

# Environmental Product Declaration

According to ISO 14025 and ISO 21930

An industry average cradle-to-gate EPD for Glass Mat Gypsum Panels produced by Gypsum Association member companies for the USA and Canadian Markets.

Declaration Number: EPD- 038

Date of Issue: 09/13/2016

Period of Validity: 5 years

## EPD Summary Results - 1 MSF of 1/2" and 5/8" Glass Mat Gypsum Panels

Category Indicator	Unit	1 MSF 1/2" GMGP	1 MSF 5/8" GMGP
Global warming potential	kg CO <sub>2</sub> equiv.	358	417
Ozone depletion potential	kg CFC-11 equiv.	5.8E-05	6.6E-05
Acidification potential	kg SO <sub>2</sub> equiv.	2.8	3.4
Eutrophication potential	kg N equiv.	0.51	0.58
Smog creation potential	kg O <sub>3</sub> equiv.	35.1	42.0
<b>Total primary energy consumption</b>			
Non-renewable, fossil	MJ, HHV	5,483	6,441
Non-renewable, nuclear	MJ, HHV	433	483
Renewable, solar, wind, hydroelectric, and geothermal	MJ, HHV	90	99
Renewable, biomass	MJ, HHV	89	94
<b>Material resources consumption</b>			
Non-renewable materials	kg	739	912
Renewable materials	kg	2.1	2.4
Recovered materials	kg	102	135
Net fresh water	L	1,705	1,952
<b>Waste generated</b>			
Hazardous waste	kg	0.27	0.28
Non-hazardous waste	kg	17.5	20.9








## ASTM International Certified Environmental Product Declaration

This is an industry average business-to-business Type III environmental product declaration (also known as an "industry-wide" or "generic" cradle-to-gate EPD) for glass mat gypsum panels as manufactured by the Gypsum Association member companies in the USA and Canada. This declaration has been prepared in accordance with ISO 14025 [5], ISO 21930 [6], ISO 14040 [2], ISO 14044 [3] the governing glass mat gypsum panels category rules [1] and ASTM International’s EPD program operator rules [7].

The intent of this document is to further the development of environmentally compatible and more sustainable construction products by providing comprehensive environmental information related to potential impacts of glass mat gypsum panels available in the USA and Canada in accordance with international standards.

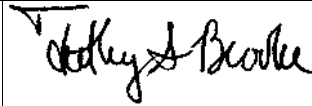

### Environmental Product Declaration Summary

General Summary	
<b>Owner of the EPD</b>	
	<p><b>Gypsum Association (GA)</b>                      6525 Belcrest Road, Suite 480                      Hyattsville, MD 20782                      Link (URL): <a href="http://www.gypsum.org">www.gypsum.org</a>  <a href="mailto:info@gypsum.org">info@gypsum.org</a></p> <p>The GA is a not-for-profit trade association founded in 1930. Its mission is to promote the use of gypsum while advancing the development growth, and general welfare of the gypsum industry in the U.S. and Canada on behalf of its member companies. GA members include all the active gypsum board (panel) manufacturers in the U.S. and Canada.</p> <p>Each GA member company provided both LCI and meta-data for the reference year 2013. GA members, with the inclusion of their Canadian holdings and affiliates, produce and ship over 95% of the glass mat gypsum panel sheathing consumed in the USA and Canada.</p> <p>The owner of the declaration is liable for the underlying information and evidence.</p>

GA Member Companies Corporate Locations	
	<p><b>American Gypsum Company LLC</b>            3811 Turtle Creek Blvd., Suite 1200            Dallas, TX 75219, USA            Member Link (URL):  <a href="http://www.americangypsum.com/">http://www.americangypsum.com/</a></p>
	<p><b>CertainTeed Gypsum, Inc.</b>            CertainTeed Gypsum Canada, Inc.            20 Moores Road            Malvern, PA 19355, USA            Member Link (URL):  <a href="http://www.certainteed.com/gypsum">http://www.certainteed.com/gypsum</a></p>
	<p><b>Continental Building Products Operating Company, LLC</b>            12950 Worldgate Drive            Suite 700, Herndon, VA 20170, USA            Member Link (URL):  <a href="http://www.continental-bp.com/en/">http://www.continental-bp.com/en/</a></p>
	<p><b>Georgia-Pacific Gypsum LLC</b>            133 Peachtree Street NE            Atlanta, GA 30303, USA            Member Link (URL):  <a href="http://www.buildgp.com/Georgia-Pacific-Gypsum">http://www.buildgp.com/Georgia-Pacific-Gypsum</a></p>
	<p><b>National Gypsum Company</b>            2001 Rexford Road            Charlotte, North Carolina 28211, USA            Member Link (URL):  <a href="http://nationalgypsum.com/">http://nationalgypsum.com/</a></p>
	<p><b>PABCO® Gypsum</b>  <i>a division of PABCO® building products, LLC</i>            10600 White Rock Road, Suite 100            Rancho Cordova, CA 95670, USA            Member Link (URL):  <a href="http://www.pabcogypsum.com/">http://www.pabcogypsum.com/</a></p>

