



Low-Carbon Cement and Concrete Demand and Legislation

ACI Concrete Convention

October 17th, 2021

California Nevada Cement Association

WHO WE ARE

- A non-profit trade association
- Funded by the seven producers and distributors of Portland cement in CA & NV
- Advocates for infrastructure funding
- In partnership with agencies/owners, consultants, and contractors to provide:
 - Research
 - Educational opportunities
 - Design assistance
 - Technical expertise
 - Construction feasibility



Agenda

Objective: Describe the drivers that are leading to the demand for lower carbon cement and concrete

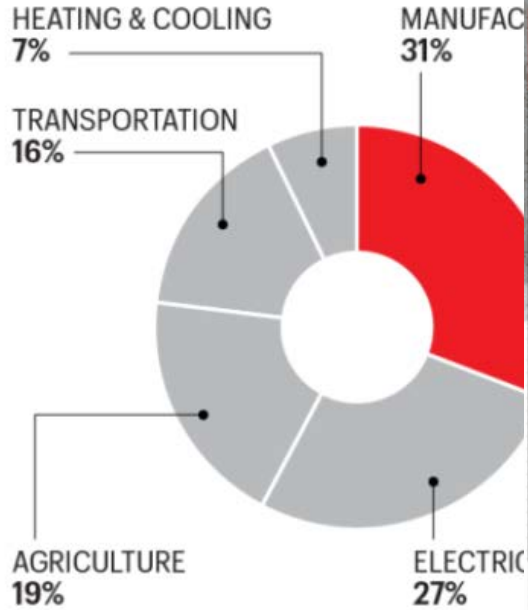
- Perception vs Reality
- Internal Needs
- Private Owners
- Public Owners
- Designers
- Legislation
- Local Codes



PLC Concrete at UCSD

Perception

SOURCES OF GREENHOUSE GAS EMISSIONS THE LARGEST SOURCE OF GREENHOUSE GAS EMISSIONS FROM MANUFACTURING. CEMENT PRODUCTION IS RESPONSIBLE FOR 31% OF ALL MANUFACTURING EMISSIONS.



SOURCE: RHODIUM GROUP



Guardian concrete week

Concrete: the most destructive material on Earth

After water, concrete is the most widely used substance on the planet. But its benefits mask enormous dangers to the planet, to human health - and to culture itself

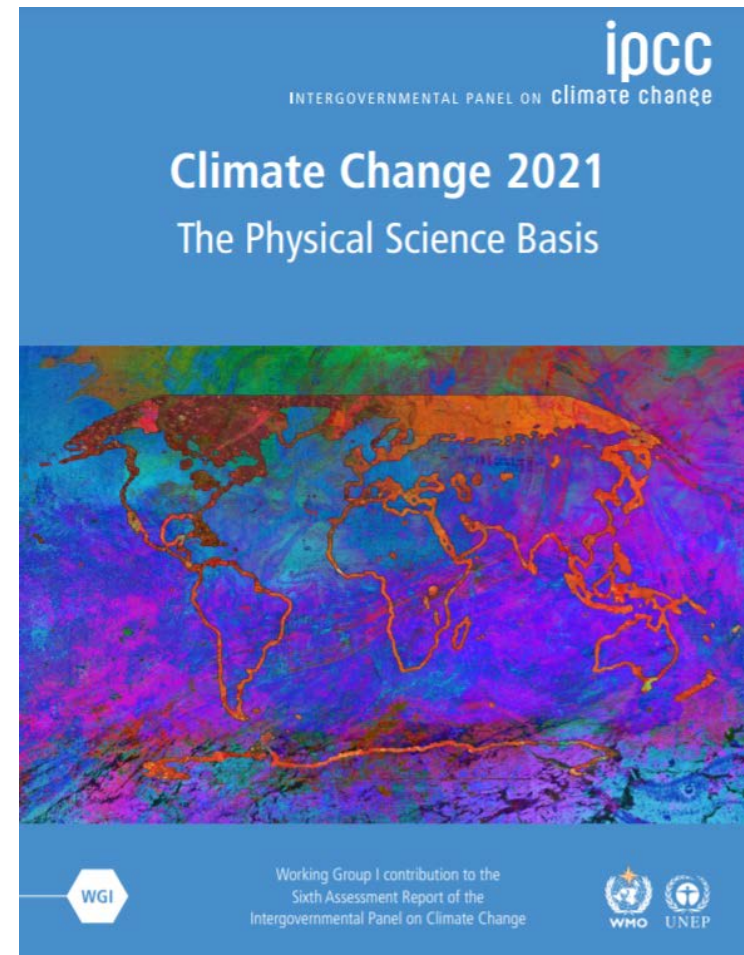
TRY
ENGE



Reality

"Direct CO2 emissions from carbonates in cement production are around four per cent of total fossil CO2 emissions,"

