BUILDINGENERGY BOSTON

Electrification Journeys: How Two Companies Decarbonized Their Manufacturing Processes

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Curated by Stephen Stuart

Northeast Sustainable Energy Association
(NESEA)
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GLAVEL
FOAM GLASS GRAVEL

TIMBERHP
BY GO LAB

Learning Objectives

Demystify Electrification, Inspire Others to

1. Define the concept of embodied carbon in building materials.

1. Analyze the implications of electrifying manufacturing and importance of transparency in EPDs.

1. Communicate the benefits of sourcing low embodied carbon materials.

1. Advocate for material manufacturers to modernize their approach to sustainability.

Graphic by Stacy Smedley, 2021

Understanding a Building's Carbon Footprint

Embodied Carbon

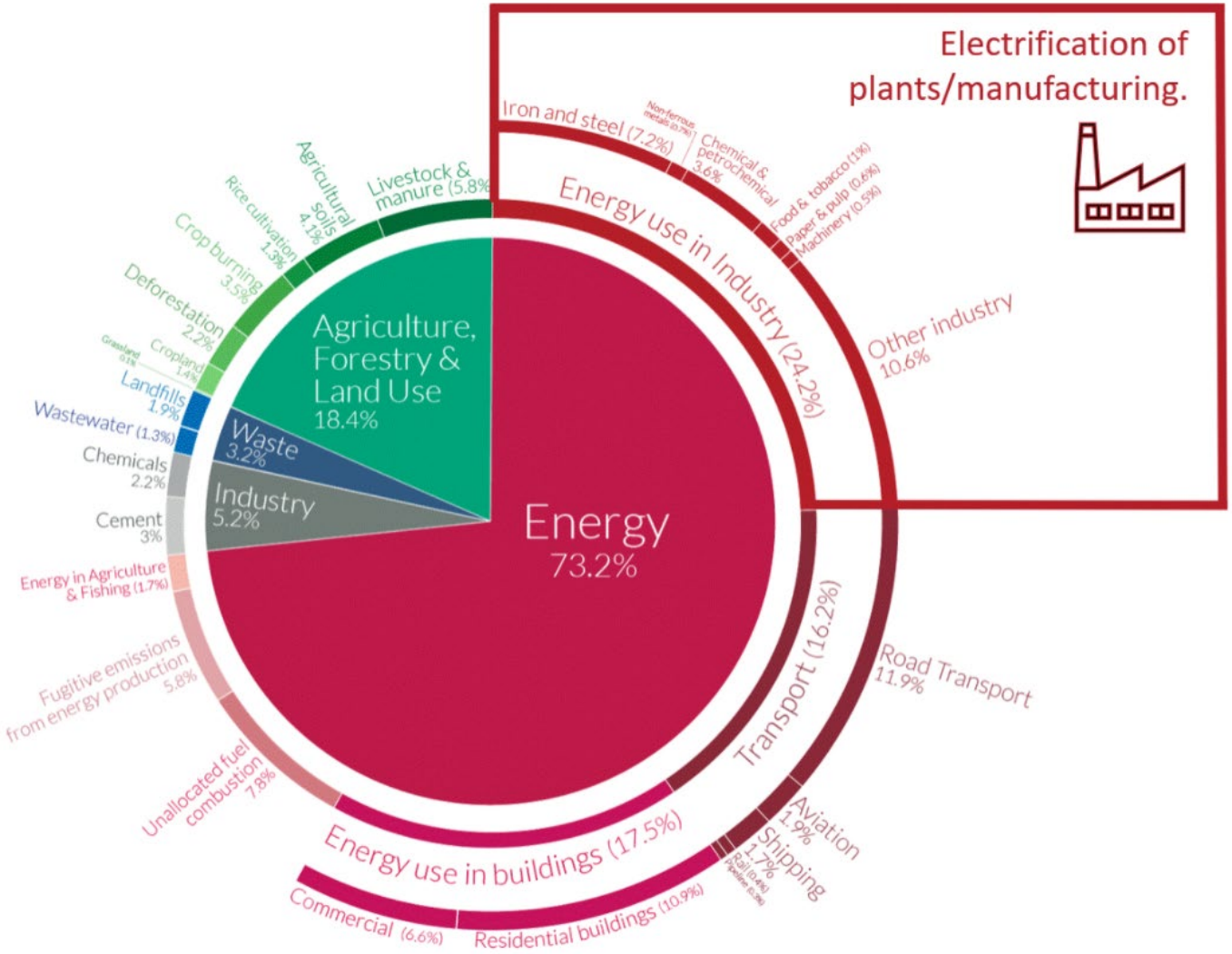
Manufacturing Emissions

(extraction through manufacturing of building product)

