ENVIRONMENTAL PRODUCT DECLARATION

ROLL FORMED STEEL PANELS

CSSBI
Canadian Sheet Steel Building Institute

We are Canada's foremost authority on sheet steel, its products, and its many applications. We are an industry association responsible for the development and dissemination of industry standards. A source for technical information and resources, we provide expert guidance to the general public and sheet steel manufacturers alike. Our overall mission is to pursue the advancement of sheet steel as the most durable and reliable building material on the market today.

As an association, the CSSBI and our members recognize that sustainable construction is important and essential part of our world's long-term ecological and economical prosperity.

This EPD and other research on the topic of sustainability demonstrates that roll formed steel panels for building applications can play a significant role in any sustainable project.

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

CSSBI Canadian Sheet Steel Building Institute

ROLL FORMED STEEL PANELS
Industry-Wide EPD

According to ISO 14025

This declaration is an Environmental Product Declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	CSSBI - Canadian Sheet Steel Building Institute
DECLARATION NUMBER	4786662040.101.1
DECLARED PRODUCT	Roll Formed Steel Panels
REFERENCE PCR	Insulated Metal Panels & Metal Composite Panels, and Metal Cladding: Roof and Wall Panels
DATE OF ISSUE	Februray 26, 2016
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Life cycle assessment results Interpretation of results

The PCR review was conducted by:	UL Environment Review Panel Thomas Gloria (Chairperson)
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Britt Willingham Britt Willingham, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas Gloria Tom Gloria, Industrial Ecology Consultants

Description of organization and product

Organization Description

We are Canada's foremost authority on sheet steel, its products, and its many applications. We are an industry association responsible for the development and dissemination of industry standards. A source for technical information and resources, we provide expert guidance to the general public and sheet steel manufacturers alike. Our overall mission is to pursue the advancement of sheet steel as the most durable and reliable building material on the market today.

The CSSBI can help turn design visions into realities. Sheet steel products have significant advantages over other building products, often providing more strength and immediate cost savings. Always at the forefront of current designs and product technologies, our Institute provides the technical guidance architects, designers, engineers, and builders need to achieve structurally sound and ambitious designs with steel.

Please visit for www.cssbi.ca for the most up to date information and to see the current list of our members.

Product description and intended applications

The panels are roll formed from coils of Galvanized (100% zinc) or Galvalume (55% aluminum 45% zinc) coated steel that may be painted using a continuous coil coating process. A variety of profiles are available for steel roofing, decking and cladding system applications. The panel widths typically range from 12" to 36" (305 mm to 914 mm) and the thickness range is 14 to 29 gauge (1.98 mm to 0.36 mm). The profile depth is 4" (102 mm) or less.

The thickness of coatings (i.e. zinc layer and paint coatings) varies according to intended end-use of the products. Indoor as well as outdoor use is targeted.

Table 1 describes the material specification for a typical painted panel.

Material	Specification Details	Weight (kg/m²)	Average content in total weight (%)
Non coated steel substrate	0.64 mm (24 gauge)	5.90	95.2%
Metallic coating (Zinc or equivalent)	275 g/m² (G90)	0.27	4.3%
Paint coating (total for both sides)	30 µm	0.03	0.5%
Total		6.20	100%

Table 1: Typical specification for a painted panel

Materials

The Life Cycle Assessment results in this study are for roll formed panels used for cladding, decking and roofing applications in building construction. Hot dip galvanized steel coil production, paint coil coating and panel roll forming operations were modeled to obtain the LCA results.

Availability of Raw materials

Low carbon steels used for construction applications have an iron content of approximately 98%. Iron is by mass the most abundant element on our planet and the fourth most common element in the Earth's crust.

Steel is also the most recycled material. Approximately 80 million tons of steel are available annually to be recycled into new steel products in North America without degradation of properties.