**GA Member Companies Corporate Locations (continued)**

 		<b>United States Gypsum Company</b> 550 West Adams Street Chicago, IL 60661-3676, USA Member Link (URL): <a href="http://www.usg.com/content/usgcom/en.html">http://www.usg.com/content/usgcom/en.html</a>	
 		<b>CGC INC.</b> 350 Burnhamthorpe Road West 5th Floor Mississauga, ON, L5B 3J1, Canada Member Link (URL): <a href="http://www.usg.com/content/usgcom/en_CA_east.html">http://www.usg.com/content/usgcom/en_CA_east.html</a>	
<b>Product Group and Name</b>		Glass Mat Gypsum Panel	
<b>Product Definition</b>		Glass mat gypsum panels (known as glass mat panels) are designed to be used as exterior substrate or sheathing for weather barriers. The substrates consist of a noncombustible water-resistant gypsum core, surfaced with glass mat partially or completely embedded in the core [9].	
<b>Product Category Rules (PCR)</b>		ASTM International, Product Category Rules for Preparing an Environmental Product Declaration for Glass Mat Gypsum Panels, August 2016 [1].	
<b>Certification Period</b>		09.13.2016 – 09.13.2021	
<b>Declared Unit</b>		1,000 square feet (1MSF) of Glass Mat Gypsum Panel with a nominal finished thickness of 1/2" and 5/8"	
<b>ASTM Declaration Number</b>		EPD-038	
<b>EPD Information</b>			
<b>Program Operator</b>		ASTM International	
<b>Declaration Holder</b>		Gypsum Association (GA)	
<b>Product group</b>	<b>Date of Issue</b>	<b>Period of Validity</b>	<b>Declaration Number</b>
Glass Mat Gypsum Panel	09/13/2016	5 years	EPD- 038

<p><b>Declaration Type</b></p> <p>A “cradle-to-gate” EPD for Glass Mat Gypsum Panels manufactured by GA members. Activity stages or information modules covered include production with the product ready for shipment at the manufacturing plant (modules A1 to A3). The declaration is intended for use in Business-to-Business (B-to-B) communication.</p>					
<p><b>Applicable Countries</b></p> <p>United States and Canada</p>					
<p><b>Product Applicability</b></p> <p>Glass Mat Gypsum Panels are typically used as exterior building envelope sheathing providing weather barriers, mold and fire resistance for new construction or renovation work.</p>					
<p><b>Content of the Declaration</b></p> <p>This declaration follows Section 11; Content of the EPD, ASTM International, Product Category Rules for Preparing an Environmental Product Declaration for Glass Mat Gypsum Panels, March 2016.</p>					
<p><b>This EPD was independently verified by ASTM in accordance with ISO 14025:</b></p> <table border="0"> <tr> <td style="text-align: center;"><u>Internal</u></td> <td style="text-align: center;"><u>External</u></td> </tr> <tr> <td></td> <td style="text-align: center;">X</td> </tr> </table>	<u>Internal</u>	<u>External</u>		X	 <p>Tim Brooke          100 Barr Harbor Drive, PO Box C700          West Conshohocken, PA 19428-2959, USA  <a href="http://www.astm.org/EPDs.htm">www.astm.org/EPDs.htm</a></p>
<u>Internal</u>	<u>External</u>				
	X				
<p><b>EPD Project Report Information</b></p>					
<p><b>EPD Project Report</b></p>	<p>An Industry Average Cradle-to-Gate Life Cycle Assessment of Glass Mat Gypsum Panel for the USA and Canadian Markets, August 2016.</p>				
<p><b>Prepared by</b></p> 	<p>Lindita Bushi, Jamie Meil and Grant Finlayson          Athena Sustainable Materials Institute          119 Ross Avenue, Suite 100          Ottawa, Ontario, Canada K1Y 0N6          email: <a href="mailto:info@athenasmi.org">info@athenasmi.org</a>  <a href="http://www.athenasmi.org">www.athenasmi.org</a></p>				
<p><b>This EPD project report was independently verified by in accordance with ISO 14025 and the reference PCR:</b></p>	<p>Thomas P. Gloria, Ph.D.          Industrial Ecology Consultants          35 Bracebridge Rd.          Newton, MA 02459-1728          direct: 617.553.4929          mobile: 857.636.0585          email: <a href="mailto:t.gloria@industrial-ecology.com">t.gloria@industrial-ecology.com</a></p>				