GLAVEL

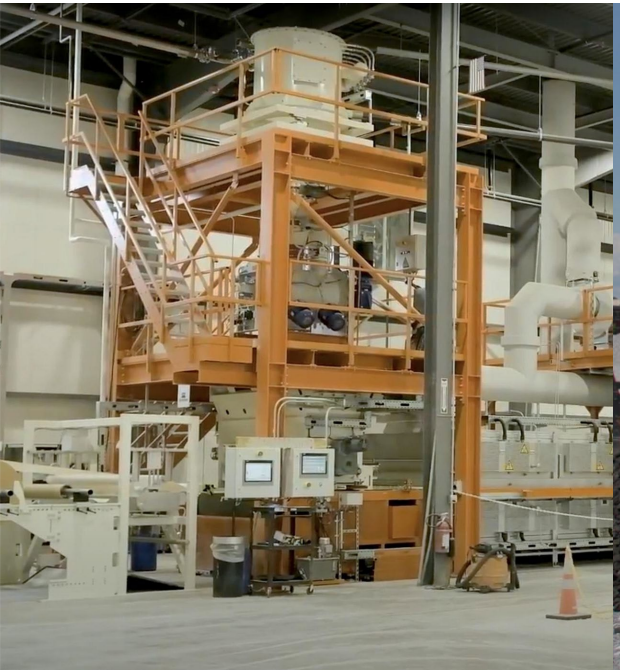
FOAM GLASS GRAVEL®

The Eureka Effect


Electrification of plants/manufacturing.
Energy
73.2%
Agriculture, Forestry & Land Use
18.4%
Waste
3.2%
Industry
5.2%
Livestock & manure (5.8%)
Agricultural soils 4.1%
Rice cultivation 1.3%
Crop burning 3.5%
Deforestation 2.2%
Grassland 0.1%
Cropland 1.4%
Landfills 1.9%
Wastewater (1.3%)
Chemicals 2.2%
Cement 3%
Energy in Agriculture & Fishing (1.7%)
Fugitive emissions from energy production 5.8%
Unallocated fuel combustion 7.8%
Energy use in buildings (17.5%)
Commercial (6.6%)
Residential buildings (10.9%)
Transport (16.2%)
Road Transport 11.9%
Aviation 1.9%
Shipping 1.7%
Rail (0.4%)
Pipeline (0.3%)
Energy use in Industry (24.2%)
Iron and steel (7.2%)
Non-ferrous metals (0.3%)
Chemical & petrochemical 3.6%
Food & tobacco (1%)
Paper & pulp (0.6%)
Machinery (0.5%)
Other industry 10.6%

Manufacturing

Recycled Feedstock
Carbon Neutral Electrons



Transportation

Lightweight
Bulk deliveries

Installation

2 for 1 install
Eliminate EPS/XPS


TIMBERHP
BY GO LAB

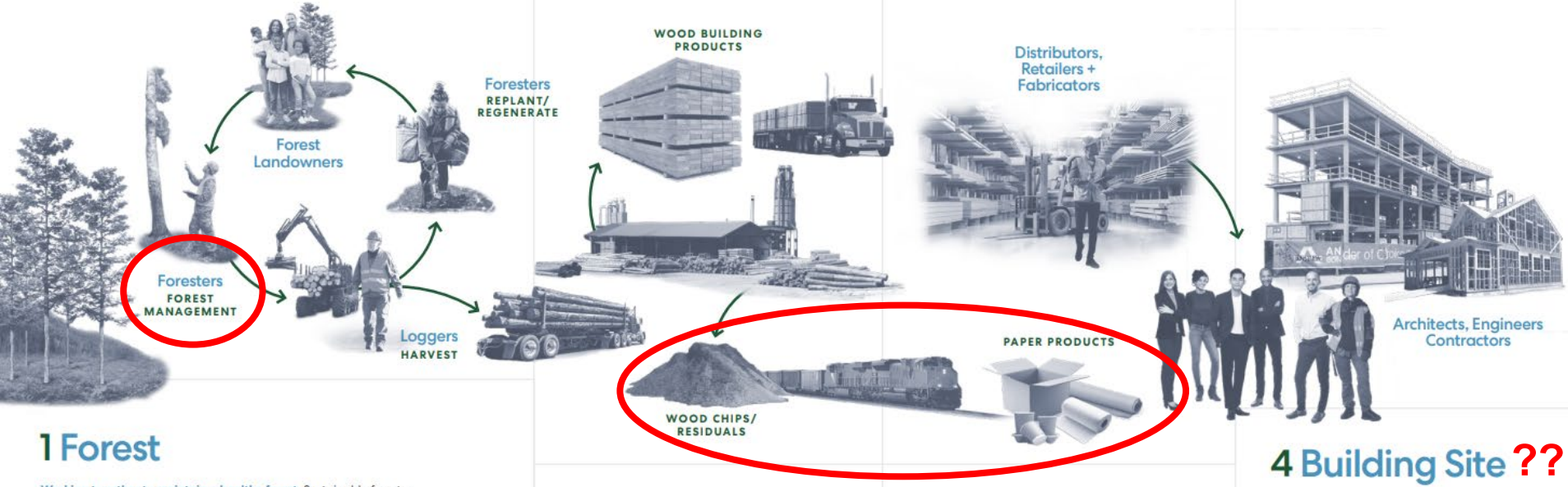
Made from clean, species-agnostic, softwood residuals; insulating wood fiber composites are a perfect fit for the US wood products manufacturing sector.

