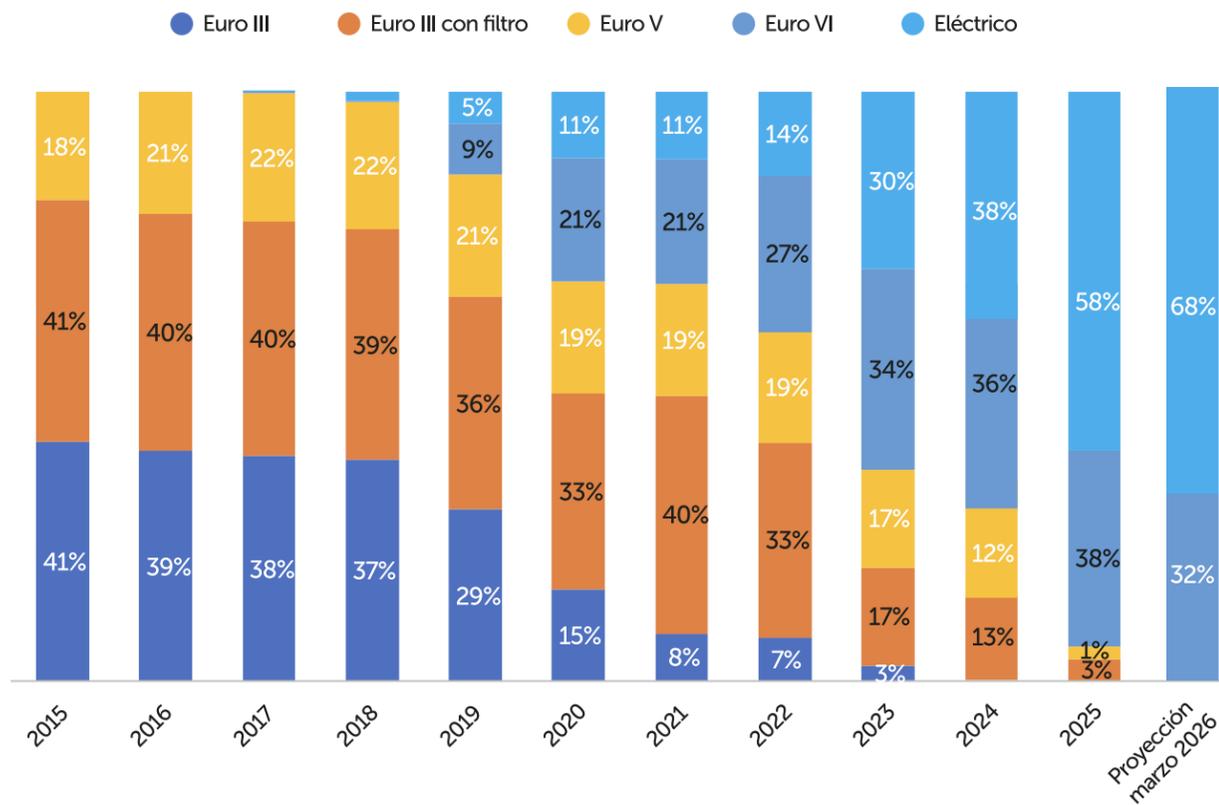
A. Electric buses and technology for the people

➔ 1. Technological evolution

In just over two decades, Santiago went from operating a fragmented and highly polluting public transportation system to consolidating one of the most advanced electromobility ecosystems in the world. Following the implementation of Transantiago in 2005, the city embarked on a path of modernization that reached a turning point in 2017, when the first two electric buses began operating and the first National Electromobility Strategy was published.

Eight years later, this government policy has translated into a profound transformation: as of December 2025, RED Movilidad operates 3,849 electric buses, equivalent to 58% of its fleet, making Santiago the city with the most electric buses in Latin America and the second largest outside of Chinese cities. This number will continue to grow, reaching 4,400 electric buses by March 2026, representing 68% of the base operating fleet.

Figure 2: Technological Evolution of the Fleet 2015 – Projection 2026



Source: Prepared by DTPM (2025)

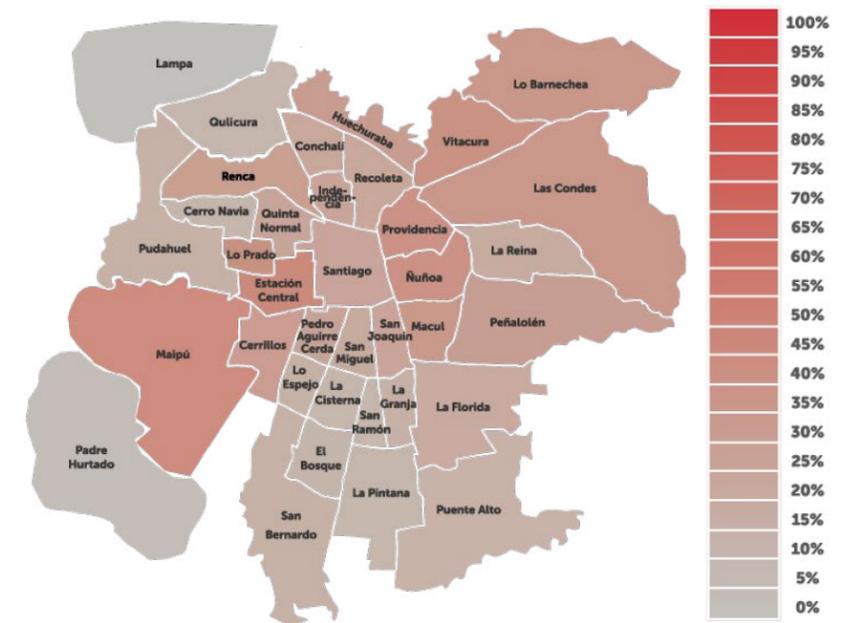
The technological transition has substantially improved the system's operation: quieter, more comfortable, and more efficient buses, equipped with assistance technologies that enhance safety and the user experience. Electrification has become a structural component of the

system, advancing by more than a decade the sectoral goals of the National Electromobility Strategy (2022), which aims for 100% zero-emission sales for public transport vehicles by 2035 and 100% zero-emission operation by 2050.

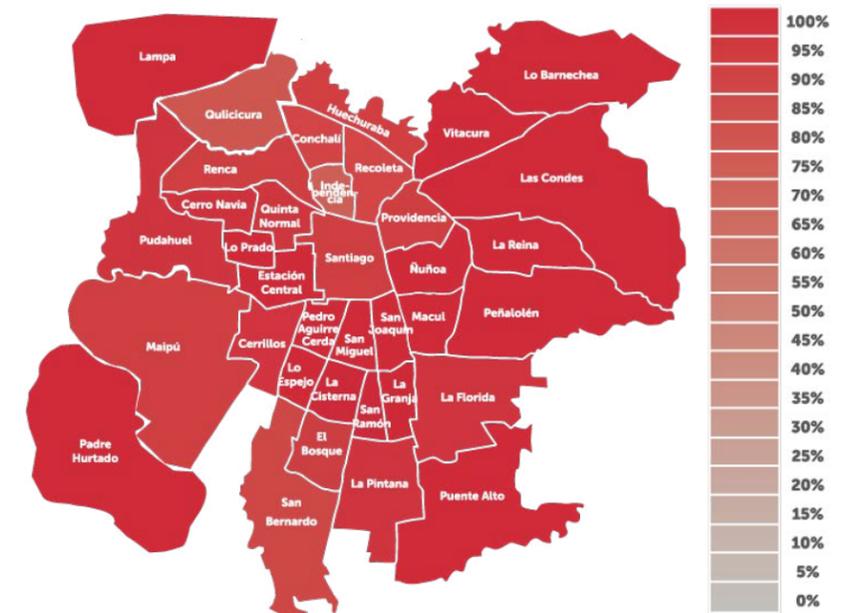
The following illustrations illustrate this technological transition at the territorial level.

Image1: Territorial Impact of the Fleet 2021–2025

Porcentaje de buses alto estándar por comuna 2021



Porcentaje de buses alto estándar por comuna 2025



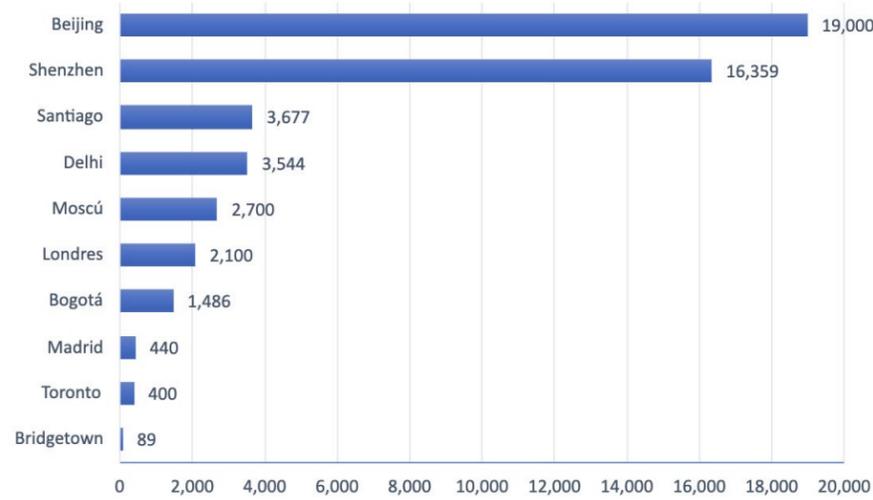
→ 2. Chile in the international context of electromobility

Santiago's leadership in electromobility is widely recognized internationally. According to the data platform of the Centre for Sustainable Mobility (CMS) and the ZEBRA alliance, which monitors more than 52,000 electric buses in 18 countries, Santiago continues to be the leading city in Latin America and the Caribbean in terms of its operational electric fleet, standing out for its implementation

capacity, technical standardization, and scalability of the model.

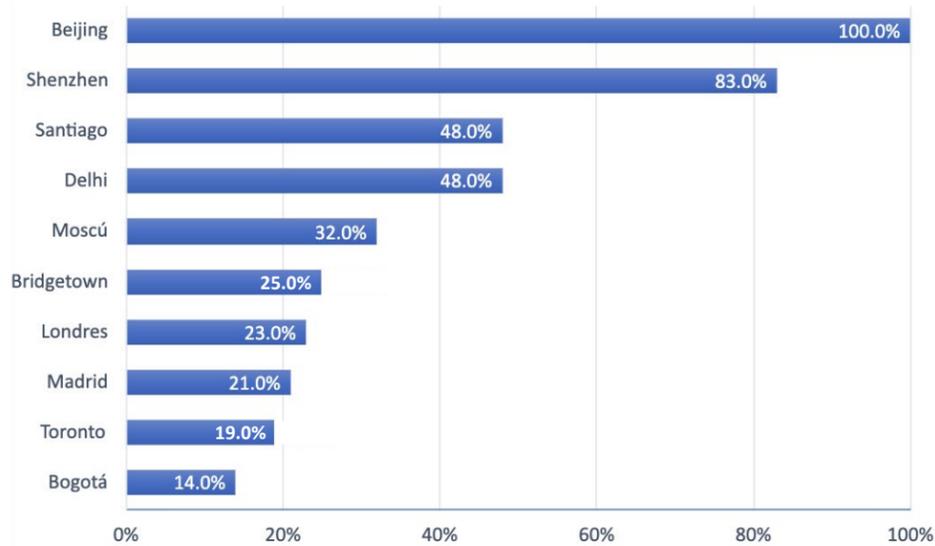
In 2025, the CMS reporting and georeferencing platform shows more than 52,000 buses, highlighting Santiago, Chile, as the city with the most electric buses in Latin America and the Caribbean.

Figure 3: Number of electric buses per city (2025)



Source: Centre of Sustainable Mobility (www. (https://cmsostenible.org/))

Figure 4: Percentage of electric buses per city (2025)

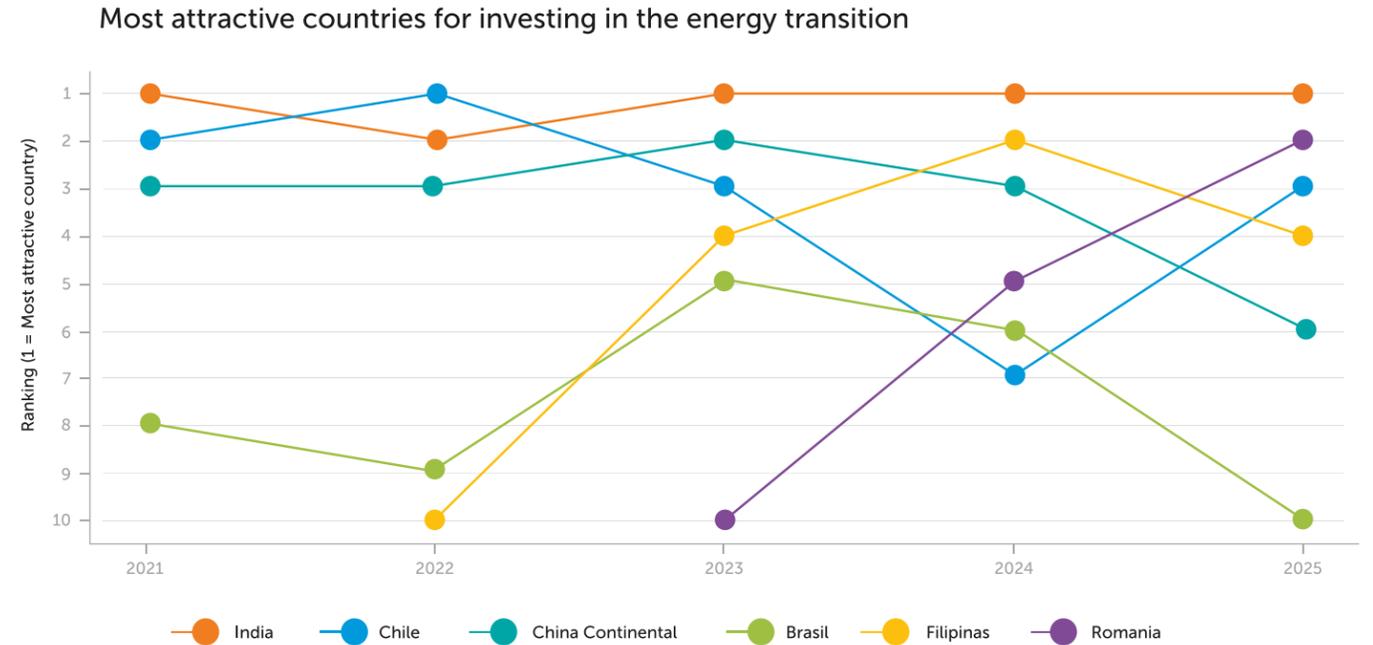


Source: Centre of Sustainable Mobility (www. (https://cmsostenible.org/))

This leadership is also confirmed in the context of progress in the country's energy sector, according to the BloombergNEF Global Climatescope report, which in its 2025 edition ranks Chile as the number one country in Latin America and third among emerging markets most attractive for investment in energy transition, particularly highlighting the strength of its regulatory foundations.

The following chart compares the ranking of different countries in the global attractiveness index during the 2021–2025 period. Chile has maintained a top 10 position since 2021, consistently ranking among the top three countries, reflecting its institutional maturity and regional potential.

Figure 5: Global ranking of the most attractive countries for investing in the energy transition



Source: Prepared by DTPM with data from Climatescope, Bloomberg NEF (2021-2025)

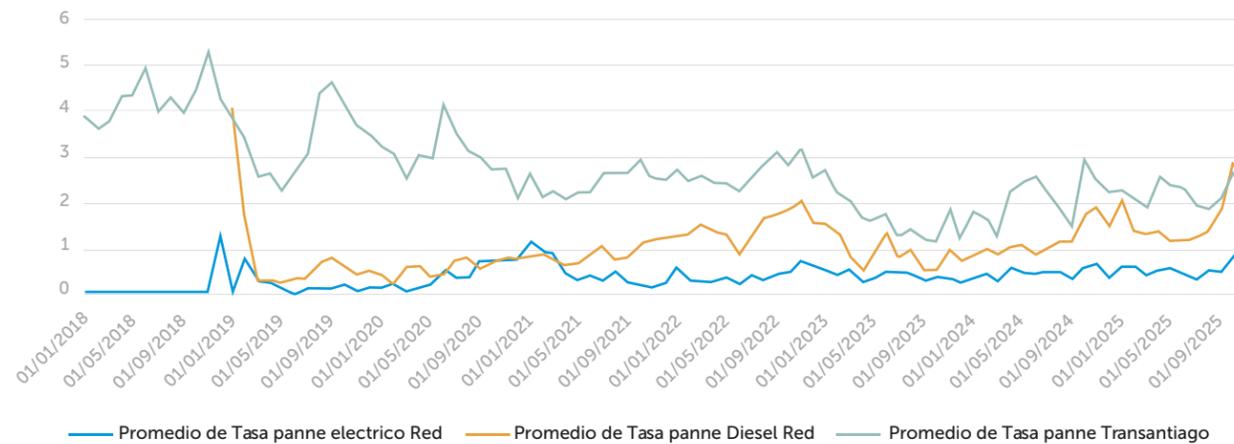
→ 3. Reliability and maintenance

a) Fleet reliability and operational performance

Fleet reliability is a key indicator for evaluating the quality and continuity of public transportation service. In the RED Movilidad System, this indicator is calculated based on the number of buses that experience mechanical failures (breakdowns) and trigger the contingency protocols of the Bus Monitoring Centre (CMB). Monitoring this data provides an objective view of the fleet's mechanical

condition and operational performance. To facilitate comparisons, the indicator is normalized as a rate per 100,000 kilometres travelled. The following graphs compare the rate according to standard and type of propulsion.

Figure 6: Mechanical failure rate (breakdowns) per 100,000 kilometres travelled by propulsion standard and type (2018-2025)



Fuente: Elaboración propia con datos DTPM (2025)

The analysis by technology type reveals consistent differences in the breakdown rate per 100,000 kilometres for electric buses (BEVs) and diesel buses. During 2025, BEVs registered a rate of approximately 0.5, significantly lower than that observed in diesel buses, demonstrating better mechanical performance and greater operational stability. This gap is partly explained by the simpler architecture of electric buses and by more standardized and preventive maintenance schemes.

In contrast, while the older standard diesel fleet (Transantiago) exhibits a higher relative incidence of the average failure rate (2.2) associated with the aging and accumulated wear of its components, and the RED standard diesel buses reach a rate of (1.6), electric buses show higher and more stable levels of reliability, even under more intensive operating conditions. In aggregate terms, this lower breakdown rate translates into greater effective fleet availability, fewer service interruptions, lower costs for operators, and a direct improvement in the regularity perceived by users.

b) Intelligent maintenance and monitoring

From a maintenance perspective, electromobility has driven an evolution in the system's technical management models, from contractual obligations for maintenance certification by an entity separate from the operator to controls by the DTPM (Metropolitan Public Transport Authority), and the concept of invalid issuance due to loss of certification, thus ensuring that vehicles extend their useful life. Furthermore, operators have strengthened specialized capabilities, incorporated new diagnostic routines, and advanced towards more predictive maintenance schemes, which has allowed them to reduce failures, optimize downtime, decrease costs, and improve operational safety.

This process has been complemented by the incorporation of intelligent monitoring and telemetry tools, which allow operational data to be transformed into key information for decision-making. In this context, during 2025, the DTPM conducted a study that implemented a telemetry system applied to the RED public transport network with the objective of measuring, transmitting, analysing, and converting data into indicators and alerts, strengthening oversight, road safety, and maintenance management,

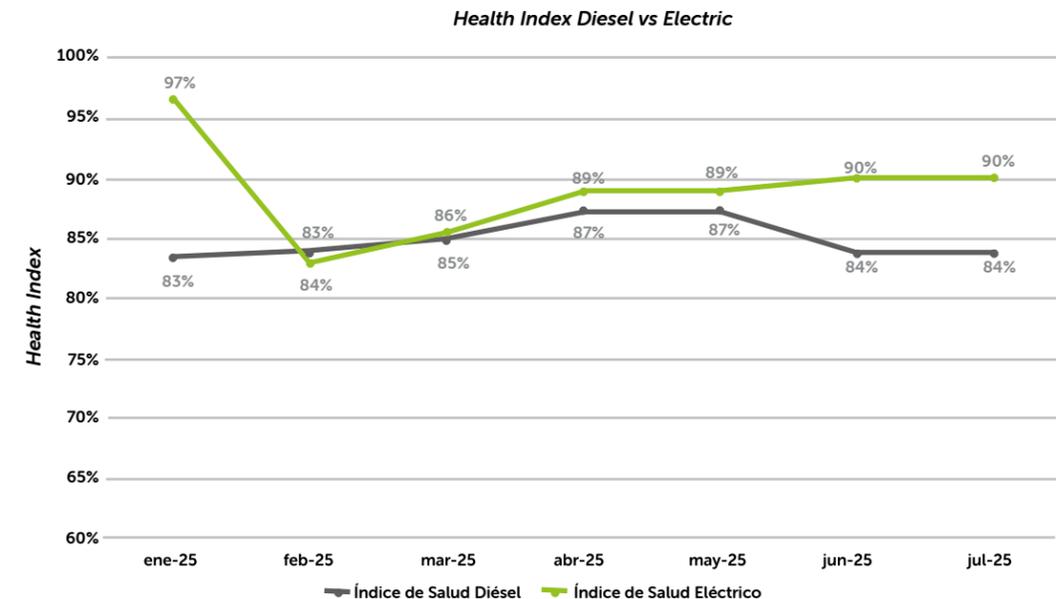
and laying the groundwork for a future ministerial fleet monitoring centre. The study considered a sample of 188 Euro VI diesel buses and 166 electric buses of various brands, monitored over a seven-month period. Data was collected using GPS, concentrators, and specialized sensors, with variables differentiated according to the technology type. For the diesel buses, monitoring focused on fuel consumption, engine condition, pressures, temperatures, and critical systems such as brakes and suspension. For the electric buses, variables such as state of charge (SOC), battery health (SOH), charging cycles, energy regeneration, climate control, and energy consumption were monitored, allowing for a more precise characterization of the fleet's operational behaviour.

The results show that the performance of both technologies is strongly influenced by climatic and operational factors. In the diesel fleet, the best performance was observed during months with less congestion, while higher consumption was recorded in winter, associated with prolonged idling for heating. In the electric fleet, the highest consumption was concentrated in summer due to the intensive use of air conditioning, while the best efficiency levels were achieved in months of lower demand and congestion, with consumption in the range of 1.38–1.4 kWh/km. In winter, consumption increases again due to the energy required for heating the passenger compartments in buses equipped with this system.

Additionally, a Fleet Health Index was developed, with a scale of 0 to 100, which allows for an integrated evaluation of the vehicles' technical condition. In the case of electric buses, the index considers a risk component (70%), regeneration (15%), and performance (15%), while for diesel buses it is structured into risk (70%) and performance (30%). The results show better performance for the electric fleet, which achieved an average index of 89.0, classified as "good," along with a remarkable regeneration rate of 38.4%. In contrast, diesel buses experienced more critical incidents, particularly related to oil pressure and AdBlue levels, impacting their operational reliability.

The study provides a series of dashboards covering everything from the health of diesel and electric maintenance to fleet availability and safety heat maps, thus laying the groundwork for defining joint alerts and technical compliance standards for the RED Movilidad fleet.

Figure 7: Proposed Fleet Health Index by Technology Type



Source: Prepared by DTPM based on data from the study "Consulting to Develop a Pilot Plan for Fleet Control and Maintenance through DTPM Telemetry (2025)"

Overall, the results confirm that the electrification of the RED Movilidad System not only provides environmental benefits but also raises the standard of maintenance and technical management of public transport, consolidating a more reliable fleet that contributes to the travel experience of users.

a) The Smart Bus in RED Movilidad

The modernization of the RED Movilidad System has gone beyond the incorporation of electric buses. In recent years, the fleet has evolved toward a “Smart Bus” standard, understood as an integrated technological platform capable of generating, processing, and transmitting information in real time, with the purpose of improving operations, strengthening safety, and enhancing the travel experience for users.

This progress has been driven through the road usage bidding processes, which have incorporated increasingly stringent technological requirements for the fleet. These requirements integrate systems that support drivers, enable more efficient operational management, and provide clear and timely information to passengers, consolidating a more inclusive, reliable, and people-centred public transportation system.

(1) Embedded technological architecture

The bus fleet features an advanced technological architecture comprised of multiple interconnected onboard systems. This digital infrastructure allows for real-time operational monitoring, anticipation of failures, improved road safety, and faster response to operational and safety incidents.

Among its core components are the CAN Bus telemetry systems, which collect critical vehicle information, such as energy consumption, temperature sensor readings, fluid levels, door openings, braking, and overall performance, and transmit it to control centres. This information is key to optimizing maintenance, maximizing fleet availability, and ensuring more reliable service.

In addition, the newer buses include CCTV streaming, enabling continuous operational monitoring. This system is complemented by a panic button, which facilitates a coordinated response with control centres and, when necessary, with law enforcement, reinforcing the safety of drivers and passengers.

(2) Active safety and driving support

Technology also plays a central role in accident prevention and the protection of all road users. Advanced Driver Assistance Systems (ADAS) stand out in this area, alerting drivers to the presence of pedestrians, cyclists, or obstacles near the bus. By the end of 2025, more than 2,500 buses in the system will be equipped with these sensors, and nearly half will transmit real-time alerts, strengthening the active safety of operations.

Additionally, fatigue and distraction detection systems have been incorporated, using cameras and artificial intelligence to identify signs of tiredness or inattention.

These preventative alerts help reduce risks, protect the health of drivers, and increase travel safety.

Another significant advancement is the Safe Zones System, required in the latest bidding process, which automatically limits the maximum bus speed in sensitive areas such as school zones or pedestrian areas, as previously defined, improving urban coexistence and reducing risks.

