ENVIRONMENTAL PRODUCT DECLARATION

700 SERIES FIBERGLAS™ INSULATION

UNFACED AND FACED

700 Series FIBERGLAS™ Insulation Faced with ASJ Max Facing

Owens Corning, and its family of companies, is a leading global producer of residential and commercial building materials, glass fiber reinforcements, and engineered materials for composite systems. Founded in 1938, Owens Corning has earned its reputation as a market leading innovator of FIBERGLAS™ technology by consistently providing new solutions that deliver a strong combination of quality and value to its customers across the world.

Building Materials products – primarily roofing and insulation – are focused on making new and existing homes and buildings energy efficient, comfortable, and attractive. Owens Corning is committed to balancing economic growth with social progress and sustainable solutions to its building materials and composites customers around the world.

This Environmental Product Declaration is a component of our stated goal to provide life cycle information on all core products.

www.owenscorning.com

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

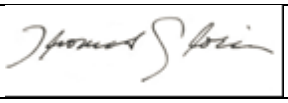
ENVIRONMENTAL PRODUCT DECLARATION

700 Series FIBERGLAS™ Insulation

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. 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	Owens Corning
DECLARATION NUMBER	4786077032.107.1
DECLARED PRODUCT	Owens Corning® 700 Series FIBERGLAS™ Insulation Manufactured by Owens Corning in the United States
REFERENCE PCR	PCR Building Envelope Thermal Insulation v1.3 (June 1, 2014)
DATE OF ISSUE	August 21, 2015
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics 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:	UL Environment
	PCR was approved by an expert panel
	333 Pfingsten Road Northbrook, IL 60611
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	
	Wade Stout
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	
	Thomas Gloria, Industrial Ecology Consultants

ENVIRONMENTAL PRODUCT DECLARATION

700 Series FIBERGLAS™ Insulation

According to ISO 14025

Product Definition and Information

Product Description

700 Series FIBERGLAS™ Insulations are flexible, semi-rigid or rigid rectangular boards used for a variety of thermal and acoustical insulating projects. They are made of inorganic glass fibers with a thermosetting binder and are available in a variety of thicknesses, densities and facing options. 700 Series FIBERGLAS™ Insulations save energy and reduce heat transfer, lowering heating and cooling costs. They also efficiently reduce sound transmission.

Manufacturing Locations

This Environmental Product Declaration (EPD) represents the production of 700 Series FIBERGLAS™ Insulation manufactured at the Owens Corning Newark Insulation Plant located at 400 Case Ave, Newark, OH 43055.

Application and Uses

Type 701 – Lightweight, resilient, flexible insulation in batt or blanket form, used on mechanical equipment with irregular surfaces where compressive strength is not a performance issue and where an exterior finish will be supported mechanically.

Type 703 – Semi-rigid boards for use on mechanical equipment, storage tanks and air conditioning ductwork.

Type 705 – A high-strength, rigid board for use on chillers, hot and cold equipment, and heating and air conditioning ductwork where high abuse resistance and good appearance are required.

Type 706 & 707 – Insulation for use in acoustical wall panels and specialized ceiling applications.

Types 703 and 705 are available with factory-applied FRK (foil reinforced kraft), ASJ (All-Service Jacket), or ASJ Max facings. Both facings are vapor retarders and provide finished appearance in mechanical applications. ASJ Max is replacing ASJ in calendar year 2015.

Installation

700 Series FIBERGLAS™ Insulation is made for easy handling and installation. As a semi-rigid product that is easy to cut and install, its flexibility allows it to conform to building shapes and construction irregularities.

Types 703 and 705 are board insulations usually impaled over weld pins on flat surfaces. They are cut in segments and banded in place on irregular surfaces.

Find detailed installation instructions at www.owenscorningcommercial.com

Production

Material Content

700 Series FIBERGLAS™ Insulation consists of two major components, the glass fiber, and the binder system. The glass fiber is made from various inorganic minerals, which are referred to as batch chemicals. The binder system consists of non-renewable organic materials.

