





8. Environmental Management

8.1 Our Management

At Metro we work hard every single day to be a clean means of transportation that contributes to depolluting the City of Santiago. In practical terms, this means that we focus our efforts of encouraging energy efficiency initiatives and the appropriate use of natural resources.

These actions are a part of our constant efforts at Metro to sustainably develop our operations, follow good practices within our organization and with our suppliers, contractors, customers and the community as a whole. Environmental management is a mainstream concept at our company, even though the key tasks are handled by the Customer and Sustainability Management Division, which sets Metro's environmental management policies and guidelines.

Generally speaking, electric-powered mass transit systems such as Metro are known for being the most environmentally sustainable option for large cities. Therefore, our most relevant contribution to the environment lies in the impact we do not generate from our services. For example, because people prefer riding on Metro, the city of Santiago has cleaner air, less congested streets, and less noise pollution, all of which would be radically different if our passengers were to prefer other means of transportation to get around the city.



Our contribution to the environment can be summed up on the next slide.

On average, the following resources are required to transport 1,300 passengers in Santiago:

1 train



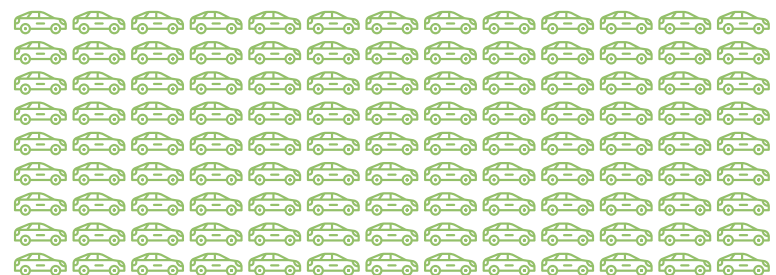
8 buses



325 collective taxis



930 cars





8.2 Managing Energy

Long-Term Power Agreement

[G4-DMA] At Metro we have made an effort to innovate and be a pioneer in the use of Non-Conventional Renewable Energy (NCRE) in Chile. Accordingly, in 2016 we signed two electric power supply agreements to source at least 60% of our energy needs with NCRE.

This pledge came to fruition when the following two NCRE projects began operations: the “El Pelicano” photovoltaic power plant and the “San Juan de Aceituno” wind farm.

After adding these two new contracts to our grid, by the end of 2017 our power grid will consist of 42% solar power (from the El Pelicano photovoltaic project), 18% wind power (from the San Juan wind farm) and 40% conventional energy (from Enel Distribución).

El Pelicano Solar Park

Holding	Total-Sunpower
Capacity	100 MW - 300 GWh/year
Location	Regions III & IV, La Higuera - Vallenar

Parque Eólico San Juan

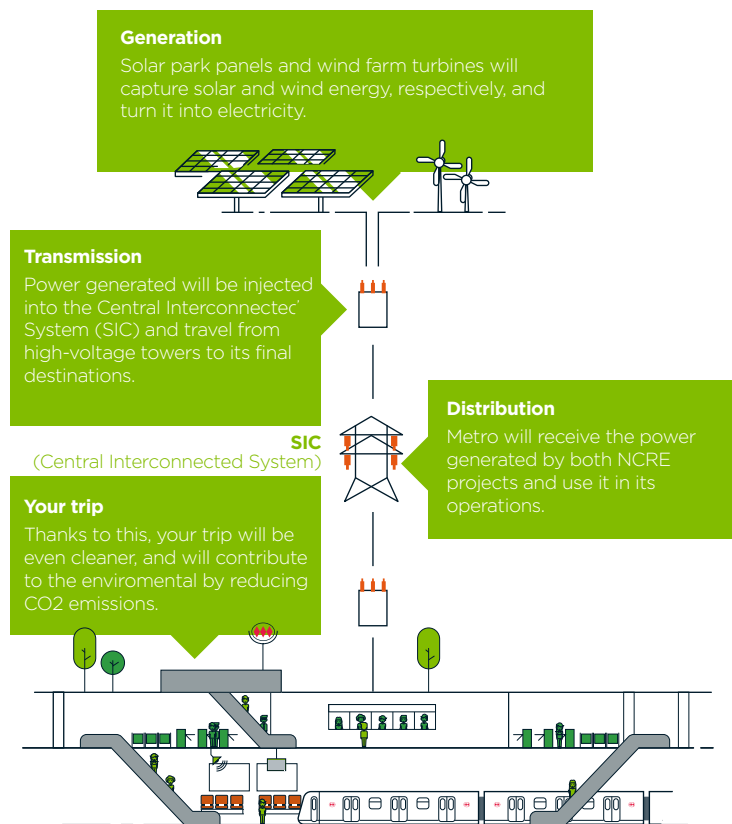
Holding	Latin America Power
Capacity	185 MW - 605 GWh/year
Location	Region III, Freirina





