

# REGENERATION

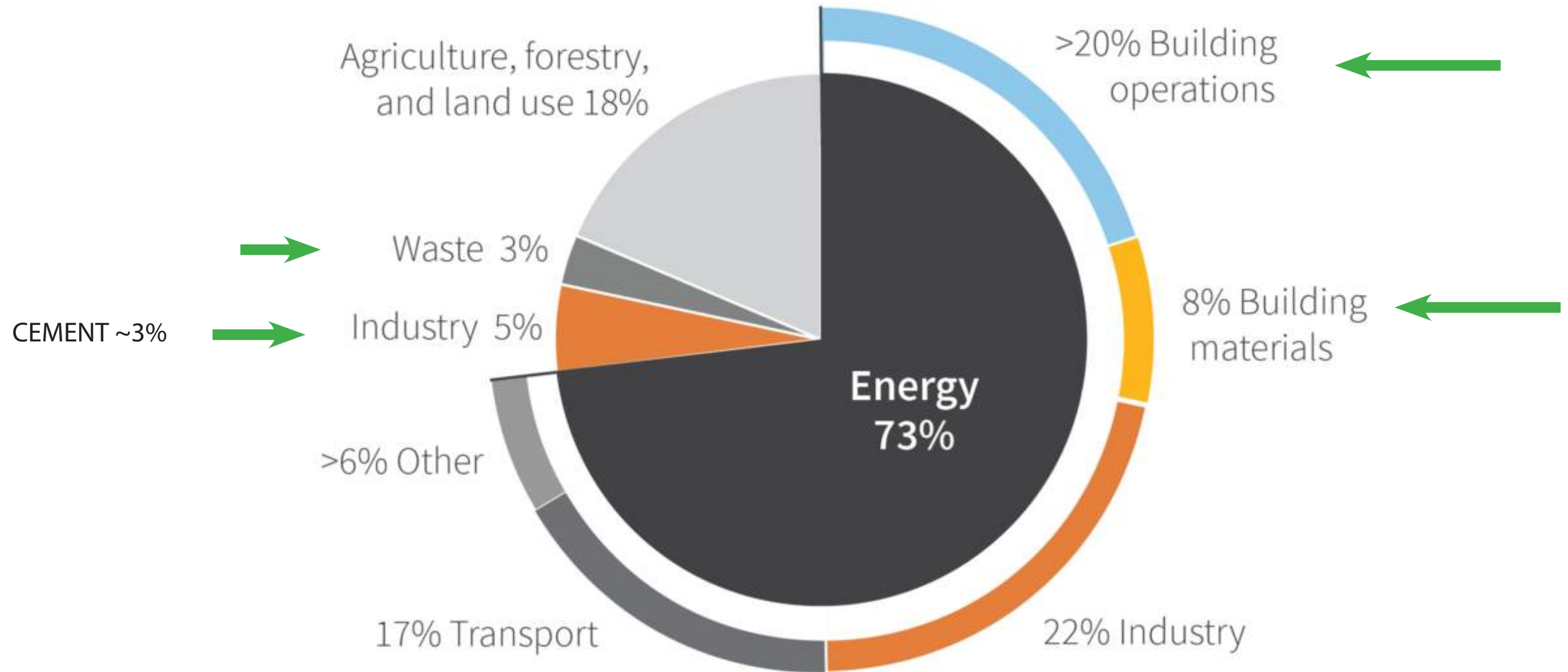
“CARBON ARCHITECTURE” OR

SUSTAINABLE BUILDING MATERIALS

LEADERS IN ENERGY: REGENERATION SERIES

JOËL ONORATO, STUDIOMB

MAY 29, 2024



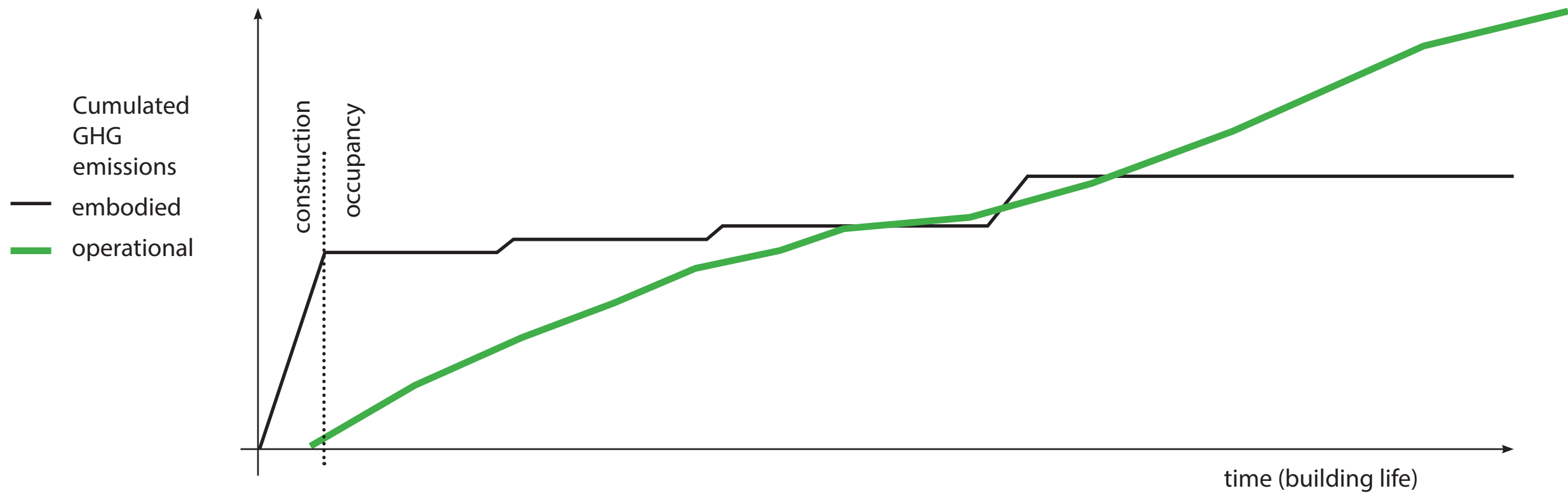
Global CO<sub>2</sub> emissions by sector. Adapted from the UNEP 2019 Global Status Report and OurWorldInData.org, based on data from Climate Watch and the World Resources Institute.

