ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025

VILLA VERA building

EPD registration number: S-P-01139
Approval date: 2017/02/15
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Based on PCR 2014:02 Buildings, version 1.0
EPD® scope: Spain

General information

Manufacturer: Isover-Saint Gobain Ibérica SL, GLASSOLUTIONS Saint Gobain, Saint Gobain Placo Ibérica SA, Weber-Saint Gobain Ibérica SL. Calle Príncipe de Vergara 132. 28002 Madrid.
Programme used: The International EPD® System. Más información en www.environdec.com
EPD® registration number: S-P-01139
PCR identification: PCR 2014:02 Buildings version 1.0
Product name and manufacturer represented: Villa Vera Building; Saint Gobain Ibérica SL
UN CPC code: 531 Buildings
EPD owner: Saint Gobain Ibérica SL
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Declaration issued: 2017/02/15**, valid until:** 2020/02/14

EPD programme operator	The International EPD® System. EPD® International AB. www.environdec.com.
PCR review conducted by:	The International EPD® System technical committee
LCA and EPD® prepared by Isover Saint Gobain Ibérica, Weber Saint Gobain Ibérica, GLASSOLUTIONS Saint Gobain and Saint Gobain Placo Ibérica SA	
Independent verification of the declaration and data, according to EN ISO 14025:2010 Internal ☐ External ☒	
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www.isover.es **www.weber.es** **www.placo.es** **glassolutions.es**	

Product description

Product description and description of use:

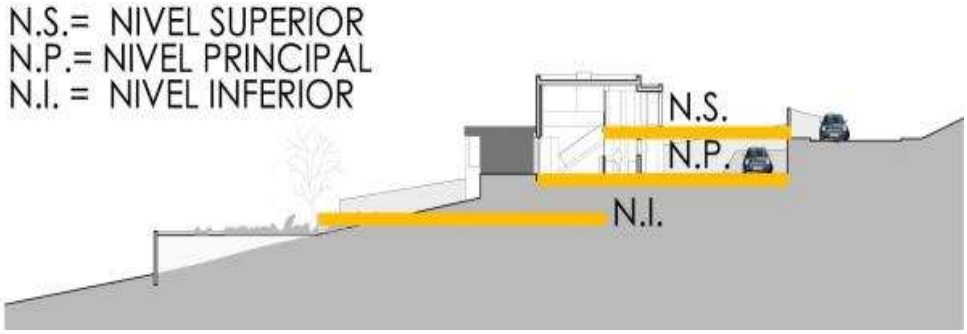
This Environmental Product Declaration (EPD®) describes the environmental impacts of the life cycle of Villa Vera, an individual dwelling residential building of 366 m^2 and an Atemp[1] of 195 m^2, with a lifespan of 50 years.

[1] Temperature controlled area, i.e. spaces that are intended to be heated or cooled by an energy system, limited by the inside of the building envelope.

Villa Vera, located in Chiva (Spain), has been developed by Estudio 1403 in a clear commitment to sustainable architecture and energy efficiency through the combination of different strategies both passive and the installation of high efficiency for HVAC equipment, together with energy and water consumption monitoring through various sensors installed in the building. This has allowed the building to obtain a rating of Very Good in the BREEAM ES certification, being the first residential building in Spain to obtain this certification.
The construction of Villa Vera on site began on march 2012 and ended on 2014.

This house synthetizes the commitment and know-how of Saint Gobain Group in the development of sustainable construction, answering the consumers' demand of low energy and resources consuming dwellings through its life cycle. Most of the passive strategies introduced to get an optimum energy behaviour have been met with Saint Gobain systems and products (Isover Saint Gobain Ibérica, Weber Saint Gobain Ibérica, GLASSOLUTIONS Saint Gobain and Saint Gobain Placo Ibérica SA).

Villa Vera consists of three levels due to the slope of the terrain, with a semi basement and two residential floors, with direct access from the outside at all levels.
The housing is designed to form a complete unit on the main floor. The main level consists on a living-dining room, kitchen, two bedrooms, two bathrooms and a multipurpose room.
The workroom is located at the top level.
On the lower level the technical room and another space with no currently defined use is located.



The situation of the terrain has determined the orientation of the house and the strategies adopted to thermally isolate the building. Moreover, the house has comfortable levels of natural lighting and gaps in all orientations to favour natural ventilation.

The thermal insulation installed in the housing is wider than the strictly necessary by legislation to prevent heat loss. In addition, the mineral wool provides good acoustic insulation.
In building facade, it has increased the thickness of the outer insulation and incorporated an inner insulation sheet that improves the performance of the enclosure both thermal and acoustic level airborne noise.
All windows are of aluminium with thermal break and low emissivity double glazed.
The main deck, with a rainwater retention system, and secondary decks, with a gravel coverage of 6 cm thickness, help to improve the thermal inertia and insulation of the building.

On the foundation, it has been placed an insulating panel that helps minimizing heat losses by contact with the ground.