Clean Energy for your trip

Starting in 2017 Metro will use non-conventional renewable energy (NCRE) to meet some of its electric power consumption. More than 60% of Metro's energy requirements will be sourced by a 100MW photovoltaic power plant and an 184.4MW wind farm.



Did you know...?

- ...on average, a car ride pollutes 146 more times than your Metro ride.
- ...60% of the energy Metro consumes that comes from clean sources is equivalent to the average consumption of 104,000 households.
- ...both NCRE projects led by Metro will allow Chile to reduce its country level emission by some 130,000 tons of CO2 a year.
- ...80% of the energy Metro consumes corresponds to its operations and 20% to equipment, stations and workshops work.

Expected Outcome

- Stable energy prices less than 100 USD/MWh regardless of the marginal cost.
- For reference purposes, our NCRE consumption is equivalent to the energy consumption of 104,000 households.
- Both NCRE projects will enable us to reduce CO2 emissions at the country level by some 130,000 tons annually, which is equivalent to planting 7.8 million trees.

Energy Consumed in Operations

[G4-EN3] The electric power we consume for our operations is sourced from the Central Interconnected System (SIC), which has made it possible for us to operate satisfactorily throughout the year. Our power consumption has remained stable in recent years as illustrated in the graph below:

Year	Power Draw in KW/h		
	Trains	Lighting	Total
2014	336.574.654	77.781.428	414.356.082
2015	337.948.001	78.435.492	416.383.493
2016	338.206.021	79.740.764	417.946.786

Energy Efficiency

[G4-EN6] In August 2016 we published our Energy Efficiency Plan, within the framework of our commitment to sustainability and the efficient use of energy. The plan calls for replacing outdated light fixtures with better technological solutions, and relocating fixtures so as to optimize their use, at 19 stations along Line 1. Total energy saved will be equal to the energy consumed by 1,300 households.



This project consists of an efficient lighting system providing up to 60% savings in every consumption, and it was implemented at the following stations: Escuela Militar, Alcántara, El Golf, Tobalaba, Los Leones, Manuel Montt, Salvador, Baquedano, Universidad Católica, Santa Lucía, Universidad de Chile, Los Héroes, República, Unión Latinoamericana, Estación Central, Universidad de Santiago, Alberto Hurtado, Ecuador and Las Rejas.

The result has been significant progress at stations and energy savings:

Enhanced lighting, half the equipment, and a 60% reduction in energy consumed by lighting.	Remodeled electric power distribution system for station lighting. The previous system was obsolete and nearing the end of its service life.	Installation of an energy management system at each station for better control over energy use and consumption.	Savings estimated at: 2,840,489 kWh/year.
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Along with all the other ongoing activities we carry out at Metro to promote energy efficiency and good energy consumption habits, this initiative has led to an unexpected positive outcome. In late 2016 the Ministry of Energy recognized our efforts by awarding us the Energy Efficiency Seal. The purpose of this award is to distinguish leading companies in the field of energy efficiency promotion and development in Chile. All of this has brought about economic, social and environmental benefits resulting from lower operational costs, better quality of life for society, and a smaller carbon footprint.