PROCESS:

From Seedling to Sawmill to Site

Here's a look at how wood works to create value, minimize waste, provide employment, and protect forests through its sustainable cycle of growing, harvesting, and replanting.

THINK WOOD.



1 Forest

Working together to maintain a healthy forest. Sustainable forestry generates forest products which provide an economic incentive for landowners to keep forests as forests, avoiding deforestation—while protecting water, wildlife, and recreation. The forest sector replants over 783 million seedlings per year (University of Washington CINTRAFOR Research, 2021).

Did you know there are many types of Forest Landowners?
Public (Federal/State), Corporate, Family Landowners and Tribal.

2 Sawmill

Sawmills transform wood from logs to lumber, by debarking, squaring and cutting each log into its most efficient yield. There is very little waste involved in the process; every piece of the log is used, including residuals like bark and wood chips.

3 Distribution

Lumber makes its way to customers. Lumber is transported—via rail or truck—to a distribution center, a retailer, or in some cases, directly to a construction site. Residuals are used to create other products we use every day like mulch, paper, or cardboard.

4 Building Site ??

Wood buildings store carbon throughout their service lives. From dimensional lumber to mass timber, wood is often the go-to framing choice for single family homes, multifamily, and commercial buildings. Wood is also well-suited to off-site prefabrication, offering cost, quality, and scheduling advantages. Assembling wood buildings as a prefabricated "kit of parts" has the added benefit of being a low-carbon alternative.

Operational sources of carbon emissions on site:

Electrical Energy Demand:
Equipment fans, pumps, motors etc. estimated energy consumption : 20,000 megawatt-hours per year make sense, not front loaders.

Thermal Energy Demand:
Steam generation for fiber drying and building heat. Estimated thermal load: xx MMBtu

Transport and handling:
materials and finished goods, demand not determined but small. Will electrify somethings that make sense, not front loaders.

Addressing emissions from electric usage: **Maximum projected load ~10MW for the facility**

- **29MW of on-site generation with direct line**
- **Hydro facility output: projected 10MW 95% of the year**
- **Energy Efficiency implementation: Load reduction targets via lighting retrofit, fans and refiner optimization with minimum load need and var. frequency drive motors**

Photos from Eagle Creek renewable energy https://www.eaglecreekre.com

Thermal Energy: **Projected Demand 30MW**

direct, onsite natural gas pipeline

Largest consumption in process:

1. **Dryers**
2. **Boilers**
3. **Space heating**

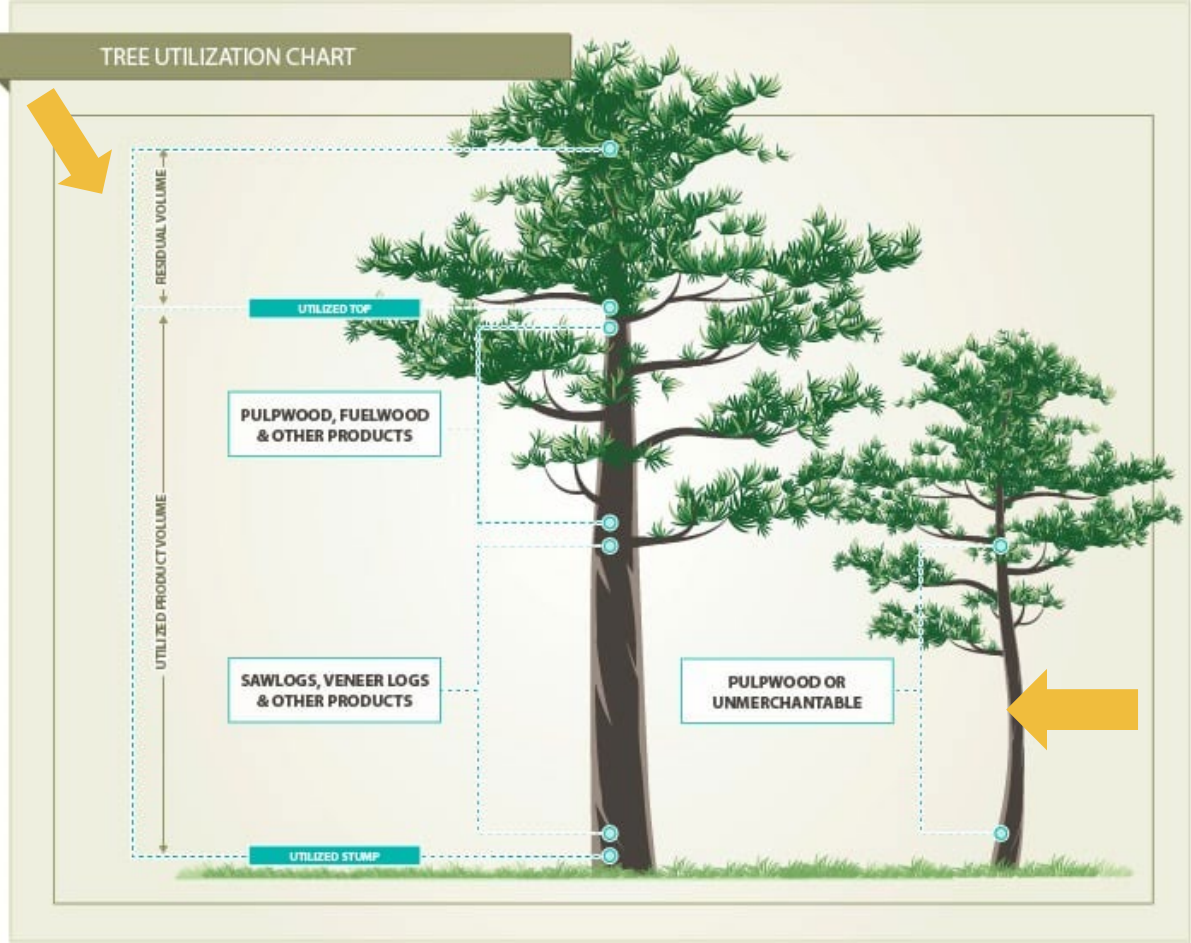
Strategy now :

- **employ all feasible conservation technologies; closed loop drying.**

Future replacement of energy source:

- **Biomass via CHP, combined heat and power $60M cap ex.**
- **Renewable natural gas via digestion. Projected efficiency 69% (!) $40m. Does not yield enough fuel**

