CORADIA POLYVALENT ENVIRONMENTAL PRODUCT DECLARATION





ECO-MOBILITY PARTNER

ENVIRONMENTAL PRODUCT DECLARATION





Jean-Baptiste Eyméoud SENIOR VICE PRESIDENT ALSTOM FRANCE

ALSTOM, AT THE FOREFRONT **OF SUSTAINABLE MOBILITY**

For Alstom, transport systems must be fluid, respectful of the environment, safe, connected and accessible. The company works to promote the image of rail transport as the most sustainable mode of motorised transport. In recent years, the innovations developed and implemented by Alstom have enabled us to reduce the energy consumption of our solutions as well as their environmental impact.

More than 10 years ago, Alstom systematically introduced eco-design into its engineering procedures for that very purpose. It has given rise to environmental dashboards that focus on fundamental topics at the start of the development phase, the quantification of the environmental impact (life cycle assessments) and more ecological solutions. Today, more than 100 experts (eco-designers, experts for acoustic and energy-saving materials) endeavour to ensure the environmental performance of each solution.

THE CORADIA POLYVALENT SOLUTION, THE MOST ECOLOGICAL TRAIN OF ITS GENERATION

Coradia Polyvalent is the fruit of the work of all our teams. This train meets the challenges of regional and mainline transportation, including increased traffic, the renewal of ageing rolling stock and intermodality, while at the same time respecting the environment. I am proud to present this product environmental Declaration to you here.

ENVIRONMENTAL PRODUCT DECLARATION

SHARING OUR ENVIRONMENTAL PERFORMANCE

Through its ecodesign approach, Alstom integrates the environmental dimension into the design of its solutions in order to reduce their environmental impact. The company sets out to limit energy costs and is committed to reducing the carbon footprint associated with transportation.

This Product Environmental Declaration is a completely transparent means of communicating the environmental performance of the Coradia Polyvalent range of rolling stock.

PROMOTER **OF SUSTAINABLE** MOBILITY

Alstom, a major player in ecological transport, develops and offers a range of systems, equipment and services for the rail sector. As well as taking the life cycle into account, from concept to recycling including maintenance and energy consumption, we offer innovative solutions that respect the environment and meet the mobility needs according to a socially responsible model. Sustainable development is at the heart of our strategy. Our approach is guided by firm beliefs when it comes to rail transport: an efficient mode of transport in terms of energy, limiting pollution and greenhouse gas emissions while contributing significant benefits in terms of urban congestion and the optimisation of space and safety.

This family of trains is a powerful, ecological and economic offering, suitable for periurban, regional or intercity transport. This document has been compiled in accordance with ISO 14025:2006 and the life-cycle analysis in accordance with the principles of ISO 14040:2006 and the product category rules for rolling stock (UN CPC 495 PCR 2.0 2009:05 of 2013/02/04).



Alstom has defined its objectives for the energy efficiency of its **solutions** and **operations**. The company undertakes to reduce the energy consumption of its transport solutions by 20% by 2020, compared to the level of 2014. In addition, Alstom undertakes to reduce the energy intensity of its operations by 10% between now and 2020.



OUR COMMITMENTS TO SUSTAINABLE RAILWAY SYSTEMS

Our ecodesign policy aims to design and supply complete, efficient and sustainable rail systems while improving the environmental performance of our products and services throughout their life cycle. Objectives, action plans and indicators are defined for each product range to push our priorities forward. For each project, the collaboration with our suppliers and the periodic progress reviews during the development process enable us to meet regulatory requirements, satisfy client expectations and achieve our environmental objectives. Each employee involved in the design is trained in the challenges and benefits of ecodesign. Subsequently, each product is manufactured in accordance with a system of environmental management.