Table 1: Material Content for 700 Series FIBERGLAS™ Insulation

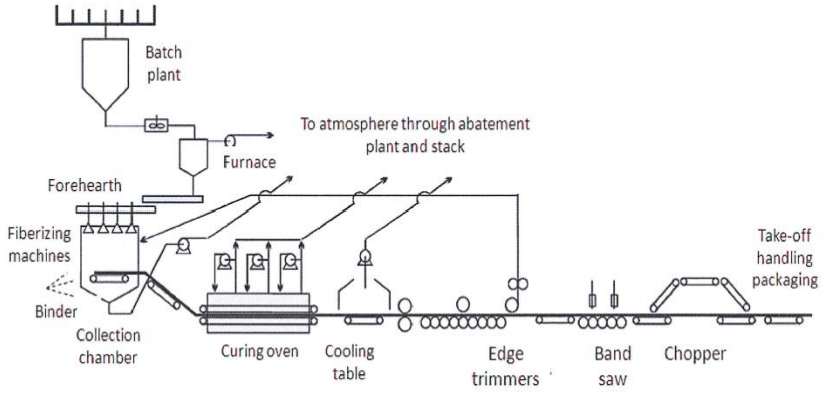
Material	Function	Quantity (mass%	Non-Renewable	Renewable	Recycle Material	Origin	Transportation Mode	Transportation (Miles)
Cullet	Glass Batch	45-48%	■		■	North America	Truck	120-150
Silicates	Glass Batch	0-3%	■			North America	Truck	525-600
Sand	Glass Batch	14-17%		■		North America	Truck	20-50
Borates	Glass Batch	10-13%	■			Global	Rail	525-600
Soda Ash	Glass Batch	3-6%	■			North America	Rail	1600
Other Oxides	Glass Batch	<1%	■			North America	Truck/Rail	535-580
Phenol Urea Formaldehyde Resin	Binder	5-12%	■			North America	Truck	95-140
Dust Suppressant	Binder	<1%	■			North America	Truck	95-140
Coupling Agent	Binder	<1%	■			North America	Truck	95-140
Carboxylic Acid Additive	Binder	<1%	■			North America	Truck	95-140

Table 2: Material Content for Facing Options

Material	Function	%Quantity (Mass/m^2)	Non-Renewable	Renewable	Recycle Material	Origin	Transportation Mode	Transportation (miles)
FRK Facing								
Aluminum Foil	Exterior layer	15-18%		■	■	North America	Truck	400-600
Elastomeric Polymer	Barrier coating	11-14%	■			North America	Truck	400-600
Fiberglass Mat	Reinforcement	17-20%	■			North America	Truck	400-600
Emulsion	Adhesive	11-14%	■			North America	Truck	400-600
Natural Kraft	Interior layer	46-49%	■			North America	Truck	400-600
ASJ Max Facing								
Polymer Film	Exterior layer	25-28%	■			North America	Truck	400-600
Proprietary	Core	37-40%	■			North America	Truck	400-600
Fiberglass Mat	Reinforcement	22-25%	■			North America	Truck	400-600
Aluminum Foil	Interior layer	10-13%		■	■	North America	Truck	400-600
ASJ Facing								
High Intensity White Kraft	Exterior layer	51-54%	■			North America	Truck	400-600
Flame Resister	Adhesive	1-4%	■			North America	Truck	400-600
Fiberglass Mat	Reinforcement	27-30%	■			North America	Truck	400-600
Elastomeric Polymer	Barrier coating	3-6%	■			North America	Truck	400-600
Aluminum Foil	Interior layer	11-14%		■	■	North America	Truck	400-600

Manufacturing Process

Figure 1: Owens Corning General Process Flow for unfaced FIBERGLAS™ Products



Life Cycle Assessment – Product System and Modeling

Functional Unit

The functional unit of the insulation as defined by the PCR is one square meter (m^2) of insulation material with a thickness that gives an average thermal resistance R_{SI} = 1 m^2 K/W and with a building service life of 60 years. Unless indicated otherwise, all results in this declaration have been provided for the functional unit amount of 700 Series FIBERGLAS™ Insulation.

