Cement Industry Roadmap to Carbon Neutrality

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IRMCA ConcreteState ICPA NRMCA

PORTLAND CEMENT ASSOCIATION
ROADMAP TO CARBON NEUTRALITY BY 2050

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TWO SOURCES OF CARBON DURING CEMENT MANUFACTURING…

$$CaCO_3 \longrightarrow CaO + CO_2$$

$$C + O_2 \longrightarrow CO_2$$

U.S. Cement Industry contribution to global GHG = 0.17% CO_{2eq}

U.S. Cement Industry contribution to U.S. GHG = 1.25% CO_{2eq}

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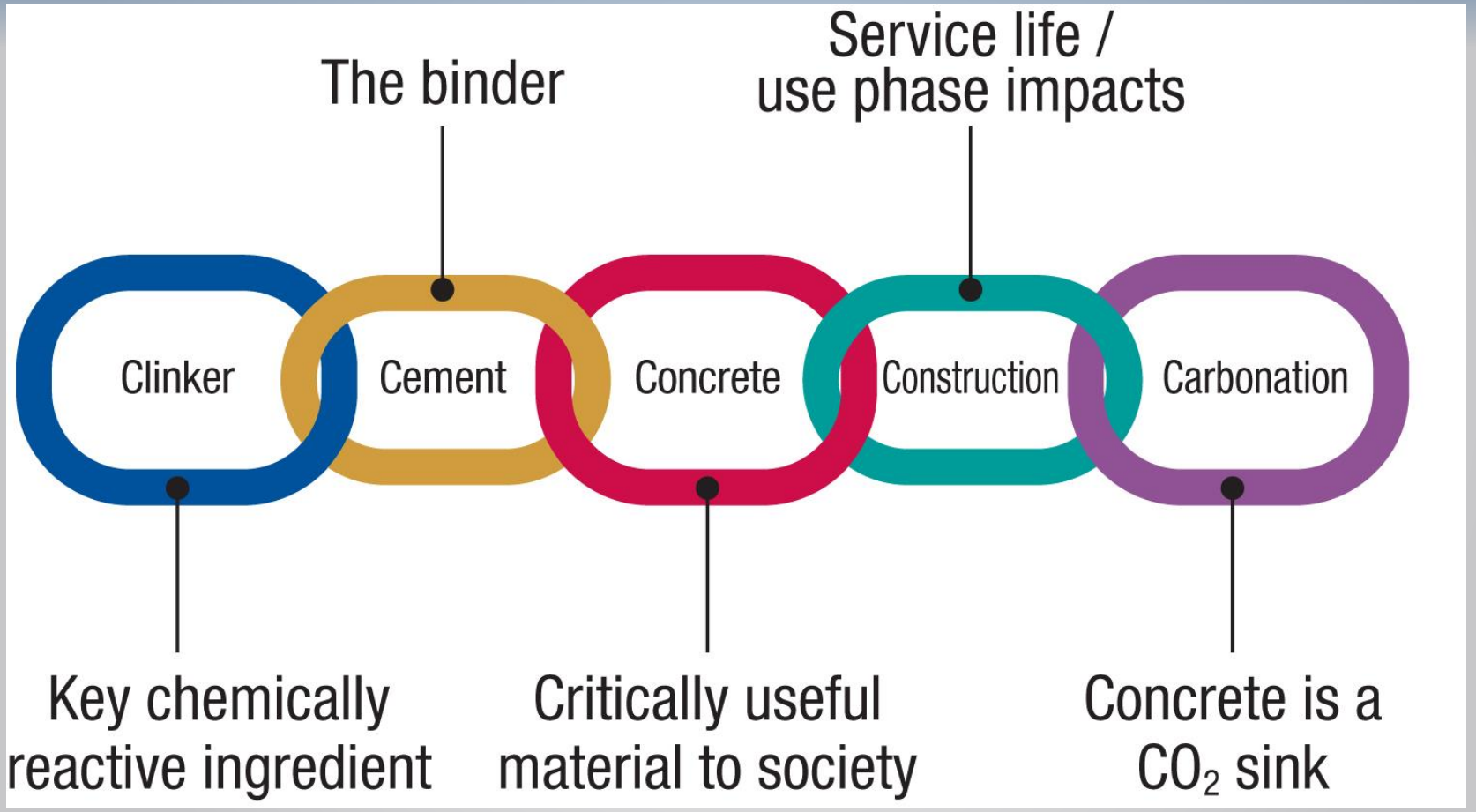
IMPACTS ALL ALONG THE VALUE CHAIN



THE FIVE “C’s”

