

# Barcelona Metro S7000

## Environmental Product Declaration in accordance with ISO 14025

Programme operator: EPD International AB  
Programme: The International EPD® System, [www.environdec.com](http://www.environdec.com)

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**ALSTOM**  
• mobility by nature •



Transports  
Metropolitans  
de Barcelona



eservats  
reservados  
seats



Es obligatori cedir el seient.  
Es obligatori ceder el asiento.  
It is mandatory to give up your seat.



Deixeu sortir



Deixe sair





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## Alstom, at the forefront of sustainability

Alstom develops and offers a range of systems, equipment and services for the rail sector and key to its mission is supporting the transition towards global sustainable transport systems that are inclusive, safe and efficient.

As a promoter of sustainable mobility, Alstom places environmental issues at the heart of its R&D strategy, constantly designing solutions and products which are less energy-consuming, quicker to install, cheaper to maintain, and with higher lifespan and reduced carbon footprint.

For more than 25 years, the company has worked systematically by introducing Ecodesign in its engineering procedures.

Today, Alstom can rely on a team of Ecodesign engineers to ensure the environmental performance of its portfolio and its ability to develop innovative solutions tackling key environmental challenges.

# Sustainable mobility

Alstom's mission is to support the transition to sustainable transport systems by delivering mobility solutions that are safe, reliable and inclusive everywhere in the world.



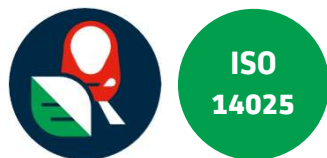
## Environmental Management

Alstom has an environmental management system fully in place and targets 100 % of manufacturing sites and regional centers with over 200 employees to be certified according ISO 14001:2015 Standard for Environmental management.

In the environmental management system, Alstom is including the life cycle perspective of products, from concept to recycling including maintenance and energy consumption. Alstom offers innovative solutions that respect the environment and meet the mobility needs according to a socially responsible model.

To continuously improve Alstom products and ways of working, environmental targets for sites and products are implemented and regularly evolved following return of experience and best practice.





## Communicating Environmental Performance

Alstom communicate the environmental performance of products through Environmental Product Declarations (EPDs) following the International EPD® System. EPDs are developed in line with the Product Category Rules for Rolling Stock (PCR 2009:05) as well as the principles and procedures of ISO 14025:2006.

They are based on Life Cycle Assessment methodology and function as an externally validated communication tool, providing complete transparency to the benefit of customers and other stakeholders. The external validation is carried out by independent verifiers approved by the technical committee of the International EPD® System.

Life cycle assessment (LCA) is a technique assessing the environmental impacts associated with all stages of a product's life cycle from cradle to grave (i.e., from raw material extraction through materials processing, manufacturing, distribution, use, repair and maintenance, and disposal or recycling).



## Barcelona Metro S7000

Barcelona Metro S7000 Rolling stock vehicles are part of the Metropolis platform, that is built on the principle of customization with modularity.

The five-car vehicles are fitted with a driver's cab at each end and are prepared for GoA 4 level driverless functionality.

The new trains include a total of 40 doors with equidistant spacing (4.197 mm) and a longitudinal seating configuration to optimize accessibility, comfort, capacity and passenger flow, together with direct LED lighting, air conditioning with smart management of fresh air and state of art passenger information system, incorporating large displays above every door.



# Product information

The Barcelona Metro S7000 Rolling Stock is designed for commercial service in Metro Barcelona L3. The vehicle can operate with a maximum speed up to 80 km/h.

For a better understanding of the metro performance under different loading scenarios, two passenger capacities are considered for this study:

- A total capacity of 389 passengers, including 108 seated passenger and 2 standing passengers per m<sup>2</sup>.
- A total capacity of 953 passengers, including 108 seated passengers and 6 standing passengers per m<sup>2</sup>.



## KEY BENEFITS OF S7000

### A SAFER ENVIRONMENT

The vehicle is developed with a strong emphasis to avoid the use of hazardous substances in the product as well as during production and maintenance providing a safer environment for our customers, passengers and employees.



### A VEHICLE ACCESSIBLE TO ALL

The vehicle is offering inclusive accessibility thanks to a floor without height differences throughout the train, and with optimized gap between the platform and the vehicle. Priority seats are clearly distinguished by a specific red colour for instant identification. Flexible multipurpose areas are provided for wheelchair users, parents with pushchairs, bulky luggage or standees, bicycles or strollers.

### A SATISFACTORY WORKING ENVIRONMENT

The cab is optimized and studied to provide a satisfactory working environment for the driver, including separate air conditioning, direct access from platform and track and certified ergonomoy.



### EASE OF MAINTENANCE

An optimized maintenance cycle will be achieved thanks to Conditioned Based Maintenance.

Main characteristics	Vehicle data
Type of vehicle	Metro cars
Configuration	5 cars Mc-Mi-T-Mi-Mc 80% motorization rate
Expected service lifetime	40 years
Production site	Santa Perpetua (Barcelona)
Length over coupler covers	Trainset 87.124 mm
	Cabin cars 18.380 mm
	Intermediate cars 16.788 mm
Width	2.909 mm (carbody 2.710 mm)
Weight (empty)	152.774 kg
Bogies	B20C type. Disc brakes. Roller Bolster
Wheel diameter (new wheels)	840 mm
Doors per side	20 (4 per car)
Door width	1.300 mm
Seats	108
Capacity	398 passengers AW2 (all seats occupied and 2 pass/m <sup>2</sup> ) 953 passengers AW3 (all seats occupied and 6 pass/m <sup>2</sup> )
Voltage	1200 Vdc
Maximum operation speed	80 km/h



### Carbody

Light weight integrated welded structure of aluminium extruded profiles. Roller bolster in carbon steel to secure interface with bogies.



### Comfort

An independent efficient air conditioning system by car provides to the passengers treated air as per EN 14750-1 B Category. It's equipped with a smart management of fresh air.



### Propulsion and electrical equipment

The energy-efficient and service-proven OptONIX 1500™ propulsion system will reduce maintenance costs and increase energy efficiency. There will be 4 OptONIX drives per train feeding 4 asynchronous motors each.