A REDUCED CARBON FOOTPRINT

Rail transport is the most sustainable form of motorised transport. It is one of the most efficient forms of transport in terms of energy, and also one which emits less CO2. This excellent performance reflects the efficiency of rail transport and demonstrates the degree to which efficient electric traction capable of recovering the energy generated during braking can prove advantageous. The pursuit of the development of new sources of clean and renewable energies will allow the rail sector to continue to improve its environmental performance.

170qr

CO2 emissions per passenger per km¹





90qr



ENVIRONMENTAL PRODUCT DECLARATION

TECHNICAL DESCRIPTION OF THE RANGE



The Coradia Polyvalent range is the new solution from Alstom fully compliant to TSI (Technical Specification for Interoperability) for the peri-urban, regional and mainline train market. This new generation of trains is modular and accessible. Alstom developed the Coradia Polyvalent "around" the passenger, while trying to take account of all profiles: improved access thanks to a low floor (corridor without steps), efficient information systems, and generous space for luggage, etc.

CORADIA POLYVALENT, A FAMILY OF PRODUCTS

The models in the **Coradia Polyvalent** range are designed to suit peri-urban, regional, intercity and cross-border lines, both in France and abroad. They represent a solution capable of travelling at a maximum speed of 200 km/h to meet the needs of mainlines.





THE CORADIA **POLYVALENT RANGE**

REGIONAL

PERI-URBAIN

INTERCITY

CROSS-BORDER

EXPORT



COMFORT AND MODULARITY

The comfort of the trains is tailored to suit the specific needs of clients, as a function of level of service and required usage. There are more than 100 technical and interior fitting options: sitting and standing room, modification of the number of seats in first class, partitioning of the passenger compartments, number and type of toilet and doors to improve access, etc.

Modularity allows adaptation closer to the crowd.

The number of seats for passengers varies from 160 to 350. Moreover, trains can operate easily in

multiple units to provide capacity of 1,000 seats

(3 long trainsets coupled).

ADAPTABILITY

The Coradia Polyvalent range uses electric motors but there are multiple power modes, allowing the train to travel on all types of networks, electrified or not.



* Dual-mode mission profile example in table page 10

TRAINSET CAPACITY

	PERI-URBAIN	REGIONAL
56m 3 cars		162 L
72m 4 cars	180 🐛 🛛 221 🛉	220 🛓
110m 6 cars	294 💪 351 🛉	354 🖌

POWER DIVERSITY

Electric power supply Voltages 1,5kV, 15 kV, 25kV

Bi-modal power supply* powerpack units (fuel)



DESIGN

Coradia Polyvalent rolling stock is entirely designed and assembled in France, with six of the 12 Alstom sites in France involved in the project: Reichshoffen for design and assembly, Ornans for motors, le Creusot for bogies, Tarbes for traction drives, Villeurbanne and Saint-Ouen for onboard informatics systems.



ENVIRONMENTAL PRODUCT DECLARATION



DESIGNED FOR THE ENVIRONMENT

The Coradia Polyvalent range offers numerous technological innovations to improve energy efficiency, reduce the environmental impact of the materials used, limit noise and substance emissions into the air, water and soil, and forecast the end of life of the material.





of volatile organic components

to limit heat loss

ENVIRONMENTAL PRODUCT DECLARATION

LIFE CYCLE CHARACTERISATION

The first train of Coradia Polyvalent range is the Régiolis. It was designed by Alstom for the SNCF² and French regions, and went into service in April 2014. As a result, a Régiolis configuration representative of the range was selected for the characterisation of the life cycle in accordance with ISO 14040:2006. This characterisation forms the basis for the information presented in this environmental product declaration. This **regional version** has the capacity to serve all French regional lines at a maximum speed of 160 km/h. It is designed to cover 150,000 km per year and have a life cycle of 40 years. The regional version of four cars can transport 220 passengers in the normal load (EN 15663:2009: full tanks and all seats occupied) for "regional" operation. For its electrical power supply, the train has two pantographs, and for diesel power four thermal motor blocks operating as an electricity generating unit. Preventive maintenance includes optimization of spare parts consumption and train availability. Its curb running weight is 152 tonnes, divided up as follows:

EIME® software was used for modelling, as was a database updated in October 2014. The energy mix chosen is a French electric mix (ELCD: 2002).

