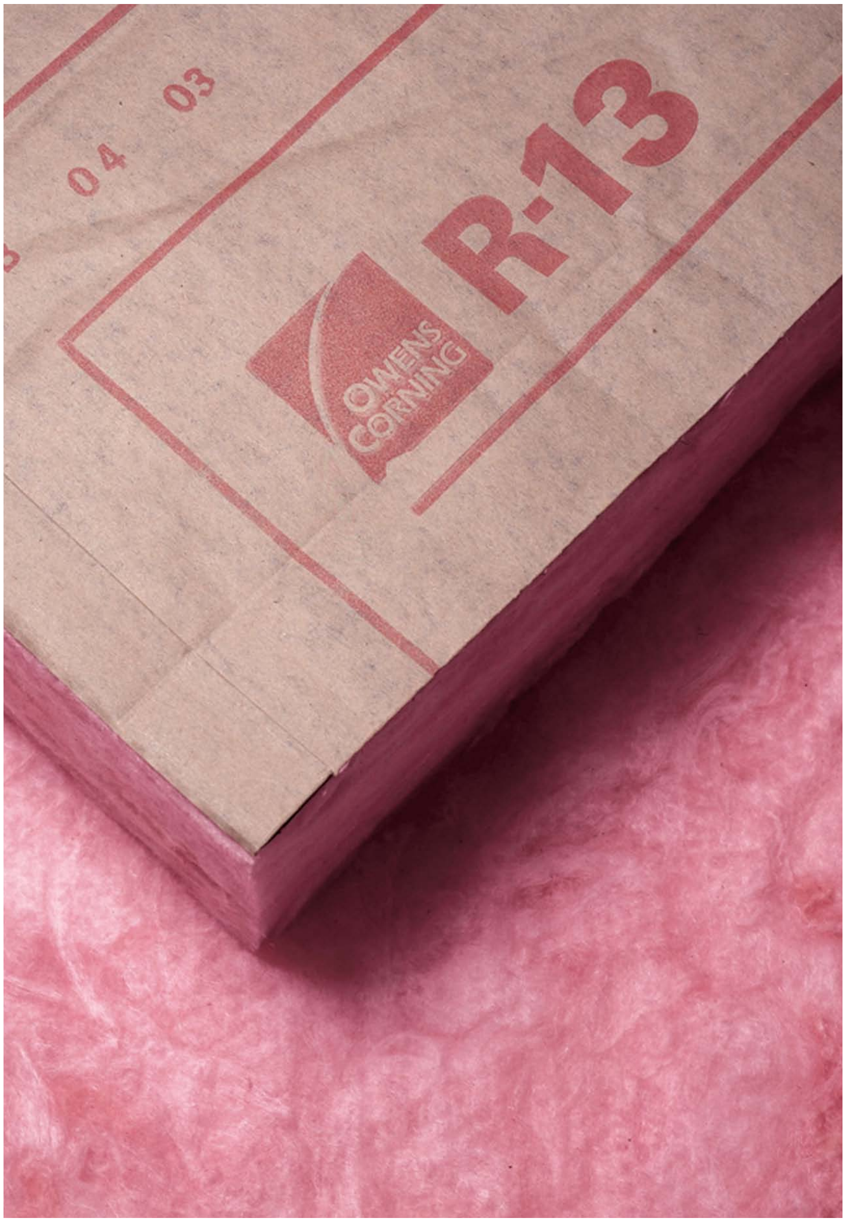
Environmental Product Declaration

EcoTouch® Kraft-Faced Insulation



Owens Corning EcoTouch® Insulation with PureFiber® Technology enhances comfort, energy savings and sustainability in new and existing structures.

OWENS CORNING®

INNOVATIONS FOR LIVING®

Owens Corning, and its family of companies, are 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 glass-fiber 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

This declaration is an environmental product declaration in accordance with ISO 14025 that describes the environmental characteristics of the aforementioned product. It promotes the development of sustainable products. This is a certified declaration and all relevant environmental information is disclosed.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	Owens Corning
DECLARATION NUMBER	12CA25418.102.1
DECLARED PRODUCT	EcoTouch® Kraft-faced Insulation. Manufactured by Owens Corning in the United States and Canada.
REFERENCE PCR	PCR Building Envelope Thermal Insulation (ULE 2011)

DATE OF ISSUE	July 31, 2013
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 Panel 333 Pfingsten Road Northbrook, IL 60062 epd@ul.com
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL X EXTERNAL	Loretta Tam
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria

Product Definition and Information

Product Description

EcoTouch® PINK® FIBERGLAS™ Kraft-Faced Insulation with PureFiber® Technology is flexible insulation and is made in R-values from 11 to 38 for use in United States building application. The EcoTouch® Kraft-faced Insulation has a strong asphalt-coated paper facing on one side. Stapling flanges are provided for standard frame widths. The kraft-faced insulation is manufactured in thicknesses from 31/2" to 12".

