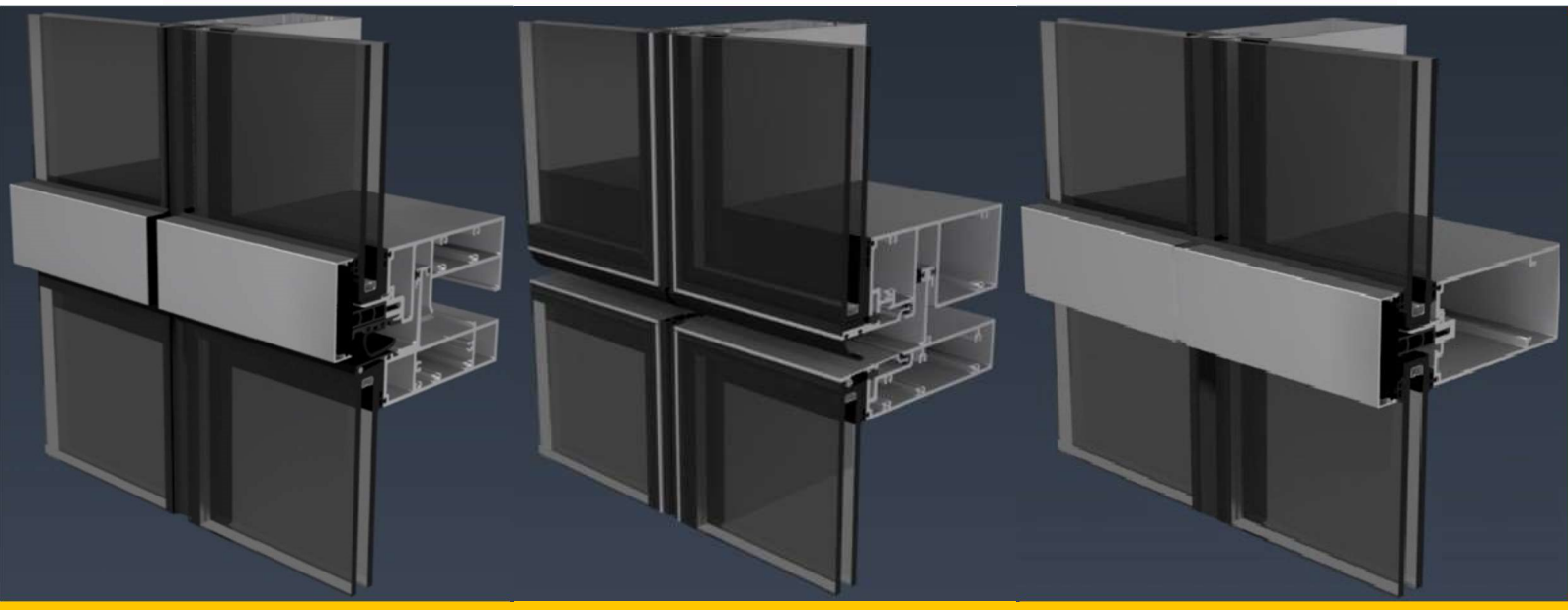
ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025:2016 and EN15804+A1 for:

1 m^2 of Aluminum Curtain Wall Systems

EF30 UW, EF35 UW, EF30 SW

ENVIRO | FACADES®



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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at http://info.nsf.org/Certified/Sustain/epd_search.asp

PROGRAM INFORMATION

PROGRAM OPERATOR

NSF Certification LLC
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Ann Arbor, MI 48105

www.nsf.org

The EPD owner, Erie Architectural, has the sole ownership, liability, and responsibility for the EPD.

DECLARATION HOLDER

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LCA CONSULTANT

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PROGRAM DETAILS

Product category rules (PCR):	IBU Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report v.2.0.1. April 2021 IBU Part B: Requirements on the EPD for Curtain Walling, V1.6, Nov 2017
PCR review was conducted by:	The Independent Expert Committee IBU

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification (internal) ☒ EPD verification (external)

Third party verifier: Jack Geibig, jgeibig@ecoform.com

Tony Favilla, afavilla@nsf.com

Accredited or approved by: NSF Certification, LLC

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☒ No

GENERAL INFORMATION

COMPANY INFORMATION

Erie Architectural Products are a leading manufacturing company who specialize in the engineering, manufacture and distribution of curtain wall systems across the United States. Erie Architectural Products are the study commissioner and EPD owner. They operate one production site where all the aluminum curtain wall systems were manufactured.