<b>PCR Information</b>	
<b>Program Operator</b>	ASTM International
<b>Reference PCR</b>	ASTM International, Product Category Rules for Preparing an Environmental Product Declaration for Glass Mat Gypsum Panels
<b>Date of Issue</b>	August 2016
<b>PCR review was conducted by:</b>	Gary Jakubcin, B&G Jakubcin and Associates, LLC (Chairperson) email: <a href="mailto:gary.jakubcin@gmail.com">gary.jakubcin@gmail.com</a> Steven Butler, ACG Materials Mark Flumiani, Innogyps

# 1 PRODUCT IDENTIFICATION

## 1.1 PRODUCT DEFINITION

Glass mat gypsum panels (GMGP) UNSPSC Code 30161500, as defined in ASTM C1177/C1177M are designed to be used as an exterior substrate or sheathing for weather barriers [9]. The substrates consist of a noncombustible water-resistant gypsum core, surfaced with a glass mat partially or completely embedded in the core [9]. Typically, GMGPs are 4' wide and 8' length panels (4'x8') produced with a square edge and are compatible with most exterior wall and roof applications. GMGP may be available in other lengths and can vary in thickness and fire rating properties depending on the application (e.g., tile backer board). The focus of this industry average LCA study is exterior sheathing applications for panels with a finished nominal thickness of  $\frac{1}{2}$ " and  $\frac{5}{8}$ ". GMGPs are also proprietary products and while they all employ glass matting and a water-resistant gypsum core the panel composition varies across manufacturers.



**Figure 1 Glass Mat Gypsum Panels**

## 1.2 PRODUCT STANDARD

Applicable product standards for GMGPs (UNSPSC Code 30161500) include:

- ASTM C1177/C1177M *Specification for Glass Mat Gypsum Substrate for Use as Sheathing*
- ASTM C11 *Terminology Relating to Gypsum and Related Building Materials and Systems*
- ASTM C22/C22M *Specification for Gypsum*
- ASTM C473 *Test Methods for Physical Testing of Gypsum Panel Products*

- ASTM C1264 *Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products*
- ASTM E119 *Test Methods for Fire Tests of Building Construction and Materials*

## 2 PRODUCT APPLICATION

GMGPs are typically used as exterior building envelope sheathing providing weather barriers, mold and fire resistance for new construction or renovation work.

## 3 DECLARED UNIT

The declared unit is 1,000 square feet (1MSF) of GMGPs with a nominal finished thickness of  $\frac{1}{2}$ " and  $\frac{5}{8}$ " [1].

## 4 MATERIAL CONTENT

Table 1 below presents the weighted average composition by input material for one thousand square feet (1MSF) of  $\frac{1}{2}$ " and  $\frac{5}{8}$ " GMGPs as derived from the GA member facilities LCI data collection for the reference year 2013.

**Table 1: Weighted Average Material Content for 1MSF of GMGPs by Thickness**

Inputs	Units	$\frac{1}{2}$ " GMGP	$\frac{5}{8}$ " GMGP
<b>Gypsum material and glass matting</b>			
Natural gypsum ore	Pounds	1,440	1,816
Pre-consumer gypsum-FGD synthetic gypsum	Pounds	205	275
Post-consumer gypsum <sup>1</sup>	Pounds	19.1	23.6
Glass matting	Pounds	99.0	99.0
<b>Additives (both dry and wet)</b>			
Starch	Pounds	0.4	0.4
Fiberglass (other than matting above)	Pounds	2.8	4.2
Dispersant	Pounds	2.6	2.8
Retarder	Pounds	0.3	0.3
Potassium Sulfate	Pounds	2.2	2.3
Dextrose	Pounds	0.01	0.00
Boric Acid	Pounds	0.09	0.16
Land Plaster	Pounds	1.2	1.5

<sup>1</sup> Post-consumer gypsum includes GMGP on-site construction off-cuts and recovered gypsum material collected from demolition sites.



Inputs (Table 1 continued)	Units	<sup>1</sup> / <sub>2</sub> " GMGP	<sup>5</sup> / <sub>8</sub> " GMGP
Foaming agent (soap)	Pounds	0.4	0.4
Ball mill (BM) accelerator	Pounds	2.6	2.6
Edge Paste	Pounds	2.2	2.3
Fly ash	Pounds	0.6	0.6
Silicone products	Pounds	8.8	9.8
Wax	Pounds	0.8	0.9
Biocide, sodium omadine, sodium trimetaphosphate (STMP), barium metaborate monohydrate (Busan) and emulsion solids <sup>2</sup>	Pounds	0.5	1.0
Prime paint	Pounds	2.4	2.4
Water	Pounds	1,365	1,734
Total (wet weight)	Pounds	3,089	3,886
<b>Finished density (with 1.7% MC)</b>	<b>Pounds</b>	<b>2,027</b>	<b>2,578</b>
Final moisture content (MC)	%	1.7%	1.7%

## 5 PRODUCT STAGE

The Product Stage includes the following modules [1]:

- A1 Raw material supply;
- A2 Transport to the manufacturer; and
- A3 Manufacturing operations.

