# THIRD PARTY VERIFIED - E P D

## ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804

# ANODISED ALUMINIUM COIL AND SHEET

| | |
|---|---|
| **Products** | **Anodised coil and sheet for wall cladding**<br>**Thickness:1.5, 2 and 3mm- Anodic layer:10, 15 and 20 µm**<br>C-Wall ® and C-Brite ® and other anodising qualities |
| Declaration holder | COIL ADDING VALUE TO ALUMINIUM |
| Publisher and programme holder | EUROPEAN ALUMINIUM |
| Declaration number | EPD1–COIL NV/SA-2017 |
| Issue date | 1 Jan 2017 |
| Valid until | 31 Dec 2022* |

*The validity of this EPD has been extended for a period of 1 year, an update is under development.

## 1/ GENERAL INFORMATION

- **Owner of the declaration**

COIL NV/SA
Roosveld 5
3400 Landen – Belgium

- **Programme holder**

European Aluminium
(previously European Aluminium Association)
Avenue de Broqueville, 12
1150 Brussels - Belgium

Signature :

Dr Gerd Götz, Director General

- **Product Category Rules (PCR) used for the verification**

PCR for Aluminium Building Products – version of 30 January 2013

- **Verification**

| | |
|---|---|
| EN 15804 serves as core PCR completed by PCR for Aluminium Building Products | |
| Verification of the EPD by an independent third party in accordance with ISO 14025 | |
| Internally | X Externally |

- **Verifier**

Carl-Otto Nevén
NEVÉN Miljökonsult/Environmental Cons.
Kvarnåsvägen 8; SE-43331 Partille; Sweden

Signature

- **Product group covered and applicability**

This EPD covers anodised aluminium coil and sheet used for wall cladding with a thickness of 1,5 to 3 mm and an anodic layer up to 20 µm.
This EPD has been calculated from a modelling software developed by thinkstep via an i-report in GaBi 6. The data and parameters for the anodising process have been calculated on basis of figures collected among Coil NV for the year 2014. European average data have been used for the upstream aluminium processes.

**This EPD is only applicable to the above listed products produced by COIL NV/SA and which have been anodised by COIL NV/SA.**

- **Functional Unit**

1 m² of anodised aluminium coil or sheet

- **Liability**

The owner of the declaration is liable for the underlying manufacturing information and evidence.

## 2. Product

### 2.1. Product description and application

This Environmental Product Declaration (EPD) is for business to business communication. The EPD refers to anodised aluminium coil and sheet.

The aluminium and aluminium alloy slabs are rolled to the requisite thickness and treated thermally in accordance with customer specifications. Afterwards aluminium coil is pre-treated and then continuously anodised. The type of anodising and the delivery dimensions (i.e. full coil or cut-to-length sheet) are customised according to client requirements.

Anodised aluminium coils and sheets are semi-finished products which are further processed (e.g. by cutting, forming or machining operations) to be converted into a final product and installed on a building, e.g. roofing panel.

This EPD provide LCA results for the following nine variations of the anodised coil and sheet:

- Three aluminium coil and sheet thicknesses: 1,5 mm, 2 mm or 3mm
- Three anodic layer thicknesses: 10, 15 or 20 µm

### 2.2. Technical data

C-Wall ® and C-Brite ® are commercial products. Technical data are available at http://www.coil.be/en/products/target-groups/architects-contractors/ .

According to the client requirements, anodised coils and sheets are produced from other anodising qualities made of alloy series EN-AW 1xxx (e.g. 1085), 3xxx, 5xxx (e.g. 5005, 5754) and 6xxx (e.g. 6061) for which the precise composition and microstructure are optimized to satisfy the anodising requirements. On average, these anodised coils and sheets contain at least 95%w of aluminium. The technical data related to these anodised aluminium coil and sheet are publicly available or can be provided by COIL NV/SA.

### 2.3. Relevant Standards for market Applications

Most relevant standards for applications of aluminium sheet products in buildings are EN 485-2, EN 507, EN 508-2, EN 573-3, EN 1396, EN 13501-1, EN 14782, EN 14783, EN 13964/+A1. Please refer to the latest version of those standards.

### 2.4. Delivery status

The material is supplied semi-finished in customised dimensions for further processing.

### 2.5. Metal and coil production (background processes)

As described in details in the Environmental profile report of the European Aluminium Industry /EPR/, aluminium is extracted from bauxite via alumina refining followed by an electrolysis to produce primary aluminium. Aluminium supply may also come from recycling of aluminium scrap. However, in this EPD, only primary aluminium has been considered for the aluminium supply. This is a conservative assumption since aluminium recycling generates much less environmental impact than primary production. After electrolysis, the liquid primary aluminium is mixed with small quantities of alloying elements such as silicon, iron, magnesium and zinc. The alloying elements are not considered in the LCA model and are substituted by primary aluminium. This proxy appears as reasonable considering that on average the alloying elements contribute to less than 5 % of the weight of the aluminium rolled product.

