Environmental Product Declaration

Program Operator: Smart EPD®
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IN ACCORDANCE WITH ISO 14025:2006 AND ISO 21930:2017



ECOMATERIAL TECHNOLOGIES
A CRH COMPANY

SmartEPD-2026-091-1125-01

Coal Ash – Oak Grove

Date of Issue	Expiration Date	Last Updated
Oct 29, 2026	**Oct 29, 2031**	**Oct 29, 2026**

Refer to the EPD Library at **www.smartepd.com** for the latest EPD listing information

General Information



Eco Material Technologies

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Product Name:	Coal Ash – Oak Grove
Declared Unit:	1 metric ton
Declaration Number:	SmartEPD-2026-091-1125-01
Date of Issue:	October 29, 2026
Expiration:	October 29, 2031
Last updated:	October 29, 2026
EPD Scope:	Cradle to gate A1 - A3
Market(s) of Applicability:	North America

General Organization Information

Eco Material Technologies and its subsidiary Green Cement LLC, are the leaders in developing, producing, and marketing supplementary cementitious materials (SCMs) for the concrete industry. Eco Material Technologies products offer the most efficient and readily available solution to lower the carbon footprint of concrete as the industry moves towards decarbonization. Eco Material Technologies offers fly ash sourced from current production and harvested from landfills and surface impoundments. It also offers ground bottom ash, natural pozzolans, blended SCMs, and high performance modified pozzolans.

Further information can be found at: https://ecomaterial.com/

Limitations, Liability and Ownership

Environmental declarations from different programs may not be comparable (ISO, 2006). Even when the same PCR was followed, different LCA software and background LCI datasets may lead to different results for upstream or downstream of the life cycle stages declared.

Comparison of the environmental performance of construction products using the EPD shall consider all the relevant information modules over the full life cycle of the products within the construction works. Such a comparison requires scenarios in the construction works context. Comparisons are possible at the sub-construction works level, for example for assembled systems, components or services for one or more life cycle stages, provided they meet requirements as outline in ISO 21930 5.5. Information has been provided as transparently as possible in this project report to allow a clear understanding of the limitations of comparability.

Much of the data utilized for this EPD is based on information supplied by the manufacturer. TrueNorth Collective is not responsible for the accuracy, completeness, or reliability of the data provided by the manufacturer or any information or conclusions derived therefrom.

The EPD owner has sole ownership, liability, and responsibility for the EPD.

Reference Standards

Standard(s):	ISO 14025:2006 and ISO 21930:2017
Core PCR:	Smart EPD® Part A Product Category Rules for Building and Construction Products and Services, 1000 v1.2 Date of issue: March 14, 2025
Sub-category PCR:	Smart EPD® Part B PCR for Supplementary Cementitious Materials, 1000-002 v1.0 Date of issue: May 07, 2024 Valid until: December 31, 2026
Sub-category PCR review panel:	Contact Smart EPD for more information.
General Program Instructions:	Smart EPD General Program Instructions v.2.0, March 2025

Verification Information

LCA Author/Creator:	Jana Fogarty TrueNorth Collective info@truenorthcollective.net
EPD Program Operator:	Smart EPD info@smartepd.com www.smartepd.com 585 Grove St., Ste. 145, Herndon, VA 20170, USA
Verification:	Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071: External Jack Geibig | Ecoform, LLC | jgeibig@ecoform.com Independent external verification of EPD, according to ISO 14025 and reference PCR(s): External Jack Geibig | Ecoform, LLC | jgeibig@ecoform.com

Product Information

Declared Unit:	1 metric ton
Mass:	1000 kg
Product Specificity:	✗ Product Average ✓ Product Specific

Product Description

Oak Grove coal ash is a blend of fly ash and ground bottom ash that can be used to partially replace cement in concrete. Bottom ash is dried and ground onsite to produce consistent product meeting our high quality standards that is then blended with fly ash sourced from current plant production. The resulting product is concrete-grade, ASTM C618 compliant coal ash with improved performance consistency and availability.