FUNCTIONAL UNIT

The functional unit allows to present environmental footprint results of this product environmental declaration according to the service provided. That is, to transport one passenger for one kilometer at the regional level of comfort and service offered by the Régiolis.





MASS DISTRIBUTION ACCORDING TO PCR CATEGORIES

ENVIRONMENTAL PERFORMANCE IN FIGURES

FROM MATERIALS...

The materials used in the manufacture of the train and the preventive maintenance items needed for its efficient operation have been inventoried. This inventory is a key element in the process of continuously improving our products. Indeed, it helps to understand the composition of the materials in the train, to optimize the level of recycled and recyclable materials used and to quantify the environmental footprint by analyzing the life cycle alongside other characteristics.

... TO SUBSTANCES

For many years, Alstom has pro-actively undertaken to reduce the presence of hazardous substances in the material and components used for its solutions. Indeed, progressively replacing a Substance of Very High Concern (SVHC) is a means of:

- avoiding its production and the corresponding risks
- avoiding its use in our factories and at our suppliers
- avoiding any leak or emission into the soil or the air breathed by passengers and the operators of rolling stock
- avoiding emissions during incineration when the substance containing it becomes waste
- avoiding additional costs for end-of-life treatment
- permitting a material to be recycled.

Alstom standards relate mainly to the European Registration, Evaluation, Authorisation of Chemical substances (REACh) and the principles adopted by the industry and contained in RISL (Railway Industry Substances List³ - UNIFE-FIF-VDB-ASSIFER).

Elastomers Electric and equipment Fluids Glass Metals Modified or materials Other Polymers TOTAL

Electric and electronic equipement | **11** % Elastomers | 1 % Other | 2 % -Glass | 2 %

Polymers | 4 %

Alstom uses secondary raw materials to limit the impact on the environment and give them a second life. The proportion of recycled materials is higher than 20%.

WEIGHT DISTRIBUTION TABLE

	Train (4 cars)	Maintenance of a dual-mode train (40 years)
	1,581 kg	1,545 kg
electronic	16,716 kg	513 kg
	4,257 kg	43,988 kg
	3,264 kg	202 kg
	115,122 kg	1,688 kg
ganic natural	1,553 kg	25,077 kg
	2,871 kg	11,960 kg
	6,953 kg	355 kg
	152,317 kg	85,328 kg

WEIGHT DISTRUBUTION OF MATERIALS IN TRAIN BY PCR CATEGORY

PAINTING

Sandblasting

Painting

FITTING

Interior fitting

Cabling

TRAIN MANUFACTURE PROCESS

CARBODYSHELL

Welding

Straightening

TRAIN-SET FORMING

Installation

on bogies

Testing

ENVIRONMENTAL PRODUCT DECLARATION

ENVIRONMENTAL MANAGEMENT DURING MANUFACTURE

The Alstom sites involved in the manufacture of the Coradia Polyvalent are ISO 14001:2004 certified to guarantee environmentallyresponsible management and the continuous improvement of our environmental performance.

The impact on the environment from our industrial activities such as energy and water consumption, the management of waste and the emission of volatile organic substances are the focus of continuous improvement programmes based on environmental objectives, indicators and action plans. A quarterly review is carried out at group level, then communicated to all the project and site managers.

ENERGY CONSUMPTION DURING TRAIN ASSEMBLY

The manufacture of a train requires 64.8 MWh of electricity at the Reichshoffen plant and corresponds approximately to the electricity required for six weeks of commercial service.

ENERGY CONSUMPTION DURING **TRAIN OPERATION**

Simulations are carried out on two kinds of route, with three possible modes of operation. The calculations of energy consumption take account of traction, braking and any auxiliary equipment. They include the preconditioning phase, the commercial service phase and the service maintenance phase.

