

The Embodied Carbon Story of a Green Builder

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TC Legend Homes/Powerhouse Designs



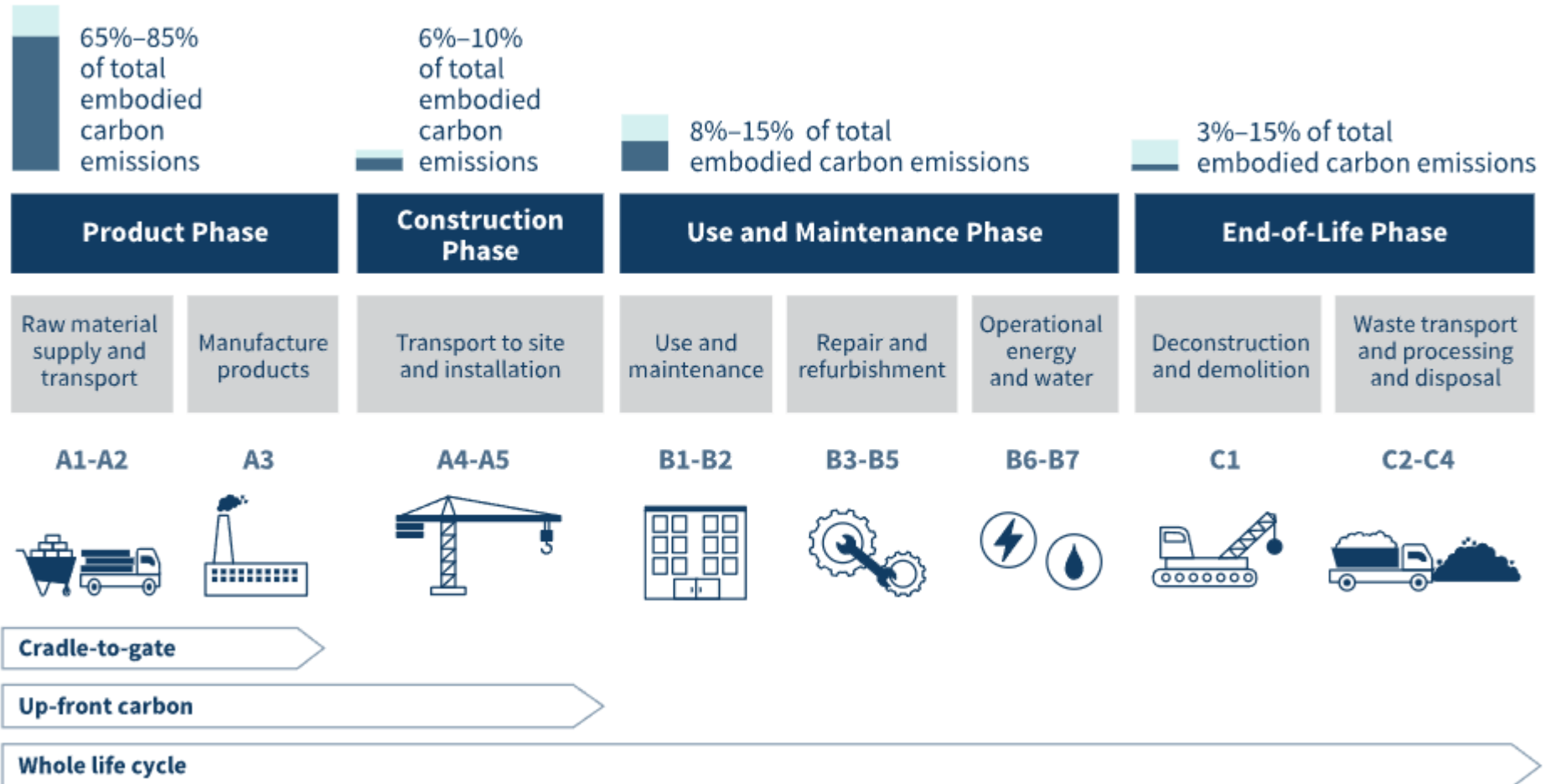
TC Legend Homes & Powerhouse Designs

- +35 High Performance Homes built since 2009
- 9-Time DOE Housing Innovation Award (HIA) Winner
- Design & Build Priorities:
 - Resiliency
 - Affordability
 - Indoor Air Quality
 - Comfort and functionality
 - Net Zero or Net Positive Energy
 - Embodied Carbon