Information and connectivity for users From a travel experience perspective, the Smart Bus transforms the bus interior into an informative and connected space. Variable message signs provide real-time information about the route, upcoming stops, available connections, and system messages, reducing uncertainty and making it easier to navigate during the journey.

The fleet also includes free Wi-Fi connectivity and USB charging ports, with one port for every two seats, including Type-C connectors in the newest buses. These features cater to the digital habits of the population and contribute to a more comfortable travel experience, especially on longer journeys.

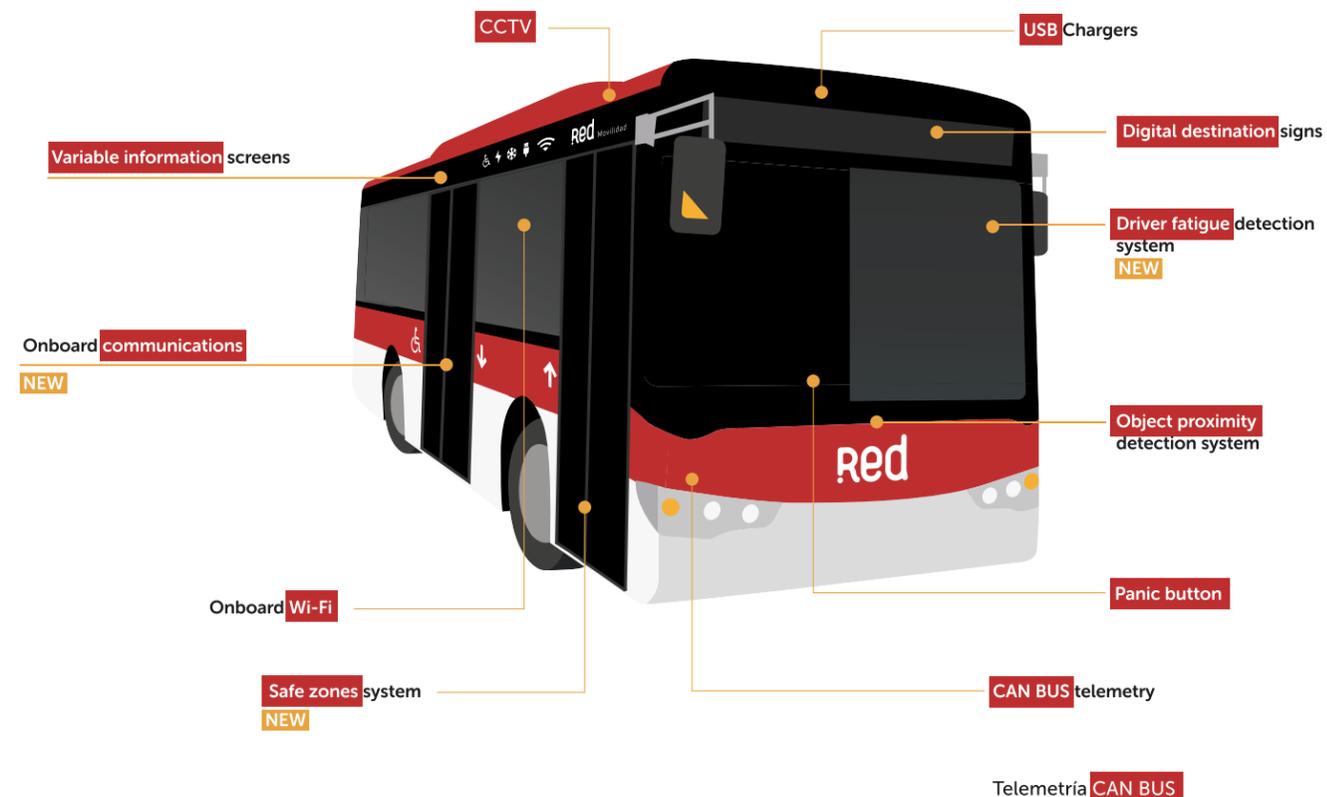
(3) Emerging technologies and future projections

The development of the Smart Bus lays the groundwork for the progressive integration of emerging technologies into public transportation management. The integration of artificial intelligence, the Internet of Things (IoT), and Big Data will enable progress toward increasingly predictive operations, capable of anticipating demand, preventing failures, and optimizing the network as a whole.

Likewise, technologies such as augmented reality open opportunities to improve staff training and maintenance, while biometric solutions strengthen security and the traceability of operational events.

Together, these advancements position RED Movilidad as a regional leader in technological innovation applied to public transportation, consolidating a safer, more inclusive system that is better connected to people’s daily needs.

Image 2: Technological architecture embedded in buses of the RED Movilidad System



b) Improvements in interior comfort

The modernization of the RED Movilidad System is also reflected in a substantial improvement in the interior comfort of buses, understood as a set of physical, ergonomic, and environmental conditions that directly impact travel comfort and users’ perception of service quality.

This progress is not only the result of incorporating electric buses, but also of a progressive process of regulatory and design updates, which has allowed vehicle standards to be adapted to the real characteristics and needs of the population. Within this framework, the modifications introduced to Supreme Decree No. 122, particularly in its 2012 and 2017 updates, laid the foundation for a structural improvement in onboard comfort, correcting long-standing deficiencies related to ergonomics, interior layout, and travel conditions.

(1) Physical comfort and environmental conditions

RED standard buses incorporate redesigned seats based on ergonomic principles, improving their tilt, height, and arrangement, which reduces fatigue on long journeys. In addition, a more efficient distribution of handrails and grab handles, adapted to the morphology of the national population, facilitates movement within the bus and improves stability during travel.

Electric buses have also allowed for a significant reduction in noise and vibrations, creating a quieter and more stable interior environment. This attribute, along with the progressive incorporation of air conditioning systems, has substantially improved thermal conditions inside the buses, increasing comfort both during periods of high temperatures and in adverse weather conditions. These improvements have been particularly valued by women, senior citizens, and frequent users, who historically identified noise, uncomfortable seats, and interior instability as negative aspects of public transportation.

(2) Interior design and travel experience

The interior design of buses has also evolved toward a more modern and functional standard. The addition of separate driver cabins, besides improving their safety, contributes to a more organized and comfortable interior environment for passengers. Likewise, more uniform interior lighting and higher-quality materials reinforce the perception of a well-maintained, clean, and modern space.

Taken together, these improvements reduce the historical gap between public transport and private cars in terms of comfort, reinforcing the idea that it is possible to make daily journeys in a comfortable environment, even on long trips or during peak demand.

(3) Accesibilidad universal como parte del confort

The interior comfort of the RED Movilidad System is closely linked to advances in universal accessibility, understood not only as a functional requirement but also as a central component of a dignified and inclusive travel experience.

Since its inception, the system has established requirements to guarantee low-floor buses, access ramps, reserved spaces for wheelchairs, clearly marked priority seating, ergonomic handrails, and differentiated call buttons. These measures facilitate access to and movement within the bus, reducing physical barriers and

improving the independence of people with reduced mobility, senior citizens, users of strollers, and people with reduced mobility.

Thanks to this sustained process, the proportion of buses with low floors and inclusive equipment increased from 79% in 2013 to 99% in 2025, consolidating an accessibility standard that is now an integral part of the system's comfort. The remaining percentage corresponds to smaller buses, which will be progressively replaced by electric units that meet this standard.

(4) A more comfortable journey that encourages choosing public transport

The improvements in interior comfort, along with the technological and environmental advancements already described, create a more pleasant, quieter, and accessible travel experience. This new standard helps reduce the stress associated with daily commutes and reinforces the appeal of public transport as a viable alternative to car use.

In this way, RED Movilidad is not only making progress in decarbonizing transport, but also in making travel a more comfortable and human experience, strengthening its role as a central pillar of modern, inclusive, and sustainable urban mobility.

Table 2: Components of the Intelligent Bus in RED Movilidad standard (2025)

Technological Component	Presence in the fleet
Electric buses in operation	3.849
Air-conditioned buses	5.957
Buses with Advanced Driver Assistance Systems (ADAS)	2.589
Buses with cameras	6.024
Total number of cameras	+ 36.000
Buses with real-time CCTV transmission	3 406
Buses with integrated panic button	1.318
Buses with CAN Bus telemetry	5.957
Buses with Wi-Fi and USB chargers	99%

B. Infrastructure for electromobility: resilience, energy management and urban transformation

The expansion of electromobility within the RED Movilidad System has required the development of a robust infrastructure capable of supporting the continuous operation of a growing fleet of electric buses and meeting the demands of an essential public service. In this context, electric bus depots have become a strategic component of the system: not only in operational terms, but also in energy, urban, and social terms.

Unlike the diesel model, electric operation depends directly on the availability and quality of the energy supply, making electric bus depots critical nodes in the public transportation ecosystem. Their design, location, backup capacity, and integration with the electrical grid are now key factors for the resilience and reliability of the service, where public-private coordination is essential.

➔ 1. Electric bus depots: the backbone of the electric bus system

The electric bus depots, called Public Transport Charging Centres (CCTP) according to RIC No. 15 of the Superintendency of Electricity and Fuels (SEC) constitute the critical infrastructure that supports the operation of electric buses in the RED Movilidad System. These facilities concentrate essential functions such as battery charging, operational planning and control, fleet maintenance, personnel coordination, and complementary logistical activities. This multifunctionality makes them strategic nodes, closely linked to the stability and capacity of the urban electricity distribution network.

In this context, the expansion of electromobility has required close coordination, led by the DTPM, with other actors in the energy sector, both public and private. This has consolidated a permanent inter-institutional coordination framework that has allowed for anticipating energy requirements, planning network reinforcements, monitoring works, and reducing the time associated with connecting and commissioning new electric depots, thus strengthening reliability as the electric fleet grows.

Key players in this scheme include companies that currently provide energy and charging solutions, such as Copec Voltex and Enel X, responsible for the design

and implementation of the charging infrastructure at the electric vehicle depots. Likewise, distribution companies Enel Distribución, Empresa Eléctrica de Puente Alto (EEPA), and Compañía General de Electricidad (CGE) play a crucial role in ensuring capacity and continuity of supply in the areas where the depots are located. This collaboration, along with public agencies such as the National Energy Commission (CNE), the Superintendency of Electricity and Fuels (SEC), the National Electric Coordinator, and the Environmental Assessment Service (SEA), has been fundamental in enabling the accelerated deployment of the electric fleet and safeguarding the operational resilience of the system.

From a temporal perspective, the transition to electromobility began in 2017 with the incorporation of two electric buses as a pilot program. Starting in 2019, with the arrival of the first batches of electric buses, the first five electric bus depots were opened, initiating a sustained expansion of the charging infrastructure. Five new facilities were added in 2020; two more in 2022; and then in 2023, the network grew considerably, adding 14 electric bus depots. Two more were incorporated in 2024; and in 2025, the largest increase to date was achieved with 17 new facilities.

As a result, by the end of 2025, the RED Movilidad System had 73 bus depots, 45 of which were e-bus depots (61% of the total), distributed across 15 municipalities in Greater Santiago. In the last four years alone, 35 electric bus depots were developed, representing a cumulative increase of 350% compared to 2021, making this one of the most significant expansions of energy infrastructure for public transportation in Latin America. This deployment has allowed for the progressive and diversified expansion of charging depots electrification in municipalities such as La Pintana, Quilicura, Renca, Lo Prado, Cerro Navia, San Bernardo, Estación Central, Cerrillos and La Florida.

Table 3: Charging infrastructure and electric fleet by municipality, 2025

Inauguration	Depot	Municipality	Electric fleet	Power [kW]
01-03-2019	BCG-E	Maipú	108	5843
01-03-2019	Juanita	Puente Alto	101	5225
01-10-2019	Los Acacios	Maipú	104	2960
01-10-2019	Los Espinos	Peñalolén	155	6550
01-11-2019	Los Nogales	Maipú	145	1920
01-01-2020	El Salto	Huechuraba	106	2676
01-06-2020	Las Palmas	Pudahuel	100	3600
01-07-2020	Los Lingues	Pudahuel	116	2400
01-08-2020	Los Abedules	Las Condes	51	1864
01-10-2020	El Conquistador	Maipú	204	8800
01-11-2022	Santa Rosa	La Pintana	60	3082
01-12-2022	Recoleta	Huechuraba	107	2108
01-01-2023	Colo Colo	Quilicura	65	2460
01-01-2023	Lo Echevers	Quilicura	88	3842
01-01-2023	Condell	Renca	80	2772
01-02-2023	Las Torres	Peñalolén	58	2435
01-02-2023	Santa Clara	Huechuraba	30	1134
01-03-2023	Pie Andino	Puente Alto	98	3539
01-03-2023	Camilo Henríquez	Puente Alto	48	2107
01-03-2023	Diagonal Las Torres (A. Casanova)	Peñalolén	195	7523
01-03-2023	La Primavera	Puente Alto	78	2570
01-03-2023	Los Tilos	Puente Alto	60	2312
01-06-2023	Santa Marta	Huechuraba	60	2464
01-10-2023	Las Araucarias (Pajaritos)	Lo Prado	32	690
01-10-2023	Las Parras	Cerro Navia	87	3600
01-11-2023	Los Pinos	Maipú	58	1760
01-03-2024	La Vara	San Bernardo	107	4500
01-05-2024	OGM	San Bernardo	107	3930
01-02-2025	Lo Marcoleta	Quilicura	200	1907
26-07-2025	San José	San Bernardo	29	511
26-07-2025	Los Libertadores	Huechuraba	18	511
02-08-2025	Gabriela	Puente Alto	122	2671
16-08-2025	Patio Pie Andino	Puente Alto	93	2693
16-08-2025	San Alfonso	Estación Central	83	1534
30-08-2025	Los Almendros (Enea)	Pudahuel	73	2340
30-08-2025	Los Rosales (La Estrella)	Cerro Navia	80	1920
30-08-2025	Los Aromos (Rio Claro)	Peñalolén	12	450
30-08-2025	Cerrillos	Cerrillos	32	1089
06-09-2025	Los Sauces	Pudahuel	77	1802
18-10-2025	Diego Portales	La Florida	95	2590
25-10-2025	Lo Blanco 1	La Pintana	50	2113
22-11-2025	Ducaud	San Bernardo	96	1931
25-10-2025	Las Perdices	La Florida	30	2035
06-12-2025	Lo Blanco 2	La Pintana	76	2949
30-12-2025	René Olivares/El Bosque	Maipú	75	2683

TOTAL 3.849 124.841

This growth is reflected in the consolidation of electromobility hubs in strategic municipalities, where large fleet volumes and greater installed capacity are concentrated. Maipú is positioned as the system's main hub, with the consolidation of six electric bus depots by 2025. Also noteworthy is the construction of the first electric bus depots in the municipalities of La Florida, Cerrillos, and Estación Central during 2025.

2025 marks a shift in the implementation strategy. Unlike previous periods, characterized by gradual incorporations, a simultaneous rollout occurred with the construction of 17 electric bus depots in multiple municipalities, consolidating electromobility as a structural component of the system and laying the technical and territorial groundwork for its future expansion to other regions of the country.

Furthermore, with the arrival of approximately 600 new buses, it is projected that by March 2026, 10 new electric bus depots will be added, bringing the total to 55.

Image 3: Historical evolution of electric bus depots in the RED Movilidad System, 2021-2026

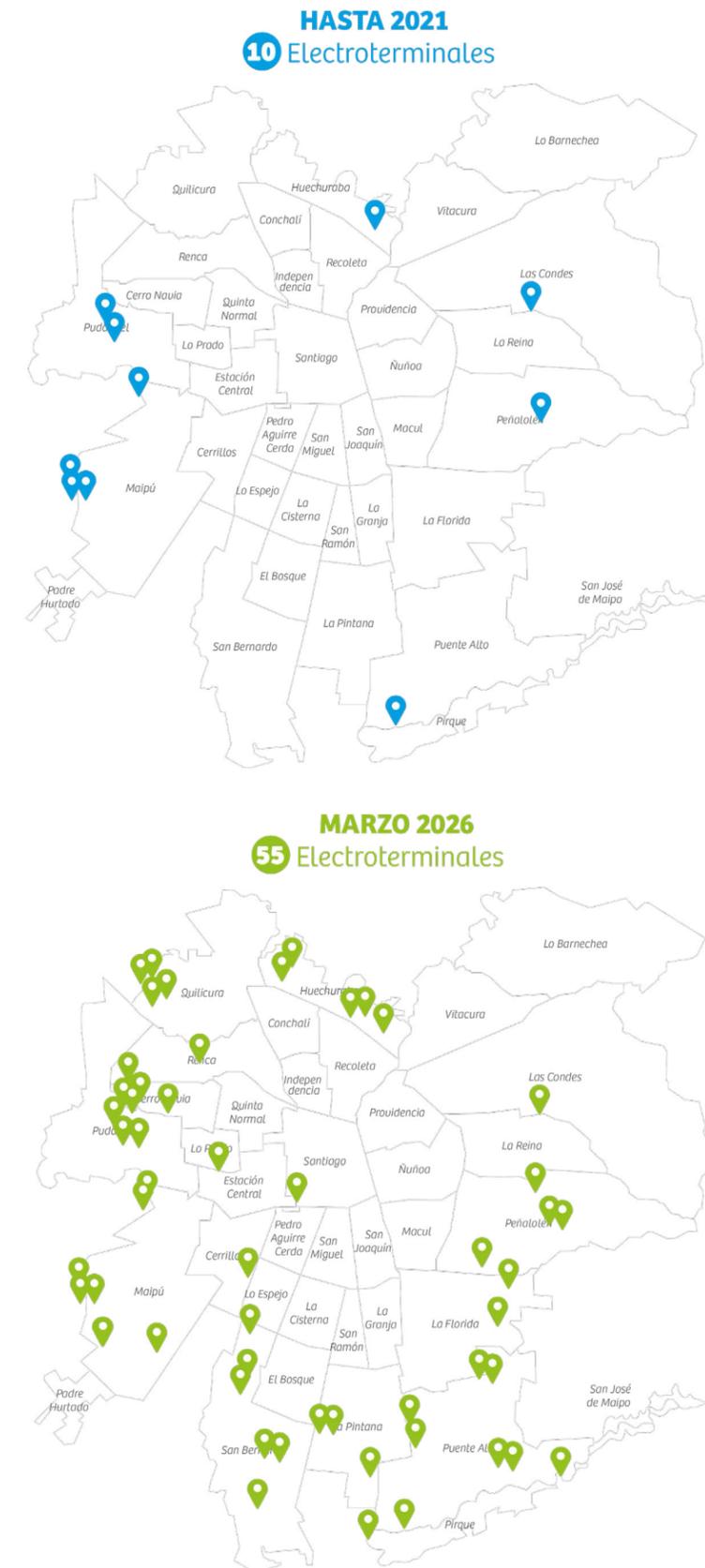
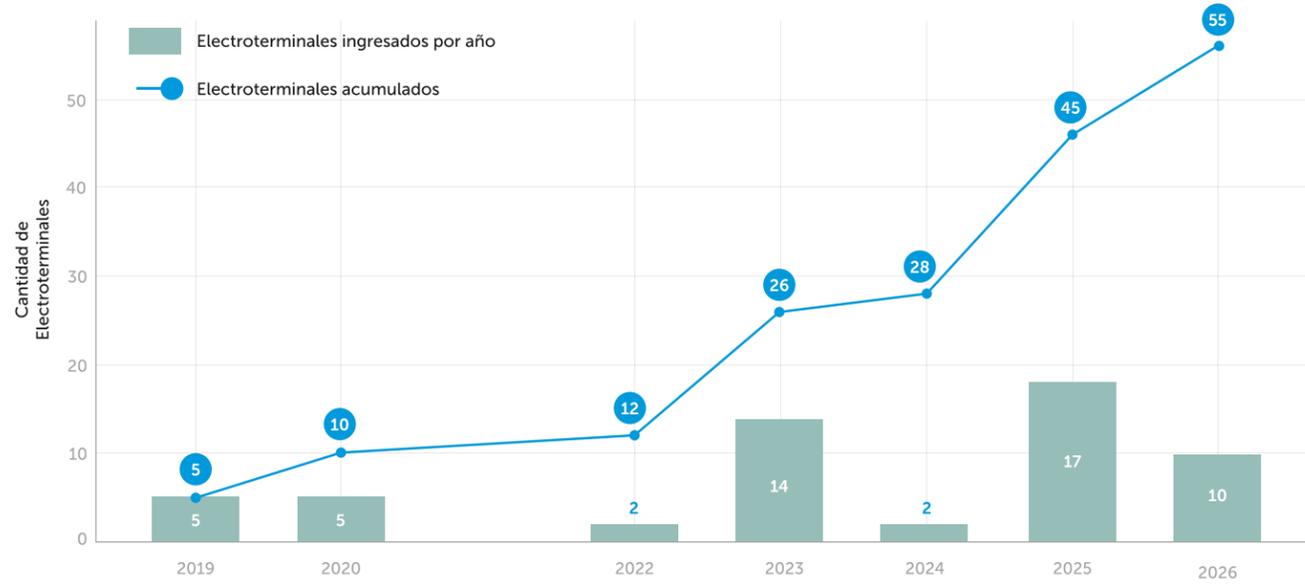
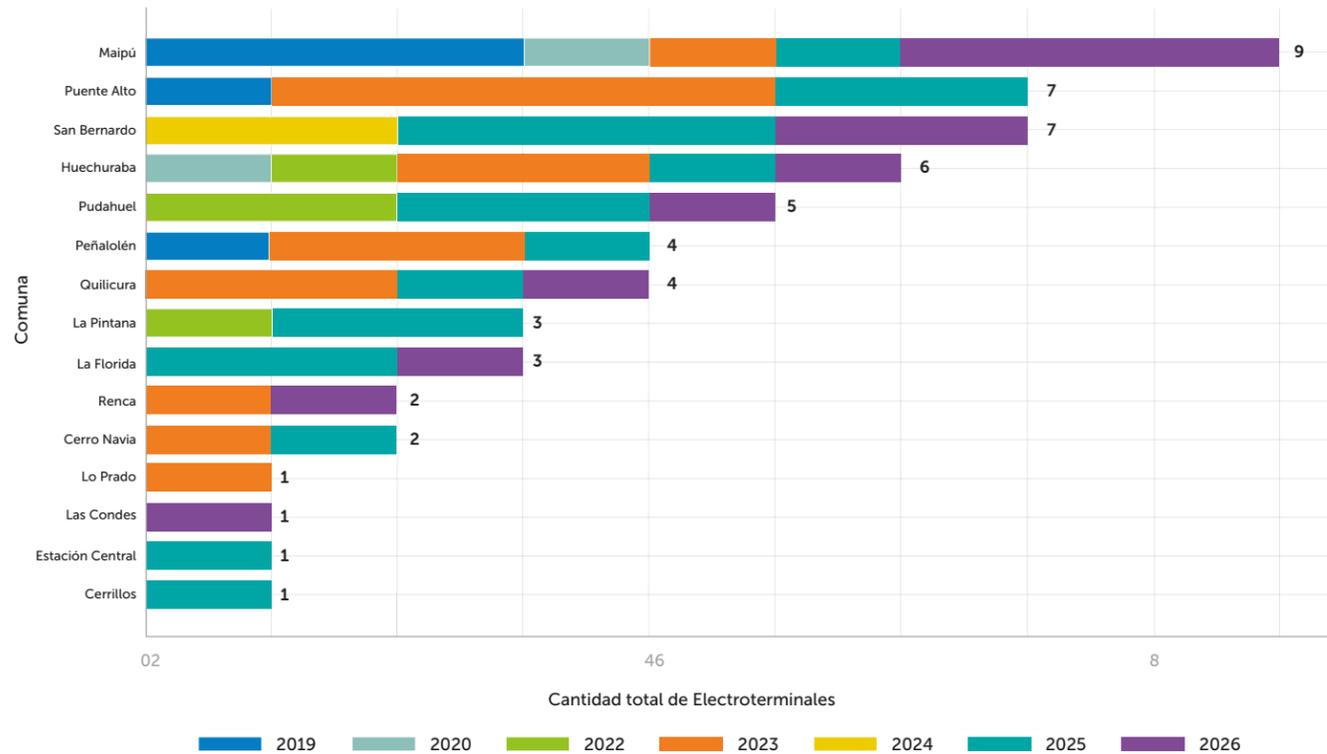


Figure 8: Historical evolution of electric bus depots in the RED Movilidad System, 2017-2025



Fuente: Elaboración propia con datos del DTPM (2025)

Figure 9: Electric bus depots of the RED Movilidad System by commune and year of incorporation



Fuente: Elaboración propia con datos del DTPM (2025)

2. Charging infrastructure and standardization

The development of charging infrastructure for electric buses has been accompanied by a deliberate process of technological standardization. In Chile, plug-in technology has become the predominant solution for fleet charging due to its operational simplicity, flexibility, and wide market availability.

