Zero Net Carbon Building Zoning

Embodied Carbon Public Meeting Presentation

boston planning & development agency

April 27, 2021

Zoom Meeting Guidance

The BPDA will record this meeting and post it on BPDA's Zero Net Carbon Building Zoning webpage. The recording will include the presentations, discussions and a transcript of Q&A / Chat comments.

It is possible that participants may be recording this meeting as well.

If you prefer not to be recorded during the meeting, please turn off your microphone and camera.

Zoom Meeting Guidance

- Help us ensure that this conversation is a pleasant experience for all.
- Please mute your mics during the presentation to avoid background noise.
- It's great to see you! Participant video can be on during the meeting.
- **Use the Chat** feature for questions and comments during the presentation.
- Use the Raise Hand feature during the discussion segment.
- Please be respectful of each other's time.

- As always please feel free to reach out to me directly!
  John Dalzell, AIA, LEED Fellow at John.Dalzell@Boston.gov

COVID-19 Resources

Stay up-to-date with COVID-19 related announcements, City of Boston reopening plans, and resources for you and your community at:

boston.gov/coronavirus

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AGENDA

1. Welcome and ZNC Overview (10 min)
2. What is embodied carbon (10 min)
3. Emerging Low Carbon Solutions (10 min)
4. Policy Examples (10 min)
5. Questions and Discussion (30 min)
6. Leadership CLF Boston Hub (5 min)
7. Next Steps (5 min)

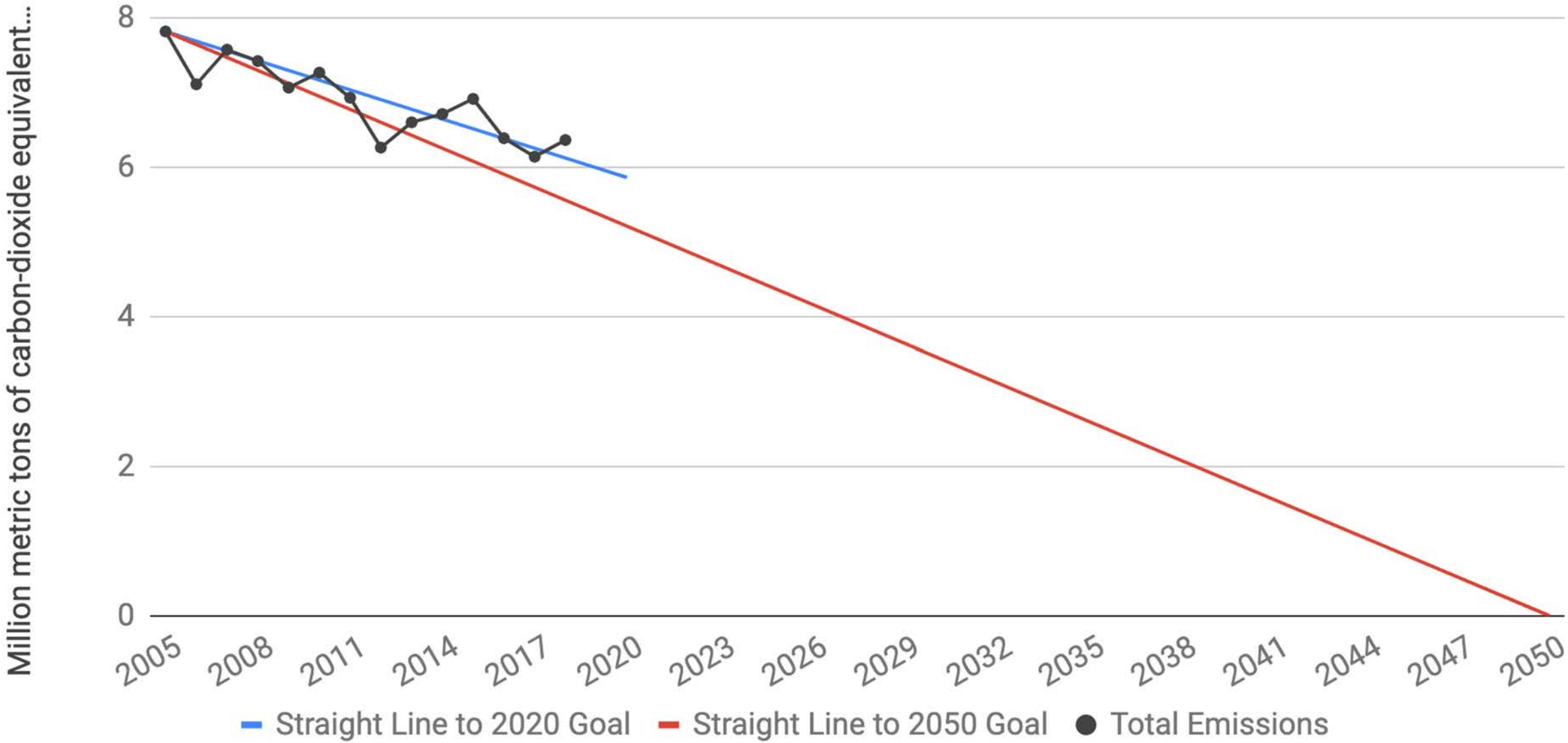
GOALS

- Raise awareness of the impacts of building embodied carbon and low carbon building materials and practices
- Assess standards and policies for reducing building embodied carbon
- Identify action opportunities to reduce building embodied carbon and advance practices and policies

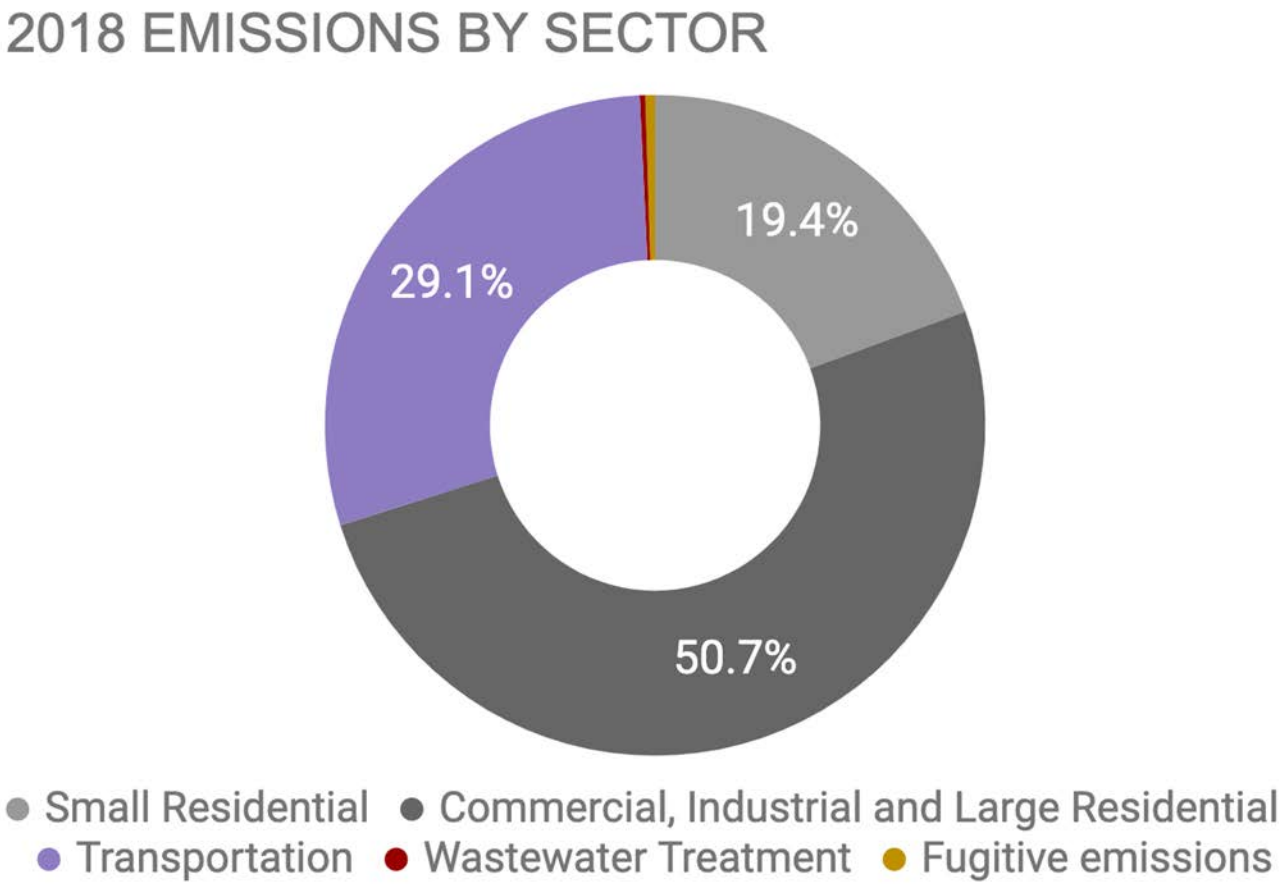
B

RESILIENT BOSTON HARBOR

BOSTON COMMUNITY GREENHOUSE GAS EMISSIONS



Scope 1, Scope 2… Scope 3?



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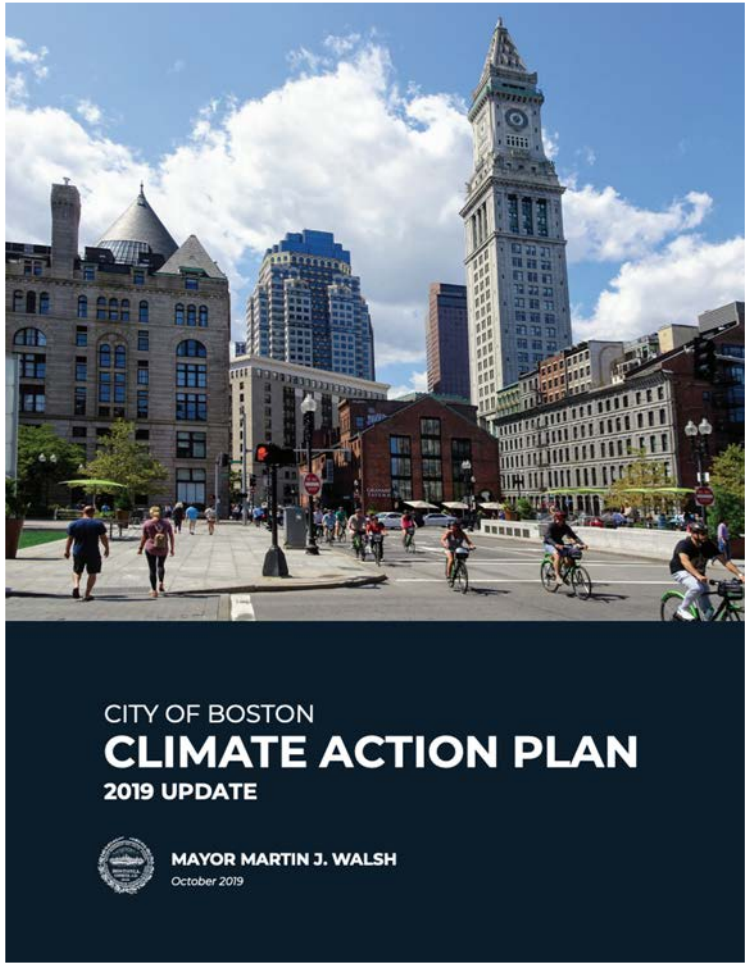
2019 Climate Action Plan Update

Based on the results of Carbon Free Boston, we identified 18 strategies to accelerate emissions reductions, including:

- Strengthen green building zoning requirements to a zero net carbon standard
- Develop a building emissions performance standard
- Decarbonize the consumption of Boston residents and businesses
    - Explore embodied carbon and action to increase material reuse and use of carbon-sequestering materials



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ZNC Building Zoning

POLICY FRAMEWORK

- **Low Carbon Building**
  Establish attainable reach emission targets
- **On-site Renewable Energy**
  Optimize Generation within limitations
- **Renewable Energy Procurement**
  Establish weighted affordable and meaningful options and standards

PRACTICE & REPORTING

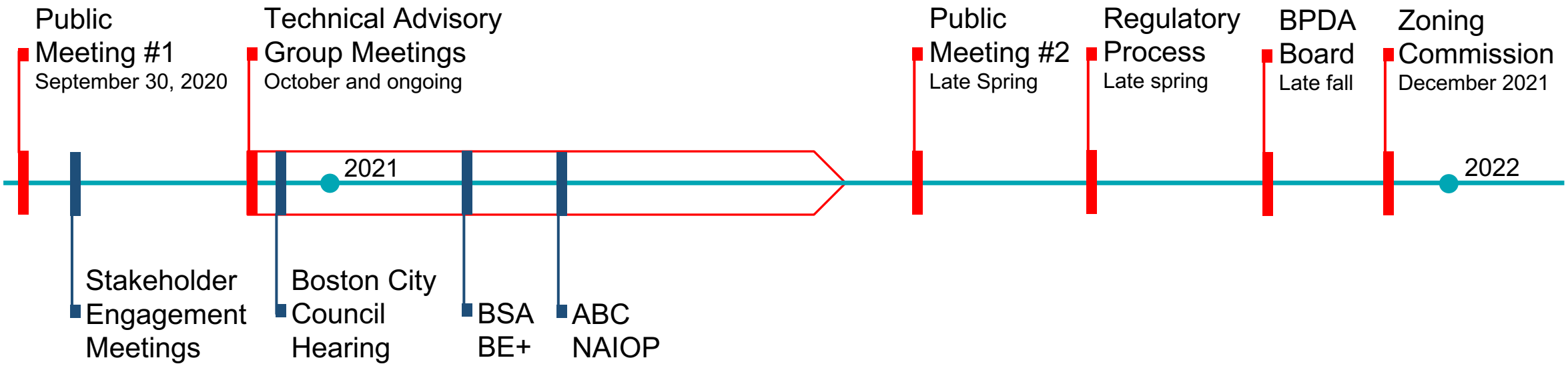
- **Utilize Industry Best Practices**
  Work with existing & emerging standards
- **Update Review / Reporting Procedures**
  Align ZNC and BERDO standards and coordinate metro area policies

