WOOD AS A GREEN BUILDING MATERIAL

Life-Cycle Assessment of Wood in Residential and Commercial Construction

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Outline

- Green building guidelines, standards, and policy
- CORRIM's effort to document wood as green based on product and building life-cycle studies
- Example of a whole building and wall assembly life-cycle studies comparing wood to steel and concrete
- Summary
- Benefits to using wood products for green building

Green Building Guidelines, Standards, and Policy

- **Examples of green building guidelines, certification, and assessment:**
  - **LEED (Leadership in Energy and Environmental Design)**
  - **Green Globes (Green Building Initiative)**
  - **NAHB Model Green Home Building Guidelines**
  - **BEES (Building for Environmental and Economic Sustainability)**

Examples of Green Building to Certification Standards

Green Globes

Blakely Hall

LOCATION: Issaquah, Washington
FLOOR SPACE: 7,000 ft²
BUDGET: : $1,500,000 USD
CONSTRUCTION DATES: 2004–2005
OWNER: Issaquah Highlands Council & Port Blakely Communities
ARCHITECT: Webber + Thompson, PLLC Architects
LANDSCAPE ARCHITECT: Jane Garrison
STRUCTURAL ENGINEER: Coughlin Porter Lundeen
MECHANICAL ENGINEER: Pro Staff Mechanical
ELECTRICAL ENGINEER: North Star Electric
CIVIL ENGINEER: Coughlin Porter Lundeen
COMMISSIONING AGENT: Abacus Engineering

LEED

Kelley Engineering Center
Oregon State University

Green Building Guidelines, Standards, and Policy

- **Washington State Law Mandates Green Building**

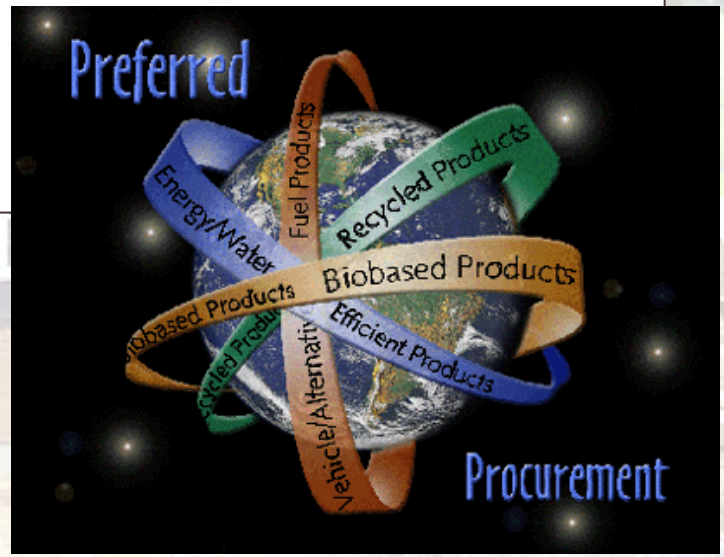
  April 21, 2005 Olympia, Washington

  Washington's Gov. Christine Gregoire signed the high performance green buildings bill into law which, according to the governor's office, makes Washington the first state to require that new public buildings meet "green building" standards of energy efficiency, water conservation and other environmental standards.

Standard follows LEED for buildings greater than $5 million.

Green Building Guidelines, Standards, and Policy

- **U. S. Government Agencies go to Environmentally Preferable Purchasing (EPP)—USDOE, USDA, others….**
  - **Bio-based products**
  - **Fuel products**



Green Building Guidelines, Standards, and Policy

- Nations (161) sign Kyoto Protocol to limit CO_2 emissions
- U.S. government proposes to reduce "carbon intensity"
- Governors of seven NE States agree to reduce CO_2 emissions and propose carbon credit exchange
- Governors of three Western States sign Global Warming Initiative

NAHB–How to Get Green

- Green Building Guidelines say to "incorporate environmental issues into project's decision-making process."
- Green Building Guidelines say to base "the selection of building material on their environmental impact."

Guidelines—Use Life Cycle Analyses to Assess Projects

ENVIRONMENTAL ISSUES

- Raw Material
- Product Manufacture
- Home Building Process
- Maintenance & Operation
- Home Demolition
- Product Reuse

To Determine Whether a Material or Home is Green

- Is it a renewable resource?
- Does it use resource efficient material?
- Does environmental data such as energy consumption and CO_2 emissions exist for material (use Life-Cycle Inventory)?
- Is Life-Cycle Analysis (LCA) used to analyze product or building
- Are there comparisons of environmental impacts to select best material, building design, wall assembly, etc.?

Demonstrating Wood is a Green Building Material

Easy to say but can it be proved!

Need for Unbiased, Sound Environmental Data

Consortium for Research on Renewable Industrial Materials

National effort to document the environmental performance of all wood products.

CORRIM, Inc.

- A non-profit corporation formed by 15 research institutions to conduct life-cycle inventory (LCI) and life-cycle assessment (LCA) studies of wood products.