### Material selection

Materials selected to achieve the best balance between light weight, recyclability & recoverability and ease of maintenance.

# Life cycle description

Environment impacts of Metro S7000 trains have been characterized through the realization of a cradle-to-grave LCA in accordance with ISO 14040:2006 and ISO 14044:2006 methodology, and the requirements of the PCR for Rolling stock, UN CPC 495, 2009:05 version 3.04. The UN CPC of the metro is 4951. The SIMAPRO 9.3.0.3 and the ECOINVENT 3.8 database were used to perform this life cycle impact assessment.

## Functional unit

**The functional unit for the performed LCA is the transport of 1 passenger over 1 km, using a 5 car Metro S7000 in service for 40 years operation, with a running distance of 4.800.000 km.**

- Four different scenarios are studied, taking into account:
- 389 Passenger (AW2), in regenerative and rheostatic mode
  - 953 passengers (AW3), in regenerative and rheostatic mode

## Cut-off rules

The exclusion rules applied are in line with the indications of the PCR for Rolling stock (PCR 2009:05).

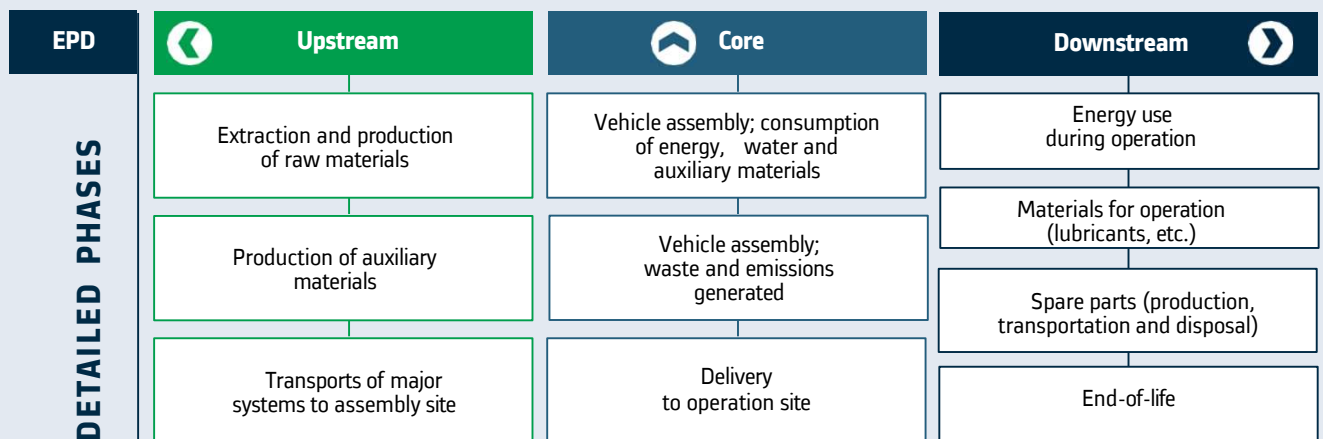
- 99,29% of weight of the metro has been inventoried
- 83,94% by weight of transport from suppliers has been included

## Life Cycle Description

Material and energy production data used for the upstream module is based on data from the supply chain and the recycled content has been considered by the average market values from the LCI data base used.

The core module includes primary data of the auxiliary materials, energy consumptions, and waste production for the manufacturing of the metro unit in the Alstom Barcelona plant, located in Santa Perpetua de Mogoda (Spain). The reference period for the plant is the year 2021. It also includes the impact from final transportation of the vehicle to the customer site.

The power supply for the vehicle operation in the in the downstream module is considered to be 100% renewable energy since TMB has 100% renewable energy certified by the CNME with Guarantee of Origins. Data used for maintenance materials is based on the planned preventive maintenance of the vehicle over its entire service life. The end-of-life is modelled in line with the ISO 21106:2019 methodology. The recyclability and recoverability potential of each material is assessed based on its nature, its integration in the trainset, and the technology available today. As a result, metals and most single material polymers are considered as highly recyclable whereas most composite polymers are considered to be hardly recyclable and mostly recoverable.



## Allocations

In the upstream module, no allocation is required except the allocations built into the databases of the LCA software.

For the vehicle assembly in the core module, the impact of the production plant is allocated by the total working hours in that plant and the total working hours dedicated to the manufacturing one metro. Impacts and benefits of the recycling of waste are excluded from the scope of the study.

Burdens linked to incineration are included, but impact and benefits linked to the use of the energy from incineration are also excluded.

## Data quality

Whenever possible, specific data was used. In particular, 99,63 % of the mass of the train was inventoried with specific data, and a 84,09% of the delivery of components was inventoried with specific data. In both cases, the missing data was analysed by a sensitivity analysis according to the PCR for Rolling stock (PCR 2009:05).

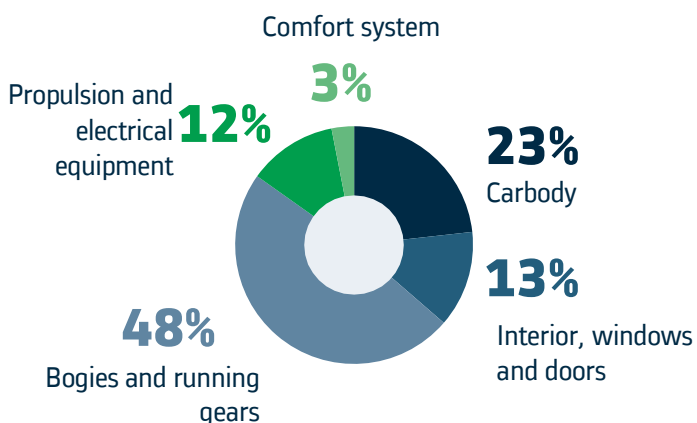
For this study, the missing data do not contribute more than 1% for the considered impact categories, therefore, no additional effort has been done as established by PCR for Rolling stock (PCR 2009:05).