This cradle-to-gate environmental product declaration is for 1m^2 of the following aluminum curtain wall systems, produced from the locations fully owned and operated by Erie Architectural in Lakeshore, Canada:

- EF30 UW
- EF35 UW
- EF30 SW

Further information regarding Erie Architectural Products can be accessed from www.erieap.com

PRODUCT INFORMATION

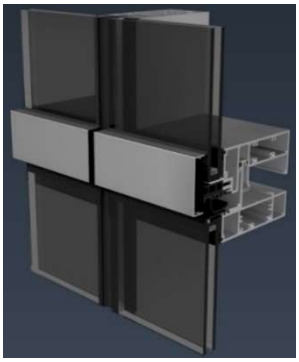
Curtain wall systems clad a building envelope with glass and aluminum to protect the interior from the elements and create a safe and comfortable work environment for the building occupants. Curtain walls are designed to only carry their own weight. The wall transfers wind loads to the main building structure, also known as the main wind force resisting system (MWFRS), at connection points in the floors or columns of the building. A curtain wall is designed to resist air and water infiltration, as well as sway created by wind and seismic forces and its own weight.

Curtain walls may span from floor to floor, used in punched opening applications, or span multiple floors, and take into consideration design requirements such as: thermal expansion and contraction; building sway and movement; water diversion; and thermal efficiency for cost-effective heating, cooling and lighting in the building.

The following curtain wall systems are covered by this LCA study:

- EF30 UW - ENVIRO|FACADES® Unitized Curtain Wall System

  A high-performance unitized curtain wall system designed to meet the industry's most challenging designs. A perfect solution for even the most stringent environmental conditions. The system is designed to be assembled and glazed in a climate-controlled environment for increased quality assurance of critical seals and frame workmanship. Both captured and SSG options are available.

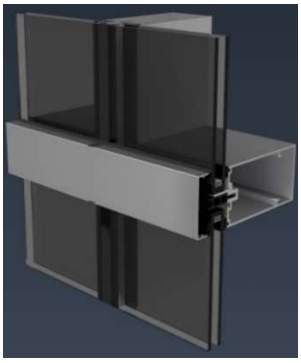


- EF35 UW – ENVIRO|FACADES® Unitized Curtain Wall System

  A high-performance unitized curtain wall system designed to meet the industry's most challenging designs. A perfect solution for large spans and blast/impact mitigation. The system is designed to be assembled and glazed in a climate-controlled environment for increased quality assurance of critical seals. Features 4-sided SSG construction with aluminum trims.

- EF30 SW – ENVIRO|FACADES® Stick-Built Curtain Wall System

  A high-performance stick-built curtain wall system designed to meet the industry's most challenging designs. A perfect solution for even the most stringent environmental conditions. The system is designed to be assembled and glazed in the field. Both captured and SSG options are available.



TECHNICAL SPECIFICATIONS OF PRODUCT

TECHNICAL SPECIFICATION DETAILS FOR EF30 UW

Name	Notes	Value and unit
Thermal Transmittance (U-Factor) AAMA 1503.1, AAMA 507, and NFRC 100	1,2,4	0.38 – 0.40 Btu/hr●ft^2●°F
Solar Heath-Gain Coefficient (SHGC) NFRC 200		Based on glass
Condensation Resistance Factor (CRFf) AAMA 1503.1	1,2,3,4	Minimum of 75
Water Infiltration** ASTM E 331 and AAMA 501.1	2	25 psf
Air Infiltration** ASTM E 283 at 6.24 psf	2	0.01 cfm/ft^2
Impact Resistance ASTM E 1886/1996, Testing Application Standard 201/202/203	2,3,4,5	A,D Missile Type