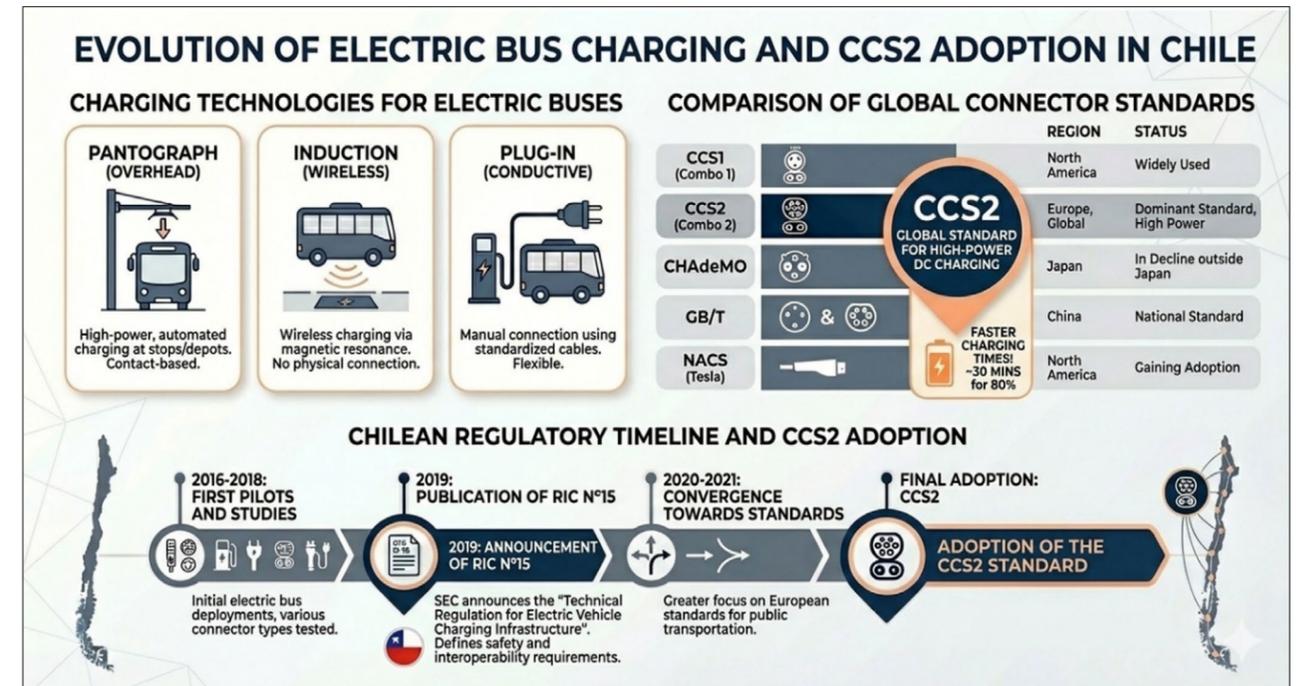
After an initial period characterized by the coexistence of multiple international charging standards (CCS1, CHAdeMO, GB/T, among others), in 2019 the Chilean Superintendency of Electricity and Fuels (SEC) published Technical Regulatory Specification RIC No. 15, establishing a pioneering regulatory framework in the region for charging infrastructure. This specification does not define a single connector standard but rather requires compliance with a set of international IEC standards—including IEC 62196-1, IEC 62196-2, IEC 62196-3, and IEC 62893-3—aimed at guaranteeing electrical safety, interoperability, performance, and technical compatibility of charging systems.

In this regulatory context, the consolidation of the CCS-2 connector as the operating standard for the metropolitan

public transportation system is not due to the imposition of a specific standard by the SEC's technical regulations, but rather to a process of technological and industrial convergence aligned with the IEC standards framework required by RIC No. 15 and its widespread adoption internationally. This convergence is reflected in the charging infrastructure installed in the system, which totals more than 1,800 connectors, of which approximately 60% correspond to CCS-2 technology. The remaining percentage comprises chargers with GB/T, CCS-1, and Menneke Type 2 standards, mostly associated with the initial implementation phases. The 2019 tender specifications of the DTPM (Metropolitan Public Transportation Authority) incorporated this convergence as a technical requirement, allowing for its full adoption by manufacturers and operators, and continuing with this requirement in subsequent tender processes.

At the national level, according to information from the SEC, there are approximately 6,255 chargers as of December 2025, reflecting the country's progress in electromobility infrastructure and the consolidation of an energy ecosystem capable of supporting the electrification of urban transport.

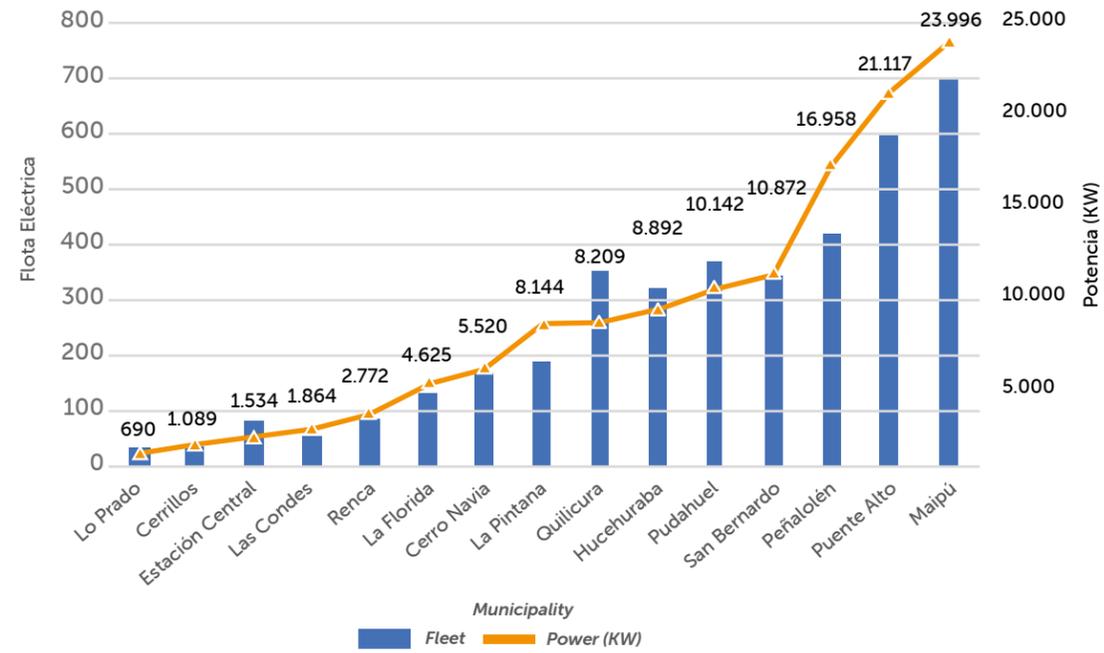
Image 4: Evolution of electric bus charging and the adoption of CCS2 in Chile



The territorial analysis of the relationship between electric vehicle fleet size and installed capacity per municipality shows a direct correlation between fleet size and installed capacity, reflecting progressive planning aligned with system needs. Peñalolén, Puente Alto, Pudahuel, and Maipú have the largest electric vehicle fleets and charging capacity; in municipalities with intermediate-

sized fleets, infrastructure consistently keeps pace with operational growth; and in smaller municipalities, fleet size is maintained according to territorial efficiency criteria.

Figure 10: Relationship between electric fleet and installed capacity per municipality



Source: Prepared by DTPM (2025)

3. Smart charging network: energy management in support of operations

The daily operation of a large-scale electric fleet demands much more than physical charging infrastructure. It requires advanced fleet management and intelligent charging systems capable of balancing energy consumption, safeguarding battery health, and ensuring compliance with the service levels required by the routes of the RED Movilidad System.

In practice, transport operators manage a continuous planning and control cycle, beginning with scheduling daily services and assigning buses based on available range, route type, gradients, distance, and expected demand. From this operational planning, fleet management systems determine the optimal charging windows for each vehicle, considering agreed-upon times and electricity rates, available power, and prioritizing buses that will begin operations during peak hours or travel longer distances.

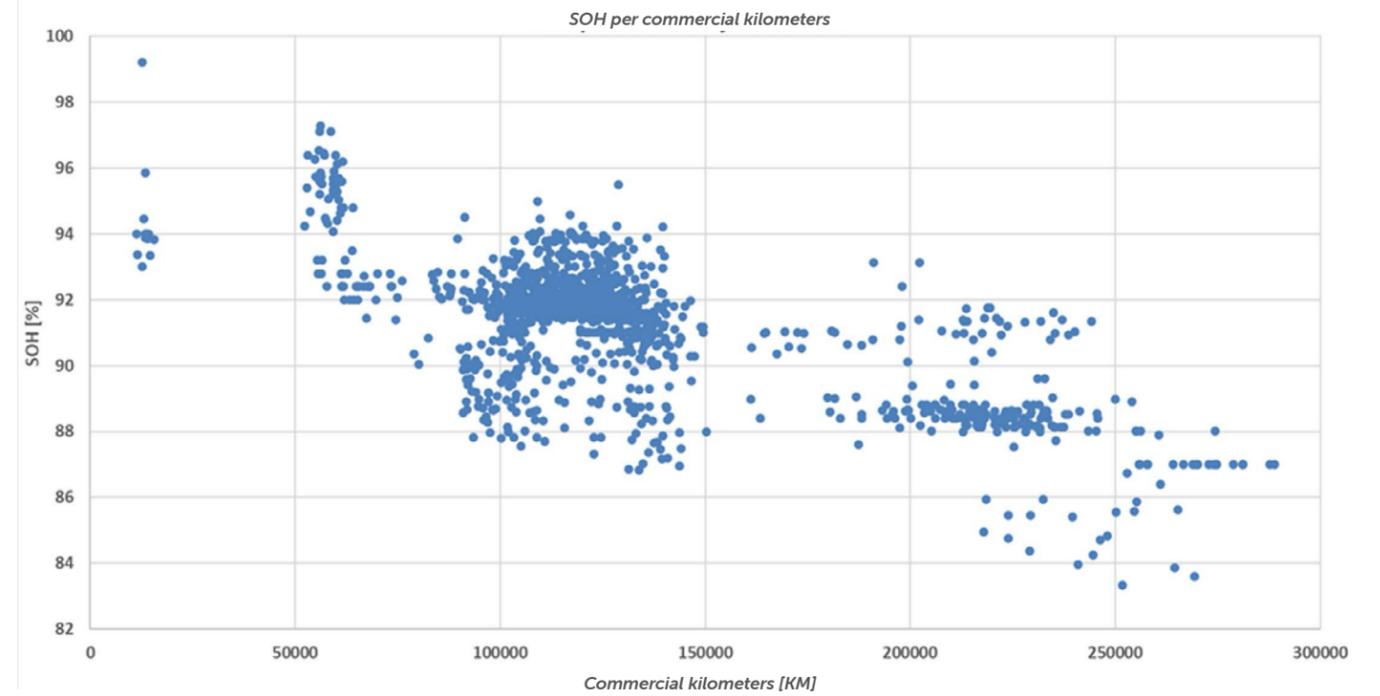
During charging periods, intelligent energy management systems modulate the power delivered to each bus, preventing overloads on the internal network of the electric depot and optimizing the use of available electrical capacity. This process considers variables such as the battery's state of charge, its temperature, the history of charge and discharge cycles, and the vehicle's future scheduling. Charging ceases to be an isolated action and becomes a dynamic process, integrated into the system's daily planning and operation.

Once charging is complete, the generated information, such as charge levels, times, power used, and battery behaviour, is fed back into the management systems, allowing for adjustments to future planning and anticipation of potential maintenance needs. This continuous planning-charging-operation-monitoring cycle constitutes the core of the smart charging network that supports the system's electromobility.

This approach was analysed in depth in the Electric Bus Charging Management Study developed by the DTPM during 2025, which evaluated real-world operation and charging strategies at 26 electric bus depots within the system, considering a sample of more than 400 electric buses from different brands and operators. The study identified that charging strategies vary according to operational conditions, available infrastructure, and fare structures, revealing two predominant patterns: a nighttime peak (9:00 PM–5:00 AM) associated with main fleet charging, and a daytime peak (10:00 AM–3:00 PM) linked to opportunity charging.

The results show that, despite these operational differences, operators maintain adequate battery health (SOH) levels, with an average close to 91% and minimum values observed around 83% in older buses. Projections indicate that, under current charging management strategies, SOH would remain within acceptable ranges even into the tenth year of operation, if monitoring and control practices are maintained.

Figure 11: Comparison of SOH with respect to commercial kilometres travelled.



Source: Prepared by DTPM (2025)

The study also identifies best practices and areas for improvement relevant to smart charging network management, such as continuous monitoring of the initial and final State of Charge (SOC) of each charge, moderation in the intensive use of fast charging, incorporation of thermal "cool-off" periods between operation and charging, and standardization of periodic SOC measurement protocols. These recommendations reinforce the need for charging management systems capable of dynamically adjusting power and charging times according to battery status and operational needs.

From a regulatory and contractual perspective, these systems are not optional. The DTPM requires, through concession contracts, the implementation of fleet and charging management platforms that allow for detailed monitoring of electric bus charging processes.

This requirement addresses the need to protect battery performance and lifespan, since improper charging practices, such as overcharging, unnecessary fast charging, or poor thermal management, can rapidly degrade battery capacity, reducing range and affecting service reliability.

In this way, the smart charging network fulfils a dual strategic function: ensuring the operational continuity of the system by aligning energy and service; and safeguarding public and private investment in electric vehicles. Empirical evidence gathered by the DTPM confirms that data-driven charging management, continuous monitoring, and consistent technical criteria are critical factors for sustaining the long-term reliability, efficiency, and resilience of the RED Movilidad System.

→ 4. Service continuity during contingencies

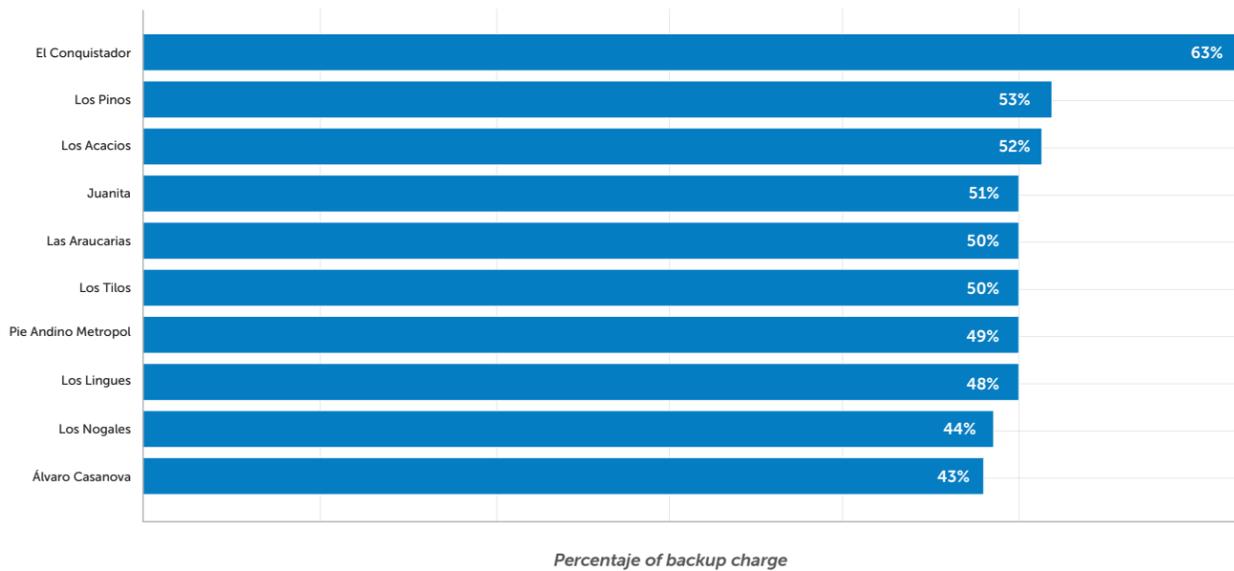
The resilience of electric vehicle depots has become a core attribute of the RED Movilidad system. Unlike the diesel model, where fuel storage mitigated external disruptions, the electric fleet relies on the stability of the supply during critical load windows.

In this context, the sizing of backup systems is a key factor. While RIC No. 15 allows operators to define specific criteria, in practice, designs have aligned with SEC recommendations, typically establishing a minimum backup capacity of 25% of the installed load, with autonomy periods of between 4 and 8 hours. In larger-scale depots, load-sharing schemes are also incorporated

among several transformers to prevent significant losses of operational capacity in the event of localized failures.

In terms of installed capacity, all the system's electric vehicle depots meet the minimum backup threshold, and several significantly exceed this standard. The El Conquistador depot stands out with a 63% backup capacity, as does the consistent performance of operators such as Metbus, Metropol, and STU, whose depots generally operate at over 45% backup capacity relative to their installed power. Below is a detailed list of the ten depots with the highest backup capacity based on their installed system power.

Figure 12: Top 10 bus depots with the greatest backup capacity in the RED Movilidad System



Source: Prepared by DTPM (2025)

Table 4: Top 10 bus depots based on their percentage of backed-up charge

Depots	Percentage of backed-up charge [%]	Backed-up chargers	Generator set brand	Generator set capacity [kVA]	Number of Generators	Fuel tank capacity [L]	Hours of backup at maximum power	Emissions regulations
El Conquistador	63	36	Cummins	900	9	1600	8.0	Euro Stage
Los Pinos	53	9	Cummins	550	4	500	4.6	EPA Tier 2
Los Acacios	52	11	Cummins	550	2	1000	4.6	EPA Tier 2
Juanita	51	19	Cummins	1110 / 1265	2	1000	5.7	EPA Tier 2
Las Araucarias	50	3	Cummins	440	1	500	4.8	EPA Tier 2
Los Tilos	50	7	Cummins	565 / 1000	2	1250	6.7	EPA Tier 2
Pié Andino Metropol	49	22	Cummins	825 / 550 / 1110	3	800	4.3	EPA Tier 2
Los Lingues	48	22	Cummins	900 / 706	4	1250	7.5	EPA Tier 2
Los Nogales	44	7	Cummins	720 / 565	2	1250	6.5	EPA Tier 2
Álvaro Casanova	43	3	Cummins	565	1	1000	6.5	EPA Tier 2

Source: Prepared by DTPM (2025)

In parallel, an analysis of contingent events over the past year shows that most recorded interruptions had an average duration of less than three hours and a frequency of between one and three interruptions per depot. However, the most complex events do not necessarily correspond to prolonged outages, but rather to micro-outages and brief voltage drops, which require restarting chargers and reprogramming charging strategies.

To address these risks, the system has strengthened inter-institutional coordination between the DTPM, operators, distribution companies, the SEC (Superintendency of Electricity and Fuels), and the National Energy Commission, establishing protocols for reporting, monitoring, and early response to contingencies, especially in adverse weather conditions.

Additionally, the SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index) indicators, defined by the international standard IEEE-1366 and adopted in the Chilean Technical Standard for Service Quality (NTCS), are used as a reference to evaluate the reliability of the electricity supply in the territories where the power plants operate. This information is integrated with surveys and interviews with operators to capture the actual operating experience.

a) Resilience in action: how to operate in the face of power supply events

Beyond the physical backup infrastructure, the energy resilience of the RED System's electrical depots increasingly relies on operational management and inter-institutional coordination capabilities in the face of power outages. This resilience is built upon both technological systems and operational protocols that enable a timely, coordinated, and phased response to contingencies.

First, operators have advanced fleet management and intelligent charging systems that allow them to balance energy consumption with the service levels required by the routes. These systems make it possible to prioritize critical services, modulate power, stagger charging processes, and reorganize operations in the face of temporary energy restrictions, constituting a first line of defence against network stress events. This operational "care cycle" is key to maintaining service continuity even before activating backup systems.

From the DTPM's perspective, these systems are part of the monitoring mechanisms required by the concession contracts. Monitoring battery charge cycles, power output, and operating conditions helps safeguard battery performance, autonomy, and lifespan, given that an inadequate strategy can prematurely deteriorate assets and affect service continuity in the medium term.

Operational resilience is focused on critical nodes with high fleet density, such as Peñalolén, Puente Alto, Maipú, and Pudahuel. To date, 100% of the system's 45

bus depots have operational backup systems, meeting safety standards. The El Conquistador bus depot (Maipú) stands out in this regard for having the most robust system, with 63% backup capacity provided by nine 900 kVA generators. Similarly, the operator Metbus excels in maintaining average backup levels close to 50% of its installed capacity.

Additionally, an inter-institutional working group has been established to coordinate system stakeholders and respond to service interruptions. Upon detection of an event, the monitoring centres of the operating companies activate internal procedures, report to the corresponding distributor, and inform the Bus Monitoring Centre (CMB) of the DTPM. The CMB, in direct coordination with the contingency counterparts of the distributors and the National Service for Disaster Prevention and Response (SENAPRED), requests updates on the supply status and expedites restoration, prioritizing the operational continuity of the bus depots.

Accordingly, there are challenges and opportunities for developing greater resilience in the system. For example, in the event of longer-lasting events or anticipated weather conditions, monitoring is currently carried out through periodic reports on the status of the bus depots and by activating close coordination with the SEC (Superintendency of Electricity and Fuels) and the companies involved. Along these lines, the formalization of a contingency action protocol for the first quarter of 2026 is currently underway. This protocol will provide guidelines and action scales according to the criticality levels of power outage events.

Additionally, and in conjunction with the SEC, work is underway to consolidate access to information regarding the status of chargers during the first half of 2026. This will improve monitoring in the event of contingencies, as well as enable the development of preventive and evaluative actions regarding their availability.

b) Challenges and obstacles in the quality of electricity supply

Finally, a relevant input for analysing the resilience of distribution networks has been identified. This is based on information generated using SAIDI (which measures the average duration of power outages) and SAIFI (which measures the frequency of outages) indicators, following the IEEE-1366 guidelines. These indicators, along with strengthened preventive maintenance of chargers and electrical infrastructure, are key to protecting critical assets and ensuring the system's operational availability.

The analysis of these indicators and the information provided by the electric vehicle depot operators allowed for the identification of depots most vulnerable to power outages, such as: Santa Marta in Huechuraba, La Farfana in Maipú, Diagonal Las Torres in Peñalolén, Los Lingues in Pudahuel, and OGM in San Bernardo. These locations are strategic due to their high population and fleet density. To mitigate these risks, we are working in coordination with organizations across the energy ecosystem and

prioritizing reinforcement and backup measures at the most vulnerable electro-depots.

Taken together, these advances reinforce the fact that energy resilience has been progressively integrated as a core component of the RED Movilidad model, essential for sustaining the expansion of electromobility and ensuring reliable and continuous public transportation for people.



→ 5. Network infrastructure and its contribution to urban transformation

a) Electric bus depots and urban transformation: a new relationship with the territory

The infrastructure for electromobility not only enables the system's operation but also acts as a catalyst for urban transformation. The transition from a model where depots were exclusively owned by operators to a public management scheme, initiated in 2017 and consolidated from 2022 onwards with the participation of the public company "Desarrollo País," has allowed for optimized service planning, reduced costs, lessened operational rigidities, and a higher urban and labour standard for these facilities.

and ensuring that this critical infrastructure meets criteria of public interest, territorial equity, and long-term sustainability.

As of the end of 2025, Desarrollo País had acquired 24 bus depots for the operation of the RED Movilidad System, representing approximately 33% of the total. Of these, 16 are electric, reflecting the strategic emphasis on enabling suitable infrastructure for electric operation. A significant portion of these acquisitions falls under the 2023 road usage tender, which required 23 properties for its implementation: 16 existing depots had to be electrified, 3 were already operating electric, and 4 were new. These 4 new depots were also electrified.

The shift to this model responds to the need to overcome structural limitations of the historical scheme, in which the location, capacity, and standard of bus depots depended exclusively on the decisions and assets of the operating companies. This generated rigidities in system planning, advantages for future incumbents, difficulties in optimizing routes, higher costs associated with non-commercial kilometres, and low incentives to invest in quality infrastructure for workers.

In this context, Desarrollo País acquired 19 bus depots associated with the process, 4 of which were already under lease agreements.

The four new electric bus depots described below were conceived as strategic points and elements to optimize the network, reduce non-commercial kilometres, and raise the urban and labour standard of the system.

In this context, the incorporation of Desarrollo País enabled progress toward strategic depot ownership, facilitating more flexible, transparent, and efficient planning, reducing barriers to entry for new operators,

Table 5: Electric bus depots characteristics acquired by Desarrollo País

Name Depot-Operator	Municipality	Services that it will host for its operation	Main axes by services	Capacity – Ability (square meters and parking spaces)	Total projected workers	Power and chargers
Las Acacias Conecta	San Bernardo	306 H07 H08 H12 H13	Lo Ovalle Gabriela Mistral Club Hípico Portugal	30.000 m ² y 140 bus parking spaces	255	1 MW 11 cargadores
El Retiro Gran Américas	San Bernardo	207 207c 207e 209 209c 234 290e F28	Santa Rosa	23.700 m ² y 184 bus parking spaces	325	2 MW 17 cargadores
Jardín Alto Gran Américas	La Florida	322 323 E03 E05 E07 E10 E20	Walker Martínez Santa Amalia Eliás Fernández Albano	8.829 m ² y 49 bus parking spaces	244	1.9 MW 15 cargadores
Los Peumos Voy	Maipú	110 118 506e 509	Manuel A. Matta Grecia 5 de Abril Simón Bolívar Vespucio Sur	20.000 m ² y 100 bus parking spaces	79	2 MW 17 cargadores

In the four new projects developed from scratch, the electric vehicle depots incorporate not only energy infrastructure but also urban mitigation measures: lighting, paving, road improvements, universal accessibility, bike lanes, landscaping, and environmental control during construction. Furthermore, their design integrates employee well-being spaces, such as break rooms, cafeterias, lactation rooms, and bicycle parking, reinforcing a comprehensive vision of sustainability.

Likewise, the development of these electric vehicle depots has required close coordination of parallel works, simultaneously integrating the depot's civil works and the electric charging infrastructure. This has allowed for optimized timelines, minimized urban impacts, and ensured the system's operational continuity. This approach is especially relevant in the context of the transition to electromobility, where energy infrastructure is an enabling requirement for operation.

Taken together, the electromobility infrastructure in RED Movilidad not only supports the operation of the electric fleet, but also redefines the relationship between transport, energy and the city, consolidating an energy transition model that is technically, socially and territorially responsible and coherent.

Image 5: Target image of new bus depots



Ilustración 6: Avances electroterminales Jardín Alto y El Retiro



b) Urban infrastructure that strengthens sustainable mobility

Continuing the development of electric bus depots as key components of urban transformation, road infrastructure and public transport support systems play an equally strategic role in consolidating a sustainable, efficient, and people-centred mobility system. Electrification requires not only energy and suitable depots, but also urban conditions that allow bus travel to be competitive with private cars.

Within this framework, the DTPM is implementing an Infrastructure Master Plan, as established by Law No. 20,378, which allows for the allocation of resources for the development of priority bus lanes, bus stops, and enforcement systems. These investments aim to reduce congestion, improve service reliability, and make the overall system more efficient.

