



# Impact of Fuel, Anti-Strip, Asphalt Binder, WMA, and Fractionated RAP on EPDs

**Illinois Bituminous Paving  
Conference**

**December 5, 2023**

Joseph Shacat

Director of Sustainable  
Pavements

[jshacat@asphaltpavement.org](mailto:jshacat@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**\*
- **Follows a standard methodology**
  - Product Category Rules (PCR)
- **Independently verified**



## EPD “Nutrition” Label

### Your Building Product

Amount per Unit

LCA IMPACT MEASURES	TOTAL
Primary Energy (MJ)	12.4
Global Warming Potential (kg CO <sup>2</sup> eq)	0.96
Ozone Depletion (kg CFC- 11 eq)	1.80E-08
Acidification Potential (mol H <sup>+</sup> eq)	0.93
Eutrophication Potential (kg N <sup>-</sup> eq)	6.43E-04
Photo-Oxidant Creation Potential (kg O <sub>3</sub> 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.

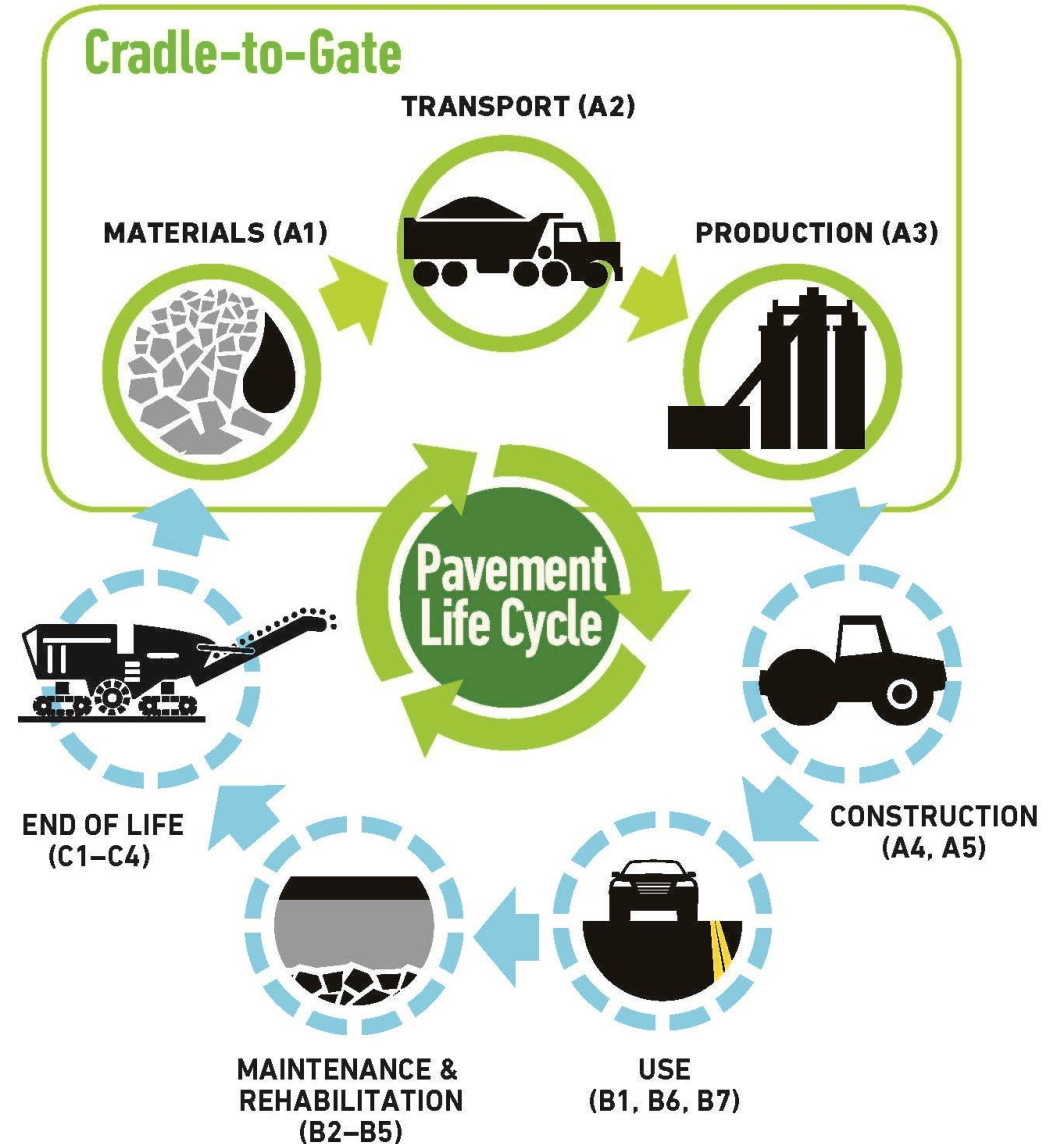
# Life Cycle Assessment and EPDs

Cradle-To-Grave LCA

LCA  PAVE

EPDs

**Emerald**  
ECO LABEL