PRINCIPLES & VALUES

- **Leadership** - recognize & reward excellence
- **Feasibility** - we can do good and do well!
- **Balance** - varying success across strategies
- **Innovation** - encourage new practices
- **Transformation** - accelerate pace and breadth of change throughout the industry

ZNC Building Zoning

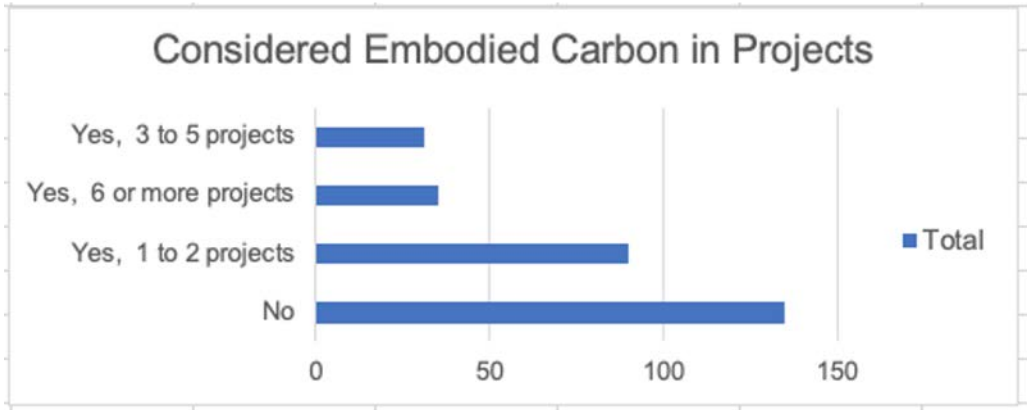
PUBLIC PROCESS TIMELINE



- Open House and Office Hours events - *to be schedule*
- Organizational Meetings – *as requested*

Registrant Responses

- ***Wide range of professional perspectives***
- ***Many experienced in considering embodied carbon in projects - 156!***



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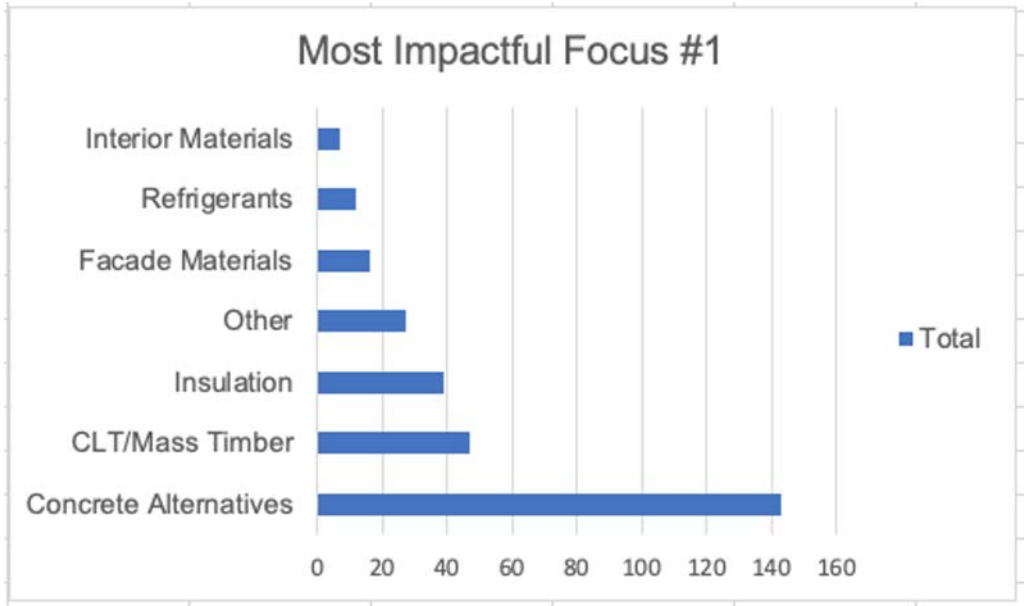
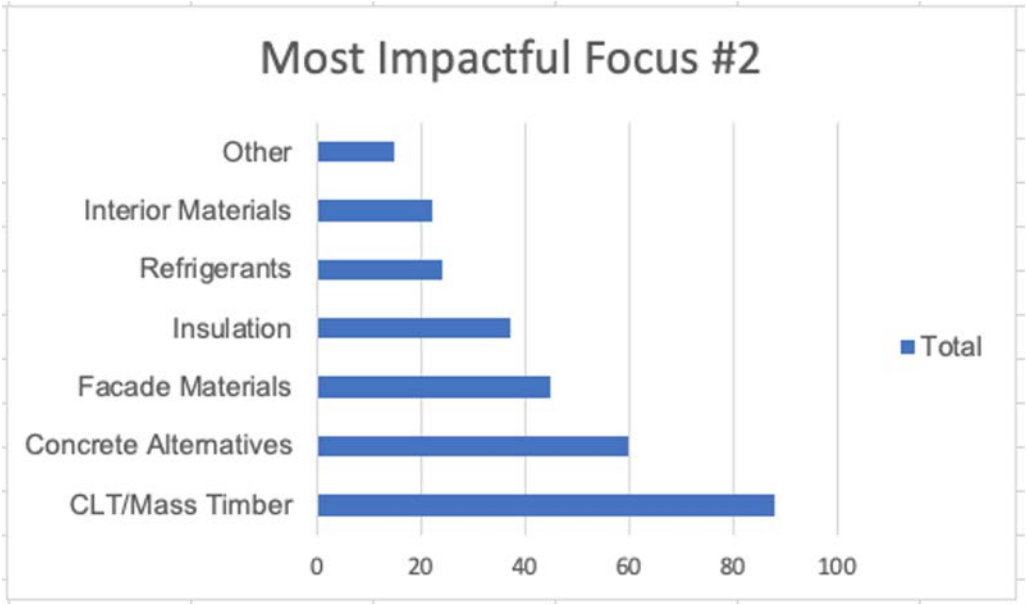
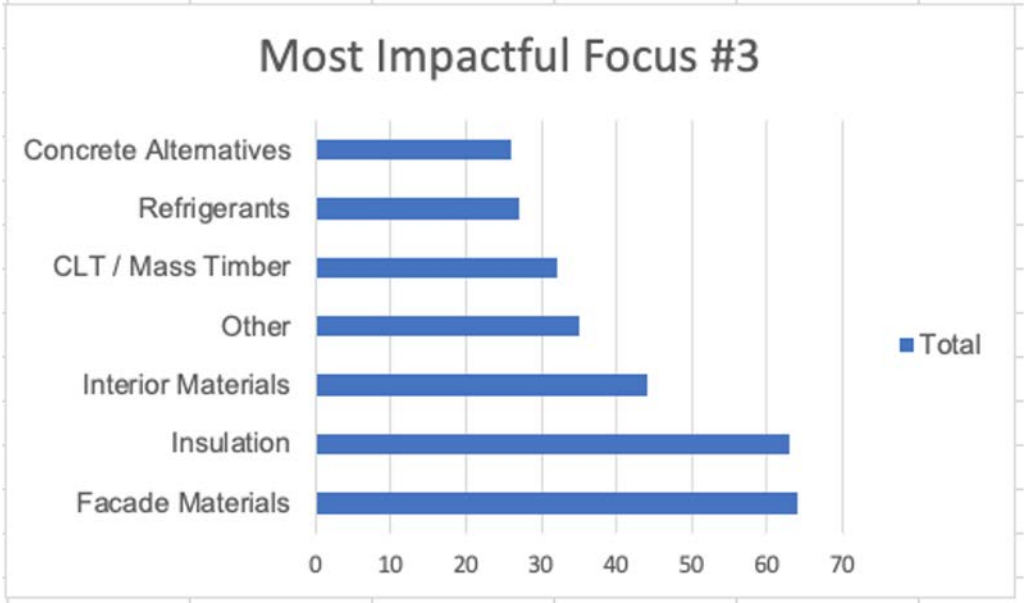
Registrant Responses

Most impactful focuses for reducing embodied carbon:

- ***Concrete Alternatives***
- ***CLT / Mass Timber***
- ***Facade Materials / Insulation***







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INTRODUCTIONS

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Buro Happold / Carbon Leadership Forum

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Architecture 2030

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LeMessurier

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Embodied Carbon in Design & Construction

Lindsay Rasmussen, CPCH®, Assoc. AIA

Senior Program Manager, Architecture 2030

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By 2060, world population is expected to increase by about
2.67 billion people
Source: World Bank
architecture 2030

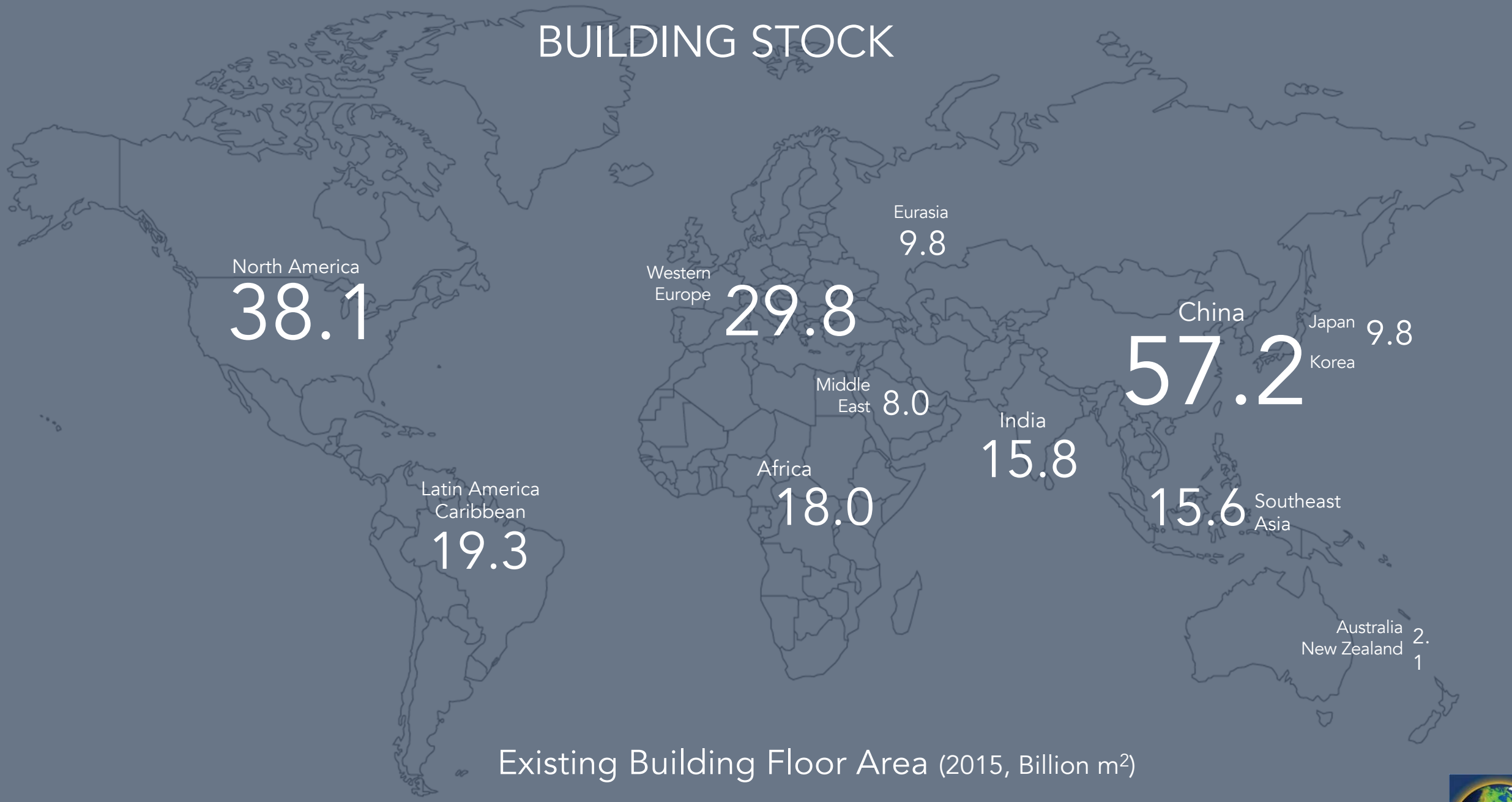

By 2060, world *urban population* is expected to increase by about
2.75 billion people
absorbing the entire population growth estimate.
Source: UN Population Division
architecture 2030


Today, global building floor area is about
223 billion m2
Source: Global Status Report, GABC
architecture 2030


