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A Life Cycle Assessment for an American Residential Duplex

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Abstract
The study examines a life cycle assessment of a typical American residential home in Denver, Colorado USA. A detailed materials list was generated from the list of purchases and subcontractor payments throughout the construction of the house. With this information, the embodied energy and greenhouse gas emissions during three phases - construction phase, operation phase and end-of-life phase of the life of the house were generated using CES EduPack. The construction phase considers all materials, appliances and mechanical equipment to make the house liveable. The operation phase examines the gas, electricity and water consumed during the 50-year life of the house. The end-of-life phase summarizes the effects of different disposal methods of the home. The environmental impacts of the construction phase and operation phase are responsible for a majority of the embodied energy and greenhouse gas emissions while the end-of-life has a negligible effect.

Abstract - Español
El estudio consiste en una evaluación del ciclo de vida de una casa residencial estadounidense típica en Denver, Colorado, EE. UU. A partir de la lista de cobros y pagos durante la construcción de la misma, se genera el inventario de los materiales que sirve para calcular la energía incorporada y las emisiones de gases de efecto invernadero durante tres fases: la fase de construcción, la fase de operación y la fase de fin de la vida útil de la casa. El cálculo se realiza mediante CES EduPack, un programa específico de evaluación del impacto ambiental de los materiales. La fase de construcción considera todos los materiales, electrodomésticos y equipos mecánicos que la casa necesita para ser habitable. La fase de operación examina el consumo de suministros básicos durante los 50 años de vida útil de la casa. La fase de fin de vida resume el impacto ambiental en la demolición. La mayor proporción de la energía incorporada y las emisiones de gases de efecto invernadero se deben a la fase de construcción y la fase de operación, mientras que el final de la vida tiene un impacto menos significativo.

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Nomenclature

CES - CES 2019 Edupack materials software
CO_2 - carbon dioxide
CO_2eq - kilograms of carbon dioxide equivalent
EIA - U.S. Energy Information Administration
EoL - end-of-life
EPA - Environmental Protection Agency
EU - European Union
GEC - global energy consumption
GHG - greenhouse gas emissions
HVAC - heating ventilation and air conditioning
kg - kilogram
km - kilometer
kW - kilowatt
kWh - kilowatt hour
L - liters
LCA - life cycle assessment
LED - light emitting diode
MJ - megajoules
POS - point-of-sale
PV - photovoltaic
PVC - polyvinyl chloride
U.S. - United States

1. Introduction

The constructed environment - residential and commercial - is responsible for large quantities of the global energy consumption (GEC) and greenhouse gas emissions (GHG). Roughly 20% of the GEC and GHG are a product of the constructed environment [1]. Additionally, the United States (U.S.) Energy Information Administration (EIA) estimates energy, used by the building sector, accounted for 20% of the GEC in 2018 and will continue to grow, on average, 1.3% per year from 2018 to 2050 [2]. With a single sector responsible for such large contributions to energy consumption and emissions, “business as usual”, with regard to construction, will not be an acceptable path moving forward regarding climate change. Projections suggest that improvements in construction, within the European Union (EU) alone, would affect 42% of final energy consumption, 35% of all GHG, 50% of all resources and could reduce water consumption by 30% [3]. Across the globe, it is pertinent that developing nations - the largest consumers of resources - lead the way to facilitate the transition to a more sustainable constructed environment.

With climate change, energy consumption, energy efficiency measures, and GHG all being topics at the forefront of conversation today, it is important to understand the impacts of typical construction techniques in the U.S. - a major contributor to global warming. The aim of this analysis is to assess the environmental impact of the construction, occupation and end-of-life (EoL) phases of a typical North American residential home. The focus of this life cycle assessment (LCA) will be the embodied energy, the total energy required to produce the materials used during construction and over the life of the house. At the same time, the GHG represented by carbon dioxide equivalent (CO_2eq) totals, the global warming potential of different GHG if all gases were converted to carbon dioxide, will be considered.

The residential home being considered is located in Denver Colorado, USA and was built using standard concrete foundation and stick framing construction techniques. The home is a duplex and was built with energy efficiency in mind. It is facing south, with a large portion of the windows on this elevation to allow for natural light and passive heating, as shown in Figure 1.

Figure 1. South elevation of duplex at 3505 E Bruce Randolph, Denver Colorado, USA

To view all elevations and construction details, refer to drawings of the home which are included in Appendix 1. In addition to fiberglass insulation, foam insulation was used to seal the house; this is not required by the building code. The duplex has a six-kilowatt (kW) solar photovoltaic (PV) array to produce energy, on site, for consumption or use by the electrical grid. Building materials were chosen to reduce the maintenance during the life of the house, for example brick and stucco were used outside. In theory, the house will never need to be painted again or need exterior details replaced. Inside, polyvinyl chloride (PVC) engineered flooring was used - waterproof and scratch proof it was chosen to last the life of the house and eliminate the use of tile in the kitchen and bathrooms. High efficiency appliances, mechanical equipment and an electric water heater were installed to take advantage of the PV array. High efficiency light emitting diode (LED) lighting is used throughout the home. This is not considered a luxury home and may be considered representative of the typical American home construction of similar size with respect to impact per square foot.

2. Functional Unit and Data Gathering

The functional equivalent for this analysis will be the type of building (residential home) and the total usable area of the duplex, 3,798 square feet (353 square meters). A reference period of time of 50 years will be used. It is not uncommon for a home in the Denver area to be occupied for 50 years or for homes to see a longer life [4]. Lifetimes of similar studies vary from 25 - 100 years, while shorter lifetimes are recommended recently to make studies more applicable to the challenges of climate change mitigation for the upcoming decades [5].

The system boundaries will follow a cradle-to-grave approach while undertaking the LCA process. Life cycle phases will include; the construction phase, operation phase and end-of-life (EoL) phase. The LCA results will be expressed by embodied energy and CO_2eq. This data will be produced by CESEdupack software (CES) [6] that uses the kilogram masses for materials. CES estimates the embodied energy and CO_2eq from mining or production of raw materials, manufacturing products and the transport of materials from production, the point-of-sale (POS) and finally the construction location. Distances from the manufacture to the POS and finally to the construction site were used in the calculations. There is a level of uncertainty in evaluating the life cycle environmental impact of the materials. This is due to the error inherent in the estimation process used to calculate the masses of large quantities of materials. Additionally, assumptions were made regarding product origins when manufactured locations when unknown. The resources considered will consist primarily of plastics, wood, steel and concrete.

The construction phase will contain the pre-phases of raw materials, material supply, production, transportation and use at the construction site. The operation phase will account for water and energy consumed by the house and the carbon dioxide (CO_2) emitted as a result producing this energy. Consumption data was retrieved from the four occupants of the duplex for one year and will be extrapolated for 50 years. Replacement appliances, mechanical systems and ordinary maintenance will be considered during the use phase. The EoL phase will examine various scenarios for the demolition, demolition and partial recycling or complete recycling of the building materials. The geographic scale will be limited to the physical boundaries of the house and materials in close proximity, such as the solar array on the roof. Elements such as infrastructure development, landscaping and any other elements outside the home and excavation will vary greatly from project to project and will not be considered.

2.1 Materials and Construction Phase

The system boundaries include construction materials, omitting materials that account for less than 5% of the total mass by weight to simplify calculations. As a result, any material with a total weight of less than 300 pounds (roughly 136 kilograms), was discarded in calculations. It is worth noting, that with this omittance it is estimated that 99.28% of the total materials being used are being accounted for. The material list in Table 1 was created from the list of expenses that was generated during the construction phase of the home. The list of expenses is included in Appendix 2, along with the full version of the material list showing progressively simplified versions.

Table 1. Material list used in construction phase

Material	Tonnes	Material	Tonnes
Electricity	2,545 (kWh)	Copper	0.13
Diesel	0.17	Aluminum	0.02
Cement, hardy board, brick	147.69	Fiberglass insulation	0.33
Steel	2.26	Gypsum drywall	3.18
Lumber	18.88	Pine doors	0.51
Gutters	0.26	Cabinets	0.80
Shingles	2.02	Granite	0.72
Ice barrier	0.00	Coretec flooring	0.70
Glass	0.29	Acrylic bathtubs	0.22
Vinyl	0.52		

After compiling a material list containing respective masses, the data was analyzed by CES to obtain embodied energy and CO_2eq. An example of the summarized results for lumber, are shown in Table 2, while the complete energy analysis of each material is included in Appendix 4.

Table 2. Lumber embodied energy and CO_2eq footprint summary

Phase	Energy (MJ)	Energy (%)	CO_2eq (kg)	CO_2eq (%)
Material	3.47E+05	92%	1.64E+04	88%
Manufacture				
Transport	2.06E+04	6%	1.48E+03	8%
Use				
Disposal	9.44E+03	3%	6.61E+02	4%
Total (for first life)	3.77E+05	100%	1.85E+04	100%
EoL potential	-9.87E+04		2.66E+04	

For certain materials, as is the case with lumber, the manufacture category values are zero; for these materials CES calculates this value into the material energy category. All lumber was produced by Boise Cascade of Boise, Idaho, USA and purchased from Straight Lumber, in Denver, Colorado. Distances used by CES are 1,317.7 kilometers (km) and 10.3 km respectively. In Figure 2, marked by the green pin, the location of the home is indicated. Orange pins show the locations of the sources and POS of lumber, steel and cement materials, making up the majority of the mass of the duplex.

Figure 2. Locations of the home (green), lumber, steel and cement (orange) sources

The various lumber types that were used include Douglas-Fir, Pine, plywood composite and Glulam beams. The values associated with the different lumber types can be referenced in Appendix 3. An equivalent process was executed for all materials listed in Table 1, with CES results available in Appendix 3 for all materials.

Materials used in the heating ventilation and air conditioning (HVAC) material calculations did not follow this process; information could not be obtained retroactively from the subcontractor regarding material quantities. A study of a Canadian homes' HVAC system is used to obtain values for embodied energy and CO_2eq. The home in the study is of a comparable size and uses the same construction methods [7].

The environmental impacts of the construction of the house will be outlined next. Site excavation was done with a CAT 320D excavator over the course of two days. The CAT 320D consumes 18.5 liters of diesel per hour, operating for 12 hours for two days [8]. It is estimated that 444 liters of diesel were consumed during the excavation process emitting 1,190 kg of CO_2 [9]. The electricity consumed during the construction process was gathered from the utility provider, Xcel Energy, totaling 2,545 kilowatt hours (kWh) or 9,160 megajoules (MJ) consumed. The CO_2 emitted from electricity consumption is 2,296 kg, using Xcel Energy's emission intensity of 1.19 pounds CO_2 per kWh for 2018 [10].

The appliances and mechanical equipment required to make the house livable after construction are listed in Table 3 with values for embodied energy and CO_2eq from LCAs previously completed [7] [11] [12] [14] [14]. Data was not located regarding a dishwasher; values were assumed to be equal to that of a stove. GHG for a refrigerator were not included in the referenced text [12] and values were assumed equal to that of a stove. The values for embodied energy and GHG of the inverter are extrapolated using proportions from the data of a 2.2 kW inverter to obtain values for a 3 kW inverter [15].

Table 3. Embodied energy and GHG for appliances and mechanical systems

Component	Energy (MJ)	CO_2eq (kg)
Dishwasher	1.66E+02	9.68E+01
Stove	1.66E+02	9.68E+01
Fridge	5.99E+03	9.68E+01
6 kW Solar PV	1.31E+05	7.61E+03
Inverter	5.76E+03	4.58E+03
Water Heater	8.01E+02	3.20E+02
Air Conditioner	2.40E+03	2.50E+02
Furnace	8.01E+02	5.10E+01

Table 4 shows the total embodied energy and GHG CO_2eq for the different categories affecting the environmental impact, the manufacture and transportation of materials, the electricity and diesel used during the construction phase of the home. Figures 3 and 4 give a visual representation of the categories that control the environmental impact of the home.

Table 4. Totaled embodied energy and GHG for construction phase

	Energy (MJ)	Percent of total	CO_2eq (kg)	Percent of total
Materials	1.15E+06	81.9%	9.90E+04	80.7%
Manufacture	4.25E+04	3.0%	3.12E+03	2.5%
Transport	5.63E+04	4.0%	4.05E+03	3.3%
Diesel			1.19E+03	0.9%
Electricity	9.16E+03	0.7%	2.30E+03	1.9%
Appliances, mechanical	1.47E+05	10.5%	1.31E+04	10.7%
Total	**1.41E+06**	**100%**	**1.23E+05**	**100%**

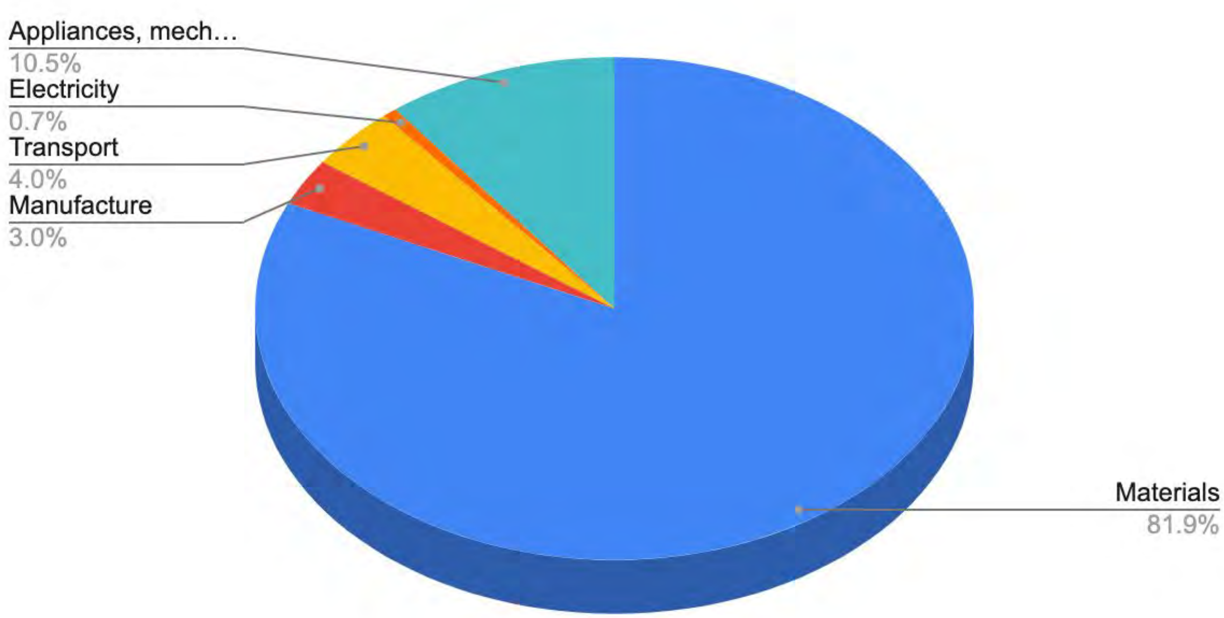

Figure 3. Embodied energy, category contributions

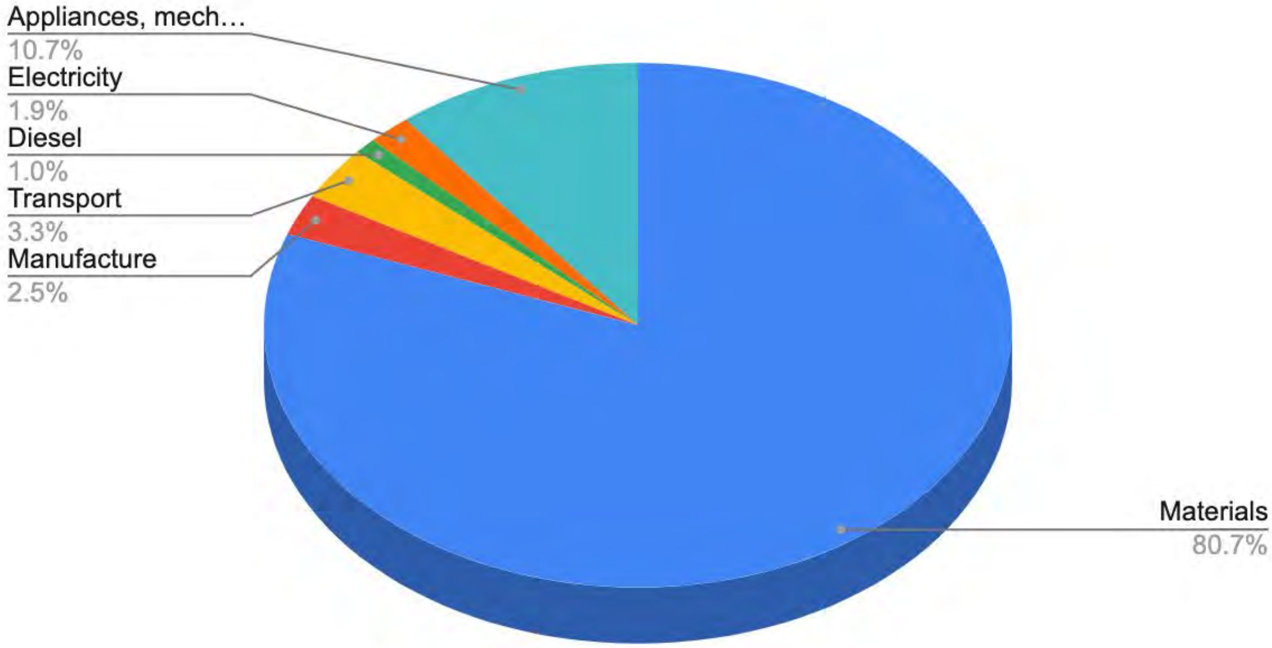

Figure 4. GHG, category contributions

2.1.1 Life Cycle Impact Assessment - Discussion

The summarized results of Table 4 highlight the impact of materials on the total impact of the pre-use phase of the home. Materials are responsible for nearly 81.9% of the total impact, of that, cement makes up 44.3% of the embodied energy and 62.9% of the GHG. The lumber category accounts for the next largest impact with 30.3% of the embodied energy and 16.7% of the GHG. This is not surprising; these material categories contribute to a majority of the total mass. Cement, hardy board and other related materials account for nearly 82.6%, of total mass, while the lumber category constitutes 10.6% - together constituting 93.2% of the total mass. The environmental impact of each material is presented in Figures 5 and 6.

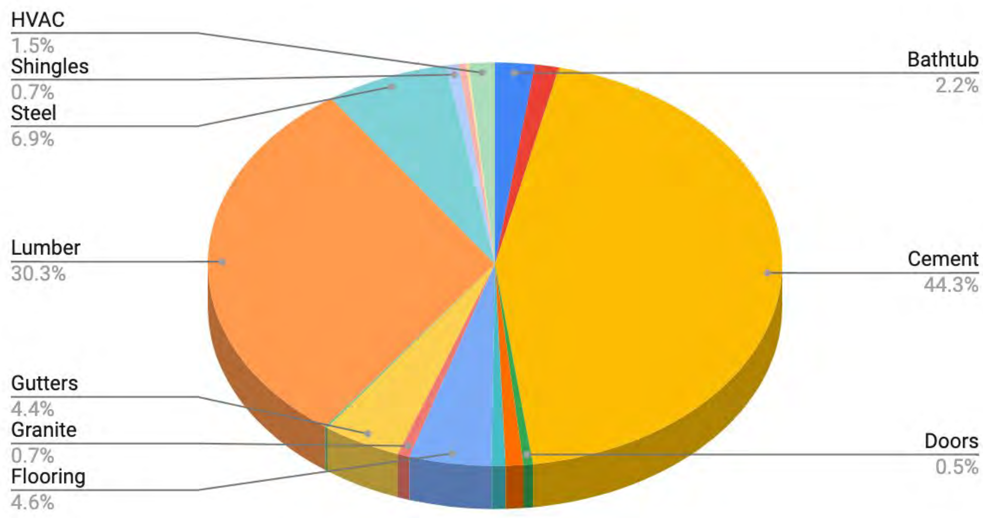

Figure 5. Embodied energy, contributed by each material category

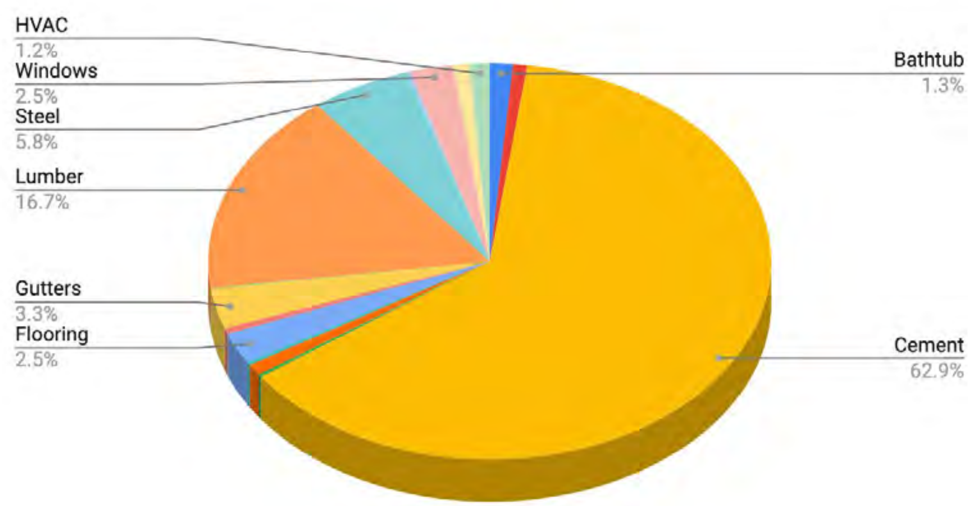

Figure 6. CO_2eq contributed by each material category

With cement having the largest contribution to the environmental impact of the house, a reduction of the quantity of the cement used in the foundation will be considered. While continuing to meet local building codes the height of the foundation could be reduced to three feet, from the current nine-foot height. This minimum is required to negate the effects of the frost or freezing ground that could have detrimental effects on the operation of the house. This would reduce the quantity of concrete used in the foundation by approximately 66%, or nearly 40,000 kgs, reducing the total embodied energy of the house by 7.68% and the GHG emissions by 13.62%. A modest reduction of the total impact of the house. This does result in the reduction of the usable square footage of the house by 1,524 square feet (141 square meters), eliminating the basement with the reduction in foundation height.

Using the U.S. Environmental Protection Agency's (EPA) greenhouse gas equivalencies calculator [16], normalized results have been generated. Details outlining the information the EPA uses within its calculator are provided in Appendix 3. The impact an average European has, over the course of a year, is also evaluated for comparison [17]. The embodied energy required for construction is equivalent to the GHG from 59.7 passenger vehicles driven for one year, the CO_2 emissions from 640 barrels of oil, the carbon sequestered by 361 acres of U.S. forest in one year or the average emissions of 9 Europeans. These values are summarized in Table 5, as well as the equivalent of the CO_2eq for this stage.

Table 5. Comparison of different energy equivalencies, construction phase

Consumption Equivalents		
	Embodied Energy	**CO_2eq**
Passenger vehicles driven for one year	59.7	26.5
Barrels of oil consumed	640.0	284.0
Acres of U.S. forest in one year	361.0	160.0
Average European	9.0	12.0

2.2 Operation Phase

The operation phase will take into account the consumption of natural gas, electricity and water over a 50-year lifespan. Utility consumption is based on observed data received from occupants of the dwelling over the course of a year. Table 6 presents the annual consumption of gas, electricity and water for the home.

Table 6. Annual consumption of gas, electricity and water

Month	Electricity Consumed (kWh)	Gas Consumed (therm)	Water (liters)	Energy Generated (kWh)
1	640	96	3.63E+02	6.54E+02
2	650	96	3.63E+02	5.14E+02
3	250	104	3.94E+02	5.80E+02
4	160	55	2.08E+02	7.98E+02
5	308	50	1.89E+02	8.52E+02
6	420	28	1.06E+02	1.07E+03
7	190	2	7.57E+00	1.02E+03
8	80	0	0.00E+00	1.17E+03
9	60	25	9.46E+01	9.98E+02
10	30	60	2.27E+02	1.11E+03
11	250	74	2.80E+02	6.80E+02
12	440	86	3.26E+02	4.62E+02
Yearly Total	**3,478**	**676**	**2.56E+03**	**9.90E+03**

The impacts of replacement appliances, inverters, and roofing materials will be considered in this phase. The life expectancy for each component was taken from the Study of Life Expectancy of Home Components [18]. The inverter life expectancy used in calculations is 12 years. This was chosen after discussing real world inverter lifespans seen by Buglet Solar Electric, an installer in Golden, Colorado, USA. This coincides with many manufacturer inverter warranty lengths. The energy and GHG impacts of each component and the number of times each is replaced and their respective total impact are in Table 7.

Table 7. Life expectancy of expected replacement appliances and materials

Component	Life expectancy	Times Replaced	Energy per component (MJ)	CO_2eq (kg)	Energy of replacement components (MJ)	CO_2eq of replacement components (kg)
Dishwasher	15	3	1.66E+02	9.68E+01	4.97E+02	2.90E+02
Stove	15	3	1.66E+02	9.68E+01	4.97E+02	2.90E+02
Fridge	15	3	5.99E+03	9.68E+01	1.80E+04	2.90E+02
Solar panels	25	1	1.31E+05	7.61E+03	1.31E+05	7.61E+03
Inverter	12	4	5.76E+03	4.58E+03	2.30E+04	1.83E+04
Water Heater	10	4	8.01E+02	3.20E+02	3.20E+03	1.28E+03
AC	15	3	2.40E+03	2.50E+02	7.20E+03	7.50E+02
Roof	20	2	9.98E+03	2.46E+02	2.00E+04	4.92E+02
Furnace	20	2	8.01E+02	5.10E+01	1.60E+03	1.02E+02
Total					**2.05E+05**	**2.94E+04**

Table 8 lists the total embodied energy and GHG of all replacement components, electricity, gas and water consumption during the 50-year life of the house. Electricity consumption is adjusted on a yearly basis for degradation of the solar PV system. This accounts for degradation of 2% after the first year and 0.5% for every year after for the LG320N1K solar panels and an annual reduction in electricity production. This cycle is restarted on year 25 when the panels reach the end of their 25-year life expectancy [19]. After these adjustments, the total energy consumed over 50 years is totaled.

Table 8. Gas, electricity and water consumption totals

Component	50 year total	Energy (MJ)	Percent of total	CO_2eq (kg)	Percent of total	Total water (liters)
Gas	3.38E+04 Therms	3.92E+04	3.25%	1.79E+03	1.01%	
Electricity	2.68E+05 kWh	9.64E+05	79.78%	1.46E+05	82.34%	
Appliances, mechanical, roof		2.05E+05	16.97%	2.94E+04	16.65%	
Total		**1.21E+06**	**100.00%**	**1.77E+05**	**100.00%**	**1.78E+07**

2.2.1 Life Cycle Impact Assessment - Discussion

The impact of the house during its use phase is influenced greatly by the electricity consumption of the house, accounting for nearly 80% of the energy and 82% of the GHG. The replacement appliances, shingles on the roof and solar panels account for roughly 17% of the embodied energy and GHG, the next largest portion of the impact. The gas consumption of the duplex has the smallest contribution to the impact with 3% of the embodied energy and 1% of the GHG emissions. The only consumption of natural gas in the house is the furnace for heating. Electric stoves and water heaters were installed to take advantage of the solar PV installed on this house. If gas stoves and water heaters were installed, which are often typical in American homes, the impact of the gas consumption would increase and electricity consumption would decrease.

It should be noted that solar panels do not degrade as fast as conservative manufacture estimates. With the conservative estimate listed in the panel specifications the solar PV system is still producing 86% and 73.5% of its nominal power at year 25 and 50 respectively [20]. It is not likely that the solar panels will be replaced in the lifetime of the house, consequently this would reduce the overall environmental impact of the solar panel system and total home impact. If the solar panels were not replaced at year 25, the 50-year embodied energy would be reduced by 10.85% and the GHG reduced by 4.30%. This would be an expense averted and considerably reduce the environmental impact.

Again, using the EPA's greenhouse gas equivalencies calculator, normalized results are shown in Table 9 for comparison purposes with the construction phase. The embodied energy required for construction is equivalent to the GHG from 59.7 passenger vehicles driven for one year, the CO_2 emissions from 640 barrels of oil or the carbon sequestered by 361 acres of U.S. forest in one year. Comparing the consumption equivalents, Table 9 contains the equivalent of the construction and operations phases of the life of the house.

Table 9. Comparison of different energy equivalencies, construction and operation phase

Consumption Equivalents	Construction phase		Operation phase	
	Embodied Energy	**CO_2eq**	**Embodied Energy**	**CO_2eq**
Passenger vehicles driven for one year	59.7	26.5	51.3	38.0
Barrels of oil consumed	640.0	284.0	54.9	409.0
Acres of U.S. forest in one year	361.0	160.0	310.0	231.0
Average European	9.0	12.0	8.0	18.0

According to the EPA, the average American consumes 333 liters of water per day in their home [21] or 118,419 liters per year. The total water consumed by the four occupants of the duplex for the last year was 355,320 liters, this includes the water used outside of the house for watering the grass. Considering average rates given by the EPA, the current occupants are consuming 118,359 liters less annually. Consumption rates lower than the national average could be due to the fact that all faucets, shower heads and toilets in the duplex are new and high efficiency products. This consumption value is highly dependent on occupant behaviors and should be expected to vary throughout the life of the dwelling.

For comparison purposes, 15,000 liters of water are required in the production of one kilogram of beef and 8,000 liters are required during the production of a pair of jeans [22]. The water consumed by the duplex in one year uses the same amount of water to produce 23 kilograms of beef or 44 pairs of jeans. The lifetime consumption of water in the duplex is equal to 1,884 kilograms of beef and 2,220 pairs of jeans.

2.3 End-of-Life (EoL) Phase

There are multiple avenues to analyze the end-of-life phase of a residential house. The first, to be examined, will be the demolition of the house while sending all materials directly to the landfill. The second is if materials are completely recycled. The third method will be using the recycle rates obtained from the EPA in their 2015 Analysis of Construction and Demolition Debris Management in the United States [23]. Table 10 contains the embodied energy and GHG for complete disposal of all materials used. CES calculates the embodied energy and GHG for different disposal methods of materials. Results were produced for the different disposal options for each material and can be referenced in Appendix 3. Table 10 has the totals for embodied energy and GHG for the scenario where all materials are disposed of in a landfill.

Table 10. Impact for complete disposal of home materials

	Energy (MJ)	**CO_2eq (kg)**
Disposal	3.57E+04	2.51E+03

Table 11 below lists the embodied energy and GHG for the complete recycling or down-cycling of all materials.

Table 11. Impact for complete recycling of home materials

	Energy (MJ)	**CO_2eq (kg)**
Recycle	9.07E+04	6.35E+03
EoL Potential	-1.97E+05	-1.09E+04
Total	**-1.06E+05**	**-4.59E+03**

In Table 12, the recycle rates of U.S. residential construction materials are listed. Combustion of recycled wood materials has significant CO_2 emissions and will be considered in the following scenario. It is assumed materials not listed in the following Table will be discarded at a landfill at a rate of 100% and the values used in the first end-of-life scenario will be used.

Table 12. Recycle rates of U.S. residential construction materials

Material Type	Total next use	Combustion
Concrete	82.57%	
Wood	30.54%	20.51%
Gypsum drywall	17.16%	
Metal	84.95%	
Asphalt shingles	15.03%	

In Table 13, the environmental impact results for partial recycling of materials at EPA rates can be reviewed. With the combustion of wood, the energy required for the disposal and recycling of materials can be recovered and energy is recovered in the process. However, significant GHG must be considered as a negative impact emission that is not realized in other scenarios.

Table 13. Environmental impact results for partial recycling of materials

	Energy (MJ)				CO_2eq (kg)			
	Disposal	Recycle	EoL Potential	Combustion	Disposal	Recycle	EoL Potential	Combustion
Cement	5.14E+03	6.09E+04	-1.22E+04		3.61E+02	4.27E+03	-8.50E+02	
Lumber	2.63E+03	2.88E+03	-5.77E+02	-2.02E+04	1.83E+02	6.60E+01	-1.30E+01	5.46E+03
Drywall	5.26E+02	2.73E+02	-5.44E+01		3.70E+01	1.90E+01	-4.00E+00	
Steel	1.43E+03	1.43E+03	-5.28E+04		5.00E+00	6.24E+03	-3.69E+03	
Shingles	2.12E+02	2.12E+02	-9.50E+02		2.40E+01	3.80E+01	-3.00E+00	
All other materials	9.25E+02				6.47E+01			
Total				**-1.03E+04**				**1.22E+04**

2.3.1 Life Cycle Impact Assessment - Discussion

The chosen method of disposal will dictate the type of contributions the demolition of the house will have on the total environmental impact. The smallest impact is realized with the complete recycling of the materials of the house. This scenario can offset some of the impact seen by the house in previous stages, however the impact is limited. The orders of magnitude in this stage are much less than the construction and operation phases of the house. Complete recycling of all materials is also not a likely outcome for the materials used to construct the house and the quality of the materials will be degraded when compared to their first use. Figure 6 quantifies the results for the different EoL options for the home, with only one scenario resulting in the offset of energy and emissions.

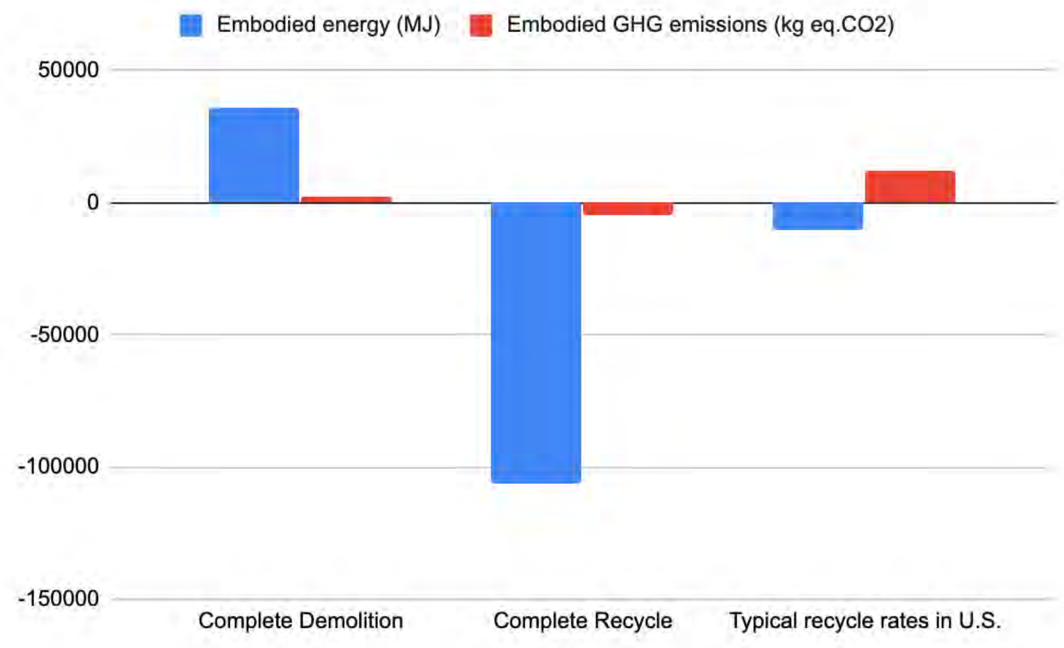

Figure 6. Embodied energy and GHG for different EoL options

Using the results for the most optimist disposal of the house, consumption equivalents are compared in Table 14. If all materials are recycled, slightly more than 10% of the embodied energy for the previous two phases can be recovered, while only 1.5% of the GHG emissions are negated. The results suggest that if complete recycling of the materials is possible, it should be executed. It is hard to declare if the current recycle rates in the U.S. justify the process, considering the major gains in energy offset result in additional GHG being produced. Complete disposal requires slightly more energy, but has less GHG emissions.

Table 14. Comparison of different energy equivalencies, all phases

	Consumption Equivalents					
	Construction phase		Operation phase		EoL Phase	
	Embodied Energy	CO_2eq	Embodied Energy	CO_2eq	Embodied Energy	CO_2eq
Passenger vehicles driven for one year	59.7	26.5	51.3	38.2	-0.4	2.6
Barrels of oil consumed	640.0	284.0	54.9	409.0	-4.7	28.3
Acres of U.S. forest in one year	361.0	160.0	310.0	231.0	-2.6	15.9
Average European	9.0	12.0	8.0	18.0	-0.1	1.2

3. Life Cycle Totals

Figures 7, 8 and 9 show the totals for each of the phases and their respective environmental impact of the home. Arguably the worst-case scenario - complete disposal of the house at a landfill - is included in this graph to show how much greater the environmental impact of the home is in the previous two phases.

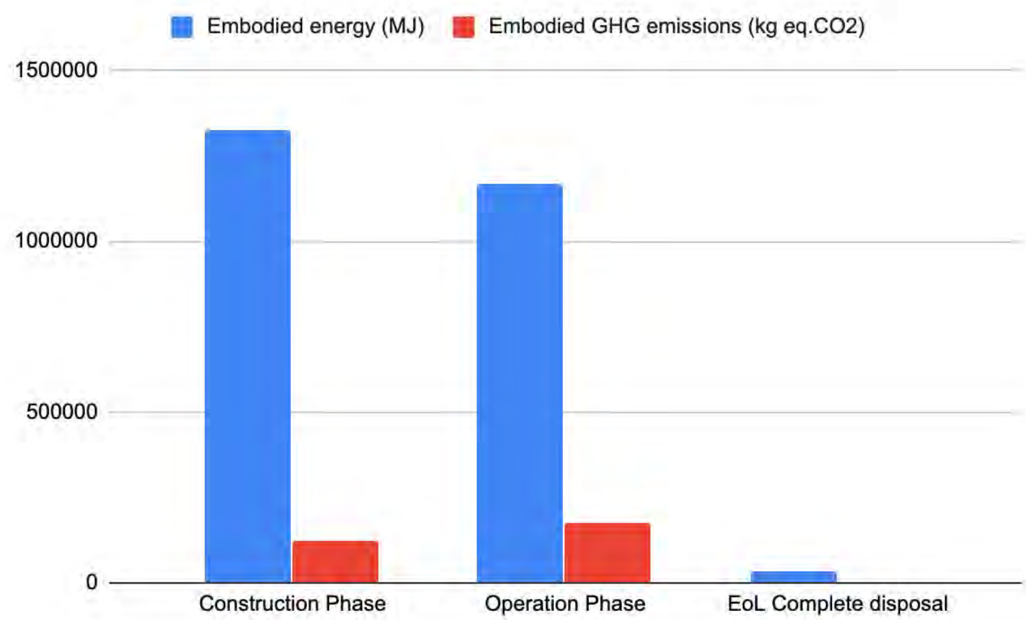

Figure 7. Embodied energy and GHG

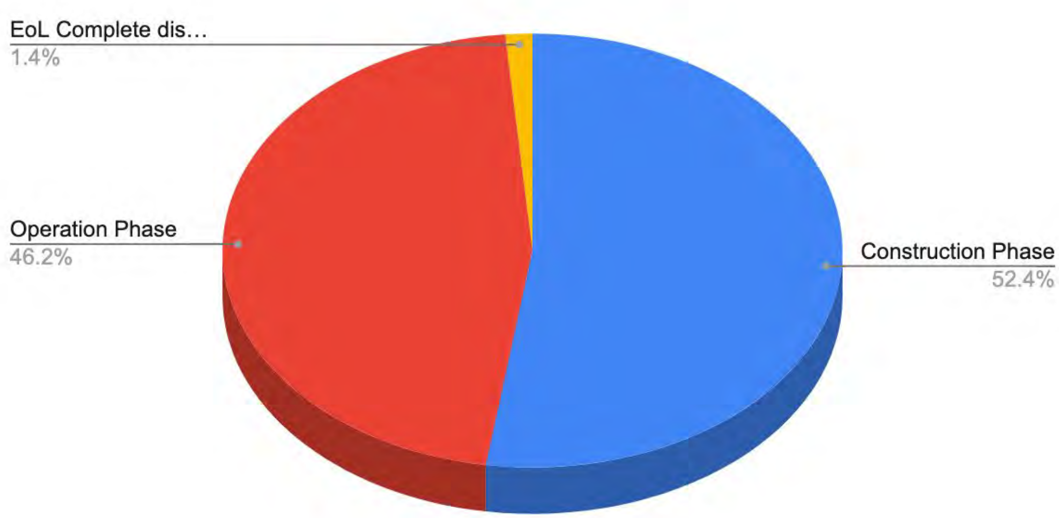

Figure 8. Embodied energy phase contributions

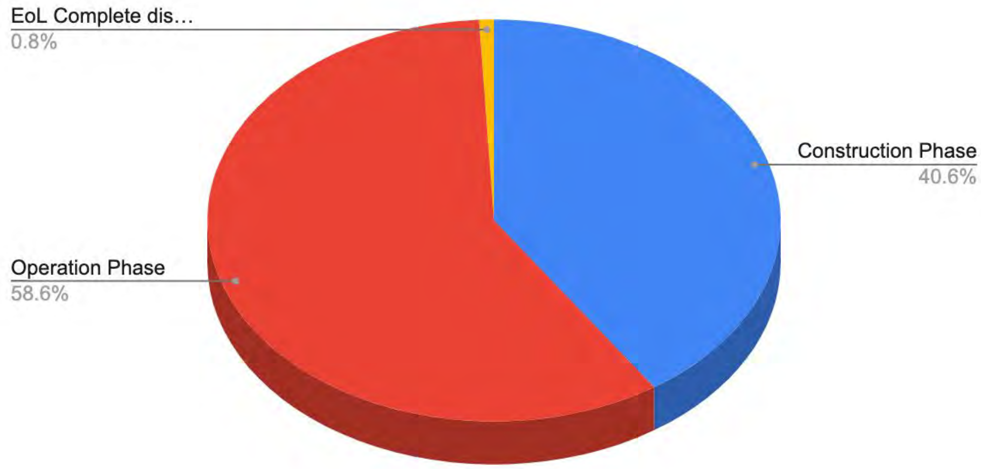

Figure 9. GHG total phase contributions

With summarized results of the three phases it is possible to compare the impact each phase has on the total impact over the life of the house. The initial phase and the operation phase of the home have similarly large impacts that are orders of magnitude larger than the EoL phase. Figures 8 and 9 show the large contributions from the initial phase and use-phase of the home. The EoL makes up less than 2% of the total contribution to embodied energy and GHG, using data for the least optimistic scenario.

4. Conclusions

A phase-based LCA provides a breakdown of the life cycle environmental impacts of a typical American residential home. Unfortunately, the EoL potential is minimal when compared to the previous two stages of the house. The contributions for embodied energy and CO_2 equivalent by the first two stages of the house, 98.6% and 99.2% respectively, make up a very high percentage. However, they are in line with the findings of other LCA studies of buildings with ranges of 60-90% [24].

The highlighted roles of the materials used during construction and the energy required to occupy the house are the areas where the most improvement in embodied energy and GHG reductions can be made. It is important to consider; the house is already constructed and the environmental impact of this phase already done. This study is another example that demonstrates the need for sustainable building materials and building methods. The use of the large quantities of raw resources amplifies the importance in developing new, more efficient and thought-out methods of construction that allow these materials to be reused - reducing the quantity of raw materials needed for the next construction project.

The energy consumption of the house is where the largest impact can be made, specifically with reduction of energy use from the grid. An expansion of the existing solar array should be considered if major reductions are to be made over the life of the house. With the house already sealed by high quality and duplicative insulation, there is little improvement to be made in the losses department.

It has been established that the constructed environment is responsible for a massive portion of all resources consumed by modern and developed societies. This is another case study that highlights the large concentration of natural resources and embodied energy confined to the boundaries of a two-family home. Reduction in the size, amount of materials, and type of materials used can provide improvements in the pre use phase of the home. Energy consumed during the life of the house calls attention to the importance of reducing consumption and transitioning energy sources to renewable energy - reducing the impact of energy consumed from the grid. Until this transition is met, homeowners can help by purchasing high efficiency appliances, lights, mechanical equipment and solar PV when possible. The small EoL benefits suggest that extending the life of the house may be the best use of the resources until construction methods more conducive to recycling are established.

5. Resumen en Español

Este estudio examina un análisis del ciclo de vida (ACV) de una casa residencial estadounidense, de Denver, Colorado, EE.UU. El área total utilizable del dúplex es de 353 metros cuadrados (3.798 pies cuadrados) y se utilizará un período de referencia de 50 años para la vida útil de la casa. Los límites del sistema seguirán un método “cradle-to-grave”, con las unidades de los resultados en megajulios de energía incorporada y kilogramos de CO_2eq. El ACV está compuesto de tres fases: la fase de construcción, la fase de operación y la fase de fin de vida. Se ha generado una lista detallada de materiales a partir de la lista de compras durante la construcción. Con esta información, la energía incorporada y las emisiones de gases de efecto invernadero durante las tres fases se han calculado con el programa CESEduPack.

La fase de construcción considera todos los materiales, electrodomésticos y equipos mecánicos para hacer que la casa sea habitable. Los resultados en la Tabla 4 destacan el impacto de los materiales en el impacto total en esta fase de la vida del hogar. Los materiales son responsables de casi el 81,9% del impacto energético total y el 80,7% del total de GEI (gases de efecto invernadero). Los materiales responsables de la mayoría de las contribuciones son hormigón y madera, que representan aproximadamente el 82,6% de la masa de la estructura.

La fase de operación examina el gas, la electricidad y el agua consumidos durante los 50 años de vida de la casa. Estos datos se han adquirido extrapolando los datos de consumo de los ocupantes de la casa durante un período de un año. Se han considerado los impactos de los electrodomésticos nuevos, los inversores para los paneles solares y los materiales para tejados, utilizando las tasas media de vida útil de los EE.UU. de cada componente. Esta fase de operación depende en gran medida del consumo de electricidad de la casa, responsable de casi el 80% de la energía y el 82% de los GEI. La sustitución de electrodomésticos y materiales también juega un papel importante, ya que representan el 17% de la energía incorporada y CO_2eq.

La fase de fin de vida resume los efectos de los diferentes métodos de fin de vida del hogar: eliminación completa, eliminación parcial y reciclaje o reciclaje completo de todos los materiales. Se ha considerado el método de eliminación más probable, utilizando las tasas de reciclaje de la EPA de 2015 de los EE.UU. para edificios residenciales. Los materiales considerados para el reciclaje son hormigón, madera (reciclado y combustión), paneles de yeso, tejas de metal y asfalto para el tejado. Las tasas de reciclaje se pueden ver en la Tabla 12. Los resultados de este método de eliminación son difíciles de justificar, ya que la compensación de la energía incorporada no es significativa y hay un aumento de GEI, como resultado de la combustión de la madera.

Comparar los equivalentes de energía y emisiones de la casa con el consumo anual de un equivalente europeo promedio proporciona un marco de referencia útil. La energía incorporada de la fase de construcción, operación y EoL es equivalente al total anual consumido por 9, 8 y -0,1 europeos, mientras que el CO_2eq de las fases es 12, 18 y 1,2 respectivamente. Se pueden ver comparaciones adicionales en la Tabla 14. Los impactos ambientales de la fase de construcción y la fase de operación son responsables de la mayoría de las emisiones de energía incorporada y gases de efecto invernadero, mientras que el final de la vida útil tiene un efecto insignificante.

Se ha establecido que el entorno construido es responsable de una porción masiva de todos los recursos consumidos por las sociedades modernas y desarrolladas. Este estudio destaca la gran concentración de recursos naturales y energía incorporada en un hogar. La reducción en el tamaño, la cantidad de materiales y el tipo de materiales utilizados puede proporcionar mejoras en la fase previa al uso del hogar. La energía consumida durante la vida de la casa llama la atención sobre la importancia de reducir el consumo y la transición de las fuentes de energía a energías renovables, reduciendo el impacto de la energía consumida desde la red. Hasta que se cumpla esta transición, los propietarios pueden ayudar comprando electrodomésticos de alta eficiencia, luces, equipos mecánicos y energía solar fotovoltaica cuando sea posible. Los pequeños beneficios de EoL sugieren que extender la vida útil de la casa puede ser el mejor uso de los recursos hasta que se establezcan métodos de construcción más propicios para el reciclaje.