The liquid alloy is then casted into slabs, i.e. starting material for the coil production process. Aluminium coils are produced through the rolling process. The slabs are hot rolled at temperature around 400-500°C and then cold rolled to aluminium coils. Typical thickness of aluminium coils are comprised between 0,5 & 3 mm. The aluminium is delivered as a mill finish coil to the continuous anodising process.

The two above processes constitute the background processes as described in the flow diagram below. The average LCI datasets reported in / EPR/ have been used.

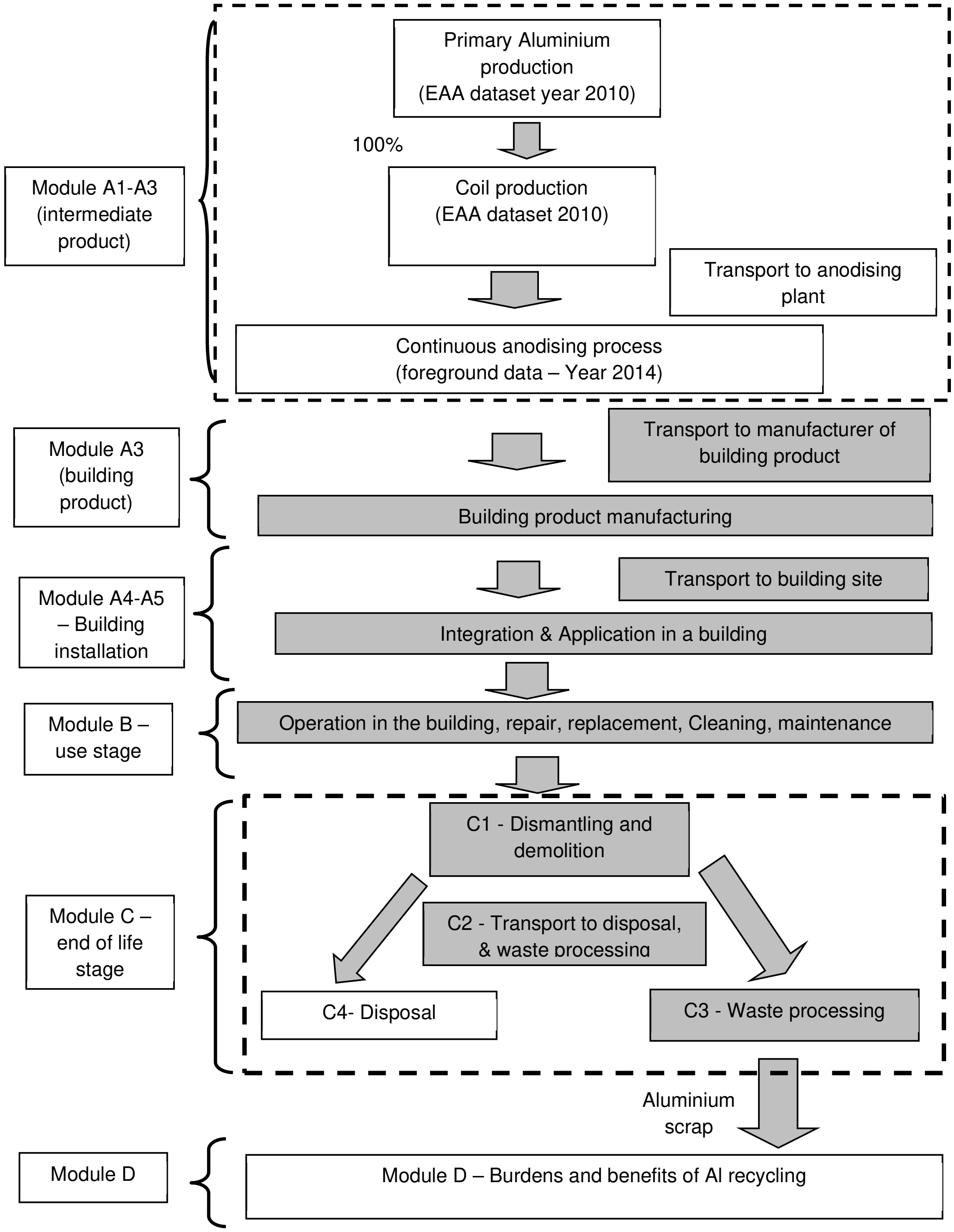



Figure 1. Life cycle flow diagram of the anodised coil and sheet, [processes and life cycle stages in grey boxes are not covered]

The production of the mill finish aluminium coil has been modelled using the average datasets published by the European Aluminium as described in the Environmental profile report /EPR/. This proxy appears as reasonable considering the product covered in this EPD comes from a European coil producer which has contributed to the development of the European Aluminium LCI datasets on coil production. The mill finished aluminium coils are supplied to COIL NV/SA. COIL NV/SA is a major continuous anodiser of aluminium coil.