TECHNICAL SPECIFICATION DETAILS FOR EF35 UW

Name	Notes	Value and unit
Thermal Transmittance (U-Factor) AAMA 1503.1, AAMA 507, and NFRC 100	1,2,4	0.45 – 0.47 Btu/hr●ft2●°F
Solar Heath-Gain Coefficient (SHGC) NFRC 200		Based on glass
Condensation Resistance Factor (CRFf) AAMA 1503.1	1,2,3,4	Minimum of 73
Water Infiltration** ASTM E 331 and AAMA 501.1	2	25 psf
Air Infiltration** ASTM E 283 at 6.24 psf	2	>0.01 cfm/ft2
Impact Resistance ASTM E 1886/1996, Testing Application Standard 201/202/203	2,3,4,5	A,D

TECHNICAL SPECIFICATION DETAILS FOR EF30 SW

Name	Notes	Value and unit
Thermal Transmittance (U-Factor) AAMA 1503.1, AAMA 507, and NFRC 100	1,2,4	0.35 – 0.39 Btu/hr●ft2●°F
Solar Heath-Gain Coefficient (SHGC) NFRC 200		Based on glass
Condensation Resistance Factor (CRFf) AAMA 1503.1	1,2,3,4	Minimum of 78
Water Infiltration** ASTM E 331 and AAMA 501.1	2	20 psf
Air Infiltration** ASTM E 283 at 6.24 psf	2	>0.01 cfm/ft2

Notes:
**(1) Calculated based on U (Center of Glass) = 0.29*
(2) Varies by project specific construction
(3) Dependent on glazing specified
(4) Based on products tested
***Predominantly describes the framing*

PRODUCT COMPOSITION

The product composition for the three aluminum curtain wall systems is provided in the Tables below. The systems contain 0% bio-based material and does not contain any substances hazardous to health or the environment (in particular carcinogenic, mutagenic, toxic to reproduction, allergic, PBT5 or vPvB6 substances). No substances that are listed in the "Candidate List of Substances of very high concern for authorisation" are contained in the curtain wall systems.

PRODUCT COMPOSITION OF EF30 UW

Material	Mass (kg/m2)	Percentage (%)
Aluminum	11.55	21.58%
Polyvinyl chloride	0.236	0.44%
Silicone gasket	0.202	0.38%
Insulation (mineral wool)	6.98	13.04%
Backpan	2.69	5.04%
Insulated glass unit	31.66	59.16%

PRODUCT COMPOSITION OF EF35 UW

Material	Mass (kg/m2)	Percentage (%)
Aluminum	12.65	18.26%
Polyvinyl chloride	0.12	0.17%
Silicone gasket	9.50E-02	0.14%
Insulation (mineral wool)	6.98	10.07%
Backpan	2.89	4.17%
Insulated glass unit	46.56	67.19%

PRODUCT COMPOSITION OF EF30 SW

Material	Mass (kg/m2)	Percentage (%)
Aluminum	4.27	98.23%
Polyvinyl chloride	2.36E-02	0.54%
Silicone gasket	5.34E-02	1.23%

The curtain wall systems are packaged using crating wood and plastic wrap prior to shipping to installation sites.

