

**INNOVATION IN LOW-  
CARBON CEMENT  
ADDITIVES & CONCRETE  
ADMIXTURES**



**C1**

**ABOUT US**





## NORTH AMERICA BUSINESS UNIT

SAINT-GOBAIN CONSTRUCTION CHEMICALS

**8 Application Labs** and **2 Innovation Centers**

**200+** Years of Experience in Tech Services

**Leader in Sustainable Solutions**

**Over 400 Employees**

**MARKETS & SECTORS WE OPERATE IN**

- Concrete Admixtures and Technologies
- Cement Additives
- Flooring: Ductilcrete and Cemfloor

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## INNOVATIVE CEMENT ADDITIVES FOR LOW CO<sub>2</sub>



### PLC & BLENDED CEMENTS

#### GLOBAL CEMENT PRODUCTION IS 4.6 BILLION TONS PER YEAR\*

- Estimated 12-23% increase – 2050

#### PLC & BLENDED CEMENTS

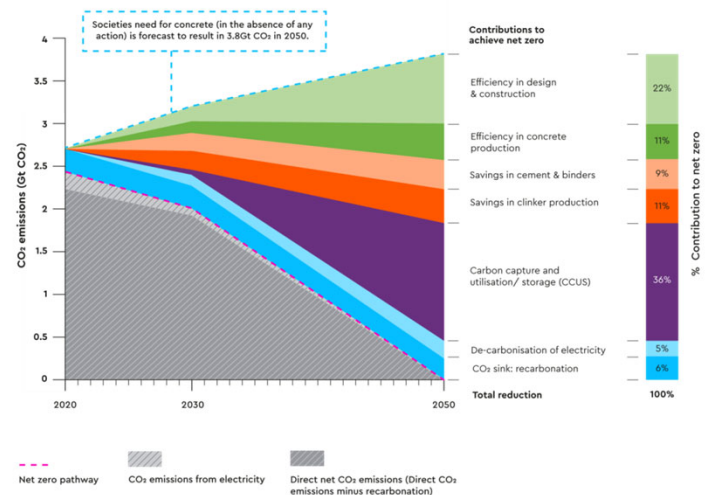
- Reduced GWP footprint, reduced (thermal) energy, extended plant/quarry life

#### PRODUCTION CHALLENGES

- Cement strength impacts
- Finer grinding → decreased mill efficiency
- Increased water demand → field performance impacts
- Market conversion

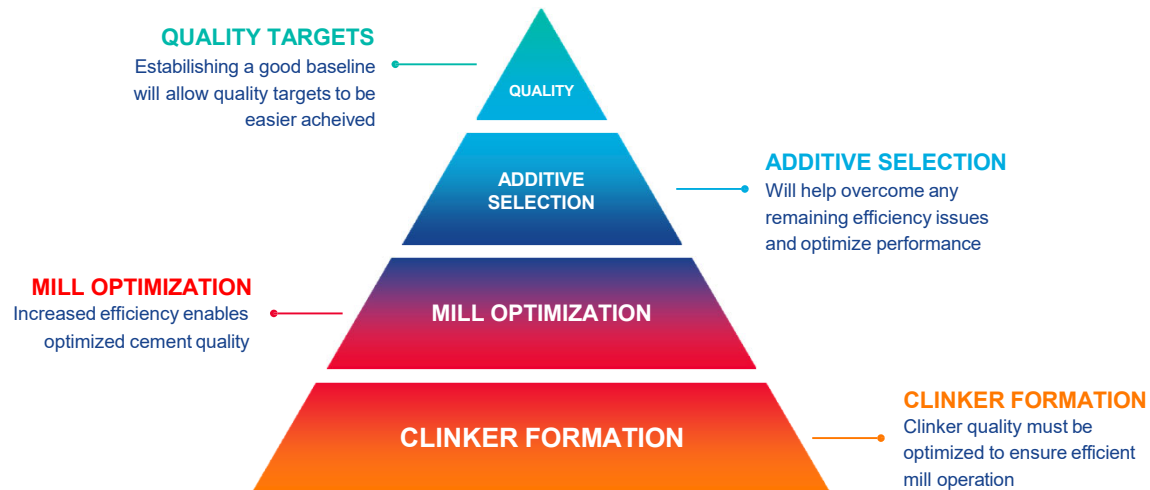
Source: Global Cement and Concrete Association

#### GETTING TO NET ZERO



## PLC & BLENDED CEMENTS

Key Optimization Levers



## CEMENT ADDITIVE FAMILIES



### GRINDING AIDS

- Improve grinding efficiency
- Reduced agglomeration
- Better handling and flowability
- Increase tons/hour & reduce specific energy consumption
- Enhanced productivity, distribution & cost savings



### QUALITY IMPROVERS

- Significantly improve cement performance and quality
- Increase strength, adjust setting times, reduce water demand, control air content...