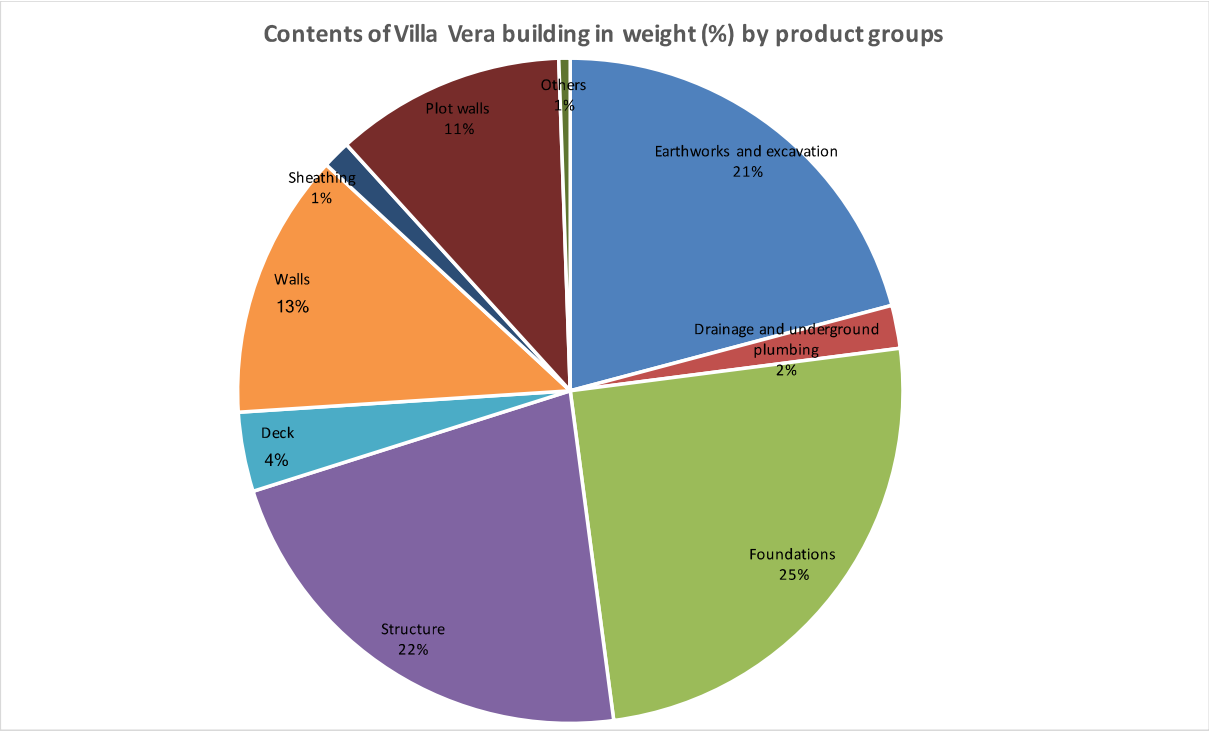


Figure 1 Description of the contents of Villa Vera building in weight (%) by product groups

MATERIALS/COMPONENTS	SUBSTANCES	QUANTITY OR WEIGHT (%)
Earthworks and excavation	Diesel consumption and sand and soil	20% (sand and soil)
Drainage and underground plumbing	Sumps Trap drains Pipes Septic tank	2% PVC and gravel
Foundations	Concrete and steel	10 cm levelling 25 and 30 cm retaining walls
Structure	Reinforcing steel Concrete	22%
Deck	Gravel EPDM Geotextile PP plots XPS	28 cm deck
Walls	Arliblock 20 and 15 Mortar Gypsum plasterboard Placo BA 15 cm Isover Arena mineral wool Concrete block Isofex ETICS Ventilated façade Arena 40	15 cm and 20 cm with arliblock Between 10,5 and 15 cm for partition walls 8 cm ETICS 6 cm Ecovent 4 cm Arena
Waterproofing and insulation	XPS Bitumen adhesive compound PS with geotextile HDPE with geotextile	6 cm XPS 1,5 kg/m2 Bitumen adhesive compound 1 mm PS and 140g/m2 of geotextile 320 g/m2 HDPE with geotextile
Sheathing	Shale flooring Webercol mortar Aluminium skirting board Paint Gypsum plasterboard Placo Ba	1 cm shale pavement and 2 cm for stairs 1,5 cm mortar 6 cm skirting 10 mm ceiling

	10mm ceiling	
Window joinery	Aluminium window frame Double glazing	
Inner doors	Interior wood doors	
Installations	Downpipes Solar DHW Ventilation Wiring and lighting Underfloor heating	
Exterior walls	Reinforced concrete Concrete block	11%

Content of substances of very high concern (SVHC) are evaluated based on the products with an EPD® that Villa Vera is based on:

- ISOFEX (Isover-Saint Gobain Ibérica SL)
- Arena (Isover-Saint Gobain Ibérica SL)
- Thermosilence M (Isover-Saint Gobain Ibérica SL, Saint Gobain Placo Ibérica SA, Weber-Saint Gobain Ibérica SL)
- Thermosilence F (Isover-Saint Gobain Ibérica SL, Saint Gobain Placo Ibérica SA, Weber-Saint Gobain Ibérica SL)
- Ecovent (Isover-Saint Gobain Ibérica SL)
- CLIMAPLUS® / CLIMALIT® PLUS (GLASSOLUTIONS Saint Gobain)

These EPDs® do not declare any content of SVHC (substances of very high concern). Referring to the other construction products used in Villa Vera building, any hazardous substance listed in the "Candidate List of Substances of Very High Concern (SVHC) for authorization[2]" has been used in a percentage higher than 0,1% of the product weight.

The environmental performance of Villa Vera is directly dependent on its size. This is why the environmental performance is reported in addition per square meter temperature controlled spaces (Atemp).

LCA calculation information

FUNCTIONAL UNIT	The life cycle of Villa Vera building, an individual dwelling residential building of 366 m^2 built area and an Atemp[3] of 195 m^2, with a lifespan of 50 years. In order to allow the comparison of different building, the results are also expressed per m^2 Atemp.
SYSTEM BOUNDARIES	Cradle to Grave: Mandatory stages = A1-3, A4-5, B1-7, C1-4. Optional stage = D not taken into account
REFERENCE SERVICE LIFE (RSL)	50 years
CUT-OFF RULES	No more than 1% of the total energy consumption and 1% of the total mass input has been omitted from each unit process. For each information module (A1-3, A4-5, B1-B7 and C1-C4), not more than 5% of material and energy input flows have been excluded. Environmental impacts of infrastructure, construction, production equipment, and tools that are not directly consumed in the production process are not accounted for in the life cycle inventory.

[2] http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp

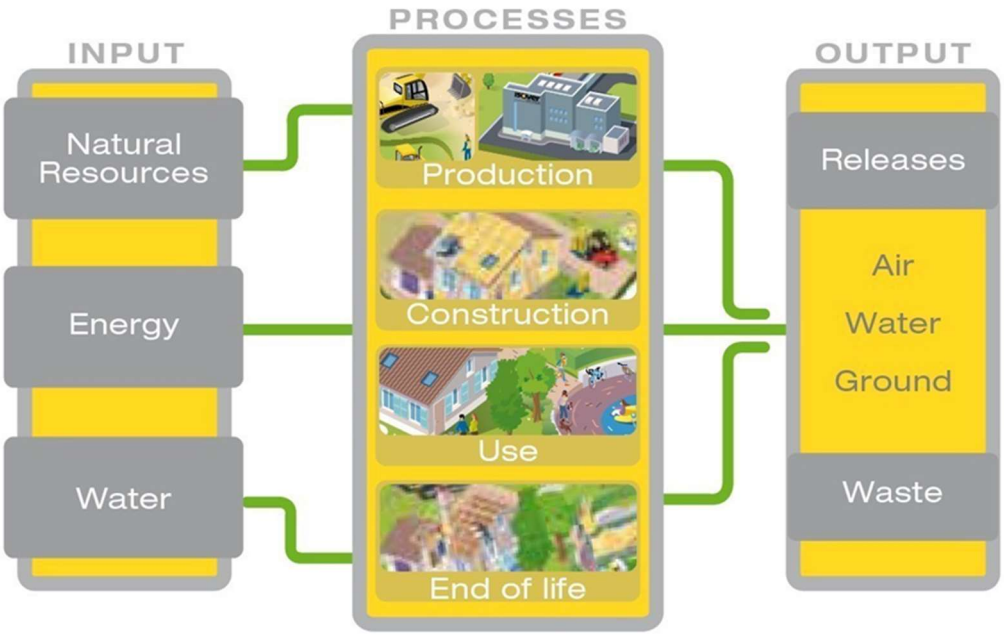
[3] Temperature controlled area, i.e. spaces that are intended to be heated or cooled by an energy system, limited by the inside of the building envelope.

	Employee-related activities such as transport to and from work are not included. Communication installations and lamps have not been included.
ALLOCATIONS	Allocation criteria are based on physic units
COBERTURA GEOGRÁFICA Y PERIODO TEMPORAL	Spain 2015

- EPD® of construction products may not be comparable if they do not comply with EN15804.
- EPDs® within the same product category but from different programmes may not be comparable.
- The verifier and the programme operator do not make any claim nor have any responsibility of the legality of the product.

Life cycle stages

Flow diagram of the Life Cycle



Product stage, A1-A3

Description of the stage: the product stage of Villa Vera building is subdivided into 3 modules A1, A2 and A3 respectively, Raw material supply, Transport and Manufacturing.

According to the PCR, the results for upstream processes shall be declared as a single aggregated information module, A1-3.

