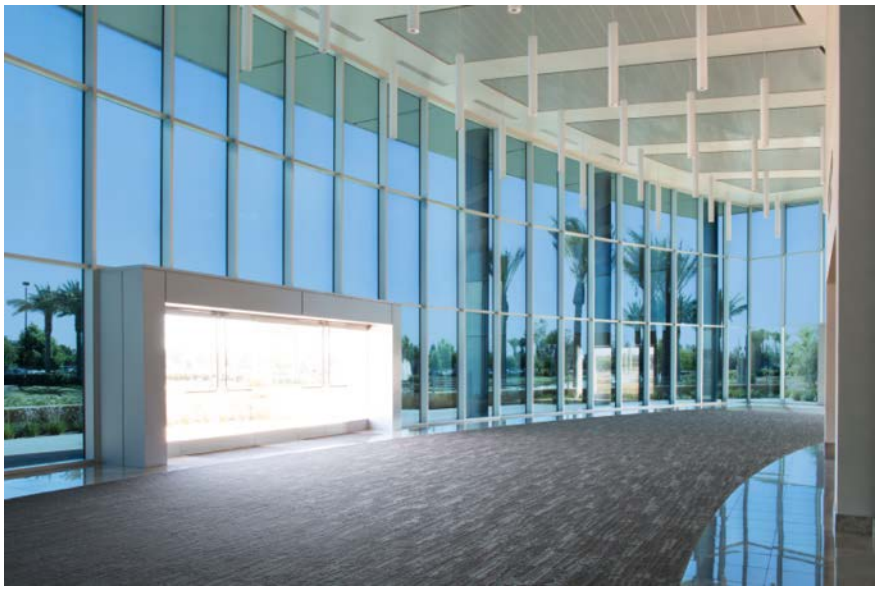
ENVIRONMENTAL PRODUCT DECLARATION

VIEW DYNAMIC GLASS

PROCESSED GLASS



View Dynamic Glass tints in response to outdoor conditions, providing greater comfort and efficiency without ever compromising the view

A leader in building innovation, View Inc. is the first company to successfully advance the large-scale commercialization of dynamic glass. Situated at the intersection of human wellness, smart technology, and energy efficiency, View manufactures View Dynamic Glass, a new generation of architectural glass that intelligently transitions through multiple tint states to control the sun's energy, providing an enhanced occupant experience and optimum natural light and thermal comfort.

UL CERTIFIED
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ENVIRONMENTAL PRODUCT DECLARATION

view

Dynamic Glass

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025 and EN 15804. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g., Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	View, Inc
DECLARATION NUMBER	4787622529.101.1
DECLARED PRODUCT	View Dynamic Glass
REFERENCE PCR	UL Core PCR part A. Part B: Processed Glass EPD Requirements (v 1.0, 2016)
DATE OF ISSUE	December 7, 2016
PERIOD OF VALIDITY	5 years
CONTENTS OF THE DECLARATION	Product definition and information about material science
	Information about basic material and the material's origin
	Description of the product's manufacture
	Indication of product processing
	Information about the in-use conditions
	Life cycle assessment results
	Testing results and verifications
The PCR review was conducted by:	
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Wade Stout, ULE EPM
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Industrial Ecology Consultants

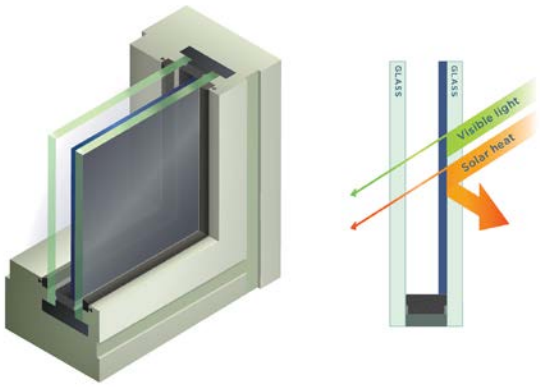
Product Description

Product Description

The declared product is one square meter of a View Dynamic Glass insulating glass unit (IGU). Dynamic glass is produced in many sizes, and the ratio of materials in this declaration is based on the average sized IGU of 20 square feet. While different sized IGUs may have slightly different ratios of materials, this composition is considered representative of the product line.

Dynamic Glass is an IGU product, containing an electrochromic layer on one surface of the glass which tints when an electrical current is applied. The electrochromic layer is deposited via a vacuum-based physical vapor deposition process. The other components in the IGU include uncoated glass, a silicone foam spacer, polyisobutylene primary seal and a silicone secondary sealant, wiring, and argon gas. For further description and percent mass composition, please refer to the Base Materials / Ancillary Materials section below.

Figure 1 – Dynamic Glass Cross-section



Application

Dynamic Glass is used in both commercial and residential settings, and can be installed in any window, skylight, or curtain wall to create a climate adaptive barrier to the outdoors.