© Copyright 2020, Carbon Leadership Forum

# EMBODIED VERSUS OPERATIONAL CARBON: THE SAVINGS ARE NOW

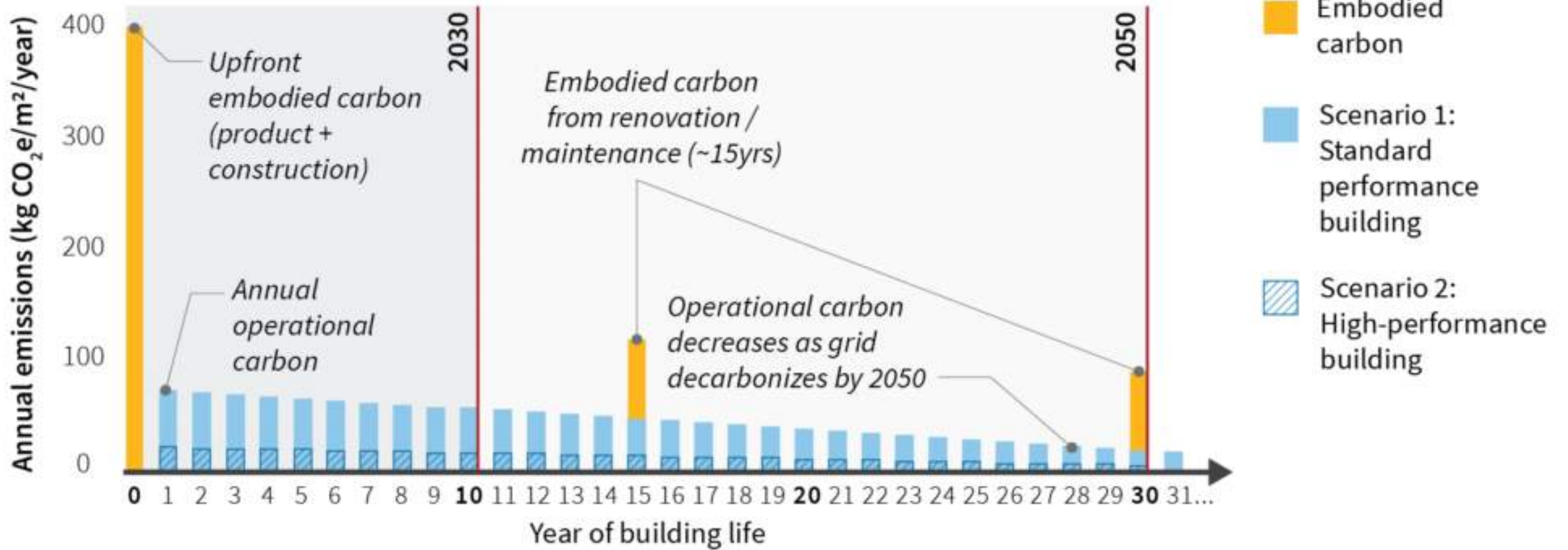
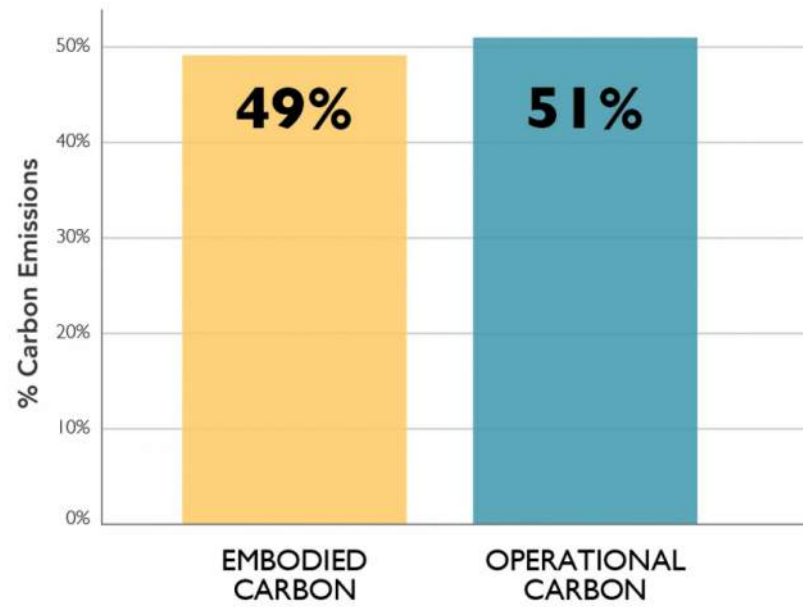


© Copyright 2020, Carbon Leadership Forum



# MATERIALS MATTER, JUST AS MUCH

Total Carbon Emissions of Global New Construction from 2020-2050  
Business as Usual Projection



© Copyright 2020, Carbon Leadership Forum

REDUCE NEEDS

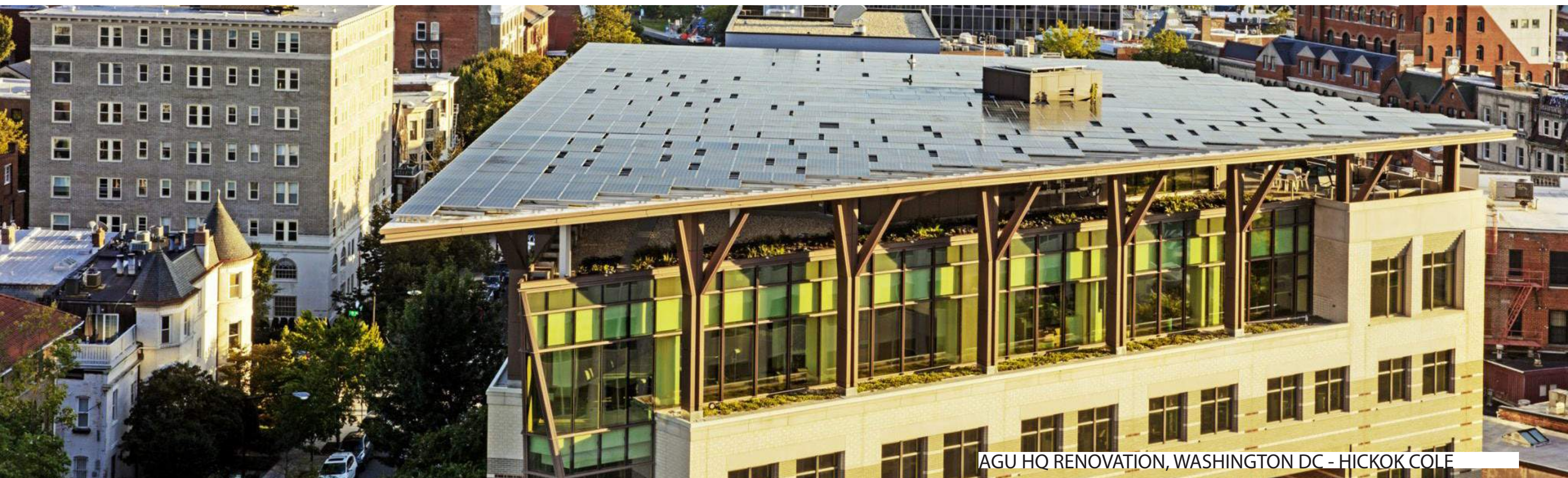
- HEATING
- COOLING
- LIGHTING
- WATER

- TRANSPORTATION TO SITE
- DIRECT IMPACT AT SITE LEVEL  
(BIODIVERSITY, STORMWATER,  
SEWAGE, POLLUTION...)

