

# ENVIRONMENTAL AND HEALTH PRODUCT DECLARATION



## EPD

*In accordance with NF EN 15804+A1 and its French National supplement NF EN 15804/CN*



**PLADUR® F13**

**PLADUR® F15**

► Issue date: August 2020  
Version: 1.0



## Contents

Warning.....	3
Reading guide .....	3
Precaution for use of EPD for product comparison.....	3
<b>1. General Information.....</b>	<b>4</b>
<b>2. Description of the functional unit and the product .....</b>	<b>5</b>
Description of the functional unit.....	5
Description of the product and use of the product.....	5
Other technical characteristics not included in the functional unit .....	5
Description of the main components and/or materials of the product.....	5
Description of the reference service life.....	6
<b>3. Life cycle stages .....</b>	<b>7</b>
Life cycle diagram .....	7
Product stage, A1-A3.....	7
Construction stage, A4-A5.....	8
Life stage in use (excluding potential savings), B1-B7.....	10
End-of-life stage, C1 - C4 .....	10
Recycling/reuse/recovery potential,D.....	10
<b>4. Information for the life cycle analysis calculation.....</b>	<b>11</b>
<b>5. Results of the life cycle analysis.....</b>	<b>11</b>
<b>6. Additional information on release of dangerous substances to indoor air, soil and water during the use stage.....</b>	<b>16</b>
Indoor air .....	16
Soil and water .....	16
<b>7. Contribution of product to quality of life inside buildings.....</b>	<b>17</b>
Characteristics of product involved in creating hygrothermal comfort conditions in the building .....	17
Characteristics of product involved in creating acoustic comfort conditions in the building .....	17
Characteristics of product involved in creating visual comfort conditions in the building .....	17
Characteristics of product involved in creating olfactory comfort conditions in the building .....	17
<b>8. Additional information.....</b>	<b>17</b>
LCA interpretation .....	17
Environmental commitment .....	20
<b>ANNEX I DISAGGREGATED RESULTS .....</b>	<b>21</b>

## Warning

The information in this declaration has been furnished under the responsibility of PLADUR® GYPSUM, S.A.U., (EPD issuer), according to NF EN 15804+A1 and the French national supplement NF EN 15804/CN.

Any use, in part or in whole, of the information displayed in this document shall at the very least be accompanied by the full reference to the original FDES and to the issuer thereof who shall be able to provide a full copy.

## Reading guide

Details for enhanced reading the declaration or the data contained in the declaration.

The display inventory data meets the requirements of the NF EN 15804 + A1. In the following tables -9.0E-03 should be read as  $-9.0 \times 10^{-3}$  (scientific writing).

The units used are specified to each stream, and they are:

- Kilogram "kg"
- Litter "l"
- Kilowatt hour "kWh"
- Mega joules "MJ"
- Square metre "m<sup>2</sup>"
- Cubic metre "m<sup>3</sup>"
- Carbon dioxide equivalent "CO<sub>2</sub> eq"
- Functional Unit "FU"
- Chlorofluorocarbon "CFC"
- Sulphur dioxide "SO<sub>2</sub>"
- Phosphate "PO<sub>4</sub><sup>3-</sup>"
- Antimony "Sb"

Abbreviations:

- EPD: Environmental Product Declaration
- PCR: Product Category Rules
- FDES: Environmental and Health Declaration Form
- LCA: Life Cycle Assessment
- UF: Functional Unit
- MNA: Module not evaluated

## Precaution for use of EPD for product comparison

Construction product EPDs cannot be comparable if they do not comply with standard NF EN 15804+A1.

Standard NF EN 15804+A1 defines in paragraph 5.3 Comparability of EPD for construction products, the conditions whereby construction products may be compared, based on the information provided by the FDES:

"Comparison of the environmental performance of construction products using the EPD information shall be based on the product's use in and its impacts on the building and shall consider the complete life cycle (all information modules)."

NOTE 1: The literal French translation of EPD (Environmental Product Declaration) is DEP (Déclaration Environnementale de Produit). However, in France, the term FDES (Environmental and Health Declaration Form) is commonly used and contains both the Environmental Declaration and Health information for the product covered by the FDES. The FDES is thus an "EPD" supplemented with health information.

## 1. General Information

**Manufacturer:** PLADUR® GYPSUM, S.A.U.  
Ctra. Andalucía Km. 30.200  
28343 VALDEMORO (Madrid) – Spain  
www.pladur.es  
Contact: David Sáenz de Villaverde  
Mail: david.saenz@pladur.com

**Production site:** Valdemoro – SPAIN and Gelsa – SPAIN

**Type of EPD:** Cradle to grave, Individual EPD

**Type of verification:** An independent verification has been performed according to EN ISO 14025: 2.010. This external verification has been carried out by a third part

**Name of the verifier:** Nicolas Béalu from EVEA

**Date of issue of the verification certificate:** 31/08/2020

**Publication date:** August 2020

**Valid until:** August 2025

**Programme name:** Programme INIES <http://www.inies.fr/>



**Programme operator:** Association HQE. Avenue du Recteur Poincaré numéro 4 - 75016 Paris.

**Product name:** This EPD covers PLADUR® F13 and PLADUR® F15 fire protection plasterboards.

PLADUR® F plasterboards are fire resistant, due to the addition of glass fiber in the gypsum core, which considerably increases fire protection. These boards are recommended for application in general indoor building work and suspended ceilings where fire protection is required, and as part of special structural protection systems, installation galleries and partition walls, etc.

These two products differ mainly in their thickness (12.5 and 15 mm) and weight (10.70 and 12.60 kg/m<sup>2</sup>).

**Product Category Rules:** CEN standard EN 15804+A1 and the French national supplement NF EN 15804/CN provide the Product category definition rules (PCR).

**Scope:** This LCA is based on production data of the period November 2018 - October 2019 corresponding to the manufacturing sites located in Spain and distributed in France.

**FDES destination:** B2B

The LCA calculations, LCA report and the FDES document has been carried out by Anthesis Lavola.

## 2. Description of the functional unit and the product

### Description of the functional unit

Considering the features of this product, the functional unit can be described as:

To cover 1 square meter (m<sup>2</sup>) of wall with PLADUR® F plasterboards, with a weight of 11.65 kg/m<sup>2</sup>, over a life reference time of 50 years, conferring fire protection characteristics.

(This EPD covers PLADUR® F13 and PLADUR® F15 plasterboards, with a thickness of 12.5 and 15 mm and a weight of 10.70 and 12.60 kg/m<sup>2</sup> respectively).

### Description of the product and use of the product

PLADUR® F plasterboards are made of standard composition components: a gypsum and glass fibre core, and paper, and are produced in a continuous rolling process.

The gypsum core is covered with paper in both sides of the board: the face paper is rosy, and the reverse side paper is brown (kraft paper). The boards also incorporate different components that confer specific properties to the product, specifically glass fibre that increases fire protection by the board. The products are finished with longitudinal tapered edges and straight transversal edges.

PLADUR® F plasterboards are recommended for application in general indoor building work and suspended ceilings where fire protection is required, and as part of special structural protection systems, installation galleries and partition walls, etc.

### Other technical characteristics not included in the functional unit

The plasterboards are manufactured according to the specification EN-520.

