



PA DEP, CLIMATE CHANGE ADVISORY COMMITTEE

RICK BOHAN, P.E., FACI, SVP SUSTAINABILITY

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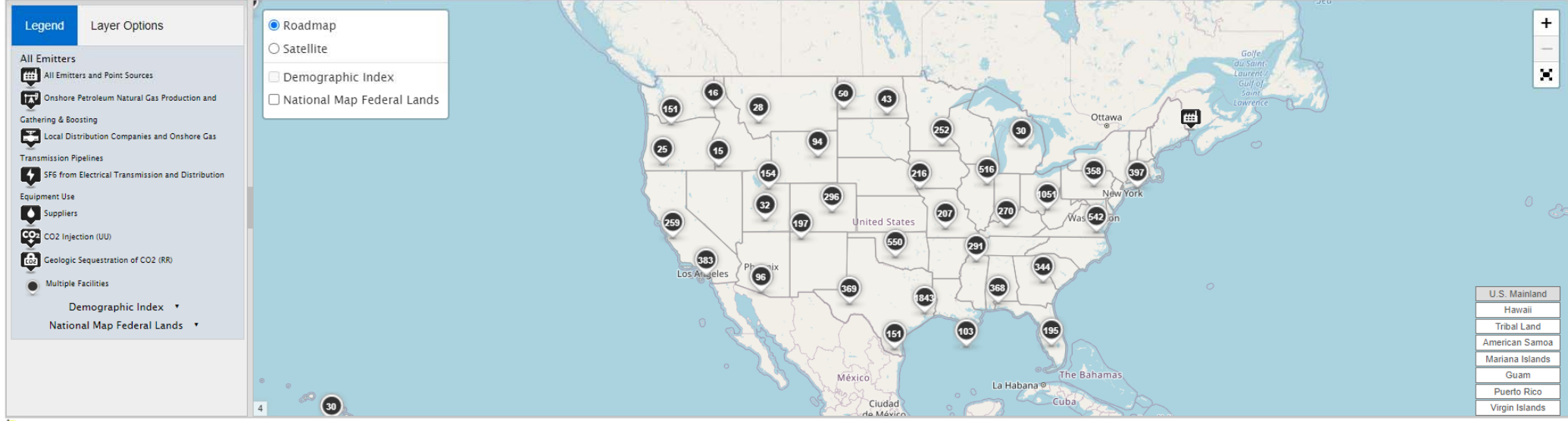
Data Year: 2020 | Facility Type: All Emitters | Search Options: Find a Facility or Location

Browse to a State: Choose State | Emissions by Fuel Type: Choose Fuel Type | Filter By: Greenhouse Gas | Emission Range | Filter By Status: All Facilities

Data View: Map | List | Trends | Bar Chart | Pie Chart

APPLY SEARCH | Clear Filter | Export Data

Sector	Power Plants	Petroleum and Natural Gas Systems	Refineries	Chemicals	Other	Minerals	Waste	Metals	Pulp and Paper	Total Reported Emissions
2020 GHG Emissions (Million Metric Tons CO ₂ e)	1,495	316	161	184	118	109	105	78	35	2,602
# of Reporting Facilities	1,339	2,377	140	453	1,320	379	1,465	294	221	7,634



This data set does not reflect total U.S. GHG emissions. Learn more about related EPA GHG data sources. Data reported to EPA as of 08/07/2021.

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APPLY SEARCH | Clear Filter | Export Data

Sector	Power Plants	Petroleum and Natural Gas Systems	Refineries	Chemicals	Other	Minerals	Waste	Metals	Pulp and Paper	Total Reported Emissions What's this?
2020 GHG Emissions (Million Metric Tons CO ₂ e)	---	---	---	---	---	66	---	---	---	---
# of Reporting Facilities	---	---	---	---	---	92	---	---	---	---