+

USE  
RENEWABLE ENERGY  
FOR WHAT'S LEFT

- SOLAR
- GEOTHERMAL
- WIND



AGU HQ RENOVATION, WASHINGTON DC - HICKOK COLE

“REDUCE, REUSE, RECYCLE”

REDUCE/  
HAVE A POSITIVE  
ENVIRONMENTAL  
IMPACT  
(CARBON,...)

+

WITHIN A  
CIRCULAR  
ECONOMY  
FRAMEWORK

GOOD  
(ONE-TIME)

BETTER  
(LIFE-TIME)

# ENTANGLED IN A LINEAR ECONOMY



Framework where materials are perpetually kept in use to achieve 3 goals:

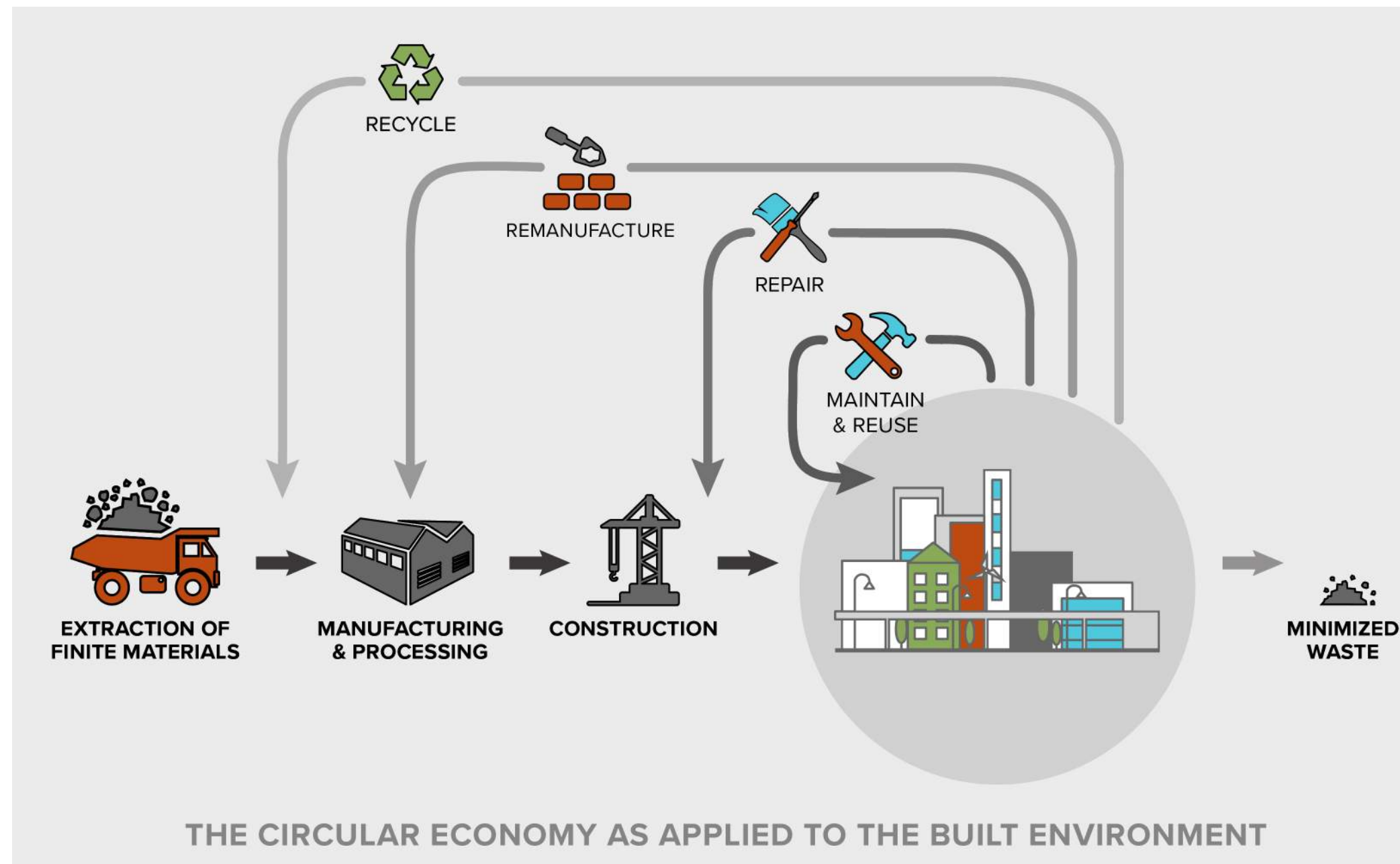
- minimizing extraction of finite natural resources
- eliminating negative environmental and health impacts / having positive ones
- eliminating waste



3 Principles (Ellen McArthur Foundation):

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

# REUSE, REPAIR, REMANUFACTURE, RECYCLE ... : MAXIMIZE VALUE, MINIMIZE CARBON



# CONCRETE

## REDUCE - EMBODIED CARBON

### REDUCE CEMENT CONTENT:

- BY DESIGN
- BY PERFORMANCE BASED SPECIFICATIONS
- BY PARTLY REPLACING WITH SCMs
- BY CURING STRATEGIES
- BY INNOVATIVE PROCESSES ("BIOCONCRETE")

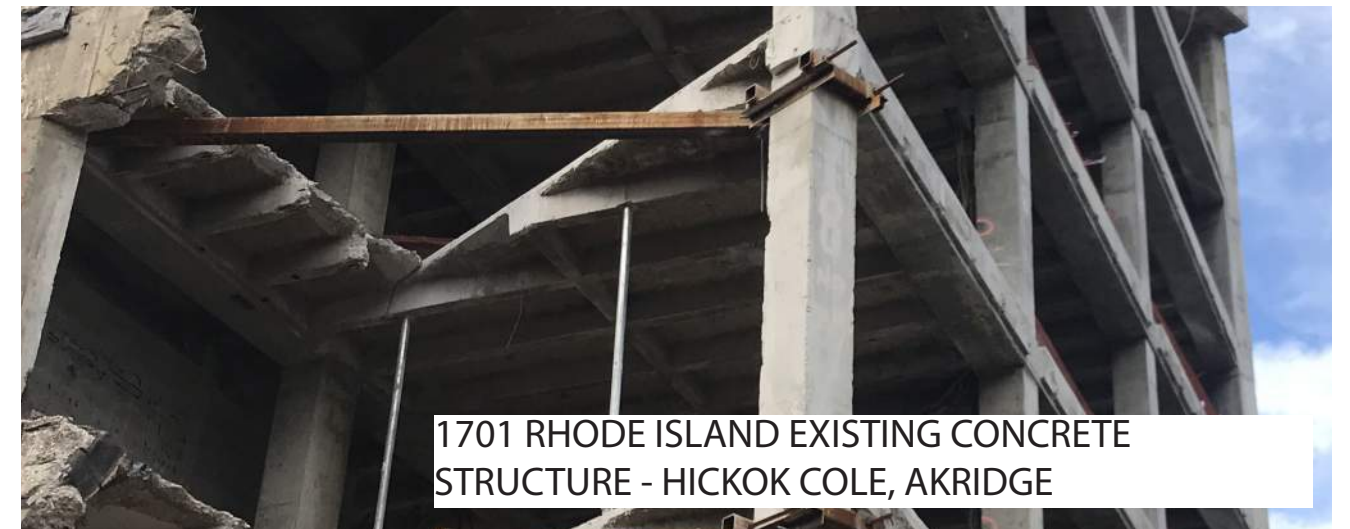
## REUSE

### REUSE EXISTING STRUCTURES

## RECYCLE

### CRUSHED AND:

- USED IN SITE/ROAD FILL
- USED AS RECYCLED AGGREGATES IN ROAD CONSTRUCTION (UP TO 30 %)
- NOT YET IN REINFORCED CONCRETE