Life Cycle Stages Assessed

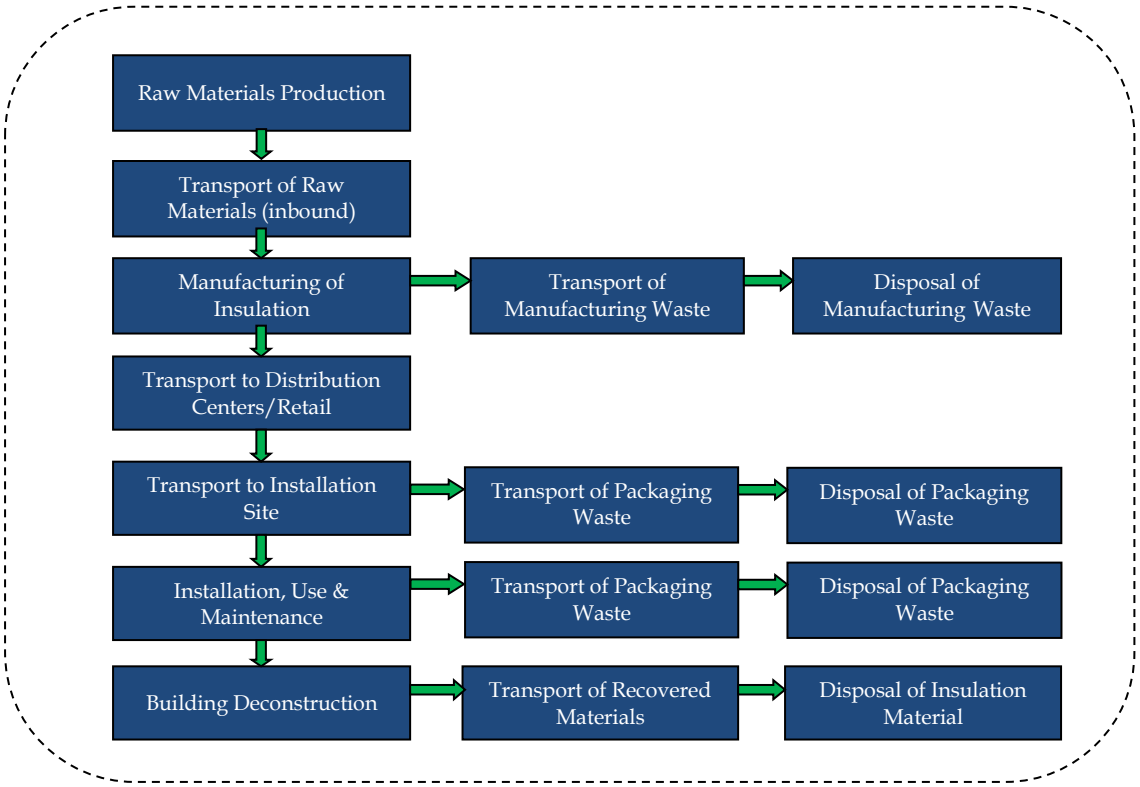
The underlying LCA, which provides the basis for this EPD, has been prepared following the requirements outlined in the applicable PCR. The LCA evaluates the fiberglass insulation by modeling the product life cycle considering the five stages mandated by the applicable PCR:

- Raw Materials Acquisition
- Manufacturing
- Distribution
- Installation and maintenance
- End-of-life (e.g., disposal, reuse, or recycle)

This EPD presents data that has been aggregated over the aforementioned life cycle stages.

System Boundaries

Figure 2: System boundaries



Assumptions

Assumptions are normal and necessary in conducting life cycle assessment. For the underlying cradle-to-grave LCA, assumptions have been made for both the installation and maintenance phase as well as the end-of-life phase. Assumptions regarding these phases can be found in the respective sections below.

Cut Off Criteria

The cut-off criteria for including or excluding materials, energy, and emissions data from the study are listed below, as per the applicable PCR.

- **Mass** – If a flow is less than 2% of the cumulative mass of the model it may be excluded, providing its environmental relevance is not a concern.
- **Energy** – If a flow is less than 1% of the cumulative energy of the model it may be excluded, providing its environmental relevance is not a concern.
- **Environmental relevance** – If a flow meets the above criteria for exclusion, yet is thought to potentially have a significant environmental impact, it will be included. Material flows which leave the system (emissions) and whose environmental impact is greater than 2% of the whole impact of an impact category that has been considered in the assessment must be covered. This judgment was made based on experience and documented as necessary.

The sum of the excluded material flows must not exceed 5% of mass, energy, or environmental relevance. The application of these criteria in the different life cycle steps is documented in the following sections.

- **Infrastructure and capital goods:** Inputs and outputs associated with infrastructure (construction, maintenance and demolition of buildings/plants, road surfaces, transport equipment etc.) are not included. This is based on experience from previous LCAs, where the contribution from these items is negligible due to the long life time of the equipment compared to that from the high production volume of the material during that lifetime;
- **Packaging:** Packaging is of a low mass compared to the quantity of product. As such, it has been excluded to reduce data collection efforts;
- **Workforce burdens:** Similarly, workforce impacts, such as travel to and from work, washing facilities, accommodation, canteen etc. when considered per processed ton of product, are considered likely to be insignificant and have been excluded; and
- **Installation and maintenance:** The mass and energy use at the manufacturing stage is limited to some electric tooling (such as screw drivers) and other small elements to fix the insulation boards. According to Owens Corning's manufacturing and product specialists, its mass and energy contribution is below the cut-off rules.