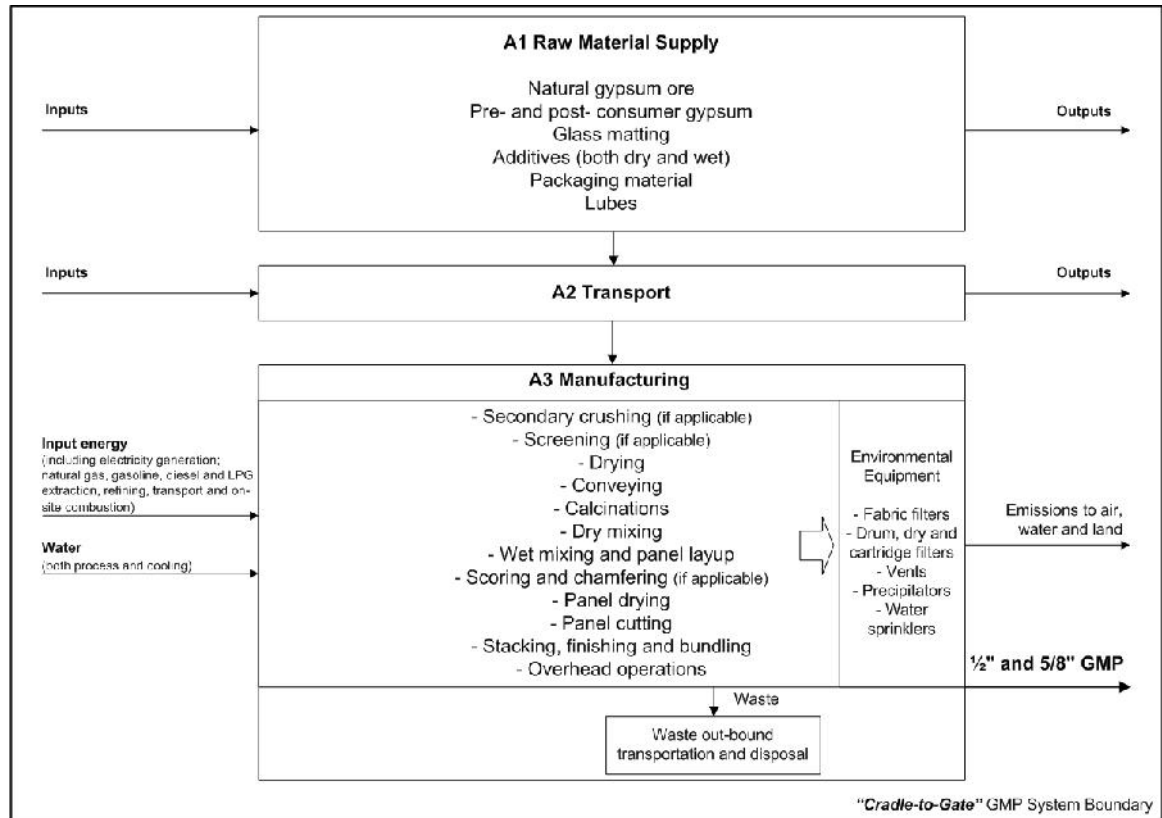
Construction, Use and End-of-life stages are excluded from the system boundary. Figure 2 shows the product stage system boundary for the declared product system.

The Product Stage includes the following processes [1]:

- Extraction and processing of raw materials, including fuels used in product production;
- Average and/or specific transportation of raw materials from the extraction site or source to manufacturing site, inclusive of empty backhauls (where applicable);
- Manufacturing of GMGPs;
- Product packaging with product ready for shipment to distribution points or customers;
- Average or specific transportation from manufacturing site to recycling/reuse/landfill for pre-consumer wastes and unutilized by-products from manufacturing, including empty backhauls; and

<sup>2</sup> LCI data are rolled up for confidentiality reasons.

- Final disposition of pre-consumer wastes inclusive of transportation.



