

Photo courtesy of Jeffrey Roscoe



The Role of Wood Products in Green Building

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The complex process of building design and construction must meet many criteria – aesthetics, safety, budget, code compliance, occupant comfort, durability, and more. Architects and other design professionals are increasingly recognizing the value of adding green building to the list.

This course will help you understand that sustainable design begins with sustainable building materials. Because there are many factors to consider in assessing a building's sustainability, it can be challenging to fully understand the long-term impacts of choosing one building material over another. However, material choice greatly affects the environmental impact of buildings, both during construction and over the building's life cycle.

Because 80 percent of a building's embodied carbon comes from the structural

materials used to build it, building material specification is impactful. "Upfront" embodied carbon is the total amount of greenhouse gas emissions associated with the harvesting/extraction, transportation, and manufacturing of materials used in building construction. The effects of sustainable building design extend well beyond the construction phase to the way a building performs over its lifetime through lower energy use (operational carbon) and occupant health and well-being, for example.

Architects can incorporate sustainable features into their designs through their choice of building materials. Wood building products and components fit well within many sustainable building scenarios, while also adding other benefits such as natural warmth and beauty. Wood is a versatile, durable building material that can be used in almost any building

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Learning Objectives

After reading this article, you should be able to:

1. Explain the role wood products play in sustainable building design and construction.
2. Describe common green building standards, certification, and ratings programs and identify some of their similarities and differences.
3. Recognize terms used for green building and understand how things like forest certification, EPDs, and LCAs can be used to meet green building standards.
4. Discuss green building trends regarding building codes, building types, and procurement policies.

To receive AIA credit, you are required to read the entire article and pass the quiz. Visit ce.architecturalrecord.com for the complete text and to take the quiz for free.

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GREEN BUILDING TERMINOLOGY

People use many terms when describing green building, and it's important to understand what they mean in a design and build context.

Carbon footprint: Includes both the embodied carbon and the operational carbon of a building.

Carbon sequestration: Carbon can be captured and stored in a material over time, reducing the amount of carbon dioxide that material releases into the atmosphere. Because trees absorb and store carbon dioxide from the atmosphere, they can be considered a carbon sink.

Carbon sink: Something that absorbs more carbon than it releases. A healthy, growing forest is an example of a carbon sink.

Cradle-to-Gate: Life cycle stages from harvesting/extraction to the factory gate, before it is transported to the job site.

Cradle-to-Grave: All life cycle stages from harvesting/extraction through end-of-life, including landfilling.

Embodied carbon: Carbon dioxide equivalent (kgCO₂eq) emissions from the declared life cycle stages. It can be measured from cradle-to-gate and cradle-to-grave (end of its use).

Green building: High-performance building approach that uses environmentally responsible and resource-efficient building practices to reduce a building's carbon impact throughout its life.

Life Cycle Assessment (LCA): Evaluates the environmental impacts of a product or building throughout declared life cycle stages. It may include both operational and embodied carbon emissions.

Operational carbon: Carbon emissions created by using energy to power, heat, or cool a building.

Volatile Organic Compound (VOC): A carbon-based compound that can easily evaporate and become gaseous under normal atmospheric conditions. VOCs are emitted by thousands of products and can contribute to poor air quality.

Whole Building Life Cycle Assessment (WBLC): An LCA that covers all stages in the life cycle of a building and its components, from raw material extraction (cradle) to product manufacturing, transportation, building construction and operation, and eventual recycling or disposal (grave).

application. It is renewable and sustainable, and wood products typically require less energy to produce than other building materials. Green building standards also recognize wood's contribution to improved energy performance over time.

THE BASICS OF GREEN BUILDING

The world's ability to meet climate goals depends on reducing carbon emissions, and the building industry accounts for nearly 40 percent of annual global CO₂ emissions. Architects and designers are showing that buildings can be constructed sustainably, with a reduced carbon footprint, while still meeting critical design goals including functionality, cost, comfort, and more.