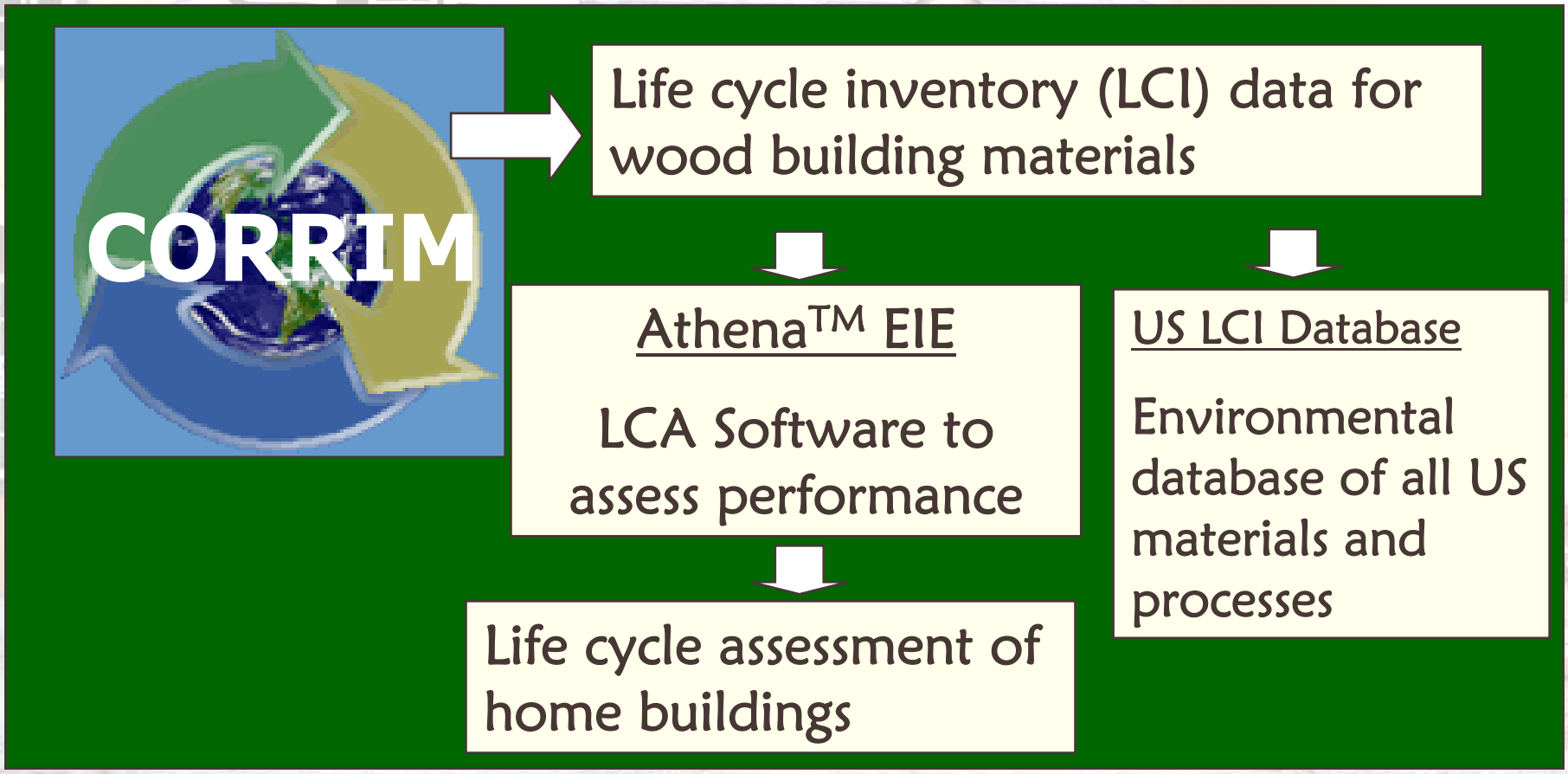
CORRIM'S Purpose

- To develop a public database and models of environmental performance measures over the life cycles of all wood products
- To examine a range of management, product, and process alternatives to identify strategies to improve environmental performance of wood products and residential buildings

CORRIM's Research Protocol

- CORRIM's research follows Life-Cycle Inventory (LCI) and Life-Cycle Assessment (LCA) international protocol of ISO 14040s Standards

CORRIM to Provide Environmental Data for Wood Products



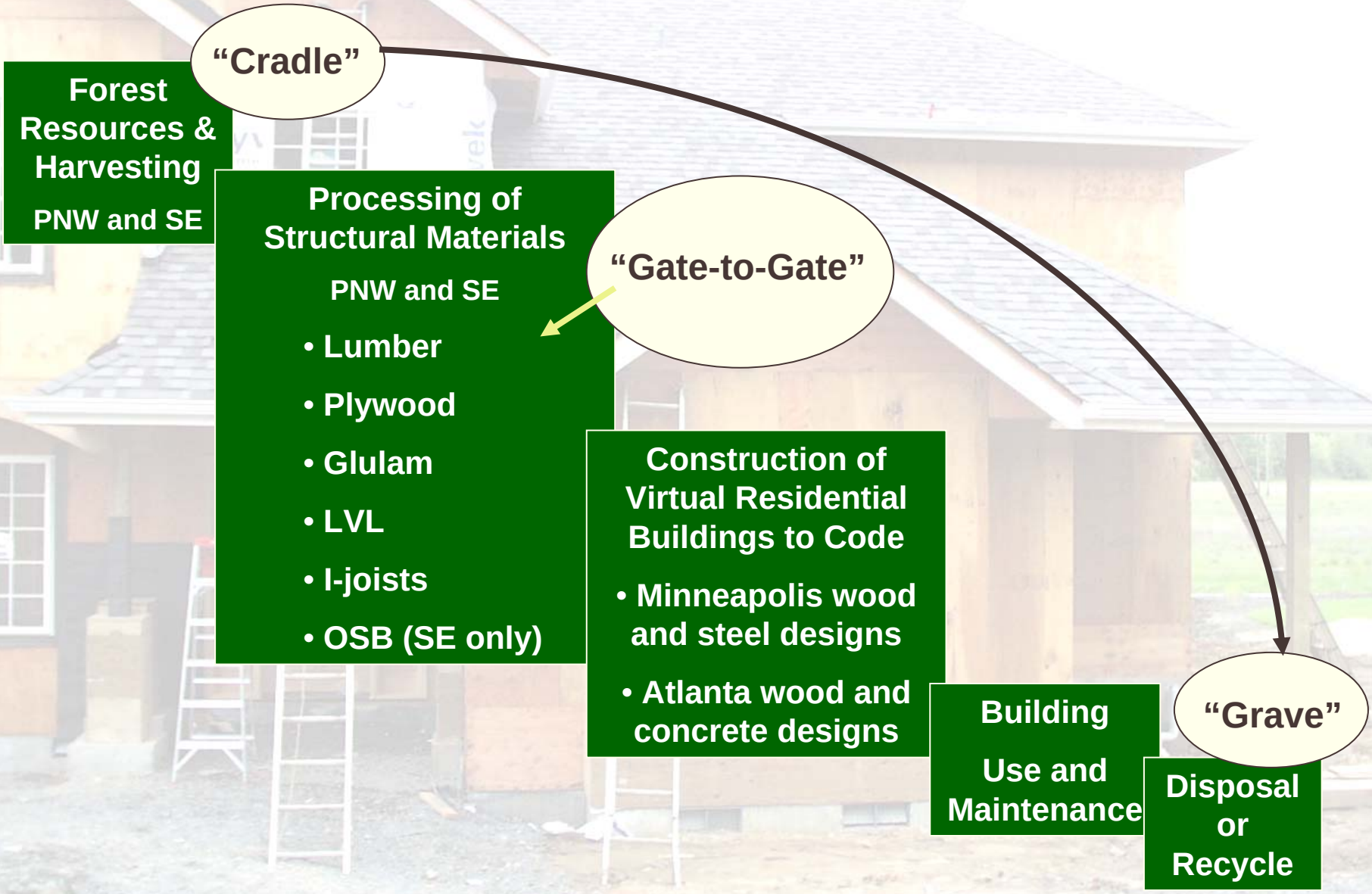
CORRIM'S Initial Effort Targeted Structural Wood Products and Home Construction