Description of the scenarios and other additional technical information:

A1, Raw material supply
This module includes the extraction and processing of raw materials and energy from the primary sources for the manufacturing of all construction products used in Villa Vera building.

A2, Transport
This module includes the transportation to the factory where raw materials are processed.

A3, Manufacture
This module includes the manufacture of products and packaging materials.

Construction process stage, A4-A5

Description of the stage: the construction process stage is the core process of Villa Vera building and is subdivided into 2 modules: A4, Transport and A5, Construction and installation.
According to the PCR the results of the life cycle inventory of processes within the core module of the life cycle are reported in an aggregated information module, A4-5.

A4, Transport to and from site: this module includes the transport from the construction products originating from factory to the building site, in Chiva (Valencia, Spain).
The transport is calculated according to scenarios, described in the table below.

PARAMETER	VALUE/DESCRIPTION
Fuel type and consumption of vehicle and vehicle type used for transport e.g. long distance truck, boat etc.	Average truck trailer with a 16-32t payload, diesel consumption of 26 litres for 100 km
Distance	300 km[4] except construction products and ancillary materials that comes from a known manufacturer
Capacity utilization (including empty returns)	100 % of the capacity in volume % of empty returns assumed in Ecoinvent 3.2
Bulk density of transported products	Different bulk density according to the type of construction product
Volume capacity utilisation factor	Not applicable

A5, Installation in the building: this module includes

- Waste produced during the installation of the product, that is sent to landfill.
- Additional manufacturing processes done in order to compensate losses.
- Packaging waste processing, which are 100% collected and recycled.

PARAMETER	VALUE/DESCRIPTION
Ancillary materials for installation (specified by material)	Only specified for the installation of products with an EPD®
Water use	Specified for the installation of products with an EPD and for mortars
Other resource use	Wood for the structure
Quantitative description of energy type (regional mix) and consumption during the installation process	Diesel for the machinery used in the construction site
Waste materials on the building site before waste processing, generated by the product's installation (specified by type)	Losses declared in construction products EPD and in WRAP[5]: Thermosilence M: 2% Thermosilence F: 2% Arliblock: 2,5% Isofex: 5% Arena: 5% Ecovent: 5% Structure: 2,5% Flooring: 2%
Output materials (specified by type) as results of waste processing at the building site e.g. of collection for recycling, for energy recovering, disposal (specified by route)	Losses are considered to be landfilled.

[4] A4 Distance proposed by EeBGuide, 2011.
[5] WRAP 2008, Net Waste Tool. Guide to Reference Data, Version 1.0

Direct emissions to ambient air soil and water	-

Use stage (excluding potential savings), B1-B7

Description of the stage: the use stage is divided into the following modules:

- B1: Use
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment
- B6: Operational energy use
- B7: Operational water use

Description of the scenarios and additional technical information:
Once installation is complete, the following actions or technical operations are required during the use stages until the end of life stage.

B2. MAINTENANCE	
PARAMETER	**VALUE/DESCRIPTION**
Maintenance process	Cleaning, watering and repainting
Maintenance cycle	Cleaning: weekly Repainting: every 10 years
Ancillary materials for maintenance	Soap: 5ml/l of floor cleaning water Paint for repainting: 0,166 kg/m^2
Waste material resulting from maintenance	Not significant
Net fresh water consumption during maintenance	General water use: 0,099m^3/day Floor cleaning: 1 l/day
Energy input during maintenance, energy carrier type and amount if applicable and relevant	Not significant

B3. REPAIR	
PARAMETER	**VALUE/DESCRIPTION**
Repair process	Repair of EPDM of the roof
Inspection process	-
Repair cycle	EPDM: 1 substitution cycle (lifespan 40 years)
Ancillary materials	Not relevant
Waste material resulting from repair	EPDM: 243 kg
Net fresh water consumption during repair	Not relevant
Energy input during repair, energy carrier type and amount	Not relevant

B4. REPLACEMENT	
PARAMETER	**VALUE/DESCRIPTION**
Replacement cycle	2 replacements of the gas boiler (lifespan 20 years)
Energy input during replacement, energy carrier type and amount if applicable and relevant	-
Exchange of worn parts during the product's life cycle	The whole product (38,5 kg)

B5. REFURBISHMENT	
PARAMETER	**VALUE/DESCRIPTION**
Refurbishment process	Substitution of indoor doors (lifespan 30 years)
Refurbishment cycle	1 cycle
Energy input during repair, energy carrier type and amount if applicable and relevant	-
Material input for refurbishment, including ancillary materials for the refurbishment process	11 Wood doors
Waste material resulting from Refurbishment	702 kg of wood
Further assumptions for scenario development	Lifespan 30 years