While there are many ways to approach it, the goal of green building is to design projects

and use construction processes that are environmentally responsible and resource-efficient and to reduce carbon emissions both during construction and throughout a building's life cycle. This can be accomplished a number of ways, from smart site selection and construction material choice to how the design and building materials impact energy use over the life of the building.

A 2018 study from the World Green Building Council found that additional costs of green building can be outweighed by the life cycle benefits of creating a better building, which include lower energy consumption, improved occupant satisfaction and well-being, and better financial performance in terms of improved lease rates and developer return on investment. The 71 global companies that participated

in the study found that staff turnover and absenteeism decreased while productivity and job satisfaction increased—all of which translate to measurable economic benefits.

TOOLS USED TO ASSESS GREEN BUILDING CERTIFICATION

There are as many reasons to pursue green building certification as there are certification programs from which to choose. Certification can be used to comply with client, civic, or jurisdictional requirements; it can also serve as a marketing tool for the building owner to help attract tenants.

To understand green building certification, it is important to become familiar with the primary methods that are used to assess certification requirements.

Life Cycle Assessment (LCA)

An LCA is a performance-based methodology that measures the environmental impact of a product, assembly, or structure over its life span; it's a way to assess the sustainability of a building and its constituent parts.

LCA measures the energy required to both construct and operate a product or building over its lifetime, beginning with the extraction or harvest of the material through to its manufacture, distribution, installation, use, and end-of-life disposal.

LCA analysis is required for many green building certification programs; results allow project teams to understand the overall impact of choosing one building product or construction system over another.

LCA studies consistently show that wood products have a lower environmental impact than alternative materials. The Consortium for Research on Renewable Industrial Materials (CORRIM) has done numerous LCA studies comparing wood products to other building materials, and has found that wood has lower carbon emissions and uses less overall energy to produce than other products.

There are numerous LCA options available to help guide design decisions by evaluating the environmental impact of everything from individual building products to entire buildings, known as WBLC (Whole Building Life Cycle Assessment).

LCAs provide varying levels of detail and complexity:

- Athena EcoCalculator is a free tool that measures the LCA of common building assemblies. Data is pulled from a library

of predefined options for quick and simple assessments. Separate calculators are available for commercial and residential assemblies, and calculations are based on an assumed building service life of 60 years.

- Athena Environmental Impact Estimator is a more robust tool that evaluates whole building LCAs; it also measures the environmental impacts of the building’s ongoing operation, allowing for easy comparison of design options. This tool can be used for new construction, renovations, and additions on all building types.
- The Embodied Carbon in Construction Calculator (EC3) is a database populated with product EPDs. It is useful after a building has been designed. SimaPro and GaBi Solutions are life cycle inventory databases that also have tools to conduct an LCA and measure the environmental impact of individual building products.
- Tally, a Revit software plug-in, uses the GaBi database to evaluate WBLCA.
- One-Click is another LCA tool that can be used for early design optimization, life-cycle costing, and benchmarking against similar projects and other metrics.

Forest Certification

Forest certification programs help ensure that a forest landowner is following sustainable forest management practices, including harvest methods and replanting. There are several programs used in North American forest management:

- American Tree Farm System (ATFS)
- Canadian Standards Association (CSA)
- Forest Stewardship Council (FSC)
- Sustainable Forestry Initiative (SFI)



For each, a third-party certifier evaluates the forest management practices being followed by landowners and foresters against the organization’s requirements. While all have the same basic mission—to provide guidelines that support sustainable forest management—there are differences in the requirements of

Table courtesy of WoodWorks

		Emissions Considered		Acceptability for Green Building Credits	
		Embodied Carbon	Operational Carbon	LEED v4.1	Green Globes
Athena Impact Estimator for Buildings	Detailed, robust WBLCA	Yes	Yes	Yes	Yes
Tally	Detailed, robust WBLCA; can be integrated with Revit	Yes	Yes	Yes	Yes
One-Click LCA	WBLCA with regionalized generic data and global EPD library	Yes	Yes	Yes	Yes
Athena EcoCalculator	Simplified LCA for evaluating common building assemblies	Yes	Yes	Yes	Yes
Embodied Carbon in Construction (EC3/ Beta Version)	EPD database, sortable by embodied carbon enabling product comparisons	Yes	No	Pilot credit	No
WoodWorks Carbon Estimator	Carbon	Yes	No	No	No
WoodWorks Carbon Calculator	Detailed estimate based on wood products used (wood structures only)	Yes	No	No	No

LCA tools and carbon calculators.

