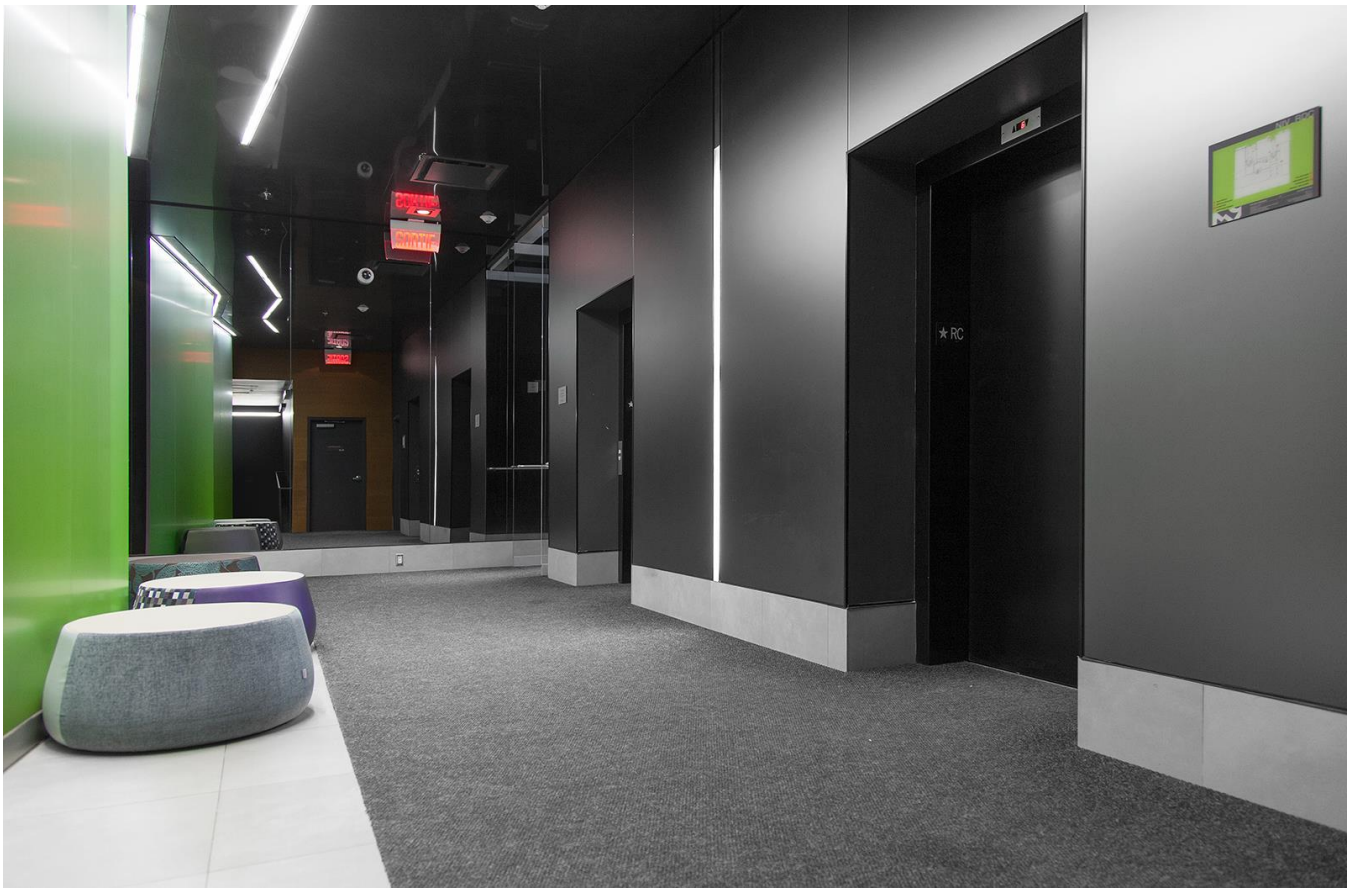
Environmental Product Declaration

Acid-etched and Unetched Mirrors

Walker Glass Company Ltd.



Walker Glass Company Ltd. is pleased to present this environmental product declaration (EPD) for acid-etched and unetched mirrors. This EPD was developed in compliance with CAN/CSA-ISO 14025 and has been verified by Lindita Bushi, Athena Sustainable Materials Institute.

The LCA and EPD were prepared by Vertima Inc. The EPD includes cradle-to-gate life cycle assessment (LCA) results.

For more information about Walker Glass Company Ltd. products, please go to http://walkerglass.com/.

For any explanatory material in regards to this EPD, please contact the program operator.

This EPD was not written to support comparative assertions. Even for similar products, differences in declared unit, use and end-of-life stage assumptions and data quality may produce incomparable results. It is not recommended to compare EPDs with another organization, as there may be differences in methodology, assumptions, allocation methods, data quality such as variability in data sets and results of variability in assessment software tools used.

Environmental Product Declaration

CSA Group Registered Based on ISO 14025 and Other Requirements

For more information visit csaregistries.ca/epd

#1224-4167

October 2017 - 2022

1 GENERAL INFORMATION

PROGRAM OPERATOR	CSA Group 178 Rexdale Blvd Toronto, ON Canada M9W 1R3 www.csagroup.org
PRODUCT	Acid-etched and Unetched Mirrors
EPD REGISTRATION NUMBER	1224-4167
EPD RECIPIENT ORGANIZATION	Walker Glass Company Ltd. 9551 Ray Lawson Montreal, QC H1J 1L5 (514) 352-3030 http://walkerglass.com/
REFERENCE PCR	PCR Guidance for Building-Related Products and Services – Part B: Processed Glass EPD Requirements UL Environment August 17th, 2016 to August 17th, 2021
DATE OF ISSUE	October 30, 2017
PERIOD OF VALIDITY	October 30, 2022
CONTENT OF THE EPD	Product System Description
	LCA Calculation Rules
	Life Cycle Assessment Results and Interpretation
	Additional environmental information
	References
The PCR review was conducted by:	Jack Geibig Ecoform jgeibig@ecoform.com
The LCA and EPD were prepared by:	Vertima Inc. www.vertima.ca
This EPD and related data were independently verified by an external verifier, Lindita Bushi, according to CAN/CSA-ISO 14025:2006 and ISO 21930:2007.	Lindita Bushi, Athena Sustainable Materials Institute

2 PRODUCT SYSTEM DESCRIPTION

Walker Glass Company Ltd. (hereinafter referred to as "Walker") is a Canadian manufacturing company of processed glass products, including acid-etched glass and mirrors specified for use in many architectural applications. Its manufacturing facility is based in Montreal, Quebec.