ASTM C125 defines Bottom Ash as the “ash that results from combustion of ground or powdered coal that is not transported by the flue gases. Processed bottom ash is bottom ash ground to fly ash-like fineness. Processed bottom ash is a pozzolan and offers similar benefits when used in concrete as those offered by the use of fly ash.

Product Specifications

Product SKU(s): ASTM C125 defines Bottom Ash as the “ash that results from combustion of ground or powdered coal that is not transported by the flue gases. Processed bottom ash is bottom ash ground to fly ash-like fineness. Processed bottom ash is a pozzolan and offers similar benefits when used in concrete as those offered by the use of fly ash. This product is a mixture of processed bottom ash and freshly produced fly ash. Actual blend proportions may differ and are not guaranteed; consistency is maintained within performance specifications Class / Subclass | Coal ash (ASTM C618 Class F, AASHTO M295 Class F, CSA A3001 Type F) Sub-Category | Bottom Ash Relative Density | 2.2 – 2.8

Product Classification Codes: Masterformat - 30111500

Material Composition

Material/Component Category	Origin	% Mass
Ground Bottom Ash	Franklin TX	40% - 60%
Fresh Fly Ash	Franklin TX	40% - 60%

Biogenic Carbon Content	kg C per metric ton
Biogenic carbon content in product	0
Biogenic carbon content in accompanying packaging	0

Hazardous Materials
None

EPD Data Specificity

Primary Data Year: 5/2023-4/2024

Manufacturing Specificity:

- ✗ Industry Average
- ✗ Manufacturer Average
- ✓ Facility Specific

Averaging:

Averaging was not conducted for this EPD

System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	ND
	A5	Assembly / Install	ND
Use	B1	Use	ND
	B2	Maintenance	ND
	B3	Repair	ND
	B4	Replacement	ND
	B5	Refurbishment	ND
	B6	Operational Energy Use	ND
	B7	Operational Water Use	ND
End of Life	C1	Deconstruction	ND
	C2	Transport	ND
	C3	Waste Processing	ND
	C4	Disposal	ND
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	ND

Note:

ND = Module not declared

Product Composition Diagram

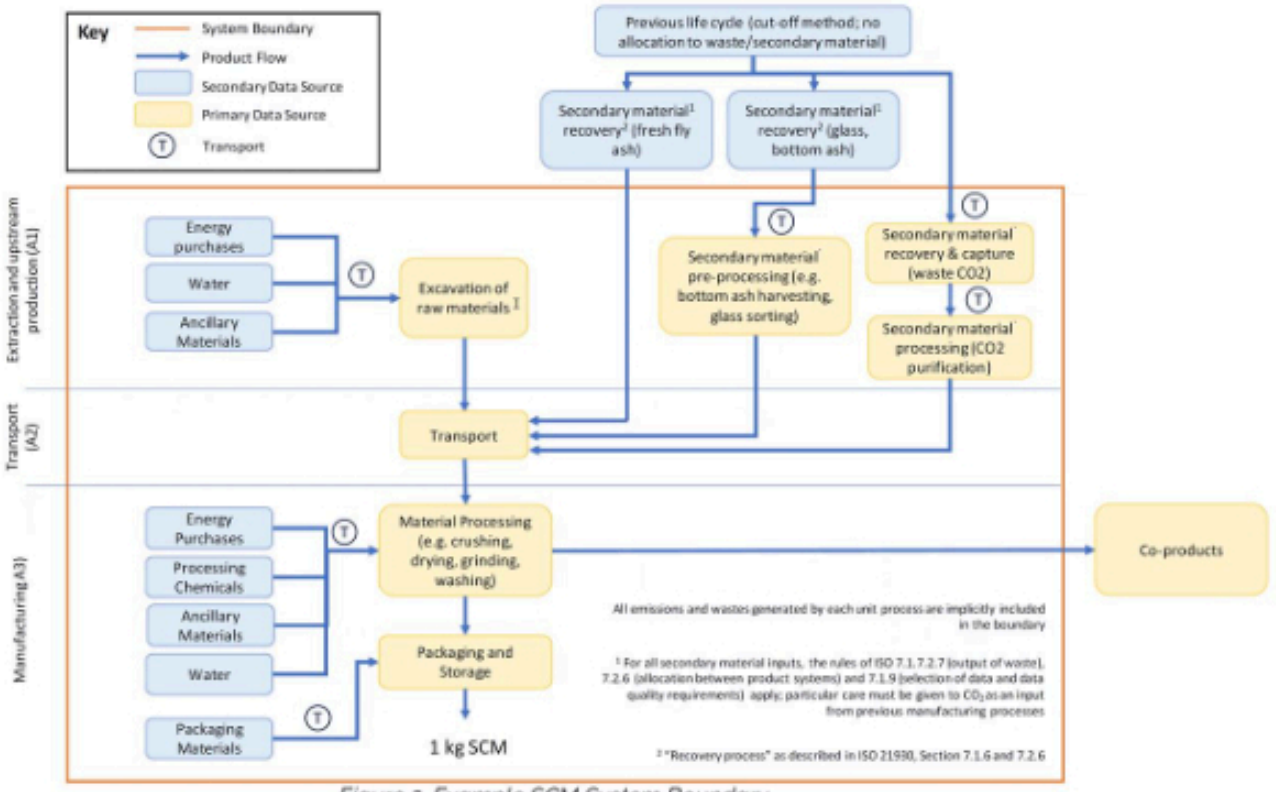
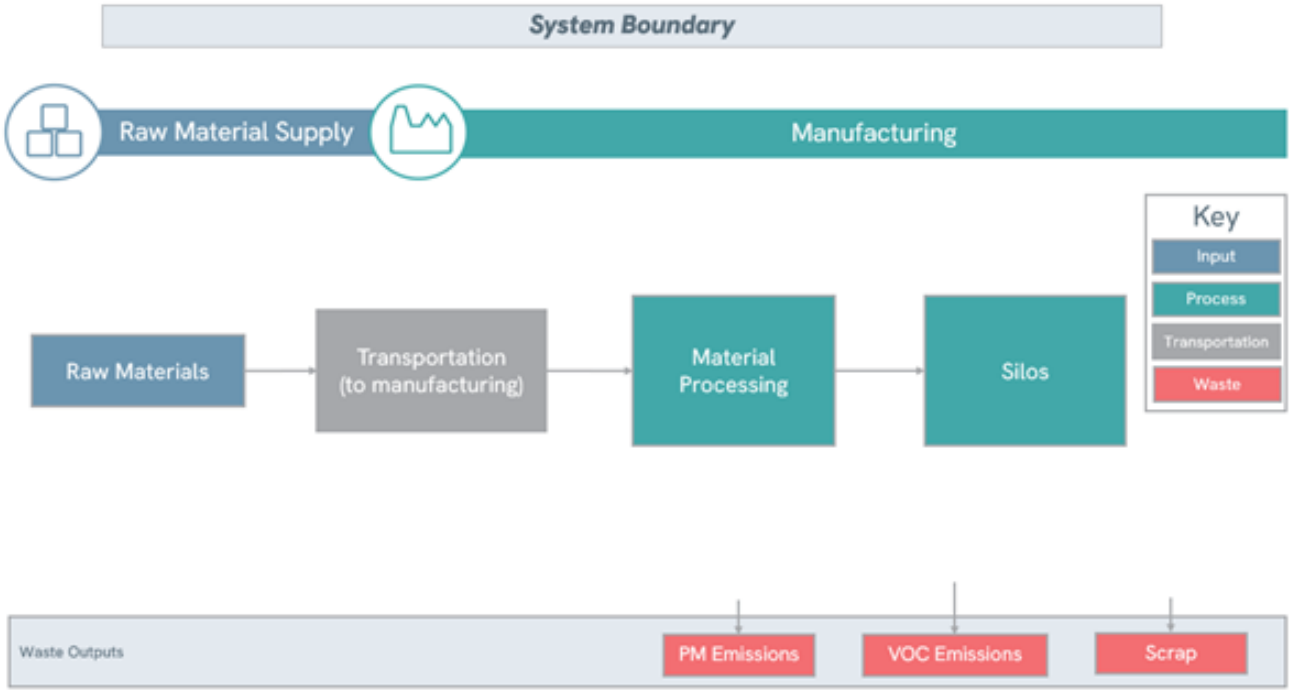