TABLE OF ENERGY CONSUMPTION DURING OPERATION

	Electric mode	Dual-mode	Thermal mode
Route	Lyon-Modane	Paris-Granville	Paris-Granville
Round trip distance	462 km	368 km	368 km
Electric operation part	100%	24.50%	
Thermal operation part		75.50%	100%
Number of round-trip stations	10	18	18
Energy consumption: Electricity and/or fuel* (/km.passenger)	1,72E-02 kWh	5,00E-03 kWh + 6,60E-03 L	8,97E-03 L

EMISSIONS DURING **OPERATING PHASE**

Carbon emissions linked to energy consumption during train operation are directly dependent on the type of power available on the network.

Operation on non-electrified regional lines requires the consumption of liquid fuel. To limit the emission of pollutants by thermal motors, Alstom chooses the most efficient technology. The motors are homologated according to file UIC 624 and meet level IIIB. They therefore comply with the European environmental standards in force.

NOISE EMISSIONS

Aside from respect for the standard and homologation of the Régiolis train according to "Noise" STI 2006/66/EC, design steps are undertaken and innovative technical solutions implemented in order to reduce as much as possible the nuisance caused to the environment, the wellbeing of people living near the stations serviced and passengers by sound and electromagnetic waves. The table below shows the values measured outside the operating train (a Régiolis) 7.5 m from the centre of the track and at a height of 1.2 m.

A RECYCLABLE TRAIN

Alstom is pro-active in the choice of design and anticipates the end of life of products while favouring recyclable materials. A recycling manual containing instructions and recommendations on how to dispose of the train at the end of its life is available for the client. In accordance with ISO 22628:2002, the level of recyclability of the train is 93.3% and the recoverability rate 98.5%.

3.00E+01 2.50E+01 2.00E+01 1.50E+01 1.00E+01 0.50E+00 0.00E+00

Hydrocarbon em PM emissions (g CO emissions (g NO_x emission (g

Parking Starting acceler Speed - 80 km/ Speed - 160 km

* According to the emission factors from the methodology guide from the Ministry of Ecology, Sustainable Development and Energy: CO2 information for transport services (Oct 2012). ^s Régiolis regional train with 4 carriages

CARBON EMISSIONS gco2eq /km.passenger 4

TABLE OF MOTOR THERMAL EMISSIONS

	Dual-mode	Thermal mode
ssions (g/km.passenger)	1.36E-03	1.75E-03
)/km. passenger)	4.08E-04	5.24E-04
/km.passenger)	1.09E-03	1.40E-03
J/km.passenger)	4.87E-02	6.26E-02

TABLE OF ACOUSTIC MEASUREMENTS

	Measureme	ents taken⁵	Regulators thresholds		
	Electric Thermal mode mode		Electric mode	Thermal mode	
	54 dBA	61 dBA	< 68 dBA	< 73 dBA	
ration	72 dBA	78 dBA	< 82 dBA	< 83 dBA	
′h	79 dBA	80 dBA	< 81 dBA	< 82 dBA	
ı/h	88 dBA	88 dBA	< 90 dBA	< 91 dBA	