# Content declaration

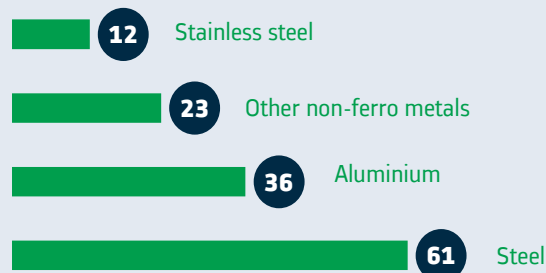
## Rolling stock manufacturing

Share of mass by PCR categories



## Rolling stock composition

Top four metals for manufacturing (metric tons)



of recycled (pre-consumer or postconsumer) content included in the train, based on the average market values from the LCI data base used

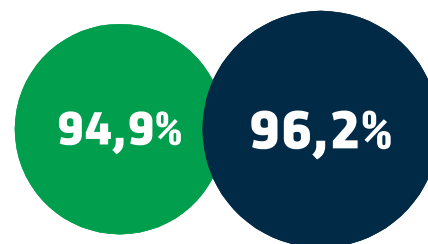
Bill of materials (mass in kg)	Upstream (vehicle)	Downstream (spare parts)	TOTAL
Metals	135.921	70.046	205.967
Electric and Electronic Equipment (EEE)	6.138	1.143	7.281
Polymers – filled and unfilled	2.102	2.310	4.412
Glass / Safety Glass	1.734	10	1.744
Elastomers	2.454	1.464	3.917
Composites	2.420	0	2.420
Modified Organic Natural Materials (MONM)	3	0	3
Oil, grease, etc.	128	301	429
Mineral wool	474	0	474
Acids, cooling agents, etc.	46	0	46
Other	264	6.711	6.975
<b>TOTAL</b>	<b>151.684</b>	<b>81.984</b>	<b>233.668</b>



## Hazardous substances

Alstom's standard for hazardous substances management considers European regulation (REACH) and railway sector principles through the RISL (Railway Industry Substances List), which has been considered during the design of the vehicle as well as for chemicals used during maintenance.

In some areas, use of hazardous substances according to RISL has not been avoidable due to functional and safety requirements, including lead in electronics, and the refrigerant gas mix used for the air conditioning system. However, no hazardous substances are used in any prohibited application at the time of production of the Barcelona Metro S7000.



**Recyclability rate**

**Recoverability rate**

### A recyclable solution

using materials featuring high recyclability and considering disassembly early in the design phase maximise the overall recoverability of the Barcelona Metro S7000. Material recycling and energy recovery aggregate to a 96,2% recoverability rate by applying **ISO 21106:2019** methodology.

# Additional information

## Energy consumption during operation

Energy consumption data is based on a simulation 35,42 km track line in Barcelona, with a speed of 26 km/h average and including 26 intermediate stops. Simulations were carried out considering both the electricity consumed by traction according to UNE-EN 5091:2020, and by the air conditioning of the vehicle (35 °C outside and 32 °C inside).

Four operational scenarios have been taken into account. Firstly, two different loading scenarios were considered for the passenger capacity; 389 and 953 passengers. Secondly, the electricity consumption was calculated for two different brake operation scenarios; regenerative mode –when the line has the ability to receive part of the kinetic energy from the train in the braking stage– and rheostatic mode – when the train only consumes energy provided by the line.

- 389 passenger capacity in regenerative and rheostatic mode
- 953 passenger capacity in regenerative and rheostatic mode

	Operation	
	389	953
Number of passenger (for energy calculation)	389	953
Energy consumption in regenerative mode per km	5,21 kWh/km	6,41 kWh/km
Energy consumption in rheostatic mode per km	11,20 kWh/km	14,44 kWh/km
Energy consumption in regenerative mode over 40 years	24.984.800 kWh	30.760.000 kWh
Energy consumption in rheostatic mode over 40 years	53.782.400 kWh	69.300.000 kWh
Distance travelled per year	120.000 km	
Track distance (for energy calculation)	35,42 km	
Operation time	365 days and 12,64 h/day, over 40 years	

The PCR for Rolling Stock (PCR 2009:05) stipulates that for the electricity consumed during the downstream module, the impacts of the production of electricity must be calculated using the specific data of the electricity as produced or purchased when possible.

The electricity consumption of the vehicle is considered to be 100% renewable energy since TMB has 100% renewable energy certified by the CNMC with Guarantee of Origin. For the origin of the 2021 renewable sources data from Red Eléctrica Española was used taking into account only the renewable origins.

## Noise emissions

	Unit	Exterior dB(A)	Interior dB(A)
Stationary noise	LpAeq	57	64
Acceleration	LpA <sub>fmax</sub>	79	73
Constant speed noise 30 km/h	LpAeq, Tp	70	-
Constant speed noise 50 km/h	LpAeq, Tp	76	-
Constant speed noise 80 km/h	LpAeq, Tp	82	68



The noise levels for Barcelona Metro S7000 were measured in accordance with ISO 3095:2013 & ISO 3381:2005