Parameter	Value	
	PLADUR® F13	PLADUR® F15
Classification under specification EN-520	F	F
Nominal weight (kg/m <sup>2</sup> )	10.7	12.6
Thickness (mm)	12.5	15
Thermal resistance (m <sup>2</sup> K/W)	0.05	0.06
Reaction to fire	A2-s1, d0	A2-s1, d0
Vapour permeability	10	10

### Description of the main components and/or materials of the product

PLADUR® F13 and PLADUR® F15 plasterboards are composed of gypsum (calcium sulphate) and two coating sheets of cellulose.

The plasterboards are palletized and wrapped with polyethylene film.

Packaging description considered per Functional Unit:

Packaging description	Value (kg/FU)
Wood feet or pallet	6.74E-02
Protection corner	1.84E-03
Plastic film	1.98E-03

Installation components for PLADUR® F13 and PLADUR® F15 boards are described below:

Parameter	Value
PLADUR® setting joint compound	0.34 kg/m <sup>2</sup>
Water	0.17 l/m <sup>2</sup>
PLADUR® paper joint tape	1.30 m/m <sup>2</sup>
PM PLADUR® screws	15p/m <sup>2</sup> x 1.25 g/p = 18.75 g/m <sup>2</sup>

During the life cycle of the product, no substances listed in the “Candidate List of Substances of Very High Concern (SVHC) for authorization” as hazardous substances are used.

### Description of the reference service life

The reference service life of plasterboards has been estimated to be at least 50 years according to the Standard 15686, when the indicated conditions for packaging, transport, storage, installation, use, maintenance, and repair are met.

Moreover, as they will be used on buildings, it coincides with the Building Reference Service Life, estimated as 50 years.

Parameter	Value
Reference service life	50 years
Declared product properties (at the gate) and finishes, etc.	The declared product has the properties determined by the specification EN-520 and it is CE certified.
Design application parameters (if instructed by the manufacturer), including references to any appropriate practices	The product shall be applied in accordance with the manufacturer's instructions.
Assumed quality of work, when installed in accordance with the manufacturer's instructions	The quality of the work is presumed to comply with the EN-520.
Outdoor environment, (for outdoor applications), e.g. weathering, pollutants, UV, and wind exposure, building orientation, shading, temperature	Not applicable
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	The product is subject to sanitary labelling on indoor air quality.
In-use conditions, e.g. frequency of use, mechanical exposure	The product shall be used under conditions that comply with the manufacturer's instructions and the standards mentioned above.
Maintenance e.g. required frequency, type and quality and replacement of components	No maintenance is necessary when using the product.

### 3. Life cycle stages

#### Life cycle diagram



#### Product stage, A1-A3

##### Description of the stage

The product stage includes raw materials extraction, additives production, transport from the quarry or the additive supplier to the processing plant, and the manufacturing process.

##### ***A1 Raw materials supply***

This module takes into account the supply and treatment of all raw materials and energy that occur upstream of the manufacturing process. In particular, it covers the supply of gypsum, core and paper sheets and additives.

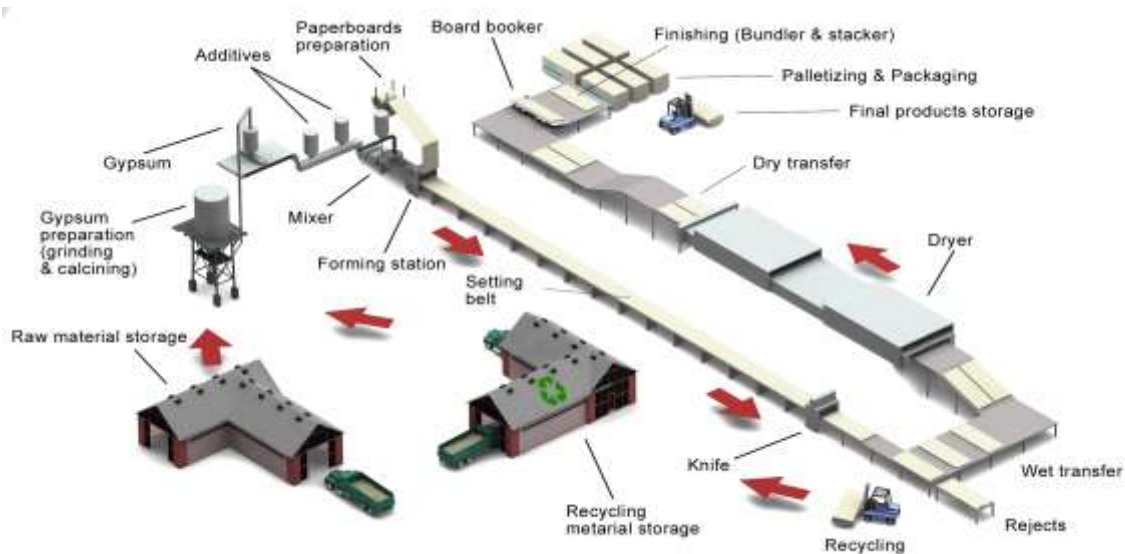
##### ***A2 Transport***

Raw materials are transported from the quarry and suppliers to the manufacturing sites. The model comprises transport by road for each raw material.

##### ***A3 Manufacturing***

This module includes energy and water consumption in the manufacturing process, as well as management of waste resulting from the process and packaging production.

## Manufacturing process diagram



Raw materials are homogeneously mixed in the mixer to form gypsum plaster, which is discharged through output pipes on a paperboard sheet that is advancing on the forming belt. In parallel, a second paperboard sheet is added to form the Laminated Plasterboard. The board continues advancing on the production line until it acquires enough hardness to be cut. It is subsequently dried in a continuous process. Finally, it is stacked, palletised, and shrink-wrapped to form the packaged product.

This manufacturing process allows the introduction of recycled material at the beginning of the production process.

## Construction stage, A4-A5

### Description of the stage

The construction stage is divided into two modules: A4, transport to the construction site and A5, installation in the building.

#### ***A4 Transport to the construction site***

This module includes transport from the manufacturing factories to the construction site. The product distribution is mainly done to Spain, France, and Portugal, but as FDES geographical scope is France, a 100% French market scenario is considered.

Transport is calculated based on a scenario including the following parameters:

Parameter	Value
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long-distance truck, boat etc.	Lorry of 16-32 tones capacity EURO VI
Distance to the construction site	PLADUR® F13 and PLADUR® F15 plasterboards are manufactured in Spain (manufacturing sites located in Valdemoro, Madrid and Gelsa, Zaragoza). Considering the French market, the average distance is 500 km.
Capacity utilization (including empty returns)	38% of the volume capacity 100% empty returns
Bulk density of transported product	848 kg/m <sup>3</sup>



### A5 Installation in the building

This module includes materials that are necessary for the installation of the product in the building.