Phase 1 Report

July 2004

Reports, presentations, publications, and news releases available on: www.corrim.org

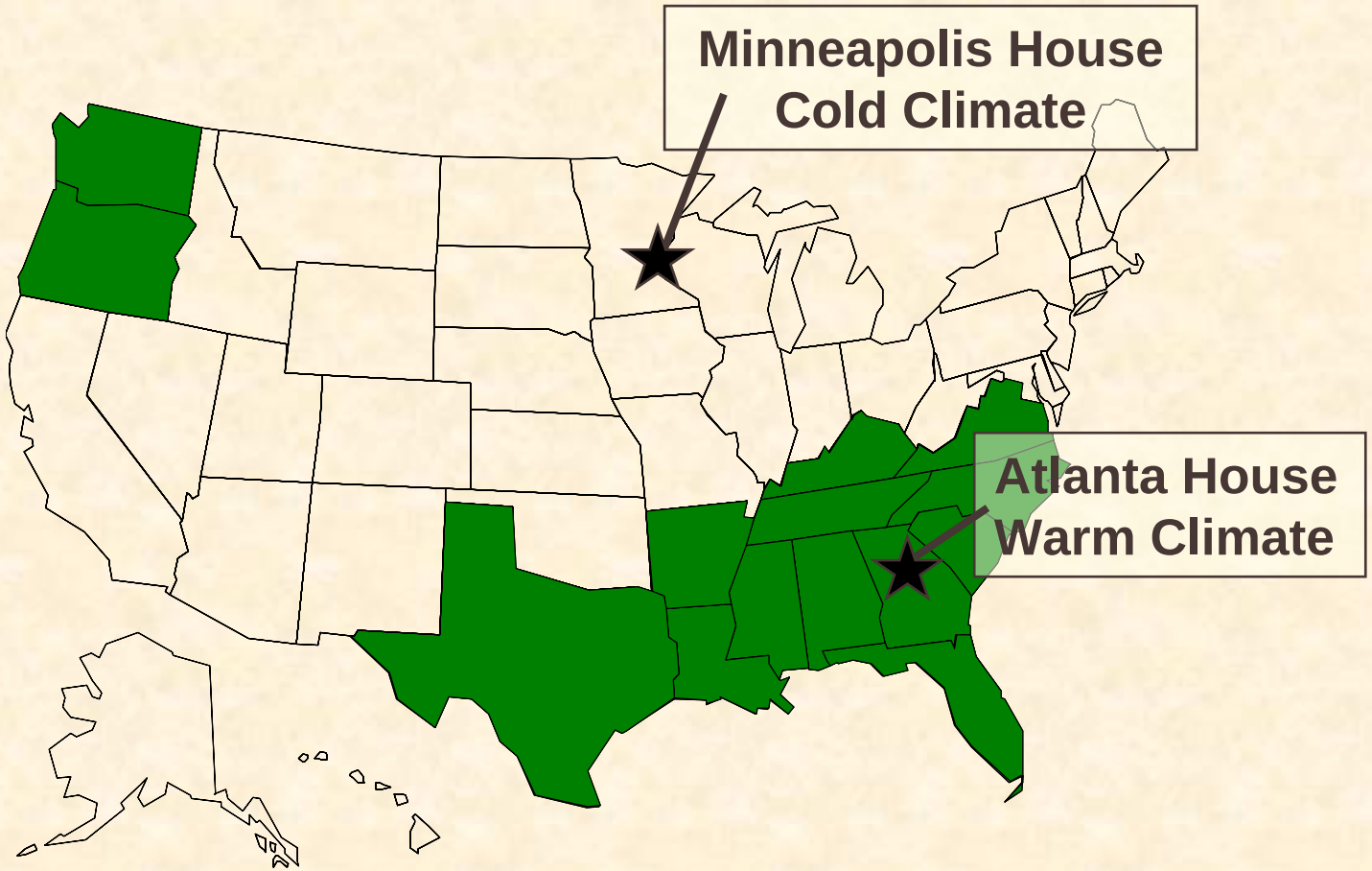
Overview CORRIM's Phase 1 Research



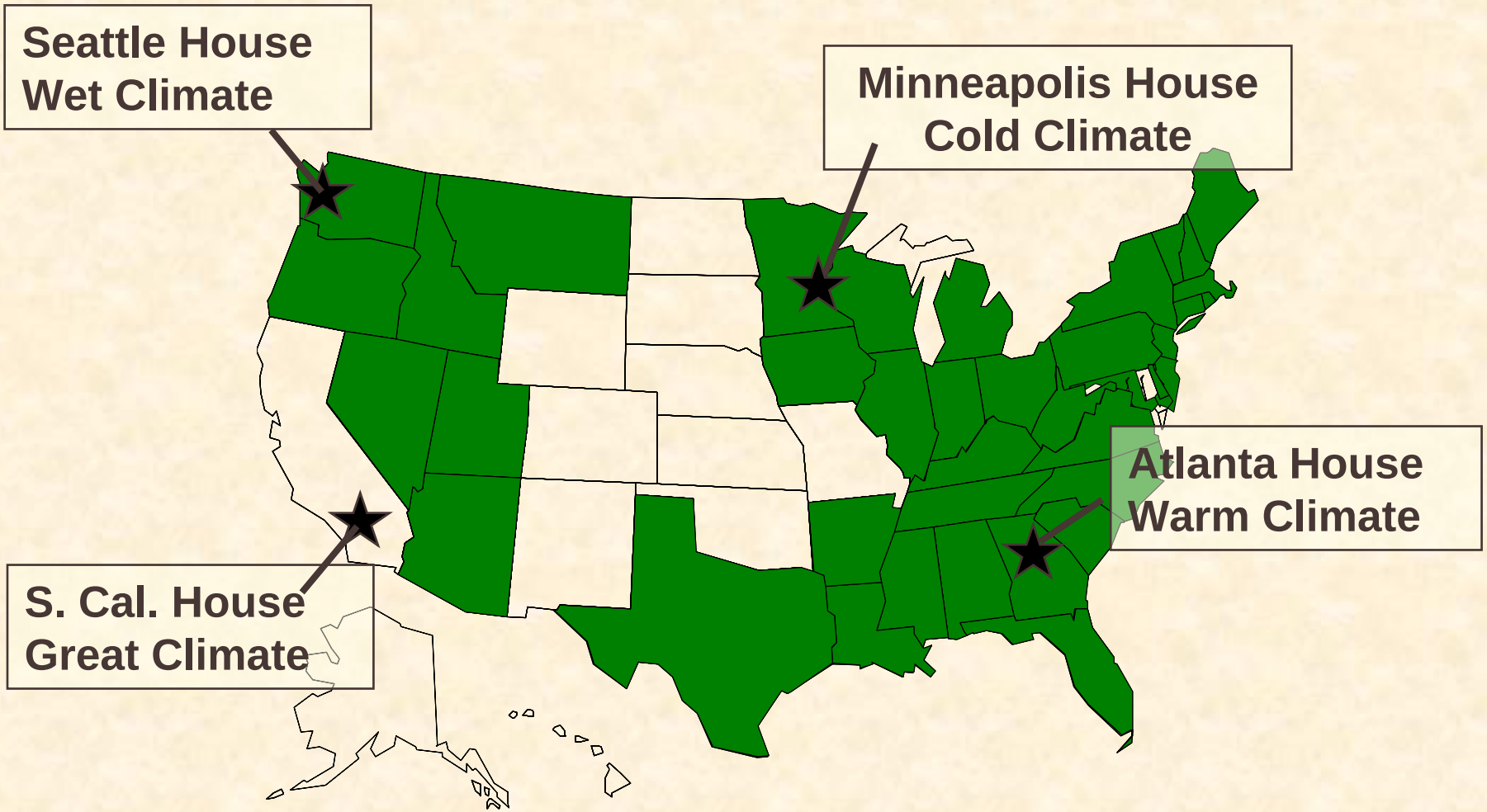
Output of CORRIM Study

- LCIs of forest, harvesting, and structural wood products.
- LCAs of the construction, use, and maintenance of residential buildings.
- Carbon tracking and storage for forest, wood products, and substitution products.
- Biomass (wood) fuel use.
- Sensitivity analyses of LCI and LCA models.
- Benefit cost analyses.

Phase 1-- Collected Forest and Production Data & Studied Residential Buildings