Raw Material Extraction and Origin

Galvanized coils can be produced along the Blast Furnace (BF) steelmaking route as shown in Figure 1 or the Electric Arc Furnace (EAF) steelmaking route. For the blast furnace route, the process begins with raw materials extraction (mainly iron ore, hard coal and limestone) which are prepared in the coke making, sintering and pelletizing plants, and which are then fed into the BF. Pig iron, the BF product is then poured into the BOF (basic oxygen furnace) and steel scrap is added (typically 25% of the load weight). The BOF process reduces the carbon level in the liquid pig iron converting it to liquid steel. Then the outgoing 'liquid' steel is refined in a ladle metallurgy operation with added elements in order to give a targeted chemical composition

For the EAF route, the furnace feedstock is typically 90% scrap and 10% pig iron or directly reduced iron. Chemistry refinement is also conducted in a ladle metallurgy station.

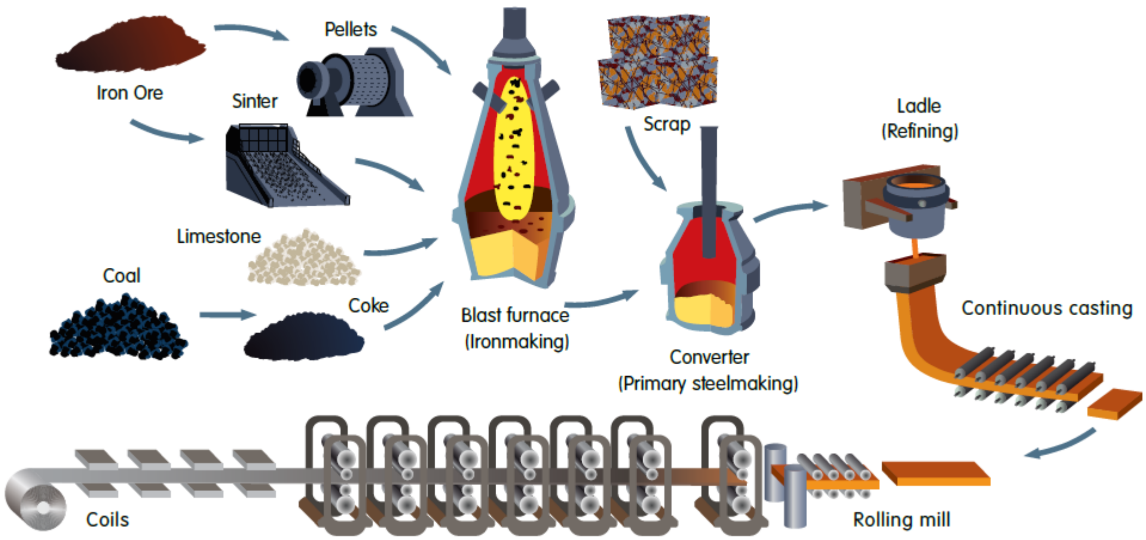

Figure 1: Primary Steelmaking and Hot Rolling Operations

Liquid steel from the ladle is then continuously cast through a mold to produce slabs which are subsequently hot rolled into coils. This product is known as hot rolled steel and is of a significantly heavier thickness than the finished product thickness that is considered in this study.

The hot rolled coils pass through a pickling operation where hydrochloric acid removes scale (iron oxide) from the strip surface before passing through a cold rolling mill where the strip is reduced to the final ordered thickness. The cold roll coils are then transported to a hot dip galvanizing line. For roofing and cladding applications, the hot dip galvanized coils may be subsequently processed through a paint coil coating line.

Roll Forming Process

Roll forming is a continuous bending operation where the steel strip is passed through consecutive sets of rolls, each performing only an incremental part of the bend until the desired profile is obtained. The steel coils are roll formed into a variety of profiles and cut to the required length into panels depending on the requirements of the building project.

