ENVIRONMENTAL PRODUCT DECLARATION

# ALUMINUM WINDOWS SYSTEMS

YKK AP AMERICA, ENERGFACADE® ENERGY EFFICIENT BUILDING SOLUTIONS, PROTEK®
HURRICANE MITIGATION AND BLAST MITIGATION SYSTEMS

*There are a large number of uses for architectural-grade windows. At Lee High School in Jacksonville, FL, YKK AP's operable windows were chosen in keeping with the historic look of the building.*

*All YKK AP products are manufactured, finished and inspected for quality in the YKK AP environmentally certified, state-of-the-art facility in Dublin, GA.*

YKK AP America is taking positive steps toward sustainable manufacturing helping to balance ecology and economy—improving theenvironment and society over the longterm. YKK AP® is the proud manufacturer of architectural products,including aluminum sun control systems, which provide safe and comfortable environments for building occupants and help reduce energy usage.

A dedicated partner in green building design and sustainability, YKK AP helps create innovative, high quality architectural systems that add to the strength, energy efficiency and longevity of the building envelope.

All YKK AP® products are created in a facility that is a model of environmental responsibility. YKK AP's U.S. manufacturing plant in Dublin, GA, is ISO 14001 certified and has been recognized by the U.S. Department of Energy for exceptional leadership in industrial energy efficiency.

For additional information, visit commercial.ykkap.com.

UL CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

# ENVIRONMENTAL PRODUCT DECLARATION

YKK AP America

Windows

According to ISO 14025
and ISO 21930:2017

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|---|---|
| EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE | UL ENVIRONMENT<br>333 PFINGSTEN RD, NORTHBROOK, IL 60062<br>WWW.UL.COM<br>WWW.SPOT.UL.COM |
| GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER | Program Operator Rules v 2.7 2022 |
| MANUFACTURER NAME AND ADDRESS | YKK AP Headquarters<br>101 Marietta Street NW, Suite 2700<br>Atlanta, GA 30303 |
| DECLARATION NUMBER | 4789555932.107.1 |
| DECLARED PRODUCT & DECLARED UNIT | Windows, 1.82 $m^2$ |
| REFERENCE PCR AND VERSION NUMBER | Product Category Rules for Building Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Edition 6 (ULE, 2022) ; and Part B: Requirements on the EPD for Requirements on the EPD for Windows and doors (IBU V1.7, 08.01.2019) (IBU/UL, 2014) (IBU, 2019) |
| DESCRIPTION OF PRODUCT APPLICATION/USE | Self-supporting façade element / Used in construction / Windows application |
| MARKETS OF APPLICABILITY | North America |
| DATE OF ISSUE | December 1, 2022 |
| PERIOD OF VALIDITY | 5 years |
| EPD TYPE | Company specific |
| EPD SCOPE | Cradle to gate with options |
| YEAR(S) OF REPORTED PRIMARY DATA | 2019 |
| LCA SOFTWARE & VERSION NUMBER | GaBi v10 (Sphera, 2020) |
| LCI DATABASE(S) & VERSION NUMBER | GaBi 2021 (CUP 2021.1) |
| LCIA METHODOLOGY & VERSION NUMBER | IPCC AR5 (GWP), CML-IA v4.8, (GaBi, 2021), TRACI 2.1 (Bare, 2012) |

| | |
|---|---|
| The sub-category PCR review was conducted by: | Institut Bauen und Umwelt (IBU)<br>PCR review panel<br>ibu-epd.com |
| This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017)<br>☐ INTERNAL ☒EXTERNAL | Cooper McCollum, UL Environment |
| This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by: | Sphera |
| This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by: | James Mellentine, Thrive ESG |

LIMITATIONS

The environmental impact results of steel products in this document are based on a declared unit and therefore do not provide sufficient information to establish comparisons. The results shall not be used for comparisons without knowledge of how the physical properties of the steel product impact the precise function at the construction level. The environmental impact results shall be converted to a functional unit basis before any comparison is attempted. See the results section for additional EPD comparability guidelines.

Environmental declarations from different programs (ISO 14025) may not be comparable.

YKK AP America

Windows

According to ISO 14025
and ISO 21930:2017

## Product Definition And General Information

### Description of Organization

YKK AP is the single-source solution for architectural windows that are designed and engineered to provide worry-free, built-to-last quality. YKK AP® commercial window systems offer a variety of configurations to accommodate most any project requirement. This includes zero-sightline windows that may be installed in most YKK

AP storefronts, window wall or curtain wall systems.

Windows with the ProTek® hurricane and blast mitigating designation are designed to protect buildings from the impacts of hurricanes and man-made disasters. These building systems have been independently tested to the requirements of ASTM E 1886, ASTM E 1996 and the test requirements for the Florida High Velocity Hurricane Zone (TAS 201, TAS 202, & TAS 203).

Commercial windows with the enerGfacade® energy saving solution designation utilize YKK AP's MegaTherm® thermal barrier technology to deliver up to 30% greater energy efficiency than traditional thermally broken systems. YKK AP commercial windows accept a variety of glazing options, spacers and gas fills for even greater efficiency and occupant comfort.

All YKK AP products are manufactured, finished and inspected for quality in YKK AP's environmentally certified, state-of-the-art facility in Dublin, GA. As a result, YKK AP products fit together without a lot of jobsite re-work. YKK AP offers a complete suite of tools and engineering services to assist in proper system selection, specification and installation.

***Materials & Coatings***

*Aluminum Alloys: 6063 T5, 6063 T6,6061 T6*

*Available Finishes: ANODIZED PLUS®, AAMA 2604/2605*

*Painted Finishes*

### Product Description

The following YKK AP America window systems are covered by this EPD (glazing is excluded from this study):

**YOW 350 XT 3-1/2" enerGfacade® Thermally Broken Operable Window System for Insulating Glass**

YOW 350 XT achieves state of the art energy performance while utilizing standard 1" insulating glass. Innovative design attributes minimize energy loss through a multitude of thermal barriers. This factory glazed window wall system has an overall depth of 3-1/2" and is thermally broken by a combination of MegaTherm® Thermal Breaks and gasketing to insulate multiple air chambers. Improved occupant comfort is achieved by interior surfaces that are significantly warmer than traditional window systems in cold climates.

**YOW 225 H 2-1/4" ProTek® Impact Resistant Operable Window**

YOW 225 H windows have been designed and engineered to the highest standards so as to provide a window that will be worry free. The windows have successfully passed the impact and cycle requirements of ASTM E 1886, ASTM E 1996, and the test requirements for the Florida High Velocity Hurricane Zone (TAS 201, TAS 202, & TAS 203). The windows are glazed with laminated monolithic glass. The vents are flush with the frame thus eliminating unsightly overlap.

### YOW 225 TUH 2-1/4" ProTek® Thermally Broken Impact Resistant and Blast Mitigating Operable Window

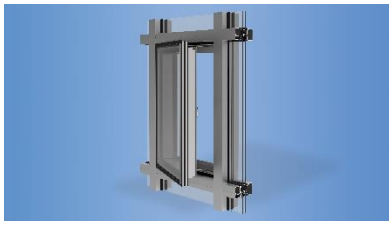
Performance boosting YOW 225 TUH windows now feature oversize window options and expanded installation options while providing an increase in school security over safety glazing. These additions eliminate job specific engineering and testing as maximum vent size increased from 15 SF to 24 SF with cost effective .090" PVB for LMI. Product specifications for YOW 225 TUH include openings to 7'-9" tall singles and doubles, or continuous window runs with stacking mullions. For larger openings, the operating windows can be installed in YKK AP impact rated storefront and curtain wall systems. The most cost effective and weather resistant configuration is a double casement in a master frame featuring a reduced sight line and no secondary penetrations of mullions or sill starter.

### YFW 400 TUH 4" ProTek® Thermally Broken Impact Resistant and Blast Mitigating Fixed Window

YFW 400 TUH ProTek® thermally broken impact resistant and blast mitigating fixed windows have been designed and engineered to the highest of standards. The quality 4" frame depth fixed window is universal to our 4" depth impact resistant operable window systems. This fixed window system will easily integrate with our YVS 410 TUH Single and Double Hung window system utilizing the same stacking mullions. Integral horizontal and vertical mullions provide greatly expanded configurations. Superior air and water performance enhance this factory glazed product making it an excellent substitution for smaller storefront punched openings. The YFW 400 TUH is a high performance window that is designed for the high velocity winds of south Florida. Additional benefit is provided by the labor savings when used as a factory glazed fixed window. This window system not only provides additional security against burglary but also the minimal hazard level of ASTM F 1642 for blast mitigation. With varied infill and components, YFW 400 TUH windows can meet the requirements for Impact Resistance and Blast Mitigation. So for your next window project, think YFW 400 TUH!