B6-B7. OPERATIONAL ENERGY AND WATER USE	
PARAMETER	**VALUE/DESCRIPTION**
Ancillary materials specified by material	-
Net fresh water consumption	0,190 m^3/day
Type of energy carrier	Natural gas: 0,93 kWh/day Electricity: 10,34 kWh/day
Power output of equipment	-
Characteristics performance	Dishwasher: 0,005 m^3/day HVAC: 2,28 kWh/day Lighting: 0,27 kWh/day Computer and monitoring: 1,41 kWh/day Ceramic hob and oven: 1,85 kWh/day Office equipment: 0,69 kWh/day Washing machine and dishwasher: 0,73 kWh/day Other energy consumption: 3,11 kWh/day
Further assumptions for scenario development e.g. frequency and time period of use, number of occupants	Occupied by two adults and one child

End of Life Stage, C1-C4

Description of the stage: this stage includes the next modules:

C1, Deconstruction, demolition

At the end of the building's life, the entire building is demolished, an activity that implies diesel consumption.

C2, Transport to waste processing

The demolition waste is transported to the waste manager, in this case to inert landfill.

C3, Waste processing for reuse, recovery and/or recycling

No scenario for recycling has been considered.

C4, Disposal

The whole construction waste is landfilled.

Description of the scenarios and additional technical information:

End of Life:

PARAMETER	VALUE/DESCRIPTION
Collection process specified by type	776 tn collected with mixed construction waste
Recovery system specified by type	0 tn for reuse, recovery or recycling
Disposal specified by type	776 tn mixed construction waste to landfill
Assumptions for scenario development (e.g. transportation)	Average truck trailer with a 16-32t payload, diesel consumption of 26 litres for 100 km 50 km of average distance to landfill

Reuse/recovery/recycling potential, D

Description of the stage: module D has not been taken into account.

LCA results

LCA model, aggregation of data and environmental impact are calculated from Simapro 8 software. CML-IA baseline v 4.1 impact method has been used as well as EDIP 2003 impact model for the calculation of waste production. Ecoinvent 3.2 database has been used to obtain the inventory of generic data as well as information from EPDs® of different products of Saint Gobain Group. The quantity of raw materials used have been taken directly from construction works. Water and energy consumption have been monitored and corresponds to reality.

Note that the results refer to the whole Villa Vera building and for 1 m^2 Atemp.

ENVIRONMENTAL IMPACTS

Parameters	Product stage	Construction stage	Use stage							End of Life Stage				D Reuse, recovery, recycling
	Production A1-A3	Construction A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstructon / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Global Warming Potential (GWP) – *kg CO2 equiv/FU* *kg CO2 equiv/m²* *Atemp*	1,34E+05	1,99E+04	0,00E+00	4,35E+03	6,71E+02	2,02E+02	1,41E+03	8,07E+04	1,34E+03	3,14E+03	6,46E+03	0,00E+00	4,12E+03	MND[6]
	6,87E+02	1,02E+02	0,00E+00	2,23E+01	3,44E+00	1,04E+00	7,23E+00	4,14E+02	6,87E+00	1,61E+01	3,31E+01	0,00E+00	2,13E+01	MND
	The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.													
Ozone Depletion (ODP) *kg CFC 11 equiv/FU* *kg CFC 11 equiv/m²* *Atemp*	7,32E-03	3,98E-03	0,00E+00	4,04E-04	1,53E-04	1,56E-05	1,22E-04	7,64E-03	1,55E-04	5,74E-04	1,19E-03	0,00E+00	1,39E-03	MND
	3,75E-05	2,04E-05	0,00E+00	2,07E-06	7,85E-07	8,00E-08	6,26E-07	3,92E-05	7,95E-07	2,94E-06	6,10E-06	0,00E+00	7,13E-06	MND
	Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.													
Acidification potential (AP) *kg SO2 equiv/FU* *kg SO2 equiv/m²* *Atemp*	5,45E+02	9,19E+01	0,00E+00	2,27E+01	3,20E+00	1,83E+00	7,70E+00	5,86E+02	7,03E+00	2,39E+01	2,57E+01	0,00E+00	3,10E+01	MND
	2,79E+00	4,71E-01	0,00E+00	1,16E-01	1,64E-02	9,38E-03	3,95E-02	3,01E+00	3,61E-02	1,23E-01	1,32E-01	0,00E+00	1,59E-01	MND
	Acid depositions have negative impacts on natural ecosystems and the man-made environment including buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.													
Eutrophication potential (EP) *kg (PO4)3- equiv/FU* *kg (PO4)3- equiv/m²* *Atemp*	1,93E+02	2,11E+01	0,00E+00	1,06E+01	8,61E-01	1,11E+00	2,83E+00	1,04E+02	3,52E+00	5,49E+00	5,85E+00	0,00E+00	6,61E+00	MND
	9,90E-01	1,08E-01	0,00E+00	5,43E-02	4,41E-03	5,69E-03	1,45E-02	5,33E-01	1,81E-02	2,82E-02	3,00E-02	0,00E+00	3,39E-02	MND
	Excessive enrichment of waters and continental surfaces with nutrients, and the associated adverse biological effects.													
Photochemical ozone creation (POPC)	4,38E+01	4,08E+00	0,00E+00	1,98E+00	1,74E-01	1,23E-01	5,40E-01	2,36E+01	3,14E-01	6,35E-01	1,09E+00	0,00E+00	1,52E+00	MND