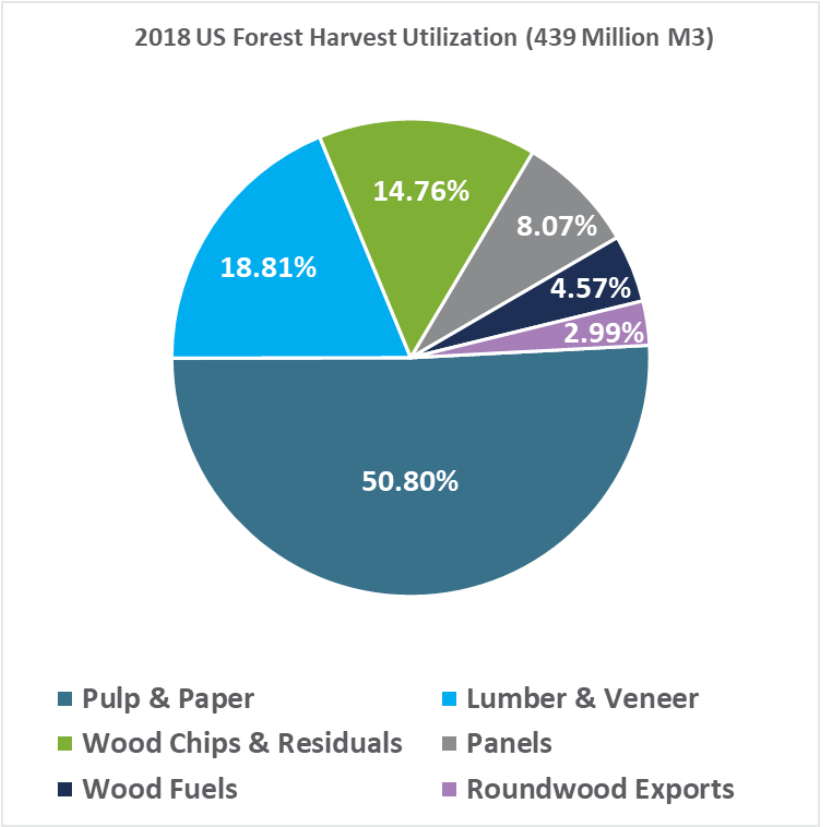
Biomass utilization **directly impacts responsible forestry**



Using biomass from wood harvests we:

- **reduce wildfire risk**
- **Maximize yields, reducing volume harvested**
- **Divert and eliminate traditional fossil fuel sources**
- **Great fit for our needs: steam demands are low grade heat, perfect for biomass application, surplus can heat building.**

Is there enough?
Yes! plenty of raw material



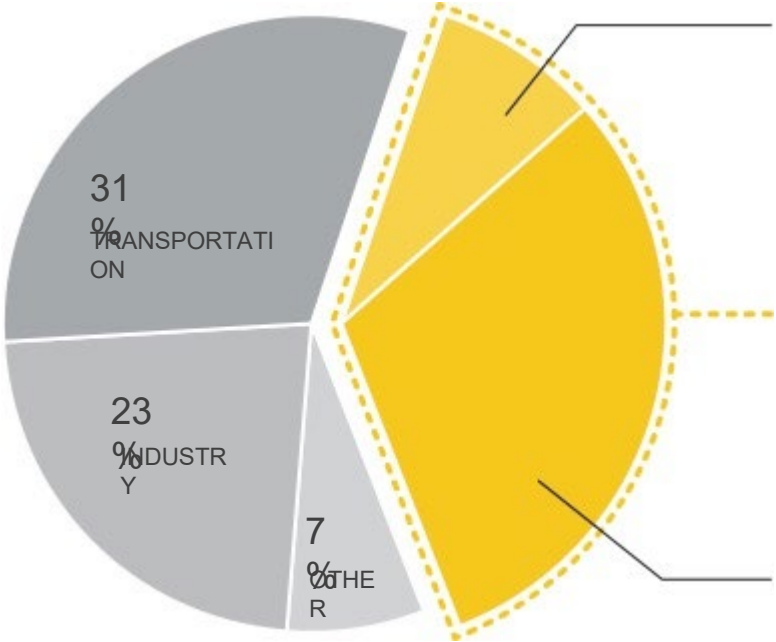
Paper industry decline; filling some of that void

Residual market could grow in many areas
Potential from MMW and C&D waste streams

Category	Consumption (M^3)	% of Harvest
Pulp & Paper	222,869,941	50.80%
Lumber & Veneer	82,512,000	18.81%
Wood Chips & Residuals	64,762,168	14.76%
Panels	35,413,100	8.07%
Wood Fuels	20,048,722	4.57%
Roundwood Exports	13,131,700	2.99%
Total Roundwood	438,737,631	**100.00%**

Built Environment and Energy Consumption

(CO_2e emissions in 2017)



8.2%
THE IMPACT FROM MATERIALS & CONSTRUCTION
(EMBODIED ENERGY)

39%
BUILDINGS

30.8%
THE IMPACT OF BUILDING OPERATIONS
(OPERATIONAL ENERGY)

Source: Global Alliance for Building and Construction, *Global Status Report*, 2019; US EIA, *EIA International Energy Outlook 2017*, 2017.