### YVS 410 TUH 4" ProTek® Thermally Broken Side Loading Impact Resistant and Blast Mitigating Hung Window

The YVS 410 TUH ProTek® Hung Window is designed to capture the side rails of the sash, providing a high level of security and dependability for both new construction and renovation projects. The use of YKK AP's ThermaBond Plus® poured and de-bridged system provides superior thermal qualities. The windows have successfully passed the impact and cycle requirements of ASTM E-1886, ASTM E 1996, and the test requirements for the Florida High Velocity Hurricane Zone (TAS 201, TAS 202, & TAS 203). A full selection of quality block and tackle, spiral, and Class 5 Ultra-Lift® balances are available. Optional SecurSweep sweep locks are available that incorporate a special security latch to prevent tampering from the outside.



### YES SSG TUH Vent ProTek® 1-7/8" Thermally Broken Vent Window for Storefront and Curtain Wall

Provide ventilation for your storefront or curtain wall project using a product that meets the 2012 International Energy Conservation Code (IECC) through Zone 6 with standard Low E (U = 0.29 COG). In addition to exceptional thermal performance and condensation resistance in an SSG Vent product, this system also provides AW PG 65 architectural performance. The YES SSG TU Vent seamlessly blends with the surrounding framing system to become virtually invisible when viewed from a distance.

### YOW 350 T 3-1/2" Thermally Broken Operable Window System for Insulating Glass

YOW 350 T windows have been designed and engineered to provide the highest level of performance. They have an overall depth of 3-1/2", the strength of 1/8" wall thickness, and are thermally broken by means of MegaTherm® technology to conserve energy, reduce operating costs, and allow for a dual finish option to fit design needs. This system, when coupled with its mullion options and full line of accessories, can be used as a factory glazed window wall system.

### YOW 225 2-1/4" Operable Window for Monolithic & Insulating Glass

YOW 225 windows have been designed and engineered to provide a quality window that will be worry free. The windows may be glazed with either monolithic or insulating units. The YOW 225 window system has been developed to provide a variety of configurations to accommodate project requirements. The vents are flush with the frame thus eliminating unsightly overlap. The windows may be installed as independent units or adapted to fit most YKK AP storefronts, window wall, or curtain wall systems.

### YOW 225 TU 2-1/4" Thermally Broken Operable Window for Insulating Glass

YOW 225 TU windows have been designed and engineered to provide the highest level of quality. The windows have an overall depth of 2-1/4" and are thermally broken by means of ThermaBond Plus® technology developed by YKK AP. YOW 225 TU windows may be installed as independent units or adapted to fit into most YKK AP storefront, window wall, or curtain wall systems. The vents are flush with the frame thus eliminating unsightly overlap. YOW 225 TU windows are available in a variety of configurations to accommodate project requirements.

### YFW 400 TU 4" Thermally Broken Fixed Window

YFW 400 TU thermally broken fixed windows have been designed and engineered to the highest of standards. The quality 4" frame depth fixed window is universal to our 4" depth impact resistant operable window systems his fixed window system will easily integrate with our YVS 410 TU Single and Double Hung window system utilizing the same stacking mullions. Integral horizontal and vertical mullions provide greatly expanded configurations. Superior air and water performance enhance this factory glazed product making it an excellent substitution for smaller storefront punched openings. The YFW 400 TU is a high performance window. Additional benefit is provided by the labor savings when used as a factory glazed fixed window.

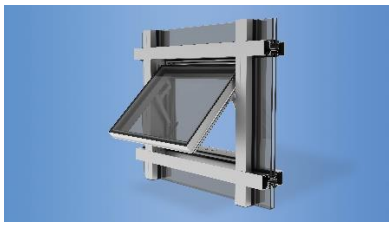
This window system not provides additional security against burglary.

### YVS 400 TU 4" Thermally Broken Hung Window for Monolithic & Insulating Glass

The YVS 400 TU Hung Window is designed to tilt in for easy cleaning of the exterior glass surfaces from the inside of the building without removing the sash. To reduce the possibility of injury while cleaning the glass surfaces, optional SafSupport tilt arms are available on each side of the sash. YKK AP's ThermaBond Plus® poured and de-bridged system provides superior thermal qualities. Optional SecurSweep sweep locks incorporate a special security latch to prevent tampering from the outside. A full assortment of receptors, sill flashing, vertical and horizontal stacking mullions, panning, trim, muntins, and screens complete the window system.

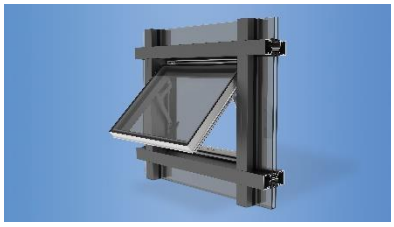
### YVS 410 TU 4" Thermally Broken Side Loading Hung Window

The YVS 410 TU Hung Window is designed to capture the side rails of the sash, providing a high level of security and dependability for both new construction and renovation projects. The use of YKK AP's ThermaBond Plus® pour and debridge system provides superior thermal qualities and a patented process to prevent dry shrinkage. A full selection of quality block and tackle, spiral, and Class 5 Ultra-Lift® balances are available. Optional SecurSweep sweep locks are available that incorporate a special security latch to prevent tampering from the outside.



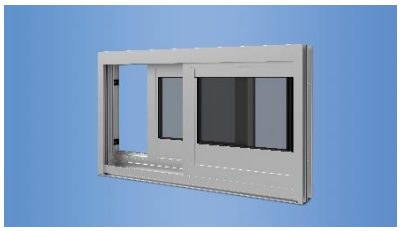
### YES SSG Vent. 2-3/4" Vent Window for Storefront, Window Wall and Curtain Wall

The YES SSG Vent enables designers to provide ventilation to architectural aluminum wall systems without adding the large. This product is an excellent choice for schools, offices and other commercial structures requiring ventilation. The vent seamlessly blends in with the surrounding framing system to become virtually invisible when viewed from a distance. Sightline of traditional windows.



### YES SSG TU Vent Thermally Broken Vent Window for Storefront, Window Wall and Curtain Wall

Provide ventilation for your storefront or curtain wall project using a product that meets the 2012 International Energy Conservation Code (IECC) through Zone 6 with standard Low E (U = 0.29 COG). In addition to exceptional thermal performance and condensation resistance in an SSG Vent product, this system also provides AW PG 65 architectural performance. The YES SSG TU Vent seamlessly blends with the surrounding framing system to become virtually invisible when viewed from a distance.

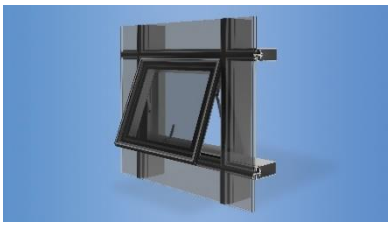


### YSW 400 T 4" Thermally Broken Sliding Window for Monolithic & Insulating Glass

YSW 400 T is an architectural grade (AW) rated sliding window that offers ease of operation. The window is thermally broken by YKK AP MegaTherm® technology to conserve energy and reduce operating costs. Standard heavy-duty hardware provides years of worry free operation.

### YPI 1500 1-1/2" Interior Access Panel Windows

YPI 1500 is an interior secondary access panel window system designed for new and retrofit installations where enhanced thermal (heat and cold), sound (acoustical), or privacy performance are critical to occupant comfort. YPI 1500 can be integrated into most new and retrofit Storefront, Window Wall and Curtain Wall systems with little disruption to building occupants. When existing windows are weather-tight, and ventilation unnecessary, YKK AP interior accessory windows will improve thermal performance, reduce sound infiltration, and add privacy and security with optional between-glass Venetian blinds.



### YOV SSG Vent Thermally Broken Vent for Storefront, Window Wall and Curtain Wall

The YOV SSG Vent enables designers to provide ventilation to architectural aluminum wall systems without adding the large sight line of traditional windows, as it seemlessly blends with the surrounding framing system to become virtually invisible when viewed from the exterior. This product is an excellent choice for schools, offices and other commercial structures requiring ventilation.

### YOW 350 TUH 3-1/2" ProTek® Thermally Broken Impact Resistant and Blast Mitigating Operable Window

YOW 350 TUH is approved for use with a variety of interlayers, including the cost effective .090" PVB for large missile. Multiple installation anchoring options are included. Vent sizes to 36" x 60" and 60" x 36" are available as singles, twins or in larger configurations with fixed windows. Vent windows are engineered to design pressures of +/- 65 psf. Fixed windows reach higher design pressures and larger sizes.

### YOW 350 TU 3-1/2" Thermally Broken Operable Window

YOW 350 TU windows have been designed and engineered to provide the highest level of quality. The windows have an overall depth of 3-1/2" and are thermally broken by means of ThermaBond Plus® technology developed by YKK AP. YOW 350 TU windows may be installed as independent units or adapted to fit into most YKK AP storefront, window wall, or curtain wall systems. The vents are flush with the frame thus eliminating unsightly overlap. YOW 350 TU windows are available in a variety of configurations to accommodate project requirements.

