PCA’s Roadmap to Carbon Neutrality by 2050

February 27, 2023  |  Paul Tennis  | Sr. Director, Research and Product Standards

SCIENCE: Steel and Cement Manufacturing Innovations to Enable A Low Carbon Economy
ROADMAP TO CARBON NEUTRALITY
A more sustainable world is Shaped by Concrete

Available online at www.cement.org
PCA’S ROADMAP TO CARBON NEUTRALITY

Everyone in the value chain has a role to play

Clinker and Cement – cement manufacturers

Concrete – ready mix producers, designers, specifiers

Construction – designers, specifiers, contractors

Carbonation – scientists, designers, contractors
Concrete *is* Environmentally Friendly
Concrete is the most widely used construction material.
Clinker and Cement
OPTIMIZING CLINKER PRODUCTION

Near- and mid-term
- Efficiency improvements – some opportunities remain
- Increased use of decarbonated/pre-calcined raw feed materials
- Reduced reliance on fossil fuels (esp. coal and pet coke)

Mid- to long-term
- Transformative fuels and technologies: H₂, plasma heating, oxyfuel/oxy-calcination, electric calcination…
- CCUS: solvents, sorbents, membranes, algae…
- High-risk, high-reward R&D required
OPTIMIZING CEMENTS

- Clinker-to-cement ratio (target 75% by 2050, not including replacement with SCMs)
- Increased acceptance/adoption of PLCs (Type IL) and other blended cements (Types IP, IS, and IT).
- Zero emissions manufacturing & transportation (focus on fuels, CCUS, decarbonated raw materials)
- New cements

![GWP per US Cement Industry-Wide EPDs](chart.png)

- 2016 Portland Cements: 1040 GWP (CO2-eq/metric tonne cement)
- 2021 Portland Cements: 922 GWP (CO2-eq/metric tonne cement)
- 2021 PLCs: 846 GWP (CO2-eq/metric tonne cement)

www.greenercement.com
PCA’S ROADMAP – ONE YEAR PROGRESS REPORT

**CLINKER**
Key chemically reactive ingredient
- CCUS Studies
- Input/Review of DoE Decarbonization Roadmap and Carbon Capture Cost Analysis
- PCA and PCA Member company Energy Star Awards
- Continuing energy efficiency improvements

**CEMENT**
The binder
- More than 20% of all cements consumed in the U.S. are now lower carbon cements including portland-limestone cements and other blended cements, up from less than 5% just two years ago

**CONCRETE**
Critically useful material to society
- GSA Low-Embodied Carbon Concrete specification
- 40,000 Type III EPDs for Ready Mixed Concrete available today with most produced in the last two years

**CONSTRUCTION**
Service life / use phase impacts
- BuildingGreen.com “The Contractor’s Commitment”

**CARBONATION**
Concrete is a CO₂ sink
- IPCC Recognition
- NIST Low Carbon Cements and Concretes Consortium
- Preliminary results from MIT show historical carbon uptake of US building sector is as large as 4 Mt CO₂ per year

February 2023 – about 77,000 concrete EPDs in US and Canada and 80,000 globally
In 2022, use of PLC in the US resulted in avoided emissions of about 1.3 million metric tons of CO₂.
We’ve begun to make progress, but to achieve carbon neutrality for cement and concrete:

- Transformative technologies at massive scale are needed – particularly to address clinker-related emissions.
- Government engagement (regulations, investments in R&D) will be critical.
- Inertia will take us somewhere, but not where we need to go. Purposeful action is required by many stakeholders at every step of the life cycle.
Thank you!
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