EPDs 201

November 28, 2023

Richard Willis
VP of Engineering,
Research and Technology
rwillis@asphaltpavement.org

What is an EPD?

- **Environmental Product Declaration**
  - **Quantified** environmental information on the **life cycle** of a product to enable **comparisons** between products fulfilling the **same function***
- **"Nutrition label" for environmental impacts**
- **Independently verified**

EPD "Nutrition" Label

Your Building Product

Amount per Unit

LCA IMACT MEASURES	TOTAL
Primary Energy (MJ)	12.4
Global Warming Potential (kg CO^2 eq)	0.96
Ozone Depletion (kg CFC- 11 eq)	1.80E-08
Acidification Potential (mol H^+ eq)	0.93
Eutrophication Potential (kg N^- eq)	6.43E-04
Photo-Oxidant Creation Potential (kg 03 eq)	0.121

Your Product's Ingredients: Listed Here

https://westcoastclimateforum.com/cfpt/concrete/strategy1

*Source: ISO 14025:2006. **EPDs from different Product Categories should NOT be compared to each other.**

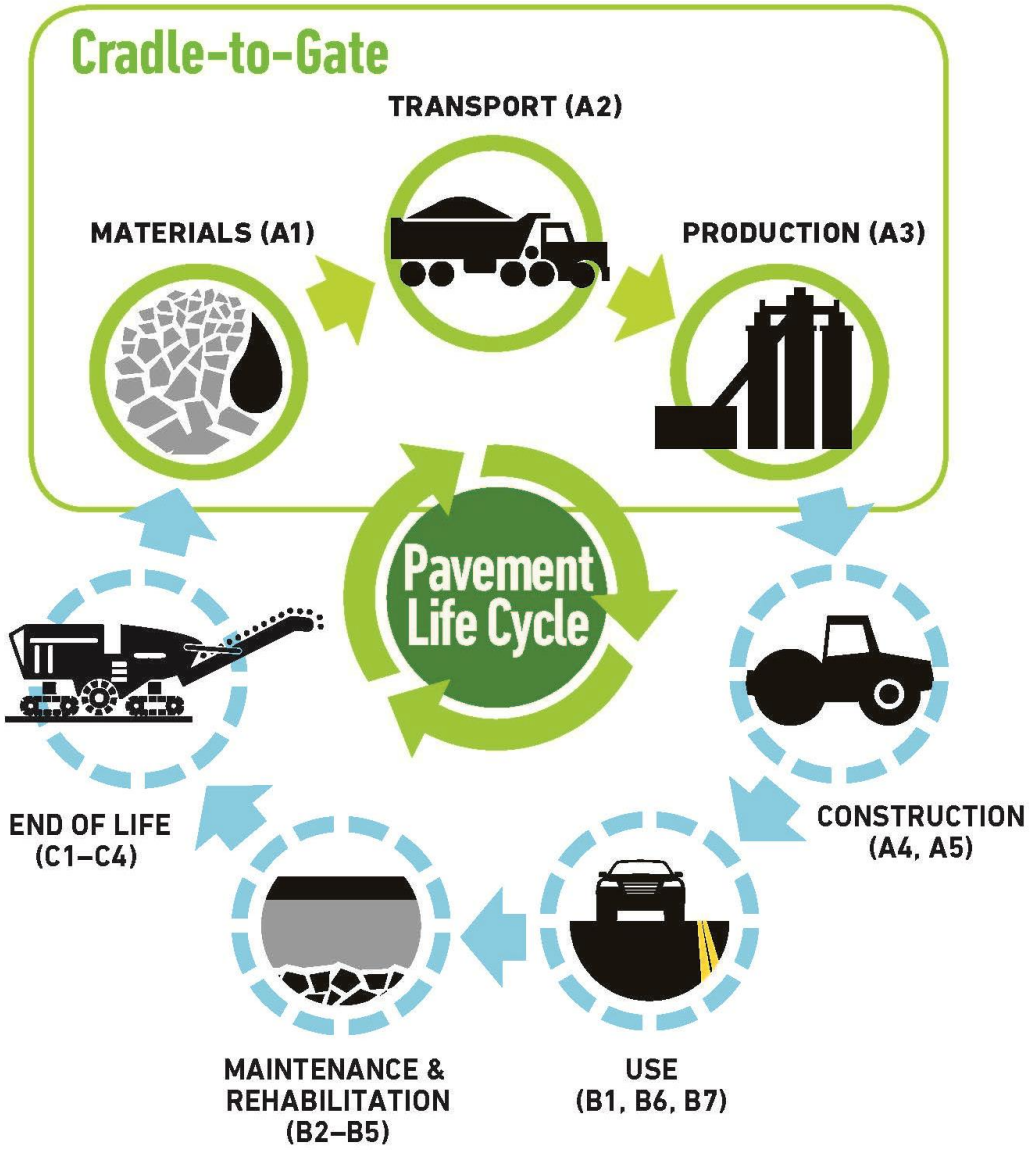
Life Cycle Framework – LCA and EPDs

Cradle-To-Grave LCA

LCA PAVE

EPDs

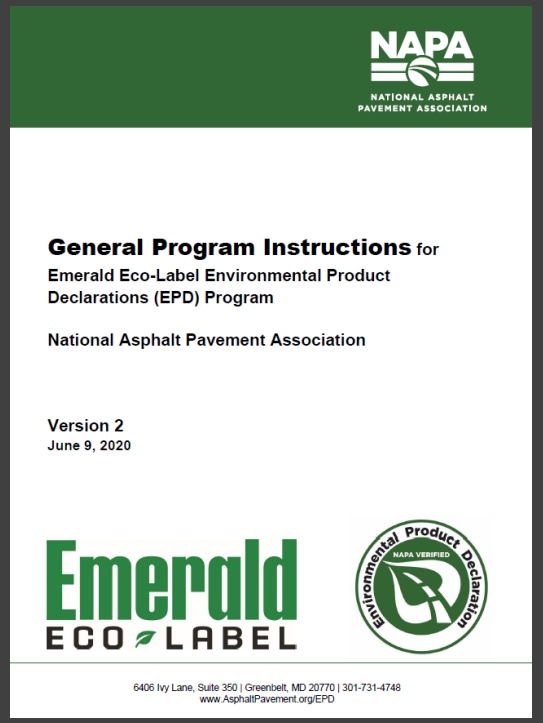
Emerald ECO LABEL



Overview of Emerald Eco-Label EPD Tool

Key Components of NAPA's EPD Program

General Program Instructions


NATIONAL ASPHALT PAVEMENT ASSOCIATION

General Program Instructions for
Emerald Eco-Label Environmental Product Declarations (EPD) Program

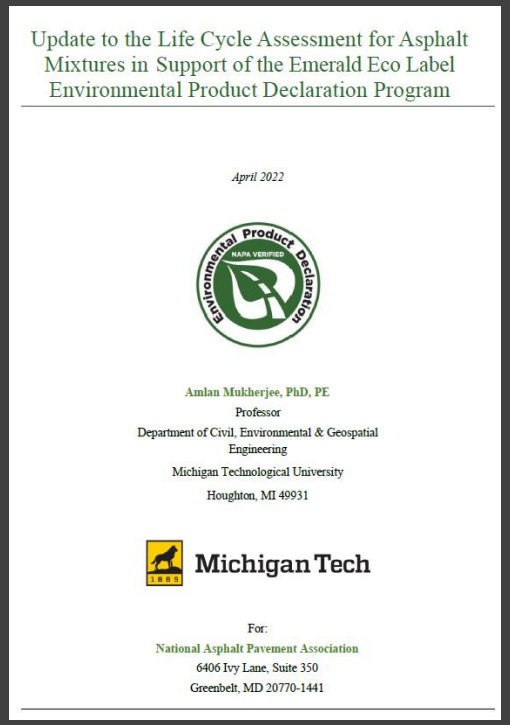
National Asphalt Pavement Association

Version 2
June 9, 2020

Emerald ECO LABEL

6406 Ivy Lane, Suite 350 | Greenbelt, MD 20770 | 301-731-4748
www.AsphaltPavement.org/EPD

Underlying Life Cycle Assessment


Update to the Life Cycle Assessment for Asphalt Mixtures in Support of the Emerald Eco Label Environmental Product Declaration Program

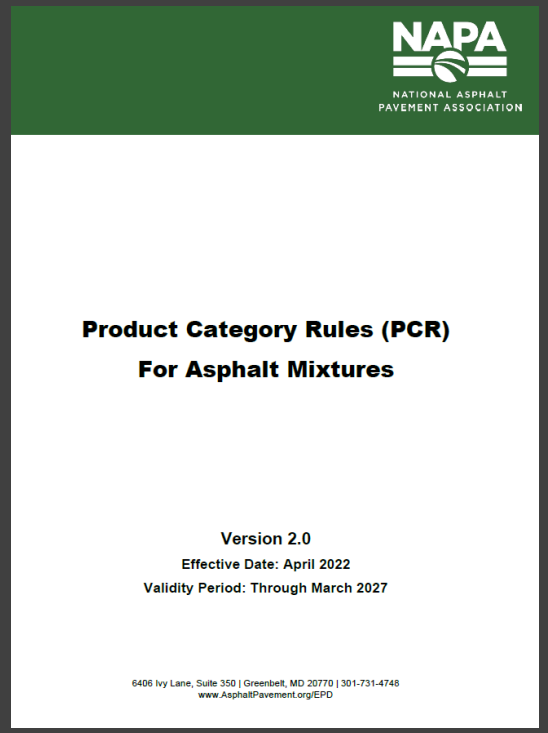
April 2022

Amlan Mukherjee, PhD, PE
Professor
Department of Civil, Environmental & Geospatial Engineering
Michigan Technological University
Houghton, MI 49931

Michigan Tech

For:
National Asphalt Pavement Association
6406 Ivy Lane, Suite 350
Greenbelt, MD 20770-1441

Product Category Rules (PCR)