## 2.6. Continuous anodising process (foreground processes)

Continuous anodising constitutes the foreground process for which specific data from Coil NV/SA have been used (year 2014). Continuous anodising at the Coil plant consists in the following processes:

1) Cleaning & degreasing in alkaline solution + rinsing
2) Etching + rinsing
3) Neutralisation + rinsing
4) Anodising + rinsing
5) Colouring + rinsing
6) Sealing + rinsing

The thickness of the anodised layer is adapted according to the client requirements via a variation of the coil speed through the line and current intensity of the anodising process. Data collected from COIL NV/SA cover all these process steps.

## 2.7. Health and safety aspects during production installation and use

Continuous anodising requires the use of acid and alkaline solutions as well as some organometallic salt for colouring purposes. All those processes are very well controlled and workers are not in direct contacts with those solutions or related emissions. Waste solutions are systematically collected and treated.
There are no relevant aspects of occupational health and safety during the further processing and installation of the aluminium coil and sheet. Under normal installation, no measurable environmental impacts can be associated to use of anodised aluminium coil. There is no release of any substance from the REACH SVHC list during further processing or during the use phase.

## 2.8. Packaging

The material is supplied as rolled strips (i.e. coils) or stacked sheets in the dimensions specified by the customer. Wooden pallets, cardboard paper, recycled plastic foil and metallic straps made of steel or plastic are used as packaging materials. After use, packaging materials can be re-used or recycled. Wooden pallets, plastic, paper and straps can be collected separately and directed to the recycling circuit.

## 2.9. Further processing, use and reference service life

Anodised coil and sheet are intermediate products which are used for the production of various aluminium products used in the building sector. This EPD covers anodised coil and sheet which are mostly used as wall cladding for buildings. This EPD does not cover the downstream processes to convert this intermediate product into a final building products.

In normal use, anodised aluminium products are not altered nor corroded over time. A regular cleaning (e.g. once a year) of the product is sufficient to secure a long service life. However, the use of too alkaline (pH >10) or too acidic (pH < 4) cleaning solution should be avoided. Since the use phase is not covered in the EPD, no specific information can be given about the reference ‘Service Life’. Nevertheless, in practice, a service life of 50 years can be assumed in normal use for such application /DURABILITY/.

Aluminium is a non-combustible construction material and has a European Fire Class A1 rating in accordance to EN 13501 as well as Directive 96/603/EC. Therefore it does not make any contribution to fire.

## 2.10. End of life stage

Anodised aluminium sheet is fully recyclable. Hence, after use, the product is collected and directed to a company specialised in aluminium recycling. Recycled aluminium produced by these recyclers can be used again as primary material. The economic value of aluminium sheet at the end of life largely cover the costs related to the destruction and collection operations.

A study performed by Delft University has demonstrated an average collection rate of at least 96% for aluminium applications in the construction sector /DELFT/. Only a small fraction of the aluminium sheet escapes the recycling route. This small fraction (4%) is then considered as landfilled in the LCA model.

From collected scrap up to the new aluminium ingot, 4% of additional aluminium loss is assumed. Hence, the overall recycling rate of aluminium in the LCA model has been fixed to 92%.

The waste code for aluminium in accordance with the European Waste Catalogue (EWC) is 17 04 02.

## 3. LCA: Calculation rules

### 3.1. Functional Unit and specific mass

The functional unit corresponds to 1 m² of anodised aluminium coil or sheet. The corresponding mass of the 3 representative products are reported in the next table.

| Coil or sheet thickness | Mass of the functional unit |
|---|---|
| 1,5 mm | 4.05 kg |
| 2 mm | 5.4 kg |
| 3 mm | 8.1 kg |

For each sheet thickness, the LCA results are reported for three different anodic layer thicknesses, respectively 10 µm, 15 µm and 20 µm. The thickness of the anodic layer does not influence the mass of the functional unit.

### 3.2. System boundaries

Type of EPD: Cradle to gate – with options

The production stage (modules A1-A3) includes processes that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as waste processing.

For the end of life stage, a collection rate of 96% is assumed and directed to recycling (module D). The 4% lost product is modelled through landfilling (module C4). Considering the few losses along the recycling chain, it is assumed that 92% of the Al sheet is effectively recycled as new ingot. Hence, an end of life recycling rate of 92% is used within module D to reflect the benefits of recycling through the substitution principle.
According to the Product Category Rules, modules C1, C2 and C3 should be addressed in the EPD. For aluminium coils and sheets, however, these 3 modules do not contribute significantly to the EPD results. These aluminium coils and sheets are indeed only intermediate building products for which it is difficult to define precisely deconstruction and transport scenarios. Therefore these three modules were not calculated.