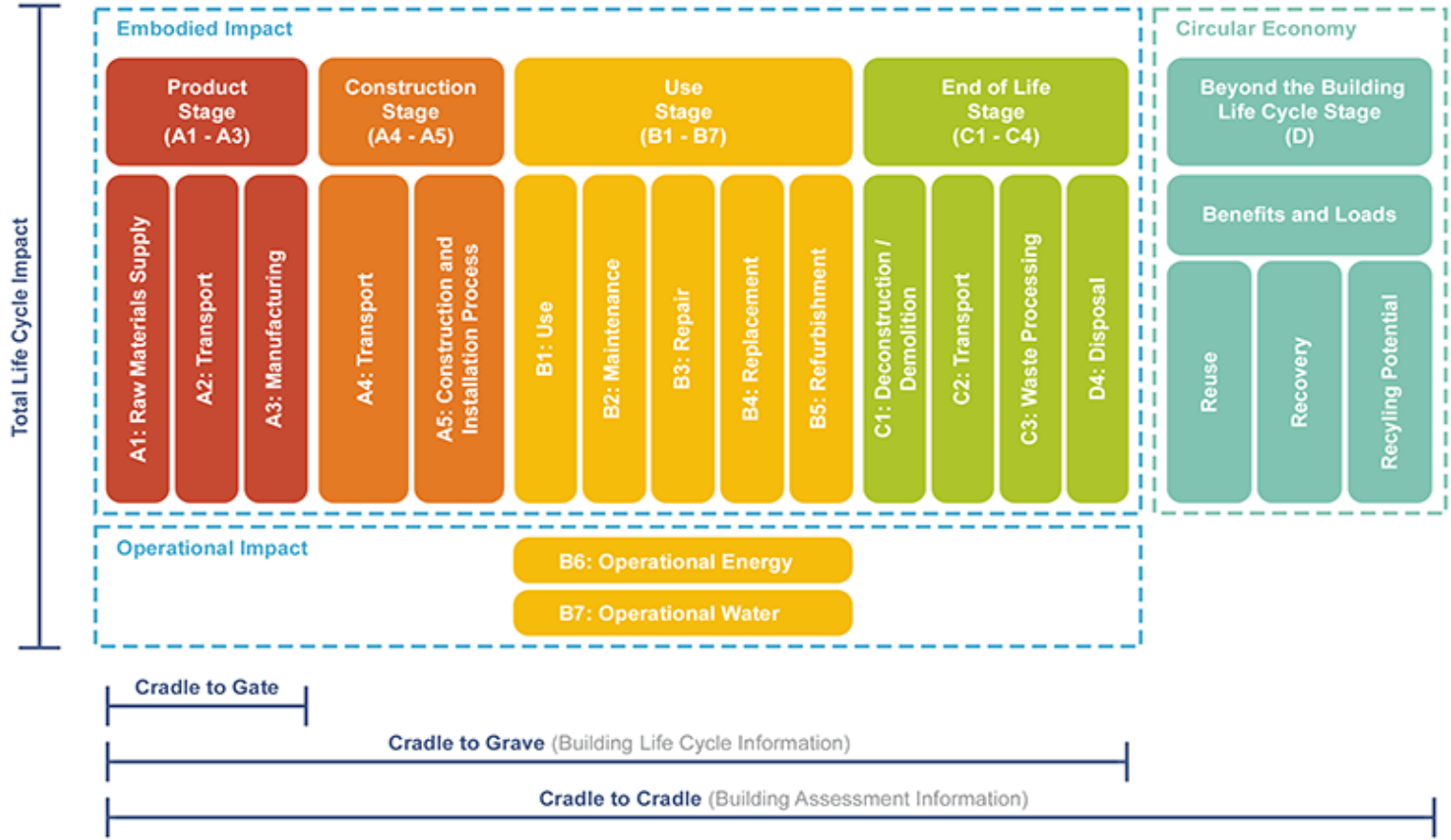
The construction and operation of buildings in the United States alone is responsible for almost