Figure 2. Example SCM System Boundary

Plants

Oak Grove Oak Grove, KY, USA

Product Flow Diagram



Assumptions and estimations used within the LCA are described below:

- Raw materials are assumed to be secondary materials with no impact burden carried into the production of supplementary cementitious materials.
- For facilities that no data was collected for transport distances, 100 kilometers by truck was assumed.
- Transportation for product scrap to disposal facility is assumed to be equal to that of the raw material transportation.

The end-to-end process is fully developed and implemented in the respective location for the manufacturing facility where the product is produced. Input and output flows are selected to represent US-specific activities where granular inventory is available. Regional electricity process for the respective grid location for the product manufacturing facility was chosen. US-specific inventory flows and proxies are used where available to represent the production pathways in US.

Software And Database

LCA Software:	SimaPro v. 9.6		
LCI Foreground Database(s):	Ecoinvent v. 3.10	GLO, RoW, US	Cut Off
LCI Background Database(s):	Ecoinvent v. 3.10	GLO, RoW, US	Cut Off

A foreground LCI database is the database used to model the primary, site-specific data collected for this EPD. A background LCI database is the database used to model generic or non-specific data.

Data Quality

Life cycle inventory data used in this study are evaluated based on three categories: precision and completeness, consistency and reproducibility, and representativeness.

Precision and completeness:
Foreground data are sourced from primary information provided by EMT and has been reviewed by TNC to ensure precision and completeness. In order to balance out seasonal variations, operations data over a 12-month period, is used to represent production activities. In addition, key model input such as mass balance, energy balance and emission inventory are reviewed by TNC.
Ecoinvent v3.10.1 (2023) is used as the main database for background data. Ecoinvent is widely used in research and industry to support life cycle assessment practices.

Consistency and reproducibility: To ensure consistency, primary data were collected at the same level of granularity. All input and output information, modelling assumptions and dataset choices are provided in this report for the purpose of reproducibility. Similar data is provided for all products studied in this report. Differences in the data are from location and function of the products studied. Where the raw material used in manufacturing is considered a secondary material of another process the material is considered to have zero burden. This is consistent through all products in the study. For similar processes among products in the study the same database is used where applicable.

Representativeness:
Process selection of proxies for the database processes used in the model is based on the technology, geography, and time information provided by EMT. TNC is not responsible for the accuracy, completeness, or reliability of the data provided by the manufacturer or any information or conclusions derived therefrom.

There are no exceptions in inclusion of value-add activities and all flows are included in this study. This study uses a mix of primary and secondary data modeled using Ecoinvent v3.10.1 database to represent the raw material supply, transportation and manufacturing energy inputs. Database processes are selected with support of EMT to represent the equipment and manufacturing of each product. For each product type the manufacturing process is fundamentally the same for all products. However, there may be variations across manufacturing equipment in terms of age, technology, brand, and other factors. The manufacturing processes used throughout production of each product may vary slightly.

Life Cycle Module Description

Supplementary Cementitious Materials are products that strengthen the concrete mixture and provide varying other benefits based on the product added. The blended fresh/harvested fly ash at Bowen include a variety of processing steps once the raw material is transported to the manufacturing facility. The raw materials for production of the supplementary cementitious materials are transported via truck. The raw materials used for all products are zero burden materials considering they are secondary materials that the burden of their production is accounted for in primary products. The burden associated with the transportation of the raw materials is reported in module A2.