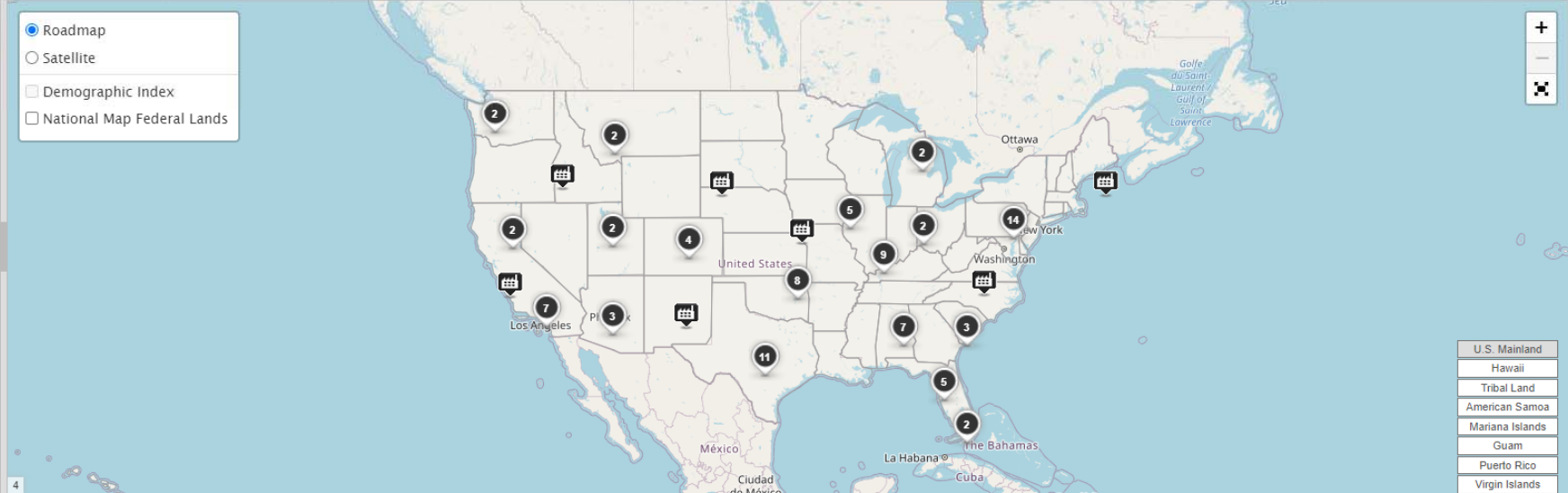
Legend | Layer Options

- Roadmap
- Satellite
- Demographic Index
- National Map Federal Lands

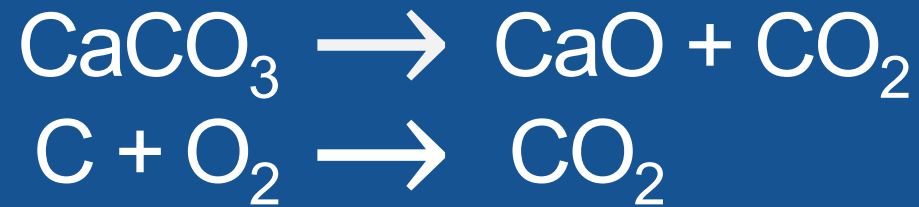
All Emitters

- All Emitters and Point Sources
- Onshore Petroleum Natural Gas Production and Gathering & Boosting
- Local Distribution Companies and Onshore Gas Transmission Pipelines
- SFG from Electrical Transmission and Distribution
- Equipment Use
- Suppliers
- CO₂ Injection (IU)
- Geologic Sequestration of CO₂ (RR)
- Multiple Facilities