2 Gigatons

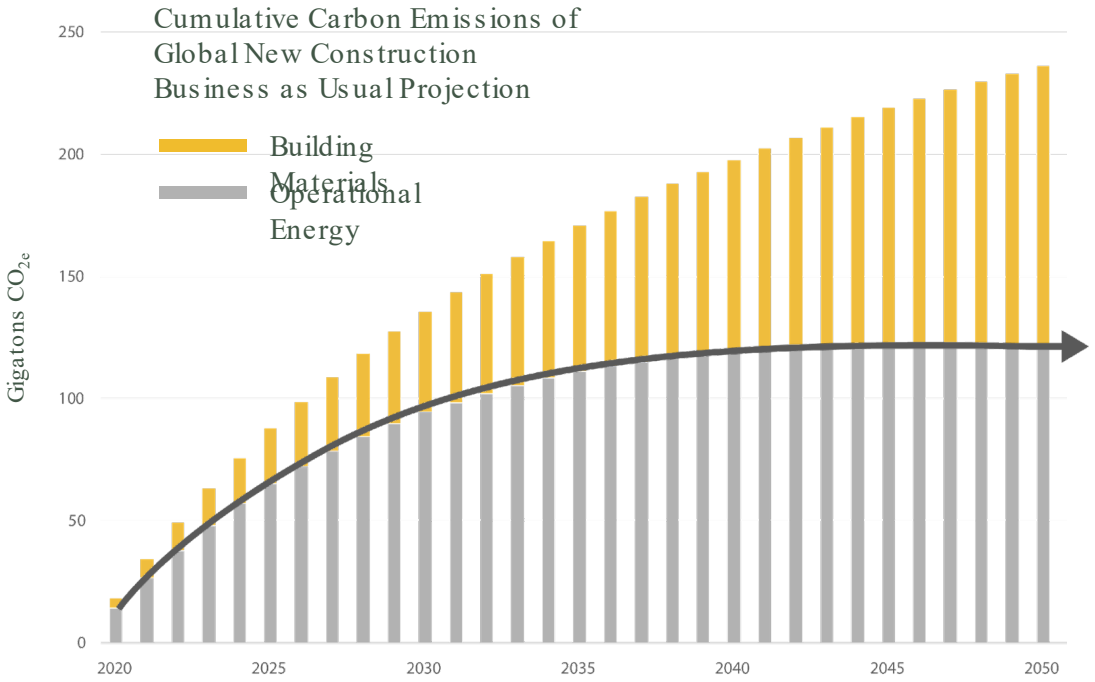
CO_2 emissions annually.

The prescription for dramatically reducing that impact is well understood and immediately technologically achievable.

Embodied Carbon - Life Cycle Analysis



Embodied Carbon is increasingly significant



Source: AIA 2030

By 2050, it is projected that embodied carbon will take up almost half the total carbon emissions from new construction.

Energy Retrofit Programs

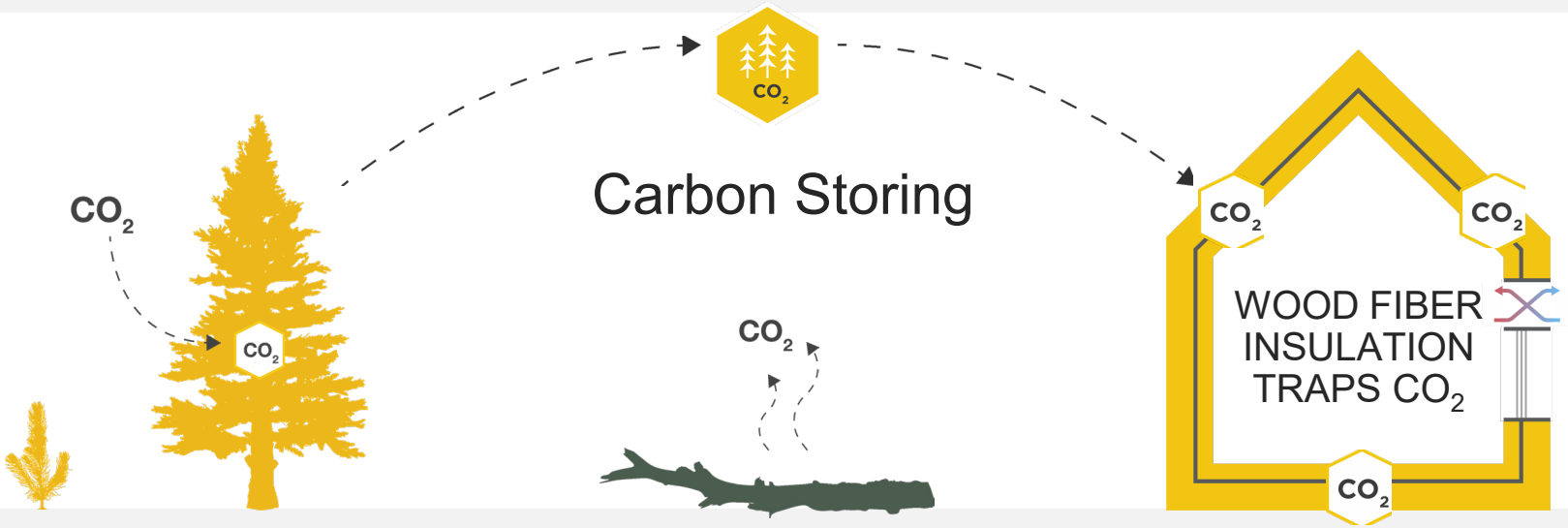
+

Renewable Energy

Reduced Operational CO_{2e}

Solution :

