Healthy for People and Planet

Why Healthier Materials Are Essential to High Performing Building Designs

Lisa Carey Moore and Jacob Deva Racusin

New Frameworks integrated ecostrategy Materially Better™

Learning Objectives

1. Identify where chemicals of concern exist using six classes approach

2. Explore the relationship/overlap between materials that support healthy indoor environments, and materials that have low embodied carbon values

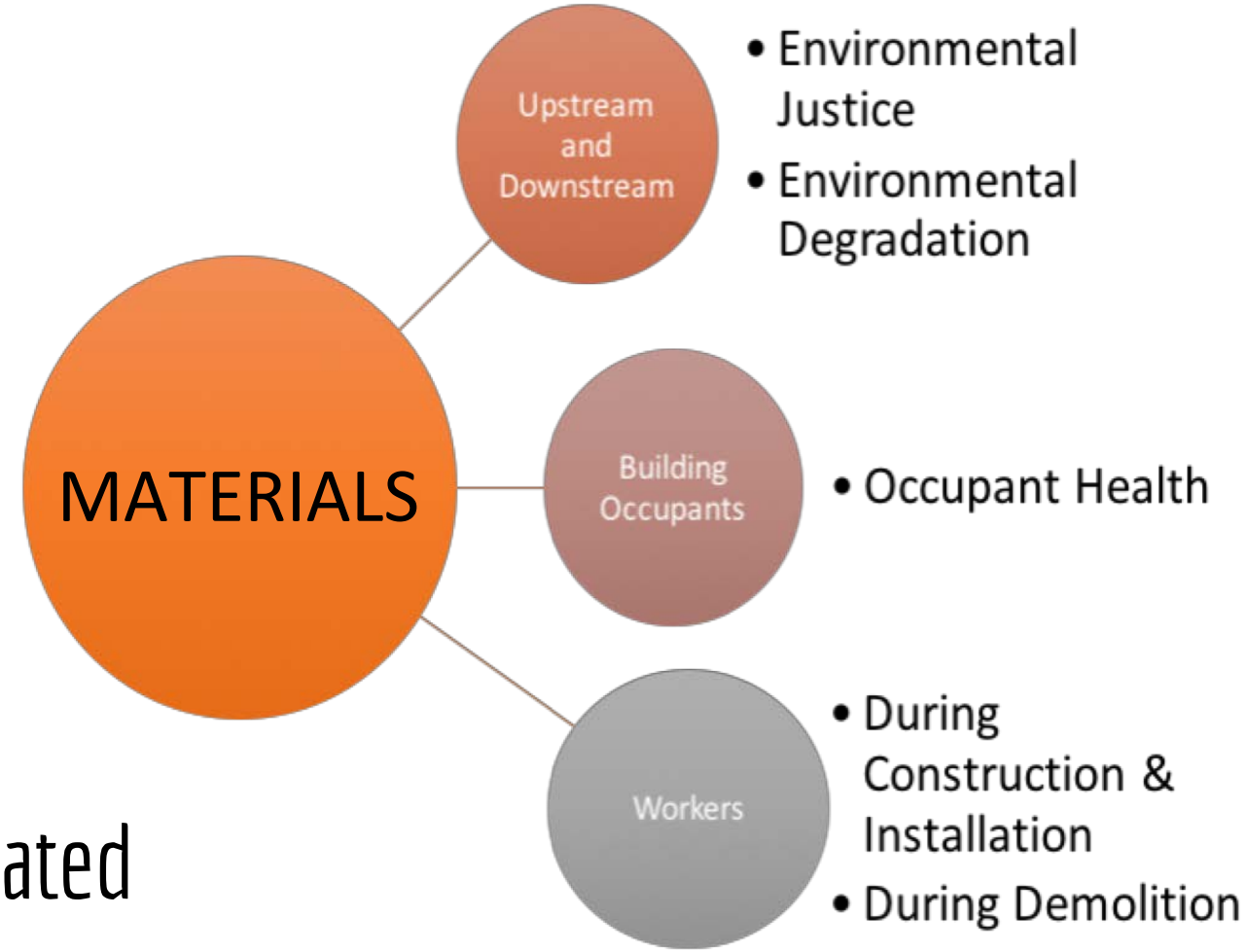
3. Understand the importance of material selection in high performance buildings, as evidenced in impacts on both occupant and environmental health and carbon footprint

4. Identify processes and goals for healthy buildings and for low carbon construction practices, and identify which material solutions best support these goals

Who are you?