The functional unit of the product as defined by the PCR is 1 square meter of insulation material with a thickness that gives an average thermal resistance RSI=1 m2K/W and with a building service life of 60 years.

The results of this declaration represent an average performance for a number of products and manufacturing plant locations.

Manufacturing Locations

Owens Corning North American Insulation Manufacturing Locations can be found across the United States and Canada.

Owens Corning Kraft-faced insulation products are only sold in the United States. Unless due to market conditions, the manufacturing of Kraft-faced insulation batts and rolls is limited to the manufacturing plants located in the United States.

Delmar Plant[a] Fuera Bush, N.Y. 12067	Edmonton Plant[a] Edmonton, Alberta, Canada T6S1A1
Fairburn Plant Fairburn GA., 30123	Kansas City Plant Kansas City, KS. 66115
Santa Clara Plant Santa Clara, CA. 95050	Toronto Plant[a] Scarborough, Ontairo, Canada M1V1Z5
Waxahachie Plant[b] Waxahachie, TX 75165	

(a) Manufacturing location was not included in LCA for kraft-faced insulation.
(b) The Waxahachie plant was converted in May 2011 and uses the same process and bill of materials as the plants covered in the study.

Application and Uses

EcoTouch® Kraft-faced Insulation can be used in a wide range of exterior wall, roof and ceiling applications for residential and commercial applications when a vapor retarder is required. The EcoTouch® Insulation is provided with a wide range of R-values and thicknesses with excellent thermal control. The R30C, and R38C products provide excellent thermal performance in limited space of cathedral ceilings. EcoTouch® Insulation enhances interior noise control by improving Sound Transmission Class (STC) of walls and floor/ceiling assemblies.

Installation

EcoTouch® Insulation is easy to handle and install. Sized for installation in either wood or metal frame construction, EcoTouch ® Kraft-faced Insulation can be friction fit or stapled into place. Trimming and fabrication can be done with an ordinary utility knife and is easily installed into odd-shaped cavities and small spaces. With less dust than other fiberglass insulation products, EcoTouch® Insulation has excellent stiffness and recovery characteristics.

EcoTouch® Kraft-faced Insulation is manufactured in widths to fit the standard spacing between ceiling, wall and floor framing members. The flanges can be stapled to either the face or side of the stud, or left unfolded when installing via friction fit. EcoTouch FastBatt insulation has a "tabless" facing – designed specifically for friction application. Wire or metal straps may be used to temporarily hold the insulation in place in applications where installation of the finish material may be delayed.

EcoTouch® Kraft-faced Insulation for cathedral ceiling products are intended to be friction-fit between rafters. Cathedral ceiling insulation should be installed to provide a minimum of 1" ventilation passageway between the roof deck and insulation.

For metal studs, EcoTouch® Kraft-faced Insulation can be friction-fit in place until the interior finish is applied. Insulation should fill the cavity and the wall should eventually be closed on both sides.

EcoTouch® Kraft-faced Insulation can be applied between furring strips, hat channels, or Z-shaped furring in areas where a finished surface will be installed. Contact furring strip manufacturer for appropriate fastening system. NOTE: in applications where the thickness of the insulation exceeds the depth of the space between the furring strips, the insulation will be compressed and experience some reduction in R-value. See Owens Corning publication no. 10017857 for a list of "compressed R-values".

Material Content

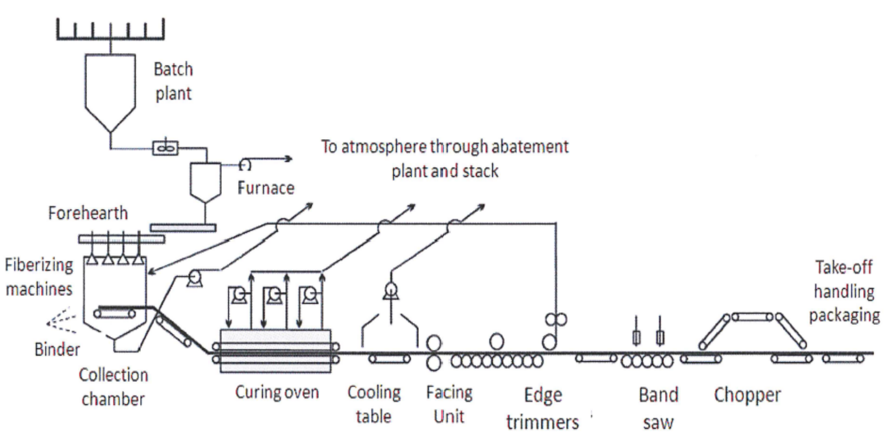
EcoTouch® Kraft-Faced Insulation consists of three major components, the fiberglass, the binder system and the facing system. The fiberglass is made from various inorganic minerals, which are referred to as batch chemicals. The binder system consists of renewable and non-renewable organic materials. The facing system consists of two components, kraft-paper and asphalt.

