ENVIRONMENTAL PRODUCT DECLARATION

Quiet-Tech Insulation

NSF Certified Environmental Product Declaration www.nsf.org

Quiet-Tech
A CLEAN RECYCLED CARPET AND FIBER PRODUCT

Program Operator	NSF Certification LLC 789 N. Dixboro, Ann Arbor, MI 48105 www.nsf.org
General Program instructions and Version Number	Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Version 3.2
Manufacturer Name and Address	Quiet-Tech Recycling Corporation, LLC 360 West 1st Ave Roselle, New Jersey 07203
Declaration Number	EPD10446
Declared Product and Functional Unit	1 m_2 of insulation with a thickness that gives an average thermal resistance RSI = 1 m_2K/W for a period of 75 years
Reference PCR and Version Number	Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Version 3.2 Part B: Building Envelope Thermal Insulation EPD Requirements (UL Environment V2.0, 2018)
Product's intended Application and Use	Acoustic Batt Insulation
Product RSL	75 years
Markets of Applicability	North America
Date of Issue	September 7, 2020
Period of Validity	5 years from date of issue
EPD Type	Product Specific
Range of Dataset Variability	N/A
EPD Scope	Cradle to Grave
Year of reported manufacturer primary data	2019
LCA Software and Version Number	GaBi 9.2.1.68
LCI Database and Version Number	GaBi Database Version 9.2, Service Pack 40
LCIA Methodology and Version Number	TRACI 2.1 CML 2001-Jan 2016
The Core PCR (Part A) review was conducted by:	Lindita Bushi, PhD (chair), Athena Sustainable Materials Institute Hugues Imbeault-Tétreault, Groupe Ageco Jack Geibig, Ecoform
The sub-category PCR review was conducted by:	Thomas Gloria, PhD (Chair), Industrial Ecology Consultants Christoph Koffler, PhD, Sphera Andre Desjarlais, Oak Ridge National Laboratory

This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Life Cycle Assessment Calculation Rules and Report Requirements" v3.2 (December 2018), based on CEN Norm EN 15804 (2012) and ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017) ▭ Internal ▭ External	Jenny Oorbeck joorbeck@nsf.org
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting, LLC
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Terrie Boguski, Harmony Environmental, LLC

Limitations:
Environmental declarations from different programs (ISO 14025) based upon differing PCRs may not be comparable.
Comparison of the environmental performance of Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR.
Full conformance with the PCR for Building Envelope Thermal Insulation allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all reference standards, use the same sub-category PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.
Upon written request to Quiet-Tech, additional explanatory material can be provided to facilitate understanding of the data contained in this declaration.

1. Description of Company

In the late 1990s during the height of New York City's construction and renovation projects, Sean Ragiel, then an implementation manager for Waste Management Inc., noticed a fatal environmental flaw: most of the city's post-consumer carpet was incinerated or dumped into landfills, creating a significant burden on our waste stream. Understanding carpet has many valuable nylon components that can be harvested and repurposed as diverse end-use products, Sean saw an opportunity. Merging his inspiration with his more than 18 years of experience in the daily operations, management and analysis of waste management processes, Sean founded CarpetCycle in 1999 with one primary mission: find uses for post-consumer carpet and divert a valuable non-degradable, non-renewable resource from landfills. Out of that mission, Quiet-Tech Recycling Corporation (Quiet-Tech) was founded to focus on the creation of the insulation product manufactured from the recycled carpet and fiber.

2. Product Description

This EPD is conducted for representative products derived from Quiet-Tech's line of products produced at the facility located in Irvington, New Jersey. Quiet-Tech's insulation primarily consists of recycled carpet and recycled clothing. There are several advantages to Quiet-Tech insulation. It is an acoustic batt insulation that offers soundproofing capabilities to help reduce sound transmission between walls and is effective for sound dampening rooms. The UNSPSC code for this insulation product is 30141508 and the CSI code is 07 21 00. The results in this EPD are valid for all Quiet-Tech products manufactured at the company's Irvington, New Jersey facility.

3. Application

Quiet-Tech insulation is used as acoustic batt insulation in a variety of interior applications including commercial, light commercial, institutional, and residential.