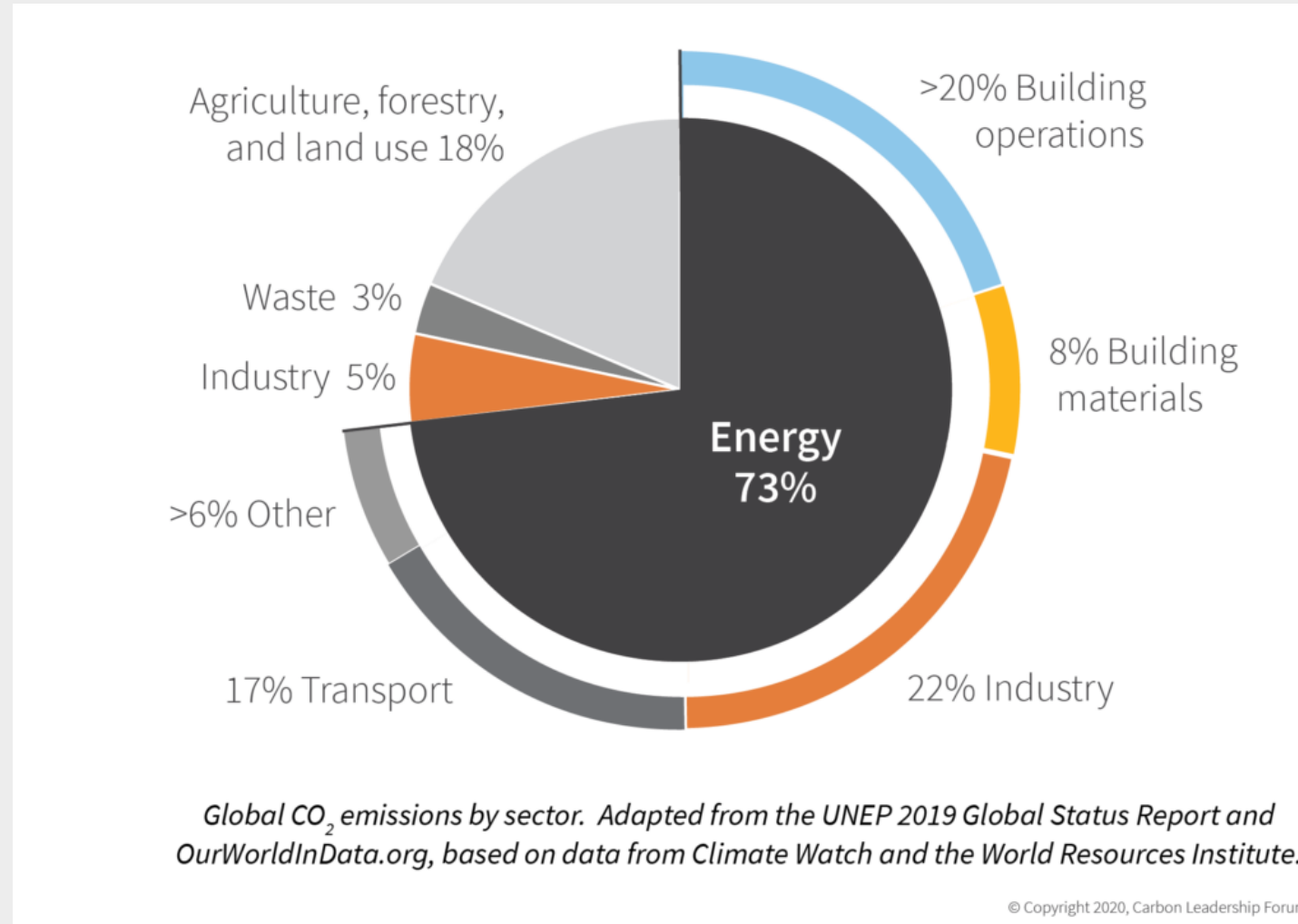


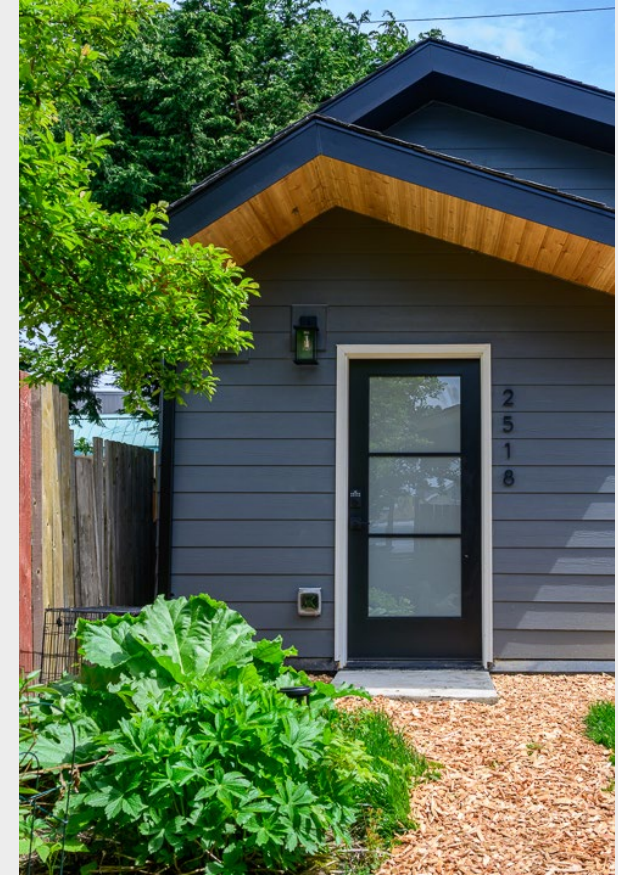
What is Embodied Carbon?

Life-Cycle Assessment Phases



Why Do We Care About Embodied Carbon?