By 2060, global building floor area will increase by
230 billion m2
or double the current worldwide building stock.
Source: Global Status Report, GABC
architecture 2030

architecture 2030

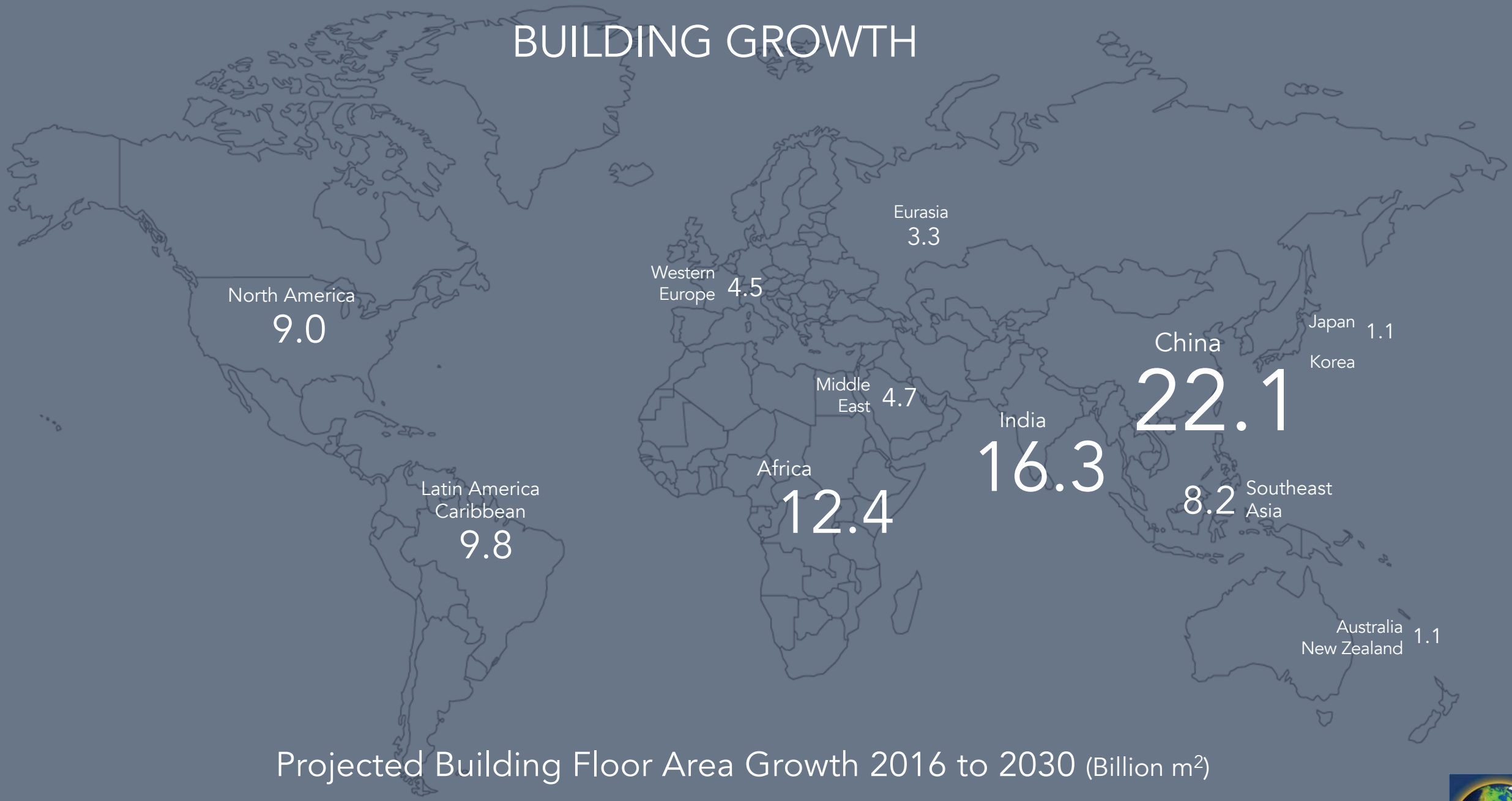
BUILDING STOCK



Existing Building Floor Area (2015, Billion m^2)

Source: Architecture 2030 Global ABC, Global Status Report 2016

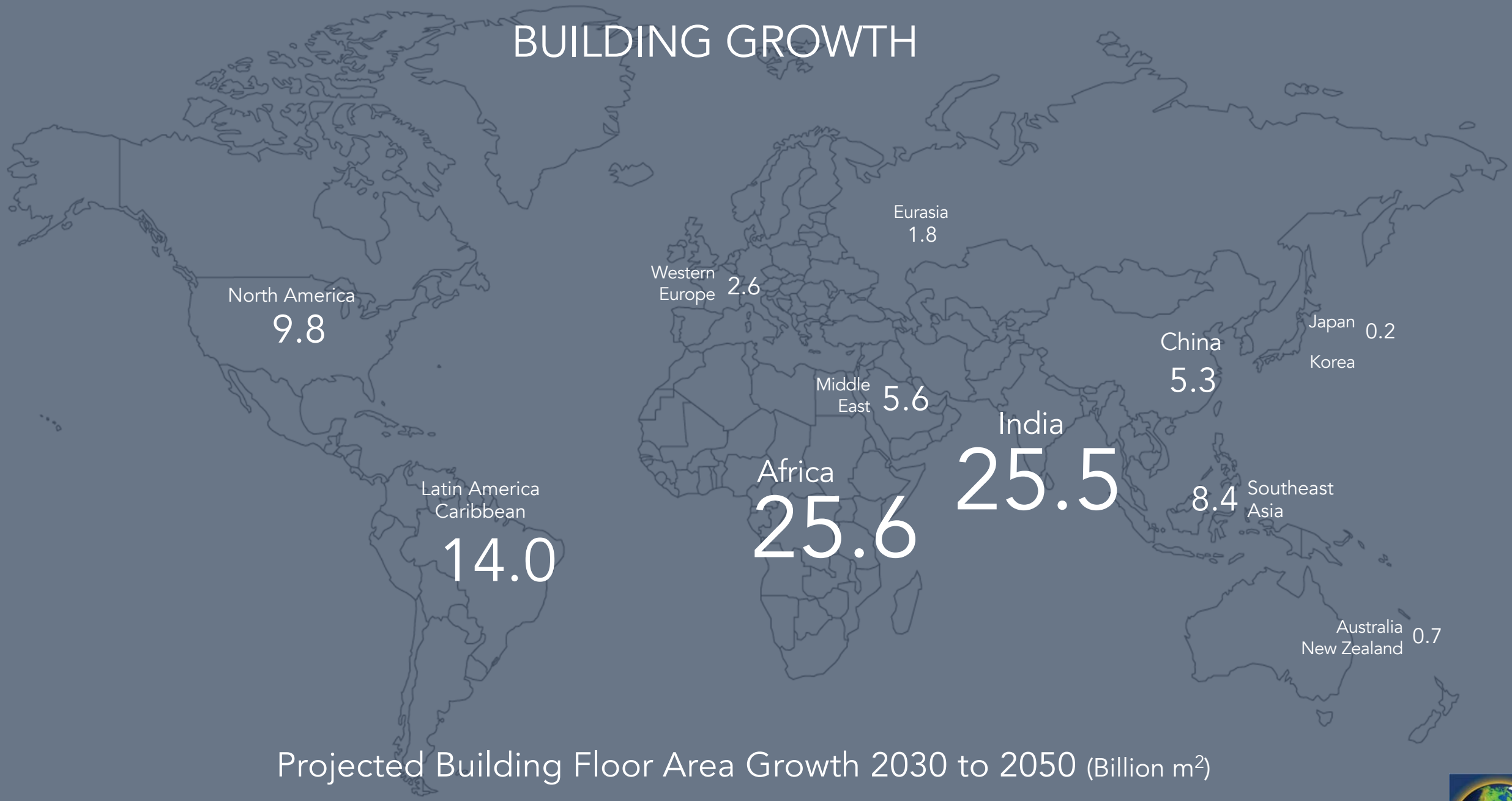
BUILDING GROWTH



Projected Building Floor Area Growth 2016 to 2030 (Billion m^2)

Source: Global ABC, Global Status Report 2016

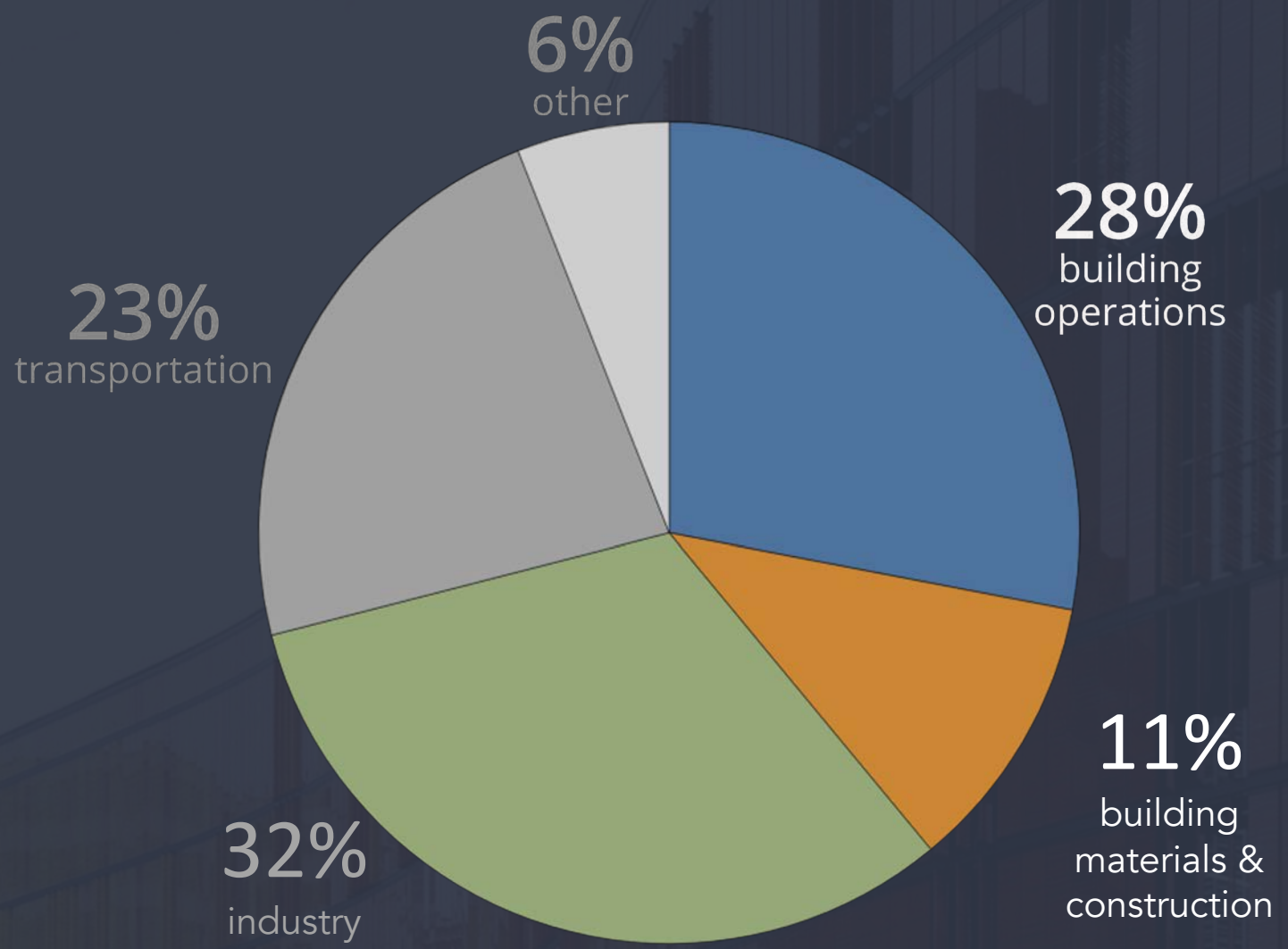
BUILDING GROWTH



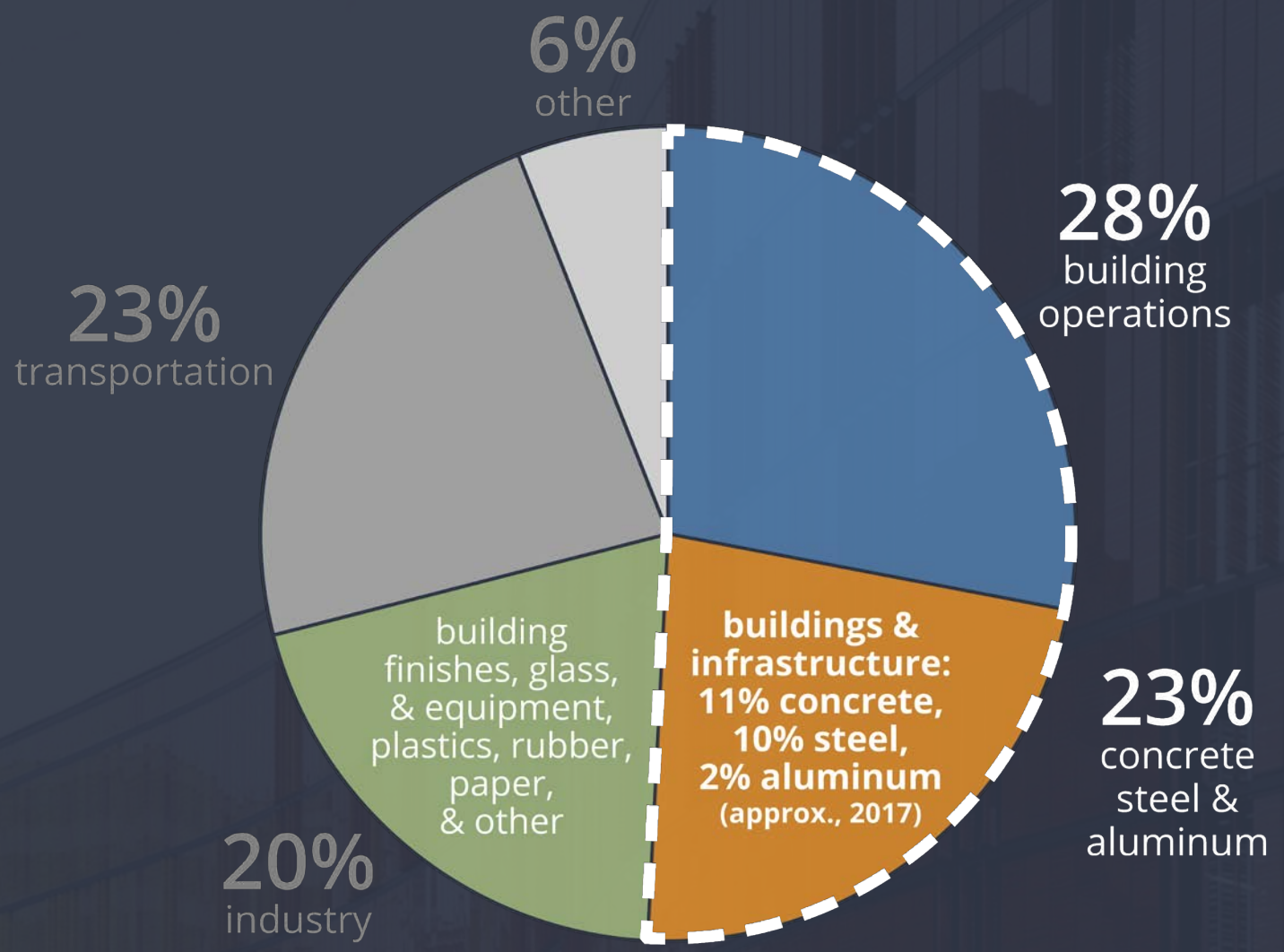
Projected Building Floor Area Growth 2030 to 2050 (Billion m^2)