# Baseline Reference Mix

# Simple Mix from a Typical Plant

- **Materials (A1)**

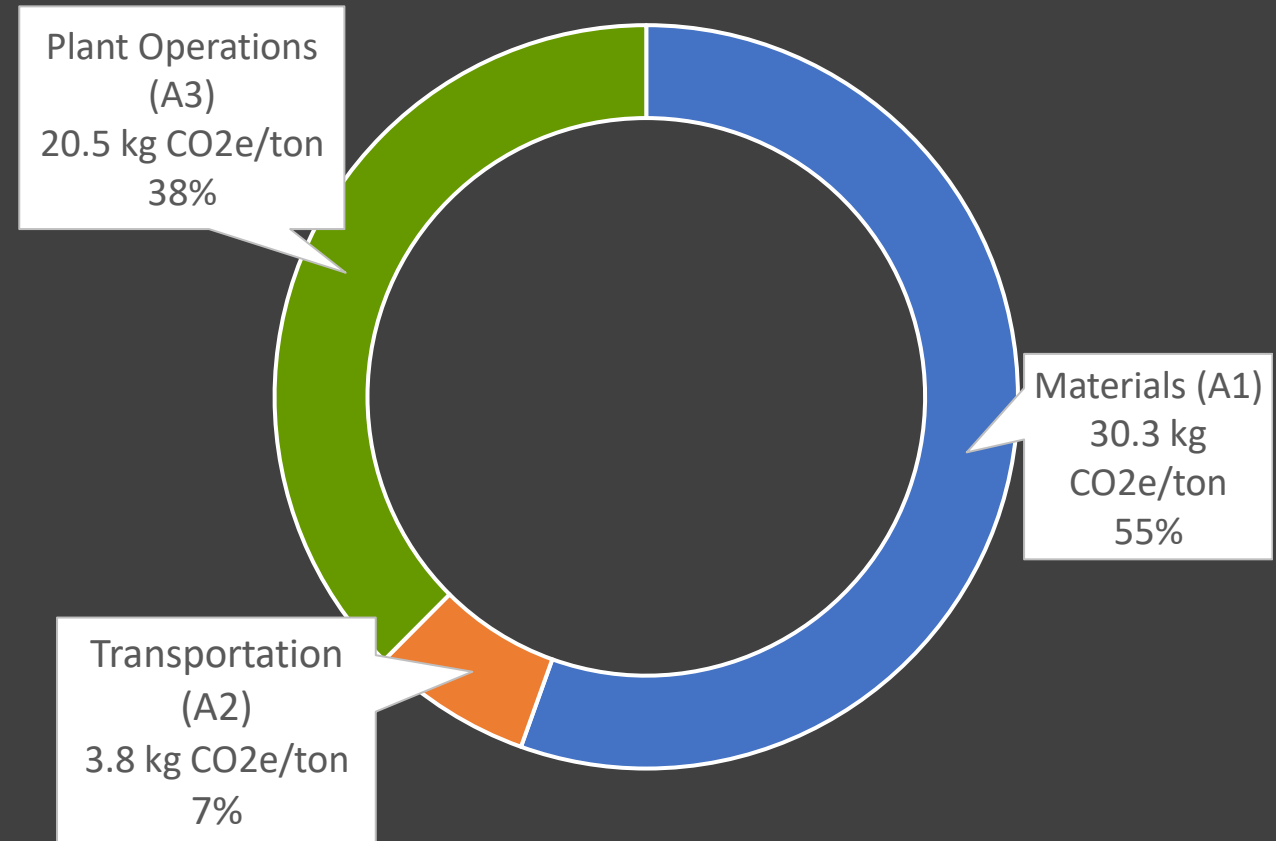
- 95% aggregates
- 5% asphalt binder

- **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)**

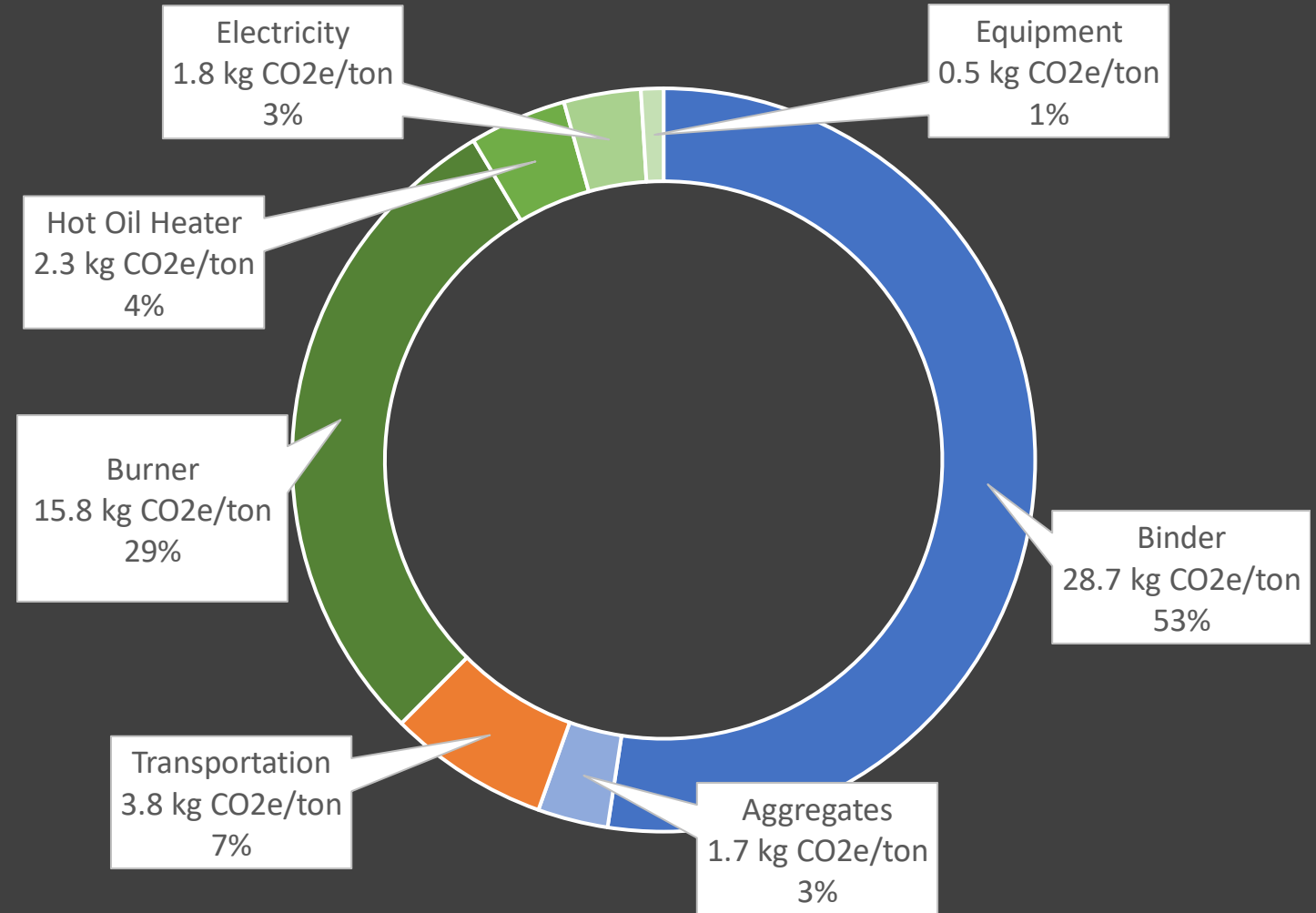
- 95% aggregates
- 5% asphalt binder

- **Transport (A2)**

- 22 miles by truck

- **Plant Energy (A3)**

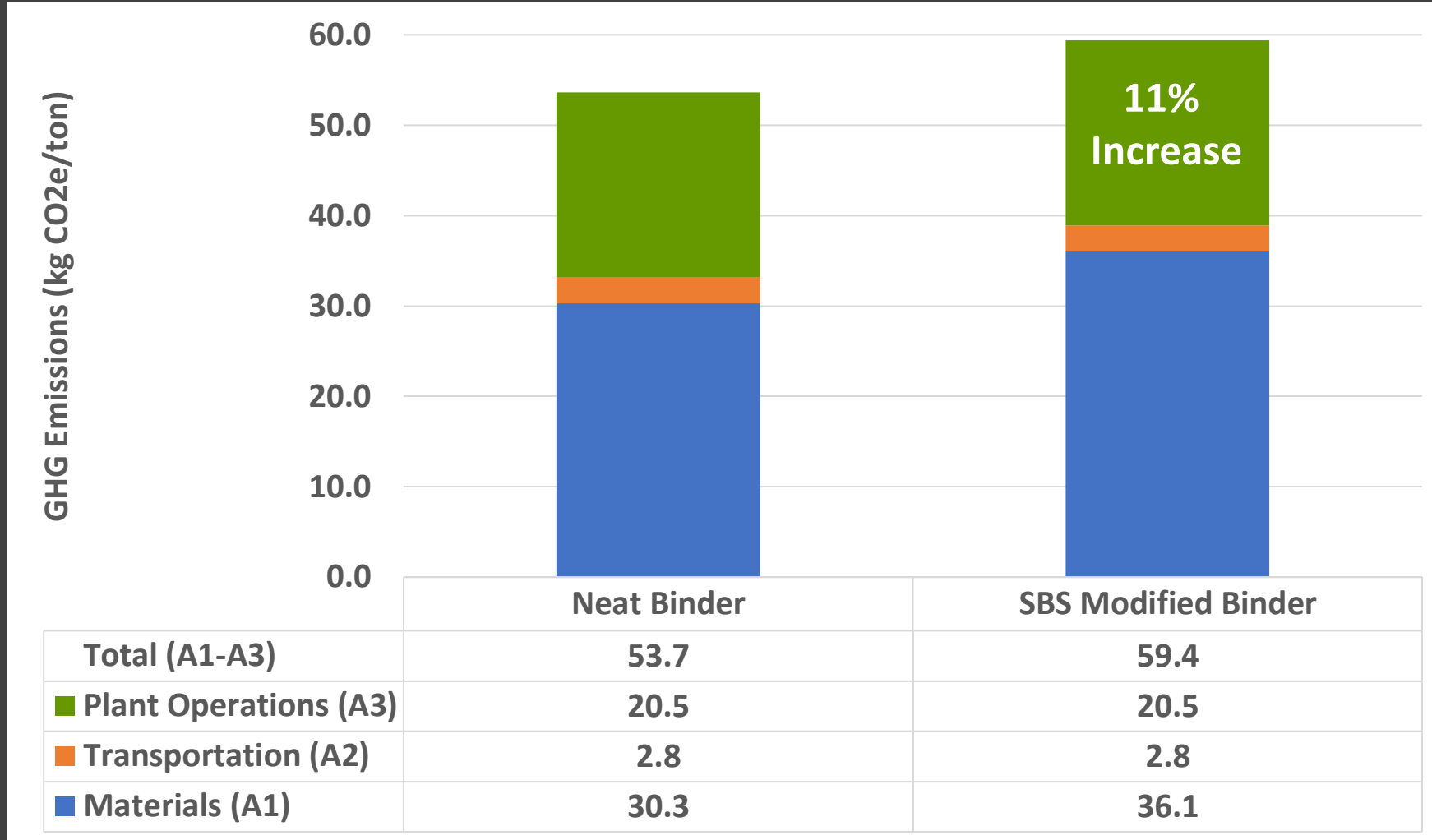
- Burner fuel – Natural Gas
- 289,000 Btu/ton
- 3.3 kWh/ton – Average grid