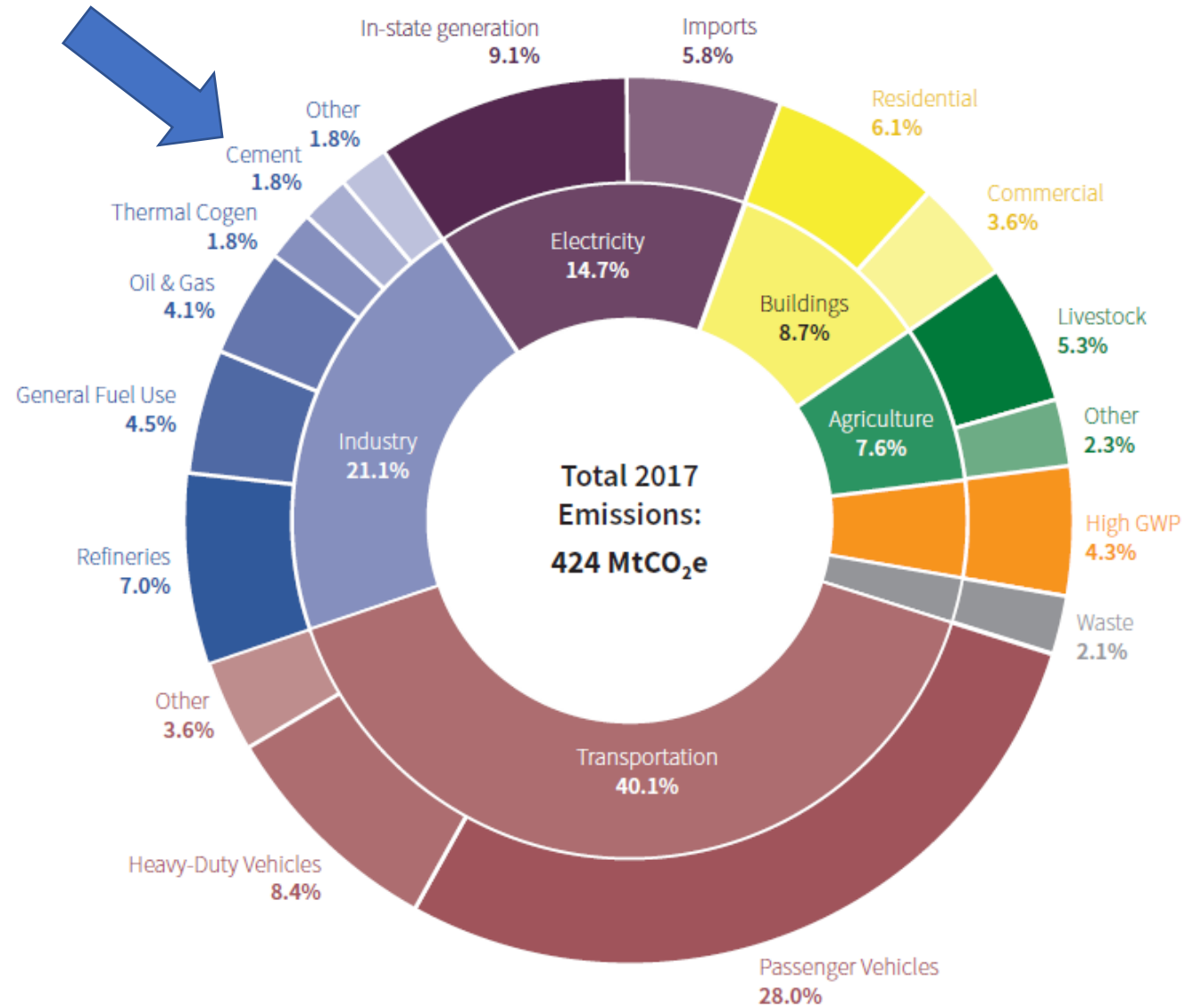
"The uptake of CO2 in cement infrastructure (carbonation) offsets about one half of the carbonate emissions from current cement production."



Intergovernmental Panel on Climate Change (IPCC)
26th UN Climate Change Conference of the Parties
(COP26) – 3949 pages

Reality

CALIFORNIA GREENHOUSE GAS EMISSIONS BY SECTOR AND SUBSECTOR, 2017



**The California
Cement Industry
is committed to
carbon neutrality
by 2045**



PLC accomplishes about 10% of this goal

Private Owners



ENR 2020 Top 100 Green Building Contractors

RANK 2020	RANK 2019	FIRM	GREEN ACCREDITED STAFF	GREEN DESIGN REVENUE (\$ MIL.)
1	1	THE TURNER CORP., New York, N.Y.	1051	6,560.34
2	3	CLARK GROUP, Bethesda, Md.	439	4858.45
3	4	SWINERTON, San Francisco, Calif.	194	4152.60
4	2	AECOM, Los Angeles, Calif.	1000	3384.65
5	5	HENSEL PHELPS, Greeley, Colo.	508	3143.06
6	6	SKANSKA USA, New York, N.Y.	339	2675.53
7	10	THE WHITING-TURNER CONTRACTING CO., Baltimore, Md.	305	2430.26
8	11	CLAYCO, Chicago, Ill.	100	2377.00
9	8	GILBANE BUILDING CO., Providence, R.I.	335	2176.07
10	14	PCL CONSTRUCTION, Denver, Colo.	298	2108.40