In addition to the lighting renewal project, in 2016 Metro continued to adopt a series of energy efficiency measures. Our 2014-2016 energy savings are illustrated in the table below:

Initiatives	2014 Energy Savings	2015 Energy Savings	2016 Energy Savings	Standards, Methods & Assumptions Used
Loops System	11.2	11.26	11.28	Estimated 4% savings in total energy consumed by Line 1, 2 and 5 traction
Energy generated during braking	60.2	60.83	60.88	Estimated 18% savings in total energy consumed by traction
Electric Power Management Software and Transport Supply Scheduling	6.2	6.84	6.69	Estimated 18% savings in total energy consumed by traction
Using Smart Lighting	1.8	1.84	1.94	Estimated 10% savings in energy consumed by Line 4 & 4A lighting and power
Updating L1 Lighting System			2.84	We randomly measured the energy consumed by lighting at some stations in order to determine energy savings. This also involved analyzing energy consumption with and without the savings project for a certain period of station operations. For estimation purposes, we assumed 20 hours of lighting were used daily at stations, considering that lights remain on during the entire time Metro is open.

[G5-EN5] In terms of energy consumed for traction, energy intensity increased slightly despite recording a drop in the number of car/kilometers travelled throughout the year. Likewise, we also recorded a slight increase in the energy intensity of lighting, which is associated with higher consumption at stations due to HVAC systems, elevators, and lighting, among others.

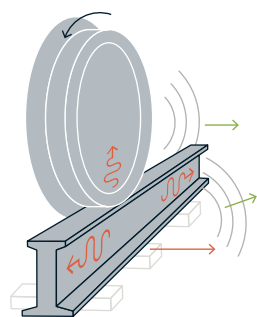
8.3 Environmental Impact Mitigation

Primary Environmental Impact of Operations

[G4-DMA] [G4-EN27] In 2013 we took on a significant commitment to reduce the environmental impact of our operations. As such, in 2016 we continued to focus on implementing our “Environmental Investment Plan.” This plan consists of carrying out projects that enable us to meet environmental targets in several areas.

The plan entails the following aspects: noise and vibration, non-hazardous industrial waste, hazardous industrial waste, liquid industrial waste, and hazardous chemical substances. These aspect must be managed throughout the entire network, including workshops, train depots and technical facilities.

Metro’s network runs throughout the entire city and its infrastructure is involved and interacts with many residential, commercial and industrial neighborhoods. In certain areas the latter causes noise and vibrations resulting from our normal activities, such as train maintenance and parking. In order to address this issue, Metro has an annual portfolio of projects that attained various degrees of progress in 2016 given their complexity:



Noise and Vibration Study Stage

- Vibro-Acoustic Mitigation Quilín Train Depot
- Vibro-Acoustic Mitigation Puente Alto Workshops
- Acoustic Mitigation San Eugenio Workshops
- Soundproofing track machinery.
- Track Machinery Soundproofing Maipú Line 5
- Soundproofing SER Stage II

Implementation Stage

- Soundproofing SER Stage I, completed.

Waste Management

[G4-DMA] [G4-EN23] Our solid wastes are removed in accordance with legal regulations currently in effect. In 2016, we produced 215,144 kg in tires, 57% of which was recycled by Polambiente, a company that produces recycled rubber beads, powder and granules that are used as filler for artificial grass fields and other applications. The remainder (43%) is transferred to the Cemento Melón La Calera Plant where it is used to fuel the cement production process.

Waste generated by Metro is transferred to companies authorized to dispose of said waste at landfills or recycle the waste, depending on the nature of the waste. Inert waste, derived primarily from excavation works, is generally used as filler to level off land, thereby extending the useful life of these products.