Source: Global ABC, Global Status Report 2016

Total Annual Global Fossil Fuel Emissions by Sector

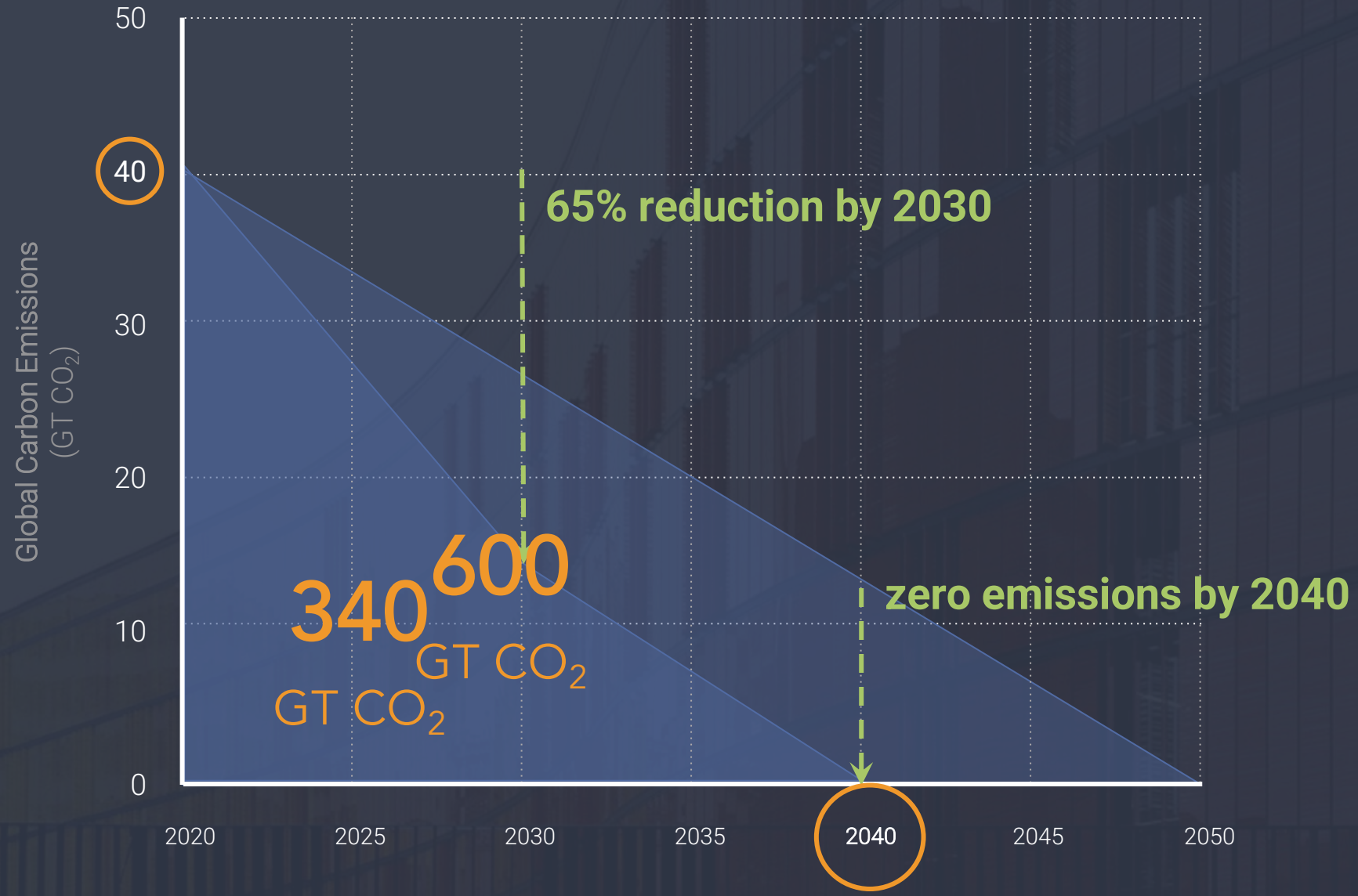


Total Annual Global Fossil Fuel Emissions by Sector



GLOBAL CARBON BUDGET: 340 GT CO_2
67% CHANCE OF MEETING 1.5°C

Intergovernmental Panel on Climate Change



architecture 2030

DECARBONIZING
the Building Sector

NEW BUILDINGS

EXISTING BUILDINGS

EMBODIED CARBON

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HOW DO WE REDUCE EMBODIED CARBON?

REUSE

REDUCE

SEQUESTER

REUSE

Urban areas:
Repurpose & upgrade

Existing buildings:
Renovate, adaptive reuse, & use local or recycled materials

New buildings:
Design to deconstruct & reuse materials

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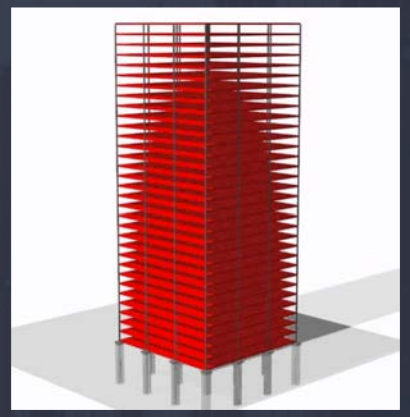
REDUCE

Land use

Growth boundaries

Infill

Densification



Structure optimization

Specify low to zero carbon materials

min. 40% reduction
65% x 2030
Zero x 2040

Low/zero carbon materials

SEQUESTER

Sustainable mass timber

Carbon sequestering aggregate

CO_2 concrete injection

Biomaterials

Landscapes / soil

Urban agriculture

Embodied Carbon Reduction Framework

Regulations • Codes • Incentives • Programs

Low Carbon Options for Structures

Mike Gryniuk, PE

Associate, LeMessurier

Chair, SE 2050 Commitment Program

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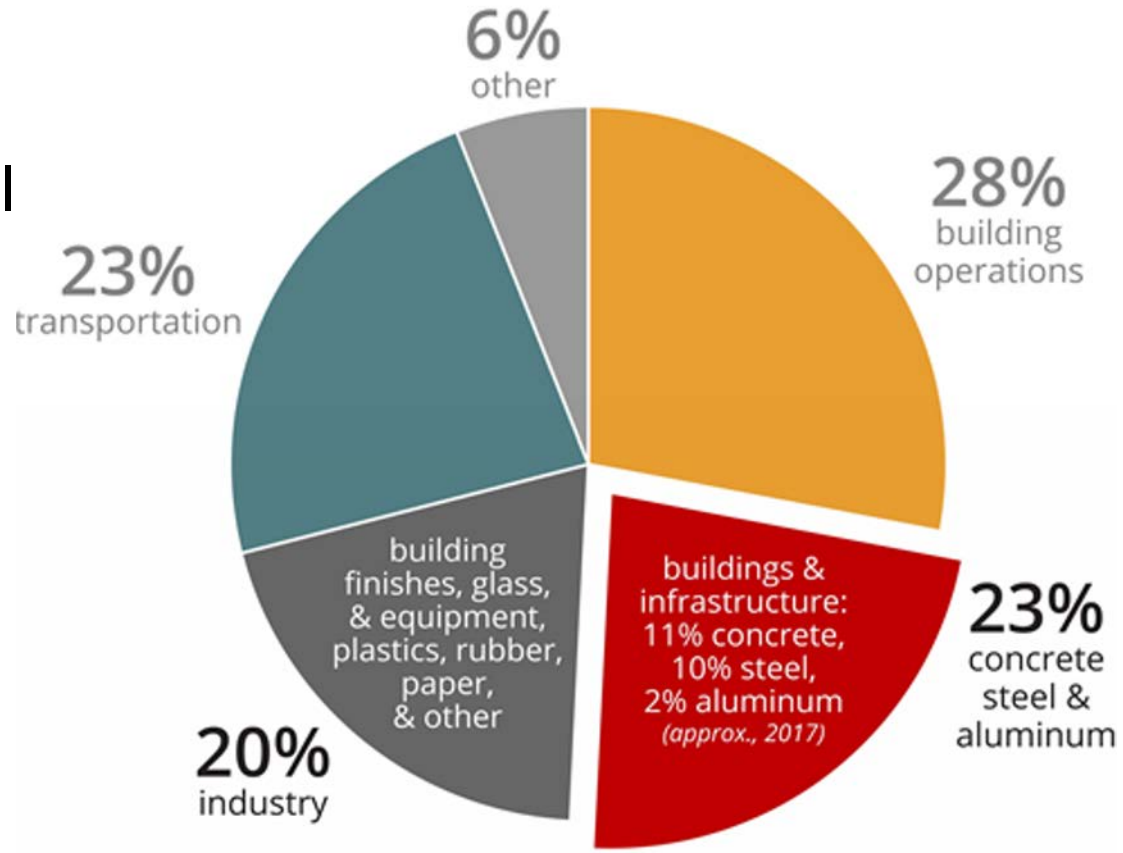
Embodied Carbon and Structural Systems

- One quarter of global CO2 emissions comes from the production of structural materials
- The structural system is 50% +/- of total embodied carbon of a new building

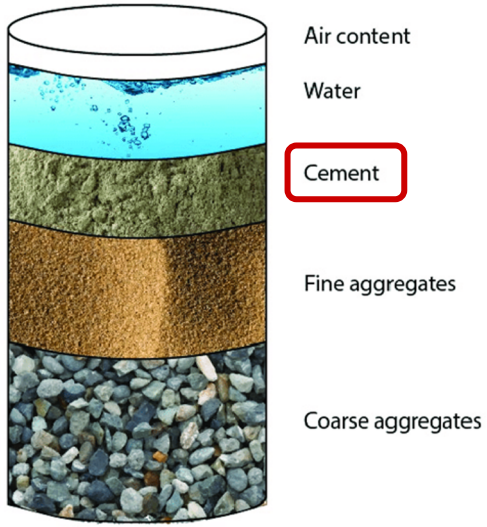
https://newsroom.ucla.edu/releases/ucla-scientists-confirm:-new-technique-could-make-cement-manufacturing-carbon-neutral

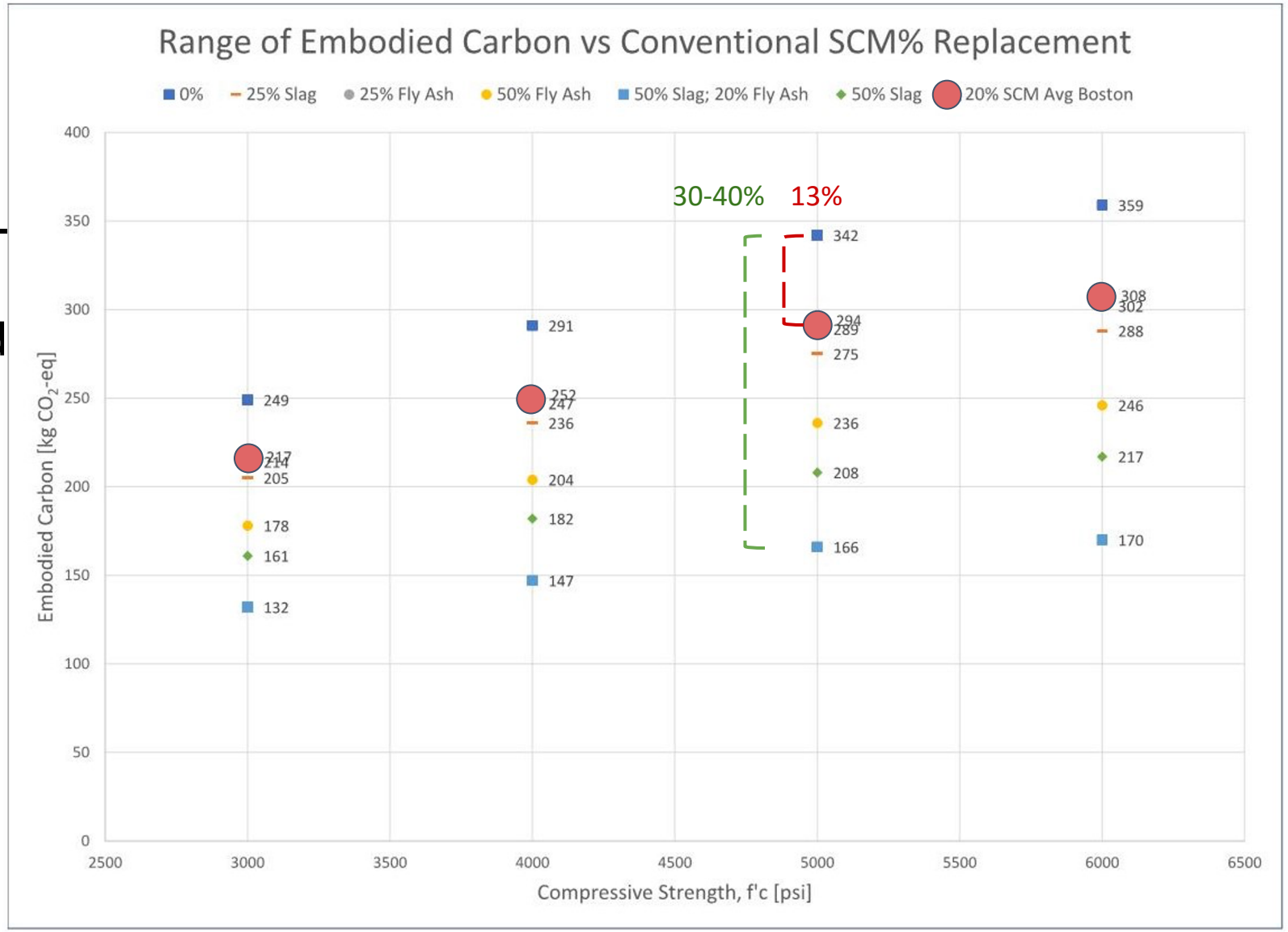


Data Sources: Global Alliance for Buildings and Construction, *2018 Global Status Report*; IEA

Embodied Carbon Reductions of Concrete

- Avg today 13% (20% portland replacement)
- Achievable today 30-40%*
- Addt'l 50%+ required





*Not applicable to every structural component, exposure class or finish requirement

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Embodied Carbon Reductions of Concrete

	Portland cement replacement						PC repl / CO_2 storing	CO_2 storing
	Fly Ash	Slag Cement	Silica Fume Cement*	Portland-Limestone Cement*	Natural Pozzolans	Ground Glass Pozzolans	Carbon Mineralization	Carbon Sequestering Aggregates
Description	Direct replacement	Direct replacement	Blended cement	Blended cement	Direct replacement	Direct replacement	Injection of CO_2 byproduct	Artificial aggregates produced with CO_2 byproduct
EC reduction potential**	30-40%	30-40%	4-6%	4-15%	30-40%?	30-40%	5-7% and CO_2 storing	CO_2 storing
Readily available***	**Yes**	**Yes**	**Yes**	**Yes**	**Possibly**	**Possibly**	No	No
In use today	**Yes**	**Yes**	**Yes**	**Yes/Initial**	**Possibly**	**Initial**	No	No

*Used in conjunction with direct replacement **Not applicable to every structural component class or finish requirement ***Supply chains varies

Embodied Carbon Reductions of Concrete

- Boston University - Center for Computing & Data Sciences
- Goal of 10% reduction structural and facade system EC (total)
- Focused on concrete
- High portland cement replacement concrete mixes
- About 2,000 T of design CO_2eq savings
- Trial batches / test data
- Achieved 13% reduction (no change to facade)

Embodied Carbon and Mass Timber

- Mass Timber – use of large-scale prefabricated engineered wood products, typically panelized products
- Glue laminated columns and beams
- No longer an ‘emerging’ technology – its here.
- Significant benefits for embodied carbon reduction*
- Applicable for certain building types and structures

Glulam -
Glue laminated timber

CLT - Cross-laminated timber
(NLT - Nail-laminated timber)
(DLT - Dowel-laminated timber)

*Provided the timber is from a sustainably harvested forest

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LeMessurier

Embodied Carbon and Mass Timber

- Hybrid systems of mass timber panels and steel beams
- Provides embodied carbon reductions over conventional steel framing systems with added structural benefits like longer spans, fewer columns, etc.