SIZE OF THE U.S. GREEN BUILDING MARKET

\$81bn

SHARE OF U.S. COMMERCIAL OFFICE GREEN BUILDING DESIGN MARKET

21.2%

REVENUE OF U.S. EDUCATIONAL GREEN CONTRACTING MARKET

759.06m USD

Source: Statista.com

Public Owners

MUSH Sector: Municipalities, Universities, Schools & Hospitals

SLED agencies: State, Local, Education

50 States

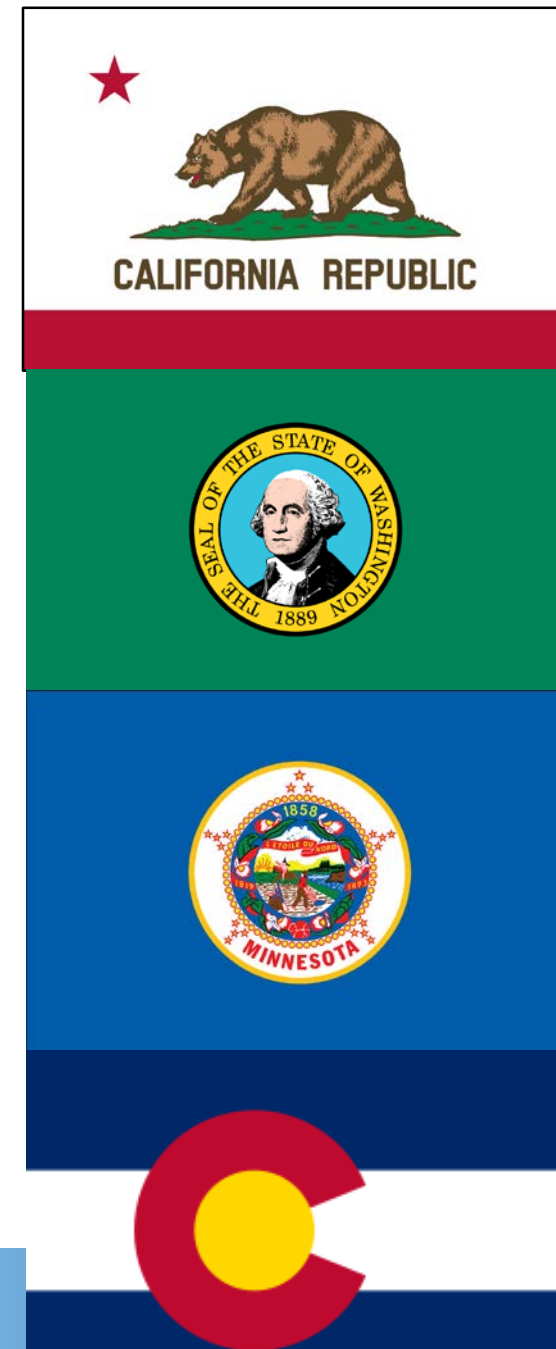
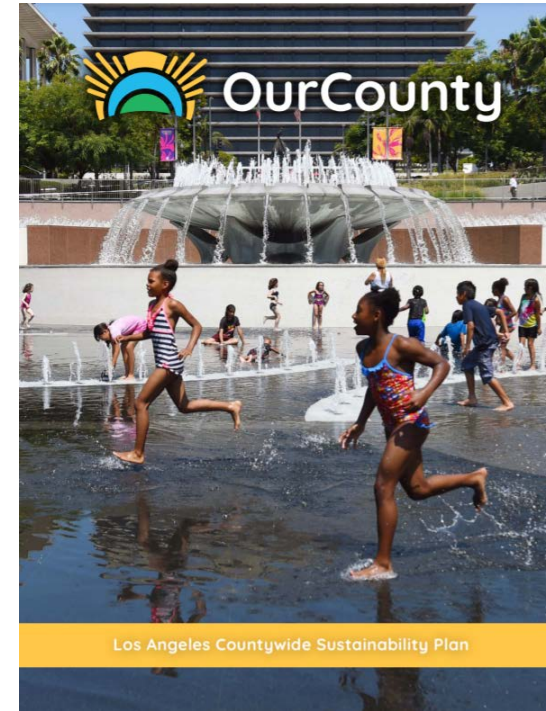
3,000+ Counties / Boroughs / Parishes

36,000+ Cities / Towns / Municipalities

12,000+ Public School Systems

2,000+ Higher Education Institutions

38,000+ Special Districts



Designers



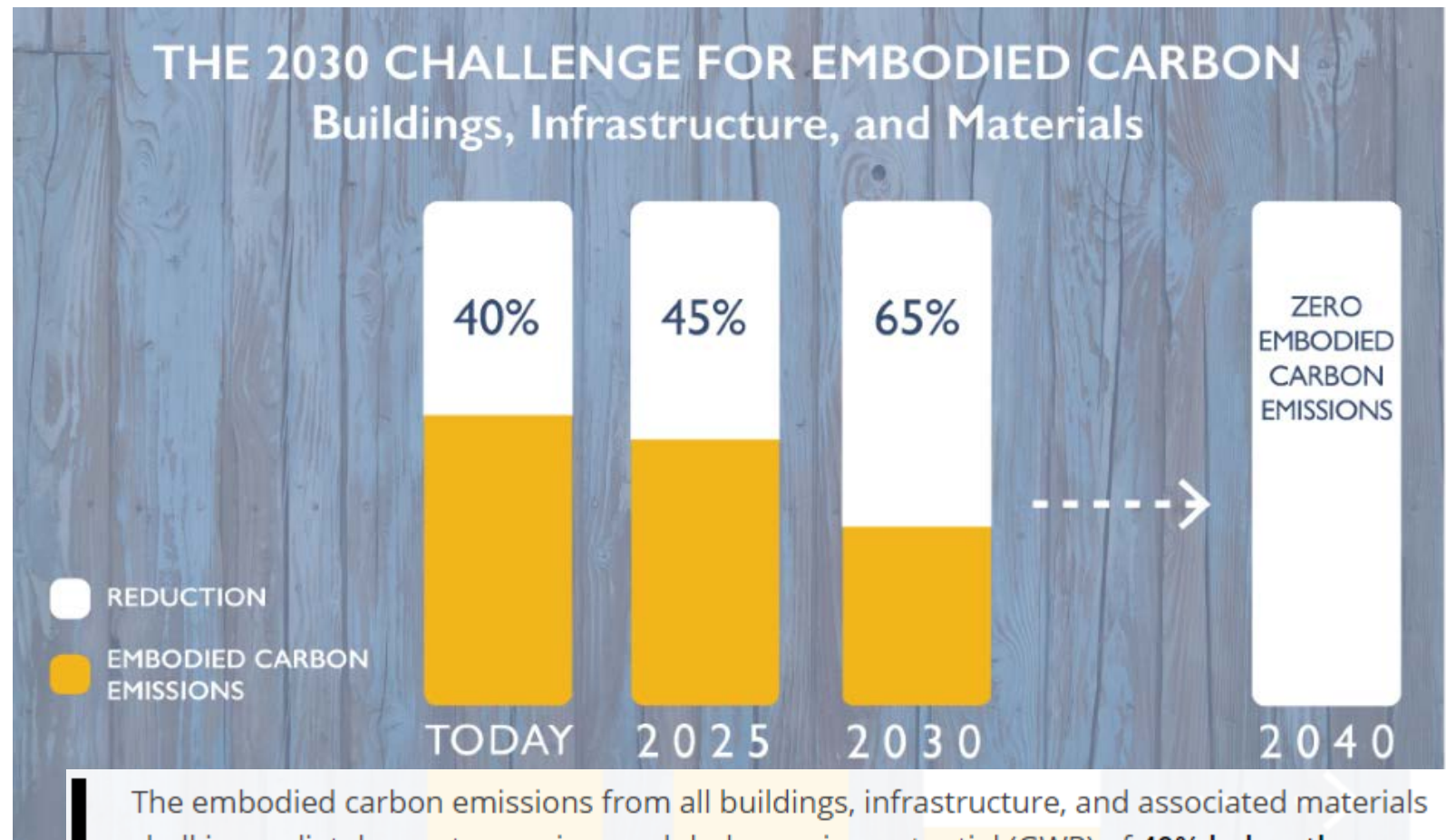
AIA



2030 CHALLENGE

All new buildings, developments, and major renovations shall be carbon-neutral by 2030.