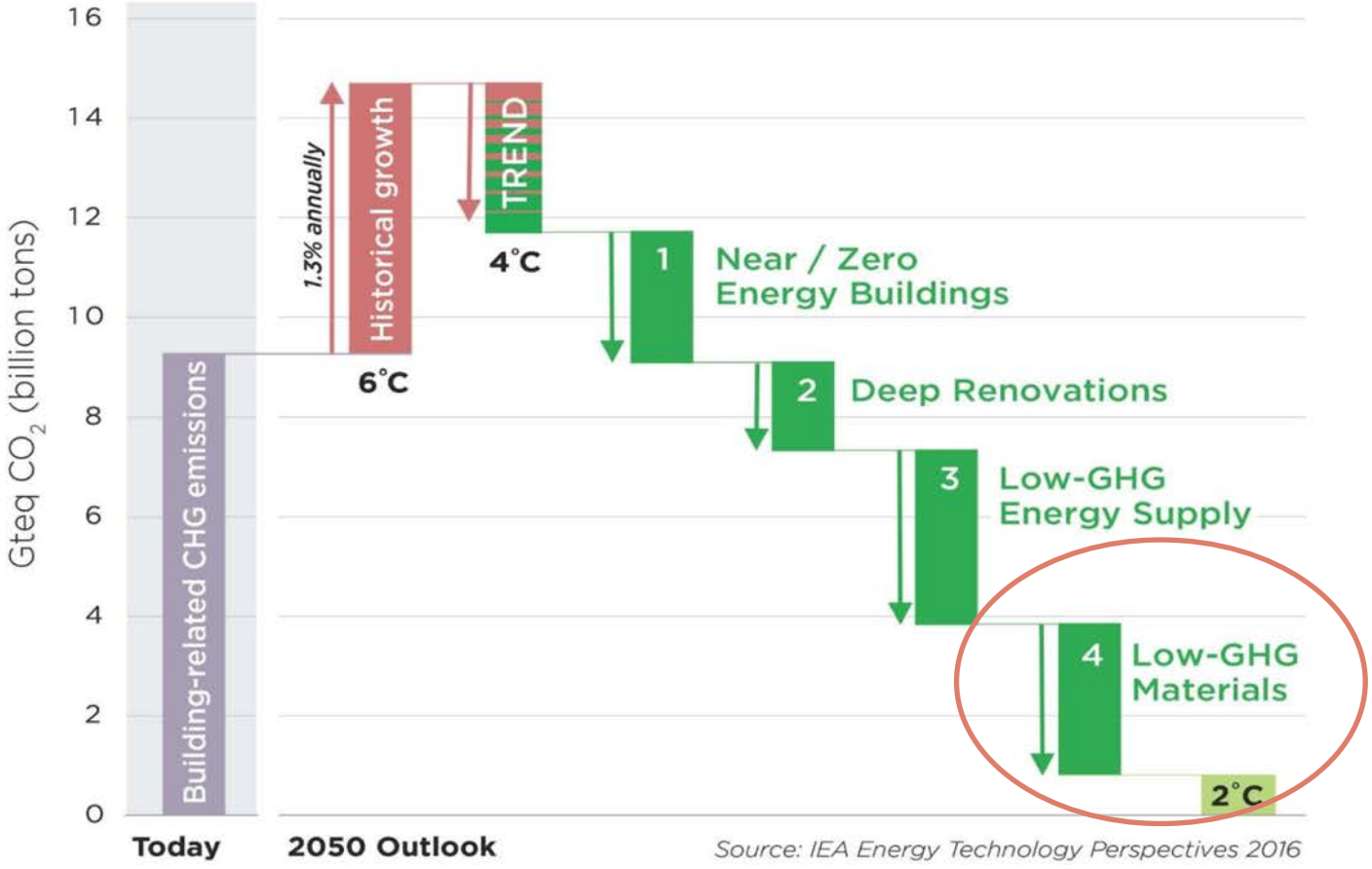
GOAL

Over time, all harms eliminated

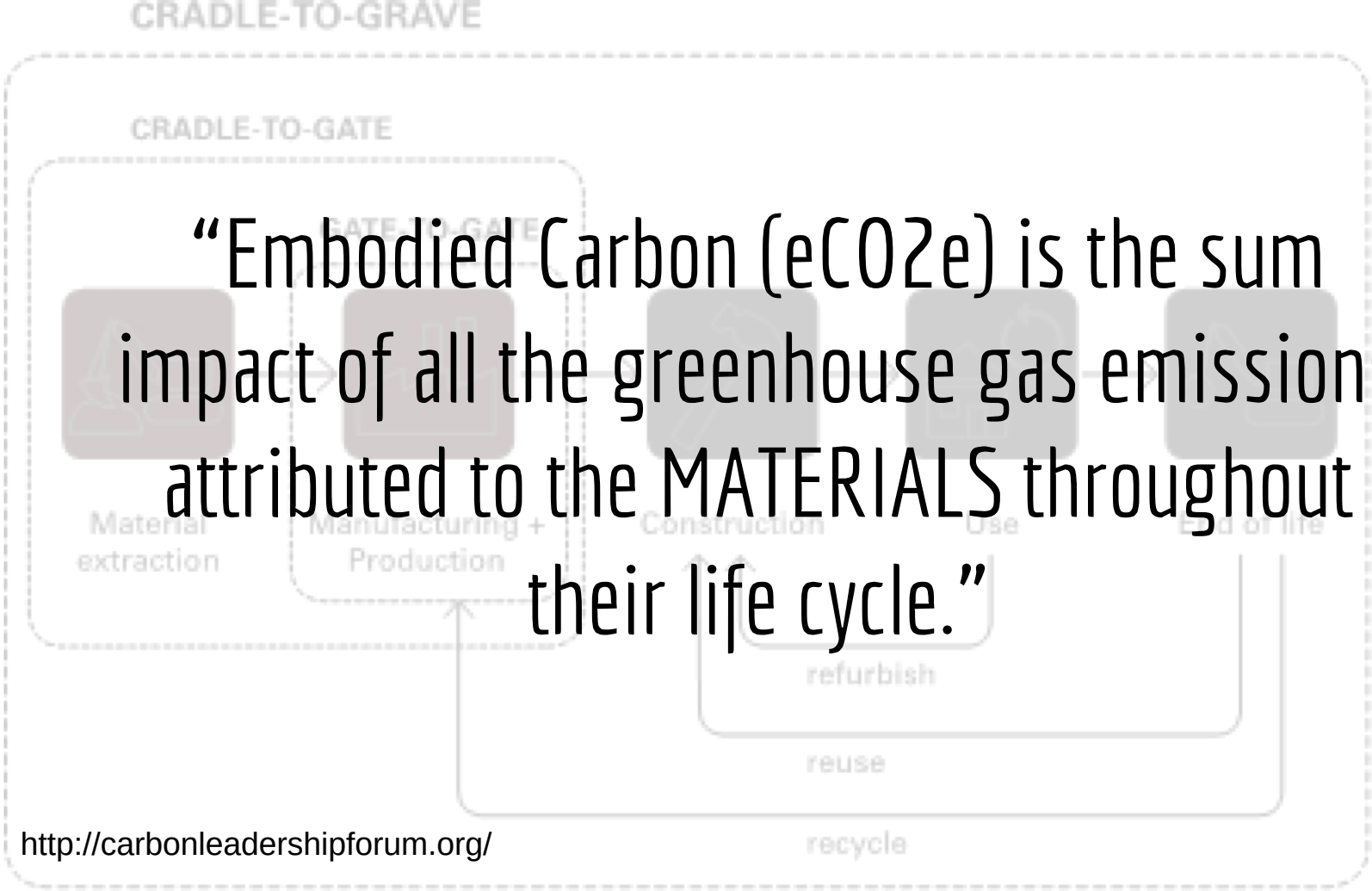


Split of Global Building-related Emissions & Emissions Reduction Potential

4 Key global policy priorities for <2˚C Scenario



Source: IEA Energy Technology Perspectives 2016



“Embodied Carbon (eCO2e) is the sum impact of all the greenhouse gas emissions attributed to the MATERIALS throughout their life cycle.”

http://carbonleadershipforum.org/

86,000
Chemicals Made in
USA

Chemicals Tested
in USA

THE SIX CLASSES OF CHEMICALS OF CONCERN

1	2	3	4	5	6
Highly Fluorinated	Antimicrobials	Flame Retardants	Bisphenols + Phthalates	Some Solvents	Certain Metals






How to reduce your exposure to harmful chemicals
SixClasses.org

GREEN SCIENCE POLICY INSTITUTE

http://greensciencepolicy.org/topics/six-classes/

Health Impacts

Highly Fluorinated: Kidney and testicular cancer; elevated cholesterol; decreased fertility; thyroid disease; interference with hormone function. **Antimicrobial:** Developmental; hormonal; reproductive problems; antibiotic resistance. **Flame Retardants:** Lowered IQ and hyperactivity in children; cancer; hormone disruption; decreased fertility; **Bisphenols & Phthalates:** Mimic or block hormones disrupting vital body systems; asthma; neuro-developmental problems; allergies; cognitive problems; obesity; type II diabetes; heart disease; decreased fertility; prostate cancer; reduced fertility. **Solvents:** Neurological problems and increased cancer risks. **Certain Metals:** Mercury/Arsenic/Cadmium and Lead exposure can cause brain development to be impacted; increase risk of cancer; neurological and cardiovascular effects; lung and kidney damage.

1. Highly Fluorinated

Where are they?

Stain & Water Repellents

- Furniture upholstery
- Carpets
- Drapery

FEP/teflon insulated Wire and Cable

Metal coatings “PVDF” type

Health + Carbon:

Ask manufacturer to remove stain and water repellants in finishes.

Eliminate products that need water and stain repellents.

2. Antimicrobials

Where are they?

Wall and window finishes
Flooring
Surfaces in lav & kitchen areas
Acoustical ceiling comp. & panels
Polyurethane adhesives
Foam and cellulose insulation

Health + Carbon:

Ask manufacturers to eliminate Antimicrobials.

See: Building Green "*Antimicrobial Chemicals in Buildings-Hygiene or Harm?*"

3. Flame Retardants

Where are they?

- Furniture Foam
- Building Insulation
- Textiles
- Fabric blinds and drapes
- Paints and coatings
- Wire and Cable sheathing
- Electronic Cases**

Health + Carbon:

Ask manufacturers to eliminate FRs.

Design/Build without foam insulation and products that contain these harmful chemicals.

TB 117-2013 for Furniture = meet flammability standards without chemical flame retardants

4. Bisphenols & Phthalates

Where are they?

Bis: Polycarbonates used for electrical enclosures, luminaire lenses, furniture/cabinets, epoxy products (paints, grouts, surfaces)

Phthalates: Vinyl Flooring, plastic divider curtains, plastic filters and screens, glues, caulks, paints.

See: Healthy Building Network's DataCommons: https://commons.healthymaterials.net/home
LBC's Red List: https://living-future.org/declare/declare-about/red-list/#red-list-cas-guide

Plastics that are “better” for Health……

1. **PET** (#1 recycled) **is recycled into new PET products,** spun into **polyester fiber** (carpets, stuffing for furniture, small pieces in light fixtures & plumbing components).

2. **LDPE/HDPE** (#2) **simple to recycle**, can be used to make everything from wastewater pipe to baby changing stations. Durable when exposed to the elements. **Substitute for PVC** where code allows.

3. **Polyolefins, Modified Polyphenylene (mPPE). Highly recyclable and less material needs to be used.** Growth in electrical cable/wire.

5. Solvents

Where are they?

They disperse or dissolve...

- Oil based paints
- Adhesives
- Sealants
- Blowing Agents for foam

Health + Carbon:

Eliminate CA Class II Banned list.

Water based products.