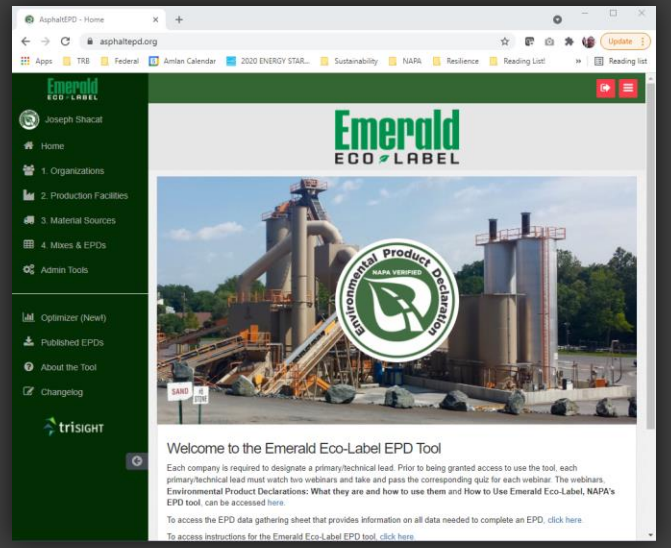

NATIONAL ASPHALT PAVEMENT ASSOCIATION

Product Category Rules (PCR)
For Asphalt Mixtures

Version 2.0
Effective Date: April 2022
Validity Period: Through March 2027

6406 Ivy Lane, Suite 350 | Greenbelt, MD 20770 | 301-731-4748
www.AsphaltPavement.org/EPD

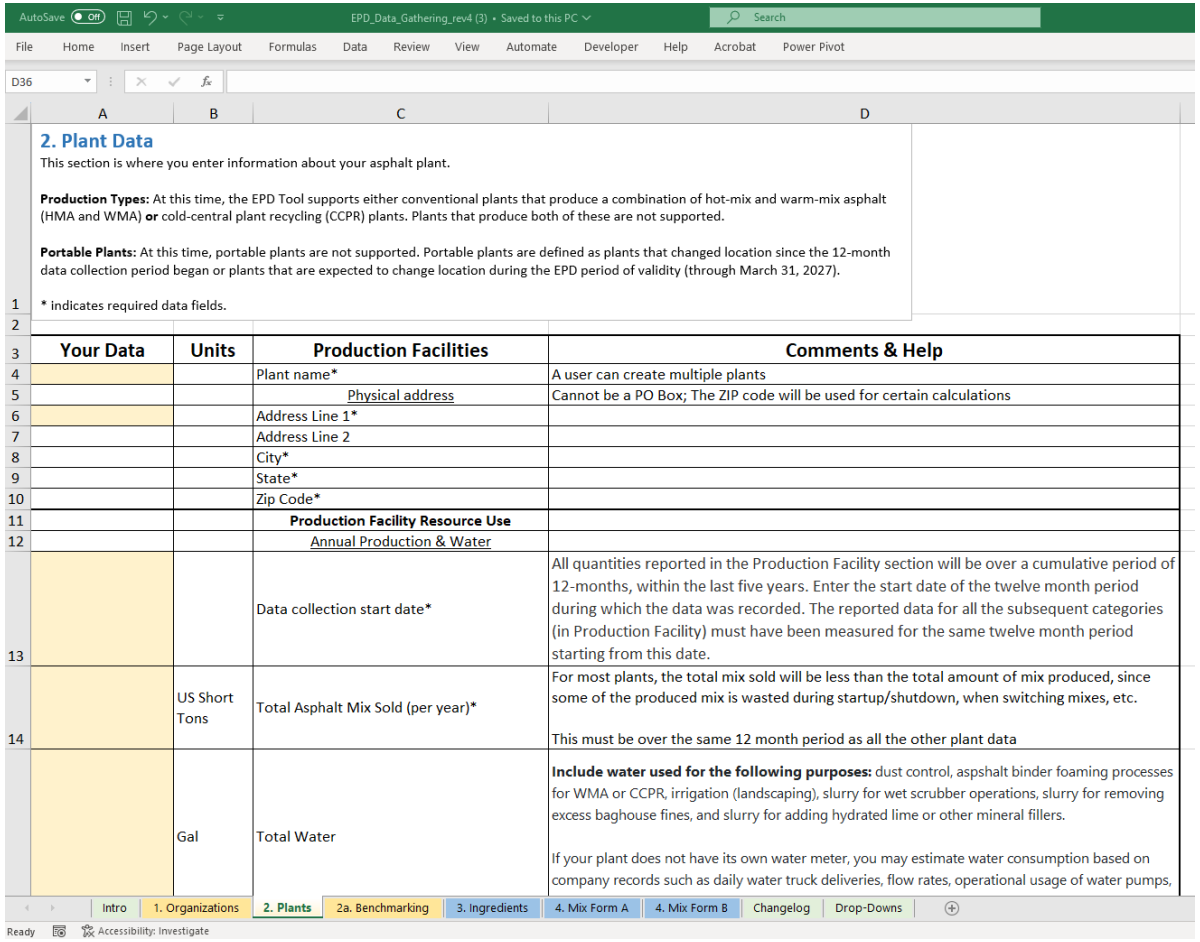
EPD Software



Learn more at www.asphaltpavement.org/epd

How to use Emerald Eco-Label

- **Register** at https://asphaltepd.org/
- **Watch two webinars** and pass the quizzes
- **Compile data** for plant and mixes
  - Use EPD Data Gathering spreadsheet
- **Purchase access** for your plant(s)
- **Enter data** for plant and mixes to produce EPDs
- **Upload supporting documentation**



AutoSave Off | EPD_Data_Gathering_rev4 (3) • Saved to this PC | Search

File Home Insert Page Layout Formulas Data Review View Automate Developer Help Acrobat Power Pivot

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2. Plant Data

This section is where you enter information about your asphalt plant.

Production Types: At this time, the EPD Tool supports either conventional plants that produce a combination of hot-mix and warm-mix asphalt (HMA and WMA) **or** cold-central plant recycling (CCPR) plants. Plants that produce both of these are not supported.

Portable Plants: At this time, portable plants are not supported. Portable plants are defined as plants that changed location since the 12-month data collection period began or plants that are expected to change location during the EPD period of validity (through March 31, 2027).

* indicates required data fields.

Your Data	Units	Production Facilities	Comments & Help
		Plant name*	A user can create multiple plants
		Physical address	Cannot be a PO Box; The ZIP code will be used for certain calculations
		Address Line 1*	
		Address Line 2	
		City*	
		State*	
		Zip Code*	
		Production Facility Resource Use	
		Annual Production & Water	
		Data collection start date*	All quantities reported in the Production Facility section will be over a cumulative period of 12-months, within the last five years. Enter the start date of the twelve month period during which the data was recorded. The reported data for all the subsequent categories (in Production Facility) must have been measured for the same twelve month period starting from this date.
	US Short Tons	Total Asphalt Mix Sold (per year)*	For most plants, the total mix sold will be less than the total amount of mix produced, since some of the produced mix is wasted during startup/shutdown, when switching mixes, etc. This must be over the same 12 month period as all the other plant data
	Gal	Total Water	**Include water used for the following purposes:** dust control, aspshalt binder foaming processes for WMA or CCPR, irrigation (landscaping), slurry for wet scrubber operations, slurry for removing excess baghouse fines, and slurry for adding hydrated lime or other mineral fillers. If your plant does not have its own water meter, you may estimate water consumption based on company records such as daily water truck deliveries, flow rates, operational usage of water pumps,

Intro | 1. Organizations | 2. Plants | 2a. Benchmarking | 3. Ingredients | 4. Mix Form A | 4. Mix Form B | Changelog | Drop-Downs

Ready | Accessibility: Investigate

Data requirements for the plant

- **12 consecutive months of data**
  - Within the past five years
- **Fuel consumption**
  - Burner
  - Hot oil heater
  - Generator
  - Equipment
- **Electricity consumption**
- **Water consumption**
- **Total mix sold (tons)**

Your data is confidential!

Photo courtesy of Duval Asphalt

Data requirements for mix designs

- **Material content (by weight of total mix)**
  - Aggregates
  - Asphalt binder
  - RAP and RAS
  - Additives
- **Transportation mode and distance**
  - Truck, rail, or barge
- **Mix production temperature**

Your data is confidential!

Photo courtesy of Rock Road Companies, Inc.

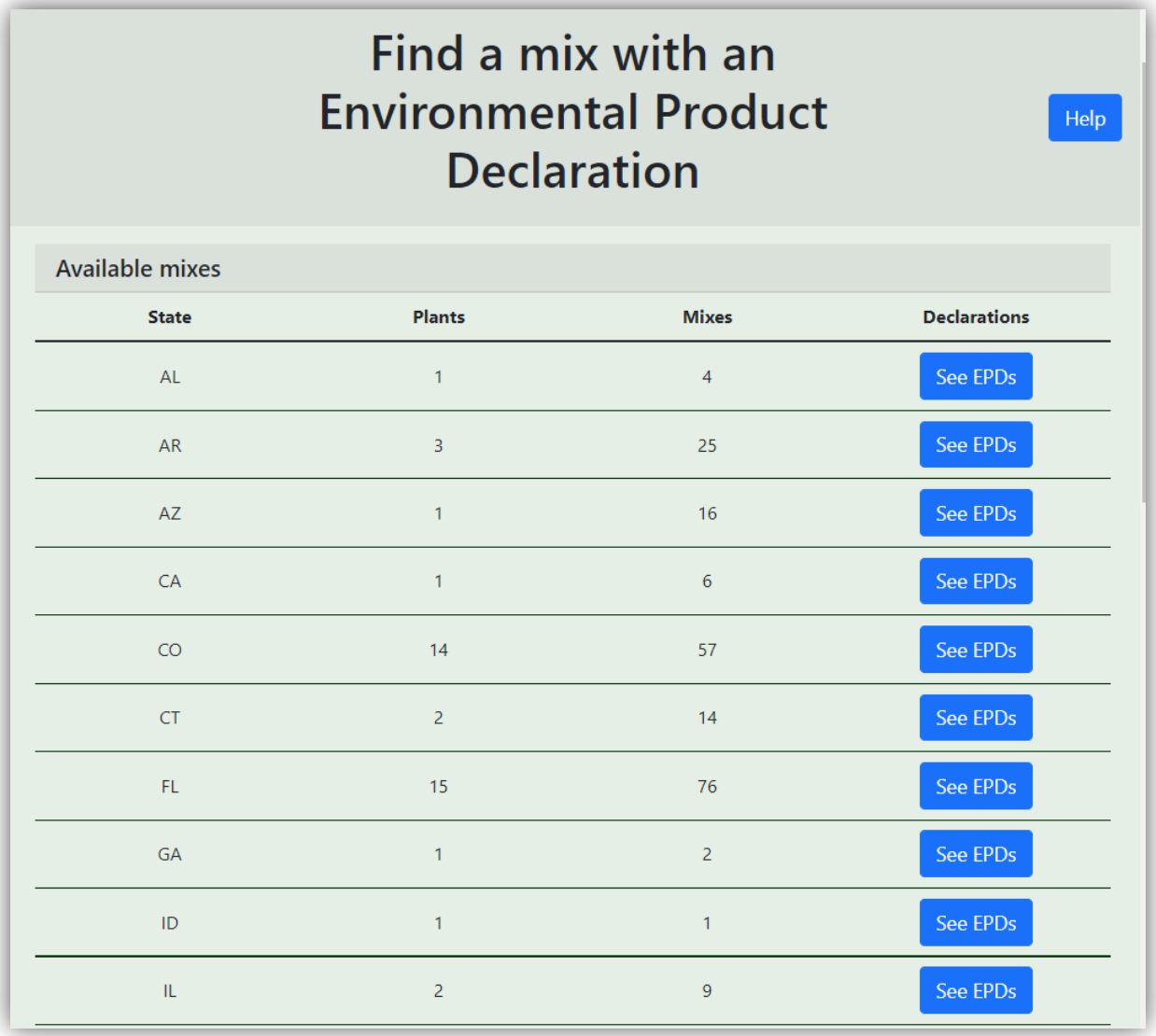
Where can I find published EPDs?