**Total = 54.7 kg CO2e/ton**

# Material Considerations (A1)

# Impact of Asphalt Binder Modification (SBS)





# What About Mix Performance?

Polymer modification can extend pavement life by 5-10 years

- Assume baseline service life of 15 yrs
  - $53.7 / 15 \text{ yrs} \rightarrow 3.6 \text{ kg CO}_2\text{e/ton/yr}$
- Assume modified mix lasts 20 yrs
  - $59.4 / 20 \text{ yrs} \rightarrow 3.0 \text{ kg CO}_2\text{e/ton/yr}$

**The result is a 17% reduction on an annualized basis**

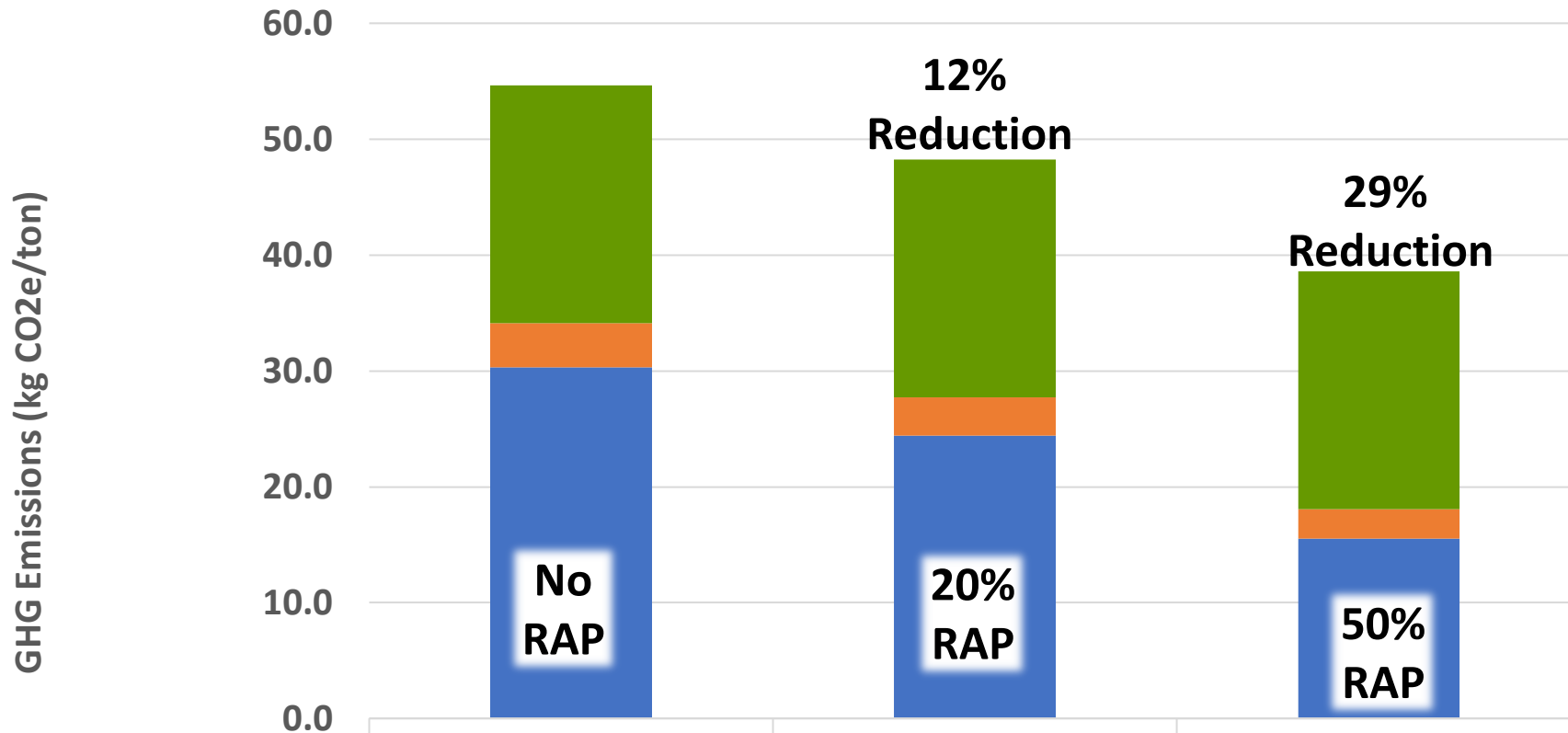
Feed the EPD data into a full-life cycle LCA for a more detailed analysis