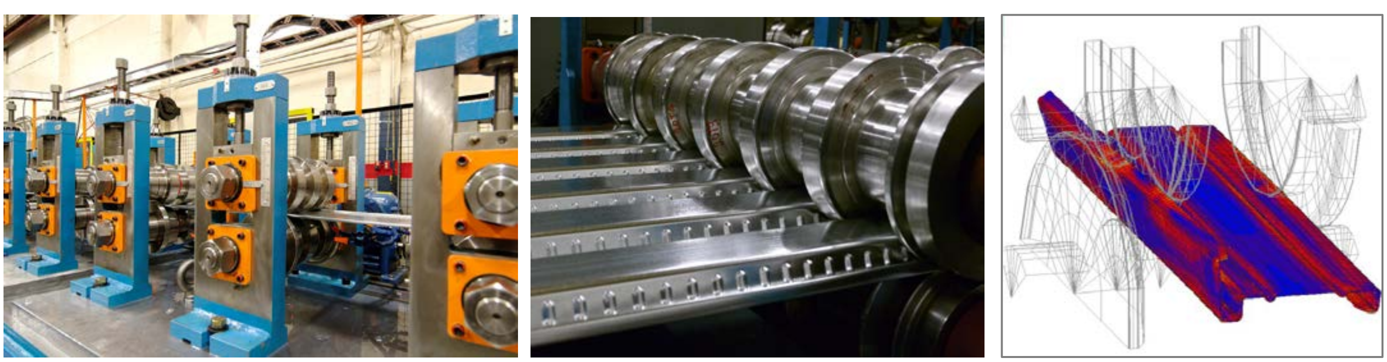

Figure 2: Roll Forming Process

Range of Applications

The roll formed panel applications for this study include cladding, roofing and decking (floor and roof). Roll formed panels may be used in residential, agricultural and commercial building construction applications as shown in Figure 3.

Project Dream Home – Peterborough, ON (Vicwest)

PJC Office – Varennes, QC (Canam Group Inc.)

Commonwealth Stadium – Edmonton, AB (Vicwest)

University of Guelph Dairy Research Unit – Elora, ON (Agway Metals Inc.)

Figure 3: Examples of Residential, Commercial and Agricultural roll formed steel panel applications

Product Performance and Quality Control Data

A detailed list of performance and quality control standards for steel cladding, roofing and decking applications is available in the appendix of the LCA background report.

Requirements of the Underlying Life Cycle Assessment

This LCA study was conducted according to the requirements in the Product Category Rule (PCR) "Insulated Metal Panels & Metal Composite Panels and Metal Cladding: Roof and Wall Panels" created by UL Environment and published on October 9th, 2012.

Declared Unit

The declared unit for this study is defined as coverage of 1000 square feet (93 square meters) with steel panel product.

To achieve a declared unit of 1000 square feet (93 square meters) of steel panel coverage, an industry average reference flow of 577 kg is required.

System Boundaries

The system boundary is cradle-to-gate with options. Therefore the life cycle stages taken into account include raw materials supply, transportation, the North American manufacturing of hot dip galvanized coils, paint coil coating, panel roll forming and end of life recycling.

Credits and loads are calculated for each environmental indicator according to the Worldsteel end of life methodology. These values are representative of the credits and loads of recycling steel at the end of life beyond the system boundaries.

These stages correspond to the A1 to A3 and D modules as defined in the EN15084 standard. A summary of the modules and source of data used in this LCA study is provided in Table 2.

The objective of this study is to provide the environmental profile of roll formed panels. Therefore, consideration was not given to stages A4-A5 (transportation to the building site and the construction process), B1 to B7 (use phase) and C1 to C4 steps (end-of-life).