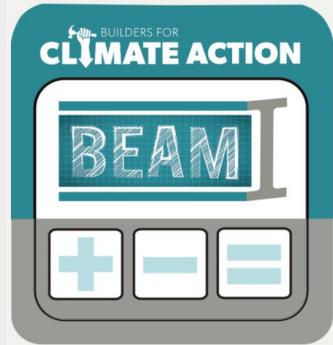
Calculate
Embodied
Carbon

Create
Company
Baseline

Set Emission
Reduction
Goals

Explore
Alternative
Materials

Establishing an Embodied Carbon Baseline



One Click LCA



MATERIAL CARBON PROJECT RESULTS

PROJECT INFORMATION

Project Name	17 Cascade Ln	Construction Year	2022
Design Firm(s)	Jake Evans & Ted Clifton	Number of Bedrooms	3
Engineering Firm(s)	Bradley Engineering	Stories Above Grade	2
Builder / Developer	TC Legend Homes		
Development Project	Excalibur Homes	CONDENSED AREA	
Street Address	17 Cascade Ln	Above Grade	1400 R²
City	Bellevue	Below Grade	0 R²
Province / State	Washington	Total	1400 R²
Country	United States		
Building Type	Single Detached House	ENDING AREA	
Construction Type	New Construction	Garage	240 R²
Project Stage	Construction Complete	Total	1640 R²

MATERIAL CARBON EMISSIONS BY SECTION

Foundations & Slabs	3,245 kg CO ₂ e
Foundation Walls	3,791 kg CO ₂ e
Structural Elements	219 kg CO ₂ e
Exterior Walls	2,233 kg CO ₂ e
Party Walls	8 kg CO ₂ e
Exterior Wall Cladding	1,093 kg CO ₂ e
Windows	2,543 kg CO ₂ e
Interior Walls	434 kg CO ₂ e
Floors	27 kg CO ₂ e
Ceilings	186 kg CO ₂ e
Roof	2,047 kg CO ₂ e
Garage	52,208 kg CO ₂ e
NET TOTAL	19,771 kg CO₂e

MCE (kg CO₂e) 19,771 MCE (kg CO₂e) 19,771

Choose a Tool

Select Project Set

Calculate!



MATERIAL CARBON RESULTS

Net Project Emissions	19,771 kg CO ₂ e	MCE (kg CO ₂ e)	152 kg CO ₂ e
MCE by Area Type			
Total Area	129.8		26.4
Conditioned Area	108.9		21.3
	kg CO ₂ e/m²	kg CO ₂ e/m²	