### 3.3. Estimates and assumptions

It has been assumed that the aluminium coils and sheet were composed of primary aluminium only. In practice, aluminium sourcing can also be based partly on recycled aluminium. This assumption is then conservative. Considering that anodised aluminium coils and sheets are composed on average of at least 95% of aluminium, alloying elements were not considered and a pure aluminium coil and sheet has been assumed as a proxy.

### 3.4. Cut-off criteria

All known operating data were taken into consideration in the analysis. The ignored processes or flows contribute to less than 5% to the impact categories under review.

### 3.5. Background data

GaBi 6 2014- the software system for comprehensive analysis developed by thinkstep (previously PE International) – was used for modelling the life cycle for the manufacturing of anodised aluminium sheet. Generic GaBi 6 data sets have been used for energy, transport and consumables. For the aluminium primary production, recycling and sheet production, the datasets described in the EAA environmental report have been used /EPR/.

### 3.6. Foreground data and EPD-data tool

Foreground data refer to the anodising process at COIL NV/SA in Landen (Belgium). COIL NV/SA data of the year 2014 have been used for developing an EPD-data software tool which generates EPD indicators based on several key product specifications. This EPD-data software tool has been used to generate the EPD results.

### 3.7. Data quality

The data quality can be considered as good. The foreground data collection has been done thoroughly, all relevant flows are considered. Technological, geographical and temporal representativeness is appropriate. The use of European average data for the upstream aluminium processes is a reasonable proxy.

### 3.8. Allocation

Any aluminium scrap produced at anodising process level is sent to an external recycler. This recycling loop has been modelled in the GaBi model so that only the anodised sheet exits the gate. Hence, the production process does not deliver any co-products.
For the end-of-life stage, sheet scrap is sent to a recycling treatment (melting process) and credits are calculated. Both the recycling and the credits are modelled in module D.

### 3.9. Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared have been drawn up in accordance with EN 15804, and the building context or product-specific characteristics are taken into consideration.

## 4. LCA scenarios and additional technical information

Modules A4, A5, B1-B7 are not taken into consideration in this Declaration. Modules C1, C2 and C3 were not calculated due to their low contribution to the results and the scenario uncertainty. Only primary aluminium is used as sourcing, i.e. no recycled aluminium is considered at production level. Hence, the recycling credits reported in Module D are based on an overall recycling rate of 92% and a conservation of the inherent properties through recycling.

| Production | | | Installation | | Use stage | | | | | | | End-of-Life | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw material supply (extraction, processing, recycled material) | Transport to manufacturer | Manufacturing | Transport to building site | Installation into building | Use / application | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | Deconstruction / demolition | Transport to EoL | Waste processing for reuse, recovery or recycling | Disposal | Reuse, recovery or recycling potential |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| X | X | X | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | X | X |