Carbon storing wood products used in construction yield a net benefit to the atmosphere



Atmospheric carbon dioxide is taken up by trees and, through photosynthesis, stored as carbon in biomass

At the end of the tree's life, when left to decay, this stored carbon returns to the atmosphere slowly

Harvesting trees as the source material for building products can delay the release of that carbon for the life of the building and potentially far longer

Carbon Footprint

-9 kg CO_2

Per 100SF @ R=1

2 kg CO_2

Per 100SF @ R=1

14 kg CO_2

Per 100SF @ R=1

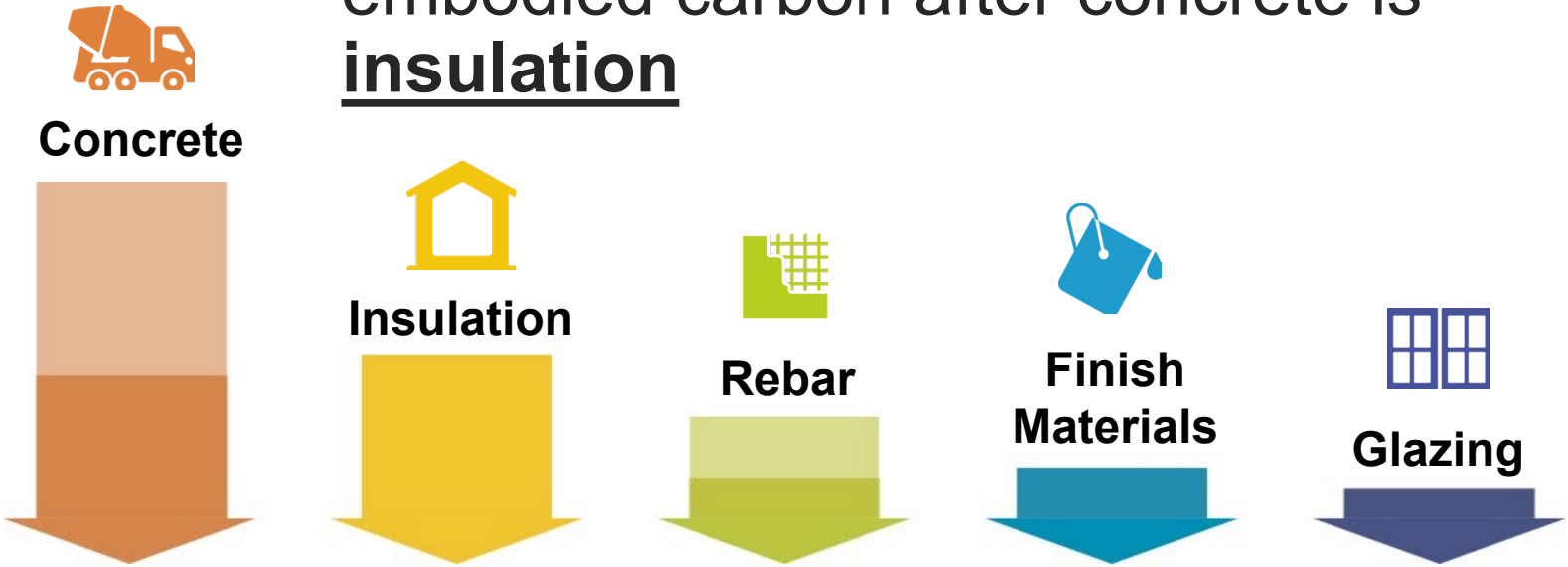
15 kg CO_2

Per 100SF @ R=1

36 kg CO_2

Per 100SF @ R=1

The greatest opportunity for reducing embodied carbon after concrete is **insulation**



TOP BUILDING MATERIAL CATEGORIES FOR **REDUCING EMBODIED CARBON**

Data Source: RMI

Discussion Questions

What is the first step someone aspiring to electrify can do?
What is the next milestone in electrification for Glavel + TimberHP?
Which is more critical, radical or incremental change?

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