asphaltepd.org/published/

- The most comprehensive and up-to-date directory of EPDs for asphalt mixtures

www.asphaltpavement.org/epd

- Program documents and other information
  - Product Category Rules (PCR)
  - Underlying Life Cycle Assessment (LCA)
  - Other documents



Find a mix with an Environmental Product Declaration

Help

Available mixes

State	Plants	Mixes	Declarations
AL	1	4	See EPDs
AR	3	25	See EPDs
AZ	1	16	See EPDs
CA	1	6	See EPDs
CO	14	57	See EPDs
CT	2	14	See EPDs
FL	15	76	See EPDs
GA	1	2	See EPDs
ID	1	1	See EPDs
IL	2	9	See EPDs

EPD Optimizer Tool

- Easily **compare** two of your own mixes to each other
- More **granular analysis** of data
- Create **plant variants** to see how changes to plant operations affect EPDs
- Evaluate **economic** and **environmental** impacts of certain changes
  - Switching fuel types
  - Aggregate moisture reduction

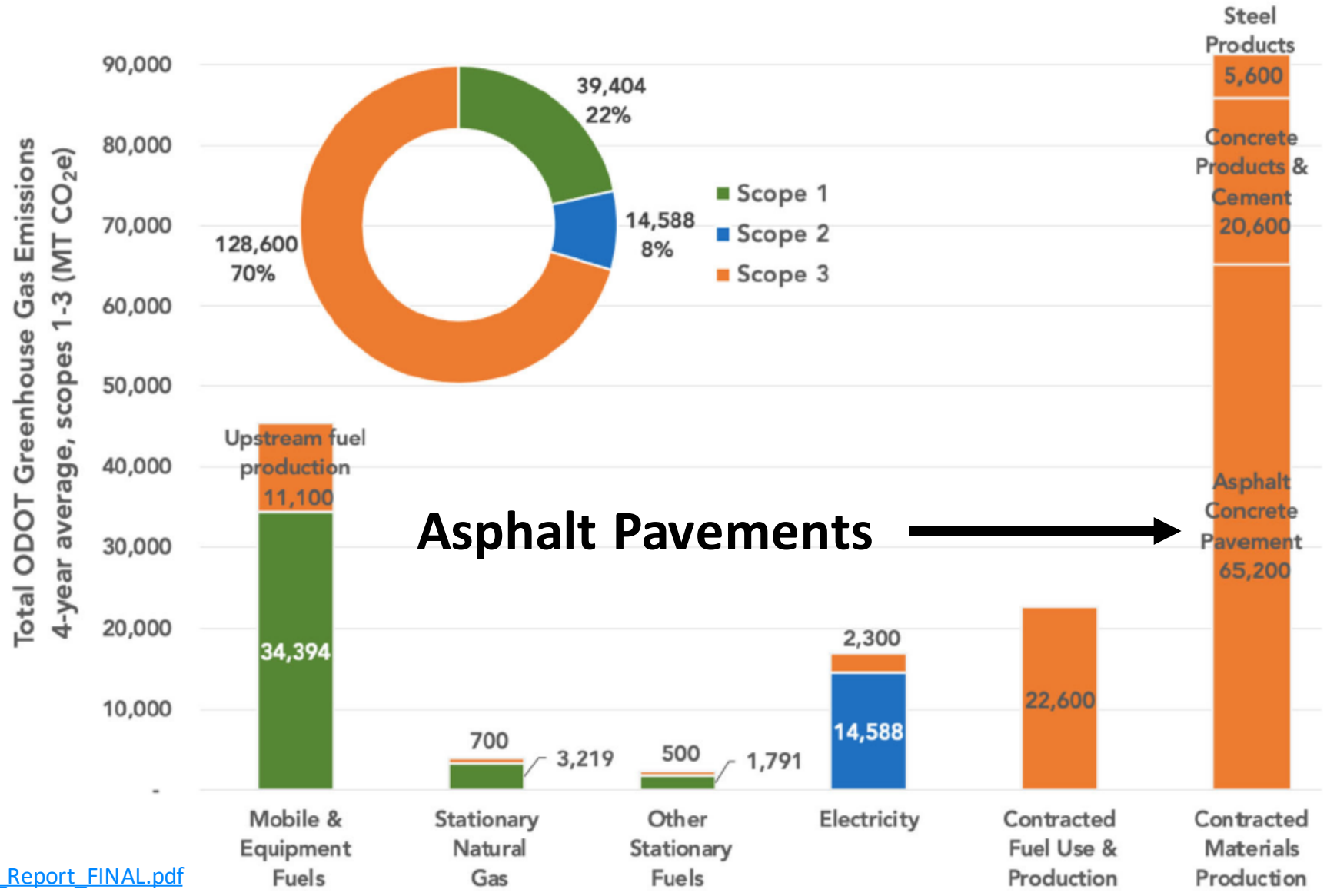
Emerald ECO LABEL OPTIMIZER BETA

Emerald ECO LABEL OPTIMIZER BETA

Recording available on NAPA's store at **goaspha.lt/Optimizer.**

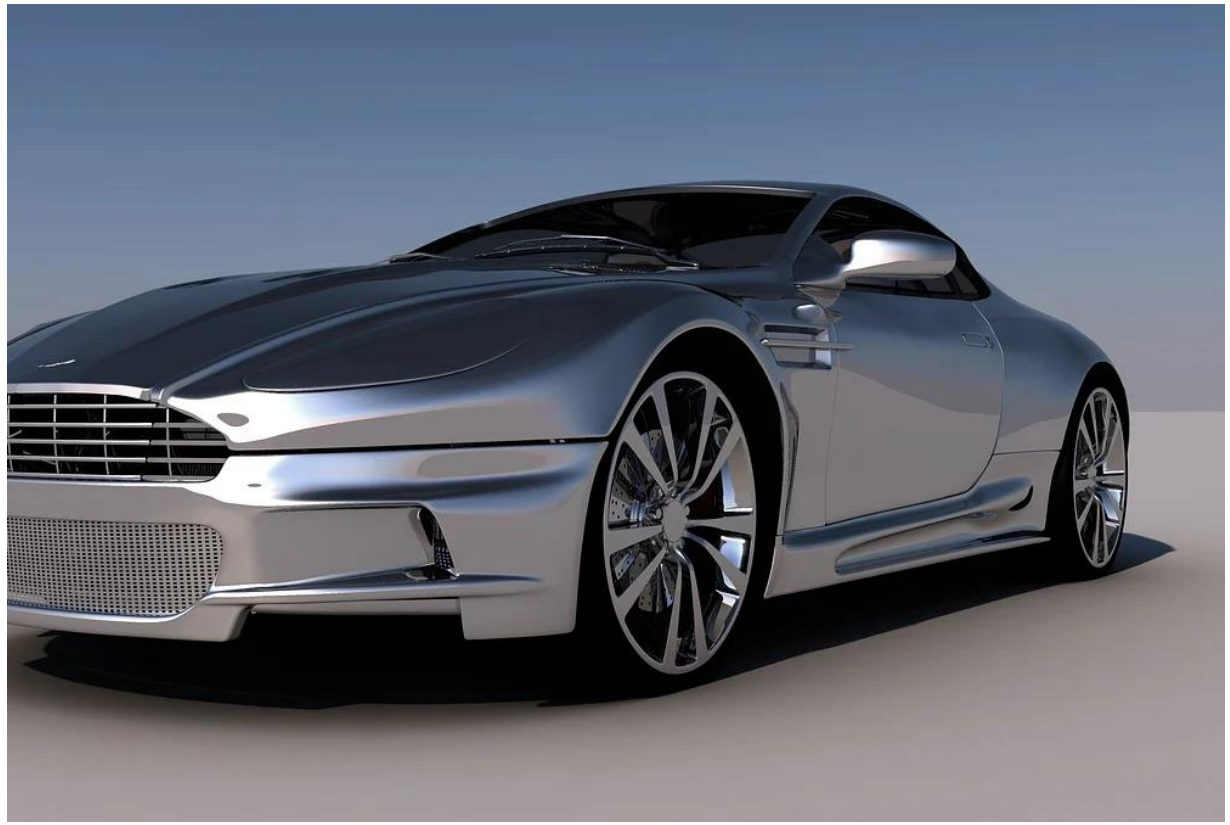
Oregon DOT GHG Emissions Inventory (2016-2019 4-yr Average)