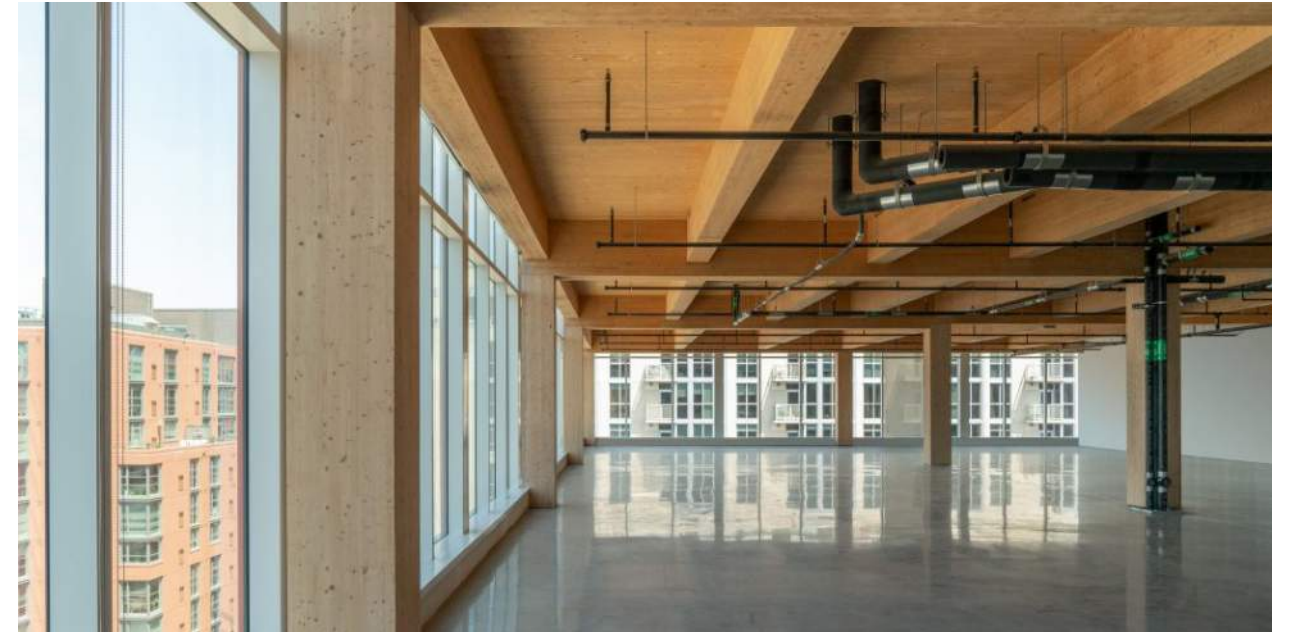
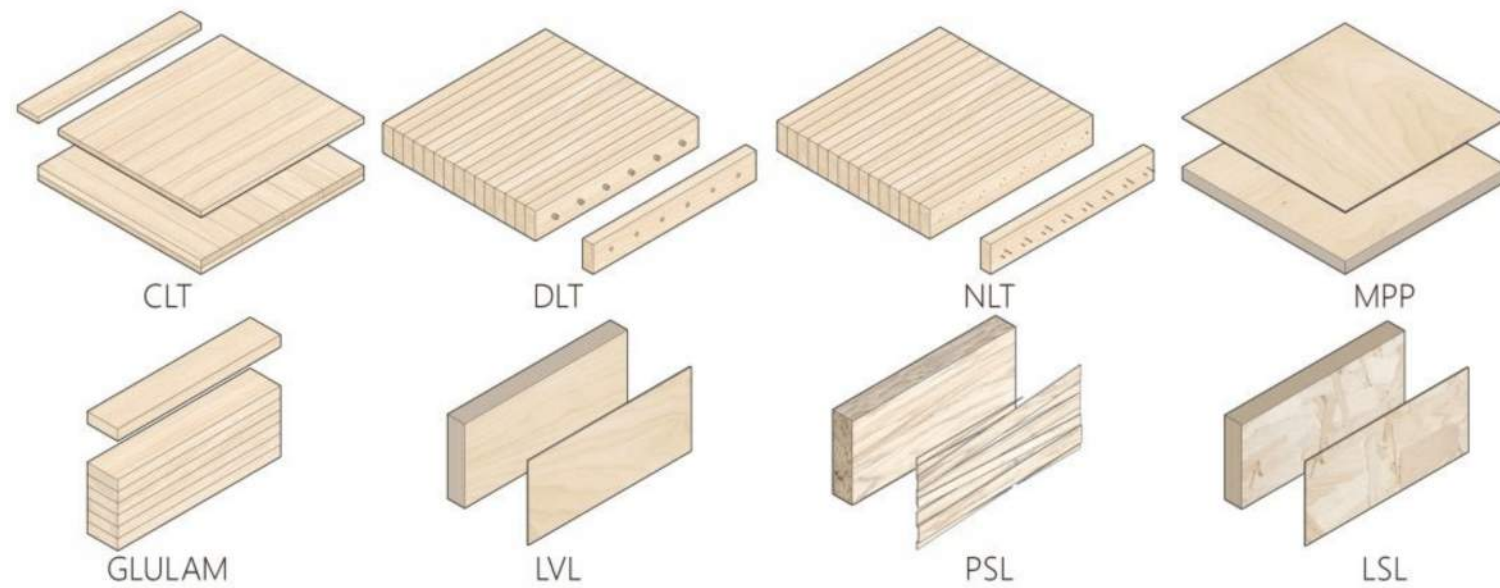


# WOOD

## REDUCE + STORE (CARBON)

SAWN TIMBER

MASS TIMBER



80 M MASS TIMBER ADDITION, WASHINGTON DC - HICKOK COLE

## SUSTAINABLE FORESTRY!

- CLIMATE SMART FORESTRY PRACTICES
- CERTIFIED WOOD: SFI, CSA, FSC , (PEFC IN EUROPE)
- CARBON ACCOUNTING AT FOREST LEVEL