**Figure 2 Product stage (module A1 to A3) system boundary**

The Product Stage excludes the following processes [1]:

- Capital goods and infrastructure
- Personnel related activities (travel, office operations and supplies)
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

## 6 LIFE CYCLE INVENTORY

### 6.1 DATA COLLECTION AND REPRESENTATIVENESS

Data collection was based on an initial survey of all GA member facility operations. GA members operate 31 facilities in the USA and Canada producing various GMGP products. Some facilities are 100% dedicated to the production of GMGP while others may produce both GMGP and paper faced gypsum boards. In total 11 facilities operated by the 7 GA company members (American Gypsum Company LLC; CertainTeed Gypsum, Inc.; CertainTeed Gypsum Canada, Inc.; Continental Building Products Operating Company, LLC; Georgia-Pacific Gypsum LLC; National Gypsum Company; PABCO® Gypsum, a division of PABCO® building products, LLC; United States Gypsum Company and CGC Inc.) completed LCI data collection questionnaires representing 35% of all GA member facilities producing GMGP. To ensure representativeness, the GMGP manufacturing plant sample also considered the scale of operations including a mix of small, medium and large GMGP production volume facilities, their geographical location in each US census region and their source of gypsum – adjacent quarry, mine, imported gypsum ore and their use of FGD synthetic gypsum. All LCI data were averaged on the annual production basis across facilities.

### 6.2 CUT OFF RULES, ALLOCATION RULES AND DATA QUALITY REQUIREMENTS

*The cut-off requirements* as per the ASTM PCR for glass mat gypsum panels, Section 7.2, were followed [1]. All input/output flow data reported by the participating GA member facilities were included in the LCI modelling. None of the reported flow data were excluded based on the cut-off criteria.

*Allocation procedures* observed the requirements and guidance of ISO 14044:2006, Clause 4.3 and those specified in ASTM PCR for glass mat gypsum panels, Section 7.5 [1]. ISO requirements and recommendations were followed for allocation procedures in general (Clause 4.3.4.2) and allocation procedures for reuse and recycling (Clause 4.3.4.3). The majority of the GA facility operations produce other products besides GMGPs as well as other GMGP products other than thickness of  $\frac{1}{2}$ " and  $\frac{5}{8}$ " for exterior sheathing applications and as such allocation was necessary. As a result, plant specific generic formulations for 1 MSF of the two products of interest were used to model and calculate the required input raw (both primary and secondary) and ancillary materials. "Mass" was deemed as the most appropriate physical parameter for allocation used for the GMGPs system (between  $\frac{1}{2}$ " and  $\frac{5}{8}$ " GMGP products and other types of calcined co-products) to estimate the input energy flows (electricity, natural gas, propane, etc.), water input, process emissions and waste flows.

"Mass" was also deemed as the most appropriate physical parameter for allocation of the total environmental load of the quarry system between the main product and co-products. For synthetic FGD gypsum, an ISO 14044 conformance system expansion

methodology was used whereby the GMGP product system is debited for intermittent treatment of FGD (de-watering, transportation) and credited for avoided landfilling of FGD - see Section 3.2.4 for details [11].

In addition, the following allocation rules are applied- see Section 7.5 [1]:

- Allocation related to transport is based on the mass and distance of transported product;
- The environmental flows related to the disposal of the manufacturing (pre-consumer) solid and liquid waste are allocated to module A3 Manufacturing.

*Data quality requirements*, as specified in ASTM PCR for glass mat gypsum panels, Section 7.3, were observed [1]. This section also describes the achieved data quality relative to the ISO 14044:2006 requirements [3]. Data quality is judged on the basis of its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source) and representativeness (geographical, temporal, and technological).

**Precision:** The GA participating member companies through measurement and calculation collected primary data on their production of GMGPs. For accuracy the LCA team individually validated these plant gate-to-gate input and output data.

**Completeness:** All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to provide an industry average for GMGPs with a thickness of  $1/2$ " and  $5/8$ ". The relevant background materials and processes were taken from the US LCI Database (adjusted for known data placeholders known as "dummy"), ecoinvent v 3.1 LCI database for US and Canada and modeled in SimaPro LCA software v.8.1.0.60, April 2016.

**Consistency:** To ensure consistency, the LCI modeling of the production weighted input and output LCI data for the GMGPs used the same modeling structure across the selected GA member facilities, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, emissions to air, water and soil, and material recycling and pre-consumer solid and liquid waste treatment. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

**Reproducibility:** Internal reproducibility is possible since the data and the models are stored and available in GA Athena LCI database developed in SimaPro, 2016. A high level of transparency is provided throughout the EPD report as the weighted average LCI profile is presented for the declared product [13]. The provision of more detailed data to allow full external reproducibility was not possible due to reasons of confidentiality.



**Representativeness:** The data are representative according to temporal, geographical, and technological requirements as per the ASTM PCR for glass mat gypsum panels, Section 7.1. The representativeness of the data is summarized as follows.