el of recyclability of the train	Recoverability rate of the train
93.3%	98.5%

FOCUS ON INDICATORS

RESOURCES AND WASTE

			Upstream module	Core module	Downstrea	am module	
	Flow category for the functional unit	Total	Raw materials	Production and delivery	Operation and maintenance	End of life	
	RENEWABLE RESOURCES						
	Material resources (kg/km.passenger)	9.36E-05	1.04E-06	9.25E-05	9.70E-08	0.00E+00	
	Water for the production of materials	7.03E-05	2.86E-07	6.99E-05	9.48E-08	0.00E+00	
	• Wood	1.76E-05	6.15E-07	1.70E-05	2.13E-09	0.00E+00	
	Paper and cardboard	2.39E-06	1.38E-08	2.38E-06	5.26E-11	0.00E+00	
	Miscellaneous	3.30E-06	1.26E-07	3.17E-06	0.00E+00	0.00E+00	
	Energy resources (MJ/km.passenger)	1.06E-02	3.93E-05	5.42E-05	1.05E-02	1.12E-06	
	• Hydropower	9.64E-03	1.55E-05	3.01E-05	9.59E-03	9.93E-07	
	Solar energy	6.11E-04	1.23E-06	1.20E-06	6.08E-04	7.69E-08	
	Wind power	2.71E-04	9.48E-07	1.54E-06	2.69E-04	3.22E-08	
ш	Miscellaneous	7.28E-05	2.16E-05	2.13E-05	2.98E-05	1.63E-08	
MOD	NON-RENEWABLE RESOURCES						
CTRIC	Material resources (kg/km.passenger)	1.70E-04	1.14E-04	1.45E-05	4.21E-05	0.00E+00	
ELE	• Metals	1.26E-04	9.59E-05	8.09E-06	2.21E-05	0.00E+00	
	 Other (fibres, gas and organic and inorganic chemicals) 	1.82E-05	8.49E-07	3.36E-06	1.40E-05	0.00E+00	
	• Polymers	1.21E-05	9.23E-06	1.86E-06	1.01E-06	0.00E+00	
	Miscellaneous	1.39E-05	7.71E-06	1.20E-06	4.95E-06	0.00E+00	
	Energy resources (MJ/km.passenger)	2.27E-01	1.06E-02	1.94E-03	2.15E-01	5.90E-05	
	• Uranium	1.93E-01	3.29E-03	7.33E-04	1.89E-01	3.11E-05	
	• Carbon	1.38E-02	2.45E-03	6.90E-05	1.13E-02	6.95E-06	
	Natural gas	1.30E-02	2.10E-03	9.10E-04	9.97E-03	1.16E-05	
	Miscellaneous	7.44E-03	2.73E-03	2.32E-04	4.47E-03	9.32E-06	
	Water (global inventory) (kg/km.passenger)	4.80E-02	1.69E-02	5.65E-04	3.05E-02	9.17E-06	
	Waste (kg/km.passenger)	6.62E-03	1.87E-03	1.01E-04	4.63E-03	1.63E-05	

