Cement Industry Roadmap to Carbon Neutrality

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PORTLAND CEMENT ASSOCIATION
ROADMAP TO CARBON NEUTRALITY BY 2050
TWO SOURCES OF CARBON DURING CEMENT MANUFACTURING...

\[ \text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2 \]

\[ \text{C} + \text{O}_2 \rightarrow \text{CO}_2 \]

U.S. Cement Industry contribution to global GHG = 0.17% CO$_{2\text{eq}}$

U.S. Cement Industry contribution to U.S. GHG = 1.25% CO$_{2\text{eq}}$
IMPACTS ALL ALONG THE VALUE CHAIN

THE FIVE “C’s”

- Clinker: Key chemically reactive ingredient
- Cement: Critically useful material to society
- Concrete: Concrete is a CO₂ sink
- Construction: Service life/use phase impacts
ADDRESSING CLINKER TODAY - TRANSITIONAL

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

SUSTAINABLE/RESILIENT CONSTRUCTION
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
CLIMATE RELATED WEATHER EVENTS REQUIRE SMART CONSTRUCTION... AND SMART CONSTRUCTION MUST BE SUSTAINABLE CONSTRUCTION

2021 Kentucky Tornados
SUSTAINABLE CONSTRUCTION IS RESILIENT

2018 Hurricane Michael Mexico Beach, FL
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 CO₂ after nearly 80 years
- Concrete can absorb 10% of the CO₂ emissions generated during the manufacture and transportation of both cement and concrete

The Pentagon
Climate and Sustainability start with the 5 “C’s”
THE BIG TEN – NEEDED POLICIES

- Research, Development & Innovation
- Regulations, Permitting & Guidance
- Financial Incentives & Support
- Performance-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
Cement Industry
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