4. Technical Data

Table 1: Technical Details

Parameter	Test Method	Quiet-Tech Insulation	Unit
Thermal Conductivity	ASTM C518	1.18	m_2K/W
Surface Burning Characteristics	ASTM E84	Class A	
Resistant to Mold and Mildew	ASTM C1338	Passed	
Dimensional Tolerance	ASTM C167-15	Passed	
Odor Emission	ASTM C1304-08	Passed	
Critical Radiant Flux Gas	ASTM E970-17	Passed	
Note: Compliance with model building codes does not always ensure compliance with state or local building codes, which may be amended versions of these model codes. Always check with local building code officials to confirm compliance.			

5. Declaration of Methodological Framework

This EPD is considered a Cradle-to-Grave study. A summary of the life cycle stages included in this EPD is presented in Table 6. The reference service life is outlined in Table 8 and is only applicable if all manufacturing guidelines are followed regarding site-selection and installation, found online. No known flows are deliberately excluded from this EPD. Third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impacts in all impact categories required by the PCR.

6. Flow Diagram

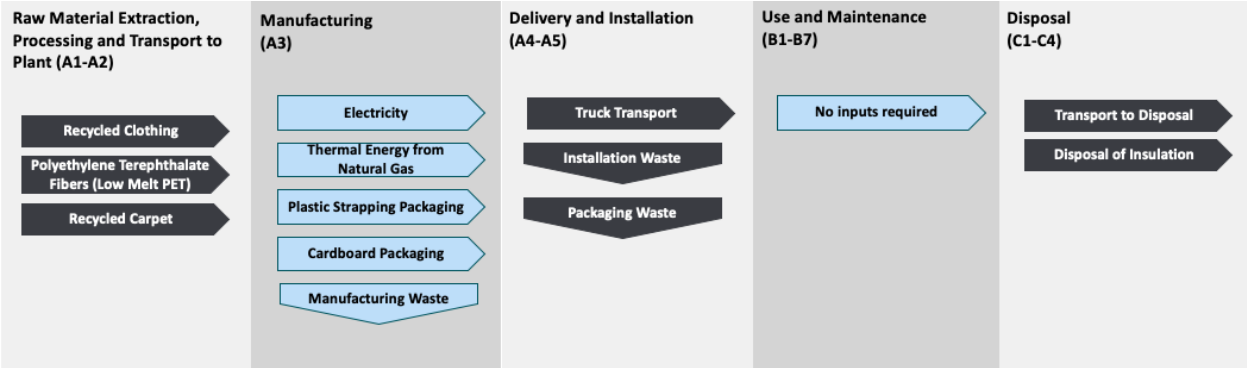

Figure 1: System Boundary

7. Manufacturing

Quiet-Tech sources used and recycled carpet and clothing from suppliers, which are mixed together with a low-melt polyester. Once the materials are combined, the mixture is laid out into a large sheet and ran through a heated conveyor in order to slightly melt the PET to hold everything together. Then, the sheet is cut into strips, packaged, and shipped to customers. The recycled carpets used in the product are obtained from California and the recycled clothing is transported from Georgia. Once the insulation is manufactured, it is packaged in cardboard and plastic strapping.

8. Material Composition

Table 2: Material Composition

Material	Quiet-Tech Insulation
Recycled Carpet	33%
Recycled (shredded) Clothing	52%
Low-Melt PET	15%
No substances required to be reported as hazardous per local regulations **are associated with the production of this product.**	

9. Packaging

Table 3: Packaging Inputs, per functional unit

Input	Disposal Mechanism	Value	Unit
Cardboard packaging waste	Landfilled (100%)	0.090	kg
Plastic strapping waste	Landfilled (100%)	0.001	kg

Packaging waste disposal has been modeled as per guidelines in section 2.8.5 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Quiet-Tech insulation is cut into 16”x60” batts which are then stacked in groups of 75 and baled together to be shipped.

10. Product Installation

Other than the insulation itself, there are no additional materials required for installation of Quiet-Tech insulation. The battings are hand-laid into the wall cavity and pieces are cut to size as needed. Packaging and installation waste disposal have been modeled as per guidelines in section 2.8.5 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements.

11. Use Conditions

As required in the PCR, the results are based on the estimated service life (ESL) of the building of 75 years. Since insulation usually lasts as long as the building itself, the RSL of the building is assumed to be 75 years. Hence, no replacements are necessary during the service life of the building. The study does not include the impacts associated with use, maintenance, repair, replacement, and refurbishment (B1-B5) as minimal resources are used in the rare occasion that maintenance, repair, replacement, or refurbishment is necessary.