→ (1) Priority lanes for buses: less congestion, more efficiency

Currently, a significant portion of public transportation services operate on mixed-use roads, sharing space with private vehicles. This situation exposes public transport to congestion, affecting average speed and reliability. To address this, the construction of dedicated bus corridors, exclusive lanes, and bus-only lanes has been promoted, along with the installation of enforcement cameras on strategic routes.

These measures have effectively prioritized public transport, improved punctuality and reducing travel and waiting times, as well as optimizing operational costs. By 2025, the system will have 494 km of priority lanes for buses and emergency vehicles (87 km of segregated corridors, 22.8 km of exclusive lanes, and 384 km of bus-only lanes), in addition to 526 enforcement cameras, with a cumulative investment of approximately \$4.5 billion, aimed at ensuring the proper use of this infrastructure.

→ (2) Bus stops: safety, accessibility and gender perspective

The travel experience doesn't begin or end on the bus, but at the bus stop. Therefore, strengthening safe, accessible, and well-equipped bus stops is a central component. Currently, there are 11,990 bus stops in the city; approximately 80% have shelters, and the rest have basic signage.

More than 8,000 bus stops meet the standard defined by the DTPM (Metropolitan Public Transport Authority) and are maintained with funding from the Authority, covering 30 of Santiago's 34 districts. In recent years, progress has been made in creating safe and gender-sensitive bus stops, incorporating improved lighting, universal accessibility, and real-time information systems.

By 2025, more than 500 bus stops will be equipped with panic buttons, some of them connected to municipal security centres, variable message signs (VMS), and audible buttons for people with visual impairments. Within this network, 368 bus stops have photovoltaic lighting, contributing to the system's environmental sustainability and reinforcing safety in public spaces.



C. Human capital as an engine of change

→ 1. Green jobs

The integration of electric buses into the RED Movilidad network is driving a systemic transformation that transcends technology and manifests itself in labour, operational, cultural, service, and institutional changes. From a human capital perspective, this process is perceived as a structural advancement toward a more modern, safe, and sustainable system, contributing to employee well-being and improving the quality of urban life by reducing noise and emissions, and creating more specialized and socially recognized green jobs.

To gain a deeper understanding of these changes, the DTPM conducted a qualitative study in 2025. This study was based on interviews with representatives from operating companies, technical teams, and professionals with strategic roles in the implementation, operation, maintenance, and change management of the system, along with focus groups with drivers and maintenance personnel. This approach allowed for a reconstruction of the process from an experiential, organizational, and institutional perspective.

a) Dimensions of change in human capital

The research identified five dimensions of change in human capital:

1. Experiential: Accounts from drivers and technicians demonstrate a direct improvement in working conditions. Reduced noise and vibration, along with greater comfort in the cab, are associated with less physically demanding workdays and greater employee well-being. These changes also strengthen professional pride in operating technology with high environmental standards, reinforcing a sense of belonging to the system.

2. Operative: The transition to electric buses has brought about a visible transformation of workspaces. Bus yards and depots are evolving into cleaner, more organized, and safer environments, with new electrical protocols, standardized procedures, and greater traceability of operations.

3. Organizational: Electromobility has driven the emergence of new roles and profiles, such as charging management, charging station operators, data support and analysis, and electrical maintenance, along with increasing technological sophistication of equipment. This process is accompanied by greater formalization of procedures and the intensive use of operational information and stricter safety protocols, resulting in more professionalized organizations.

4. Service: Improvements in comfort, reduced noise, and fleet modernization translate into a better user experience. This change strengthens the system's image, contributing to its positive public perception and a higher quality of service.

5. Institutional: The process of implementing electromobility is consolidated as a long-term public policy, with state leadership, intersectoral coordination (transport-energy) and digitized and flexible oversight.

b) Stages of the implementation process

The qualitative study identifies a three-stage transition: an initial phase of exploratory pilots characterized by high uncertainty and dependence on manufacturers; a second stage of technical and regulatory organization, where standards, job profiles, and safety protocols are defined; and a third phase of operational consolidation and scaling, in which technology is more stably integrated, the fleet expands, and service reliability is strengthened.

Among the main facilitators of the process are improved working conditions, training programs, and technical support. In contrast, the initial barriers are associated with concerns about electrical safety, limited training time, and dependence on external support, which reinforces the need to move toward continuous training programs, public-private coordination, updated training offerings, and active communication of progress.

c) Implications for generating more green jobs and optimizing change management

Based on the results of the qualitative study and the quantitative results detailed in the section electric bus depots: environmental nodes for urban well-being, a set of strategic implications are identified to consolidate electromobility as a quality green jobs policy and strengthen change management in the system:

- **Professionalization and inclusion:** Technological advancements and a cleaner environment promote the inclusion of women and young people in driving and maintenance and strengthen green career paths with improved skill standards.

- **Training and certification:** Prioritize training programs (electrical safety, load management, data analysis, efficient driving) and certification of profiles to increase technical autonomy and service quality.

- **Coordination and data:** To deepen management with information (operation-loading-maintenance) and public-private coordination to reduce external dependence and accelerate incident resolution.

- **Communication and visibility:** Scale up territorial and organizational communication so that more workers and neighbours recognize the changes, maximizing the legitimacy and social appropriation of the process.

Electromobility within the RED Movilidad network significantly contributes to employee well-being, raises service standards, reduces environmental impacts, and strengthens community values, creating the conditions for quality green jobs. To consolidate and scale these benefits, it is crucial to maintain ongoing training, systemic coordination among the various stakeholders in the electromobility ecosystem, curriculum updates, and active communication, ensuring the sustainability of the transformation and equitable access to job opportunities in the energy transition.

→ 2. Training for staff of operating companies

During the year 2025 and considering the information reported up to the end of September, the operating companies of the System recorded 7,471 people trained and 98,164 hours of training accumulated in topics related to electromobility, operation of electric buses, maintenance and energy efficiency.

Table 6: People and hours of training applied by transport operating companies, September 2025.

UN/ US	Trained personnel	Total hours of training
UN2	494	3.952
UN3	712	2.136
UN4	5	15
UN5	2.027	16.216
US8-US9	75	1.026
US10-US12	140	2.240
US11-US13	1.932	31.166
US14-US15	711	3.555
US17-US18	1.375	37.858
Total	7.471	98.164

The training provided during the period covers a wide range of skills critical to electromobility, highlighting:

- **Electromobility and technical operation:** Operation of electric buses, energy management and maintenance.

- **Safe operation of electric buses and quality of service:** Road safety, defensive driving and evasive manoeuvres, highlighting the use of full immersion simulators in the case of the Metbus company.

- **Induction and regulations:** Training programs for driving personnel entering the system, reinforcing emergency procedures and protocols for electric vehicles.

A key aspect is the direct participation of the electric bus suppliers, who provided a total of 3,282 hours of training, primarily related to specific fleet models. This type of training strengthens the transfer of specialized technical knowledge and ensures that personnel possess skills aligned with the manufacturer's specifications, both in driving and maintenance.

Finally, regarding the job profiles within the operating companies, the training activities focused mainly on drivers, reflecting the priority on the safe and efficient operation of electric buses. However, training was also provided for maintenance personnel, operators, and support staff, including assistants and supervisors, strengthening their skills in driving, technical management, and service supervision.



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III. Sustainable impacts for the city and its inhabitants

A. Environmental benefits

To assess the environmental benefits of electromobility within the RED Movilidad System, the DTPM developed an integrated methodological approach in 2025 that combines emissions estimates, on-site monitoring campaigns, and statistical analysis of operational variables. This approach allows for the analysis of electrification impacts at different scales: system, road axis, and infrastructure, and distinguishes the effects of the technological shift in public transport on the city and its inhabitants.

The assessment considers, on the one hand, the calculation of local and global emissions using recognized methodologies consistent with sectoral and climate instruments. Additionally, direct noise and air quality measurement campaigns were conducted on strategic road axes and at electric bus depots, using an ex-ante/ex-post comparative design, synchronized with milestones in the incorporation of electric buses.

In the case of urban noise, given its high sensitivity to fleet changes and operating conditions, the analysis integrates information from monitoring stations, disaggregated vehicle counts, and statistical models. This approach allows for estimating the noise contribution of public transport and projecting results in corridors without continuous monitoring.

In assessing air quality, particularly fine particulate matter (PM2.5), greater attribution complexity is recognized due to the coexistence of multiple emission sources and the influence of meteorological factors. However, the comparative approach allows for identifying trends consistent with technological upgrades, especially in corridors and facilities that have undergone operational transformations from diesel fleets to 100% electric configurations.

The measurements at the axis and depot levels were financed and technically supported by the Centre for Sustainable Mobility and the "Support for the Chilean Sustainable Transport Strategy (CLETS)" Project, led by the Ministry of the Environment.

This methodological framework underpins the results presented in the following sections, enabling an integrated interpretation of the environmental benefits of electromobility and ensuring consistency across the different levels of analysis.

➔ 1. Local and global emissions: progress towards carbon neutrality

Emission reduction has been a central pillar of electromobility within the RED Movilidad System. In 2025, the Ministry of Transport and Telecommunications (MTT), through the Secretariat of Transportation and Infrastructure (SECTRA), updated its methodology for estimating local and global emissions to strengthen annual comparability and align the process with national climate monitoring instruments.

The new methodology is based on a simplified approach consistent with the operational guidelines of the Sectoral Plan for Climate Change Mitigation and Adaptation to Transport (PSMACC). This allows for the integration of RED Movilidad System results into the official monitoring of climate commitments, facilitating the tracking and progress toward sectoral goals for carbon neutrality by 2050. Under this approach, the 2025 results maintain the trend observed in previous periods: a sustained reduction in both local and global emissions, in line with the expansion of the electric fleet and the progressive decrease in diesel buses in operation.

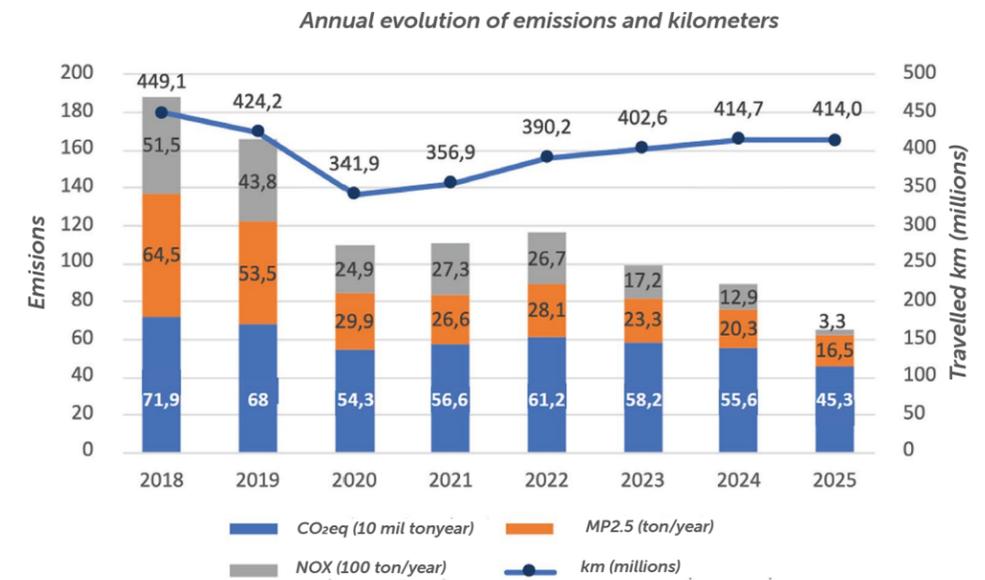
Overall, the total annual CO₂eq of the RED Movilidad System decreased to 453 kt in 2025, representing an 18.6% reduction compared to 2024 (556.4 kt). The emissions intensity indicator (gCO₂/km-bus) also showed improvement, reaching 1,094.7 gCO₂/km-bus, equivalent to an 18.4% reduction compared to the previous year. This decrease is mainly due to the increase in kilometres travelled by electric buses and the greater energy efficiency of the new models incorporated during the period.

The reductions are even more significant when compared to 2018, a year in which the participation of electric buses in the fleet was still in its early stages. Considering this starting point, the system has achieved a reduction of 265.4 kt of CO₂eq, corresponding to a cumulative decrease of 36.9% in overall emissions, demonstrating the structural effect of electrification on these emissions.

Regarding local emissions, the performance is equally favourable. In 2025, NO_x emissions were reduced by 74.6% compared to 2024, while fine particulate matter (PM2.5) emissions decreased by 18.7%, from 20.3 to 16.5 tons, reflecting the direct impact of the accelerated retirement of diesel buses in operation.

When compared to 2018 levels, the cumulative reductions reach 93.6% for NO_x and 74.4% for PM2.5, results consistent with the transition from a predominantly diesel fleet to a system with a greater presence of electric buses.

Figure 13: Atmospheric emissions 2018-2025 (Tons/year)



Source: : Prepared from Sectra's Simplified Tool (DTPM)

Table 7: Monitoring of Annual Emissions from RED Movilidad Buses

Year	MP _{2.5} (Ton)	MP ₁₀ (Ton)	NO _x (Ton)	COV (Ton)	COV (Ton)	CO ₂ eq (kt)	KM travelled (millions)	Emission intensity (gCO ₂ eq/Km-bus)
2018	64,5	82,1	5.151,5	246,7	1.393,1	63	449,1	1.600,2
2019	53,5	70,0	4.378,5	206,7	1.192,4	718,6	424,2	1.603,5
2020 (Covid19)	29,9	43,2	2.487,2	114,4	680,6	680,2	341,9	1.587,9
2021 (Covid19)	26,6	40,4	2.734,9	126,0	751,1	543,0	356,9	1.586,6
2022	28,1	43,2	2.667,4	120,6	739,4	566,3	390,2	1.567,7
2023	23,3	39,0	1.723,5	67,1	498,5	611,7	402,6	1.448,9
2024	20,3	36,4	1.290,0	50,0	382,0	583,3	414,7	1.341,8
2025	16,5	32,6	327,3	19,3	113,6	453,2	414,0	1.094,7
Variation % 2018-2025-	-74,4%	-60,2%	-93,6%	-92,2%	-91,8%	-36,9%	-7,8%	-31,6%
Variation % 2024-2025	-18,7%	-10,5%	-74,6%	-61,3%	-70,3%	-18,6%	-0,2%	-18,4%

Fuente: Elaboración propia a partir de la Herramienta Simplificada – Sectra (2025)

The impact of these reductions is best understood by placing the results of the Mobility Network System within the regional inventory. According to the Air Pollution Prevention and Decontamination Plan (PPDA) , in the Metropolitan Region, emissions are distributed roughly into three parts: mobile, stationary, and residential sources. Within the third associated with the transportation sector, RED buses contribute only 3.3% of total CO₂eq emissions, while cars and motorcycles account for nearly 90%. A similar pattern is observed in fine particulate matter: RED buses generate only 3.7% of fine particulate matter (PM_{2.5}), compared to 89.3% from private vehicles .

This relatively low weight of public transport in regional emissions does not reflect a lesser importance of the sector but rather is precisely the result of the sustained emissions reductions achieved through fleet electrification. In this sense, the RED Movilidad System stands out as one of the most cost-effective measures in

the transport sector, both for its direct contribution and for its demonstrative value for large-scale zero-emission technologies.

Finally, to complement the environmental results presented, and with the aim of valuing the benefits associated with the reduction of greenhouse gas emissions, the social pricing methodology in effect for 2025 of the National Investment System (SNI), under the Ministry of Social Development and Family, is applied. Within this framework, it is possible to quantify the savings associated with the avoided negative externalities resulting from the reduction of CO₂eq emissions in the period 2018–2025. Thus, the reduction of polluting emissions translates into savings in negative externalities of approximately \$18.721 billion pesos annually.

Table 8: Economic valuation of CO₂eq emission reductions through a social carbon price (2018–2025)

Carbon Social Pricing	CLP/t CO ₂ eq
	70.540
Reduction CO₂eq (t)	Savings (MM\$)
265.400	18.721

Source: Social Prices 2025 | National Investment System



→ 2. Energy consumption and energy efficiency

The electrification of the RED Movilidad System has entailed a structural transformation in its pattern of energy consumption reflects a progressive transition from the intensive use of fossil fuels to an electric power model, which is significantly more efficient and consistent with the country's decarbonization goals.

Between 2018 and 2025, diesel consumption by the system's bus fleet decreased from 260.1 million litres to 134.9 million litres, representing a cumulative reduction of 48.1%. This decline is consistent with the gradual retirement of diesel buses and their replacement with electric buses, particularly from 2019 onward, when the systematic incorporation of zero-emission buses began.

In parallel, the system's electricity consumption increased steadily, rising from 11.3 GWh in 2018 to 398 GWh in 2025, equivalent to a growth of more than 3,400% in seven years. This increase does not constitute a net increase in the total energy consumption of the system, but a technological substitution: electric power replaces diesel with a much higher efficiency in terms of useful energy per kilometre travelled.

Table 9: Energy consumption by source of the RED Movilidad System

Year	Diesel (million lt)	Power (GWh)
2018	260,1	11,3
2019	242,3	37,7
2020	189,0	63,5
2021	196,8	67,1
2022	212,9	91,7
2023	195,0	199,0
2024	183,3	263,7
2025	134,9	397,9

Source: Prepared by DTPM with data from Sectra's Simplified Tool (DTPM)

Complementing the shift in the energy consumption matrix, the RED Movilidad System has progressively strengthened the energy efficiency requirements for buses incorporated into the system. The RED standard stipulates that vehicles entering the system under new concession contracts must comply not only with current regulations on pollutant emissions and cleaner technologies, but also with minimum energy efficiency requirements, measured in megajoules per kilometre (MJ/km) under the "TS-STGO" operating cycle, which is representative of real-world traffic conditions in Santiago.

Compliance with these parameters is verified during the bus homologation process at the Vehicle Control and Certification Centre (3CV), ensuring that vehicles incorporated into the system achieve adequate levels of energy performance under real-world operating conditions. Furthermore, energy efficiency is a key factor in the bidding and awarding processes for concessions, through the efficiency evaluation factor (PEF), incentivizing the incorporation of buses with lower energy consumption and improved operational performance. In this way, electromobility in the RED Movilidad network not only reduces the use of fossil fuels, but also promotes an increasingly efficient vehicle fleet, aligning environmental objectives with the economic and operational sustainability of the system.

→ 3. Source of the energy

The environmental contribution of electromobility depends not only on the technological replacement of diesel buses with electric ones, but also on the origin of the energy used for their operation. In this sense, the electrification of public transport makes perfect climate sense when it is linked to an increasingly clean and renewable energy mix.

Globally, the International Energy Agency (IEA) identifies electric vehicles as the leading technology for decarbonizing land transport, a sector that in 2023 accounted for more than 15% of global energy-related emissions. . In Chile, this need is even more relevant: according to the National Greenhouse Gas Inventory, the Energy sector accounted for 77% of the country's total emissions in 2018, with a significant share attributable to transport .

In this context, the RED Movilidad System has incorporated explicit requirements to ensure that the operation of its electric fleet is consistent with the principles of energy sustainability. Through the bidding terms, specifically clause 3.2.3.6, the DTPM requires each operator to submit, prior to the start of operations, a sworn statement from its electricity suppliers certifying that there is a positive monthly balance between the renewable energy injected into the electrical system and the energy contractually committed.

This requirement is structured in three complementary elements. First, the technical feasibility of the electricity supply is required, through a certificate that verifies that the distribution network associated with the electric vehicle depot has the necessary capacity to sustain the charging cycles without affecting service continuity. Second, a legal commitment from the energy supplier

is established, formalized through a sworn statement, guaranteeing compliance with the renewable supply standards required by the system. Finally, the positive balance mechanism ensures that suppliers are net generators of renewable energy, meaning that the clean energy they inject into the national electricity system exceeds the renewable energy they commit to supplying to their customers.

This compliance is verified through the National Renewable Energy Registry (RENOVA), managed by the National Electricity Coordinator, which allows for transparent and traceable verification of the renewable origin of the energy consumed by system operators.

Together, these requirements ensure that the electromobility of the RED Movilidad System not only reduces emissions in the daily operation of buses but also aligns with the country's energy transition, strengthening the environmental coherence of the entire electricity supply chain associated with public transportation.

Tabla 10: Cuadro declaraciones suministro energía renovable

Operator / Concessionaire	Supplier	Contract period	Certified consumption (MWh)	% Renewable Energy	Verification mechanism
Conecta	EMOAC SpA	August 2025 - present	Depending on dispatch	100%	RENOVA / Blockchain
Metropol	EMOAC SpA	January 2024 - present	Depending on dispatch	100%	RENOVA / Coordinador Eléctrico
Voy	ENEL Generación S.A	August 2025 - present	Depending on dispatch	No especificada	No especificada
STU	EMOAC SpA	February 2023 - present	Depending on dispatch	100%	RENOVA / Coordinador Eléctrico
RBU	ENEL Generación S.A	January 2023 - present	Depending on dispatch	100%	Certificado IREC
Gran América	EMOAC SpA	August 2025 - present	Depending on dispatch	100%	RENOVA / Coordinador Eléctrico

Source: : Prepared by DTPM (2025)

→ 4. Quieter cities: reducing urban noise

The introduction of electric buses has transformed the soundscape of Greater Santiago, reducing noise levels on major roads and improving people's quality of life.

Although a variation of 1 decibel (dB(A)) may seem small, on a logarithmic scale it represents a reduction of nearly 20% in the acoustic energy emitted into the environment. This means that, even if the difference may not be noticeable to the human ear, the city receives considerably less noise. Therefore, complementing the traditional dB(A) analysis with its equivalent percentage of acoustic energy allows for a better understanding of electromobility's contribution to reducing noise pollution.

Electric buses operating in the RED System and certified by the Vehicle Control and Certification Centre (3CV) emit on average 5 to 6 dB(A) less than required by current regulations (80–81 dB(A)) , Under dynamic testing both indoors and outdoors, this difference means that an electric bus generates between 68% and 75% less noise energy than a traditional diesel bus, which explains much of the impact observed on city streets .

To assess the expression of this impact at the urban level, the records of four stations of the Noise Monitoring Network of the Ministry of the Environment (MMA) were analysed . For each station, a representative weekday from different years was selected, considering peak hours (8:00–9:00 and 19:00–20:00), the number of buses of different technological compositions (diesel or electric) that passed the measurement point, and a count of private vehicles, allowing for a more precise attribution of the contribution of public transportation.

The analysis shows that, on most road corridors and at different times, noise levels tend to decrease in 2025 compared to the first year measured, with more significant reductions on corridors with greater technological upgrades, such as Alameda and Santa Rosa. In these cases, the cumulative decreases reach between -4.4 and -3.4 dB(A) during the morning peak hours, significant values for high-traffic corridors.

In terms of acoustic energy, the reductions reach up to 64% on corridors with the highest penetration of electric buses, reflecting a structural change consistent with the progressive increase of this technology. This reduction reached 44% in 2023 versus the 64% achieved in 2025.

In this context, the occasional increases in noise observed on some routes are not due to setbacks in electromobility, but mainly to variations in the composition of traffic flow, particularly the relative increase in heavy vehicles recorded in vehicle counts, whose noise contribution may overshadow the reduction effect generated by the

technological upgrade of public transport. On the main electrified routes, the underlying trend continues to be one of decrease and stabilization at levels lower than those observed at the beginning of the analysed periods.

a) Results by station of the Noise Monitoring Network of the Ministry of Environment

Alameda (N° 924). The Alameda has the most extensive historical data series, allowing for a clear observation of the evolution of ambient noise since the start of electrification.

Between 2019 and 2025, noise levels decreased by 4.4 dB(A) in the morning and 3.6 dB(A) in the afternoon, a significant reduction for one of Santiago's busiest avenues. In terms of acoustic energy, the cumulative decrease between 2019 and 2025 reached 64% in the morning and 56% in the afternoon, demonstrating a structural change attributable to the increased presence of electric buses, whose share rose from 12% in 2019 to 54% in 2025 in the morning, and from 14% to 56% in the afternoon.

This trend was already significant in 2023. On a representative day that year, a 44% reduction in noise levels was recorded during the morning rush hour (8:00–9:00 a.m.) and a 40% reduction during the evening rush hour (7:00–8:00 p.m.), compared to 2019. This was consistent with the increased share of electric buses on the route, which reached 36% in 2023. These results anticipate the structural effect that will solidify in subsequent years.

Thus, when comparing 2025 to 2024, further reductions of -2.2 dB(A) in the morning and -1.5 dB(A) in the evening are observed. During this same period, noise levels decreased by 40% in the morning and 29% in the afternoon, consistent with the increased share of electric vehicles on the route, which rose from 41% in 2019 to 54% in 2025 in the morning, and from 43% to 56% in the afternoon.

Vehicle counts show limited variations in private traffic between 2024 and 2025, reinforcing the conclusion that the observed reduction is mainly due to the technological upgrade of public transportation (Table 12).

San Miguel (Santa Rosa N° 3453). Between 2020 and 2025, noise levels along this axis will decrease by 3.4 dB(A) during the morning and afternoon hours. The year-on-year comparison between 2025 and 2024 shows more modest reductions of 0.4 dB(A) during the afternoon and an increase of 1.1 dB(A) during the morning.

In terms of noise levels, a 54% reduction is observed between 2020 and 2025, and a moderate 9% decrease during the afternoon between 2024 and 2025. These results are consistent with the increased participation of electric buses on the route, which had no presence in 2020 and now represent 31% in 2025.

At the same time, vehicle counts show increases in private traffic, especially trucks during the morning and afternoon peak hours, suggesting that the observed noise reductions are occurring despite greater vehicular demand from outside the RED System.

La Florida (Walker Martínez N° 300–380). Between 2022 and 2025, noise levels decreased by 0.9 dB(A) in the morning, while in the afternoon they increased slightly by 0.5 dB(A). The year-on-year comparison between 2024 and 2025 shows reductions of 0.5 dB(A) in the morning and an increase of 2.2 dB(A) in the afternoon.