Photo courtesy of Gensler | David Lauer Photography

THE ALLIANCE FOR SUSTAINABLE COLORADO

Location: Denver, Colorado; **Architect:** Gensler

Since reuse is considered by some to be the ultimate sustainable building approach, this renovation of a six-story warehouse qualified for LEED v4 Platinum certification and won a long list of green building awards, including the National Leadership Award from the U.S. Green Building Council. The renovation reconfigured a 1908 building to create collaborative, shared workspaces and conference rooms. Since the building is home to an organization whose goal is to promote sustainability, the design team took full advantage of the existing wood structural members while adding features to reduce energy use. The design left the original heavy timber beams exposed and incorporated other natural wood elements to reinforce wood’s biophilic benefits, promoting health and wellness in the workplace.



how each program is structured.

It is important to recognize that forests are not required to be certified. Some private and public landowners follow sustainable forest management practices but choose not to pay for certification. In contrast, some lands are certified by multiple programs. As of 2017, nearly 100 million acres of U.S. forested land were certified; about 15 percent was certified by more than one program. Canada had more than 430 million acres of certified forests, and about 10 percent of that had double certification.

U.S. federal timberlands are not certified, but this does not mean they are not being sustainably managed. In 2007, the Pinchot Institute conducted a study of five national forests and found their management practices met many of the certification requirements in terms of forest planning, protection of threatened and endangered species, and others.

Many state regulations meet or exceed forest certification requirements. For example, all forestlands and conservation areas managed by the Washington State Department of Natural Resources (2.4 million acres) are certified under the SFI program. About 176,000 acres of those forestlands are also certified under the FSC U.S. Forest Management Standard. In 2016, nearly 5 million acres of Oregon timberlands were certified by ATFS, FSC, or SFI.

While several green building standards have required use of wood from certified forests in the past, many are also now recognizing wood harvested from what is known as legal, or responsible, product source categories. A responsible source is defined as a forest site that is replanted after harvest by

trained loggers, where endangered species are protected and best management practices are followed. Once the responsible source is established and verified, its products must be delivered through a chain-of-custody (CoC) that can be used to obtain credit under the green building standard. CoC documentation verifies the source of the timber as it moves from forest to construction site.

Leadership in Energy and Environmental Design (LEED), one of the most well-known green building certification programs, requires that wood products be from certified forests. However, LEED v4.1 has a Pilot Alternative Compliance Path, allowing wood products sourced from ASTM D7612-certified forests to earn LEED credit if they are all from legal (noncontroversial) sources such as forests managed using responsible practices and if at least 70 percent (based on cost) are from responsible sources.

Environmental Product Declarations (EPDs)

While forest certification verifies that a forest is being managed sustainably, an EPD is a way to verify the environmental impact of a specific product. EPDs allow architects to evaluate a product's lifetime environmental impact in terms of embodied energy, carbon emissions, and waste generation, as well as for other factors such as global warming and ozone depletion. When considered alongside other factors such as recycled content or VOC emissions, EPDs help architects make informed building material choices.

The International EPD System is a global program for environmental declarations based on ISO 14025 (Environmental Labels and Declarations) and the European standard EN 15804 (Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products). Wood EPDs are third-party verified by UL Environment, an independent certifier of the sustainable attributes of various products. EPDs for softwood lumber and plywood, oriented strand board (OSB), glue-laminated beams (glulam), laminated veneer lumber (LVL), wood I-joists, laminated strand lumber (LSL), and other wood building products are published by the American Wood Council.