12. Product Reference Service and Building Estimated Service Life

According to Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL Environment, V3.2, 2018, the Estimated Service Life (ESL) of the building is assumed to be 75 years. Since insulation is expected to last as long as the building itself, the Reference Service Life (RSL) of Quiet-Tech insulation is taken to be 75 years. This assumption is confirmed from the Life Expectancy Chart for Homes from the International Association of Certified Home Inspectors (https://www.nachi.org/life-expectancy.htm), as well as multiple other sources online.

13. Disposal

At the end of its useful life in a building, Quiet-Tech insulation can be sent to the landfill, reused in new buildings, or sent to a waste-to-energy incineration facility. However, all waste has been classified according to regional-specific legislation as laid out in Section 2.8.6 in Part A: Life Cycle Assessment Calculation Rules and Report Requirements from UL Environment, as outlined below.

Table 4: End of Life, per functional unit

	Disposal Mechanism	Values	Unit
Collected as mixed construction waste	-	2.02	kg
Waste to be processed	100% landfilled	2.02 landfilled	kg

LIFE CYCLE ASSESSMENT BACKGROUND INFORMATION

1. Functional Unit

The function of insulation is to slow the rate of heat transfer.

Table 5: Functional Unit

	Quiet-Tech Insulation
Functional Unit [m_2]	1 m_2 of insulation material with a thickness that gives an average thermal resistance R_{SI} = 1 m_2K/W over 75 years
Average Weight [kg]	2.02
Thickness to achieve Functional Unit	0.0538 m (2.12”)

2. System Boundary

This EPD is considered a Cradle-to-Grave study. A summary of the life cycle modules included in this EPD is presented in Table 6. Infrastructure flows have been excluded.

Table 6: Summary of Included Life Cycle Modules

Module Name	Description	Analysis Period	Summary of Included Elements
A1	Product Stage: Raw Material Supply	2019	Raw Material sourcing and processing as defined by secondary data.
A2	Product Stage: Transport	2019	Shipping from supplier to manufacturing site. Fuel use requirements estimated based on product weights and measured and calculated distance.
A3	Product Stage: Manufacturing	2019	Energy and material inputs required for manufacturing products from raw materials. Packaging materials and manufacturing waste are included as well.
A4	Construction Process Stage: Transport	2019	Shipping from manufacturing site to project site. Fuel use requirements estimated based on assumed distance recommended by the PCR (Part B).
A5	Construction Process Stage: Installation	2019	Installation materials, installation waste and packaging material waste.
B1	Use Stage: Use	2019	No inputs required for the use of the product.
B2	Use Stage: Maintenance	2019	No inputs required for maintenance as minimal resources are used in the rare occasion that maintenance is necessary.
B3	Use Stage: Repair	2019	No inputs required for repairs as minimal resources are used in the rare occasion that a repair is necessary.
B4	Use Stage: Replacement	2019	No inputs required for replacement manufacturing as minimal resources are used in the rare occasion that a replacement is necessary.
B5	Use Stage: Refurbishment	2019	Quiet-Tech insulation lasts as long as the building and generally, does not need refurbishment.
B6	Operational Energy Use	2019	No Operational Energy Use of Building Integrated System During Product Use
B7	Operational Water Use	2019	No Operational Water Use of Building Integrated System During Product Use
C1	EOL: Deconstruction	2019	No inputs required for deconstruction.
C2	EOL: Transport	2019	Shipping from project site to landfill, incineration or recycling center. Fuel use requirements estimated based on product weight and assumed distance recommended by the PCR (Part B).
C3	EOL: Waste Processing	2019	Waste processing included for landfill.
C4	EOL: Disposal	2019	Assumes all products are sent to landfill. Assumptions from Part A PCR.
D	Benefits beyond system	MND	Module Not Declared

3. Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44. The majority of the estimations are within the primary data. Some assumptions made in the study that may have affected the results are:

- The primary data was collected as annual totals including all utility usage and production information and was divided by production during this period to derive an energy use-per-production unit for use in the LCA.
- Transport from the manufacturing plant to the installation site is assumed to be 1000 miles.
- Installation tools are used enough times that the per square meter impacts are negligible.
- The disposal pathways and the corresponding transportation distances of unused product waste, packaging waste, and post-consumer product waste are assumed in accordance with the PCR.
- The inclusion of overhead energy, water and waste data was determined appropriate due to the inability to sub-meter and isolate manufacturing energy from overhead energy.
- The use and selection of secondary datasets from GaBi – The selection of which generic dataset to use to represent an aspect of a supply chain is a significant value choice. Collaboration between LCA practitioner, Quiet-Tech associates and GaBi data experts was valuable in determining best-case scenarios in the selection of data. However, no generic data can be a perfect fit. Improved supply chain specific data would improve the accuracy of results, however budgetary and time constraints have to be taken into account.