Module	Scope	Data Source	Region	Year
A1	Production of Hot Dip Galvanized Coil	Worldsteel	North America	2006 to 2010
A1	Paint Coil Coating	Primary Data Collection	Canada	2014
A2	Transportation to Roll Forming operation	Primary Data Collection	Canada	2014
A3	Roll Forming	Primary Data Collection	Canada	2014
D	Credit for end of life recycling	Worldsteel	Global	2005-2008

Table 2 : Modules included in System Boundary and Source of LCI Data

Background Data

This LCA study was modeled using the Gabi 7.2 software develped by Thinkstep AG. The manufacture and transport of steel panels involves hundreds of distinct upstream unit processes. Details of upstream unit processes are provided in Appendix 6 of the Worldsteel methodology report. The majority of these datasets for the North American region were sourced from the Gabi US LCI database and from various product trade associations. These unit processes are responsible for small contributions to the final indicator results.

Life Cycle Assessment Results and Analysis

Life cycle impact results for the declaclared unit of 1000 sq feet (93 square meters) of roll formed panels are shown for both Traci 2.1 and CML (2001 – April 2013) impact characterisation methods. 24 gauge (0.64 mm) steel panel thickness was used by default to obtain these results.

Environmental Impact Indicators (TRACI 2.1)	A1	A2	A3	D
Global Warming Air, [kg CO2-Equiv.]	1,310	20	60	-414
Acidification [kg SO2-Equiv.]	7.08	0.09	0.22	-1.00
Eutrophication [kg N-Equiv.]	0.308	0.008	0.010	-0.007
Ozone Depletion Air [kg CFC 11-Equiv.]	2.93E-05	1.70E-10	1.46E-08	1.43E-05
Smog Air [kg O3-Equiv.]	104	3	4	-10
Environmental Impact Indicators (CML 2001 - 2013)	**A1**	**A2**	**A3**	**D**
GWP 100 years [kg CO2-Equiv.]	1,310	20	60	-414
Abiotic Depletion (ADP elements) [kg Sb-Equiv.]	0.0265	0.0000	0.0001	-0.0042
Abiotic Depletion (ADP fossil) [MJ]	16,000	278	3,370	-4,350
Acidification Potential (AP) [kg SO2-Equiv.]	6.96	0.07	0.22	-0.99
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	0.574	0.018	0.022	-0.027
Ozone Layer Depletion Potential [kg R11-Equiv.]	2.68E-05	1.59E-10	1.35E-08	1.32E-05
Photochem. Ozone Creation Potential [kg Ethene-Eq.]	0.603	0.009	0.051	-0.220

Table 3: Life cycle impacts of 1000 square feet (93 square meters) of roll formed panels