2.1 DESCRIPTION OF PRODUCT

The products presented in this EPD are Walker Textures® acid-etched mirror and standard mirror (hereinafter referred to as "unetched mirror"). In the context of acid-etched mirrors, flat glass has undergone a silvering process as well as a chemical etching process; and for unetched mirrors, a silvering process only. Figure 1 provides illustrations of Walker Textures® acid-etched mirror and unetched mirror.

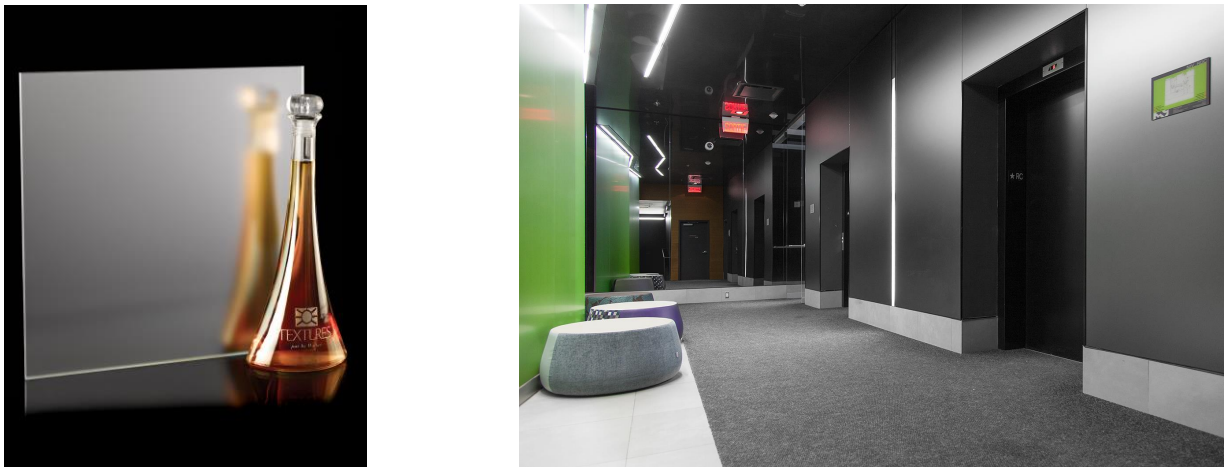


Figure 1: Representations of Walker Textures® acid-etched mirror and unetched mirror. On the left, Walker Textures® acid-etched mirror with Satin finish. On the right, Walker Textures® acid-etched mirror and unetched mirror as part of a building interior.

Walker Textures® acid-etched mirrors include two distinct finishes offering completely different looks: Opaque and Satin. The frosted appearance of the Opaque finish is characterized by its less polished surface and much lower reflection. The Satin finish is characterized by a highly polished surface and reduced reflection (Table 1).

Table 1: Description of the two finishes Satin and Opaque for acid-etched mirror products.

Finish	Reflection	Surface	Cleanability
Walker Textures® Satin	Higher	Smoothest	Most contaminants are easily removed
Walker Textures® Opaque	Lower	Slightly rougher	Certain contaminants may be more difficult to remove

2.2 PRODUCT APPLICATION

Walker Textures® acid-etched mirror and unetched mirror can be used in both residential and commercial building applications and are suitable for interior applications only.

2.3 TECHNICAL DATA

For specific properties and performance data of Walker Textures® acid-etched mirror please consult the following links: http://walkerglass.com/products/acid-etched-mirror/ .

Physical Properties may be found in Table A3.

2.4 PLACING ON THE MARKET / APPLICATION RULES

Walker Textures® acid-etched mirror products are made from selected mirrors which conform to the following standards:

- ASTM C 1503-08 (2013) Standard Specification for Flat Glass Mirrors [7]
- CAN/CGSB-12.5-M86 Type 1B National Standard of Canada – Mirrors, Silvered [8]

Unetched mirrors are also compliant to the aforementioned standards.

Even though the standard CAN/CGSB-12.5-M86 Type 1B has been withdrawn, Walker continues to follow it for some specifications since it still is an acknowledged reference in the market.

2.5 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

Walker Textures® acid-etched mirrors are available in two finishes: Satin and Opaque, with etching on one face only.

Walker Textures® acid-etched mirrors and unetched mirrors are available in thicknesses from 3 mm to 6 mm, lengths up to 144 in. and heights up to 100 in. The available colors are clear, bronze, grey, black, blue and ultra-clear.

Thicknesses and dimensions depend on glass availability from suppliers.

Please refer to the following links: http://walkerglass.com/products/acid-etched-mirror/ for acid-etched mirrors and http://walkerglass.com/products/stock-sheet-mirror/ for unetched mirrors.

2.6 MATERIAL COMPOSITION

The raw material input for the production of acid-etched and unetched mirrors is detailed in Table 2.

Table 2: Material composition of 1 m² of Walker Textures® acid-etched mirror and unetched mirror.

	Mass in final product (%)	
Materials	**Walker Textures® Acid-etched Mirror**	**Unetched Mirror**
Flat Glass	97.5 - 98.6	
Protective paint – Top coat	0.68 - 1.25	
Protective paint – Base coat	0.68 - 1.25	
Silver nitrate	0.01	
Copper sulfate	0.01	
Tin chloride	< 0.01	
TOTAL	**100**	

All processed glass products are manufactured at Walker's manufacturing plant located in Montreal, Quebec.

2.7 MANUFACTURING AND PACKAGING

Walker's products are stored with interleaving paper or powder and can be shipped either by blocks or cases. Both types of packaging require slightly different raw materials. All materials were modeled for the packaging scenario since both packaging are used simultaneously. Mirrors packaging is presented in Table 3.

Table 3: Amount of packaging materials per DU for Walker Textures® acid-etched mirrors and unetched mirrors.