## Product Average

This EPD covers a weighted average window product with surface finish. The results for the final product are calculated for the Dublin, GA production site in GA.

## Application

Window systems are used in buildings.

## Industry Standards

- AAMA: AAMA 1801, AAMA 910, AAMA 507, AAMA 1503, AAMA 501.5
- ASTM: ASTM E1425, ASTM E90, ASTM E413, ASTM E1332, ASTM E2235, ASTM E283, ASTM F1642, ASTM E987, ASTM F2090, ASTM F588, ASTM E2068, ASTM E330, ASTM E331, ASTM E547
- Other: NFRC 100, NFRC 102, NFRC 200, NFRC 500, NYC DOH
- ProTek® hurricane and blast mitigation products: TAS 201, TAS 202, TAS 203, ASTM E1886, ASTM E1996

YKK AP® does not test or rate the declared products for extraordinary effects, i.e., performance under unforeseeable influence of fire, water or mechanical destruction.

## Declaration of methodological framework

A “cradle-to-gate with options” analysis using life cycle assessment (LCA) techniques was conducted for this EPD. The analysis was done according to the product category rule (PCR) for Windows and Doors published by the German Institute Construction and Environment (IBU) and followed LCA principles, requirements and guidelines laid out in the ISO 14040/14044 standards.

## Delivery Status

YKK AP® windows vary in size depending on the application. This includes zero-sightline windows that may be installed in most YKK AP storefronts, window wall or curtain wall systems. Windows with the ProTek® hurricane and blast mitigating designation are designed to protect buildings from the impacts of hurricanes and man-made disasters. Commercial windows with the enerGfacade® energy saving solution designation utilize YKK AP’s MegaTherm® thermal barrier technology to deliver up to 30% greater energy efficiency than traditional thermally broken systems. YKK AP commercial windows accept a variety of glazing options, spacers and gas fills for even greater efficiency and occupant comfort.

## Properties of the product as delivered

Table 1: Technical specification

| Name | Notes* | Value | Unit |
|---|---|---|---|
| Thermal Transmittance (U-Factor) (AAMA 1503.1, AAMA 507 and NFRC 100) | 1, 2, 4 | 0.31 – 0.48 | Btu/hr•ft²•°F |
| Solar Heat-Gain Coefficient (SHGC) (NFRC 200) | 1, 2, 4 | 0.14 – 0.25 | |
| Condensation Resistance Factor (CRFf) (AAMA 1503.1) | 2, 3, 4 | 25 – 77 | |
| Water Infiltration (ASTM E331 and AAMA 501.1)** | 2 | 9 – 15 | psf |
| Air Infiltration (ASTM E283, AAMA/NAFS 101/I.S.2/A440, NFRC 400 at 1.57 psf)** | 2 | 0.20 | cfm/ft² |
| Impact Resistance (ASTM E1886/E1996, Testing Application Standard 201/202/203) | 2, 3, 4 | A, D | |
| Window Performance Class | 2 | AW | |
| Performance Grade | 2 | 40 – 100 | |

* (1) Calculated based on U (Center of Glass) = 0.20 and SHGC (COG) = 0.25 (2) Varies by product type (3) Dependent on glazing specified
(4) Based on products tested
** Predominantly describes the framing

## Material Composition: Base and ancillary materials

Windows are made primarily from Aluminum. Some other assembly components such as screws, sealing compounds are also used. Glazing is excluded from this EPD. Base and Ancillary material for weighted average product are presented for Window product family.

Table 2: Base and Ancillary material

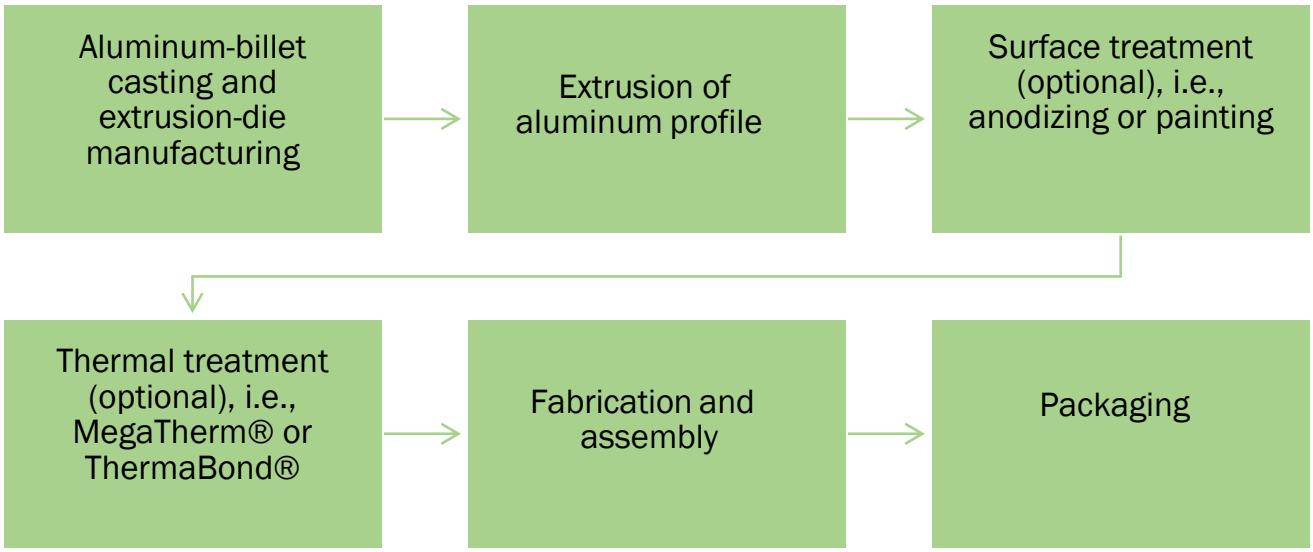
| Material | Mass [kg] | Mass [%] |
|---|---|---|
| Acrylonitrile-butadiene-styrene compound (ABS) | 4.46E-03 | 0.02 |
| Aluminium extrusion profile | 1.52E+01 | 66.76 |
| Aluminum extrusion (mill finish) | 1.45E-02 | 0.06 |
| Butane (iso-Butane) | 9.59E-03 | 0.04 |
| MegaTherm insulation material | 2.83E-01 | 1.24 |
| Nylon 6 compound | 9.52E-02 | 0.42 |
| Polyoxymethylene part (POM) | 1.20E-02 | 0.05 |
| Polypropylene part (PP) | 3.12E-02 | 0.14 |
| Polyvinylchloride part (PVC) | 6.27E-02 | 0.27 |
| PP/EPDM-part | 2.41E+00 | 10.59 |
| PVC foam | 5.75E-04 | 0.00 |
| Special high grade zinc | 4.40E-02 | 0.19 |
| Spray Foam Set | 1.87E-01 | 0.82 |
| Stainless steel cold rolled coil | 7.26E-01 | 3.18 |
| Steel part | 1.27E+00 | 5.58 |
| Styrene-butadiene-rubber (SBR) | 5.94E-02 | 0.26 |
| ThermaBond insulation material | 8.98E-02 | 0.39 |
| Tin | 2.27E+00 | 9.97 |

Note: Glazing is excluded from this study.

## Manufacturing

All YKK AP® products are manufactured, finished, and inspected for quality in our environmentally certified, state-of- the-art facility in Dublin, GA.

The manufacturing process comprises the following steps shown below:




The main material input into the YKK AP manufacturing process is aluminum ingot, which is first alloyed to the desired grade and cast into billets. Subsequently, the billets are extruded into profiles using steel dies that are manufactured on-site. The extruded profiles may then be anodized or painted. Optional thermal treatment, whereby a system is thermally broken, leads into the product's fabrication and assembly. The complete assemblies are packed for shipment.

## Packaging

Packaging data were not tracked, and was below the cut-off criteria, therefore, not included in the primary data provided by YKK. The life cycle impact of the overall product would likely be dominated by metals.

## Transportation

Transportation to the customer or construction site is outside the scope of this EPD.

## Product Processing/Installation

Outside of the scope of this EPD (installation stage excluded).

## Use

Outside of the scope of this EPD.

## Reference Service Life, Condition of Use

Outside of the scope of this EPD (use stage excluded).

## Recycling and Disposal

Aluminum extrusions are a highly efficient sustainable building material. Aluminum is 100% recyclable and can be recycled repeatedly. Recycled aluminum is identical to smelted aluminum but requires only 1/20 of the energy to manufacture. In building and construction aluminum scrap has a recycling rate of 95% [AA, 2013]. The remaining 5% is sent to landfill.

Table 3 Recycling and disposal

| Name | Unit |
|---|---|
| Deconstruction | -- |
| Transportation to the disposal site | 100 km by truck |
| Waste processing | -- |
| Disposal to landfill | 5% |
| Recycling rate of the product | 95% |
| Removals of biogenic carbon | N/A |

### Environment and Health

**Product manufacturing:** Plant emissions to air/soil/water are monitored (if applicable) and comply with local laws.

**Product use:** YKK AP® products 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 of the scope of this EPD.

## Life Cycle Assessment Background Information

### Declared Unit

The declared unit for an EPD is (1.23 m x 1.48 m) 1.82 $m^2$ of windows product. Frame-percentage range is based on NRFC 100 test specimen sizes and configurations.