Designers

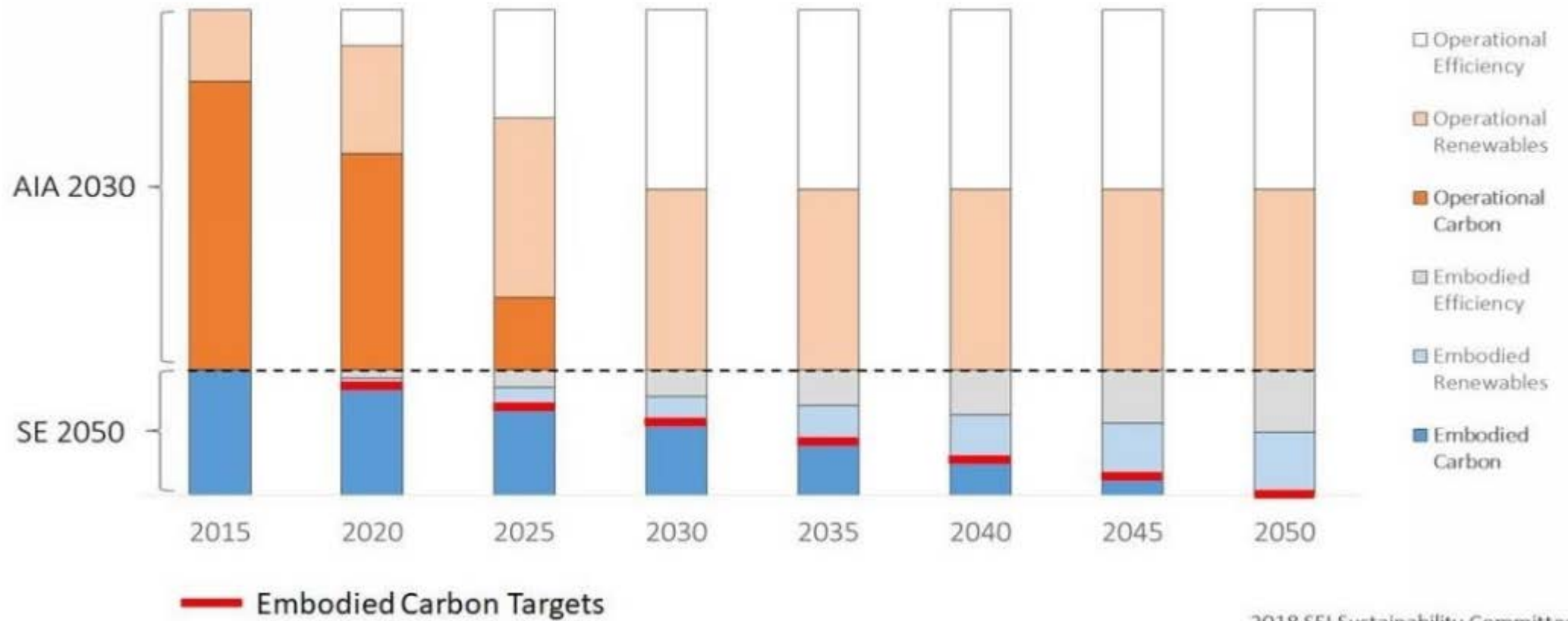


The embodied carbon emissions from all buildings, infrastructure, and associated materials shall immediately meet a maximum global warming potential (GWP) of **40% below the industry average today**. The GWP reduction shall be increased to:

- 45% or better in 2025
- 65% or better in 2030
- Zero GWP by 2040

Designers

SE 2050 + AIA 2030



2018 SEI Sustainability Committee

Environmental Legislation

Laws

Bills

Codes



CARB: California Air Resources Board

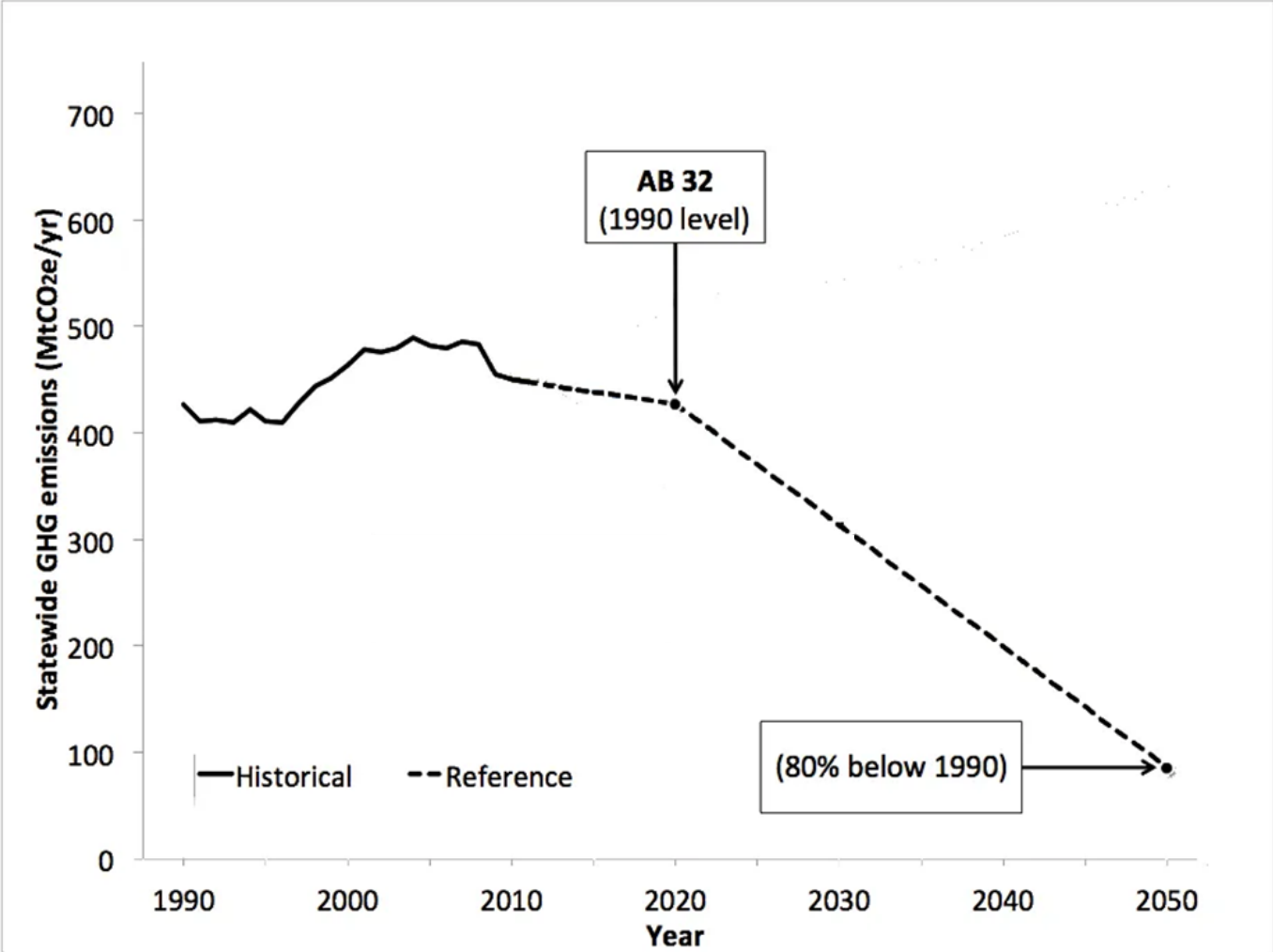
- Established in 1967 when Ronald Reagan signed the Mulford-Carrell Act
- CARB's mission is to promote and protect public health, welfare, and ecological resources through effective reduction of air pollutants while recognizing and considering effects on the economy.
- CARB is the lead agency for climate change programs and oversees all air pollution control efforts in California to attain and maintain health-based air quality standards.
- The state's 'Clean Air Agency'



AB-32: California Global Warming Solutions Act (2006)

- Established GHG targets:
 - Back to 2000 levels by 2010
 - To 1990 levels by 2020 (431 MMT CO₂e)
 - To 80% below 1990 levels by 2050 (86 MMT CO₂e)
- Authorized CARB Cap-and-Trade Program as a carbon pricing mechanism
- Requires 'large' industrial sources to report and verify their GHG emissions
- Scoping Plan gets updated every five years (looks at effectiveness, emissions 'trajectory', and new technology and areas for improvement)

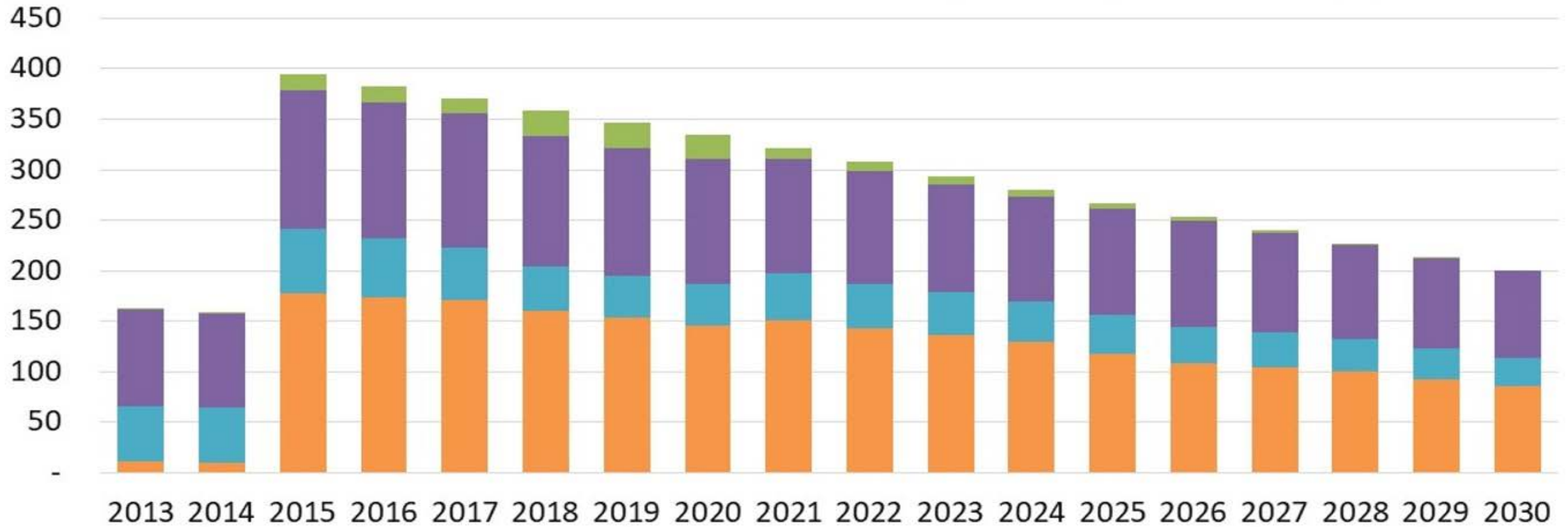
AB-32: California Global Warming Solutions Act (2006)



Cap and Trade (2012)

- Covers +/- 80% of the state's GHG emissions from +/- 600 entities
- Annual auction floor price for allowances increases 5% each year
 - (Currently \$17.71)
- Allowances (credits) available reduce by 4% each year (The Cap)
- Credits are allocated up to what is allowed to be emitted
- Additional credits can be bought or traded for (The Trade)
- Some allowances are “allocated” (given for free) to industry to aid in the transition and to help prevent “leakage”
- August 2021 auction average **\$23.30**, generated \$1.6B
- \$18.3B since inception

2013–2030 Allowances by Year (MMTCO₂e)