# Impact of Anti-Strip

## Anti-Strip

- **Hydrated Lime (1%) adds ~12.6 kg CO<sub>2</sub>e/ton**
  - 53.7 → 66.3 kg CO<sub>2</sub>e/ton
- **Evotherm M1 adds ~1.0 kg CO<sub>2</sub>e/ton**
  - 53.7 → 54.7 kg CO<sub>2</sub>e/ton
- **Biobased liquid anti-strips can be carbon negative!**

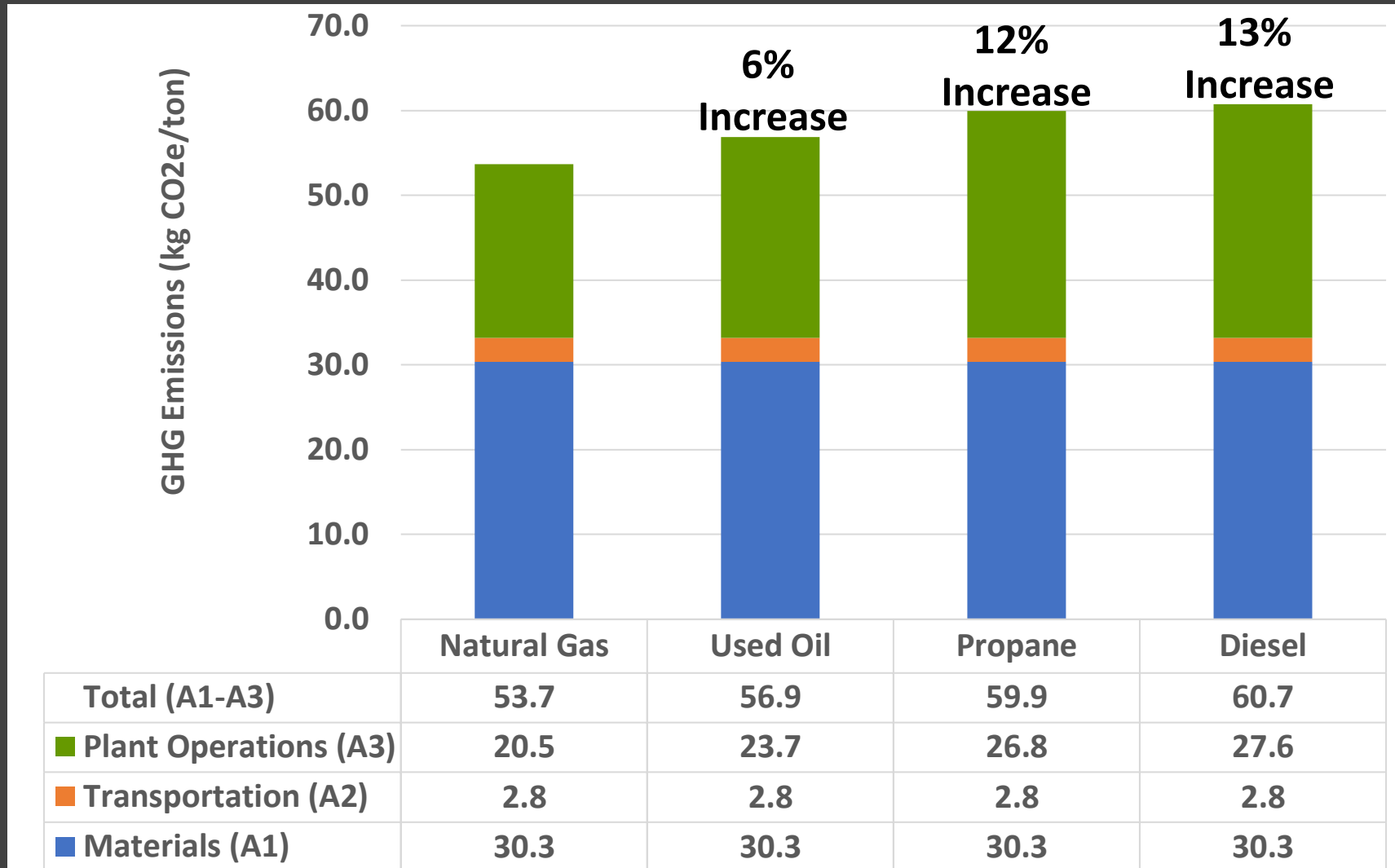
# Use of RAP to Reduce Emissions



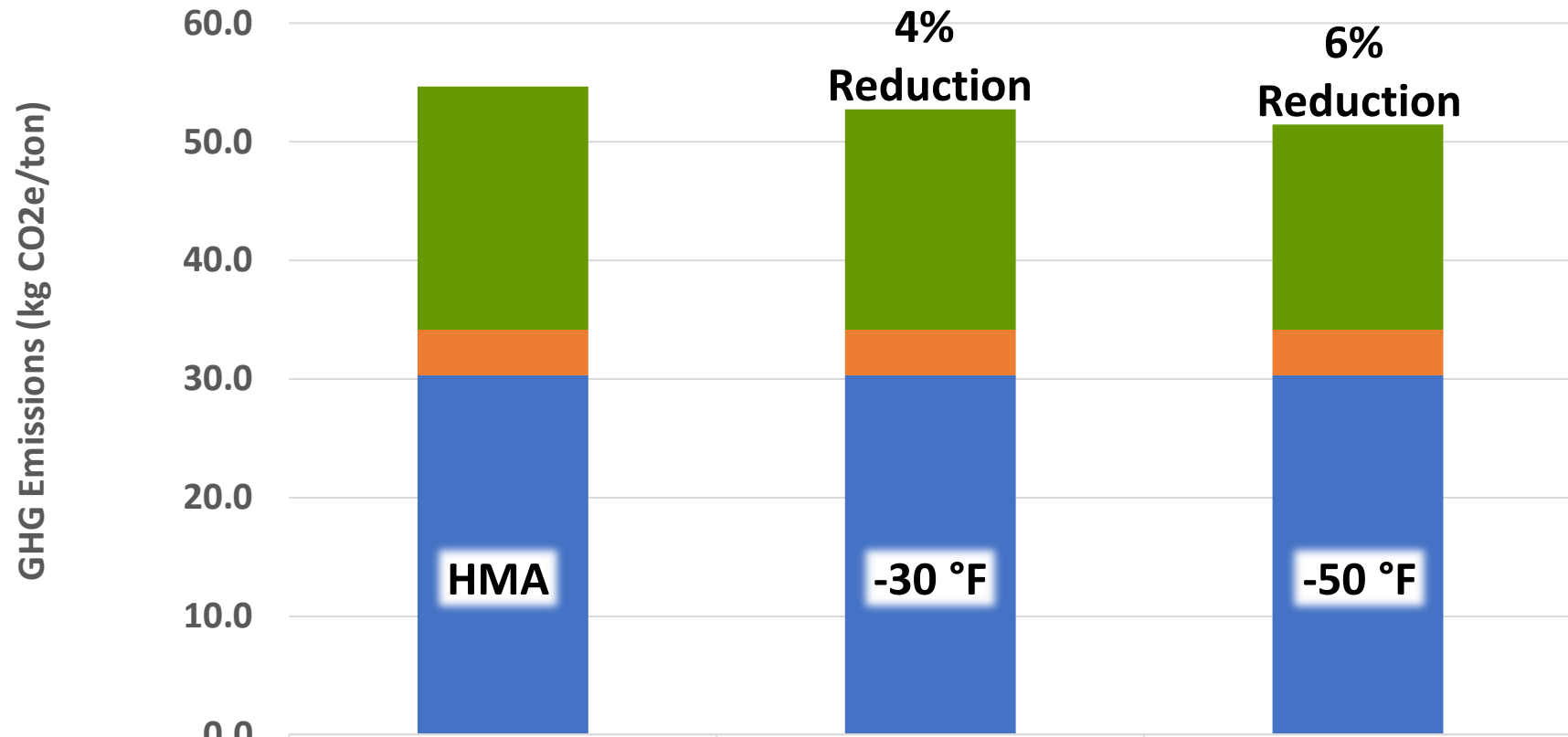
	No RAP	20% RAP	50% RAP
Total (A1-A3)	54.7	48.2	38.6
Plant Operations (A3)	20.5	20.5	20.5
Transportation (A2)	3.8	3.3	2.6
Materials (A1)	30.3	24.4	15.5