Demographic Index | National Map Federal Lands



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

U.S. Cement Industry contribution to U.S. GHG = 2.5% CO_{2eq}

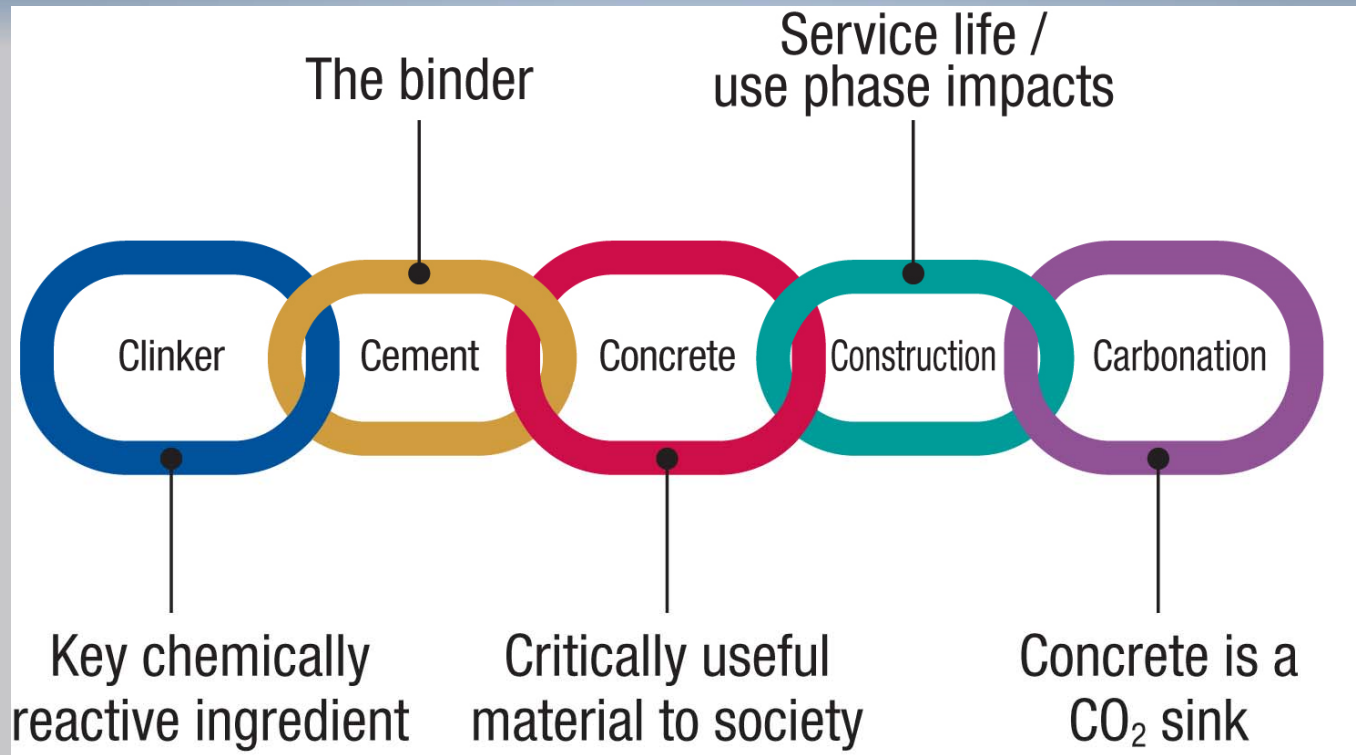
SOCIETY NEEDS CONCRETE... AND CONCRETE NEEDS SOCIETY



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THE VALUE CHAIN – WHY THIS APPROACH?