Transportation

The transportation stage has been modeled by splitting inbound transportation and outbound transportation (or distribution). Inbound transportation includes the transportation of all raw materials, including the batch, binder and packaging materials from suppliers to the Newark manufacturing facility. The outbound transportation or distribution includes the transportation of the final product to customers.

Period under Consideration

For the Newark, OH manufacturing facility considered in the LCA, Owens Corning primary data was collected for the 2014 calendar year.

Secondary Background Data

Life-cycle modeling and calculation of potential environmental impacts were conducted using the LCA software SimaPro 8.0.4 developed by PRé Consultants bv. The LCI database libraries were the source of the secondary data used in the study. Of the various databases available, the LCI database used primarily for secondary data was the ecoinvent database. In situations where LCI databases did not contain life-cycle inventory data for certain specific materials or processes used in either the manufacturing of precursor, input raw materials or the manufacturing of insulation itself, LCI data for a similar material or process was used as a substitute. In order to determine the most representative substitute, preliminary analyses were conducted.

Data Quality

To determine how representative the data used to model the life-cycle of 700 Series FIBERGLAS™ Insulation manufactured in 2014 is, the temporal, geographical and technological aspects of the data were assessed. For Owens Corning's Newark, OH facility analyzed in the underlying LCA study, the data used adequately represents the technology used in 2014 in the United States. The secondary data used from SimaPro LCI databases was the most appropriate and current data available. When production data was not available for a specific material in use, available LCI data on similar materials were analyzed to determine the best surrogate.

Allocation

Owens Corning's Newark facility manufactures multiple products. Primary data of materials and utilities consumption was provided on the facility level instead of the product level, and therefore allocation was required. Machine operating hours (MOH) were used to allocate the utility consumption and other manufacturing impacts (such as air emissions) to each individual product. In transportation the product is volume limited and not mass limited. Since fiberglass products are volume limited for finished goods-transportation, a sensitivity analysis was performed for this study.

Installation and Maintenance

700 Series FIBERGLAS™ Insulation products are installed by hand, which occasionally requires tools and specially designed mechanical fasteners and screws. The energy and material usage associated with the installation stage are below the cut-off rules and therefore have not been considered. The waste generated, furthermore, during installation is limited to the original product packaging. Once installed, insulation requires no maintenance if the environment around it is not disturbed.

End-of-Life

It is assumed that no recycling occurs at end-of-life and that all construction waste is sent to landfill. The average distance from the demolition site to the construction material landfill is assumed to be 100 miles by use of an industrial garbage truck.

Life Cycle Assessment – Results

Use of Material and Energy Resources

Table 3: Primary Energy Demand per Functional Unit (by Type) for 700 Series FIBERGLAS™ Insulation

Environmental Indicator	Unit	700 Series Board Unfaced
Non renewable, fossil oil, coal, natural gas	MJ	9.64E+01
Non-renewable, nuclear	MJ	1.38E+01
Non-renewable, biomass	MJ	1.65E-03
Renewable, biomass	MJ	6.10E-01
Renewable, water	MJ	6.14E-01
Renewable, wind, solar, geothermal	MJ	1.96E-01
TOTAL Primary Energy Demand	**MJ**	**1.12E+02**

Table 4: Primary Energy Demand per Functional Unit (by Type) for 700 Series FIBERGLAS™ Insulation Facing Materials

Environmental Indicator	Unit	FRK Facing	ASJ Max Facing	ASJ Facing
Non renewable, fossil oil, coal, natural gas	MJ	6.80E+00	9.78E+00	7.92E+00
Non-renewable, nuclear	MJ	3.22E-01	5.62E-01	4.34E-01
Non-renewable, biomass	MJ	4.47E-03	2.99E-03	3.31E-04
Renewable, biomass	MJ	2.02E+00	2.57E+00	3.39E+00
Renewable, water	MJ	4.40E-01	4.96E-01	4.88E-01
Renewable, wind, solar, geothermal	MJ	1.60E-02	2.42E-02	2.56E-02
TOTAL Primary Energy Demand	**MJ**	**9.60E+00**	**1.34E+01**	**1.23E+01**

Table 5: Primary Energy Demand per Functional Unit (by Resource) for 700 Series FIBERGLAS™ Insulation