# Plant Operations (A3)

# Impact of Fuel Type



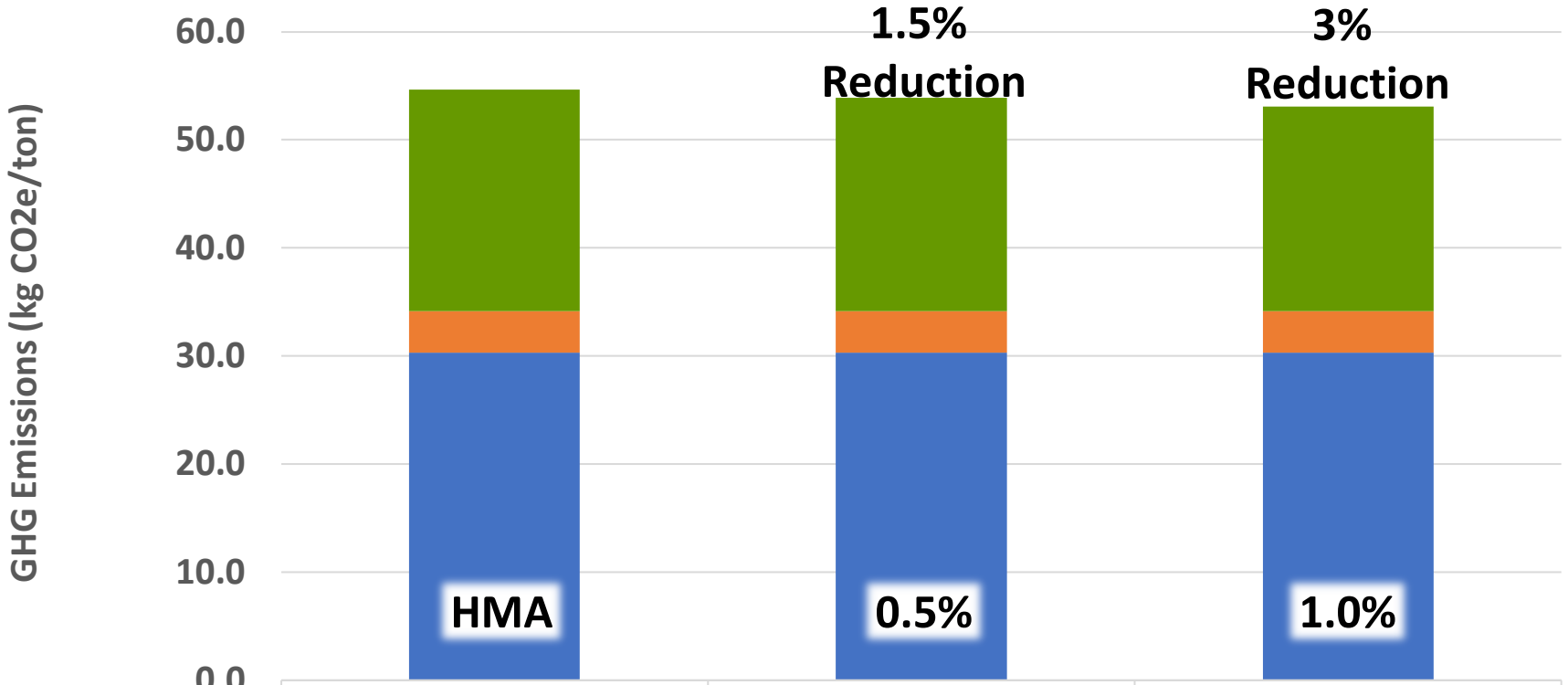
# WMA – Reduced Mix Production Temp



	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

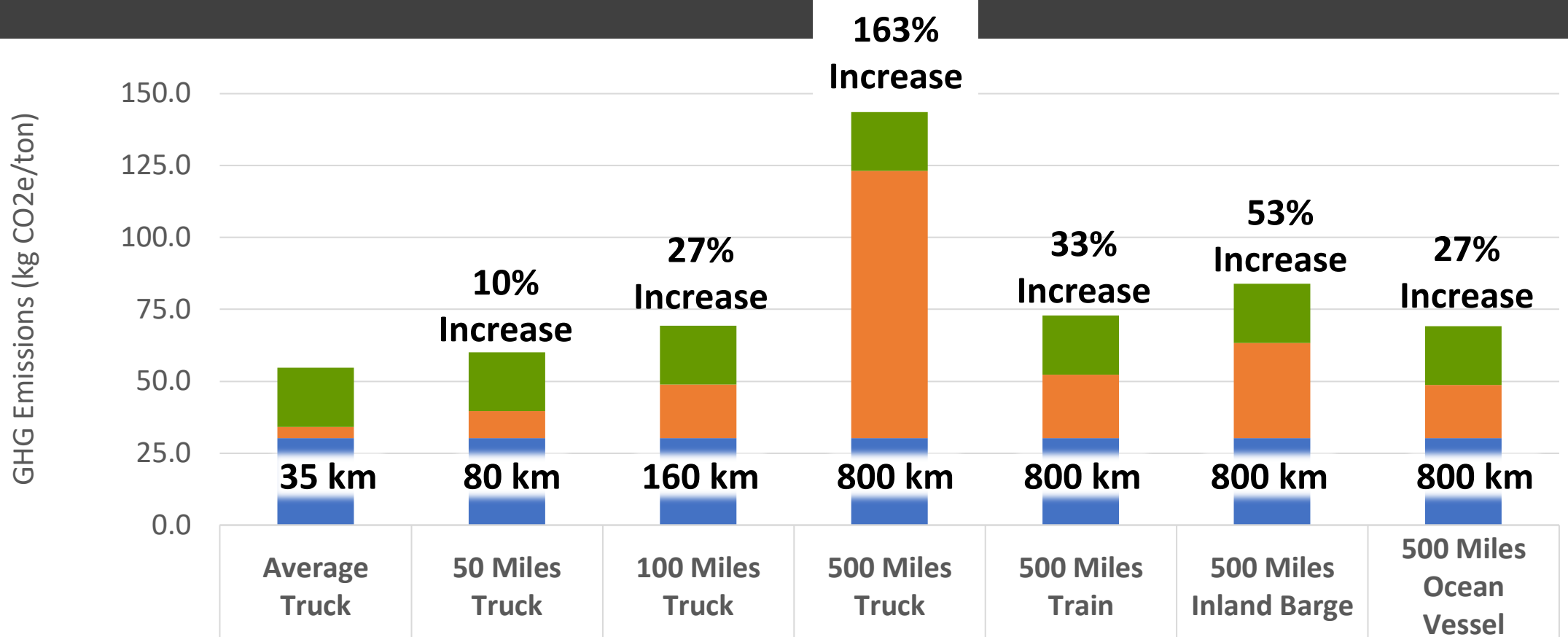
**Assume 10% Reduction in Burner Fuel Consumption per 1% Reduction in Agg. Moisture**