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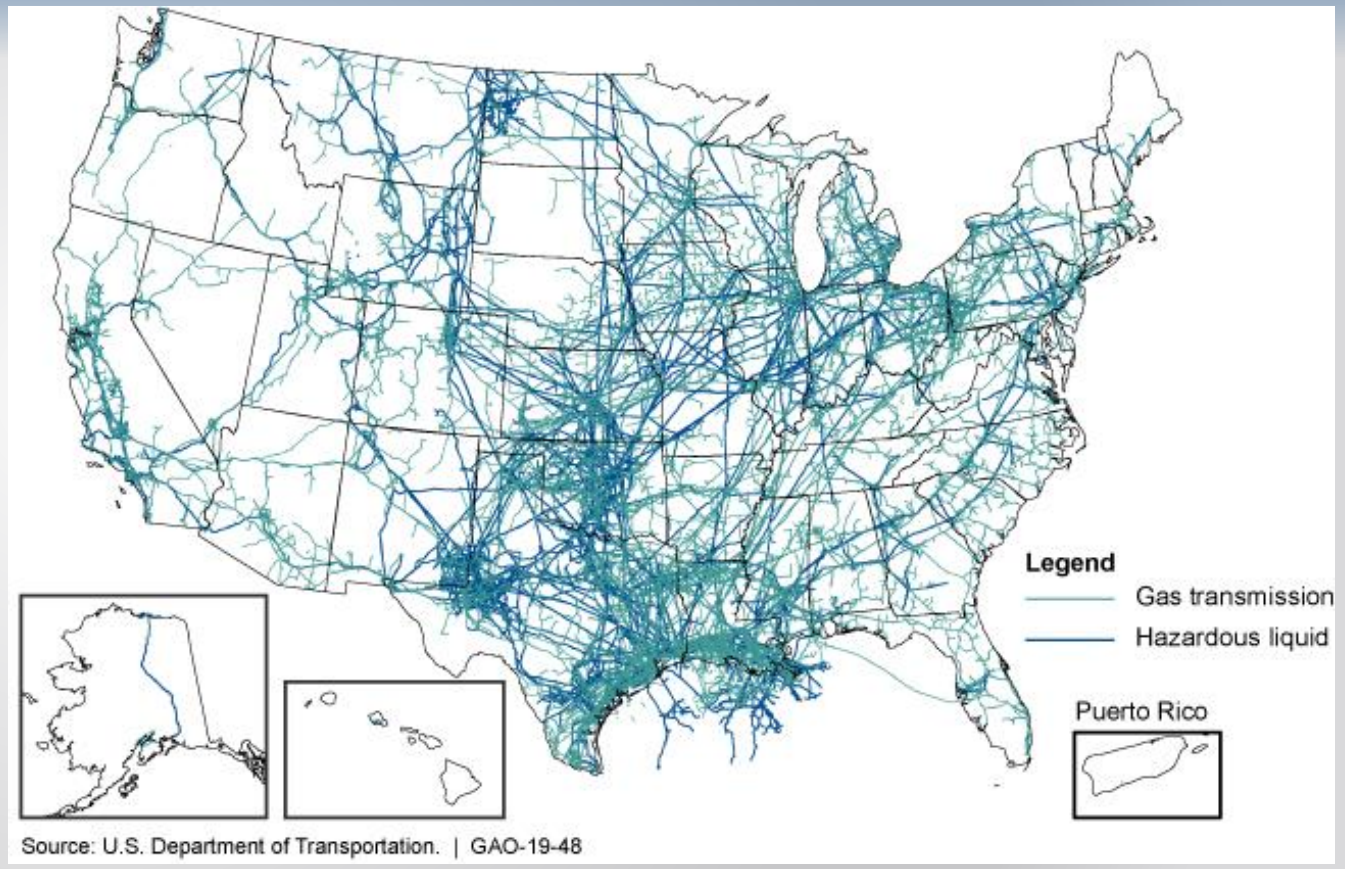
ADDRESSING CLINKER TODAY - TRANSITIONAL

- Increased use of alternative raw materials
- Efficiency gains in the manufacturing process
- Fuel switching/fuel substitution/renewables

ADDRESSING CLINKER TOMORROW - TRANSFORMATIVE

- Transformative fuels and technologies like hydrogen
- Incorporating carbon capture utilization storage (CCUS)

INFRASTRUCTURE NEEDS – NEW PIPELINE CAPACITY NEEDED FOR CO_2, H_2, NATURAL GAS



TRANSFORMATIVE

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INFRASTRUCTURE NEEDS – ENERGY

- Energy consumed by CCUS is significant and existing energy production is woefully inadequate
- Energy delivered by On-Site Power Generation requires added grid capacity
- Energy from renewable sources requires added grid capacity

TRANSFORMATIVE

OPTIMIZING CEMENT

- Right-sizing the amount of clinker in cement
- Using more non-gypsum additions
  - Recognizing the benefits of Portland limestone cements (ASTM C150)
- Choosing the right cement specification for the specific application
- Zero emissions bulk transportation (rail/truck)

OBSTACLES TO OPTIMIZING CONCRETE – INSTITUTIONAL INERTIA

PRESCRIPTIVE BASED SPECIFICATIONS:

- Limits on how much supplementary cementitious material (SCM) can be used
- Restrictions on the use of fly ash as an SCM
- Minimum requirements for how much cementitious material should be used
- Limits on water-cementitious materials ratio
- Restrictions on aggregate grading

THE SOLUTION?