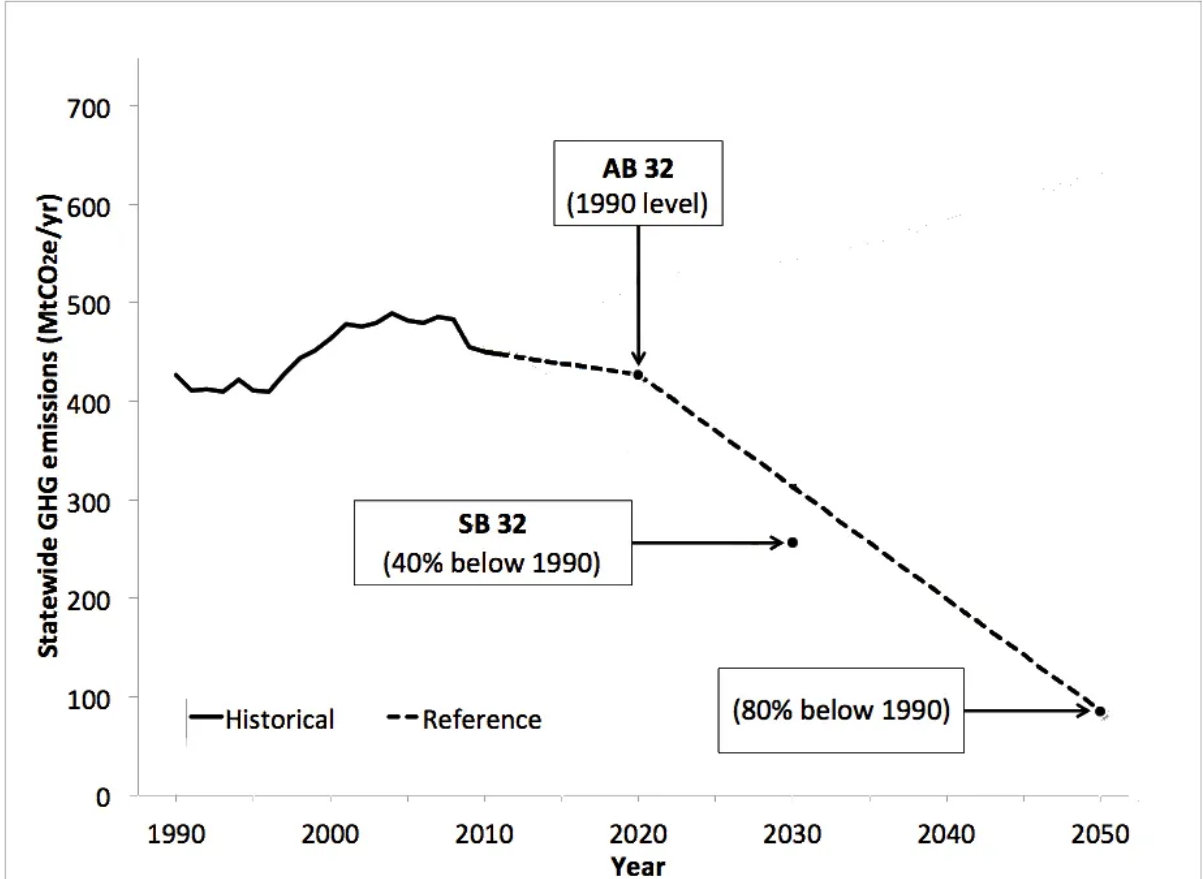


- Allowance Price Containment Reserve *
- Allocation to Electrical Distribution Utilities and Natural Gas Suppliers
- Industrial and Other Allocation (estimate)
- State-Owned Allowances

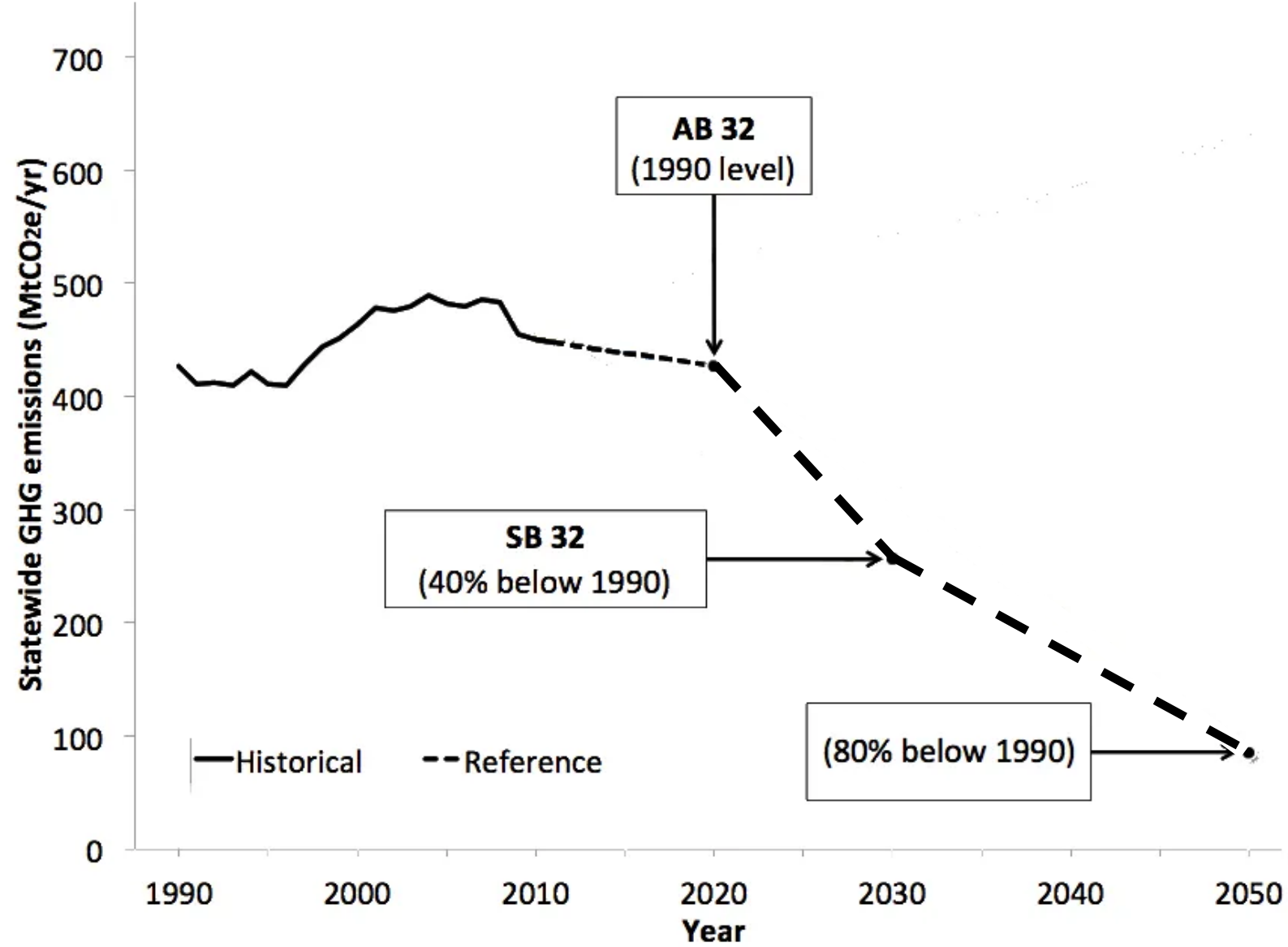
*Some allowances were put into a reserve at the start of the cap-and-trade program. If an entity could not meet the allowance requirement, they could purchase from this reserve at a higher price. This contingency has never been used.