Environmental Indicator	Unit	700 Series Board Unfaced
Non-renewable Resources		
Fossil oil	MJ	1.56E+01
Natural gas	MJ	5.56E+01
Coal	MJ	2.49E+01
Fossil, other	MJ	3.55E-01
Nuclear	MJ	1.38E+01
Biomass	MJ	1.65E-03
Non-renewable Total	MJ	1.10E+02
Renewable Resources		
Biomass	MJ	6.10E-01
Water	MJ	6.14E-01
Wind	MJ	1.26E-01
Solar	MJ	4.66E-05
Geothermal	MJ	6.98E-02
Renewable Total	MJ	1.42E+00
TOTAL Primary Energy Demand	**MJ**	**1.12E+02**

Table 6: Primary Energy Demand per Functional Unit (by Resource) for 700 Series FIBERGLAS™ Insulation Facing Materials

Environmental Indicator	Unit	FRK Facing	ASJ Max Facing	ASJ
Non-renewable Resources				
Fossil oil	MJ	2.18E+00	3.81E+00	2.09E+00
Natural gas	MJ	1.88E+00	2.85E+00	2.71E+00
Coal	MJ	2.69E+00	3.07E+00	3.07E+00
Fossil, other	MJ	4.86E-02	5.52E-02	5.56E-02
Nuclear	MJ	3.22E-01	5.62E-01	4.34E-01
Biomass	MJ	4.47E-03	2.99E-03	3.31E-04
Non-renewable Total	**MJ**	**7.13E+00**	**1.03E+01**	**8.36E+00**
Renewable Resources				
Biomass	MJ	2.02E+00	2.57E+00	3.39E+00
Water	MJ	4.40E-01	4.96E-01	4.88E-01
Wind	MJ	4.89E-03	6.88E-03	8.02E-03
Solar	MJ	4.67E-06	5.39E-06	5.16E-06
Geothermal	MJ	1.11E-02	1.73E-02	1.75E-02
Renewable Total	**MJ**	**2.47E+00**	**3.09E+00**	**3.90E+00**
TOTAL Primary Energy Demand	**MJ**	**9.60E+00**	**1.34E+01**	**1.23E+01**

Figure 3: Non-Renewable Energy Resources by Source for 700 Series FIBERGLAS™ Insulation and Facing Options