- Shift from prescriptive to performance-based specifications
- Incentivize innovation with today's products instead of institutionalizing inertia with yesterday's practices
- The right mix using the right materials for the right application to achieve the right performance

OPTIMIZATION OF THE BUILT ENVIRONMENT – MAKE IT ABOUT MORE THAN THE MATERIALS

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SUSTAINABLE/RESILIENT CONSTRUCTION

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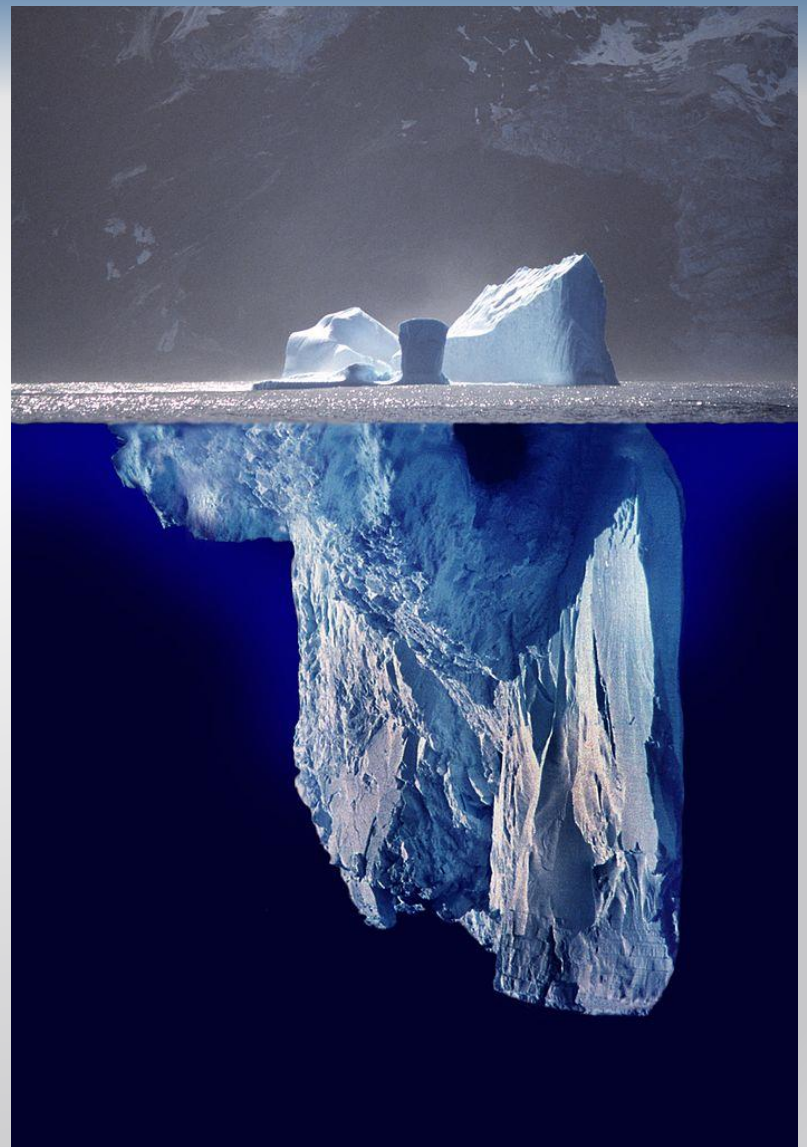
LOWEST INITIAL CARBON MAY NOT EQUAL LOWEST OVERALL CARBON

- EMPHASIZE **FULL** LIFE CYCLE
  - Use phase all under the water line
- EPDs
  - Often stop at Cradle to Gate
  - Embodied carbon only
  - Comparison not based on full LCA



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CLIMATE RELATED WEATHER EVENTS REQUIRE SMART CONSTRUCTION… AND SMART CONSTRUCTION MUST BE SUSTAINABLE CONSTRUCTION

2021 Kentucky Tornados

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SUSTAINABLE CONSTRUCTION IS RESILIENT

2018 Hurricane Michael Mexico Beach, FL

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BUILDING BACK BETTER MEANS CONCRETE CONSTRUCTION

2021 Colorado Wildfires

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THE IMPORTANCE OF FULL LIFE CYCLE

- Completed January 1943
- 435,000 cubic yards of concrete
- 43,000 tons of steel
- 680,000 tons of sand and gravel
- Still absorbing CO_2 after nearly 80 years
- **Concrete can absorb 10% of the CO_2 emissions generated during the manufacture and transportation of both cement and concrete**

The Pentagon

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SOCIETY NEEDS CONCRETE…
AND CONCRETE NEEDS SOCIETY

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Climate and Sustainability start with the 5 “C’s”

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COOPERATION / COLLABORATION / COORDINATION

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THE BIG TEN – NEEDED POLICIES

- Research, Development & Innovation
- Regulations, Permitting & Guidance
- Financial Incentives & Support
- Preformance-Based Material Standards
- Market-Based Carbon Pricing
- Market Acceptance
- Community Acceptance
- Cradle-to-Cradle Life Cycle-Based Procurement
- Low-Carbon Infrastructure
- Level Playing Field

Broad recognition of the value of cement and concrete

THEN

POLICIES TO ENHANCE/LEVERAGE/FURTHER SUPPORT THOSE VALUES

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QUESTIONS/DISCUSSION

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