- Time related coverage:
  - GMGPs manufacturing process- primary collected data from 11 facilities: reference year 2013 (12 months);
  - In-bound/ out-bound transportation data- primary collected data from 11 facilities: reference year 2013 (12 months);
  - Natural gypsum ore - primary collected data from six quarries and one gypsum ore underground mine: reference year 2010 (12 months); the upstream natural gypsum ore profiles were updated with the most recent U.S., Canada and Spain electricity grids data; the activity data for the natural gypsum ore extraction process are deemed timely robust and no material changes are expected in the quarry/mine operations;
  - Generic data: the most appropriate LCI datasets were used as found in the US LCI (adjusted) Database, ecoinvent v.3.1 database for U.S., Canada and global, 2014.
- Geographical coverage: the geographical coverage is the U.S. and Canada.
- Technological coverage: typical or average.

## 7 LIFE CYCLE ASSESSMENT

### 7.1 RESULTS OF THE LIFE CYCLE ASSESSMENT

This section summarizes the product stage life cycle impact assessment (LCIA) results including resource use and waste generated metrics based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The results are calculated on the basis of one thousand square feet of GMGP with a nominal thickness of  $1/2$ " and  $5/8$ " (Table 2).

As per ASTM PCR for glass mat gypsum panels, the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2012 impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD [1]. These are relative expressions only and do not predict category impact end-points, the exceeding of thresholds, safety margins or risks. Total primary energy includes the total energy consumed over the cradle-to-gate (modules A1-A3) in delivering the declared unit (including pre-consumer waste treatment). Material resource consumption and generated waste reflect cumulative life cycle inventory flow information. In addition, "recovered materials" indicator (including pre-consumer FGD synthetic gypsum, post-consumer gypsum) is reported under "material resources consumption."

Figures 3 and 4 provide a percent contribution summary by information module for each of the selected LCIA indicators and LCI parameters for  $1/2$ " and  $5/8$ " GMGPs, respectively.

Contribution analysis is an analytical method used to support the interpretation of LCA results and to facilitate the reader's understanding of the environmental profile of the declared product.

**Table 2: EPD Summary Results - 1 MSF of 1/2" and 5/8" GMGPs**

Category Indicator	Unit	1 MSF 1/2" GMGP	1 MSF 5/8" GMGP
Global warming potential, GWP	kg CO <sub>2</sub> equiv.	358	417
Ozone depletion potential, ODP	kg CFC-11 equiv.	5.8E-05	6.6E-05
Acidification potential, AP	kg SO <sub>2</sub> equiv.	2.8	3.4
Eutrophication potential, EP	kg N equiv.	0.51	0.58
Smog creation potential, POCP	kg O <sub>3</sub> equiv.	35.1	42.0
<b>Total primary energy consumption</b>			
Non-renewable, fossil, PENR-fossil	MJ, HHV	5,483	6,441
Non-renewable, nuclear, PENR-nuclear	MJ, HHV	433	483
Renewable, solar, wind, hydroelectric, and geothermal, PER-SWHG	MJ, HHV	90	99
Renewable, biomass, PER-biomass	MJ, HHV	89	94
<b>Material resources consumption</b>			
Non-renewable materials, NRMR	kg	739	912
Renewable materials, RMR	kg	2.1	2.4
Recovered materials, RM	kg	102	135
Net fresh water, NFW	L	1,705	1,952
<b>Waste generated</b>			
Hazardous waste, HW	kg	0.27	0.28
Non-hazardous waste, NHW	kg	17.5	20.9