# Transportation (A2 and A4)



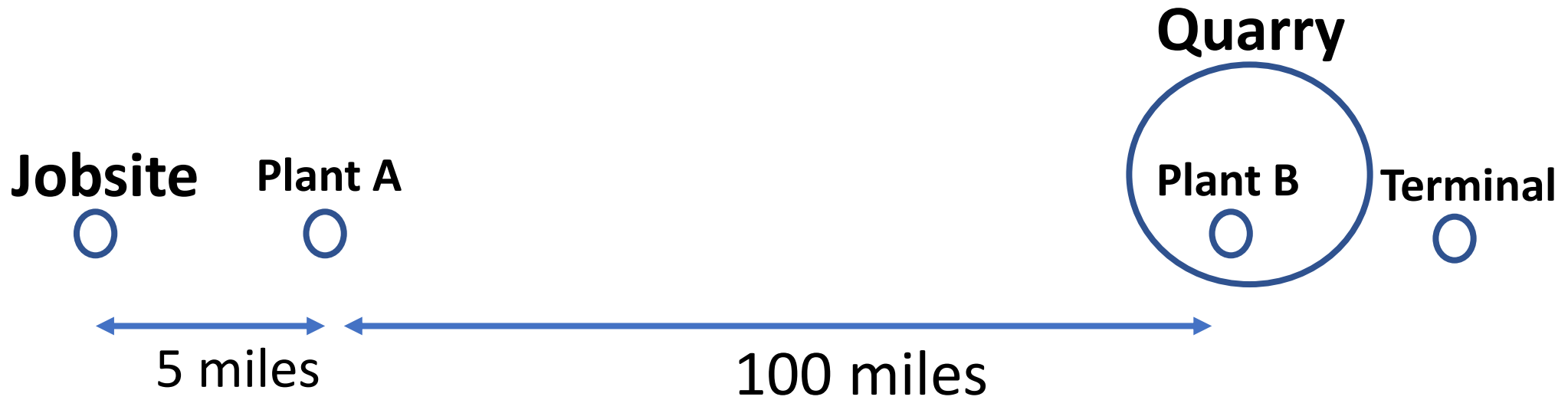
# A2 Transport Distance and Mode



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

# Transport Distance – What about A4?

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



**Plant A (City Plant)**

**A1-A3 = 69.4 kg CO<sub>2</sub>e/ton**

A4 = 0.9 kg CO<sub>2</sub>e/ton

A1-A4 = 70.3 kg CO<sub>2</sub>e/ton

**Plant B (Country Plant)**

**A1-A3 = 50.9 kg CO<sub>2</sub>e/ton**

A4 = 19.4 kg CO<sub>2</sub>e/ton

A1-A4 = 70.3 kg CO<sub>2</sub>e/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.



# Illinois Members

## Gold Club (50+ Years)

- BP
- E.D. Etnyre & Co.
- Gallagher Asphalt
- Geneva Construction
- Gunther Construction Co.
- Howell Asphalt Co.
- Kankakee Valley Construction
- Open Road Paving Co.
- S.G. Hayes & Company

## Members

- Allied-Locke Industries
- Applied Research Associates, Inc.
- Arrow Road Construction Co.
- Asphalt Plus LLC
- Asphalt Sales & Products Inc.

- ASTEC
- Bigane Paving Co.
- Chicago Testing Laboratory
- Curran Contracting Co.
- Digital Forces Corp.

## 30-Plus Club

- Advanced Asphalt Co.
- BLS Enterprises, Inc.
- Charles E. Mahoney
- Diamond Construction Co.
- E.T. Simonds Materials Co.
- Iroquois Paving Corp.
- Litchfield Bituminous Corp.
- Monmouth Asphalt
- Truman L. Flatt & Sons Co. Inc.
- William Charles Construction Co. LLC

## State Advisor: Dan Gallagher, Gallagher Asphalt

- ECF Inc.
- Freesen, Inc.
- Gearflow
- Global Track Warehouse
- Helm Civil



# Illinois Members

## Members

- Hoerr's Blacktop & Sealcoating
- Holcim US
- Humboldt Mfg. Co.
- Interstate Asphalt
- K-Five Construction Corp.
- Keyesport Asphalt LLC
- MAT Asphalt LLC
- Murphy Pavement Technology Inc.
- Nouryon
- Ogden Avenue Materials
- OMI Industries
- Open Road Paving Co.
- Peter Baker & Son Co.
- Phillips 66
- Southwest Oil
- Tri-State Asphalt LLC
- United Contractors Midwest
- Vulcan Materials Co. Central Division
- W.L. Miller Co.

## State Advisor

Dan Gallagher, Gallagher Asphalt Corp.

# Thank you, Illinois!