MCE (kg CO₂e) 19,771 MCE (kg CO₂e) 152

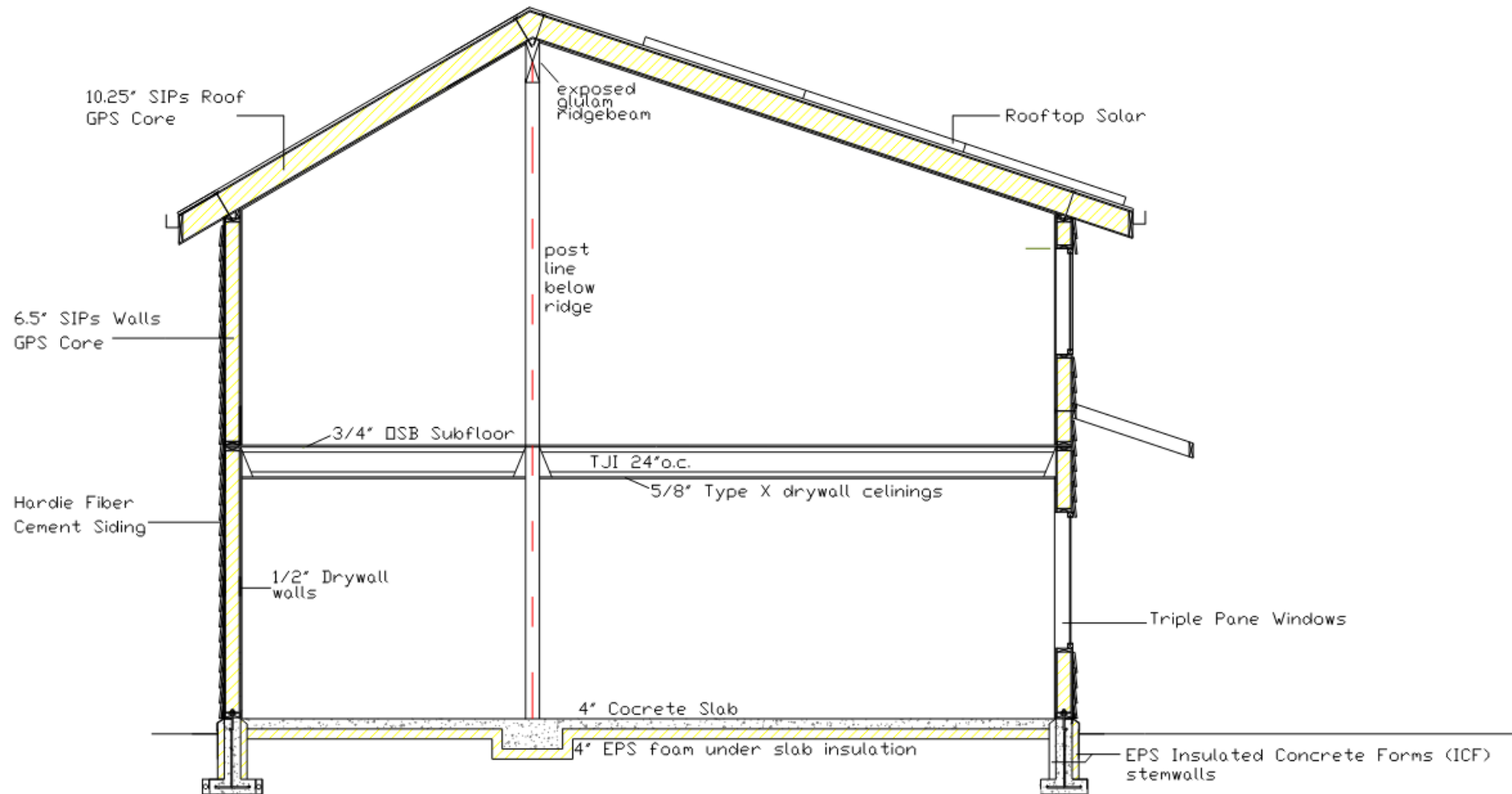
HIGHEST CARBON MATERIAL APPLICATIONS

SECTION	kg CO ₂ e	MATERIAL
Windows	2,543	Window - triple pane / Vinyl Frame / BECA Study [2]
Foundations & Slabs	3,245	Concrete - 2501-3000 psi, 30-39% FA/SL / NWCA
Garage	52,208	Concrete - 2501-3000 psi, 30-39% FA/SL / NWCA
Exterior Walls	2,233	EPS foam board with graphite / BASF / Neopor /
Foundation Walls	3,791	Concrete - 2501-3000 psi, 30-39% FA/SL / NWCA
Roof	1,093	EPS foam board with graphite / BASF / Neopor /