Packaging materials	Walker Textures® Acid-etched Mirrors (kg per DU)	Unetched Mirrors (kg per DU)
Interleaving paper	3.6E-2	3.1E-2
Interleaving powder	2.7E-4	0
Blocks		
Plastic wrap	9.43E-4	8.08E-4
Styrofoam	9.49E-4	8.13E-4
Cases		
Metal strapping	4.06E-3	4.00E-3
Plastic wrap	1.68E-4	1.66E-4
Cardboard corners	1.68E-2	1.65E-2
Wood cases	1.10E-1	1.09E-1

Manufacturing and packaging processes are presented in section 3.2 of this EPD. Packaging materials such as Styrofoam (polystyrene), wood cases and interleaving paper may be reused, depending on their final state. Plastic wraps, cardboard corners and metal strapping may be recycled.

2.8 ENVIRONMENT AND HEALTH DURING MANUFACTURING

Walker Glass Company Ltd. is fully committed to the diligent protection of both the environment and the health and safety of its workers and its customers' workers. Its manufacturing process includes state-of-the-art environmental control equipment and workers are equipped with the highest quality personal protection gear.

2.9 PRODUCT INSTALLATION AND CONDITION OF USE

Please refer to specific guidelines for handling, fabrication, installation and cleaning of Walker Textures® acid-etched mirror and unetched mirror. Documentation may be accessed using the following links: http://walkerglass.com/products/acid-etched-mirror/ and http://walkerglass.com/products/stock-sheet-mirror/

Possible transformation processes for Walker Textures® acid-etched products can be found here: http://walkerglass.com/services/processes/.

2.10 WARRANTY

10 Year WARRANTY

Limited Warranty on Acid-etched Surface Degradation

Walker Glass Company Ltd. warrants, for a period of 10 years following the date of purchase, that the acid-etched surface will not degrade, provided that the surface is not subjected to any conditions that would otherwise lead to premature degradation of unetched float glass.

Limited Warranty for Unetched Mirror

During a period of ten (10) years from the date of original purchase, Walker Glass Company Ltd. warrants all mirror manufactured by Walker not to contain defects in the silver film which substantively affect the Mirror's appearance.

For more information on Walker's warranties, please contact our customer service department. http://walkerglass.com/contact/

2.11 ENVIRONMENT, HEALTH AND SAFETY DURING USE

For this EPD, the system boundaries encompass a cradle-to-gate scope. Environmental impacts of product in use phase are excluded from this declaration, per *UL Environment PCR Guidance for Building-Related Products and Services – Part B: Processed Glass EPD Requirements* [4].

Nonetheless, it can be said that Walker's research and development process strives to create architectural products that have a sustainable impact on buildings and its occupants.

2.12 EXTRAORDINARY EFFECTS

No extraordinary effects are to be reported.

2.13 RE-USE PHASE

According to the Glass Association of North America (GANA), a wide variety of architectural glass products can be recycled. Out-dated mirrors can be repurposed into mirror tiles, garden or greenhouse mirror and refurbishing decor items [10].

2.14 DISPOSAL

Additionally, based on GANA information bulletin [10], Walker Textures® acid-etched and unetched mirrors will potentially be landfilled as a non-hazardous waste.

2.15 FURTHER INFORMATION

For further information about Walker Glass Company Ltd. products, please visit http://walkerglass.com.

3 LCA CALCULATION RULES

3.1 Reference Flow and Declared Unit

The selected declared unit (DU) for this study is **1 m² of processed glass**. All products have the same density 2531 kg/m³, which correspond to the density of flat glass. Table 4 presents all products targeted by this report and their respective DU.

Table 4: Declared unit of studied products, including mass per m² of processed glass, conversion factor to 1 kg and average thicknesses.

Item	Unit	Walker Textures® Acid-etched Mirror	Unetched Mirror
Declared unit	m²	1	1
Mass per piece	kg	15.0	13.1
Conversion factor to 1 kg	-	0.0667	0.0763
Thickness (average)	mm	5.92	5.19

The thickness for each product has been calculated using a weighted average based on production data for each thickness.

3.2 System Boundaries

According to UL Environment's PCR [4], the LCA modelling only covers Cradle-to-Gate stages. Three (3) Life cycle stages are therefore considered, namely A-1) Raw materials acquisition, A-2) Raw materials transportation to the manufacturing plant and A-3) Manufacturing. Construction (A-4; A-5), use (B-1 to B-5) and end-of-life (C-1 to C-4) stages are not included in the present EPD. Figure 2 presents the process flow diagram.