X= Modules calculated, MND = Modules Not Declared

## 5. LCA results

The results for the 9 product variations, i.e. 1.5mm, 2mm and 3 mm coil and sheet thicknesses for respectively 10, 15 and 20 µm anodic layer thicknesses are reported in the 3 next tables.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mass of the declared unit (1m² of 1,5 mm thick Al sheet)** | | **kg** | **4,05** | | | | | | | | |
| **Anodic layer thickness** | | **µm** | **10** | | | **15** | | | **20** | | |
| ENVIRONMENTAL IMPACTS | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| GWP | Global warming potential | [kg CO2-eq.] | 40,5 | 0,0026 | -30,3 | 41,2 | 0,0026 | -30,3 | 41,9 | 0,0026 | -30,3 |
| ODP | Ozone layer depletion potential | [kg CFC11-eq.] | 1,91E-06 | 2,86E-14 | -1,66E-06 | 1,91E-06 | 2,86E-14 | -1,66E-06 | 1,91E-06 | 2,86E-14 | -1,66E-06 |
| AP | Acidification potential of land and water | [kg SO2-eq.] | 0,15 | 1,56E-05 | -0,121 | 0,151 | 1,56E-05 | -0,121 | 0,153 | 1,56E-05 | -0,121 |
| EP | Eutrophication potential | [kg PO43--eq.] | 0,01 | 2,12E-06 | -0,007 | 0,0102 | 2,12E-06 | -0,007 | 0,0103 | 2,12E-06 | -0,007 |
| POCP | Photochemical oxidation potential | [kg ethene-eq.] | 0,00953 | 1,5E-06 | -0,00749 | 0,00966 | 1,5E-06 | -0,00749 | 0,00979 | 1,5E-06 | -0,00749 |
| ADPE | Abiotic depletion potential (elements) | [kg Sb-eq.] | 2,66E-05 | 8,98E-10 | -1,33E-05 | 2,68E-05 | 8,98E-10 | -1,33E-05 | 2,70E-05 | 8,98E-10 | -1,33E-05 |
| ADPF | Abiotic depletion potential (fossil fuels) | [MJ] | 440 | 0,0338 | -318 | 449 | 0,0338 | -318 | 458 | 0,0338 | -318 |
| | | | | | | | | | | | |
| RESOURCE USE | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| PERE | Use of renewable primary energy excluding renewable primary energy resources used as raw materials | [MJ] | 163 | - | - | 166 | - | - | 168 | - | - |
| PERM | Use of renewable primary energy resources used as raw materials | [MJ] | 0 | - | - | 0 | - | - | 0 | - | - |
| PERT | Total use of renewable primary energy resources | [MJ] | 163 | 0,00398 | -138 | 166 | 0,00398 | -138 | 168 | 0,00398 | -138 |
| PENRE | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | [MJ] | 576 | - | - | 588 | - | - | 600 | - | - |
| PENRM | Use of non-renewable primary energy resources used as raw materials | [MJ] | 0 | - | - | 0 | - | - | 0 | - | - |
| PENRT | Total use of non-renewable primary energy resources | [MJ] | 576 | 0,035 | -423 | 588 | 0,035 | -423 | 600 | 0,035 | -423 |
| SM | Use of secondary materials | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RSF | Use of renewable secondary fuels | [MJ] | 0,0181 | 0,000065 | -0,0153 | 0,0182 | 0,000065 | -0,0153 | 0,0184 | 0,000065 | -0,0153 |
| NRSF | Use of non- renewable secondary fuels | [MJ] | 0,167 | 0,000132 | -0,141 | 0,169 | 0,000132 | -0,141 | 0,17 | 0,000132 | -0,141 |
| FW | Use of net fresh water | [m3] | 0,331 | 7,15E-06 | -0,279 | 0,335 | 7,15E-06 | -0,279 | 0,339 | 7,15E-06 | -0,279 |
| | | | | | | | | | | | |
| OUTPUT FLOWS AND WASTE CATEGORIES | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| HWD | Hazardous waste disposed | [kg] | 2,49E-07 | 8,00E-10 | 0 | 2,56E-07 | 8,00E-10 | 0 | 2,62E-07 | 8,00E-10 | 0 |
| NHWD | Non-hazardous waste disposed | [kg] | 8,86 | 0,162 | -7,28 | 8,87 | 0,162 | -7,28 | 8,87 | 0,162 | -7,28 |
| RWD | Radioactive waste disposed | [kg] | 0,0558 | 4,89E-07 | -0,0436 | 0,0571 | 4,89E-07 | -0,0436 | 0,0585 | 4,89E-07 | -0,0436 |
| CRU | Components for re-use | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MFR | Materials for recycling | [kg] | 0 | 0 | 3,89 | 0 | 0 | 3,89 | 0 | 0 | 3,89 |
| MER | Materials for energy recovery | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EEE | Exported electrical energy | [MJ] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EET | Exported thermal energy | [MJ] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 1 LCIA results for 1 m² of 1.5 mm-thick anodised coil and sheet.