Interior Walls	434	OSB sheathing / 1/2" AWC & CMC Industry Avg
Exterior Wall Cladding	819	Fiber Cement Siding / Cambria / Paratec / 8 mm GS
Garage	795	Metal Panels - Steel / Metal Building Manufacturers
Garage	792	Concrete - 2501-3000 psi, 30-39% FA/SL / NWCA

LOWEST CARBON MATERIAL APPLICATIONS

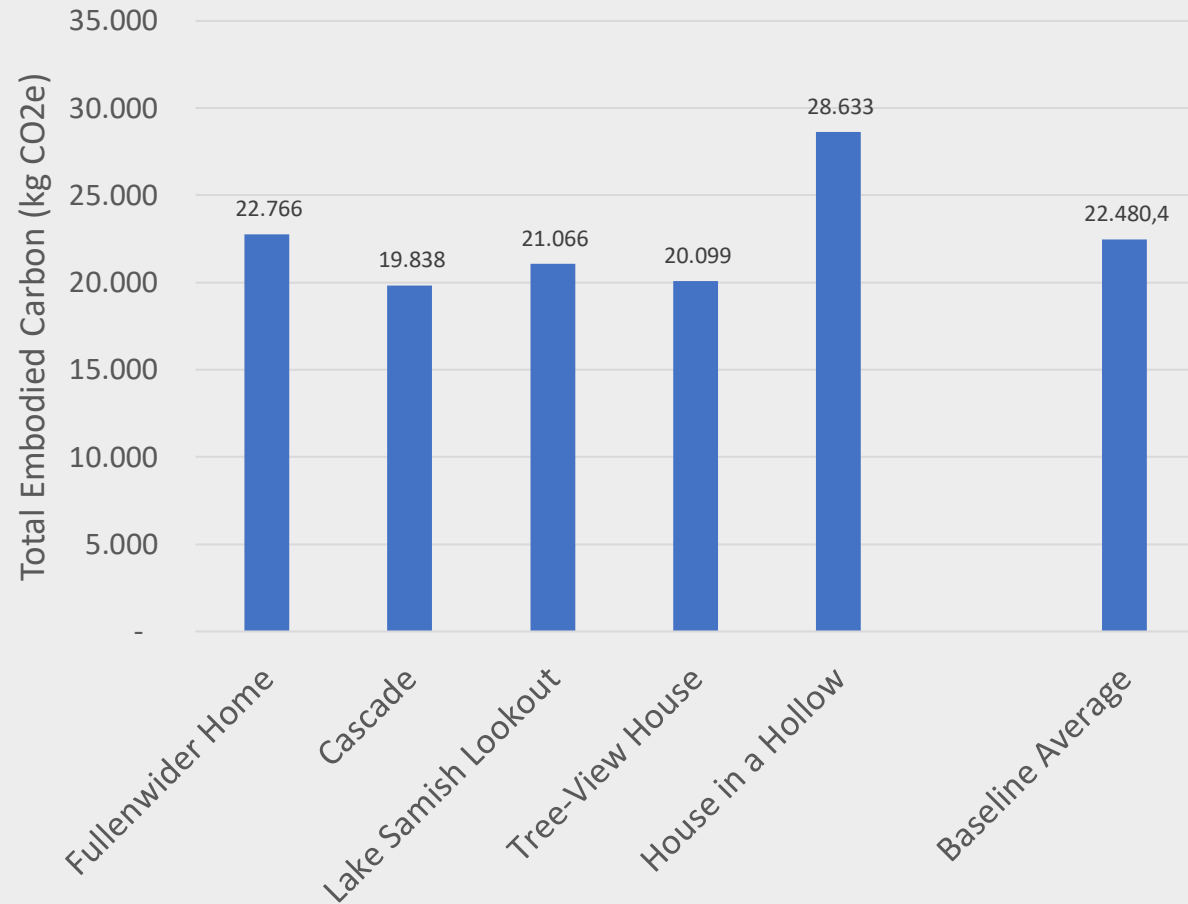
SECTION	kg CO ₂ e	MATERIAL
Floors	498	Laminated Bamboo Flooring / MOISO / Bamboo IB
Roof	2	Wood / SPF / 2x6 Lumber / AWC & CMC Industry
Garage	4	Cedar Siding / Western Red Cedar Lumber Assoc /