Phase 2—Additional Forests and Construction Sites

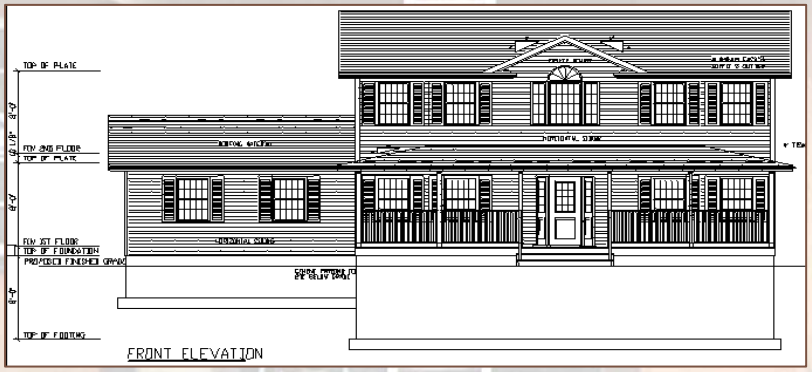


Example of Whole House Life-Cycle Analyses to Compare Building Materials

- Compared wood- to steel-framed home for cold climate
- Compared wood-framed to concrete block wall home for warm climate

Designed Homes to Local Building Code

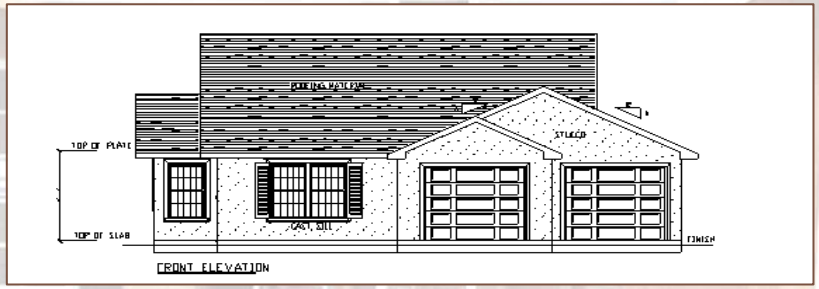
Minneapolis House
Cold Climate



Compared wood- to steel-framed house designed to same R code. The house is 2,062 sq.ft., two story, concrete basement, sheetrock, insulation, OSB sheathing, wood trusses, vinyl windows, vinyl siding and asphalt roofing.