Once the raw materials are transported to the manufacturing facility, a variety of processes may or may not be performed. These processes include feeding, screening, drying, classifying, and adding to silos. The following processes are relevant for the manufacturing of the product in this study:

- Use of various fuel sources within the manufacturing process
- processing of raw and secondary materials
- water use within the manufacturing process
- emissions from the combustion of secondary fuels and waste used in the manufacturing process
- waste management from manufacturing and manufacturing wastages transport up to the recycler or disposal (assumed to be equal to that of the transport to the manufacturing facility)

The following processes are irrelevant to the manufacturing of the products in this study

- generation of electricity from primary energy resources used in manufacturing including their extraction, refining and transport
- production of ancillary materials such as processing chemicals
- carbon capture utilization

LCA Discussion

Allocation Procedure

Annual production volume and product mass were used to allocate facility-level inputs, outputs, and emissions. At the manufacturing plant in Oak Grove, KY, the electricity, natural gas, propane, diesel, gasoline, and water consumption is provided for facility-wide production over the reference year. These totals are allocated by mass of production to the appropriate product. There are no co-products produced from the manufacturing of the product in this study.

Cut-off Procedure

For the processes within the system boundary, all energy and material flows were included in the model. No known flows were excluded. All upstream and downstream activities were included using a combination of primary and secondary data. While most inventory data were sourced from primary resources, representative proxies were used to close gaps in the absence of primary data.

The cut-off criteria for the PCR defaults to ISO 21930, Section 7.1.8. The model follows this criteria by including all known and available processes in the calculations filling data gaps with conservative assumptions, using 1% cut-off criteria with a 5% maximum total, and using a mass balance to ensure correct calculation of material and energy flows.

Renewable Electricity

Energy Attribute Certificates (EACs) such as Renewable Energy Certificates (RECs) or Power Purchase Agreements (PPAs) are included in the baseline reported results:	✕ No

Results

Environmental Impact Assessment Results

TRACI 2.1

per 1 metric ton of product.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact Category	Unit	Method	A1 - A3
GWP-total	kg CO2 eq	TRACI 2.1	3.54e+1
GWP-total (excl biogenic)	kg CO2 eq	TRACI 2.1	3.52e+1
GWP-total (incl biogenic)	kg CO2 eq	TRACI 2.1	3.54e+1
ODP	kg CFC 11 eq	TRACI 2.1	5.58e-7
AP	kg SO2 eq	TRACI 2.1	7.87e-2
EP	kg N eq	TRACI 2.1	7.05e-2
POCP	kg O3 eq	TRACI 2.1	1.85e+0
HTP-c	CTUh	TRACI 2.1	8.71e-8
HTP-nc	CTUh	TRACI 2.1	1.46e-7
ETP-fw	CTUe	TRACI 2.1	1.24e+2
PM	kg PM2.5 eq	TRACI 2.1	1.45e-6

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Resource Use Indicator

per 1 metric ton of product.

Indicator	Unit	A1 - A3
PERE	MJ	0
PERM	MJ	0
PERT	MJ	0
PENRE	MJ	0
PENRM	MJ	0
PENRT	MJ	0
RPRE	MJ	1.88e+1
RPRM	MJ	0
RPRT	MJ	1.88e+1
NRPRE	MJ	5.64e+2
NRPRM	MJ	0
NRPRT	MJ	5.64e+2
ADP-fossil	MJ	6.52e+1
SM	kg	0
RSF	MJ	0
NRSF	MJ	0
FW	m3	7.16e-2
RE	MJ	0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM = Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

Waste and Output Flow Indicators

per 1 metric ton of product.

Indicator	Unit	A1 - A3
HWD	kg	0
NHWD	kg	0
RWD	kg	0
HLRW	kg	0
ILLRW	kg	0
CRU	kg	0
MFR	kg	0
MER	kg	0
MNER	kg	0
EEE	MJ	0
EET	MJ	0