- **Asphalt = 35% of ODOT Emissions**

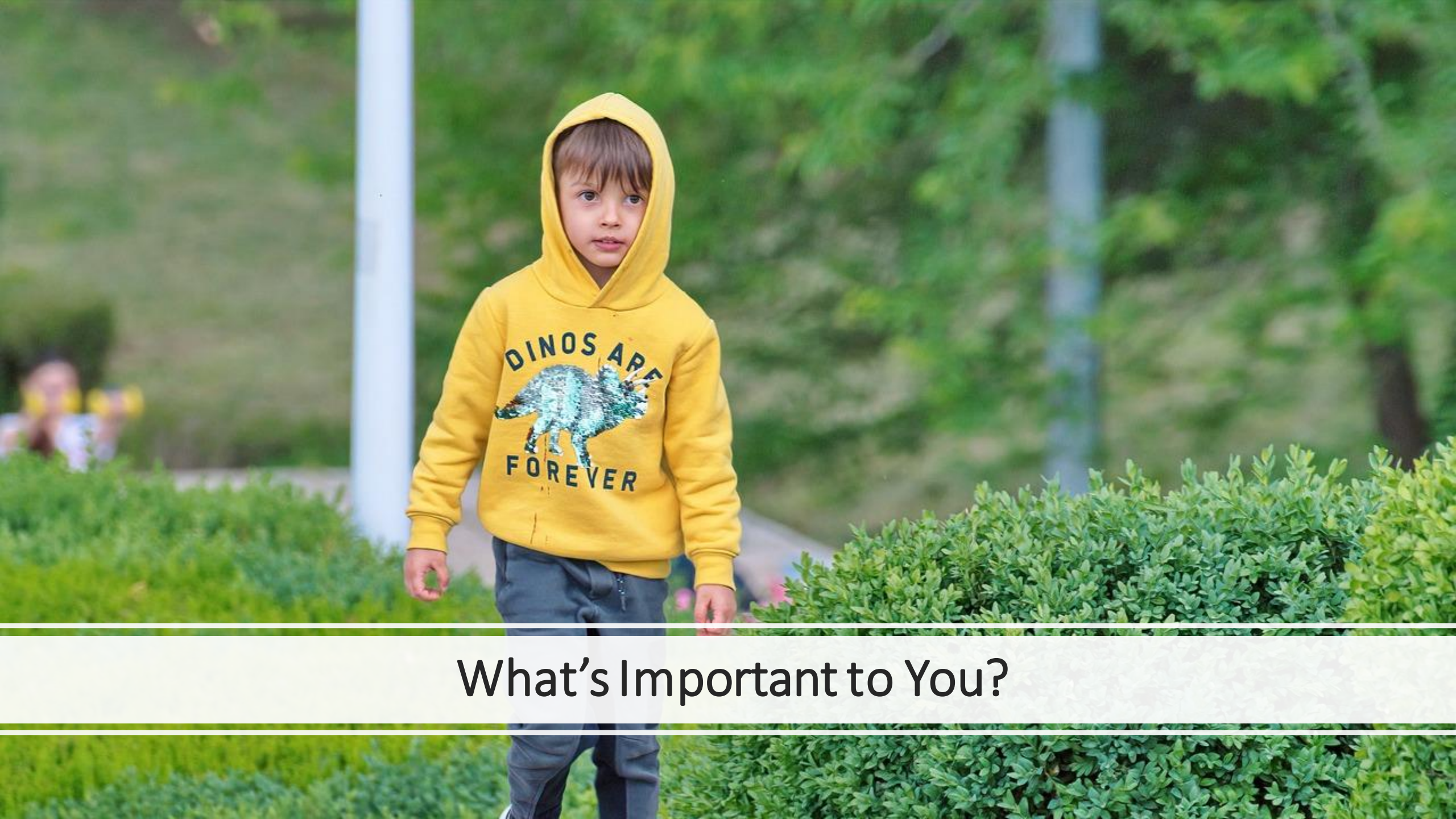


https://www.oregon.gov/odot/climate/Documents/GHG_Report_FINAL.pdf

What’s Important to You?



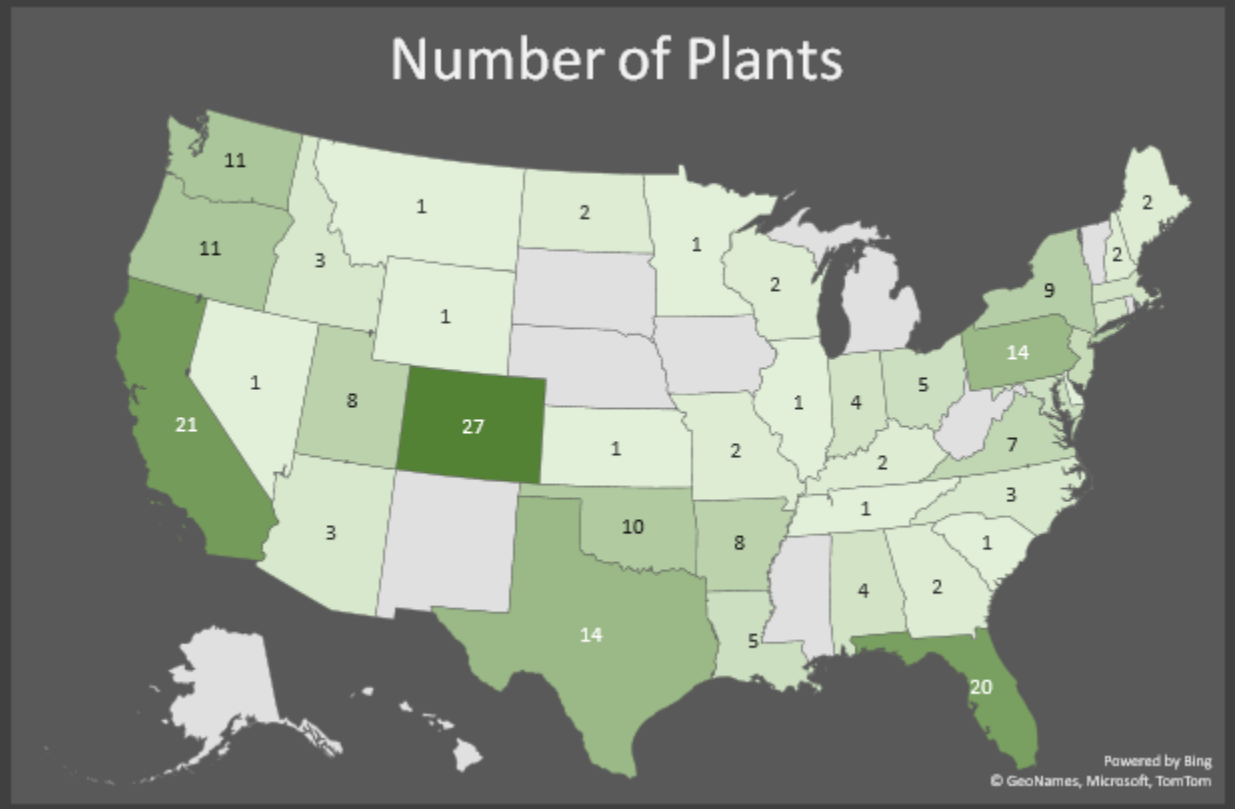
What's Important to You?

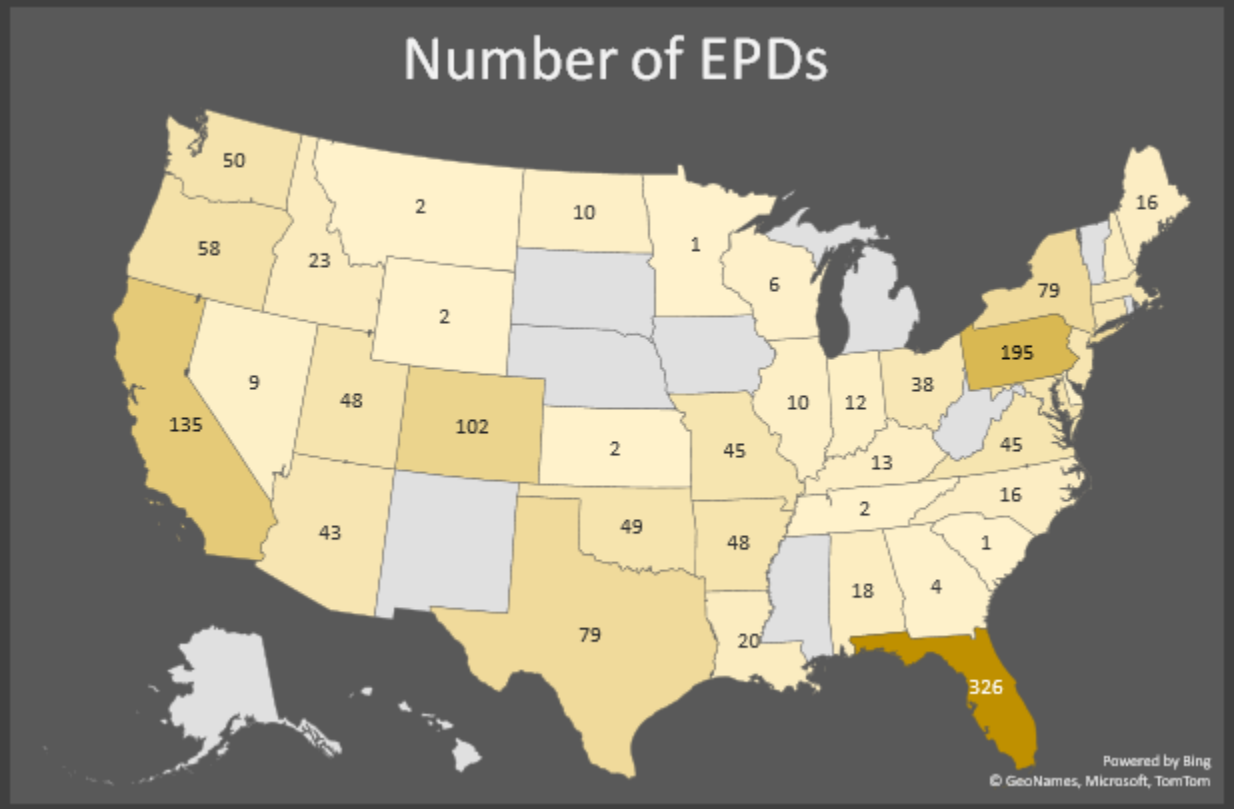


What's Important to You?

Published EPDs in October 2023

- 229 plants with 1,718 EPDs across 39 states





NAPA’s Approach to Benchmarking

Low Carbon Material Pilot Program

- Federal office buildings, courthouses, and land ports of entry

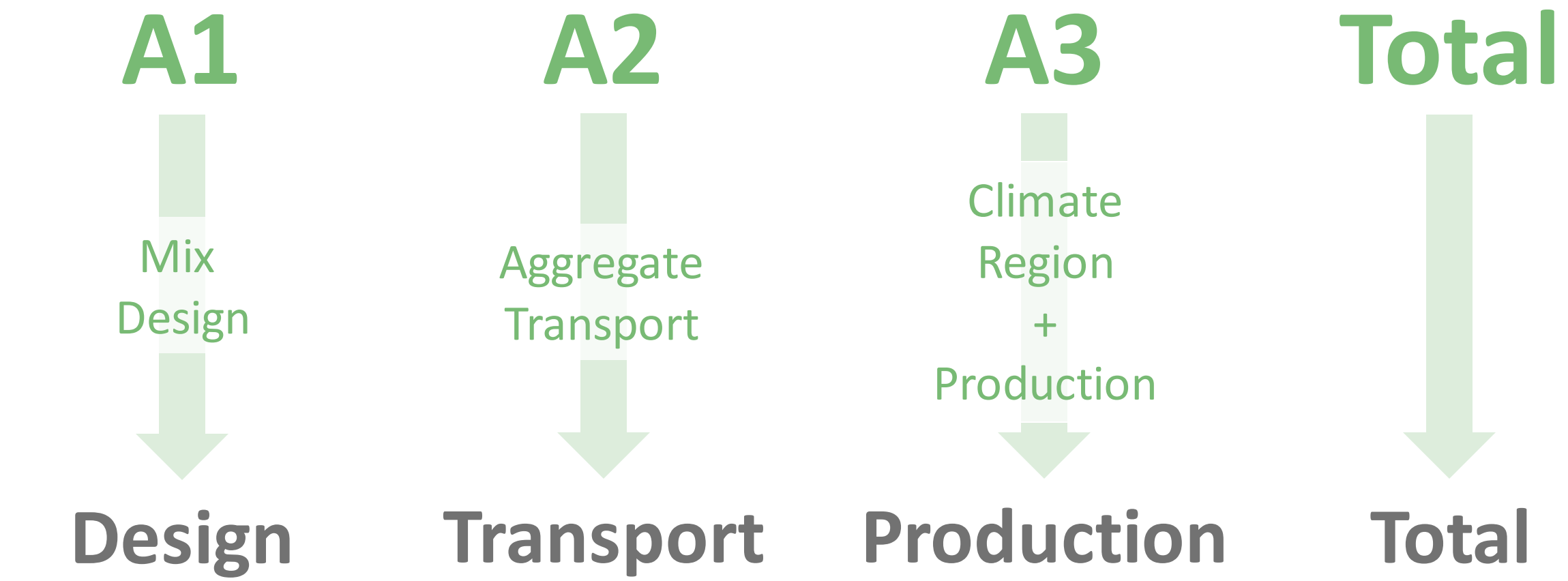
GSA IRA Limits for Low Embodied Carbon Asphalt - May 16, 2023 (EPD-Reported GWPs, in kilograms of carbon dioxide equivalent per metric ton - $kgCO_2e/t$)		
Top 20% Limit	**Top 40% Limit**	**Better Than Average Limit**
55.4	**64.8**	**72.6**

https://www.gsa.gov/about-us/newsroom/news-releases/gsa-pilots-buy-clean-inflation-reduction-act-requirements-for-low-embodied-carbon-construction-materials-05162023