4. Cut-off Rules

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit. As the tools used during the installation of the product are multi-use tools and can be reused after each installation, the per-declared unit impacts are considered negligible and therefore are not included. No known flows are deliberately excluded from this EPD.

5. Data Sources

Primary data was collected by Quiet-Tech associates for onsite energy and waste during the course of manufacturing. Raw material suppliers provided data related to raw material collection and processing. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was used from GaBi Database Version 9.2, Service Pack 40. All calculation procedures adhere to ISO14044.

6. Data Quality

The geographical scope of the manufacturing portion of the life cycle is New Jersey, USA. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. Primary data were provided by the manufacturer and represent all information for calendar year 2019. Primary data provided by the manufacturer is specific to

the technology that the company uses in manufacturing their product. It is site-specific and considered of good quality. Data used to allocate energy and water on a per-unit of product produced includes overhead energy such as lighting, heating and sanitary use of water. Sub-metering was not available to extract process only energy and water use from the total energy use. Sub-metering would improve the technological coverage of data quality. Secondary data were utilized from the GaBi database and this data is considered of very high quality.

7. Period under Review

The period under review is calendar year 2019.

8. Allocation

General principles of allocation were based on ISO 14040/44. There are no products other than insulation that is produced as part of the manufacturing processes studied in the EPD. Since there are no co-products, no allocation based on co-products is required. To derive a per unit value for manufacturing inputs such as electricity and natural gas, allocation based on total production in square feet was adopted. Discussions with Quiet-Tech staff divulged this was a more representative way than via mass to allocate the manufacturing inputs based on the manufacturing processes used and the types of products created. As a default, secondary GaBi datasets use a physical mass basis for allocation. Throughout the study recycled materials were accounted for via the cut-off method. Under this method, impacts and benefits associated with the previous life of a raw material from recycled stock are excluded from the system boundary. Additionally, impacts and benefits associated with secondary functions of materials at end of life are also excluded (i.e. production into a third life or energy generation from the incineration plant). The study does include the impacts associated with reprocessing and preparation of recycled materials that are part of the bill of materials of the products under study.

9. Comparability and Benchmarking

The user of the EPD should take care when comparing EPDs from different companies. Assumptions, data sources, and assessment tools may all impact the variability of the final results and make comparisons misleading. Without understanding the specific variability, the user is therefore, not encouraged to compare EPDs. Even for similar products, differences in use and end-of-life stage assumptions, and data quality may produce incomparable results. Comparison of the environmental performance of insulation products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR for insulation products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

LIFE CYCLE ASSESSMENT SCENARIOS

Table 7: Transport to building site (A4)

Name	Truck	Unit
Fuel type	Diesel	-
Fuel Economy	38.8	L/100km
Vehicle type	Truck - Trailer, basic enclosed / 45,000 lb payload - 8b	-
Transport distance	1609	km
Capacity utilization	78	%
Weight of products transported	2.1	kg
Volume of products transported	0.0747	m_3

Table 8: Reference Service Life, per functional unit

Name	Value	Unit
RSL	75	years
Declared product properties (at the gate) and finishes, etc.	See Table 1	-
Design application	Installation per recommendation by manufacturer	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Accepted industry standard	-
Indoor environment (if relevant for indoor applications)	Normal building operating conditions	-
Use conditions, e.g. frequency of use, mechanical exposure	Normal building operating conditions	-

Table 9: Installation into the building (A5), per functional unit

Name	Value	Unit
Ancillary materials	0	kg/m_2
Net freshwater consumption	0	kg/m_2
Electricity Consumption	0	kWh
Product loss per functional unit	0.040	kg
Waste materials at the construction site before waste processing, generated by product installation	0.119	kg
Biogenic carbon contained in packaging	0.125	kg CO_2

Table 10: End of life (C1-C4), per functional unit

Name		Value	Unit
Assumptions for scenario development		Product is disposed of with the underlying building materials	
Collection process	Collected separately	0	kg
	Collected with mixed construction waste	2.02	kg
Recovery	Reuse	0	kg
	Recycling	0	kg
	Landfill	2.02	kg
	Incineration	0	kg
	Incineration with energy recovery	0	kg
	Energy conversion efficiency rate	N/A	%
Disposal	Insulation to Landfill	2.02	kg
Removals of biogenic carbon (excluding packaging)		0.291	kg CO_2