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

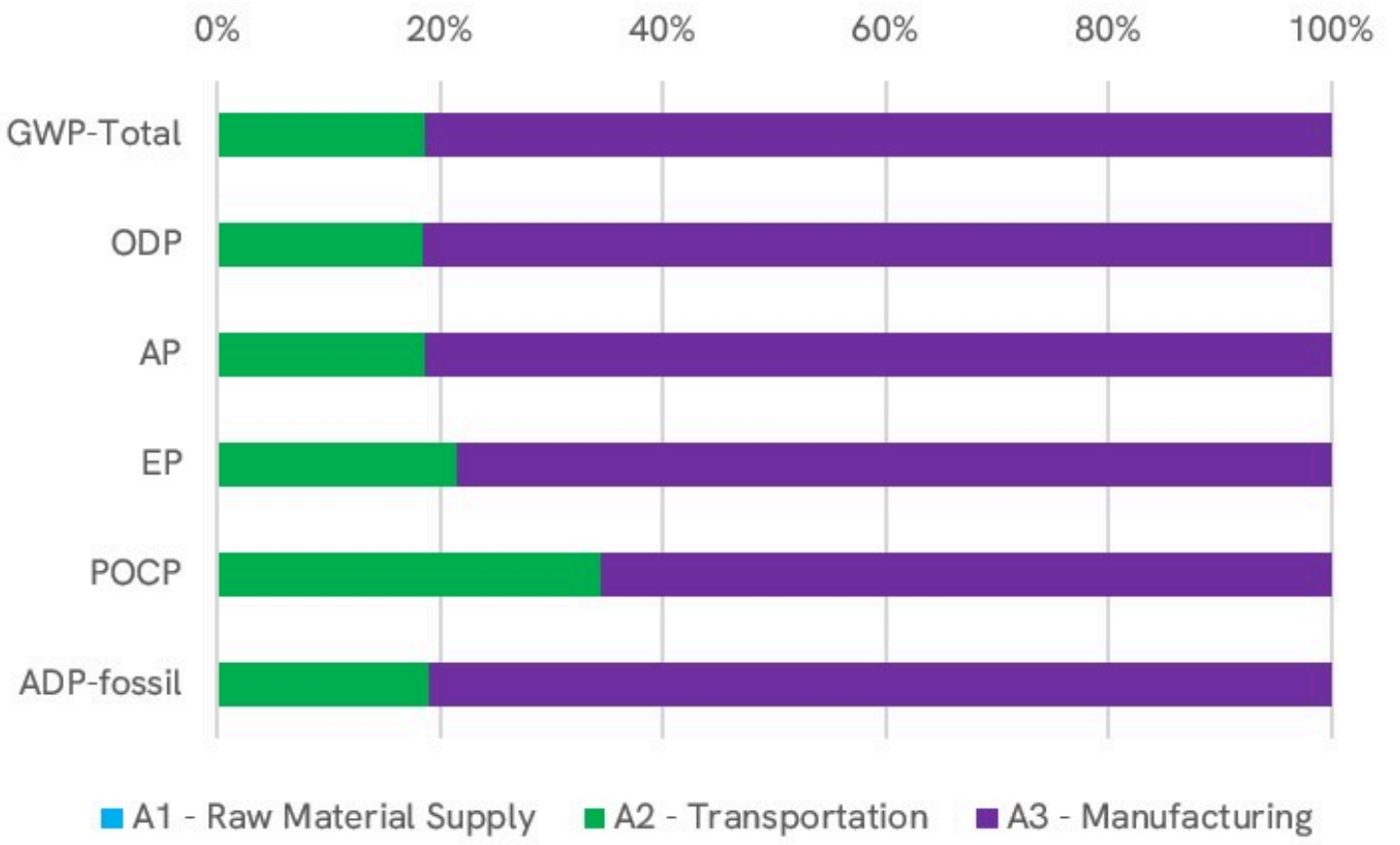
Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Interpretation

For supplementary cementitious materials analyzed in this study manufacturing (A3) had the largest impact with some facilities having significant impact from raw material transportation (A2) as well. Raw materials (A1) include no burden in the impacts since they are secondary materials and the impacts associated with the materials are included in the primary product. For supplementary cementitious materials studied the global warming potential impacts were largely due to emissions from electricity and combustion of hard coals and natural gas within the manufacturing process. While this is expected it also gives the largest opportunity of potential with the expansion of green energy in North America. Efficiency or renewable energy improvements made to support the processes of transforming the raw materials to the product, including those in system boundary would advance continued impact reduction efforts. Reduction in operations downtime would also optimize impact potential.

LCA results are based on a relative approach and indicate potential environmental effects therefore do not predict actual impacts on category impacts.



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