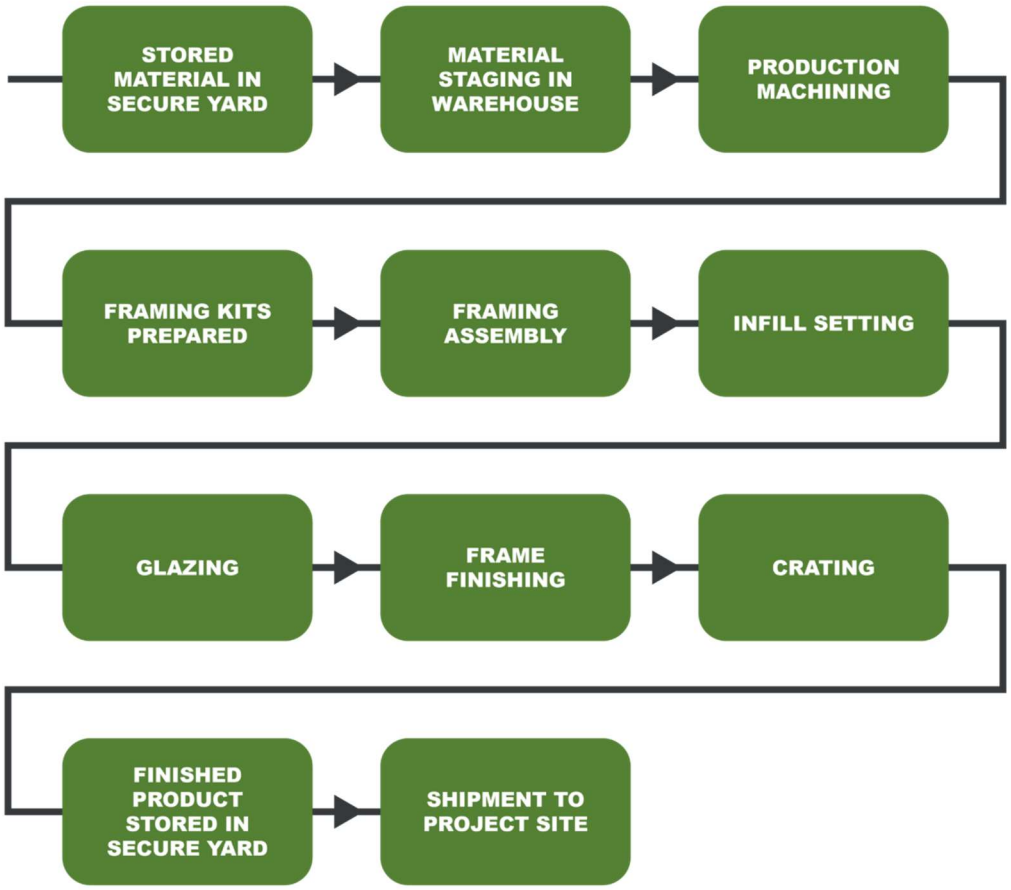
PACKAGING REQUIREMENTS

Material	Mass (lb/m2)
Crating wood	4.62
Shrink wrap	3.55E-04
Sill wrap	0.439
Silicone block	4.00E-02

MANUFACTURING

All Erie Architectural aluminum curtain wall systems are manufactured, finished and inspected for quality in Erie Architectural facility in Lakeshore, Canada.

The manufacturing process comprises the following production stages:



Materials are received into the production site in Lakeshore, Canada where they are stored prior to going to the production floor where the aluminum is cut, fabricated and assembled into frame units. Glazing is then added. Once the frames are finished, the wall systems are packaged and then stored in the yard prior to shipment.

The aluminum curtain wall systems are not expected to create exposure conditions that exceed safe thresholds for health impacts to humans or flora/fauna under normal operating conditions. Use stage is outside the scope of this EPD.

LCA INFORMATION

LIFE CYCLE ASSESSMENT – PRODUCT SYSTEM AND MODELING

A cradle-to-gate analysis using life cycle assessment (LCA) techniques was conducted for this EPD. The analysis was done according to the product category rule (PCR) for curtain wall and followed LCA principles, requirements and guidelines laid out in the ISO 14040/12044 standards. A comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account. For calculating the LCA, SimaPro v9 software and ecoinvent 3.6 datasets were used.

DECLARED UNIT

The declared unit for the EPD is one square meter ($1m^2$) of curtain wall product. In line with the PCR, the conversion factor to 1kg of product is provided in the table below.

System	Conversion factor to 1kg
EF30 UW	1/53.5
EF35 UW	1/69.3
EF30 SW	1/4.35

SYSTEM BOUNDARY

This cradle-to-gate analysis provides information on the product stage of the aluminum curtain wall system,comprising modules A1-A3 as shown in the table below.

Upstream	Core	Downstream													Other Environmental Information
Product Stage			Construction Process Stage		Use Stage							End of Life Stage			Benefits and Loads Beyond the System Boundary
Raw Material Supply	Transport	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Demolition	Transport	Waste Processing	Disposal	Future Reuse, Recycling or Energy Recovery 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	MND	MND

X = included in LCA; MND = Module not declared

ESTIMATES AND ASSUMPTIONS

This study was performed based on primary production data for the manufacture of the three aluminum curtain wall systems covered by the scope of this EPD.

It has been estimated that the aluminum profiles were composed of a mix of 41% recycled material (20% post-industrial and 21% post-consumer recycled material. This estimate was provided by EAP based on actual data.

Beyond that, no significant assumptions have been made. All of the raw materials and energy inputs were models using processes and flows that closely follow actual production raw materials and processes. All of the raw material and energy flows have been accounted for.