Wood EPDs take a "cradle-to-gate" approach, measuring environmental impact from raw material harvest through manufacturing to the point when the product is ready

to ship from the manufacturing facility. Since wood products are manufactured all across North America, and since they are used in many applications, it is difficult to make assumptions about their end-use environmental impact, which makes "cradle-to-grave" or "cradle-to-cradle" measurements difficult to obtain.

EPDs are becoming increasingly important in building design and construction. Products with verified EPDs can receive credit through LEED v4.1, Green Globes, and other green building rating systems. EPDs can also be used to show compliance with International Green Construction Code (IgCC) and other green building codes. In fact, the 2018 IgCC requires that at least 10 materials installed in a building have an EPD.

Green Building Rating Systems

There are many reasons a building owner chooses to seek green building certification for their project. Some state and local governments have made certification a requirement to meet energy efficiency goals. Some certified buildings may qualify for tax-related incentives. Additionally, developers are finding that a growing number of commercial and residential tenants have their own sustainability goals or commitments which factor into their choice to live or work in a certified green building. At the same time, some building owners require that their project be designed to follow green building standards, but they don't apply or pay for certification.

Regardless of the reason, architects have numerous building standards, certifications, and rating systems available to help guide them toward sustainable design principles. Virtually all of them emphasize efficient use of building material resources, as well as energy and water use, indoor air quality, and



other factors.

There are many well-known national green building certification programs, including:

- Leadership in Energy and Environmental Design (LEED)
- Green Globes
- National Green Building Standard (NGBS)
- Living Building Challenge, Energy Star, BREEAM (Building Research Establishment Environmental Assessment Method), and others.

The environmental advantages of using wood products are recognized by each certification system, but each program varies in how wood use is credited. With two of the most well-known programs, LEED v4 and Green Globes v1.4, it is possible to earn 8 to 10 percent of potential credits through substantial use of wood in construction.

Green building rating systems also assign credits based on the use of LCA tools, renewability of the resource, EPD availability, forest certification, locally produced materials, third-party certification, ability for materials to be recycled, and more.

LEED

LEED is one of the most well-known green building rating systems. Operated by the U.S. Green Building Council (USGBC), the current version is LEED v4.1. LEED’s Building Design and Construction rating system can be used to certify new construction and major renovation projects for many building types including mixed-use, retail, hospitality, education, and healthcare.

LEED gives designers the ability to earn points for a project by taking design measures that are deemed to positively impact the environment, like using sustainable materials or making efficient use of resources. The number of points earned allows a project to be designated in one of four ways: Certified, Silver, Gold, or Platinum -- with Platinum being the highest level. The Alliance for Sustainable Colorado, a renovation project in Denver, qualified for LEED v4 Platinum certification, in part due to its reuse of the existing wood structural members.



LEED v4.1 uses many of the tools described above, including WBLCA, which allows for a whole building comparison of the environmental impacts of various structural materials. It also recognizes products that have a qualified EPD conforming to ISO 14025 (Environmental Labels and Declarations) and ISO 21930 (Sustainability in Buildings and Civil Engineering Works).

Use of wood as a building material is covered in the Materials and Resources Chapter of LEED v4.1 in the Building Design and Construction (BD+C) category; credits recognize wood’s favorable environmental attributes such as certification, recycled content in engineered wood products, and wood that is manufactured and/or harvested within a 500-mile radius of the project.