| Mass of the declared unit (1m² of 2-mm thick Al sheet) | | kg | 5,4 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Anodic layer thickness** | | **µm** | **10** | | | **15** | | | **20** | | |
| ENVIRONMENTAL IMPACTS | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| GWP | Global warming potential | [kg CO2-eq.] | 53 | 0,00347 | -40,5 | 53,7 | 0,00347 | -40,5 | 54,4 | 0,00347 | -40,5 |
| ODP | Ozone layer depletion potential | [kg CFC11-eq.] | 2,54E-06 | 3,82E-14 | -2,21E-06 | 2,54E-06 | 3,82E-14 | -2,21E-06 | 2,54E-06 | 3,82E-14 | -2,21E-06 |
| AP | Acidification potential of land and water | [kg SO2-eq.] | 0,197 | 2,08E-05 | -0,162 | 0,199 | 2,08E-05 | -0,162 | 0,2 | 2,08E-05 | -0,162 |
| EP | Eutrophication potential | [kg PO43--eq.] | 0,0129 | 2,83E-06 | -0,00934 | 0,0131 | 2,83E-06 | -0,00934 | 0,0132 | 2,83E-06 | -0,00934 |
| POCP | Photochemical oxidation potential | [kg ethene-eq.] | 0,0125 | 0,000002 | -0,00998 | 0,0126 | 0,000002 | -0,00998 | 0,0128 | 0,000002 | -0,00998 |
| ADPE | Abiotic depletion potential (elements) | [kg Sb-eq.] | 3,25E-05 | 1,20E-09 | -1,77E-05 | 3,27E-05 | 1,20E-09 | -1,77E-05 | 3,29E-05 | 1,20E-09 | -1,77E-05 |
| ADPF | Abiotic depletion potential (fossil fuels) | [MJ] | 577 | 0,0451 | -424 | 586 | 0,0451 | -424 | 594 | 0,0451 | -424 |
| | | | | | | | | | | | |
| RESOURCE USE | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| PERE | Use of renewable primary energy excluding renewable primary energy resources used as raw materials | [MJ] | 215 | - | - | 217 | - | - | 220 | - | - |
| PERM | Use of renewable primary energy resources used as raw materials | [MJ] | 0 | - | - | 0 | - | - | 0 | - | - |
| PERT | Total use of renewable primary energy resources | [MJ] | 215 | 0,0053 | -184 | 217 | 0,0053 | -184 | 220 | 0,0053 | -184 |
| PENRE | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | [MJ] | 754 | - | - | 766 | - | - | 779 | - | - |
| PENRM | Use of non-renewable primary energy resources used as raw materials | [MJ] | 0 | - | - | 0 | - | - | 0 | - | - |
| PENRT | Total use of non-renewable primary energy resources | [MJ] | 754 | 0,0467 | -565 | 766 | 0,0467 | -565 | 779 | 0,0467 | -565 |
| SM | Use of secondary materials | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RSF | Use of renewable secondary fuels | [MJ] | 0,0239 | 8,66E-05 | -0,0204 | 0,0241 | 8,66E-05 | -0,0204 | 0,0242 | 8,66E-05 | -0,0204 |
| NRSF | Use of non- renewable secondary fuels | [MJ] | 0,22 | 0,000177 | -0,187 | 0,222 | 0,000177 | -0,187 | 0,224 | 0,000177 | -0,187 |
| FW | Use of net fresh water | [m3] | 0,437 | 9,53E-06 | -0,372 | 0,441 | 9,53E-06 | -0,372 | 0,445 | 9,53E-06 | -0,372 |
| | | | | | | | | | | | |
| OUTPUT FLOWS AND WASTE CATEGORIES | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| HWD | Hazardous waste disposed | [kg] | 3,17E-07 | 1,07E-09 | 0 | 3,23E-07 | 1,07E-09 | 0 | 3,29E-07 | 1,07E-09 | 0 |
| NHWD | Non-hazardous waste disposed | [kg] | 11,7 | 0,22 | -9,71 | 11,7 | 0,22 | -9,71 | 11,7 | 0,22 | -9,71 |
| RWD | Radioactive waste disposed | [kg] | 0,0729 | 6,52E-07 | -0,0581 | 0,0742 | 6,52E-07 | -0,0581 | 0,0756 | 6,52E-07 | -0,0581 |
| CRU | Components for re-use | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MFR | Materials for recycling | [kg] | 0 | 0 | 5,18 | 0 | 0 | 5,18 | 0 | 0 | 5,18 |
| MER | Materials for energy recovery | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EEE | Exported electrical energy | [MJ] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EET | Exported thermal energy | [MJ] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 2 LCIA results for 1 $m^2$ of 2 mm-thick anodised coil and sheet.