The reduction in noise energy during the morning reached 19% between 2022 and 2025 and continued to decrease by 11% between 2024 and 2025. In this area, all

trips in 2022 were made with diesel buses; by 2025, the gradual increase in the electric fleet reached 43%.

The increase in noise levels during the afternoon coincides with an increase in private traffic, particularly trucks (17%) and motorcycles (55%), between 2024 and 2025.

El Bosque (Alejandro Guzmán 925). This axis shows moderate decreases typical of the urban environment. In the period 2022–2025, there is a slight decrease of -0.5 dB(A) (AM) and -0.2 dB(A) (PM). Year-on-year, 2025–2024 shows more marked reductions: -1.5 dB(A) in the morning and -1.1 dB(A) in the afternoon.

Acoustic energy also shows improvements: -11% (AM) and -5% (PM) between 2022 and 2025. Operationally, the electric component, which was zero in 2022, increases to 37% in 2025. Meanwhile, vehicle counts show moderate variations in private traffic.

Figure 14 Annual evolution of noise levels in Alameda (L_{Aeq} dB) and distribution of the technological composition of the fleet during AM and PM hours.

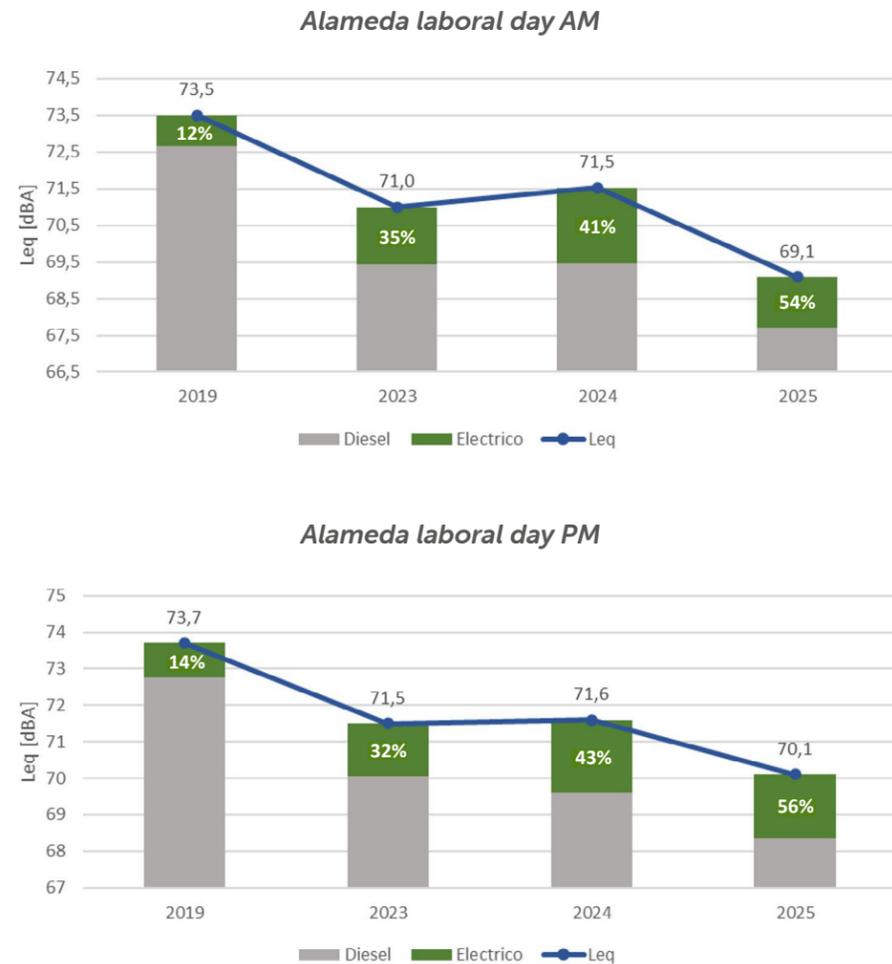


Table 11: Noise levels in decibels (dB(A)) at Noise Monitoring Stations and distribution of bus routes by technology.

Estaciones monitoreo	Fecha de análisis		Niveles de ruido en decibeles (dB(A))		Distribución de expediciones de buses según tecnología			
	Día	Año	8–9 hrs	19–20 hrs	8–9 hrs		19–20 hrs	
					Diésel	Eléctrico	Diésel	Eléctrico
Alameda (Altura N°924)	13-08-2019	2019	73,5	73,7	88%	12%	86%	14%
	17-08-2023	2023	71,0	71,5	65%	35%	68%	32%
	07-11-2024	2024	71,3	71,6	59%	41%	57%	43%
	23-10-2025	2025	69,1	70,1	46%	54%	54%	56%
	2019 vs 2025	Decibeles (dB(A))	-4,4	-3,6				
	2024 vs 2025	Decibeles (dB(A))	-2,2	-1,5				
San Miguel (Santa Rosa N°3453.)	23-09-2020	2020	67,9	66,6	100%	0%	100%	0%
	12-09-2023	2023	65,3	64,7	68%	32%	73%	27%
	07-11-2024	2024	63,4	63,6	67%	33%	78%	22%
	23-10-2025	2025	64,5	63,2	71%	29%	69%	31%
	2020 vs 2025	Decibeles (dB(A))	-3,4	-3,4				
	2024 vs 2025	Decibeles (dB(A))	+1,1	-0,4				
La Florida (Walker Martínez N°300-380)	09-11-2022	2022	65,7	66,1	100%	0%	100%	0%
	14-11-2023	2023	66,5	65,6	100%	0%	100%	0%
	07-11-2024	2024	65,3	64,4	100%	0%	100%	0%
	23-10-2025	2025	64,8	66,6	57%	43%	68%	32%
	2022 vs 2025	Decibeles (dB(A))	-0,9	+0,5				
	2024 vs 2025	Decibeles (dB(A))	-0,5	+2,2				
El Bosque (Alejandro Guzmán 925)	02-11-2022	2022	61,9	62	100%	0%	100%	0%
	30-11-2023	2023	62,6	66,4	65%	35%	70%	30%
	07-11-2024	2024	62,9	62,9	74%	26%	71%	29%
	23-10-2025	2025	61,4	61,8	68%	32%	63%	37%
	2022 vs 2025	Decibeles (dB(A))	-0,5	-0,2				
	2024 vs 2025	Decibeles (dB(A))	-1,5	-1,1				
		Energía acústica (%)	-64%	-56%				
		Energía acústica (%)	-40%	-29%				
		Energía acústica (%)	-54%	-54%				
		Energía acústica (%)	+29%	-9%				
		Energía acústica (%)	-19%	+12%				
		Energía acústica (%)	-11%	+66%				
		Energía acústica (%)	-11%	-5%				
		Energía acústica (%)	-29%	-22%				

Source: : Prepared by DTPM (2025)

Table 12: Vehicle counts and variations 2024 and 2025.

Ejes viales	Fecha de conteo	AM (8-9 hrs)				PM (19-20 hrs)			
		Buses	Vehículos Livianos	Camiones	Motos	Buses	Vehículos Livianos	Camiones	Motos
Alameda (Altura N°924)	07-11-2024	420	3.616	97	145	454	3.659	57	245
	23-10-2025	357	2.290	70	151	424	2.804	37	164
	Variación (%)	-15%	-37%	-28%	4%	-7%	-23%	-35%	-33%
San Miguel (Santa Rosa N°3453.)	07-11-2024	123	2.141	97	164	120	1.684	76	116
	23-10-2025	119	2.168	70	88	105	2.444	102	100
	Variación (%)	-3%	1%	-28%	-46%	-13%	45%	34%	-14%
La Florida (Walker Martínez N°300-380)	07-11-2024	19	1.086	22	32	32	1.202	18	53
	23-10-2025	35	1.198	43	30	30	1.199	21	82
	Variación (%)	84%	10%	95%	-6%	-6%	0%	17%	55%
El Bosque (Alejandro Guzmán 925)	07-11-2024	35	456	29	19	51	426	19	24
	23-10-2025	40	470	31	19	43	433	24	14
	Variación (%)	14%	3%	7%	0%	15%	2%	26%	-42%
Gran Avenida (Altura Metro El Llano)	07-11-2024	164	3178	66	128	164	2984	105	109
	23-10-2025	165	2741	79	110	158	3035	117	97
	Variación (%)	1%	-16%	17%	-16%	-4%	2%	10%	-12%
Diego Portales (Tramo Av Florida - Sta Cecilia)	07-11-2024	86	907	38	30	70	693	20	67
	23-10-2025	74	782	46	26	56	705	22	60
	Variación (%)	-16%	-16%	17%	-16%	-25%	2%	10%	-12%
Av Gabriela, Tramo Los Gómeros - Nemesio Vicuña	07-11-2024	80	892	20	17	90	752	29	27
	23-10-2025	72	769	24	15	79	765	32	24
	Variación (%)	-11%	-16%	17%	-16%	-14%	2%	10%	-12%

Source: : Prepared by DTPM (2025)



b) Complementary analysis with vehicle counts and statistical modelling

To more accurately determine whether the noise reductions observed on the analysed routes are attributable to the increase in the electric vehicle fleet, the DTPM supplemented the measurements taken at MMA stations with a detailed analysis of traffic flows and their statistical relationship to the recorded noise levels. This approach allows for distinguishing the specific effect of public transport from other mobile sources and also provides the methodological basis for estimating the acoustic impact on routes where continuous monitoring stations do not exist.

The analysis combined three components:

1. Vehicle counts broken down by electric buses, diesel buses, light vehicles, and heavy vehicles.
2. Correlation analysis to assess the direct association between noise levels and public transport flows.
3. Linear regression models to estimate the specific contribution of each vehicle type and its interaction with speed.

(1) Correlation analysis: the dominant role of the diesel bus in urban noise

A Pearson correlation analysis was applied between noise levels (in dB(A)) and the recorded traffic flows on each measured corridor. First, the total bus flow was evaluated, and then it was broken down into diesel and electric buses to capture their differentiated effects.

The results show that the relationship between total bus flow and noise is strong and positive, meaning that the greater the bus traffic, the higher the recorded sound pressure. However, the disaggregated analysis reveals significant differences between diesel and electric buses. The former shows a strong correlation with ambient noise (coefficient = 0.766), while electric buses show a more moderate correlation (coefficient = 0.609), confirming that the acoustic impact of diesel buses is greater than that of electric buses.

These results support the hypothesis that the decrease in urban noise on the evaluated corridors is largely explained by the reduction in the fleet of heavy diesel vehicles and the introduction of electric buses with lower noise emission levels.

(2) Linear regression models: estimating the acoustic contribution of public and private transport

To analyse the integrated contribution of public and private transport to environmental noise, five multiple linear regression models were developed, incorporating traffic flows and speeds of light vehicles, heavy vehicles, and buses (electric and diesel).

The model with the best statistical fit (adjusted $R^2 = 0.88$) yielded results consistent with the correlation, allowing for the estimation of the specific acoustic contribution of each vehicle type:

- The flow of electric buses has a negative effect; that is, their presence contributes to reducing the total noise recorded.
- However, the interaction between flow and speed showed that, as speed increases, the noise contribution of electric buses also increases. That is, at speeds below 13 km/h, their contribution is practically nil. Above that speed, the impact increases, although it remains substantially lower compared to diesel buses.

For quantitative reference: An electric bus contributes 0.005 dB(A) at 30 km/h. In contrast, a diesel bus contributes 0.019 dB(A), regardless of speed—almost four times more. These results suggest that, even under different operating conditions, electric buses have a significantly lower noise impact and contribute to the overall reduction of urban noise. Overall, the model estimates that electric buses account for only 3% of the total noise at the monitored locations. Meanwhile, diesel buses account for 44%, despite transporting equivalent passenger volumes.

“Entre 2023 y 2025, el Sistema RED redujo hasta en un 80% las emisiones de los principales contaminantes locales, mientras disminuyó en casi un 25% su huella de carbono, aun cuando la oferta de transporte aumentó.”

(3) Use of the model to estimate noise on shafts without noise monitoring stations

One of the main advantages of this analysis is that it allows the evaluation to be extended to road corridors where noise monitoring stations do not exist. The statistical models developed, based on traffic flows, average speeds, and the technological composition of the fleet, allow for the projection of probable noise levels and, consequently, the identification of the specific contribution of public transportation in different operational and technological fleet replacement scenarios.

This approach is especially useful on densely populated or high-traffic roads, where technological upgrades can generate significant benefits for the community, but where there is no historical record to allow for a "before and after" comparison.

(a) Results on Avenida Diego Portales: empirical validation of the model

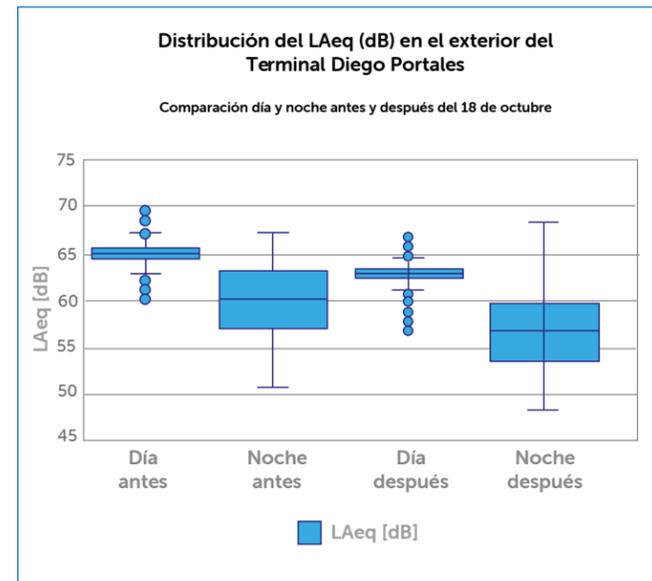
The Avenida Diego Portales axis constitutes the most robust case for evaluating the predictive capacity of the model, since in addition to the estimates, direct measurements were carried out on the ground between the months of September to December with the support of the Centre for Sustainable Mobility (CMS).

The technological upgrade on the corridor took place on October 18, 2025, following the replacement of diesel buses with electric ones on services E01, E02, E04, E08, E09, E11, and E14. For this corridor, the model projected significant reductions of -1.6 dB(A) during the morning peak hours and -0.9 dB(A) during the afternoon peak hours, with acoustic energy reductions of between 31% and 19%, respectively.

Independent measurements confirmed the downward trend in noise levels, although the decreases were lower than those estimated by the model. On average, it was observed that:

- During the daytime period, noise levels decreased from 63.82 dB(A) before the replacement to 63.41 dB(A) after electrification, corresponding to a reduction of -0.5 dB(A) and 10% less acoustic energy.
- During the night period, levels decreased from 54.05 dB(A) in the previous scenario to 52.90 dB(A) with 100% electric operation, equivalent to a reduction of -1.15 dB(A) and -30% acoustic energy.

Figure 15: LAeq variation (dB) – Diego Portales axis Ex ante / Ex post day and night



Fuente: Mediciones del Centro de Movilidad Sostenible (2025)

(b) Results on the Gran Avenida José Miguel Carrera axis

In the case of Gran Avenida, the model estimates anticipated reductions of around 21% in noise levels (-1 dB(A)) in the morning following the introduction of the new electric buses to service 301, which began on November 22, 2025.

Measurements, however, recorded an average decrease of -0.1 dB(A). During the daytime, there was a slight

increase of 0.2 dB(A) at night, equivalent to a 5% change in acoustic energy. The correlation between projection and measurement demonstrates that the model moderately captures the impact of the gradual withdrawal of diesel buses from trunk corridors.

(c) Results on Gabriela Avenue: projection without direct measurement

On the Avenida Gabriela corridor, where the vehicles operating services 325, E12, E13, E15c, and E16 were renewed during August 2025, there are no historical noise measurements, making the model the only estimation tool.

The model projected an 11% reduction in acoustic energy (-0.5 dB(A)) during a typical weekday afternoon rush hour and a slight increase of 9% (0.4 dB(A)) during the morning

rush hour when comparing the period before and after the replacement with this new technology.

These results reinforce the model's usefulness in approximating the combined effect of the removal of diesel buses and the specific operational conditions of the corridor, allowing for the evaluation of potential impacts in the absence of direct measurements.

Table 13: Results of noise monitoring campaign and projections on axes, before and after the replacement of diesel buses with electric ones, (LAeq (dB))

Sitio de monitoreo	Condition	Value before	Value after	Variation	Acoustic energy
Axis Diego Portales	Total	59,8	59,2	-0,6	-13%
	Day	62,5	62,0	-0,5	-10%
	Night	54,5	53,6	-0,9	-19%
Axis Gran Avenida	Total	68,0	67,9	-0,1	-2%
	Day	69,7	69,6	-0,1	-2%
	Night	64,2	64,4	0,2	-5%
Proyections	Condition	2024	2025	Variation	Acoustic energy
Axis Diego Portales	8:00 – 9:00	66,3	64,7	-1,6	-31%
	19:00-20:00	65,8	64,8	-0,9	-19%
Axis Gran Avenida	8:00 – 9:00	70,6	70,5	-0,1	-2%
	19:00-20:00	71,05	71,08	0,0	+1%
Axis Av. Gabriela	8:00 – 9:00	63,9	64,3	0,4	+9%
	19:00-20:00	65,3	64,8	-0,5	-11%

Fuente: Mediciones del Centro de Movilidad Sostenible (2025)

Table 14: Modelling of noise levels in decibels (dB(A)) on road axes where there are no Noise Monitoring Stations, 2024-2025

Modeled road axes	Date of analysis		Noise levels in decibels (dB(A))		Distribution of bus routes according to technology			
	Day	Year	8-9 hrs	19-20 hrs	Diésel	Eléctrico	Diésel	Eléctrico
					8-9 hrs	19-20 hrs	8-9 hrs	19-20 hrs
Gran Avenida (Altura Metro El Llano)	07-11-2024	2024	70,6	71,1	90%	10%	88%	12%
	26-11-2025	2025	69,6	70,0	57%	43%	52%	48%
	2024 vs 2025	Decibels (dB(A))	-1,00	-1,6				
		Acoustic energy (%)	-21%	-22%				
Diego Portales (Tramo Av Florida - Sta Cecilia)	07-11-2024	2024	66,3	65,8	100%	0%	100%	0%
	23-10-2025	2025	64,7	64,8	0%	100%	5%	95%
	2024 vs 2025	Decibels (dB(A))	-1,6	-0,93				
		Acoustic energy (%)	-31%	-19%				
Av Gabriela Tramo Los Gomerós - Nemesio Vicuña	07-11-2024	2024	63,9	65,3	4%	96%	7%	93%
	23-10-2025	2025	64,3	64,8	3%	97%	6%	94%
	2024 vs 2025	Decibels (dB(A))	+0,4	-0,5				
		Acoustic energy (%)	+9%	-11%				

Source: Prepared by DTPM (2025)

c) Importance of continuous monitoring

Continuous monitoring of MMA stations, combined with statistical models of flow, speed, and noise, constitutes a strategic tool for the environmental management of the system. It allows for tracking the evolution of urban noise levels, evaluating the impact of the technological transition, and moving toward data-driven decision-making.

The results obtained confirm that electromobility is an effective instrument for mitigating noise pollution, contributing to a quieter, healthier, and more resilient city. As the proportion of electric buses in the fleet increases, noise levels are expected to continue decreasing, reinforcing the importance of moving toward a more efficient and citizen-friendly public transportation system.



5. Road-level air quality

In addition to inventory calculations, in 2025 the DTPM, with support from the Centre for Sustainable Mobility, conducted direct measurement campaigns along three structural axes of the RED Movilidad system: Alameda, Gran Avenida José Miguel Carrera, and Diego Portales. These campaigns aimed to evaluate the impact of the technological upgrade on fine particulate matter (PM2.5) concentrations associated with vehicular traffic, especially in areas where electric buses were introduced on specific dates.

Measurements were taken over a period of at least three weeks before and three weeks after the upgrade, with equipment installed at strategic intersections to accurately capture the "before and after" transformation. In the case of Alameda, the comparison was made between measurements taken in 2024 and continuous records collected throughout 2025, creating two comparable series despite having been developed in different periods.

Unlike urban noise, which responds locally and immediately to fleet changes, PM2.5 presents a greater complexity in terms of causal attribution in open urban corridors. This is explained by its regional and multi-source nature, the coexistence of electric and non-electric fleets, the influence of weather conditions, dust resuspension associated with mixed traffic, and the presence of emission sources unrelated to public transport. In this context, comparative analysis allows us to identify trends consistent with technological upgrades, but it does not always allow us to directly attribute the observed variations to the electrification of public transport.

From a methodological perspective, it is necessary to consider that, in open urban corridors with partial electrification, PM2.5 is not a suitable indicator for

causally evaluating the local impact of technological upgrades, due to the dominance of regional background noise and sources not controlled by the intervention. In these cases, the observed variations should be interpreted as expressions of the general urban context, rather than as direct effects of electromobility, which reinforces the need to complement this analysis with other variables that allow for a more precise evaluation of the impact of the observed changes on people who travel in urban corridors.

a) Results per axis:

On the Alameda corridor, measurements show an increase of 1.69 µg/m³ of PM2.5 between 2024 and 2025, equivalent to 20%. This behaviour is consistent with the complexity of the corridor, characterized by a high volume of private vehicle traffic, multiple emission sources, and variable ventilation conditions, which makes it difficult to attribute isolated changes to the technological upgrade of public transportation.

On Gran Avenida, where the fleet replacement, mainly of the 301 services, took place on October 18, 2025, an increase of 2.7 µg/m³ of PM2.5 was recorded between the period before and after the change.

In contrast, the Diego Portales corridor constitutes a demonstrative case in terms of causal attribution. On this corridor, a 100% technological upgrade of diesel buses to electric buses was completed, eliminating the main local source of primary emissions. In this context, concentrations decreased from 11.67 µg/m³ in the period prior to the incorporation of the new fleet to 8.02 µg/m³, representing an absolute reduction of 3.65 µg/m³ and a relative decrease of 31.2%.

Table 15: Results of the air quality monitoring campaign along the Alameda, Gran Avenida and Diego Portales axes, before and after the replacement of diesel buses with electric ones, (PM Average (µg/m³))

Monitoring site	Indicator	Pollutant	Previous value	After Value	Difference	Variation %
Axis Alameda	MP Average (µg/m ³)	MP ₁₀	16,22	46,89	30,67	189,09%
		MP _{2,5}	8,24	9,93	1,69	20,51%
Axis Diego Portales	MP Average (µg/m ³)	MP ₁₀	29,43	20,29	-9,14	-31,06%
		MP _{2,5}	11,67	8,02	-3,65	-31,28%
Axis Gran Avenida	MP Average (µg/m ³)	MP ₁₀	23,18	29,64	6,46	27,87%
		MP _{2,5}	9,02	11,75	2,73	30,27%

Source: Measurements from the Centre for Sustainable Mobility, 2025

These results allow us to establish that the causal attribution of PM2.5 reductions to technological replacement is methodologically valid mainly under certain conditions, among which the following stand out:

- Full or near-full electrification of the fleet
- Effective elimination of local diesel sources
- Confined or semi-confined environments
- Clearly defined ex-ante/ex-post periods, and
- Sufficiently extensive measurement series.

Under these conditions, the elimination of the dominant emission source allows for the observation of clear and attributable reductions in fine particulate matter associated with the electrification of public transport.

Overall, measurements at the corridor level show that, while air quality in urban corridors is influenced by multiple factors, the electrification of public transport

generates verifiable improvements in contexts where the technological shift is profound and well-defined (such as on the Diego Portales corridor). In other cases, the observed variations should not be interpreted as an adverse effect of electromobility, but rather as an expression of the regional urban background pollution and sources not controlled by the intervention.

This analysis reinforces the need to interpret PM2.5 as a complementary and contextual indicator, suitable for long-term structural assessments, and to prioritize its use in environments where minimum validity conditions for causal attribution are met.



→ 6. Electric bus depots: environmental nodes for urban well-being

Electric bus depots have become established as spaces where sustainability is expressed in multiple dimensions. Beyond their operational function, these sites contribute to noise reduction, improved air quality, and the well-being of the communities that live near them daily.

To understand these effects, the DTPM conducted a series of studies in 2025 at five electric bus depots: Diego Portales, BCE1, BGC-E, Catemito, and Ducaud, evaluating three dimensions in an integrated manner:

- Noise levels,
- Air quality,
- perception of neighboring communities and workers.

The measurements were taken between October and December 2025, depending on the depot, and following a common methodological design.

This comprehensive approach allows for an analysis of how the electrification of public transport transforms the environmental and social conditions around the depots, and whether these changes are consistent with the increase in the electric fleet at each facility.

b) Diego Portales Depot: a demonstrative case of the comprehensive impact of electrification

The transformation of the Diego Portales depot, located in the La Florida district, is the most comprehensive example for evaluating the impact of electrification in an urban environment. On October 18, 2025, the depot transitioned from operating entirely with diesel buses to 100% electric operation, following the addition of 95 buses and a change of operator (from Vule to Voy Santiago US15), becoming the first bus depot in the district to be electrified. This milestone allowed for real-world measurement of how noise, air quality (PM2.5), and the perception of the surrounding community change when a depot completely eliminates local emissions associated with combustion.

The results show consistent improvements in all three dimensions.:

Noise Levels. Measurements taken before and after the replacement show a substantial decrease in noise, both inside and outside the depot. Inside, levels were reduced by 3.98 dB(A) during the day and 0.47 dB(A) at night, equivalent to a 60% and 10% reduction in acoustic energy, respectively.