Materials	Function	Quantity (% by mass)	Non-Renewable	Renewable	Recycle Material	Origin	Transportation Mode	Transportation (Miles)
Cullet	Glass Batch	25-75%	■		■	North America	Rail/Truck	10-800
Sand	Glass Batch	8-25%		■		North America	Truck	10-250
Borates	Glass Batch	10-30%	■			Global	Ship/Rail/Truck	350-6200
Soda Ash	Glass Batch	0.5-6%	■			North America	Rail/Truck	350-2000
Other Oxides	Glass Batch	1-2%	■			North America	Rail/Truck	225-2000
Limestone	Glass Batch	0-5%	■			North America	Truck	125-200
Carbohydrate Polyol	Binder	2-10%		■		North America	Truck	500-2200
Bio-Based Polycarboxlic Acid	Binder	1-5%		■		North America	Truck	200-2000
Cure Accelerator	Binder	0.2-1%	■			North America	Truck	250-2300
Surfactant	Binder	0-0.1%	■			North America	Truck	400-2300
Vegetable Oil	Binder	0-3.5%		■		North America	Truck	500-2200
Silane	Binder	0.03-.1%	■			North America	Truck	250-2700
Pink Colorant	Binder	0.1-0.2%	■			North America	Truck	350-2800
Kraft Paper	Facing	(a)		■		North America	Truck	700-2000
Asphalt	Facing	(a)	■			North America	Truck	25-400

Table 1: Material content of Kraft-Faced Insulation

(a) Material percentage for the Functional Unit RSI=one is not applicable and would distort the data. For Kraft-faced products, the percent of facing material varies as a function of Product R-Value and square foot weight. In example, for R-38C Batt, the facing component would be 3% of the Kraft-faced insulation's overall weight. For an R-11 product, the facing would be 12.5% of the overall products weight.