| Mass of the declared unit (1m² of 3-mm thick Al sheet) | | kg | 8,1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Anodic layer thickness** | | **µm** | **10** | | | **15** | | | **20** | | |
| ENVIRONMENTAL IMPACTS | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| GWP | Global warming potential | [kg CO2-eq.] | 78 | 0,0052 | -60,7 | 78,7 | 0,0052 | -60,7 | 79,4 | 0,0052 | -60,7 |
| ODP | Ozone layer depletion potential | [kg CFC11-eq.] | 3,81E-06 | 5,73E-14 | -3,32E-06 | 3,81E-06 | 5,73E-14 | -3,32E-06 | 3,81E-06 | 5,73E-14 | -3,32E-06 |
| AP | Acidification potential of land and water | [kg SO2-eq.] | 0,293 | 3,12E-05 | -0,243 | 0,294 | 3,12E-05 | -0,243 | 0,296 | 3,12E-05 | -0,243 |
| EP | Eutrophication potential | [kg PO43--eq.] | 0,0188 | 4,24E-06 | -0,014 | 0,0189 | 4,24E-06 | -0,014 | 0,019 | 4,24E-06 | -0,014 |
| POCP | Photochemical oxidation potential | [kg ethene-eq.] | 0,0185 | 0,000003 | -0,015 | 0,0186 | 0,000003 | -0,015 | 0,0187 | 0,000003 | -0,015 |
| ADPE | Abiotic depletion potential (elements) | [kg Sb-eq.] | 4,44E-05 | 1,80E-09 | -2,65E-05 | 4,46E-05 | 1,80E-09 | -2,65E-05 | 4,47E-05 | 1,80E-09 | -2,65E-05 |
| ADPF | Abiotic depletion potential (fossil fuels) | [MJ] | 850 | 0,0676 | -635 | 859 | 0,0676 | -635 | 868 | 0,0676 | -635 |
| | | | | | | | | | | | |
| RESOURCE USE | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| PERE | Use of renewable primary energy excluding renewable primary energy resources used as raw materials | [MJ] | 318 | - | - | 320 | - | - | 323 | - | - |
| PERM | Use of renewable primary energy resources used as raw materials | [MJ] | 0 | - | - | 0 | - | - | 0 | - | - |
| PERT | Total use of renewable primary energy resources | [MJ] | 318 | 0,00795 | -277 | 320 | 0,00795 | -277 | 323 | 0,00795 | -277 |
| PENRE | Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | [MJ] | 1110 | - | - | 1120 | - | - | 1140 | - | - |
| PENRM | Use of non-renewable primary energy resources used as raw materials | [MJ] | 0 | - | - | 0 | - | - | 0 | - | - |
| PENRT | Total use of non-renewable primary energy resources | [MJ] | 1110 | 0,0701 | -847 | 1120 | 0,0701 | -847 | 1140 | 0,0701 | -847 |
| SM | Use of secondary materials | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RSF | Use of renewable secondary fuels | [MJ] | 0,0356 | 0,00013 | -0,0306 | 0,0357 | 0,00013 | -0,0306 | 0,0358 | 0,00013 | -0,0306 |
| NRSF | Use of non- renewable secondary fuels | [MJ] | 0,327 | 0,000265 | -0,281 | 0,329 | 0,000265 | -0,281 | 0,33 | 0,000265 | -0,281 |
| FW | Use of net fresh water | [m3] | 0,647 | 1,43E-05 | -0,558 | 0,651 | 1,43E-05 | -0,558 | 0,655 | 1,43E-05 | -0,558 |
| | | | | | | | | | | | |
| OUTPUT FLOWS AND WASTE CATEGORIES | | | | | | | | | | | |
| Parameter | | Unit | A1-3 | C4 | D | A1-3 | C4 | D | A1-3 | C4 | D |
| HWD | Hazardous waste disposed | [kg] | 4,52E-07 | 1,60E-09 | 0 | 4,58E-07 | 1,6E-09 | 0 | 4,64E-07 | 1,60E-09 | 0 |
| NHWD | Non-hazardous waste disposed | [kg] | 17,3 | 0,33 | -14,6 | 17,3 | 0,33 | -14,6 | 17,3 | 0,33 | -14,6 |
| RWD | Radioactive waste disposed | [kg] | 0,107 | 9,77E-07 | -0,0871 | 0,108 | 9,77E-07 | -0,0871 | 0,11 | 9,77E-07 | -0,0871 |
| CRU | Components for re-use | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MFR | Materials for recycling | [kg] | 0 | 0 | 7,78 | 0 | 0 | 7,78 | 0 | 0 | 7,78 |
| MER | Materials for energy recovery | [kg] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EEE | Exported electrical energy | [MJ] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EET | Exported thermal energy | [MJ] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

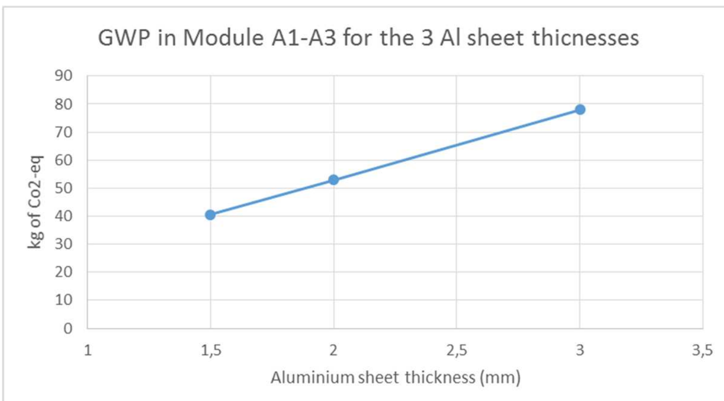
Table 3 LCIA results for 1 m² of 3 mm-thick anodised coil and sheet.

## 6. LCA interpretation

- Production of the aluminium coil and sheet (module A1-A3)