ALLOCATION

No multi-output (i.e. co-product) allocation was performed in this study. In terms of generic data, the main database used, ecoinvent v3.6 (cut-off), defaults to an economic allocation for most processes. However, in some cases a mass-based allocation is used, where there is a direct physical relationship. The allocation approach of specific ecoinvent modules is documented on their website and method reports (see www.ecoinvent.org).

The production plant produced products exclusively during the timeframe for data collection and no co-products were produced, therefore the flow of materials and energy and the associated release of substances and energy into the environment were therefore related exclusively to the aluminum curtain wall systems included within the scope of this LCA

With regard to allocation of recycled content within upstream data, according to the “polluter pays principle” required by EN 15804, in this study the Ecoinvent “cut-off” datasets have been adopted for all the selected items.

CUT-OFF CRITERIA

In case of insufficient input data or data gaps for a unit process the cut-off criteria were 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input flows per module was a maximum of 5% of energy usage and mass.

In practice, all input and outputs, for which data are available, have been included in the calculation. Data gaps have been filled by conservative assumptions with average or generic data. Capital items for the production processes (machines, buildings, etc.) were not taken into consideration.

DATA SOURCES AND QUALITY

Specific data for all core processes were collected from Erie Architectural Products from their site in Lakeshore, Canada for a time period of twelve months from 2019.09.20 to 2020.10.01. Selected generic data were collected for the upstream life cycle stages from the LCI database ecoinvent v3.6 (cut-off).

The data quality can be considered as good. The LCA models have been checked and most relevant flows are considered. Technological, geographical and temporal representativeness is appropriate.

The LCA software SimaPro (version 9) was used to build a model for the product systems under investigation using specific and generic inventory data. In addition, SimaPro was used to apply characterization models and factors from the impact assessment methods to generate results.

ENVIRONMENTAL PERFORMANCE

The environmental performance of the assessed product is declared and reported using the parameters as specified in the PCR. These LCIA results and other environmental results are presented in the table below per declared unit to three significant figures. As additional information, since the products are sold to the North American market, the results have also been reported against the TRACI 2.1 method.

1M^2 OF EF30 UW

ENVIRONMENTAL IMPACTS: CML 2001 (APR 2013)

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing environmental impacts					
Global warming potential (GWP)	kg CO_2 equiv.	191	8.62	7.59	207
Ozone Depletion Potential (ODP)	Kg CFC-11 equiv.	8.56E-06	1.50E-06	6.13E-07	1.07E-05
Acidification potential (AP)	kg SO_2 equiv.	1.14	0.0282	0.0169	1.19
Eutrophication potential (EP)	kg $(PO_4)_3$-equiv.	0.276	6.64E-03	0.0123	0.295
Formation potential of tropospheric ozone (POCP)	kg NMVOC equiv.	0.0634	1.17E-03	1.33E-03	0.0659
Abiotic depletion potential – elements (ADPE)	kg Sb equiv.	4.47E-03	2.30E-04	3.58E-05	4.74E-03
Abiotic depletion potential – fossil (ADPF)	MJ, net calorific	1859	127	83.8	2070

ENVIRONMENTAL IMPACTS: TRACI 2.1

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing environmental impacts					
Global warming potential (GWP)	kg CO_2 equiv.	189	8.61	7.18	205
Ozone depletion potential (ODP)	Kg CFC-11 equiv.	1.12E-05	2.00E-06	7.57E-07	1.40E-05
Acidification potential (AP)	kg SO_2 equiv.	1.16	0.0316	0.0182	1.21
Eutrophication potential (EP)	kg N equiv.	0.5149	9.52E-03	0.0281	0.5525
Smog Potential (SP)	Kg 0_3 equiv.	13.4	0.667	0.320	14.4
Fossil fuel consumption (FF)	MJ	136	18.1	12.9	167