ACTIONS THE CEMENT INDUSTRY IS TAKING TODAY

AT THE CEMENT PLANT



Increase the use of decarbonated raw materials



Decrease the use of traditional fossil fuels by 5X



Increase the use of alternative fuels



Push efficiency and decrease energy intensity for one metric ton of clinker



Utilize carbon capture to avoid the release of CO₂ emissions

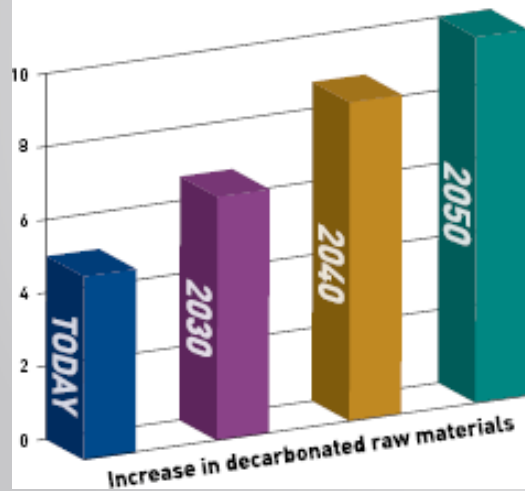


Reduce clinker production emissions

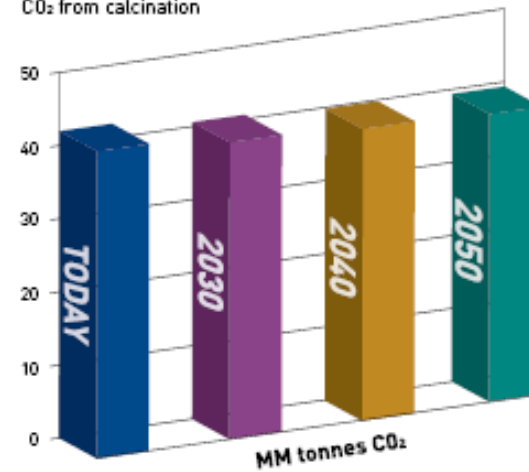
AT THE PLANT: ALTERNATIVE RAW MATERIALS

Making cement: Addressing the chemical fact of life

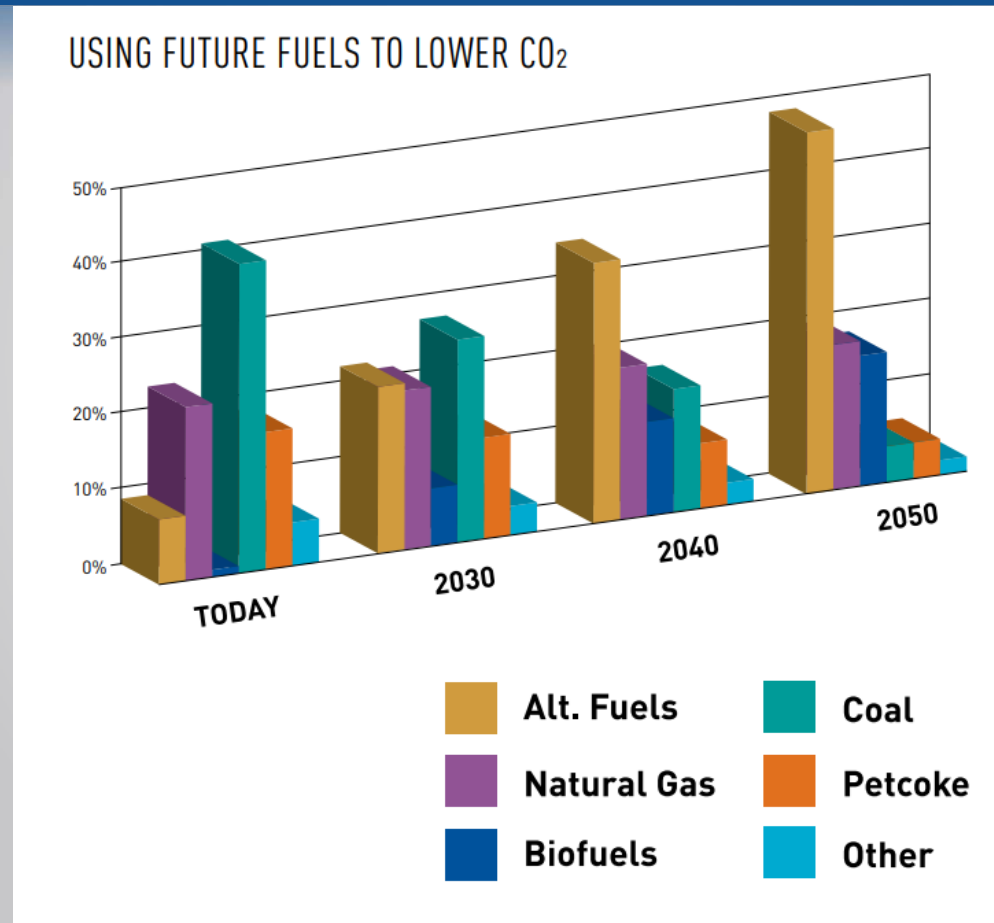
HOW WE'LL GET THERE
Percent of decarbonized raw materials