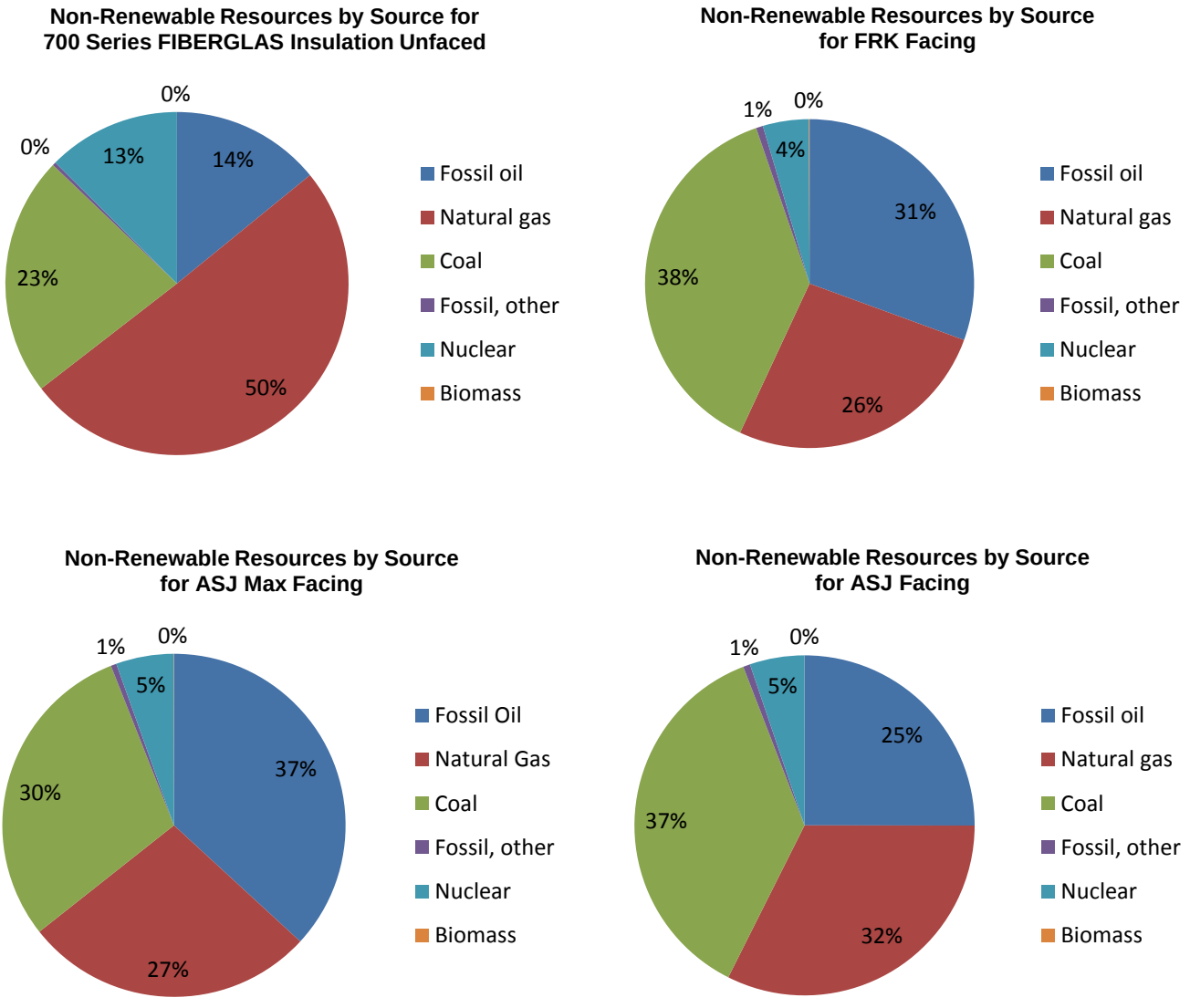


Figure 4: Renewable Resources by Source for 700 Series FIBERGLAS™ Insulation and Facing Options