Building designers can use the LEED credit library to determine which points can

be earned for using wood. For example, using the Alternative Compliance Path in LEED v4.1, Responsible Sourcing of Raw Materials provides 1 to 2 points, rewarding project teams for selecting products verified to have been sourced responsibly. To achieve a LEED point under this criterion, the user must know that:

- 100 percent of the wood used is from legal (noncontroversial) sources, and



Photo courtesy of Jeremy Bittermann; Lara Swimmer; Shawn Records

OREGON CONSERVATION CENTER CASE STUDY



Location: Portland, Oregon; **Architect:** Lever Architecture

The renovation and expansion of the Oregon Conservation Center utilized both mass timber and light wood-frame construction to reimagine an outdated office building. The building’s collaborative interior reflects the environmental mission of its main tenant, The Nature Conservancy. Building designers specified glulam columns and beams with cross-laminated timber (CLT) panels manufactured in Oregon from FSC-certified lumber. Rooftop solar panels provide 25 percent of the building’s electrical needs. By incorporating ample daylighting and efficient mechanical systems, the building has lowered its electricity usage by more than half. Wood interiors are exposed to create a warm, natural aesthetic; designers also used wood as the building’s exterior siding to provide a durable finish. This project qualified for LEED Gold certification and has received numerous design awards.

USGBC RECOGNIZES ALL CERTIFICATION STANDARDS FOR LEED POINTS			
PROGRAM NAME	Legal (non-controversial) Compliant?	Responsible Sources Compliant?	Certified Sources Compliant? (CoC)
Sustainable Forestry Initiative (SFI)	• Forest Management (via SFI CoC certificate)	Yes	Yes
	• SFI Fiber Sourcing certificate	Yes	No
American Tree Farm System (ATFS)	• Forest Management (via SFI CoC certificate)	Yes	Yes
Canadian Standards Association (CSA)	• Forest Management (via SFI CoC certificate)	Yes	Yes
Programme for the Endorsement of Forest Certification (PEFC)	• Forest Management (via PEFC chain of custody certificate)	Yes	Yes
	• PEFC Due Diligence System	Yes	No
Forest Stewardship Council (FSC)	• Forest Management (via FSC chain of custody certificate)	Yes	Yes
	• FSC Controlled Wood certificate	Yes	No

- 70 percent is from responsible sources

Once the above two criteria are satisfied, then chain-of-custody (CoC) certification can satisfy the final requirement that at least 25 percent (based on cost) of all permanently installed building materials (such as structural wood framing) meet the Responsible Extraction Criteria. Wood products sourced from certified sources as defined by ASTM D7612-10 (2015) satisfy the requirements of this credit.

Green Globes

This green building assessment and certification program from the Green Building Initiative (GBI) generates a building score based on a 1000-point rating system. Green Globe certification recognizes responsible material selection as well as efforts to conserve energy and reduce water consumption over time. The assessment is verified by a third party, then awarded a rating based on accumulated points -- either one, two, three, or four Green Globes.

Like LEED, Green Globes has several qualification categories: new construction, existing buildings, core and shell, sustainable interiors, multifamily new construction, and existing buildings. The certification process evaluates multiple assessment areas, including project management, site, energy, water, materials and resources, emissions, and indoor environment. An architect's choice of wood for structure and finish falls under the materials and resources category.

Specifying wood can help project teams

achieve higher scores in their Green Globes assessment, with points related to energy and acoustic properties, renewability, and economic value to both the project itself and to the communities who manufacture the wood products.

Projects can earn points for the use of certified wood products including SFI, FSC, ATFS, and CSA. Points can also be earned for using traditional lumber framing, mass timber, and engineered wood products. Construction methodologies, like prefabricated components, also qualify for Green Globes points due to reduced construction waste.

National Green Building Standard

While many architects think of the National Green Building Standard (NGBS) as limited to single-family homes, this green building certification program covers multifamily construction as well. The goal of NGBS is to

help architects build beyond existing code, to design buildings that are sustainable and cost-effective.

Approved by the American National Standards Institute (ANSI), the NGBS is a points-based system with four certification levels – Bronze, Silver, Gold, and Emerald. The current version is the ICC 700-2020 NGBS. Wood use earns points in several categories, including resource efficiency, energy efficiency, and indoor environmental quality. In fact, several wood product manufacturers have specific NGBS-certified products available. NGBS compliance is verified by third-party inspectors overseen by Home Innovation Research Labs.