Technical Data

Table 1 – Dynamic Glass Technical Data

Tint Stage	Visible Transmittance (%)	Interior Visible Reflectance (%)	Exterior Visible Reflectance (%)	U-Value	Solar Heat Gain Coefficient
Tint 1	58%	18%	15%	0.29	0.41
Tint 2	40%	17%	12%	0.29	0.28
Tint 3	6%	16%	9%	0.29	0.11
Tint 4	1%	17%	10%	0.29	0.09

Market Placement / Installation Requirements

View Dynamic Glass is produced according to the following standards:

- ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings
- ASTM C1036 Standard Specification for Flat Glass
- ASTM C1048 Standard Specification for Heat-Treated Flat Glass
- ASTM E2141 Standard Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units
- ASTM E2240 Standard Test Method for Assessing the Current Voltage Cycling Stability at 90 C (194 F) of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units
- ASTM E2241 Standard Test Method for Assessing the Current Voltage Cycling Stability at Room Temperature of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units
- ASTM E2354 Standard Guide for Assessing the Durability of an Absorptive Electrochromic Coating within Sealed Insulating Glass Units
- ASTM E2355 Standard Test Method for Measuring the Uniformity of an Absorptive Electrochromic Coating on a Glazing Surface
- ASTM C1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
- ASTM C1172 Standard Specification for Laminated Architectural Flat Glass
- ASTM E2188 Standard Test Method for Insulating Glass Unit Performance
- ASTM E2189 Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units
- ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation
- IGMA TB-1201-89(05) Sealant Manufacturers Minimum Sealant Dimensions and Placement Survey
- IGMA TM-4000-02(07) Insulating Glass Manufacturing Quality Procedures Technical Manual
- American National Institute (ANSI) Z97.1-2009 Standard - Safety Glazing Materials Used in Buildings
- Consumer Product Safety Commission (CPSC) 16 CFR 1201 - Safety Standard for Architectural Glazing Materials

Delivery Status

Dynamic Glass IGUs are available in a variety of shapes, sizes, and cavity depths. The maximum available IGU size is an industry leading 6ft x 10ft.

Base Materials / Ancillary Materials

Dynamic Glass contains 0% recycled content. The following table describes the material composition of Dynamic Glass:

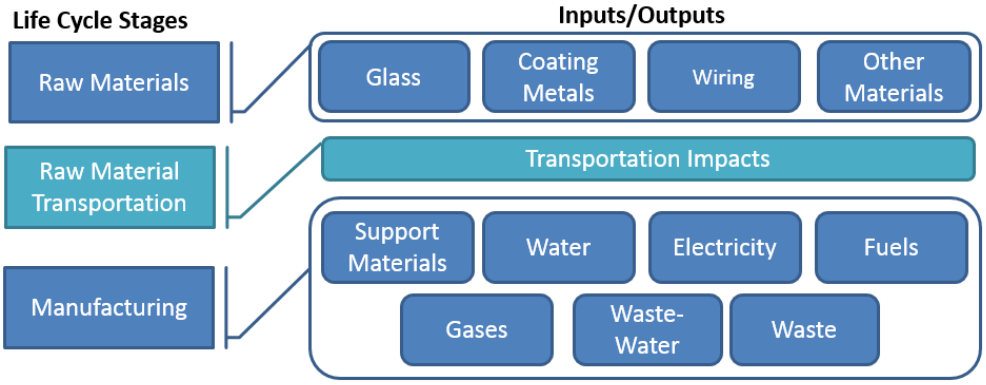
Table 2 – View Dynamic Glass Composition

Constituent	% Composition
Float Glass	93%
Silicon	5%
Spacer	1%
Wiring	<1%
Metals	<1%
Other Support Materials	<1%

Manufacturing

Dynamic Glass is manufactured in Olive Branch, MS. The process starts with float glass, which is washed, polished, and tempered, before being coated with a proprietary blend of metals to achieve its electrochromic properties. The coated glass is then combined with uncoated glass, a spacer, and sealant to form an insulating glass unit (IGU), which is wired to provide electrical current to the glass surface. Completed IGUs then undergo thorough cycle testing and quality assurance before being packaged for distribution.

Figure 2 – Dynamic Glass Process Flow Diagram



Environmental and Health Considerations during Manufacturing

View is committed to minimize the environmental impact of our Dynamic Glass production and distribution. Employees are aware of View's environmental roles and responsibilities through training and support from the management team. View has established procedures to monitor waste streams for compliance in existing recycling programs. Additionally, the company includes human rights, labor practices, and work environment in the published code of conduct. The health and safety of employees and contractors is a primary focus point, and View continually strives for zero injuries by providing extensive training and personal protective gear that meets or exceeds industry standards.