SB-32: California Global Warming Solutions Act (2016)

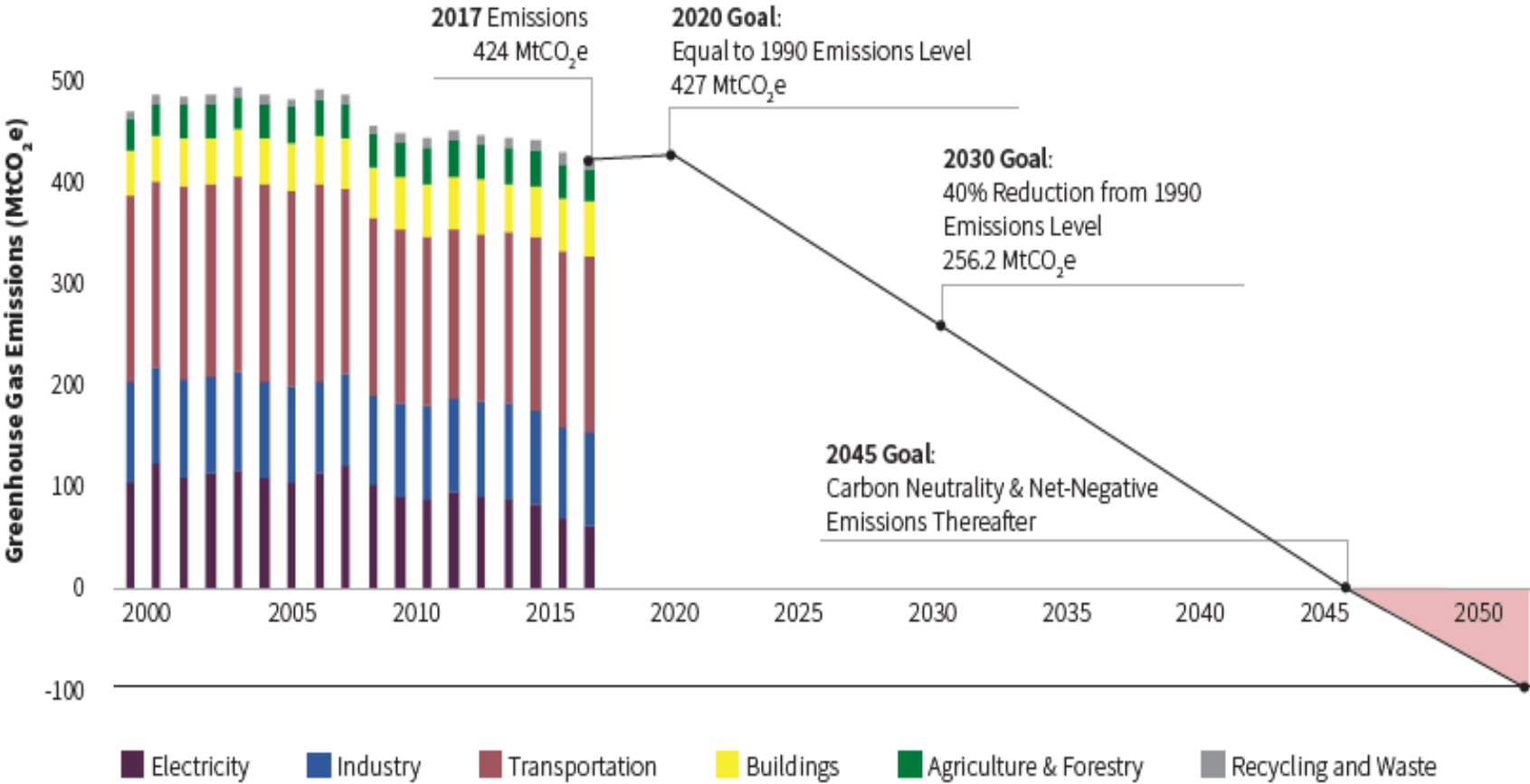
Mandates a reduction in GHG emissions to 40% below the 1990 levels by 2030 (258.6 MMT CO₂e)



SB-32: Trajectory



E.O. B-55-18 (2018)

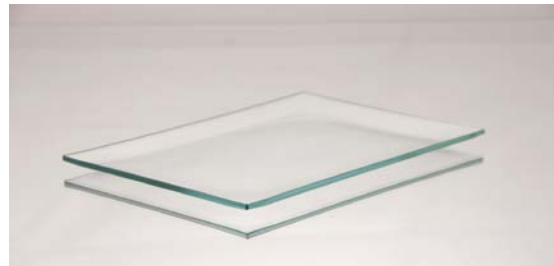


California has already met its 2020 emission reduction target; however, it has increasingly stringent goals in 2030 and by midcentury that require additional technologies, policies, and decarbonization solutions. Source: Energy Futures Initiative and Stanford University, 2020.