[6] MND= Module Not Declared

	Ethene equiv/FU *Ethene equiv/m² Atemp*	2,24E-01	2,09E-02	0,00E+00	1,02E-02	8,92E-04	6,31E-04	2,77E-03	1,21E-01	1,61E-03	3,26E-03	5,59E-03	0,00E+00	7,85E-03	MND
		Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.												
	Abiotic depletion potential for non-fossil resources (ADPelements) *- kg Sb equiv/FU* *kg Sb equiv/m² Atemp*	9,45E-01	5,07E-02	0,00E+00	2,73E-02	2,05E-02	1,29E-02	1,65E-02	2,48E-01	4,73E-03	9,99E-04	1,90E-02	0,00E+00	4,60E-03	MND
		4,85E-03	2,60E-04	0,00E+00	1,40E-04	1,05E-04	6,77E-08	6,62E-05	1,27E-03	2,43E-05	5,12E-06	9,74E-05	0,00E+00	2,36E-05	MND
	Abiotic depletion potential for fossil resources (ADP-fossil fuels) - *MJ/FU* *MJ/m² Atemp*	1,57E+06	3,33E+05	0,00E+00	5,28E+04	1,93E+04	2,73E+03	2,05E+04	1,09E+06	1,93E+04	4,51E+04	9,79E+04	0,00E+00	1,17E+05	MND
		8,05E+03	1,71E+03	0,00E+00	2,71E+02	9,90E+01	1,40E+01	1,05E+02	5,59E+03	9,90E+01	2,31E+02	5,02E+02	0,00E+00	6,00E+02	MND
		Consumption of non-renewable resources, thereby lowering their availability for future generations.												

RESOURCE USE

Parameters	Product stage	Construction stage	Use stage							End of Life Stage				D Reuse, recovery, recycling
	Production A1-A3	Construction A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding primary energy resources used as raw material – MJ/FU	1,43E+05	5,48E+03	0,00E+00	2,08E+04	7,29E+02	3,36E+02	1,82E+04	3,27E+05	2,73E+03	2,52E+02	1,29E+03	0,00E+00	2,96E+03	MND
MJ/m² Atemp	7,35E+02	2,81E+01	0,00E+00	1,06E+02	3,74E+00	1,72E+00	9,33E+01	1,68E+03	1,40E+01	1,29E+00	6,60E+00	0,00E+00	1,52E+01	MND
Use of renewable primary energy resources used as raw material - MJ/UF	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MJ/m² Atemp	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/FU	1,43E+05	5,48E+03	0,00E+00	2,08E+04	7,29E+02	3,36E+02	1,82E+04	3,27E+05	2,73E+03	2,52E+02	1,29E+03	0,00E+00	2,96E+03	MND
MJ/m² Atemp	7,35E+02	2,81E+01	0,00E+00	1,06E+02	3,74E+00	1,72E+00	9,33E+01	1,68E+03	1,40E+01	1,29E+00	6,60E+00	0,00E+00	1,52E+01	MND
Use of non-renewable primary energy excluding primary energy	1,57E+06	3,33E+05	0,00E+00	5,28E+04	1,93E+04	2,73E+03	2,05E+04	1,09E+06	1,93E+04	4,51E+04	9,79E+04	0,00E+00	1,17E+05	MND

WASTE CATEGORIES

resources used as raw material - MJ/UF MJ/m² Atemp	8,05E+03	1,71E+03	0,00E+00	2,71E+02	9,90E+01	1,40E+01	1,05E+02	5,59E+03	9,90E+01	2,31E+02	5,02E+02	0,00E+00	6,00E+02	MND
Use of non-renewable primary energy resources used as raw material – MJ/FU - MJ/UF MJ/m² Atemp	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/FU MJ/m² Atemp	1,57E+06	3,33E+05	0,00E+00	5,28E+04	1,93E+04	2,73E+03	2,05E+04	1,09E+06	1,93E+04	4,51E+04	9,79E+04	0,00E+00	1,17E+05	MND
	8,05E+03	1,71E+03	0,00E+00	2,71E+02	9,90E+01	1,40E-01	1,05E+02	5,59E+03	9,90E+01	2,31E+02	5,02E+02	0,00E+00	6,00E+02	MND
Use of secondary material kg/FU kg/m² Atemp	5,14E+02	1,27E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND
	2,64E+00	6,53E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND
Use of renewable secondary fuels- MJ/FU MJ/m² Atemp	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels - MJ/FU MJ/m² Atemp	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of net fresh water - m³/FU[7] m³/m² Atemp	1,53E+03	1,43E+02	0,00E+00	2,01E+03	2,70E+00	1,73E+00	8,96E+00	4,17E+02	3,59E+03	4,90E+00	1,90E+01	0,00E+00	1,29E+02	MND
	7,84E+00	7,35E-01	0,00E+00	1,03E+01	1,39E-02	8,86E-03	4,60E-02	2,14E+00	1,84E+01	2,51E-02	9,74E-02	0,00E+00	6,63E-01	MND

[7] Neither the use of water for turbine use or cooling during the production of hydraulic and nuclear electricity have been taken into account.