Mechanical fasteners (better for adaptation/deconstruction)

https://www.arb.ca.gov/db/solvents/solvents.htm

6. Certain Metals

Mercury, Arsenic, Cadmium, Hexavalent Chromium and Lead

Where are they?

- MEP
- Drywall
- Electronic products
- Paints, metal coatings
- CRVI in galvanization & chrome plate

Health + Carbon:

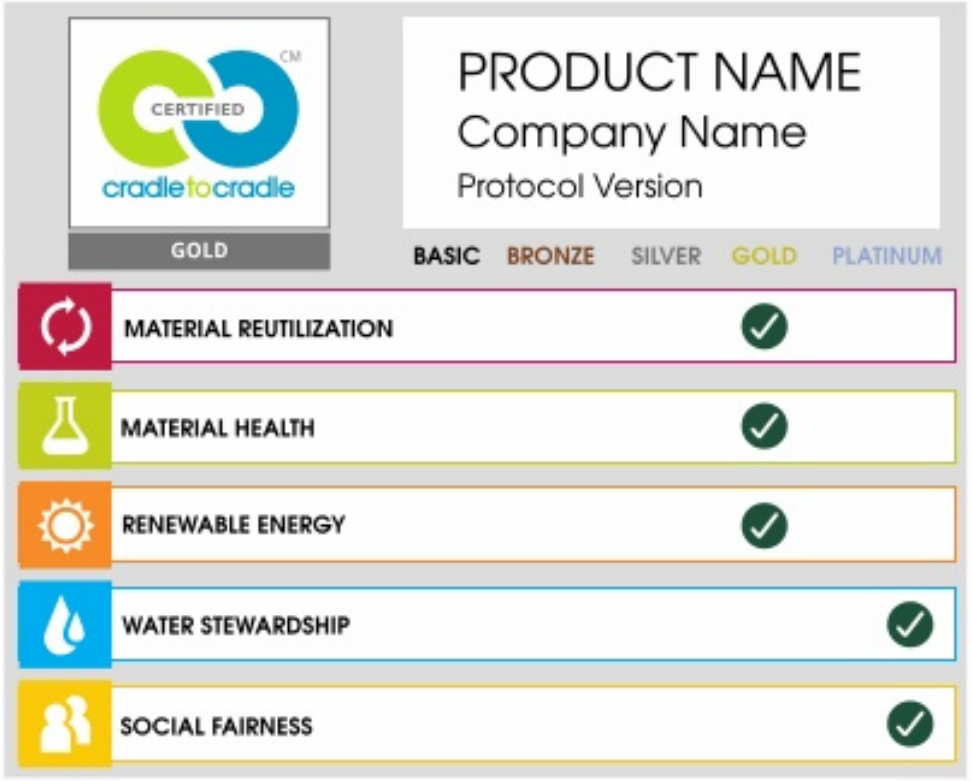
Lead Free

Recycled content gyp board has trace mercury ***but best for eCO2!***

Electronics that have RoHS & WEEE recycling;

CRIII for galvanizing and plating.

Our Scorecard



COMPONENT	INGREDIENT NAME	CAS#	%	SOURCE
All colors except Rose Quartz, Red Rock, Painted Desert	Water	7732-18-5	75-85%	
empty	Lithium silicate	12627-14-4	10-15%	
	Titanium dioxide	13463-67-7	5-10%	
	Ferric oxide yellow	51274-00-1	1-5%	
	Iron Oxide Red	1309-37-1	1-5%	
	Iron oxide	1317-61-9	1-5%	
	Potassium siliconate	31795-24-1	1-5%	
	Ethylene glycol	107-21-1	1-3%	
	Silicon hydroxide	21645-51-2	< 1%	

CONTENT INVENTORY

Inventory Reporting Format

- ○ Nested Materials Method
- ◉ Basic Method

Threshold Disclosed Per

- ○ Material
- ◉ Product

Threshold level

- ○ 100 ppm
- ◉ 1,000 ppm
- ○ Per GHS SDS
- ○ Per OSHA MSDS
- ○ Other

Residuals/Impurities

- ◉ Considered
- ○ Partially Considered
- ○ Not Considered

Explanation(s) provided for Residuals/Impurities?

◉ Yes ○ No

Are All Substances Above the Threshold Indicated:

Characterized
Percent Weight and Role Provided? ◉ Yes ○ No

Screened
Using Priority Hazard Lists with Results Disclosed? ◉ Yes ○ No

Identified
Name and Identifier Provided? ○ Yes ◉ No

CONTENT IN DESCENDING ORDER OF QUANTITY

Summary of product contents and results from screening individual chemical substances against HPD Priority Hazard Lists and the GreenScreen for Safer Chemicals®. The HPD does not assess whether using or handling this product will expose individuals to its chemical substances or any health risk. Refer to Section 2 for further details.

MATERIAL | **SUBSTANCE** | *RESIDUAL OR IMPURITY*
GREENSCREEN SCORE | HAZARD TYPE

TECTUM WALL & CEILING PANELS [AMERICAN ASPEN NoGS MAGNESIUM OXIDE LT-UNK SODIUM SILICATE LT-P1 | END MAGNESIUM SULFATE, ANHYDROUS LT-UNK CALCIUM CARBONATE BM-3 UREA LT-UNK QUARTZ LT-1 | CAN TITANIUM DIOXIDE LT-1 | CAN | END SILICA,

Number of Greenscreen BM-4/BM3 contents..... 1
Contents highest concern GreenScreen Benchmark or List translator Score..... BM-1
Nanomaterial..... No

INVENTORY AND SCREENING NOTES:

Residuals / impurities in select raw materials are quantitatively mea
are displayed in the HPD when greater than 1000ppm.

Health Product DECLARATION

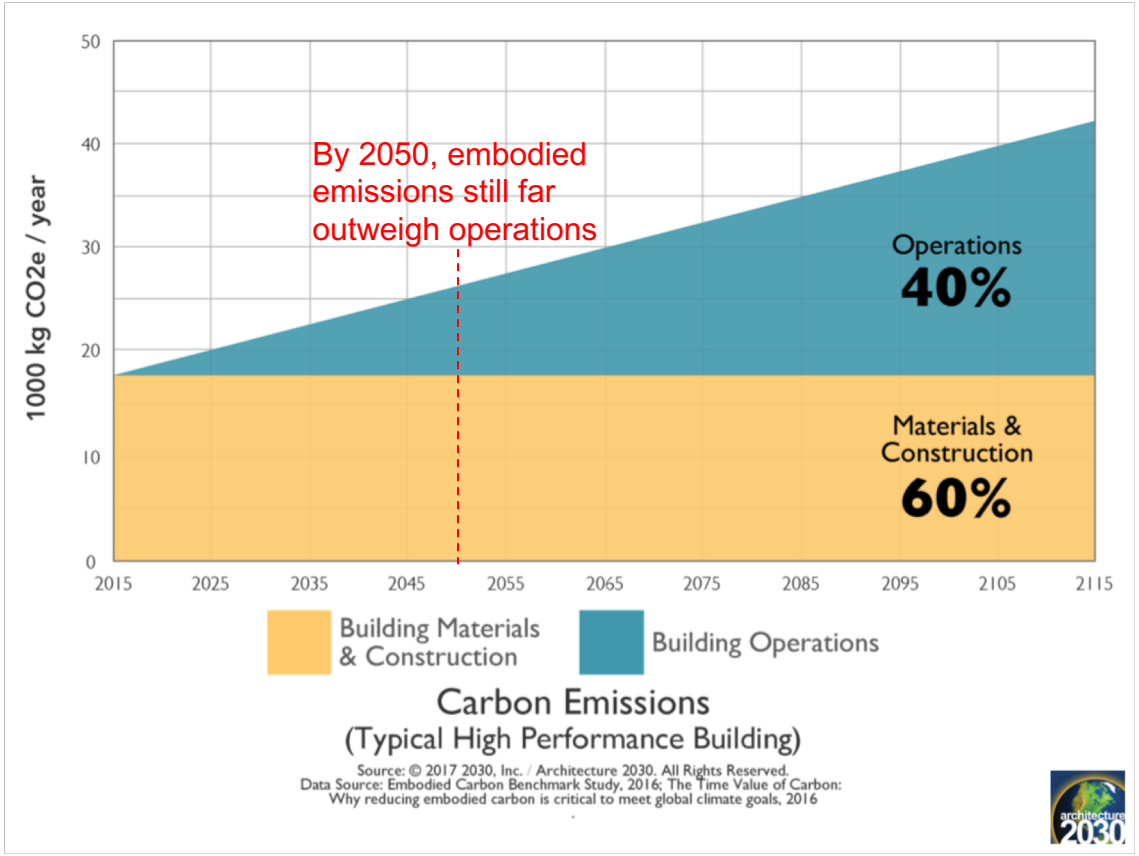
Questions?