Parameter	Value
Installation instructions	PLADUR® F13 and PLADUR® F15 plasterboards are indicated to be installed using PLADUR® joint compound (that must be mixed with water to obtain an adequate joint compound) and PLADUR® paper joint tape.
Ancillary materials for installation (specified by material)	PLADUR® joint compound: 0.34 kg/m <sup>2</sup> of plasterboard PLADUR® paper joint tape: 1.30 m/m <sup>2</sup> of plasterboard Screws: 15 screws of 1.25 g per m <sup>2</sup> of plasterboard
Water use	0.17 litres/m <sup>2</sup> Joint compound must be mixed with clean water in the recommended amount in a clean container and be stirred with a mechanical beater. It is recommended to leave the obtained dough stand between 5 and 10 minutes before application.
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	No energy is required for product installation
Waste produced on the building site before waste processing, generated by the product's installation (specified by type)	5% of product and ancillary materials as installation waste: Plasterboard: 0.05 m <sup>2</sup> PLADUR® joint compound: 0.017 kg PLADUR® paper joint tape: 0.065 m Screws: 0.75 p Packaging waste: Wood: 0.064 kg Protection corner: 1.94E-03 kg Plastic film: 2.08E-03 kg
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Wasted plasterboard and installation materials: landfill Packaging waste. Protection corner and Plastic film: Landfill Packaging waste. Wood: Collection for recycling
Direct emissions to ambient air, soil, and water	No direct emissions are emitted to air, soil, or water

## Life stage in use (excluding potential savings), B1-B7

### Description of the stage

The use phase is divided into seven modules:

- B1: Use or application of the installed product
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment
- B6/B7: Use of energy and water

No technical operations are required during the use phase. Thus, plasterboards have no environmental impacts during this stage.

Moreover PLADUR® F13 and PLADUR® F15 plasterboards are classified as A+ according to the French VOC label.

## End-of-life stage, C1 - C4

### Description of the stage

This step includes the following different modules: C1, deconstruction or demolition; C2, transport to the waste treatment plant; C3, waste treatment for reuse, recovery and/or recycling; C4 waste disposal.

#### End-of-life

Parameter	Value
Demolition	It is assumed that plasterboards are demolished using tools that consume diesel and some particles are emitted to the atmosphere during this demolition. Energy consumption and particle emissions from bibliography has been considered: Diesel consumption: 35.9MJ/Tn Particles emission: 0.15 kg/Tn
Collection process specified by type	12.02 kg/m <sup>2</sup> collected as mixed demolition waste (plasterboard and installation materials)
Recovery system specified by type	0 kg for reuse, recycling, or energy recovery (0%)
Disposal specified by type	12.02 kg to landfill (100%)
Assumptions for scenario development, e.g. transportation	Waste is transported 50 km by lorry 16-32 tones EURO VI.

## Recycling/reuse/recovery potential,D

Module D, of benefits and loads beyond the system boundaries, has not been evaluated.

## 4. Information for the life cycle analysis calculation

<b>PCR used</b>	CEN standard EN 15804+A1 and the French national supplement NF EN 15804/CN provide the Product category definition rules (PCR)
<b>System boundaries</b>	From cradle to grave Stages: A1-3, A4-5, B1-7, C1-4 Module D not evaluated
<b>Allocations</b>	Allocation criteria are based on mass and m <sup>2</sup> of produced plasterboard
<b>Geographic representativity and time-related representativity of primary data</b>	The representativity is: <ul style="list-style-type: none"> <li>- Geographic: manufactured in Spain for the French market</li> <li>- Temporal: manufactured during the period November 2018 - October 2019</li> </ul> Primary data obtained from the company (2018 and 2019) and generic data from Ecoinvent 3.5 (cut-off) Software used: Simapro (v9.0)
<b>Variability of the results</b>	The plasterboard covered by this EPD is an arithmetic average of PLADUR® F13 and PLADUR® F15 boards produced in both manufacturing sites. They have the same composition and production process and they only differ in the proportion of some components. Moreover, in one plant part of the content comes from internal recycling process. Their environmental impacts differ maximum 23% (see Annex I).  The environmental performance is presented as an arithmetic average of 2 PLADUR® F13 and PLADUR® F15, produced in the two PLADUR® Gypsum S.A.U manufacturing plants.

## 5. Results of the life cycle analysis

In tables below, results for the functional unit are summarized. The disaggregated results for each product are presented in Annex I.

ENVIRONMENTAL IMPACTS																			
Environmental impacts	Production Stage	Construction Stage			Use Stage								End-of-life stage					Total Life Cycle	D Benefits and loads beyond the system boundary
	Total A1 - A3 production	A4 Transport	A5 Installation	Total A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction / Demolition	C2 Transport	C3 Waste processing	C4 Landfill disposal	Total C1-C4		
Global Warming kg CO <sub>2</sub> eq/FU	3.88E+00	9.45E-01	4.15E-01	1.36E+00	0	0	0	0	0	0	0	0	3.95E-02	9.68E-02	0	1.56E-01	2.92E-01	5.53E+00	MNA
Ozone Depletion kg CFC 11 eq/FU	2.87E-07	1.75E-07	4.57E-08	2.20E-07	0	0	0	0	0	0	0	0	7.17E-09	1.79E-08	0	3.70E-08	6.21E-08	5.69E-07	MNA
Acidification of soil and water kg SO <sub>2</sub> eq/FU	6.96E-03	2.26E-03	2.55E-03	4.81E-03	0	0	0	0	0	0	0	0	3.00E-04	2.31E-04	0	3.54E-01	3.55E-01	3.67E-01	MNA
Eutrophication kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	1.57E-03	3.03E-04	2.61E-04	5.64E-04	0	0	0	0	0	0	0	0	6.50E-05	3.10E-05	0	1.72E-04	2.68E-04	2.40E-03	MNA
Photochemical ozone creation Ethene eq/FU	4.81E-04	1.44E-04	1.51E-04	2.95E-04	0	0	0	0	0	0	0	0	7.89E-06	1.47E-05	0	1.42E-02	1.42E-02	1.50E-02	MNA
Depletion of abiotic resources (elements) kg Sb eq/FU	3.11E-06	2.89E-06	1.11E-06	4.01E-06	0	0	0	0	0	0	0	0	1.34E-08	2.96E-07	0	1.84E-07	4.93E-07	7.61E-06	MNA
Depletion of abiotic resources (fossil) MJ/FU	3.67E+01	1.44E+01	5.30E+00	1.97E+01	0	0	0	0	0	0	0	0	5.68E-01	1.48E+00	0	3.63E+00	5.67E+00	6.21E+01	MNA
Water pollution - m <sup>3</sup> /FU	8.16E-01	3.19E-01	1.47E-01	4.66E-01	0	0	0	0	0	0	0	0	1.22E-02	3.27E-02	0	1.90E-01	2.35E-01	1.52E+00	MNA
Air Pollution - m <sup>3</sup> /FU	6.07E+02	9.38E+01	7.23E+01	1.66E+02	0	0	0	0	0	0	0	0	4.99E+01	9.62E+00	0	1.47E+03	1.53E+03	2.30E+03	MNA