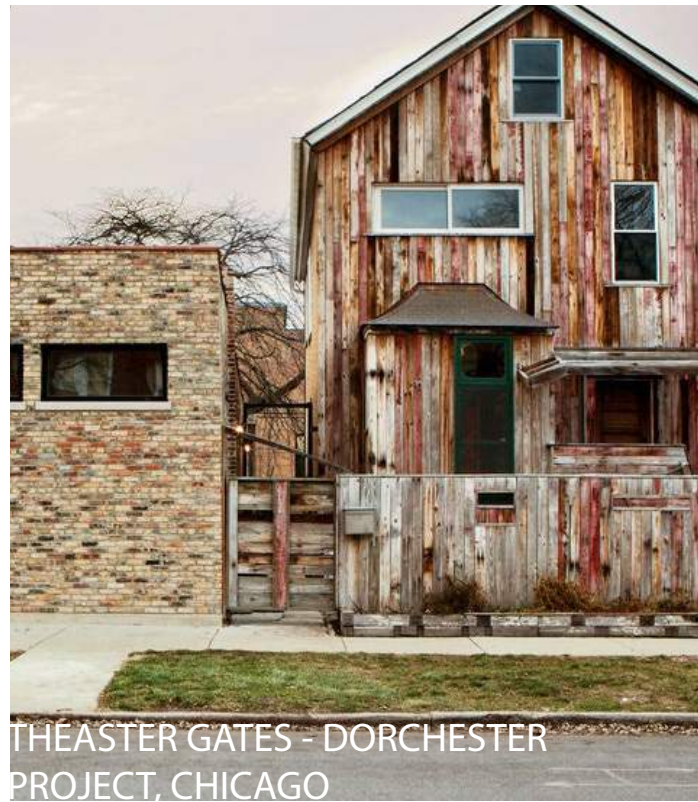


# WOOD

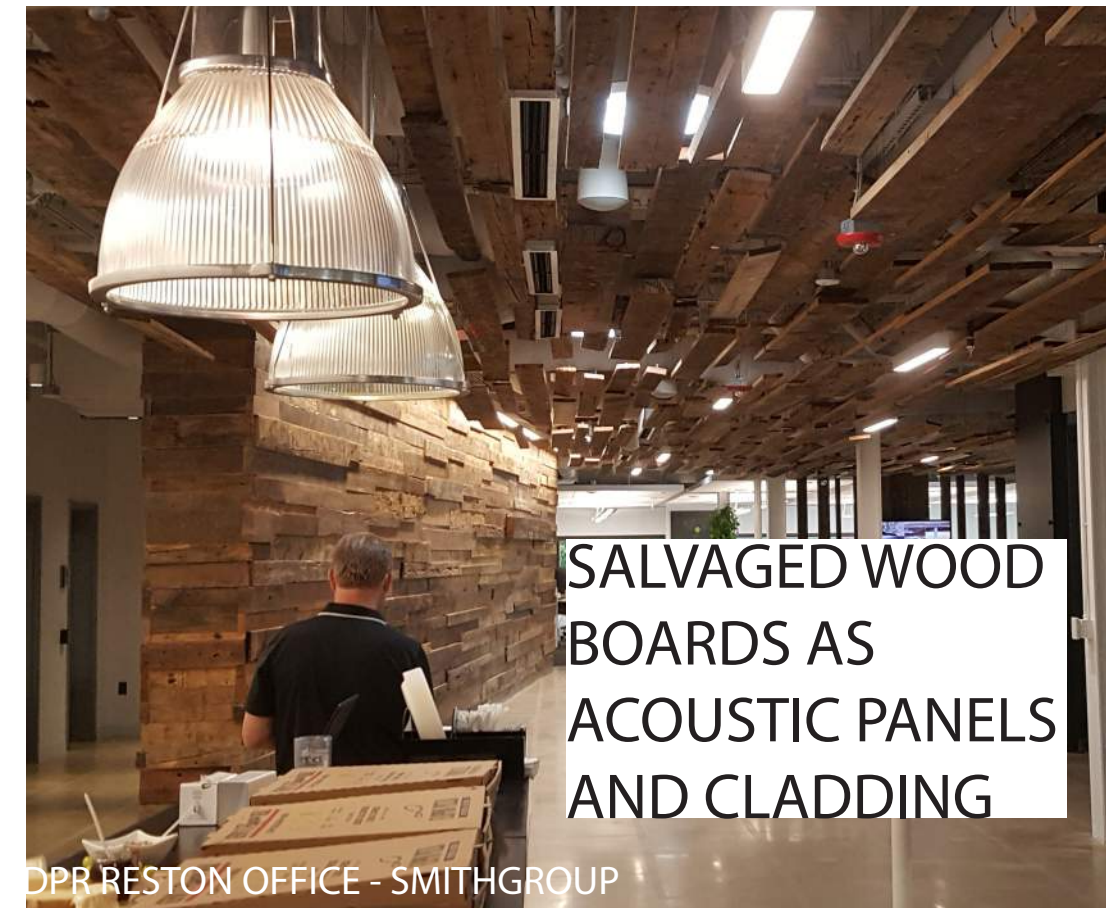
## REUSE

HIGH QUALITY  
OLD TIMBER

CARBON  
STORAGE  
EXTENDED



SALVAGED WOOD  
BOARDS AS NON  
STRUCTURAL  
SPACERS

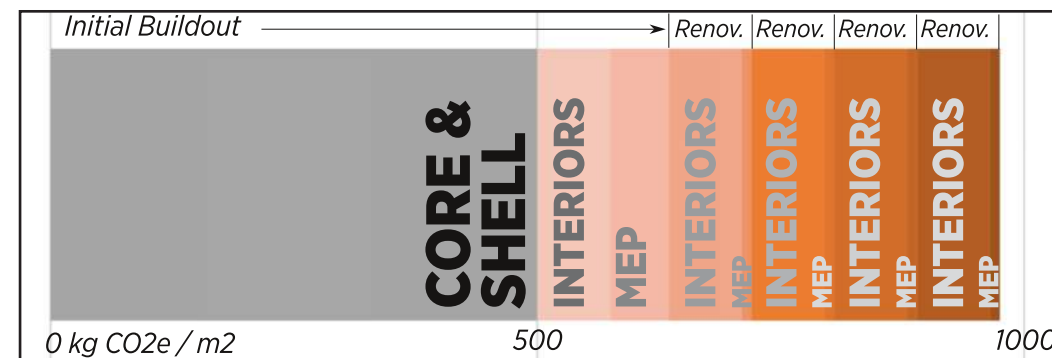


SALVAGED WOOD  
BOARDS AS  
ACOUSTIC PANELS  
AND CLADDING

**1** Demolition waste from commercial renovations is over 20% of the total US construction & demolition waste stream.

Sources:

**3** Several interior materials have high embodied carbon, are widely used, and are easily reusable.



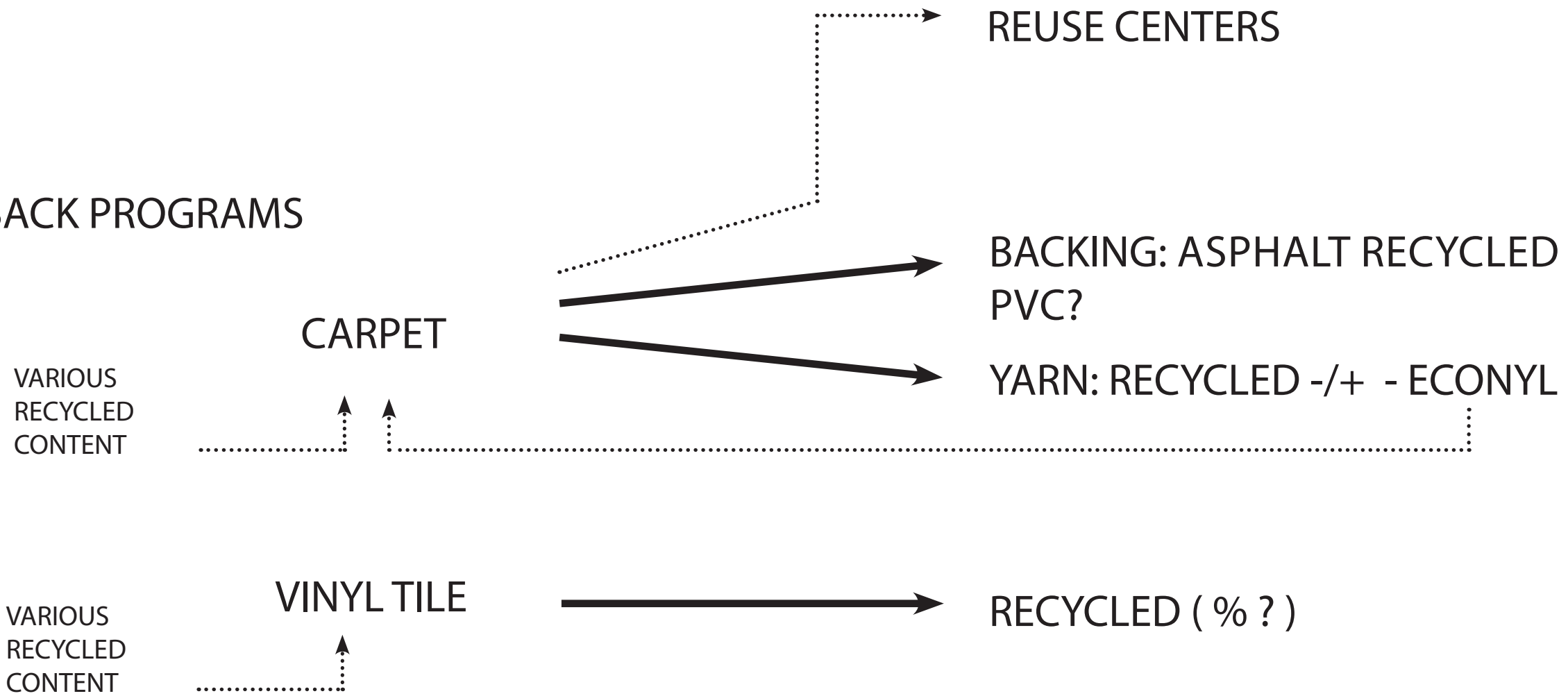
**2** Initial embodied carbon of interior materials is a fraction of that of core & shell, but is appreciable over the lifetime of building renovations.

# FLOORING (COMMERCIAL CONSTRUCTION)

## REUSE

## RECYCLE

### TAKE-BACK PROGRAMS



# CHEAT SHEET 1

## -DISPOSING - CONSIDER DECONSTRUCTION

REUSE / DONATE > REPAIR > REMANUFACTURE > RECYCLE COMPOST > WASTE TO ENERGY

## -SOURCING CRITERIA - ORIGIN

EXISTING > SALVAGED > REPAIRED/REMANUFACTURED > RECYCLED RENEWABLE CARBON STORING > MADE WITH VIRGIN RAW MATERIALS

## -SOURCING CRITERIA - END-OF-LIFE-

DURABLE + REUSABLE + REPAIRABLE UPGRADABLE + TRULY RECYCLABLE COMPOSTABLE



UNDERSTANDING, BEING AWARE OF THE ISSUE, AND MOTIVATED TO ACT

LIGHT CHANGES IN DAILY OPERATIONS

EXPERIMENT CIRCULARITY IN PROJECTS

DEMONSTRATE THE POSSIBILITY AND BENEFITS OF CIRCULAR BUILDING

DEVELOP AWARENESS AND COMMITMENT IN THE PROFESSION

INNOVATE: IMPLEMENT FULLER CIRCULARITY



POLICIES TO GET THERE FAST ENOUGH

# QUESTIONS?

BRICKS?

RENEWABLE BETTER THAN TECHNOLOGICAL CYCLE?

COST PREMIUM ?

THAT'S TOO EXPENSIVE!

STOP BEING LESS BAD?

CASE STUDIES?

EUROPE?

## WHAT WOULD YOU LIKE TO KNOW MORE ABOUT?

POSSIBLE POLICIES?

WOOD END OF LIFE?

IS RECYCLING NOT ENOUGH?

WHAT'S NEXT?

## REFERENCES

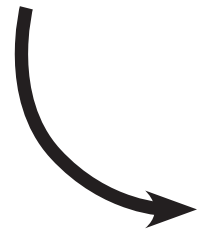
- Ellen McArthur Foundation
- Peter Lacy, Jakob Rutqvist, Waste to Wealth: The Circular Economy Advantage, Palgrave Macmillan UK, 2015
- Public Architecture, Design for Reuse Primer 2.0., 2010
- B. Guy, G. Ciarimboli, Design for Disassembly in the built environment: a guide to closed-loop design and building, prepared for King County, WA., available online
- Webster, Mark D., Helena Meryman, Adam Slivers, Tonatiuh Rodriguez-Nikl, Lionel Lemay, Kathrina Simonen, Harinee Trivedi, Lindsey Maclise, Dirk Kestner, Kenneth Bland, Won Lee and Emily Lorenz. "Structure and Carbon – How Materials Affect the Climate." SEI Sustainability Committee; Carbon Working Group, November 2012. ASCE.
- Arup, Graeme DeBrincat, Eva Babic, Re-thinking the life-cycle of architectural glass