Why does embodied carbon (eCO2e) matter?

1. Cannot reach WGBC “zero by 2050” goal **without addressing eCO2e.**

2. Embodied emissions are large, and immediate - **timing is critical, cannot be offset**.

3. As **grid “de-carbonizes”**, operational CO2e reduces.



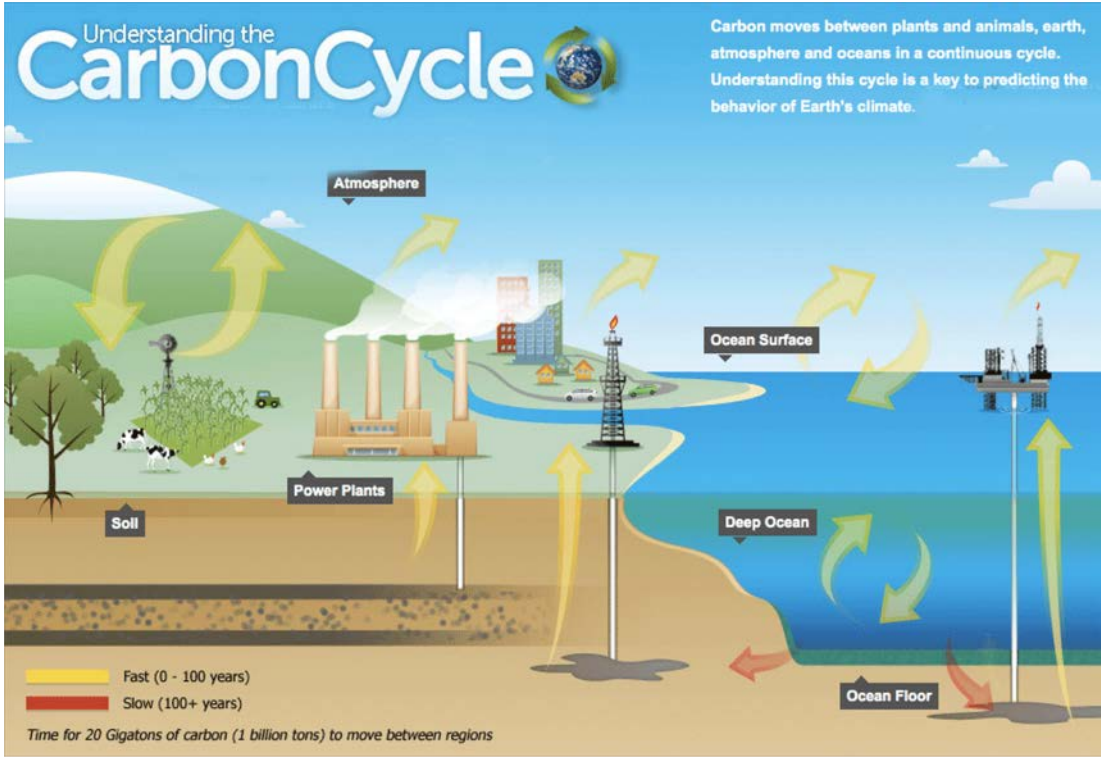
Why does embodied carbon (eCO2e) matter?

4. High eCO2e insulation could yield **more total CO2e than less insulation.**

5. Carbon-storing materials can help **reverse atmospheric CO2e load**.

6. Plant-based materials can amplify **carbon-smart silvi/agriculture.**

7. Plant-based materials can support **carbon-smart economies.**



We know we can get to net zero.....

Image Credit: Edwin Dehler-Seter

Measuring Carbon

Carbon Databases

- eCO2e values for various materials
- not normalized to common units
- not directly comparable between different materials.

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Environmental Product Declaration (EPD)
- document providing independently-verified, transparent data
- info about multiple life-cycle environmental impact of products
- units and methodologies may vary widely!

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Whole Building Life Cycle Analysis (WBLCA)
- technique that identifies, quantifies and evaluates the environmental impacts (inputs and outputs) of a building from cradle to grave/cradle
- comprehensive, thorough, comparable

Example: Expanded PolyStyrene (EPS)