Main Construction-Related Environmental Aspects

Mitigating Environmental Impact of Line 3 and 6 Construction

[G4-DMA] [G4-EN30] At Metro we begin integrating environmental criteria in the project design phase in order better control and mitigate environmental impacts. The latter also enables us to comply with regulatory standards stipulated by environmental authorities and adopt the necessary measure to reduce the potential impact of our projects.

The main impacts are described as follows:

Noise: for works under way (building tunnels and stations that use noisy machinery) we have implemented several different mitigation measures such as noise silencers, perimeter acoustic barriers, and acoustic tunnels, among others, that significantly reduce the impact and inconveniences affecting communities. Metro personnel are also available on site to address community members’ concerns regarding the matter and arrange for solutions so as to minimize the inconvenience.

[G4-EN23] Regarding the waste produced during the construction of Metro’s new Lines 6 and 3, there was significantly less waste produced in 2016 when compared to 2015 since we are in the final stage of tunnel building.

Air pollution: minimizing air pollution is important, especially PM10. To this end we have a series of measures such as dampening areas with truck traffic, washing truck tires, and others.



Protecting archaeological heritage: archaeological surveys are conducted prior to the construction phase to make sure any possible findings are protected. In the event archaeological remains are found, the area under survey is expanded and remains are removed. Once the area has been cleared by the Council of National Monuments, we are able to begin the construction phase under archaeological supervision to ensure that new findings are protected

All findings are recorded and analyzed in the laboratory, and, when appropriate, pieces are sent abroad for C14 identification, followed by conservation, packaging and delivery to the National Natural History Museum. Some of the more representative archaeological sites will be prepared for exhibition in 2017 as part of a joint effort undertaken by Metro and the National Natural History Museum.



Environmental Audits on Contractors

[G4-DMA] [G4-14] [G4-EN33] In 2016 we formally instituted an Environmental Auditing process for our civil works and systems contractors, covering a total of 16 companies involved in the P63 project during this period.

The main conclusions drawn from this process point out some minor observations that do not have any real or potentially negative environmental impact on our supply chain.

Finally, we would like to underscore that we have not terminated any contract on the grounds of significantly negative environmental impacts.

8.4 Using Resources Responsibly

[G4-DMA] At Metro we are concerned with responsibly managing the resources we use for our operations and building new projects; likewise, we are also concerned with fostering a culture of environmentally friendly work among all Metro collaborators

Material Consumption

[G4-EN1] We use a variety of different materials and consumables at our maintenance workshops in order to ensure our operations run smoothly. In 2016, we significantly increased our consumption of lubricants, solvents, refrigerants and acetylene.

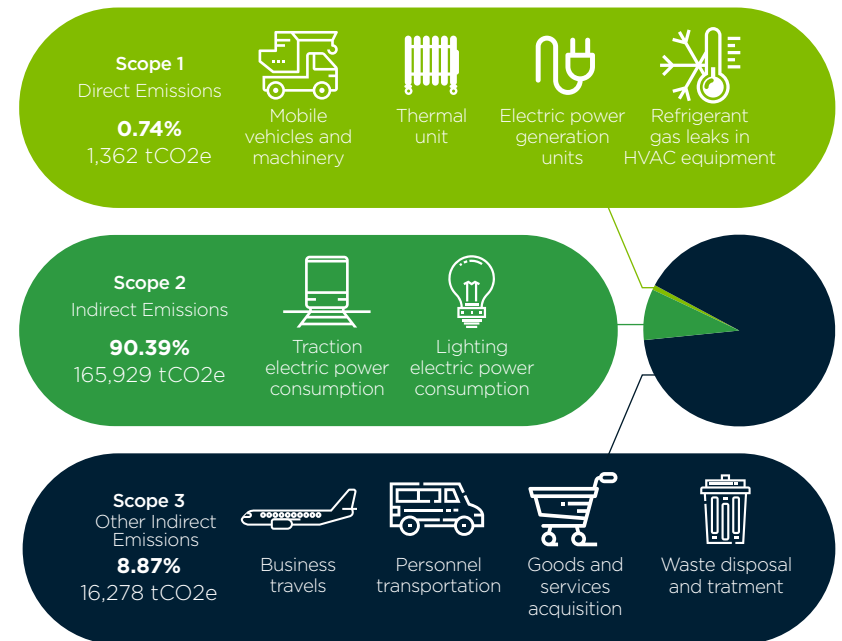
Material	Unit of Measure	2014 (Quantity)	2015 (Quantity)	2016 (Quantity)	% Change
Tires	Ton	67	155	119	-23%
Lubricants	L	3,584	28,983	46,501	160%
Grease	Kg	3,295	3,218	5,248	163%
Nitrogen	m3	6,640	10,982	8,728	-20%
Oxygen	m3	578	443	627	142%
Solvents	L	10,229	10,459	22,187	212%
Acetylene	Kg	419	431	686	159%
Refrigerants	L	268	724	1,212	167%