BUILDING SUSTAINABLY USING WOOD

When designing to meet green buildings standards, wood adds value on a number of levels. Wood is the only major building material that is renewable. As trees grow, they release oxygen and absorb CO2. And when those trees are harvested, the carbon is sequestered and held in the wood for as long as the wood remains in use.

When wood is used for the structure of a building, it reduces the carbon footprint in two ways – through carbon storage and through avoided greenhouse gas emissions, since wood products use less energy from fossil fuels in their manufacture than other materials. In fact, wood products comprise 47 percent of the industrial raw material manufactured in the U.S., yet consume only 4 percent of the energy needed for production. Every ton of wood used in place of an alternative building material potentially avoids 2.1 tons of carbon, or 7.7 tons of carbon dioxide equivalent (CO2e).

Wood building materials also provide benefits for the ongoing operating efficiency of a building. Wood has a relatively high R-value which provides good insulating value. Wood also has lower thermal

Name	Version	Certifications	Building Types	Wood Relevance
LEED Leadership in Energy and Environmental Design U.S. Green Building Council	LEED v4/	Certified	Commercial: all	Rewards use of sustainable materials; wood can be sourced from any certified forests (SFI, FSC, ATFS, CSA and Programme for the Endorsement of Forest Certification (PEFC)); recognizes products with EPDs, accepts whole building LCA.
		Silver	Industrial: all	
		Gold	Mixed use: all	
Green Globes Green Building Initiative		Platinum	Residential: all	Awards credits for LCA, EPD procurement, and reuse of existing buildings and materials
		One Green Globe	Commercial: all	
		Two Green Globes	Mixed use: all	
		Three Green Globes	Residential: multi-family only	
National Green Building Standard Home Innovation Research Labs	ICC/ASHRAE 700-2015	Four Green Globes	Residential: all, including single- and multi-family	Credits use of wood and recyclable construction materials; Requires inspection by third-party verifiers during framing and upon completion.
		Bronze		
		Silver		
		Gold		
		Emerald		

Green building rating and certification systems.

conductivity than other materials such as steel or concrete, making wood-framed buildings more efficient to insulate. Light-frame wood, mass timber, and prefabricated wood construction can all be used to create an efficient building envelope.

One of the most effective ways to improve indoor air quality is to reduce the use of materials that emit pollutants. Wood's natural beauty can also be left exposed to a building's interior, eliminating the need for additional interior finishes which could add VOCs. The Oregon Conservation Center in Portland, Oregon, left its wood structure exposed to the interior, creating a natural finish for tenants.

Demand for wood products provides an incentive for forest owners to keep their lands actively managed and healthy. A young, growing forest produces 1 ton of oxygen and absorbs 1.4 tons of CO2 for every 1 ton of wood. When a forest is left unmanaged, older trees eventually stop absorbing carbon from the atmosphere and then release carbon when they decompose or die from wildfire, insect damage, or disease.

WOOD BUILDING SYSTEMS

Wood construction can support green building of many occupancy types, including multifamily, mixed-use, office, industrial, education, healthcare, and more. Three common framing types all provide green building benefits.

Light-Frame

Light-frame is the most common form of wood construction, accounting for roughly 80 percent of wood-framed construction in the U.S. Wood can be used in structural applications such as roof, floor, and wall framing, but also for other components such as doors and windows, exterior and interior

finishes, trim, siding, and decking.

- The two predominant types of light-frame wood construction are:
- Type III, used primarily for multifamily residential building
- Type V, which permits wood to be used for all structural elements of the building

The Orchards at Orenco project in Hillsboro, Oregon, is a good example of a light-frame wood structure that added sustainable value through its energy efficiency. Designers used 2x10 dimensional lumber to frame the walls, which gave them width to add extra insulation, reducing overall energy use of the complex by 60 to 70 percent.