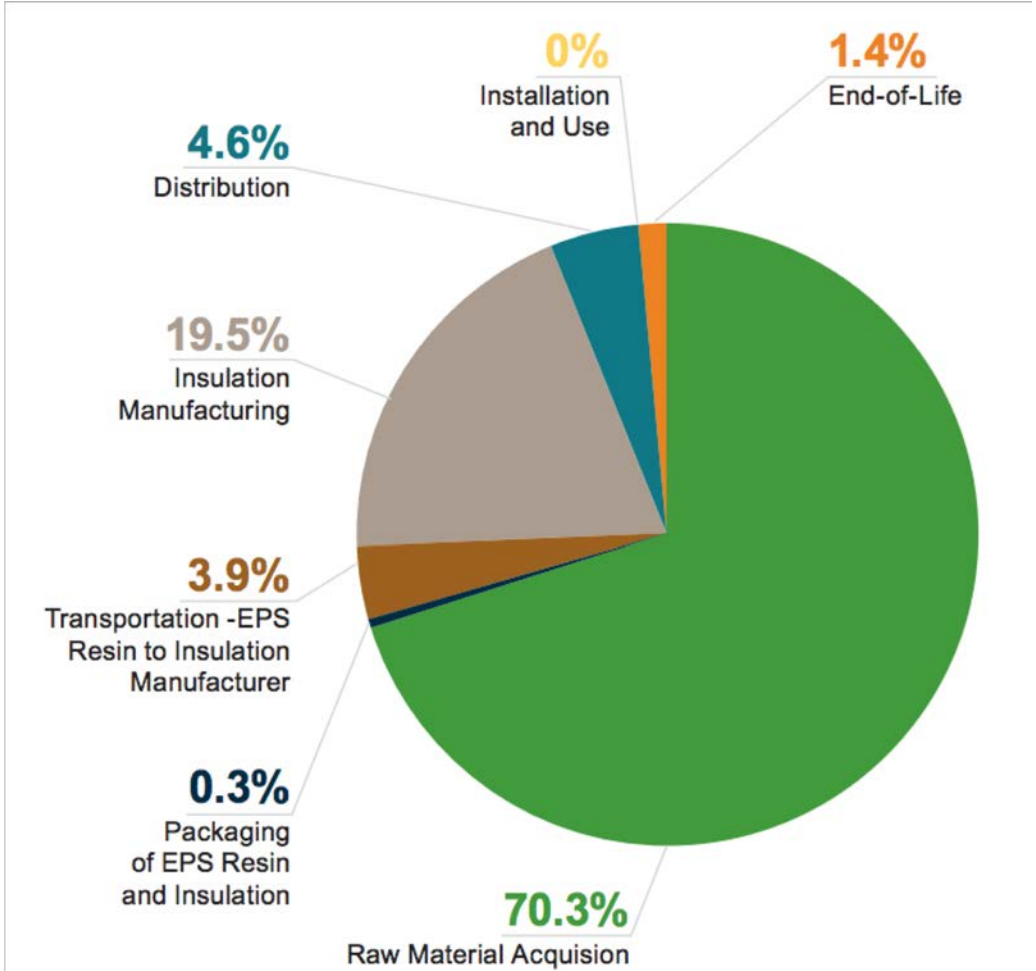
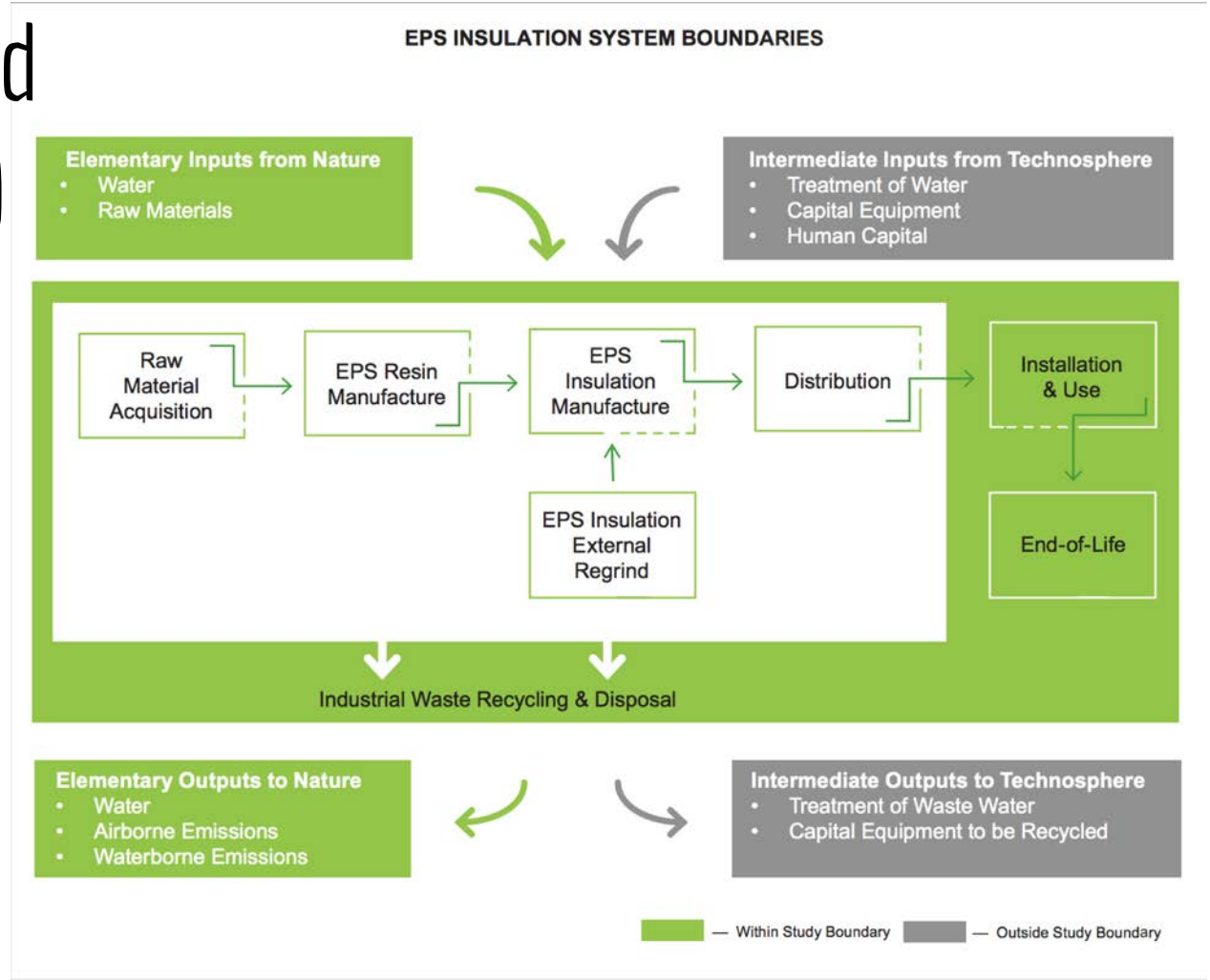


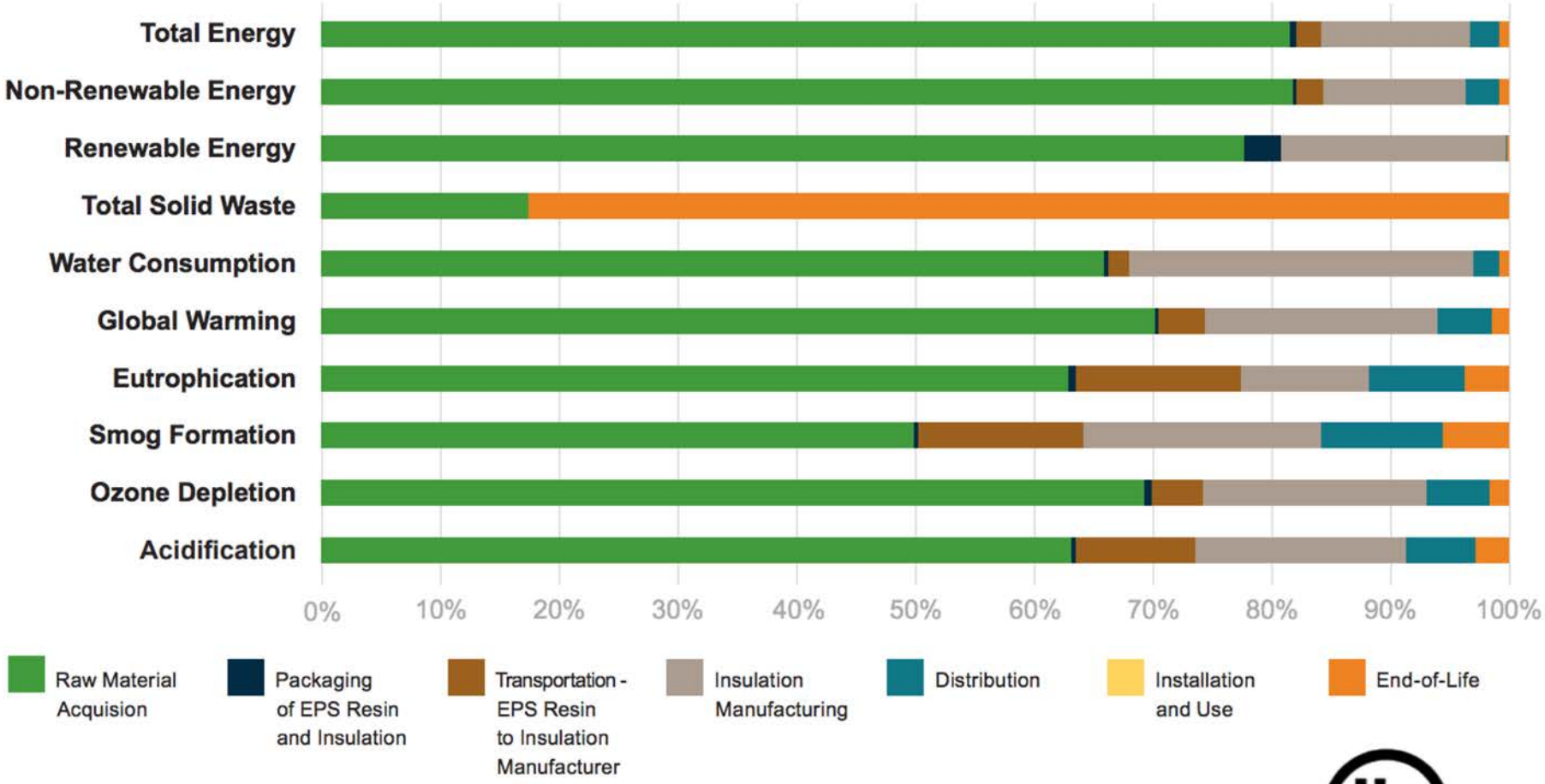
Figure 4: Global Warming Potential Results for EPS Insulation

Source: industry EPD

Example: Expanded PolyStyrene (EPS)