RESOURCE USE

Resource Use	Production Stage	Construction Stage			Use Stage								End-of-life stage					Total Life Cycle	D Benefits and loads beyond the system boundary
	A1 - A3 production	A4 Transport	A5 Installation	Total A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction / Demolition	C2 Transport	C3 Waste processing	C4 Landfill disposal	Total C1-C4		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	3.93E+00	1.55E-01	1.08E+00	1.24E+00	0	0	0	0	0	0	0	0	3.35E-03	1.59E-02	0	1.17E-01	1.36E-01	5.30E+00	MNA
Use of renewable primary energy resources used as raw materials- MJ/FU	5.92E+00	0.00E+00	4.93E-01	4.93E-01	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0	0.00E+00	0.00E+00	6.41E+00	MNA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	9.85E+00	1.55E-01	1.57E+00	1.73E+00	0	0	0	0	0	0	0	0	3.35E-03	1.59E-02	0	1.17E-01	1.36E-01	1.17E+01	MNA
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	4.19E+01	1.55E+01	5.76E+00	2.12E+01	0	0	0	0	0	0	0	0	6.14E-01	1.59E+00	0	3.93E+00	6.13E+00	6.93E+01	MNA
Use of non-renewable primary energy resources used as raw materials- MJ/FU	8.50E-02	0.00E+00	5.21E-02	5.21E-02	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0	0.00E+00	0.00E+00	1.37E-01	MNA
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	4.20E+01	1.55E+01	5.81E+00	2.13E+01	0	0	0	0	0	0	0	0	6.14E-01	1.59E+00	0	3.93E+00	6.13E+00	6.94E+01	MNA
Use of secondary material- kg/FU	3.11E-01	0.00E+00	1.55E-02	1.55E-02	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0	0.00E+00	0.00E+00	3.26E-01	MNA
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	MNA
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0	0.00E+00	0.00E+00	0.00E+00	MNA
Net use of fresh water - m3/FU	1.65E-02	2.38E-03	2.86E-03	5.24E-03	0	0	0	0	0	0	0	0	7.57E-05	2.44E-04	0	3.57E-03	3.89E-03	2.57E-02	MNA

WASTE CATEGORY																			
Waste Category	Production Stage	Construction Stage			Use Stage								End-of-life stage					Total Life Cycle	D Benefits and loads beyond the system boundary
	A1 - A3 production	A4 Transport	A5 Installation	Total A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction / Demolition	C2 Transport	C3 Waste processing	C4 Landfill disposal	Total C1-C4		
Hazardous waste disposed -kg/FU	9.02E-02	9.15E-03	1.83E-02	2.75E-02	0	0	0	0	0	0	0	0	3.36E-04	9.37E-04	0	6.26E-02	6.38E-02	1.82E-01	MNA
Non-hazardous waste disposed - kg/FU	4.45E-01	7.71E-01	2.76E-01	1.05E+00	0	0	0	0	0	0	0	0	2.22E-03	7.90E-02	0	1.21E+01	1.22E+01	1.36E+01	MNA
Radioactive waste disposed - kg/FU	1.02E-04	9.86E-05	2.26E-05	1.21E-04	0	0	0	0	0	0	0	0	4.02E-06	1.01E-05	0	2.22E-05	3.63E-05	2.60E-04	MNA

OUTPUT FLOWS																				
Output Flows	Production Stage	Construction Stage			Use Stage								End-of-life stage					Total Life Cycle	D Benefits and loads beyond the system boundary	
	A1 - A3 production	A4 Transport	A5 Installation	Total A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction / Demolition	C2 Transport	C3 Waste processing	C4 Landfill disposal	Total C1-C4			
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNA
Materials for recycling kg/FU	3.56E-01	0.00E+00	8.20E-02	8.20E-02	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.38E-01	MNA
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNA
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNA
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNA
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0	0	0	0	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MNA

## 6. Additional information on release of dangerous substances to indoor air, soil and water during the use stage

### Indoor air

#### VOCs and Formaldehyde

According to the French rule on sanitary labelling on indoor air quality (“qualité de l’air intérieur”), started in the “Décret n° 2011-321 du 23 mars 2011 (NOR: DEVL1101903D) et l’arrêté du 19 avril 2011 (NOR: devl1104875a)”, on the labelling of emissions of volatile organic compounds of construction products, wall or floor covering and paints and varnishes, PLADUR® F13 and PLADUR® F15 plasterboards have been rated as class A+ product by an independent labelled laboratory: EUROFINS.

The limit values of the emissions' classes refer to the total of the VOC emissions and also to the evaluation of 10 single substances (in  $\mu\text{g}/\text{m}^3$ ). A+ rating is the highest level of certification.

The basis of testing is ISO 16000 and the certificate test numbers are:



- PLADUR® F13: G22227B (Valdemoro) y 392-2018-00485001 (Gelsa)
- PLADUR® F15: G22227B (Valdemoro) y 392-2018-00485001 (Gelsa)

#### Absence of carcinogenic, mutagenic and toxic to reproduction (C.M.R.) substances

The test has also evaluated accomplishment with the French regulation on 4 carcinogenic, mutagenic and toxic to reproduction substances (“4 substances C.M.R.”), stated in Rule of April the 30<sup>th</sup> 2009 (NOR: DEVP0908633A) and Rule of May the 28<sup>th</sup> 2009 (NOR: DEVP0910046A).

These four tested substances are:

- Trichloroethylene, CAS number: 79-01-6.
- Benzene, CAS number: 71-43-2.
- Bis(2-ethylhexyl) phthalate, CAS number: 117-81-7.
- Dibutyl phthalate, CAS number: 84-74-2.

#### Radioactivity

Gypsum is a material where natural radioactivity is the lowest of all mineral building materials. Thus, plasterboard radioactivity is negligible compared to the natural radioactivity of the environment.

#### Growth of microorganisms

No growth of microorganisms is observed at the gypsum board surfaces under normal conditions of design and use of buildings.

### Soil and water

This product is not classified as toxic for water or the environment in its safety data sheet, under normal use conditions.



## 7. Contribution of product to quality of life inside buildings

### Characteristics of product involved in creating hygrothermal comfort conditions in the building

Wall insulation contributes to a more healthy and comfortable indoor air quality, increasing thermal comfort.

PLADUR® F13 plasterboards have a thermal conductivity of at least 0.25 W/mK, a thermal resistance of 0.05 m<sup>2</sup>K/W and a vapour permeability of 10 which is translated into a more hygrothermal comfort conditions in the interior of the buildings where the boards are installed.

PLADUR® F 15 plasterboards have a thermal conductivity of at least 0.25 W/mK, a thermal resistance of 0.06 m<sup>2</sup>K/W and a vapour permeability of 10 which is translated into a more hygrothermal comfort conditions in the interior of the buildings where the boards are installed.

### Characteristics of product involved in creating acoustic comfort conditions in the building

Acoustic insulation contributes to create a more healthy and comfortable environments. Plasterboard partitions provide high acoustic insulation, improving the acoustic comfort in the building which they are installed.

### Characteristics of product involved in creating visual comfort conditions in the building

Not applicable under normal use conditions.

### Characteristics of product involved in creating olfactory comfort conditions in the building

The product is odorless, but it has not been measured according to any standard.

## 8. Additional information

### LCA interpretation

Product stage (modules A1-3), the transport of the plasterboard from PLADUR® Gypsum S.A.U. manufacturing plant to the French market (module A4) and plasterboard disposal (module C4) are the most relevant life cycle stages for all impact categories.

Product stage has a contribution that goes from 26% of the life cycle impact (Air pollution) to 70% (Global warming), even though for Acidification and Photochemical ozone creation its impact is less than 5%.

The product distribution has a significant impact, with more than 10% of the life cycle impact, for 6 of the 9 analysed impact categories. This stage has a maximum contribution of 38% for Depletion of abiotic resources (elements) impact category.