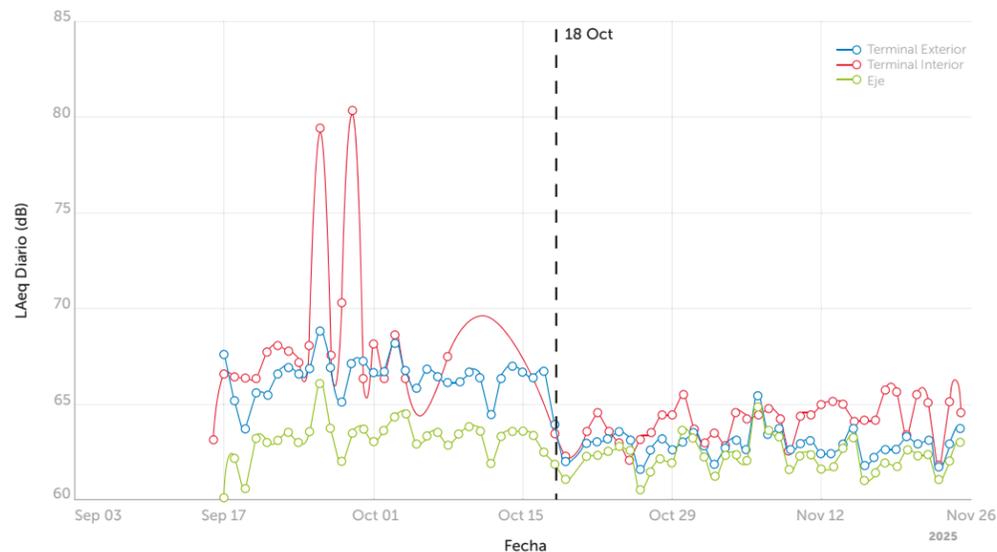
In the surrounding area, the noise levels confirm the trend observed inside. During the day, levels decreased by 2.62 dB(A), a change noticeable to residents living near the depot. At night, the change is more pronounced, registering a decrease of 3.3 dB(A), equivalent to 53% less energy. Overall, the depot shows a structural improvement in its acoustic footprint, consistent with the replacement of the diesel fleet with electric vehicles.

Table 16: Results of noise monitoring campaign at Diego Portales bus depot, before and after the replacement of diesel buses with electric ones, (LAeq (dB))

Monitoring site	Condition	Previous value	After value	Variation (LAeq dB)	Acoustic energy
Depot Diego Portales Punto 1 (Exterior)	Total	63,26	60,41	-2,85	48%
	Día	65,15	62,53	-2,62	45%
	Noche	59,48	56,18	-3,3	53%
Depot Diego Portales Punto 2 (Interior)	Total	62,91	60,08	-2,83	48%
	Día	64,68	60,7	-3,98	60%
	Noche	59,32	58,85	-0,47	10%

Fuente: Mediciones del Centro de Movilidad Sostenible (2025)

Figure 16: LAeq variation (dB) at DP depot – Ex ante / Ex post



Source: Measurements from the Centre for Sustainable Mobility (2025)

Air Quality (PM2.5). Concentrations of fine particulate matter (PM2.5) in the area surrounding the bus depot decreased significantly after electrification: from 12.13 $\mu\text{g}/\text{m}^3$ in the period prior to electrification to 7.80 $\mu\text{g}/\text{m}^3$, equivalent to an absolute reduction of 4.33 $\mu\text{g}/\text{m}^3$ from the daily average and a relative decrease of 35.7%.

Inside the depot, the behaviour is consistent with the outdoor analysis. Concentrations fell from 14.45 $\mu\text{g}/\text{m}^3$ to 8.06 $\mu\text{g}/\text{m}^3$, also representing a reduction of 6.39 $\mu\text{g}/\text{m}^3$ from the daily average and a relative decrease of 44%

compared to the previous diesel operation. These results indicate a substantial improvement in air quality both inside and outside the depot, consistent with the complete replacement of diesel buses with an electric fleet.

Table 17: Results of the air quality monitoring campaign at the Diego Portales bus depot, before and after the replacement of diesel buses with electric ones, (PM Average ($\mu\text{g}/\text{m}^3$))

Monitoring site	Condition	Previous value	After value	Variation (LAeq dB)	Acoustic energy
Depot Diego Portales Punto 1 (Exterior)	Total	63,26	60,41	-2,85	48%
	Día	65,15	62,53	-2,62	45%
	Noche	59,48	56,18	-3,3	53%
Depot Diego Portales Punto 2 (Interior)	Total	62,91	60,08	-2,83	48%
	Día	64,68	60,7	-3,98	60%
	Noche	59,32	58,85	-0,47	10%

Source: Measurements from the Centre for Sustainable Mobility (2025)

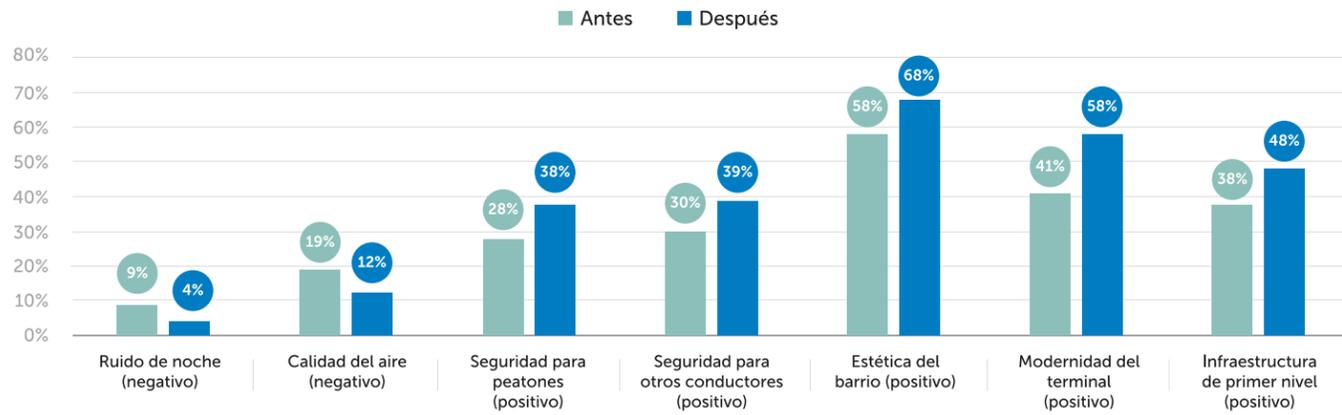
Perspective of the neighbouring community. A survey of 500 residents before and after electrification shows that the community consistently perceives the environmental and urban benefits of the technological upgrade. A significant decrease in negative opinions regarding the bus depot was observed, falling from 7% to 2%, along with lower levels of perceived pollution (from 19% to 12%) and a reduction in annoyance associated with nighttime noise (from 9% to 4%).

At the same time, familiarity with electric buses increased, and recognition of their contribution to the neighbourhood grew. Residents highlighted improvements in the aesthetics, modernity, and infrastructure of the e-bus depot, as well as a greater appreciation of the urban environment: the proportion of residents who perceive a positive contribution to the neighbourhood's development increased from 82% to 87%, while the perceived contribution to property values rose from 74% to 82%.

Neighbourhood safety is another area where electrification has generated favourable effects. Following the upgrade, the positive perception of safety for drivers increased from 30% to 39%, pedestrian safety rose from 28% to 38%, and neighbourhood security improved from 20% to 26%. These changes reflect a more peaceful daily experience, with less incidental noise and a more orderly environment in the public space.

In environmental terms, residents identified less noise during the day and night, better air quality, and greater order in their surroundings, fully consistent with the objective measurements of noise and particulate matter obtained along the corridor. Overall, the results show that the electrification of the bus depot not only improves environmental conditions but also strengthens the integration of the facility with its community, consolidating its role as a more welcoming, safe, and valued urban hub.

Figure 17: Perception of the neighbouring community – Diego Portales depot (before vs after)



Fuente: Elaboración propia con datos DTPM (2025).

c) Employee perceptions: evidence from EC1 and BGC-E

The analysis of the social dimension also includes those who operate and maintain the system daily. In October 2025, the DTPM surveyed 200 workers at the BCE1 (diesel) and BGC-E (electric) depots, both operated by Vule in the Maipú district, to understand how electrification is transforming their working conditions, perceptions, and expectations regarding their future work. The BGC-E depot was one of the first in the system to be electrified, in 2019.

The results show that the technological transition is already part of the staff's daily experience. Nine out of ten workers report having had some degree of contact with or operation of electric buses, reflecting a growing and increasingly normalized technical culture in daily operations.

Regarding **working conditions**, the overall perception is favourable: 75% consider their bus depot a comfortable place to work, and although 25% report high levels of exhaustion or stress, the majority indicate that these feelings have not increased with the arrival of the electric buses. The stability of these indicators suggests that electrification has not generated additional workload, even at bus depots with established electric operation like BGC-E.

The impact attributed to electromobility is overwhelmingly positive. Eighty-nine percent value the change from diesel to electric operation, highlighting improvements in ride smoothness, reduced vibrations, lower perceived noise, and cleaner, more comfortable operation. In environmental terms, between 20% and 30% of workers report feeling exposed to noise, vibrations, or

emissions; however, when comparing different periods, most acknowledge a decrease in these nuisances since the introduction of electric buses, especially regarding noise and odours associated with diesel.

Regarding **capacity building**, while 78% report having received training to operate in an electric environment, 31% consider the training still insufficient, identifying needs for more in-depth mechanical training and access to specialized instructors. These results highlight the importance of strengthening continuing education programs, essential for a system moving towards increasingly electrified and technologically demanding operations.

Regarding **well-being**, 64% reported some physical discomfort in the last month, mainly headaches or sore throats, although there were no significant differences between depots nor a direct association with electromobility. This suggests that these discomforts are more likely due to factors inherent in the general operation of the depots.

Finally, future expectations are one of the most illustrative indicators of the transformation process: 91% of workers believe their work will improve thanks to electromobility. This level of optimism reveals a sense of opportunity and perceived modernization, positioning the technological transition not only as an environmental advancement but also as a concrete improvement in working conditions and the experience of those who sustain the system's daily operation.

d) Diesel vs electric bus depots: comparison between similar scale operations

The Catemito (diesel) and Ducaud (electric) bus depots, located in the San Bernardo district, are facilities of comparable size and operation, each with approximately 100 buses and a surface area of 20,000 square meters. The analysis aimed to compare the environmental impacts and perceptions of workers and the neighbouring community between facilities with different technological compositions. This was achieved through continuous instrumental measurements taken between November 21 and December 20, 2025, both inside and outside the facilities, as well as structured surveys of workers and residents. At the time of publication of this report, the final emission concentration data were not yet available.

Noise Results: At the Catemito depot, which operates 100% diesel, measurements show average equivalent sound pressure levels (Leq) of 61.6 dB(A) inside and 60.4 dB(A) outside, with values below the occupancy standard limit of 85 dB(A) defined by Supreme Decree No. 594/1999 for an 8-hour workday.

At the Ducaud depot, following its complete transition to electromobility on November 22, 2025, significant reductions in noise levels are observed, with average values of 54.3 dB(A) inside and 54.6 dB(A) outside, representing differences of -7.3 dB(A) and -5.8 dB(A) respectively compared to Catemito. In terms of acoustic energy, these differences equate to an approximate reduction of 81% inside (5.4 times lower) and 74% outside (3.8 times lower), resulting in a noticeably quieter environment.

Table 18: Environmental comparison of Catemito (Diesel) and Ducaud (Electric) bus depots, 2025

Indicator	Catemito (Diesel)	Ducaud (Electric)	Difference regarding Ducaud
Noise. Average Indoor Leq	61,6 dB(A)	54,3 dB(A)	-7,3 dB(A)
Noise. Average Outdoor Leq	60,4 dB(A)	54,6 dB(A)	-5,8 dB(A)
Community Perception			
Neighborhood Acoustic Environment Assessment: "very little noise or none" + "normal noise"	56%	62%	+6%
Neighborhood Acoustic Environment Assessment: "very noisy"	23%	7%	-16%
Perception of smoke/gas/combustion odors: "never"	68%	87%	+19%

Fuente: Proyecto CLETS – Evaluación de Impacto de Terminales Diesel y Eléctrico.

Community and Staff Perception. The community perception assessment, based on surveys of households adjacent to the Catemito (diesel) and Ducaud (electric) bus depots, shows clear differences favouring the electric operation. In Ducaud, a higher proportion of households rate the neighbourhood's acoustic environment as having "little or no noise" or "normal noise" (62%), and the fraction perceiving "a lot of noise" is significantly reduced (7%), compare to Catemito (56% and 23%, respectively). This 16-percentage-point difference in the least bothersome category compared to the diesel depot constitutes a robust social finding, aligned with the lower instrumentally measured noise emissions. In terms of perceived air quality, the results also favour the electric depot. 87% of households near Ducaud report never perceiving odours associated with smoke, gases, or combustion, compared to 68% in Catemito.

From the workers' perspective, the transition to electromobility is associated with improvements in working conditions and well-being. Drivers report lower levels of noise and vibration, as well as a more comfortable operating environment, while yard and maintenance personnel identify a decrease in tasks associated with combustion (oils, filters, waste) and the acquisition of new skills related to electrical and digital systems. These changes reinforce a perception of greater safety, cleanliness, and professionalism in the work environment. The comparison between Catemito and Ducaud confirms that a higher proportion of electric vehicles generates cumulative benefits in terms of both the environment and social perception. This analysis offers a useful framework for replicating the experience in other regions of the country that are advancing in the incorporation of electromobility, facilitating evidence-based investment and planning decisions.



➔ 7. Impacts on public health: cleaner air and well-being

The link between air quality and public health is central to evaluating the benefits of electromobility. The sustained reduction of local air pollutants, particularly fine particulate matter (PM2.5), is associated with a lower incidence of respiratory and cardiovascular diseases, with especially relevant effects on children, the elderly, and people with chronic illnesses.

In the RED Movilidad System, the progressive replacement

of diesel buses with electric buses has contributed to reducing direct and indirect PM2.5 emissions in the Metropolitan Region, complementing other pollution control and emissions reduction policies such as the early incorporation of buses meeting Euro VI emissions standards. This contribution is particularly significant in a region where chronic exposure to fine particulate matter has historically been one of the main environmental risk factors for health.

a) Health assessment of the impact of the reduction of PM_{2,5}

To estimate the health benefits associated with improved air quality, the Environmental Health Department of the Ministry of Health conducted a scenario analysis using the World Health Organization's (WHO) AirQ+ tool, developed by the European Centre for Environment and Health. This methodology allows for the estimation of health impacts, in this case all-cause mortality in the population over 30 years of age, based on variations in average annual PM2.5 concentrations and the exposed population.

The analysis considered three scenarios representative of the public transportation transition process in the Metropolitan Region: 2015, 2022, and 2025. For 2025, the average annual PM2.5 concentration estimated up to December 10 was used, maintaining the 2022 mortality incidence rate (*). Additionally, an assumption was incorporated attributing 3.7% of the total health impact of public transportation to PM2.5, according to sector estimates of the system's contribution to this pollutant.

Table 19: Estimated impact of PM2.5 reduction on mortality (Metropolitan Region)

Year	Incidence per 100,000 inhabitants.	Population RM	Average concentration MP2,5 (µg/m³)	Attributable cases All-cause mortality over 30 years
2015	550	7.314.176	7.472	7.472
2022	610	8.310.984	6.785	6.785
2025*	610*	8.470.000	6.601	6.601

Fuente: Ministerio de Salud, Departamento de Salud Ambiental (2025)

The results show a reduction of 687 deaths averted between 2015 and 2022, associated with the decrease in average PM2.5 concentrations. Of this total, an estimated 25 deaths averted are specifically attributable to the electrification of public transport. An additional 184 deaths averted between 2022 and 2025 are estimated, with 7 of these specifically attributable to the electrification of public transport. While these figures represent a fraction of the total health impact, they are significant given that this is a specific sectoral policy with direct effects on urban corridors with high population density and cumulative benefits over time.

b) Consistency with national scientific evidence

The results observed in the RED Movilidad System are consistent with recent scientific evidence on the evolution of air quality in Chile. A study published in the journal *Atmosphere*, based on the analysis of more than 180 million hourly records from the National Air Quality Information System (SINCA) for the period 1993–2024, confirms a sustained and statistically significant improvement in the main air pollutants at the national level, and particularly in the Metropolitan Region (Basoa et al., 2025).

The study shows reductions in PM_{2.5} concentrations in Chile, with decreases of approximately -2 to -5 µg/m³ per year at most monitoring stations, and a cumulative reduction of nearly 40% in Santiago compared to levels observed at the beginning of the 2000s. Similarly, NO_x concentrations show negative trends, with decreases of between -4.8 and -6.6 ppbv per year, a pollutant associated with emissions from the transportation sector.

The study identifies that the improvements in air quality are not due to a single measure, but rather to a package of sustained public policies, including: the modernization of public transportation towards electromobility, the progressive introduction of more stringent emission standards (Euro VI), the reduction of older diesel fleets, and the strengthening of Air Pollution Prevention and Decontamination Plans (PPDA).

The reduction in pollutants is most evident in densely populated metropolitan areas, implying a decrease in chronic exposure for the population, with expected health benefits in both the short and long term, particularly in respiratory and cardiovascular diseases. The study concludes that the progress achieved confirms the effectiveness of the implemented policies but also underscores the need to maintain and deepen structural measures, especially in the transportation sector, to consolidate the observed improvements and address persistent challenges such as tropospheric ozone.

In a complementary vein, a study currently underway by Felipe González and Hugo Silva, academics at King's College London and the Pontifical Catholic University of Chile, respectively, analyses the direct impact of diesel bus pollution on respiratory health and assesses whether the transition to electromobility functions as a public health policy. The researchers use an innovative approach that cross-references traffic data with hospital records, observing what happened when older buses were gradually replaced by electric ones within a 500-meter radius of healthcare facilities.

Preliminary results consistently reinforce the evidence presented in this report. Full electrification of the fleet operating near hospitals virtually eliminates emergency medical visits caused by transport emissions. The impact is particularly noticeable among children, preventing approximately 16 emergency room admissions for respiratory problems each month in children aged 5 to 14, and 4 admissions in children aged 1 to 4.

c) Health, well-being and integrated public policy

From a public health perspective, electromobility within the RED Movilidad System is not only an environmental mitigation measure but also a preventative intervention, reducing risk factors associated with respiratory and cardiovascular diseases. The decrease in noise, the improvement in air quality, and the modernization of the urban environment further enhance the well-being and quality of life of users and residents in the areas served by the system.

Thus, advances in electromobility are consolidated as part of an integrated public policy approach, where transportation, energy, the environment, and health converge to generate tangible benefits for the population and strengthen the role of public transportation as essential infrastructure for healthier and more sustainable urban development.

8. Circular economy and second life of batteries

a) Waste management and valorization

The advancement of electromobility has also spurred new opportunities in the circular economy. Waste management, component recovery, and the development of strategies for the reuse of batteries are fundamental pillars for reducing environmental impacts and fostering a more sustainable production chain within the RED Movilidad System.

During 2025, in collaboration with the Environmental Information Division and the Circular Economy Office of the Ministry of the Environment, the DTPM analysed waste management figures from 2023 and 2024 to evaluate the performance of concessionary companies and their progress in regulatory compliance. This work also included capacity building for the correct registration of waste in the Single Window System of the Pollutant

Release and Transfer Register (PRTR) and its connection to the Extended Producer Responsibility Law (EPR Law) in order to improve data traceability and highlight the environmental management practices implemented by concessionary companies. In this context, 18 professionals in charge of waste management participated in two sector training sessions on October 22 and November 7, 2025.

Image7: Waste management training for concessionaires of the RED Movilidad System, 2025



In 2024, the depots and workshops of the RED System managed 13,899.8 tons of waste, corresponding to 76 operational sources. This volume represents an 11.1% increase compared to 2023, when 12,515.7 tons were recorded. This increase is explained by better consistency in the recording of reported waste and by greater coverage in total kilometres travelled by the concessionary companies, in accordance with the requirements of sector regulations and the Extended Producer Responsibility (EPR) Law.

The composition of the waste shows that a significant portion comes from industrial waste, primarily hazardous waste associated with washing system effluents, oils and lubricants, lead-acid batteries, and parts contaminated with hydrocarbons, which accounted for 50.7% of the total in 2024. At the same time, non-hazardous industrial waste increased its relative share, reaching 49.3% of the total in 2024, with significant growth in waste related to the daily operation of depots, such as unsorted household waste and bulky waste.

Between 2023 and 2024, an increase in the generation of metals and bulky waste was observed, consistent with increased maintenance and fleet renewal activities, as well as a decrease in the disposal of end-of-life tires. An increase in lead-acid batteries and electronic waste was also recorded.

Regarding waste management, during 2024 the companies operating the RED Movilidad System managed all the waste generated, of which 78.8% was disposed of and 21.2% recovered.

The high proportion of waste disposed of reflects the operational nature of the system, as well as the presence of waste streams with limited technical recovery alternatives, particularly hazardous waste. This hazardous waste is treated through controlled processes, such as bioremediation and energy recovery, while waste without viable alternatives is disposed of in secure landfills, in compliance with current environmental regulations. However, opportunities have been identified to strengthen source separation, especially for household waste from bus cleaning at the end of their routes, which would increase its recovery potential.

Waste recovery focused primarily on non-hazardous waste, with energy recovery being the most prevalent (1,195.8 tons), followed by composting (670.0 tons) and recycling (1,083 tons). This prevented the final disposal of a significant portion of the waste generated at depots and workshops. A substantial part of this waste consisted of items prioritized under the Extended Producer Responsibility (EPR) Law, such as end-of-life tires.

Table 20: Type of Waste generated by the concessionary companies of the RED Movilidad System, 2023-2024

Waste Classification	Type of waste	2023		2024		Variation 2023-24
		Tons	%	Tons	%	
Non-Hazardous Industrial Waste	End-of-life tires	441,8	3,5	327,7	2,6	-26%
	Metals	195	1,6	485,2	3,9	149%
	Glass	44,6	0,4	9	0,1	-80%
	Unseparated household solid waste	3.844,7	30,7	4.546,7	36,3	18%
	Wastewater	1.346,8	10,8	1.199	9,6	-11%
	Bulky waste	68,6	0,5	278,4	2,2	306%
	Total Non-Hazardous Industrial Waste		5.941,4	47,5	6.846,0	49,3
Hazardous Industrial Waste	Oils and lubricants	822,4	6,6	828,6	6,6	1%
	Lead-acid batteries	522,1	4,2	622	5	19%
	Electronic waste	6,6	0,1	2,5	0,02	-62%
	Empty oil drums	1	0,05	2,4	0,02	145%
	Washing system wastewater	4.881,2	39	5.249,8	41,9	8%
	Parts and components contaminated with hydrocarbons	339,6	2,7	347,3	2,8	2%
	Other waste contaminated with hydrocarbons (sawdust, rags, textiles, containment materials)	1,5	0,01	1,2	0,01	-18%
	Total Hazardous Industrial Waste		6.574,3	52,5	7.053,8	50,7
Total RED System		12.515,7	100	13.899,8	100	11%

Fuente: Elaboración propia en base a información de Datos abiertos RETC

Figure 18 : Percentage and types of waste recovered, 2024.



Fuente: Elaboración propia en base a información de Datos abiertos RETC

As the incorporation of electric buses increases, a progressive reduction in the generation of waste associated with internal combustion, such as oils, lubricants, and parts contaminated with hydrocarbons, is projected. This will have positive effects on both the environmental impact of the depots and waste management costs. This structural change will strengthen the circularity indicators of the RED System and facilitate the integration of new reuse and repair cycles aligned

with the Extended Producer Responsibility (EPR) Law and the country's environmental standards.

Joint monitoring between the DTPM and the concessionaires will allow for the continuous evaluation of these advances and generate new opportunities to improve the operational sustainability of public transport in Santiago.

b) Opportunities for second-life electric batteries

During 2025, the DTPM launched two initiatives aimed at understanding and managing the complete lifecycle of batteries in the RED Movilidad System's electric buses. These initiatives address usage, degradation, maintenance, and reuse possibilities, integrating technical evidence with operational and energy planning decisions.

(1) Battery degradation study: empirical evidence for more efficient management

In 2025, and in collaboration with Project ZEBRA and the International Council on Clean Transportation (ICCT), The DTPM developed a pioneering study aimed at quantifying the actual degradation of electric bus batteries in Santiago, in order to anticipate replacement needs, estimating the State of Health (SOH) of the batteries through an empirical and non-invasive method, using exclusively telemetry information from the system between October and December 2024.

To this end, 4,487 charging events of 50 electric buses were analysed, processing data on energy charged, state of charge (SOC) variation, mileage, and operating conditions. The methodology compares the actual energy delivered during charging with the theoretical energy that a new battery would require to produce the same SOC variation, allowing the level of degradation to

be inferred without the need to disassemble equipment or conduct laboratory tests.

Preliminary results show that the analysed buses have a SOC above 82%. The newest buses (2 to 4 years of operation) have average SOC values above 93%, while older units from the same manufacturer with more mileage (4 to 6 years of operation) have average SOC values above 86%. Importantly, even buses over 6 years old and with more than 325,000 km maintain average SOC values above 90%, reinforcing the evidence regarding battery durability within the system's operational context.

Another finding is that among buses of the same model, a correlation is observed between battery degradation and mileage. This pattern suggests that, for planning purposes, mileage should be among the metrics used to project battery replacements.

The proposed method proved to be reliable and replicable, with an average confidence interval of ± 1.4 percentage points (95% CI). Its main strength is that it uses information that the system already routinely monitors (telemetry), enabling the implementation of a permanent fleet-wide battery health monitoring program. This monitoring mechanism will be fundamental for optimizing maintenance decisions, designing second-use strategies, and anticipating the demand for battery and vehicle replacements required by the system.



(2) Libr3 Project: business models for second life

In November 2025, the DTPM began its participation in Project LiBR3 (Lithium Battery Reuse, Recycling and Reduction), an initiative funded by the Production Development Corporation (CORFO) and led by CircularTEC, which seeks to develop technological solutions and business models for the advanced reuse of batteries in stationary energy storage systems.

The project, with a maximum duration of four years, aims to design a strategic plan that incorporates technological, regulatory, and economic elements to facilitate the reuse of batteries from electric buses and cars. Its objectives include the development of State of Health (SOH) assessment protocols for cells and modules, the standardized reconditioning of battery packs, and the evaluation of the technical, economic, and environmental feasibility of their integration into energy storage systems linked to renewable energy sources.