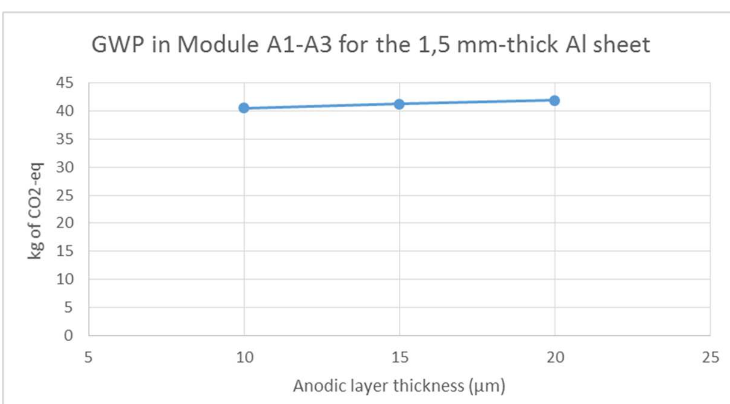
The majority of the environmental impacts come from the aluminium coil and sheet manufacturing. Within the manufacturing processes, the primary aluminium production is dominant, especially the alumina production and the electrolysis. This is particularly the case in this EPD since it is assumed that the sheet is composed of 100% primary aluminium. The rolling process, which converts ingot into coil, and the subsequent foreground anodising process contribute much less to the LCA results. The LCA modelling and the impact of the primary aluminium production are detailed in the environmental profile report /EPR/.

The evolution of GWP of Module A1-A3 for the 3 sheet thicknesses with an anodic layer of 10 µm is reported in the next diagram. Doubling the thickness of the aluminium sheet almost doubles the GWP value from 40.5 kg for the 1.5 mm-thick sheet to 78 kg of $CO_2$-equiv for the 3 mm-thick sheet. The other indicators follow the same trends, e.g. ODP increases from $1.91 \times 10^{-6}$ to $3.81 \times 10^{-6}$ [kg CFC11-eq.] and acidification potential from 0.15 to 0.293 [kg SO2-eq.].




- Anodising process (module A1-A3)

The anodising process influences only slightly the EPD results of anodised sheets, e.g. an increase of the anodic layer from 10 to 20 µm generates an increase of the various indicators which is comprised between 0 and 5% as illustrated in the next diagram showing the evolution of GWP of module A1-A3 for the 1.5 mm-thick aluminium sheet.



- End of life stage (C4)

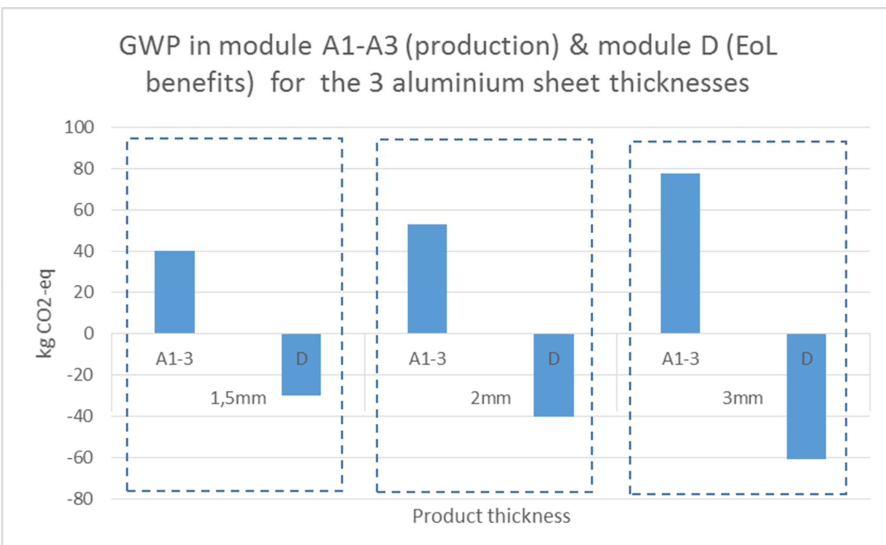
The following assumptions have been used to model the end of life stage, i.e. module C and module D.

| Processes | Fraction | %w of the Functional Unit | Al sheet of 1.5mm (kg) | Al sheet of 2mm (kg) | Al sheet of 3mm (kg) |
|---|---|---|---|---|---|
| Collection | kg collected separately for recycling | 96% | 3.89 | 5.18 | 7.78 |
| Disposal | kg for landfilling (mixed waste) | 4% | 0.16 | 0.22 | 0.32 |

The contribution of Module C4 (disposal) is very limited compared to module A1-A3 and module D. Only a small fraction (4%w) of the product is directed to landfilling. No specific comments are then relevant for this module.

- Module D

Since no recycled aluminium was considered at production level, all the recycling benefits are considered in module D. Calculation rules for module Dare explained in the annex C of the PCR document /PCR/. A recycling rate of 92% is used (as justified earlier). Considering that recycling saves up to 95% of the impact of the primary production, the benefit is very significant. This effect is shown in the following diagram which reports module A1-A3 and module D for the 3 aluminium sheet thicknesses with an anodic layer of 10 µm.




The GWP savings, i.e. negative values, reported in module D can reach up to 75% compared to the GWP reported in module A1-A3. Most of the other indicators show the same trends. The savings calculated in Module D go from 50% (ADP –element) up to 87% (ODP).

This demonstrates the importance to consider module D into the building life cycle assessment.

## 7. References



| | |
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