THE RESULTS
CO₂ from calcination

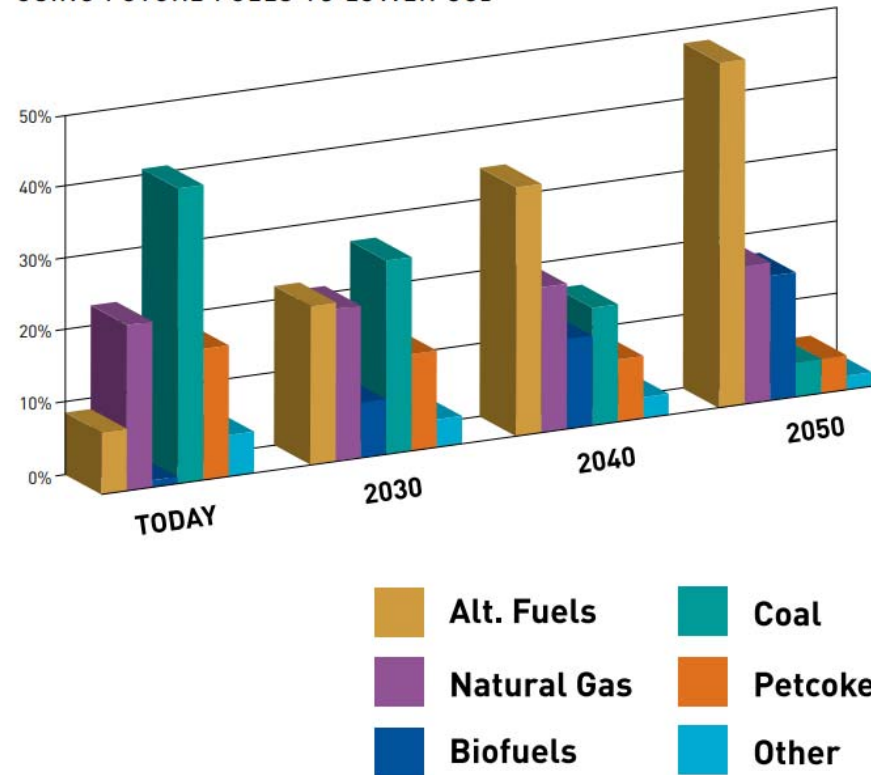


AT THE PLANT: FUEL SWITCHING/FUEL SUBSTITUTION



AT THE PLANT: INCREASING COMBUSTION EFFICIENCY

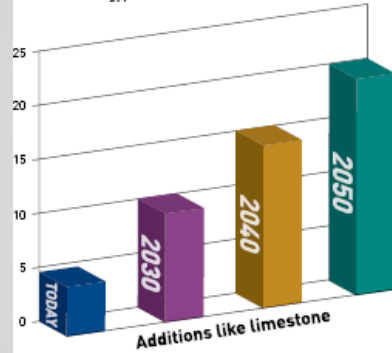
USING FUTURE FUELS TO LOWER CO₂



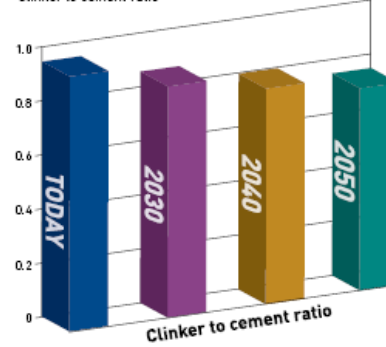
AT THE PLANT: OPTIMIZING THE PRODUCT

Optimizing cement: Changing the composition

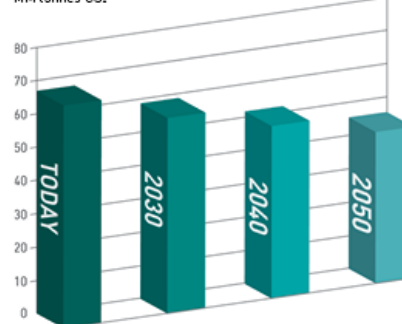
HOW WE'LL GET THERE: PART 1
Percent of non-gypsum additions