Manufacturing Process



Environmental Product Declaration

Use of Material and Energy Resources

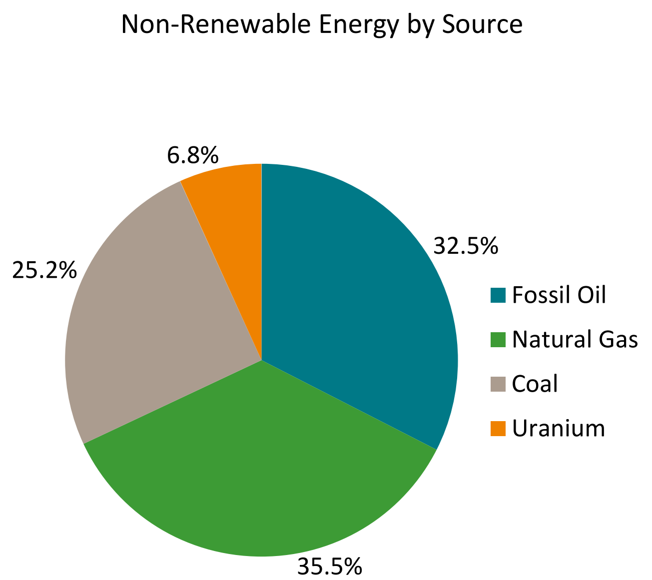
Table 1: Total Primary Energy

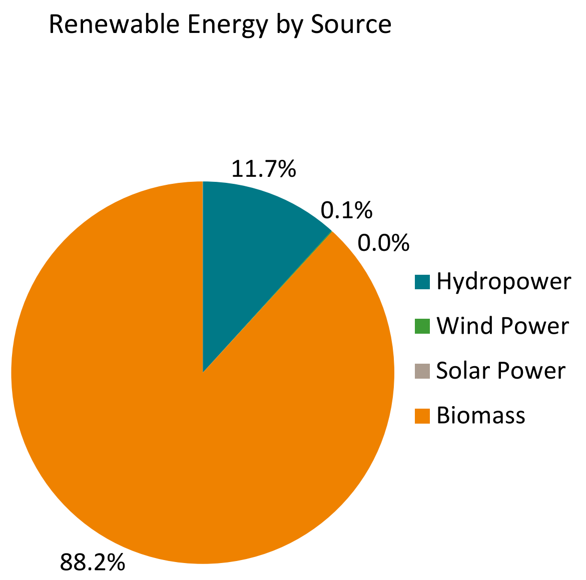
Total Primary energy	Unit	Total
Non-renewable, fossil	MJ-Eq.	12.21
Non-renewable, nuclear	MJ-Eq.	0.89
Renewable, biomass	MJ-Eq.	3.16
Renewable, wind, solar, geothermal	MJ-Eq.	0.003
Renewable, water	MJ-Eq.	0.42

Table 2: Total Primary Energy Detail by Source Type

Non-Renewable Primary Energy Source	Unit	Total	Renewable Primary Energy Source	Unit	Total
Fossil Oil	MJ-Eq.	4.26	Hydropower	MJ-Eq.	0.42
Natural Gas	MJ-Eq.	4.65	Wind Power	MJ-Eq.	0.003
Coal	MJ-Eq.	3.3	Solar Power	MJ-Eq.	0
Uranium	MJ-Eq.	0.89	Biomass	MJ-Eq.	3.16

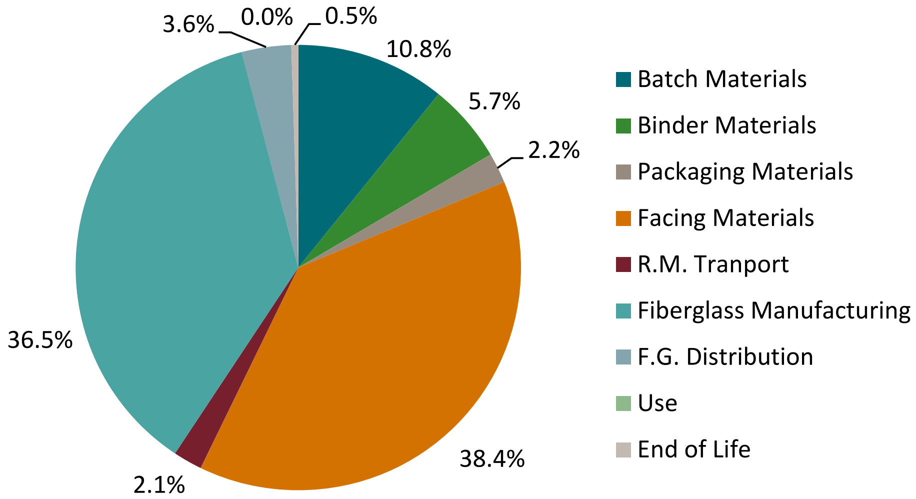
Charts for Non-Renewable Energy and Renewable Energy Source





Primary Energy by Life Cycle Stages

As seen by the pie chart on the below, for the functional unit of one square meter of material a RSI=1, the facing component is the dominant source of primary energy across the life cycle of the product. As the insulation's R-value increases, the percent contribution for the facing materials decreases as a percent of total. For example, for the R30 Insulation product, the facing material's contribution to total life cycle primary energy is at 10.5%.