### SPECIALTY ADDITIVES

- Cement functionality
- Better control of air content
- e.g. Masonry performance, Chromium reduction



## QUALITY IMPROVER PRODUCT BENEFITS



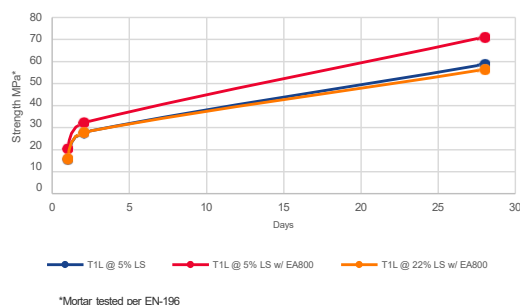
### MECHANISMS

- Facilitate hydration (phase specific catalysis, chelation, etc.)
- Improve hydration product and pore system distribution
- Improve hydrate morphology, stability of phases
- Promote earlier age strength development

### BENEFITS

- Improved mill efficiency/production
- Higher quantities of SCMs
- Offset of alternative raw materials or fuels
- Lower CO<sub>2</sub>, improved concrete performance

### ENVIROADD™ 800 SERIES PERFORMANCE



## NA CASE STUDY WITH ENVIROADD™ 5000 SERIES

### OBJECTIVE

- Increase mill output to meet market demand

### ACTION PLAN

- Develop customized strength enhancing grinding aid
- Match strength to benchmark through Blaine reduction

### RESULTS

- **13%** increase in mill efficiency
- **2%** increase to limestone replacement
- Strength increased **3-6%** at all stages
- **2.2%** further decrease in embodied CO<sub>2</sub>
- Field feedback mentioned reduced wet-out/mixing times, less cleaning of the truck fins, and easier finishing

	Dosage (ppm)	Blaine (m <sup>2</sup> /kg)	Packset	Air Content (%)	N.C.(%)
Baseline DEG	550	470	3	8.7%	28.5
Quality Improver	1400	470	2	8.6%	28.1
Quality Improver – Optimized Production	1400	420	1	8.6%	27.3



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## INNOVATIVE CONCRETE ADMIXTURES FOR LOW CO<sub>2</sub>



### CASE STUDY – SEATTLE STORM PROJECT

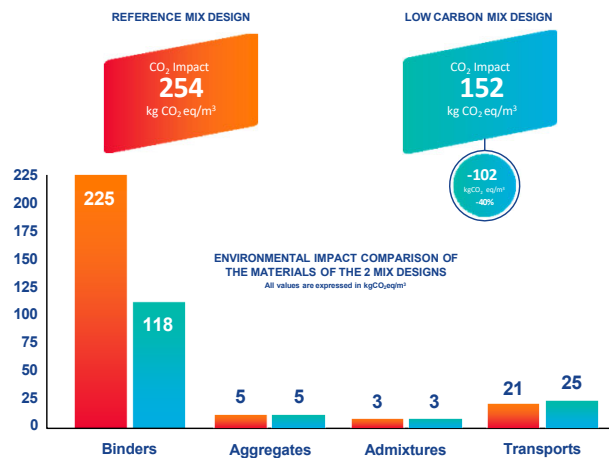
Carbon Optimization Solutions: CONCERA® & ADVA®

**Project exceeded a 40%  
reduction vs. typical  
regional average mixes**

Region	San Francisco / Los Angeles, CA	Portland, OR / Seattle, WA	Seattle, WA
Concrete Compressive Strength	Embodied Carbon Limits (kg CO <sub>2</sub> e/m <sup>3</sup> )	Embodied Carbon Limits (kg CO <sub>2</sub> e/m <sup>3</sup> )	Embodied Carbon Limits (kg CO <sub>2</sub> e/m <sup>3</sup> )
0-2500 psi	260	266	-
2501-3000 psi	298	291	117 – 80% slag mix
3001-4000 psi	313	343	159 – 50% slag mix
4001-5000 psi	338	406	182 – 50% slag mix 256 – 18% slag mix
5001-6000 psi	358	429	277 – 18% slag mix
6001-8000 psi	394	498	156 – 80% slag mix 155 – 80% slag mix
>8001 psi	-	-	-