The installation stage accounts with maximum 15% of the impact (Depletion of abiotic resources (elements) impact category).

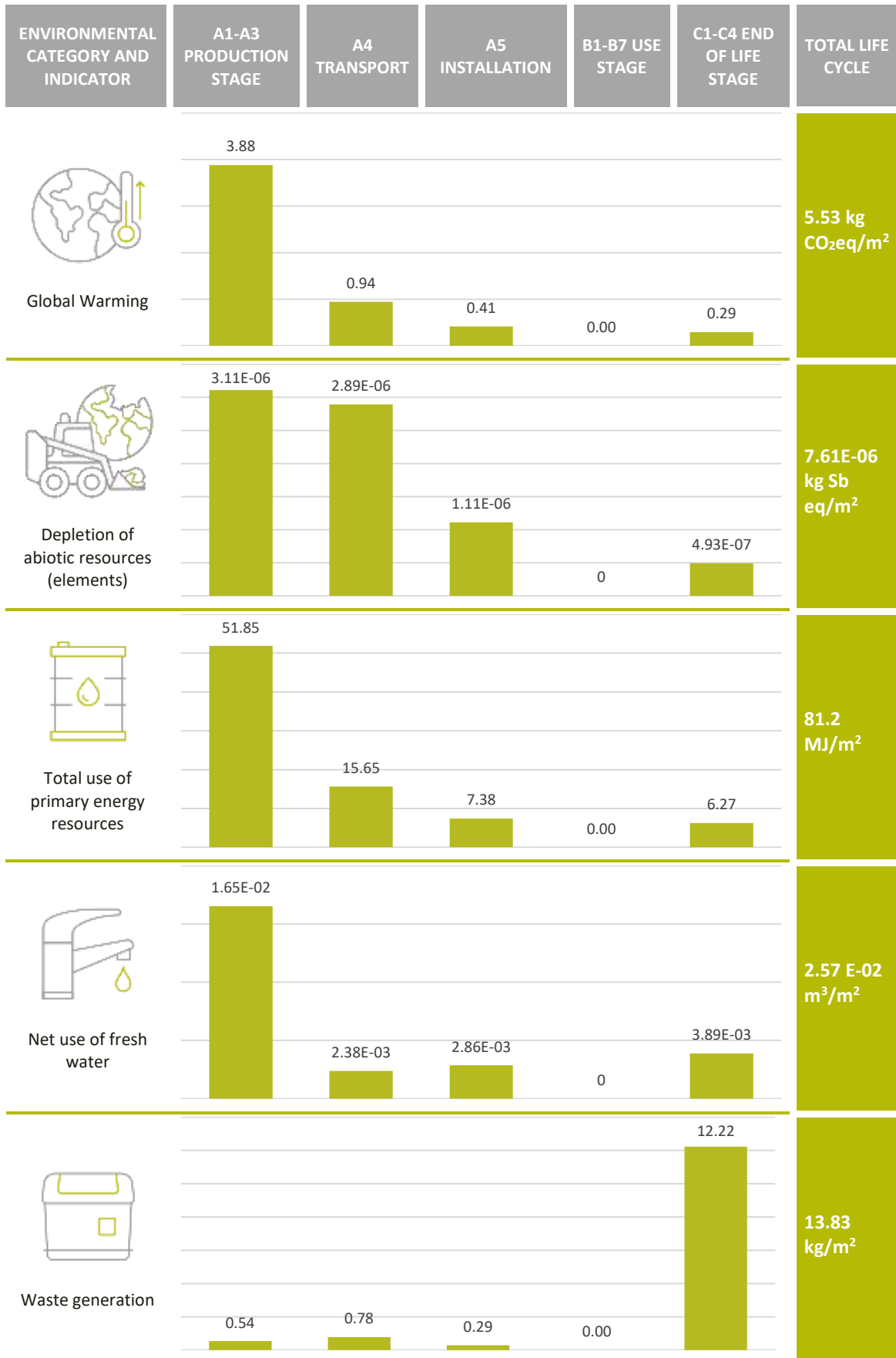
As it is assumed the most conservative scenario for the end of life stage, 100% of the product landfilled, modules C1-4 account a significant impact specially for three impact categories: Acidification (97%), Photochemical ozone creation (95%) and Air pollution (66%).

No technical operations are required during the use phase. Thus, plasterboards have no environmental impacts during this stage.

Regarding resource use indicators, 86% of the primary energy use comes from non-renewable sources, while 14% comes from renewable sources. 74% of the renewable energy is consumed in the product stage, whereas this stage consumes 60% of the non-renewable primary energy. 22% of the non-renewable energy is used in A4 module for the product distribution.

64% of water consumed takes place in the product stage, while 9% is consumed in module A4, 11% is consumed in the installation module (A5) and 14% in module C4 (landfill disposal). It has to be considered that water is directly consumed in both the manufacturing process and installation.

Waste disposed (hazardous, non-hazardous, and radioactive waste) are generated in various life cycle stage: 4% in product stage, 6% in A4 module, 2% in A5 module and 88% in end of life stage, mainly in C4 module.



## Environmental commitment

PLADUR® plasterboards are manufactured in the company facilities in Valdemoro (Madrid) and Gelsa (Zaragoza), in compliance with the Directive laying down the obligations on integrated prevention and pollution control.

The facilities have the Integrated Environmental Authorisation, ACIC-MO-AAI-1007/14 10-AM-00076.4/06 record. This authorization was granted by the Ministry of Environment on September the 23rd 2009 and modified automatically by the same Ministry on February the 2<sup>nd</sup> 2015.

Data related to pollutant emissions to air, soil and water and waste transferred from the facility are annually reported, according to 166/2006 Regulation and 508/2007 Decree and PLADUR® installation has the greenhouse gases emission authorization, also granted by the Ministry of Environment (10-AGEI-M-002/2014).

The company has also made the necessary arrangements to comply with the REACH Regulation, on the registration, evaluation, authorization and restriction of substances and chemical preparations, obtaining the following registration number: 01-2119444918-26-0236.

Moreover, PLADUR® Gypsum S.A.U. (PLADUR®) has implemented an Environmental Management System in accordance with UNE-EN-ISO 14001:2015, certified by AENOR, that covers the following activities: design and manufacture of plasterboards in different sizes and characteristics (standard, waterproof, vapor barrier, fire resistance, thermal and acoustic insulating, honeycomb sandwich and decorative panels), adhesive compounds and associated metal profiles. Certification number is GA-2011/0624.

The Quality Management System of PLADUR® Gypsum S.A.U. allows that the raw materials rejected during the production process are recycled internally, reducing impacts derived from the extraction and processing of raw materials. Moreover, materials used for manufacturing PLADUR® products are characterized by having a low impact over their life cycle. PLADUR® Gypsum S.A.U. facilities are located near the main raw material quarries, reducing impacts related to transportation.

Water efficiency is also a priority for PLADUR® Gypsum S.A.U. Specifically, in Valdemoro plant there is a pond where rainwater and industrial wastewater are collected, to be entered again in the industrial processes after being treated.