TC Legend Homes Typical House

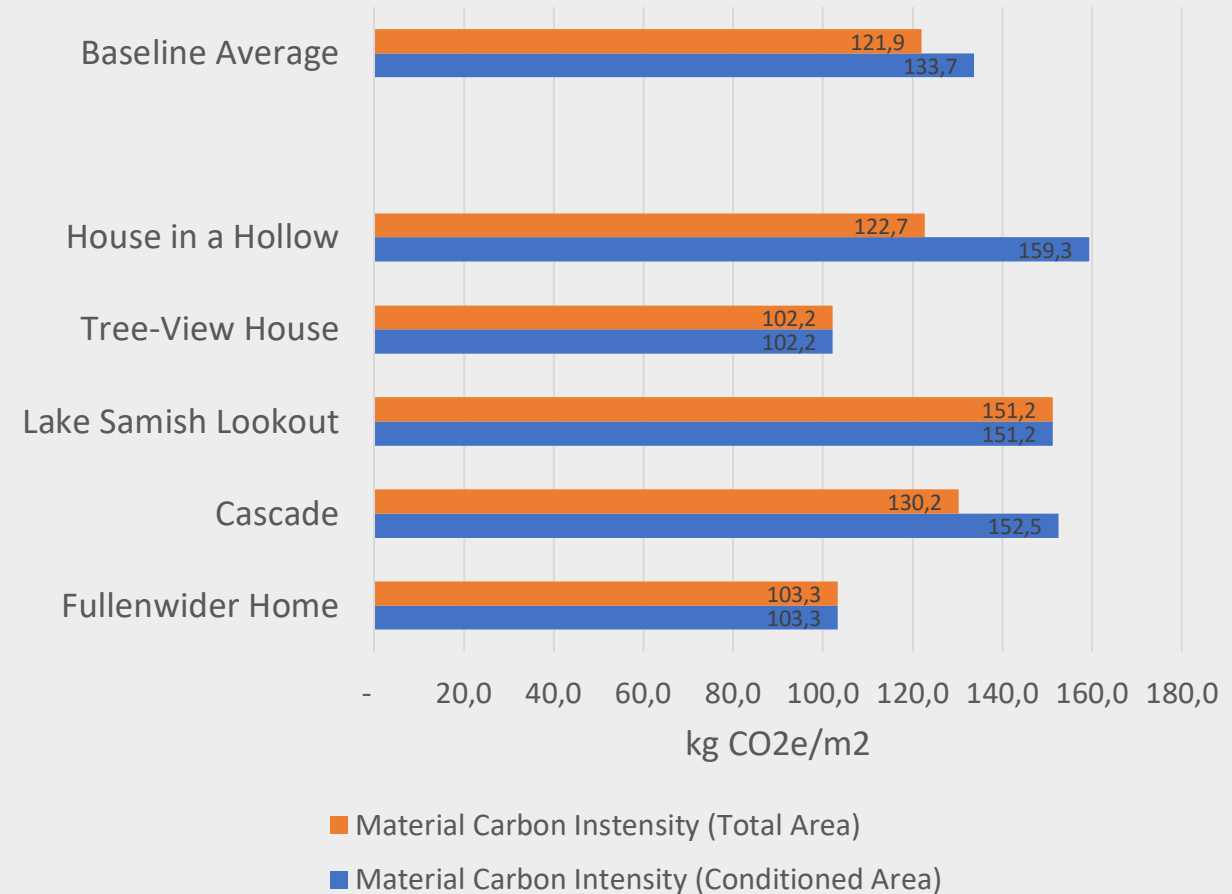


TC Legend Homes Embodied Carbon Baseline

Embodied Carbon Project Totals

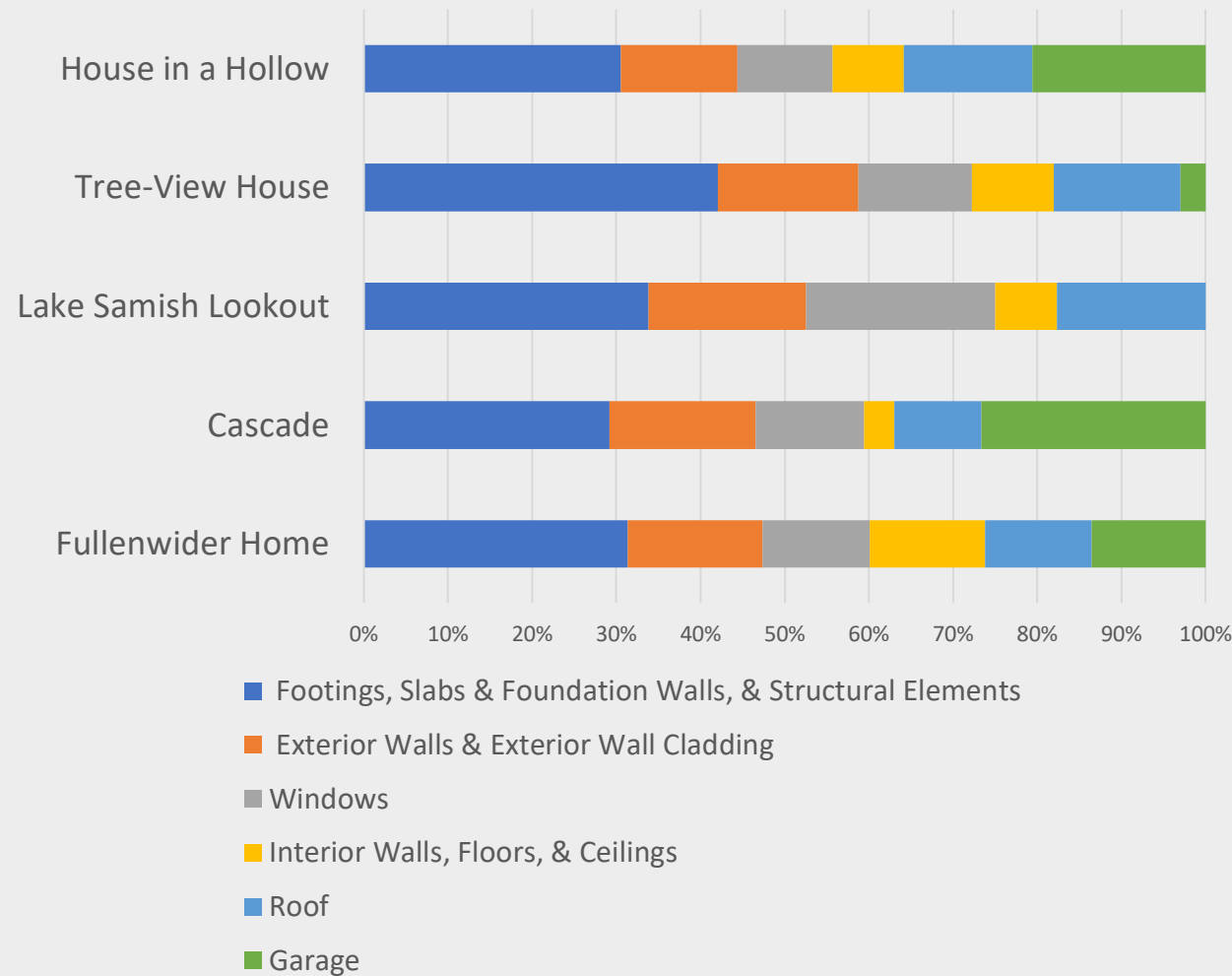


Material Carbon Intensity

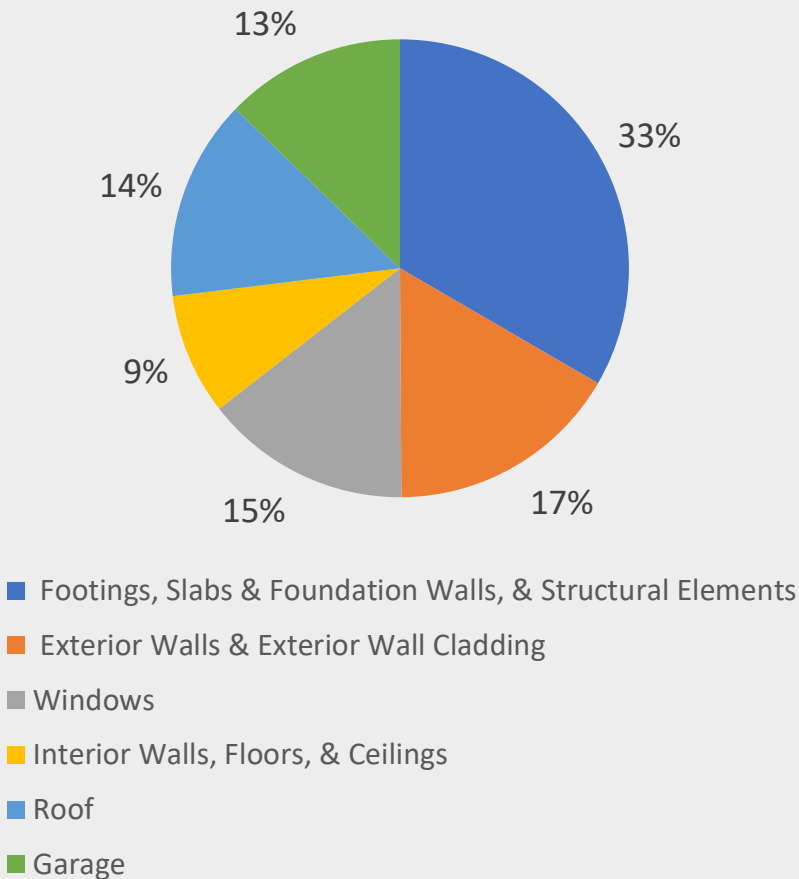


TC Legend Homes Embodied Carbon Baseline

Material Carbon Emissions by Components



Baseline Material Carbon Emissions by Component



TC Legend Homes Embodied Carbon Reduction Goals

- **Base:**