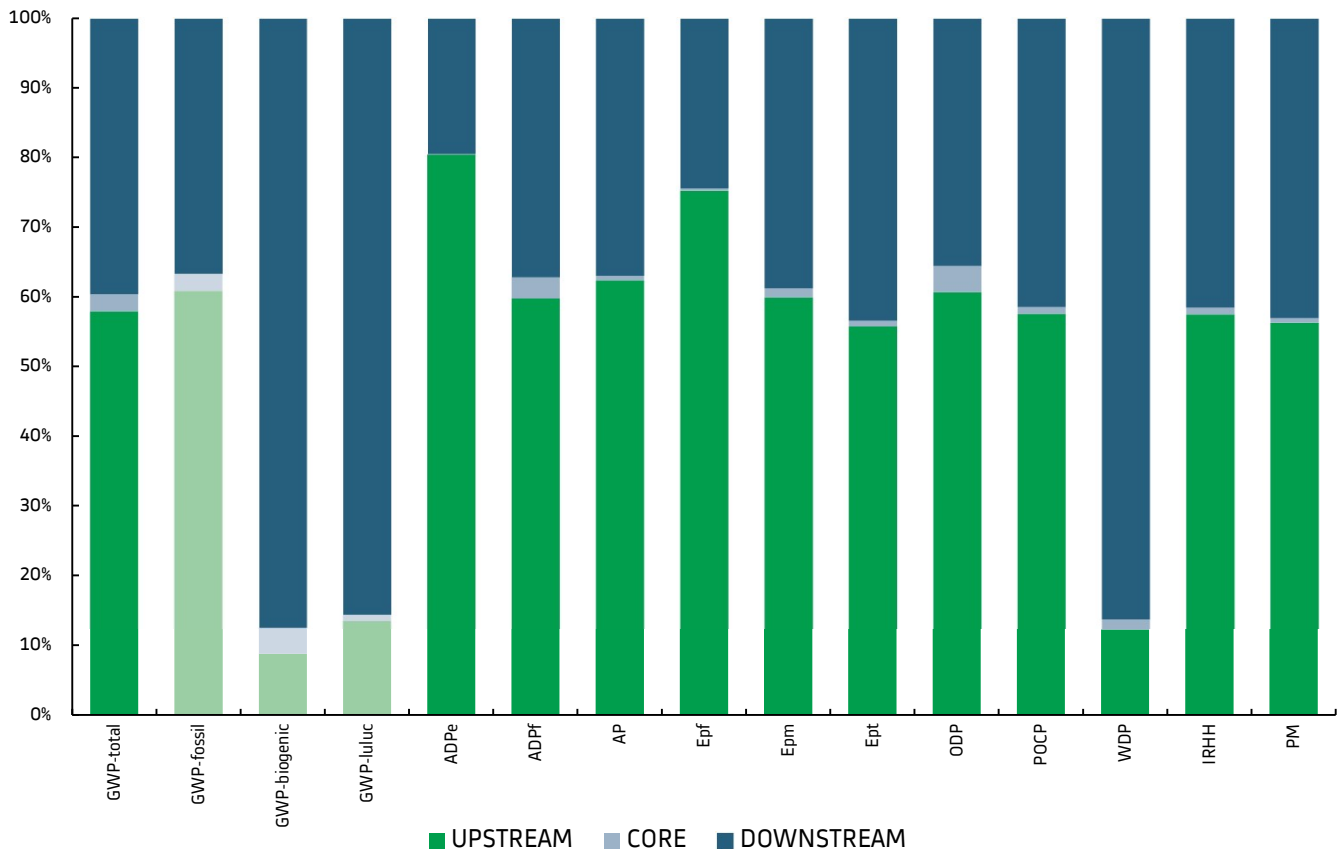
# Environmental performance

## The relative contribution from each phase of the life cycle of Barcelona Metro S7000: 389 passenger & regenerative mode

### Contribution of each phase to the environmental impacts

For most indicators, the upstream and downstream have the highest contributions to the environmental impacts.

The GWP-total for the whole life cycle of the metro is 4.254.157 kg CO2 eq; the upstream and downstream contributions to this impact are 58% and 40% respectively.



### Configuration

Life cycle description information and environmental performance results published in this EPD correspond to the one of the design configurations developed by Alstom. To know the performance associated to other possible configurations of the solution, please contact Alstom.



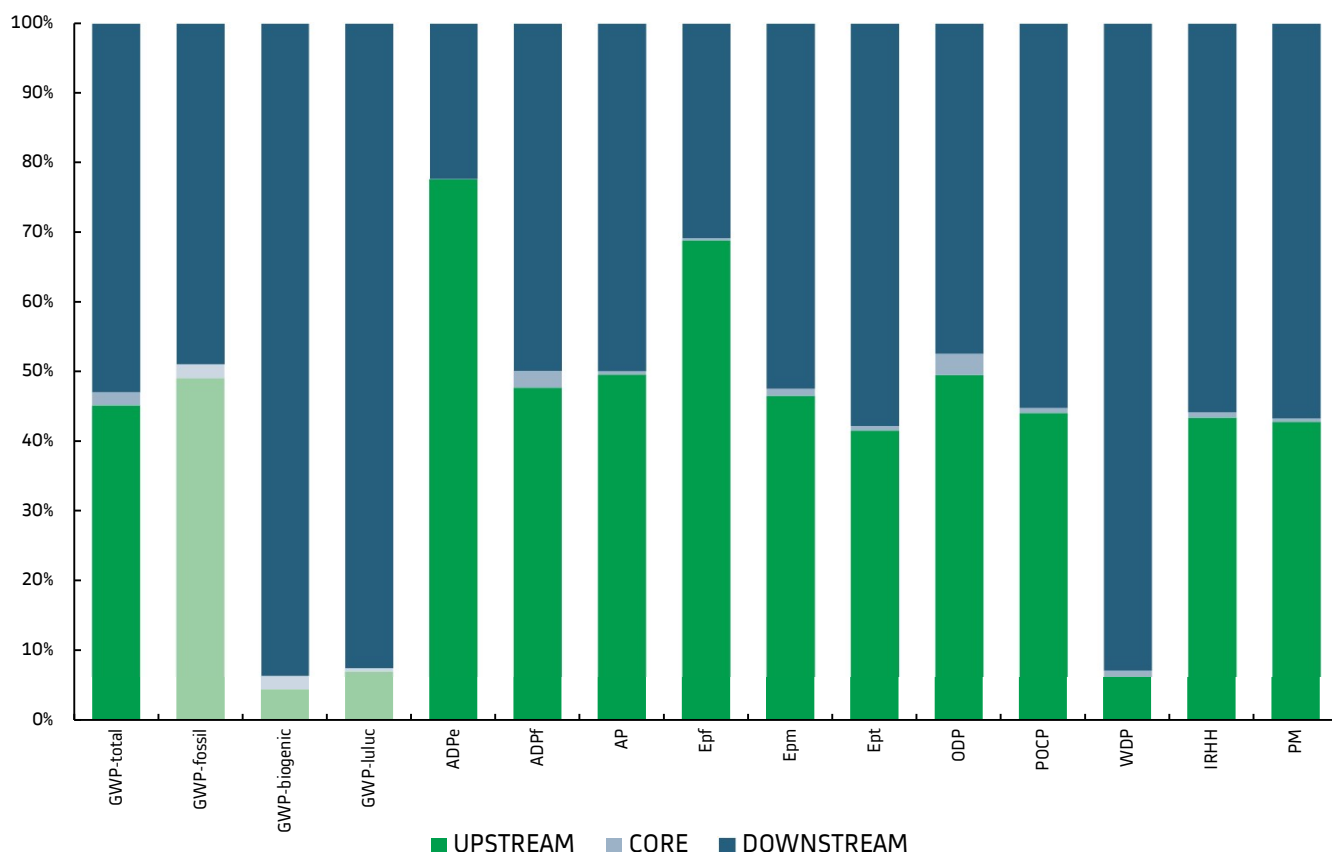
## The relative contribution from each phase of the life cycle of Barcelona Metro S7000: 389 passenger & rheostatic mode

### Contribution of each phase to the environmental impacts

This scenario has the highest GWP-total per functional unit

For most indicators, the upstream and downstream have the highest contributions to the environmental impacts.