FHWA Benchmarking Approach

- Industry is empowered to establish its own benchmarks
- Agencies implement industry benchmarking approach
  - Paid for by FHWA grants

NAPA Approach: Deconstruct the Benchmark by Life Cycle Phase



A1: Impact of *Mix Specifications* on GWP

Starting Point: **36.6** kg CO2e/tonne mix

Use adjustment factors

A1 Material	Mass balanced with	GWP Intensity kg CO_2e/tonne ingredient (*/shtn)	Adjustment factor for using ingredient for additional 1% of mixture by mass kg CO_2e/tonne mixture (*/shtn)
Neat Binder	Aggregate	631.51 (573.06)	**+6.30 (+5.71)**
3.5% SBS Modified Binder	Aggregate	758.71 (688.49)	**+7.57 (+6.86)**
Lime	Aggregate	1389.0 (1259.9)	**+13.87 (+12.58)**
RAP	Aggregate + Neat Binder	0.781 (0.710)	**-0.357 (-0.325)**
Aggregate (USLCI, prescribed)	Neat Binder	1.94 (1.761)	**-6.30 (-5.71)**

9.5mm Superpave

Baseline Mix Design, US Avg A2/A3

A1

94.5% Aggregate
5.5% Binder

36.6

kg CO2e

A2

Transport

Transport

A3

Production

Production

Total

Total

GSA

72.6

64.8

55.4

9.5mm Superpave: Wisconsin

Standard Mix, US Average A2, Dry Freeze Average A3

A1

94.5% Aggregate
5.5% Binder

36.6

kg CO2e

A2

Transport

A3

Production

Total

Total

A2: Impact of *Aggregate Availability* on GWP

Some states have different benchmarks

A2 by State	Florida kg CO2 e/tonne (kg CO2 e/shtn)	Louisiana kg CO2 e/tonne (kg CO2 e/shtn)	All Others kg CO2 e/tonne (kg CO2 e/shtn)
20%	3.3 (3.0)	15.7 (14.2)	0.21 (0.18)
40%	18.7 (17.0)	24.0 (21.8)	1.4 (1.2)
50%	36.9 (33.5)	28.7 (26.0)	2.5 (2.2)
Average	41.3 (37.5)	28.9 (26.2)	3.9 (3.5)

9.5mm Superpave: Wisconsin

Standard Mix Design, US Average A2, Dry Freeze Average A3

A1

94.5% Aggregate
5.5% Binder

36.6
kg CO2e

A2

3.9
kg CO2e

A3

Production

Total

Total

A3: Impact of Climate Region on GWP

4 Climate Regions

- Wet Freeze
- Wet No-Freeze
- Dry Freeze
- Dry No-Freeze

Objective 2: Phase-by-phase Benchmarking

A3: Impact of *Climate* on GWP

Benchmarks differ by climate region

A3 by AASHTO Region	Wet No freeze kg CO2e/tonne (kg CO2e/shtn)	Wet Freeze kg CO2e/tonne (kg CO2e/shtn)	Dry No freeze kg CO2e/tonne (kg CO2e/shtn)	Dry Freeze kg CO2e/tonne (kg CO2e/shtn)
20%	23.2 (21.0)	20.9 (19.0)	17.5 (15.9)	21.9 (19.9)
40%	25.4 (23.0)	22.8 (20.6)	20.0 (18.1)	23.6 (21.4)
50%	26.1 (23.7)	23.6 (21.4)	21.8 (19.8)	25.8 (23.4)
Average	27.5 (25.0)	24.6 (22.3)	23.0 (20.8)	27.1 (24.6)

9.5mm Superpave: Utah

+1% Lime Mix Design, US Average A2, Dry Freeze Average A3

A1

94.5% Aggregate
5.5% Binder

36.6
kg CO2e

A2

National Average

3.9
kg CO2e

A3

Wet Freeze

24.6
kg CO2e

Total

65.1

72.6

64.8

55.4

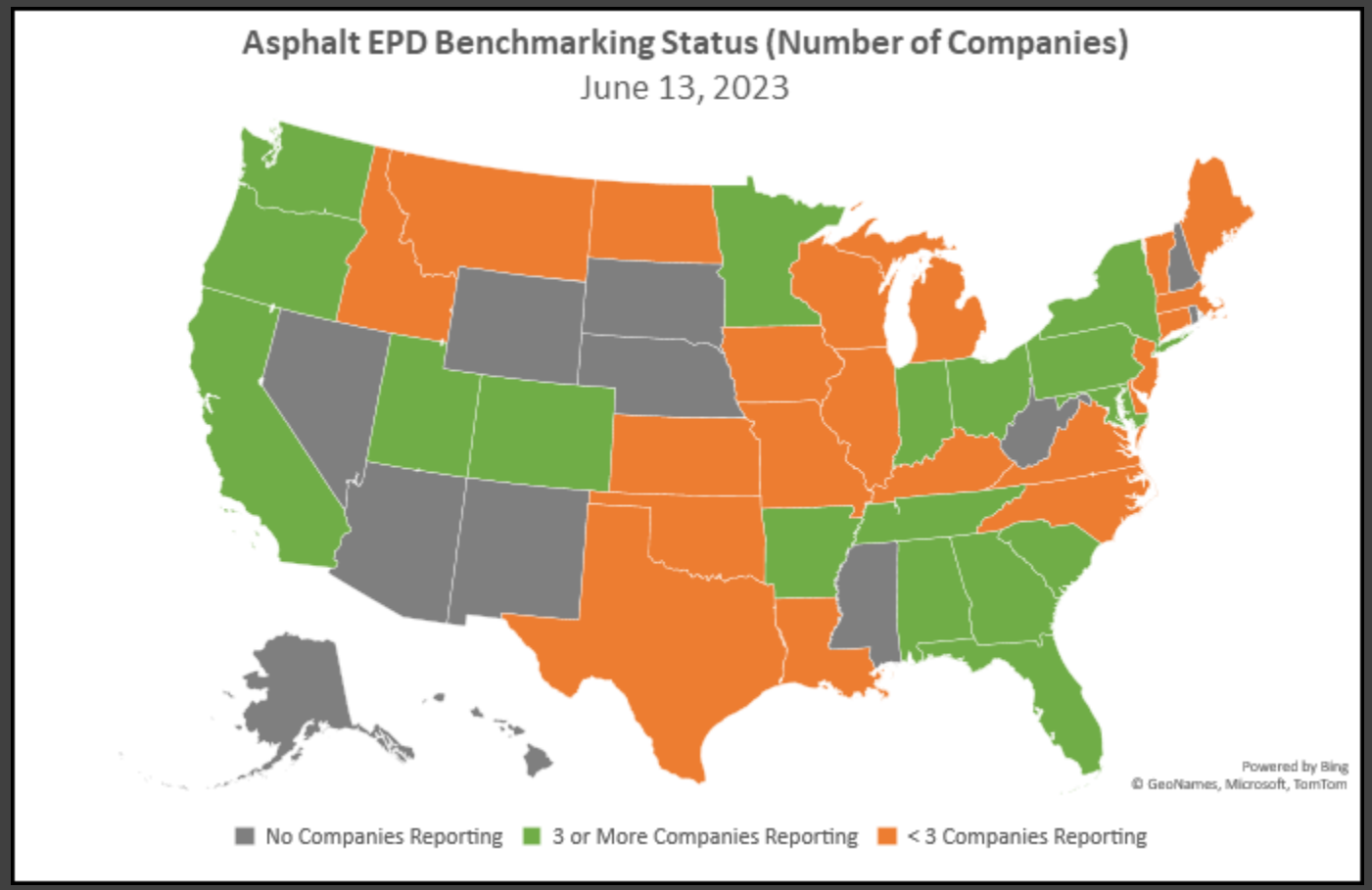
9.5mm Superpave: Wisconsin

Standard Mix Design, US Average A2, Dry Freeze Average A3

[all values in kg CO2 e. / tonne]	A1 (Baseline Mix)	A2 (National Benchmark)	A3 (Wet Freeze)	A1-A3 Total (Proposed Method)	Current A1-A3 GSA Thresholds
20%	36.6	0.2	20.9	**57.7**	55.4
40%		1.4	22.8	**60.8**	64.8
50%		2.5	23.6	**62.7**	x
Average		3.9	24.6	**65.1**	72.6

NAPA EPD Benchmarking Initiative

- No cost to participate
- Will enable agencies to develop reasonable estimates for industry averages based on:
  - local conditions
  - key parameters in their specifications
- *This is an interim solution*