For the DTPM, this collaboration will result in a pilot project at an electric bus depot within the RED System, where a hybrid stationary energy storage solution will be implemented, composed of new and used batteries

removed from electric buses. This pilot project will allow for the evaluation of the battery's capacity to support operations during periods of power restrictions or high tariffs, enabling more efficient load management strategies for concessionaires and reducing costs associated with peak demand.

The LiBR3 project addresses a broader sectoral challenge: building a sustainable business model that allows for the management of the replacement, reconditioning, and marketing of second-life batteries in Chile. This includes defining stakeholders, responsibilities, financing schemes, and safety standards, aligning with the circular economy hierarchy and the principles of the Extended Producer Responsibility Law (REP Law).

The initiative is sponsored by the National Automotive Association of Chile (ANAC), the Chilean Association of Renewable Energies and Storage (ACERA), the Association of Non-Regulated Electricity Customers (ACENOR), Generadoras de Chile, ATLAS Development Chile, Enel X and Phibrand, which reinforces its potential for scalability and adoption within the energy and transport sector.



→ 9. Efficient use of water: responsible practices in bus depots

The efficient use of water has been positioned as a strategic dimension of the sustainability of the RED Movilidad System. During 2025, the DTPM strengthened the systematic collection of water data for the years 2024 and 2025, to characterize the available infrastructure in depots and workshops, quantify consumption, and promote management measures that reduce the use of the resource and enhance its reuse.

a) Washing and water supply infrastructure

The system boasts a diverse infrastructure for bus washing operations, including automated, semi-automated, and manual stations, as well as specialized cleaning areas. Considering both years of analysis, 58 washing stations were counted, with automatic and semi-automatic systems predominating, representing the largest proportion of the installed infrastructure (57%).

In terms of water supply, the depots primarily use the municipal water system as their main source, supplemented, in some cases, by reuse systems associated with the recirculation processes of the washing systems.

These recirculation systems, present in a growing number of depots, allow for the reuse of some of the water used in the washing cycles, resulting in a significant reduction in consumption per bus. At the depots that reported using these systems, operators report average savings of approximately 70%, depending on the technology implemented and the washing frequency.

b) Consumption pattern: What is water used for at bus depots

Bus washing constitutes the primary use of water resources at system depots, accounting for 47.5% of total consumption in both 2024 and 2025. This is followed by sanitary consumption associated with staff (32.3%), services associated with common areas such as dining rooms and kitchens (12%), and irrigation of green areas (7%). Other operational uses represent a marginal fraction of consumption (1.2%).

In aggregate terms, total system consumption amounts to 369,378 m³ annually in 2024 and 307,054 m³ in 2025, representing an approximate decrease of 17%, attributed to improvements in operational management and the progressive implementation of water efficiency measures.

c) Water management and efficiency measures

Analysis of measures reported by operators shows that the RED System already has several practices aimed at optimizing water use, which have been consolidated between 2024 and 2025. Among the main actions implemented are:

1. Optimization of the washing process. Integration of recirculation systems in automated equipment, adjustments to washing frequency, and calibration of nozzles and pressure to reduce flow rate while maintaining required cleaning standards.

2. Operational management and maintenance. Strengthening leak control, preventive maintenance on pumps and control panels, and increased use of sectorized meters that allow identification of anomalous consumption, facilitating resource management.

3. Infrastructure and efficiency solutions. Incorporation of low-consumption technologies in bathrooms and common areas and internal reuse of treated wastewater for irrigation.

4. Training and change management. Development of training programs for staff, standardization of operating procedures and updating of internal manuals, promoting a culture of responsible water use in depot activities.

d) Wastewater treatment and discharge

In terms of wastewater management, concessionaires report that 100% of their wastewater is discharged into the sanitary sewer system. Additionally, automated washing systems incorporate pretreatment processes, such as grease separators, settling systems, and filtration processes, which allow for controlled sludge discharge, in accordance with current regulations.

The RED Movilidad System has made steady progress toward more efficient and responsible water management. The introduction of electric buses and the modernization of infrastructure have driven concrete improvements, marking the transition from a heterogeneous model to a regulated, standardized, and technologically more robust system.

These advances reflect the operators' growing commitment to sustainability and consolidate a culture of responsible water use in line with the demands of modern public transportation.

B. Transforming the way we move

→ 1. Expansion of services with a participatory approach

Strengthening ties with communities has been central to consolidating a public transportation system that is more responsive to the territory and local realities. Since 2022, the Creating Networks program has systematically incorporated the voices of the people into the planning of the RED Movilidad System, generating spaces for technical-citizen dialogue that enrich the diagnosis and decision-making process.

Through local workshops, working groups and meetings, and on-site support, this program has identified specific needs, such as adjustments to bus stops, route modifications, enhanced service schedules, and relocation of control points, all of which directly impact the quality of travel and the urban experience of the system. This approach has allowed the community to understand the technical planning criteria and has enabled the DTPM (Metropolitan Public Transportation

Authority) to gather firsthand information on the local impacts and implications of the implemented measures.

During 2025, this participatory work was integrated into a network-scale operational optimization process, the objective of which was to redistribute the fleet to ensure more efficient bus use, increase service capacity on high-demand routes, and expand territorial coverage to underserved areas. This optimization allowed for the creation and strengthening of key peak-hour services, such as the new 225c, C30e, C26c, and 421c routes, improving connectivity in the southeastern, eastern, and northern parts of the city. New direct connections were also established between neighbourhoods and service hubs, such as Población Huamachuco–Hospital Félix Bulnes and El Mirador–Metro Cerrillos.

The process also allowed for expanded coverage to new urban areas through extensions or the creation of services in zones such as Av. Pdte. Pedro Alessandri (San Bernardo), Praderas de Lo Aguirre (Pudahuel), La Platina (La Pintana), General Gambino (Conchalí), Villa Portales (Estación Central), and Población Lo Sierra (Lo Espejo).

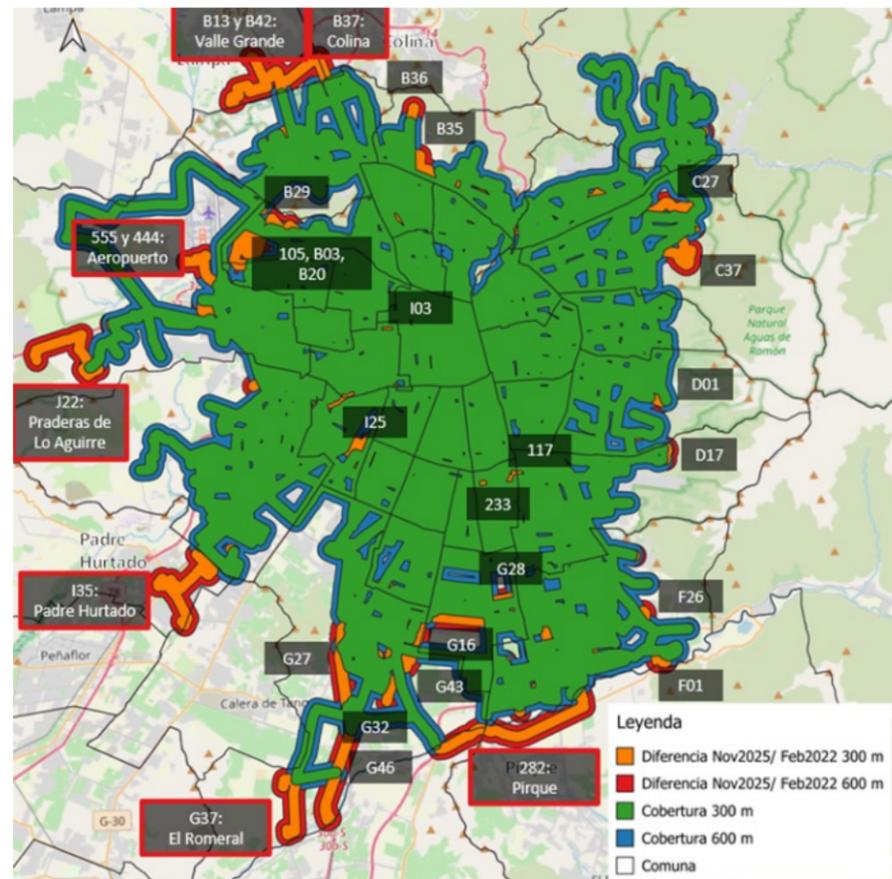
Also noteworthy is the addition, for the first time, of regular services to the suburban areas of Pirque, connecting to the Puente Alto Metro Plaza and the Nos Train Station, and to Colina, through the link between the Los Libertadores industrial park and the intermodal station of the same name. In addition, accessibility in Puente Alto was improved with the new F28 (Bajos de Mena) and 234 (Ejército Libertador) bus services.

Taken together, these changes, along with those implemented over the past three years, have increased the number of people with access to the RED Movilidad network within a 5-minute walk (300 meters) by more than 150,000, reaching 94% of households in the 34 municipalities of Greater Santiago. This progress confirms

the value of the participatory approach in guiding planning toward more territorially relevant solutions, while simultaneously consolidating a more integrated, efficient, and equitable network.

“El sistema de transporte público urbano alcanza un 77% de transacciones en modos de propulsión eléctrica a diciembre 2025”

Image 8: Coverage and service expansion map of the RED System



Fuente: Elaboración propia con datos DTPM (2025).

→ 2. Mobility culture: campaigns, education and citizen participation

Throughout 2025, DTPM implemented a series of actions aimed at informing the public about operational changes and improvements to the system and promoting its proper use. These initiatives included on-site monitors, distribution of printed materials, installation of signage in shelters, transfer stations, and buses, advertising in the press, and campaigns in digital media and on public roads.

Together, these measures have contributed to consolidating a more attractive and understandable public transportation system for users, enhancing its social value and supporting the transition to more sustainable mobility patterns.

Table 21: DTPM Information Campaigns (2025)

Campaign
"Let's Be Kinder" Campaign to Reduce Tolls and Promote Good Practices
National Car-Free Day
Promoting Public Transportation Use
Changes to the Operational Plan
Special Operational Plans (SOPs) and Detours
Campaigns with Monitors on Payment Methods and the Red App
Educational Team in Schools

Source: Prepared by DTPM (2025)

a) National Car-Free Day: citizen activation for sustainable mobility

The “National Car-Free Day,” established in Chile in 2018, aims to raise awareness of the negative socio-environmental effects of the irrational use of automobiles and promote sustainable mobility. Since 2022, the DTPM has played a leading role in this commemoration, recognizing it as a strategic opportunity to promote the use of public transport and its social value, along with walking and cycling as sustainable and efficient alternatives for getting around the city.

In this context, and through collaborative work with civil society organizations, universities, public institutions, entrepreneurs, and private companies, the visibility of this day has been strengthened over the last four years through community-wide activities and a metropolitan-wide communications campaign.

As the main event, the Mobility Walk was held for the fourth consecutive year in 2025, transforming Agustinas Street into a large temporary pedestrian space, open to meeting people, culture, and experiencing the city in a different way. The event featured 54 booths from public and private

institutions, social organizations, and universities, offering information, talks, classes, and educational activities on sustainable mobility. The program included a showcase of technological advancements in electromobility related to public transportation, as well as spaces for talks and cultural activities.

Likewise, for the second consecutive year, the Plaza de la Constitución was transformed into a large educational and recreational space for more than 300 children from various schools, who enjoyed plays, interactive exhibits, and games designed to promote learning about sustainable mobility. The commemoration also included cultural activities, outreach in public spaces, media campaigns, and the participation of sectoral and municipal authorities, consolidating National Car-Free Day as a relevant instance of raising public awareness about sustainable mobility.

Image 9: Images commemorating World Car-Free Day, 2025



b) Carbon footprint information in the RED Movilidad APP

In 2025, the DTPM (Metropolitan Public Transport Authority) incorporated a new feature into the RED Movilidad app that allows users to see the carbon footprint avoided by traveling by public transport instead of a private car when planning their route. This tool strengthens the system’s environmental transparency and makes climate information more accessible to the public in a simple and useful way.

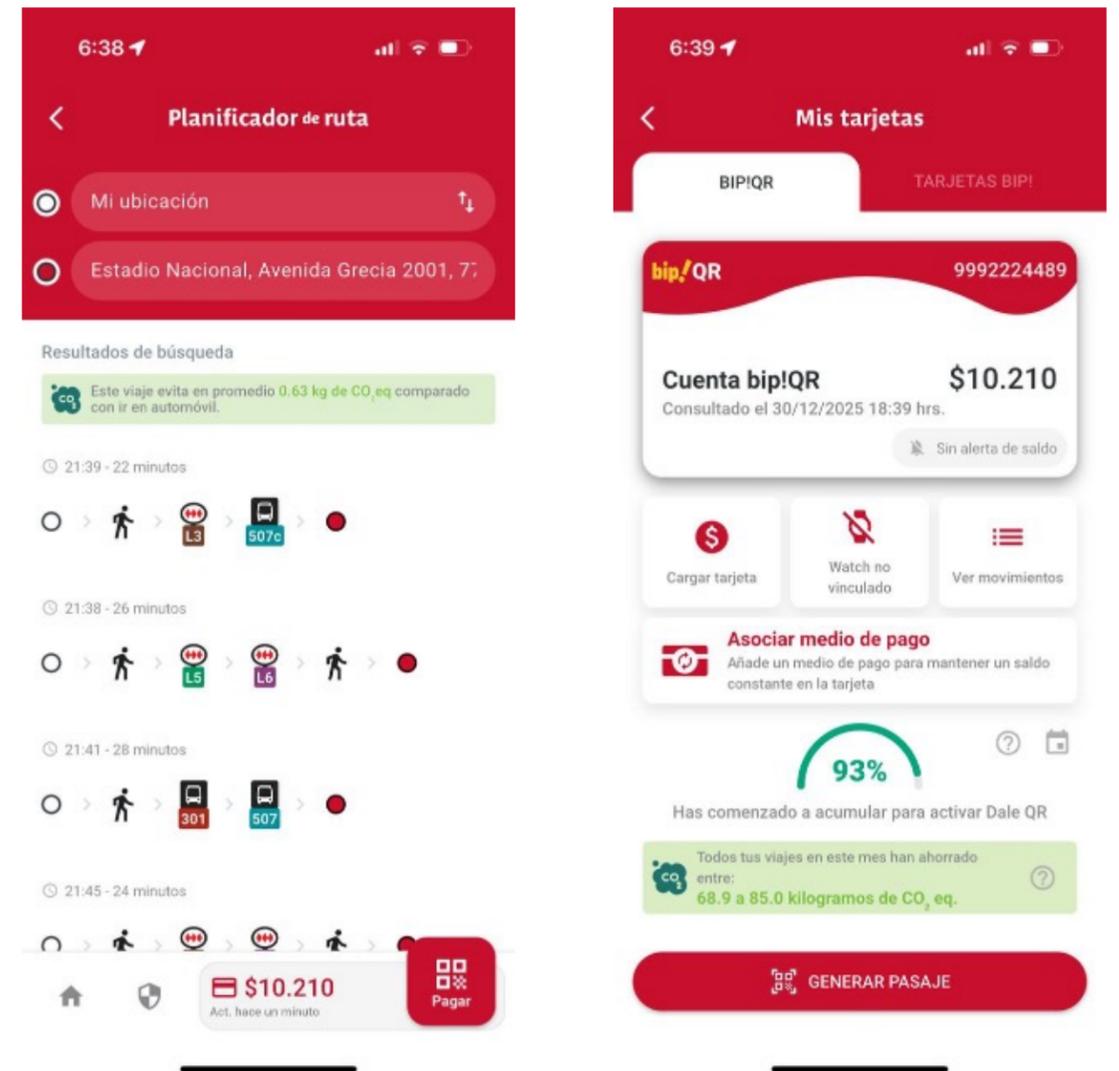
The app automatically calculates the emissions avoided for each planned trip, using official emission factors (Chile Footprint 2024 and DEFRA 2023), the estimated distance of the journey, and system occupancy rates. When a route is selected, the app shows the user the number

of kilograms of CO₂eq they would avoid emitting if the same trip were made by private car.

In addition, a monthly history was implemented where users can view the total emissions avoided on all their trips during the month, through a summary indicator that is dynamically updated with their card usage data. Both features include an information button that explains the methodology used, reinforcing the traceability and consistency of the calculations.

This innovation complements the DTPM’s efforts to communicate the real benefits of electromobility and public transport, promoting more informed travel decisions aligned with the city’s climate action.

Image 10: Carbon footprint information in the RED Movilidad APP

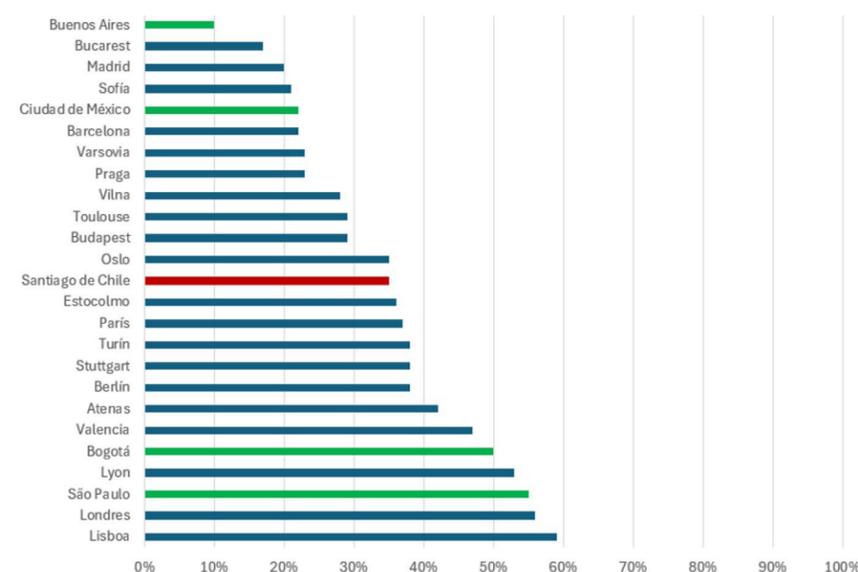


→ 3. Subsidies and tariffs for an accessible system

Public transportation is a fundamental pillar for social and territorial integration, providing mobility within the city so that its citizens can effectively exercise all their rights. From this perspective, the transportation subsidy is a strategic social investment that finances the system, becoming an independent source of income separate from fares paid by users. This generates progressive incentives that prevent income level from becoming a barrier to accessing fundamental rights such as employment, health, or education. In Chile, this vision was consolidated with the enactment of Law No. 20,378 in 2009, which established a permanent subsidy that now represents approximately 65% of the system's revenue, with the remaining 35% collected through fares. This funding has been the structural basis for the transformation of mobility in Santiago, allowing for the maintenance of daily operations and progress in modernization processes, such as fleet renewal and the significant integration of electromobility.

Like Santiago, social investment in public transportation is a tool used in most cities worldwide with systems comparable to Chile's. The debate surrounding public transportation subsidies is technically and politically settled globally, as evidenced by the following graph, which shows that fare revenues in the studied cities require state funding for their systems. In Latin America, in particular, all cities with regulated public transportation have a funding structure based on state contributions, promoting its use as a primary mode of transportation.

Figure 19: Proportion of fare revenue in different public transport systems around the world



Fuente: EMTA Barometer (2024). Funding and financing of public transport in Latin America and the Caribbean (IADB, 2025)

This subsidy-based financing structure enables the management of the system under criteria of redistribution and spatial equity, in which the State corrects inequalities in access to mobility through differentiated fare schemes. For example, students receive a reduced, flat fare of \$250 through the TNE (National Student Card), while senior citizens benefit from discounts through the Bip! Adulto Mayor (Senior Citizen Card) or the TAM (Major Citizen Card). For the adult segment, the Dale QR! (Dale QR!) monthly maximum allows those who pay with a QR code to travel for free once they reach CLP \$41,000, thus limiting monthly public transportation expenses. These fare policies guarantee access to dignified transportation for those without private alternatives, facilitating their

effective integration into the opportunities offered by the city.

Beyond the individual impact, the subsidy is a key tool for advancing environmental sustainability and reducing social costs. By making public transportation economically attractive, the shift from private means of transport, primarily cars, is encouraged, with direct effects on reducing major negative externalities such as congestion, road accidents, and carbon dioxide emissions. Thanks to this public investment, Santiago has positioned itself as an international leader in electromobility, boasting the largest fleet of electric buses outside of China. This progress, along with the sustained expansion of the

Metro and EFE train networks, has allowed for a high-quality system that improves the urban experience even for those who are not regular users.

Fare integration is perhaps the most concrete expression of the operational efficiency made possible by the subsidy. The current model in Santiago allows for up to two transfers within a 120-minute period, optimizing household transportation expenses and promoting smoother and more efficient intermodal mobility. In this regard, the subsidy established by Law No. 20,378 not only finances bus operations but also the entire integrated system, including the operation of the Metro, the Tren Nos commuter rail line, complementary services such as technology, financial management, and the fare collection network, as well as the necessary infrastructure. Therefore, the subsidy not only acts as a financial instrument but also enables the system's territorial expansion, incorporating high-standard services in historically underserved areas. Thus, the system grows not only in infrastructure and coverage but also in social legitimacy by addressing long-standing connectivity demands from the public.

Finally, as described in previous sections, the subsidy has been a fundamental tool for attracting investment and participation in the system. Its long-term validity, supported by a legal framework, provides financial certainty regarding economic sustainability and resilience, mitigating risks for financial institutions through state backing of public policy. Thus, the incorporation of electromobility and the entire supporting structure has attracted a total investment of more than USD \$2.2 billion in buses and USD \$154 million in charging infrastructure, making Santiago an attractive hub for investment in clean and renewable energy.

→ 4. Gender and mobility: the impetus of the Women Drivers Program

The Women Drivers Program is a public-private initiative coordinated by the Metropolitan Public Transportation Authority (DTPM), local governments, and companies. It aims to help close gender gaps related to low levels of formal employment and the feminization of poverty by including women in public transportation driving positions.

Since its implementation, the Women Drivers Program has shown sustained growth in the training and development of women. In 2022, the year the Program began, 67 women benefited from 4 courses, marking the start of this initiative, which has grown over the years. The following year, in 2023, the number increased slightly to 75 beneficiaries, maintaining the same number of courses.

The real momentum was seen in 2024, when the training offerings doubled to 8 courses, reaching 181 women, reflecting a growing commitment to women's inclusion in the workforce. Finally, in 2025, the program consolidated its expansion with 11 courses and 252 beneficiaries, achieving its greatest impact since its inception.

In total, between 2022 and 2025, the program has benefited 575 women through 27 courses in various districts of the capital, demonstrating significant progress. However, the challenge remains to sustain this pace and ensure that more women have access to job opportunities in public transportation.

Table 22: Total number of beneficiaries of the Women Drivers Program

Year	Total number of beneficiaries	Courses per year
2022	67	4
2023	75	4
2024	181	8
2025	252	11
Total	575	27

Source: : Prepared by DTPM (2025)

→ 5. Exploring new energy sources: Green hydrogen in public transport

The development of green hydrogen as a clean energy source has acquired a strategic role in Chile, driven by the National Green Hydrogen Strategy (2020) and by the country's goal of moving towards carbon neutrality by 2050. Its development is articulated through an institutional architecture that connects this long-term vision with concrete actions defined in the Green Hydrogen Action Plan 2023–2030, aimed at accelerating

its adoption in key sectors, including transportation. In this context, the RED Movilidad System has positioned itself as an urban laboratory for the introduction and validation of zero-emission technologies, expanding the scope of electromobility beyond battery-electric buses, in line with the National Electromobility Strategy and its goal of moving towards zero-emission public transportation operations.

Under this roadmap, Measure 54 of the Action Plan takes on relevance, aimed at bringing this technology closer to the public through the piloting of fuel cell buses (FCEB) in public transportation. In compliance with this mandate, the DTPM has promoted studies, institutional alliances, and technical preparation processes that now allow progress towards the implementation of the first hydrogen bus pilot program in Santiago starting in 2026.

a) Technical-economic evaluation study for hydrogen buses: operating conditions in Santiago³⁷

During 2022, a technical-economic analysis was conducted to evaluate the feasibility of introducing hydrogen buses on 20 routes of the RED Movilidad System, with support from the Climate and Clean Air in Latin American Cities Program (CALAC+), funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by the Swiss Foundation for Technical Cooperation (Swisscontact).

The study characterized buses available on the market, with costs between USD 600,000 and 800,000, and confirmed that at least four models easily meet the technical and energy requirements for operating in Santiago. Through energy simulations, the actual hydrogen consumption per route was estimated, with values ranging from 1.3 kg/trip (service G04) to 8 kg/trip (service 712). The average efficiency ranges from 7.7 to 10.7 kg H₂/100 km, depending on the speed profile and topography.

Daily fleet simulations reveal hydrogen demands ranging from 245 kg H₂/day (G04) to 1,390 kg H₂/day (301). This analysis allows for determining the size of the refuelling infrastructure needed for a pilot project and its potential scalability. In environmental terms, the study confirms that FCEB buses do not generate local emissions, but notes that the carbon footprint depends on the hydrogen source: only green hydrogen reduces emissions compared to a diesel bus. For this reason, any pilot project is recommended to operate with hydrogen produced using renewable energy (green PPA or equivalent source).

To prioritize a pilot route, a multivariable model was developed that integrates emissions, demand, operational complexity, and scalability potential to select the best alternative based on its high environmental impact, high passenger demand, and technical feasibility. This study provides an initial roadmap for moving from simulation to detailed engineering of the pilot project.

b) Operational safety study for hydrogen buses: requirements, risks and control measures

In 2023, the DTPM, with support from CALAC+, commissioned an operational safety study to identify the technical, regulatory, and safety conditions necessary for operating hydrogen buses in the RED System.