The GWP-total for the whole life cycle of the metro is 5.459.496 kg CO2 eq; the upstream and downstream contributions to this impact are 45% and 53% respectively.



### Configuration

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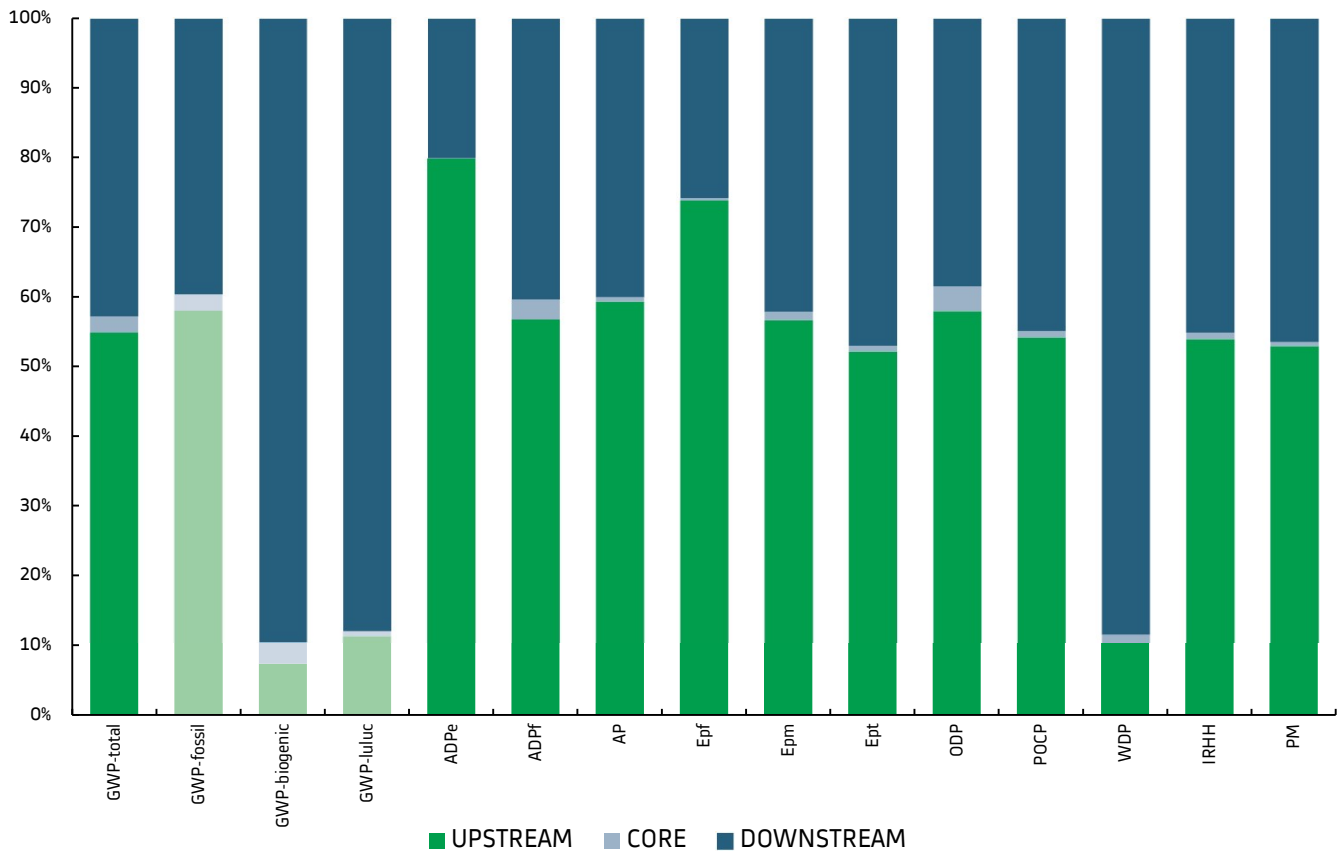
# The relative contribution from each phase of the life cycle of Barcelona Metro S7000: 953 passenger & regenerative mode

## Contribution of each phase to the environmental impacts

This scenario has the lowest GWP-total per functional unit

For most indicators, the upstream and downstream have the highest contributions to the environmental impacts.

The GWP-total for the whole life cycle of the metro is 4.495.881 kg CO2 eq; the upstream and downstream contributions to this impact are 55% and 43% respectively.