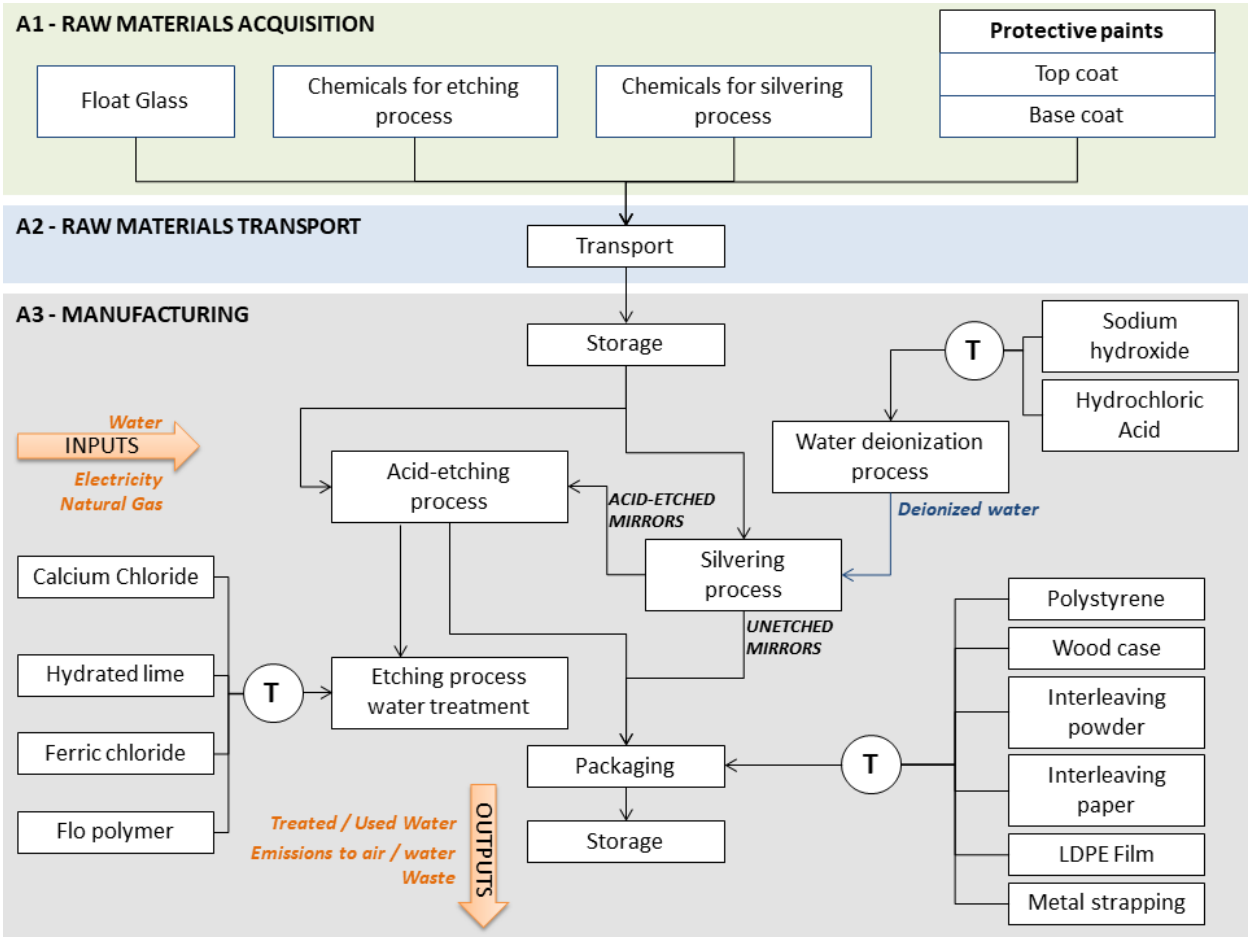


Figure 2: System boundaries of Cradle-to-Gate LCA of Walker Textures® acid-etched mirror and unetched mirror. "T" refers to transport.

Raw materials acquisition: this stage includes the extraction and transformation of raw materials needed to produce flat glass (soda-lime glass), all the chemicals used for the silvering and etching processes, as well as raw materials to produce protective paints for mirrors.

Raw materials transportation: this stage includes the transportation of raw materials from Walker's suppliers to the Montreal plant.

Manufacturing: this stage includes water and energy (electricity, heat) consumption for manufacturing processes (silvering and acid-etching). Chemicals needed in the etching process water treatment and in deionization process have been considered here, as well as their transport to the plant. Emissions to air from the VOC burner (silvering line) and scrubbers (acid-etching line) have also been considered. Emissions to water from the manufacturing plant have been counted as well.

Acid-etched mirror production generates 1% of losses, whereas unetched mirror production generates 2% of losses. These losses have been determined by weight and are considered as waste.

Finally, packaging materials to make products ready for shipment, as well as their transport to Walker's manufacturing plant are covered by this stage.

3.3 Calculation Method

The openLCA software v1.6 [12], open source software, was used to calculate the inventory and to assess potential environmental impacts associated with the inventoried emissions.

3.4 Uncertainty

Uncertainty due to data quality can affect LCA results. This uncertainty can be due to incompleteness or lack of geographical, technological or temporal correlation. Another source of uncertainty comes from processes chosen for modeling.

The highest level of uncertainty in the present study comes from emissions to air and water sourced from environmental reports and their allocations. The use of generic chemical processes may also be a source of uncertainty. The resulting *ADP – fossil fuels* indicator is also a source of high uncertainty because it was estimated from non-specific EPD results.

3.5 Cut-off Criteria

According to the UL Environment PCR – Part A [18], if a mass flow or energy flow represents less than 1% of the cumulative mass or energy flow of the system, it may be excluded from system boundaries. However, these flows should not have a relevant environmental impact. Also, at least 95% of the energy usage and mass flow shall be included

In the present study, no primary data (input material, energy consumption) was excluded from the system boundaries.

Water consumption was assumed to be 100% dedicated to manufacturing processes (silvering, acid-etching). Therefore, water consumption at plant for other purposes (e.g. employees' needs) was excluded from the study. For this study, no data on the construction, maintenance or dismantling of the capital assets, daily transport of the employees, office work, business trips and other activity from Walker's employees was included in the model. The model only takes into account the processes associated with infrastructures that are already included in the *ecoinvent* unit processes.

3.6 Background Data

Inventory data was collected from the Walker's manufacturing plant located in Montreal (QC). Walker Textures® acid-etched mirror and unetched mirror are manufactured in Montreal only, so it can be stated that the data gathered is 100% representative of all products. This data included: total annual mass of products produced at the manufacturing plant, as well as the total annual mass of products under study; amount of raw materials entering the production of Walker Textures® acid-etched and unetched mirrors; losses of these materials; distances and transportation mode for the supply of raw materials; energy consumption (electricity, heat), emissions to the environment, water consumption and waste generation at the Walker's manufacturing plant; and materials needed for packaging, as well as distance and mode of transportation.

Data used to model flat glass was taken from Vitro Architectural Glass Flat Glass Products EPD [13]. This EPD was chosen because Vitro is an important supplier to process glass companies in North America, and therefore was considered more representative than actual *ecoinvent* process for flat glass.

When primary data was not available, unit processes were selected either from the *ecoinvent* v3.3 - cut-off, database, one of the most comprehensive LCI databases currently available [15], or from the US LCI database [16] for transport processes, that are more representative of North America in general.

When *ecoinvent* unit processes were not available specifically for Quebec or North America, they were adapted by replacing their electricity input process by the *ecoinvent* process "Market for Electricity, medium voltage – CA QC", or by "Market group for Electricity, medium voltage - RNA".

3.7 Data Quality

This study is specific to a particular manufacturer: Walker Glass Company Ltd. The primary data, mostly obtained from the manufacturer, is representative of the current technologies and materials used by this company. As primary data was collected directly from plants where processed glass products are manufactured, it can be stated that it is 100% representative of the technologies in use and of geographical areas.