Life Cycle Assessment-Product System and Modeling of Life Cycle

Functional Unit

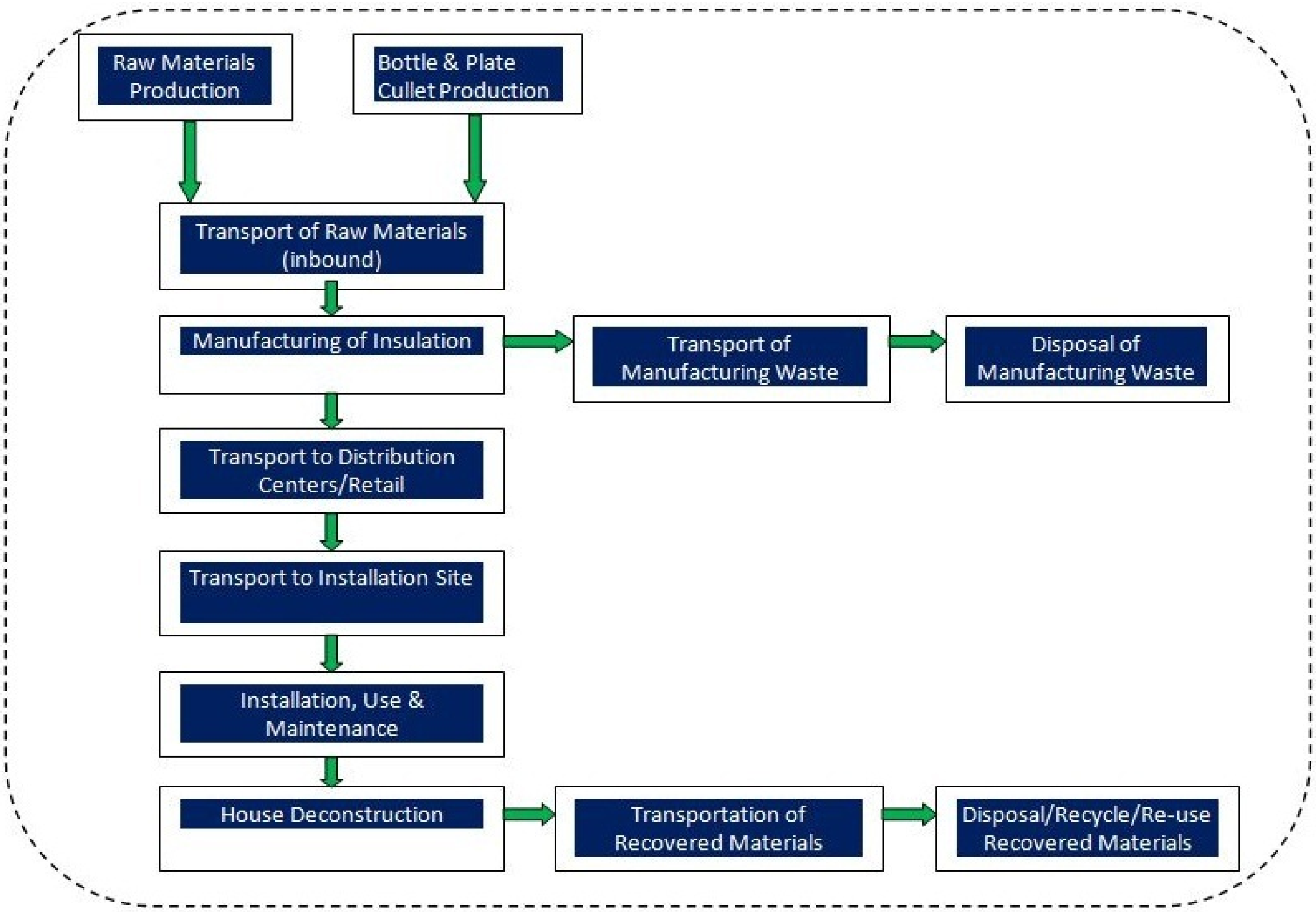
The functional unit of the product as defined by the PCR is 1 square meter of insulation material with a thickness that gives an average thermal resistance RSI=1 m2K/W and with a building service life of 60 years.

Life Cycle Stages Assessed

The EcoTouch® Insulation study for the manufacturing of Kraft-faced fiberglass batts and rolls was a cradle-to grave analysis, which included the following:

- Raw material production including extraction of primary raw materials, raw material manufacturing, raw materials for packaging, recycle cullet collection and processing,
- All raw material, packaging material and recycle cullet material to manufacturing locations.
- Fiberglass manufacturing
- Packaging of Finished Goods.
- Finished Good Transportation to from Manufacturing Facilities to Distribution centers, and Retailers.
- End-of-Life; Decommissioned material transportation to Waste Landfill and Landfill.

System Boundaries



Assumptions

Assumptions are critical in conducting a life cycle assessment. For this cradle-to-grave life cycle, a major assumption is for the installation, use and maintenance phase. Installing Kraft-faced fiberglass batt is performed by hand. They are unrolled or unwrapped, cut to appropriate size and friction fit into a wall cavity between the studs. After friction fitting batt into wall cavity, the kraft-paper flange is stapled to the wood stud. Once the batt is installed, the interior wall is finished and the batt is completely encased and protected. During the sixty-year life of the home as defined in the study, the batt would require no other utility source to operate (passive device). Finally, unless some type of serious damage occurred to the wall of a home, the maintenance on a fiberglass batt would not be required. In conclusion, for this study, a use/maintenance phase was performed and its impacts were determined to be zero. The major benefit of insulation is that it does save energy over the life of the home. See section on "Additional Environmental Benefits" for energy savings for homes due to insulation of walls and ceilings. Data used in the report represents 74% of the Kraft-faced production for the year, 2011.