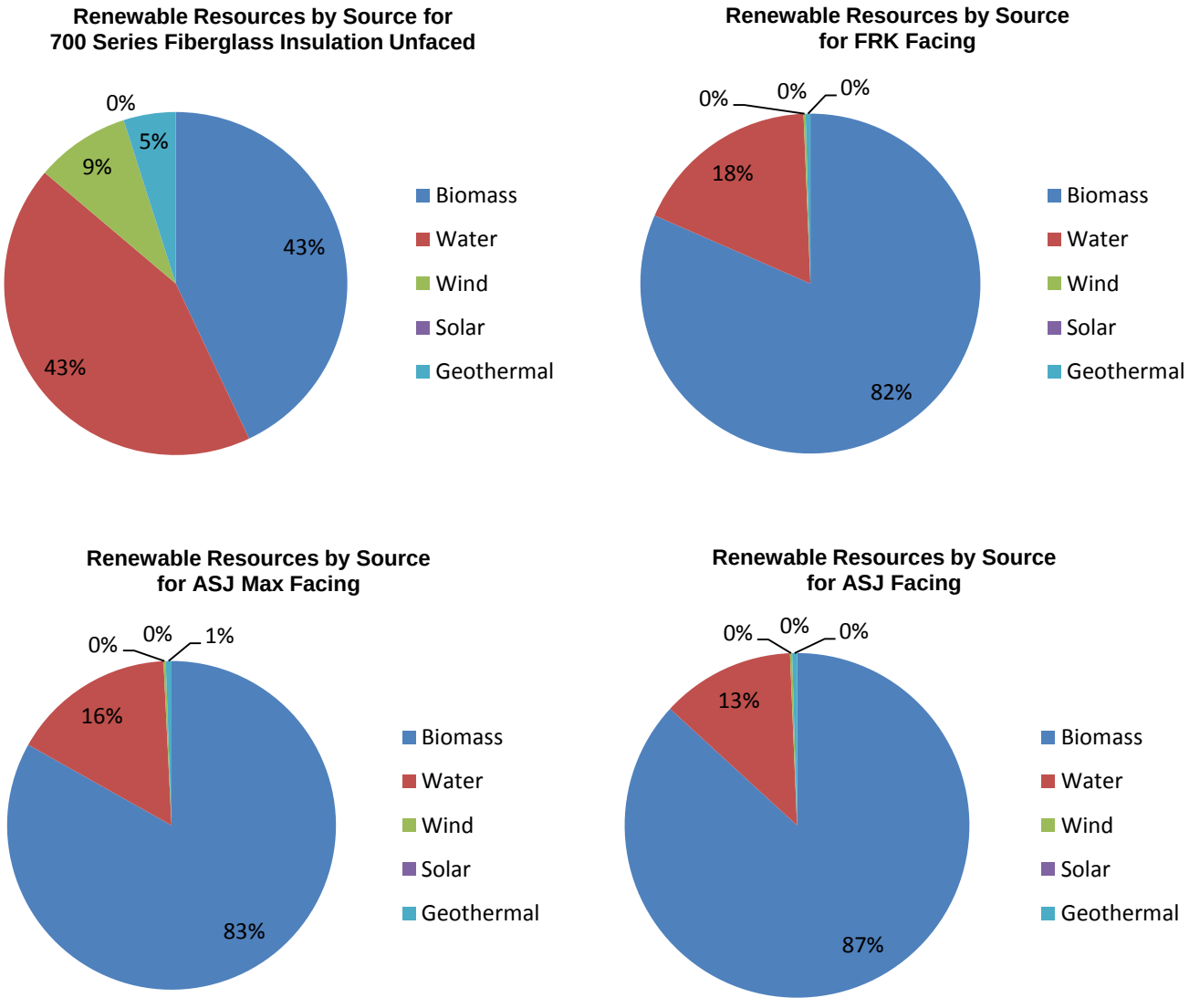
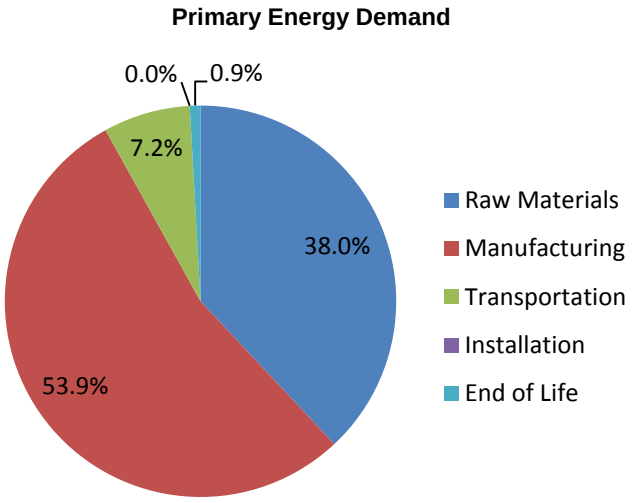
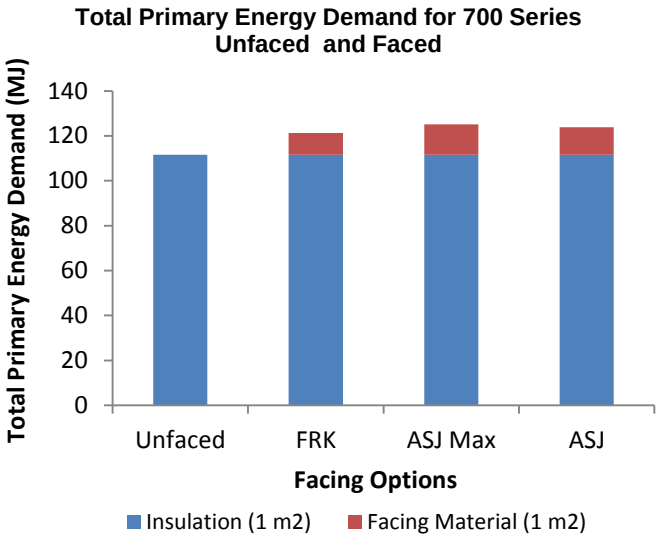


Figure 5: Primary Energy Demand by Life Cycle Stage for 700 Series FIBERGLAS™ Insulation and Facing Material





Life Cycle Assessment - Results

Table 7: Cradle-to-Gate Life Cycle Impact Assessment Results for 1m^2 of 700 Series FIBERGLAS™ Insulation at R_{SI} = 1

Impact category	Unit	TOTAL	Raw Materials - Batch	Raw Materials - Binder	Inbound transportation	Manufacturing	Distribution	Installation and Maintenance	End-of-life
Global Warming	kg CO_2 eq	6.02E+00	9.25E-01	7.10E-01	1.11E-01	3.81E+00	4.07E-01	0.00E+00	6.34E-02
Acidification	kg SO_2 eq	4.74E-02	5.83E-03	6.05E-03	8.81E-04	3.17E-02	2.53E-03	0.00E+00	4.15E-04
Eutrophication	kg N eq	1.21E-02	1.95E-03	9.38E-04	8.96E-05	8.79E-03	2.87E-04	0.00E+00	4.69E-05
Smog Creation	kg O_3 eq	4.12E-01	6.58E-02	2.86E-02	2.67E-02	2.06E-01	7.33E-02	0.00E+00	1.21E-02
Ozone Depletion	kg CFC-11 eq	8.63E-07	8.79E-08	1.72E-07	2.76E-08	4.59E-07	1.01E-07	0.00E+00	1.56E-08