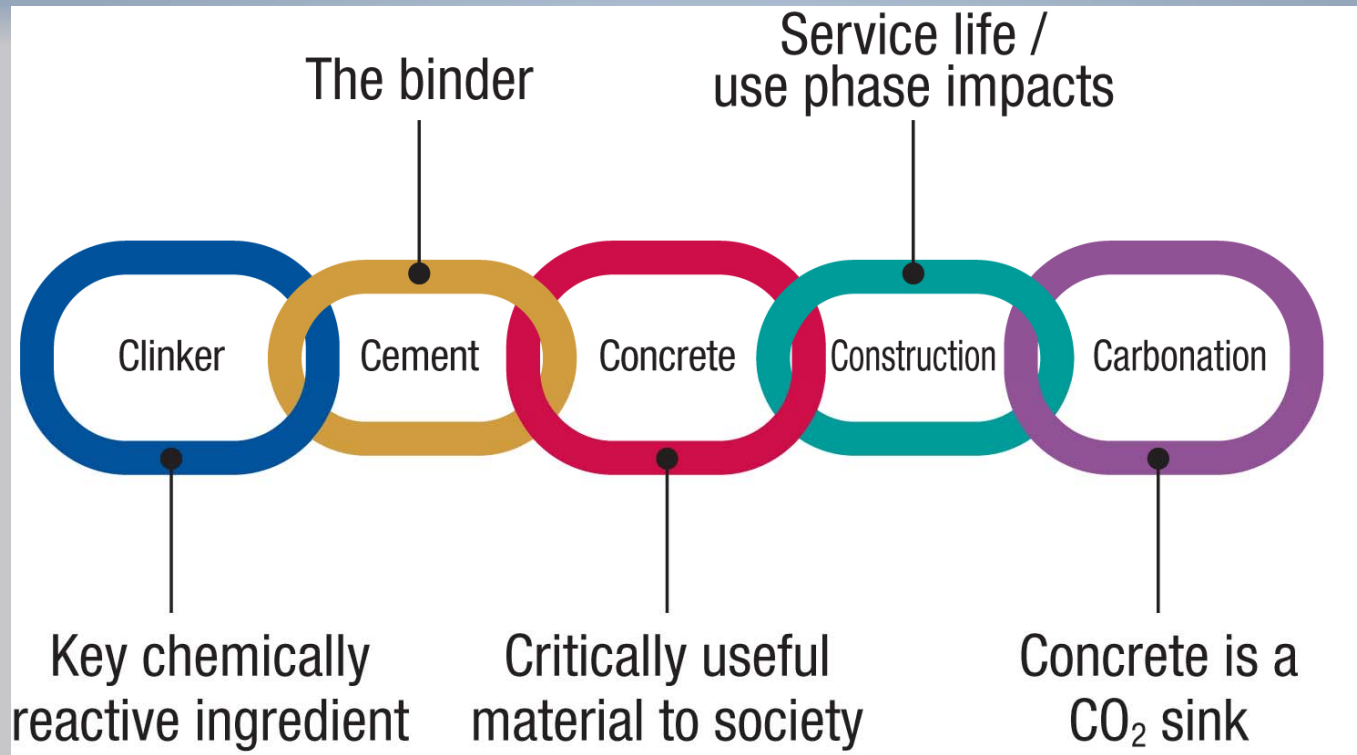
HOW WE'LL GET THERE: PART 2
Clinker to cement ratio



THE RESULTS
MM tonnes CO₂



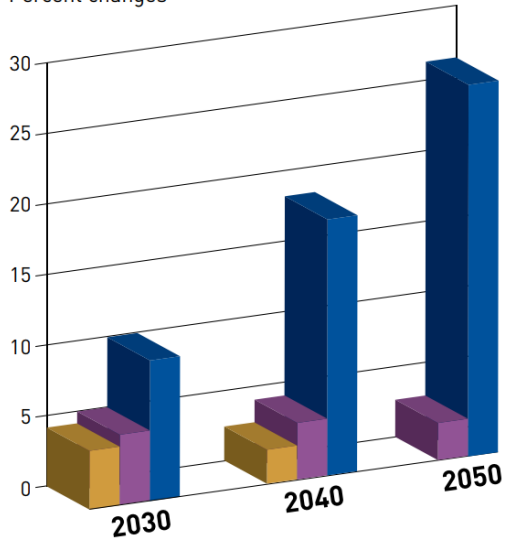
WHAT ACTIONS CAN BE TAKEN BEYOND THE PLANT AND BEYOND THE PRODUCT?