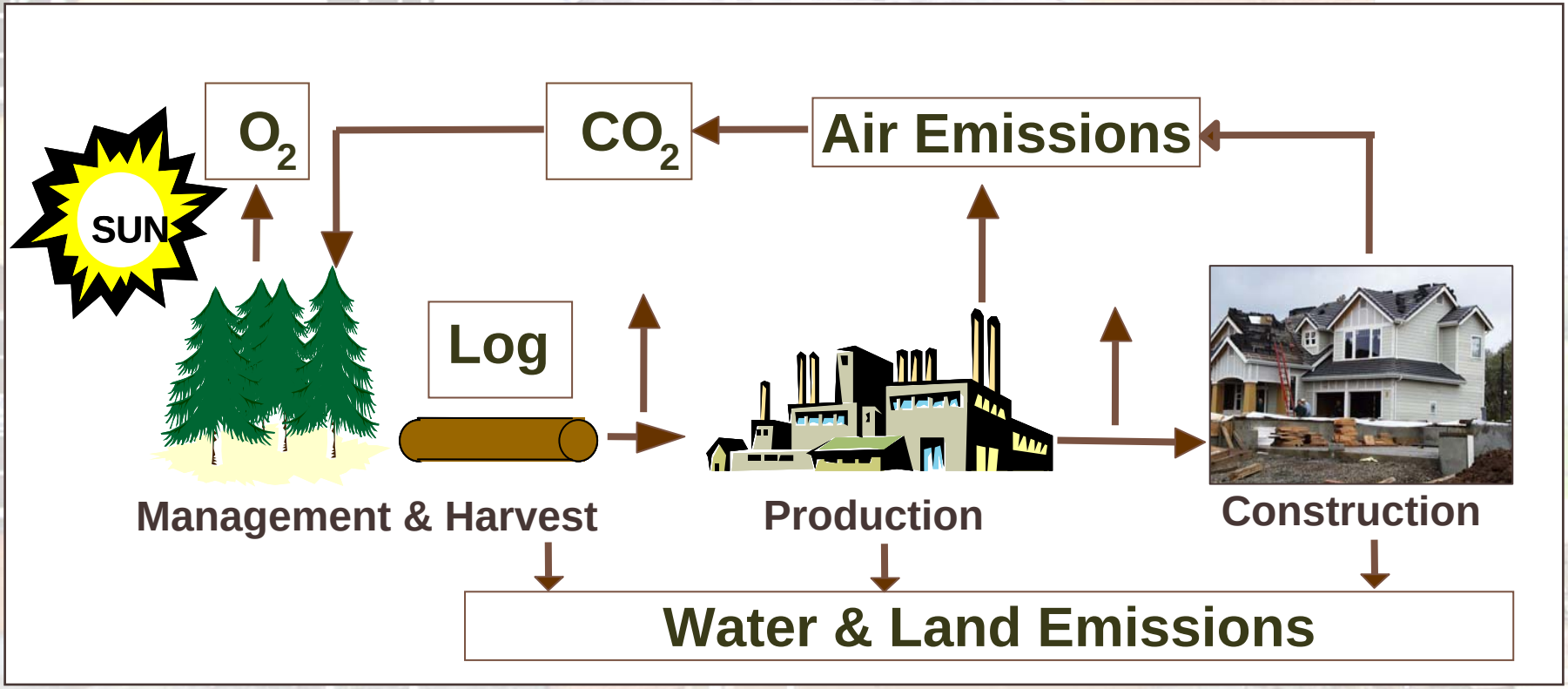
Designed Homes to Local Building Code

Atlanta House
Warm Climate



Compared wood framed to concrete block exterior walls designed to same R code. The house is 2,153 sq.ft., one story, slab on grade, sheetrock, insulation, wood studs, wood trusses, OSB sheathing, vinyl windows, stucco siding and asphalt roofing.

CORRIM's Life-Cycle Assessment of Wood Products & Buildings

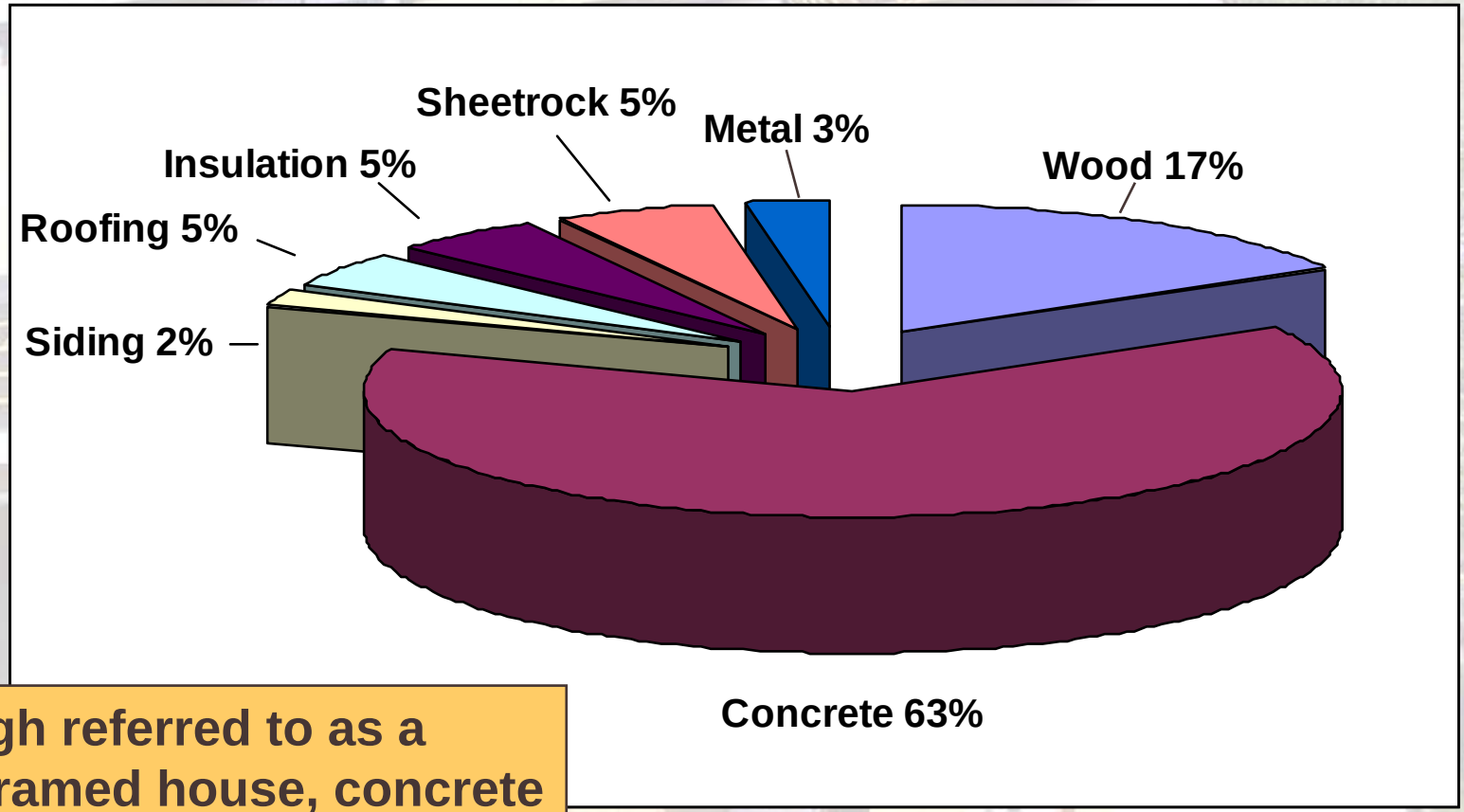


Life-Cycle Assessment In Terms of Environmental Performance Indices

- Embodied Energy
- Global Warming Potential
- Emissions to air, water and land
- Resource Use