Mass Timber Hybrid – CLT deck panels and steel beams and columns

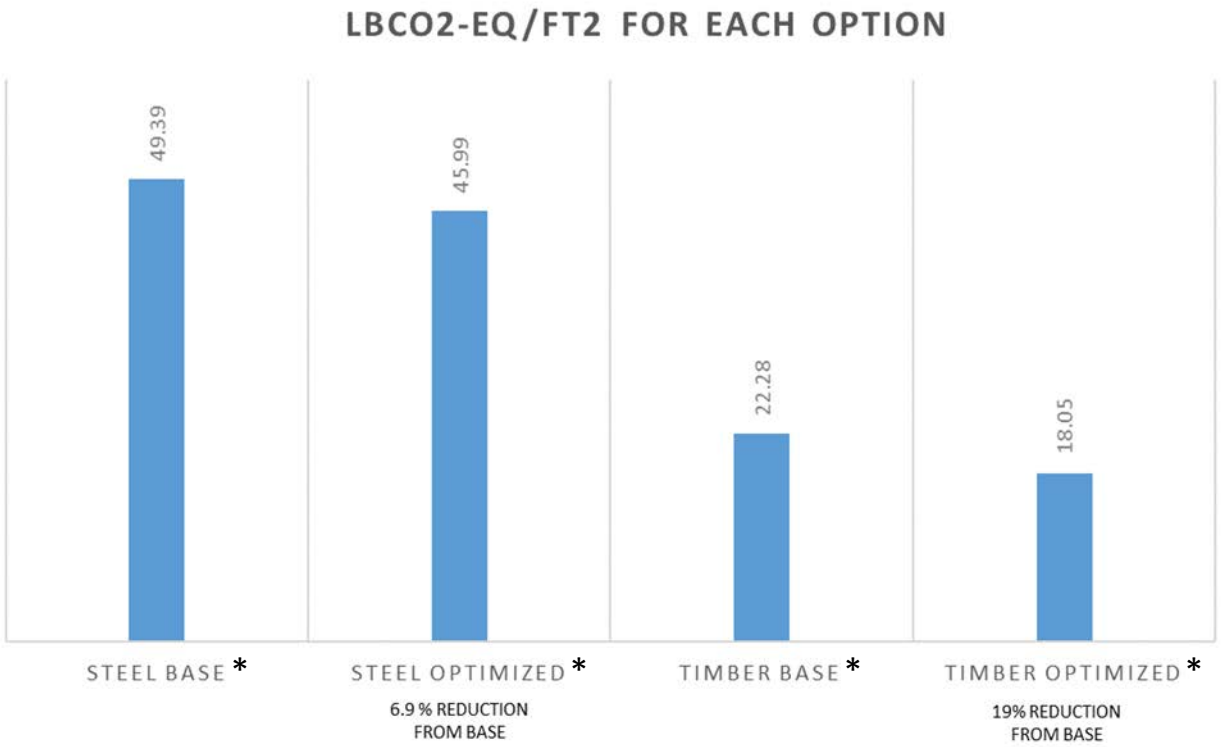
Embodied Carbon Reductions of Steel

- Majority of embodied carbon comes from material production
- Typical steel sourcing is domestic with 70%-90% recycled content
- Different shapes have different embodied carbon
- Design optimization and finding ways to reduce impacts on other structural materials like concrete foundations, etc.
- Higher grades of steel where applicable

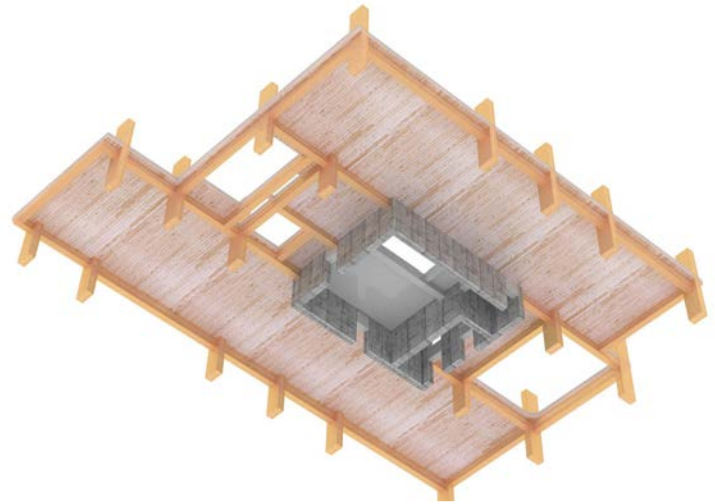
Steel allowed shedding of load to existing foundation elements with higher capacities - eliminated the need for new foundations

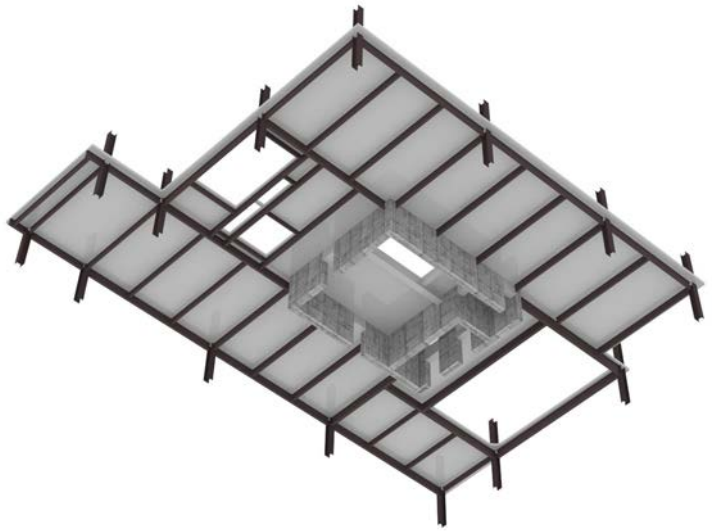
Embodied Carbon and Structural Systems

- Early system choices are critical for determining final embodied carbon impacts



7% reduction** 55% reduction** 64% reduction**





*Slice of building at mid height not including impacts of the complete structure **From steel base

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Embodied Carbon Reductions of Structures

- We should be measuring our embodied carbon
  - We don’t know what today’s impacts are
- We can make modest to relatively significant reductions in embodied carbon of our structural systems today
  - We need to take advantage of available options now
- Embodied carbon discussions should be happening at the project concept stage
- Educational resources and collaboration across disciplines
- Need a nudge
  - Policy updates, incentives, etc

SEI STRUCTURAL ENGINEERING INSTITUTE ASCE | SE2050 COMMITTING TO NET ZERO

www.se2050.org

Policy Examples

Meghan Lewis

Senior Researcher, Carbon Leadership Forum at University of Washington

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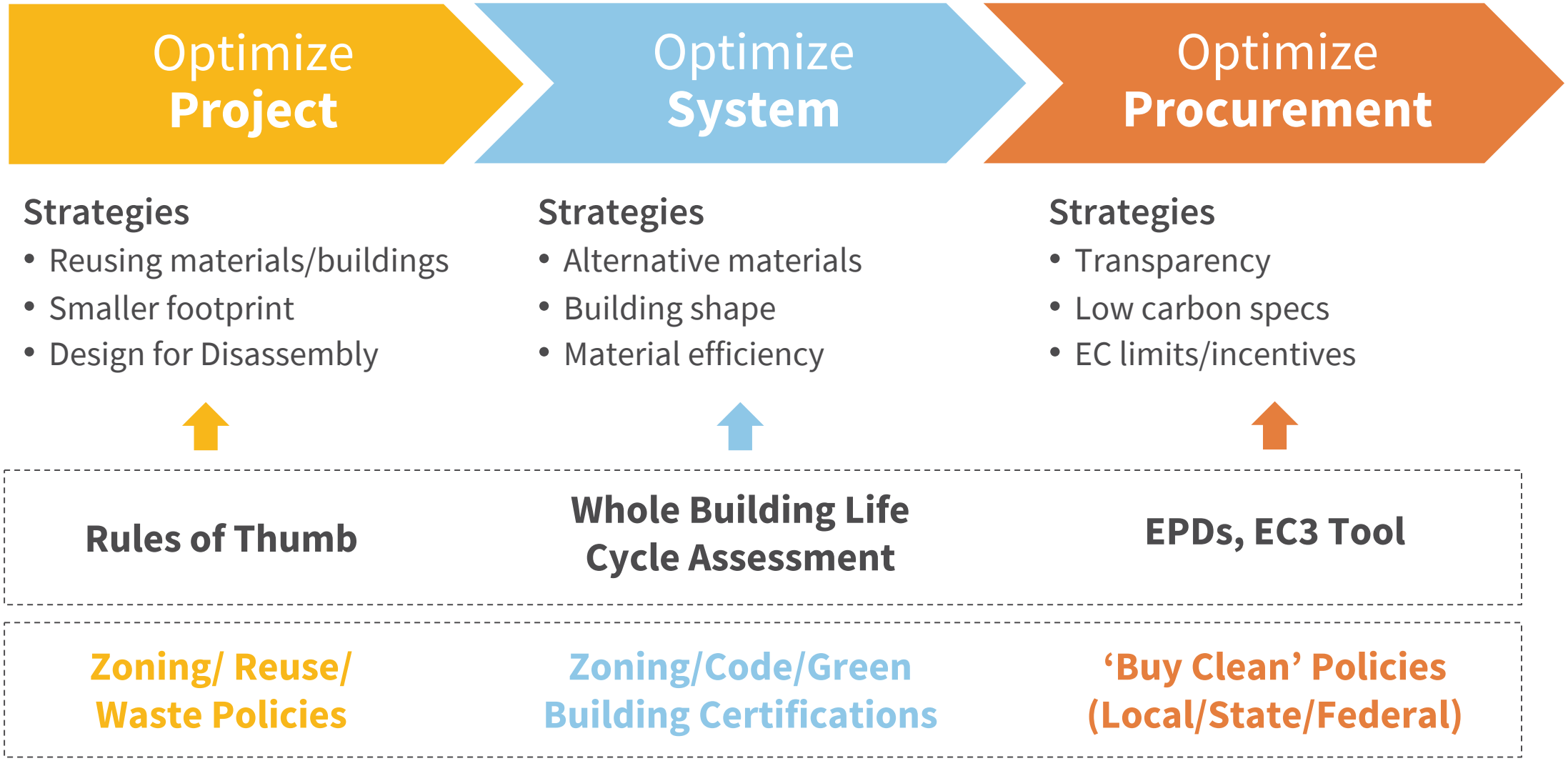
Tying Policy Opportunities to Embodied Carbon Strategies



Performance-Based Policies Two Approaches

Building Approach

- Uses **Whole Building LCA tools or early-design estimators** to measure performance

- Incentivizes **Designers** to collaborate to design a lower carbon building
- Captures strategies like:
  - Building/material reuse
  - Use of bio-based materials
  - Efficient structural design

Material Approach

- Use **Environmental Product Declarations** to measure performance

- Incentivizes **Manufacturers** to invest in clean manufacturing and **Contractors** to procure low carbon materials
- Captures strategies like:
  - Concrete mix designs
  - Mfg plant efficiency/fuel source

Performance-Based Policies Certifications and Policy Examples

% Reduction Target

LEED v4 awards points to teams that *"conduct a life-cycle assessment of the project's structure and enclosure that demonstrates a* ***minimum of 10% reduction, compared with a baseline building.***" *(Credit)*

Building GWP Limits

The Zero Carbon Certification requires that *"The total embodied carbon emissions of the project must not exceed 500 kg-CO_2e/m².*"

Building Approach

% Reduction Target

LEEDv4 awards points to teams that achieve low-range (between 0-30% - 1pt) or mid-range reductions (above 30% - 2pts) reductions from baselines, using the CLF Material Baselines and EPDs for verification (Pilot Credit)

Material GWP Limits

Ex: Rebar purchased for State of California projects must be below the global warming potential limit of 1.06 metric tons CO_2eq per metric ton of rebar *(DGS Buy Clean California requirements, not that BCCA also includes steel, glass, and mineral wool).*

Material Approach

Growing Embodied Carbon Policy Landscape

Federal Buy Clean proposed, **GSA** developing

- **State procurement bills introduced in 8 states in 2021 alone** (WA, OR, CA, MN, CO, NY, NJ, CT)

Local

Local procurement like in LA and Portland's Low-Carbon Concrete Purchasing Program