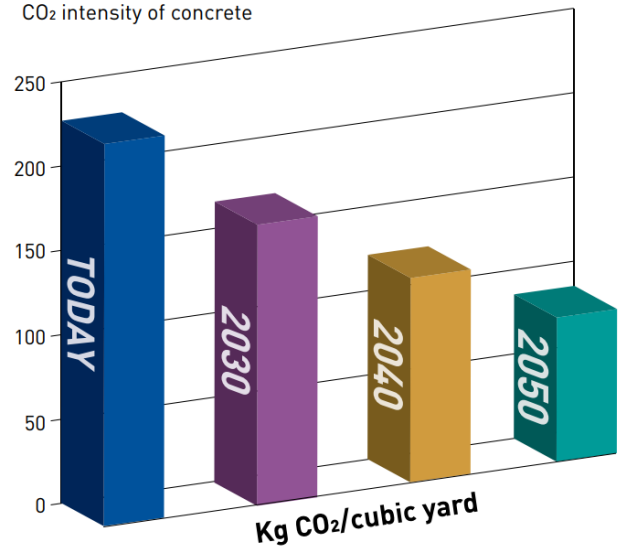
OPTIMIZING CONCRETE

Optimizing concrete: Pushing performance

HOW WE'LL GET THERE
Percent changes



THE RESULTS
CO₂ intensity of concrete



OPTIMIZING CONCRETE FURTHER

OPTIMIZING THE DESIGN AND CONSTRUCTION OF THE BUILT ENVIRONMENT



Lower concrete manufacturing
emissions to zero at the plant



Transition to zero
emission fleets

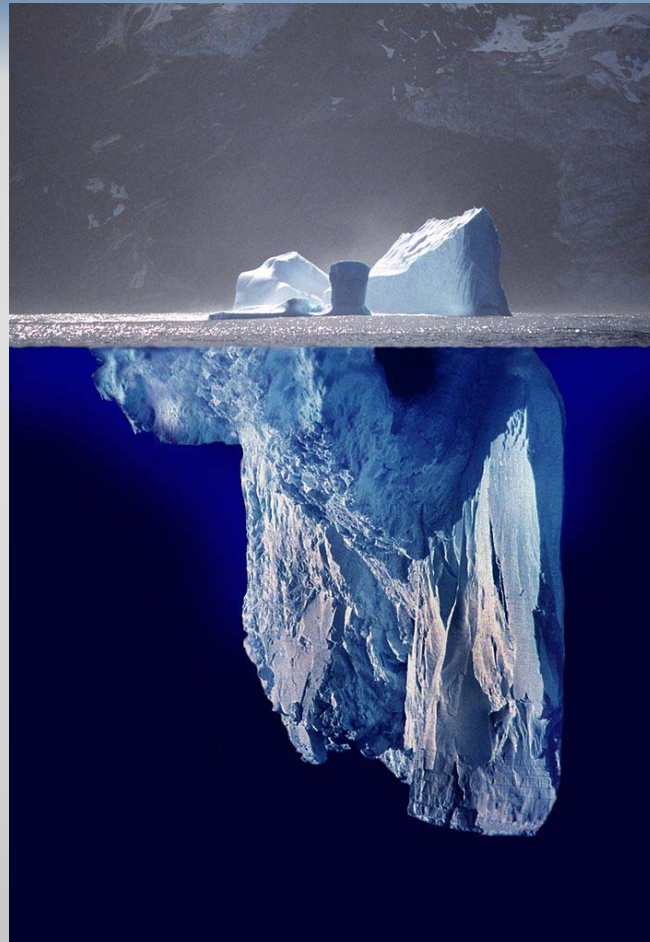


Optimize
concrete mixes

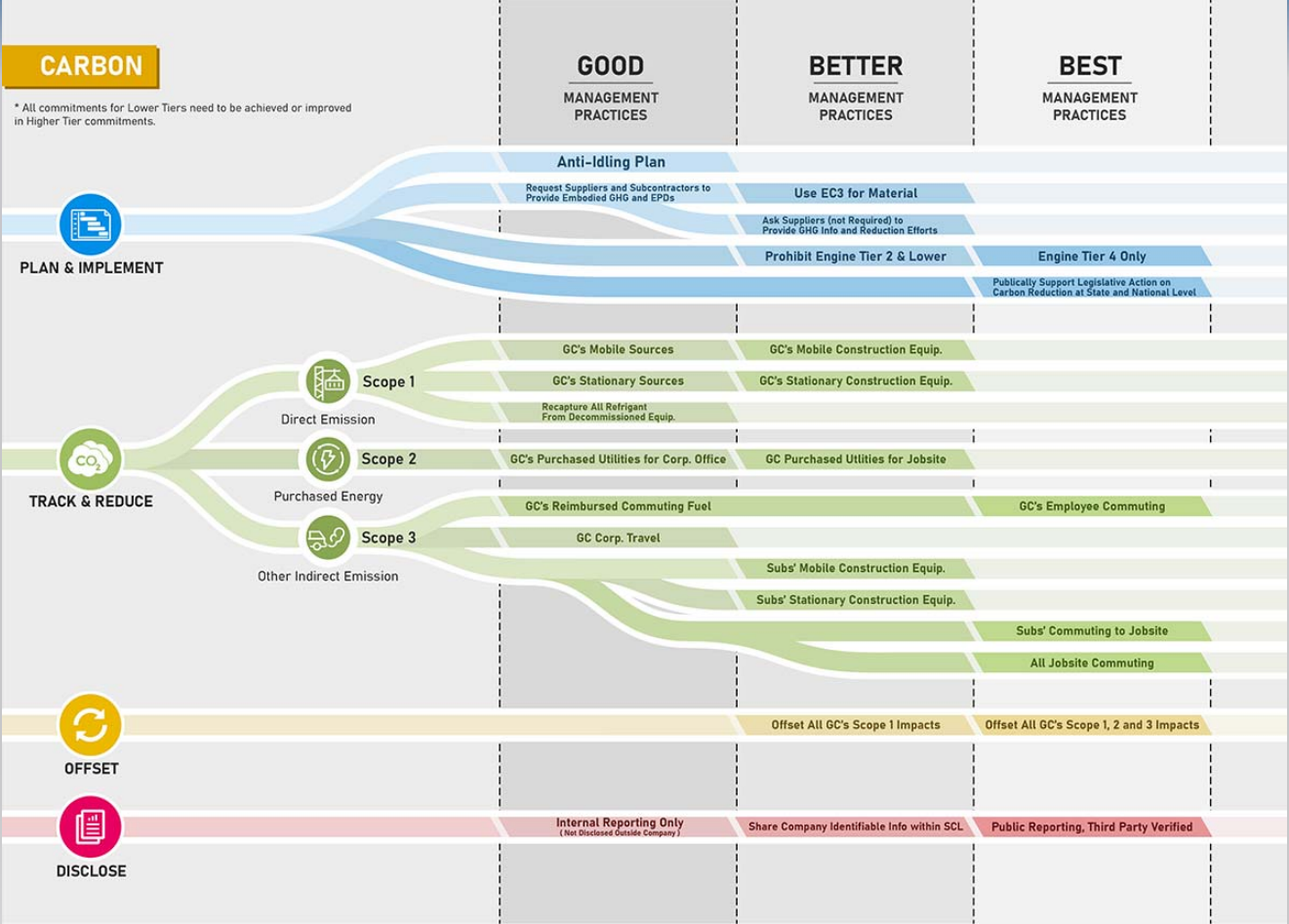


Reduce
overdesign

LOWEST INITIAL CARBON MAY NOT EQUAL LOWEST OVERALL CARBON

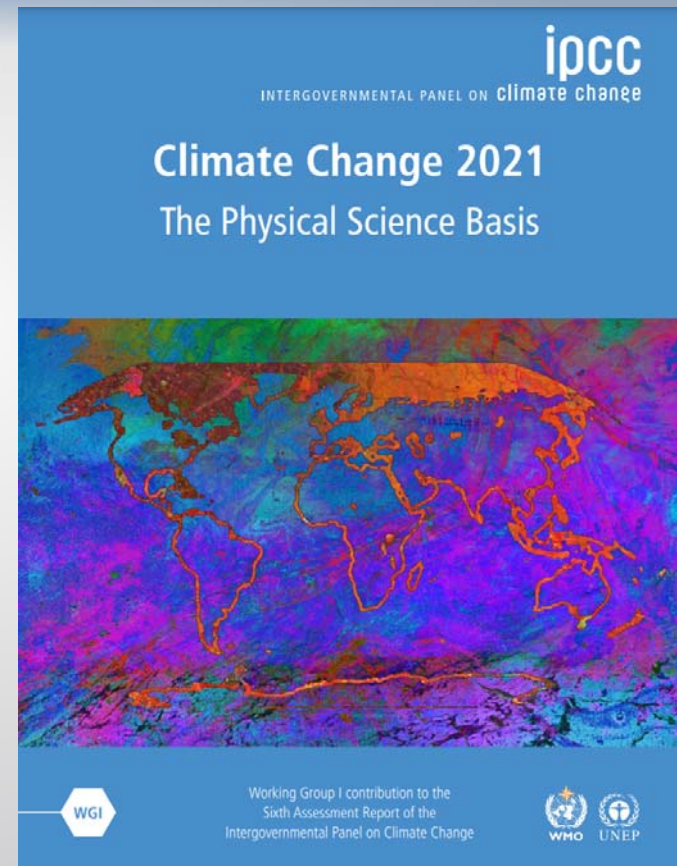


TRENDS TODAY TO DECARBONIZE THE CONSTRUCTION SITE



RECOGNITION OF CARBON UPTAKE BY IPCC

Direct CO₂ emissions from carbonates in cement production are around 4% of total fossil CO₂ emissions, and grew at 5.8% yr⁻¹ in the 2000s but a slower 2.4% yr⁻¹ in the 2010s. **The uptake of CO₂ in cement infrastructure (carbonation) offsets about one half of the carbonate emissions from current cement production (Friedlingstein et al., 2020).**



THE BIG TEN



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

QUESTIONS?
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