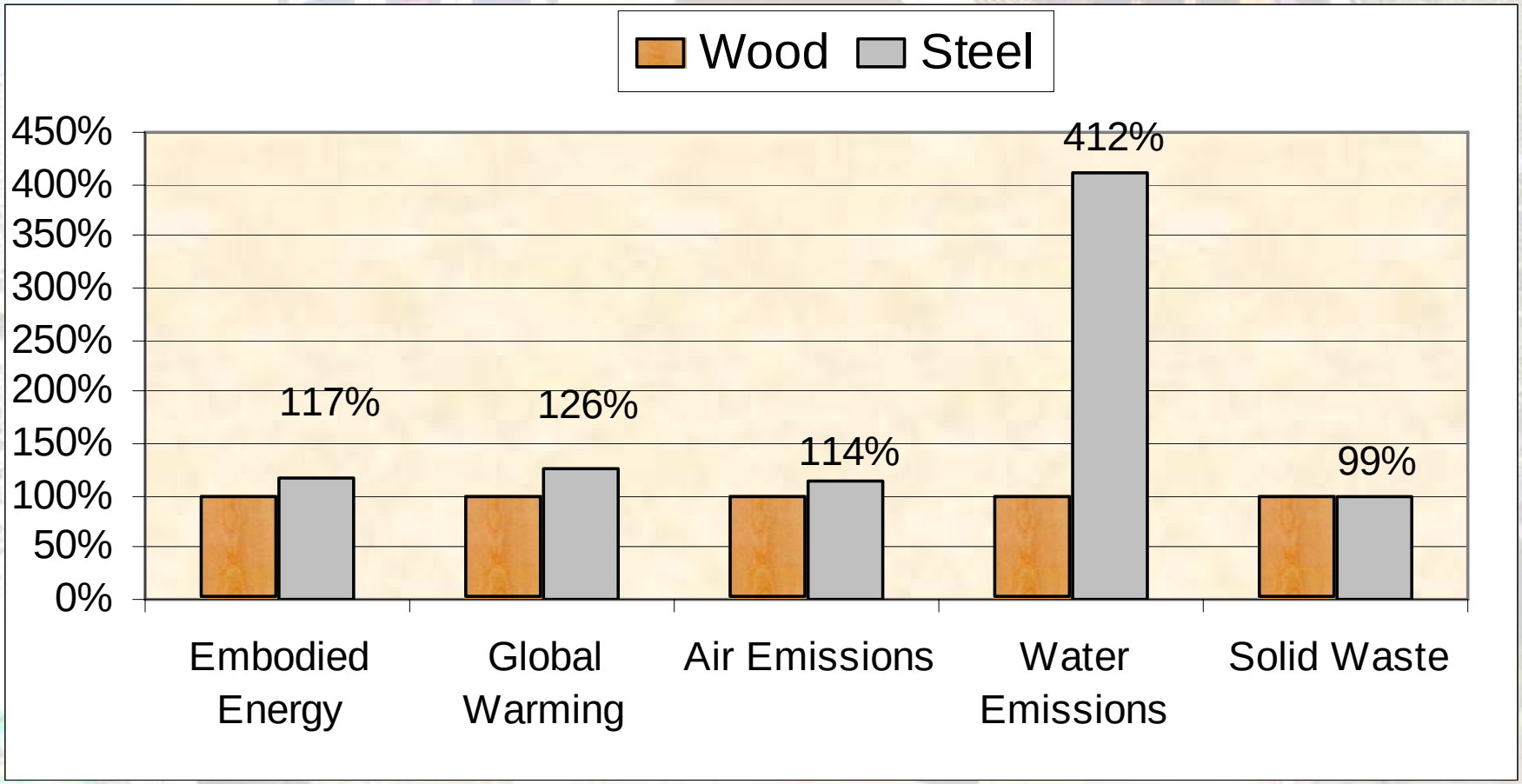



Cold Climate Wood-Framed House Components by Mass

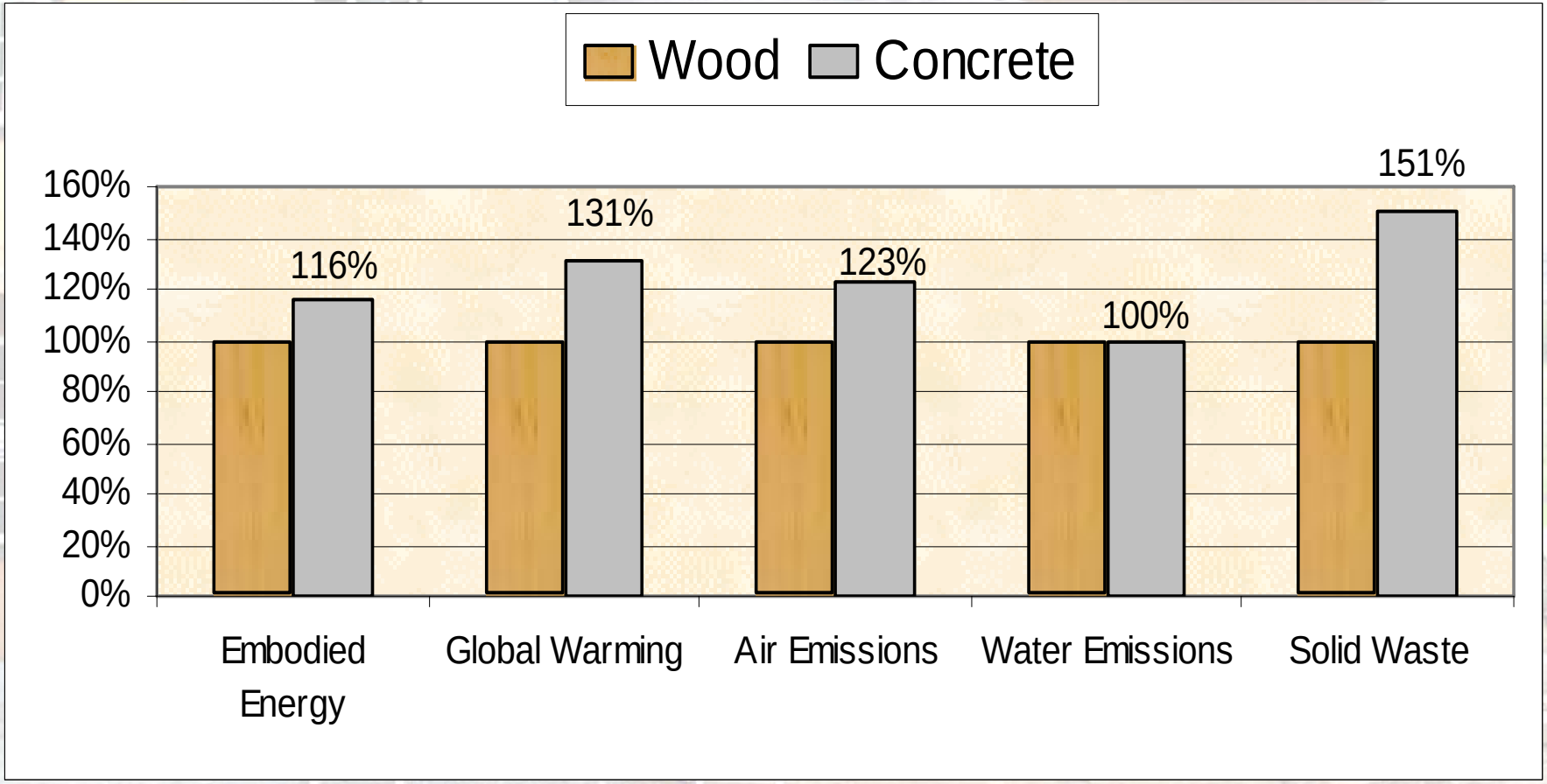


Although referred to as a wood-framed house, concrete is the dominant mass, with other materials playing lesser roles by mass.