Table 8: Cradle-to-Gate Life Cycle Impact Assessment Results for Facing Materials

Impact category	Unit	FRK Facing	ASJ Max Facing	ASJ Facing
Global warming	kg CO2 eq	5.67E-01	6.91E-01	6.66E-01
Acidification	kg SO2 eq	4.48E-03	5.25E-03	5.27E-03
Eutrophication	kg N eq	1.29E-03	1.59E-03	2.00E-03
Smog	kg O3 eq	4.38E-02	5.46E-02	5.35E-02
Ozone depletion	kg CFC-11 eq	3.98E-08	4.86E-08	5.11E-08

Non-Hazardous Waste and Water Consumption

The water consumed and waste generated over the cradle-to-gate life cycle of 700 Series Fiberglas™ insulation is shown in the tables below.

Table 9: Water usage (m^3) for 1m^2 of 700 Series FIBERGLAS™ insulation material at R_{SI} = 1

Water usage	Unit	700 series insulation 1m^2 , R_{SI}-1
Water	m^3	4.26E-04

Table 10: Table 9: Water usage (m^3) for 1m^2 of facing material at RSI = 1

Water usage	Unit	FRK Facing	ASJ Max Facing	ASJ Facing
Water	m^3	2.83E-04	2.98E-04	2.96E-04

Table 11: Waste-to-landfill (kg) for 1m^2 of 700 Series FIBERGLASs™ insulation material at R_{SI} = 1

Waste	Unit	700 series insulation 1m^2 , R_{SI}-1
Waste to landfill	kg	3.17E+00
Hazardous waste	kg	3.02E-05

Table 12: Waste-to-landfill (kg) for 1m^2 of facing Material

Waste	Unit	FRK Facing	ASJ Max Facing	ASJ Facing
Waste to landfill	kg	0.102	0.161	0.141
Hazardous waste	kg	-	-	-

Environmental Impact Values for "R" Values other than the Functional Unit

The 700 Series FIBERGLAS™ Insulation is sold in various R values in the USA. The impact assessment was determined using the Functional Unit provided. As presented in Table 13 below, the potential impact increases when the R value increases, as the thickness of the board is greater. For this analysis, it was assumed that the density of the board is constant for all R values and thicknesses. Facings were not included in the chart below because facing quantities do not scale with increased insulation thickness.

Table 13: Impact category values for 1m^2 of 700 Series FIBERGLAS™ Insulation materials at various R_{SI} values

Thickness (inch)	R_{SI} m2 K/W	Global Warming Potential kg CO_2 eq	Acidification Potential kg SO_2 eq	Eutrophication Potential kg N eq	Smog Creation Potential kg O_3 eq	Ozone Layer Depletion Potential kg CFC-11 eq
1.0	0.73	4.40E+00	3.46E-02	8.83E-03	3.01E-01	6.30E-07
1.5	1.09	6.56E+00	5.16E-02	1.32E-02	4.49E-01	9.41E-07
2.0	1.46	8.79E+00	6.91E-02	1.77E-02	6.02E-01	1.26E-06
2.5	1.82	1.10E+01	8.62E-02	2.20E-02	7.50E-01	1.57E-06
3.0	2.18	1.31E+01	1.03E-01	2.64E-02	8.98E-01	1.88E-06
3.5	2.55	1.54E+01	1.21E-01	3.09E-02	1.05E+00	2.20E-06
4.0	2.91	1.75E+01	1.38E-01	3.52E-02	1.20E+00	2.51E-06

Optional Environmental Information

CERTIFIED RECYCLED CONTENT™ SCS GLOBAL SERVICES

AVERAGE 53% RECYCLED CONTENT
31% PRE-CONSUMER
22% POST-CONSUMER

References

- Product Category Rules for Preparing an Environmental Product Declaration (EPD) for Product Group: Building Envelope Thermal Insulation, Version 1.3, June 1, 2014
- ISO 14025:2006(E), Environmental labels and declarations – Type III environmental declarations – Principles and procedures, 1 July 2006
- ISO 14040:2006(E), Environmental management – Life cycle assessment – Principles and framework, 1 July 2006
- ISO 14044:2006(E), Environmental management – Life cycle assessment – Requirements and guidelines, 1 July 2006