The analysis reviewed national and international regulations, including standards from the United States, the European Union, and Germany. Key standards applicable to the safe operation of hydrogen were prioritized, such as NFPA 2, ISO 15916, ISO 19880-1, ISO 14687:2019, ASME B31.12, and ISO 26142, all relevant to the generation, storage, transport, refuelling, and maintenance of FCEB buses.

The study developed a risk matrix for each stage of the process, reinforcing the crucial role manufacturers play in system safety. The report recommended acquiring vehicles with a proven track record, having at least three years of continuous international operation, and requiring robust protocols for refuelling, leak detection, ventilation, cylinder handling, and emergency management.

The report also provides cross-cutting recommendations, such as developing safe operating protocols, procedures for specialized maintenance, and a training plan for drivers, mechanics, and emergency teams. These measures will allow the pilot program to operate with safety standards equivalent to those used in more advanced markets.

c) Collaboration agreements: public-private partnership to make the pilot project viable

To ensure that the pilot program has realistic operational conditions, especially regarding the secure supply of green hydrogen, the MTT, through the DTPM, has established strategic agreements that consolidate the necessary technical and logistical coordination.

(1) Collaboration agreement between the Ministries of Energy, Environment and 26 actors

In 2022, a Collaboration Agreement was signed between the Ministries of Transport and Telecommunications, Energy, and Environment, along with 26 stakeholders from the private sector and academia. Its objective is to work together on developing actions aimed at implementing one or more pilot programs to evaluate the performance of hydrogen-powered electric buses within the RED System.

This agreement enabled the Ministry of Energy, the German Cooperation Agency (GIZ), and the DTPM to collaborate to accelerate the design of the hydrogen bus pilot program. This collaboration has facilitated technical studies, risk analyses, and energy demand estimates for alternative services.

(2) Agreement for the supply of green hydrogen – Ecosystem H2 Chile

At the end of 2025, a second agreement, led by H2 Chile and a consortium of companies including Marval, Clean Logistics, Copec, IEE Mining, and Walmart Chile, agreed to supply green hydrogen for pilot buses in the RED Movilidad System. This alliance will ensure a secure supply system with quality standards and operational continuity for the actual operation of FCEB buses.

Thanks to this agreement, it is guaranteed that the pilot program will operate exclusively on green hydrogen, an essential condition for the project to contribute to the reduction of global emissions and remain consistent with the country's climate goals.

d) Towards the implementation of the first hydrogen bus pilot project in the RED Movilidad System

The work carried out in recent years in the areas of technical studies, safety assessments, and inter-institutional collaboration agreements has allowed the DTPM to move from the analysis phase to the concrete implementation of the first hydrogen bus pilot program in urban public transport.

The pilot program involves the acquisition and operation of two hydrogen fuel cell buses (FCEBs), currently in the procurement process, with equivalent technological characteristics but different production origins: one will be manufactured in Chile, while the second will be acquired from an international supplier. Both vehicles will operate on a route to be defined within a group previously prioritized based on its operational characteristics.

Their commissioning will allow for the generation of evidence under real operating conditions in Santiago, evaluating energy performance, range under different load regimes, logistical and infrastructure requirements, refuelling procedures, associated operational costs, as well as acceptance by drivers and users.

The pilot project is currently underway and is being led by the Energy Sustainability Agency (AgenciaSE), in its role as the project's implementing agency, responsible for the technical and operational coordination among the various stakeholders. This collaborative effort, funded by the Ministry of Energy, the DTPM (Department of Transport and Public Mobility), international cooperation (GIZ and the European Union), RBU, REBORN Electric (a Chilean company that will manufacture one of the buses), and the companies in the green hydrogen supplier consortium, consolidates a collaborative governance framework that has been key to making the pilot project viable.

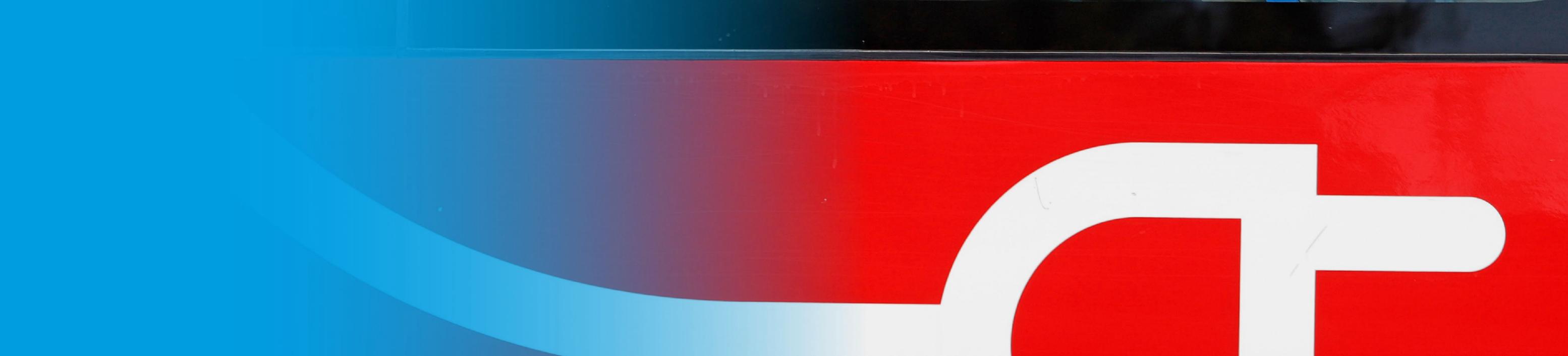
This milestone represents a decisive step in the incorporation of emerging zero-emission technologies, complementing the electrification strategy based on battery-electric buses; positioning the RED Movilidad System as a national and regional leader in the early exploration of green hydrogen applied to public transport, and reinforcing its role as a learning platform for the country's energy transition.



LEGITIMACY



LESSONS LEARNED AND FUTURE PROSPECTS



IV. Legitimacy, lessons learned and future prospects

A. People voices: user perception and satisfaction

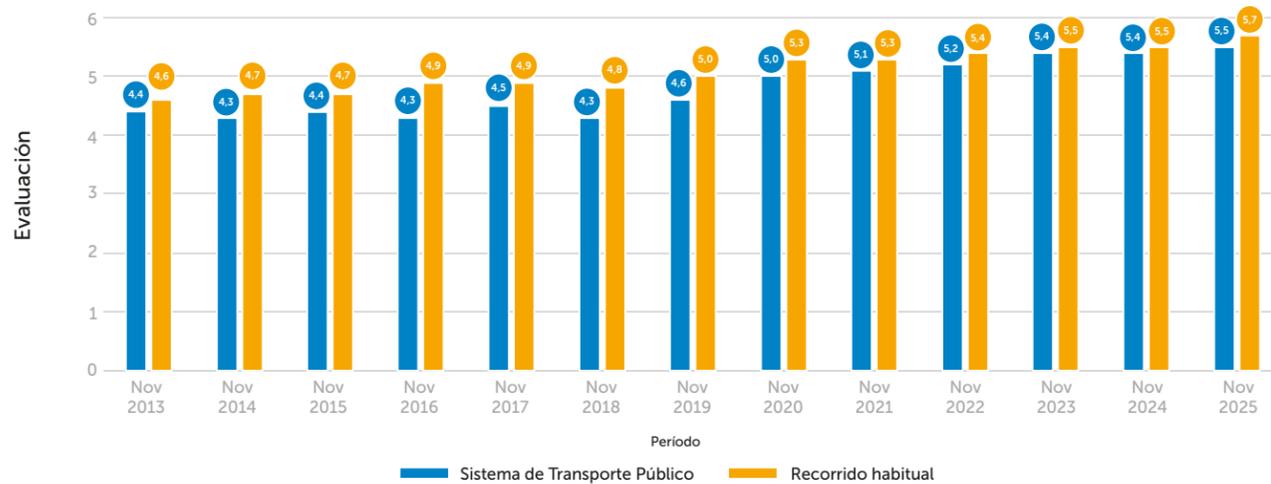
Beyond the direct experience of travel, the perception of public transportation is also shaped by its value as a relevant social actor and as a service that contributes to collective well-being. In this regard, the RED Movilidad System has shown sustained growth in its public standing, reflecting progress not only in operational performance but also in social legitimacy.

This progress is reflected in public perception. According to the Metropolitan Public Transportation User Satisfaction Study, conducted by Brújula Investigación in 2025, individual routes received an average rating of 5.7, and the system received a rating of 5.5 on a scale of 1 to 7. These historically high results contrast sharply

with the initial ratings of 4.4 and 4.6 recorded in 2013, demonstrating a sustained improvement in the service's perceived value over time.

In addition, the assessment of the system's modernity reached a historic result: 83% agreement for the attributes "It is a modern system" and "It is a system capable of improvement." This milestone is closely linked to the fleet renewal process, which in this measurement obtained its highest rating since the study began, reinforcing the perception of a system in constant transformation and improvement.

Figure 20: Results of the System evaluation and the routes (2013-2025)



Source: Prepared by DTPM (2025).

According to the Citizen Brands 2025 study, prepared by CADEM, RED Movilidad is consolidating its presence within the ecosystem of brands with a positive social impact at the national level. During the second half of 2025, the system improved its position among the 39 official Citizen Brands in the country, demonstrating a favourable public perception and greater connection to people's daily lives.

In specific dimensions of the study, RED Movilidad achieved significant milestones. In Environmental Commitment, it ranked 14th among brands most concerned about the environment, a result closely linked to the deployment of a fleet of over 3,000 electric buses by 2024, which positions the system as one of the world's leading examples of electromobility. In Quality of Life, the system ranked 20th, recognizing its contribution to daily

mobility, accessibility, and the reduction of negative externalities associated with urban transport.

Within the metropolitan public transport ecosystem, Metro de Santiago stood out significantly, leading the Social Contribution category and achieving 4th place in the overall ranking of Citizen Brands. This result reinforces the strategic role of public transport as a pillar of social cohesion, urban equity, and quality of life in the city.

"El sistema de transporte público urbano alcanza un 77% de transacciones en modos de propulsión eléctrica a diciembre 2025"

Ilustración 12: Top 30 Marcas Ciudadanas Aporte Social año 2025, CADEM

1	natura	7	PRONTO COPIC	13	kyklis	19	Soprole	25	SQM
2	BIOPARQUE BuinZOO	8	METRO DE SANTIAGO	14	Red	20	cachantun	26	aramco
3	RESIMPLE	9	AGUAS andinas.	15	paris	21	MUT	27	JUMBO
4	TESLA	10	efe TROCES DE CHILE	16	tika	22	GIRO	28	mallplaza
5	COLUN	11	patagonia	17	trembre	23		29	NotCo
6	COPEC ANOS	12	LATAM AIRLINES	18	vital de Chancohue	24	TRICICLOS	30	BIO BLO LA RADIO

Source: Citizen Brands Study CADEM (2025)

These results confirm that the transformation of the RED Movilidad System, driven by electromobility and improved service standards, is reflected not only in technical and environmental indicators, but also in growing public appreciation, consolidating public transport as a key player in the urban and social development of Santiago.



B. Chile: Global leader for sustainable, innovative and resilient transport

The transformation of the RED Movilidad System with the massive incorporation of electric buses has made Santiago a global leader in electromobility for urban public transport. With more than 3,800 electric buses in operation, and on track to reach more than 4,400 by March 2026, RED Movilidad has established itself as a benchmark in electromobility, attracting regional and global interest from governments, transport operators, multilateral organizations, and experts eager to learn more about the model that has allowed Santiago, Chile, to rise to the top in this technology.

This has been framed within Chile’s role as an ambitious country in climate action, a role that has also been strongly emphasized in the decarbonization of its transport through pioneering policies such as the National Electromobility Strategy (2017-2021) and the Framework Law on Climate Change, which established sectoral goals and timelines for achieving them. This has been communicated internationally, where in recent years Chile has stood out as a benchmark in the decarbonization of transport, leading international spaces and initiatives for other countries to join the path we have begun.

Participation in international forums. During 2024-2025, Chile was the first Latin American country to hold the presidency of the International Transport Forum, one of the leading governmental transport forums, bringing together 69 of the world’s largest economies. During the 2025 ITF summit, where RED Movilidad had a prominent

presence and role, the Chilean presidency secured two policy recommendations on road safety and the use of artificial intelligence in transport, becoming the first presidency to achieve two declarations at a single summit. These declarations will promote policies and best practices in member countries.

Likewise, during the recent COP30 in Belém do Pará, presided over by Brazil, Chile, through its Ministry of Transport and Telecommunications, led the Joint Declaration for the Decarbonization of the Transport Sector. This was the first declaration of its kind, establishing ambitious sectoral goals for the sector, and has already been endorsed by 11 countries, including Spain, Brazil, and Norway.

Global recognition and international delegations. RED Movilidad’s leadership in the transition to electromobility in urban public transport has transformed it into a large-scale laboratory for its implementation and effects. This has generated growing interest from other countries in the region and the world, demonstrated by the increasing number of international delegations that visit the DTPM (Metropolitan Public Transport Authority) each year to learn firsthand about the policies, infrastructure, and technological solutions associated with the system.

This active and constant exchange has allowed for the sharing of knowledge and lessons learned on the financing, planning, operation, and maintenance of the electric fleet, providing perspectives and insights that will amplify the development of electromobility worldwide. Details of these visits follow:



Table 23: Delegations visiting the RED System.

Mont-Year of Visit	Delegation framework	Countries
July 2022	Ministerios de Transporte, Energía, y Medio Ambiente	Brasil, Colombia, México
August 2022	Zebra – C40 – Centro Mario Molina	Costa Rica
August 2022	Viceministra de Transporte	Brasil
November 2022	State of Santa Catarina – World Bank	Republica Checa
April 2023	Business Delegation	España
April 2023	Santa Cruz de Tenerife	Guatemala
July 2023	Ministry of Energy and Mines	Costa Rica
July 2023	Ministry of Public Works and Transport	Bolivia
November 2023	Vice Ministry of Electricity and Alternative Energies	Suecia
January 2024	Frances Sprei - Embassy of Sweden – Future Congress	Países Bajos
January – October 2024	Active	Egipto
February 2024	World Bank, Cairo BRT	Brasil
March 2024	State of Minas Gerais	Reino Unido
March 2024	Transport for London	Paraguay
April-July 2024	Ministry of Public Works	Unión Europea
October 2024	European Union Delegation	Panamá
January 2025	MiBus-CAF	Brasil
March 2025	State Government of Rio de Janeiro	México, Costa Rica, Colombia, República Dominicana,
March 2025	Euroclima - GIZ	Ecuador y Perú
April 2025	Ministry of Rural Affairs and Infrastructure	Suecia
May 2025	Trade and Investment Queensland	Australia
June 2025	C40 Study Tour – South African Cities	Sudáfrica
August 2025	Stanford Study Tour	Estados Unidos
September 2025	IDB Electromobility Platform	Brasil, Paraguay y Colombia
October 2025	Transport Operators of Lima and Callao	Perú
November 2025	CMS Regional Electromobility Platform	Guatemala, Jamaica, Antigua y Barbuda, Granada, Perú, Colombia, El Salvador, Ecuador, Honduras, Brasil, Estados Unidos
November 2025	JICA-ATU	Japón y Perú
November 2025	Lima College of Engineers	Perú
November 2025	UITP Diploma for Public Transport Managers	Suiza, Bélgica, Austria, China (Hong Kong), Japón, Malasia, y Polonia
Diciembre 2025	Directorate General of Energy, Hydrocarbons and Mines	El Salvador

Source: Prepared by DTPM (2025)

Participation in international spaces. RED Movilidad has been present in various international cooperation forums and platforms, where different professionals from the DTPM have presented advances in electromobility and other aspects of the transport system, and have visited forums and trade fairs to gain knowledge, consolidating its leadership through participation in key events.

Recognitions and Strategic Alliances. The positive impact of electromobility and the introduction of low-emission buses in Santiago has been recognized with international awards, strengthening RED Movilidad's image as a success story. During 2025, Santiago was awarded an Honourable Mention in the prestigious Sustainable Transport Awards, granted by the Institute for Transport Policy and Development (ITDP). This recognition, which will be announced in January 2026,

was for the development of electromobility and its business model in the 2023 tender.

Also in 2025, the DTPM received special recognition from the International Association of Public Transport (IATA) for its Good Practices and Fare Evasion Prevention campaign and for the "Dale QR" initiative to promote the use of sustainable transport through fare capping. Furthermore, collaboration with multilateral organizations, non-profit organizations, and other national and local governments has enhanced the exchange of experiences and best practices and accelerated the adoption of new technologies for urban public transport. Below are details of some of our main partnerships:

Table 24: Strategic partnerships

Institution	Framework Project	Countries
UITP (International Association of Public Transport)	Member Country	Organizations in more than 100 countries
IDB (Inter-American Development Bank)	Latin American Observatory on Gender and Mobility	Colombia, Argentina, Mexico, Ecuador, Costa Rica, Bolivia, Peru, and Chile
CAF (Andean Development Bank) MMA (Ministry of the Environment) AGCID (Chilean Agency for International Cooperation for Development)	Chilean Strategy for Sustainable Public Transport (CLETS)	Chile
C40 (Cities Climate Leadership Group) ICCT (The International Council on Clean Transportation)	ZEBRA Zero Emission Bus Rapid-deployment Accelerator (ZEBRA)	Brazil, Colombia, Mexico, and Chile

Source: : Prepared by DTPM (2025)

Based on these experiences, Santiago's Transport System, RED Movilidad, has not only strengthened its position as a benchmark, but has also encouraged other cities to follow this example, showing that moving towards cleaner and more efficient public transport is not only possible, but is already a reality.

C. Projections

The advancement of electromobility in urban public transport in Santiago has been sustained and consistent, positioning the country as a regional and global leader in the transition to cleaner, more efficient, and people-centred mobility systems. However, the achievements to date do not represent an end point, but rather a solid foundation from which to project the consolidation, expansion, and deepening of this public policy to the rest of the country. This Second Electromobility Report invites reflection on the remaining challenges and reaffirms the State's commitment to the continuity and improvement of this policy.

Among the main challenges is the need to continue strengthening institutional capacities to manage increasingly complex, highly technological systems with growing operational demands. Electromobility not only involves the incorporation of electric buses, but also the planning of charging infrastructure, the adaptation of operating models, efficient energy management, and the continuous training of human capital. All of this requires robust coordination, situated within the context of the city we want to build, with a long-term vision that allows us to anticipate risks and ensure the system's sustainability.

Another important challenge is to deepen the territorial and social impact of electromobility. Moving towards greater equity in access to high-standard public transportation, reducing gaps between areas and regions, and ensuring that the environmental and economic benefits of this transformation effectively reach people remains a priority. In this sense, electromobility must continue to be a tool for building more humane cities that increase the well-being of users and residents and contribute to the country's climate commitments.

The upcoming implementation of the 2025 public transportation tender marks a key milestone in this new phase. This process will not only allow for the continued renewal of the fleet with high environmental standards, but also incorporate accumulated lessons learned in contract design, service quality incentives, operational efficiency, and asset management. The 2025 tender represents a strategic opportunity to further consolidate electromobility and the business model as structural pillars of the system, aligning sustainability, quality, and stability objectives for the various stakeholders involved.

On that point, there is the ongoing challenges for the efficient use of public resources. As it has been demonstrated, the path toward electromobility has allowed for reduced operating and maintenance costs, as well as lower prices resulting from competition and technological advancements. All of this has contributed, through various bidding processes, to more efficient operations, where savings have been directly passed on to competitive pricing. This has strengthened the financial stability of the public transportation system and, consequently, enabled a more efficient use of state subsidies and fares paid by users. The 2025 bidding process is particularly important in this context, given its potential for annual savings exceeding CLP \$15 billion, which are crucial for the medium- and long-term financing of the system.

The Santiago experience demonstrates that electromobility has transcended administrations and specific circumstances, establishing itself as a State Policy. The challenge ahead is to maintain this continuity, strengthening governance, ensuring conditions for its expansion, and adapting the regulatory framework to future technological and energy changes. This report seeks to contribute to that purpose by providing evidence, lessons learned, and projections that will allow us to continue moving forward, with conviction and responsibility, toward a cleaner, more modern, and more sustainable public transportation system for present and future generations.



ANNEXES



A. Glossary

- **3CV (Vehicle Control and Certification Center):** An organization that certifies vehicles' compliance with technical and environmental standards.

- **ADAS (Advanced Driver Assistance Systems):** Advanced driver assistance systems used in buses and cars.

- **AFT (Transantiago Financial Administrator):** The entity responsible for managing the revenue and payments of the public transportation system.

- **IADB (Inter-American Development Bank):** A financial institution that finances development projects in Latin America and the Caribbean, including transportation and sustainability.

- **C40 (C40 Cities Climate Leadership Group):** A global network of cities committed to combating climate change and promoting sustainable mobility.

- **CAF (Development Bank of Latin America and the Caribbean):** An organization that finances infrastructure and development projects in the region, including mobility and energy.

- **CNE (National Energy Commission):** The organization responsible for regulating and supervising the energy sector in Chile.

- **CO₂eq (Carbon Dioxide Equivalent):** A measure that expresses the impact of different greenhouse gases in terms of CO₂.

- **VOCs (Volatile Organic Compounds):** Polluting gases emitted by vehicles and industrial processes.

- **DESARROLLO PAÍS S.A.:** A Chilean state-owned company whose purpose is to promote infrastructure projects in an agile, efficient, and long-term manner through public-private partnerships, seeking to contribute to Chile and its inhabitants.

- **DTPM (Metropolitan Public Transport Authority):** The entity responsible for the management and planning of public transport in Santiago, Chile.

- **GEC (Critical Episode Management):** Measures adopted on days of high air pollution.

- **MINVU (Ministry of Housing and Urban Development):** Responsible for urban planning and infrastructure development in Chile.

- **MMA (Ministry of the Environment):** The agency responsible for formulating and implementing environmental policies in Chile, promoting the protection of ecosystems and the sustainable management of natural resources.

- **MP2.5 / MP10 (Particulate Matter):** Polluting particles suspended in the air, classified according to their diameter.

- **MTT (Ministry of Transport and Telecommunications):** The entity responsible for regulating, planning, and overseeing transport and telecommunications in Chile, ensuring their efficient and sustainable development.

- **NDC (Nationally Determined Contributions):** Climate commitments undertaken by Chile under the Paris Agreement.

- **NOX (Nitrogen Oxides):** Air pollutants generated by engine combustion.

- **PPDA (Air Pollution Prevention and Decontamination Plan):** The Ministry of the Environment's strategy to reduce pollution in Santiago.

- **SECTRA (Secretariat of Transport Planning):** A branch of the Ministry of Transport and Telecommunications (MTT) that conducts studies and planning for urban and regional transport.

- **SENAPRED (National Service for Disaster Prevention and Response):** The Chilean government agency responsible for disaster risk management and coordinating emergency response at the national level, in conjunction with regional and local authorities.

- **SERVIU (Housing and Urban Development Service):** Responsible for implementing housing policies, urban development, and managing public infrastructure.

- **SOC (State of Charge):** A percentage indicating how much energy is available in an electric vehicle's battery at any given time. It is the electric equivalent of the "fuel level" in a combustion engine vehicle.

- **SOH (State of Health)** An indicator showing the battery's "health" compared to when it was new, usually as a percentage (100% = original capacity). A lower SOH indicates that the battery has lost some of its capacity and range over time and with use.

- **UITP (International Association of Public Transport):** A global organization that promotes sustainable public transport and efficient urban mobility.

B. List of organizations and people interviewed

Profile	Organization	Name	Position
Transport operators	Subus	Jaime Trejos	Infrastructure A...
		Carlos Ruiz	Head of Maintenance C...
	Vule	Rodrigo Carreño	Assistant Operations...
	Voy	Alvaro Saavedra	Planning and Operatio...
		Jairo Rico	Maintenance Ma...
	Metbus	Diego Fuentes	Planning Man...
	Metropol	Cristian Gonzalez	Assistant Manager of Et...
		Diego Bravo	Electromobility A...
	STU	Matias Uribe	Head of Electromobility, Operations...
		Matias Salas	Professional, Operations and S...
	RBU	Gerardo Venegas	Assistant Manager of Logis...
		Carlos Vega	Operations Mar...
		Juan Carlos Flores	Maintenance Ma...
		Leonardo Victoriano	Contracts Man...
Gran Américas	Katherine Casas	Maintenance Ma...	
	Marcelo Cornejo	Operations Mar...	
Consortio Conecta	Roberto Cabrera	Maintenance Ma...	
Bus manufacturers and brand representatives	Foton, Andes Motor	Rodrigo Sepulveda	Manager of Buses and Var...
	Zhongtong	Cairns Jiang	GM/Global New Energy Bus Dir...
Energy distribution and supply companies	Enel Distribución	Luis Roa	Head of Activa...
		Hernán Martínez	Head of Network Analysis & Sol...
		Daniela Palavecino	Responsable Estudios I...
		Jennyfer Martínez	Head of B2G & Large...
	CGE	Oscar Facusse	Commercial Dir...
	Empresa Eléctrica Puente Alto (EEPA)	Cristian Humeres	Commercial Ma...
		Guillermo Guerra Godoy	Assistant Operations...
Enel X	Orlando Meneses	Head of Technical Post S...	
Copec Voltex	Pablo Ugarte	Head of Sales Public Tr...	
Charging infrastructure providers and other service providers	Dhemax	Pablo Avalos	Business Develop...
	Enerlink	Sebastián Luque	Founder & C...
	Tracktec	Walter Moreno	Operations Mar...
	Optibus	Alvaro Iriarte Sanderson	Regional Director...
Academia	Pontificia Universidad Católica	Hugo Silva	Academic...
	Universidad Técnica Federico Santa María	Mauricio Osses	Academic...
Public Institutions	Superintendencia de Electricidad y Combustibles (SEC)	Julio Clavijo	Head of Energy Sus...
	Comisión Nacional de Energía (CNE)	Enrique Cruces	Professional, Planning Su...
	Coordinador Eléctrico Nacional	Carla Hernández	Deputy Manager of Project...
	Servicio de Evaluación Ambiental (SEA)	Arturo Farias	Regional Director, Metro...

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