Parameters	Product stage	Construction stage	Use stage							End of Life Stage				D Reuse, recovery, recycling
	Production A1-A3	Construction A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste to disposal kg/FU	5,94E+00	2,36E-01	0,00E+00	6,16E-02	7,36E-03	2,07E-02	3,32E-02	1,63E+00	2,67E-02	1,97E-02	6,02E-02	0,00E+00	8,14E-02	MND
kg/m^2 Atemp	3,05E-02	1,21E-03	0,00E+00	3,16E-04	3,77E-05	1,06E-04	1,70E-04	8,36E-03	1,37E-04	1,01E-04	3,09E-04	0,00E+00	4,17E-04	MND
Non hazardous waste to disposal kg/FU	2,46E+04	5,30E+05	0,00E+00	1,61E+03	2,77E+02	7,27E+01	3,17E+02	3,61E+03	1,71E+02	4,34E+01	4,60E+03	0,00E+00	7,76E+05	MND
kg/m^2 Atemp	1,26E+02	2,72E+03	0,00E+00	8,26E+00	1,42E+00	3,73E-01	1,63E+00	1,85E+01	8,77E-01	2,23E-01	2,36E+01	0,00E+00	3,98E+03	MND
Radioactive waste disposed kg/UF	5,39E+00	2,25E+00	0,00E+00	2,05E-01	9,48E-02	9,83E-03	7,24E-02	8,71E+00	3,23E-01	3,15E-01	6,75E-01	0,00E+00	7,89E-01	MND
kg/m^2 Atemp	2,76E-02	1,15E-02	0,00E+00	1,05E-03	4,86E-04	5,04E-05	3,71E-04	4,47E-02	7,33E-04	1,66E-03	3,46E-03	0,00E+00	4,05E-03	MND

OTHER OUTPUT FLOWS

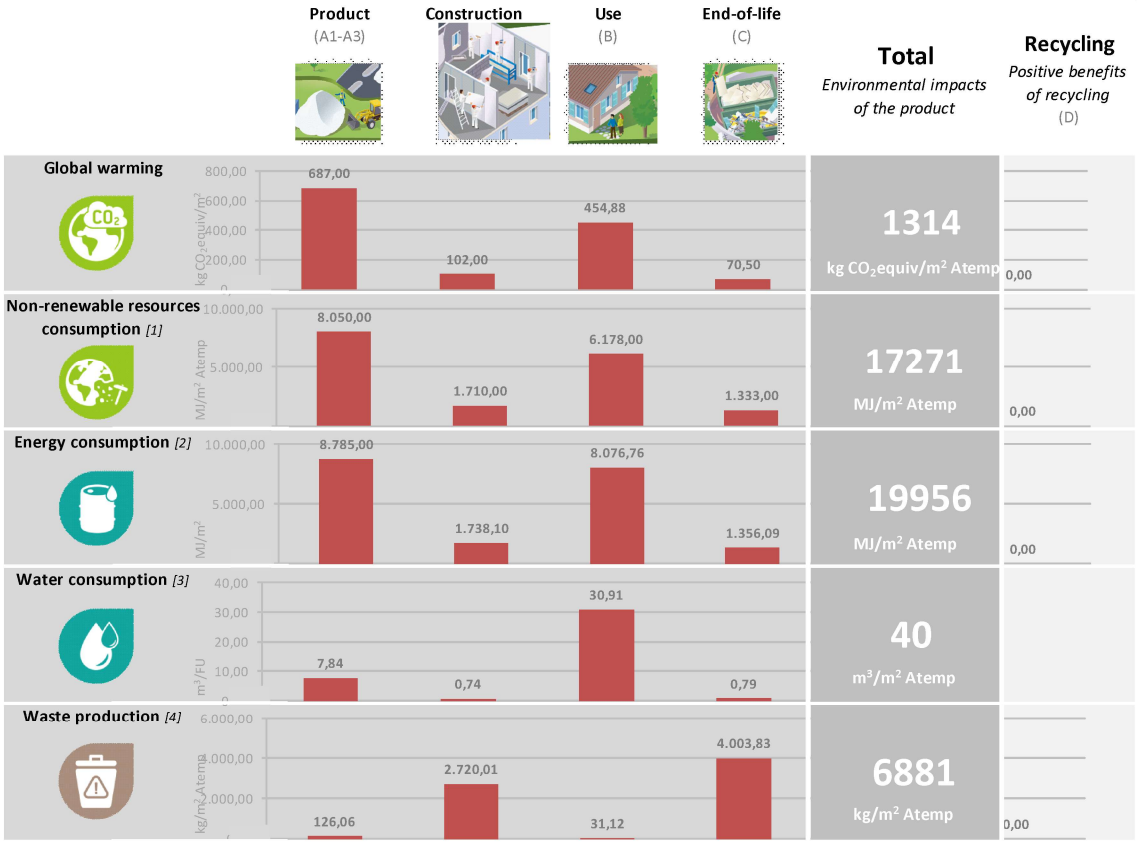
Parameters	Product stage	Construction stage	Use stage							End of Life Stage				D Reuse, recovery, recycling
	Production A1-A3	Construction A4-A5	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use *kg/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
kg/m² Atemp	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Materials for recycling *kg/FU*	8,11E+02	4,78E+02	0	0	0	0	0	0	0	0	0	0	0	MND
kg/m² Atemp	4,16E+00	2,45E+00	0	0	0	0	0	0	0	0	0	0	0	MND
Material for energy recovery *kg/FU*	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
kg/m² Atemp	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
Exported energy *MJ/UF*	0	0	0	0	0	0	0	0	0	0	0	0	0	MND
kg/m² Atemp	0	0	0	0	0	0	0	0	0	0	0	0	0	MND