Product Installation

The IGU is to be installed per specification of IGMA *North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial And Residential Use* TM 2000-90(04). Each IGU contains a 12” cable that is to be connected to the View controls system.

Packaging

Dynamic Glass utlizes two different packaging configurations. For larger scale projects, Dynamic Glass is often shipped on steel A-frames, which are designed to secure and carry completed IGUs. For this packaging configuration, the A-frames are returned to the Olive Branch, MS facility for reuse. More commonly, Dynamic Glass is packaged and shipped in wooden crates, sized to accommodate the specified product.

Condition of Use

During the use phase, Dynamic Glass may be manually controlled through a mobile applicatiion, allowing the user to control the tint level remotely, create schedules, and track energy efficiency. Additionally, Dynamic Glass is powered by a sophisticated intelleginee engine that monitors outdoor conditions and has the ability to automatically control tint levels based on cloud cover, sun angle, time of year, and latitude / longitude.

Environmental and Health Considerations During Use

There is no harmful emissive potential. No damage to health or impairment is expected under normal use of the product.

Extraordinary Effects

Fire
No harmful emissions are anticipated when the product is exposed to fire conditions.

Water
No substances are used which have a nagative impact on water quality on contact by the door with water.

Mechanical Destruction
No danger to the environment can be anticipated during mechanical destruction.

Re-use Phase

Dynamic Glass is not typically reused or recycled at the end of life.

Disposal

Dynamic Glass is not suitable for energy from waste, and as such, landfill is the typical disposal option.

Further Information

For more information, please visit www.viewglass.com or contact View at info@viewglass.com or 1-408-514-6512.

Life Cycle Assessment

Declared Unit

The declared unit of this product is one square meter of a Dynamic Glass IGU.

Table 3 – Dynamic Glass Declared Unit

Name	Value	Unit
Declared Unit	1	m^2
Mass per piece	2.99	kg
Conversion factor to 1 kg	0.33	-
Thickness	12.5	mm

System Boundary

The system boundary is cradle-to-gate, as specified by the Processed Glass Product Category Rules.

Table 4 - Description of the System Boundary

Product			Construction Installation		Use							End-of-Life				Benefits of loads beyond the system boundary		
Raw Material Extraction and Processing	Transport	Manufacturing	Transport	Construction/ Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport	Waste Processing	Disposal	Reuse	Recovery	Recycling
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Estimates and Assumptions

Product produced for research and development purposes is counted as scrap. This scrap, along with other process scrap is assumed to be disposed of in landfill, unless it is clean, flat glass in which case the glass is assumed to be recycled.

Cut-off Criteria

This EPD is in compliance with the cut-off criteria. No components and materials were omitted from the LCA.

Software and Background Data

SimaPro v8.02 Software System for Life Cycle Engineering, an internationally recognized LCA modeling software program, was used for life cycle impact assessment modeling. Background and secondary datasets were modeled using the US LCI database, developed by the National Renewable Energy Laboratory, as well as the ecoinvent v3 database, which is developed by the Swiss Centre for Life Cycle Inventories.

Data Quality

Data used for this study are as current as possible. Data sets used for calculations are within the last 10 years for generic data and within the last calendar year for manufacturer-specific primary data. All data sets is representative of the US.

Period Under Consideration

Primary data for this study was collected for the reference period from July 2015 – June 2016. Primary data includes formulations, manufacturing energy and water consumption, as well as waste generation. Water treatment chemicals and other ancillary materials are included in the scope of this study.

Allocation

Allocation was conducted per total production by area at the Olive Branch, MS facility.

Comparability

Full conformance with the PCR for North American Processed Glass allows EPD comparability only when all stages of the processed glass life cycle have been considered. 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 this PCR. Variations and deviations in the results upstream or downstream of the life cycle stages declared are possible due to the use of different Life Cycle Assessment (LCA) software and background Life Cycle Inventory (LCI) datasets.

LCA Results

Results are reported based on characterization factors from the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI 2.1 impact categories). Additionally, impact categories taken from the University of Leiden (CML) methodology are reported to facilitate the use of this EPD outside of North America.

