The Opportunity is Here for Engineers to Lead

Global CO$_2$ Emissions by Sector

- Building Operations: 28%
- Building and Infrastructure Materials: 22.7%
- Transportation: 23%
- Industry: 20.3%
- Other: 6%
Where to Start - You Can’t Manage What You Don’t Measure

- Concrete (CY)
- Rebar (Tons)
- PT (Tons)
- Str Steel (Tons)

**MATERIAL QUANTITY ESTIMATE** × **EMBODIED CARBON PER MATERIAL EPDs** = **BUILDING EMBODIED CARBON (EC) ESTIMATE**
CONCRETE
The Biggest Carbon Variables

Fly Ash

Slag

Glass Powder

Aggregate

Lower Carbon Cements – C595 & C1157
High-rise Residential Case Study

Better Aggregate = Consistency
High-rise Residential Case Study

Los Angeles Based Project

24% Carbon Reduction
No Cost Increase
The Impact of EPD’s

5000 psi Ready-Mix Concretes in Seattle

18% Reduction!
Carbon Capture & Storage
US Steel – Electric Arc Furnace…it’s about the Grid Today
US Steel – It’s About the Process Tomorrow

Carbon Free Steel Making - Molton Oxide Electrolysis (example)

2022-2023
Semi-industrial validation of MOE cell - steel production

2023
Commercial plant deployments - ferroalloy production

2024-2025
Pilot plant deployment - steel production

Second half of the decade
Commercial plant deployments - steel production

The oxygen that has been removed from the target oxide is emitted from the cell.
Can We Get Timber Right?
Growing the fibers faster
It’s in the Roots

Growth behavior is to create a bamboo forest (invasive)
Fiber Optimized Composites

Typical Glulam Beam Layup

24F-V4 Doug Fir (12 Lamination Example)

- 2 - L2 Dense Grade Outer Comp. Lams
- 1 - L2 Grade Inner Comp. Lam
- 6 - L3 Grade Core Lams
- 1 - L2 Grade Inner Ten. Lam
- 1 - L1 Grade Outer Tension Lams
- 1 - 302-24 Outer Tension Lams
The Need for NAE Leadership