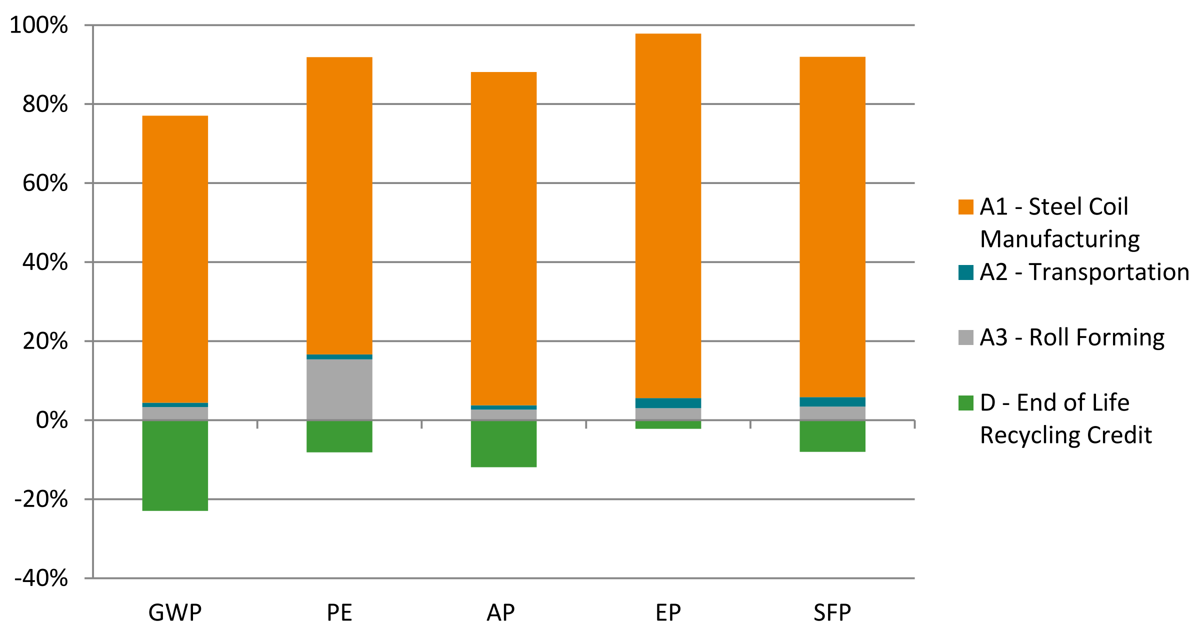

Figure 4: Life Cycle Impacts of 1000 square ft (93 square meters) of roll formed panels, TRACI 2.1 impacts and primary energy inventory

Energy and Resource Use

Resource use flows	A1	A2	A3	D
Use of renewable primary energy [MJ]	798	4	1,220	12
Use of non-renewable Energy [MJ]	17,500	288	3,580	-1,890
Use of secondary material [kg]	252	0	0	0
Net use of fresh water [m3]	14	0	0	-1

Table 4: Energy and resource use of 1000 sq ft (93 square meters) of roll formed panels

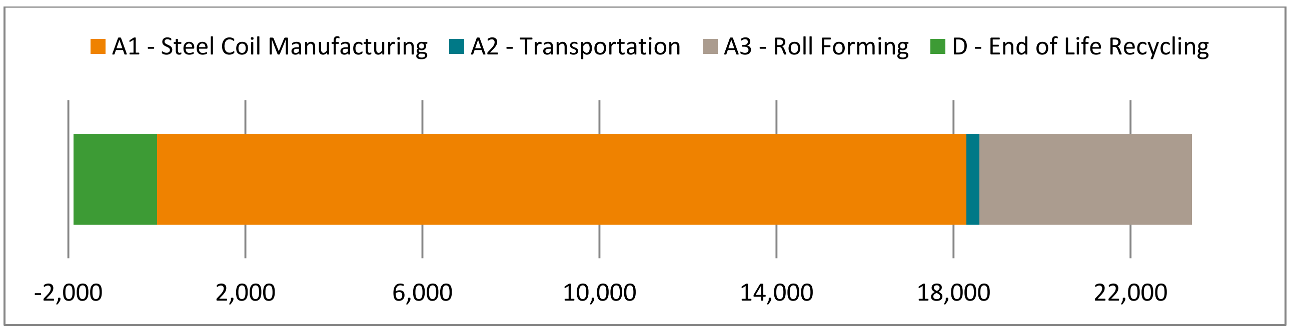

Figure 5: Total Primary Energy Use (MJ) for 1000 square ft (93 square meters) of roll formed panels