Flow category for the functional unit	Total				
RENEWABLE RESOURCES					
Material resources (kg/km.passenger)	9.37E-05				
Water for the production of materials	7.03E-05				
• Wood	1.76E-05				
Paper and cardboard	2.49E-06				
Miscellaneous	3.30E-06				
Energy resources (MJ/km.passenger)	3.16E-03				
- Hydropower	2.84E-03				
Solar energy	1.80E-04				
- Wind power	8.15E-05				
Miscellaneous	6.51E-05				
NON-RENEWABLE RESOURCES					
Material resources (kg/km.passenger)	5.73E-03				
Material resources (kg/km.passenger) Fluids 	5.73E-03 5.56E-03				
Material resources (kg/km.passenger) • Fluids • Metals	5.73E-03 5.56E-03 1.30E-04				
Material resources (kg/km.passenger) • Fluids • Metals • Other (fibres, gas and organic and inorganic chemicals)	5.73E-03 5.56E-03 1.30E-04 1.82E-05				
Material resources (kg/km.passenger) • Fluids • Metals • Other (fibres, gas and organic and inorganic chemicals) • Miscellaneous	5.73E-03 5.56E-03 1.30E-04 1.82E-05 1.93E-05				
Material resources (kg/km.passenger) . . Fluids . . Metals . . Other (fibres, gas and organic and inorganic chemicals) . . Miscellaneous . Energy resources (MJ/km.passenger) .	5.73E-03 5.56E-03 1.30E-04 1.82E-05 1.93E-05 3.33E-01				
Material resources (kg/km.passenger) . . Fluids . . Metals . . Other (fibres, gas and organic and inorganic chemicals) . . Miscellaneous . Energy resources (MJ/km.passenger) . . Uranium .	5.73E-03 5.56E-03 1.30E-04 1.82E-05 1.93E-05 3.33E-01 2.51E-01				
Material resources (kg/km.passenger) . . Fluids . . Metals . . Other (fibres, gas and organic and inorganic chemicals) . . Miscellaneous . Energy resources (MJ/km.passenger) . . Uranium . . Carbon .	5.73E-03 5.56E-03 1.30E-04 1.82E-05 1.93E-05 3.33E-01 2.51E-01 6.06E-02				
Material resources (kg/km.passenger) . . Fluids . . Metals . . Other (fibres, gas and organic and inorganic chemicals) . . Miscellaneous . Energy resources (MJ/km.passenger) . . Uranium . . Carbon . . Natural gas .	5.73E-03 5.56E-03 1.30E-04 1.82E-05 1.93E-05 3.33E-01 2.51E-01 6.06E-02 1.33E-02				
Material resources (kg/km.passenger) . . Fluids . . Metals . . Other (fibres, gas and organic and inorganic chemicals) . . Miscellaneous . Energy resources (MJ/km.passenger) . . Uranium . . Carbon . . Natural gas . . Miscellaneous .	5.73E-03 5.56E-03 1.30E-04 1.82E-05 1.93E-05 3.33E-01 2.51E-01 6.06E-02 1.33E-02 8.13E-03				
Material resources (kg/km.passenger) Fluids Metals Other (fibres, gas and organic and inorganic chemicals) Miscellaneous Energy resources (MJ/km.passenger) Uranium Carbon Natural gas Miscellaneous Water (global inventory) (kg/km.passenger)	5.73E-03 5.56E-03 1.30E-04 1.82E-05 1.93E-05 3.33E-01 2.51E-01 6.06E-02 1.33E-02 8.13E-03 5.24E-02				

DUAL-MODE

Opstream module	Core module	Downstream module	
Raw materials	Production and delivery	Operation and maintenance	End of life
1.04E-06	9.25E-05	1.90E-07	0.00E+00
2.86E-07	6.99E-05	9.48E-08	0.00E+00
6.15E-07	1.70E-05	2.13E-09	0.00E+00
1.38E-08	2.38E-06	9.27E-08	0.00E+00
1.26E-07	3.17E-06	0.00E+00	0.00E+00
3.93E-05	5.42E-05	3.07E-03	1.12E-06
1.55E-05	3.01E-05	2.79E-03	9.93E-07
1.23E-06	1.20E-06	1.77E-04	7.69E-08
9.48E-07	1.54E-06	7.90E-05	3.22E-08
2.16E-05	2.13E-05	2.21E-05	1.63E-08
1.14E-04	1.45E-05	5.60E-03	0.00E+00
2.85E-06	1.20E-06	5.55E-03	0.00E+00
9.59E-05	8.09E-06	2.61E-05	0.00E+00
8.49E-07	3.36E-06	1.40E-05	0.00E+00
1.41E-05	1.86E-06	3.34E-06	0.00E+00
1.06E-02	1.94E-03	3.21E-01	5.90E-05
2.02E-03	2.03E-04	2.49E-01	7.19E-06
3.29E-03	7.33E-04	5.66E-02	3.11E-05
2.10E-03	9.10E-04	1.03E-02	1.16E-05
3.16E-03	9.78E-05	4.86E-03	9.07E-06
1.69E-02	5.65E-04	3.49E-02	9.17E-06
1.87E-03	1.08E-04	3.64E-03	1.63E-05