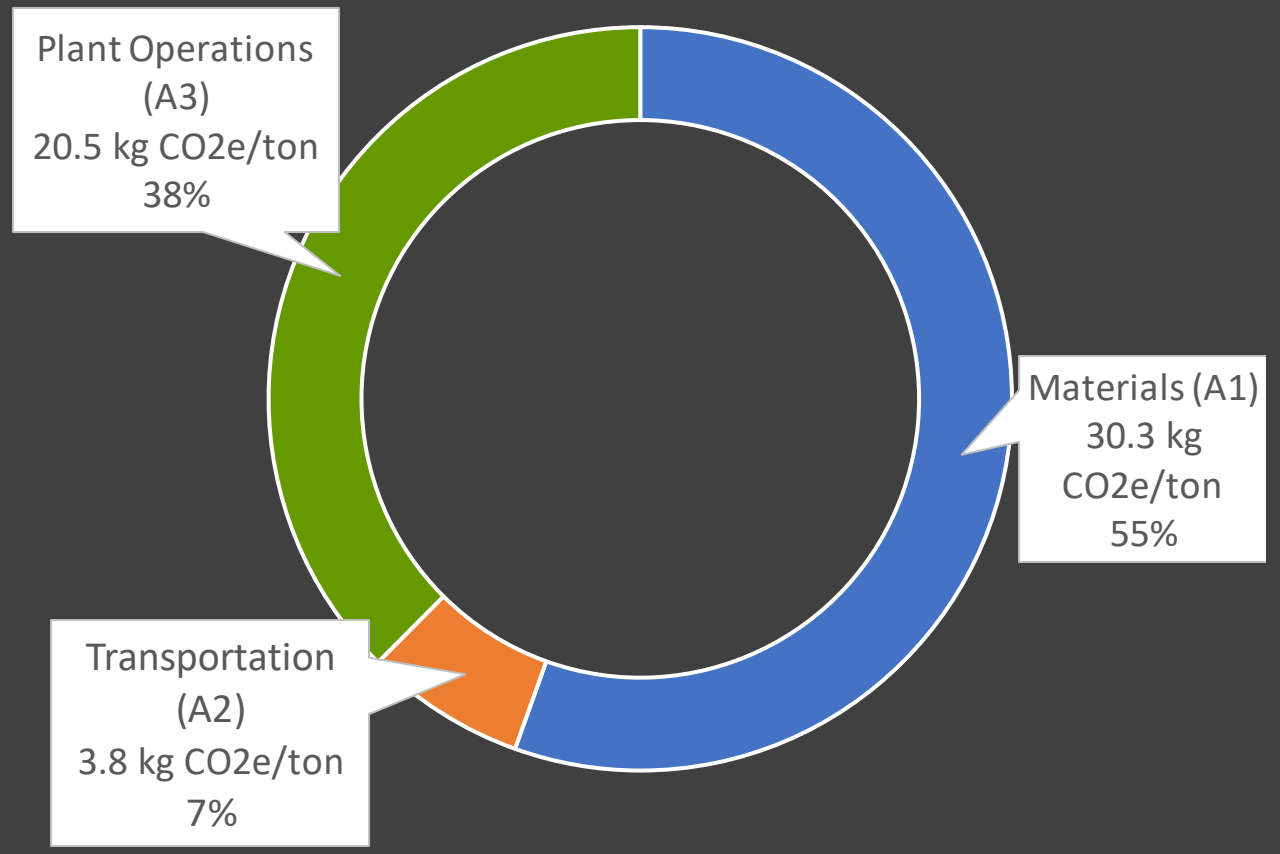


Benchmarking data collection to re-open November 6 – January 8

Levers to Reduce Emissions (and save money)

Simple Mix from a Typical Plant

- **Materials (A1)**
  - 95% aggregates
  - 5% asphalt binder
- **Transport (A2)**
  - 22 miles by truck
- **Plant Energy (A3)**
  - Burner fuel – Natural Gas
  - 289,000 Btu/ton
  - 3.3 kWh/ton – Average grid



Total = **54.7 kg CO2e/ton**

Simple Mix from a Typical Plant

- **Materials (A1)**
  - 95% aggregates
  - 5% asphalt binder
- **Transport (A2)**
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- **Plant Energy (A3)**
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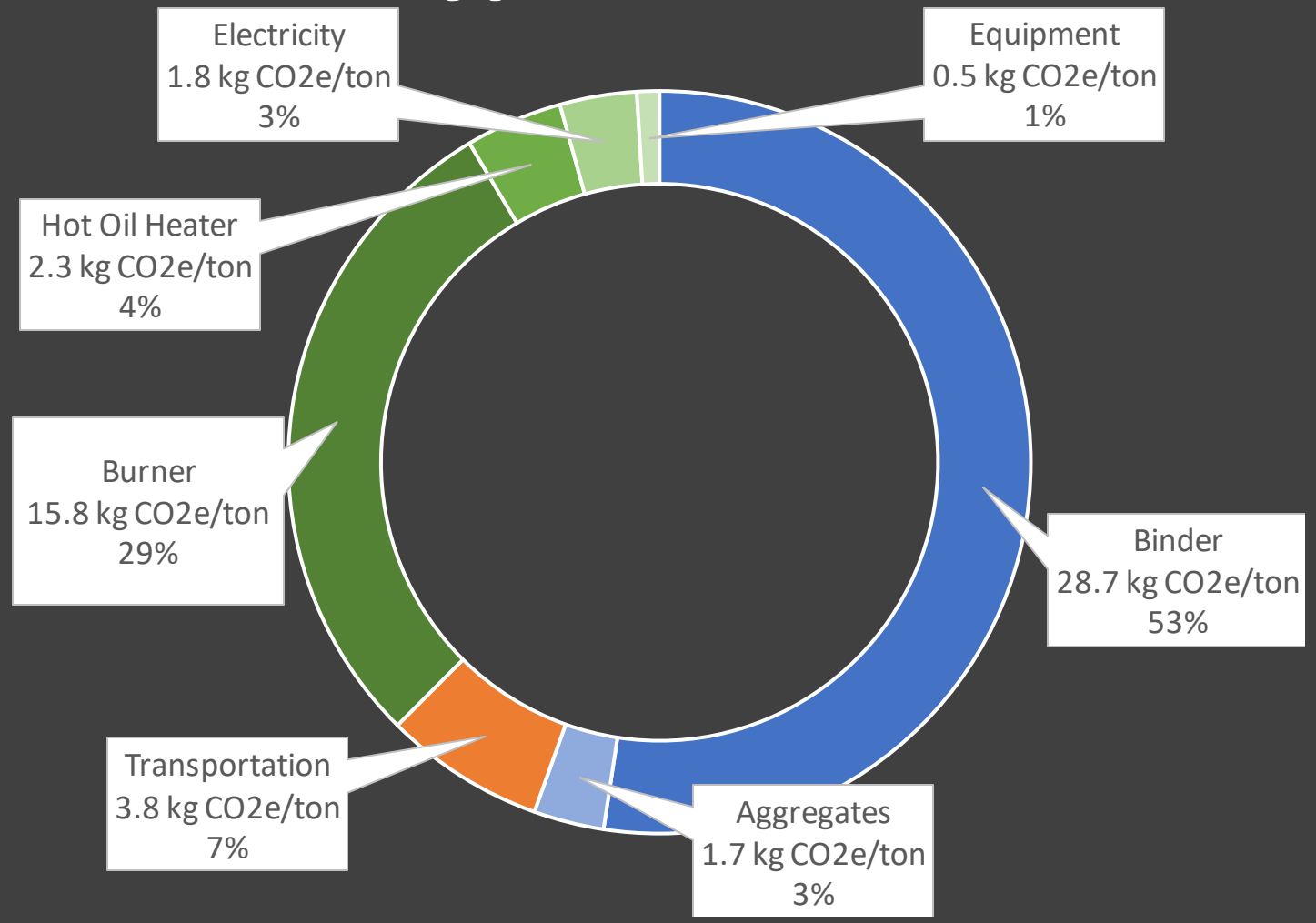
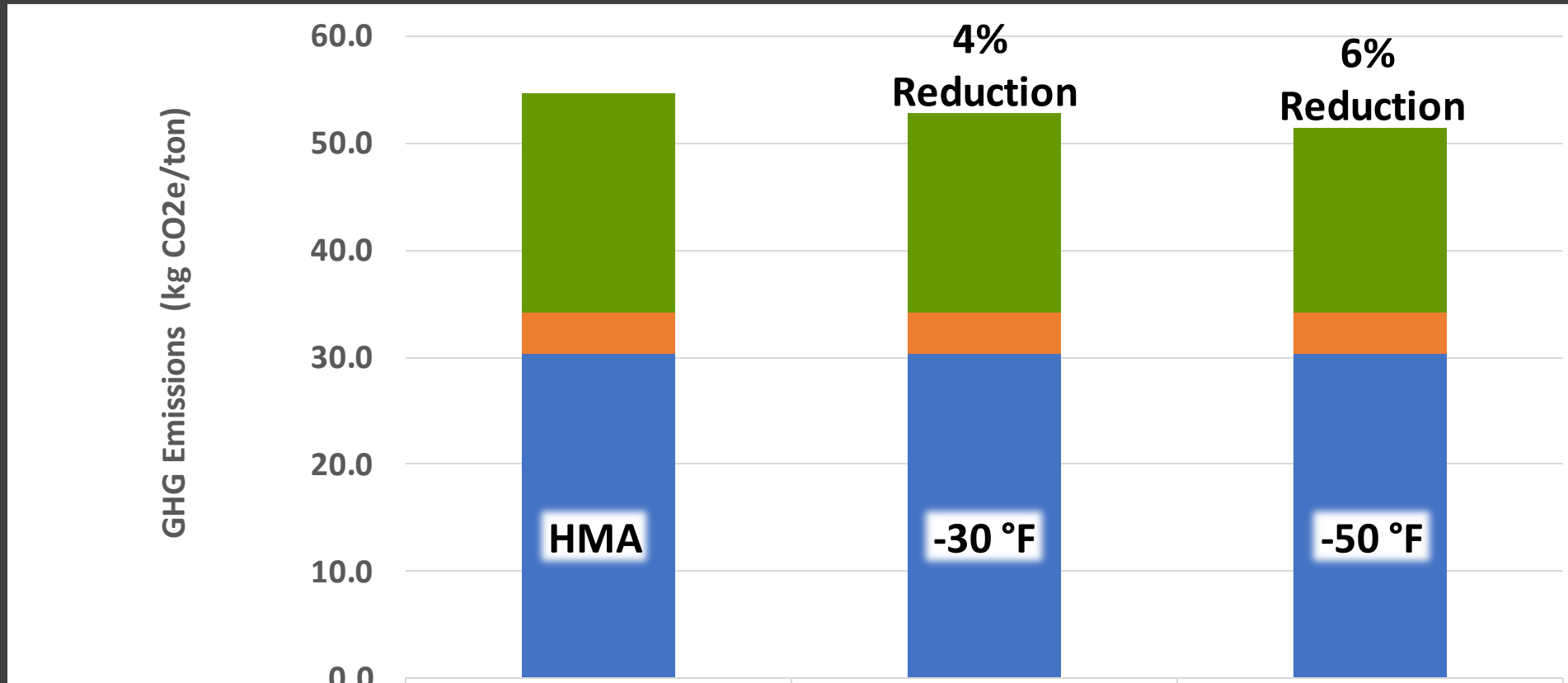