The main objectives of the organization related to the environment are:

- Minimizing air emissions
- Reducing hazardous waste
- Valuing non-hazardous waste
- Optimizing water consumption
- Increasing energy efficiency
- Improving spills prevention system

Specifically, there is an organizational commitment to climate change, energy efficiency, natural resources preservation and atmospheric emissions reduction that is translated into:

- Regular monitoring on CO<sub>2</sub> emissions
- Periodic measurements on emission points to control emitted pollutant levels
- Natural gas is used as fuel for the manufacturing process
- Natural gas is also used as preferred fuel for the vehicle fleet (trucks)
- Good energy management practices are applied in a continuous improvement management system

Criteria on energy efficiency are implemented in all manufacturing activities in order to respect the environment, preserve natural resources, reduce atmospheric emissions and contribute to minimize climate change effects.

## ANNEX I DISAGGREGATED RESULTS

Total Life Cycle	F13 Valdemoro	F15 Valdemoro	F13 Gelsa	F15 Gelsa	F13 & F15	Variation
<b>Environmental Impacts</b>						
Global Warming - kg CO <sub>2</sub> eq/FU	5.88E+00	6.51E+00	4.99E+00	4.73E+00	<b>5.53E+00</b>	15%
Ozone Depletion - kg CFC 11 eq/FU	6.47E-07	7.09E-07	4.90E-07	4.30E-07	<b>5.69E-07</b>	23%
Acidification of soil and water - kg SO <sub>2</sub> eq/FU	3.40E-01	3.97E-01	3.38E-01	3.92E-01	<b>3.67E-01</b>	9%
Eutrophication - kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	2.50E-03	2.69E-03	2.44E-03	1.97E-03	<b>2.40E-03</b>	13%
Photochemical ozone creation - Ethene eq/FU	1.39E-02	1.62E-02	1.38E-02	1.60E-02	<b>1.50E-02</b>	9%
Depletion of abiotic resources (elements) - kg Sb eq/FU	8.75E-06	9.43E-06	6.66E-06	5.59E-06	<b>7.61E-06</b>	23%
Depletion of abiotic resources (fossil) - MJ/FU	6.98E+01	7.52E+01	5.63E+01	4.70E+01	<b>6.21E+01</b>	21%
Water pollution - m <sup>3</sup> /FU	1.61E+00	1.81E+00	1.43E+00	1.22E+00	<b>1.52E+00</b>	16%
Air Pollution - m <sup>3</sup> /FU	2.15E+03	2.50E+03	2.11E+03	2.44E+03	<b>2.30E+03</b>	8%
<b>Resource Use</b>						
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	5.41E+00	5.94E+00	5.32E+00	4.55E+00	<b>5.30E+00</b>	11%
Use of renewable primary energy resources used as raw materials- MJ/FU	7.19E+00	7.93E+00	6.70E+00	3.82E+00	<b>6.41E+00</b>	28%
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	1.26E+01	1.39E+01	1.20E+01	8.37E+00	<b>1.17E+01</b>	20%
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	7.75E+01	8.37E+01	6.32E+01	5.29E+01	<b>6.93E+01</b>	20%
Use of non-renewable primary energy resources used as raw materials- MJ/FU	1.51E-01	1.41E-01	1.56E-01	1.00E-01	<b>1.37E-01</b>	19%
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	7.77E+01	8.38E+01	6.33E+01	5.30E+01	<b>6.94E+01</b>	20%
Use of secondary material- kg/FU	3.88E-01	4.00E-01	3.38E-01	1.80E-01	<b>3.26E-01</b>	31%
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	-
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	-
Net use of fresh water - m <sup>3</sup> /FU	2.53E-02	2.79E-02	2.54E-02	2.40E-02	<b>2.57E-02</b>	6%
<b>Waste Category</b>						
Hazardous waste disposed - kg/FU	2.08E-01	2.17E-01	1.90E-01	1.11E-01	<b>1.82E-01</b>	27%
Non-hazardous waste disposed - kg/FU	1.30E+01	1.51E+01	1.24E+01	1.42E+01	<b>1.36E+01</b>	9%
Radioactive waste disposed - kg/FU	2.91E-04	3.27E-04	2.16E-04	2.04E-04	<b>2.60E-04</b>	23%
<b>Output flows</b>						
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	-
Materials for recycling kg/FU	7.33E-01	8.66E-01	7.86E-02	7.39E-02	<b>4.38E-01</b>	96%
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	-
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	-
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	-
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	-

A1 - A3 production	F13 Valdemoro	F15 Valdemoro	F13 Gelsa	F15 Gelsa	F13 & F15
<b>Environmental Impacts</b>					
Global Warming - kg CO <sub>2</sub> eq/FU	3.97E+00	4.30E+00	3.81E+00	3.43E+00	<b>3.88E+00</b>
Ozone Depletion - kg CFC 11 eq/FU	3.15E-07	3.25E-07	2.94E-07	2.11E-07	<b>2.87E-07</b>
Acidification of soil and water - kg SO <sub>2</sub> eq/FU	7.19E-03	7.51E-03	7.54E-03	5.57E-03	<b>6.96E-03</b>
Eutrophication - kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	1.59E-03	1.67E-03	1.76E-03	1.25E-03	<b>1.57E-03</b>
Photochemical ozone creation - Ethene eq/FU	4.88E-04	5.28E-04	4.97E-04	4.10E-04	<b>4.81E-04</b>
Depletion of abiotic resources (elements) - kg Sb eq/FU	3.41E-06	3.31E-06	3.54E-06	2.17E-06	<b>3.11E-06</b>
Depletion of abiotic resources (fossil) - MJ/FU	4.03E+01	4.13E+01	3.81E+01	2.69E+01	<b>3.67E+01</b>
Water pollution - m <sup>3</sup> /FU	8.27E-01	9.09E-01	8.97E-01	6.32E-01	<b>8.16E-01</b>
Air Pollution - m <sup>3</sup> /FU	5.52E+02	6.31E+02	5.89E+02	6.55E+02	<b>6.07E+02</b>
<b>Resource Use</b>					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	3.99E+00	4.45E+00	4.02E+00	3.26E+00	<b>3.93E+00</b>
Use of renewable primary energy resources used as raw materials- MJ/FU	6.66E+00	7.37E+00	6.19E+00	3.45E+00	<b>5.92E+00</b>
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	1.07E+01	1.18E+01	1.02E+01	6.71E+00	<b>9.85E+00</b>
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	4.57E+01	4.71E+01	4.35E+01	3.13E+01	<b>4.19E+01</b>
Use of non-renewable primary energy resources used as raw materials- MJ/FU	9.83E-02	8.86E-02	1.03E-01	4.98E-02	<b>8.50E-02</b>
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	4.58E+01	4.72E+01	4.36E+01	3.13E+01	<b>4.20E+01</b>
Use of secondary material- kg/FU	3.70E-01	3.81E-01	3.22E-01	1.71E-01	<b>3.11E-01</b>
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Net use of fresh water - m <sup>3</sup> /FU	1.58E-02	1.71E-02	1.76E-02	1.55E-02	<b>1.65E-02</b>
<b>Waste Category</b>					
Hazardous waste disposed - kg/FU	1.17E-01	1.15E-01	1.07E-01	2.16E-02	<b>9.02E-02</b>
Non-hazardous waste disposed - kg/FU	4.75E-01	4.98E-01	4.83E-01	3.24E-01	<b>4.45E-01</b>
Radioactive waste disposed - kg/FU	1.06E-04	1.13E-04	1.08E-04	8.13E-05	<b>1.02E-04</b>
<b>Output flows</b>					
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Materials for recycling kg/FU	6.35E-01	7.48E-01	1.85E-02	2.18E-02	<b>3.56E-01</b>
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>