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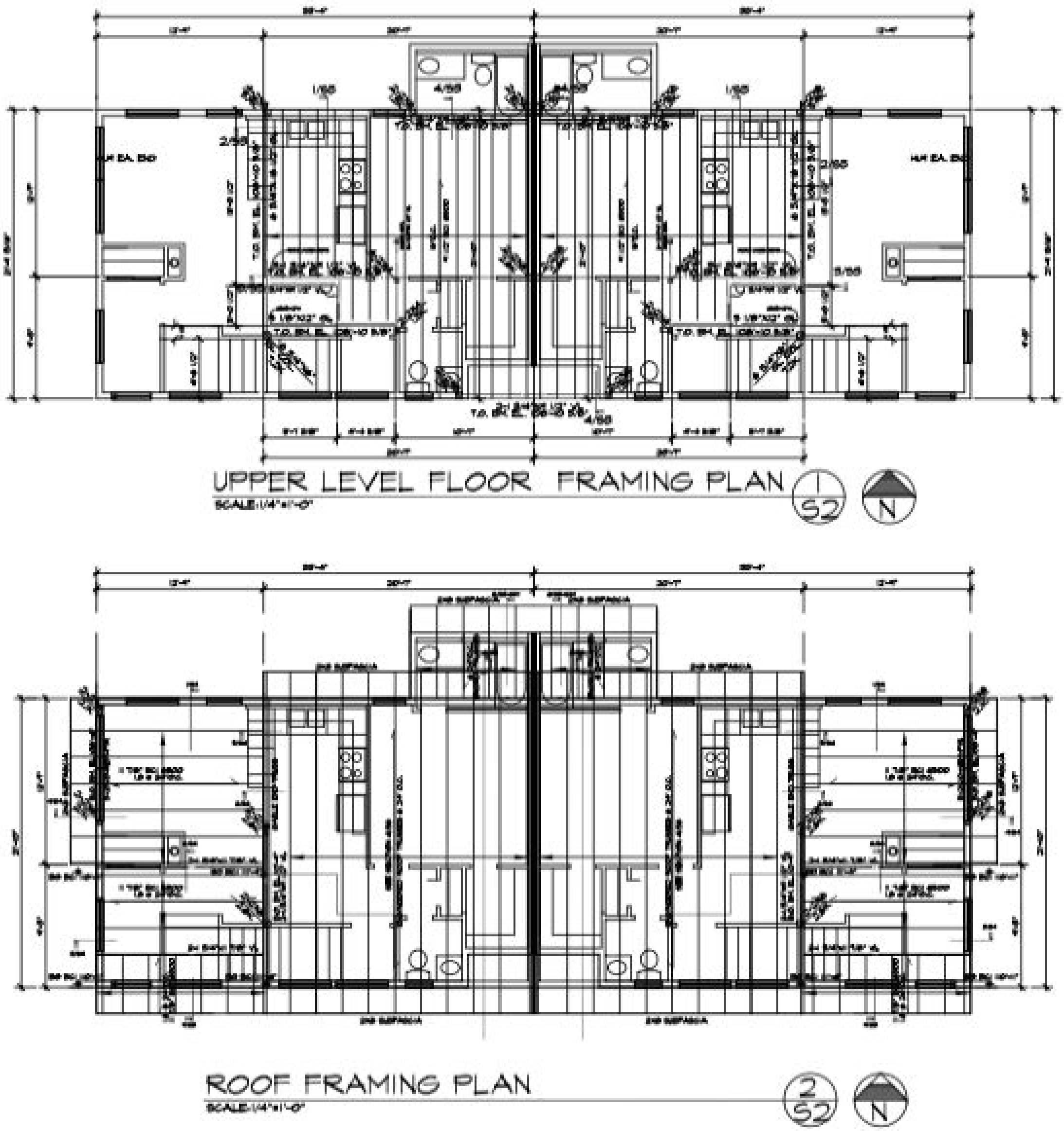
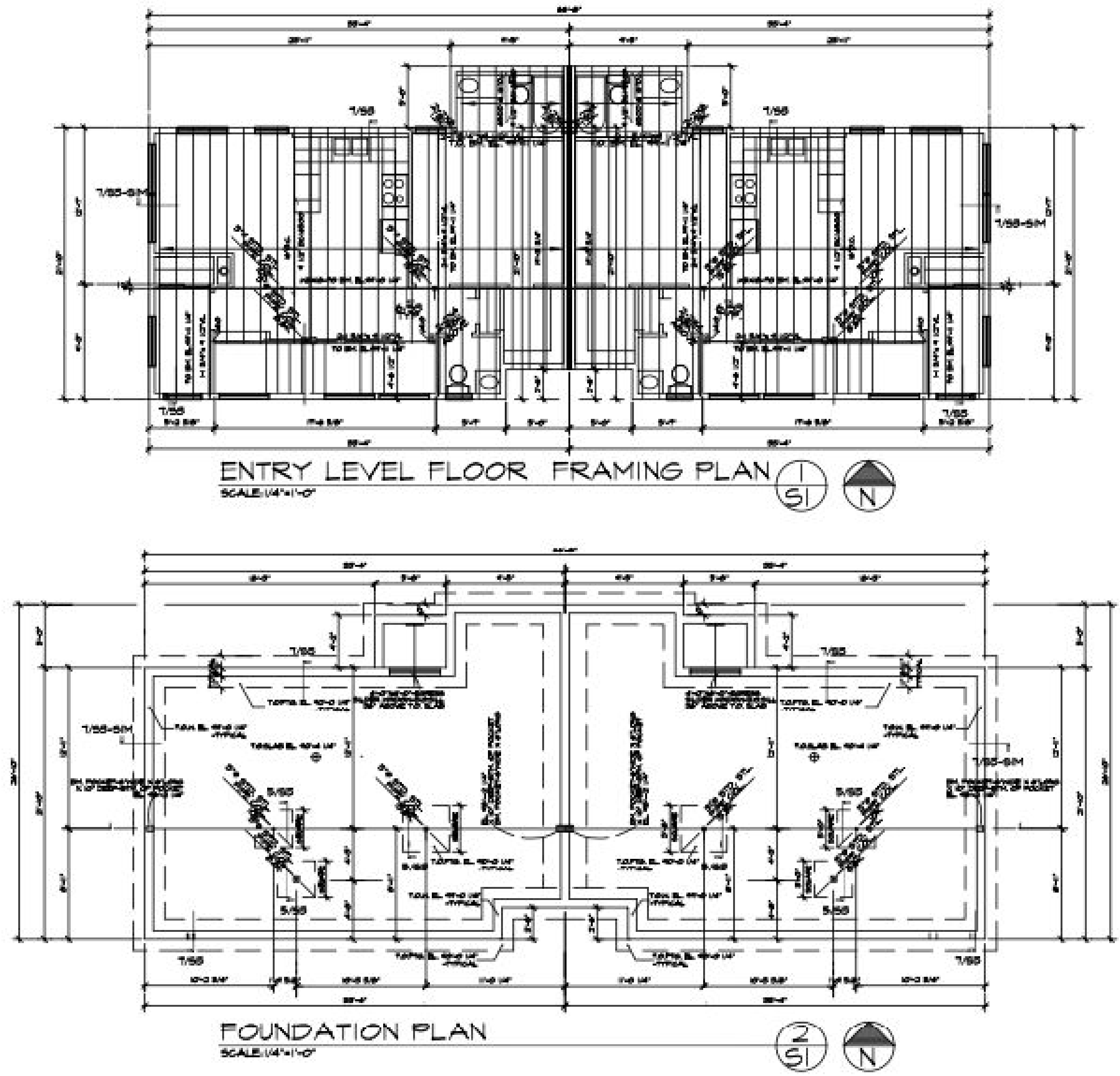
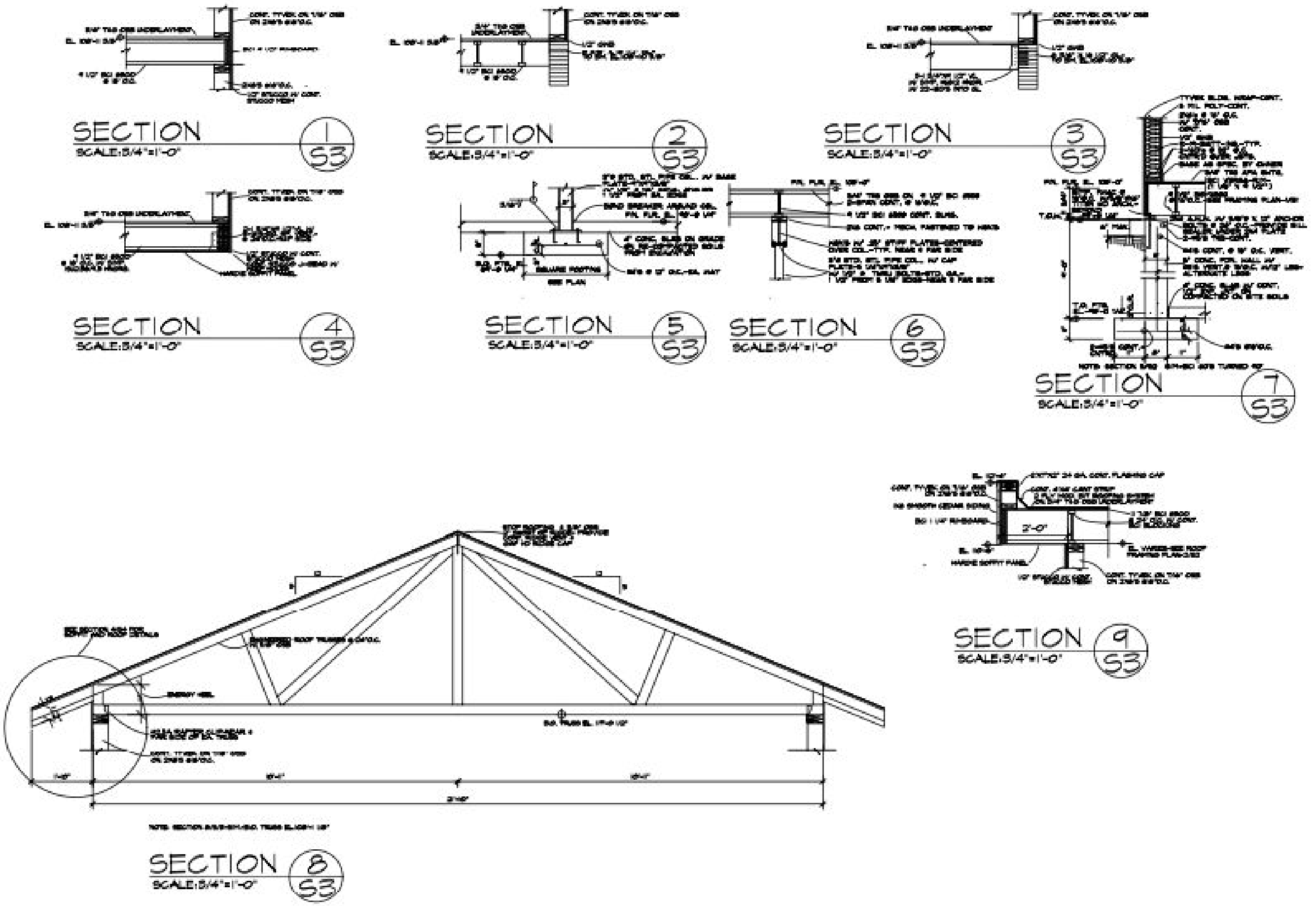
Appendix 1. House Design and Construction Details



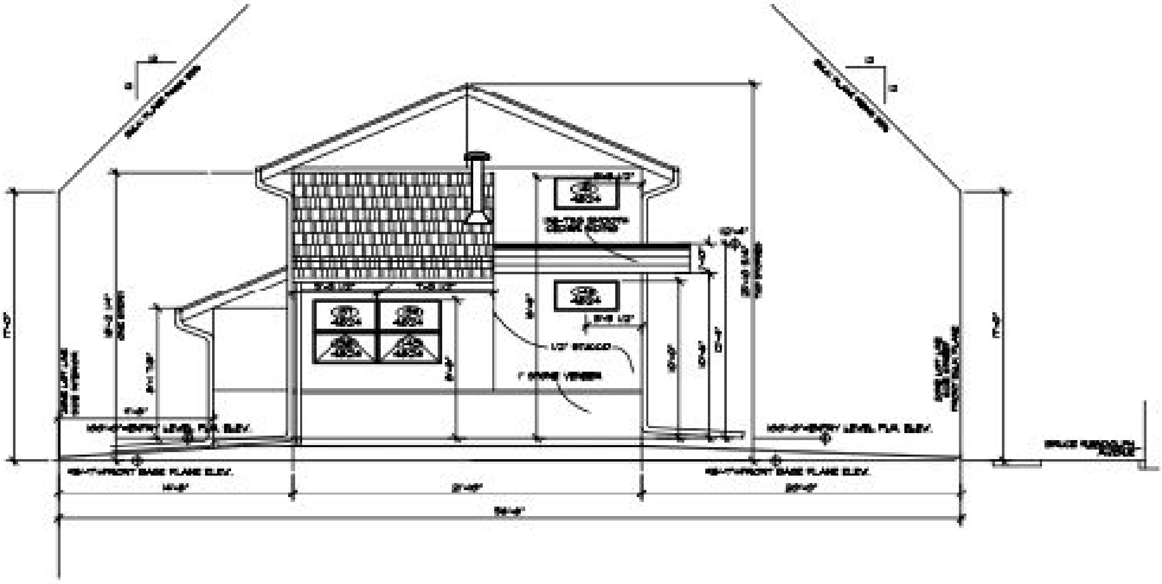
Upper level floor and roof framing plan



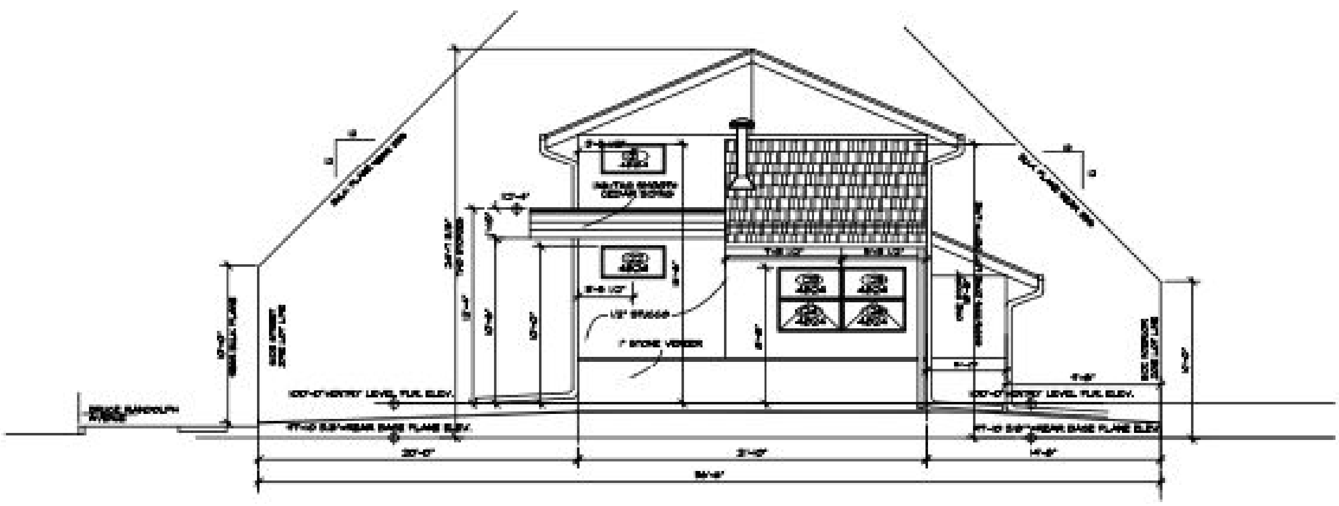
Entry level and foundation plan



Section Details

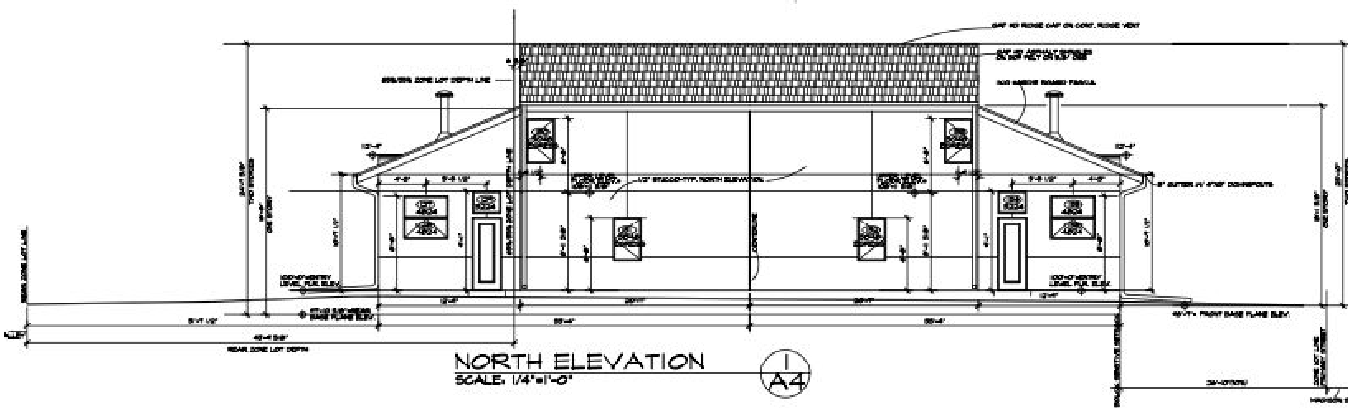


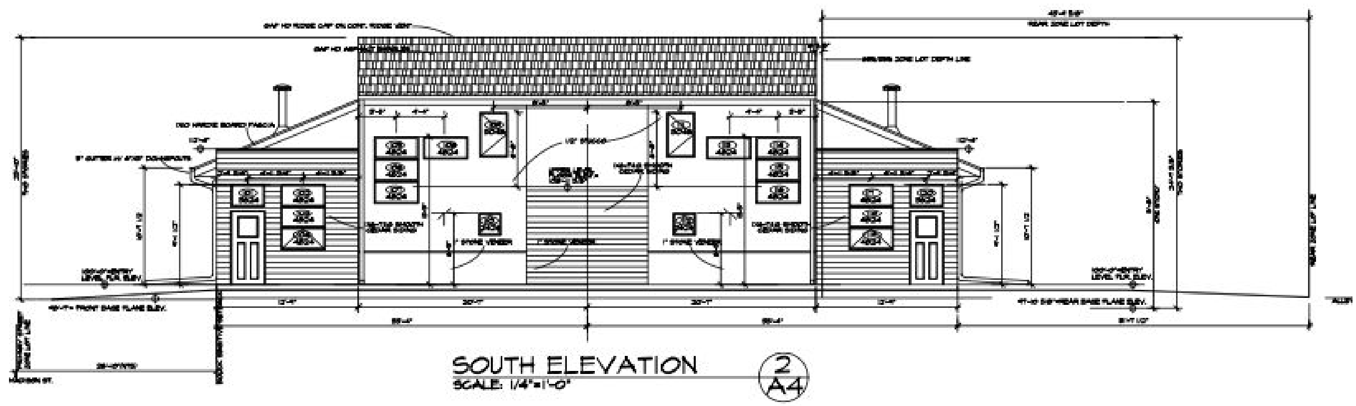
WEST ELEVATION
SCALE: 1/4"=1'-0"
1
A4



EAST ELEVATION
SCALE: 1/4"=1'-0"
2
A4

East and West elevations





North and South elevations

Appendix 2. Material Count

Zone/Area/Work	Object	Material	Units	Multiplier	Quantity	Wight per (	Weight TOT	Weight TOT K	Source Material	Distance to POS	Distance (km)	Point of Sale	Distance to Worksite	Distance (kM)
Excavation														
	Excavator 320D	Diesel	liters		444	0.83	369.41	167.53						
	Excavation Haul	Trips			56			0.00				Mile Hi Mobile C	5.1	285.60
Electricty														
	Excl Energy	299 total conusp	.1175/kwh		2545	kwh			120,000.00	330000	1.08E+05			
										51000	16715.41			
Foundation/Cement								39330.37						
								19371.67	3 foot foundation					
	Portland Cement		CY		51	2538.00	129438.00	58702.04	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Basement Slab		CY		19	2538.00	47752.00	21656.24	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Footing		CY		14	2538.00	35532.00	16114.29	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Sidewalks		CY		8	2538.00	21192.30	9611.02	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Parking		CY		10	2538.00	24466.32	11095.84	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Foundation Drain Gravel	Gravel/Rock	Ton		10	2000.00	20000.00	9070.29	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Stucco		SF	7/8"	2100	10.00	21000.00	9523.81	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	1x10" Hardy Board	Calcium Silicate	LF		343	1485.74	1485.74	673.80	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Hardy Board Soffit	Calcium Silicate	LF		686	477.83	477.83	216.70	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Brick	Calcium Silcate	SF		535	40.00	21400.00	9705.22	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
	Fake Ceder	Calcium Silcate	SF		146	20.00	2920.00	1324.26	Overlook Mine CO	93.3	150.12	Mile Hi Mobile C	5.1	8.21
								117179.42	147693.51	x				
Steel														
	STL .BEAM UL FLR-W1	Carbon Steel	LF		46	26.00	1196.00	542.40	Clairton Mill Works L	1449	2331.44	Rio Grande Co.	6.2	9.98
	# 5 Rebar	Carbon Steel	LF	1.1	1666	1.04	1911.31	866.81	Clairton Mill Works L	1449	2331.44	Rio Grande Co.	6.2	9.98
	#4 Rebar	Carbon Steel	LF	1.1	1154	0.67	847.94	384.56	Clairton Mill Works L	1449	2331.44	Rio Grande Co.	6.2	9.98
	STL Colmn	Carbon Steel	Lf		54	9.11	491.94	223.10	Clairton Mill Works L	1449	2331.44	Rio Grande Co.	6.2	9.98
	Framing Nails	Carbon Steel	Box		12	45.00	540.00	244.90	Clairton Mill Works L	1449	2331.44	Rio Grande Co.	6.2	9.98
									2261.77	x				

Lumber														
	Douglas-fir													
	WALLS-2X4 W/ T& B Pl	Douglas-Fir	LF		20	1.11	35.56	16.12	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	EXT. W/ 2X6'S 16"0.C	Douglas-Fir	LF		3000	1.94	5820.00	2639.46	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	INT.WALLS-2X4 @ 16"(	Douglas-Fir	LF		2704	1.24	3352.96	1520.62	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	EXT. W/ 2X6'S 16"0.C V	Douglas-Fir	LF		286	1.94	554.84	251.63	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	EXT. W/ 2X6'S 16"0.C	Douglas-Fir	LF		968	1.94	1877.92	851.66	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	INT.WALLS-2X4 @ 16"(	Douglas-Fir	LF		3376	1.24	4186.12	1898.47	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	2x8"	Douglas-Fir	LF		343	2.56	878.08	398.22	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	TRUSSES @24"O.C. W/ 5/8" APA SHTG.	Douglas-Fir	LF		46	32.00	1478.40	670.48	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	2X12 TREAD	Douglas-Fir	LF		128	32.00	672.00	304.76	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	1X8 RISER	Douglas-Fir	LF		128	32.00	151.68	68.79	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
									8620.20	x				
	Trim	Pine d=22lbs/ft3	LF		42	22.00	921.11	417.74	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
									417.74	x				
	Composits													
	LL STAIR LANDING 3/4" T&G OSB		Sheets		1		97.50	44.22	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	3/4" T&G OSB		Sheets		53	78.00	4160.81	1886.99	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	RIMBOX & BCI-9 1/2		LF		297	2.40	712.80	323.27	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	BCI-9 1/2"		LF		686	2.40	1647.36	747.10	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	3/4" T&G OSB		Sheets		29	78.00	2227.88	1010.37	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	Rimbox 9 1/2"		LF		73	2.40	175.20	79.46	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	11 7/8" BCI 6500		LF		436	2.98	1299.28	589.24	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	5/8" OSB SHTG on remainder of roof		Sheet		36	67.00	2432.94	1103.37	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	EXT 7/16" SHTG		Sheet		125	46.00	5750.00	2607.71	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
									8391.73	x				
	1 1/2" X 9 1/2" VERSA LAM		LF		156	3.80	592.80	268.84	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	1 3/4" X 9 1/2" VL		LF		235	4.30	1010.50	458.28	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
	1 3/4' X11 7/8 VL		LF		120	5.30	636.00	288.44	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
									1015.56	x				
	Glue Lam 6 3/4" x 16 1/2"		LF		34	28.50	969.00	439.46	Boisie Cascade, Lun	819	1317.77	Straight Lumber	6.4	10.30
									439.46	x				0.00

	Gutters	Aluminum Alloy,	LF		216	2.70	583.20	264.49	Buchner MFG	1550	2493.95	ABC Supply	4.9	7.88
									264.49	x				
	Shingles	asphalt	Bundle		63.64	70.00	4454.80	2020.32	Owens Corning Den	3.5	5.63	ABC Supply	4.9	7.88
									2020.32	x				
	Ice Barrier	Asphalt/polyethyl	rolls		20	29.20	584.00	264.85	GCP Applied Techno	1331	2141.58	ABC Supply	4.9	7.88
									264.85	x				
	Windows											Pella Windows, F	709	1140.78
	48x24 Fixed	Glass			23	14.00	322.00	146.03			0.00	Pella Windows, F	709	1140.78
	48X24 Awning	Glass			10	14.00	140.00	63.49			0.00	Pella Windows, F	709	1140.78
	32x34 Fixed	Glass			3	12.00	36.00	16.33			0.00	Pella Windows, F	709	1140.78
	36x24 Fixed	Glass			6	12.00	72.00	32.65			0.00	Pella Windows, F	709	1140.78
	24x24 Awning	Glass			2	4.00	8.00	3.63			0.00	Pella Windows, F	709	1140.78
	30x24 Egress	Glass			6	10.00	60.00	27.21			0.00	Pella Windows, F	709	1140.78
									289.34	x				
	48x24 Fixed	Vinyl			23	28.00	644.00	292.06			0.00	Pella Windows, F	709	1140.78
	48X24 Awning	Vinyl			10	28.00	280.00	126.98			0.00	Pella Windows, F	709	1140.78
	32x34 Fixed	Vinyl			3	16.00	48.00	21.77			0.00	Pella Windows, F	709	1140.78
	36x24 Fixed	Vinyl			6	12.00	72.00	32.65			0.00	Pella Windows, F	709	1140.78
	24x24 Awning	Vinyl			2	15.00	30.00	13.61			0.00	Pella Windows, F	709	1140.78
	30x24 Egress	Vinyl			6	13.90	83.40	37.82			0.00	Pella Windows, F	709	1140.78
									524.90	x				
Electrical														0.00
	Wire 14/2	Copper	LF		2000	0.06	114.00	51.70	Southwire Co.	1600	2574.40	Colorado Electric	9.9	15.93
	Wire 12/2	Copper	LF		1000	0.08	82.00	37.19	Southwire Co.	1600	2574.40	Colorado Electric	9.9	15.93
	Wire 14/3	Copper	LF		600	0.07	44.40	20.14	Southwire Co.	1600	2574.40	Colorado Electric	9.9	15.93
	Wire 10/3	Copper	LF		100	0.16	16.30	7.39	Southwire Co.	1600	2574.40	Colorado Electric	9.9	15.93
	Wire 8/3	Copper	LF		100	0.25	25.40	11.52	Southwire Co.	1600	2574.40	Colorado Electric	9.9	15.93
									127.94	x				
	Wire 250kcmills	Aluminum	LF		75	0.90	67.73	30.71	Southwire Co.	1600	2574.40	Colorado Electric	9.9	15.93
									30.71	x				0.00
Interior														0.00
	Insulation, firberglass		SF		2274	0.32	729.95	331.04	Owens Corning	961	1546.25	Home Depot	3.2	5.15
									331.04	x				
	Drywall(1/2")	Gypsum	SF		3500	2.00	7000.00	3174.60	USG Corp. Galena F	1092	1757.03	Home Depot	3.2	5.15
									3174.60	x				
	Doors	Pine	Unit		20	56.00	1120.00	507.94	Jeld Wen Doors and	1182	1901.84	Home Depot	3.2	5.15
									507.94	x				
	Bathroom													0.00
	24x24	Composit wood	Unit		2.00	57.00	114.00	51.70	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	36X24	Composit wood	Unit		4.00	65.00	260.00	117.91	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	15x24x80	Composit wood	Unit		2.00	135.00	270.00	122.45	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
														0.00

	Kitchen													0.00
	15x24x30base	Composit wood	Unit		2.00	36.00	72.00	32.65	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	36x24x30	Composit wood	Unit		2.00	65.00	130.00	58.96	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	38x24x30 corners	Composit wood	Unit		4.00	79.00	316.00	143.31	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	24x24x30	Composit wood	Unit		2.00	57.00	114.00	51.70	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
														0.00
	30x15x20wall	Composit wood	Unit		2.00	42.00	84.00	38.10	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	26x15x40	Composit wood	Unit		2.00	51.00	102.00	46.26	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	36x15x40	Composit wood	Unit		2.00	96.00	192.00	87.07	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
	15x15x40	Composit wood	Unit		2.00	51.00	102.00	46.26	Hampton Bay, Tallah	1580	2542.22	Home Depot	3.2	5.15
									796.37	x				0.00
	Granite Counter Tops	Granite	SF		84	19.00	1596.00	723.81	Trap Rock & Granite	912	1467.41	6501 E Stapletor	4.3	6.92
									723.81	x				
	Coretec flooring	PCV	SF		2100	0.73	1537.20	697.14	USFloors, Dalton, G/	1306	2101.35	Professional Floc	7.2	11.58
									697.14	x				0.00
Plumbing														0.00
	Bathtub	Acrylic	Unit		4	124.00	496.00	224.94	Sheridan, Arkansas	992	1596.13	Ferguson Plumbi	1.8	2.90
								0.00	224.94	x				
	PVC Pipe 4"	PVC and CPVC	LF	1.1	2	201.00		0.00	Rocky Mountain Coll	1.7	2.74	Ferguson Plumbi	1.8	2.8962
									0.00					
							394663.90	354867.35						
					5% of total weight		19733.19							

Appendix 3. EPA Equivalencies Calculator Information

Vehicle Equivalency [16]

Passenger vehicles are defined as 2-axle 4-tire vehicles, including passenger cars, vans, pickup trucks, and sport/utility vehicles.

In 2017, the weighted average combined fuel economy of cars and light trucks was 22.3 miles per gallon. The average vehicle miles traveled (VMT) in 2017 was 11,484 miles per year.

In 2017, the ratio of carbon dioxide emissions to total greenhouse gas emissions (including carbon dioxide, methane, and nitrous oxide, all expressed as carbon dioxide equivalents) for passenger vehicles was 0.989.

The amount of carbon dioxide emitted per gallon of motor gasoline burned is 8.89 × 10-3 metric tons, as calculated in the "Gallons of gasoline consumed" section above.

To determine annual greenhouse gas emissions per passenger vehicle, the following methodology was used: VMT was divided by average gas mileage to determine gallons of gasoline consumed per vehicle per year. Gallons of gasoline consumed was multiplied by carbon dioxide per gallon of gasoline to determine carbon dioxide emitted per vehicle per year. Carbon dioxide emissions were then divided by the ratio of carbon dioxide emissions to total vehicle greenhouse gas emissions to account for vehicle methane and nitrous oxide emissions.

Calculation

Note: Due to rounding, performing the calculations given in the equations below may not return the exact results shown.

8.89 × 10-3 metric tons CO_2/gallon gasoline × 11,484 VMT car/truck average × 1/22.3 miles per gallon car/truck average × 1 CO_2, CH_4, and N_2O/0.989 CO_2 = 4.63 metric tons CO_2E/vehicle /year

Barrels of oil Equivalency

Carbon dioxide emissions per barrel of crude oil are determined by multiplying heat content times the carbon coefficient times the fraction oxidized times the ratio of the molecular weight of carbon dioxide to that of carbon (44/12).

The average heat content of crude oil is 5.80 mmbtu per barrel. The average carbon coefficient of crude oil is 20.31 kg carbon per mmbtu. The fraction oxidized is assumed to be 100 percent.

Calculation

Note: Due to rounding, performing the calculations given in the equations below may not return the exact results shown.

5.80 mmbtu/barrel × 20.31 kg C/mmbtu × 44 kg CO_2/12 kg C × 1 metric ton/1,000 kg = 0.43 metric tons CO_2/barrel

Acres of U.S. Forests Equivalency

Forests are defined herein as managed forests that have been classified as forests for over 20 years (i.e., excluding forests converted to/from other land-use types). Please refer to the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2017* for a discussion of the definition of U.S. forests and methodology for estimating carbon stored in U.S. forests.

Growing forests accumulate and store carbon. Through the process of photosynthesis, trees remove CO_2 from the atmosphere and store it as cellulose, lignin, and other compounds. The rate of accumulation is equal to growth minus removals (i.e., harvest for the production of paper and wood) minus decomposition. In most U.S. forests, growth exceeds removals and decomposition, so the amount of carbon stored nationally is increasing overall, though at a decreasing rate.

Calculation for U.S. Forests

The *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2017* provides data on the net change in forest carbon stocks and forest area. Net changes in carbon attributed to harvested wood products are not included in the calculation.

Annual Net Change in Carbon Stocks per Area in Year t = (Carbon Stocks(t+1) - Carbon Stocks/Area of land remaining in the same land-use category

Step 1: Determine the carbon stock change between years by subtracting carbon stocks in year t from carbon stocks in year (t+1). This calculation, also found in the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2017*, uses the USDA Forest Service estimates of carbon stocks in 2018 minus carbon stocks in 2017. (This calculation includes carbon stocks in the aboveground biomass, belowground biomass, dead wood, litter, and soil organic and mineral carbon pools.)

Annual Net Change in Carbon Stocks in Year 2017 = 57,687 MMT C – 57,546 MMT C = 141 MMT C

Step 2: Determine the annual net change in carbon stocks (i.e., sequestration) per area by dividing the carbon stock change in U.S. forests from Step 1 by the total area of U.S. forests remaining in forests in year t (i.e., the area of land that did not change land-use categories between the time periods).

Applying the Step 2 calculation to data developed by the USDA Forest Service for the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2017* yields a result of 210 metric tons of carbon per hectare (or 85 metric tons of carbon per acre) for the carbon stock density of U.S. forests in 2017, with an annual net change in carbon stock per area in 2017 of 0.52 metric tons of carbon sequestered per hectare per year (or 0.21 metric tons of carbon sequestered per acre per year).

Note: Due to rounding, performing the calculations given in the equations below may not return the exact results shown.

Carbon Stock Density in Year 2017 = (57,546 MMT C × 106) / (273,623 thou. hectares × 103) = 210 metric tons of carbon stored per hectare

Annual Net Change in Carbon Stock per Area in Year 2017 = (-141.2 MMT C × 106) / (273,623 thou. hectares × 103) = -0.52 metric tons of carbon sequestered per hectare per year*

*Negative values indicate carbon sequestration.

From 2007 to 2017, the average annual sequestration of carbon per area was 0.53 metric tons C/hectare/year (or 0.21 metric tons C/acre/year) in the United States, with a minimum value of 0.49 metric tons C/hectare/year (or 0.20 metric tons C/acre/year) in 2014, and a maximum value of 0.55 metric tons C/hectare/year (or 0.22 metric tons C/acre/year) in 2011.

These values include carbon in the five forest pools: aboveground biomass, belowground biomass, dead wood, litter, and soil organic and mineral carbon, and are based on state-level Forest Inventory and Analysis (FIA) data. Forest carbon stocks and carbon stock change are based on the stock difference methodology and algorithms described by Smith, Heath, and Nichols (2010).

Conversion Factor for Carbon Sequestered in One Year by 1 Acre of Average U.S. Forest

Note: Due to rounding, performing the calculations given in the equations below may not return the exact results shown.

-0.21 metric ton C/acre/year* × (44 units CO_2/12 units C) = -0.77 metric ton CO_2/acre/year sequestered annually by one acre of average U.S. forest.

*Negative values indicate carbon sequestration.

Please note that this is an estimate for “average” U.S. forests in 2017; i.e., for U.S. forests as a whole in 2017. Significant geographical variations underlie the national estimates, and the values calculated here might not be representative of individual regions, states, or changes in the species composition of additional acres of forest.

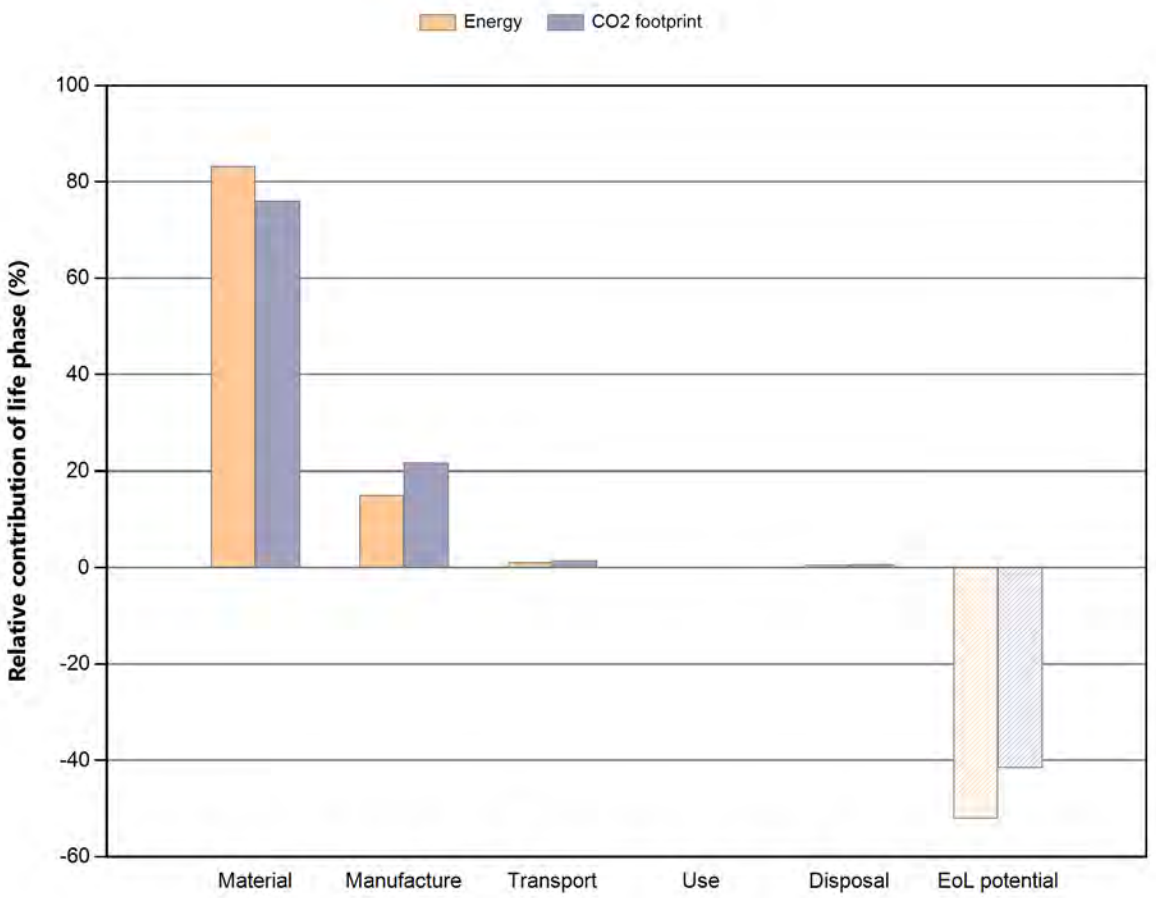
To estimate carbon sequestered (in metric tons of CO2) by additional forestry acres in one year, multiply the number of additional acres by -0.77 metric ton CO2 acre/year.

Appendix 4. CES Generated Data

Eco Audit Report

Product name	Bathtubs
Country of use	North America
Product life (years)	50

Summary:

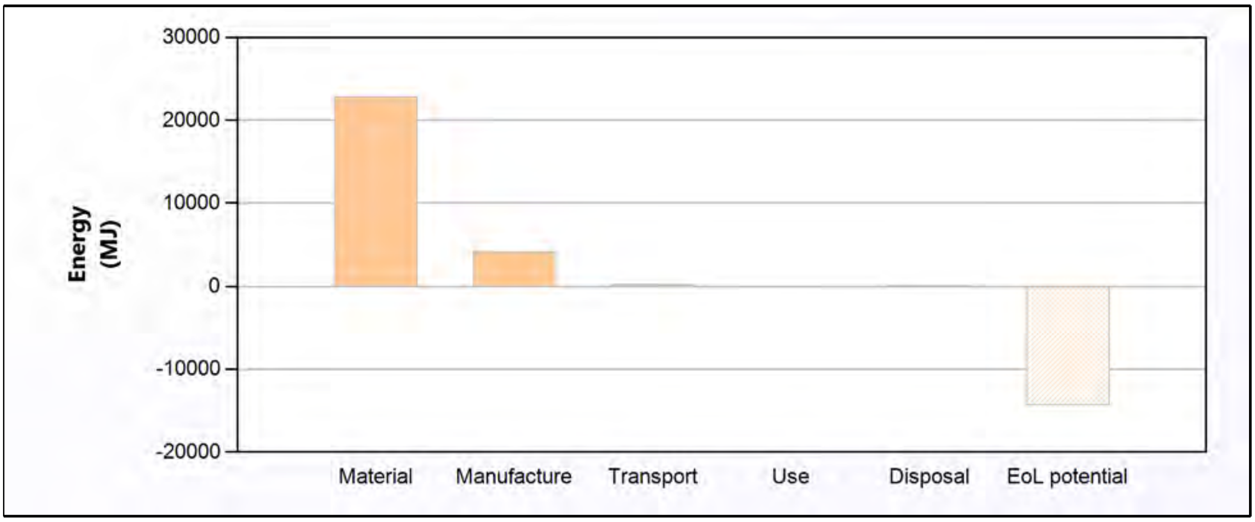


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	2.29e+04	83.2	1.1e+03	76.1
Manufacture	4.16e+03	15.1	312	21.7
Transport	295	1.1	21.3	1.5
Use	0	0.0	0	0.0
Disposal	157	0.6	11	0.8
Total (for first life)	**2.75e+04**	**100**	**1.44e+03**	**100**
End of life potential	-1.43e+04		-599	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	550

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Acrylic	PMMA (molding and extrusion)	Virgin (0%)	2.2e+02	1	2.2e+02	2.3e+04	100.0
Total				**1**	**2.2e+02**	**2.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Acrylic	Polymer molding	2.2e+02 kg	4.2e+03	100.0
Total			**4.2e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Sheridan AK. Source	40 tonne (6 axle) truck	1.6e+03	2.9e+02	99.7
Ferguson Plumbing	14 tonne (2 axle) truck	2.9	0.98	0.3
Total		**1.6e+03**	**3e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Acrylic	2.2e+02	3e+02	100.0
Total	**2.2e+02**	**3e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Acrylic	Recycle	1.6e+02	100.0
Total		**1.6e+02**	**100**

EoL potential:

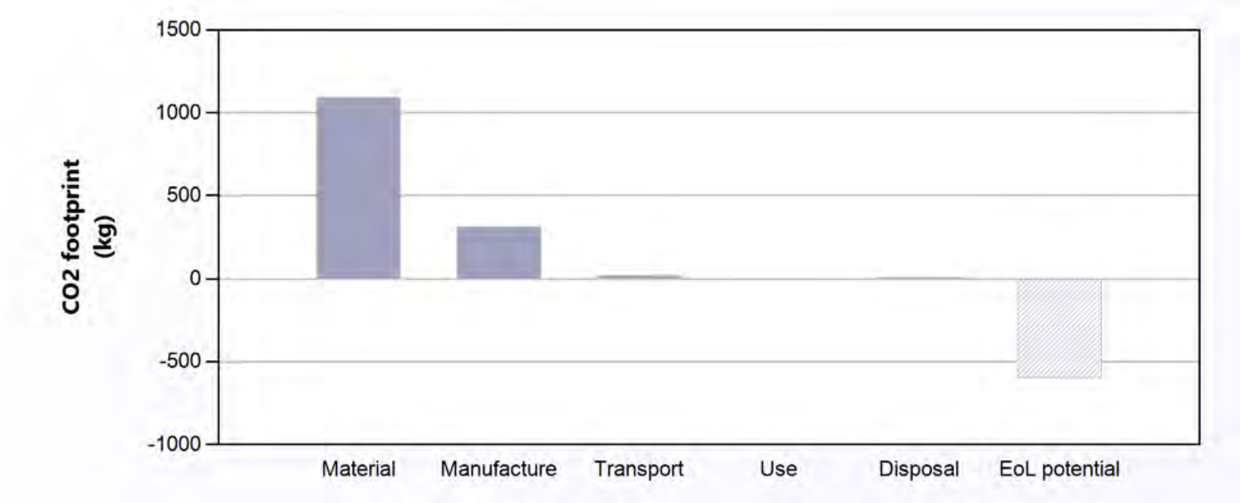
Component	End of life option	Energy (MJ)	%
Acrylic	Recycle	-1.4e+04	100.0
Total		**-1.4e+04**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	28.8

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Acrylic	PMMA (molding and extrusion)	Virgin (0%)	2.2e+02	1	2.2e+02	1.1e+03	100.0
Total				**1**	**2.2e+02**	**1.1e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Acrylic	Polymer molding	2.2e+02 kg	3.1e+02	100.0
Total			**3.1e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Sheridan AK. Source	40 tonne (6 axle) truck	1.6e+03	21	99.7
Ferguson Plumbing	14 tonne (2 axle) truck	2.9	0.07	0.3
Total		**1.6e+03**	**21**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Acrylic	2.2e+02	21	100.0
Total	**2.2e+02**	**21**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Acrylic	Recycle	11	100.0
Total		**11**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Acrylic	Recycle	-6e+02	100.0
Total		**-6e+02**	**100**

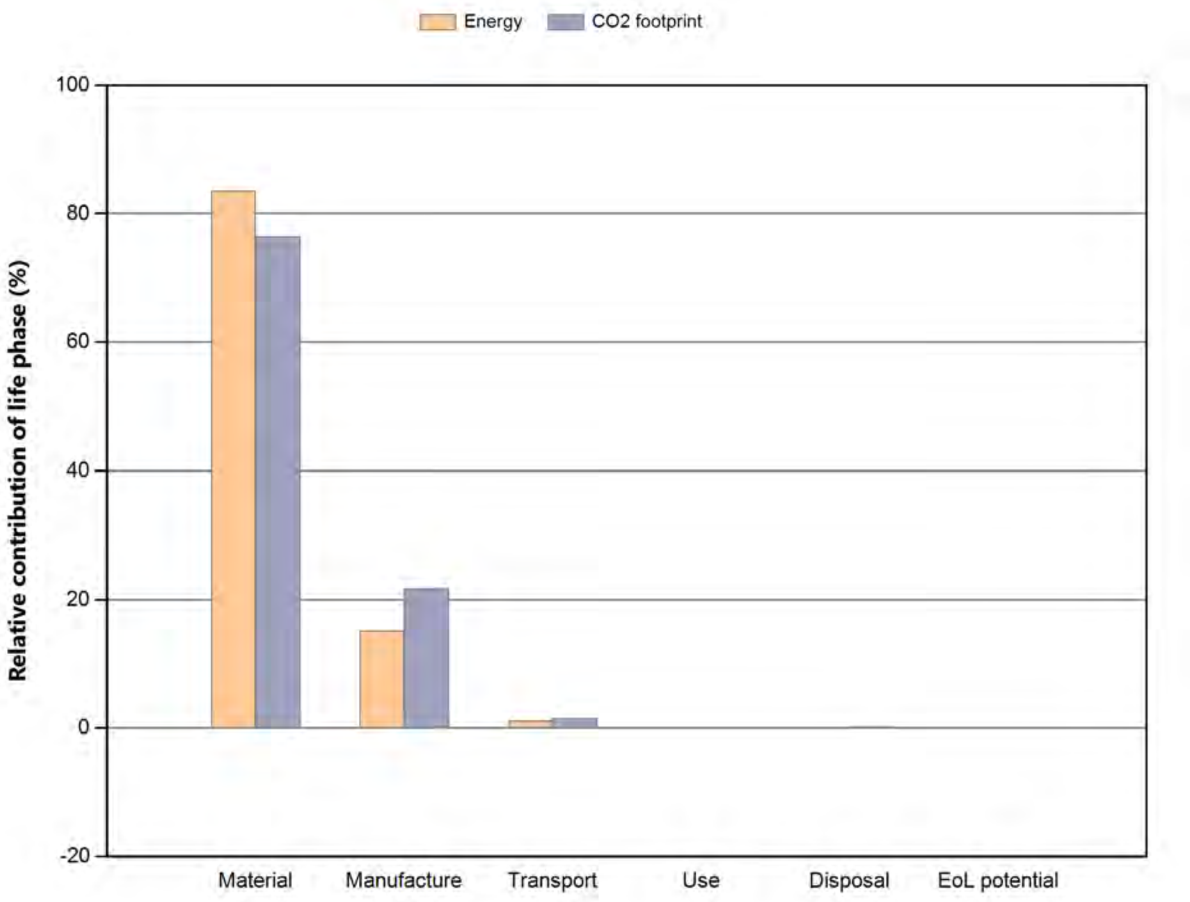
Notes:

Summary

Eco Audit Report

Product name	Bathtubs
Country of use	North America
Product life (years)	50

Summary:

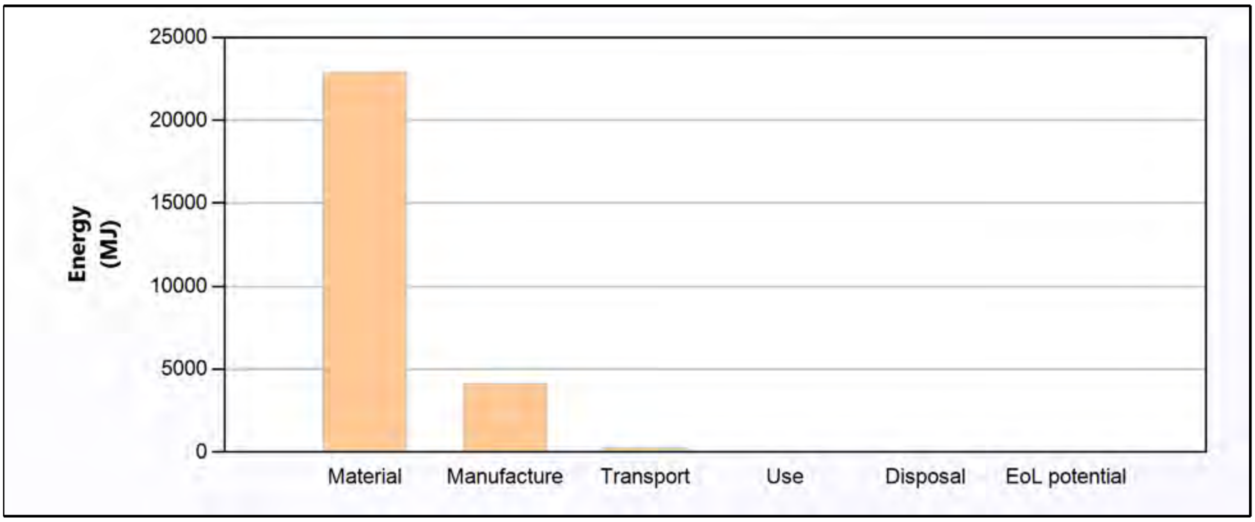


Energy details		CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	2.29e+04	83.6	1.1e+03	76.5
Manufacture	4.16e+03	15.2	312	21.8
Transport	295	1.1	21.3	1.5
Use	0	0.0	0	0.0
Disposal	45	0.2	3.15	0.2
Total (for first life)	**2.74e+04**	**100**	**1.43e+03**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	548

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Acrylic	PMMA (molding and extrusion)	Virgin (0%)	2.2e+02	1	2.2e+02	2.3e+04	100.0
Total				**1**	**2.2e+02**	**2.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Acrylic	Polymer molding	2.2e+02 kg	4.2e+03	100.0
Total			**4.2e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Sheridan AK. Source	40 tonne (6 axle) truck	1.6e+03	2.9e+02	99.7
Ferguson Plumbing	14 tonne (2 axle) truck	2.9	0.98	0.3
Total		**1.6e+03**	**3e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Acrylic	2.2e+02	3e+02	100.0
Total	**2.2e+02**	**3e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Acrylic	Landfill	45	100.0
Total		**45**	**100**

EoL potential:

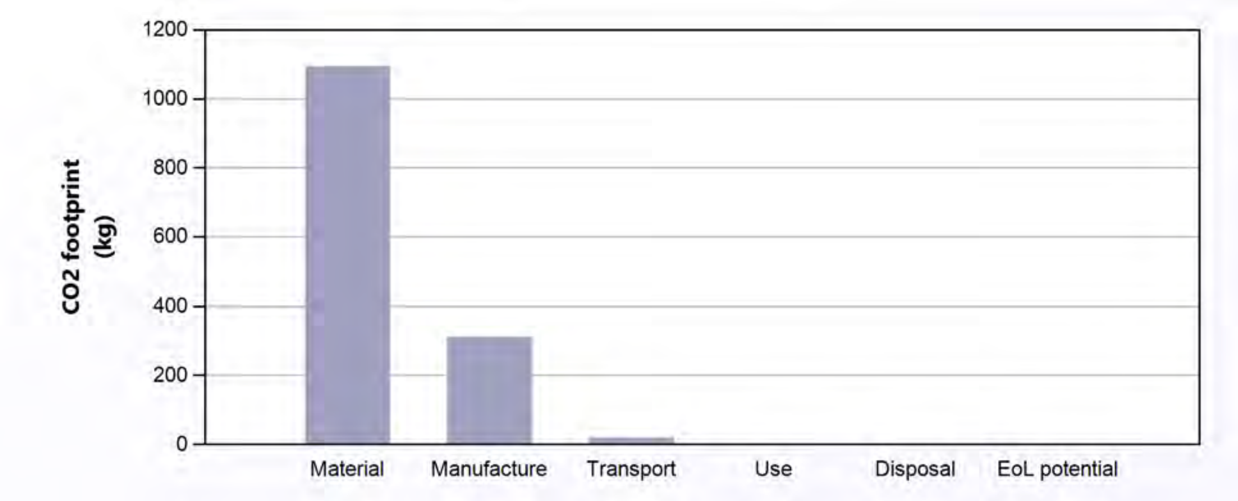
Component	End of life option	Energy (MJ)	%
Acrylic	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	28.6

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Acrylic	PMMA (molding and extrusion)	Virgin (0%)	2.2e+02	1	2.2e+02	1.1e+03	100.0
Total				**1**	**2.2e+02**	**1.1e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Acrylic	Polymer molding	2.2e+02 kg	3.1e+02	100.0
Total			**3.1e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Sheridan AK. Source	40 tonne (6 axle) truck	1.6e+03	21	99.7
Ferguson Plumbing	14 tonne (2 axle) truck	2.9	0.07	0.3
Total		**1.6e+03**	**21**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Acrylic	2.2e+02	21	100.0
Total	**2.2e+02**	**21**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Acrylic	Landfill	3.1	100.0
Total		**3.1**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Acrylic	Landfill	0	
Total		**0**	**100**

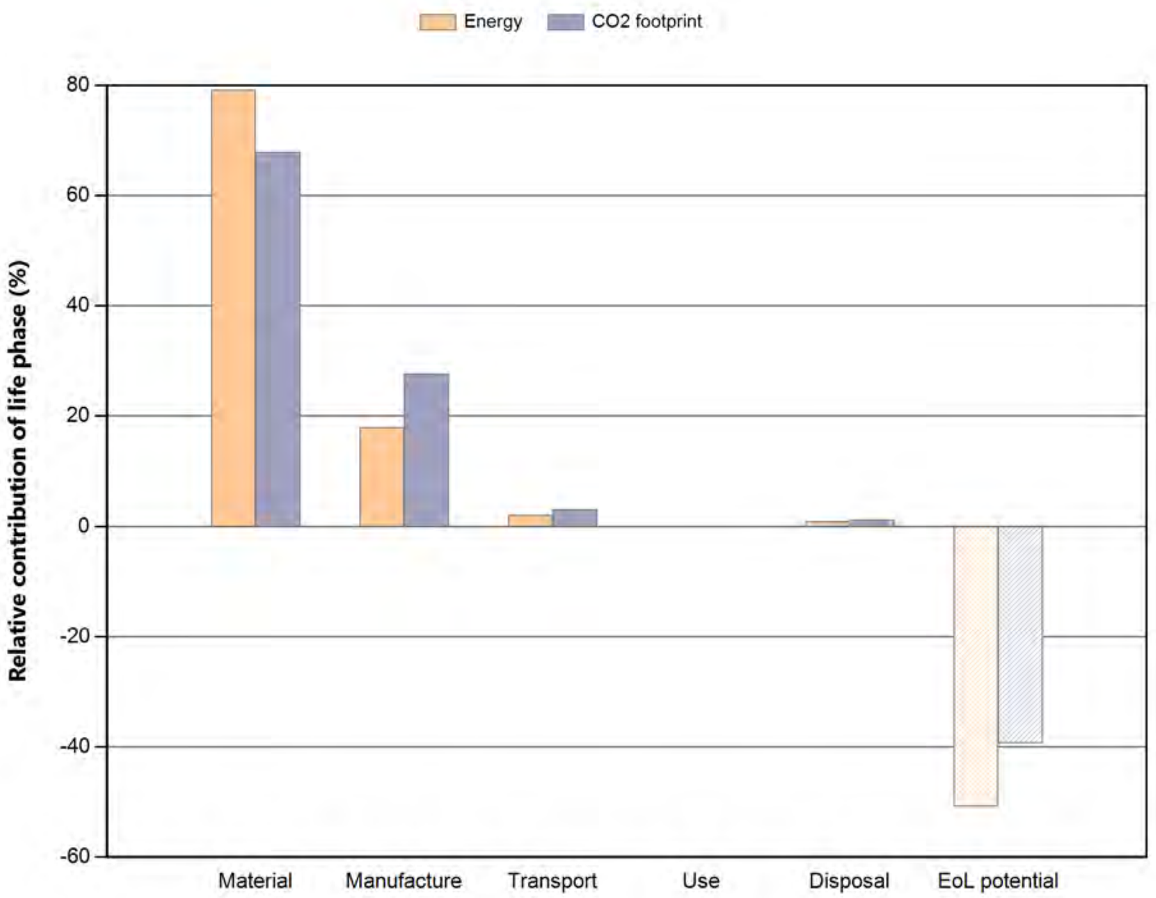
Notes:

Summary

Eco Audit Report

Product name	Flooring
Country of use	North America
Product life (years)	50

Summary:

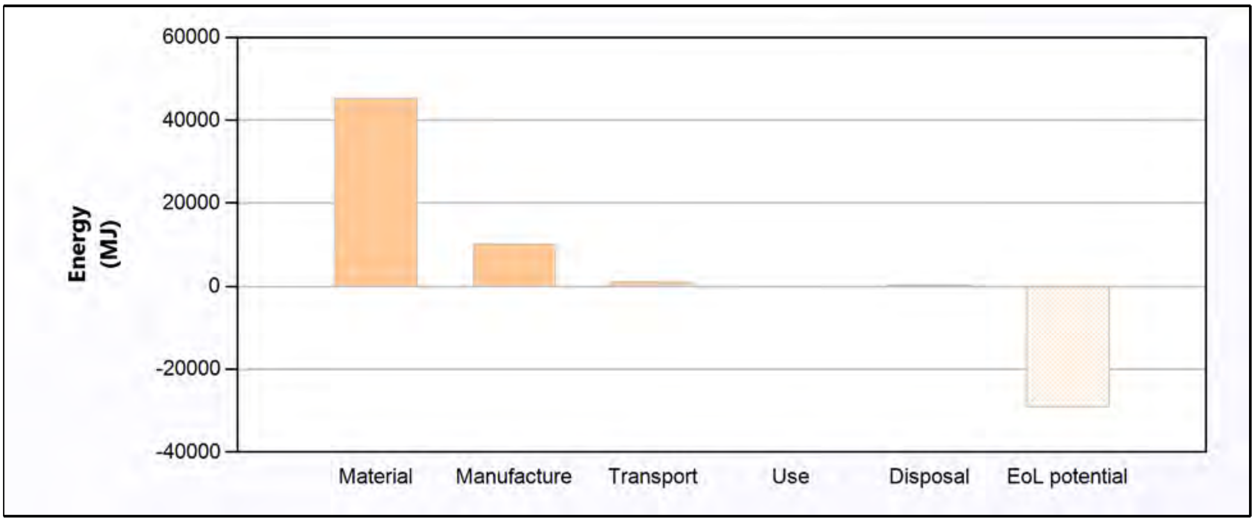


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	4.53e+04	79.2	1.88e+03	67.9
Manufacture	1.02e+04	17.9	766	27.7
Transport	1.21e+03	2.1	87.1	3.1
Use	0	0.0	0	0.0
Disposal	488	0.9	34.2	1.2
Total (for first life)	**5.72e+04**	**100**	**2.77e+03**	**100**
End of life potential	-2.91e+04		-1.09e+03	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.14e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Flooring	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	7e+02	1	7e+02	4.5e+04	100.0
Total				**1**	**7e+02**	**4.5e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Flooring	Polymer molding	7e+02 kg	1e+04	100.0
Total			**1e+04**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
USFloors Source	40 tonne (6 axle) truck	2.1e+03	1.2e+03	99.3
Profesional Flooring Supply	26 tonne (3 axle) truck	12	8.9	0.7
Total		**2.1e+03**	**1.2e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Flooring	7e+02	1.2e+03	100.0
Total	**7e+02**	**1.2e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Flooring	Recycle	4.9e+02	100.0
Total		**4.9e+02**	**100**

EoL potential:

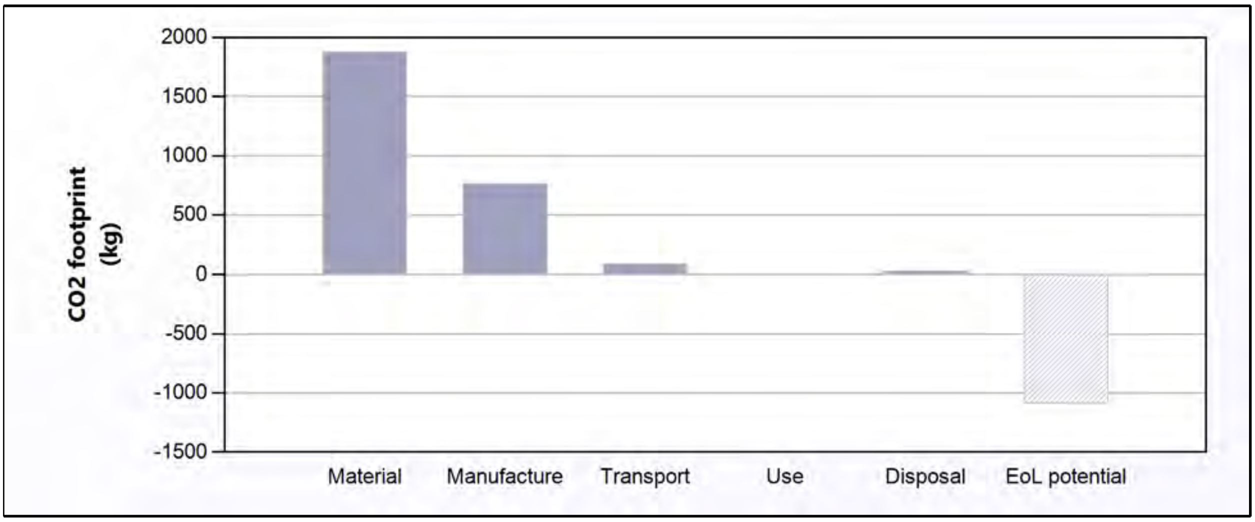
Component	End of life option	Energy (MJ)	%
Flooring	Recycle	-2.9e+04	100.0
Total		**-2.9e+04**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	55.3

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Flooring	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	7e+02	1	7e+02	1.9e+03	100.0
Total				**1**	**7e+02**	**1.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Flooring	Polymer molding	7e+02 kg	7.7e+02	100.0
Total			**7.7e+02**	**100**

Transport:

[Summary](#)

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
USFloors Source	40 tonne (6 axle) truck	2.1e+03	86	99.3
Profesional Flooring Supply	26 tonne (3 axle) truck	12	0.64	0.7
Total		**2.1e+03**	**87**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Flooring	7e+02	87	100.0
Total	**7e+02**	**87**	**100**

Use:

[Summary](#)

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

[Summary](#)

Component	End of life option	CO2 footprint (kg)	%
Flooring	Recycle	34	100.0
Total		**34**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Flooring	Recycle	-1.1e+03	100.0
Total		**-1.1e+03**	**100**

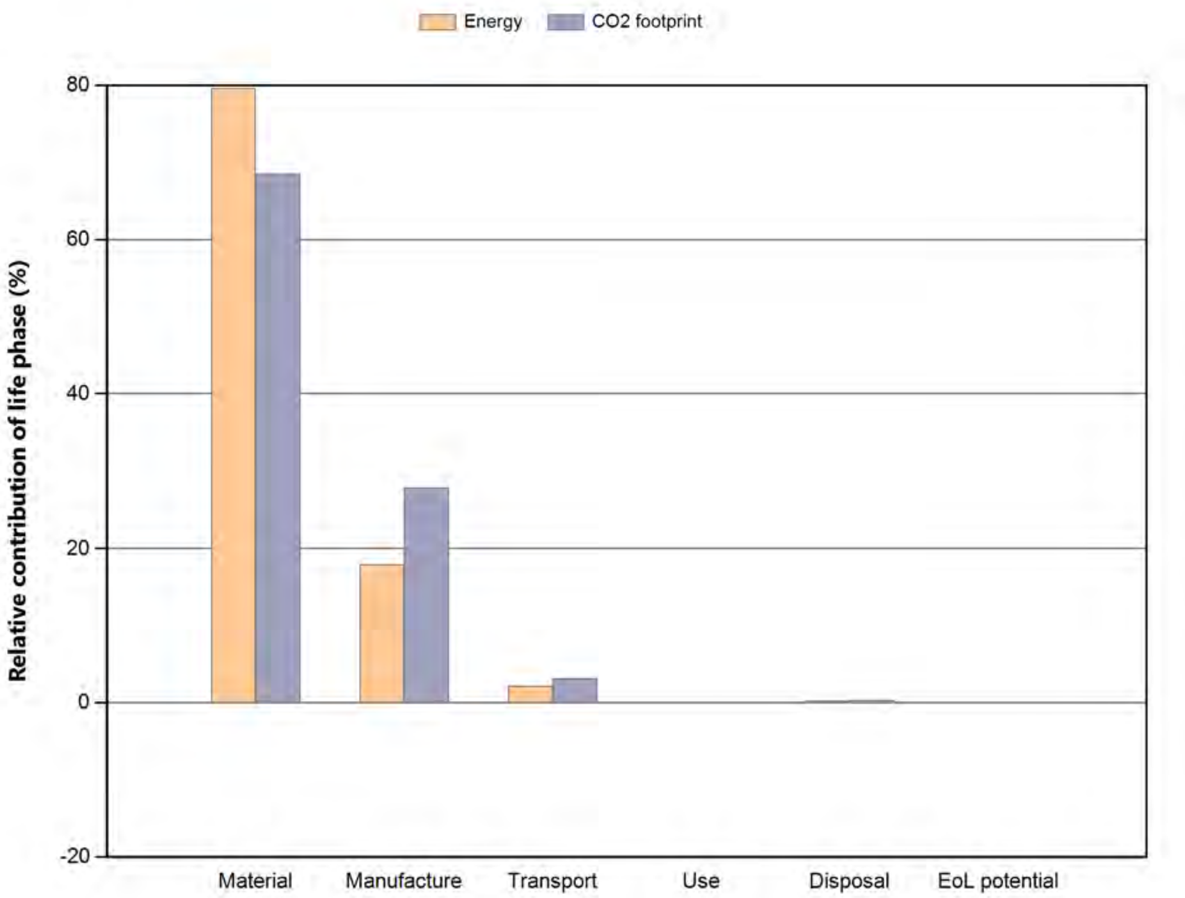
Notes:

[Summary](#)

Eco Audit Report

Product name	Flooring
Country of use	North America
Product life (years)	50

Summary:

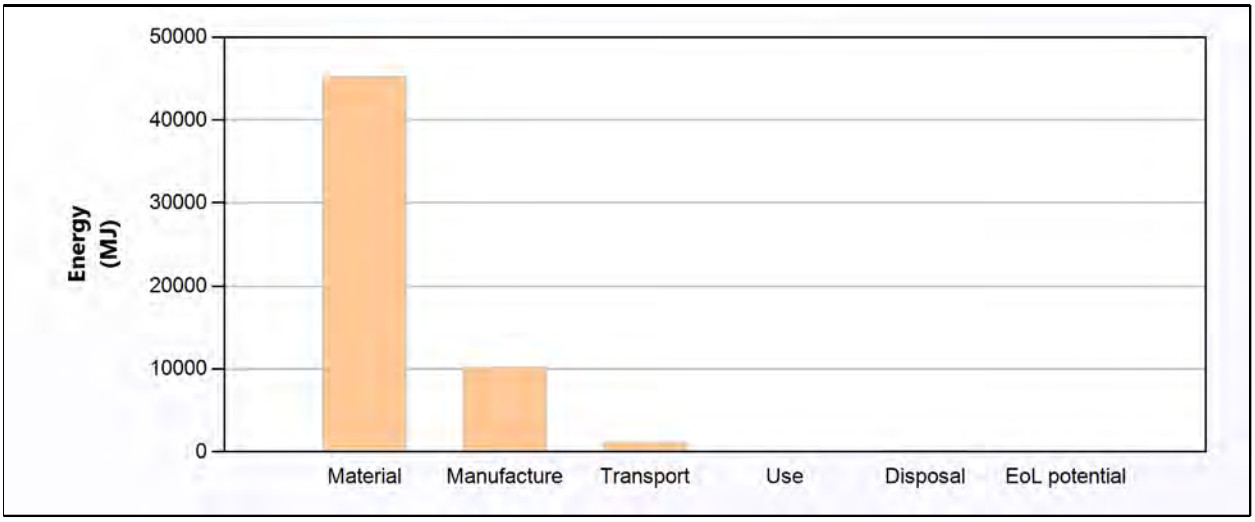


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	4.53e+04	79.6	1.88e+03	68.5
Manufacture	1.02e+04	18.0	766	27.9
Transport	1.21e+03	2.1	87.1	3.2
Use	0	0.0	0	0.0
Disposal	139	0.2	9.76	0.4
Total (for first life)	**5.68e+04**	**100**	**2.74e+03**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.14e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Flooring	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	7e+02	1	7e+02	4.5e+04	100.0
Total				**1**	**7e+02**	**4.5e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Flooring	Polymer molding	7e+02 kg	1e+04	100.0
Total			**1e+04**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
USFloors Source	40 tonne (6 axle) truck	2.1e+03	1.2e+03	99.3
Profesional Flooring Supply	26 tonne (3 axle) truck	12	8.9	0.7
Total		**2.1e+03**	**1.2e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Flooring	7e+02	1.2e+03	100.0
Total	**7e+02**	**1.2e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Flooring	Landfill	1.4e+02	100.0
Total		**1.4e+02**	**100**

EoL potential:

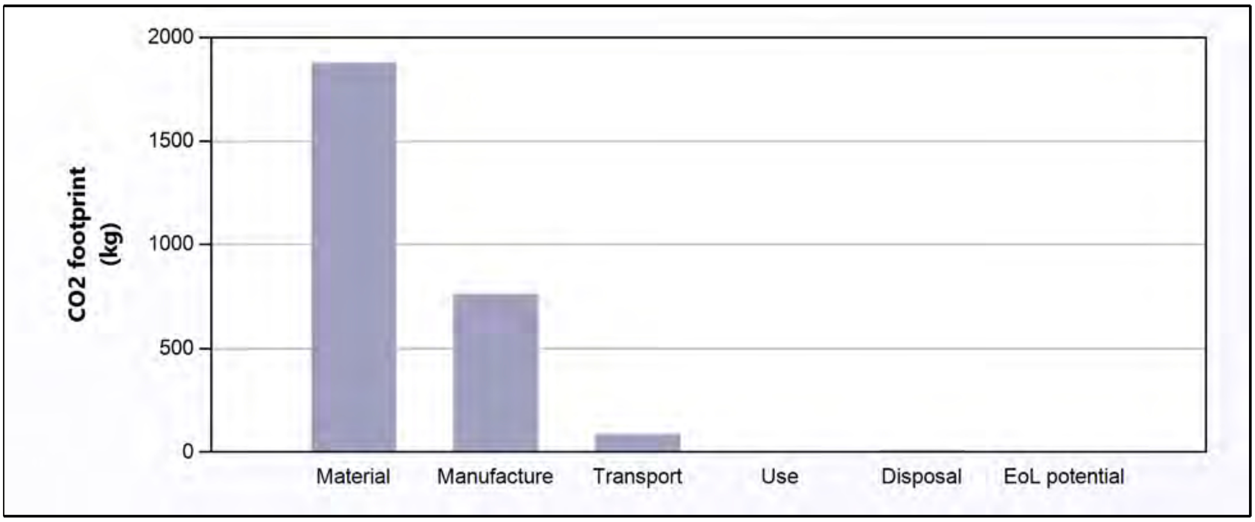
Component	End of life option	Energy (MJ)	%
Flooring	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	54.9

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Flooring	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	7e+02	1	7e+02	1.9e+03	100.0
Total				**1**	**7e+02**	**1.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Flooring	Polymer molding	7e+02 kg	7.7e+02	100.0
Total			**7.7e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
USFloors Source	40 tonne (6 axle) truck	2.1e+03	86	99.3
Profesional Flooring Supply	26 tonne (3 axle) truck	12	0.64	0.7
Total		**2.1e+03**	**87**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Flooring	7e+02	87	100.0
Total	**7e+02**	**87**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Flooring	Landfill	9.8	100.0
Total		**9.8**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Flooring	Landfill	0	
Total		**0**	**100**

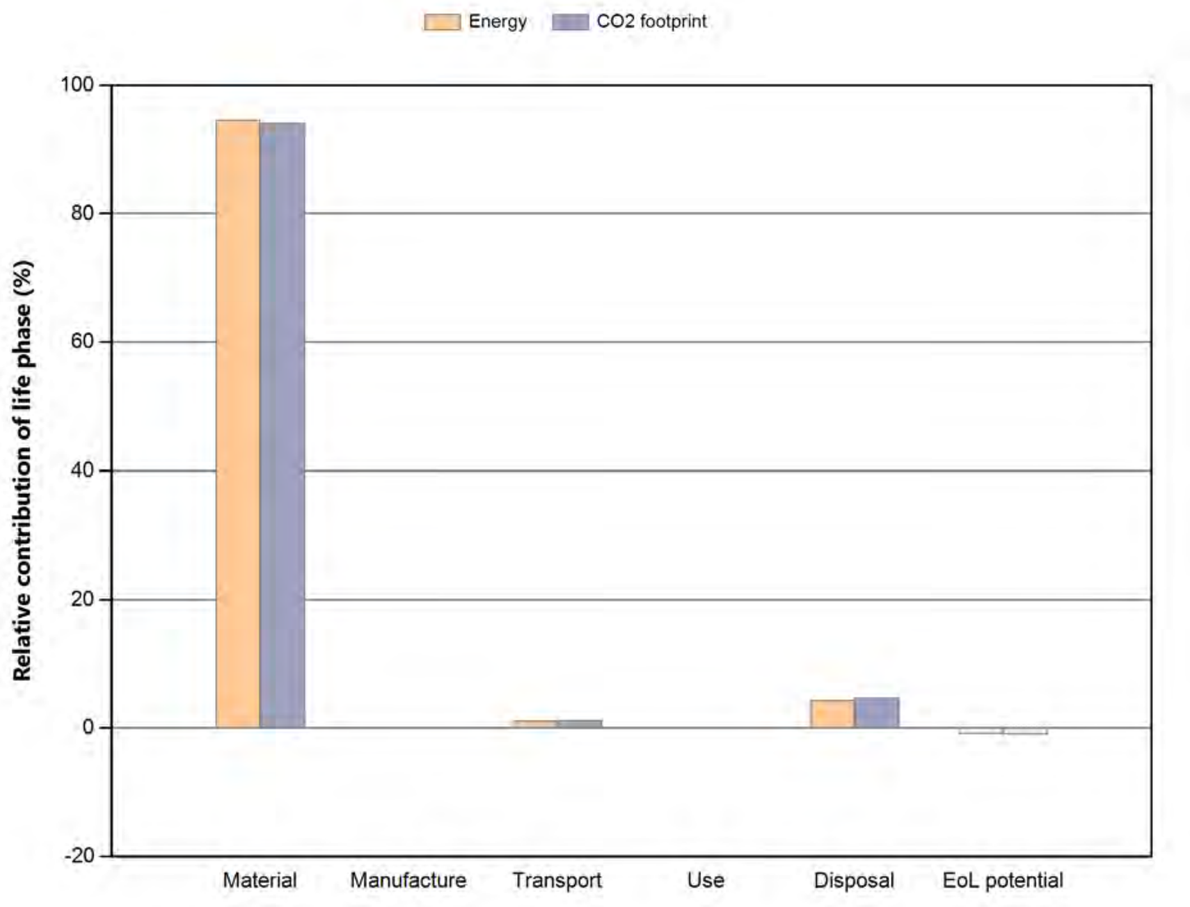
Notes:

Summary

Eco Audit Report

Product name	Counter Tops
Country of use	North America
Product life (years)	50

Summary:



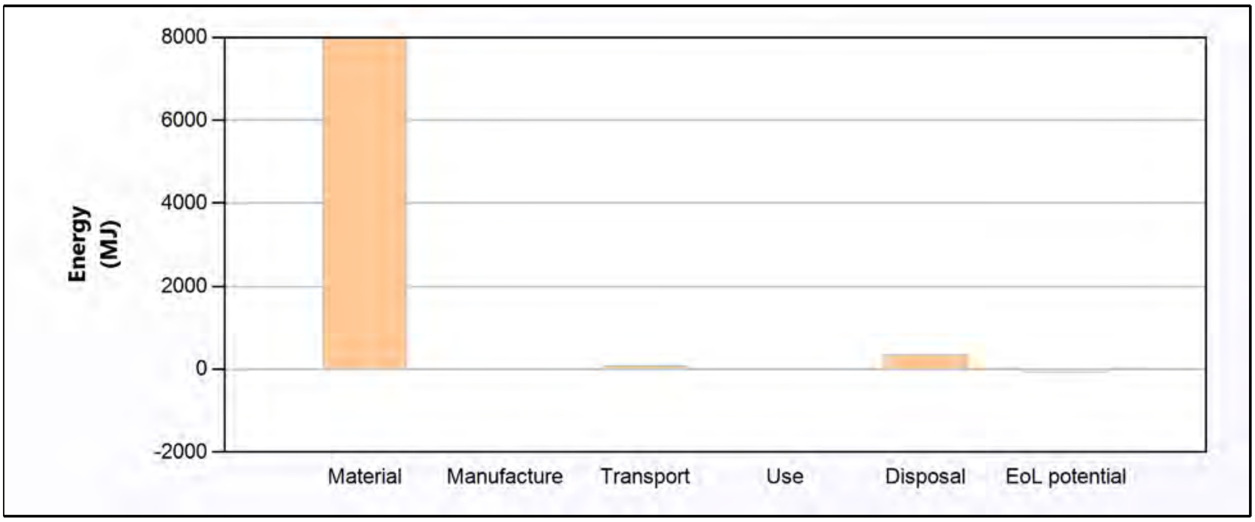
Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	7.99e+03	94.6	507	94.1
Manufacture	0	0.0	0	0.0
Transport	92.4	1.1	6.65	1.2
Use	0	0.0	0	0.0
Disposal	362	4.3	25.3	4.7
Total (for first life)	**8.44e+03**	**100**	**539**	**100**
End of life potential	-72.4		-5.07	

Eco Audit Report

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	169

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Granite	Granite(2.63)	Virgin (0%)	7.2e+02	1	7.2e+02	8e+03	100.0
Total				**1**	**7.2e+02**	**8e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Trap Rock Source	40 tonne (6 axle) truck	1.5e+02	87	94.0
6501 E Stapleton Dr POS	26 tonne (3 axle) truck	6.9	5.5	6.0
Total		**1.5e+02**	**92**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Granite	7.2e+02	92	100.0
Total	**7.2e+02**	**92**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Granite	Downcycle	3.6e+02	100.0
Total		**3.6e+02**	**100**

EoL potential:

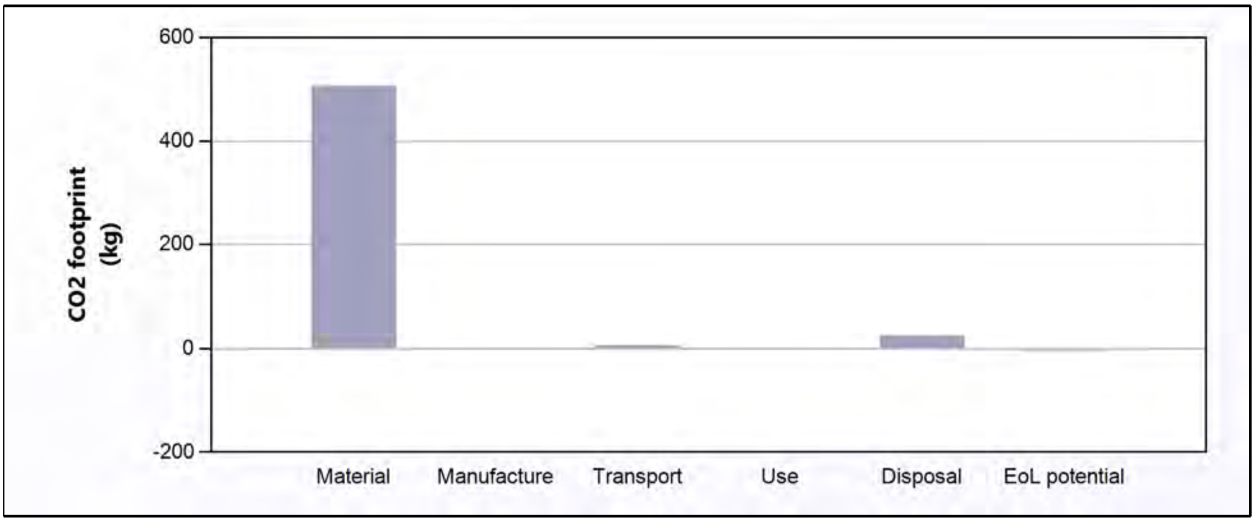
Component	End of life option	Energy (MJ)	%
Granite	Downcycle	-72	100.0
Total		**-72**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	10.8

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Granite	Granite(2.63)	Virgin (0%)	7.2e+02	1	7.2e+02	5.1e+02	100.0
Total				**1**	**7.2e+02**	**5.1e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Trap Rock Source	40 tonne (6 axle) truck	1.5e+02	6.3	94.0
6501 E Stapleton Dr POS	26 tonne (3 axle) truck	6.9	0.4	6.0
Total		**1.5e+02**	**6.7**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Granite	7.2e+02	6.7	100.0
Total	**7.2e+02**	**6.7**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Granite	Downcycle	25	100.0
Total		**25**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Granite	Downcycle	-5.1	100.0
Total		**-5.1**	**100**

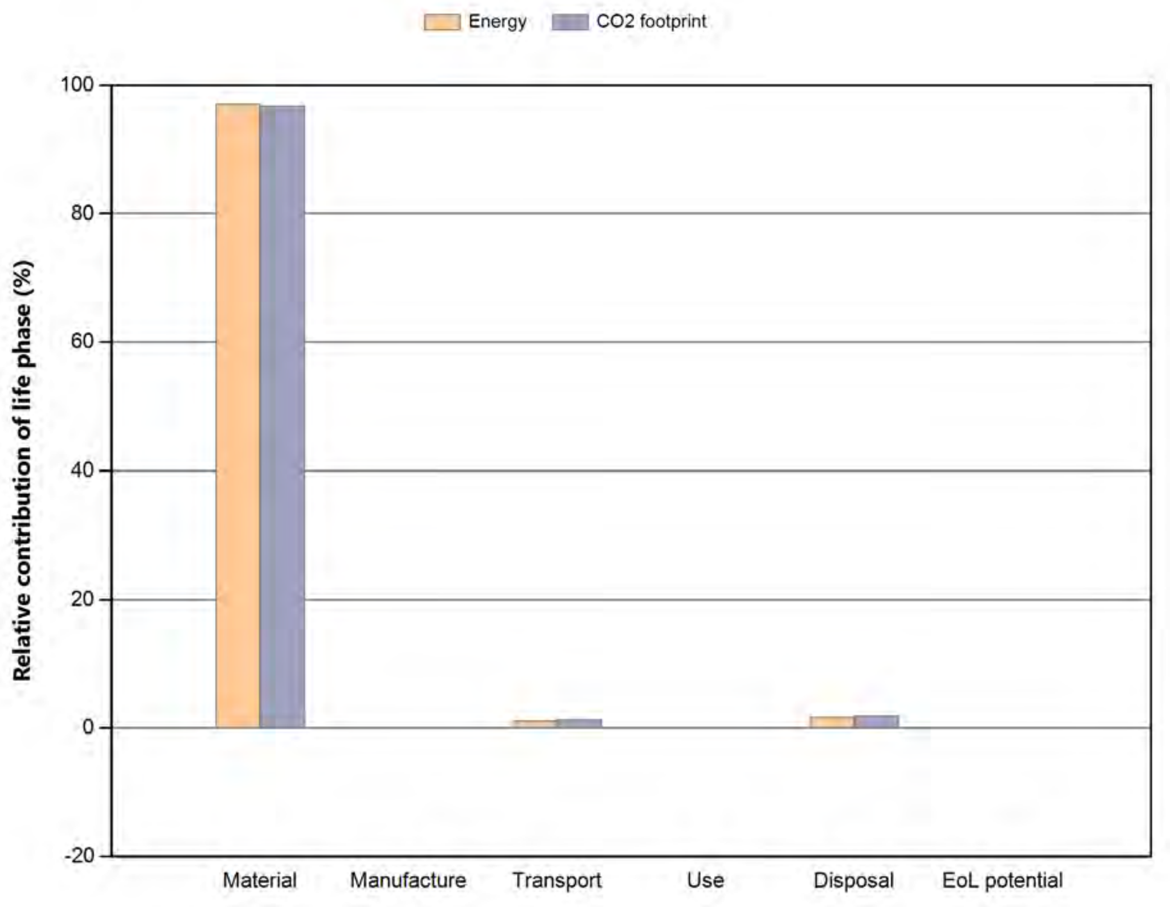
Notes:

Summary

Eco Audit Report

Product name	Counter Tops
Country of use	North America
Product life (years)	50

Summary:

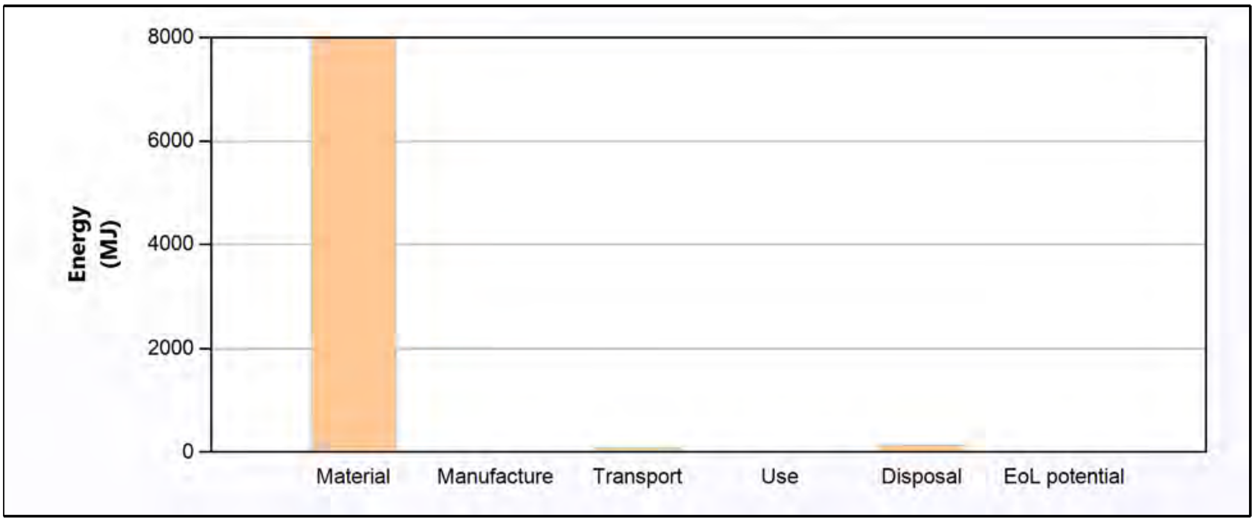


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	7.99e+03	97.1	507	96.8
Manufacture	0	0.0	0	0.0
Transport	92.4	1.1	6.65	1.3
Use	0	0.0	0	0.0
Disposal	145	1.8	10.1	1.9
Total (for first life)	**8.23e+03**	**100**	**524**	**100**
End of life potential	0		0	

Energy Analysis

[Summary]



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	165

Detailed breakdown of individual life phases

Material:

[Summary]

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Granite	Granite(2.63)	Virgin (0%)	7.2e+02	1	7.2e+02	8e+03	100.0
Total				**1**	**7.2e+02**	**8e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

[Summary]

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Trap Rock Source	40 tonne (6 axle) truck	1.5e+02	87	94.0
6501 E Stapleton Dr POS	26 tonne (3 axle) truck	6.9	5.5	6.0
Total		**1.5e+02**	**92**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Granite	7.2e+02	92	100.0
Total	**7.2e+02**	**92**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Granite	Landfill	1.4e+02	100.0
Total		**1.4e+02**	**100**

EoL potential:

Component	End of life option	Energy (MJ)	%
Granite	Landfill	0	
Total		**0**	**100**

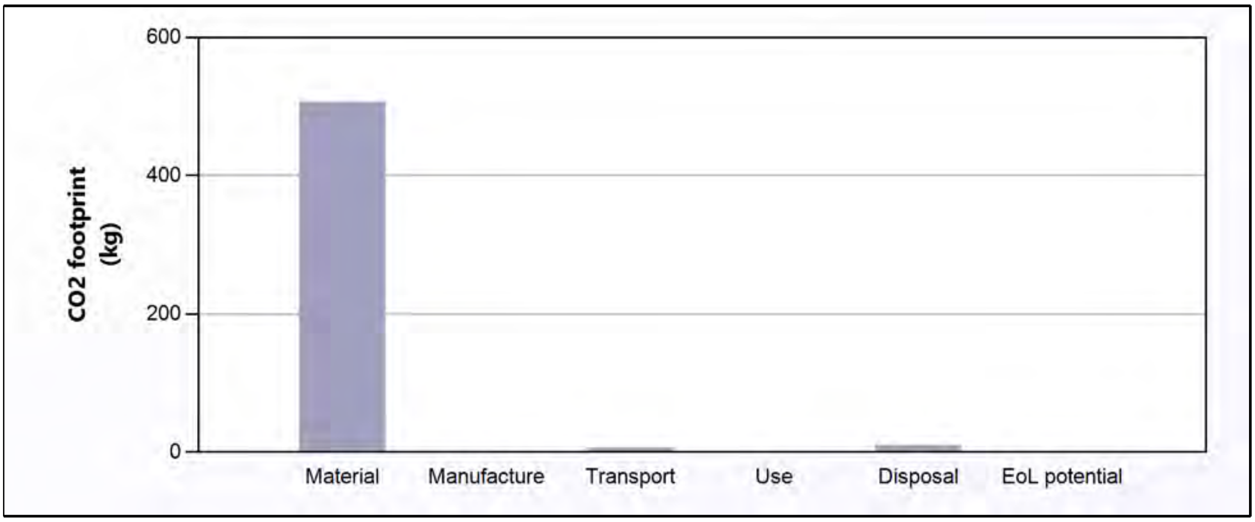
Notes:

Summary

Eco Audit Report

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	10.5

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Granite	Granite(2.63)	Virgin (0%)	7.2e+02	1	7.2e+02	5.1e+02	100.0
Total				**1**	**7.2e+02**	**5.1e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Trap Rock Source	40 tonne (6 axle) truck	1.5e+02	6.3	94.0
6501 E Stapleton Dr POS	26 tonne (3 axle) truck	6.9	0.4	6.0
Total		**1.5e+02**	**6.7**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Granite	7.2e+02	6.7	100.0
Total	**7.2e+02**	**6.7**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Granite	Landfill	10	100.0
Total		**10**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Granite	Landfill	0	
Total		**0**	**100**

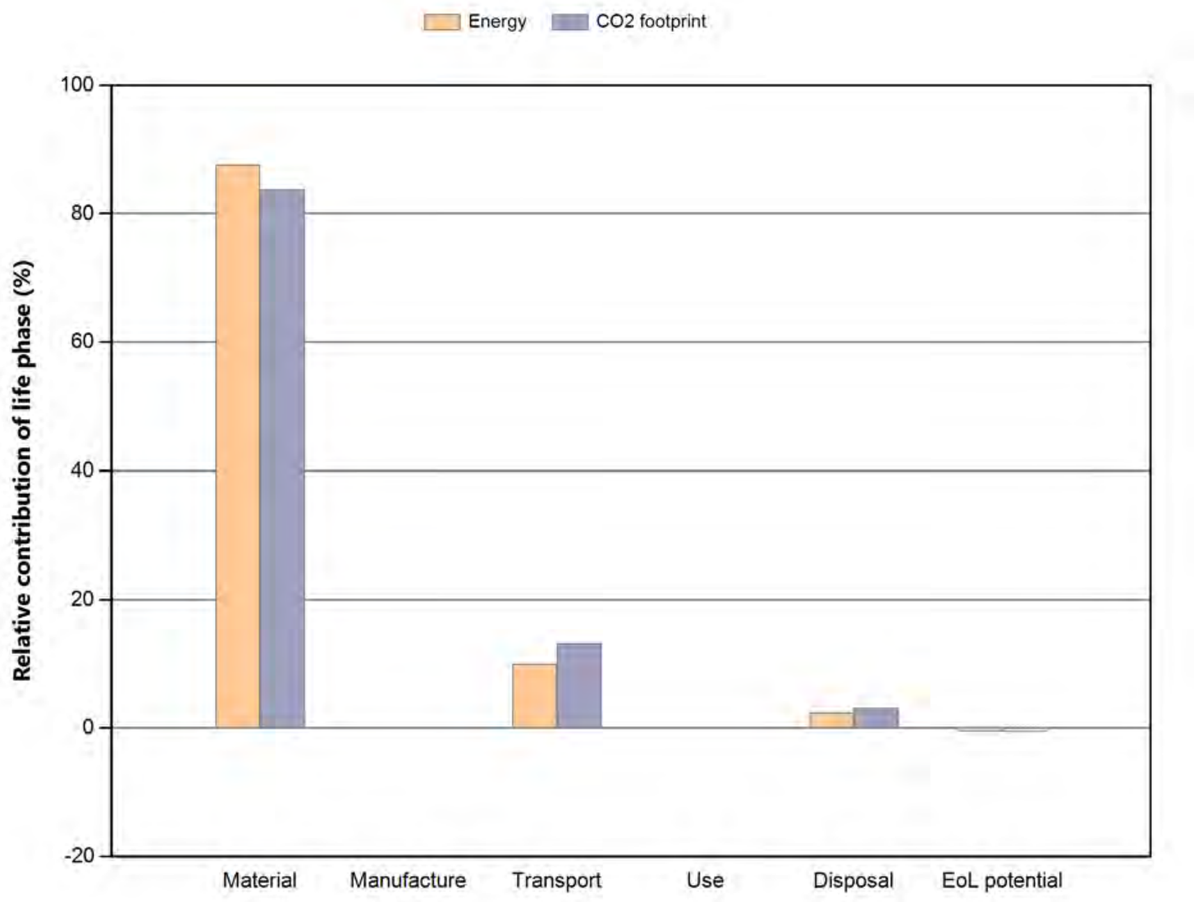
Notes:

Summary

Eco Audit Report

Product name	Cabinets
Country of use	North America
Product life (years)	50

Summary:

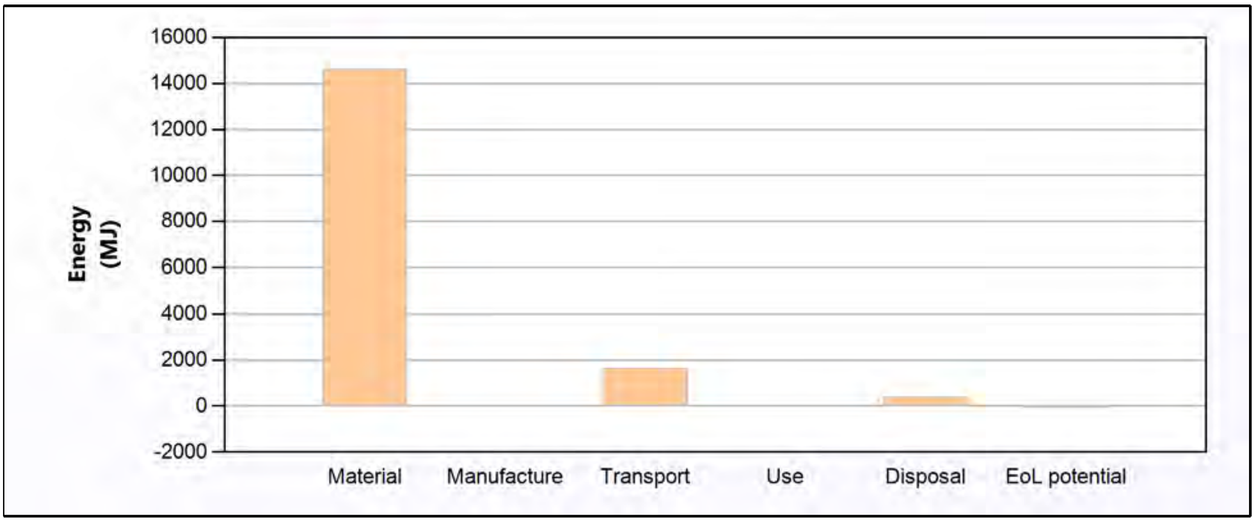


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	1.46e+04	87.7	760	83.7
Manufacture	0	0.0	0	0.0
Transport	1.66e+03	10.0	120	13.2
Use	0	0.0	0	0.0
Disposal	398	2.4	27.9	3.1
Total (for first life)	**1.67e+04**	**100**	**907**	**100**
End of life potential	-79.6		-5.57	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	334

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Cabinets	Medium density fiberboard, parallel to board	Virgin (0%)	8e+02	1	8e+02	1.5e+04	100.0
Total				**1**	**8e+02**	**1.5e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Hampton Bay	40 tonne (6 axle) truck	2.5e+03	1.7e+03	99.7
Home Depot	26 tonne (3 axle) truck	5.2	4.5	0.3
Total		**2.5e+03**	**1.7e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Cabinets	8e+02	1.7e+03	100.0
Total	**8e+02**	**1.7e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Cabinets	Downcycle	4e+02	100.0
Total		**4e+02**	**100**

EoL potential:

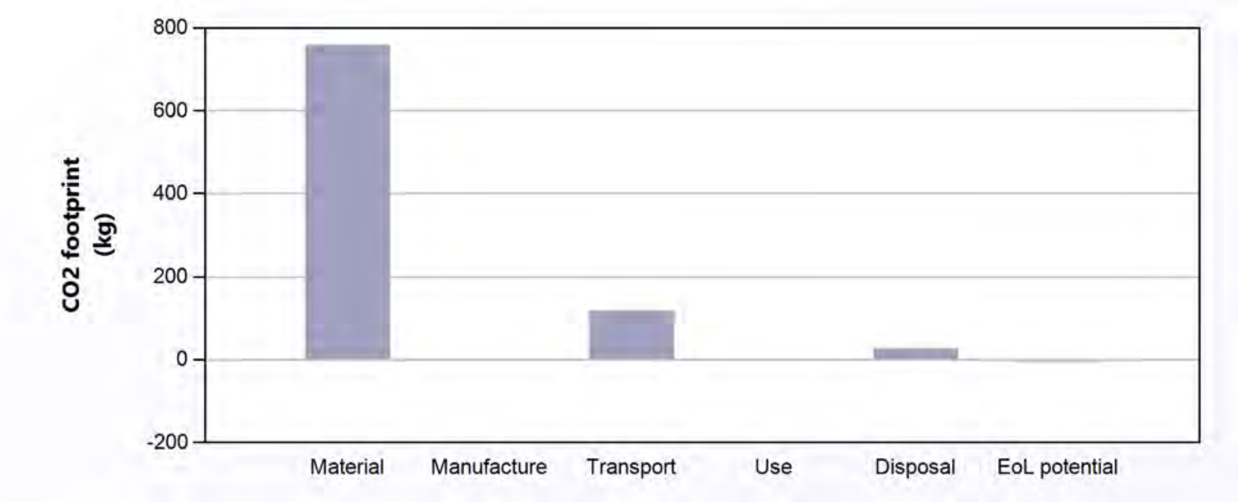
Component	End of life option	Energy (MJ)	%
Cabinets	Downcycle	-80	100.0
Total		**-80**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	18.1

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Cabinets	Medium density fiberboard, parallel to board	Virgin (0%)	8e+02	1	8e+02	7.6e+02	100.0
Total				**1**	**8e+02**	**7.6e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Hampton Bay	40 tonne (6 axle) truck	2.5e+03	1.2e+02	99.7
Home Depot	26 tonne (3 axle) truck	5.2	0.32	0.3
Total		**2.5e+03**	**1.2e+02**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Cabinets	8e+02	1.2e+02	100.0
Total	**8e+02**	**1.2e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Cabinets	Downcycle	28	100.0
Total		**28**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Cabinets	Downcycle	-5.6	100.0
Total		**-5.6**	**100**

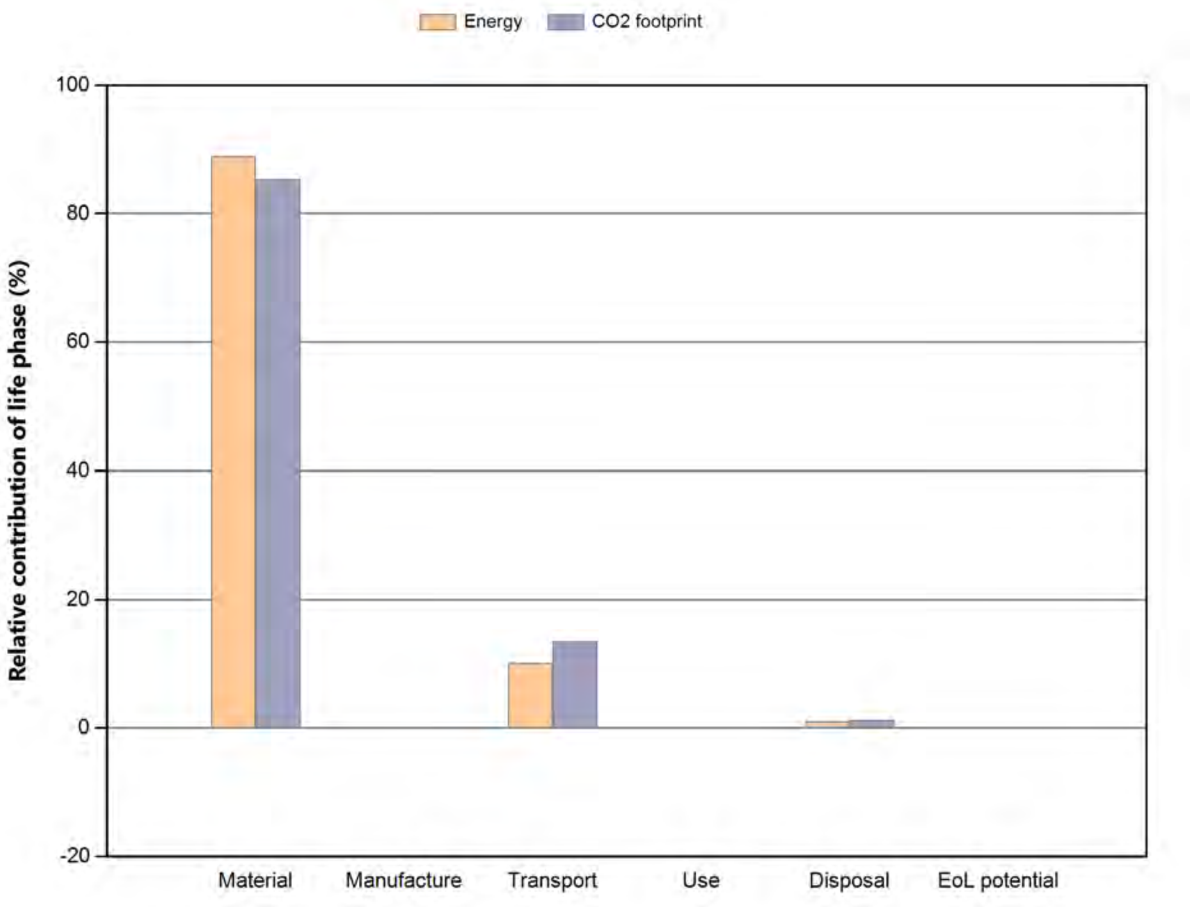
Notes:

Summary

Eco Audit Report

Product name	Cabinets
Country of use	North America
Product life (years)	50

Summary:



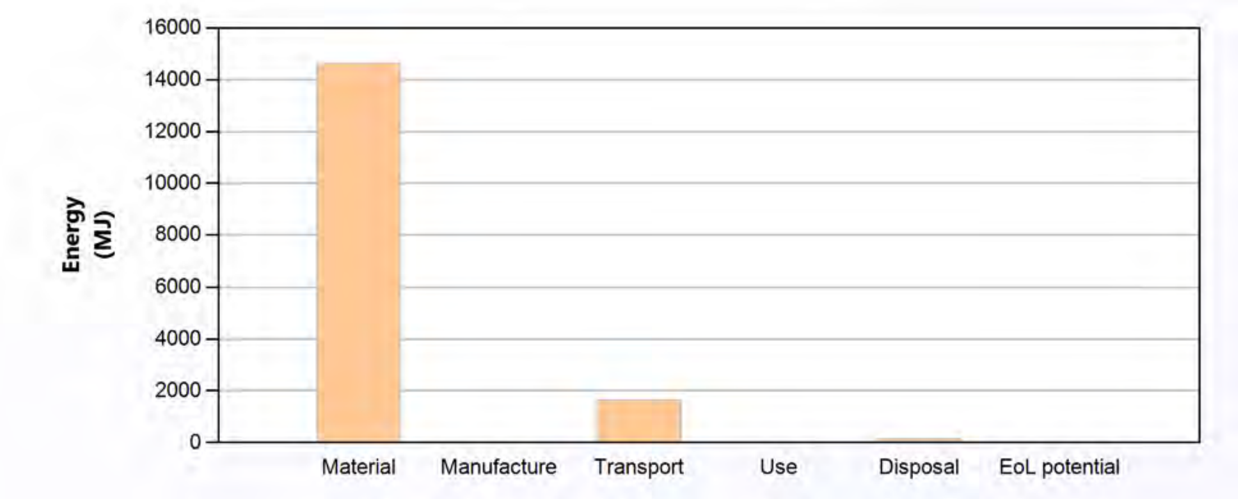
Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	1.46e+04	88.9	760	85.3
Manufacture	0	0.0	0	0.0
Transport	1.66e+03	10.1	120	13.5
Use	0	0.0	0	0.0
Disposal	159	1.0	11.1	1.3
Total (for first life)	**1.65e+04**	**100**	**891**	**100**
End of life potential	0		0	

Eco Audit Report

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	329

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Cabinets	Medium density fiberboard, parallel to board	Virgin (0%)	8e+02	1	8e+02	1.5e+04	100.0
Total				**1**	**8e+02**	**1.5e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

[Summary]

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Hampton Bay	40 tonne (6 axle) truck	2.5e+03	1.7e+03	99.7
Home Depot	26 tonne (3 axle) truck	5.2	4.5	0.3
Total		**2.5e+03**	**1.7e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Cabinets	8e+02	1.7e+03	100.0
Total	**8e+02**	**1.7e+03**	**100**

Use:

[Summary]

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

[Summary]

Component	End of life option	Energy (MJ)	%
Cabinets	Landfill	1.6e+02	100.0
Total		**1.6e+02**	**100**

EoL potential:

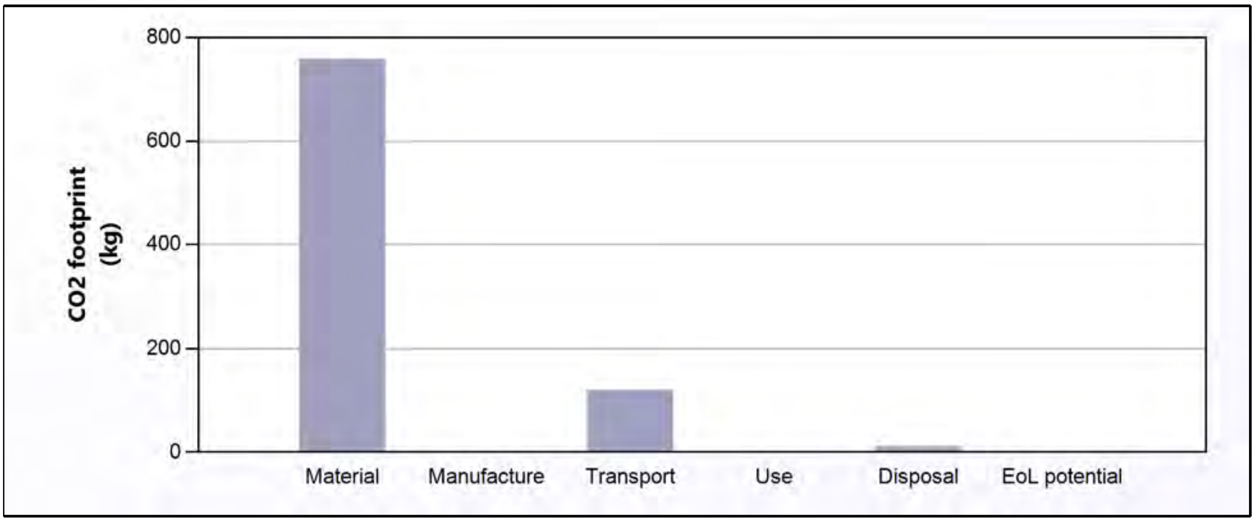
Component	End of life option	Energy (MJ)	%
Cabinets	Landfill	0	
Total		**0**	**100**

Notes:

[Summary]

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	17.8

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Cabinets	Medium density fiberboard, parallel to board	Virgin (0%)	8e+02	1	8e+02	7.6e+02	100.0
Total				**1**	**8e+02**	**7.6e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Hampton Bay	40 tonne (6 axle) truck	2.5e+03	1.2e+02	99.7
Home Depot	26 tonne (3 axle) truck	5.2	0.32	0.3
Total		**2.5e+03**	**1.2e+02**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Cabinets	8e+02	1.2e+02	100.0
Total	**8e+02**	**1.2e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Cabinets	Landfill	11	100.0
Total		**11**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Cabinets	Landfill	0	
Total		**0**	**100**

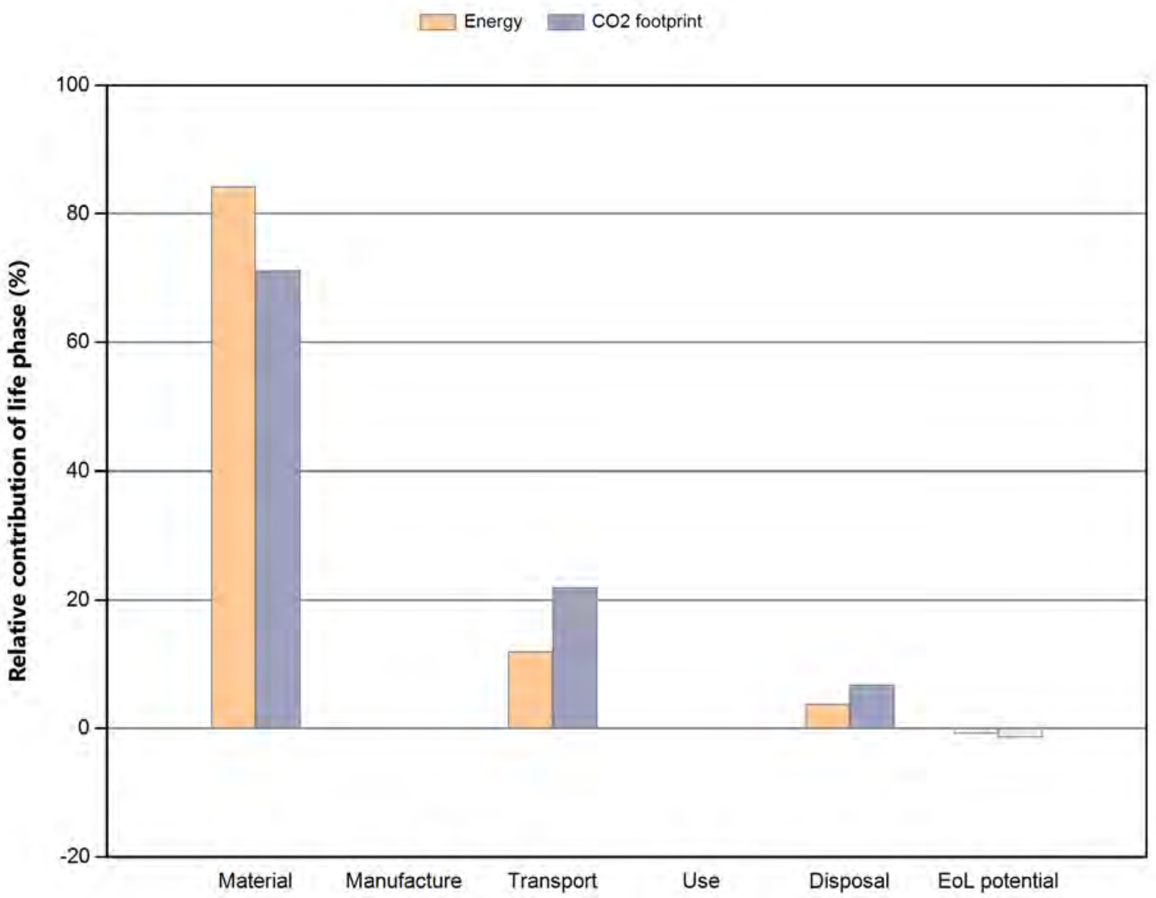
Notes:

Summary

Eco Audit Report

Product name	Doors
Country of use	World
Product life (years)	1

Summary:

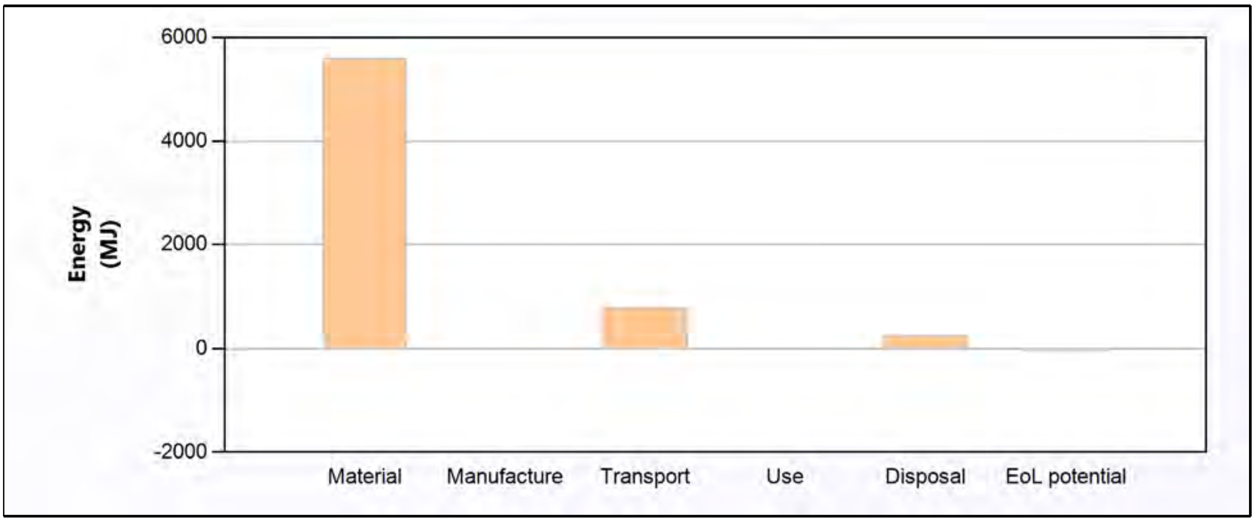


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	5.61e+03	84.2	186	71.2
Manufacture	0	0.0	0	0.0
Transport	795	11.9	57.2	22.0
Use	0	0.0	0	0.0
Disposal	254	3.8	17.8	6.8
Total (for first life)	**6.65e+03**	**100**	**261**	**100**
End of life potential	-50.8		-3.56	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	6.65e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Pine	Pine (pinus monticola) (l)	Virgin (0%)	5.1e+02	1	5.1e+02	5.6e+03	100.0
Total				**1**	**5.1e+02**	**5.6e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Jeld Wen Doors Source	40 tonne (6 axle) truck	1.9e+03	7.9e+02	99.6
Home Depot POS	26 tonne (3 axle) truck	5.2	2.9	0.4
Total		**1.9e+03**	**8e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Pine	5.1e+02	8e+02	100.0
Total	**5.1e+02**	**8e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Pine	Downcycle	2.5e+02	100.0
Total		**2.5e+02**	**100**

EoL potential:

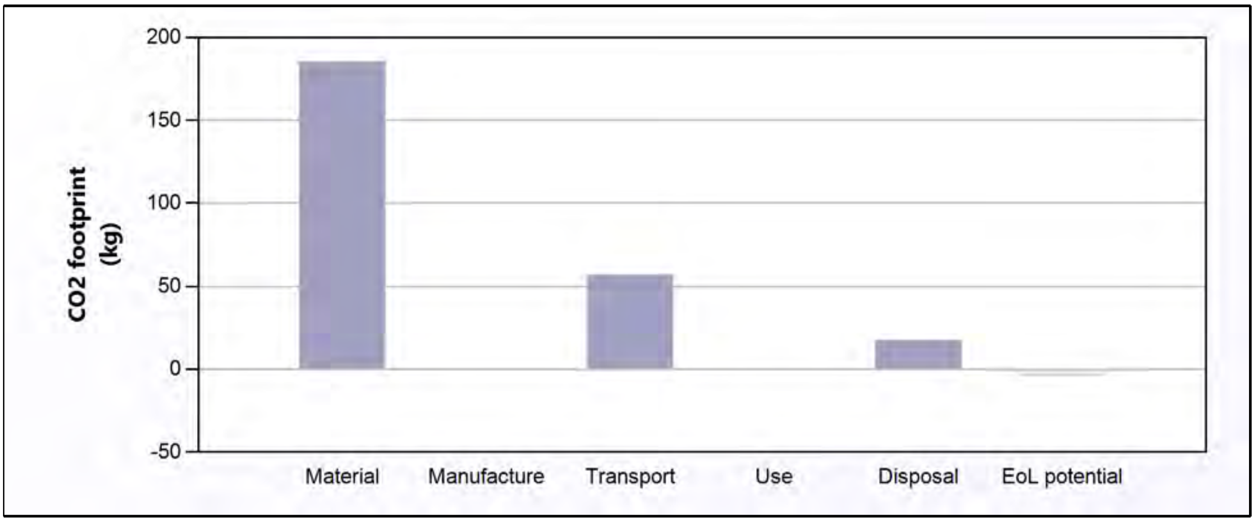
Component	End of life option	Energy (MJ)	%
Pine	Downcycle	-51	100.0
Total		**-51**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	261

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Pine	Pine (pinus monticola) (l)	Virgin (0%)	5.1e+02	1	5.1e+02	1.9e+02	100.0
Total				**1**	**5.1e+02**	**1.9e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Jeld Wen Doors Source	40 tonne (6 axle) truck	1.9e+03	57	99.6
Home Depot POS	26 tonne (3 axle) truck	5.2	0.21	0.4
Total		**1.9e+03**	**57**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Pine	5.1e+02	57	100.0
Total	**5.1e+02**	**57**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Pine	Downcycle	18	100.0
Total		**18**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Pine	Downcycle	-3.6	100.0
Total		**-3.6**	**100**

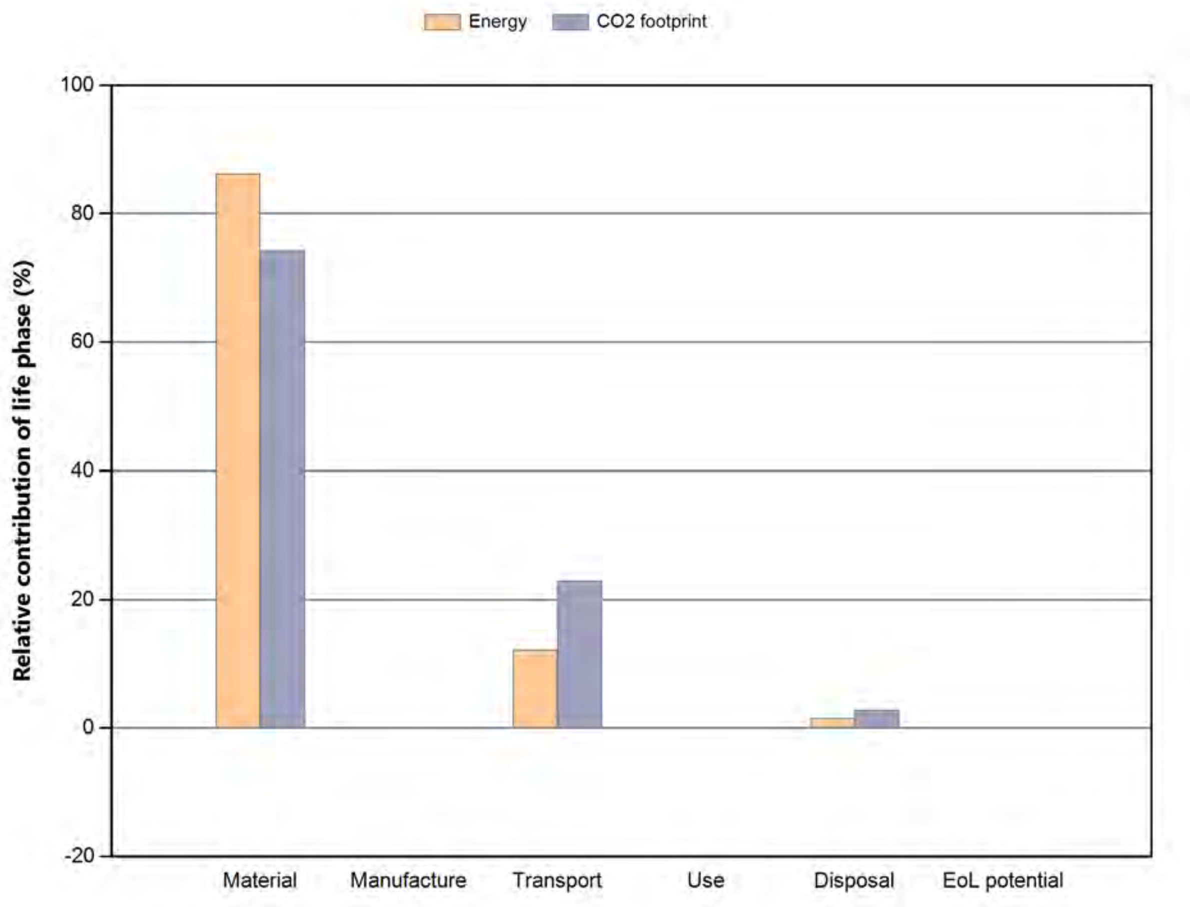
Notes:

Summary

Eco Audit Report

Product name	Doors
Country of use	World
Product life (years)	1

Summary:



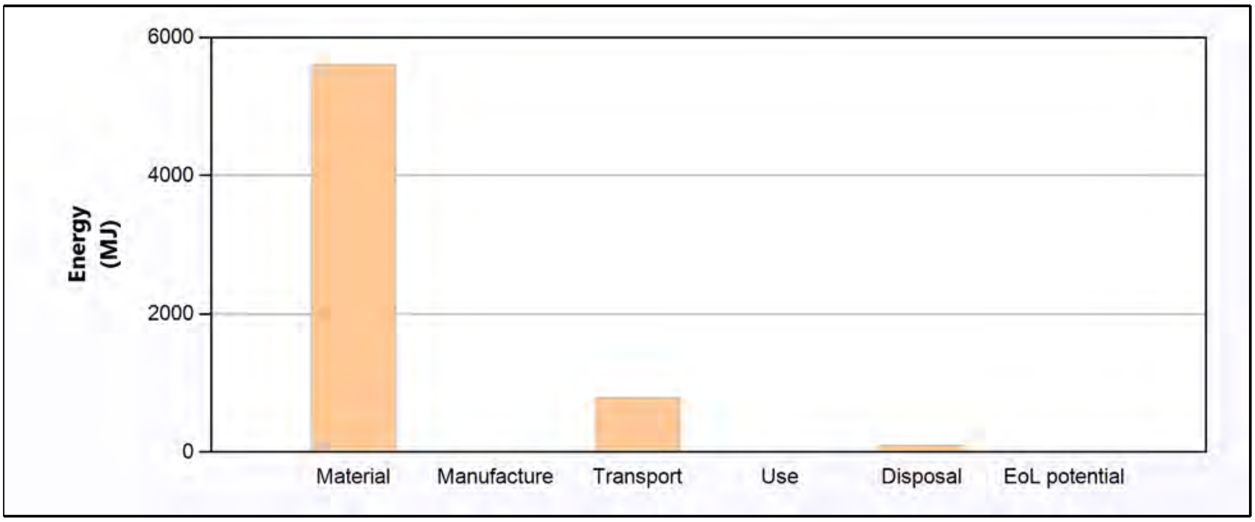
Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	5.61e+03	86.2	186	74.3
Manufacture	0	0.0	0	0.0
Transport	795	12.2	57.2	22.9
Use	0	0.0	0	0.0
Disposal	102	1.6	7.11	2.8
Total (for first life)	**6.5e+03**	**100**	**250**	**100**
End of life potential	0		0	

Eco Audit Report

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	6.5e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Pine	Pine (pinus monticola) (l)	Virgin (0%)	5.1e+02	1	5.1e+02	5.6e+03	100.0
Total				**1**	**5.1e+02**	**5.6e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Jeld Wen Doors Source	40 tonne (6 axle) truck	1.9e+03	7.9e+02	99.6
Home Depot POS	26 tonne (3 axle) truck	5.2	2.9	0.4
Total		**1.9e+03**	**8e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Pine	5.1e+02	8e+02	100.0
Total	**5.1e+02**	**8e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Pine	Landfill	1e+02	100.0
Total		**1e+02**	**100**

EoL potential:

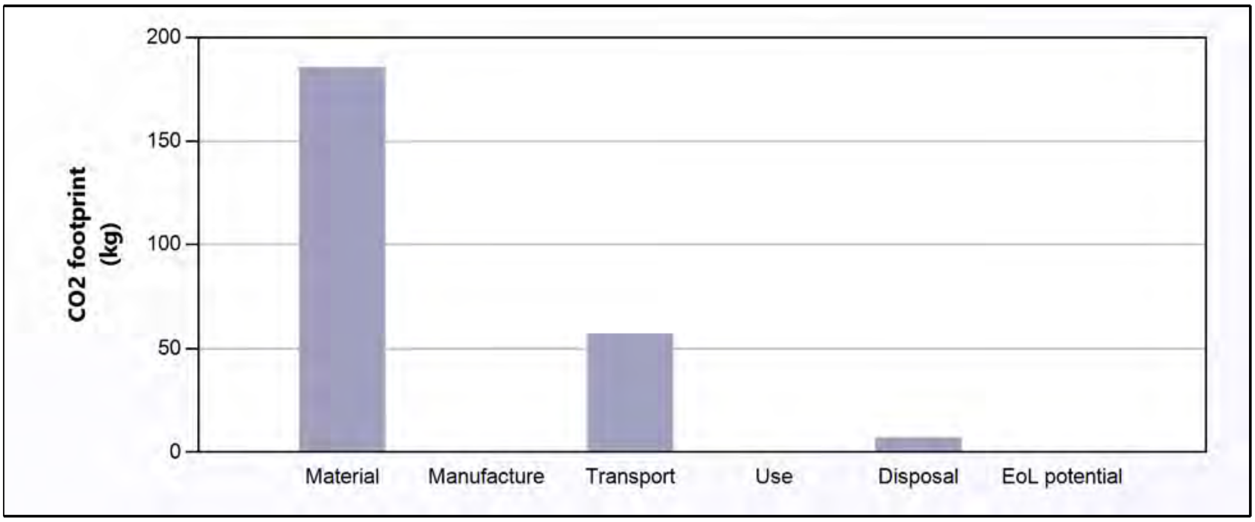
Component	End of life option	Energy (MJ)	%
Pine	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	250

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Pine	Pine (pinus monticola) (l)	Virgin (0%)	5.1e+02	1	5.1e+02	1.9e+02	100.0
Total				**1**	**5.1e+02**	**1.9e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Jeld Wen Doors Source	40 tonne (6 axle) truck	1.9e+03	57	99.6
Home Depot POS	26 tonne (3 axle) truck	5.2	0.21	0.4
Total		**1.9e+03**	**57**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Pine	5.1e+02	57	100.0
Total	**5.1e+02**	**57**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Pine	Landfill	7.1	100.0
Total		**7.1**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Pine	Landfill	0	
Total		**0**	**100**

Notes:

Summary

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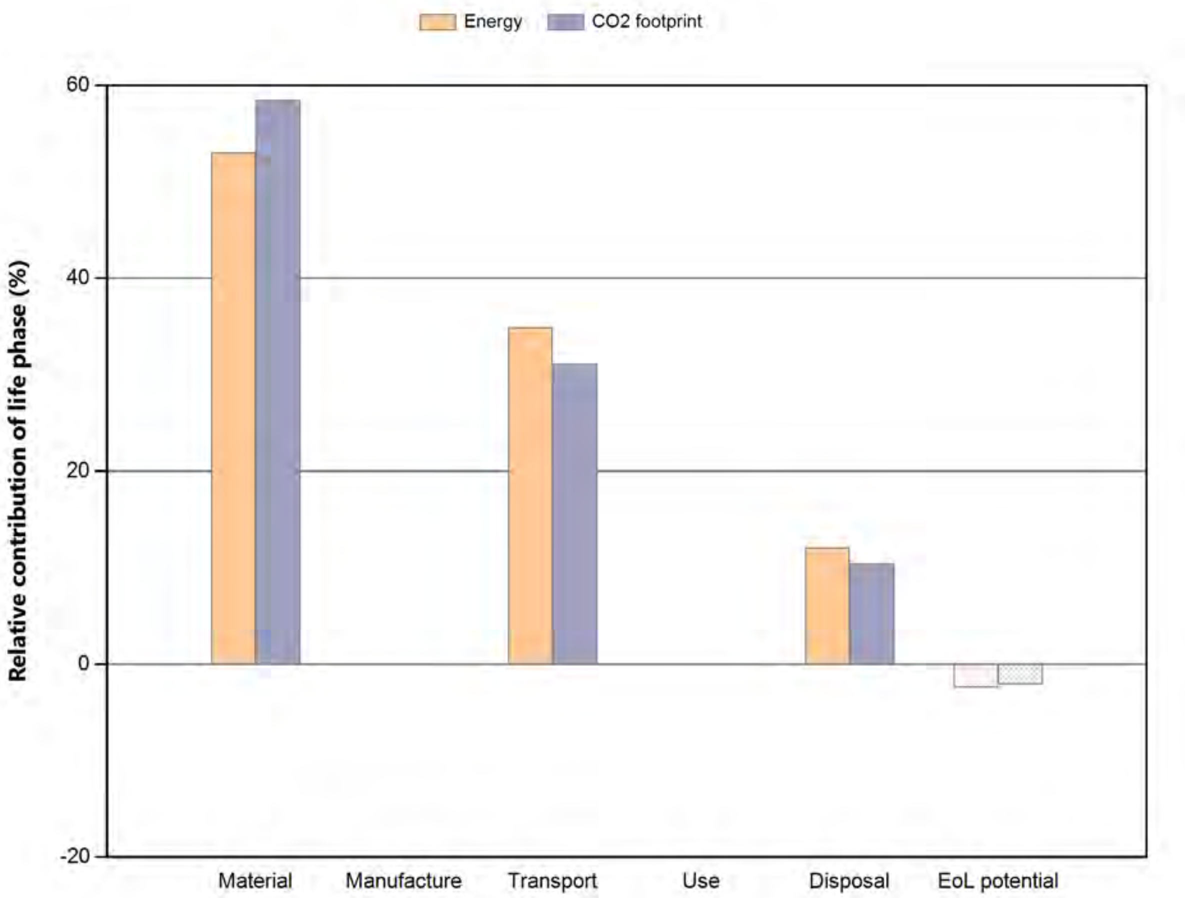
Eco Audit Report

Product name	Drywall
Country of use	World
Product life (years)	1

Summary:

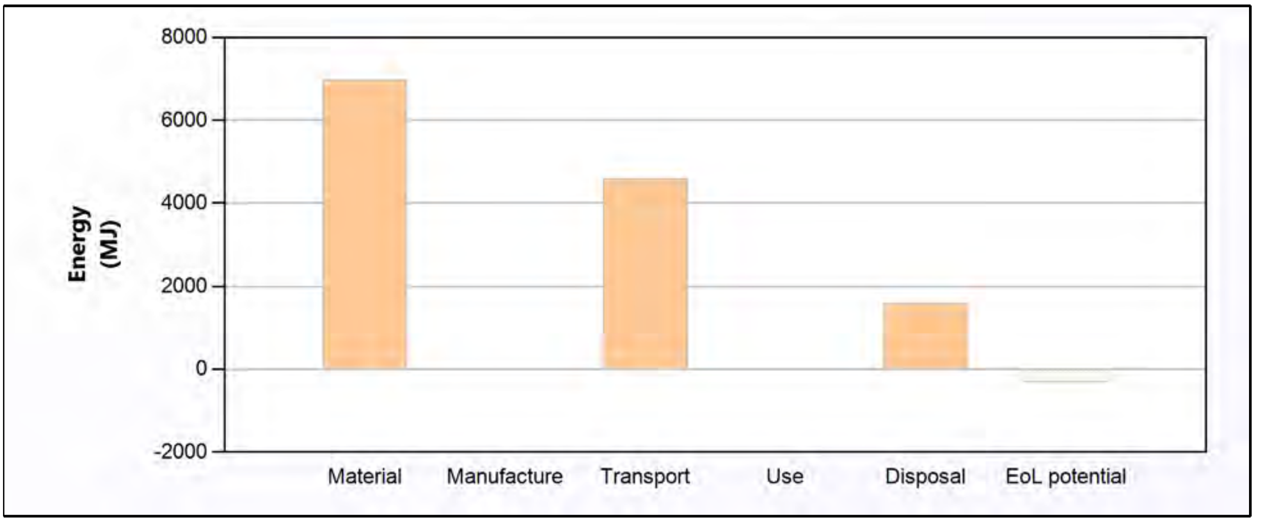


Energy details		CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	6.98e+03	53.0	621	58.5
Manufacture	0	0.0	0	0.0
Transport	4.59e+03	34.9	330	31.1
Use	0	0.0	0	0.0
Disposal	1.59e+03	12.1	111	10.5
Total (for first life)	**1.32e+04**	**100**	**1.06e+03**	**100**
End of life potential	-317		-22.2	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.32e+04

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Drywall	Plaster of paris	Virgin (0%)	3.2e+03	1	3.2e+03	7e+03	100.0
Total				**1**	**3.2e+03**	**7e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

[Summary](#)

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
USG Corp. Source	40 tonne (6 axle) truck	1.8e+03	4.6e+03	99.7
Home Depot POS	32 tonne (4 axle) truck	5.2	15	0.3
Total		**1.8e+03**	**4.6e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Drywall	3.2e+03	4.6e+03	100.0
Total	**3.2e+03**	**4.6e+03**	**100**

Use:

[Summary](#)

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

[Summary](#)

Component	End of life option	Energy (MJ)	%
Drywall	Downcycle	1.6e+03	100.0
Total		**1.6e+03**	**100**

EoL potential:

Component	End of life option	Energy (MJ)	%
Drywall	Downcycle	-3.2e+02	100.0
Total		**-3.2e+02**	**100**

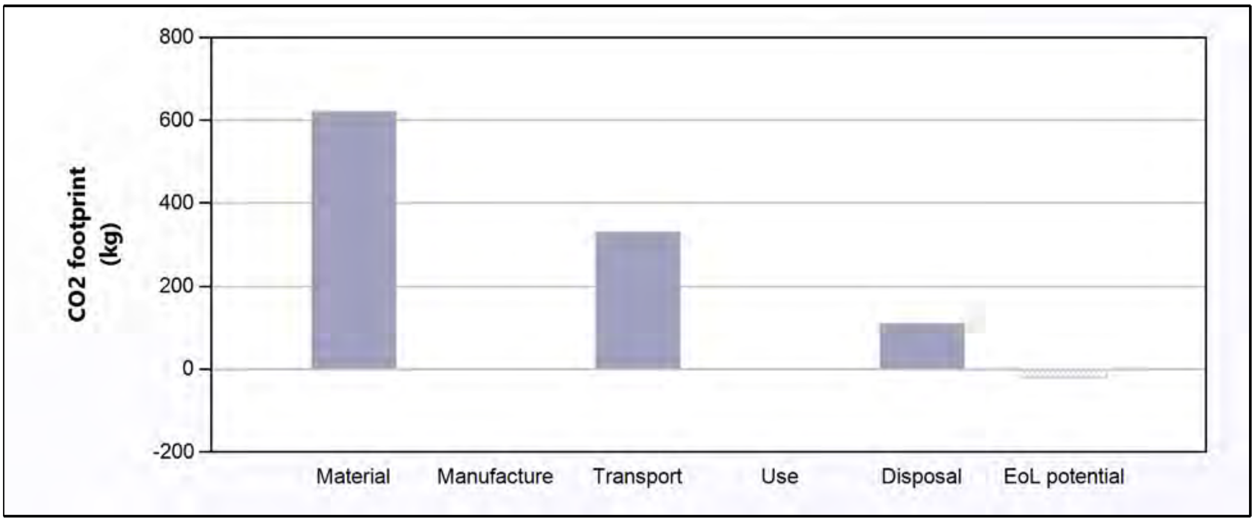
Notes:

[Summary](#)

Eco Audit Report

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.06e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Drywall	Plaster of paris	Virgin (0%)	3.2e+03	1	3.2e+03	6.2e+02	100.0
Total				**1**	**3.2e+03**	**6.2e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
USG Corp. Source	40 tonne (6 axle) truck	1.8e+03	3.3e+02	99.7
Home Depot POS	32 tonne (4 axle) truck	5.2	1.1	0.3
Total		**1.8e+03**	**3.3e+02**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Drywall	3.2e+03	3.3e+02	100.0
Total	**3.2e+03**	**3.3e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Drywall	Downcycle	1.1e+02	100.0
Total		**1.1e+02**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Drywall	Downcycle	-22	100.0
Total		**-22**	**100**

Notes:

Summary

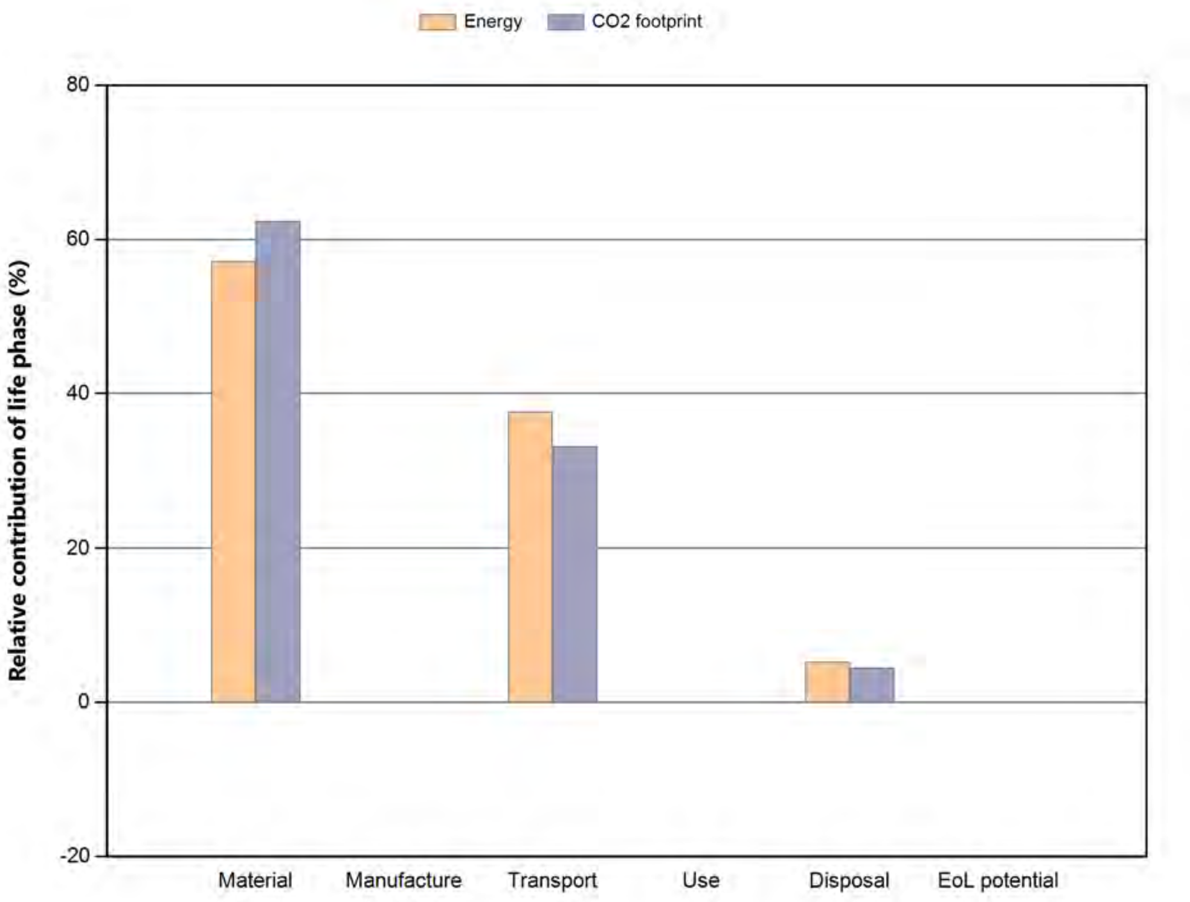
Eco Audit Report

Product name Drywall

Country of use World

Product life (years) 1

Summary:

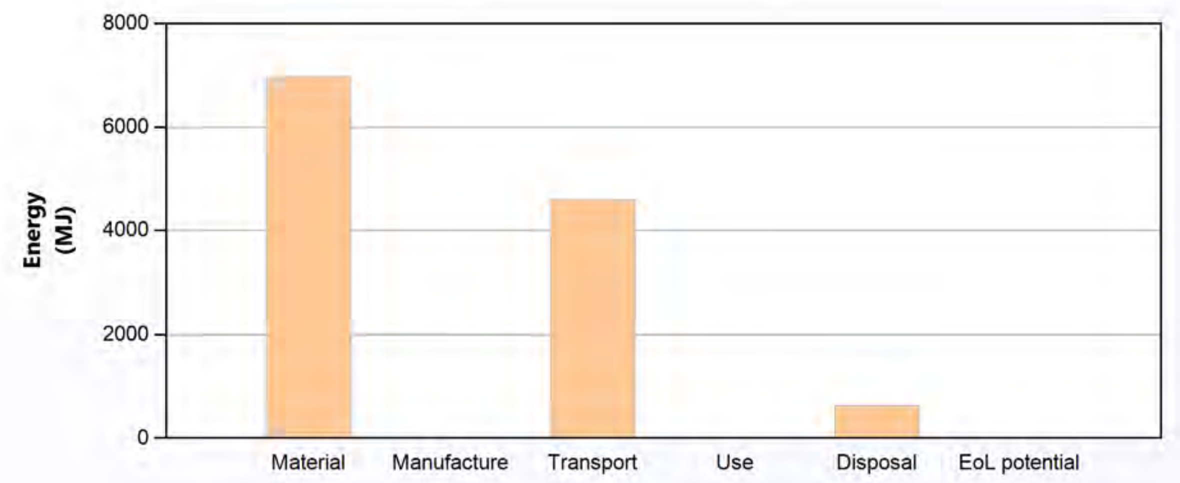


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	6.98e+03	57.2	621	62.4
Manufacture	0	0.0	0	0.0
Transport	4.59e+03	37.6	330	33.2
Use	0	0.0	0	0.0
Disposal	635	5.2	44.4	4.5
Total (for first life)	**1.22e+04**	**100**	**996**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.22e+04