Table 4 - Life Cycle Impact Assessment Results

Life Cycle Impact Assessment Results					
Declared Unit: 1 square meter					
TRACI 2.1		**A1**	**A2**	**A3**	**Units**
GWP	Global warming potential	1.8E+02	1.7E+01	6.7E+02	kg CO_2 Eq.
ODP	Depletion potential of the stratospheric ozone layer	4.0E-05	6.7E-10	1.9E-05	kg CFC 11 Eq.
AP	Acidification potential	1.5E+00	8.7E-02	6.7E+00	kg SO_2 Eq.
EP	Eutrophication potential	4.9E-01	4.9E-03	4.4E-01	kg N Eq.
POCP	Photochemical ozone creation potential	1.7E+01	2.3E+00	4.5E+01	kg O_3 Eq.
ADPF	Abiotic depletion potential for fossil resources	2.5E+02	3.2E+01	4.2E+02	MJ surplus energy
CML		**A1**	**A2**	**A3**	**Units**
GWP	Global Warming Potential	1.8E+02	1.7E+01	6.7E+02	kg CO_2 Eq.
ODP	Depletion potential of stratospheric ozone layer	2.3E-05	6.6E-10	1.4E-05	kg CFC-11 Eq.
AP	Acidification potential	8.8E+00	7.3E-02	7.2E+00	kg SO_2 Eq.
EP	Eutrophication potential	6.9E-01	1.2E-02	3.9E-01	kg $(PO_4)^3$ Eq.
POCP	Photochemical ozone creation potential	3.3E-01	4.5E-03	2.7E-01	kg ethane Eq.

Table 5 - Use of Resources

Use of Resources					
Part C Resource Use		**A1**	**A2**	**A3**	**Units**
PERE	Renewable primary energy as energy carrier	0.0E+00	0.0E+00	1.2E+02	MJ (LHV)
PERM	Renewable primary energy resources as material utilization	0.0E+00	0.0E+00	2.2E-01	MJ (LHV)
PERT	Total use of renewable primary energy resources	8.2E+01	0.0E+00	1.2E+02	MJ (LHV)
PENRE	Non-renewable primary energy as energy carrier	2.3E+03	2.4E+02	1.0E+04	MJ (LHV)
PENRM	Non-renewable primary energy as energy material utilization	0.0E+00	0.0E+00	0.0E+00	MJ (LHV)
PENRM	Total use of non-renewable primary energy resources	2.3E+03	2.4E+02	1.0E+04	MJ (LHV)
SM	Use of secondary material	0.0E+00	0.0E+00	0.0E+00	MJ (LHV)
RSF	Use of renewable secondary fuels	0.0E+00	0.0E+00	0.0E+00	MJ (LHV)
NRSF	Use of non-renewable secondary fuels	0.0E+00	0.0E+00	0.0E+00	MJ (LHV)
FW	Use of net fresh water	2.5E+02	0.0E+00	2.1E+01	m^3

Table 6 - Output Flows and Wastes

Output Flows and Waste Categories					
Part D Waste		**A1**	**A2**	**A3**	**Units**
HWD	Disposed-of-hazardous WASTE	3.5E-03	0.0E+00	1.5E-02	kg
NHWD	Disposed-of non-hazardous WASTE	1.1E+01	0.0E+00	7.4E+01	kg
RWD	Disposed-of Radioactive WASTE	1.7E-03	0.0E+00	9.0E-03	kg
CRU	Components for reuse	0.0E+00	0.0E+00	0.0E+00	kg
MFR	Materials for recycling	3.0E-01	0.0E+00	5.0E-01	kg
MET	Materials for energy recovery	0.0E+00	0.0E+00	0.0E+00	kg
EEE	Exported electrical energy (waste to energy)	0.0E+00	0.0E+00	0.0E+00	MJ
EET	Exported thermal energy (waste to energy)	0.0E+00	0.0E+00	0.0E+00	MJ

LCA Interpretation

The cradle-to-gate life cycle of Dynamic Glass is driven by both the raw material extraction and processing stage (A1) and the manufacturing stage (A3), while impacts from raw material sourcing (A2) are minor. Within the raw material extraction and processing stage (A1), the upstream production of flat glass drives the impact. Within the manufacturing stage (A3), electricity consumption is the most impactful input.

References

- ISO 21930: Sustainability in building construction – Environmental declaration of building products
- EN 15804: Sustainability of construction works, Environmental product declarations, Core rules for the product category of construction products.
- EPA, Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI)
- FTC Part 260, Green guides
- (ILCD, 2010) Joint Research Commission, 2010, ILCD Handbook: General Guide for Life Cycle Assessment
- Intergovernmental Panel on Climate Change (IPCC)
- ISO 14025:2006 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures*
- ISO 14040:2006 *Environmental management - Life cycle assessment – Principles and framework*
- ISO 14044:2006 *Environmental management - Life cycle assessment – Requirements and guidelines*
- Product Category Rules for Building Related Products and Services; Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report; UL Environment and Institut Bauen und Umwelt e.V. Version 1.3
- PCR Guidance for Building-Related Products and Services; Part B: Processed Glass EPD Requirements; UL Environment and Institut Bauen und Umwelt e.V. Version 1.0; Published 8/17/2016
- IGMA *North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial And Residential Use* TM 2000-90(04)
- ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings
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LCA Development

This EPD and corresponding LCA were prepared by Sustainable Solutions Corporation of Royersford, Pennsylvania.

SustainableSolutions CORPORATION

Contact View

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