Source: industry EPD

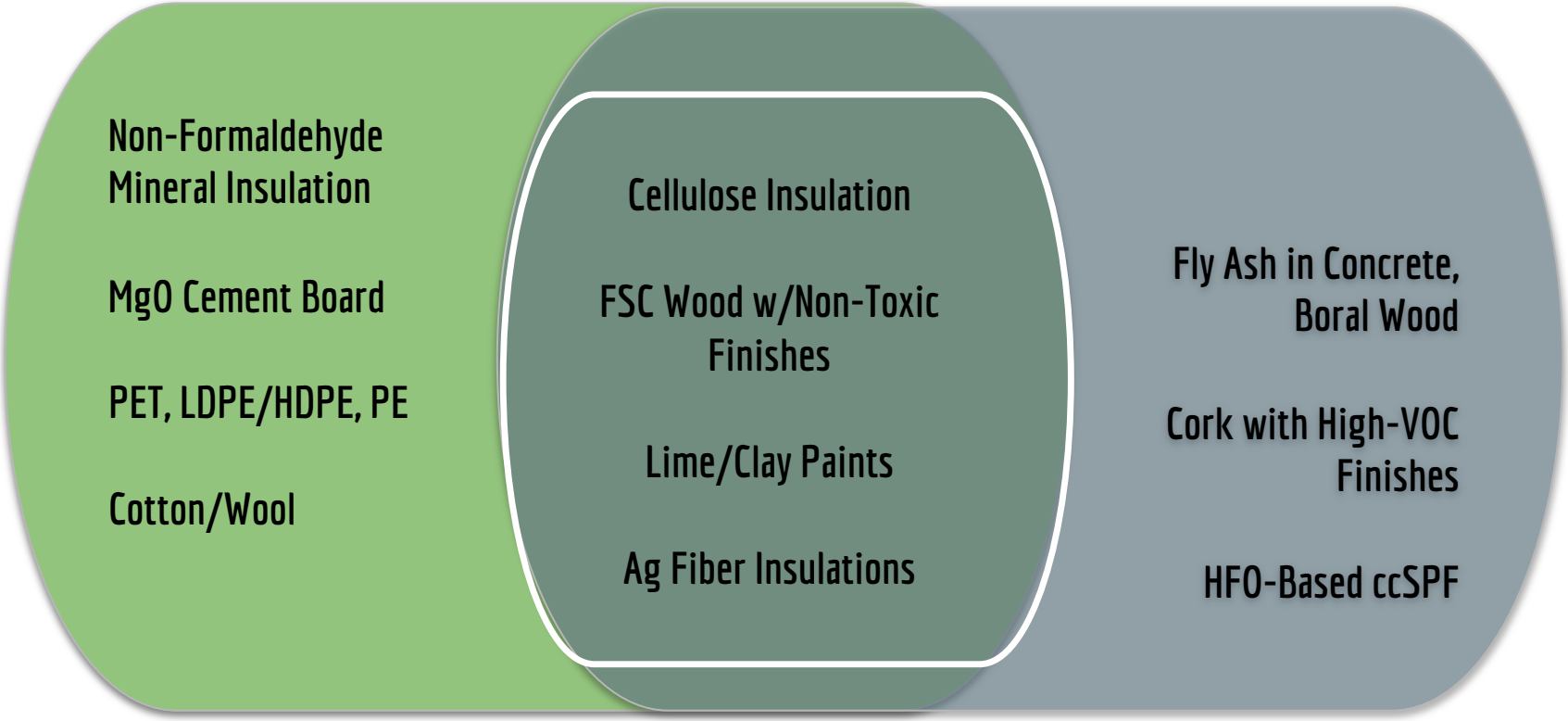


Environment

Figure 7: Normalized Results for EPS Insulation

Materials and Methods [15-20 min]

Health + Carbon: Material "Sweet Spot"



Structure

	Baseline	Better	Best
Material Type	Standard Portland Cement, virgin steel	Fly-ash concrete, recycled steel	CO2-cured concrete/reduction strategies, wood*
Impact	*High eCO2e, toxic treatments (CR6 or PFOAs), emissions (i.e. mercury)*	*Lower eCO2e, toxins in fly ash and treatments*	*Lowest carbon/carbon storing, non/low toxic***

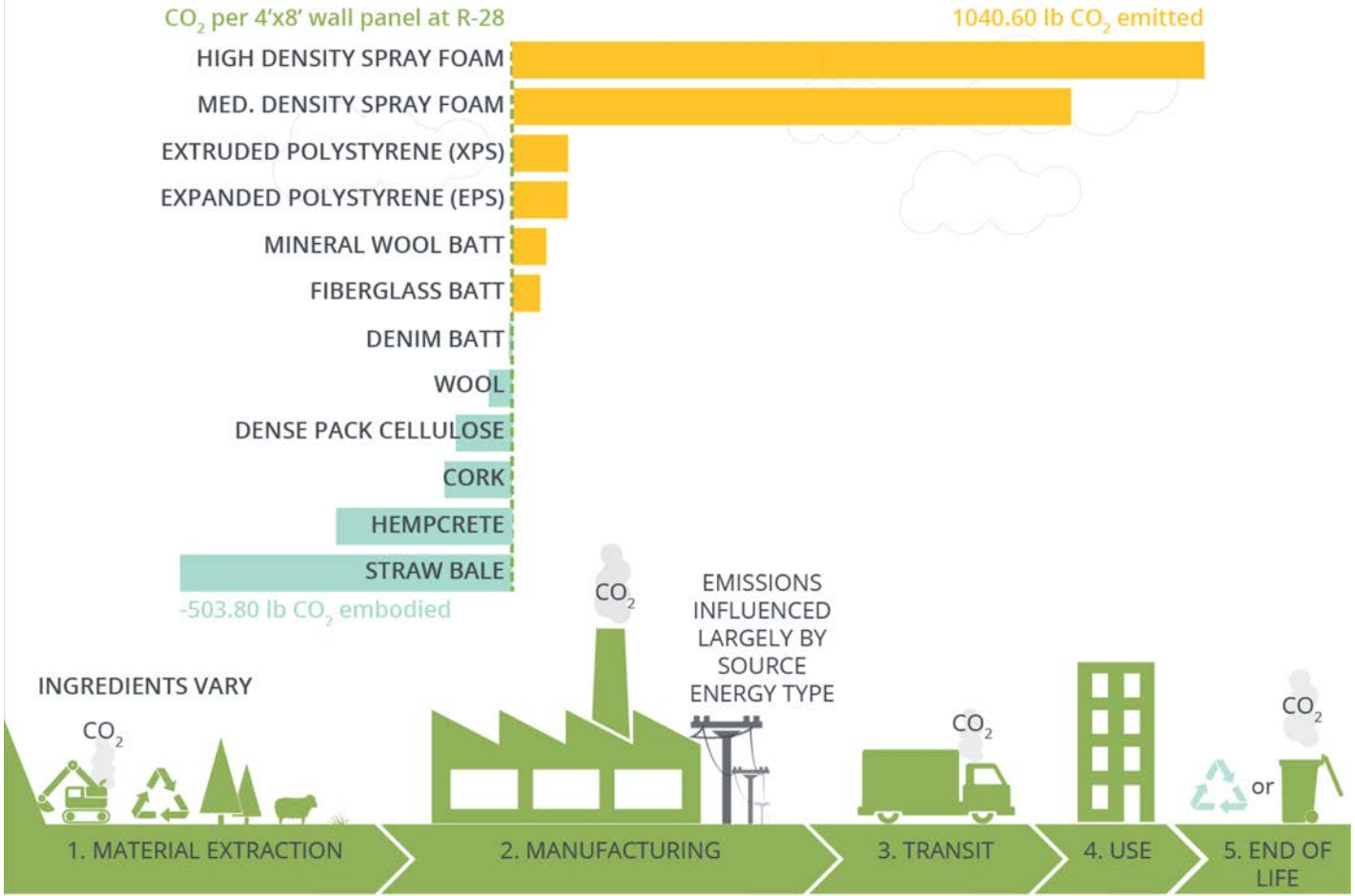
*FSC or comparable management practices must be applied. Use reclaimed wood where feasible.
**Avoid Phenol formaldehyde in adhesives used for laminated timbers, MDF; toxins in wood treatments

Insulation-Rigid

	Baseline	Better	Best
Material Type	XPS	Mineral Board Polyisocyanurate (PIR)	Fiber Board Hempcrete++
Impact	*High eCO2e, Flame Retardants*	*Less toxic, high carbon* *PIR is lower carbon, moderately toxic*	*Lowest carbon/carbon storing, non/low toxic***

++ While not a rigid board, a rigid insulation once it cures
**Avoid Phenol formaldehyde in adhesives used for the fiber board products