RESOURCE USE AND OUTPUT / WASTE PARAMETERS

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing use of resources					
Use of renewable primary energy resources – use as energy carrier	MJ, net calorific value	190	1.44	26.3	218
Use of renewable primary energy resources – use as raw materials	MJ, net calorific value	26.5	0.275	0.742	27.5
Use of renewable primary energy resources – total	MJ, net calorific value	217	1.71	27.1	246
Use of non-renewable primary energy resources – use as energy carrier	MJ, net calorific value	2531	128.4	262.4	2922
Use of non-renewable primary energy resources – use as raw materials	MJ, net calorific value	0	0.0	0.0	0
Use of non-renewable primary energy resources – total	MJ, net calorific value	2531	128.4	262.4	2922
Use of secondary material	kg	4.82	0	0	4.82
Use of renewable secondary fuels	MJ, net calorific value	0	0	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0	0	0	0
Net use of fresh water	m^3	1.19	0.0106	0.535	1.74
Parameters describing waste production					
Hazardous waste disposed	kg	0.0236	1.18E-03	5.31E-03	0.0301
Non-hazardous waste disposed	kg	32.9	6.06	3.63	42.6
Radioactive waste disposed	kg	3.53E-03	8.43E-04	5.12E-03	9.50E-03
Parameters describing outputs flows					
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	6.57	6.57
Materials for energy recovery	kg	0	0	0	0
Export energy, electricity	MJ	0	0	0	0

Note that the LCIA results are relative expressions and do not predict impacts on category end-points, the exceeding of thresholds, safety margins or risks

1M^2 OF EF35 UW

ENVIRONMENTAL IMPACTS: CML 2001 (APR 2013)

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing environmental impacts					
Global warming potential (GWP)	kg CO_2 equiv.	221	11.69	6.85	239
Ozone Depletion Potential (ODP)	Kg CFC-11 equiv.	9.93E-06	2.04E-06	5.49E-07	1.25E-05
Acidification potential (AP)	kg SO_2 equiv.	1.36	0.0383	0.0154	1.42
Eutrophication potential (EP)	kg $(PO_4)_3$- equiv.	0.316	9.00E-03	1.07E-02	0.336
Formation potential of tropospheric ozone (POCP)	kg NMVOC equiv.	0.073	1.59E-03	1.20E-03	0.076
Abiotic depletion potential – elements (ADPE)	kg Sb equiv.	6.37E-03	3.11E-04	3.30E-05	6.71E-03
Abiotic depletion potential – fossil (ADPF)	MJ, net calorific	2153	172	77.7	2402

ENVIRONMENTAL IMPACTS: TRACI 2.1

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing environmental impacts					
Global warming potential (GWP)	kg CO_2 equiv.	219	11.7	6.5	237
Ozone depletion potential (ODP)	Kg CFC-11 equiv.	1.32E-05	2.71E-06	6.74E-07	1.66E-05
Acidification potential (AP)	kg SO_2 equiv.	1.38	0.043	0.016	1.44
Eutrophication potential (EP)	kg N equiv.	0.582	1.29E-02	2.42E-02	0.619
Smog potential (SP)	Kg 0_3 equiv.	15.9	0.905	0.274	17.1
Fossil fuel consumption (FF)	MJ	164	24.5	12.0	201

RESOURCE USE AND OUTPUT / WASTE PARAMETERS

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing use of resources					
Use of renewable primary energy resources – use as energy carrier	MJ, net calorific value	215	1.95	25.0	242
Use of renewable primary energy resources – use as raw materials	MJ, net calorific value	31.4	0.373	0.704	32.5
Use of renewable primary energy resources – total	MJ, net calorific value	246	2.32	25.7	274
Use of non-renewable primary energy resources – use as energy carrier	MJ, net calorific value	2901	174	248	3323
Use of non-renewable primary energy resources – use as raw materials	MJ, net calorific value	0	0	0	0
Use of non-renewable primary energy resources – total	MJ, net calorific value	2901	174	248	3323
Use of secondary material	kg	5.29	0	0	5.29
Use of renewable secondary fuels	MJ, net calorific value	0	0	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0	0	0	0
Net use of fresh water	m^3	1.29	0.01	0.51	1.81
Parameters describing waste production					
Hazardous waste disposed	kg	2.64E-02	1.60E-03	5.01E-03	3.30E-02
Non-hazardous waste disposed	kg	37.0	8.22	3.09	48.3
Radioactive waste disposed	kg	4.26E-03	1.14E-03	4.85E-03	1.03E-02
Parameters describing outputs flows					
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	4.66	4.66
Materials for energy recovery	kg	0	0	0	0
Export energy, electricity	MJ	0	0	0	0
Export energy, thermal	MJ	0	0	0	0

Note that the LCIA results are relative expressions and do not predict impacts on category end-points, the exceeding of thresholds, safety margins or risks.