Comparison of Wood- to Steel-Framed House



Comparison of Wood-Framed to Concrete Block House



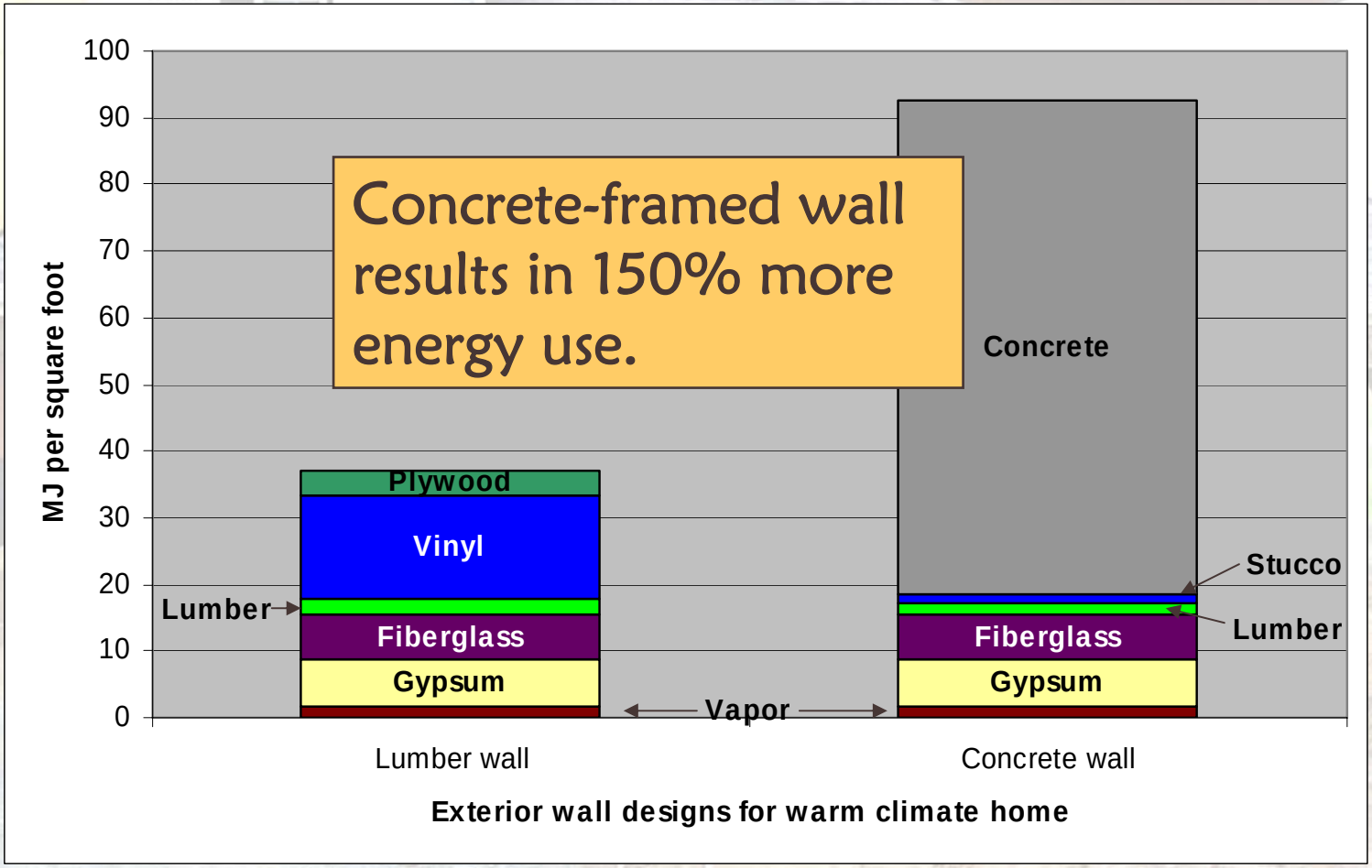
Comparison of Structural Assemblies

A menu of environmentally rated:

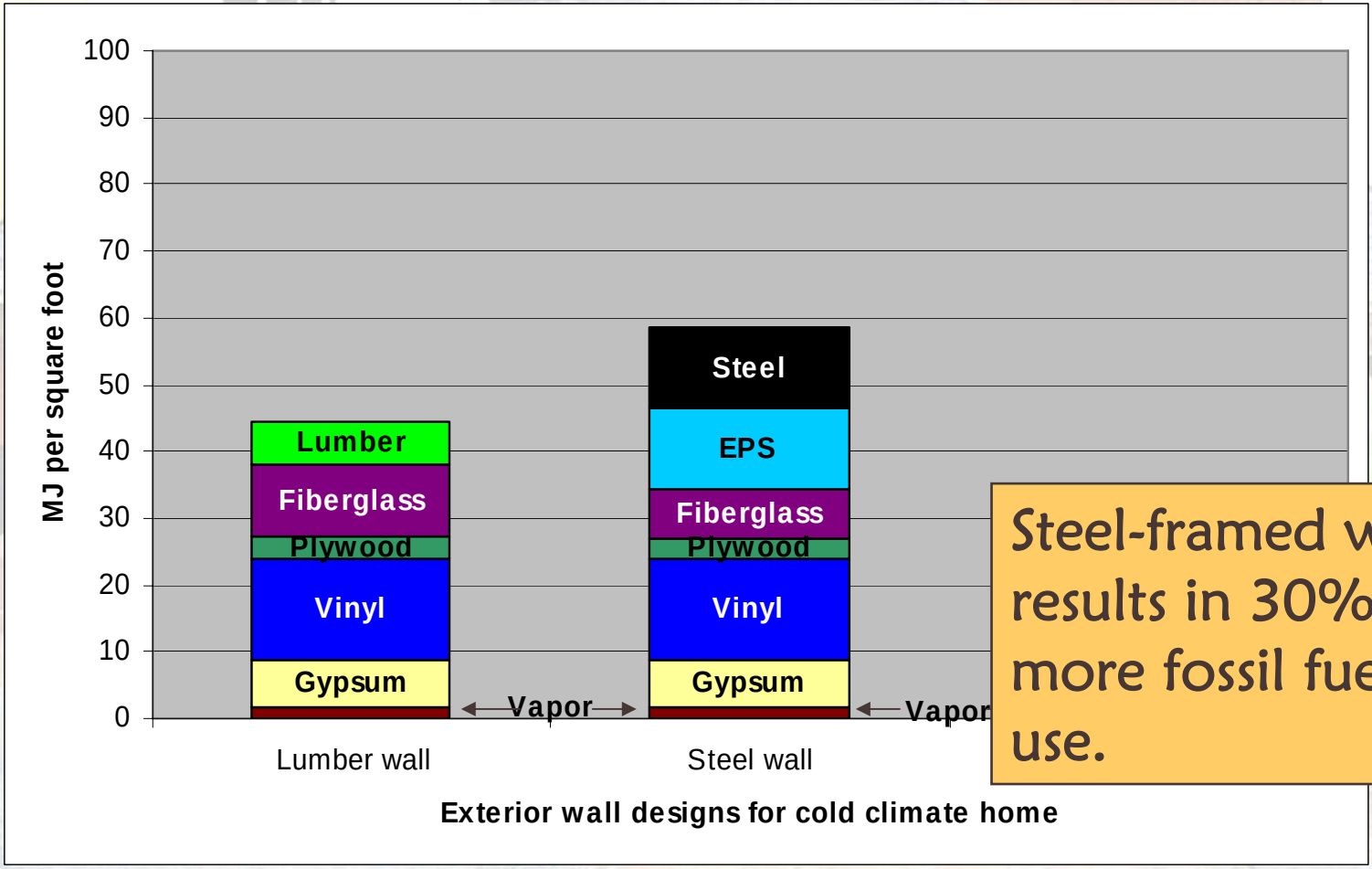
- **Wall assemblies**
- **Floor assemblies**
- **Roof assemblies**

A shopping list of construction options for contractors, designers, and architects to select environmental designs.

Fossil Fuel Consumption for Warm Climate Exterior Walls



Fossil Fuel Consumption for Cold Climate Exterior Walls



Steel-framed wall results in 30% more fossil fuel use.

CORRIM's Expanded Effort

- **CORRIM to complete Phase 2 research on wood products this summer, it expands upon the initial study:**
  - **Extends source location of forest resources to other regions**
  - **Assess home building in other regions**
  - **Assess low-rise, multi-family home buildings**
  - **Extend wood products to non-structural products such as hardwood flooring and MDF**
  - **Full product LCI's and LCA's**
  - **Component-by-component construction analyses of walls, floors, roofs and assemblies.**

Summary

- **Wood is Green—Study validates the environmental friendliness of wood compared to other common structural building materials.**
- **Material Selection—Study provides ways to enhance environmental performance of buildings through material selection and design.**
- **Publicly available database—Study provides environmental data on structural wood products.**

Benefits to Using Wood Products

- **Wood is a green building material in comparison to other materials**
  - **Data is available in U.S. LCI Database; however, for your use it will likely be by using building guidelines, standards and design assessment software (i.e., Athena™, BEES, Bio-based EPP, and eventually LEED and Green Globes)**

Benefits to Using Wood Products

- Wood is sustainable and renewable whether for forest, products, or fuel
- Wood is resource efficient
- Wood can store carbon in forest, products, and landfills removing it from the atmosphere as CO_2
  - reducing global warming

For more information please see:

CORRIM: *www.corrim.org*

Athena™: *www.athenaSMI.ca*

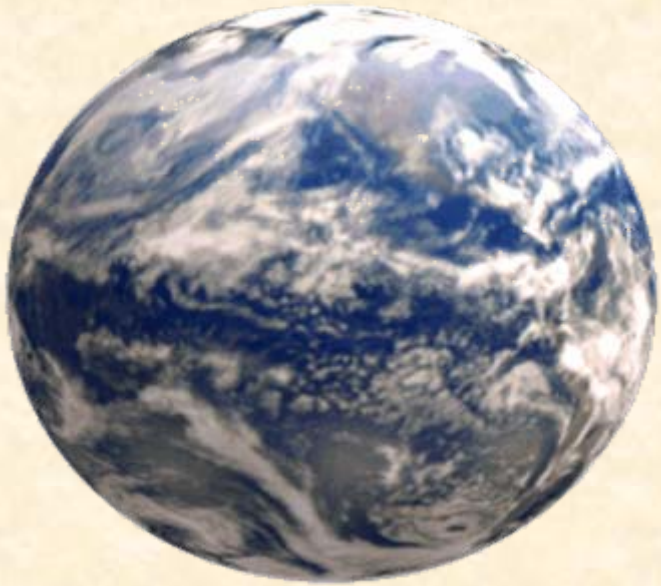
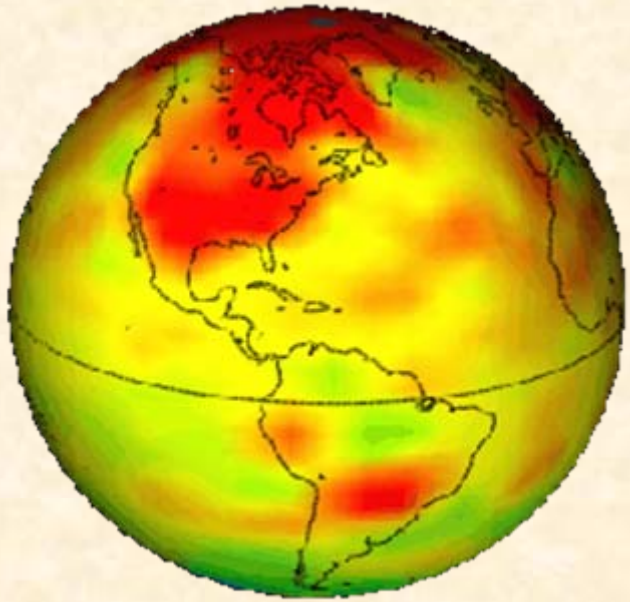
US LCI database: *www.nrel.gov/lci*

NAHB Green Build Guidelines: *www.nahb.org/gbg*

BEES: *www.bfrl.nist.gov/oae/software/bees.html*

Green Globes: *www.thegbi.com/greenglobes/*


Need for Green Building

Which Earth will we have?