Mass Timber

Mass timber framing uses large, solid wood members for walls, roofs, and floor structures. Common mass timber building components include glue-laminated (glulam) beams, cross-laminated timber (CLT), nail-laminated timber (NLT), dowel-laminated timber (DLT), and others. Mass timber fits green building goals in several ways. It replaces other more carbon-intensive structural materials with a renewable and carbon-sequestering option. Mass timber components are fabricated off-site to precise specifications, which reduces waste, speeds construction, and lowers labor costs; it also results in improved energy efficiency because



the controlled fabrication process means they can build a tighter building envelope with fewer air gaps. Type IV, also known as heavy timber construction, first included CLT in 2015. The 2021 International Building Code (IBC) allows mass timber structures of 8, 12, and 18 floors. Tall wood structures make efficient use of building sites, another consideration for green building certification.

Prefabricated or Modular Wood

Use of prefabricated assemblies and full

Photos courtesy of WoodWorks

HOW MUCH CARBON ARE WE TALKING ABOUT?



The WoodWorks Carbon Estimator and Carbon Calculator use project wood volume to estimate the total wood mass in a building and the associated carbon impacts, measuring both the carbon stored in the wood building products and the greenhouse gas emissions avoided by choosing wood instead of more energy-intensive building materials.

Stella, a 244-unit multifamily housing development in Marina del Rey, California, avoided nearly 10,000 metric tons of CO2 emissions and stored almost 4,500 metric tons of CO2 by framing with wood. This equaled the carbon equivalent of taking more than 2,600 cars off the road for one year.

V Volume of wood: 2.3 million board feet (equivalent)

T U.S. and Canadian forests grow this much wood in: 16 minutes

C Carbon stored in the wood: 4,495 metric tons of CO₂

A Avoided greenhouse gas emissions: 9,554 metric tons of CO₂

✓ TOTAL POTENTIAL CARBON BENEFIT: 14,049 metric tons of CO₂

EQUIVALENT TO:

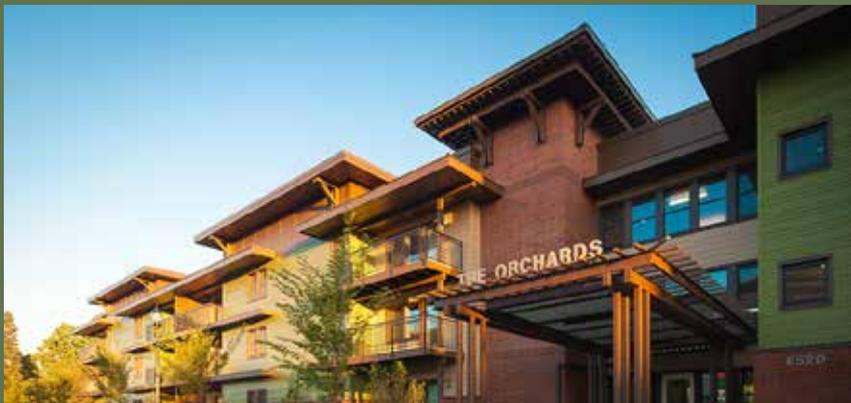
2,683 cars off the road for a year

Energy to operate a home for 1,194 years

Source: US EPA

Photo courtesy of Sara Drenzek

THE ORCHARDS AT ORENCO CASE STUDY



Location: Hillsboro, Oregon; **Architect:** Ankrom Moisan Architects, Inc.

This three-story, 57-unit, wood-framed, multifamily, affordable living project is certified Passive House, meeting stringent energy efficiency requirements. In fact, at the time it was completed, The Orchards was the largest certified multifamily Passive House project in North America. Wood framing helped the project achieve its aggressive energy efficiency goals; 2x10 wall framing allowed designers to superinsulate the walls, adding blown-in fiberglass insulation to the stud cavities as well as 1½ inches of rigid mineral wool insulation to the exterior. By taping the plywood sheathing to reduce air gaps, the project team created a tight air barrier. At the roof, exterior walls were framed to the bottom of the roof sheathing so that the air barrier and insulation could continue up and over the light-frame wood trusses, which were ledgered to the inside face of the exterior wall. Designers also relied on wood's inherent insulating properties, incorporating details to encapsulate fasteners that would have otherwise created thermal bridges. Overall, through design choices, the expected energy use from heating was reduced by 90 percent, and overall energy use was reduced by 60 to 70 percent, compared to that of a similar building.