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Drywall	Plaster of paris	Virgin (0%)	3.2e+03	1	3.2e+03	7e+03	100.0
Total				**1**	**3.2e+03**	**7e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

[Summary](#)

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
USG Corp. Source	40 tonne (6 axle) truck	1.8e+03	4.6e+03	99.7
Home Depot POS	32 tonne (4 axle) truck	5.2	15	0.3
Total		**1.8e+03**	**4.6e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Drywall	3.2e+03	4.6e+03	100.0
Total	**3.2e+03**	**4.6e+03**	**100**

Use:

[Summary](#)

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

[Summary](#)

Component	End of life option	Energy (MJ)	%
Drywall	Landfill	6.3e+02	100.0
Total		**6.3e+02**	**100**

EoL potential:

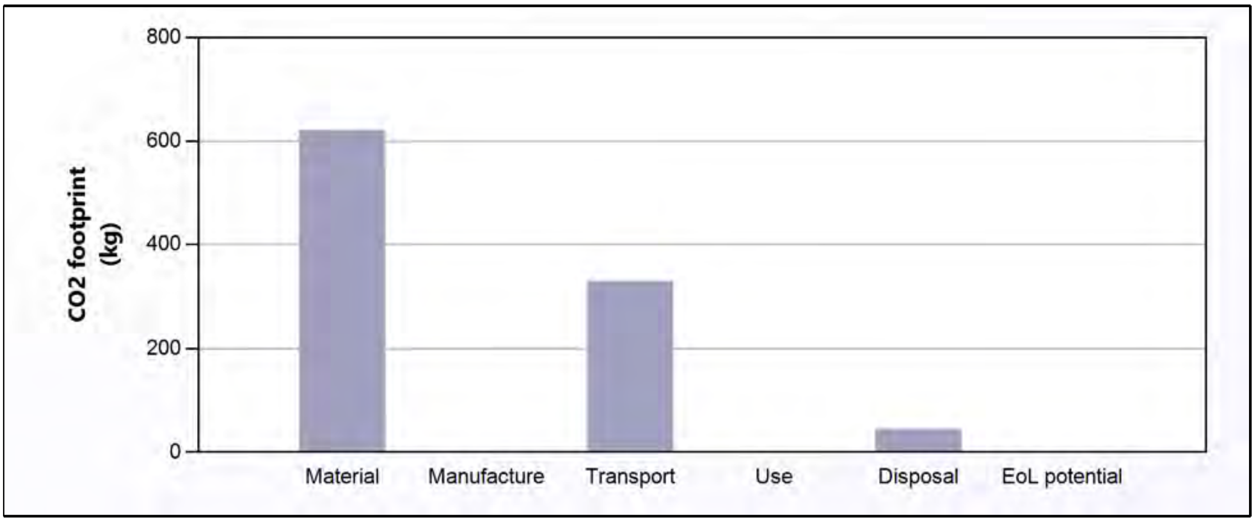
Component	End of life option	Energy (MJ)	%
Drywall	Landfill	0	
Total		**0**	**100**

Notes:

[Summary](#)

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	996

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Drywall	Plaster of paris	Virgin (0%)	3.2e+03	1	3.2e+03	6.2e+02	100.0
Total				1	3.2e+03	6.2e+02	100

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				100

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
USG Corp. Source	40 tonne (6 axle) truck	1.8e+03	3.3e+02	99.7
Home Depot POS	32 tonne (4 axle) truck	5.2	1.1	0.3
Total		**1.8e+03**	**3.3e+02**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Drywall	3.2e+03	3.3e+02	100.0
Total	**3.2e+03**	**3.3e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Drywall	Landfill	44	100.0
Total		**44**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Drywall	Landfill	0	
Total		**0**	**100**

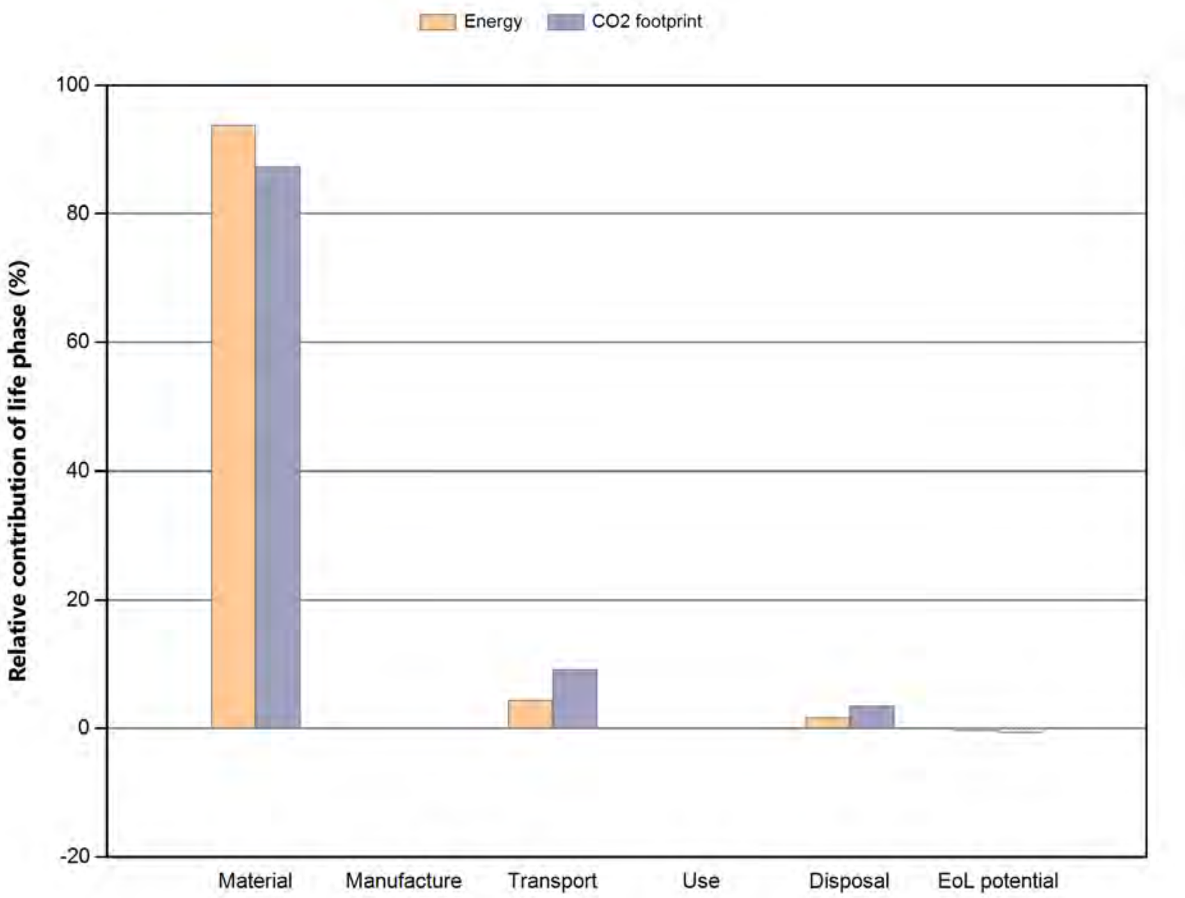
Notes:

Summary

Eco Audit Report

Product name	Insulation
Country of use	World
Product life (years)	1

Summary:



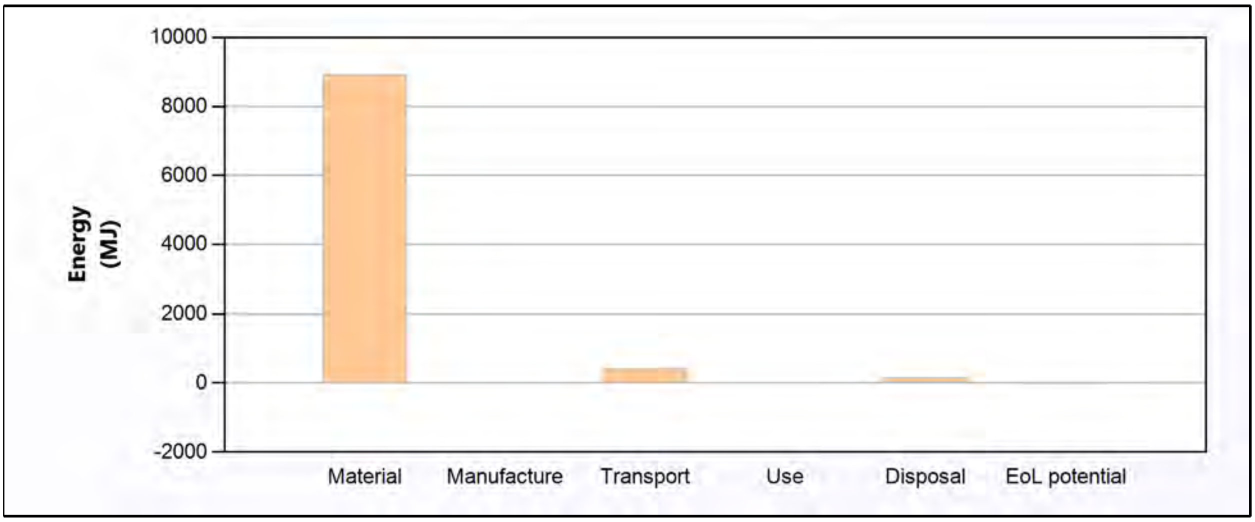
Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	8.93e+03	93.8	289	87.3
Manufacture	0	0.0	0	0.0
Transport	422	4.4	30.4	9.2
Use	0	0.0	0	0.0
Disposal	166	1.7	11.6	3.5
Total (for first life)	**9.51e+03**	**100**	**331**	**100**
End of life potential	-33.1		-2.32	

Eco Audit Report

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	9.51e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Fiberglass Insulation	SF-glass	Virgin (0%)	3.3e+02	1	3.3e+02	8.9e+03	100.0
Total				**1**	**3.3e+02**	**8.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Owens Company Source	40 tonne (6 axle) truck	1.5e+03	4.2e+02	99.6
Home Depot	26 tonne (3 axle) truck	5.2	1.9	0.4
Total		**1.6e+03**	**4.2e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Fiberglass Insulation	3.3e+02	4.2e+02	100.0
Total	**3.3e+02**	**4.2e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Fiberglass Insulation	Downcycle	1.7e+02	100.0
Total		**1.7e+02**	**100**

EoL potential:

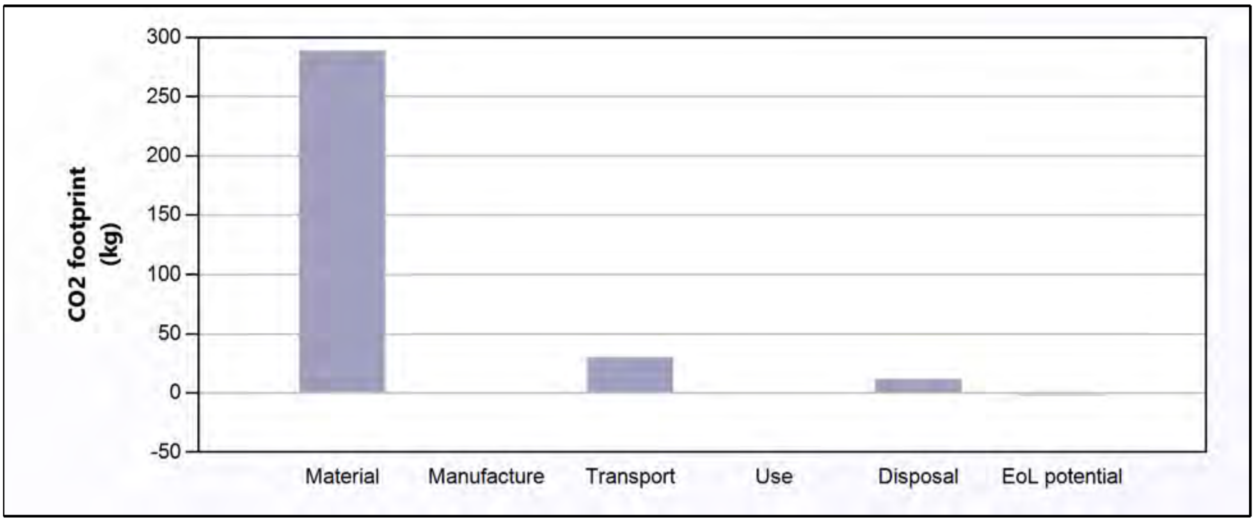
Component	End of life option	Energy (MJ)	%
Fiberglass Insulation	Downcycle	-33	100.0
Total		**-33**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	331

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Fiberglass Insulation	SF-glass	Virgin (0%)	3.3e+02	1	3.3e+02	2.9e+02	100.0
Total				**1**	**3.3e+02**	**2.9e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Owens Company Source	40 tonne (6 axle) truck	1.5e+03	30	99.6
Home Depot	26 tonne (3 axle) truck	5.2	0.14	0.4
Total		**1.6e+03**	**30**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Fiberglass Insulation	3.3e+02	30	100.0
Total	**3.3e+02**	**30**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Fiberglass Insulation	Downcycle	12	100.0
Total		**12**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Fiberglass Insulation	Downcycle	-2.3	100.0
Total		**-2.3**	**100**

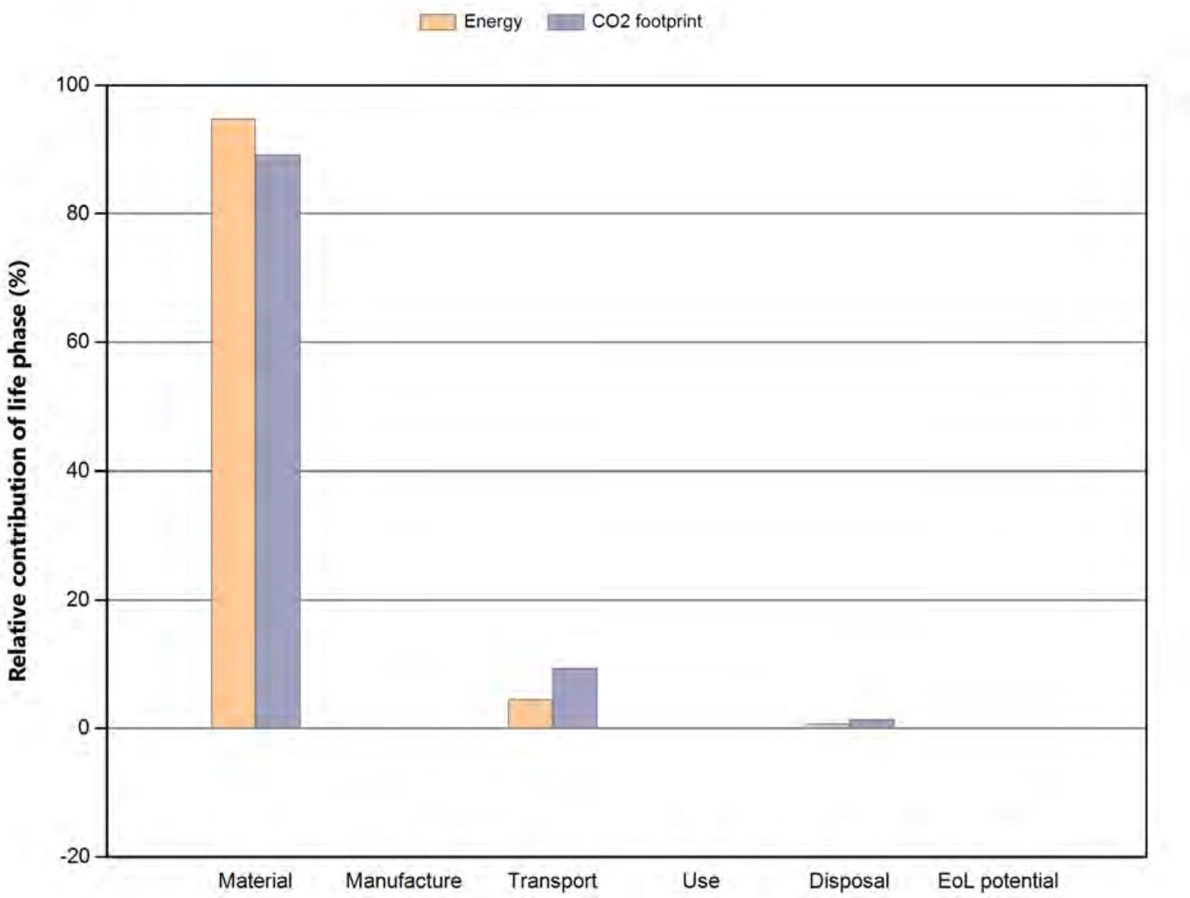
Notes:

Summary

Eco Audit Report

Product name	Insulation
Country of use	World
Product life (years)	1

Summary:

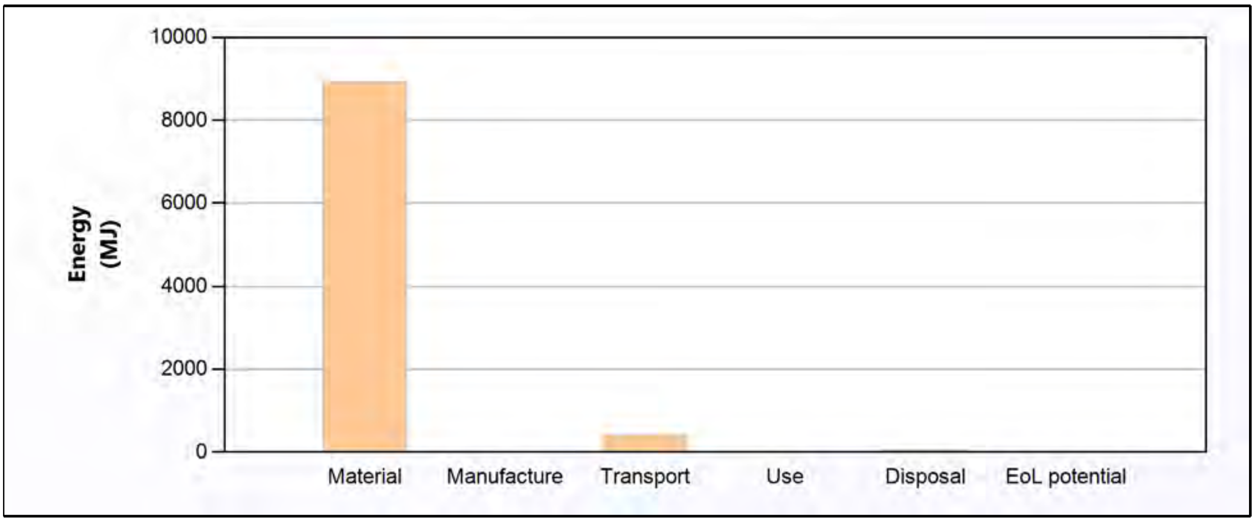


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	8.93e+03	94.8	289	89.2
Manufacture	0	0.0	0	0.0
Transport	422	4.5	30.4	9.4
Use	0	0.0	0	0.0
Disposal	66.2	0.7	4.63	1.4
Total (for first life)	**9.42e+03**	**100**	**324**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	9.42e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Fiberglass Insulation	SF-glass	Virgin (0%)	3.3e+02	1	3.3e+02	8.9e+03	100.0
Total				**1**	**3.3e+02**	**8.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Owens Company Source	40 tonne (6 axle) truck	1.5e+03	4.2e+02	99.6
Home Depot	26 tonne (3 axle) truck	5.2	1.9	0.4
Total		**1.6e+03**	**4.2e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Fiberglass Insulation	3.3e+02	4.2e+02	100.0
Total	**3.3e+02**	**4.2e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Fiberglass Insulation	Landfill	66	100.0
Total		**66**	**100**

EoL potential:

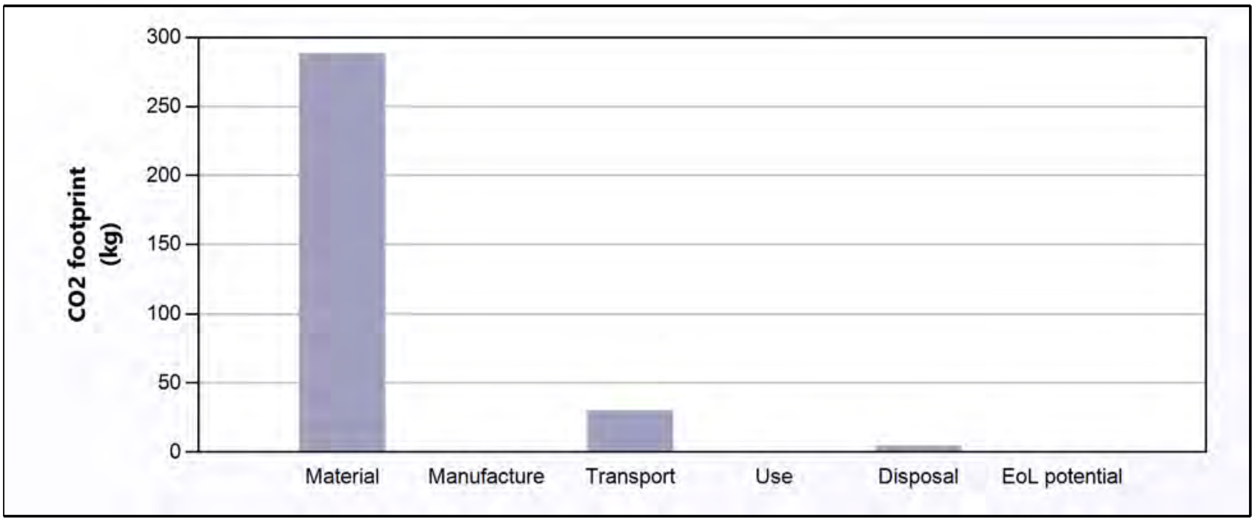
Component	End of life option	Energy (MJ)	%
Fiberglass Insulation	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	324

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Fiberglass Insulation	SF-glass	Virgin (0%)	3.3e+02	1	3.3e+02	2.9e+02	100.0
Total				**1**	**3.3e+02**	**2.9e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Owens Company Source	40 tonne (6 axle) truck	1.5e+03	30	99.6
Home Depot	26 tonne (3 axle) truck	5.2	0.14	0.4
Total		**1.6e+03**	**30**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Fiberglass Insulation	3.3e+02	30	100.0
Total	**3.3e+02**	**30**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Fiberglass Insulation	Landfill	4.6	100.0
Total		**4.6**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Fiberglass Insulation	Landfill	0	
Total		**0**	**100**

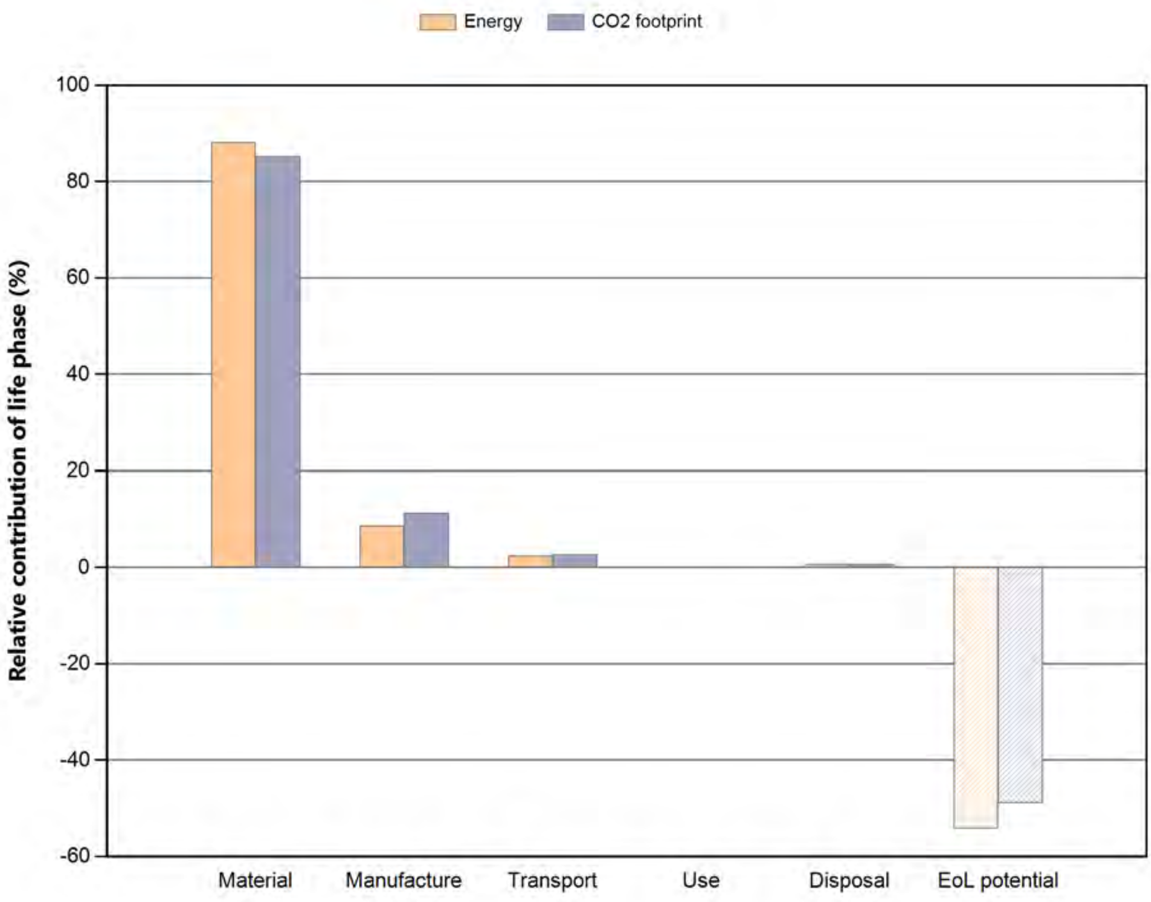
Notes:

Summary

Eco Audit Report

Product name	Wire
Country of use	World
Product life (years)	1

Summary:

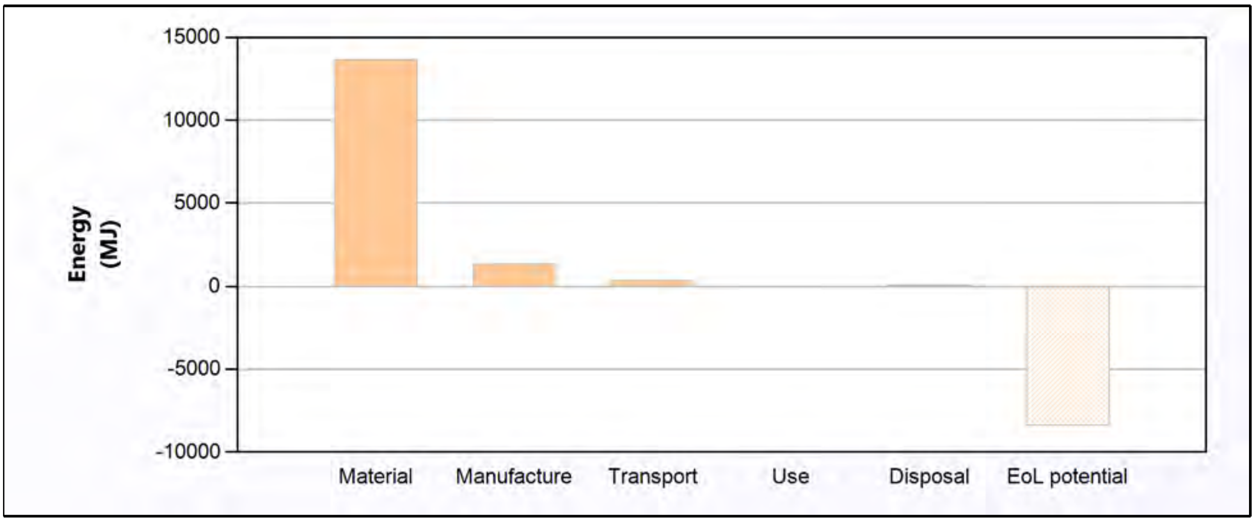


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	1.37e+04	88.1	868	85.2
Manufacture	1.35e+03	8.7	115	11.3
Transport	386	2.5	27.8	2.7
Use	0	0.0	0	0.0
Disposal	105	0.7	7.34	0.7
Total (for first life)	**1.55e+04**	**100**	**1.02e+03**	**100**
End of life potential	-8.41e+03		-498	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.55e+04

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Copper	Copper-nickel alloy, C64700, soft (98/2 copper-nickel)	Virgin (0%)	1.3e+02	1	1.3e+02	7.9e+03	57.5
Aluminum	Al-conductor steel reinforced, class AA, small	Virgin (0%)	31	1	31	5.8e+03	42.5
Total				**2**	**1.6e+02**	**1.4e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Copper	Wire drawing	1.3e+02 kg	9e+02	66.3
Aluminum	Advanced composite molding	31 kg	4.6e+02	33.7
Total			**1.4e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Southwire CO	32 tonne (4 axle) truck	2.6e+03	3.8e+02	99.4
Colorado Electrical Suppply	32 tonne (4 axle) truck	16	2.4	0.6
Total		**2.6e+03**	**3.9e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Copper	1.3e+02	3.1e+02	80.6
Aluminum	31	75	19.4
Total	**1.6e+02**	**3.9e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Copper	Recycle	90	85.4
Aluminum	Downcycle	15	14.6
Total		**1e+02**	**100**

EoL potential:

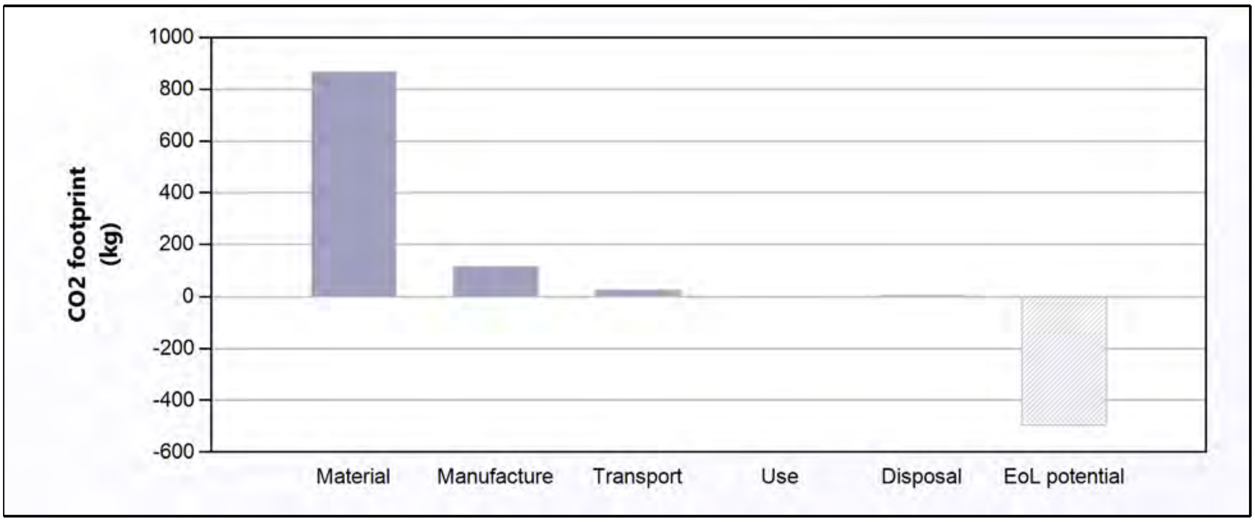
Component	End of life option	Energy (MJ)	%
Copper	Recycle	-6.1e+03	72.4
Aluminum	Downcycle	-2.3e+03	27.6
Total		**-8.4e+03**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.02e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Copper	Copper-nickel alloy, C64700, soft (98/2 copper-nickel)	Virgin (0%)	1.3e+02	1	1.3e+02	4.8e+02	55.8
Aluminum	Al-conductor steel reinforced, class AA, small	Virgin (0%)	31	1	31	3.8e+02	44.2
Total				**2**	**1.6e+02**	**8.7e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Copper	Wire drawing	1.3e+02 kg	67	58.1
Aluminum	Advanced composite molding	31 kg	48	41.9
Total			**1.2e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Southwire CO	32 tonne (4 axle) truck	2.6e+03	28	99.4
Colorado Electrical Suppply	32 tonne (4 axle) truck	16	0.17	0.6
Total		**2.6e+03**	**28**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Copper	1.3e+02	22	80.6
Aluminum	31	5.4	19.4
Total	**1.6e+02**	**28**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Copper	Recycle	6.3	85.4
Aluminum	Downcycle	1.1	14.6
Total		**7.3**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Copper	Recycle	-3.5e+02	69.2
Aluminum	Downcycle	-1.5e+02	30.8
Total		**-5e+02**	**100**

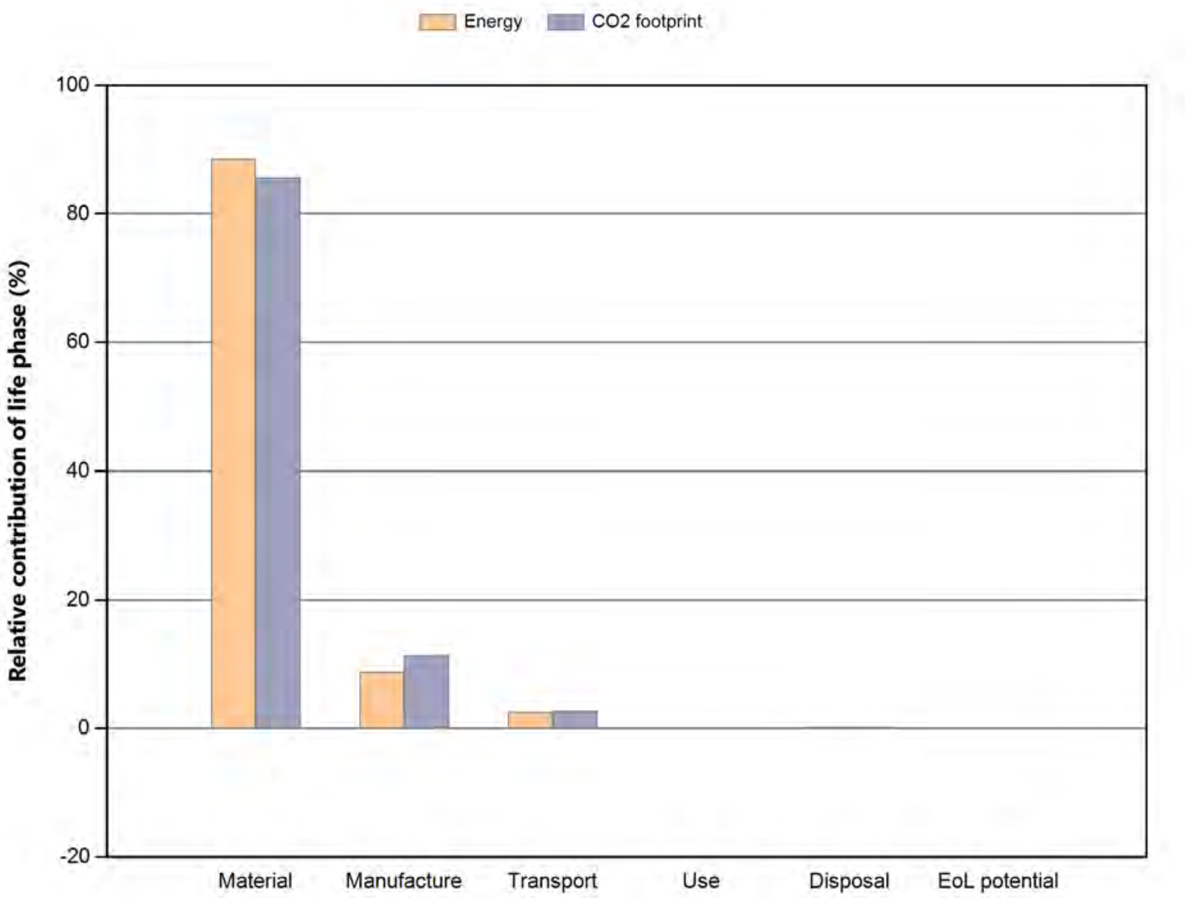
Notes:

Summary

Eco Audit Report

Product name	Wire
Country of use	World
Product life (years)	1

Summary:

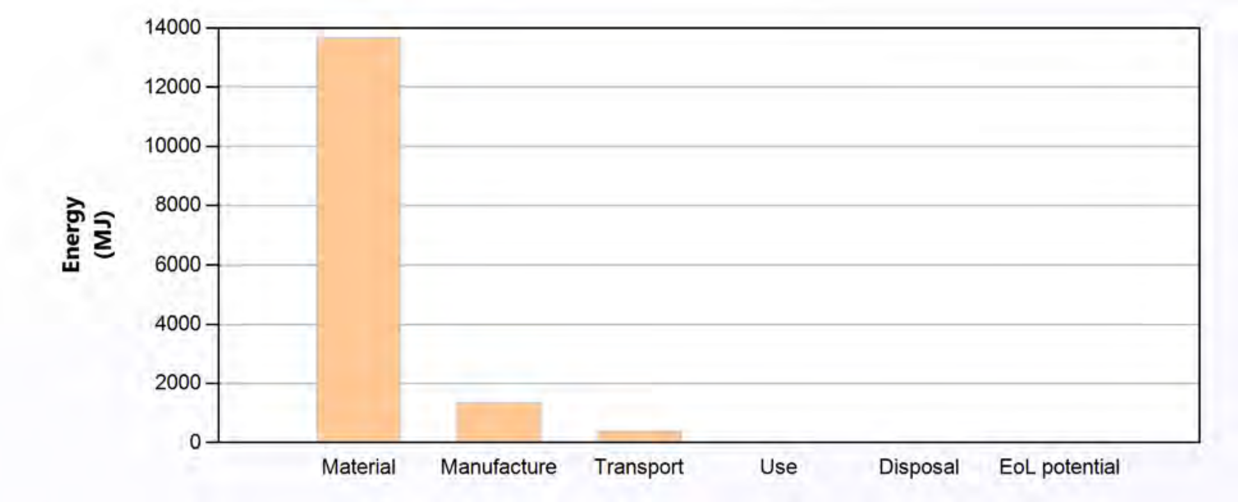


Energy details	CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	1.37e+04	88.6	868	85.7
Manufacture	1.35e+03	8.7	115	11.4
Transport	386	2.5	27.8	2.7
Use	0	0.0	0	0.0
Disposal	31.7	0.2	2.22	0.2
Total (for first life)	**1.55e+04**	**100**	**1.01e+03**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.55e+04

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Copper	Copper-nickel alloy, C64700, soft (98/2 copper-nickel)	Virgin (0%)	1.3e+02	1	1.3e+02	7.9e+03	57.5
Aluminum	Al-conductor steel reinforced, class AA, small	Virgin (0%)	31	1	31	5.8e+03	42.5
Total				**2**	**1.6e+02**	**1.4e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Copper	Wire drawing	1.3e+02 kg	9e+02	66.3
Aluminum	Advanced composite molding	31 kg	4.6e+02	33.7
Total			**1.4e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Southwire CO	32 tonne (4 axle) truck	2.6e+03	3.8e+02	99.4
Colorado Electrical Suppply	32 tonne (4 axle) truck	16	2.4	0.6
Total		**2.6e+03**	**3.9e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Copper	1.3e+02	3.1e+02	80.6
Aluminum	31	75	19.4
Total	**1.6e+02**	**3.9e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Copper	Landfill	26	80.6
Aluminum	Landfill	6.1	19.4
Total		**32**	**100**

EoL potential:

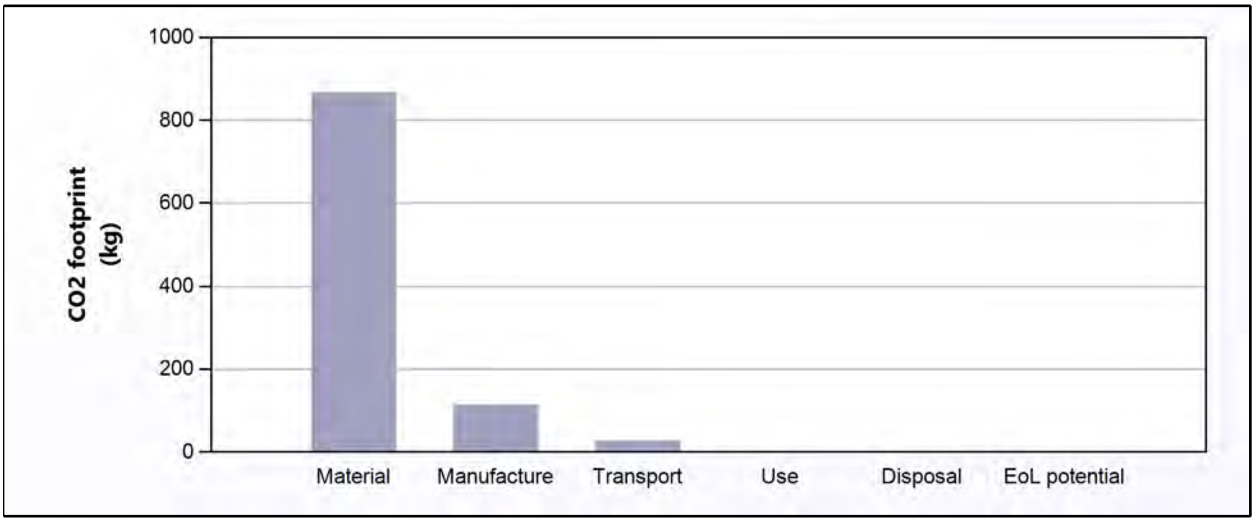
Component	End of life option	Energy (MJ)	%
Copper	Landfill	0	
Aluminum	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.01e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	**Material**	**Recycled content* (%)**	**Part mass (kg)**	**Qty.**	**Total mass (kg)**	**CO2 footprint (kg)**	**%**
Copper	Copper-nickel alloy, C64700, soft (98/2 copper-nickel)	Virgin (0%)	1.3e+02	1	1.3e+02	4.8e+02	55.8
Aluminum	Al-conductor steel reinforced, class AA, small	Virgin (0%)	31	1	31	3.8e+02	44.2
Total				**2**	**1.6e+02**	**8.7e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	**Process**	**Amount processed**	**CO2 footprint (kg)**	**%**
Copper	Wire drawing	1.3e+02 kg	67	58.1
Aluminum	Advanced composite molding	31 kg	48	41.9
Total			**1.2e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Southwire CO	32 tonne (4 axle) truck	2.6e+03	28	99.4
Colorado Electrical Suppply	32 tonne (4 axle) truck	16	0.17	0.6
Total		**2.6e+03**	**28**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Copper	1.3e+02	22	80.6
Aluminum	31	5.4	19.4
Total	**1.6e+02**	**28**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Copper	Landfill	1.8	80.6
Aluminum	Landfill	0.43	19.4
Total		**2.2**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Copper	Landfill	0	
Aluminum	Landfill	0	
Total		**0**	**100**

Notes:

Summary

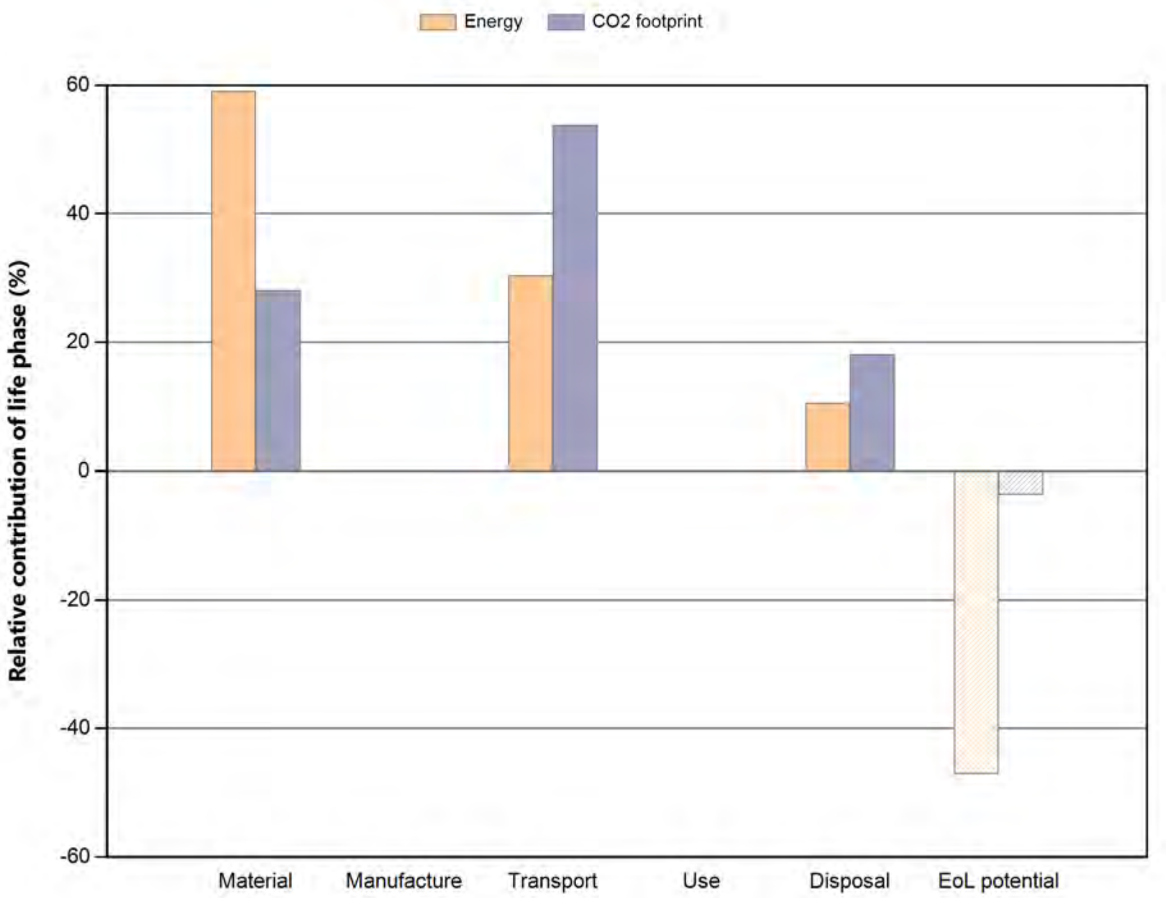
Eco Audit Report

Product name Ice Barrier

Country of use World

Product life (years) 1

Summary:

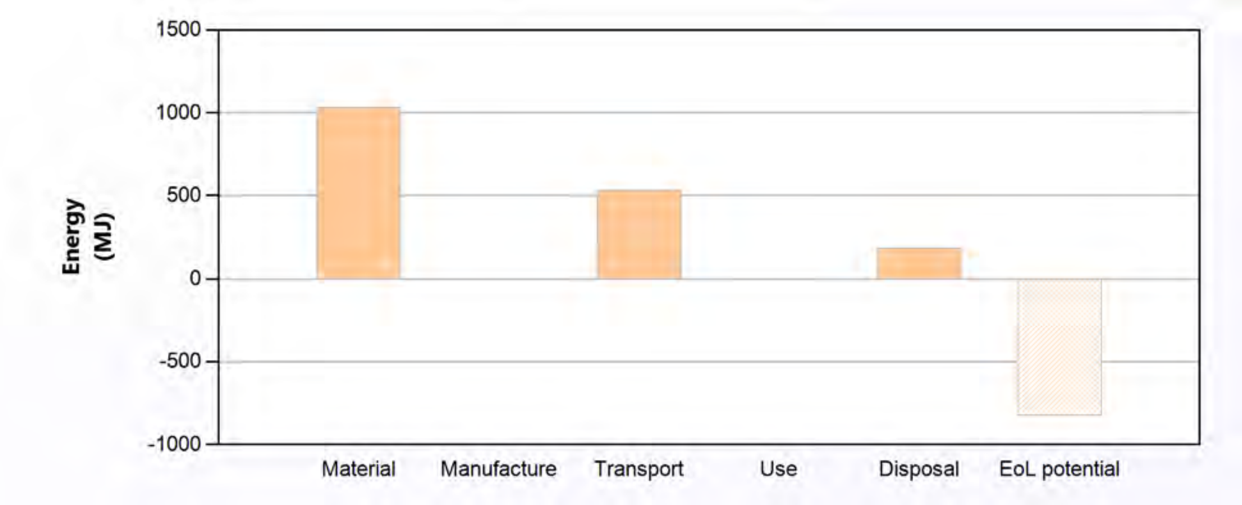


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	1.04e+03	59.1	20.1	28.1
Manufacture	0	0.0	0	0.0
Transport	533	30.4	38.4	53.8
Use	0	0.0	0	0.0
Disposal	185	10.5	12.9	18.1
Total (for first life)	**1.75e+03**	**100**	**71.4**	**100**
End of life potential	-826		-2.55	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.75e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Asphalt	Asphalt concrete	Virgin (0%)	2.6e+02	1	2.6e+02	1e+03	100.0
Total				**1**	**2.6e+02**	**1e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
GCP Applied Tech Source	32 tonne (4 axle) truck	2.1e+03	5.3e+02	99.6
ABC Supply POS	32 tonne (4 axle) truck	7.9	2	0.4
Total		**2.1e+03**	**5.3e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Asphalt	2.6e+02	5.3e+02	100.0
Total	**2.6e+02**	**5.3e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Asphalt	Recycle	1.8e+02	100.0
Total		**1.8e+02**	**100**

EoL potential:

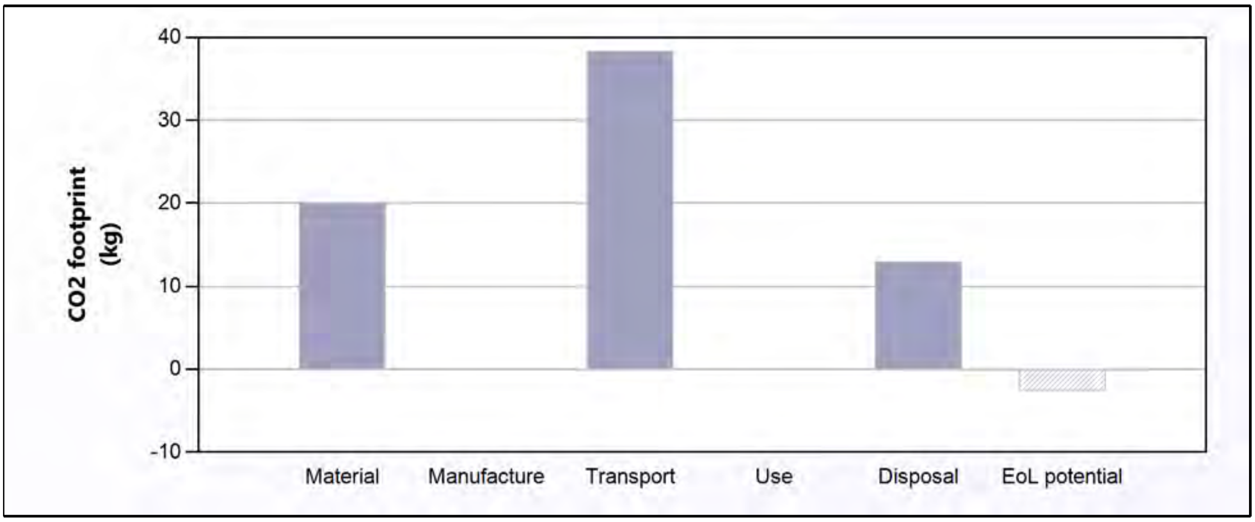
Component	End of life option	Energy (MJ)	%
Asphalt	Recycle	-8.3e+02	100.0
Total		**-8.3e+02**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	71.4

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Asphalt	Asphalt concrete	Virgin (0%)	2.6e+02	1	2.6e+02	20	100.0
Total				**1**	**2.6e+02**	**20**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
GCP Applied Tech Source	32 tonne (4 axle) truck	2.1e+03	38	99.6
ABC Supply POS	32 tonne (4 axle) truck	7.9	0.14	0.4
Total		**2.1e+03**	**38**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Asphalt	2.6e+02	38	100.0
Total	**2.6e+02**	**38**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Recycle	13	100.0
Total		**13**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Recycle	-2.5	100.0
Total		**-2.5**	**100**

Notes:

Summary

Eco Audit Report

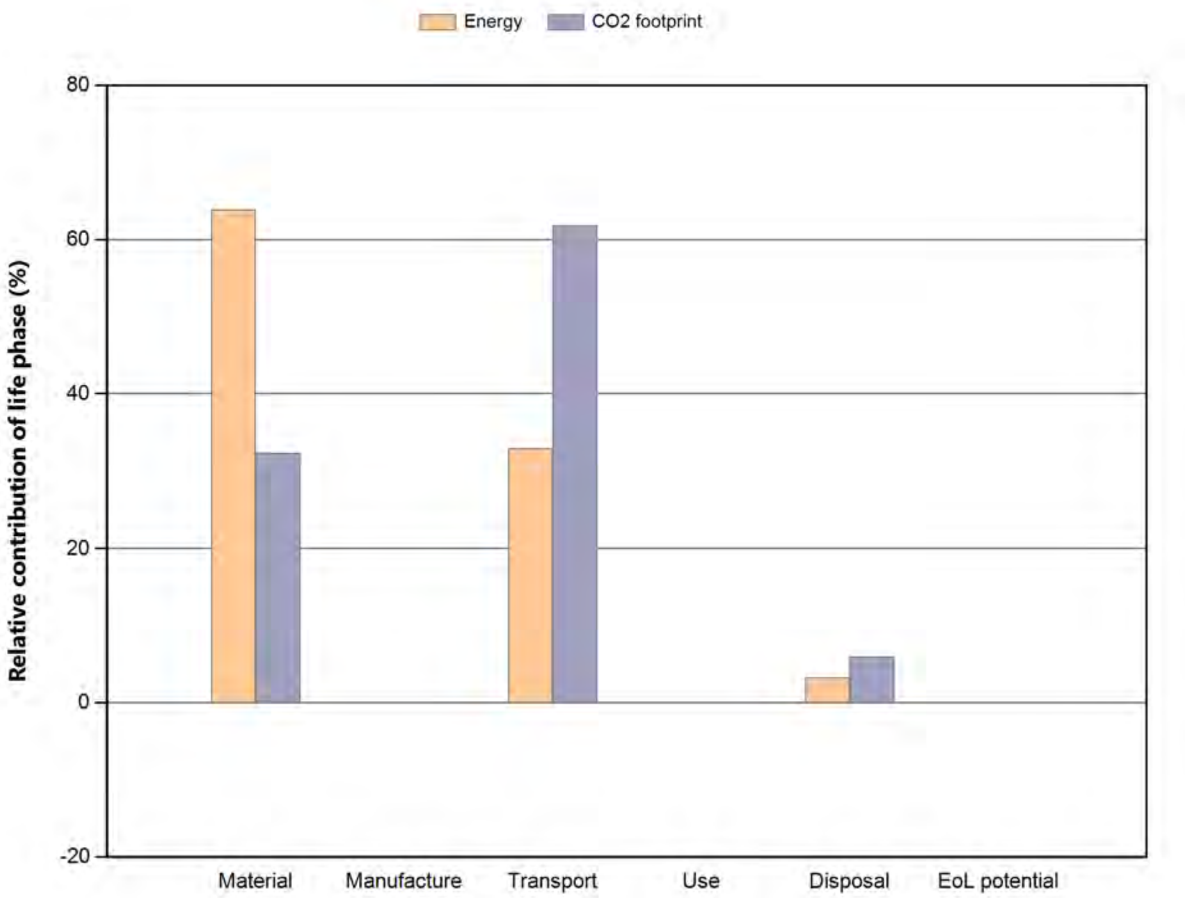
CES 2019 EDUPACK

Product name: Ice Barrier

Country of use: World

Product life (years): 1

Summary:

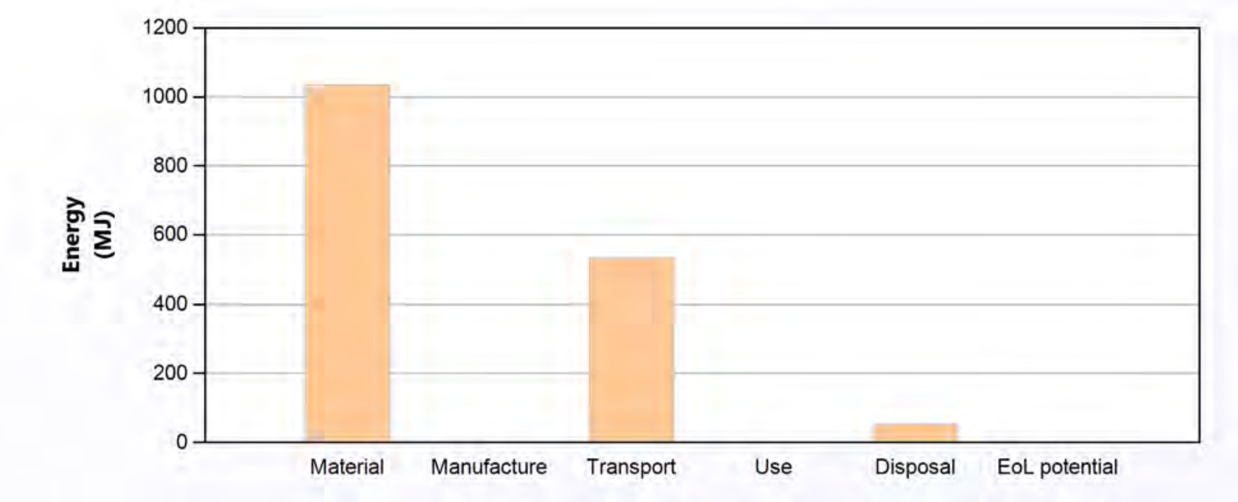


Energy details | CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	1.04e+03	63.9	20.1	32.3
Manufacture	0	0.0	0	0.0
Transport	533	32.9	38.4	61.8
Use	0	0.0	0	0.0
Disposal	52.8	3.3	3.7	5.9
Total (for first life)	**1.62e+03**	**100**	**62.2**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	1.62e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Asphalt	Asphalt concrete	Virgin (0%)	2.6e+02	1	2.6e+02	1e+03	100.0
Total				**1**	**2.6e+02**	**1e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
GCP Applied Tech Source	32 tonne (4 axle) truck	2.1e+03	5.3e+02	99.6
ABC Supply POS	32 tonne (4 axle) truck	7.9	2	0.4
Total		**2.1e+03**	**5.3e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Asphalt	2.6e+02	5.3e+02	100.0
Total	**2.6e+02**	**5.3e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Asphalt	Landfill	53	100.0
Total		**53**	**100**

EoL potential:

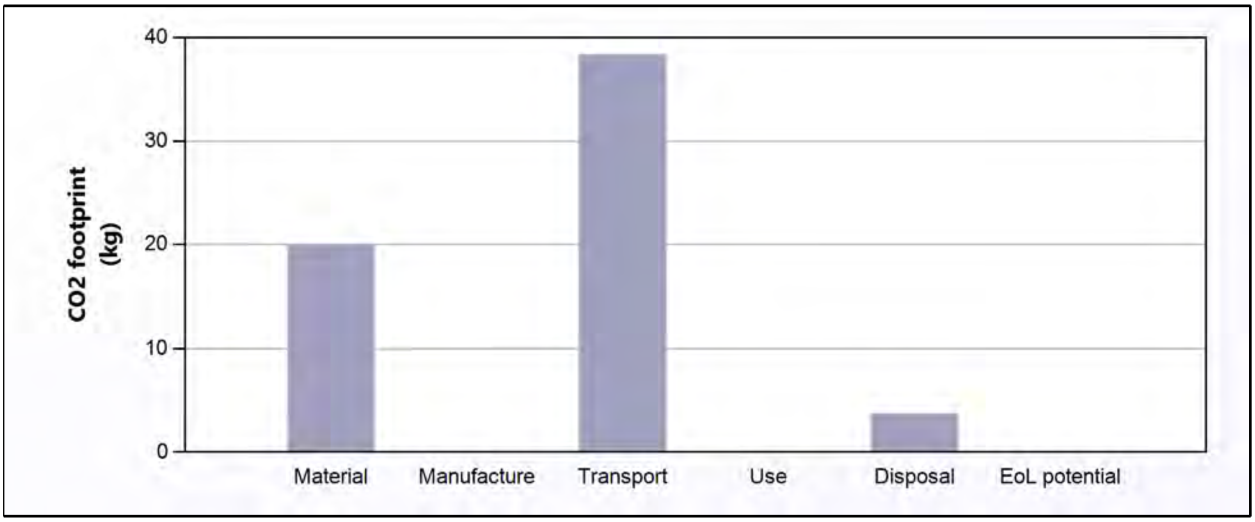
Component	End of life option	Energy (MJ)	%
Asphalt	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	62.2

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Asphalt	Asphalt concrete	Virgin (0%)	2.6e+02	1	2.6e+02	20	100.0
Total				**1**	**2.6e+02**	**20**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
GCP Applied Tech Source	32 tonne (4 axle) truck	2.1e+03	38	99.6
ABC Supply POS	32 tonne (4 axle) truck	7.9	0.14	0.4
Total		**2.1e+03**	**38**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Asphalt	2.6e+02	38	100.0
Total	**2.6e+02**	**38**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Landfill	3.7	100.0
Total		**3.7**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Landfill	0	
Total		**0**	**100**

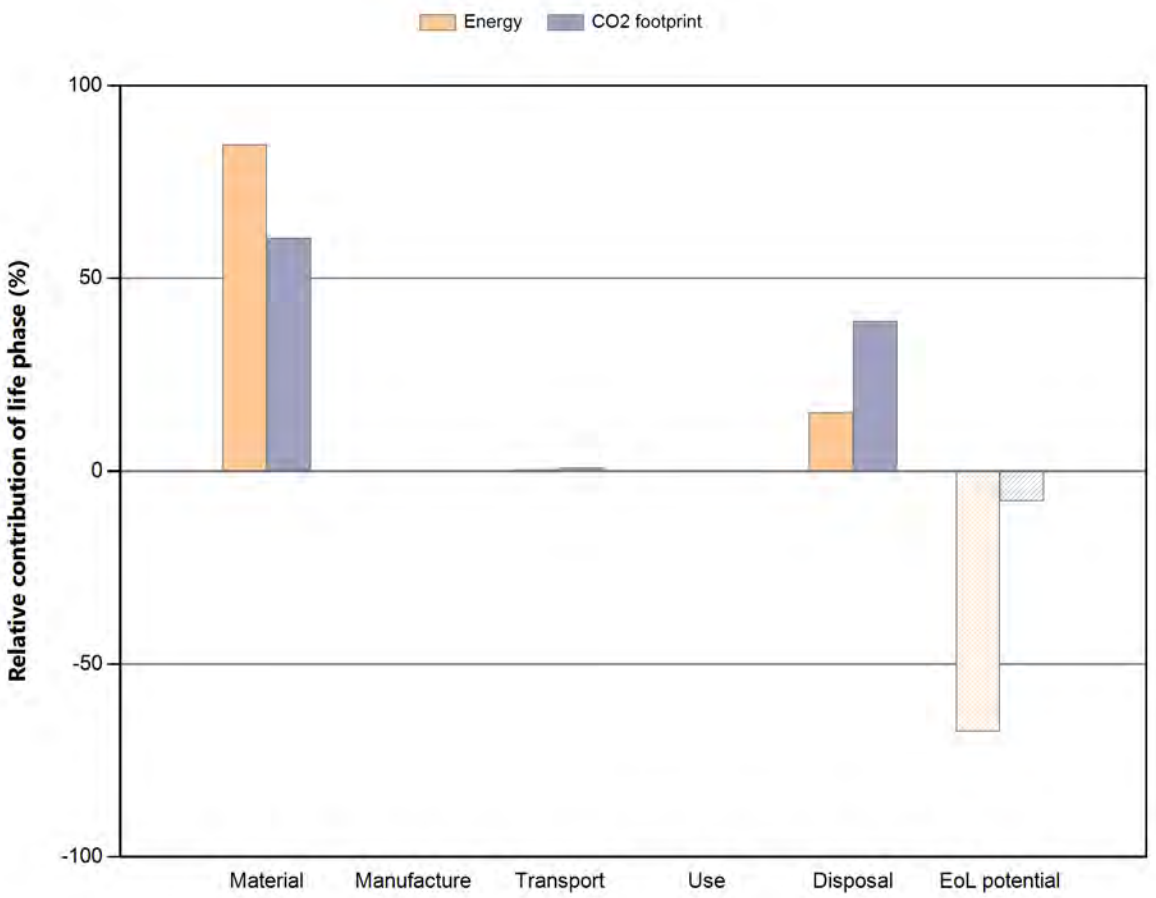
Notes:

Summary

Eco Audit Report

Product name	Shingles
Country of use	North America
Product life (years)	50

Summary:

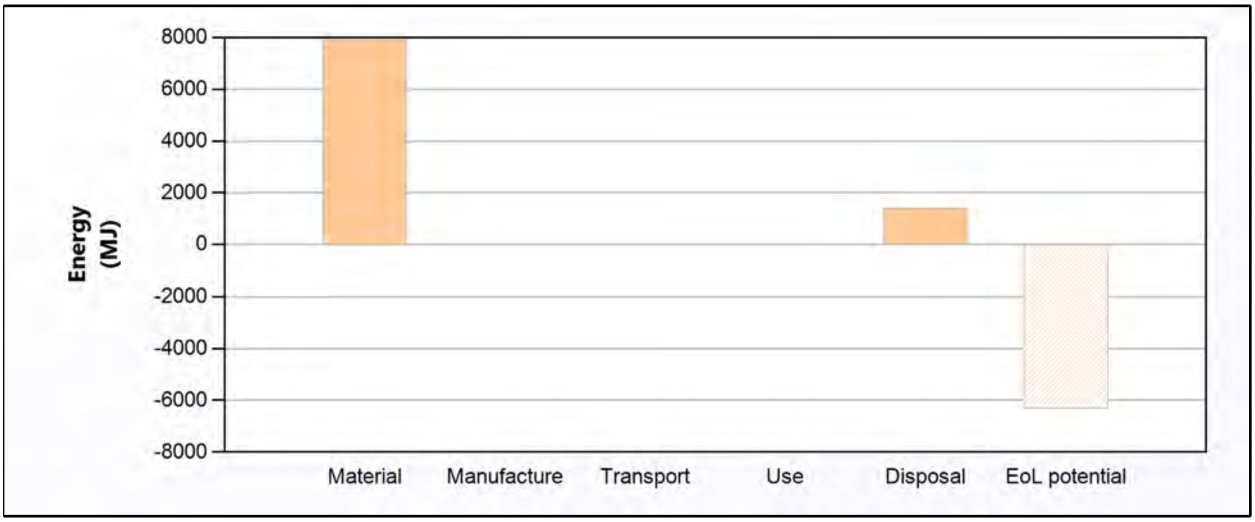


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	7.93e+03	84.6	154	60.4
Manufacture	0	0.0	0	0.0
Transport	25.7	0.3	1.85	0.7
Use	0	0.0	0	0.0
Disposal	1.41e+03	15.1	99	38.9
Total (for first life)	**9.37e+03**	**100**	**254**	**100**
End of life potential	-6.32e+03		-19.5	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	187

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Asphalt	Asphalt concrete	Virgin (0%)	2e+03	1	2e+03	7.9e+03	100.0
Total				**1**	**2e+03**	**7.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Owens Company Source	32 tonne (4 axle) truck	5.6	11	41.7
ABC Supply POS	32 tonne (4 axle) truck	7.9	15	58.3
Total		**14**	**26**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Asphalt	2e+03	26	100.0
Total	**2e+03**	**26**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Asphalt	Recycle	1.4e+03	100.0
Total		**1.4e+03**	**100**

EoL potential:

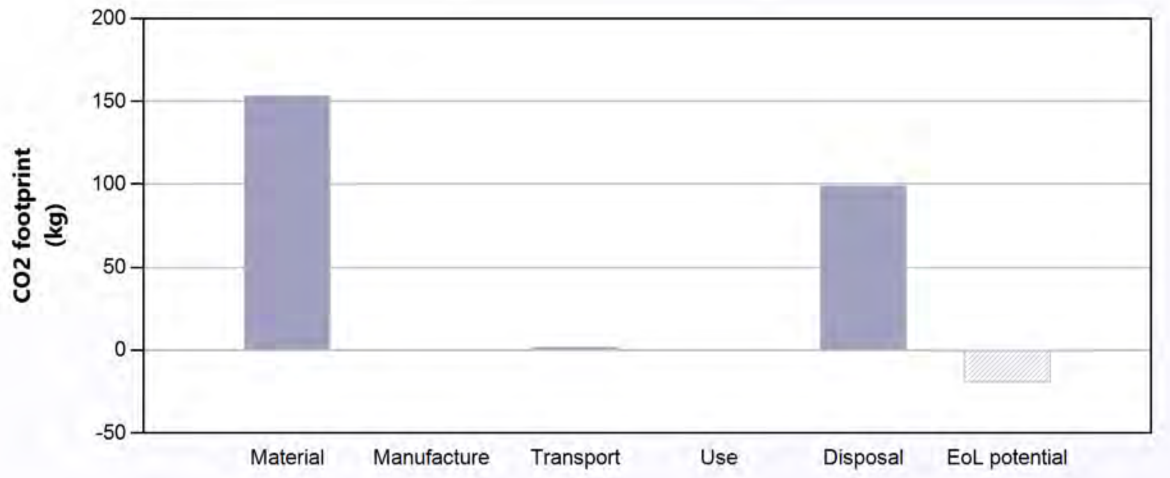
Component	End of life option	Energy (MJ)	%
Asphalt	Recycle	-6.3e+03	100.0
Total		**-6.3e+03**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	5.09

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Asphalt	Asphalt concrete	Virgin (0%)	2e+03	1	2e+03	1.5e+02	100.0
Total				**1**	**2e+03**	**1.5e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Owens Company Source	32 tonne (4 axle) truck	5.6	0.77	41.7
ABC Supply POS	32 tonne (4 axle) truck	7.9	1.1	58.3
Total		**14**	**1.8**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Asphalt	2e+03	1.8	100.0
Total	**2e+03**	**1.8**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Recycle	99	100.0
Total		**99**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Recycle	-19	100.0
Total		**-19**	**100**

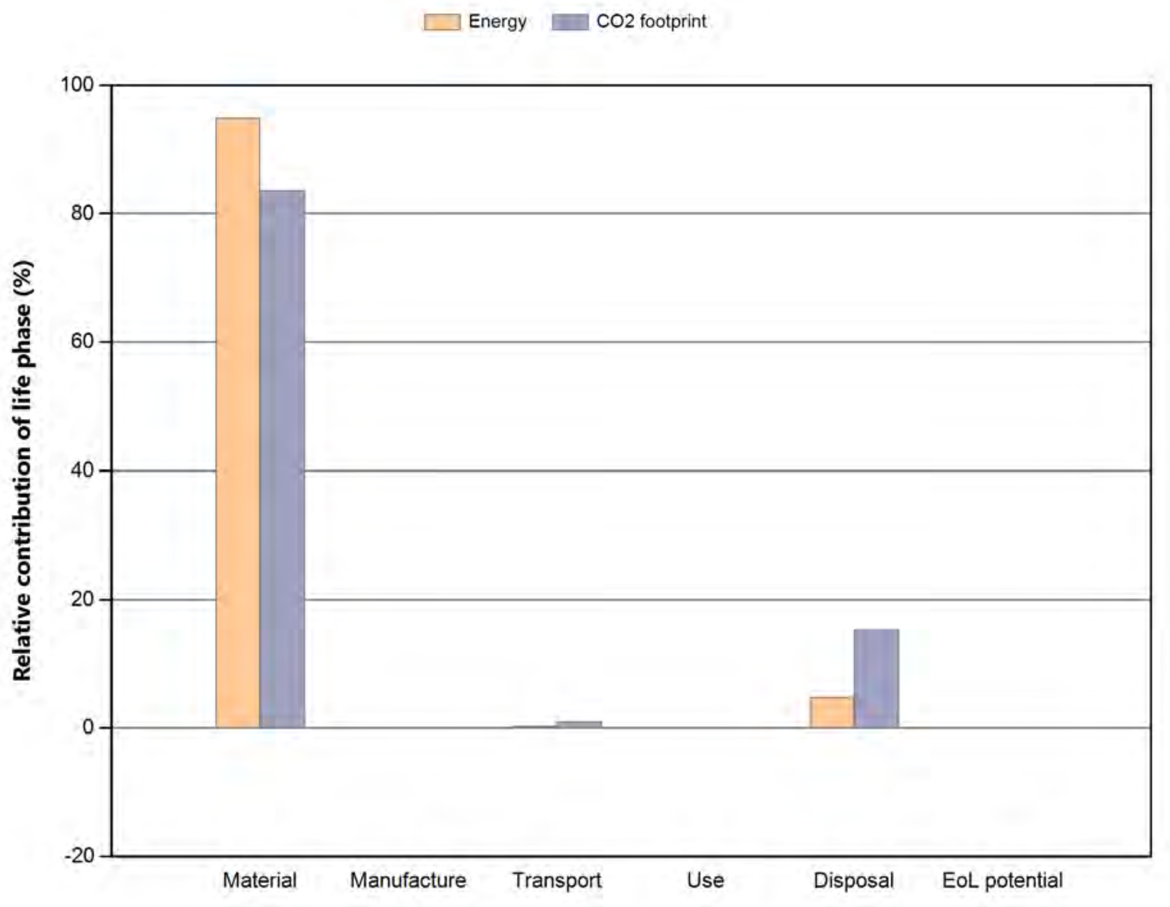
Notes:

Summary

Eco Audit Report

Product name	Shingles
Country of use	North America
Product life (years)	50

Summary:

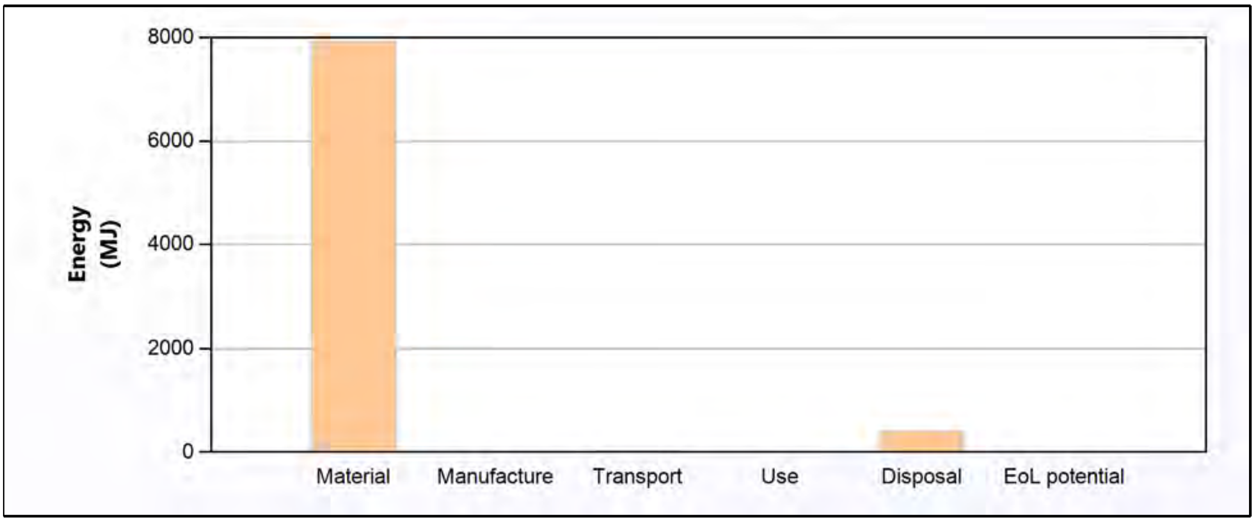


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	7.93e+03	94.9	154	83.6
Manufacture	0	0.0	0	0.0
Transport	25.7	0.3	1.85	1.0
Use	0	0.0	0	0.0
Disposal	404	4.8	28.3	15.4
Total (for first life)	**8.36e+03**	**100**	**184**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	167

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Asphalt	Asphalt concrete	Virgin (0%)	2e+03	1	2e+03	7.9e+03	100.0
Total				**1**	**2e+03**	**7.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Owens Company Source	32 tonne (4 axle) truck	5.6	11	41.7
ABC Supply POS	32 tonne (4 axle) truck	7.9	15	58.3
Total		**14**	**26**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Asphalt	2e+03	26	100.0
Total	**2e+03**	**26**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Asphalt	Landfill	4e+02	100.0
Total		**4e+02**	**100**

EoL potential:

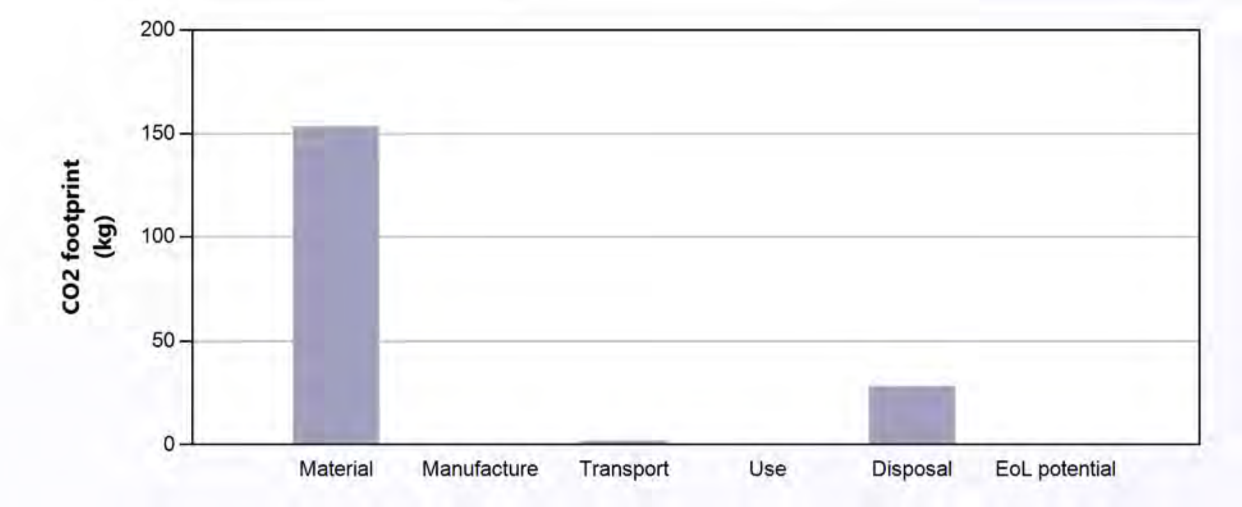
Component	End of life option	Energy (MJ)	%
Asphalt	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	3.67

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Asphalt	Asphalt concrete	Virgin (0%)	2e+03	1	2e+03	1.5e+02	100.0
Total				**1**	**2e+03**	**1.5e+02**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Owens Company Source	32 tonne (4 axle) truck	5.6	0.77	41.7
ABC Supply POS	32 tonne (4 axle) truck	7.9	1.1	58.3
Total		**14**	**1.8**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Asphalt	2e+03	1.8	100.0
Total	**2e+03**	**1.8**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Landfill	28	100.0
Total		**28**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Asphalt	Landfill	0	
Total		**0**	**100**

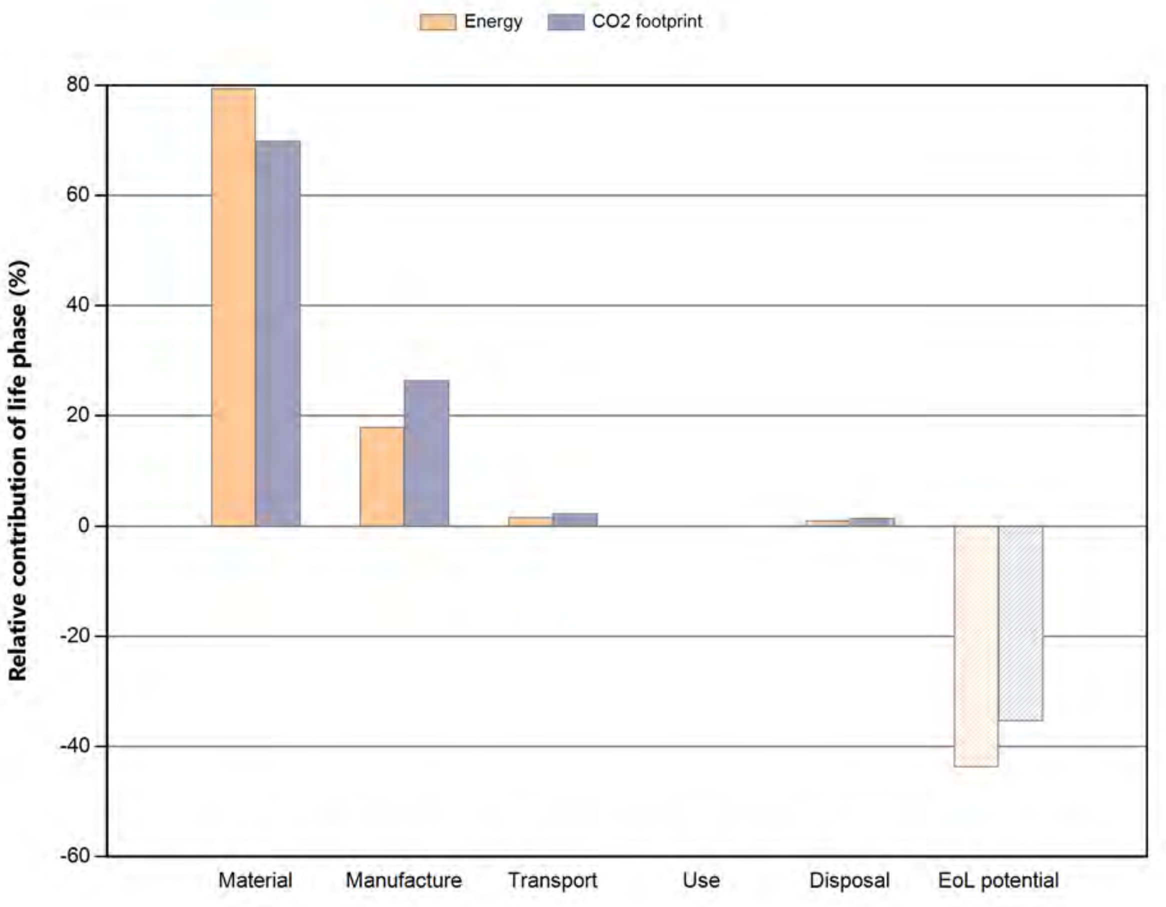
Notes:

Summary

Eco Audit Report

Product name	Glass
Country of use	World
Product life (years)	1

Summary:

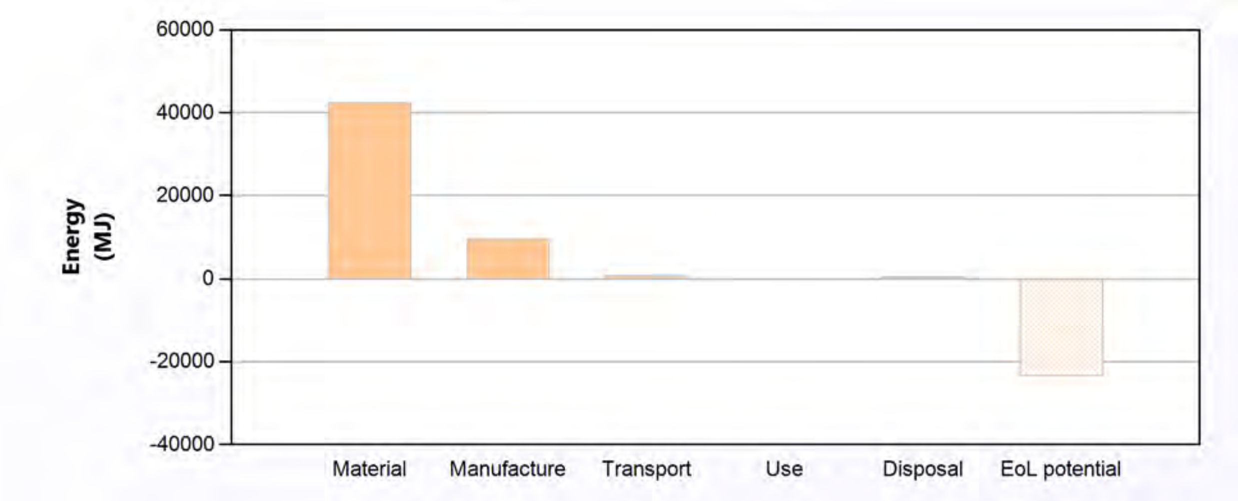


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	4.25e+04	79.4	1.92e+03	69.8
Manufacture	9.57e+03	17.9	727	26.4
Transport	873	1.6	62.9	2.3
Use	0	0.0	0	0.0
Disposal	570	1.1	39.9	1.4
Total (for first life)	**5.35e+04**	**100**	**2.75e+03**	**100**
End of life potential	-2.34e+04		-972	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	5.35e+04

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Windows	Laminated glass	Virgin (0%)	2.9e+02	1	2.9e+02	8.4e+03	19.8
Vinyl	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	5.2e+02	1	5.2e+02	3.4e+04	80.2
Total				**2**	**8.1e+02**	**4.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Windows	Glass molding	2.9e+02 kg	1.9e+03	19.6
Vinyl	Polymer molding	5.2e+02 kg	7.7e+03	80.4
Total			**9.6e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Pella windows Source and POS	32 tonne (4 axle) truck	1.1e+03	8.7e+02	100.0
Total		**1.1e+03**	**8.7e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Windows	2.9e+02	3.1e+02	35.5
Vinyl	5.2e+02	5.6e+02	64.5
Total	**8.1e+02**	**8.7e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Windows	Recycle	2e+02	35.5
Vinyl	Recycle	3.7e+02	64.5
Total		**5.7e+02**	**100**

EoL potential:

Component	End of life option	Energy (MJ)	%
Windows	Recycle	-1.5e+03	6.5
Vinyl	Recycle	-2.2e+04	93.5
Total		**-2.3e+04**	**100**

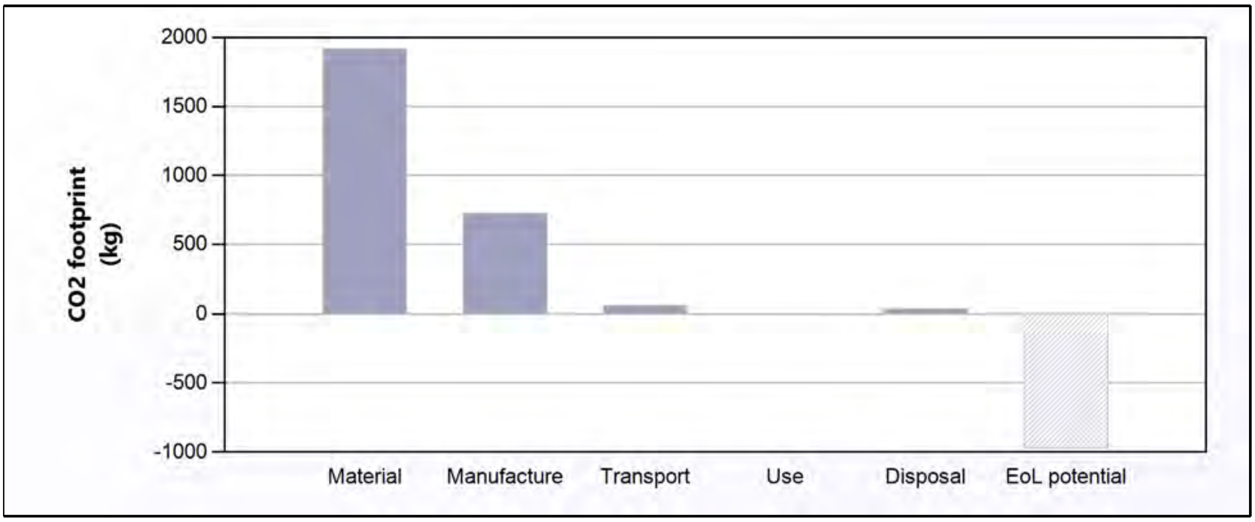
Notes:

Summary

Eco Audit Report

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	2.75e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Windows	Laminated glass	Virgin (0%)	2.9e+02	1	2.9e+02	5.1e+02	26.4
Vinyl	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	5.2e+02	1	5.2e+02	1.4e+03	73.6
Total				**2**	**8.1e+02**	**1.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Windows	Glass molding	2.9e+02 kg	1.5e+02	20.7
Vinyl	Polymer molding	5.2e+02 kg	5.8e+02	79.3
Total			**7.3e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Pella windows Source and POS	32 tonne (4 axle) truck	1.1e+03	63	100.0
Total		**1.1e+03**	**63**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Windows	2.9e+02	22	35.5
Vinyl	5.2e+02	41	64.5
Total	**8.1e+02**	**63**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Windows	Recycle	14	35.5
Vinyl	Recycle	26	64.5
Total		**40**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Windows	Recycle	-1.5e+02	15.6
Vinyl	Recycle	-8.2e+02	84.4
Total		**-9.7e+02**	**100**

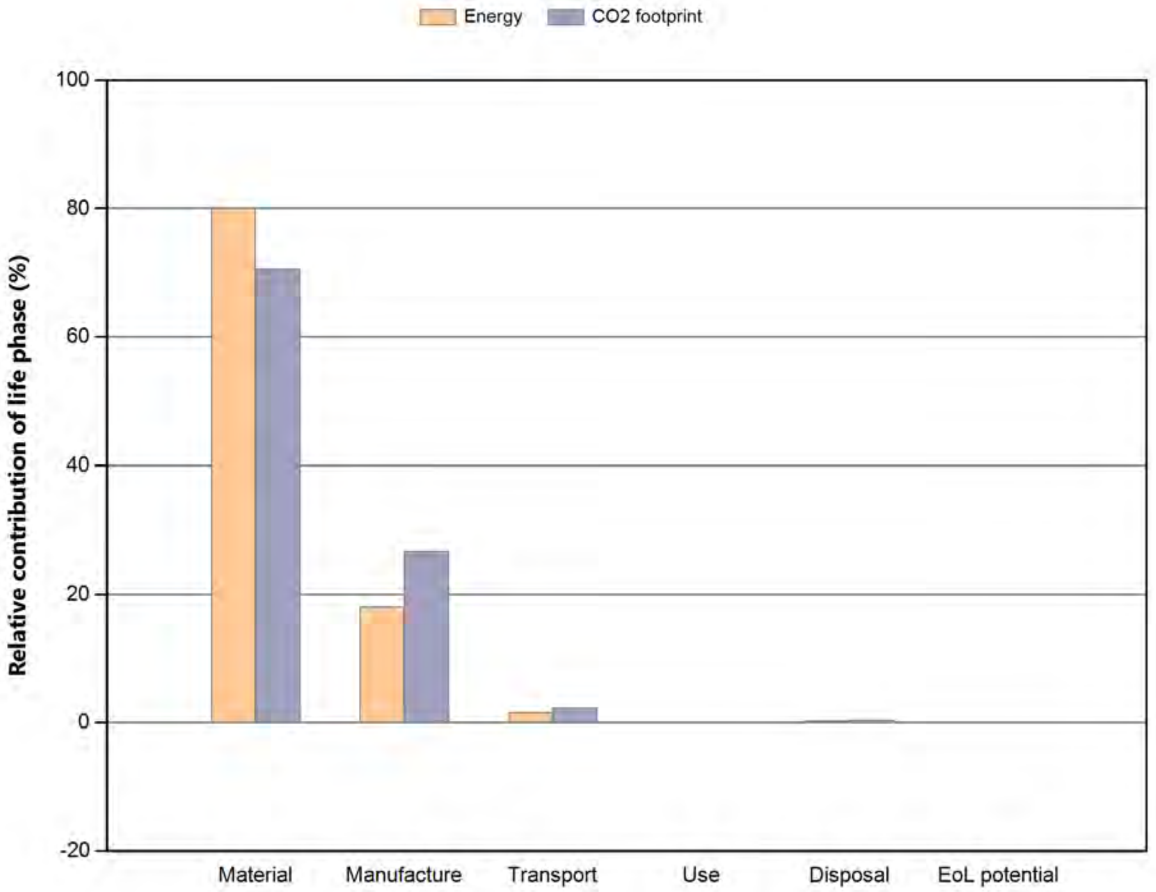
Notes:

Summary

Eco Audit Report

Product name	Glass
Country of use	World
Product life (years)	1

Summary:

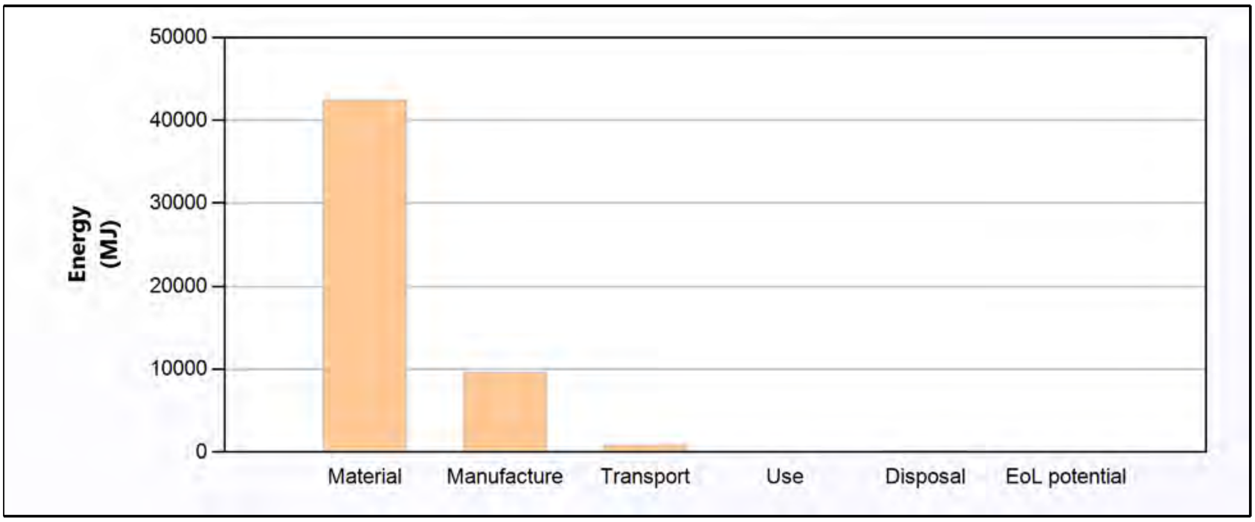


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	4.25e+04	80.0	1.92e+03	70.6
Manufacture	9.57e+03	18.0	727	26.7
Transport	873	1.6	62.9	2.3
Use	0	0.0	0	0.0
Disposal	163	0.3	11.4	0.4
Total (for first life)	**5.31e+04**	**100**	**2.72e+03**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 1 year product life):	5.31e+04

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Windows	Laminated glass	Virgin (0%)	2.9e+02	1	2.9e+02	8.4e+03	19.8
Vinyl	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	5.2e+02	1	5.2e+02	3.4e+04	80.2
Total				**2**	**8.1e+02**	**4.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Windows	Glass molding	2.9e+02 kg	1.9e+03	19.6
Vinyl	Polymer molding	5.2e+02 kg	7.7e+03	80.4
Total			**9.6e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Pella windows Source and POS	32 tonne (4 axle) truck	1.1e+03	8.7e+02	100.0
Total		**1.1e+03**	**8.7e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Windows	2.9e+02	3.1e+02	35.5
Vinyl	5.2e+02	5.6e+02	64.5
Total	**8.1e+02**	**8.7e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Windows	Landfill	58	35.5
Vinyl	Landfill	1e+02	64.5
Total		**1.6e+02**	**100**