Table 4: Declared unit

| Name | Value | Unit |
|---|---|---|
| Declared unit | 1.82 | $m^2$ |
| Conversion factor to kg | 22.8 | $kg/m^2$ |

### System Boundaries

Per the PCR, this “cradle-to-gate with options” analysis provides information on the Product Stage of the aluminum product life cycle, comprising modules A1–A3, and on the “options” Disposal and Credits, i.e., modules C4 and D. Module C1 and C3 are assumed to be zero. End-of-life transportation (C2) is assumed to be 100 km.

| DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCT STAGE | | | CONSTRUCTION PROCESS STAGE | | USE STAGE | | | | | | | END OF LIFE STAGE | | | | BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES |
| Raw material supply | Transport | Manufacturing | Transport | Construction-installation process | Use | Maintenance | Repair | Replacement1 | Refurbishment1 | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Reuse- Recovery- 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 | X | MND | X | X |

* X = module included, MND = module not declared

Time coverage: Primary data were collected on production within calendar year 2019. Background data for upstream and downstream processes (i.e., raw materials, energy resources, transportation, and ancillary materials) were obtained from the GaBi CUP 2021.1 databases.

Technology coverage: Data were collected for the production of window products at YKK AP's manufacturing facility in the United States.

Geographical coverage: All YKK AP® products are manufactured in Dublin, Georgia, USA. As such, the geographical coverage for this study is based on United States system boundaries for all processes and products. Whenever US background data were not readily available, European data or global data were used as proxies.

## Estimates and Assumptions

All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production data on raw materials and processes. All reported material and energy flows have been accounted for.

Packaging data were not tracked therefore excluded from this EPD.

No significant assumptions have been made beyond the aforementioned.

Proxy data were applied to some materials where no matching life cycle inventories were available, as documented in the background report.

## Cut-off-Criteria

As required by EN 15804, 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.

Product packaging information and end-of-life transportation are excluded from this study.

In practice, all inputs 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. No known flows are deliberately excluded from this EPD.

## Period Under Review

Primary data were collected for window production during the years 2019 and 2020. Background data for aluminum were taken from Aluminum Association (AA) dataset, which represents aluminum production during 2016. This analysis is intended to represent window manufacturing in 2019 (AA, The Aluminum Association, 2022).

## Data Sources

The LCA model was created using the GaBi 10 software system for life cycle engineering, developed by Sphera (Sphera, 2021). Background life cycle inventory data for raw materials and processes were obtained from the GaBi 2021 database (CUP 2021.1). Primary manufacturing data were provided by YKK.

In order to model the life cycle for the production and recycling of the extruded aluminum, the GaBi Professional software system developed by Sphera was used. All relevant background data necessary for the production of extruded aluminum were taken from the GaBi 2021 databases.

Industry average Aluminum Association (AA) dataset for primary Aluminum ingot is used to represent all primary Aluminum in this study.

## Data Quality

A variety of tests and checks were performed by the LCA practitioner throughout the project to ensure high quality of the completed LCA. Checks included an extensive internal review of the project-specific LCA models developed as well as the background data used. A full data quality assessment is documented in the background report.

## Allocation

No multi-output (i.e., co-product) allocation was performed in the foreground system of this study.

Primary data were collected in 2 separate stages. Primary data for different unit processes (casting, extrusion, anodizing, painting, thermal) were provided by YKK for the entire Dublin (GA) facility aggregated for all products. At this stage, inputs and outputs were allocated based on the reference mass flow of each product. In the second set of data, product BOM (bill of materials) were provided for each product including the sales volume for the year of data collection. We calculated the weighted average from each product family based on the sales volume to represent that specific product. No allocation was performed at this stage.

Allocation of background data (energy and materials) taken from the GaBi 2021 databases is documented online at https://sphera.com/wp-content/uploads/2020/04/Modeling-Principles-GaBi-Databases-2021.pdf. Also please refer to the 2022 LCA report on semi-fabricated aluminum. for more information: https://www.aluminum.org/sites/default/files/2022-01/2022_Semi-Fab_LCA_Report.pdf

Per the PCR guidance, recycling and recycled content in the cradle-to-gate system are modeled using the cut-off rule (a.k.a, the recycled content rule). All materials that are recycled from unit processes are considered to have left the system boundary. Recycled content is modeled in the system only when the percent of recycled content was specified in the material purchase.

## Interpreting the Results in Module D

The values in Module D include a recognition of the benefits or impacts related to aluminum recycling which occur at the end of the product's service life. The results included in Module D attempt to capture future benefits and impacts but are based on a methodology that uses current industry-average data reflecting current processes.

The net scrap approach is based on the perspective that material that is recycled into secondary material at end of life is able to substitute an equivalent amount of virgin material. Hence, a 'recycling credit' is given to account for this material substitution. A schematic of the Module D calculation is presented in Figure 1.

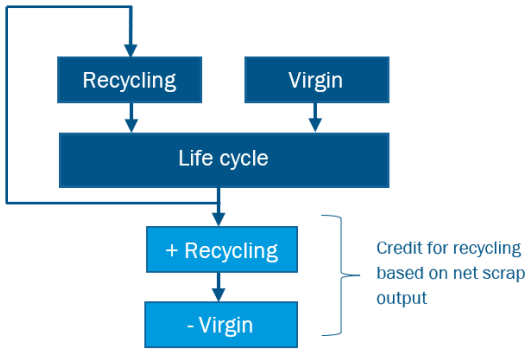



Figure 1: Schematic for the net-scrap approach (credit given at the end-of-life)

## Life Cycle Assessment Results

North American life cycle impact assessment (LCIA) results are declared using TRACI 2.1 (Bare, 2012; EPA, 2012) methodology, with the exception of GWP which is reported using the IPCC AR5 (IPCC, 2013) methodology, excluding biogenic carbon. CML -IA v4.8 results are presented as a requirement for the PCR part B. Primary energy use represents the lower heating value (LHV) a.k.a. net calorific value (NCV).

LCIA results are relative expressions and do not predict actual impacts, the exceeding of thresholds, safety margins or risks.

The result for the weighted average product is given per the declared unit of (1.23 m x 1.48 m) 1.82 $m^2$ of windows system.

**Table 5 Weighted Average of Windows per Declared Unit of 1.82 $m^2$**

| Impact Category | Unit | A1 | A2 | A3 | C2 | C4 | D |
|---|---|---|---|---|---|---|---|
| **LIFE CYCLE IMPACTS ASSESSMENT (LCIA) RESULTS** | | | | | | | |
| ***IPCC, AR5 (IPCC, 2013)*** | | | | | | | |
| Global Warming Potential | kg $CO_2$ eq. | 2.07E+02 | 1.19E+00 | 3.34E+01 | 2.18E-01 | 3.66E-01 | -1.10E+02 |
| ***CML-IA v4.8*** | | | | | | | |
| Abiotic Depletion (ADP elements) | kg Sb eq. | 1.82E-04 | 3.39E-07 | 3.15E-05 | 7.15E-08 | 1.58E-07 | -4.10E-05 |
| Abiotic Depletion (ADP fossil) | MJ | 2.14E+03 | 1.54E+01 | 4.76E+02 | 3.19E+00 | 5.48E+00 | -9.92E+02 |
| Acidification Potential (AP) | kg $SO_2$ eq. | 9.32E-01 | 1.46E-02 | 4.57E-02 | 4.84E-04 | 1.44E-03 | -5.56E-01 |
| Eutrophication Potential (EP) | kg $(PO_4)^{3-}$ eq. | 6.43E-02 | 3.13E-03 | 6.03E-03 | 1.50E-04 | 1.93E-04 | -3.33E-02 |
| Ozone Layer Depletion Potential (ODP, steady state) | kg R11 eq. | 4.32E-08 | 1.98E-16 | 1.11E-09 | 4.54E-17 | 1.22E-15 | -3.71E-14 |
| Photochem. Ozone Creation Potential (POCP) | kg $C_2H_4$ eq. | 5.13E-02 | 7.21E-04 | 3.72E-02 | -1.69E-04 | 1.37E-05 | -2.75E-02 |
| ***TRACI 2.1*** | | | | | | | |
| Acidification Potential (AP) | kg $SO_2$ eq. | 8.88E-01 | 1.88E-02 | 4.82E-02 | 6.58E-04 | 1.56E-03 | -5.17E-01 |
| Eutrophication Potential (EP) | kg N eq. | 2.38E-02 | 1.08E-03 | 4.67E-03 | 7.53E-05 | 8.68E-05 | -1.15E-02 |
| Ozone Depletion (ODP) | kg CFC 11 eq. | 4.40E-08 | 1.98E-16 | 1.11E-09 | 4.54E-17 | 1.22E-15 | -3.71E-14 |
| Resources, Fossil fuels (FF) | MJ surplus energy | 1.91E+02 | 2.05E+00 | 5.46E+01 | 4.26E-01 | 7.12E-01 | -7.33E+01 |
| Smog Formation Potential (SFP) | kg $O_3$ eq. | 8.80E+00 | 5.67E-01 | 1.42E+00 | 1.50E-02 | 2.77E-02 | -4.24E+00 |
| **RESOURCE USE INDICATORS** | | | | | | | |
| Renewable primary resources used as energy carrier (fuel) (RPRE) | MJ | 1.12E+03 | 2.37E-01 | 6.76E+01 | 1.33E-01 | 4.65E-01 | -7.16E+02 |