- Average 5% reduction in MCI by 2025 projects

- Average 15% reduction in MCI by 2028 projects

- Average 30% reduction in MCI by 2031 projects

- Average 50% reduction in MCI by 2035

- Net zero carbon for annual projects by 2035



- **Stretch:**

- Average 15% reduction in MCI by 2025 projects

- Net zero carbon for annual projects by 2032

- **Dream:**

- Average 35% reduction in MCI by 2028 projects

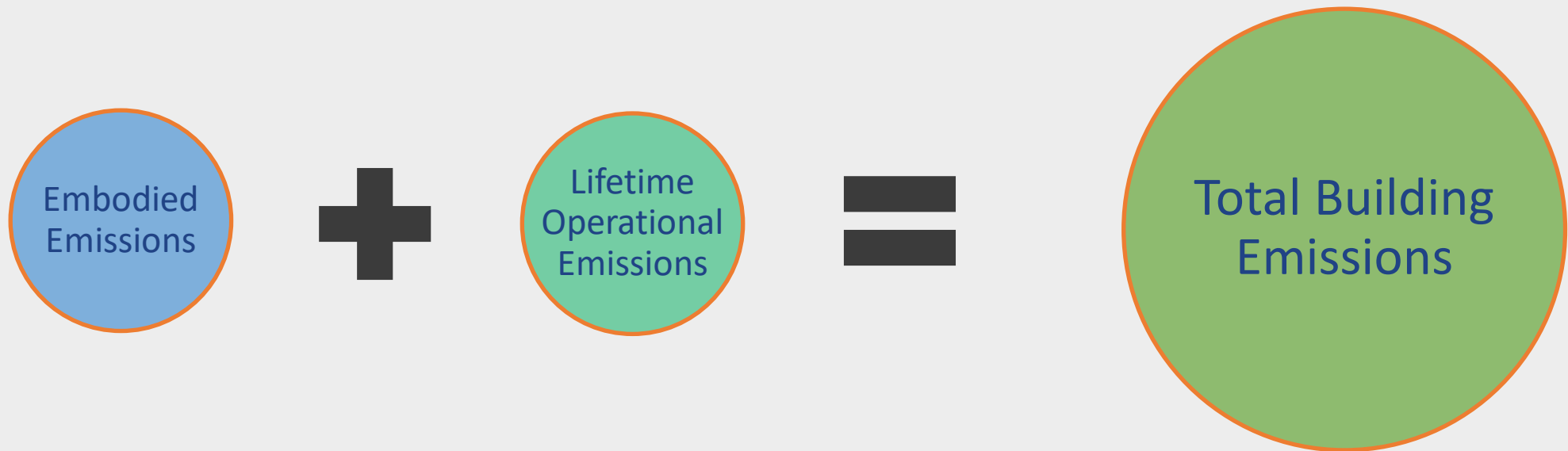
- Net zero carbon for annual projects by 2030