#### ENVIROMIX IMPACT APP RESULTS

OVERALL RESULTS PER M<sup>3</sup> OF CONCRETE



## CASE STUDY – WITH MIDWEST CUSTOMERS

Customer: Concrete Solutions, Inc. (Midwest)

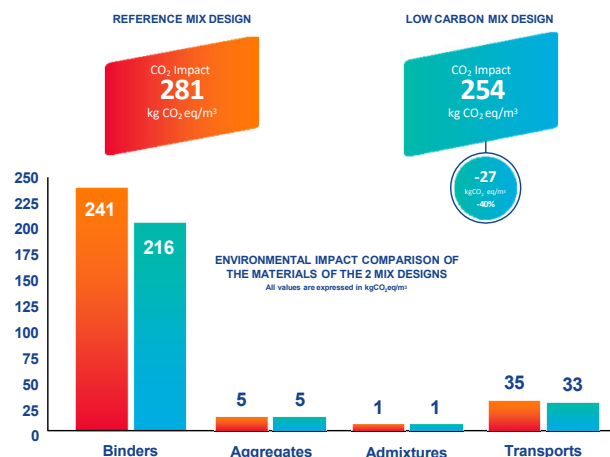
**10% enhanced strength  
with type 1L cement**

**EMX SE 30-50lb cement  
reduction in mix design**

Customer	Mix Design	Cementitious lb/y <sup>3</sup> Reference Mix	Cementitious lb/y <sup>3</sup> EMX SE 30	Cement Reduction lb/y <sup>3</sup>
A	4000 psi (Type 1L + Fly Ash)	560	510	50 (Cement)
B	3500 psi (Type 1L + Fly Ash)	440	390	50 (Cement)
C	4000 psi (Avg Portland Cement)	500	470	30 (Cement)
D	4000 psi (Type 1L + Fly Ash)	564	514	50 (Cement + Fly Ash)

### ENVIROMIX IMPACT APP RESULTS






OVERALL RESULTS PER M<sup>3</sup> OF CONCRETE



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## SUSTAINABLE PRODUCT EVOLUTION

Developing the EnviroMix Range

				
Circular Economy Solutions for Aggregates	Water Reducers Enabling SCM Use (EnviroMix 159, 728, 740)	Cement Reduction with Strength Gain (EnviroMix SE 30, 65, 70)	Proprietary Embodied Carbon App to Pre-quantify Mix GWP Results	Admix for Calcined Clay Cements

**Sustainable Design Attributes:**



Biobased



Low Carbon



Circular Economy

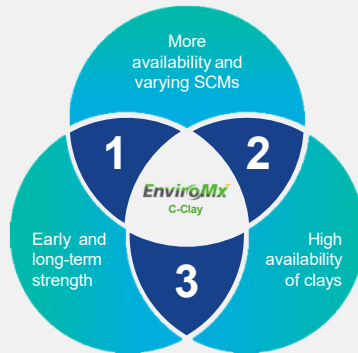
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## CREATION OF ENVIROMIX C-CLAY RANGE

Admix for Calcined Clay Cements

### NA Adaption and Projects in Progress



CO<sub>2</sub> footprint of calcined clay approx. 1/3 that of OPC;  
810 kgCO<sub>2</sub>eq/ton of cement vs 490kg

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#### ↑ SCM USE WITH ↓ AVAILABILITY

Need for SCMs with high availability to pursue global decrease of CO<sub>2</sub>

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#### HIGH AVAILABILITY OF CLAYS

Wide availability of suitable clays throughout the world; cement focused on the subject

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#### CONCRETE PERFORMANCE

Depends on quality and quantity of calcined clay used in cement



## DRIVING LOW CARBON CEMENT & CONCRETE

### Collaboration

Early involvement via cement & concrete producers  
+ design / construction team drive solutions.

### Levers

Understand key material levers. New blended cements / SCMS changing rapidly. Transport impact matters.

### Optimization

New technologies – enhance strength, reduce cement & increase strength, while maintaining workability.

Utilize CO<sub>2</sub> quantification & mix optimization tools and engage in an EPD program with 3<sup>rd</sup> party verification – it is critical to understand the impacts associated with your cements and concrete mix designs.





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