# NEW BUSINESS MODELS

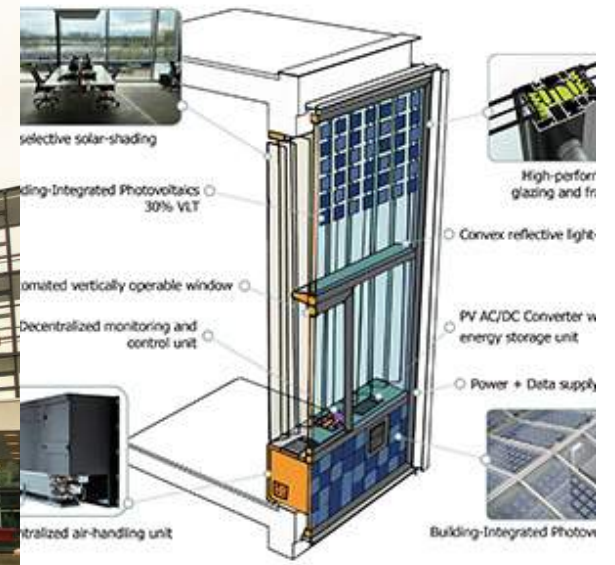
KEEPING OWNERSHIP

+

SELLING EXPERIENCE/SERVICE



INTENSIFICATION OF  
MANUFACTURER'S  
RELATIONSHIP WITH THEIR  
CONSUMERS

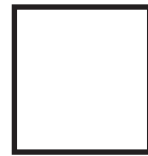


TU DELFT - FACADE LEASING PILOT PROGRAM



PHILIPS LIGHTING, ENGIE. SCHIPHOL INTERNATIONAL AIRPORT

DEPLETION OF FINITE NATURAL  
RESOURCES



INCREASING  
AMOUNT OF  
WASTE

PEOPLE'S INCREASING  
COMMITMENT TO  
SUSTAINABILITY

# ENVELOPE

## BRICKS

### REUSE

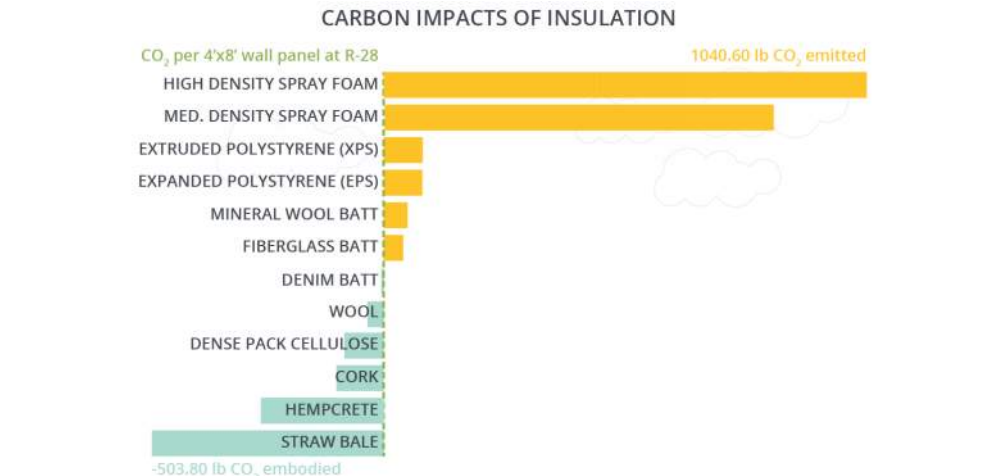


### RECYCLE

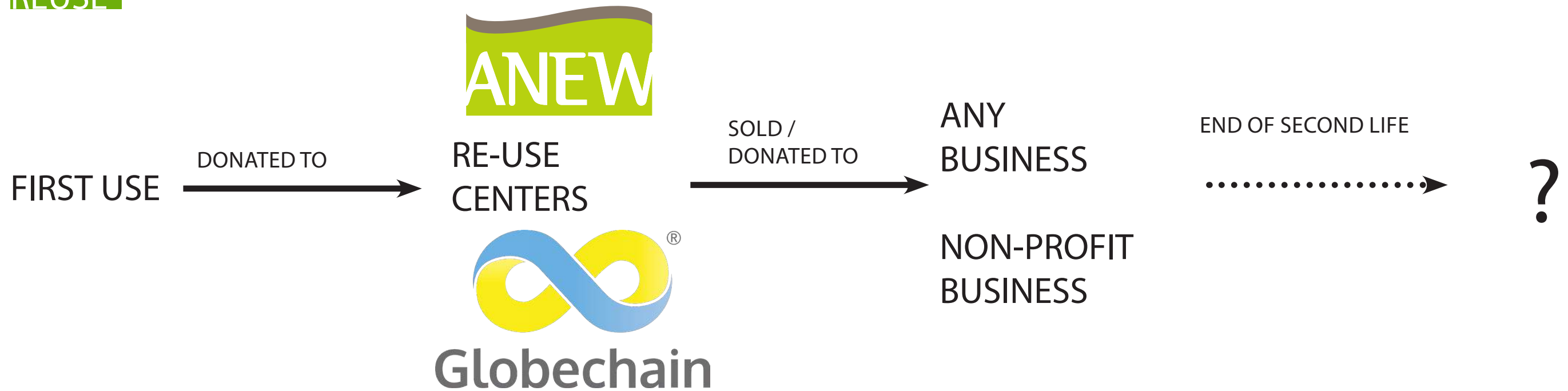


## INSULATION

### RENEWABLE + STORE



## REUSE



## REPAIR

## REMANUFACTURE

## RECYCLE

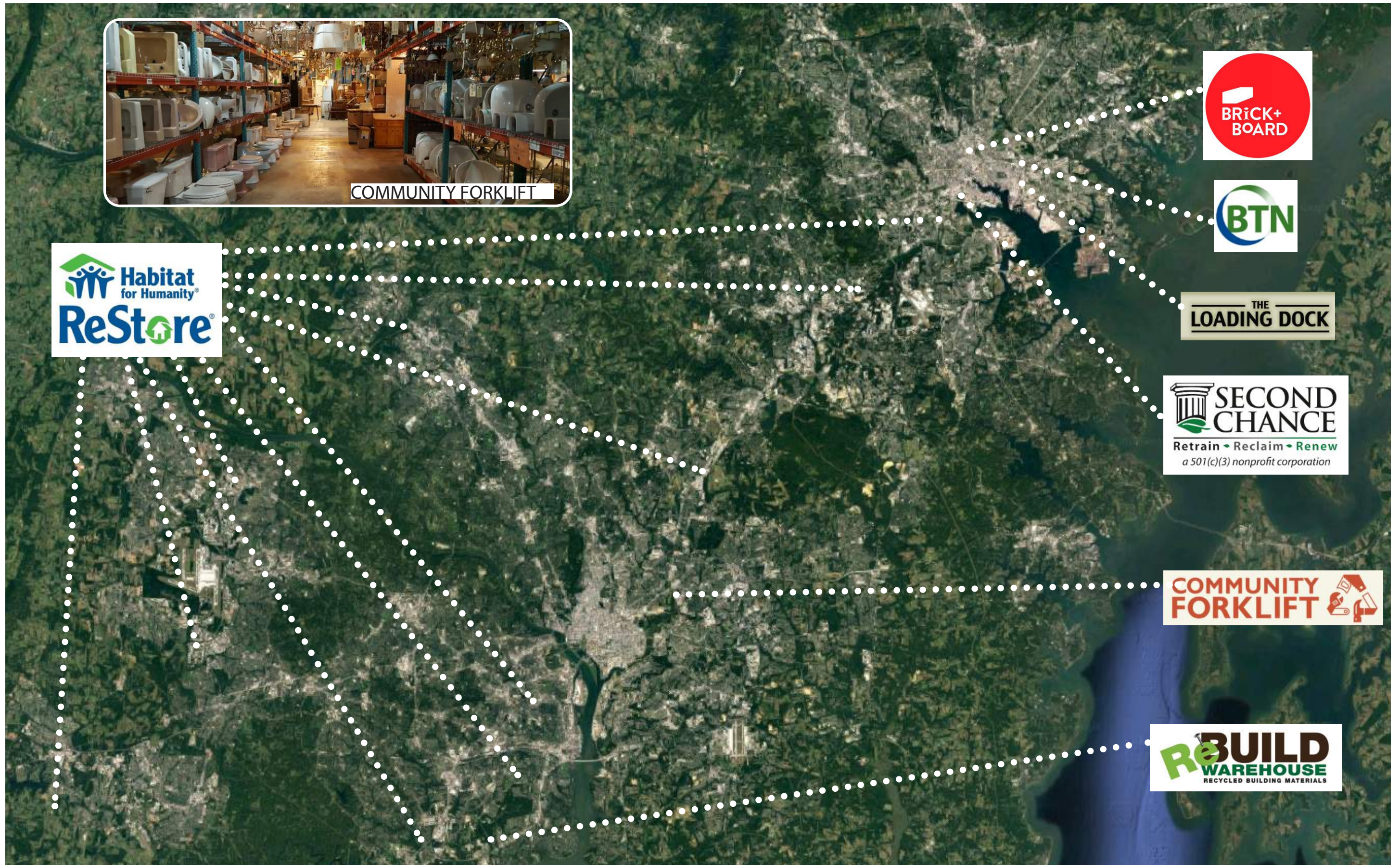
DAVIES  
OFFICE

TYPICAL  
MANUFACTURERS

ON A PRODUCT BY  
PRODUCT BASIS:

- RECYCLED CONTENT
- PARTLY RECYCLABLE
- REPAIR-REMANUFACTURE PROGRAMS
- TAKE-BACK PROGRAMS
- ...

# SOURCING (AND GIVING) - SALVAGED MATERIALS



- [PVIPVI.COM/USED-OFFICE-FURNITURE](https://pvipvi.com/used-office-furniture)
- [ETHOSOURCE/WASHINGTON-DC-USED-OFFICE-FURNITURE](https://ethosource.com/washington-dc-used-office-furniture)
- [GERSTELOFFICEFURNITURE.COM](https://gersteofficefurniture.com)
- [MAMMOTHOFFICEFURNITURE.COM/WAREHOUSE-NORTHERN-VIRGINIA](https://mammothofficefurniture.com/warehouse-northern-virginia)