Cut-Off Criteria

The cut-off criteria for the study are as follows:

- Mass – If a flow is less than 2% of the cumulative mass of the model, it may be excluded, providing it 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 – Materials of omission that may have a relevant contribution will be justified if applicable, by a sensitivity analysis.
- The sum of the excluded material flows must not exceed 5% of mass, energy, or environmental relevance.

Transportation

Each participating plant supplied the transportation distances for the shipment of all raw materials to their respective facility by the data input questionnaires as used in the study. Owens Corning's Corporate Transportation Analyst provided the finished good shipments to distributors, retail stores and other customers.

Period under Consideration

All Owens Corning primary data for the facilities used in the study were from the fiscal year of 2011

Secondary (Background) Data

The LCA modeling was created using SimaPro 7.3.2 software for life cycle engineering as developed by PRé Consultants. Secondary data was obtained using the SimaPro database for the raw materials and processes.

Data Quality

Data quality factors of temporal, geographical, and technology are very important in analyzing the primary information for the study. The Owens Corning facilities chosen for this study represents the current technology in use geographically cover the United States and Canada, and the data is from the year of 2011.

The secondary data used from the SimaPro database 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

Allocation where applicable was carried out by mass, except in transportation where the product is volume limited and not mass limited. Sensitivity analysis should be initiated if a deviation of 20% is foreseen. Since fiberglass products are volume limited for finished goods-transportation, a sensitivity analysis was performed for this study. The finish good transportation (ton-miles) was changed by +/- 25% for the sensitivity analysis. All of the environmental impact categories changed by less than 1% except for the impact category of smog potential. With a 25% increase in finished good transportation ton-miles, there is a 2% increase in the smog potential value.

Use Stage

As stated in the Assumptions' Section above, for this study, the environmental impacts are negligible for the study.

End-of-Life

For end of life, it was assumed that all materials removed from the decommissioning of a building were taken to a local construction waste landfill, using 100 miles as the average distance to landfill. At this time, there are no formal end-of-life recycling programs for fiberglass insulation. There are some documented cases where removed fiberglass was re-used in Habitat for Humanity (HFH) projects and re-sold in HFH stores.

Life Cycle Assessment-Product

The LCA Results are documented separately for the following stages

- Batch Materials: mining and manufacturing of batch minerals as used in glass batch
- Binder materials: extraction and manufacturing of chemicals as used in binder process.
- Facing materials: extraction and manufacturing of asphalt and kraft-paper products
- Cradle to gate manufacturing of packaging materials.
- Raw Material Transportation: Transport distances for batch, binder, and packaging materials to each respective Owens Corning facility
- Plant Operations: energy and environmental flows associated with the conversion of batch and binder materials and the packaging operation of finished goods for the production of fiberglass batts and rolls.
- F.G. Distribution: Transportation (Ton-Miles) for shipment of finished goods from Owens Corning facilities to the distribution, retail centers and other customers.
- End-of-Life: the transportation of decommissioned fiberglass materials and landfill burden.

Table3: Life Cycle Impact Category Values for the Functional Unit of One Square Meter, Kraft-Faced, RSI=1 (R=5.68, US)

Impact category TRACI 2.0	Unit	Total B&R 1 sqm, Kraft-Faced, RSI=1	Batch Material	Binder Material	Facing Raw Material	Packaging Materials	Raw Material Transport	Plant Operations	F.G. Transport	End-of-Life
Global warming	kg CO2 eq	7.53E-01	1.13E-01	3.54E-02	1.08E-01	1.08E-02	2.76E-02	4.03E-01	4.86E-02	7.06E-03
Acidification	mol H+ eq	2.99E-01	2.46E-02	1.11E-02	5.23E-02	4.38E-03	1.05E-02	1.77E-01	1.62E-02	2.35E-03
Eutrophication	kg N eq	5.40E-04	6.50E-05	2.53E-04	1.49E-04	3.90E-06	1.02E-05	4.11E-05	1.56E-05	2.27E-06
Smog (photo chemical ozone depletion)	kg O3 eq	5.44E-02	5.96E-03	1.90E-03	1.18E-02	1.05E-03	5.14E-03	1.95E-02	7.93E-03	1.15E-03
Ozone depletion	kg CFC-11 eq	2.42E-08	1.25E-08	4.18E-09	7.22E-09	1.06E-10	7.58E-11	1.36E-10	2.09E-12	3.04E-13
Respiratory effects	kg PM2.5 eq	1.62E-02	1.55E-03	4.97E-05	6.17E-04	2.45E-05	7.52E-05	1.28E-02	9.76E-04	1.29E-04
Waste to Landfill	kg	5.15E-01	1.90E-02	3.34E-03	7.21E-03	2.23E-04	5.74E-06	1.19E-02	0.00E+00	4.73E-01
Metered Water	kg	1.52E+01	1.86E+00	1.11E+00	1.04E+01	6.91E-01	4.67E-03	1.09E+00	0.00E+00	0.00E+00
Energy	MJ-Eq	1.67E+01	1.81E+00	9.56E-01	6.41E+00	3.65E-01	3.43E-01	6.10E+00	6.09E-01	8.84E-02