CARBON IMPACTS OF INSULATION



Carbon impacts data sources: "Making Better Buildings", Chris Magwood, 2016; SPFA Industry Average Environmental Product Declaration, Number 13CA29310.101.1, 2013

Example: Carpet Tile (Interface)

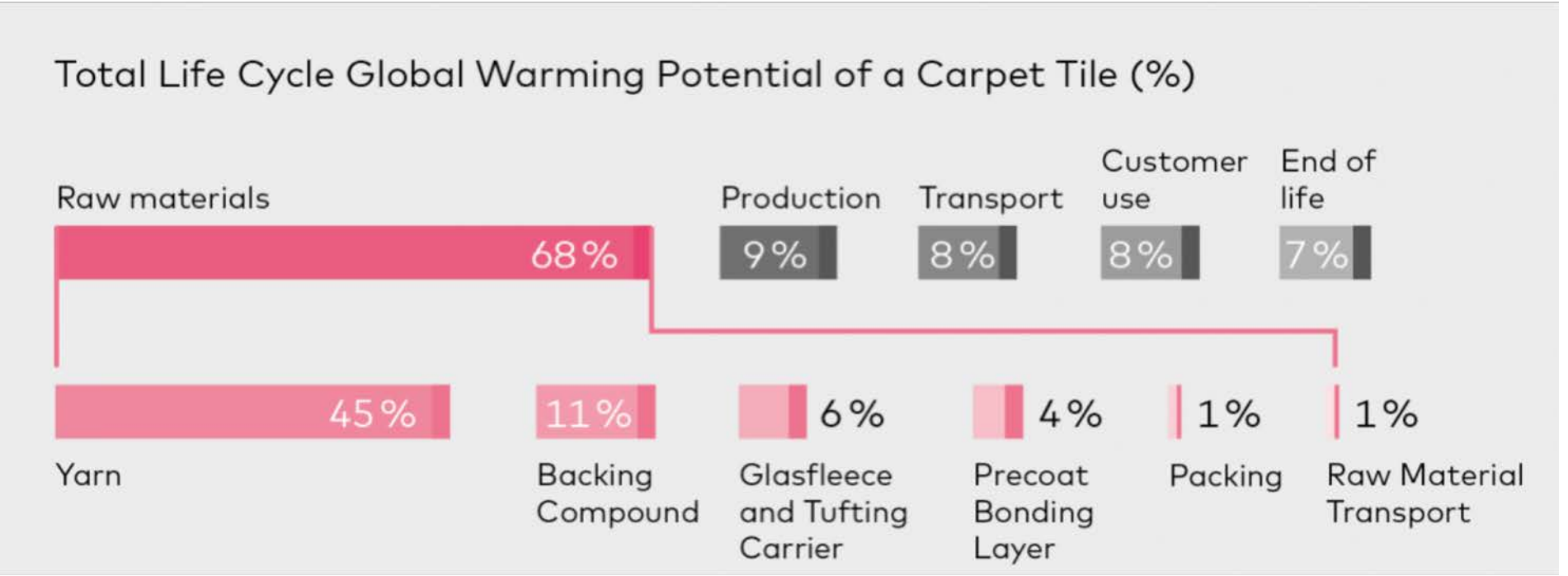
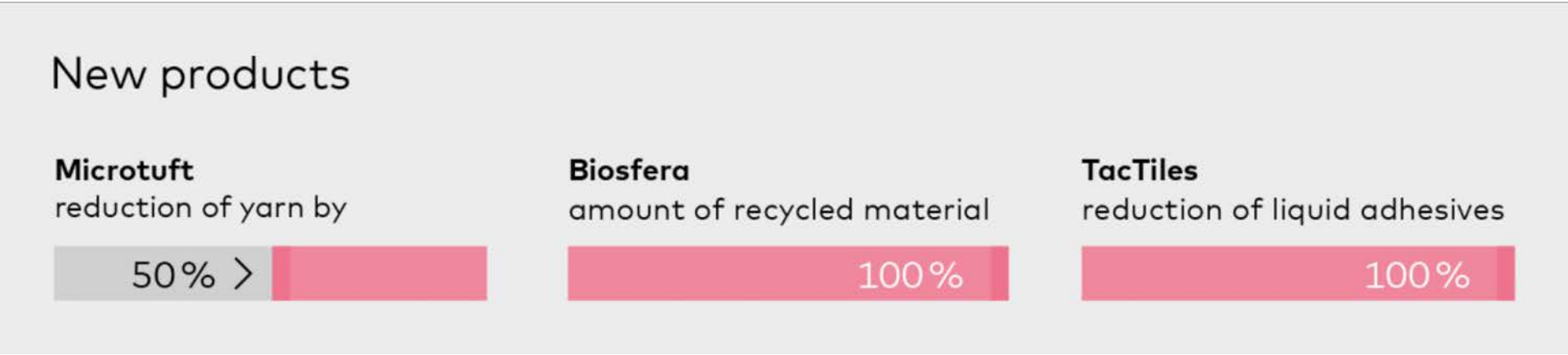


Image Source: thinkstep assessment of Interface via GaBI software

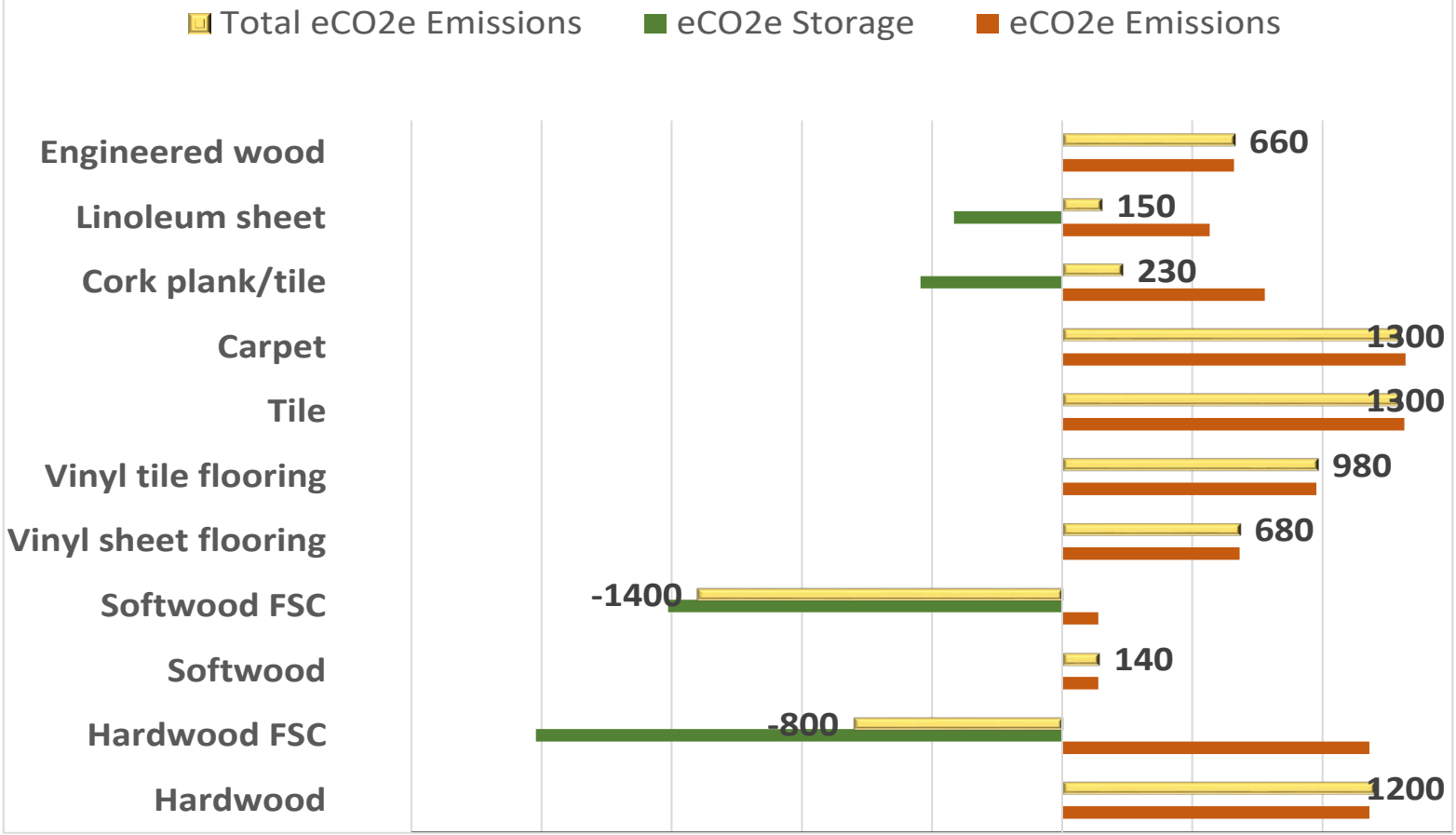
Elimination or reduction of raw materials leads to more optimal solutions….