<b>A4 Transport</b>	<b>F13 Valdemoro</b>	<b>F15 Valdemoro</b>	<b>F13 Gelsa</b>	<b>F15 Gelsa</b>	<b>F13 &amp; F15</b>
<b>Environmental Impacts</b>					
Global Warming - kg CO <sub>2</sub> eq/FU	1.22E+00	1.43E+00	5.20E-01	6.11E-01	9.45E-01
Ozone Depletion - kg CFC 11 eq/FU	2.25E-07	2.65E-07	9.62E-08	1.13E-07	1.75E-07
Acidification of soil and water - kg SO <sub>2</sub> eq/FU	2.91E-03	3.42E-03	1.24E-03	1.46E-03	2.26E-03
Eutrophication - kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	3.90E-04	4.59E-04	1.67E-04	1.96E-04	3.03E-04
Photochemical ozone creation - Ethene eq/FU	1.85E-04	2.18E-04	7.92E-05	9.31E-05	1.44E-04
Depletion of abiotic resources (elements) - kg Sb eq/FU	3.72E-06	4.38E-06	1.59E-06	1.87E-06	2.89E-06
Depletion of abiotic resources (fossil) - MJ/FU	1.86E+01	2.18E+01	7.94E+00	9.34E+00	1.44E+01
Water pollution - m <sup>3</sup> /FU	4.11E-01	4.83E-01	1.76E-01	2.06E-01	3.19E-01
Air Pollution - m <sup>3</sup> /FU	1.21E+02	1.42E+02	5.17E+01	6.07E+01	9.38E+01
<b>Resource Use</b>					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	2.00E-01	2.35E-01	8.55E-02	1.01E-01	1.55E-01
Use of renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	2.00E-01	2.35E-01	8.55E-02	1.01E-01	1.55E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	1.99E+01	2.35E+01	8.53E+00	1.00E+01	1.55E+01
Use of non-renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	1.99E+01	2.35E+01	8.53E+00	1.00E+01	1.55E+01
Use of secondary material- kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water - m <sup>3</sup> /FU	3.07E-03	3.61E-03	1.31E-03	1.54E-03	2.38E-03
<b>Waste Category</b>					
Hazardous waste disposed - kg/FU	1.18E-02	1.39E-02	5.04E-03	5.92E-03	9.15E-03
Non-hazardous waste disposed - kg/FU	9.93E-01	1.17E+00	4.24E-01	4.99E-01	7.71E-01
Radioactive waste disposed - kg/FU	1.27E-04	1.49E-04	5.43E-05	6.38E-05	9.86E-05
<b>Output flows</b>					
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

A5 Installation	F13 Valdemoro	F15 Valdemoro	F13 Gelsa	F15 Gelsa	F13 & F15
<b>Environmental Impacts</b>					
Global Warming - kg CO <sub>2</sub> eq/FU	4.33E-01	4.61E-01	3.90E-01	3.76E-01	4.15E-01
Ozone Depletion - kg CFC 11 eq/FU	4.97E-08	5.22E-08	4.22E-08	3.88E-08	4.57E-08
Acidification of soil and water - kg SO <sub>2</sub> eq/FU	2.59E-03	2.64E-03	2.52E-03	2.44E-03	2.55E-03
Eutrophication - kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	2.67E-04	2.75E-04	2.64E-04	2.40E-04	2.61E-04
Photochemical ozone creation - Ethene eq/FU	1.54E-04	1.58E-04	1.49E-04	1.45E-04	1.51E-04
Depletion of abiotic resources (elements) - kg Sb eq/FU	1.17E-06	1.20E-06	1.07E-06	1.01E-06	1.11E-06
Depletion of abiotic resources (fossil) - MJ/FU	5.69E+00	5.92E+00	5.05E+00	4.56E+00	5.30E+00
Water pollution - m <sup>3</sup> /FU	1.52E-01	1.60E-01	1.44E-01	1.32E-01	1.47E-01
Air Pollution - m <sup>3</sup> /FU	7.09E+01	7.60E+01	6.92E+01	7.29E+01	7.23E+01
<b>Resource Use</b>					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	1.09E+00	1.11E+00	1.08E+00	1.05E+00	1.08E+00
Use of renewable primary energy resources used as raw materials- MJ/FU	5.30E-01	5.66E-01	5.07E-01	3.70E-01	4.93E-01
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	1.62E+00	1.68E+00	1.59E+00	1.41E+00	1.57E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	6.17E+00	6.43E+00	5.49E+00	4.95E+00	5.76E+00
Use of non-renewable primary energy resources used as raw materials- MJ/FU	5.27E-02	5.22E-02	5.30E-02	5.03E-02	5.21E-02
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	6.23E+00	6.48E+00	5.54E+00	5.00E+00	5.81E+00
Use of secondary material- kg/FU	1.85E-02	1.90E-02	1.61E-02	8.55E-03	1.55E-02
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water - m <sup>3</sup> /FU	2.86E-03	2.95E-03	2.86E-03	2.77E-03	2.86E-03
<b>Waste Category</b>					
Hazardous waste disposed - kg/FU	1.98E-02	1.99E-02	1.89E-02	1.46E-02	1.83E-02
Non-hazardous waste disposed - kg/FU	2.89E-01	3.04E-01	2.58E-01	2.51E-01	2.76E-01
Radioactive waste disposed - kg/FU	2.42E-05	2.58E-05	2.07E-05	1.98E-05	2.26E-05
<b>Output flows</b>					
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling kg/FU	9.76E-02	1.18E-01	6.00E-02	5.21E-02	8.20E-02
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00



<b>C1 Deconstruction / Demolition</b>	<b>F13 Valdemoro</b>	<b>F15 Valdemoro</b>	<b>F13 Gelsa</b>	<b>F15 Gelsa</b>	<b>F13 &amp; F15</b>
<b>Environmental Impacts</b>					
Global Warming - kg CO <sub>2</sub> eq/FU	3.64E-02	4.26E-02	3.64E-02	4.26E-02	<b>3.95E-02</b>
Ozone Depletion - kg CFC 11 eq/FU	6.61E-09	7.74E-09	6.61E-09	7.74E-09	<b>7.17E-09</b>
Acidification of soil and water - kg SO <sub>2</sub> eq/FU	2.76E-04	3.24E-04	2.76E-04	3.24E-04	<b>3.00E-04</b>
Eutrophication - kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	5.99E-05	7.01E-05	5.99E-05	7.01E-05	<b>6.50E-05</b>
Photochemical ozone creation - Ethene eq/FU	7.27E-06	8.52E-06	7.27E-06	8.52E-06	<b>7.89E-06</b>
Depletion of abiotic resources (elements) - kg Sb eq/FU	1.23E-08	1.44E-08	1.23E-08	1.44E-08	<b>1.34E-08</b>
Depletion of abiotic resources (fossil) - MJ/FU	5.23E-01	6.13E-01	5.23E-01	6.13E-01	<b>5.68E-01</b>
Water pollution - m <sup>3</sup> /FU	1.12E-02	1.32E-02	1.12E-02	1.32E-02	<b>1.22E-02</b>
Air Pollution - m <sup>3</sup> /FU	4.60E+01	5.39E+01	4.60E+01	5.39E+01	<b>4.99E+01</b>
<b>Resource Use</b>					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	3.09E-03	3.62E-03	3.09E-03	3.62E-03	<b>3.35E-03</b>
Use of renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	3.09E-03	3.62E-03	3.09E-03	3.62E-03	<b>3.35E-03</b>
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	5.66E-01	6.63E-01	5.66E-01	6.63E-01	<b>6.14E-01</b>
Use of non-renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	5.66E-01	6.63E-01	5.66E-01	6.63E-01	<b>6.14E-01</b>
Use of secondary material- kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Net use of fresh water - m <sup>3</sup> /FU	6.97E-05	8.17E-05	6.97E-05	8.17E-05	<b>7.57E-05</b>
<b>Waste Category</b>					
Hazardous waste disposed - kg/FU	3.10E-04	3.63E-04	3.10E-04	3.63E-04	<b>3.36E-04</b>
Non-hazardous waste disposed - kg/FU	2.05E-03	2.40E-03	2.05E-03	2.40E-03	<b>2.22E-03</b>
Radioactive waste disposed - kg/FU	3.70E-06	4.33E-06	3.70E-06	4.33E-06	<b>4.02E-06</b>
<b>Output flows</b>					
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Materials for recycling kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>