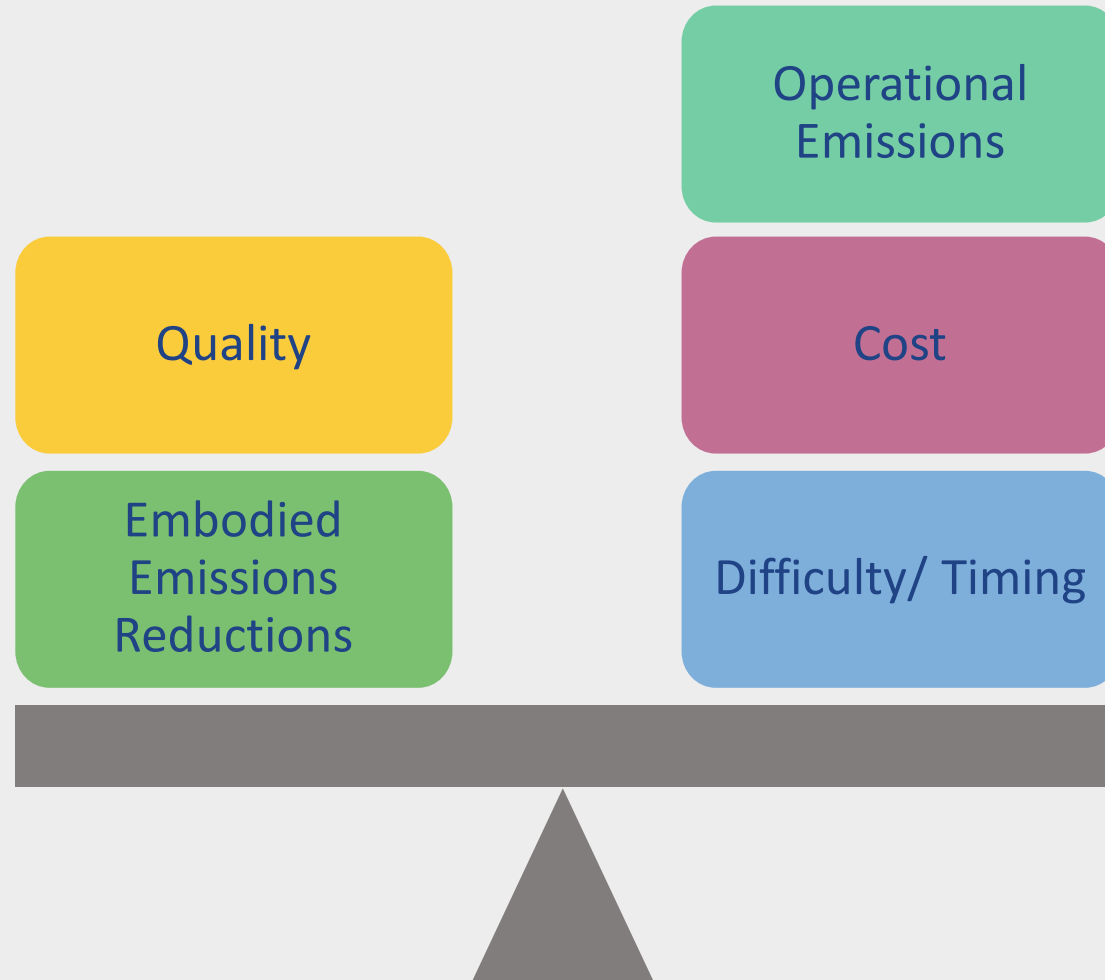
High Performance Building



New Frontier Building



Considering Material Changes

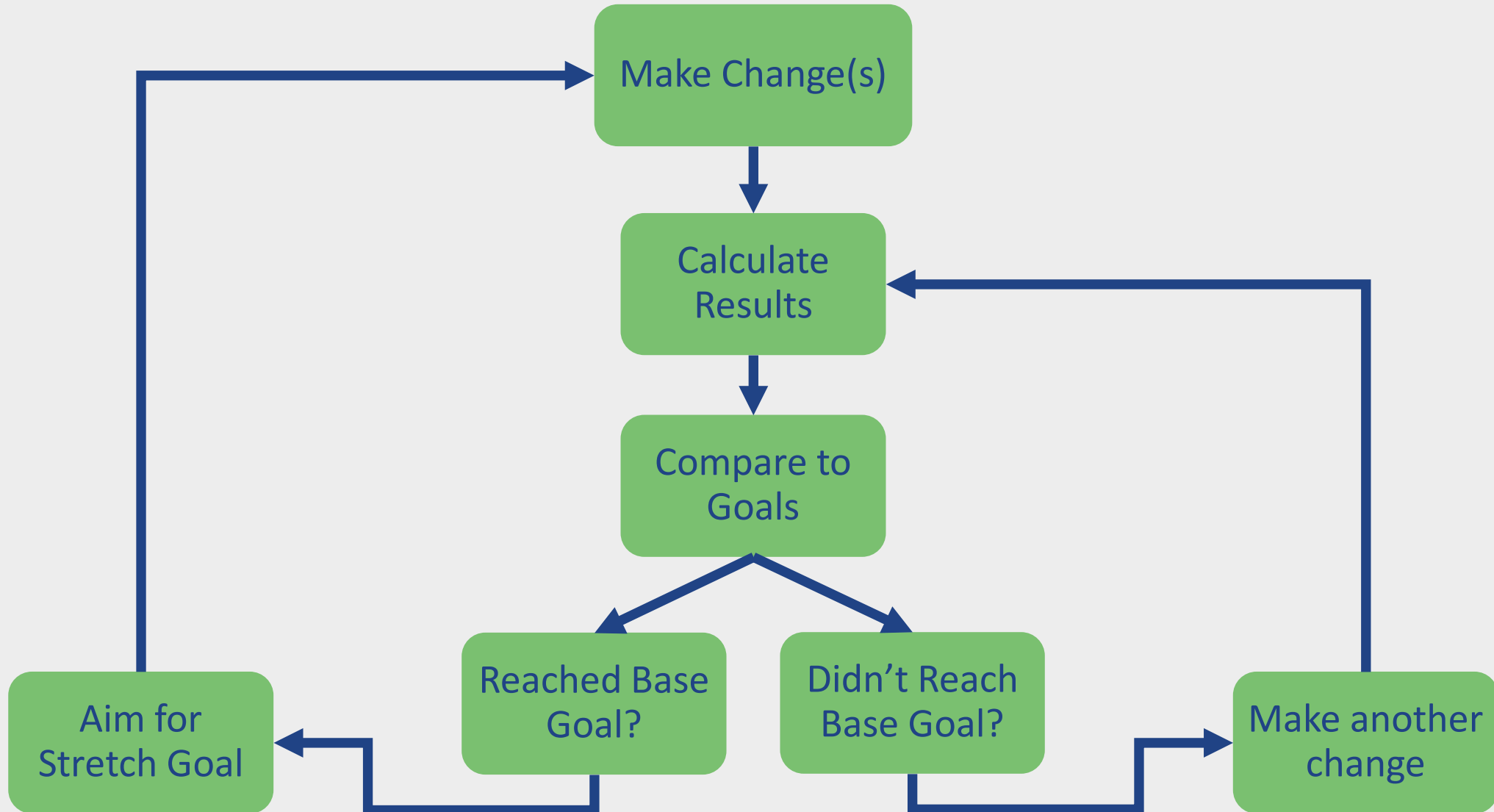


Considering Material Changes

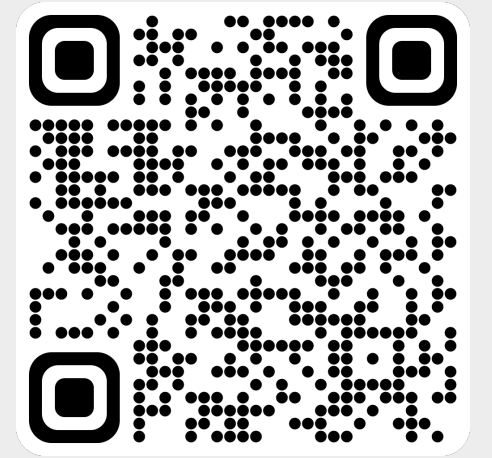
- Reduce concrete & foam where possible
- Alternative internal insulation & drywall
- Consider carbon storing, biogenic materials
- Prioritize lower carbon alternatives
 - Plywood > OSB
 - Timber > GLB > LVL
- Explore on site & local sequestration



Implementing Embodied Carbon Reductions



Questions?



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POWERHOUSE

<https://powerhouse-designs.com/embodyed-carbon-consulting>

Powerhouse Designs offers carbon related consulting and embodied calculation services.