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RESOURCES AND WASTE

	Flow category for the functional unit		Upstream module	Core module	Downstrea	ım module	
		Total	Raw materials	Production and delivery	Operation and maintenance	End of life	
RENE	NABLE RESOURCES						
Mater	ial resources (kg/km.passenger)	9.37E-05	1.04E-06	9.25E-05	1.90E-07	0.00E+00	
• Wa	ter for the production of materials	7.03E-05	2.86E-07	6.99E-05	9.48E-08	0.00E+00	
• Wo	od	1.76E-05	6.15E-07	1.70E-05	2.13E-09	0.00E+00	
• Pap	er and cardboard	2.49E-06	1.38E-08	2.38E-06	9.27E-08	0.00E+00	
• Mis	cellaneous	3.30E-06	1.26E-07	3.17E-06	0.00E+00	0.00E+00	
Energy	y resources (MJ/km.passenger)	1.19E-04	3.93E-05	5.42E-05	2.46E-05	1.12E-06	
• Hyc	Iropower	5.87E-05	2.14E-05	2.03E-05	1.71E-05	1.46E-08	
• Sola	ar energy	5.21E-05	1.55E-05	3.01E-05	5.51E-06	9.93E-07	
• Wir	nd power	3.57E-06	9.48E-07	1.54E-06	1.05E-06	3.22E-08	
• Mis	cellaneous	4.81E-06	1.47E-06	2.27E-06	9.90E-07	7.86E-08	
NON-I	NON-RENEWABLE RESOURCES						
Mater	ial resources (kg/km.passenger)	7.70E-03	1.14E-04	1.45E-05	7.57E-03	0.00E+00	
• Flui	ds	7.53E-03	2.85E-06	1.20E-06	7.53E-03	0.00E+00	
• Met	tals	1.30E-04	9.59E-05	8.09E-06	2.61E-05	0.00E+00	
• Oth inor	er (fibres, gas and organic and rganic chemicals)	1.82E-05	8.49E-07	3.36E-06	1.40E-05	0.00E+00	
• Mis	cellaneous	1.93E-05	1.41E-05	1.86E-06	3.30E-06	0.00E+00	
Energy	y resources (MJ/km.passenger)	3.63E-01	1.06E-02	1.94E-03	3.51E-01	5.90E-05	
• Ura	nium	3.39E-01	2.02E-03	2.03E-04	3.36E-01	7.19E-06	
• Car	bon	1.30E-02	2.10E-03	9.10E-04	1.00E-02	1.16E-05	
• Nat	ural gas	6.31E-03	3.29E-03	7.33E-04	2.26E-03	3.11E-05	
• Mis	cellaneous	5.15E-03	3.16E-03	9.78E-05	1.88E-03	9.07E-06	
Water	(global inventory) (kg/km.passenger)	5.28E-02	1.69E-02	5.65E-04	3.53E-02	9.17E-06	
Waste	e (kg/km.passenger)	2.54E-03	1.87E-03	1.10E-04	5.38E-04	1.63E-05	