Table 4: Life Cycle Impact Category Values for the Functional Unit of One Square Meter, Unfaced, RSI=1 (R=5.68, US)

Impact category TRACI 2.0	Unit	Total	Batch Materials	Binder Materials	Packaging Materials	Raw Material Transport	Plant Operations	F.G. Distribution	End-of-Life
Global warming	kg CO2 eq	6.18E-01	1.13E-01	3.54E-02	1.08E-02	1.41E-02	4.03E-01	3.60E-02	5.42E-03
Acidification	mol H+ eq	2.37E-01	2.46E-02	1.11E-02	4.38E-03	6.04E-03	1.77E-01	1.20E-02	1.80E-03
Eutrophication	kg N eq	3.82E-04	6.50E-05	2.53E-04	3.90E-06	5.90E-06	4.11E-05	1.14E-05	1.72E-06
Smog (photo chemical ozone depletion)	kg O3 eq	3.81E-02	5.96E-03	1.90E-03	1.05E-03	2.95E-03	1.95E-02	5.86E-03	8.83E-04
Ozone depletion	kg CFC-11 eq	1.70E-08	1.25E-08	4.18E-09	1.06E-10	7.52E-11	1.36E-10	1.57E-12	2.37E-13
Respiratory effects	kg PM2.5 eq	1.46E-02	1.55E-03	4.97E-05	2.45E-05	3.96E-05	1.28E-02	9.50E-05	1.43E-05
Waste to Landfill	kg	3.98E-01	1.90E-02	3.34E-03	2.23E-04	5.74E-06	1.19E-02	0.00E+00	3.63E-01
Metered Water	kg	4.76E+00	1.86E+00	1.11E+00	6.91E-01	4.67E-03	1.09E+00	0.00E+00	0.00E+00
Energy	MJ-Eq	9.92E+00	1.81E+00	9.56E-01	3.65E-01	1.76E-01	6.10E+00	4.45E-01	6.71E-02

How to Calculate Environmental Impact Values for "R" Values other than the Functional Unit.

The functional unit for the study is in metric units of RSI=1, which is equivalent to R=5.68 in U.S Customary Units, The U.S. Customary Unit is the value one would find stated on the label of an insulation package as sold in North America. In order to determine the burden for the desired R-value of product sold, the scaling factor for the appropriate R-value as listed in the chart below should used to multiply the impact category value for unfaced product as listed for the functional unit, in Table 4 above. Then add the appropriate impact value for the Kraft-facing as listed in the column in Table 3.

Scaling Factors for Determining Impact Category Values for Commercial R-Values in North America

Product (United States) Customary R-Value	Factor to Multiply Impact per m2 of RSI=1 (dimensionless)
R-11	2.07
R-13	3.07
R-15	4.72
R-19	3.43
R-21	4.96
R-30	5.78
R-30C	6.55
R-38	7.03
R-38C	9.17

The formula for determining the environmental burdens for the desire R-Value of Kraft-Face Insulation is as follows:

Impact Burden =
(Value of Unfaced Product-Table 4) X Multiplier factor + (Value of the Kraft System burden-Table 3)

The burdens associated with the kraft-Facing System are a constant and do not change with the R-Value of insulation.

Example: Environmental Burden for R13 Fiberglass Insulation Based on Functional Unit RSI=1 Results

In the table below, the results of the study's functional unit are multiplied by 3.07 plus the impact values as listed in the column for facing materials from table 3 above, to obtain the impact category values for Kraft-faced fiberglass insulation rated at R=13.