Primary data was collected so as to be representative of the full year 2016.

Secondary data was used only for upstream processes. For some processes, the *ecoinvent* database provided representative data for a Canadian context. These processes were used in priority. When necessary, the grid mix was changed for the grid mix of the province where the production took place.

When *ecoinvent* processes were not available for a North American context, processes were taken from the US LCI database.

3.8 Period under Review

Life cycle inventory data is representative of Walker's acid-etched and unetched mirror production for the year 2016.

3.9 Allocation

Allocation was performed on the basis of the yearly production mass of each product under study.

Data relative to energy consumption (electricity, heat) was provided for the product by Walker. Data relative to emissions, based on environmental reports, were provided for the whole plant, so allocations based on the mass production of each product were also made.

3.10 Comparability

Environmental declarations from different programs may not be comparable.
Comparison of the environmental performance of processed glass using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under UL Environment's PCR for Processed Glass [4].

Full conformance with the PCR for North American Processed Glass [4] allows EPD comparability only when all stages of the processed glass life cycle have been considered, which is not permitted under this PCR. However, variations and deviations are possible. Example of variations: different LCA software and background LCI datasets may lead to differences in results upstream or downstream of the life cycle stages declared.

4 LCA RESULTS AND INTERPRETATION

4.1 Disclaimer

LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

4.2 Results

Table 5 presents the LCIA and inventory results for 1 m^2 of processed glass using TRACI and ReCiPe methodologies, as well as primary energy consumption, consumption of renewable and non-renewable materials, water consumption, ouputs and waste generation.

Table 5: LCIA and inventory results for 1 m^2 of processed glass.

Environmental indicator	Unit	Walker Textures® Acid-etched Mirror (per DU)	Unetched Mirror (per DU)
TRACI 2.1 (with the exception of ADP elements)			
GWP	kg CO_2 eq	1.86E+01	1.33E+01
ODP	kg CFC-11 eq	1.47E-06	8.26E-07
AP	kg SO_2 eq	1.68E-01	1.30E-01
EP	kg N eq	3.02E-02	1.53E-02
POCP	kg O_3 eq	3.75E+00	3.16E+00
ADP elements [ReCiPe]	kg Fe eq	5.27E-01	2.76E-01
ADP fossil fuels	MJ Surplus	5.83E+01	4.85E+01
Resource Use			
PERE	MJ, LHV	3.95E+01	2.84E+01
Renewable, solar	MJ, LHV	2.98E+00	2.64E+00
Renewable, wind	MJ, LHV	4.58E+00	3.78E+00
Renewable, hydroelectric	MJ, LHV	2.26E+01	1.48E+01
Renewable, biomass	MJ, LHV	9.35E+00	7.24E+00
PERM	MJ, LHV	2.93E+00	2.82E+00
PERT	MJ, LHV	4.24E+01	3.13E+01
PENRE	MJ, LHV	3.88E+02	3.10E+02
Non-renewable, fossil	MJ, LHV	3.69E+02	2.95E+02
Non-renewable, nuclear	MJ, LHV	1.91E+01	1.51E+01
PENRM	MJ, LHV	8.40E-01	7.33E-01
PENRT	MJ, LHV	3.89E+02	3.11E+02
SM	MJ, LHV	0	0
RSF	MJ, LHV	0	0
NRSF	MJ, LHV	0	0
FW	m^3	4.74E+01	4.19E+01
Output Flows and Waste Categories			
HWD	kg	8.07E-03	5.61E-03
NHWD	kg	9.91E+00	3.23E+00
RWD	kg	6.05E-04	4.03E-04

Environmental indicator	Unit	Walker Textures® Acid-etched Mirror (per DU)	Unetched Mirror (per DU)
CRU	kg	0	0
MFR	kg	6.18E-01	5.42E-01
MER	kg	0	0
EE	MJ, LHV	0	0

4.3 Interpretation

Error! Reference source not found.3 and Figure 4 present the environmental impacts and energy consumption of Walker Textures® acid-etched mirror. Raw materials extraction and transformation have the highest contribution to a majority of impact categories, especially flat glass production. To a lesser degree, the production process for alkyd paint, as well the European market for titanium dioxide, contribute to the EP. The production of chemicals used for treating the wastewater coming out the acid-etching process counts for half of the A3 stage impacts.

Moreover, manufacturing contributes for more than 50% to ODP, due to the consumption of natural gas and the transport of raw materials to about 20%. The depletion of abiotic resources is mainly due to the production of flat glass for more than 61%, and to wastewater treatment occurring during the manufacturing stage (29%).