## Configuration

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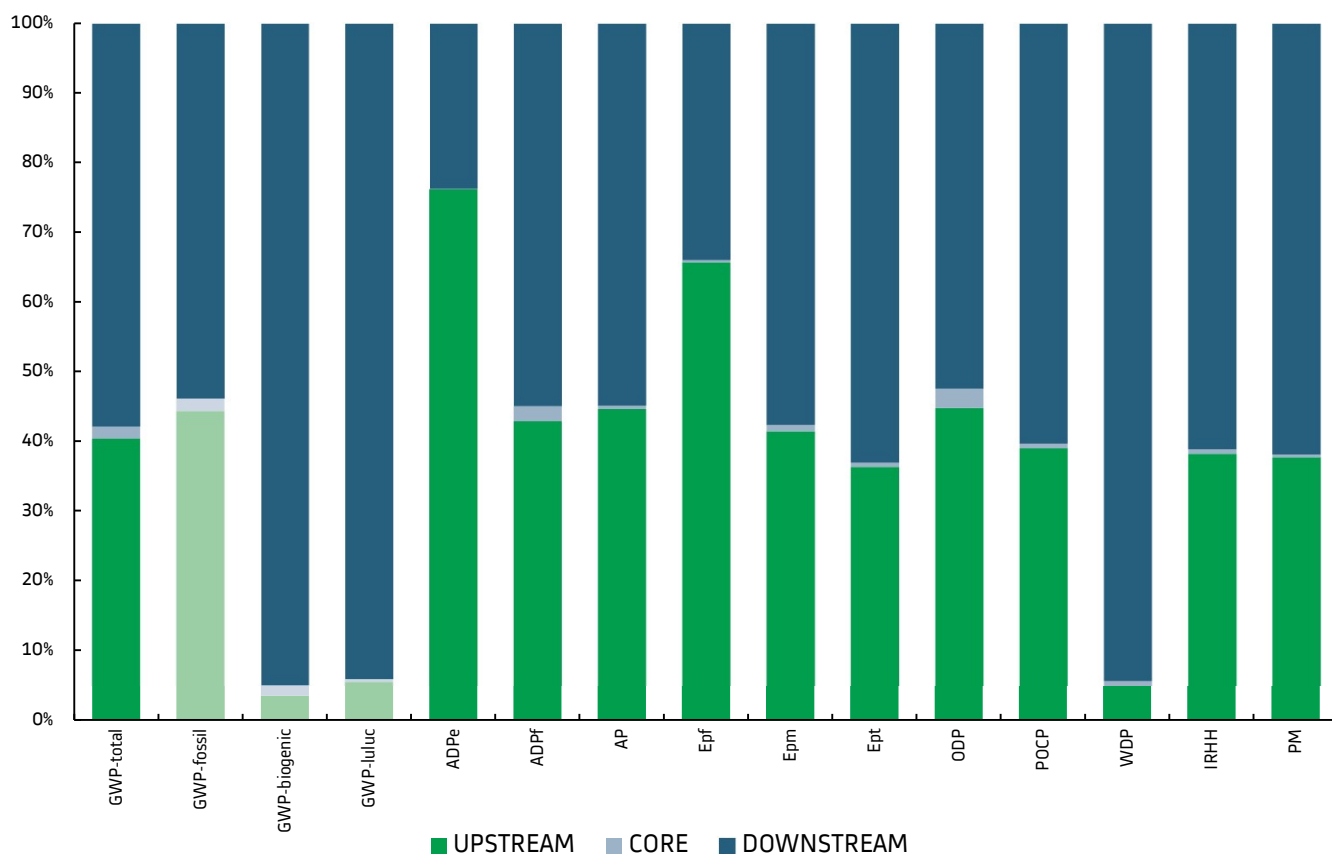


## The relative contribution from each phase of the life cycle of Barcelona Metro S7000: 953 passenger & rheostatic mode

### Contribution of each phase to the environmental impacts

For most indicators, the upstream and downstream have the highest contributions to the environmental impacts.

The GWP-total for the whole life cycle of the metro is 6.108.994 kg CO2 eq; the upstream and downstream contributions to this impact are 40% and 58% respectively.



### Configuration

Life cycle description information and environmental performance results published in this EPD correspond to the one of the design configurations developed by Alstom. To know the performance associated to other possible configurations of the solution, please contact Alstom.



Environmental impacts (indicator per functional unit) <i>Passenger capacity: 389</i>	Unit	Upstream	Core	Downstream		TOTAL	
				REGENERATIVE	RHEOSTATIC	REGENERATIVE	RHEOSTATIC
				Global warming potential (GWP) - Total	kg CO <sub>2</sub> eq. /pass.km	<b>1,32E-03</b>	<b>5,60E-05</b>
Global warming potential (GWP) - Fossil	kg CO <sub>2</sub> eq. /pass.km	1,31E-03	5,27E-05	7,88E-04	1,31E-03	<b>2,15E-03</b>	<b>2,67E-03</b>
Global warming potential (GWP) - Biogenic	kg CO <sub>2</sub> eq. /pass.km	6,42E-06	2,81E-06	6,40E-05	1,36E-04	<b>7,32E-05</b>	<b>1,45E-04</b>
Global warming potential (GWP) - Land use and land transformation	kg CO <sub>2</sub> eq. /pass.km	7,76E-06	5,03E-07	4,88E-05	1,03E-04	<b>5,71E-05</b>	<b>1,11E-04</b>
Abiotic depletion potential for minerals and metals (non-fossil resources) (ADPe)	kg Sb eq. /pass.km	4,07E-07	2,96E-10	9,85E-08	1,17E-07	<b>5,06E-07</b>	<b>5,24E-07</b>
Abiotic depletion potential for fossil resources (APDf)	MJ /pass.km	1,66E-02	8,45E-04	1,03E-02	1,74E-02	<b>2,78E-02</b>	<b>3,49E-02</b>
Acidification potential (AP)	kg H+ eq. /pass.km	1,07E-05	1,14E-07	6,33E-06	1,08E-05	<b>1,72E-05</b>	<b>2,16E-05</b>
Eutrophication potential, aquatic freshwater (EPf)	kg P eq. /pass.km	2,09E-07	9,95E-10	6,77E-08	9,35E-08	<b>2,78E-07</b>	<b>3,04E-07</b>
Eutrophication potential, aquatic marine (EPm)	kg N eq. /pass.km	1,78E-06	3,85E-08	1,15E-06	2,01E-06	<b>2,96E-06</b>	<b>3,83E-06</b>
Eutrophication potential, terrestrial (EPt)	mol N eq. /pass.km	1,88E-05	2,98E-07	1,46E-05	2,62E-05	<b>3,37E-05</b>	<b>4,53E-05</b>
Ozone depletion potential (ODP)	kg CFC 11 eq. /pass. Km	1,23E-10	7,62E-12	7,19E-11	1,18E-10	<b>2,02E-10</b>	<b>2,48E-10</b>
Photochemical ozone creation potential (POCP)	kg NMVOC eq. /pass. km	5,25E-06	8,86E-08	3,77E-06	6,60E-06	<b>9,11E-06</b>	<b>1,19E-05</b>
Water deprivation potential (WDP)	m <sup>3</sup> eq. /pass.km	3,62E-04	4,75E-05	2,55E-03	5,38E-03	<b>2,96E-03</b>	<b>5,79E-03</b>
Ionising Radiation – Human Health	kgU235 eq. /pass.km	6,97E-05	1,19E-06	5,02E-05	8,99E-05	<b>1,21E-04</b>	<b>1,61E-04</b>
Particulate Matter (PM)	Disease Incidence /pass.km	8,06E-11	8,74E-13	6,15E-11	1,07E-10	<b>1,43E-10</b>	<b>1,89E-10</b>