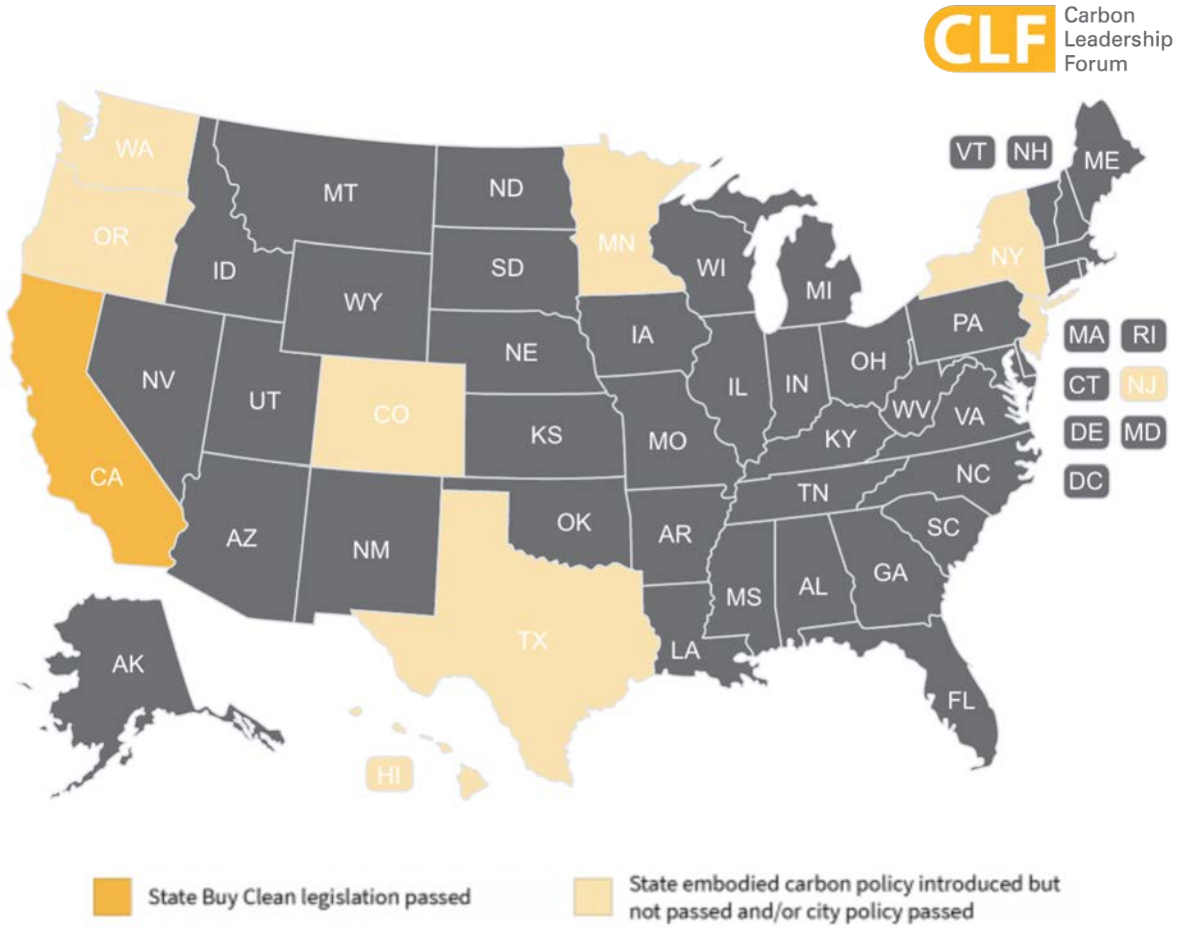
Transportation agency programs, like PANYNJ, Port of Seattle, and Sound Transit

Climate action plans in Vancouver, King County (includes Seattle), Austin, Eugene, and (upcoming) San Francisco

Building Codes like Marin County Low Carbon Concrete Code passed in 2019

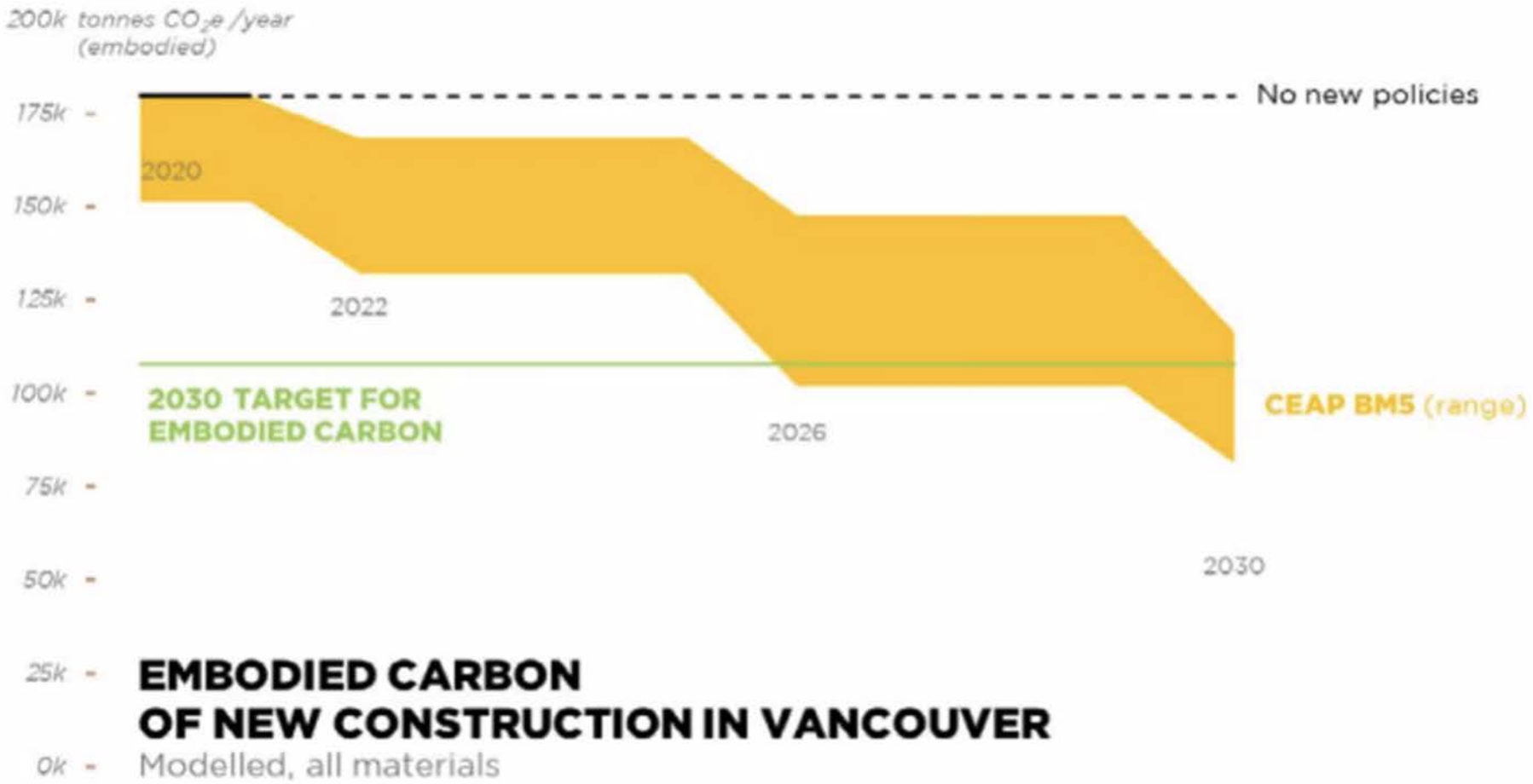
Green building incentive programs like in Seattle, San Diego, Austin, (and Somerville!)

Zoning, like in Vancouver, Helsinki, and Poorvo (Finland).



https://carbonleadershipforum.org/clf-policy-toolkit/

Case Study **City of Vancouver** Climate Emergency Action Plan



Case Study **City of Vancouver** Green Buildings Policy for Rezoning

Disclosure (2017 -)

"All projects shall **report the life-cycle equivalent carbon dioxide emissions** (ie: global warming potential impact, or 'embodied carbon') **of each building, in kgCO2e/m²**, as calculated by a whole-building life-cycle assessment (LCA)."

Link to Guidelines

Applies to more than 50% of the new floor area built in the city per year

Targets (2021/22 -)

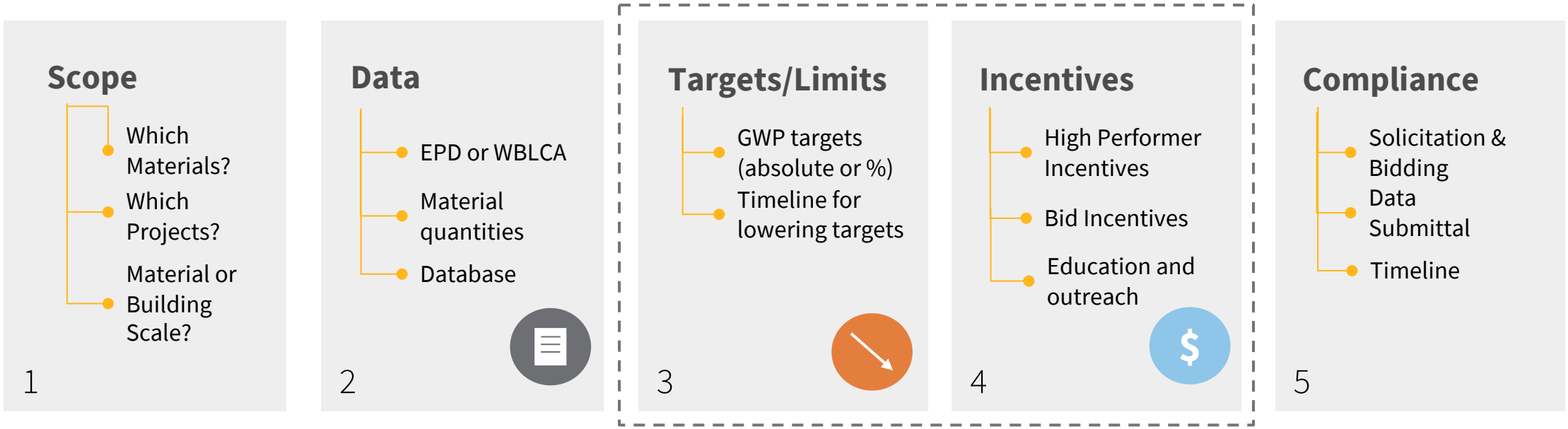
- Establish standardized **baselines** to measure reductions for developments and the city
- Require rezoning reduction targets through updates to the "Green Buildings Policy for Rezonings"
- **Learnings from rezoning will be used to update the building code by ~5 year delays** to give the broader industry the time needed to ramp up and become comfortable with these new requirements.

Inform new policies (2023 -)

- **2021/22:** The first reduction target(s) is introduced in the rezoning plan.
- **2023:** Possible first embodied carbon requirements are added to the Building By-law.
- **2025/26:** The rezoning policy targets are updated & 2021/22 rezoning targets are possibly adopted into the code.
- 2030: 2025/26 rezoning targets are adopted into the code & higher targets are set for the rezoning policy to move towards net-zero emissions.

Designing a Performance-Based Embodied Carbon Policy

Performance-based = Technology Agnostic (any strategy is accepted) BUT measurement is required



Often phase in / out

Additional Case Studies CNCA Framework

ZONING AND LAND USE POLICIES

POLICY CODE	POLICY NAME	CARBON IMPACT	COST-EFFICIENCY	IMPLEMEN-TABILITY	ENFORCE-ABILITY	SUM OF SCORES	EXAMPLES PROVIDED	
Z1	EMBODIED CARBON TARGETS FOR ZONING PROCESS	●●●●●	●●●●○	●●●○○	●●●●○	16	-	Embodied carbon specific
Z2	SET ZONING REQUIREMENTS FOR BIO-BASED MATERIALS	●●●●○	●●●○○	●●●●○	●●●●○	15	Helsinki	
Z3	CARBON-SCORED LAND SALES COMPETITIONS	●●●●○	●●●○○	●●●○○	●●●●○	14	Porvoo, Tampere	
Z4	PARKING REQUIREMENT OPTIMIZATION	●●●○○	●●●●●	●●●●○	●●●●●	17	London, Portland, Helsinki	Prescriptive strategies with large co-benefits
Z5	APARTMENT SIZE AND SPACE EFFICIENCY GUIDELINES	●●●○○	●●●●●	●●●●○	●●●●●	17	NYC	
Z6	PREFABRICATED OR MODULAR CONSTRUCTION PRIORITY	●●●○○	●●●●○	●●●○○	●●●●○	14	-	
Z7	INCREASING DENSITY USING EXISTING INFRASTRUCTURE	●●○○○	●●●●○	●●●●○	●●●●○	14	-	
Z8	USE LOW CARBON BUILDING TYPOLOGIES IN ZONING	●●○○○	●●●○○	●●●●○	●●●●●	14	-	

Source: CNCA Framework

Combining Prescriptive + Performance Approaches

Marin County Code Case Study

- **Prescriptive:** Cement Limits (max lbs portland cement / yd3)

  vs.

- **Performance:** EPD demonstrates that concrete mix is below the embodied carbon limit(kg CO_2e/m^3)

Over time, more prescriptive strategies will be available as the increased number of performance-based policies contribute to better data

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_2e/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.