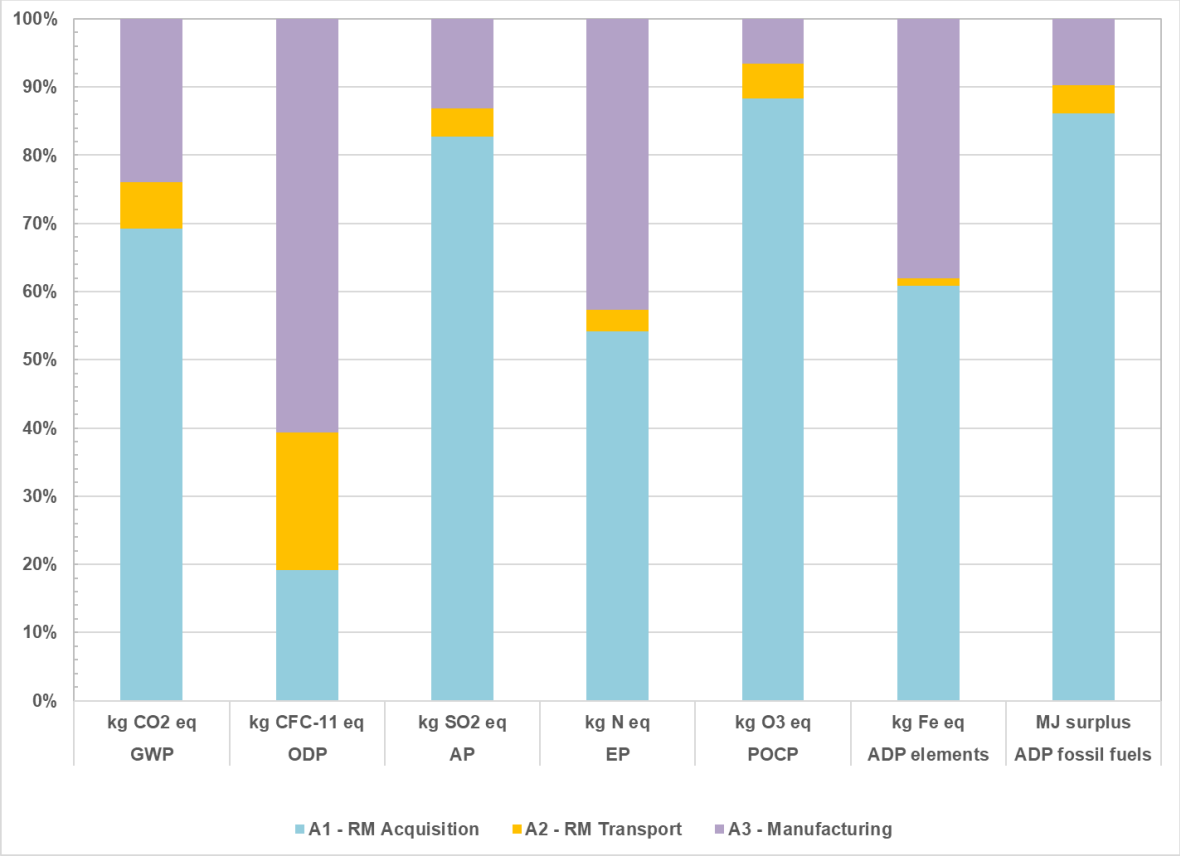


Figure 3: Contribution of life cycle stages to the environmental impacts of 1m² of Walker Textures® acid-etched mirror - TRACI & ReCiPe indicators.

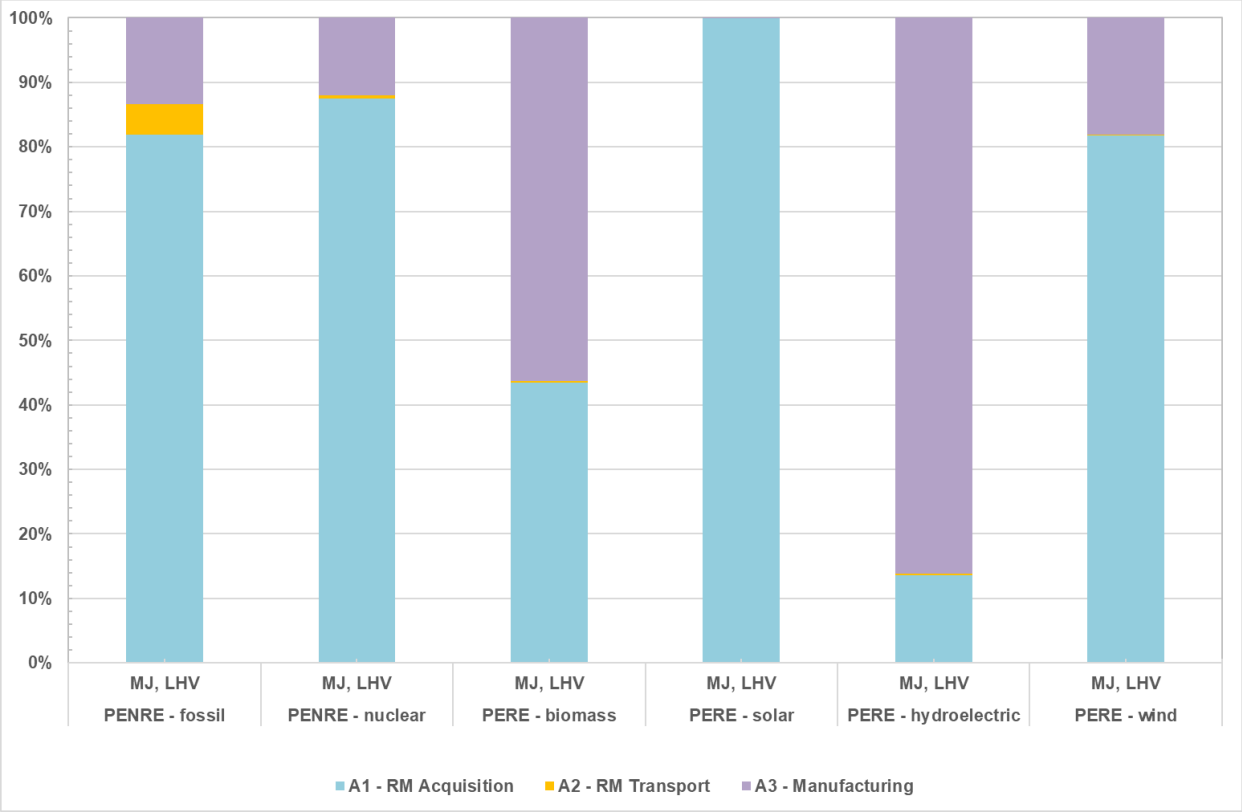


Figure 4: Contribution of life cycle stages to the environmental impacts of 1m² of Walker Textures® acid-etched mirror – Cumulative Energy Demand.

The contribution of the A1 stage to the consumption of PENRE - fossil is the highest of the three. Flat glass contributes for the most part to the impact, followed by alkyd paint production. Transport processes are based on diesel vehicles so the impact of raw materials transport is higher for this indicator. The manufacturing stage A3 consumes natural gas that is the biggest contributor of this stage with the municipal waste collection vehicle.

The contributions of A1 stage to the consumption of PENRE - nuclear comes mainly from the production of flat glass, followed by the protective paint production process that is based in Europe (RER) because of the suppliers and the production of acid-etching raw materials. Manufacturing stage A3 contributes to this indicator mainly because of the wastewater treatment process for the acid-etching process, followed by the Quebec electricity grid mix. Packaging materials and the production of natural gas also have non negligible contributions.

Packaging fabrication and the electricity grid mix from Quebec have a noticeable impact on PERE – biomass and PERE - hydroelectric indicators respectively. PERE – wind and PERE – solar are dominated by the production flat glass.