Environmental impacts (indicator per functional unit) <i>Passenger capacity: 953</i>	Unit	Upstream	Core	Downstream		TOTAL	
				REGENERATIVE	RHEOSTATIC	REGENERATIVE	RHEOSTATIC
				Global warming potential (GWP) - Total	kg CO <sub>2</sub> eq. /pass.km	<b>5,40E-04</b>	<b>2,29E-05</b>
Global warming potential (GWP) - Fossil	kg CO <sub>2</sub> eq. /pass.km	5,34E-04	2,15E-05	3,64E-04	6,48E-04	<b>9,19E-04</b>	<b>1,20E-03</b>
Global warming potential (GWP) - Biogenic	kg CO <sub>2</sub> eq. /pass.km	2,62E-06	1,15E-06	3,20E-05	7,13E-05	<b>3,58E-05</b>	<b>7,51E-05</b>
Global warming potential (GWP) - Land use and land transformation	kg CO <sub>2</sub> eq. /pass.km	3,17E-06	2,05E-07	2,44E-05	5,39E-05	<b>2,77E-05</b>	<b>5,73E-05</b>
Abiotic depletion potential for minerals and metals (non-fossil resources) (ADPe)	kg Sb eq. /pass.km	1,66E-07	1,21E-10	4,17E-08	5,16E-08	<b>2,08E-07</b>	<b>2,18E-07</b>
Abiotic depletion potential for fossil resources (APDf)	MJ /pass.km	6,77E-03	3,45E-04	4,80E-03	8,67E-03	<b>1,19E-02</b>	<b>1,58E-02</b>
Acidification potential (AP)	kg H+ eq. /pass.km	4,38E-06	4,65E-08	2,95E-06	5,38E-06	<b>7,38E-06</b>	<b>9,81E-06</b>
Eutrophication potential, aquatic freshwater (EPf)	kg P eq. /pass.km	8,53E-08	4,06E-10	2,98E-08	4,39E-08	<b>1,16E-07</b>	<b>1,30E-07</b>
Eutrophication potential, aquatic marine (EPm)	kg N eq. /pass.km	7,27E-07	1,57E-08	5,39E-07	1,01E-06	<b>1,28E-06</b>	<b>1,76E-06</b>
Eutrophication potential, terrestrial (EPt)	mol N eq. /pass.km	7,67E-06	1,21E-07	6,90E-06	1,33E-05	<b>1,47E-05</b>	<b>2,11E-05</b>
Ozone depletion potential (ODP)	kg CFC 11 eq. /pass. Km	5,00E-11	3,11E-12	3,31E-11	5,85E-11	<b>8,63E-11</b>	<b>1,12E-10</b>
Photochemical ozone creation potential (POCP)	kg NMVOC eq. /pass. km	2,14E-06	3,62E-08	1,77E-06	3,31E-06	<b>3,95E-06</b>	<b>5,49E-06</b>
Water deprivation potential (WDP)	m <sup>3</sup> eq. /pass.km	1,48E-04	1,94E-05	1,27E-03	2,82E-03	<b>1,44E-03</b>	<b>2,99E-03</b>
Ionising Radiation – Human Health	kgU235 eq. /pass.km	2,84E-05	4,84E-07	2,37E-05	4,54E-05	<b>5,27E-05</b>	<b>7,44E-05</b>
Particulate Matter (PM)	Disease Incidence /pass.km	3,29E-11	3,57E-13	2,88E-11	5,39E-11	<b>6,21E-11</b>	<b>8,71E-11</b>



Use of resources		Unit	Upstream	Core	Downstream		TOTAL	
<i>Passenger capacity: 389</i>					REGENERATIVE	RHEOSTATIC	REGENERATIVE	RHEOSTATIC
<b>RENEWABLE RESOURCES</b>								
Primary energy resources	Use as energy carrier	MJ, net calorific value /pass. km	2,79E-03	5,60E-04	5,54E-02	1,19E-01	<b>5,88E-02</b>	<b>1,22E-01</b>
	Used as raw materials	MJ, net calorific value /pass. km	4,16E-09	0,00E+00	0,00E+00	0,00E+00	<b>4,16E-09</b>	<b>4,16E-09</b>
	<b>TOTAL</b>	<b>MJ, net calorific value /pass. km</b>	<b>2,79E-03</b>	<b>5,60E-04</b>	<b>5,54E-02</b>	<b>1,19E-01</b>	<b>5,88E-02</b>	<b>1,22E-01</b>
<b>NON-RENEWABLE RESOURCES</b>								
Primary energy resources	Use as energy carrier	MJ, net calorific value /pass. km	1,65E-02	8,45E-04	1,03E-02	1,74E-02	<b>2,77E-02</b>	<b>3,48E-02</b>
	Used as raw materials	MJ, net calorific value /pass. km	8,65E-05	0,00E+00	0,00E+00	0,00E+00	<b>8,65E-05</b>	<b>8,65E-05</b>
	<b>TOTAL</b>	<b>MJ, net calorific value /pass. km</b>	<b>1,66E-02</b>	<b>8,45E-04</b>	<b>1,03E-02</b>	<b>1,74E-02</b>	<b>2,78E-02</b>	<b>3,49E-02</b>