Getting started

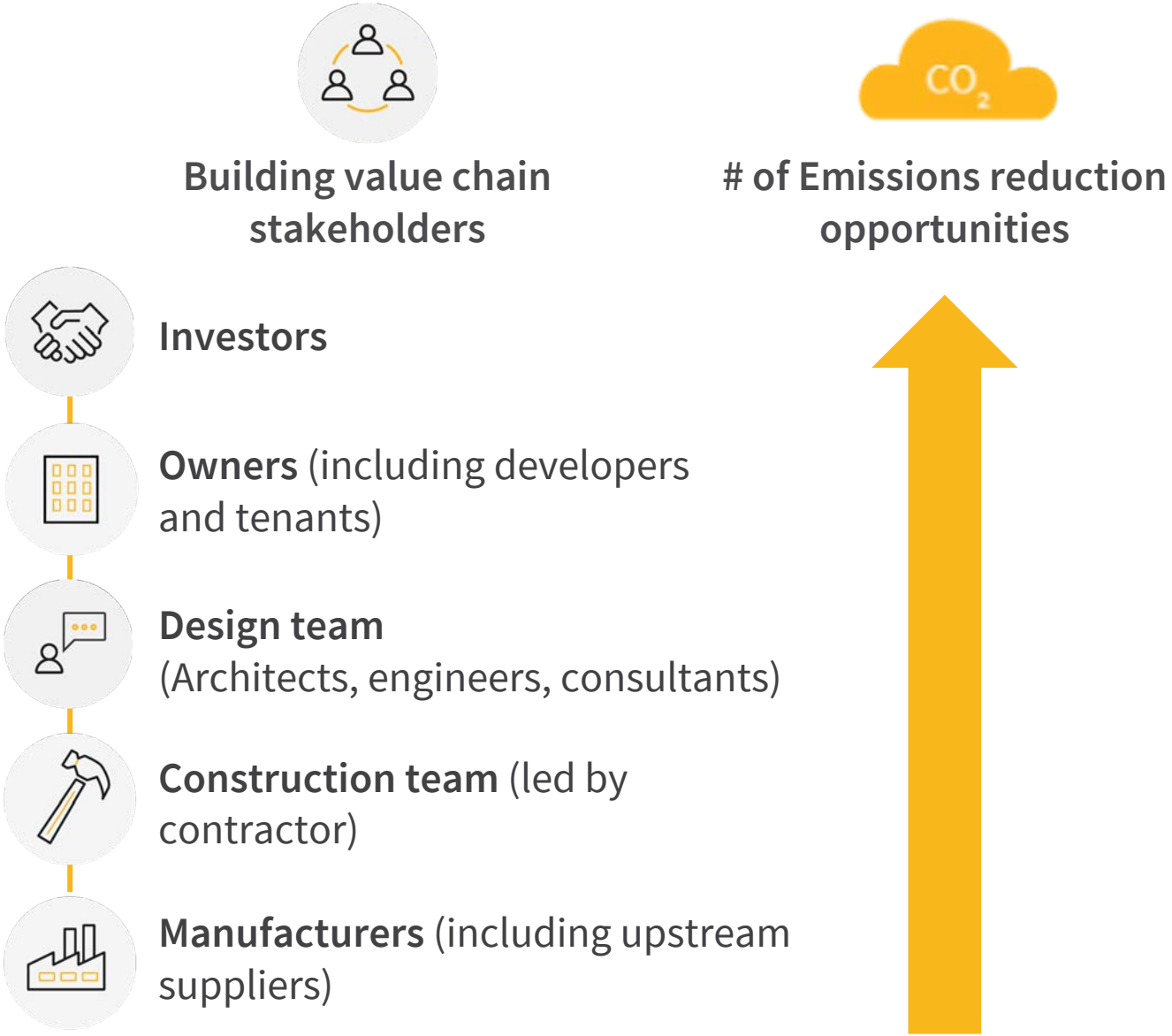
Thoughts on strategies for starting out:

- Start with data, phase-in limits or targets later on (require reporting kgCO2/sf, etc.)
- Start with a smaller scope (i.e. few materials or less projects) and phase-in more scope later on
- Building capacity and knowledge is key for embodied carbon: remember that policies can phase in reqs and lead to complementary policies in the future *(see Vancouver case study)*
- If collecting data, ensure the results are consistent (and ideally accessible in an anonymized database) to support analysis and future policies (*see pg. 17 of Vancouver guidelines for an example of encouraging consistent data)*

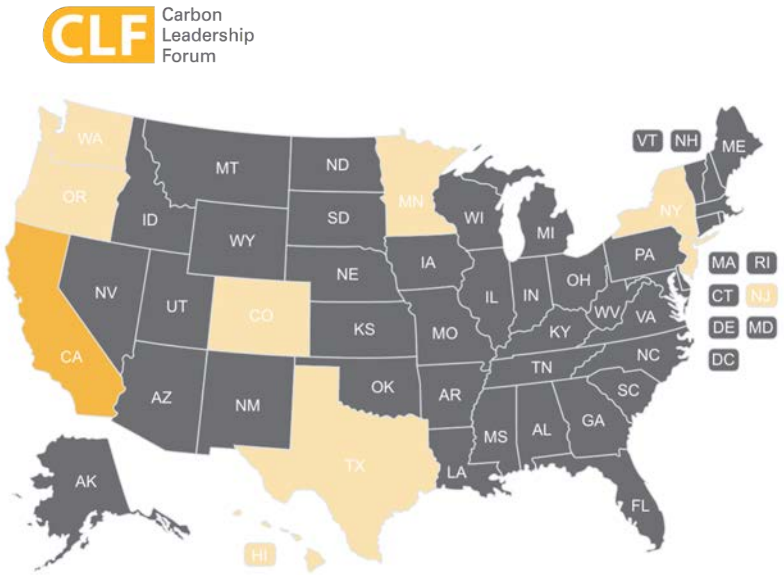
Collaboration and timing

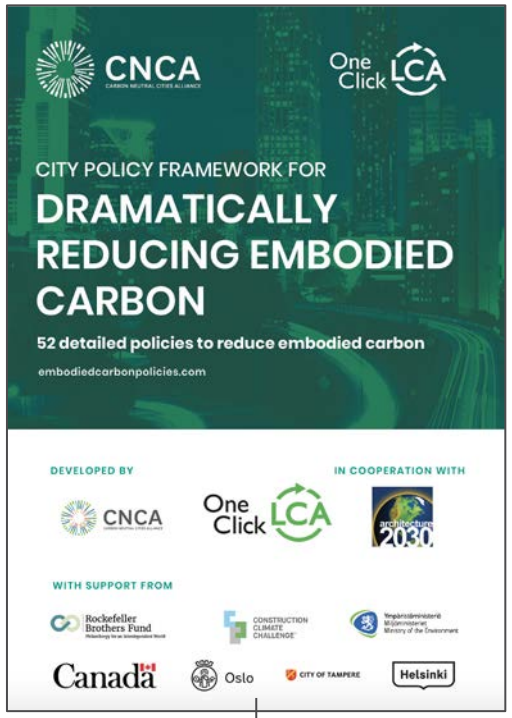
Early collaboration = more opportunities + lower cost of implementation

There is always an opportunity for reductions. The question is, how much cheaper and larger could it have been if collaboration had started earlier?



3 Great Resources for policy language and case studies

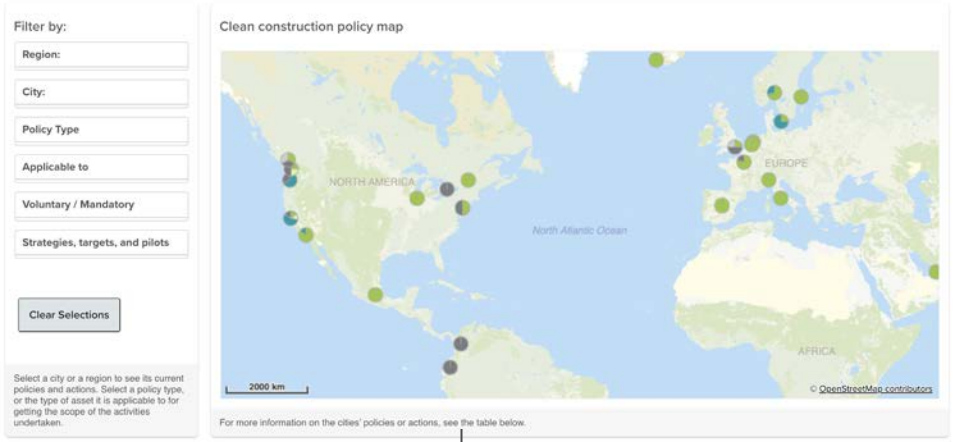




Also learn about C40's [Clean Construction Declaration](), which Los Angeles and Mexico City were two of the first cities to sign

C40 KNOWLEDGE

Clean Construction Policy Explorer (C40 Knowledge Hub)



[CLF Policy Toolkit]()

[CNCA Report]()

[Clean Construction Policy Explorer]()

Carbon Leadership Forum

Thank You!
Questions?

Discussion Questions

- Raising awareness of embodied carbon in building projects and available tools?
- Promising and impactful practices and materials?
- Emerging policy and market opportunities?

Notes:

- Today's presentation and discussion notes will be posted on our ZNC Bldg Zoning web page. Following today's meeting we will call for TAG members with expertise related to embodied carbon.
- There is early progress across sectors decarbonizing materials (eg. Renewable energy, sustainable materials, etc.)
- Low carbon concrete and Mass Timber are showing good low carbon promise. Steel less so – there are only a few mills nationally fabricating steel and limited opportunity to reduce related carbon emissions.
- We need a holistic approach involving the broader industry to really impact practices.
- Currently replacing about 20% of the Portland cement in concrete with readily available low carbon alternatives. There is still more that can be done including the strength schedule and workability of the concrete. We should focus on what we can do now locally pointing to the need for education.
- CLT is already coming to market from Canada and over seas (transit is not a major consideration).
- How do we ensure forestry practices include our sustainability values. Our national forestry resources remain plentiful. The City could play a leadership role starting with material source reporting and promoting more sustainable and beneficial forestry practices.
- In the US, forestry practices are not resulting in de-forestation.
- We are asking concrete and steel manufacturers to also do better. These concerns are not unique to wood harvesting.
- Largest barrier to entry for CLT is risk aversion, it is still a new practice.

Discussion Notes

Notes - continued:

- Case studies are a great way to drive awareness. Mass Timber has potential to allow 7 to 12 story building construction which in turn could help increase housing opportunities especially surrounding the downtown and near TOD locations.
- CLT has the added benefit of reducing building weight and reducing foundation requirements and costs. There similar benefits for construction on existing when structure weight would also be a consideration.
- There is a strong synergy with building re-use, embodied carbon reduction, and historic preservation.
- Excellent job growth protentional related to building materials salvaging and reuse.

Discussion Notes

Notes - continued:

- abc


CLF
Carbon
Leadership
Forum


BSA

CLF Boston Hub

Rachelle Ain, Co-Chair
Architect
Utile

Julie Janiski, Co-Chair
Principal
Buro Happold

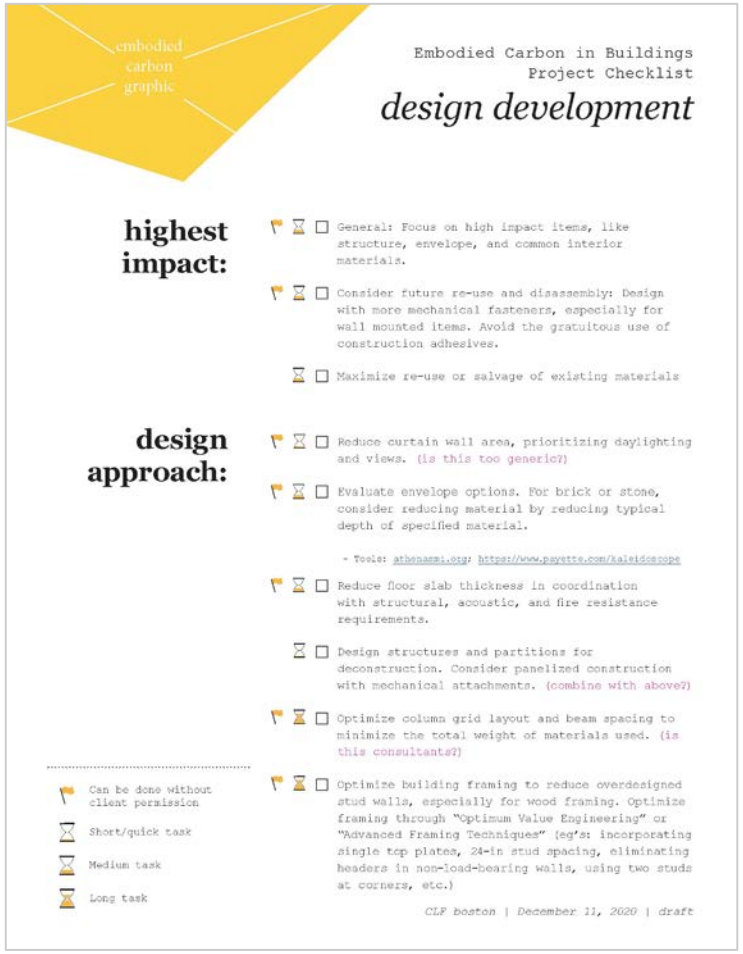
MEP2040
(working title)

Embodied Carbon Resources & Tools:

- Carbon Leadership Forum
- Architecture 2030 - Design, Planning, and Carbon Smart Palette
- BSA Embodied Carbon 101 Series
- Tally - LCA App with Revit Plugin
- EC3 - Construction EPD database & Impact Calculator
- Kaleidoscope - Embodied Carbon Design Tool
- BHoM LCA Toolkit
- BEAM Carbon Calculator
- SE2050 - Structure
- Pathfinder - Landscape
- 2Build or Not 2Build Carbon Calculator
- Athena

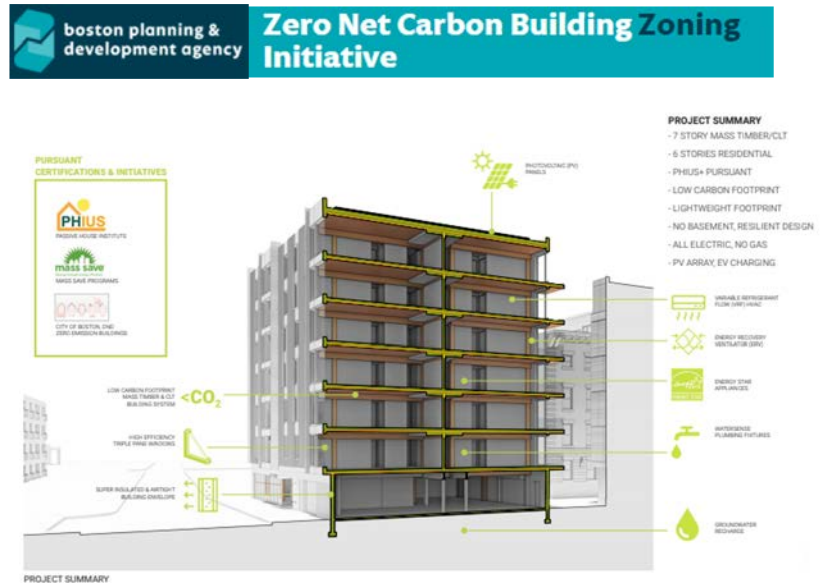
CLF Boston Hub Working Groups

- Advocacy & Policy
- Case Studies
- Design: Project Timeline
- Education Series
- Reuse Group
- Roadmap - SE2050



APRIL 28

https://www.eventbrite.com/e/decon-hackathon-tickets-148951246187



Education Series

Embodied Carbon in Buildings Conference

May 31, 2019

Call to Action!