Environmental impacts and energy consumption for 1 m² of Unetched Mirror are depicted in Figure 5 and Figure 6. As we've seen from the other product, raw materials extraction and transformation have the highest contribution to a majority of impact categories, especially flat glass production. To a lesser

degree, the production process for alkyd paint, as well the European market for titanium dioxide, contribute to the EP. However, manufacturing contributes for more than 50% to ODP, due to the consumption of natural gas and the transport of raw materials to 32%.

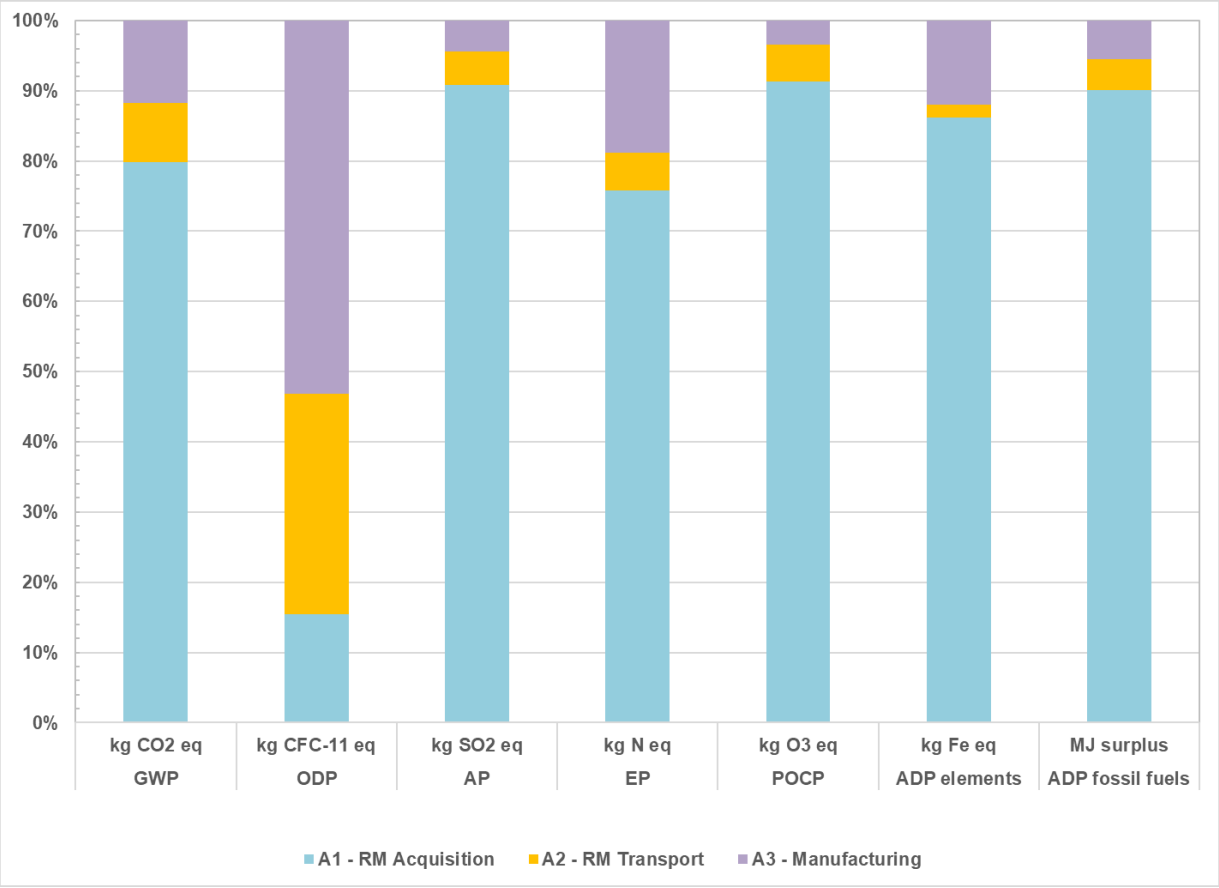


Figure 5: Contribution of life cycle stages to the environmental impacts of 1m² of unetched mirror - TRACI & ReCiPe indicators.

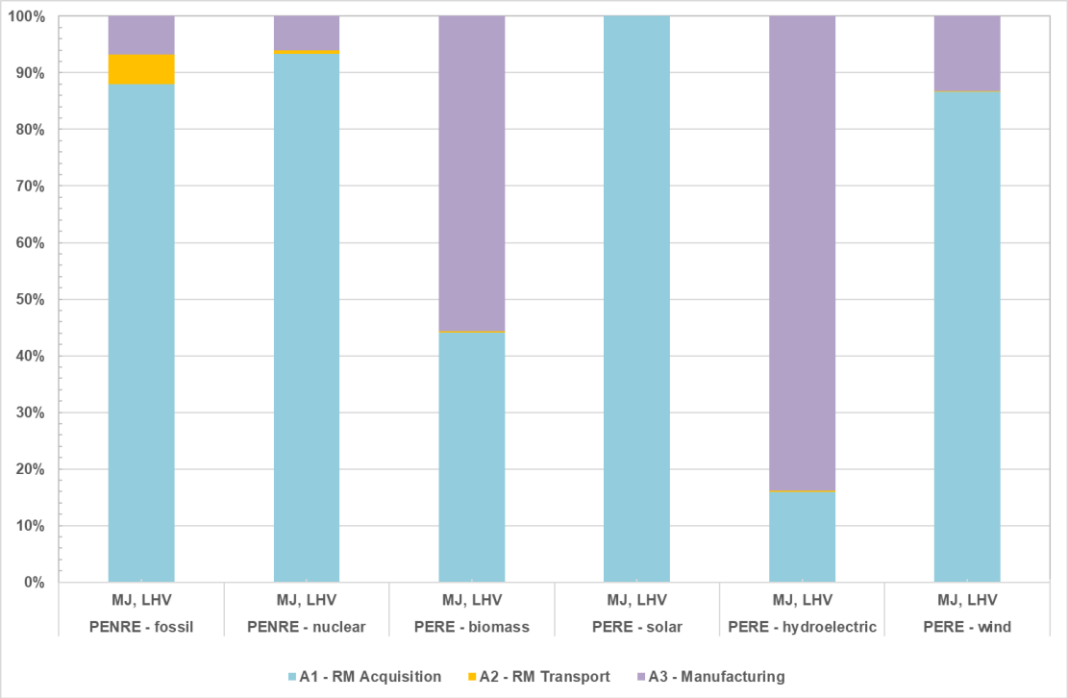


Figure 6: Contribution of life cycle stages to the environmental impacts of 1m² of unetched mirror – Cumulative Energy Demand.