Total = **54.7 kg CO2e/ton**

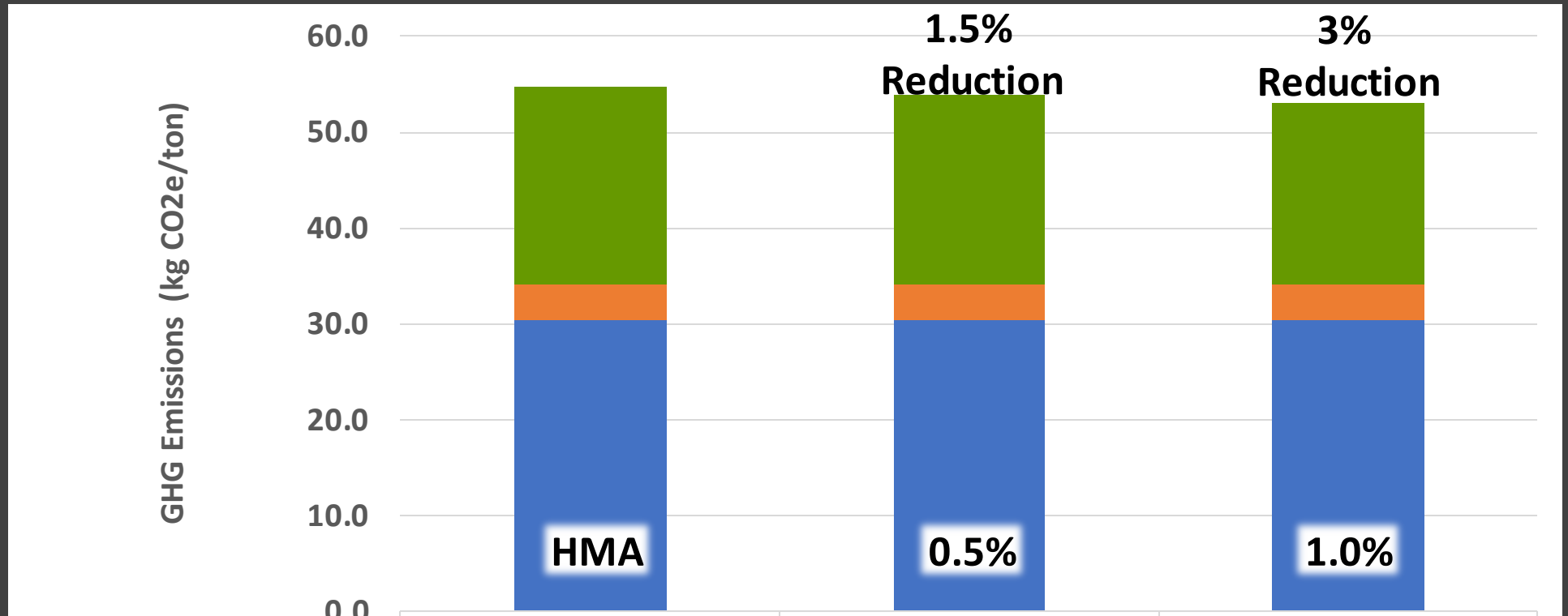
WMA – Reduced Mix Production Temp



	HMA	WMA -30°F	WMA -50°F
Total (A1-A3)	53.7	51.8	50.5
Plant Operations (A3)	20.5	18.6	17.3
Transportation (A2)	3.8	3.8	3.8
Materials (A1)	30.3	30.3	30.3

Assume 1,000 Btu/°F/ton fuel savings

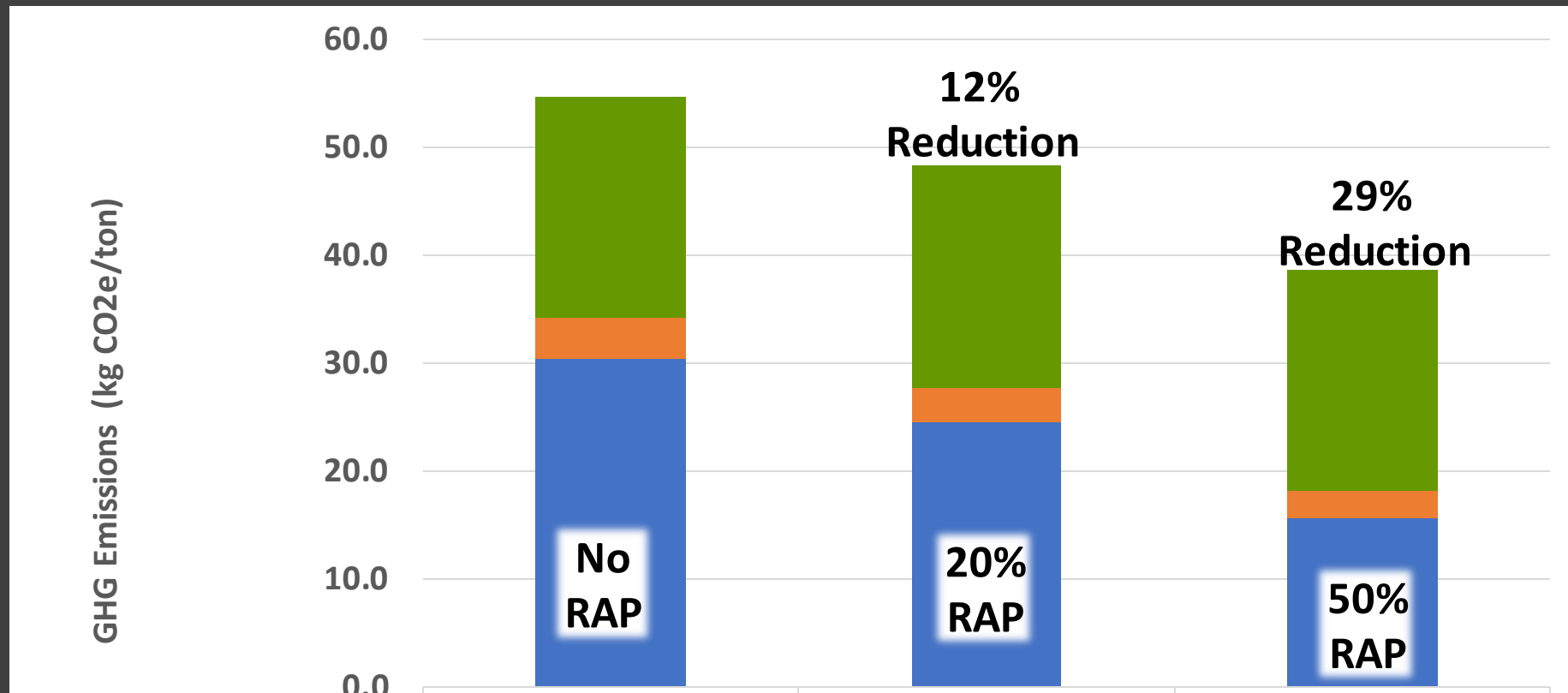
Reduced Aggregate Moisture Content



	HMA	0.5% Moist. Red.	1.0% Moist. Red.
Total (A1-A3)	53.7	52.9	52.1
Plant Operations (A3)	20.5	19.7	18.9
Transportation (A2)	3.8	3.8	3.8
Materials (A1)	30.3	30.3	30.3

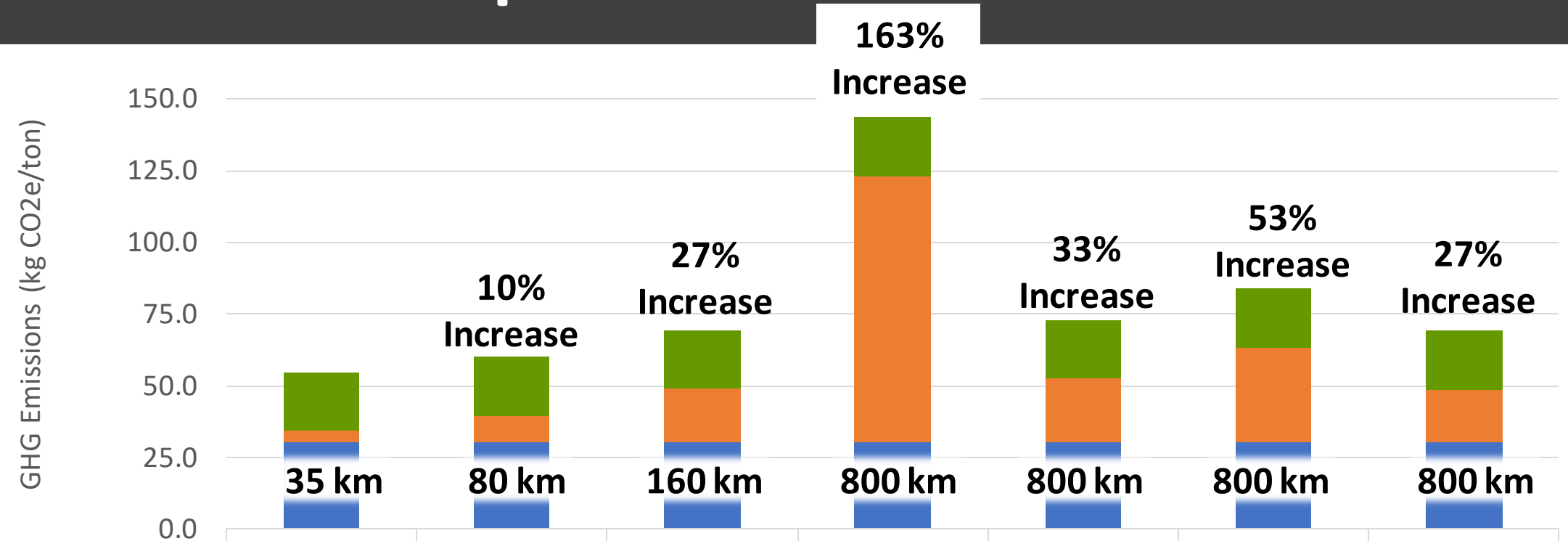
Assume 10% Reduction in Burner Fuel Consumption per 1% Reduction in Agg. Moisture

Use of RAP to Reduce Emissions



	No RAP	20% RAP	50% RAP
Total (A1-A3)	54.7	48.2	38.6
Plant Operations (A3)	20.5	20.5	20.5
Transportation (A2)	3.8	3.3	2.6
Materials (A1)	30.3	24.4	15.5