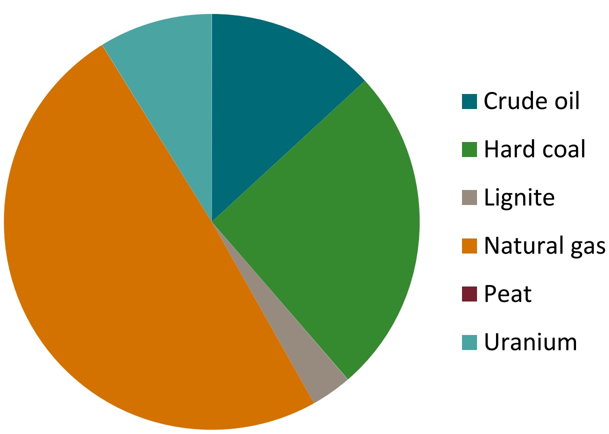

Figure 6: Non-Renewable Primary Energy Use by fuel type

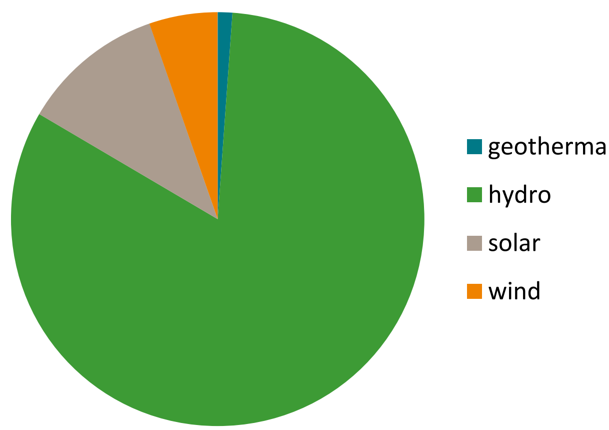

Figure 7: Renewable Primary Energy Use by fuel type

Waste and output flows

Table 5 provides additional waste output flow information. The small quantity of radioactive waste is a result of electricity consumption from the North American grid mix modeled in this study.

Waste and output flows	A1	A2	A3	D
Non hazardous waste disposed [kg]	7.8	0.0	0.0	10.3
Hazardous waste disposed [kg]	16.6	0.0	0.0	-0.2
Radioactive waste disposed [kg]	0.374	0.001	0.025	0.141

Table 5: Waste and Output Flows for 1000 sq ft (93 square meters) of roll formed panels

End of Life Recycling

Steel is currently the most recycled material in the world and it can be recovered and recycled in a manner that results in no loss of the properties associated with the primary material. The market for steel scrap (steel at the end of life) is a well established and mature market. It is therefore important that the environmental benefits associated with the recovery and recycling of this valuable resource be recognized. Table 6 provides additional information on the parameters and assumptions used to model the recycling of steel at the end of life.

Process	Units	Value
Collection process specified by type	kg collected separately	577
Recovery system specified by type	kg for recycling	531
Disposal specified by type	kg of material for final deposition	46
Assumptions for scenario development	Recycling rate	92%

Table 6: End of Life scenario for 1000 sq ft (93 square meters) of roll formed panels

Interpretation

Global Warming Potential:
The global warming potential indicator is dominated by emissions of CO2 (~90%) at the blast furnace and by energy production and use all along the production steps. Methane also contributes to a lower extent (6%) to GWP at the coke making operations. The rest (~1%) is attributed to nitrous oxide and non methane organic compounds emissions.

Total Primary Energy Use:
The majority of the primary energy demand comes from natural gas consumption (49%) and hard coal from Blast Furnace consumption (28%). The remaining sources are mostly crude oil for transportation and uranium and lignite from electricity consumption.

Acidification Potential:
Sulphur dioxide and nitrogen oxides together contribute most to the acidification potential indicator (90%). They arise primarily from electricity production and transportation.

Eutrophication Potential:
The EP for steel products is dominated by emissions to air, which contribute 94% to this impact. The main contributor is nitrogen oxides (90%). Emissions to water that contribute to this impact are from nitrogen containing substances, e.g. nitrate, ammonia.

Ozone Depletion Potential:
The ozone layer depletion indicator value is mainly determined by the zinc refining process. However, the values for the functional unit are very small, far below typical measurement thresholds and therefore can be considered negligible.

Smog formation Potential:
Carbon monoxide coming from the iron ore preparation process accounts for over 60% of the contribution to this impact. Other contributing substances include sulphur dioxide and nitrogen oxides mostly from electricity production and transportation.

References

1. Life Cycle Assessment of Roll Formed Steel Panels for Building Applications Background Report. S. Lipkowski, ArcelorMittal Global R&D. October 2015.
2. Product Category Rule for Insulated Metal Panels & Metal Composite Panels and Metal Cladding: Roof and Wall Panels. UL Environment, October 9th, 2012.
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