<b>C2 Transport</b>	<b>F13 Valdemoro</b>	<b>F15 Valdemoro</b>	<b>F13 Gelsa</b>	<b>F15 Gelsa</b>	<b>F13 &amp; F15</b>
<b>Environmental Impacts</b>					
Global Warming - kg CO <sub>2</sub> eq/FU	8.91E-02	1.04E-01	8.91E-02	1.04E-01	<b>9.68E-02</b>
Ozone Depletion - kg CFC 11 eq/FU	1.65E-08	1.93E-08	1.65E-08	1.93E-08	<b>1.79E-08</b>
Acidification of soil and water - kg SO <sub>2</sub> eq/FU	2.13E-04	2.50E-04	2.13E-04	2.50E-04	<b>2.31E-04</b>
Eutrophication - kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	2.86E-05	3.35E-05	2.86E-05	3.35E-05	<b>3.10E-05</b>
Photochemical ozone creation - Ethene eq/FU	1.36E-05	1.59E-05	1.36E-05	1.59E-05	<b>1.47E-05</b>
Depletion of abiotic resources (elements) - kg Sb eq/FU	2.73E-07	3.20E-07	2.73E-07	3.20E-07	<b>2.96E-07</b>
Depletion of abiotic resources (fossil) - MJ/FU	1.36E+00	1.59E+00	1.36E+00	1.59E+00	<b>1.48E+00</b>
Water pollution - m <sup>3</sup> /FU	3.01E-02	3.53E-02	3.01E-02	3.53E-02	<b>3.27E-02</b>
Air Pollution - m <sup>3</sup> /FU	8.86E+00	1.04E+01	8.86E+00	1.04E+01	<b>9.62E+00</b>
<b>Resource Use</b>					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	1.47E-02	1.72E-02	1.47E-02	1.72E-02	<b>1.59E-02</b>
Use of renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	1.47E-02	1.72E-02	1.47E-02	1.72E-02	<b>1.59E-02</b>
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	1.46E+00	1.71E+00	1.46E+00	1.71E+00	<b>1.59E+00</b>
Use of non-renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	1.46E+00	1.71E+00	1.46E+00	1.71E+00	<b>1.59E+00</b>
Use of secondary material- kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Net use of fresh water - m <sup>3</sup> /FU	2.25E-04	2.63E-04	2.25E-04	2.63E-04	<b>2.44E-04</b>
<b>Waste Category</b>					
Hazardous waste disposed - kg/FU	8.63E-04	1.01E-03	8.63E-04	1.01E-03	<b>9.37E-04</b>
Non-hazardous waste disposed - kg/FU	7.28E-02	8.52E-02	7.28E-02	8.52E-02	<b>7.90E-02</b>
Radioactive waste disposed - kg/FU	9.30E-06	1.09E-05	9.30E-06	1.09E-05	<b>1.01E-05</b>
<b>Output flows</b>					
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Materials for recycling kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>

C4 Disposal	F13 Valdemoro	F15 Valdemoro	F13 Gelsa	F15 Gelsa	F13 & F15
<b>Environmental Impacts</b>					
Global Warming - kg CO <sub>2</sub> eq/FU	1.43E-01	1.68E-01	1.43E-01	1.68E-01	1.56E-01
Ozone Depletion - kg CFC 11 eq/FU	3.41E-08	4.00E-08	3.41E-08	4.00E-08	3.70E-08
Acidification of soil and water - kg SO <sub>2</sub> eq/FU	3.26E-01	3.82E-01	3.26E-01	3.82E-01	3.54E-01
Eutrophication - kg (PO <sub>4</sub> ) <sup>3-</sup> eq/FU	1.59E-04	1.86E-04	1.59E-04	1.86E-04	1.72E-04
Photochemical ozone creation - Ethene eq/FU	1.31E-02	1.53E-02	1.31E-02	1.53E-02	1.42E-02
Depletion of abiotic resources (elements) - kg Sb eq/FU	1.69E-07	1.98E-07	1.69E-07	1.98E-07	1.84E-07
Depletion of abiotic resources (fossil) - MJ/FU	3.34E+00	3.91E+00	3.34E+00	3.91E+00	3.63E+00
Water pollution - m <sup>3</sup> /FU	1.75E-01	2.05E-01	1.75E-01	2.05E-01	1.90E-01
Air Pollution - m <sup>3</sup> /FU	1.35E+03	1.58E+03	1.35E+03	1.58E+03	1.47E+03
<b>Resource Use</b>					
Use of renewable primary energy excluding renewable primary energy resources used as raw materials - MJ/FU	1.08E-01	1.26E-01	1.08E-01	1.26E-01	1.17E-01
Use of renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	1.08E-01	1.26E-01	1.08E-01	1.26E-01	1.17E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials- MJ/FU	3.62E+00	4.24E+00	3.62E+00	4.24E+00	3.93E+00
Use of non-renewable primary energy resources used as raw materials- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renew primary energy resources (primary energy and primary energy resources used as raw materials)- MJ/FU	3.62E+00	4.24E+00	3.62E+00	4.24E+00	3.93E+00
Use of secondary material- kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water - m <sup>3</sup> /FU	3.29E-03	3.85E-03	3.29E-03	3.85E-03	3.57E-03
<b>Waste Category</b>					
Hazardous waste disposed - kg/FU	5.76E-02	6.75E-02	5.76E-02	6.75E-02	6.26E-02
Non-hazardous waste disposed - kg/FU	1.11E+01	1.30E+01	1.11E+01	1.30E+01	1.21E+01
Radioactive waste disposed - kg/FU	2.05E-05	2.40E-05	2.05E-05	2.40E-05	2.22E-05
<b>Output flows</b>					
Components for re-use kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery kg/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Electricity - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Steam- MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported Energy - Process gases - MJ/FU	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00



[www.pladur.es](http://www.pladur.es)

**Pladur®**  
Makes it a reality