Flat glass contributes greatly to the impact, followed by alkyd paint production. Transport processes are based on diesel vehicles so the impact of raw materials transport is higher for this indicator. The manufacturing stage consumes natural gas that is the biggest contributor of this stage with the municipal waste collection vehicle.

The contributions of A1 stage to the consumption of nuclear energy comes mainly from production of flat glass, followed by the protective paint production process which is based in Europe (RER) because of the suppliers. Manufacturing contributes to this indicator mainly because of the interleaving paper produced in Ontario, Canada and imported electricity from the Quebec grid mix.

Packaging fabrication and the electricity grid mix from Quebec have a noticeable impact on renewable resources indicators.

5 ADDITIONAL ENVIRONMENTAL INFORMATION

In addition, Walker has undergone a third-party verification process with Vertima Inc. where Walker's products and its entire supply chain were assessed. At the end of the process, they received the certification Validated Eco-Declaration® summarizing verified environmental claims, as well as Vertima's Environmental Data Sheet.

Walker has also published a *Health Product Declaration®* for its Walker Textures® acid-etched mirror. More details are available on the HPDC public repository: https://www.hpd-collaborative.org/hpd-public-repository/.

6 REFERENCES

[1] ISO (2006) ISO 14040. Environmental management – Life cycle assessment - Principles and framework. 20pp.

[2] ISO (2006) ISO 14044. Environmental management – Life cycle assessment – Requirements and guidelines. 46pp.

[3] ISO (2006) ISO 14025. Environmental labels and declarations – Type III environmental declarations – Principles and procedures. 25pp.

[4] UL Environment (2016). PCR Guidance for Building-Related Products and Services. Part B: Processed Glass EPD Requirements. Version 1.0. 14pp.

[5] ASTM International (2016) ASTM C1036-16 – Standard Specification for Flat Glass. West Conshohocken, PA. DOI: 10.1520/C1036-16

[6] Standards Council of Canada (R2017) CAN/CGSB-12.3-M91 – Flat, Clear Float Glass.

[7] ASTM International (2013) ASTM C1503-08 – Standard Specification for Silvered Flat Glass Mirror. West Conshohocken, PA. DOI: 10.1520/C1503-08R13.

[8] Standards Council of Canada (1986) CAN/CGSB-12.5-M86 – Mirrors, Silvered.

[9] GANA (2014) Recyclability of Architectural Glass Products. Glass Information Bulletin. GANA DD 04-0114. 6 pp.

[10] GANA (2012) Green Aspects of Mirror – The Reusability and Recyclability of Mirror Products. Mirror Information Bulletin. GANA MD 05-0212. 4pp.

[11] RECYC-QUÉBEC (2010) Glass. Fact sheets. *Original title: Le verre. Fiches informatives*. 8 pp.

[12] GreenDelta (©2017) About openLCA. http://www.openlca.org/the-idea/. Date accessed 2017/09/08.

[13] Vitro Architectural Glass (2017) Environmental Product Declaration – Vitro Architectural Glass Flat Glass Products. ASTM-EPD #061. 22pp.

[14] Althaus H.-J., Chudacoff M., Hischier R., Jungbluth N., Osses M. and Primas A. (2007) Life Cycle Inventories of Chemicals. Final report ecoinvent data v2.0 No. 8. Swiss Centre for Life Cycle Inventories, Dübendorf, CH.

[15] Frischknecht R., Jungbluth N., Althaus H.-J., Doka G., Heck T., Hellweg S., Hischier R., Nemecek T., Rebitzer G., Spielmann M., Wernet G. (2007) Overview and Methodology. ecoinvent report No. 1. Swiss Centre for Life Cycle Inventories, Dübendorf, 2007

[16] U.S. Life Cycle Inventory Database." (2012). National Renewable Energy Laboratory, 2012. Accessed November 19, 2012: https://www.lcacommons.gov/nrel/search

[17] http://www.3v-tech.com/en/technologies-and-solutions/12/ferric-chloride. Date accessed 2017/09/27

[18] UL Environment and IBU (2014). PCR for Building-Related Products and Services. Adapted for UL Environment from the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU). Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report. Version 1.3. 48pp.

[19] Bare, J. C., T. P. Gloria (2008). Environmental impact assessment taxonomy providing comprehensive coverage of midpoints, endpoints, damages, and areas of protection. Journal of Cleaner Production 16: 1021-1035.

[20] Vitro Architectural Glass (2017) Environmental Product Declaration – Vitro Architectural Glass Processed Glass Products. ASTM-EPD #062. 30pp.

[21] Goedkopp, M., R. Heijungs, M.A.J. Huijbregts, A. De Schryver, J. Struijs, R. van Zelm. 2012. ReCiPe 2008, A life cycle impact assessment method which comprises harmonized category indicators at the midpoint and the endpoint level. Revised 1st ed. 126 pp. ReCiPe webpage: http://www.rivm.nl/en/Topics/L/Life_Cycle_Assessment_LCA/ReCiPe (last accessed on 2017-09-10).

[22] U.S. Environmental Protection Agency (2007) Methodology for Thermal Efficiency and Energy Input Calculations and Analysis of Biomass Cogeneration Unit Characteristics. EPA-HQ-OAR-2007-0012. April 2017. Office of Air and Radiation. 31 pp. Available online at https://www3.epa.gov/airtoxics/utility/fnl_biomass_cogen_TSD_04_19_07.pdf (last accessed on 2017-09-22)

[23] FAO (2015) Wood Fuels Handbook. Food and Agriculture Organization of the United Nations. ISBN 978-92-5-108728-2. 40 pp.

[24] Staffell, Ian (2011) The Energy and Fuel Data Sheet. W1P1 – Revision 1. University of Birmingham. 11pp.

[25] CEN (2012) EN 15804:2012 – Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

[26] Vertima (2017) Life Cycle Assessment of Processed Glass – Walker Glass Company Ltd. Report. 56 pp.