LCA interpretation

The Product stage (A1-A3) is the life cycle stage with the biggest impact, since it represents more than 50% of the whole Villa Vera impact for the next impact categories: Global warming, eutrophication, photochemical oxidation, abiotic depletion and hazardous waste.

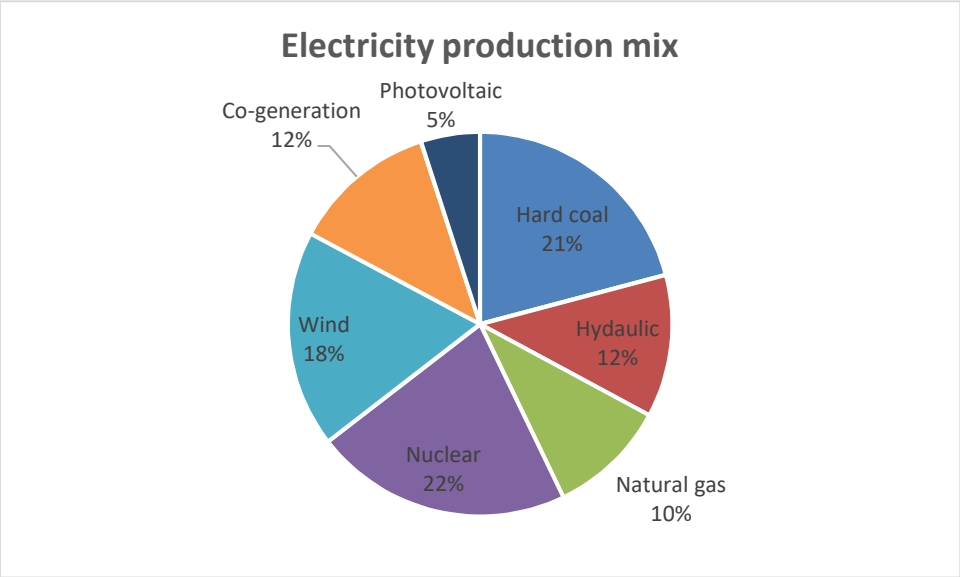
Water is mainly consumed during the use stage, since it represents 77% of the life cycle water consumption.

Waste production is mainly produced during the End of life stage (58% of the whole waste production) and Construction stage (40%). Earthworks and excavation also have a significant impact on waste production.



Additional information

The electricity production mix considered for A1-A3 product stage and B6 operational energy use is the Spanish electricity production mix in 2015[8].
The composition of the electricity production mix used is detailed in the next figure.



[8] Source: Red Eléctrica Española.

Bibliography

- ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.
- ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.
- ISO 14025:2006: Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures.
- PCR 2014:02 Buildings version 1.0
- EN 15978:2011: Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method
- General Programme Instructions for the International EPD® System, version 2.5.
- EeBGuide, 2011. Guidance Document – Part B: Buildings – Operational guidance for life cycle assessment studies of the Energy-Efficient Buildings Initiative. European Commission. Available at: http://www.eebguide.eu/eebblog/wp-content/uploads/2012/10/EeBGuide-B-FINAL-PR_2012- 10-29.pdf
- WRAP 2008, Net Waste Tool. Guide to Reference Data, Version 1.0. Available at: http://nwtool.wrap.org.uk/Documents/WRAP%20NW%20Tool%20Data%20Report.pdf
- National Association of Home Builders, Bank of America Home Equity 2007, Study of Life Expectancy of Home Components. Available at: http://actionplus-hi.com/lifeexpectancy.pdf