- [FURNITUREFINDERS.COM/OFFICE/STATES/OFFICE-FURNITURE-DISTRICT-OF-COLUMBIA.HTML](https://furniturefinders.com/office/states/office-furniture-district-of-columbia.html)
- [RE-FORM.COM/ABOUT/](https://re-form.com/about/)
- [ANDYSTERNS.COM/FAIRFAX-USED-OFFICE-FURNITURE](https://andysterns.com/fairfax-used-office-furniture)

ALLFORREUSE.ORG

# STEEL

## REDUCE - EMBODIED CARBON

## FURNACE TYPE AND PRODUCT TYPE

### REUSE

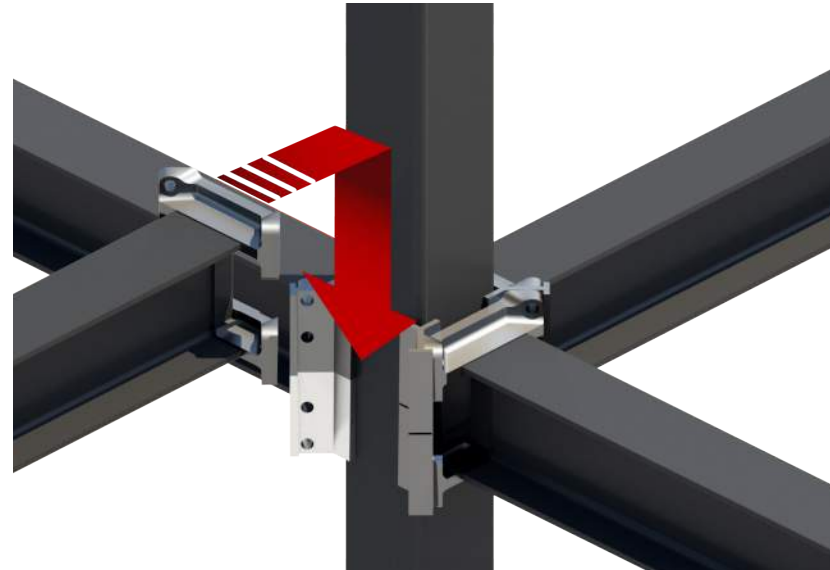
REUSED STEEL COMPONENTS HAVE “LESS THAN A QUARTER THAN THE [CARBON] IMPACT OF NEW MATERIALS (EVEN FROM RECYCLED SOURCES)”

STRUCTURE AND CARBON, ASCE, 2012

### ASSEMBLY: NOT JUST BOLTS...



LINDAPTER CLAMPING SYSTEM AT AMERICAN COPPER BUILDING, SHOP ARCHITECTS



CONXTECH - CONXL 300 SYSTEM



CBU ENGINEERING FACILITY STRUCTURE - CONXTECH, GENSLER

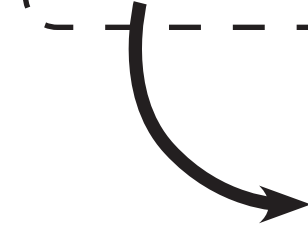
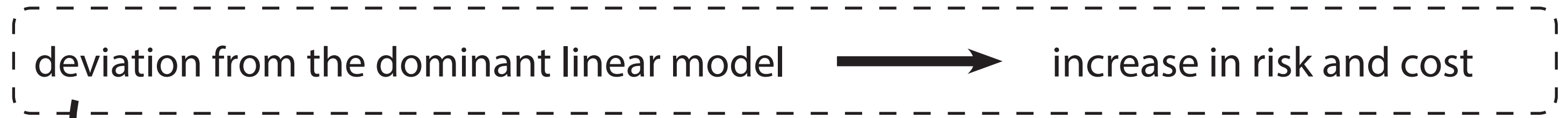
### RECYCLE



85%

RECYCLING RATE ( BUILDING STEEL)

# TODAY: OPPORTUNITIES ON A CASE BY CASE BASIS



+ variety and complexity of real estate projects  
+ circular economy looks at unexplored value

→ opportunities on a case-by-case basis

REDUCED  
CONSTRUCTION COSTS

HIGHER FLEXIBILITY  
EASE OF MAINTENANCE:  
REDUCED LIFE CYCLE COSTS

CORPORATE  
COMMITMENTS

MARKET  
DIFFERENTIATOR

IMAGE BENEFIT : TANGIBLE  
SUSTAINABILITY STATEMENT