1M² OF EF30 SW

ENVIRONMENTAL IMPACTS: CML 2001 (APR 2013)

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing environmental impacts					
Global warming potential (GWP)	kg CO_2 equiv.	55.67	0.72	7.11	63.5
Ozone Depletion Potential (ODP)	Kg CFC-11 equiv.	1.97E-06	1.26E-07	5.72E-07	2.67E-06
Acidification potential (AP)	kg SO_2 equiv.	0.305	2.37E-03	0.0158	0.324
Eutrophication potential (EP)	kg $(PO_4)_3$- equiv.	0.0832	5.59E-04	0.0111	9.48E-02
Formation potential of tropospheric ozone (POCP)	kg NMVOC equiv.	0.019	9.88E-05	1.24E-03	2.00E-02
Abiotic depletion potential – elements (ADPE)	kg Sb equiv.	1.49E-04	1.99E-05	3.43E-05	2.03E-04
Abiotic depletion potential – fossil (ADPF)	MJ, net calorific	530.0	10.63	80.49	621

ENVIRONMENTAL IMPACTS: TRACI 2.1

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing environmental impacts					
Global warming potential (GWP)	kg CO_2 equiv.	55.3	0.724	6.75	62.8
Ozone depletion potential (ODP)	Kg CFC-11 equiv.	2.63E-06	1.68E-07	7.04E-07	3.50E-06
Acidification potential (AP)	kg SO_2 equiv.	0.309	2.66E-03	0.0169	0.329
Eutrophication potential (EP)	kg N equiv.	0.161	8.05E-04	0.0251	0.187
Smog Potential (SP)	Kg 0_3 equiv.	3.54	0.056	0.285	3.88
Fossil fuel consumption (FF)	MJ	30.3	1.51	12.4	44.2

RESOURCE USE AND OUTPUT / WASTE PARAMETERS

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Parameters describing use of resources					
Use of renewable primary energy resources – use as energy carrier	MJ, net calorific value	61.9	0.123	26.2	88.2
Use of renewable primary energy resources – use as raw materials	MJ, net calorific value	6.79	0.024	0.73	7.55
Use of renewable primary energy resources – total	MJ, net calorific value	68.7	0.146	26.9	95.8

Parameter	Unit	A1	A2	A3	A1-A3 (Total)
Use of non-renewable primary energy resources – use as energy carrier	MJ, net calorific value	758	10.8	258	1027
Use of non-renewable primary energy resources – use as raw materials	MJ, net calorific value	0	0	0	0
Use of non-renewable primary energy resources – total	MJ, net calorific value	758	10.8	258	1027
Use of secondary material	kg	1.83	0	0	1.83
Use of renewable secondary fuels	MJ, net calorific value	0	0	0	0
Use of non-renewable secondary fuels	MJ, net calorific value	0	0	0	0
Net use of fresh water	m^3	0.295	8.91E-04	0.532	0.828
Parameters describing waste production					
Hazardous waste disposed	kg	8.21E-03	9.91E-05	5.25E-03	0.0136
Non-hazardous waste disposed	kg	10.6	0.500	3.21	14.3
Radioactive waste disposed	kg	8.33E-04	7.07E-05	5.07E-03	5.98E-03
Parameters describing outputs flows					
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	4.93	4.93
Materials for energy recovery	kg	0	0	0	0
Export energy, electricity	MJ	0	0	0	0
Export energy, thermal	MJ	0	0	0	0

Note that the LCIA results are relative expressions and do not predict impacts on category end-points, the exceeding of thresholds, safety margins or risks

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Intertek's Total Sustainability Assurance (TSA) proposition recognizes that with increasing value chain complexity, our clients need a trusted partner and integrative sustainable solutions. Powered by our independent technical expertise and supply chain management tools our sustainability services enable our customers to uniquely and authentically demonstrate their end-to-end commitment to sustainability, building stakeholder trust and corporate value.

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