| Impact Category | Unit | A1 | A2 | A3 | C2 | C4 | D |
|---|---|---|---|---|---|---|---|
| Renewable primary resources with energy content used as material ($RPR_M$) | MJ | 1.86E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Non-renewable primary resources used as an energy carrier (fuel) (NRPRE) | MJ | 2.18E+03 | 1.55E+01 | 3.81E+02 | 3.22E+00 | 5.60E+00 | -1.01E+03 |
| Non-renewable primary resources with energy content used as material (NRPRM) | MJ | 1.26E+01 | 0.00E+00 | 1.08E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Renewable secondary fuels (RSF) | MJ | -- | -- | -- | 0.00E+00 | -- | -- |
| Non-renewable secondary fuels (NRSF) | MJ | -- | -- | -- | 0.00E+00 | -- | -- |
| Recovered energy (RE) | MJ | -- | -- | -- | -- | -- | -- |
| Secondary material (SM) | kg | 9.72E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Use of net fresh water resources (FW) | $m^3$ | 3.77E+00 | 8.79E-04 | 1.19E-01 | 5.66E-04 | 7.69E-04 | -2.38E+00 |
| **OUTPUT FLOWS & WASTE FLOWS** | | | | | | | |
| Hazardous waste disposed (HWD) | kg | 2.08E-04 | 9.64E-10 | 4.85E-01 | 2.69E-10 | 5.29E-10 | -6.13E-07 |
| Non-hazardous waste disposed (NHWD) | kg | 6.70E+01 | 8.50E-04 | 1.23E+00 | 2.96E-04 | 1.67E+01 | -4.34E+01 |
| High-level radioactive waste, conditioned, to final repository (HLRW) | kg | 2.29E-05 | 4.89E-08 | 5.56E-06 | 1.08E-08 | 5.40E-08 | -8.63E-06 |
| Intermediate- and low-level radioactive waste, conditioned, to final repository (ILLRW) | kg | 5.83E-04 | 1.34E-06 | 1.53E-04 | 2.98E-07 | 1.44E-06 | -2.19E-04 |
| Components for reuse (CRU) | kg | -- | -- | -- | -- | -- | -- |
| Materials for Recycling (MFR) | kg | 0.00E+00 | 0.00E+00 | 3.15E+00 | 0.00E+00 | 0.00E+00 | 1.45E+01 |
| Materials for Energy Recovery (MER) | kg | -- | -- | -- | | -- | -- |
| Exported Electrical Energy (EEE) | kg | -- | -- | -- | | -- | -- |
| Exported Thermal Energy (EET) | kg | -- | -- | -- | | -- | -- |

**Comparability:** Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate and could lead to erroneous selection of materials or products which are higher impact, at least in some impact categories.

When comparing EPDs created using this PCR, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to different results for upstream or downstream of the life cycle stages declared.

**Additional Results:** Results from the other products in the windows family are presented in the Annex. The results are described separately since their coefficients of variation between results are beyond ±20%.

### Visualization of Life Cycle Impact Assessment

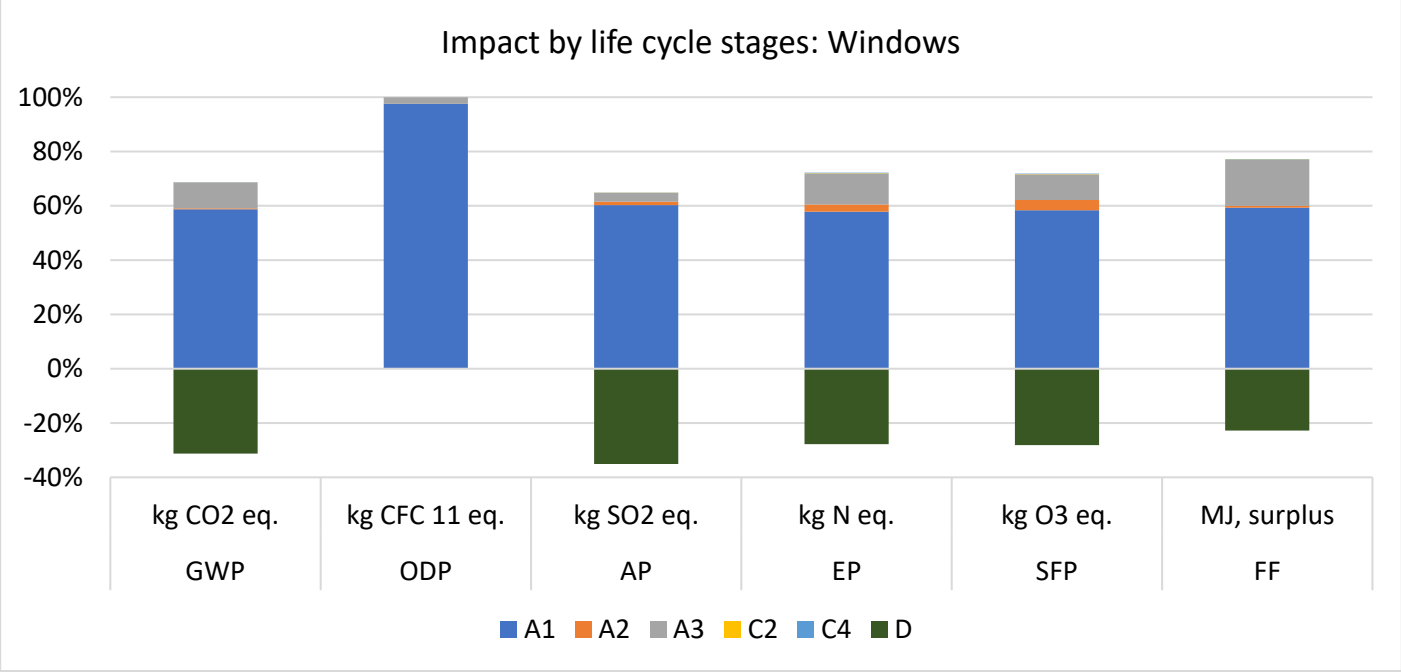



Figure 2 : Windows impact results per module

## Interpretation

The results represent the cradle-to-gate and disposal environmental performance of the evaluated window system. As shown in the figure to the right, the results indicate that the impacts are drivenby the product stage (modules A1- A3). The primary impact is derived from upstream aluminum production in module A1 (raw material supply). The YKK AP manufacturing processes account for a relatively small part of the manufacturing impact in comparison.

As module D (material credit at theend of life) clearly impacts the results, it is important to note that the applied recycling rate of 95% represents a defensible rate for aluminum extrusion products in the building and transportation sector. This is based on a conservative calculation for global aluminum recycling from these sectors. If ahigher rate is used, the credit will increase, thus lowering the net life-cycle impacts. Similarly, a lower recycling rate would raise the net life cycle impacts. As new information becomes available (e.g., the Aluminum Association publishes regional-specific recycling

rates), this EPD should be modified to reflect the most current industry conditions.

## Additional Environmental Information

### Environment and Health During Manufacturing

Environmental, occupational health and safety practices are in accordance with OSHA and individual state requirements. The process and the products do not contain any materials or substances for which there exists a route to exposure that leads to humans or flora/fauna in the environment being exposed to said materials or substances at levels exceeding safe health thresholds.