EoL potential:

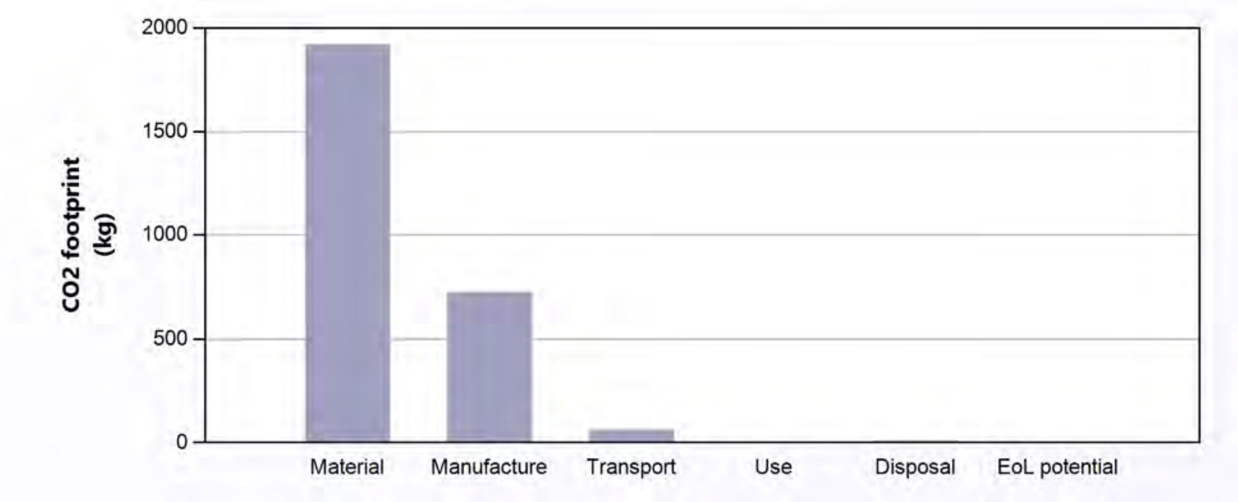
Component	End of life option	Energy (MJ)	%
Windows	Landfill	0	
Vinyl	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 1 year product life):	2.72e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Windows	Laminated glass	Virgin (0%)	2.9e+02	1	2.9e+02	5.1e+02	26.4
Vinyl	PVC (rigid, high impact, molding and extrusion)	Virgin (0%)	5.2e+02	1	5.2e+02	1.4e+03	73.6
Total				**2**	**8.1e+02**	**1.9e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Windows	Glass molding	2.9e+02 kg	1.5e+02	20.7
Vinyl	Polymer molding	5.2e+02 kg	5.8e+02	79.3
Total			**7.3e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Pella windows Source and POS	32 tonne (4 axle) truck	1.1e+03	63	100.0
Total		**1.1e+03**	**63**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Windows	2.9e+02	22	35.5
Vinyl	5.2e+02	41	64.5
Total	**8.1e+02**	**63**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Windows	Landfill	4.1	35.5
Vinyl	Landfill	7.3	64.5
Total		**11**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Windows	Landfill	0	
Vinyl	Landfill	0	
Total		**0**	**100**

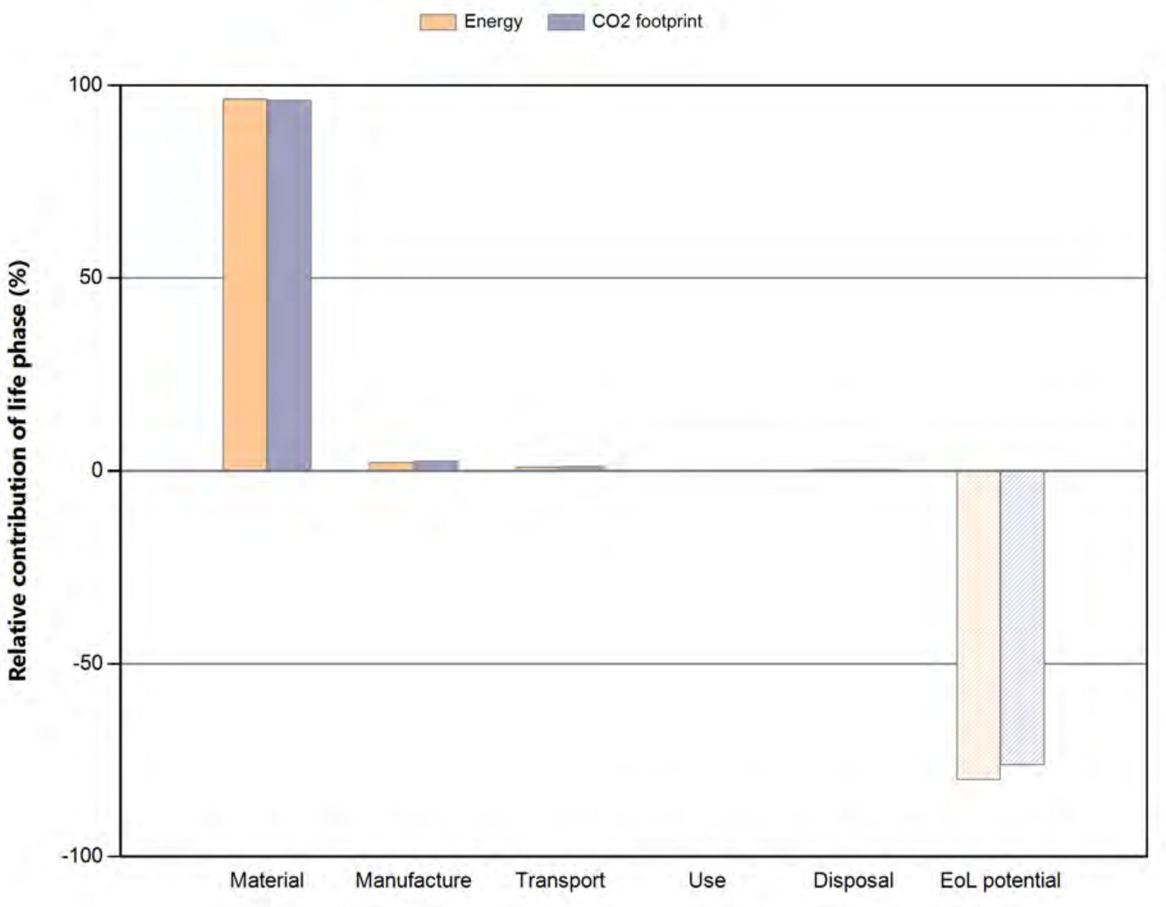
Notes:

Summary

Eco Audit Report

Product name	Gutters
Country of use	North America
Product life (years)	50

Summary:

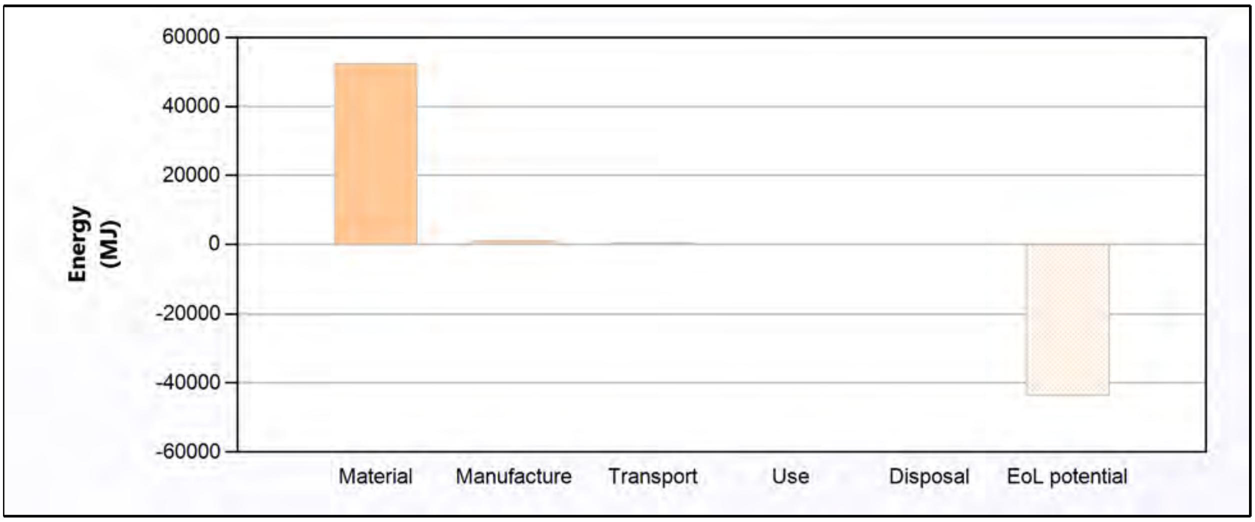


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	5.26e+04	96.6	3.41e+03	96.1
Manufacture	1.15e+03	2.1	86.1	2.4
Transport	543	1.0	39.1	1.1
Use	0	0.0	0	0.0
Disposal	185	0.3	12.9	0.4
Total (for first life)	**5.45e+04**	**100**	**3.55e+03**	**100**
End of life potential	-4.36e+04		-2.71e+03	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.09e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Aluminum Alloy	Aluminum, commercial purity, 1050A, H19	Virgin (0%)	2.6e+02	1	2.6e+02	5.3e+04	100.0
Total				**1**	**2.6e+02**	**5.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Aluminum Alloy	Roll forming	2.6e+02 kg	1.1e+03	100.0
Total			**1.1e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Buchener MF Source	40 tonne (6 axle) truck	2.5e+03	5.4e+02	99.4
ABC Supply POS	14 tonne (2 axle) truck	7.9	3.1	0.6
Total		**2.5e+03**	**5.4e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Aluminum Alloy	2.6e+02	5.4e+02	100.0
Total	**2.6e+02**	**5.4e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Aluminum Alloy	Recycle	1.8e+02	100.0
Total		**1.8e+02**	**100**

EoL potential:

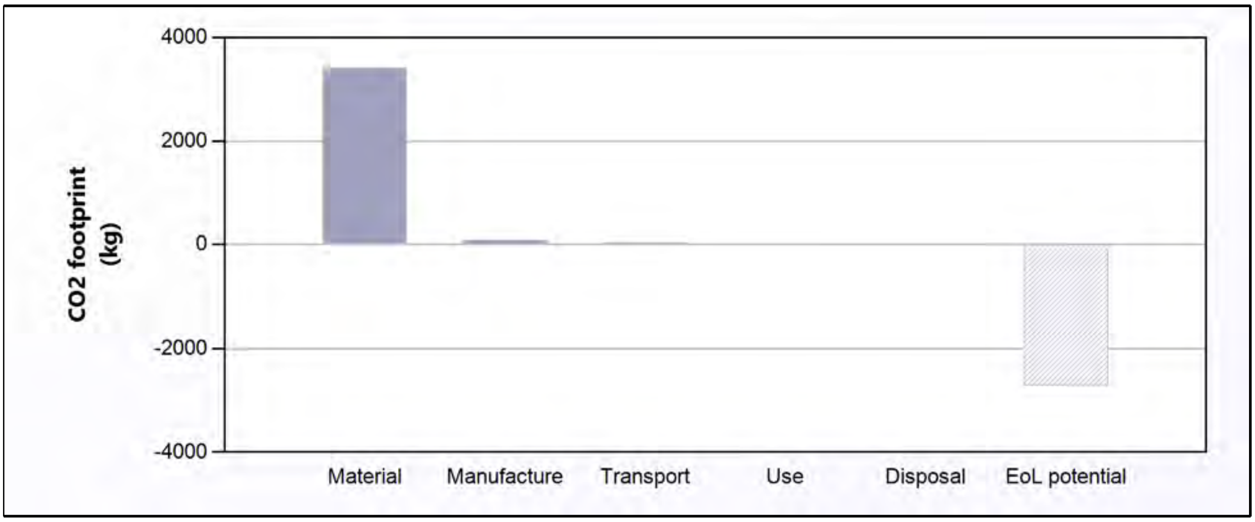
Component	End of life option	Energy (MJ)	%
Aluminum Alloy	Recycle	-4.4e+04	100.0
Total		**-4.4e+04**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	71.1

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Aluminum Alloy	Aluminum, commercial purity, 1050A, H19	Virgin (0%)	2.6e+02	1	2.6e+02	3.4e+03	100.0
Total				**1**	**2.6e+02**	**3.4e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Aluminum Alloy	Roll forming	2.6e+02 kg	86	100.0
Total			**86**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Buchener MF Source	40 tonne (6 axle) truck	2.5e+03	39	99.4
ABC Supply POS	14 tonne (2 axle) truck	7.9	0.22	0.6
Total		**2.5e+03**	**39**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Aluminum Alloy	2.6e+02	39	100.0
Total	**2.6e+02**	**39**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Aluminum Alloy	Recycle	13	100.0
Total		**13**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Aluminum Alloy	Recycle	-2.7e+03	100.0
Total		**-2.7e+03**	**100**

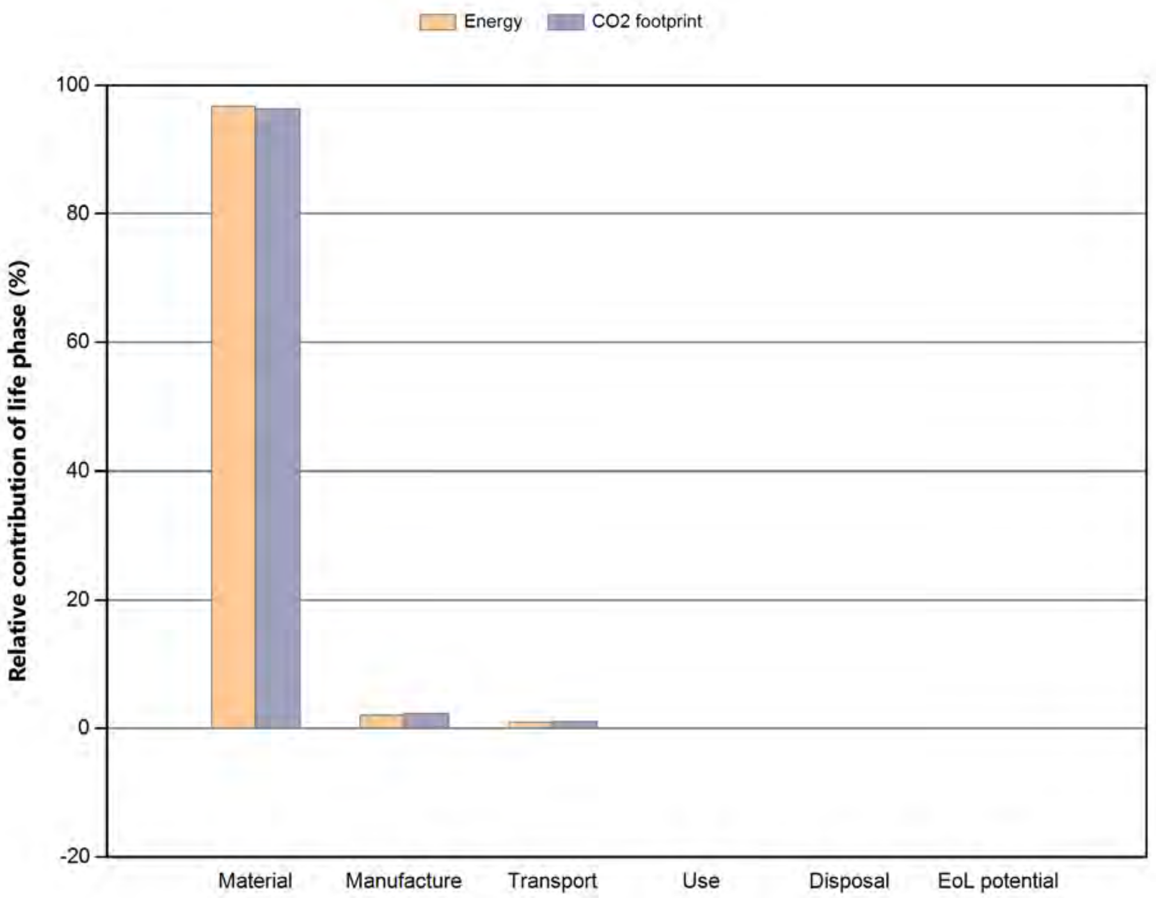
Notes:

Summary

Eco Audit Report

Product name	Gutters
Country of use	North America
Product life (years)	50

Summary:

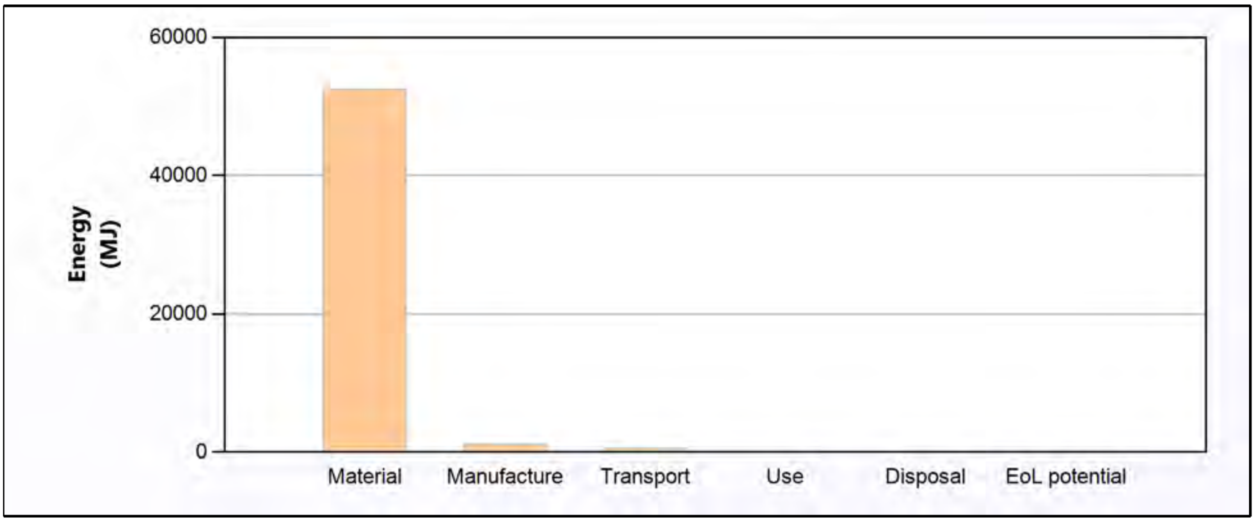


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	5.26e+04	96.8	3.41e+03	96.4
Manufacture	1.15e+03	2.1	86.1	2.4
Transport	543	1.0	39.1	1.1
Use	0	0.0	0	0.0
Disposal	52.8	0.1	3.7	0.1
Total (for first life)	**5.44e+04**	**100**	**3.54e+03**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.09e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Aluminum Alloy	Aluminum, commercial purity, 1050A, H19	Virgin (0%)	2.6e+02	1	2.6e+02	5.3e+04	100.0
Total				**1**	**2.6e+02**	**5.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Aluminum Alloy	Roll forming	2.6e+02 kg	1.1e+03	100.0
Total			**1.1e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Buchener MF Source	40 tonne (6 axle) truck	2.5e+03	5.4e+02	99.4
ABC Supply POS	14 tonne (2 axle) truck	7.9	3.1	0.6
Total		**2.5e+03**	**5.4e+02**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Aluminum Alloy	2.6e+02	5.4e+02	100.0
Total	**2.6e+02**	**5.4e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Aluminum Alloy	Landfill	53	100.0
Total		**53**	**100**

EoL potential:

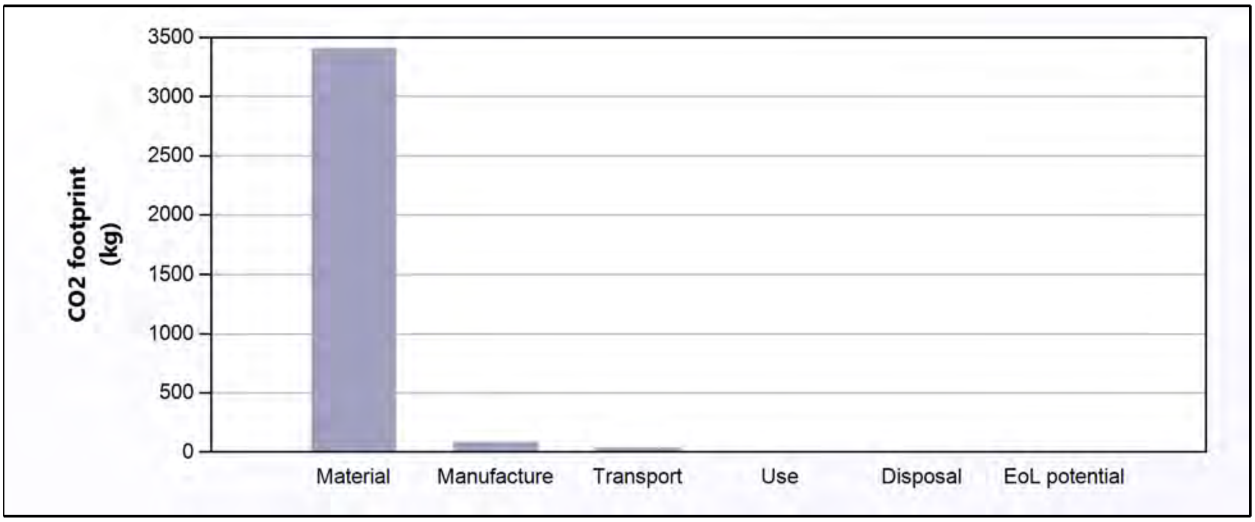
Component	End of life option	Energy (MJ)	%
Aluminum Alloy	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	70.9

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Aluminum Alloy	Aluminum, commercial purity, 1050A, H19	Virgin (0%)	2.6e+02	1	2.6e+02	3.4e+03	100.0
Total				**1**	**2.6e+02**	**3.4e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Aluminum Alloy	Roll forming	2.6e+02 kg	86	100.0
Total			**86**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Buchener MF Source	40 tonne (6 axle) truck	2.5e+03	39	99.4
ABC Supply POS	14 tonne (2 axle) truck	7.9	0.22	0.6
Total		**2.5e+03**	**39**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Aluminum Alloy	2.6e+02	39	100.0
Total	**2.6e+02**	**39**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Aluminum Alloy	Landfill	3.7	100.0
Total		**3.7**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Aluminum Alloy	Landfill	0	
Total		**0**	**100**

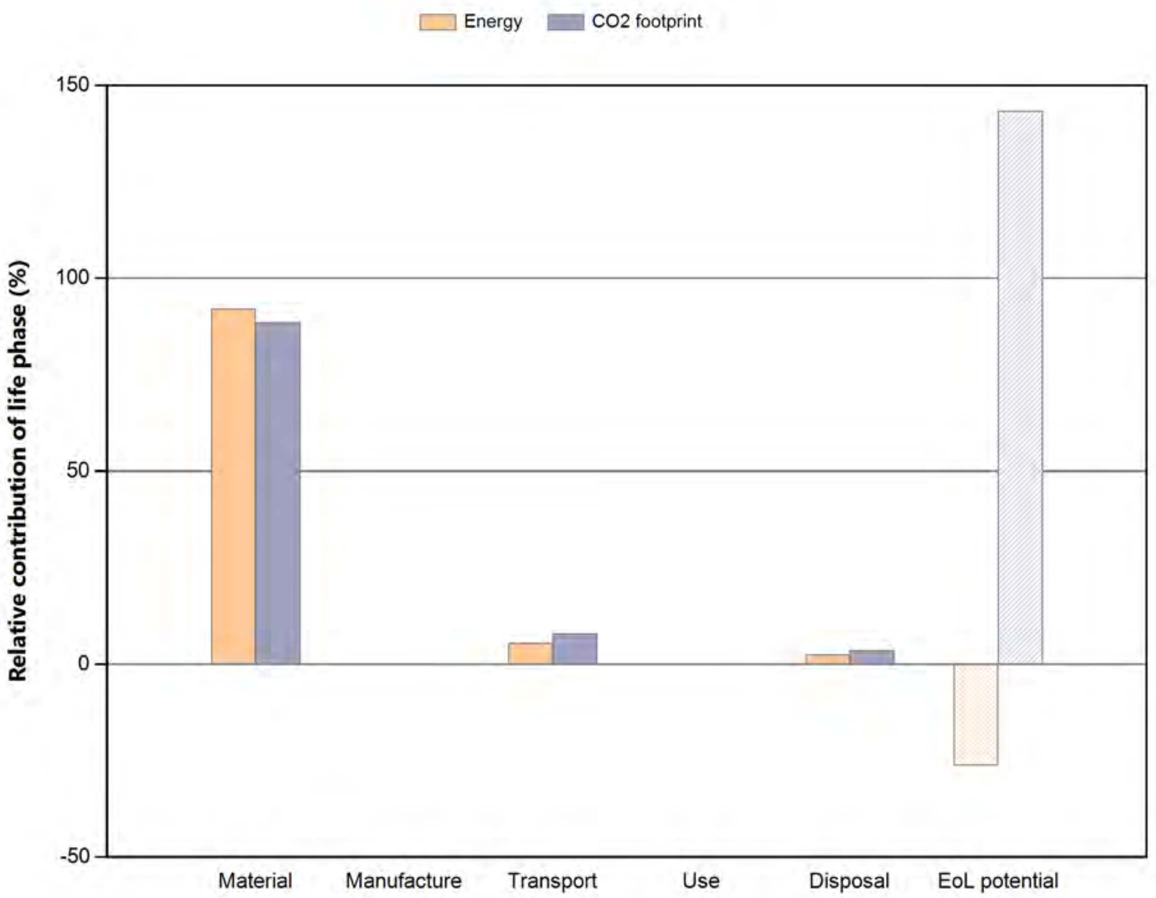
Notes:

Summary

Eco Audit Report

Product name	Lumber
Country of use	North America
Product life (years)	50

Summary:



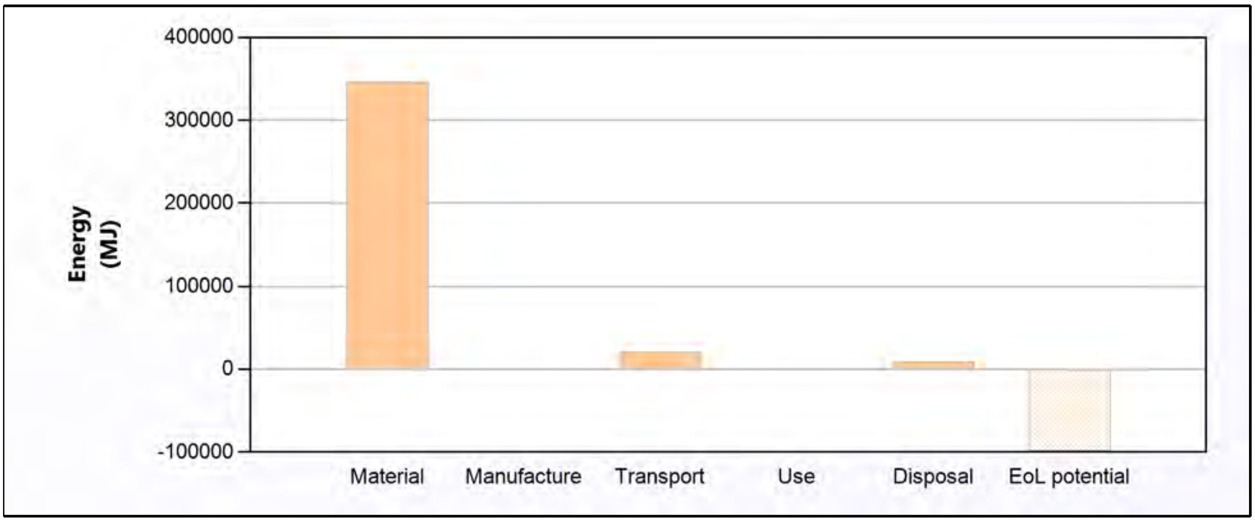
Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	3.47e+05	92.0	1.64e+04	88.4
Manufacture	0	0.0	0	0.0
Transport	2.06e+04	5.5	1.48e+03	8.0
Use	0	0.0	0	0.0
Disposal	9.44e+03	2.5	661	3.6
Total (for first life)	**3.77e+05**	**100**	**1.85e+04**	**100**
End of life potential	-9.87e+04		2.66e+04	

Eco Audit Report

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	7.53e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Douglas-fir	Douglas fir (pseudotsuga menziesii (western)) (l)	Virgin (0%)	8.6e+03	1	8.6e+03	9.5e+04	27.4
Pine	Pine (pinus monticola) (l)	Virgin (0%)	4.2e+02	1	4.2e+02	4.6e+03	1.3
OSB Composits	Plywood (3 ply, beech), parallel to face layer	Virgin (0%)	8.4e+03	1	8.4e+03	2.2e+05	62.8
Versa Lam	Glulam	Virgin (0%)	1e+03	1	1e+03	2e+04	5.9
Glulam	Glulam	Virgin (0%)	4.4e+02	1	4.4e+02	8.9e+03	2.6
Total				**5**	**1.9e+04**	**3.5e+05**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Boisie Cascade	40 tonne (6 axle) truck	1.3e+03	2e+04	99.2
Striaght Lumber	40 tonne (6 axle) truck	10	1.6e+02	0.8
Total		**1.3e+03**	**2.1e+04**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Douglas-fir	8.6e+03	9.4e+03	45.6
Pine	4.2e+02	4.5e+02	2.2
OSB Composits	8.4e+03	9.1e+03	44.4
Versa Lam	1e+03	1.1e+03	5.4
Glulam	4.4e+02	4.8e+02	2.3
Total	**1.9e+04**	**2.1e+04**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Douglas-fir	Combust	4.3e+03	45.6
Pine	Combust	2.1e+02	2.2
OSB Composits	Combust	4.2e+03	44.4
Versa Lam	Combust	5.1e+02	5.4
Glulam	Combust	2.2e+02	2.3
Total		**9.4e+03**	**100**

EoL potential:

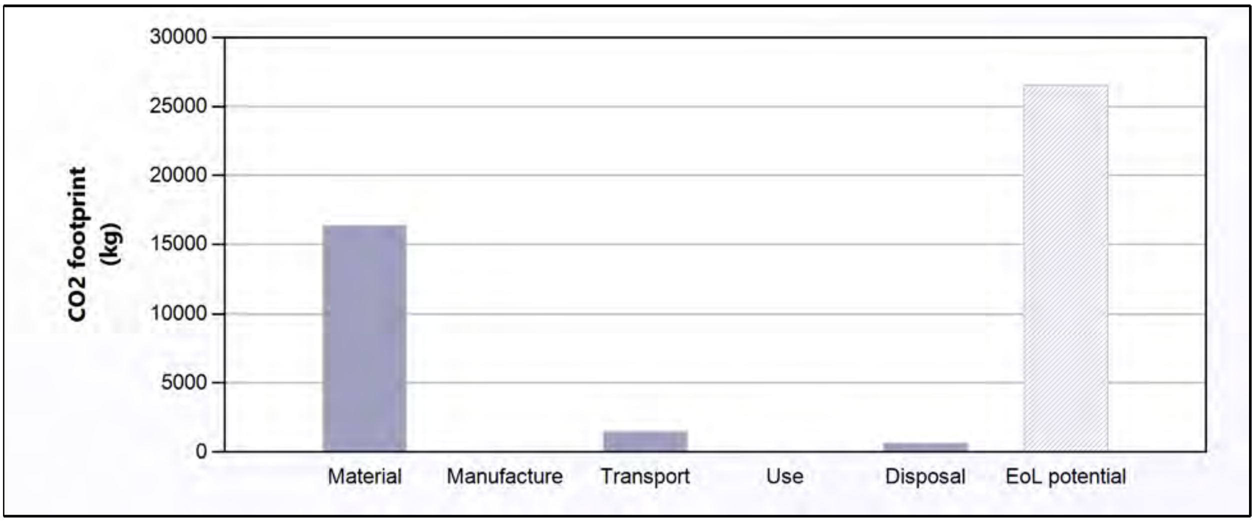
Component	End of life option	Energy (MJ)	%
Douglas-fir	Combust	-4.6e+04	46.7
Pine	Combust	-2.2e+03	2.3
OSB Composits	Combust	-4.3e+04	43.6
Versa Lam	Combust	-5.1e+03	5.1
Glulam	Combust	-2.2e+03	2.2
Total		**-9.9e+04**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	371

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Douglas-fir	Douglas fir (pseudotsuga menziesii (western)) (l)	Virgin (0%)	8.6e+03	1	8.6e+03	3.2e+03	19.2
Pine	Pine (pinus monticola) (l)	Virgin (0%)	4.2e+02	1	4.2e+02	1.5e+02	0.9
OSB Composits	Plywood (3 ply, beech), parallel to face layer	Virgin (0%)	8.4e+03	1	8.4e+03	1.2e+04	72.3
Versa Lam	Glulam	Virgin (0%)	1e+03	1	1e+03	8.6e+02	5.2
Glulam	Glulam	Virgin (0%)	4.4e+02	1	4.4e+02	3.7e+02	2.3
Total				**5**	**1.9e+04**	**1.6e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Boisie Cascade	40 tonne (6 axle) truck	1.3e+03	1.5e+03	99.2
Striaght Lumber	40 tonne (6 axle) truck	10	11	0.8
Total		**1.3e+03**	**1.5e+03**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Douglas-fir	8.6e+03	6.8e+02	45.6
Pine	4.2e+02	33	2.2
OSB Composits	8.4e+03	6.6e+02	44.4
Versa Lam	1e+03	80	5.4
Glulam	4.4e+02	34	2.3
Total	**1.9e+04**	**1.5e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Douglas-fir	Combust	3e+02	45.6
Pine	Combust	15	2.2
OSB Composits	Combust	2.9e+02	44.4
Versa Lam	Combust	36	5.4
Glulam	Combust	15	2.3
Total		**6.6e+02**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Douglas-fir	Combust	1.2e+04	46.4
Pine	Combust	6e+02	2.3
OSB Composits	Combust	1.2e+04	43.5
Versa Lam	Combust	1.4e+03	5.4
Glulam	Combust	6.2e+02	2.4
Total		**2.7e+04**	**100**

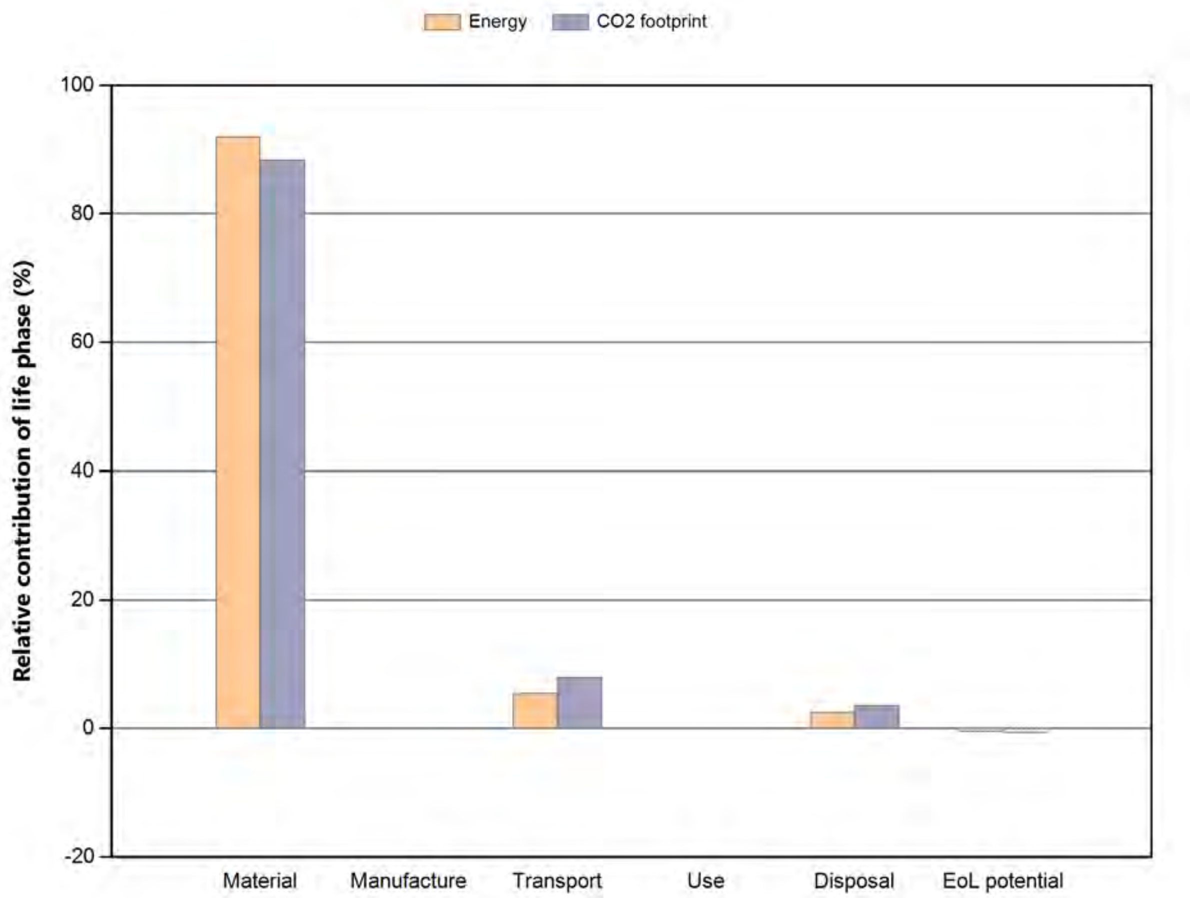
Notes:

Summary

Eco Audit Report

Product name	Lumber
Country of use	North America
Product life (years)	50

Summary:

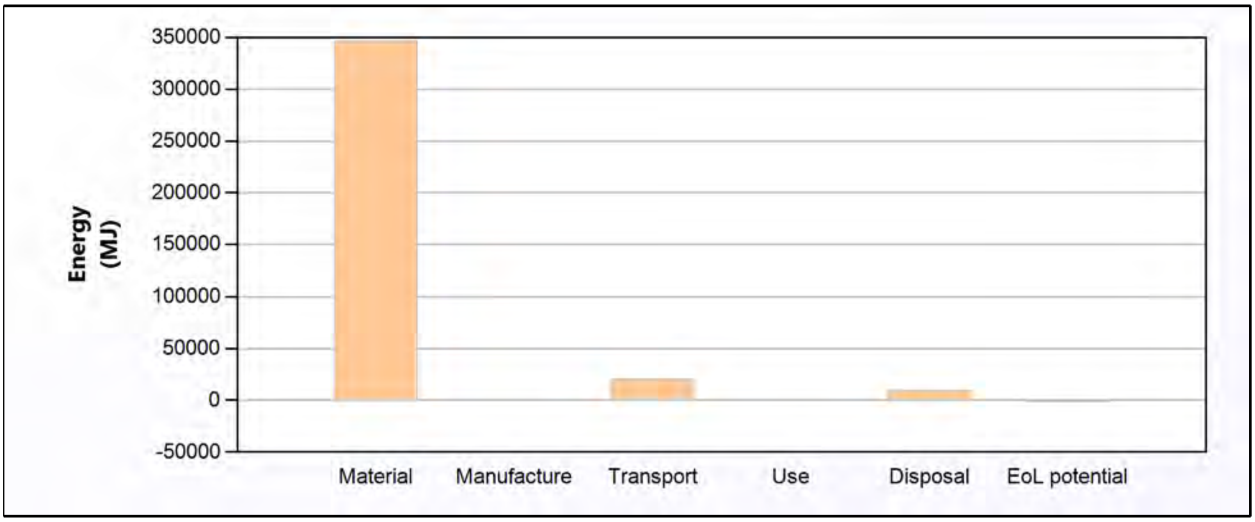


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	3.47e+05	92.0	1.64e+04	88.4
Manufacture	0	0.0	0	0.0
Transport	2.06e+04	5.5	1.48e+03	8.0
Use	0	0.0	0	0.0
Disposal	9.44e+03	2.5	661	3.6
Total (for first life)	**3.77e+05**	**100**	**1.85e+04**	**100**
End of life potential	-1.89e+03		-132	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	7.53e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Douglas-fir	Douglas fir (pseudotsuga menziesii (western)) (l)	Virgin (0%)	8.6e+03	1	8.6e+03	9.5e+04	27.4
Pine	Pine (pinus monticola) (l)	Virgin (0%)	4.2e+02	1	4.2e+02	4.6e+03	1.3
OSB Composits	Plywood (3 ply, beech), parallel to face layer	Virgin (0%)	8.4e+03	1	8.4e+03	2.2e+05	62.8
Versa Lam	Glulam	Virgin (0%)	1e+03	1	1e+03	2e+04	5.9
Glulam	Glulam	Virgin (0%)	4.4e+02	1	4.4e+02	8.9e+03	2.6
Total				**5**	**1.9e+04**	**3.5e+05**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Boisie Cascade	40 tonne (6 axle) truck	1.3e+03	2e+04	99.2
Striaght Lumber	40 tonne (6 axle) truck	10	1.6e+02	0.8
Total		**1.3e+03**	**2.1e+04**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Douglas-fir	8.6e+03	9.4e+03	45.6
Pine	4.2e+02	4.5e+02	2.2
OSB Composits	8.4e+03	9.1e+03	44.4
Versa Lam	1e+03	1.1e+03	5.4
Glulam	4.4e+02	4.8e+02	2.3
Total	**1.9e+04**	**2.1e+04**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Douglas-fir	Downcycle	4.3e+03	45.6
Pine	Downcycle	2.1e+02	2.2
OSB Composits	Downcycle	4.2e+03	44.4
Versa Lam	Downcycle	5.1e+02	5.4
Glulam	Downcycle	2.2e+02	2.3
Total		**9.4e+03**	**100**

EoL potential:

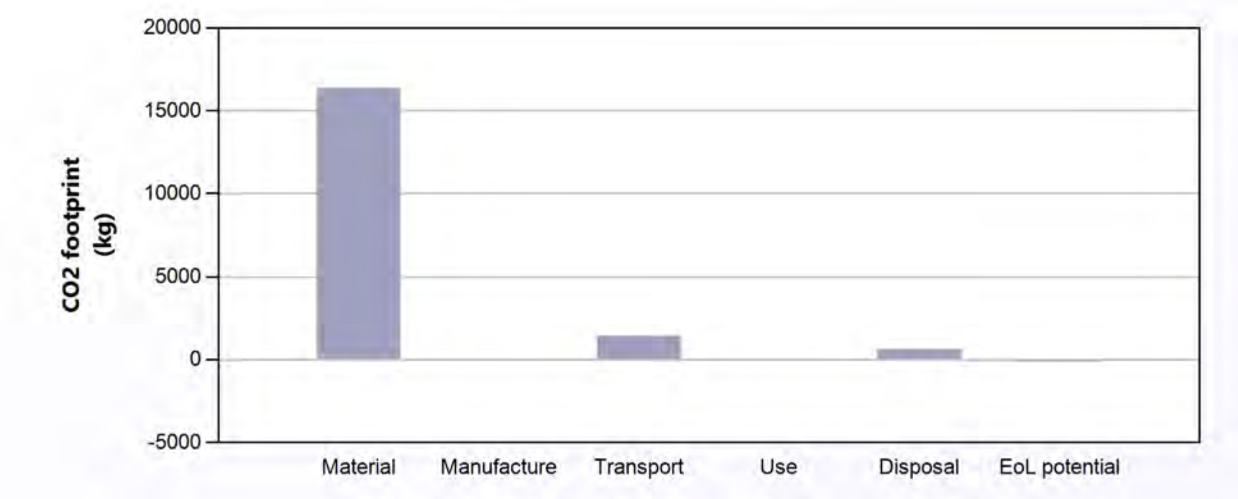
Component	End of life option	Energy (MJ)	%
Douglas-fir	Downcycle	-8.6e+02	45.6
Pine	Downcycle	-42	2.2
OSB Composits	Downcycle	-8.4e+02	44.4
Versa Lam	Downcycle	-1e+02	5.4
Glulam	Downcycle	-44	2.3
Total		**-1.9e+03**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	371

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Douglas-fir	Douglas fir (pseudotsuga menziesii (western)) (l)	Virgin (0%)	8.6e+03	1	8.6e+03	3.2e+03	19.2
Pine	Pine (pinus monticola) (l)	Virgin (0%)	4.2e+02	1	4.2e+02	1.5e+02	0.9
OSB Composits	Plywood (3 ply, beech), parallel to face layer	Virgin (0%)	8.4e+03	1	8.4e+03	1.2e+04	72.3
Versa Lam	Glulam	Virgin (0%)	1e+03	1	1e+03	8.6e+02	5.2
Glulam	Glulam	Virgin (0%)	4.4e+02	1	4.4e+02	3.7e+02	2.3
Total				**5**	**1.9e+04**	**1.6e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Boisie Cascade	40 tonne (6 axle) truck	1.3e+03	1.5e+03	99.2
Striaght Lumber	40 tonne (6 axle) truck	10	11	0.8
Total		**1.3e+03**	**1.5e+03**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Douglas-fir	8.6e+03	6.8e+02	45.6
Pine	4.2e+02	33	2.2
OSB Composits	8.4e+03	6.6e+02	44.4
Versa Lam	1e+03	80	5.4
Glulam	4.4e+02	34	2.3
Total	**1.9e+04**	**1.5e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Douglas-fir	Downcycle	3e+02	45.6
Pine	Downcycle	15	2.2
OSB Composits	Downcycle	2.9e+02	44.4
Versa Lam	Downcycle	36	5.4
Glulam	Downcycle	15	2.3
Total		**6.6e+02**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Douglas-fir	Downcycle	-60	45.6
Pine	Downcycle	-2.9	2.2
OSB Composits	Downcycle	-59	44.4
Versa Lam	Downcycle	-7.1	5.4
Glulam	Downcycle	-3.1	2.3
Total		**-1.3e+02**	**100**

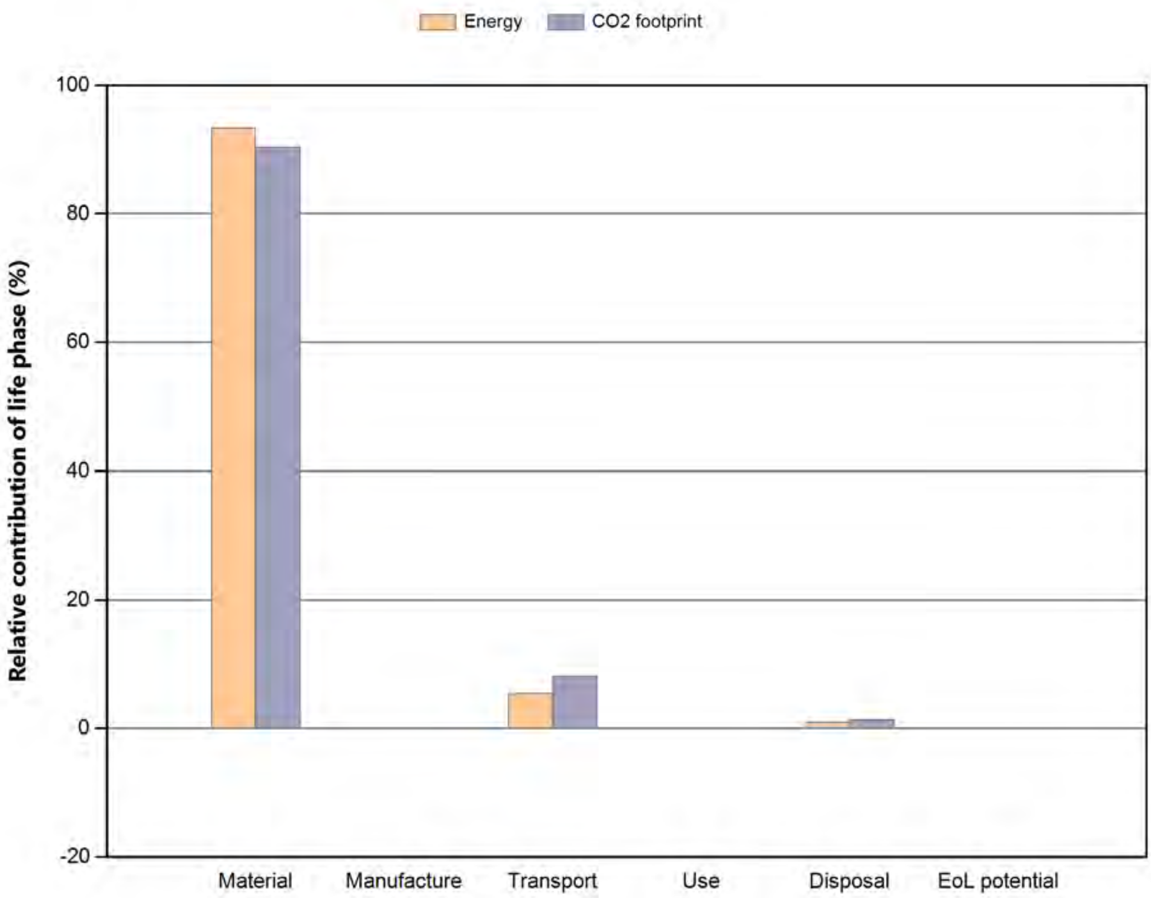
Notes:

Summary

Eco Audit Report

Product name	Lumber
Country of use	North America
Product life (years)	50

Summary:

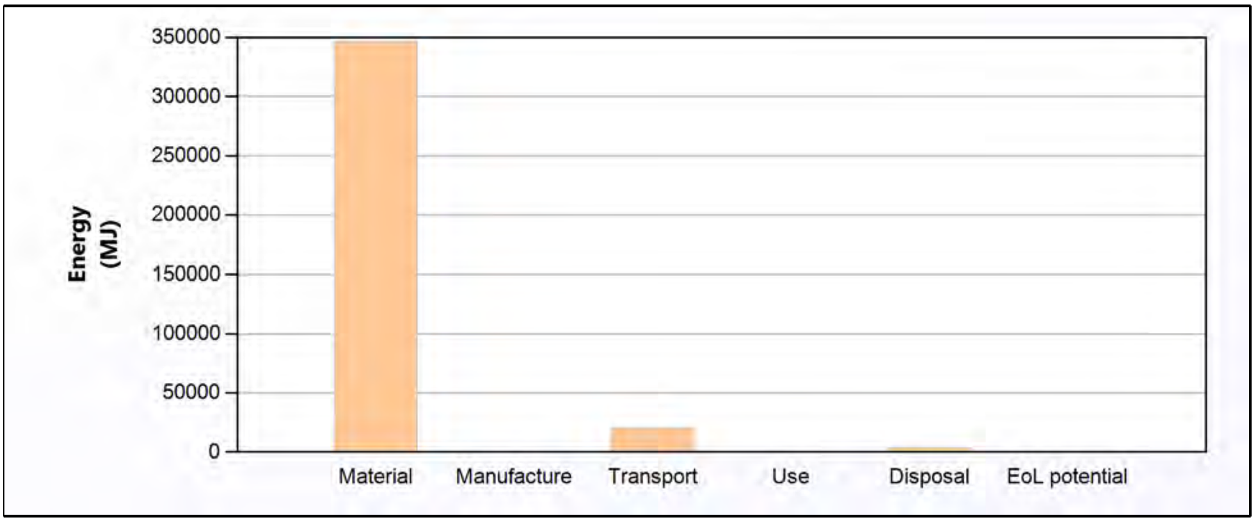


Energy details　　CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	3.47e+05	93.4	1.64e+04	90.4
Manufacture	0	0.0	0	0.0
Transport	2.06e+04	5.5	1.48e+03	8.2
Use	0	0.0	0	0.0
Disposal	3.78e+03	1.0	264	1.5
Total (for first life)	**3.71e+05**	**100**	**1.81e+04**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	7.42e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Douglas-fir	Douglas fir (pseudotsuga menziesii (western)) (l)	Virgin (0%)	8.6e+03	1	8.6e+03	9.5e+04	27.4
Pine	Pine (pinus monticola) (l)	Virgin (0%)	4.2e+02	1	4.2e+02	4.6e+03	1.3
OSB Composits	Plywood (3 ply, beech), parallel to face layer	Virgin (0%)	8.4e+03	1	8.4e+03	2.2e+05	62.8
Versa Lam	Glulam	Virgin (0%)	1e+03	1	1e+03	2e+04	5.9
Glulam	Glulam	Virgin (0%)	4.4e+02	1	4.4e+02	8.9e+03	2.6
Total				**5**	**1.9e+04**	**3.5e+05**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Boisie Cascade	40 tonne (6 axle) truck	1.3e+03	2e+04	99.2
Striaght Lumber	40 tonne (6 axle) truck	10	1.6e+02	0.8
Total		**1.3e+03**	**2.1e+04**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Douglas-fir	8.6e+03	9.4e+03	45.6
Pine	4.2e+02	4.5e+02	2.2
OSB Composits	8.4e+03	9.1e+03	44.4
Versa Lam	1e+03	1.1e+03	5.4
Glulam	4.4e+02	4.8e+02	2.3
Total	**1.9e+04**	**2.1e+04**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Douglas-fir	Landfill	1.7e+03	45.6
Pine	Landfill	84	2.2
OSB Composits	Landfill	1.7e+03	44.4
Versa Lam	Landfill	2e+02	5.4
Glulam	Landfill	88	2.3
Total		**3.8e+03**	**100**

EoL potential:

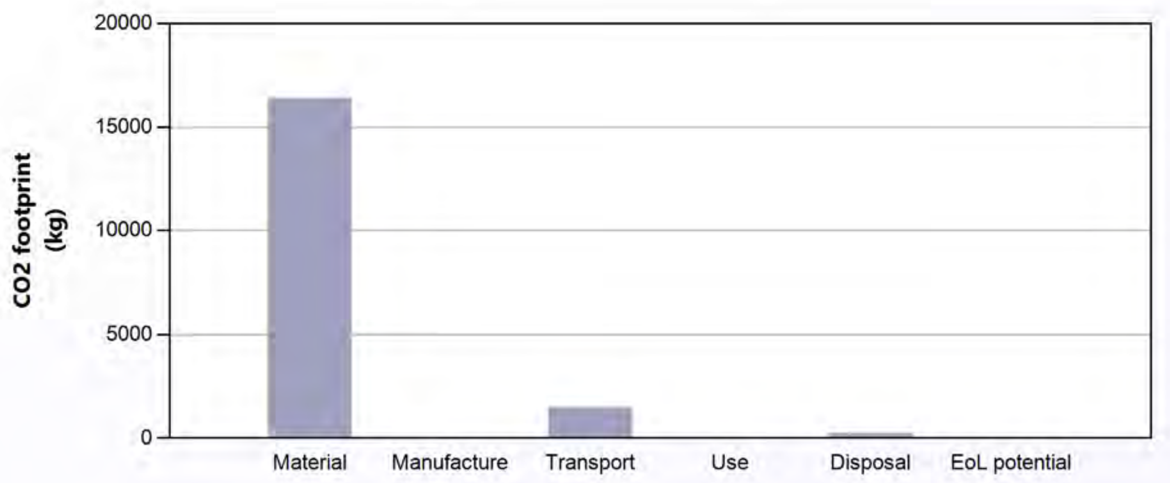
Component	End of life option	Energy (MJ)	%
Douglas-fir	Landfill	0	
Pine	Landfill	0	
OSB Composits	Landfill	0	
Versa Lam	Landfill	0	
Glulam	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	363

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Douglas-fir	Douglas fir (pseudotsuga menziesii (western)) (l)	Virgin (0%)	8.6e+03	1	8.6e+03	3.2e+03	19.2
Pine	Pine (pinus monticola) (l)	Virgin (0%)	4.2e+02	1	4.2e+02	1.5e+02	0.9
OSB Composits	Plywood (3 ply, beech), parallel to face layer	Virgin (0%)	8.4e+03	1	8.4e+03	1.2e+04	72.3
Versa Lam	Glulam	Virgin (0%)	1e+03	1	1e+03	8.6e+02	5.2
Glulam	Glulam	Virgin (0%)	4.4e+02	1	4.4e+02	3.7e+02	2.3
Total				**5**	**1.9e+04**	**1.6e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Boisie Cascade	40 tonne (6 axle) truck	1.3e+03	1.5e+03	99.2
Striaght Lumber	40 tonne (6 axle) truck	10	11	0.8
Total		**1.3e+03**	**1.5e+03**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Douglas-fir	8.6e+03	6.8e+02	45.6
Pine	4.2e+02	33	2.2
OSB Composits	8.4e+03	6.6e+02	44.4
Versa Lam	1e+03	80	5.4
Glulam	4.4e+02	34	2.3
Total	**1.9e+04**	**1.5e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Douglas-fir	Landfill	1.2e+02	45.6
Pine	Landfill	5.8	2.2
OSB Composits	Landfill	1.2e+02	44.4
Versa Lam	Landfill	14	5.4
Glulam	Landfill	6.2	2.3
Total		**2.6e+02**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Douglas-fir	Landfill	0	
Pine	Landfill	0	
OSB Composits	Landfill	0	
Versa Lam	Landfill	0	
Glulam	Landfill	0	
Total		**0**	**100**

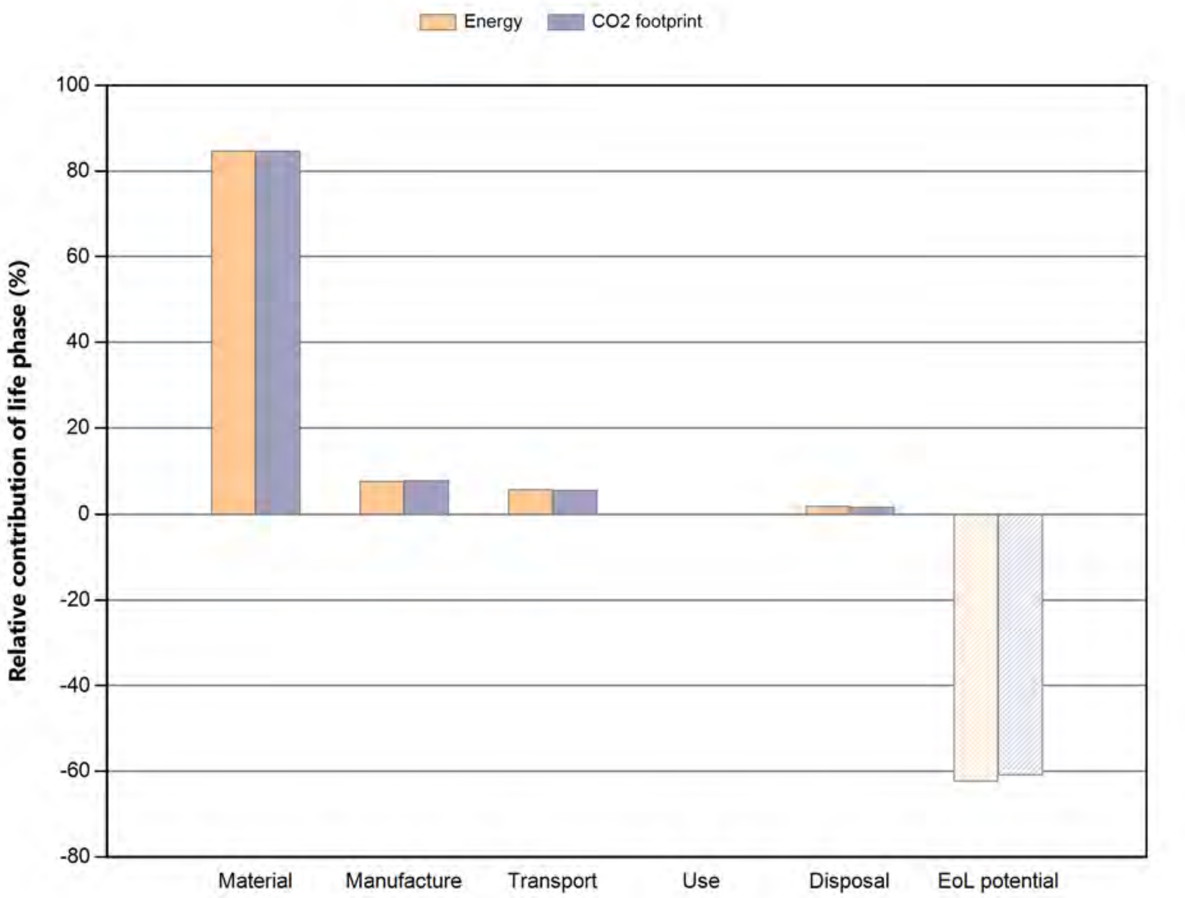
Notes:

Summary

Eco Audit Report

Product name	Steel
Country of use	North America
Product life (years)	50

Summary:

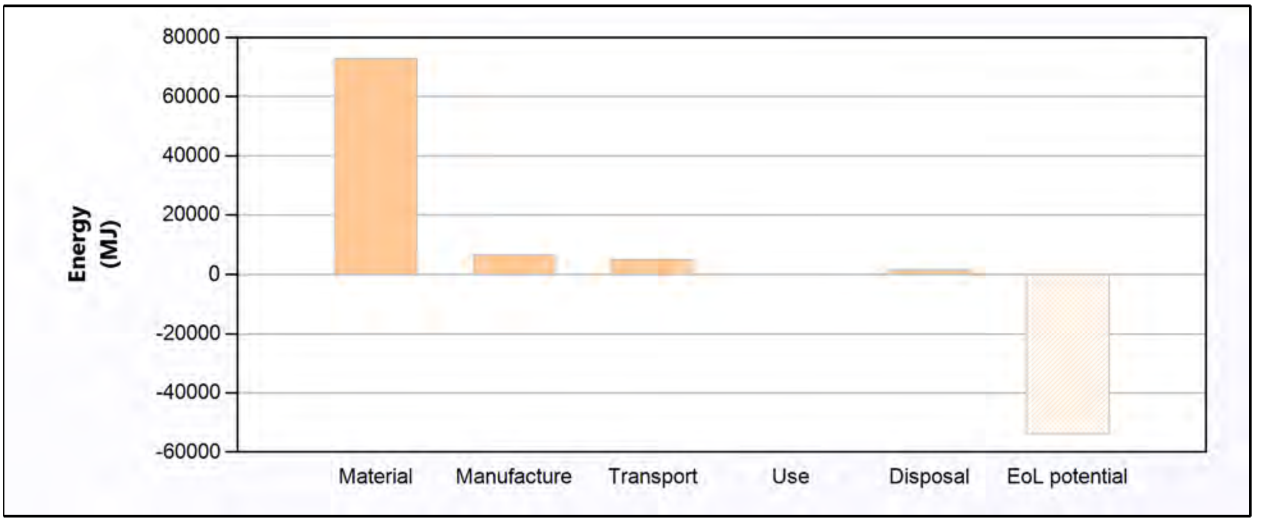


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	7.31e+04	84.7	5.36e+03	84.7
Manufacture	6.64e+03	7.7	498	7.9
Transport	4.98e+03	5.8	358	5.7
Use	0	0.0	0	0.0
Disposal	1.58e+03	1.8	111	1.8
Total (for first life)	**8.63e+04**	**100**	**6.33e+03**	**100**
End of life potential	-5.38e+04		-3.85e+03	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.73e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Carbon Steel	Carbon steel, AISI 1015, as rolled	Virgin (0%)	2.3e+03	1	2.3e+03	7.3e+04	100.0
Total				**1**	**2.3e+03**	**7.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Carbon Steel	Roll forming	2.3e+03 kg	6.6e+03	100.0
Total			**6.6e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Clairton Mill	32 tonne (4 axle) truck	2.3e+03	5e+03	99.6
Rio Grand Co. POS	32 tonne (4 axle) truck	10	21	0.4
Total		**2.3e+03**	**5e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Carbon Steel	2.3e+03	5e+03	100.0
Total	**2.3e+03**	**5e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Carbon Steel	Recycle	1.6e+03	100.0
Total		**1.6e+03**	**100**

EoL potential:

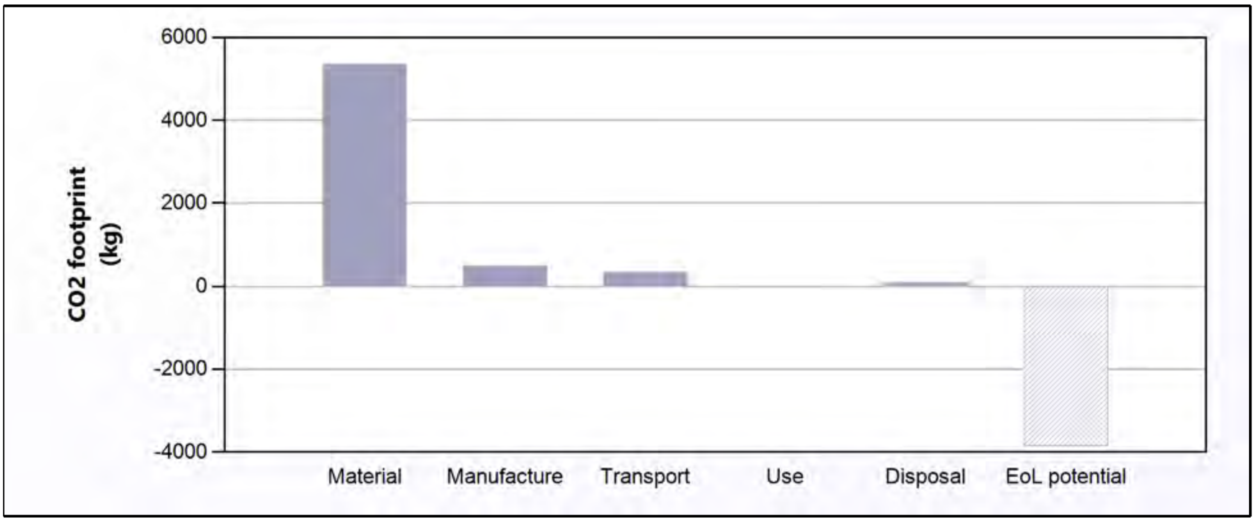
Component	End of life option	Energy (MJ)	%
Carbon Steel	Recycle	-5.4e+04	100.0
Total		**-5.4e+04**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	127

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Carbon Steel	Carbon steel, AISI 1015, as rolled	Virgin (0%)	2.3e+03	1	2.3e+03	5.4e+03	100.0
Total				**1**	**2.3e+03**	**5.4e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Carbon Steel	Roll forming	2.3e+03 kg	5e+02	100.0
Total			**5e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Clairton Mill	32 tonne (4 axle) truck	2.3e+03	3.6e+02	99.6
Rio Grand Co. POS	32 tonne (4 axle) truck	10	1.5	0.4
Total		**2.3e+03**	**3.6e+02**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Carbon Steel	2.3e+03	3.6e+02	100.0
Total	**2.3e+03**	**3.6e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Carbon Steel	Recycle	1.1e+02	100.0
Total		**1.1e+02**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Carbon Steel	Recycle	-3.9e+03	100.0
Total		**-3.9e+03**	**100**

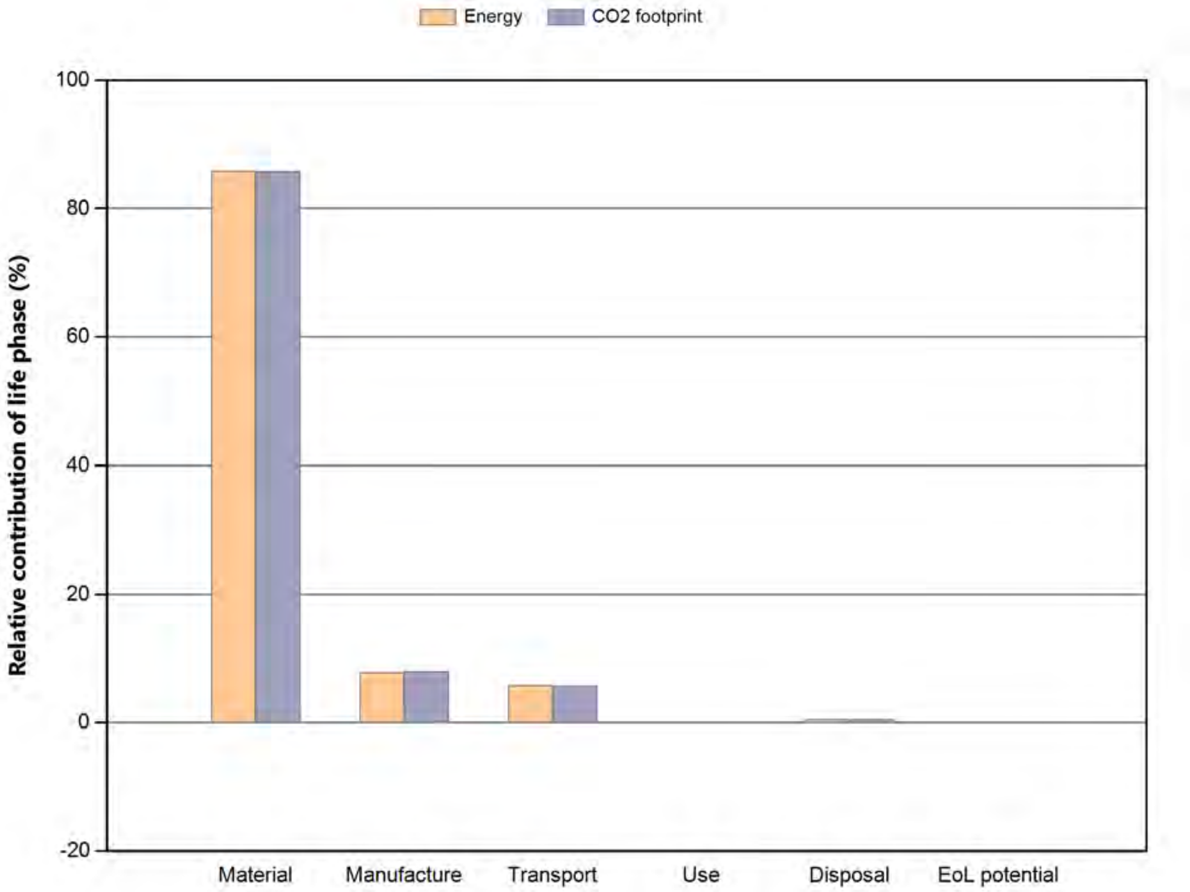
Notes:

Summary

Eco Audit Report

Product name	Steel
Country of use	North America
Product life (years)	50

Summary:

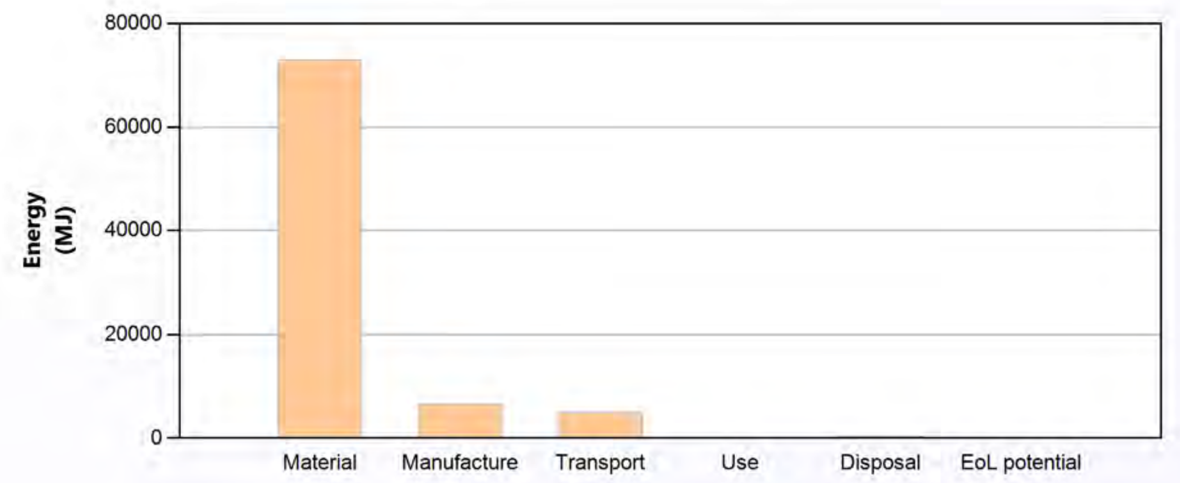


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	7.31e+04	85.8	5.36e+03	85.8
Manufacture	6.64e+03	7.8	498	8.0
Transport	4.98e+03	5.8	358	5.7
Use	0	0.0	0	0.0
Disposal	452	0.5	31.7	0.5
Total (for first life)	**8.51e+04**	**100**	**6.25e+03**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.7e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Carbon Steel	Carbon steel, AISI 1015, as rolled	Virgin (0%)	2.3e+03	1	2.3e+03	7.3e+04	100.0
Total				**1**	**2.3e+03**	**7.3e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Carbon Steel	Roll forming	2.3e+03 kg	6.6e+03	100.0
Total			**6.6e+03**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Clairton Mill	32 tonne (4 axle) truck	2.3e+03	5e+03	99.6
Rio Grand Co. POS	32 tonne (4 axle) truck	10	21	0.4
Total		**2.3e+03**	**5e+03**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Carbon Steel	2.3e+03	5e+03	100.0
Total	**2.3e+03**	**5e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Carbon Steel	Landfill	4.5e+02	100.0
Total		**4.5e+02**	**100**

EoL potential:

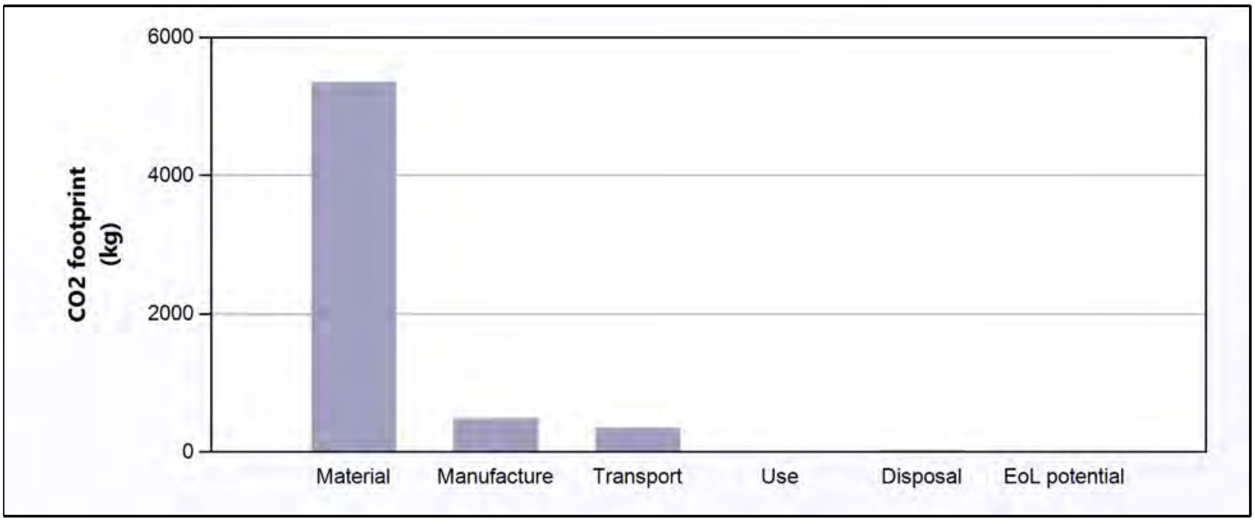
Component	End of life option	Energy (MJ)	%
Carbon Steel	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

[Summary]



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	125

Detailed breakdown of individual life phases

Material:

[Summary]

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Carbon Steel	Carbon steel, AISI 1015, as rolled	Virgin (0%)	2.3e+03	1	2.3e+03	5.4e+03	100.0
Total				**1**	**2.3e+03**	**5.4e+03**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

[Summary]

Component	Process	Amount processed	CO2 footprint (kg)	%
Carbon Steel	Roll forming	2.3e+03 kg	5e+02	100.0
Total			**5e+02**	**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Clairton Mill	32 tonne (4 axle) truck	2.3e+03	3.6e+02	99.6
Rio Grand Co. POS	32 tonne (4 axle) truck	10	1.5	0.4
Total		**2.3e+03**	**3.6e+02**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Carbon Steel	2.3e+03	3.6e+02	100.0
Total	**2.3e+03**	**3.6e+02**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Carbon Steel	Landfill	32	100.0
Total		**32**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Carbon Steel	Landfill	0	
Total		**0**	**100**

Notes:

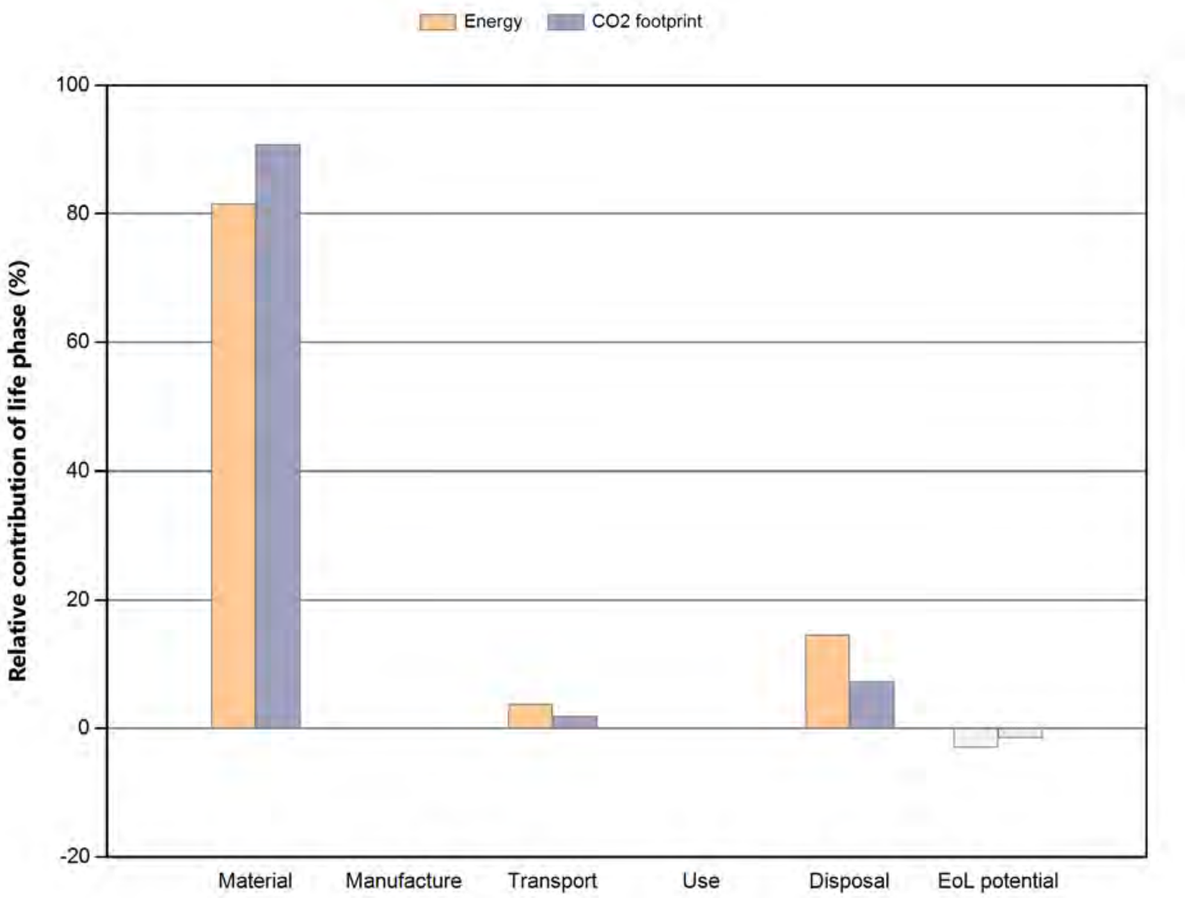
Summary

CES 2019 EDUPACK

Eco Audit Report

Product name	Cement
Country of use	North America
Product life (years)	50

Summary:

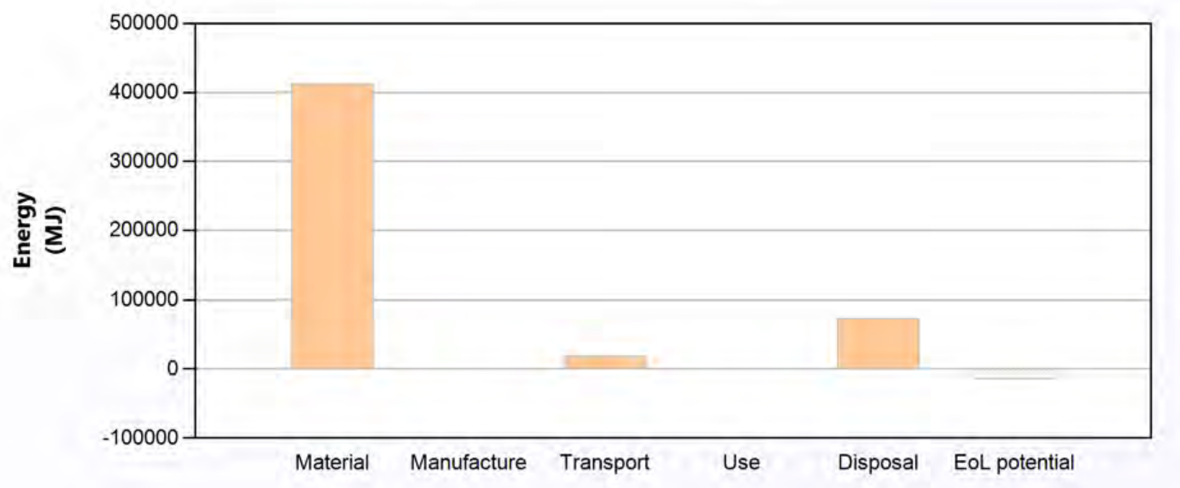


Energy details CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	4.12e+05	81.6	6.45e+04	90.8
Manufacture	0	0.0	0	0.0
Transport	1.93e+04	3.8	1.39e+03	2.0
Use	0	0.0	0	0.0
Disposal	7.38e+04	14.6	5.17e+03	7.3
Total (for first life)	**5.05e+05**	**100**	**7.11e+04**	**100**
End of life potential	-1.48e+04		-1.03e+03	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.01e+04

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Cement	Cement (rapid hardening Portland)	Virgin (0%)	1.5e+05	1	1.5e+05	4.1e+05	100.0
Total				**1**	**1.5e+05**	**4.1e+05**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Source	40 tonne (6 axle) truck	1.5e+02	1.8e+04	94.1
POS	32 tonne (4 axle) truck	8.2	1.1e+03	5.9
Total		**1.6e+02**	**1.9e+04**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Cement	1.5e+05	1.9e+04	100.0
Total	**1.5e+05**	**1.9e+04**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Cement	Downcycle	7.4e+04	100.0
Total		**7.4e+04**	**100**

EoL potential:

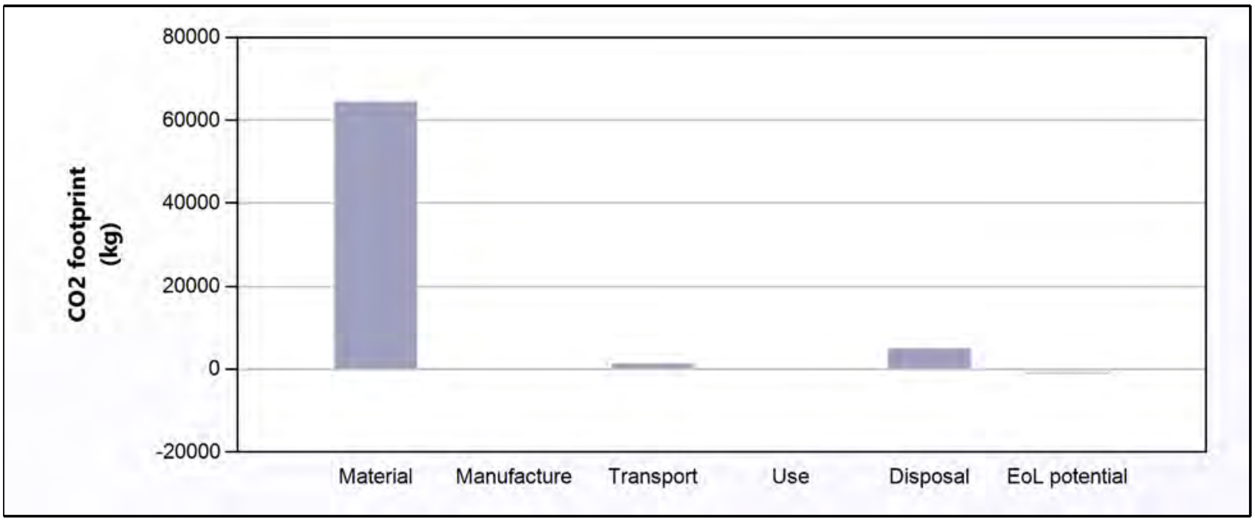
Component	End of life option	Energy (MJ)	%
Cement	Downcycle	-1.5e+04	100.0
Total		**-1.5e+04**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.42e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Cement	Cement (rapid hardening Portland)	Virgin (0%)	1.5e+05	1	1.5e+05	6.5e+04	100.0
Total				**1**	**1.5e+05**	**6.5e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Source	40 tonne (6 axle) truck	1.5e+02	1.3e+03	94.1
POS	32 tonne (4 axle) truck	8.2	82	5.9
Total		**1.6e+02**	**1.4e+03**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Cement	1.5e+05	1.4e+03	100.0
Total	**1.5e+05**	**1.4e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Cement	Downcycle	5.2e+03	100.0
Total		**5.2e+03**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Cement	Downcycle	-1e+03	100.0
Total		**-1e+03**	**100**

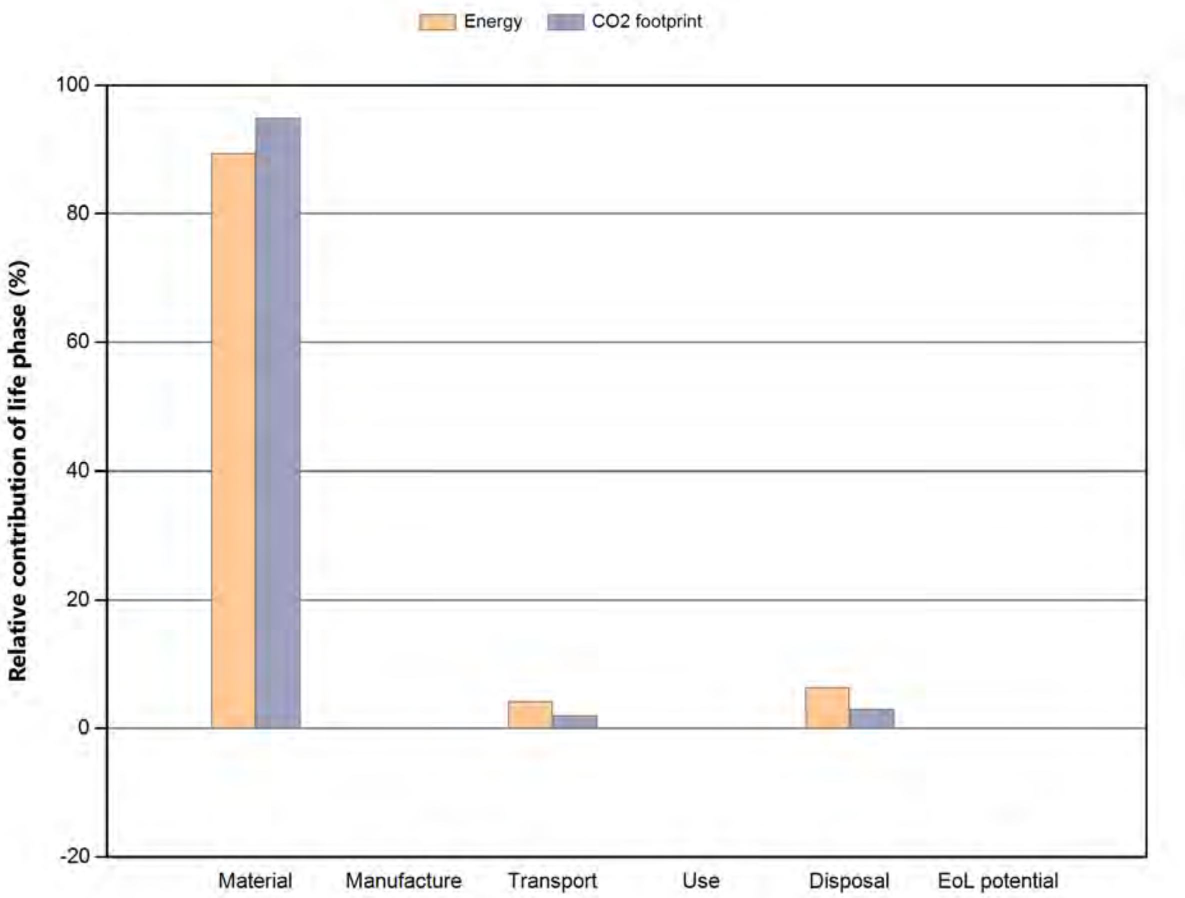
Notes:

Summary

Eco Audit Report

Product name	Cement
Country of use	North America
Product life (years)	50

Summary:

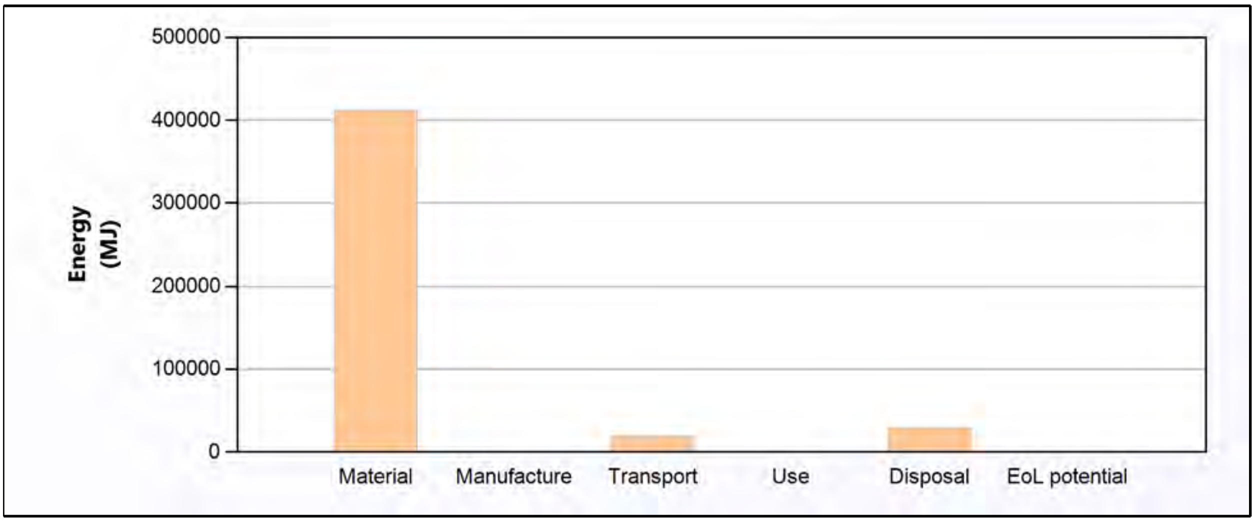


Energy details   CO2 footprint details

Phase	Energy (MJ)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	4.12e+05	89.4	6.45e+04	94.9
Manufacture	0	0.0	0	0.0
Transport	1.93e+04	4.2	1.39e+03	2.0
Use	0	0.0	0	0.0
Disposal	2.95e+04	6.4	2.07e+03	3.0
Total (for first life)	**4.61e+05**	**100**	**6.8e+04**	**100**
End of life potential	0		0	

Energy Analysis

Summary



	Energy (MJ/year)
Equivalent annual environmental burden (averaged over 50 year product life):	9.22e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (MJ)	%
Cement	Cement (rapid hardening Portland)	Virgin (0%)	1.5e+05	1	1.5e+05	4.1e+05	100.0
Total				**1**	**1.5e+05**	**4.1e+05**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	Energy (MJ)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	Energy (MJ)	%
Source	40 tonne (6 axle) truck	1.5e+02	1.8e+04	94.1
POS	32 tonne (4 axle) truck	8.2	1.1e+03	5.9
Total		**1.6e+02**	**1.9e+04**	**100**

Breakdown by components

Component	Mass (kg)	Energy (MJ)	%
Cement	1.5e+05	1.9e+04	100.0
Total	**1.5e+05**	**1.9e+04**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	Energy (MJ)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	Energy (MJ)	%
Cement	Landfill	3e+04	100.0
Total		**3e+04**	**100**

EoL potential:

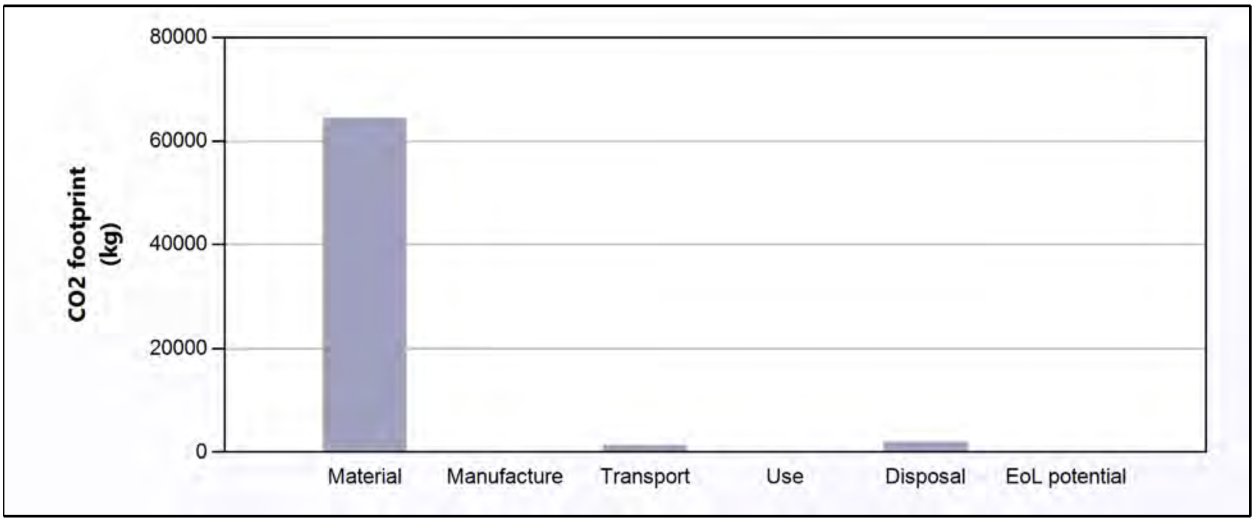
Component	End of life option	Energy (MJ)	%
Cement	Landfill	0	
Total		**0**	**100**

Notes:

Summary

CO2 Footprint Analysis

Summary



	CO2 (kg/year)
Equivalent annual environmental burden (averaged over 50 year product life):	1.36e+03

Detailed breakdown of individual life phases

Material:

Summary

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	CO2 footprint (kg)	%
Cement	Cement (rapid hardening Portland)	Virgin (0%)	1.5e+05	1	1.5e+05	6.5e+04	100.0
Total				**1**	**1.5e+05**	**6.5e+04**	**100**

*Typical: Includes 'recycle fraction in current supply'

Manufacture:

Summary

Component	Process	Amount processed	CO2 footprint (kg)	%
Total				**100**

Transport:

Summary

Breakdown by transport stage

Stage name	Transport type	Distance (km)	CO2 footprint (kg)	%
Source	40 tonne (6 axle) truck	1.5e+02	1.3e+03	94.1
POS	32 tonne (4 axle) truck	8.2	82	5.9
Total		**1.6e+02**	**1.4e+03**	**100**

Breakdown by components

Component	Mass (kg)	CO2 footprint (kg)	%
Cement	1.5e+05	1.4e+03	100.0
Total	**1.5e+05**	**1.4e+03**	**100**

Use:

Summary

Relative contribution of static and mobile modes

Mode	CO2 footprint (kg)	%
Static	0	
Mobile	0	
Total	**0**	**100**

Disposal:

Summary

Component	End of life option	CO2 footprint (kg)	%
Cement	Landfill	2.1e+03	100.0
Total		**2.1e+03**	**100**

EoL potential:

Component	End of life option	CO2 footprint (kg)	%
Cement	Landfill	0	
Total		**0**	**100**

Notes:

Summary