LIFE CYCLE ASSESSMENT RESULTS

All results are given per functional unit, which is 1 m_2 of insulation material with a thickness that gives an average thermal resistance RSI = 1 m_2K/W over 75 years. Environmental impacts were calculated using the GaBi software platform. Impact results have been calculated using both TRACI 2.1 and CML 2001-Jan 2016 characterization factors. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development, however the EPD users shall not use additional measures for comparative purposes.

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
Cradle to Grave	X			X	X	X	X	X	X	X	X	X	X	X	X	X	MND

An X in the table above signifies that a module was included in the life cycle assessment. MND stands for Module Not Declared and signifies that a life cycle stage was not evaluated in the life cycle assessment.

Figure 2: Description of the system boundary modules

Table 11: Biogenic Carbon Uptake and Emissions, per functional unit

Parameter	Parameter	Quiet-Tech Insulation	Unit
BCRP	Biogenic Carbon Removal from Product	0.291	kg CO_2
BCEP	Biogenic Carbon Emission from Product	0.013	kg CO_2
BCRK	Biogenic Carbon Removal from Packaging	0.389	kg CO_2
BCEK	Biogenic Carbon Emission from Packaging	0.389	kg CO_2

See Impact Category Key below for definition of acronyms.

Table 12: Acronym Key

Acronym	Text	Acronym	Text
Impact Categories			
ADP-elements	Abiotic depletion potential for non-fossil resources	**GWP**	Global warming potential (100 years, includes biogenic CO_2)
ADP-fossil	Abiotic depletion potential for fossil resources	**ODP**	Depletion of stratospheric ozone layer
AP	Acidification potential of soil and water	**POCP**	Photochemical ozone creation potential (Smog formation potential, SFP)
EP	Eutrophication potential	**Resources**	Depletion of non-renewable fossil fuels
LCI Indicators			
RPR_E	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	**SM**	Use of secondary materials
RPR_M	Use of renewable primary energy resources used as raw materials	**RSF**	Use of renewable secondary fuels
$NRPR_E$	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	**NRSF**	Use of non-renewable secondary fuels
$NRPR_M$	Use of non-renewable primary energy resources used as raw materials	**FW**	Net use of fresh water
HWD	Disposed-of-hazardous waste	**MR**	Materials for recycling
NHWD	Disposed-of non-hazardous waste	**MER**	Materials for energy recovery
HLRW	High-level radioactive waste, conditioned, to final repository	**EE**	Exported energy
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	**CRU**	Components for reuse
RE	Recovered energy		

10. CML Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
ADP-elements [kg Sb eq]	4.09E-07	4.24E-08	1.02E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.08E-09	0.00E+00	1.67E-08	MND
ADP-fossil fuel [MJ]	4.08E+01	3.52E+00	9.76E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.39E-01	0.00E+00	1.25E+00	MND
AP [kg SO_2 eq]	3.95E-03	9.39E-04	1.95E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.61E-05	0.00E+00	3.32E-04	MND
EP [kg Phosphate eq]	7.81E-04	2.49E-04	2.18E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E-05	0.00E+00	4.14E-05	MND
GWP [kg CO_2 eq]	2.05E+00	2.49E-01	1.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.39E-02	0.00E+00	7.85E-02	MND
ODP [kg CFC 11 eq]	3.87E-14	3.19E-17	7.91E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-18	0.00E+00	2.69E-16	MND
POCP [kg Ethene eq]	-6.87E-05	-3.59E-04	2.80E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.95E-05	0.00E+00	2.93E-06	MND

11. TRACI Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
AP [kg SO_2 eq]	4.92E-03	1.29E-03	6.49E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.57E-05	0.00E+00	3.64E-04	MND
EP [kg N eq]	5.08E-04	1.21E-04	1.89E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.57E-06	0.00E+00	2.05E-05	MND
GWP [kg CO_2 eq]	2.05E+00	2.49E-01	1.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.39E-02	0.00E+00	7.85E-02	MND
ODP [kg CFC 11 eq]	3.87E-14	3.19E-17	7.92E-16	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-18	0.00E+00	2.69E-16	MND
Resources [MJ]	5.40E+00	4.71E-01	1.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.53E-02	0.00E+00	1.63E-01	MND
POCP [kg O_3 eq]	9.73E-02	2.95E-02	3.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-03	0.00E+00	6.42E-03	MND