modular construction is growing because both approaches offer many benefits to green building in terms of efficient, cost-effective approaches. Both are suitable for light-frame wood and mass timber construction of multifamily, office, retail, and other types of building occupancies. A 2019 study by McKinsey & Company found that modular construction can trim costs by 20 percent and speed schedules by as much as 50 percent. Precise fabrication also improves the quality of the building envelope by improving airtightness. Plus, the controlled material procurement process ensures that certified materials are used.

GREEN BUILDING CODES

When building codes initially began focusing on green building, they were concentrated primarily on improving energy efficiency. Now, building codes reflect a broader global

movement to mitigate the impacts of the built environment by promoting material resource efficiency, waste reduction, indoor air quality, site selection and utilization, and more. Green building codes are designed to take a project beyond the minimum requirements in terms of energy efficiency and sustainable features. While many jurisdictions have their own requirements for sustainable building, the IgCC and CALGreen are among the most influential.

International Code Council's 2018 International Green Construction Code (IgCC)

The IgCC is considered an overlay code because it is consistent with other International Code Council (ICC) model building codes, including the International Building Code (IBC). The IgCC covers all types of new and existing commercial buildings, and establishes minimum regulations using both prescriptive

and performance-related provisions. Some jurisdictions recognize the IgCC as an equivalent standard to LEED certification requirements, while other jurisdictions have chosen to adopt only specific parts of the IgCC.

The IgCC was launched in 2009 and there have been many updates and improvements to the code since. One of the most important updates can be found in the 2018 edition of IgCC, which incorporated the provisions of ASHRAE Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings, to provide designers with a unified green building code.

The IgCC takes an integrated, whole-building approach to green building design, incorporating measures that address the efficiency and sustainability of an entire building project and encouraging the use of low-impact materials and construction techniques. Most references to wood use are found in the Materials and Resources chapter, which covers the environmental and human health impacts of materials, including resource conservation, reduced life-cycle impacts of building materials, impacts on the atmosphere, product transparency, and waste management.

Many IgCC requirements overlap those of the green building certification programs. For example, several LEED v4 credits correspond directly with specific requirements of the 2018 IgCC.

2019 CALGreen

California was the first state in the U.S. to adopt a state-mandated green building code. CALGreen was first published in 2009 with four goals: reduce greenhouse gas emissions from buildings; promote environmentally responsible, cost-effective, healthier places to live and work; reduce energy and water consumption; and respond to the environmental directives of the administration. Their original goal was to reduce greenhouse gases to 1990 levels by 2020.

The code covers regulations for energy and water efficiency and conservation, material conservation and resource efficiency, environmental quality, and more. It also details job site waste reduction guidelines. CALGreen considers LCAs, using the Athena Impact Estimator, GaBi, and SimaPro LCA tools.

Photo courtesy of Ed White



MOUNTAIN EQUIPMENT CO-OP (MEC) HEADQUARTERS

Location: Vancouver, Canada; **Architect:** Proscenium Architecture + Interiors Inc.

The Vancouver-based headquarters of Canada's largest outdoor gear retailer is a spacious open concept plan, maximizing the warmth and beauty of its nail-laminated timber construction. Interior Douglas fir millwork screens offer an inviting alternative to traditional office cubicles. A double-beam configuration serves double duty: the exposed beams give warmth and architectural interest to the interior, and their increased stiffness reduces deflections and floor vibrations. This acoustic benefit helps minimize distractions in an open office environment. The facility is estimated to be 70 percent more energy efficient than a traditional structure of the same size. It is certified LEED Platinum.



Think Wood provides commercial, multifamily, and single-family home design and build resources to architects, developers, and contractors, including education, research, design tools, and innovative project profiles. For additional information, please visit www.thinkwood.com.

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