Gypsum Association Industry Average EPD for Glass Mat Gypsum Panels

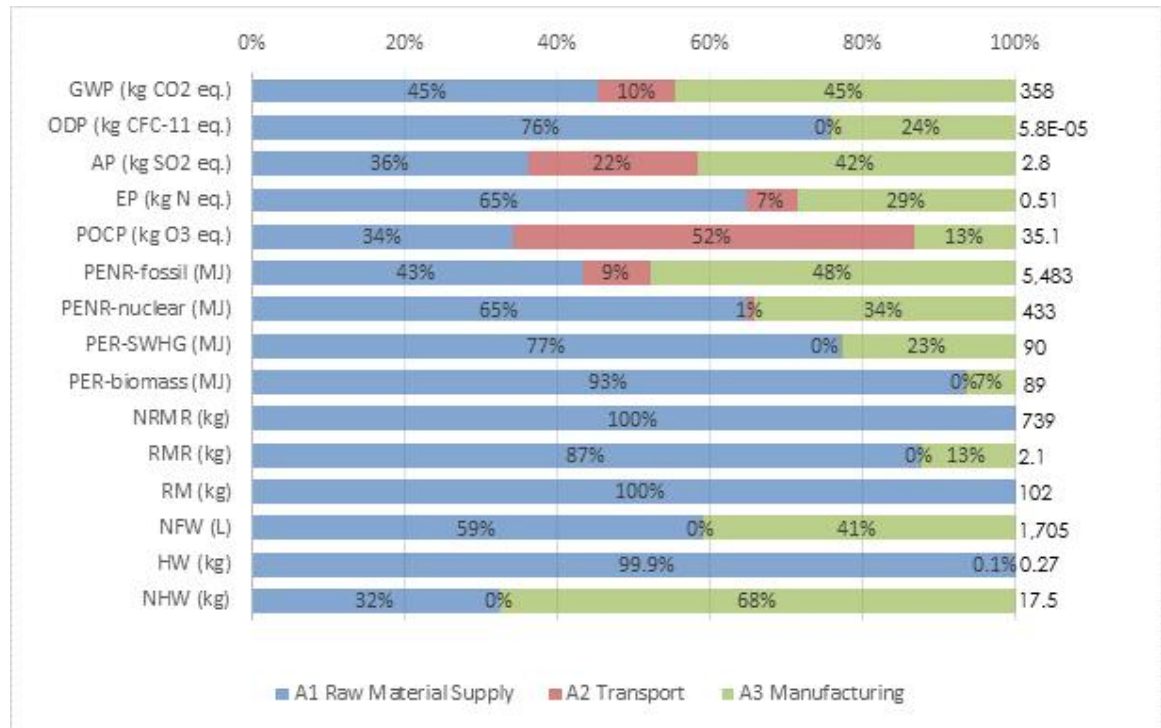


Figure 3: EPD Results by Information Module – 1 MSF of 1/2" GMGP – % Basis

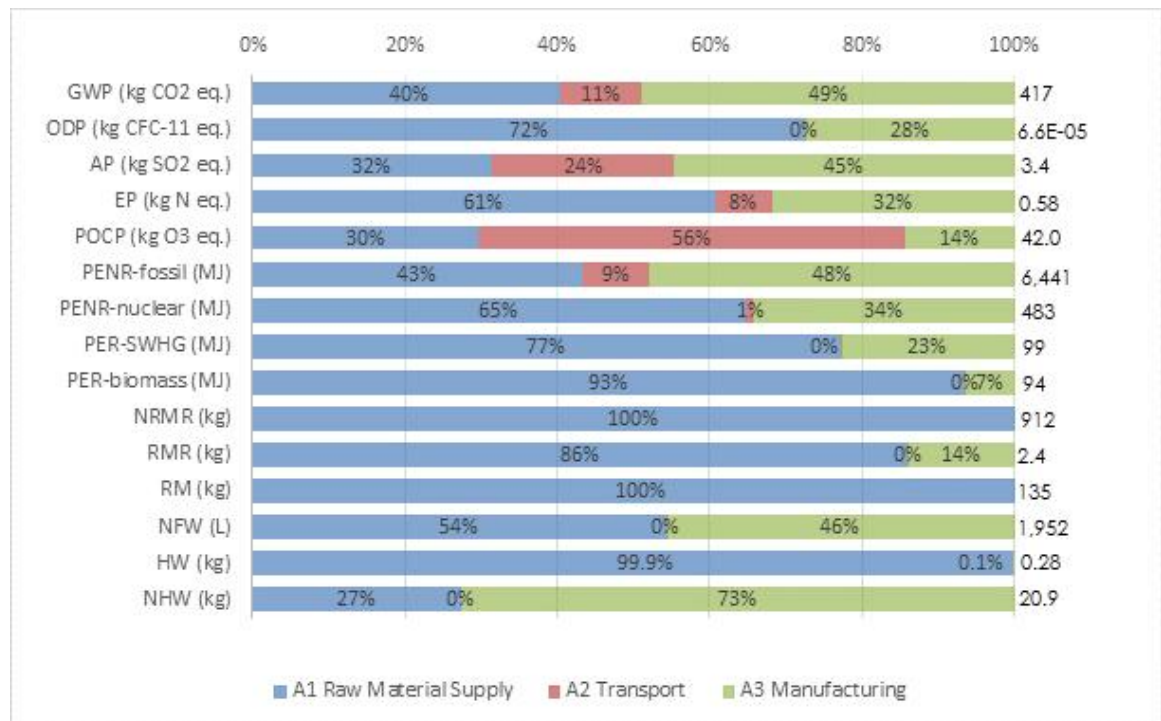


Figure 4: EPD Results by Information Module – 1 MSF of 5/8" GMGP – % Basis





## 7.2 INTERPRETATION

The cradle-to-gate manufacture of 1 MSF of  $1/2$ " and  $5/8$ " GMGP embodies about 6.1 GJ and 7.1 GJ of primary energy use and emits in the order of 358 kg and 417 kg of greenhouse gases, respectively. For both panel thicknesses, over 90% of the total primary energy is derived from non-renewable fossil fuels.

Across the three production information modules, Module A1 Raw Material Supply, generally contributes the largest share of the LCIA category results – accounting for between 30% (smog) and 76% (ozone depletion) of the impact burden. The application of pre-consumer FGD synthetic gypsum and post-consumer gypsum material in the manufacturing process is beneficial for the gypsum industry as it reduces the dependency on non-renewable material resources (natural gypsum ore).