12. Resource Use Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
RPR$_E$ [MJ]	6.33E+00	1.49E-01	1.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-02	0.00E+00	1.04E-01	MND
RPR$_M$ [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRPR$_E$ [MJ]	4.43E+01	3.54E+00	1.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.41E-01	0.00E+00	1.28E+00	MND
NRPR$_M$ [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
SM [kg]	1.76E+00	0.00E+00	3.52E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
FW [m$_3$]	1.07E-02	6.65E-04	2.48E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.40E-05	0.00E+00	1.82E-04	MND

13. Output Flows and Waste Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD [kg]	1.04E-07	6.06E-08	4.03E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.83E-09	0.00E+00	8.57E-09	MND
NHWD [kg]	7.22E-01	2.54E-04	1.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E-05	0.00E+00	1.92E+00	MND
HLRW [kg]	1.28E-06	9.62E-09	2.66E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.26E-10	0.00E+00	1.27E-08	MND
ILLRW [kg]	1.37E-03	7.97E-06	2.83E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.67E-07	0.00E+00	1.08E-05	MND
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
MR [kg]	0.00E+00	0.00E+00	2.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-01	0.00E+00	MND
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
EE [MJ]	1.92E-01	0.00E+00	3.85E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND

LIFE CYCLE ASSESSMENT INTERPRETATION

Overall for Quiet-Tech insulation, Global Warming (GWP) and Abiotic Depletion of fossil fuels are the impact categories of most significance. The largest contributor to these impacts is the low-melt PET that is utilized, contributing almost 60% of the global warming potential of this life cycle stage. Within manufacturing, electricity contributes to 3% of overall GWP impacts while thermal energy contributes to 6%. Additionally, transport of the materials from suppliers to the manufacturing facility contributes 13% of overall GWP impacts. Shipping to customer contributes around 10% of total GWP impacts, while installation contributes around 4% of GWP impacts.

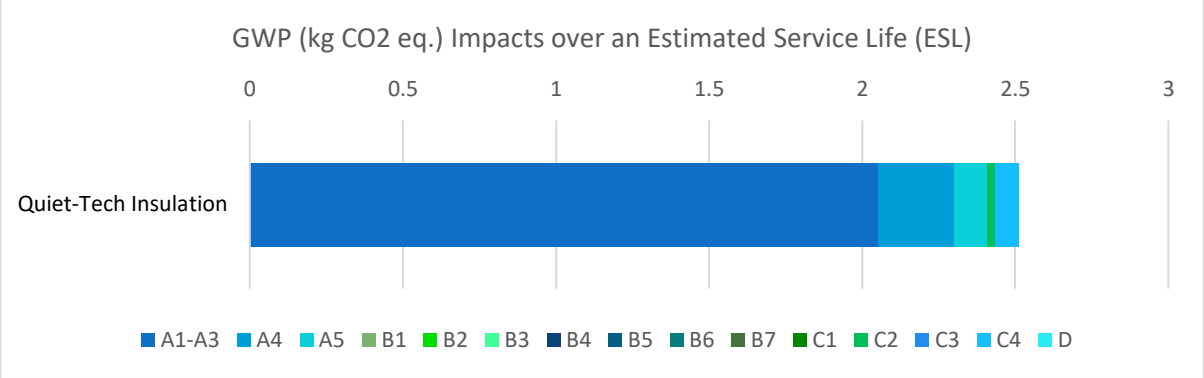

Figure 3: GWP Impacts over the entire lifecycle of Quiet-Tech Insulation

Some limitations to the study have been identified as follows:

- Availability of geographically more accurate datasets would have improved the accuracy of the study.
- Only facility-level data was provided for manufacturing processes. Sub-metering of quiet-tech specific manufacturing lines would allow for more accurate manufacturing impacts to be modeled.
- Due to the limited customer-base, an assumed distance for A4 was utilized. As more product is sold, better customer location data will be collected and utilized in future LCAs.
- Supplier data was not able to be collected for the low-melt PET causing secondary data to be utilized.
- Only known and quantifiable environmental impacts are considered.
- Due to the assumptions and value choices listed above, these do not reflect real-life scenarios and hence they cannot assess actual and exact impacts, but only potential environmental impacts.

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