### Further Information

Further information can be found at https://www.ykkap.com/residential/company/ykk-ap-america-inc/

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## Contact Information

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www.sphera.com

## Appendix

Table 6 Results for Windows YFW 400TU per Declared Unit of 1.82 m²

| | Windows YFW 400TU | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq.] | 1.03E+02 | 6.72E-01 | 1.90E+01 | 9.08E-02 | 5.58E-02 | -6.25E+01 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 4.55E-05 | 1.92E-07 | 1.79E-05 | 2.98E-08 | 2.41E-08 | -2.32E-05 |
| ADPf [MJ] | 1.02E+03 | 8.68E+00 | 2.70E+02 | 1.33E+00 | 8.35E-01 | -5.62E+02 |
| AP [kg SO2 eq.] | 4.90E-01 | 8.32E-03 | 2.59E-02 | 2.02E-04 | 2.19E-04 | -3.15E-01 |
| EP [kg Phosphate eq.] | 3.02E-02 | 1.78E-03 | 3.42E-03 | 6.26E-05 | 2.94E-05 | -1.89E-02 |
| ODP [kg R11 eq.] | 1.15E-08 | 1.12E-16 | 6.33E-10 | 1.89E-17 | 1.86E-16 | -2.10E-14 |
| POCP [kg Ethene eq.] | 2.50E-02 | 4.16E-04 | 2.12E-02 | -7.03E-05 | 2.08E-06 | -1.56E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 4.58E-01 | 1.07E-02 | 2.73E-02 | 2.74E-04 | 2.38E-04 | -2.93E-01 |
| EP [kg N eq.] | 1.07E-02 | 6.13E-04 | 2.65E-03 | 3.14E-05 | 1.32E-05 | -6.49E-03 |
| ODP [kg CFC 11 eq.] | 1.22E-08 | 1.12E-16 | 6.34E-10 | 1.89E-17 | 1.86E-16 | -2.10E-14 |
| FF [MJ surplus energy] | 8.63E+01 | 1.16E+00 | 3.10E+01 | 1.77E-01 | 1.09E-01 | -4.15E+01 |
| SFP [kg O3 eq.] | 3.90E+00 | 3.23E-01 | 8.05E-01 | 6.25E-03 | 4.22E-03 | -2.40E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 6.20E+02 | 1.32E-01 | 3.82E+01 | 5.52E-02 | 7.09E-02 | -4.06E+02 |
| RPRM [MJ] | 1.91E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 1.04E+03 | 8.74E+00 | 2.43E+02 | 1.34E+00 | 8.54E-01 | -5.72E+02 |
| NRPRM [MJ] | 4.48E+00 | 0.00E+00 | 3.37E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 1.27E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 5.53E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 2.05E+00 | 4.90E-04 | 6.73E-02 | 2.36E-04 | 1.17E-04 | -1.35E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 9.27E-06 | 5.44E-10 | 2.76E-01 | 1.12E-10 | 8.07E-11 | -3.47E-07 |
| NHWD [kg] | 3.72E+01 | 4.78E-04 | 6.99E-01 | 1.23E-04 | 2.54E+00 | -2.46E+01 |
| HLRW [kg] | 1.03E-05 | 2.76E-08 | 3.15E-06 | 4.51E-09 | 8.23E-09 | -4.89E-06 |
| ILRW [kg] | 2.62E-04 | 7.58E-07 | 8.64E-05 | 1.24E-07 | 2.19E-07 | -1.24E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 1.77E+00 | 0.00E+00 | 0.00E+00 | 8.23E+00 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |

Table 7 Results for Windows YOW 350XT per Declared Unit of 1.82 m²

| | Windows YOW 350XT | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq. | 4.25E+02 | 2.51E+00 | 7.20E+01 | 4.15E-01 | 5.51E-01 | -2.34E+02 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 9.29E-04 | 7.16E-07 | 6.72E-05 | 1.36E-07 | 2.38E-07 | -8.71E-05 |
| ADPf [MJ] | 4.45E+03 | 3.25E+01 | 1.02E+03 | 6.08E+00 | 8.25E+00 | -2.11E+03 |
| AP [kg SO2 eq.] | 1.93E+00 | 3.11E-02 | 9.87E-02 | 9.22E-04 | 2.16E-03 | -1.18E+00 |
| EP [kg Phosphate eq.] | 1.29E-01 | 6.65E-03 | 1.30E-02 | 2.86E-04 | 2.90E-04 | -7.08E-02 |
| ODP [kg R11 eq.] | 7.22E-07 | 4.18E-16 | 2.37E-09 | 8.64E-17 | 1.84E-15 | -7.88E-14 |
| POCP [kg Ethene eq.] | 1.04E-01 | 1.55E-03 | 7.93E-02 | -3.21E-04 | 2.06E-05 | -5.85E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 1.82E+00 | 3.99E-02 | 1.04E-01 | 1.25E-03 | 2.35E-03 | -1.10E+00 |
| EP [kg N eq.] | 4.71E-02 | 2.29E-03 | 1.00E-02 | 1.43E-04 | 1.31E-04 | -2.43E-02 |
| ODP [kg CFC 11 eq.] | 7.24E-07 | 4.18E-16 | 2.37E-09 | 8.64E-17 | 1.84E-15 | -7.88E-14 |
| FF [MJ surplus energy] | 4.01E+02 | 4.33E+00 | 1.17E+02 | 8.11E-01 | 1.07E+00 | -1.56E+02 |
| SFP [kg O3 eq.] | 1.68E+01 | 1.21E+00 | 3.04E+00 | 2.85E-02 | 4.17E-02 | -9.02E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 2.36E+03 | 4.95E-01 | 1.47E+02 | 2.52E-01 | 7.00E-01 | -1.52E+03 |
| RPRM [MJ] | 3.06E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 4.47E+03 | 3.27E+01 | 8.76E+02 | 6.12E+00 | 8.42E+00 | -2.15E+03 |
| NRPRM [MJ] | 7.75E+01 | 0.00E+00 | 1.73E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 2.03E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 2.07E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 8.36E+00 | 1.83E-03 | 2.56E-01 | 1.08E-03 | 1.16E-03 | -5.05E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 3.18E-04 | 2.03E-09 | 1.03E+00 | 5.12E-10 | 7.96E-10 | -1.30E-06 |
| NHWD [kg] | 1.40E+02 | 1.79E-03 | 2.62E+00 | 5.63E-04 | 2.51E+01 | -9.21E+01 |
| HLRW [kg] | 4.94E-05 | 1.03E-07 | 1.21E-05 | 2.06E-08 | 8.12E-08 | -1.84E-05 |
| ILRW [kg] | 1.26E-03 | 2.83E-06 | 3.31E-04 | 5.67E-07 | 2.16E-06 | -4.64E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 6.60E+00 | 0.00E+00 | 0.00E+00 | 3.09E+01 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |

Table 8 Results for Windows YES SSG TU VENT per Declared Unit of 1.82 m²

| | Windows YES SSG TU VENT | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq. | 1.62E+02 | 8.99E-01 | 2.54E+01 | 1.72E-01 | 3.10E-01 | -8.32E+01 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 1.40E-04 | 2.57E-07 | 2.20E-05 | 5.64E-08 | 1.34E-07 | -3.09E-05 |
| ADPf [MJ] | 1.58E+03 | 1.16E+01 | 3.66E+02 | 2.52E+00 | 4.64E+00 | -7.48E+02 |
| AP [kg SO2 eq.] | 7.33E-01 | 1.11E-02 | 3.26E-02 | 3.82E-04 | 1.21E-03 | -4.19E-01 |
| EP [kg Phosphate eq.] | 5.25E-02 | 2.37E-03 | 4.26E-03 | 1.19E-04 | 1.63E-04 | -2.51E-02 |
| ODP [kg R11 eq.] | 6.85E-09 | 1.50E-16 | 8.42E-10 | 3.58E-17 | 1.03E-15 | -2.80E-14 |
| POCP [kg Ethene eq.] | 4.11E-02 | 5.47E-04 | 3.30E-02 | -1.33E-04 | 1.16E-05 | -2.08E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 7.04E-01 | 1.42E-02 | 3.46E-02 | 5.19E-04 | 1.32E-03 | -3.89E-01 |
| EP [kg N eq.] | 1.94E-02 | 8.19E-04 | 3.07E-03 | 5.94E-05 | 7.35E-05 | -8.63E-03 |
| ODP [kg CFC 11 eq.] | 7.30E-09 | 1.50E-16 | 8.44E-10 | 3.58E-17 | 1.03E-15 | -2.80E-14 |
| FF [MJ surplus energy] | 1.34E+02 | 1.55E+00 | 4.31E+01 | 3.36E-01 | 6.03E-01 | -5.53E+01 |
| SFP [kg O3 eq.] | 7.47E+00 | 4.30E-01 | 1.15E+00 | 1.18E-02 | 2.34E-02 | -3.20E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 8.48E+02 | 1.79E-01 | 4.70E+01 | 1.05E-01 | 3.94E-01 | -5.40E+02 |
| RPRM [MJ] | 1.14E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 1.61E+03 | 1.17E+01 | 3.40E+02 | 2.54E+00 | 4.74E+00 | -7.61E+02 |
| NRPRM [MJ] | 2.67E+00 | 0.00E+00 | 3.51E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 7.56E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 7.37E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 2.88E+00 | 6.65E-04 | 8.32E-02 | 4.47E-04 | 6.51E-04 | -1.79E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 2.37E-04 | 7.30E-10 | 3.93E-01 | 2.12E-10 | 4.48E-10 | -4.62E-07 |
| NHWD [kg] | 5.17E+01 | 6.43E-04 | 8.74E-01 | 2.33E-04 | 1.41E+01 | -3.27E+01 |
| HLRW [kg] | 1.59E-05 | 3.70E-08 | 3.90E-06 | 8.55E-09 | 4.57E-08 | -6.51E-06 |
| ILRW [kg] | 4.00E-04 | 1.02E-06 | 1.07E-04 | 2.35E-07 | 1.22E-06 | -1.65E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 1.78E+00 | 0.00E+00 | 0.00E+00 | 1.10E+01 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |

Table 9 Results for Windows YOW 225TU per Declared Unit of 1.82 m²

| | Windows YOW 225TU | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq. | 1.73E+02 | 8.45E-01 | 2.38E+01 | 2.16E-01 | 4.41E-01 | -9.65E+01 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 2.31E-04 | 2.41E-07 | 2.07E-05 | 7.08E-08 | 1.90E-07 | -3.58E-05 |
| ADPf [MJ] | 1.98E+03 | 1.09E+01 | 3.44E+02 | 3.16E+00 | 6.60E+00 | -8.68E+02 |
| AP [kg SO2 eq.] | 7.20E-01 | 1.04E-02 | 3.07E-02 | 4.80E-04 | 1.73E-03 | -4.87E-01 |
| EP [kg Phosphate eq.] | 5.92E-02 | 2.23E-03 | 4.00E-03 | 1.49E-04 | 2.32E-04 | -2.92E-02 |
| ODP [kg R11 eq.] | 9.36E-09 | 1.41E-16 | 7.92E-10 | 4.50E-17 | 1.47E-15 | -3.24E-14 |
| POCP [kg Ethene eq.] | 4.25E-02 | 5.14E-04 | 3.10E-02 | -1.67E-04 | 1.65E-05 | -2.41E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 7.09E-01 | 1.34E-02 | 3.25E-02 | 6.52E-04 | 1.88E-03 | -4.52E-01 |
| EP [kg N eq.] | 3.36E-02 | 7.69E-04 | 2.89E-03 | 7.46E-05 | 1.05E-04 | -1.00E-02 |
| ODP [kg CFC 11 eq.] | 9.97E-09 | 1.41E-16 | 7.93E-10 | 4.50E-17 | 1.47E-15 | -3.24E-14 |
| FF [MJ surplus energy] | 1.93E+02 | 1.46E+00 | 4.05E+01 | 4.22E-01 | 8.58E-01 | -6.41E+01 |
| SFP [kg O3 eq.] | 7.51E+00 | 4.04E-01 | 1.08E+00 | 1.49E-02 | 3.34E-02 | -3.71E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 9.05E+02 | 1.68E-01 | 4.42E+01 | 1.31E-01 | 5.61E-01 | -6.27E+02 |
| RPRM [MJ] | 1.55E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 2.04E+03 | 1.10E+01 | 1.74E+02 | 3.19E+00 | 6.75E+00 | -8.83E+02 |
| NRPRM [MJ] | 3.65E+00 | 0.00E+00 | 1.79E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 1.03E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 6.92E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 3.10E+00 | 6.24E-04 | 7.82E-02 | 5.61E-04 | 9.27E-04 | -2.08E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 1.14E-04 | 6.86E-10 | 3.70E-01 | 2.66E-10 | 6.38E-10 | -5.36E-07 |
| NHWD [kg] | 5.07E+01 | 6.04E-04 | 8.21E-01 | 2.93E-04 | 2.01E+01 | -3.79E+01 |
| HLRW [kg] | 2.53E-05 | 3.48E-08 | 3.66E-06 | 1.07E-08 | 6.50E-08 | -7.55E-06 |
| ILRW [kg] | 6.85E-04 | 9.54E-07 | 1.01E-04 | 2.95E-07 | 1.73E-06 | -1.91E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 1.67E+00 | 0.00E+00 | 0.00E+00 | 1.26E+01 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |

Table 10 Results for Windows YOW 350T per Declared Unit of 1.82 m²

| | Windows YOW 350T | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq. | 2.59E+02 | 1.32E+00 | 3.76E+01 | 2.90E-01 | 3.89E-01 | -1.65E+02 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 3.91E-04 | 3.78E-07 | 3.24E-05 | 9.50E-08 | 1.68E-07 | -6.14E-05 |
| ADPf [MJ] | 2.83E+03 | 1.71E+01 | 5.43E+02 | 4.24E+00 | 5.83E+00 | -1.49E+03 |
| AP [kg SO2 eq.] | 1.10E+00 | 1.63E-02 | 4.86E-02 | 6.44E-04 | 1.53E-03 | -8.33E-01 |
| EP [kg Phosphate eq.] | 9.01E-02 | 3.49E-03 | 6.33E-03 | 2.00E-04 | 2.05E-04 | -4.99E-02 |
| ODP [kg R11 eq.] | 6.65E-09 | 2.20E-16 | 1.24E-09 | 6.03E-17 | 1.30E-15 | -5.56E-14 |
| POCP [kg Ethene eq.] | 6.37E-02 | 8.05E-04 | 4.87E-02 | -2.24E-04 | 1.45E-05 | -4.12E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 1.08E+00 | 2.09E-02 | 5.14E-02 | 8.74E-04 | 1.66E-03 | -7.74E-01 |
| EP [kg N eq.] | 5.36E-02 | 1.20E-03 | 4.57E-03 | 1.00E-04 | 9.24E-05 | -1.72E-02 |
| ODP [kg CFC 11 eq.] | 7.08E-09 | 2.20E-16 | 1.24E-09 | 6.03E-17 | 1.30E-15 | -5.56E-14 |
| FF [MJ surplus energy] | 2.70E+02 | 2.28E+00 | 6.38E+01 | 5.66E-01 | 7.58E-01 | -1.10E+02 |
| SFP [kg O3 eq.] | 1.09E+01 | 6.33E-01 | 1.70E+00 | 1.99E-02 | 2.95E-02 | -6.36E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 1.40E+03 | 2.64E-01 | 7.04E+01 | 1.76E-01 | 4.95E-01 | -1.07E+03 |
| RPRM [MJ] | 1.10E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 2.89E+03 | 1.72E+01 | 4.15E+02 | 4.27E+00 | 5.95E+00 | -1.51E+03 |
| NRPRM [MJ] | 2.24E+01 | 0.00E+00 | 1.41E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 7.32E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 1.08E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 4.88E+00 | 9.78E-04 | 1.24E-01 | 7.52E-04 | 8.18E-04 | -3.56E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 1.18E-04 | 1.07E-09 | 5.79E-01 | 3.57E-10 | 5.63E-10 | -9.18E-07 |
| NHWD [kg] | 7.90E+01 | 9.47E-04 | 1.29E+00 | 3.93E-04 | 1.77E+01 | -6.50E+01 |
| HLRW [kg] | 3.57E-05 | 5.45E-08 | 5.82E-06 | 1.44E-08 | 5.74E-08 | -1.29E-05 |
| ILRW [kg] | 9.85E-04 | 1.49E-06 | 1.60E-04 | 3.96E-07 | 1.53E-06 | -3.27E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 2.62E+00 | 0.00E+00 | 0.00E+00 | 2.15E+01 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |

Table 11 Results for Windows YVS 410TU per Declared Unit of 1.82 m²

| | Windows YVS 410TU | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq. | 2.75E+02 | 1.31E+00 | 3.59E+01 | 3.59E-01 | 6.03E-01 | -1.87E+02 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 6.13E-04 | 3.76E-07 | 3.10E-05 | 1.18E-07 | 2.60E-07 | -6.94E-05 |
| ADPf [MJ] | 3.37E+03 | 1.70E+01 | 5.20E+02 | 5.25E+00 | 9.02E+00 | -1.68E+03 |
| AP [kg SO2 eq.] | 1.11E+00 | 1.58E-02 | 4.63E-02 | 7.97E-04 | 2.36E-03 | -9.42E-01 |
| EP [kg Phosphate eq.] | 9.68E-02 | 3.39E-03 | 6.04E-03 | 2.47E-04 | 3.17E-04 | -5.65E-02 |
| ODP [kg R11 eq.] | 2.70E-08 | 2.20E-16 | 1.19E-09 | 7.46E-17 | 2.01E-15 | -6.28E-14 |
| POCP [kg Ethene eq.] | 6.67E-02 | 7.12E-04 | 4.66E-02 | -2.77E-04 | 2.25E-05 | -4.66E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 1.11E+00 | 2.03E-02 | 4.90E-02 | 1.08E-03 | 2.57E-03 | -8.75E-01 |
| EP [kg N eq.] | 7.23E-02 | 1.17E-03 | 4.36E-03 | 1.24E-04 | 1.43E-04 | -1.94E-02 |
| ODP [kg CFC 11 eq.] | 2.87E-08 | 2.20E-16 | 1.19E-09 | 7.46E-17 | 2.01E-15 | -6.28E-14 |
| FF [MJ surplus energy] | 3.42E+02 | 2.27E+00 | 6.12E+01 | 7.01E-01 | 1.17E+00 | -1.24E+02 |
| SFP [kg O3 eq.] | 1.05E+01 | 6.11E-01 | 1.63E+00 | 2.47E-02 | 4.56E-02 | -7.19E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 1.50E+03 | 2.79E-01 | 6.68E+01 | 2.18E-01 | 7.66E-01 | -1.21E+03 |
| RPRM [MJ] | 3.39E-02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 3.47E+03 | 1.71E+01 | 2.12E+02 | 5.29E+00 | 9.22E+00 | -1.71E+03 |
| NRPRM [MJ] | 1.71E+01 | 0.00E+00 | 3.20E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 2.26E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 1.04E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 5.40E+00 | 1.05E-03 | 1.18E-01 | 9.31E-04 | 1.27E-03 | -4.03E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 3.45E-04 | 1.08E-09 | 5.55E-01 | 4.42E-10 | 8.71E-10 | -1.04E-06 |
| NHWD [kg] | 7.83E+01 | 9.65E-04 | 1.25E+00 | 4.86E-04 | 2.74E+01 | -7.34E+01 |
| HLRW [kg] | 5.16E-05 | 5.43E-08 | 5.53E-06 | 1.78E-08 | 8.89E-08 | -1.46E-05 |
| ILRW [kg] | 1.44E-03 | 1.49E-06 | 1.52E-04 | 4.90E-07 | 2.36E-06 | -3.70E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 2.84E+00 | 0.00E+00 | 0.00E+00 | 2.38E+01 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |

Table 12 Results for Windows YES SSG TU H VENT

| | Windows YES SSG TU H VENT | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq. | 1.11E+02 | 3.38E-01 | 9.52E+00 | 1.71E-01 | 3.01E-01 | -8.72E+01 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 4.08E-04 | 9.63E-08 | 8.26E-06 | 5.61E-08 | 1.30E-07 | -3.24E-05 |
| ADPf [MJ] | 1.43E+03 | 4.37E+00 | 1.38E+02 | 2.51E+00 | 4.50E+00 | -7.84E+02 |
| AP [kg SO2 eq.] | 3.88E-01 | 4.17E-03 | 1.23E-02 | 3.80E-04 | 1.18E-03 | -4.40E-01 |
| EP [kg Phosphate eq.] | 4.89E-02 | 8.91E-04 | 1.60E-03 | 1.18E-04 | 1.58E-04 | -2.63E-02 |
| ODP [kg R11 eq.] | 2.59E-09 | 5.62E-17 | 3.16E-10 | 3.56E-17 | 1.00E-15 | -2.93E-14 |
| POCP [kg Ethene eq.] | 2.72E-02 | 2.05E-04 | 1.24E-02 | -1.32E-04 | 1.12E-05 | -2.18E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 4.23E-01 | 5.34E-03 | 1.30E-02 | 5.16E-04 | 1.28E-03 | -4.08E-01 |
| EP [kg N eq.] | 4.91E-02 | 3.07E-04 | 1.15E-03 | 5.91E-05 | 7.13E-05 | -9.05E-03 |
| ODP [kg CFC 11 eq.] | 2.76E-09 | 5.62E-17 | 3.17E-10 | 3.56E-17 | 1.00E-15 | -2.93E-14 |
| FF [MJ surplus energy] | 1.55E+02 | 5.83E-01 | 1.62E+01 | 3.34E-01 | 5.85E-01 | -5.79E+01 |
| SFP [kg O3 eq.] | 4.79E+00 | 1.61E-01 | 4.32E-01 | 1.18E-02 | 2.27E-02 | -3.35E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 5.69E+02 | 6.72E-02 | 1.77E+01 | 1.04E-01 | 3.82E-01 | -5.66E+02 |
| RPRM [MJ] | 4.27E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 1.50E+03 | 4.40E+00 | 1.69E+01 | 2.52E+00 | 4.60E+00 | -7.98E+02 |
| NRPRM [MJ] | 1.00E+00 | 0.00E+00 | 1.24E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 2.84E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 2.77E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 5.40E+00 | 1.05E-03 | 1.18E-01 | 9.31E-04 | 1.27E-03 | -4.03E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 7.30E-05 | 2.74E-10 | 1.48E-01 | 2.11E-10 | 4.34E-10 | -4.84E-07 |
| NHWD [kg] | 2.62E+01 | 2.41E-04 | 3.28E-01 | 2.32E-04 | 1.37E+01 | -3.43E+01 |
| HLRW [kg] | 2.56E-05 | 1.39E-08 | 1.46E-06 | 8.51E-09 | 4.43E-08 | -6.83E-06 |
| ILRW [kg] | 7.60E-04 | 3.81E-07 | 4.02E-05 | 2.34E-07 | 1.18E-06 | -1.73E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 6.69E-01 | 0.00E+00 | 0.00E+00 | 1.11E+01 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |

Table 13 Results for Windows YVS 400TU

| | Windows YVS 400TU | | | | | |
|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | C2 | C4 | D |
| IPCC GWP [kg CO2 eq. | 1.72E+02 | 5.96E-01 | 1.62E+01 | 2.70E-01 | 5.53E-01 | -1.24E+02 |
| **CML-IA v4.8** | | | | | | |
| ADPe [MJ] | 6.11E-04 | 1.71E-07 | 1.40E-05 | 8.84E-08 | 2.39E-07 | -4.61E-05 |
| ADPf [MJ] | 2.39E+03 | 7.75E+00 | 2.35E+02 | 3.95E+00 | 8.27E+00 | -1.12E+03 |
| AP [kg SO2 eq.] | 6.08E-01 | 7.15E-03 | 2.09E-02 | 5.99E-04 | 2.17E-03 | -6.25E-01 |
| EP [kg Phosphate eq.] | 7.01E-02 | 1.54E-03 | 2.73E-03 | 1.86E-04 | 2.91E-04 | -3.75E-02 |
| ODP [kg R11 eq.] | 8.98E-09 | 1.00E-16 | 5.36E-10 | 5.61E-17 | 1.85E-15 | -4.17E-14 |
| POCP [kg Ethene eq.] | 4.13E-02 | 3.15E-04 | 2.10E-02 | -2.09E-04 | 2.06E-05 | -3.09E-02 |
| **TRACI 2.1** | | | | | | |
| AP [kg SO2 eq.] | 6.47E-01 | 9.17E-03 | 2.22E-02 | 8.13E-04 | 2.35E-03 | -5.81E-01 |
| EP [kg N eq.] | 6.96E-02 | 5.32E-04 | 1.97E-03 | 9.31E-05 | 1.31E-04 | -1.29E-02 |
| ODP [kg CFC 11 eq.] | 9.55E-09 | 1.00E-16 | 5.37E-10 | 5.61E-17 | 1.85E-15 | -4.17E-14 |
| FF [MJ surplus energy] | 2.64E+02 | 1.04E+00 | 2.76E+01 | 5.27E-01 | 1.08E+00 | -8.24E+01 |
| SFP [kg O3 eq.] | 6.65E+00 | 2.76E-01 | 7.34E-01 | 1.85E-02 | 4.18E-02 | -4.77E+00 |
| **LCI Indicators** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| RPRE [MJ] | 9.11E+02 | 1.29E-01 | 3.02E+01 | 1.64E-01 | 7.02E-01 | -8.05E+02 |
| RPRM [MJ] | 8.79E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRPRE [MJ] | 2.49E+03 | 7.81E+00 | -5.33E+01 | 3.98E+00 | 8.45E+00 | -1.14E+03 |
| NRPRM [MJ] | 7.17E+00 | 0.00E+00 | 2.94E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF [MJ] | 5.84E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF [MJ] | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RE [MJ] | -- | -- | -- | -- | -- | -- |
| SM [kg] | 4.69E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW [m3] | 3.47E+00 | 4.86E-04 | 5.33E-02 | 7.00E-04 | 1.16E-03 | -2.67E+00 |
| **Output and waste flow** | **A1** | **A2** | **A3** | **C2** | **C4** | **D** |
| HWD [kg] | 2.28E-04 | 4.94E-10 | 2.50E-01 | 3.32E-10 | 7.99E-10 | -6.89E-07 |
| NHWD [kg] | 4.12E+01 | 4.42E-04 | 5.64E-01 | 3.66E-04 | 2.51E+01 | -4.87E+01 |
| HLRW [kg] | 4.34E-05 | 2.48E-08 | 2.50E-06 | 1.34E-08 | 8.15E-08 | -9.71E-06 |
| ILRW [kg] | 1.26E-03 | 6.79E-07 | 6.87E-05 | 3.69E-07 | 2.17E-06 | -2.46E-04 |
| CRU [kg] | -- | -- | -- | -- | -- | -- |
| MFR [kg] | 0.00E+00 | 0.00E+00 | 1.32E+00 | 0.00E+00 | 0.00E+00 | 1.56E+01 |
| MER [kg] | -- | -- | -- | -- | -- | -- |
| EEE [MJ] | -- | -- | -- | -- | -- | -- |
| EET [MJ] | -- | -- | -- | -- | -- | -- |