EMBODIED CARBON IN BUILDINGS

https://www.architects.org/embodied-carbon-in-buildings-conference

Embodied Carbon 101

June-Aug 2020

12 sessions
disciplines and process

Basic Literacy
EPDs
Structure
Envelope
MEP
Interiors
Procurement
Carbon Accounting
Certifications: Overview
Certifications: Detailed
Making the case
Process + Firm culture

https://www.architects.org/embodied-carbon-101-video-archive

Impact / Implementation

Summer 2021

~6 forum-based sessions
we are learning together
building sectors and typologies

Preservation / Re-use
Residential
Public Procurement / Public Sector
Multi-Family & Commercial
Lab & Healthcare
Landscape, Civil, & Infrastructure
Interiors

Integration Deep Dive

TBD

technical depth, practice, details, and tools

2021 Meeting Dates

- June 11, 2021
- August 12, 2021
- October 15, 2021
- December 10, 2021

Connect with us!

- Email CLF.Boston@gmail.com if you are interested in being part of the community!
- https://www.architects.org/knowledge-communities/clf-boston

Next Steps

- ZNC Embodied Carbon - Technical Advisory Group
  - Today's presentation and discussion notes will be posted tomorrow
  - Nomination sign-up form will email / post tomorrow
  - Summary report of discussions including identification of early action items and recommendations
- ZNC Building Zoning Initiative Report
  - Public Meeting #2 - late spring (date TBD)
  - Report to follow

Discussion – Chat Notes

Thank you all for your chat comments; there are so many great thoughts here! Although we are not adding any new response here, we will included all of the questions and comments in the discussions ahead.

Elliott Laffer: Is there a plan to put these restrictions in the zoning code, with enforcement by ISD and appeals to. the Board of Appeals? How will this mesh with enforcement of the state energy stretch code?(zoning)?

Kritika Kharbanda: Thanks for the informative graphs and the overall framework for tackling the issue, Lindsay! In what sector do you see the most opportunity of making a rapid change?

John Dalzell: Elliott: We are seeking recommendations which could include policy, zoning and practice actions.

Dan Whittet: Isn't there a shortage of fly ash and slag?

Alex Brooks: What is the lag between concrete mix production and actual project demand?

julie klump: is there a cost premium to using the concrete with reduced Portland?

Gary Brock: I think there needs to be common understanding of baselines of embodied carbon to understand relative reductions by project teams.

Jose Sosa: Will there be incentives for new construction and retrofit if bio materials are used? I.E Wood and Alu-clad wood windows.

Michelle Oishi: Does the hybrid steel and mass timber structure allow for deconstructability?

John Bolduc: Can you discuss supplies of alternate materials, eg, as alternates scale up is there tension between mass timber and deforestation? Think8ng of the population and building projections.

Dan Bailey:The lowest of the low hanging fruit for reducing embodied carbon seems to be retaining existing buildings rather than replacing them. As an East Boston resident, I've seen countless buildings in my neighborhood demolished (or functionally demolished) and replaced unnecessarily in recent years. How can we start thinking about Boston's existing buildings as an environmental resource to be conserved and managed? Is the City considering policies to encourage building reuse and/or discourage demolition?

Discussion – Chat Notes continued

Sarah Dooling: For Mass Timber, the key seems to be ramping up sustainable timber harvesting/sustainable forestry practices. Are (national / regional) forestry companies part of the stakeholders that the City is involving?

Dan Whittet: Great question Dan Bailey. And to John Bolduc, I am suspicious of the "managed' forest concept. From what I have read, the managed forest may have ecological downstream effects such as reduced habitat, monoculture vulnerability and soil depletion.

Kate Hollister: What can town boards do to encourage or require ZNC in new projects? Ex. my town does not have architectural requirements. What could we legally do using our subdivision rules & regulations and/or zoning bylaws?

Nick Armata (Boston Landmarks Commission): The City's current Article 85 Demolition Delay policy does not mention embodied carbon. With an overhaul of the law in the early stages, there will be opportunity to integrate EC policy while encouraging historic preservation. Will this be the case?

Michael Gryniuk: Dan Whittet - some regions have more of one or the other. Outside of Boston proper there is a lot of slab - locally in Boston its barged in and from some locations overseas - barging is a relatively low impact shipping technique. Ground glass has lot of potential and is basically the same as fly ash.

Peter Alspach: Arlington County, VA also addresses through zoning bonuses via ILFI Zero Carbon & LEED credits

Michael Gryniuk: Alex Brooks: costs vary like any global material - there are times when portland cement is more expensive than slag or flay ash and sometimes vice versa. I've seen modest increases on some projects and modest credits on others.

Tamar Warburg: What is the possible schedule for implementation of ZNC? Will it apply only to projects seeking rezoning / permitting --- or, I like BERDO to all projects over 35,000 SF?

Michael Gryniuk: Michelle Oishi (I know you): Yes. Most steel frames are bolted together and thus could be unbolted in theory. Same with the CLT connections to the steel framing - could be unscrewed. Of course some modifications of installed connection detailing would have to be modified - but it doesn't seem like an insurmountable barrier for entry.

John Dalzell: Tamar: one recommendation is to lower the Article 37 threshold to 20k sf. The ZNC Bldg Zoning schedule seeks to finalize regulations by the end of 2021.

Discussion – Chat Notes continued

Kate Hollister: How can we get the suggested performance-based embodied carbon policy that Meghan mentioned?

Michael Gryniuk: Regarding the timber questions and forest management - I couldn't agree more and it requires careful assessment for local impacts. National, its my understanding, we have a very stable forest stock in terms addressing national deforestation.

Michelle Oishi: How can concrete plants be brought into the conversation? to achieve more carbon sequestering options around Boston?

Sarah Dooling: Stakeholders also includes community advocates who can promote embodied C reduction practices as part of public review processes!

Lindsay Rasmussen, Architecture 2030 (she/her): Seconding the comment from Michael on forestry but adding that there is a lot of regional differences in forest in terms of species, rotation periods, ecological considerations, etc. Forest management is not one-size-fits all. If you're really interested in this topic, I'd encourage you to engage with local forest owners, mills, and CLT manufacturers.

Russel Feldman: As I understand from the recent Brookline experience limits what localities can do with zoning, and only the state building code can engage in carbon requirements in design or construction. Do other states provide more authority to municipalities?

Lisa Cunningham: The AG did not limit what could be done in zoning, that was a general bylaw. Brookline is in the process of bringing forward two new zoning bylaws to implement the same FFF policy.

Peter Alspach: Some approaches aim to knock down the worst offenders, but we don't really have the luxury of time for that tiered compliance approach

Peter Sun: Great job! if I missed the first half, will the recording or ppt be online afterwards? Thanks

Lisa Cunningham: The AG ruled that Brookline's bylaw conflicted with state legacy laws including utility, gas and building code law. Zoning is a viable path in MA although it is not able to capture the broad authority of a general bylaw.

keihly moore: Our structural engineer has not focused on low-embodied carbon before...are there resources we can point them to?

Michelle Oishi: https://se2050.org/

Discussion – Chat Notes continued

Andrew Hazelton: With regard to structural timber as a "low carbon" alternative for framing buildings, does (or should) the "embodied carbon" calculation take into account the negative carbon effects of cutting down forests? I have heard that deforestation and the ensuing loss of carbon absorption is a major concern on the horizon, and that policy experts such as Bill McKibben no longer advise the use biomass as a renewable energy source on account of this.

Stephen Moore - Steven Winter Assoc.: Thank you all! Great work.

Peter Alspach: how can mass timber be viewed appropriately related to the impacts of sustainable harvesting that can have significant impact on actual embodied carbon of wood? there is also the tension between use of wood for construction and need for forest retention and growth for sequestration. What is the approach to balance these aspects?

Lisa Cunningham: A group of us is also beginning to look at Building energy reporting and disclosure ordinances - if anyone is interested please let me know.

Catalina Pérez-Aguirre: Do you see any feasible opportunity for not just implementing standards and regulations but also economic incentives such as exploit low prices when high renewable generation to reduce materials production embodied carbon? Do you see any option to make materials production more elastic?

Nick Armata (Boston Landmarks Commission): Is deconstructing existing buildings rather than demolishing structures considered in policy? I've read this a way of reducing materials that end up in landfills and reusing high quality materials. This is also a way to create new skilled jobs for disadvantaged populations.

Jean Carroon: I'd like to pull attention back to Dan Bailey's comment/questions about policies supporting building reuse and/or discouragement of demolition. Even we speaking about embodied carbon we seem to pivot to new construction. I hope the City is looking at policies in Portland, Oregon and San Antonio, Texas which are also addressing the reduction of construction waste and material reuse.

Meghan Lewis (Carbon Leadership Forum, she/her): @Nick and Jean great questions/points - I can highlight a few of the policies we're seeing on the reuse side.

Discussion – Chat Notes continued

Tom Chase, New Ecology: Great conference last November hosted by Yale SOE URI jointly with Yale SOA - industrial ecologists, foresters, architects, and engineers presenting on the carbon sequestration and emissions reductions options in this area: https://uri.yale.edu/get-involved/events/hixon-center-urban-conference-future-cities-material-flows-implications-design

Olivia Huang: Another policy angle is deconstruction and building material salvaging! City of Portland, OR requires certain buildings to be deconstructed rather than demolished

Sayo Okada: How do you see the CO2e conversion from kwh would be done for reporting? Any conversion factor that would be available through certain tools?

Peter Alspach: what fraction of the new building growth do we have plentiful US forest supply to accommodate?

Lindsey Conlan: Are there existing best practices surrounding the reuse of aggregate in concrete? By reducing the amount of new aggregate in structural concrete and hardscape we could reduce the environmental impact and carbon footprint of mining for new aggregate.

Dennis Carlberg: Great session! Building owners and developers need to be asking for lowered embodied carbon to drive the creation of EPDs that help push the industry to simply begin to report the emissions associated with the manufacture of their materials. Thank you to the CLF for developing the EC3 tool!

Dan Whittet: The issue is not deforestation, it's the economics of longer growth trees which sequester more carbon, vs rapid growth rapid harvest practices. I'm no expert, but I would like to see more research.

Stefan Poltorzycki: How can local environmental and community organizations sign onto and help push initiatives proposed in this presentation?

Michael Farnola: What is the website that I can find the deck slides for todays presentation? Please post the website, thank you

Sarah Dooling: For advocates on the call, you can join Massachusetts Climate Action Network as we mobilize advocates on working with DOER on developing a true net zero stretch code. Check out the MCAN website: https://www.massclimateaction.org/ Or email me: sarah@massclimateaction.net. (Sarah Dooling, ED)

Discussion – Chat Notes continued

Peter Alspach: Given we have coming up on 8.5 years to hitting our 2030 target, do we have time for the long life cycle of pilot projects to nudge market along?

Sarah King: As an owner/developer, Skanska is using the EC3 tool on all of our projects to measure embodied carbon and set reduction targets and explain to suppliers what we're trying to do. We are beginning supplier outreach in the Boston area (particularly focused on concrete, steel, rebar), and if other owners/developers would like to collaborate on outreach, it seems like a "common ask" is helpful and appreciated by material suppliers. And the more developers/owners asking for EPDs, the more likely they are to create them. :) I'm at sarah.king@skanska.com if you want to discuss.

Tamar Warburg: That's great Sarah -- happy to discuss.

Meghan Lewis (Carbon Leadership Forum, she/her): Building Transparency and the Carbon Leadership Forum will both be launching Owner/Tenant focused toolkits as well related to that @Sarah and Tamar. Looking forward to having those links to share soon!

Dennis Carlberg: Great point on building reuse!

Dan Whittet: Agreed, Dennis. Most of the buildings that will be around in 2050 are already standing.

Tom Chase, New Ecology: Decon conference coming up in October: https://www.buildreuse.org/conference

Meghan Lewis (Carbon Leadership Forum, she/her): Also wanted to share this webinar clip (15 min) to hear Vancouver talk about their own long-term strategies from CLF Vancouver: https://www.youtube.com/watch?v=02c4MCuZhkM&t=2s

Caitlin Hart: Tomorrow’s Deconstruction Hackathon, in partnership with the Sustainable Building Institute, BuildingEase, and All for Reuse: https://www.architects.org/events/310587/2021/04/28/decon-hackathon

Andrew Hazelton: results of a quick google search: “ 'We want to debunk the myth that mass timber is in any way, shape, or form related to some kind of environmental benefit,' said John Talberth, president of the Center for Sustainable Economy, which is based near Portland. 'That’s simply not true.'" [from an article in an online Yale forestry program publication "As Mass Timber Takes Off, How Green Is This New Building Material?" BY JIM ROBBINS • APRIL 9, 2019]

Discussion – Chat Notes continued

HG Chissell: Great conversation! Next month we will be leading a Stakeholder Challenge with John Dalzell, Ben Myers, and JC Burton May 19 and 20th. Here is a discount registration link . If you are a nonprofit, please reach out for a no cost ticket.

HG Chissell: - HG Chissell / AEG Boston - https://www.eventbrite.com/e/aeg-boston-21q2-stakeholder-challenge-buildings-construction-tickets-141876663921?discount=100_Off

Meghan Lewis (Carbon Leadership Forum, she/her): For anyone looking to dive deep on the issues around wood and carbon @ Andrew, you might want to start with our series last spring: https://carbonleadershipforum.org/wood-carbon

Michael Gryniuk: Please help build the movement and spread the word about SE 2050 to your structural engineer! www.se2050.org.

Kate Hollister: Thank you

Sarah Dooling: Fantastic presentations, great chat -- thank you all.

Sophia Rini: Thank you - this was super informative!

Dennis Carlberg: Thank you all for a great session!

Caitlin Hart: Thank you so much everyone!

Stefan Poltorzycki: Thank you

Michelle Oishi: Thanks!

Ethan Vonderheide | Built Environment Plus: Thank you!

Lisa Cunningham: great job thank you!

Andrea Love: Yes, great job everyone!!!!

HG Chissell: Awesome discussion! Thank you!

Olivia Humphrey: Thank you everyone, this was a great event!