Where are these opportunities in ANY of the products you specify?

Image Source: thinkstep

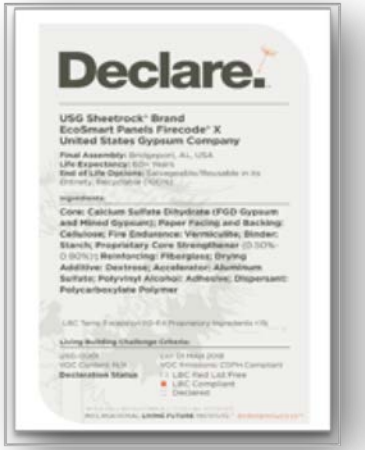
Embodied CO2e Emissions by Flooring Type, kg eCO2e per 100 m2 flooring



New Frameworks

Low Impact. High Performance.

Product Certifications: Example Gypsum Board



USDA CERTIFIED BIOBASED PRODUCT

38

Portico

38

37+ Declare Labels

61 HPDs

200+ Emissions Tested

16 EPDs

Approach:

ASK:
What do
I need?

AT THE VERY LEAST
Recyclable? Reusable?
End of life?

Material Health Assessed!

How will you do this? What criteria?

Embodied Carbon Considered!

Find companies that have completed EPD's, or done some level of LCA.

Questions?

Strategies and Practices [25’ min]

Group Think!

Address how we can get to healthier materials and better carbon outcomes via:

- Process/Project organization
- Design strategies
- Tools/metrics
- Other?

Project Organization

- **Engage the whole team** - importance of IPD and/or stakeholder buy-in
- **Goal setting and evaluation** during conceptual/schematic design
- Partner with **vendors and manufacturers** and OTHER projects in order to achieve economies of scale for preferential products.
- **Make project material goals public**: commitment to exceed 2030; Commitment to AIA's 2050 Materials Pledge, Paris agreement.....
- Establish the metrics (see below) and framework for **tracking progress**

Design

- Ask: **Do I need it?** If so, how can it adapt over time to serve multiple functions?
- **Design to deconstruct!**
- **Simplify palette**; Architecture 2030 Carbon Smart Materials Pallet
- What are your **goalposts** (see previous)?
- **Pick a CSI section** and begin there!
- **Residential vs. non-residential** projects and approaches
- **Collaboration/organizations** that pull projects together

Metrics

- Look at **whole buildings** to identify “hot spots”, or look at **comparative analysis** to make specific choices.
- Don’t get stuck on absolute values of carbon, **look for patterns** within margins of error (i.e. build with plants whenever possible).
- Look at **whole embodied carbon**: emissions, storage, recycled materials, offset impacts

Tools: Carbon

Autodesk “Tally”, One Click: Powerful WBLCA tools

Athena Impact Estimator: Free WBLCA tool

Bath Inventory of Carbon and Energy (ICE): + tried and true/ - new version coming Q1 ‘19

Building for Environmental and Economic Sustainability (BEES): + North American data

EPDs: + data sheet featuring verified life cycle data, including GWP / – units and methodologies will vary, use with caution especially in comparative analysis!

Tools: Health

Declare-Future labels to include eCO2e!

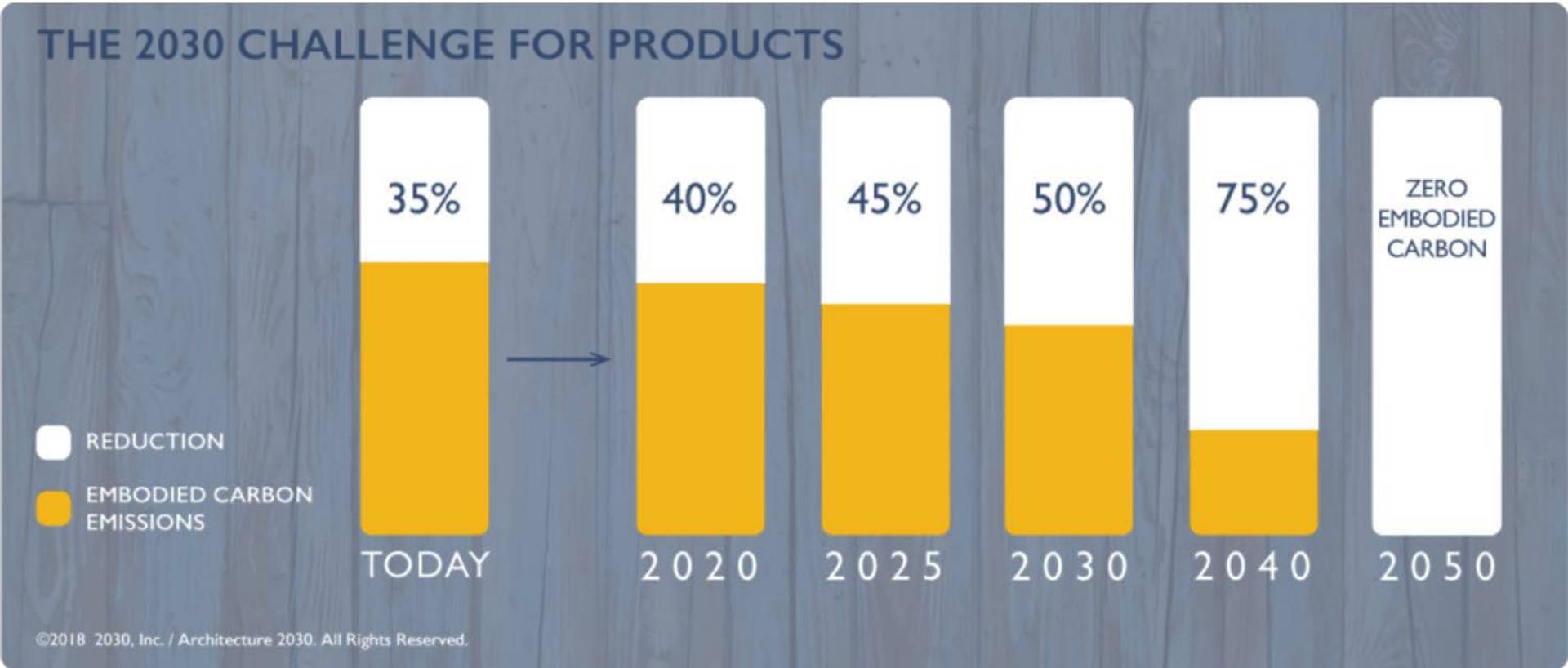
Living Product Challenge- “Handprinting” Full LCA + social justice component.

HPDs- All Materials considered + Third Party verified + 100 PPM is best!

C2C Certified Product Standard 3.1-with Material Health Score Gold/Platinum. IF Platinum for Renewable Energy /CO2 Mgmt, some benefits for carbon!

Visit MindfulMaterials for all of these…..

Commit Yourself to be part of the solution……



Parting thoughts…..

Transparency IS here to stay. Educate yourself, and *start with the products that are most prevalent in your building.*

Energy is not a proxy for carbon, and carbon is what matters to the climate! **We can't get there by reducing energy alone**! *Set carbon goals and a process for design and evaluation to meet these goals.*

We need **better metrics and data** for assessing both ingredients and carbon! *Advocate to manufactures that we need this info.*

We can't afford to do nothing!

Let's Talk Again.....

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