A2 Transport Distance and Mode



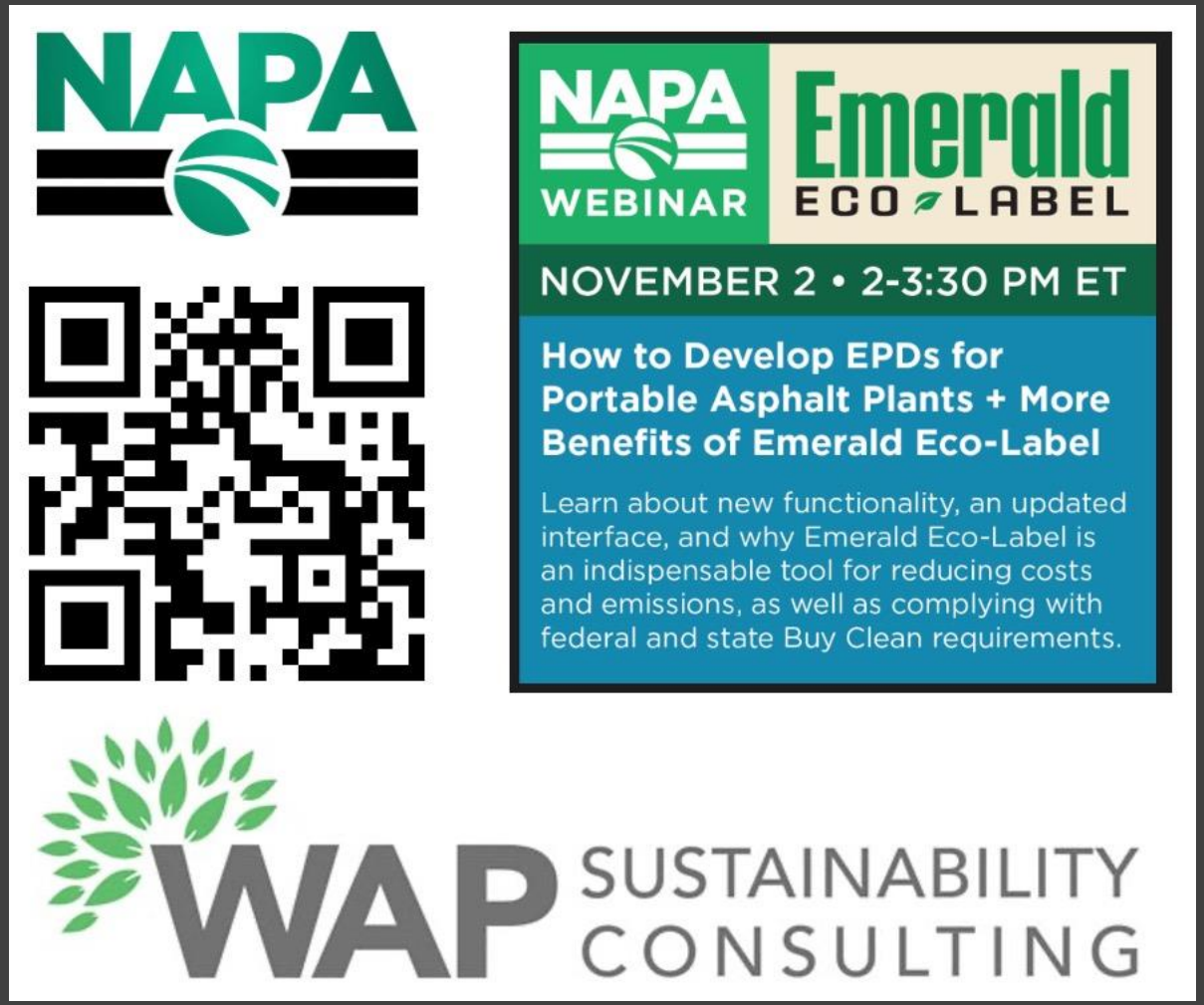
	Average Truck	50 Miles Truck	100 Miles Truck	500 Miles Truck	500 Miles Train	500 Miles Inland Barge	500 Miles Ocean Vessel
Total (A1-A3)	54.7	60.1	69.4	143.6	72.9	83.9	69.2
Plant Operations (A3)	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Transportation (A2)	3.8	9.3	18.5	92.7	22.0	33.1	18.3
Materials (A1)	30.3	30.3	30.3	30.3	30.3	30.3	30.3

EPDs are Good for Business

- Reduce Your Cost
  - Identify efficiency opportunities
  - Detect billing discrepancies
- Grow Your Market
  - LEED Projects
  - Customer Requirements
    - GSA, Private Sector
- Communicate with Stakeholders
- Motivate Your Staff

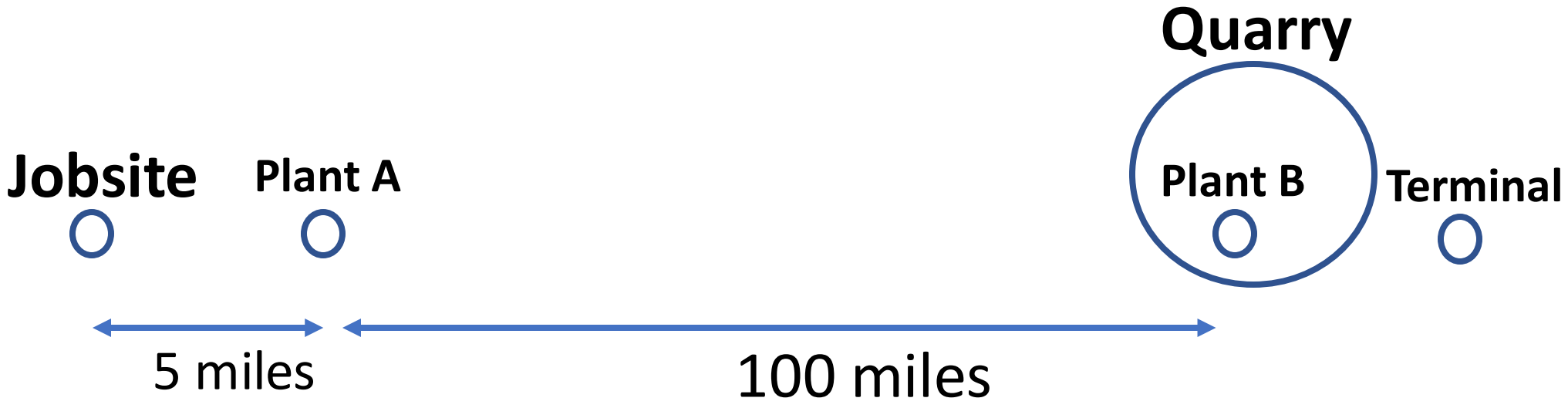
Emerald ECO LABEL OPTIMIZER BETA

EPDs for Portable Plants Available Now



Transport Distance – What about A4?

- 2 Identical plants
  - Energy efficiency, fuels, etc.
- Identical mixes
  - 95% aggregates sourced from same quarry
  - 5% binder
- Plant A – 5 miles from Job, 100 miles from Quarry
- Plant B – 105 miles from Job, 0 miles from Quarry
- Asphalt Binder Terminal located adjacent to Quarry



Plant A	
A1-A3	**= 69.4 kg CO2e/ton**
A4	= 0.9 kg CO2e/ton
A1-A4	= 70.3 kg CO2e/ton

Plant B	
A1-A3	**= 50.9 kg CO2e/ton**
A4	= 19.4 kg CO2e/ton
A1-A4	= 70.3 kg CO2e/ton

- GWP for Plant A is 36% higher than Plant B when looking only at cradle-to-gate (A1-A3).
- But both are identical when A4 is accounted for.

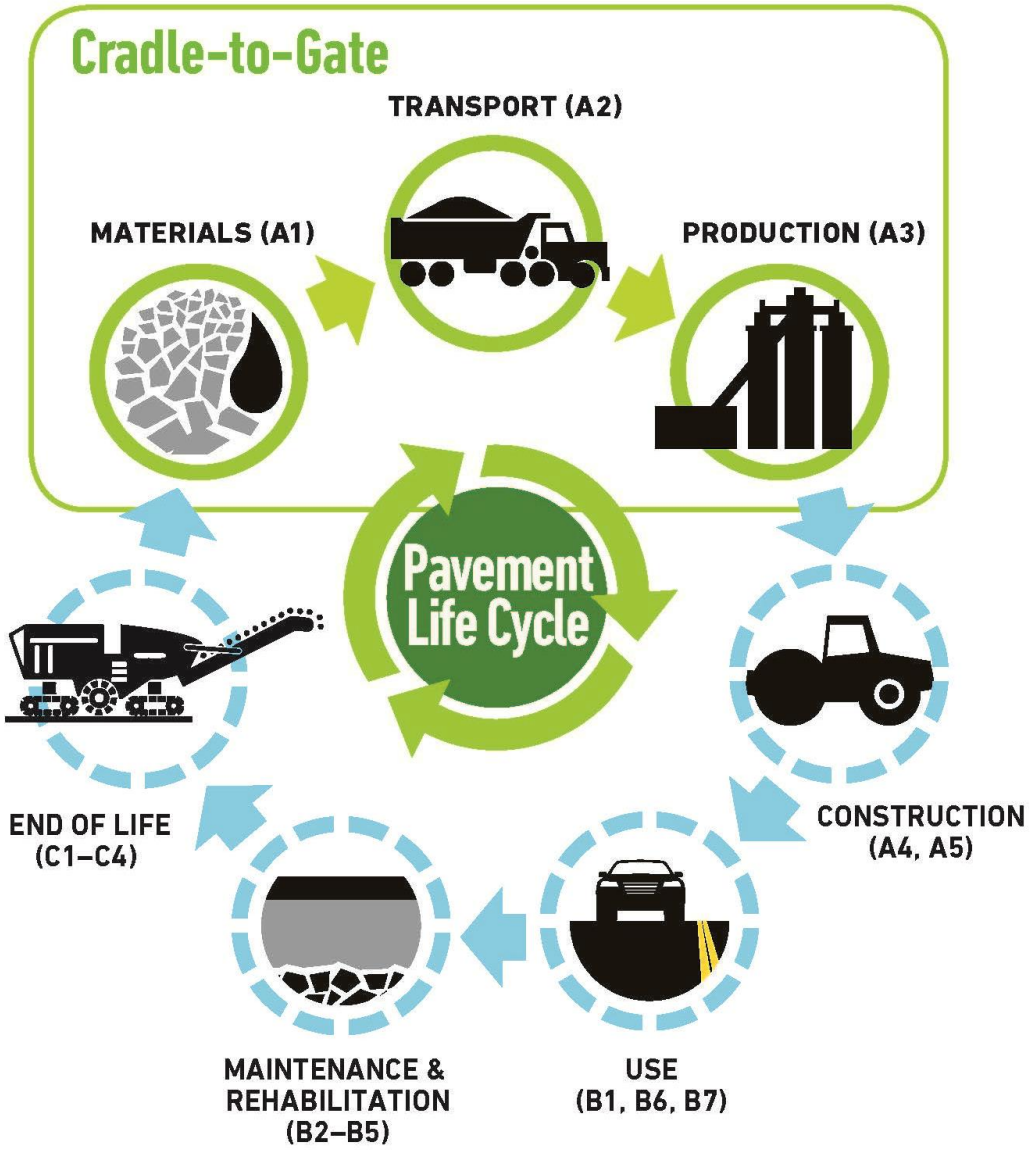
Life Cycle Framework – LCA and EPDs

Cradle-To-Grave LCA

LCA PAVE

EPDs

Emerald ECO LABEL



Thank you, Wisconsin!