Use of resources		Unit	Upstream	Core	Downstream		TOTAL	
<i>Passenger capacity: 953</i>					REGENERATIVE	RHEOSTATIC	REGENERATIVE	RHEOSTATIC
<b>RENEWABLE RESOURCES</b>								
Primary energy resources	Use as energy carrier	MJ, net calorific value /pass. km	1,14E-03	2,29E-04	2,78E-02	6,23E-02	<b>2,92E-02</b>	<b>6,36E-02</b>
	Used as raw materials	MJ, net calorific value /pass. km	1,70E-09	0,00E+00	0,00E+00	0,00E+00	<b>1,70E-09</b>	<b>1,70E-09</b>
	<b>TOTAL</b>	<b>MJ, net calorific value /pass. km</b>	<b>1,14E-03</b>	<b>2,29E-04</b>	<b>2,78E-02</b>	<b>6,23E-02</b>	<b>2,92E-02</b>	<b>6,36E-02</b>
<b>NON-RENEWABLE RESOURCES</b>								
Primary energy resources	Use as energy carrier	MJ, net calorific value /pass. km	6,74E-03	3,45E-04	4,80E-03	8,67E-03	<b>1,19E-02</b>	<b>1,58E-02</b>
	Used as raw materials	MJ, net calorific value /pass. km	3,53E-05	0,00E+00	0,00E+00	0,00E+00	<b>3,53E-05</b>	<b>3,53E-05</b>
	<b>TOTAL</b>	<b>MJ, net calorific value /pass. km</b>	<b>6,78E-03</b>	<b>3,45E-04</b>	<b>4,80E-03</b>	<b>8,67E-03</b>	<b>1,19E-02</b>	<b>1,58E-02</b>



### Global warming potential

These indicators calculate the contribution to global warming of the planet by the emission of greenhouse gases. GWP is expressed as: GWP-fossil, GWP-biogenic, GWP-land use and land use change (luluc), and GWP-Total (the sum of the other three GWP indicators).

**The result is expressed in kg CO2 equivalents.**

### Acidification potential

This indicator calculates the potential atmospheric acidification caused by the emission of gas with an acidifying effect.

**The result is expressed in kg SO2 equivalents.**

### Ionizing radiation – human health

This indicator represents the emissions of radionuclides with damage to human health and ecosystems (generally linked to use of nuclear power in an electricity mix).

**The result is expressed in kg U235 equivalents.**

### Eutrophication potential

This indicator calculates the eutrophication potential of water caused by the emission of specific substances (discharge of phosphoric, nitrogenous and organic matter).

**The result is expressed in kg phosphate equivalents.**

### Depletion of abiotic resources-elements\*

This indicator calculates the depletion of non-fossil resources, i.e., mineral and metallic resources.

**The result is expressed in kg Sb equivalents.**

### Emission of ozone-depleting gases

This indicator calculates the contribution made by the discharge of specific gases responsible for ozone layer depletion.

**The result is expressed in kg CFC-11 equivalents.**

### Photochemical ozone creation potential

This indicator calculates the potential of certain gases (NOx, CO, VOCs, etc.) to create ozone in the troposphere under the effect of solar radiation.

**The result is expressed in kg ethylene equivalents.**

### Depletion of abiotic resources-fossil fuels\*

This indicator calculates the depletion of fossil energetic resources (gas, coal, etc.).

**The result is expressed in MJ.**

### Water deprivation potential\*

The indicator represents the potential to deprive human or ecosystem when consuming water in a considered area, considering both availability and demand.

**The result is expressed in m3 equivalent deprived.**

### Particulate matter

Health impact of emissions of small particles and liquid droplets (e.g., organic chemicals, soil or dust particles)

**The result is expressed in disease incidence.**

\* The results of this environmental impact indicator shall be used with care as the uncertainties of the results are high and as there is limited experience with the indicator.

# Programme information

This Environmental Product Declaration (EPD) is based on a product Life-Cycle Assessment according to ISO 14040:2006/ISO 14044:2006 and is compliant with the requirements set in ISO 14025:2006. An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at [www.environdec.com](http://www.environdec.com). Alstom, owner of the EPD, has the sole ownership, liability and responsibility of the EPD.

**Product category rules (PCR):** Rolling stock, PCR 2009:05, version 3.04, UN CPC 495

## PCR review was conducted by:

The Technical Committee of the International EPD® System. Chair: Adriana del Borghi.  
The PCR review panel may be contacted via [info@environdec.com](mailto:info@environdec.com).

## Independent verification of the declaration and data, according to ISO 14025:2006:

EPD Process Certification (internal)

EPD Verification (external)

<b>Third party verifier</b>	Tecnalia R&I Certificacion, SL Auditor: Eva Larzabal Aperribay <a href="mailto:info@tecnali-certificacion.com">info@tecnali-certificacion.com</a> Accredited by: ENAC nº125/C-PR283 accreditation.	<b>Approved by</b>	The International EPD® System  EPD®s within the same product category but from different programs may not be comparable.
<b>Programme</b>	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden <a href="http://www.environdec.com">www.environdec.com</a>	<b>EPD owner</b>	Alstom 48, rue Albert Dhalenne 93482 Saint-Ouen, Cedex France
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**Geographical scope:** Spain

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## VERIFICATION STATEMENT CERTIFICATE CERTIFICADO DE DECLARACIÓN DE VERIFICACIÓN

*Certificate No. / Certificado nº: EPD08701*

TECNALIA R&I CERTIFICACION S.L., confirms that independent third-party verification has been conducted of the Environmental Product Declaration (EPD) on behalf of:

TECNALIA R&I CERTIFICACION S.L., confirma que se ha realizado verificación de tercera parte independiente de la Declaración Ambiental de Producto (DAP) en nombre de:

**ALSTOM SA**  
**48, rue Albert Dhalenne**  
**93482 Saint-Ouen - FRANCE**

for the following product(s):  
*para el siguiente(s) producto(s):*

**Barcelona Metro S7000 rolling stock.**  
**Barcelona Metro S7000 vehículo ferroviario.**

with registration number **S-P-08593** in the International EPD® System ([www.environdec.com](http://www.environdec.com)).  
con número de registro **S-P-08593** en el Sistema Internacional EPD® ([www.environdec.com](http://www.environdec.com)).

it's in conformity with:  
*es conforme con:*

- **ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations.**
- **General Programme Instructions for the International EPD® System v.3.01.**
- **PCR 2009:05. Rolling stock v3.04.**
- **UN CPC 4951 Railway locomotives and locomotive tenders.**



Carlos Nazabal Alsua  
Manager

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Serial Nº / Nº Serie:	EPD0870100-E

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