With the exception of acidification and smog potential impacts, Module A2 Transportation is generally a minor contributor (<10%) to the overall impact of GMGPs.

Module A3 Manufacturing is responsible for a significant share of total energy use (50%) and is generally the largest source of greenhouse gas emissions (over 45%), acidification potential (over 42%) and non-renewable fossil energy (48%). Plant energy use, specifically natural gas and electricity use, are the largest contributors to the manufacturing burdens.

## 8 ADDITIONAL ENVIRONMENTAL INFORMATION

- *Health Protection Manufacture*  
The OSHA standards are applicable and followed.
  - U.S. Department of Labor, Occupational Safety & Health Administration (OSHA), 29 CFR, PART 1910 Occupational Safety and Health Standards.  
([https://www.osha.gov/pls/oshaweb/owasrch.search\\_form?p\\_doc\\_type=STANDARDS&p\\_toc\\_level=1&p\\_keyvalue=1910](https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910) )No additional health protection measures extending beyond mandatory occupational safety measures for commercial operations are required.
- *Environmental Protection Manufacture and Equipment*  
The GA member manufacturing facilities comply with the regional (U.S. and Canadian) environmental protection requirements, monitor and report the emissions to air during the manufacturing process as per the following:
  - EPCRA Section 313 Toxic Release Inventory Reporting (U.S.)  
(<http://www.ecy.wa.gov/epcra/section313.html> )
  - The Canadian National Pollutant Release Inventory (NPRI) reporting





(<http://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=4A577BB9-1>)

Environmental equipment typically used in the GMGPs manufacturing facilities are as follows: fabric filter – high temperature (baghouse), fabric filter- low temperature (baghouse), bin vent filter, drum filter, dry filter, cartridge filter, precipitator and water sprinkler for dust control.

## 9 DECLARATION TYPE AND PRODUCT AVERAGE DECLARATION

The type of EPD based on this EPD project report is defined as:

- A “Cradle-to-gate” EPD of GMGPs covering the product stage (modules A1 to A3) and is intended for use in Business-to-Business communication.

GA EPD of GMGPs UNSPSC Code 30161500 falls under the description:

- An average product EPD, as an average from several GA manufacturers’ facilities

(In this case, GA member manufacturers as listed under “GA Member Companies Corporate Locations,” see pg. 3).

- GA EPD represents an average performance for the GMGPs with a nominal finished thickness of  $\frac{1}{2}$ " and  $\frac{5}{8}$ ".

## 10 DECLARATION COMPARABILITY LIMITATION STATEMENT

The following ISO statement indicates the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs based on the ASTM PCR for glass mat gypsum panels:

- EPDs from different programs (using different PCR) may not be comparable.
- Declarations based on the ASTM PCR for glass mat gypsum panels are not comparative assertions; that is, no claim of environmental superiority may be inferred or implied.

## 11 EPD EXPLANATORY MATERIAL

For any explanatory material, in regard to this EPD, please contact the program operator.

### **ASTM International**

Environmental Product Declarations

100 Barr Harbor Drive,

West Conshohocken,

PA 19428-2959, <http://www.astm.org>

## 12 REFERENCES

1. ASTM International, Product Category Rules for Preparing an Environmental Product Declaration for Glass Mat Gypsum Panels, August 2016.
2. ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework.
3. ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines.
4. ISO 14021:1999 Environmental labels and declarations -- Self-declared environmental claims (Type II environmental labelling).
5. ISO 14025:2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
6. ISO 21930:2007 Building construction – Sustainability in building construction – Environmental declaration of building products.
7. EN 15804:2012, Sustainability of construction works- Environmental product declarations- Core rules for the product category of construction products.
8. ASTM Program Operator for Product Category Rules (PCRs) and Environmental Product Declarations (EPDs), General Program Instructions, Version 7.0, 14/06/2016.
9. ASTM C1177/C1177M Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
10. ASTM C1658/C1658M Specification for Glass Mat Gypsum Panels.
11. A Cradle-to-Gate Life Cycle Assessment of  $\frac{1}{2}$ " Regular and  $\frac{5}{8}$ " Type X Gypsum Wallboard. Prepared by the Athena Sustainable Materials Institute, December 2011, <http://www.pharosproject.net/uploads/files/sources/1238/1337635897.pdf>, Section 4.1, pgs. 37-41.
12. ISO 14046:2014 Environmental management - Water footprint - Principles, requirements and guidelines.
13. An Industry Average Cradle-to-Gate Life Cycle Assessment of Glass Mat Gypsum Panel for the USA and Canadian Markets, Prepared by the Athena Sustainable Materials Institute, August 2016.