AB 262: Buy Clean California Act (Bonta 2017)

- EPDs required for some building materials for state-funded projects:
 - Carbon-steel rebar, flat glass, mineral-wool board insulation, and structural steel
 - Initially included concrete
- Requires Department of General Services to establish maximum acceptable GWPs
- Limits are reviewed and adjusted every 3 years (can only go down)

*A new assembly bill (AB-137) was signed extending the implementation date by 18 months to July of 2022



SB 778: Buy Clean Concrete (Becker 2021)



- EPDs for all concrete
- CARB to determine maximum GWP for concrete
 - Industry average for concrete within each project region and performance class
- Bidders demonstrate compliance w. limits or disqualification
- Agencies must use only performance-based concrete specifications
 - No more cement limits
- Potential low carbon discount of up to 5% of a bid's concrete price to a bid with low total concrete CO₂e in comparison to other qualified bids*

*Retracted by Sen. Becker – will come back with input from CNCA, Caltrans, SWCPA, CalCIMA, others

SB 596: Greenhouse gasses – cement (Becker 2021) – now law



- Net-zero or net-negative GHG cement by 2045
- CARB to have plan in-place by July 2023
- Cement GHG to be 40% below the 2019 levels by 2030
- Requires accounting for imported cement

One Bold Goal. Three Pathways. Nine Levers.

 ✓ = Action is necessary to remove barriers and fully unlock pathway.

Measure	Legislative Assistance	Regulatory Assistance	Public Acceptance	Public Funding	RD&D	Supply Limitations
PATHWAY 1: PROCESS EMISSIONS						
Portland Limestone Cement (PLC)	-	✓	✓	-	-	-
Carbon Capture Use & Storage (CCUS)	✓	✓	✓	✓	✓	-
Alternative Raw Materials (ARM)	-	✓	✓	-	✓	✓
Alternative Cements & Clinkers	-	-	-	-	✓	✓
PATHWAY 2: COMBUSTION EMISSIONS & FUEL SWITCHING						
Natural Gas	✓	✓	✓	-	-	✓
Waste Derived Fuels	✓	✓	✓	-	-	✓
Biomass	✓	✓	✓	✓	-	✓
PATHWAY 3: ELECTRICITY GENERATION						
Waste Heat Recovery	✓	-	✓	-	✓	-
On-Site Renewables	✓	-	✓	-	-	-

Local Code: Marin County Low-Carbon Concrete (2019)



Marin County Low-Carbon Concrete Code (2019)

Table 19.07.050 Cement and Embodied Carbon Limit Pathways

	Cement limits for use with any compliance method 19.07.050.2 through 19.07.050.5	Embodied Carbon limits for use with any compliance method 19.07.050.2 through 19.07.050.5
Minimum specified compressive strength f_c , psi (1)	Maximum ordinary Portland cement content, lbs/yd ³ (2)	Maximum embodied carbon kg CO ₂ e/m ³ , per EPD
up to 2500	362	260
3000	410	289
4000	456	313
5000	503	338
6000	531	356
7000	594	394
7001 and higher	657	433
up to 3000 light weight	512	578
4000 light weight	571	626
5000 light weight	629	675
Notes		
(1) For concrete strengths between the stated values, use linear interpolation to determine cement and/or embodied carbon limits.		
(2) Portland cement of any type per ASTM C150.		

Marin County Low-Carbon Concrete Code Development Doc.

To meet a goal of zero emissions by 2050, reductions imposed by code would have to ratchet down concrete emissions on an aggressive schedule that both anticipates and prompts developments in cements and carbon-storing technologies. That schedule would look something like the following (based on 2014 NRMCA values):

2020	10--30%	(current proposal)
2023	18%	
2026	26%	
2029	34%	
2032	45%	
2035	56%	
2038	67%	
2041	78%	
2044	85%	
2047	93%	
2050	100%	(requiring zero carbon technologies we have yet to invent)

- » California
 - » Buy Clean California Act (passed)
 - » AB-1365 (Public contracts: clean concrete)
 - » AB-1369 (Public Contracts: eligible materials)
 - » Caltrans EPD Implementation Project
 - » Marin County Low Carbon Concrete Code
 - » Los Angeles Executive Order No. 25 – LA’s Green New Deal, Sustainable City pLAN
 - » Los Angeles Clean Construction Declaration
 - » City of San Francisco Climate Action Plan
 - » Oakland 2030 Equitable Climate Action Plan
 - » Dublin Climate Action Plan 2030 and Beyond
 - » Albany 2019 Climate Action and Adaptation Plan

- » Colorado
 - » CO SB159 (Buy Clean Colorado, not passed)
 - » HB21-1303 (Buy Clean Colorado, passed in 2021)
 - » Minnesota:
 - » BE086 (Buy Clean and Buy Fair Minnesota Act, pilot bill)
 - » Amendment to HF278
 - » Minnesota B3 Program
 - » Texas
 - » City of Austin Climate Equity Action Plan
 - » City of Austin Green Building Program
 - » Hawaii:
 - » State of Hawaii HB1282 HD1
 - » City of Honolulu Resolution 18-283
- <https://carbonleadershipforum.org/clf-policy-toolkit/>

- » Connecticut
 - » HB 5444
- » New Jersey
 - » Assembly Bill 5223
 - » Assembly Bill A4933
- » New York
 - » New York State Low Embodied Carbon Concrete Leadership Act (LECCLA)
 - » Port Authority of NY & NJ Clean Construction Program
 - » Hastings-on-Hudson Low Embodied Carbon Concrete Resolution
- Federal
 - » CLEAN Future Act
 - » Advice Letter: Policy Recommendations for Procurement of Low Embodied Energy and Carbon Materials by Federal Agencies
 - » FHWA Order 4460.3A – Green Procurement Planning





Questions?

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