ENVIRONMENTAL IMPACTS

Impact indicator per functional unit (per km and passenger)			Upstream module	Core module	Module dov	vnstream
		Total	Raw materials	Production and delivery	Operation and maintenance	End of life
Acidification Potential (AP)	kg SO _{2 eq}	1.51E-05	4.59E-06	3.80E-07	1.01E-05	9.19E-09
Eutrophication Potential (EP)	kg PO4 ³⁻ eq	1.16E-06	2.25E-07	6.38E-08	8.73E-07	1.69E-09
Global warming Potential (GWP)	kg CO _{2 eq}	3.32E-03	5.83E-04	7.60E-05	2.66E-03	5.04E-06
Ozone Depletion Potential (ODP)	kg CFC ⁻¹¹ $_{eq}$	3.01E-09	4.03E-10	1.35E-11	2.59E-09	5.71E-13
Photochemical Ozone Creation Potential (POCP)	kg _{éthylène eq}	8.51E-07	2.23E-07	2.84E-08	5.99E-07	5.26E-10
		_	_	_	_	_
Acidification Potential (AP)	kg SO _{2 eq}	5.28E-05	4.59E-06	3.80E-07	4.78E-05	9.19E-09
Eutrophication Potential (EP)	kg PO4 ³⁻ eq	7.42E-06	2.25E-07	6.38E-08	7.13E-06	1.69E-09
Global warming Potential (GWP)	kg CO _{2 eq}	2.16E-02	5.83E-04	7.60E-05	2.09E-02	5.04E-06
Ozone Depletion Potential (ODP)	kg CFC ⁻¹¹ eq	1.37E-08	4.03E-10	1.35E-11	1.33E-08	5.71E-13
Photochemical Ozone Creation Potential (POCP)	kg _{éthylène eq}	1.36E-05	2.23E-07	2.84E-08	1.34E-05	5.26E-10
THERMAL MODE						
Acidification Potential (AP)	kg SO _{2 eq}	6.58E-05	4.59E-06	3.80E-07	6.09E-05	9.19E-09
Eutrophication Potential (EP)	kg PO4 ³⁻ eq	9.61E-06	2.25E-07	6.38E-08	9.32E-06	1.69E-09
Global warming Potential (GWP)	kg CO _{2 eq}	2.80E-02	5.83E-04	7.60E-05	2.73E-02	5.04E-06
Ozone Depletion Potential (ODP)	kg CFC ⁻¹¹ eq	1.74E-08	4.03E-10	1.35E-11	1.70E-08	5.71E-13
Photochemical Ozone Creation Potential (POCP)	kg _{éthylène eq}	1.81E-05	2.23E-07	2.84E-08	1.79E-05	5.26E-10

DEFINITIONS

AP, "Acidification Potential"

This indicator calculates the atmospheric acidification caused by the emission of gas with an acidifying effect. The result is expressed in kg equivalent SO2.

EP, "Eutrophication Potential"

This indicator calculates the eutrophication of water caused by the emission of specific substances (discharge of phosphoric, nitrogenous and organic matter). The result is expressed in kg equivalent phosphate.

GWP, "Global Warming Potential"

This indicator calculates the contribution to global warming of the planet by the emission of greenhouse gases. The result is expressed in kg equivalent CO2.

ODP, "Ozone layer Depletion Potential":

This indicator calculates the contribution made by the discharge of 22 specific gases responsible for ozone layer depletion. The result is expressed in kg equivalent CFC-11.

POCP, "Photochemical Ozone Creation Potential"

The potential for creating tropospheric ozone is caused by the discharge of specific gases which have an oxidising action under the effect of solar radiation. This indicator calculates the potential for the creation of photochemical ozone from the emission of about a hundred substances. The result is expressed in kg equivalent ethylene.

Recyclability

Ability of components, materials or both to be removed from the end-of-life flow to be recycled.

Recoverability

Ability of components, materials or both to be removed from the end-of-life flow to be recovered.

INFORMATION ON THE PROGRAMME AND VERIFICATION

Programme	The Interna EPD Intern www.envir
References	General Pro Rapport d'/
Registration number of environmental Declaration	S-P-00755
Published date	2015-10-3
Validity date	2018-10-3
Revision date	2015-11-2
Product category rules	PCR 2009:
Product group classification	UN CPC 49
Reference year for information	2014
Geographic scope	Global

Review of PCR conduct by the International EPD® System Technical Committee. Contact : pcr@environdec.com

Independent verification of the Declaration and data in accordance with ISO 14025:2006: Processes of internal certification
 K External verification

Individual verifier approved by the International EPD® System: Damien PRUNEL, Ecodesign consultant / damien.prunel@fr.bureauveritas.com Verification organisation: BUREAU VERITAS CODDE - 170 rue de Chatagnon - ZI Centr'alp - 38430 Moirans - France Tél +33 (0)4 76 07 36 46 - www.codde.fr

Environmental Product Declarations within the same product category but from different programmes may not be comparable.

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ogramme Instructions of the International EPD® System. Version 2.01. Analyse de Cycle de Vie (ACV) Alstom DID0000633659_D1.

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:05 Rolling Stock. Version 2.0 (2013-02-04)

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