Impact category	Unit	Functional Unit RSI=1 Unfaced	Values for R=13	Facing Raw Material Values	R13 Kraft-Faced Values
Global warming	kg CO2 eq	6.18E-01	1.90E+00	1.08E-01	2.01E+00
Acidification	mol H+ eq	2.37E-01	7.28E-01	5.23E-02	7.80E-01
Eutrophication	kg N eq	3.82E-04	1.17E-03	1.49E-04	1.32E-03
Smog (photo chemical ozone creation)	kg O3 eq	3.81E-02	1.17E-01	1.18E-02	1.29E-01
Ozone depletion	kg CFC-11 eq	1.70E-08	5.22E-08	7.22E-09	5.94E-08
Respiratory effects	kg PM2.5 eq	1.46E-02	4.48E-02	6.17E-04	4.54E-02
Waste to Landfill	kg	3.98E-01	1.22E+00	7.21E-03	1.23E+00
Metered Water	kg	4.76E+00	1.46E+01	1.04E+01	2.50E+01
Energy	MJ-Eq	9.92E+00	3.05E+01	6.41E+00	3.69E+01

Non-hazardous Waste and Water Consumption

Table 4 Non-hazardous Waste and Water Usage per Functional Unit of Material – 1 Sq.Meter

	Raw Materials Production	Fiberglass Production	End-of-Life
Non-Hazardous Waste (kg/Square Meter)	0.0297	0.0119	0.473
Water Consumption (Gal./Square Meter)	3.71	0.29	0

Optional Environmental Information

Indoor Environmental

- EcoTouch® Insulation has achieved GREENGUARD Children and Schools™ Certification and is verified to be formaldehyde free.

Other Environmental

- Product Recycle content for all North American Facilities as certified by SCS Scientific Certification System is 58% minimum overall and 36% from post consumer.
- UL Environment EcoLogoCM CCD-016 has listed product as a sustainable certified product.
- Unfaced EcoTouch® Insulation is certified under the USDA Bio-preferred label program with a Bio-content label of 57%.
- Product qualifies to use the Seal & Insulate with ENERGY STAR program label.

Building Use Stage Benefits

Insulation is a passive device that requires no extra utilities to operate over its useful life. Insulation of a building is responsible for reducing the energy burden associated with heating and cooling of a building. The example below provides the net energy savings (energy saved minus life cycle energy of fiberglass).

Examples Basis:

- A two story 2400 square foot home located in Chicago, Illinois and insulated with batt & roll insulation to meet the 2006 International Energy conservation Code. The methodology used for the energy analysis is ASHRAE Standard 90.2
- A two story 2400 square foot home located in Phoenix, Arizona Illinois and insulated with batt & roll insulation to meet the 2006 International Energy conservation Code. The methodology used for the energy analysis is ASHRAE Standard 90.2.

Table 5: Energy Saved in Homes for First Year and 60 Year Life

Home Location	Total Life Cycle MJ for Insulation Products used in Home	Total MJ Energy Saved for an Insulated Home vs. Non-Insulated Home	Net MJ Saved = Total MJ saved minus Total LC MJ	Payback Time (Days) for Energy Saved	MJ Saved over the 60 Year Use Phase of building
Chicago, Illinois	22,071	261,695	239,624	30.8	1.56E+07
Phoenix, Arizona	15,978	145,547	129,569	40.1	8.72E+06

The energy saved for a properly insulated home over a non-insulated home has a 30.8-day payback for a home in Chicago and a 40.1-day payback for a home in Arizona for the life cycle energy burden associated with the manufacturing of EcoTouch® Kraft-Faced Insulation.

Based on the USEPA Greenhouse Gas Equivalent Calculator, the 60-year energy savings for Chicago (i.e. the energy savings due to the fiberglass insulation) is equivalent to the annual savings of greenhouse gases from 10 automobiles for each of the 60 years. For Arizona, the energy saving due to the fiberglass insulation is equivalent to the annual savings of greenhouse gases from 5 automobiles for each of the 60 years.

For building energy savings in other areas of North America, please call 1-800-GET-PINK®

References

- Product Category Rules for Preparing an Environmental Product Declaration (EPD) for Product Groups: Building Envelope Thermal Insulation, Version 1.0, dated September 23, 2011
- EN ISO 14025:2006, Environmental labels and declarations – Type III – environmental declarations – Principles and procedures.
- EN ISO 14040, ISO 14040-2006, Environmental management – Life cycle assessment – Principles and framework.

- EN ISO, ISO 14044-2006, Environmental management – life cycle assessment – Requirements and Guidelines.
- ASTM Standard Specification C665-12, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
- ASTM Standard Specification C518-10, Standard Test Method for Steady-State Thermal Transmission properties of means of Heat Flow Meter Apparatus.
- ASTM Standard Specification C665, Type II, Class C
- ASHRAE Standard 90-2-2007, Energy-Efficient Design Low-Rise Residential Buildings
- IECC-2006, International Energy Conservation Code.