8.5 Being Accountable for Climate Change

[G4-DMA] [G4-EN15] [G4-EN16] [G4-EN17] [G4-EN18] [G4-EN19] throughout 2016 we continued to measure our corporate carbon footprint, which increased by 12% compared to 2015. By calculating this figure, we are able to identify various business areas and activities that have the greatest impact in terms of equivalent carbon dioxide emissions (CO2e).

It is worth noting that Scope 1 emissions (related to fuel consumption and air conditioning) dropped by 35% in 2016.

Metro S.A.'s Total GHG Emissions, 2016





Similarly, Scope 2 emissions (related to business administration, lighting, and train traction) account for 90% of our total emissions. Train traction, which has the greatest impact on our corporate carbon footprint at 73% of the total, increased 11% vis-à-vis 2015. .

Total
Footprint

Source	Greenhouse Gas Emissions (tCO2e)			% Change from 2015 - 2016	% Total Footprint
	2014	2015	2016		
Scope 1	328	2.097	1.362	-35%	0,74%
Fuel	154	257.54	148.94	-42%	0,08%
Air Conditioning	174	1.839.24	1213.46	-34%	0,66%
Scope 2	149.168	143.934	165.929	12%	90,39%
Administration	1.319	1.278	1.419	11%	0,77%
Lighting	26.683	25.874	30.242	12%	16,47%
Traction	121.167	116.782	134.268	11%	73,14%
Scope 3	13.597	13.560	16.278	12%	8,87%
Energy	26	36	41	11%	0,02%
Potable Water Production	39	36	35	4%	0,02%
Consumables Production	9	154	295	91%	0,16%
Cargo Transportation	46	43	38	-12%	0,02%
Personnel Transportation	5.387	5.697	5.987	5%	3,26%
Waste Water Treatment	142	137	114	-17%	0,06%
Waste Treatment	7.742	7.153	9.546	33%	5,20%
Business Travel	206	303	222	-27%	0,12%
TOTAL	162.783	159.591	183.569	12%	100

The intensity of GHG emissions in 2016 was 0.00124 tCO2-e/Car Km

[G4-EN20] Furthermore, we quantify ozone-depleting substances emitted during our operations. Trains are the primary source:

Consumption of Refrigerant Gases				
Source	Unit (kg)	2014	2015	2016
AC at Facilities	R 22	54	68	95
	R407C	11	34	68
	R410A	34	124	68
AC on Trains	R407C	1.625	619	464

[G4-EN15] [G4-EN16] [G4-EN17] Similar to previous years, this year we measured the P63 carbon footprint, which showed a 35% overall decrease in greenhouse gas emissions. The following is a summary of data broken down by project:

Carbon Footprint of Line 3 and 6 Construction (tCO2e)	2014	2015	2016
Line 3	241.271	356.070	272.344
Line 6	604.081	222.853	104.330
Total	845.352	578.923	376.674