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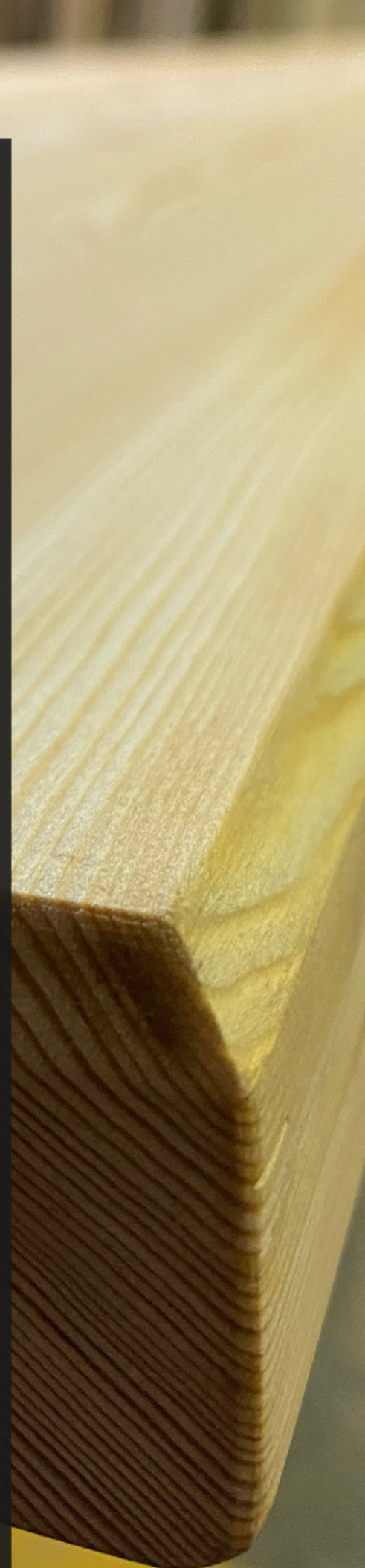
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# RECLAIMING THE URBAN TIMBER RESOURCE

Global Markets, Climate Impacts, and  
Policy Pathways for Second-Use Wood

**NORTHMARK MATERIALS**

Formerly operating as Backroads Reclamation



# RECLAIMING THE URBAN TIMBER RESOURCE

## Global Markets, Climate Impacts, and Policy Pathways for Second-Use Wood

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TITLE **Reclaiming the Urban Timber Resource: Global Markets, Climate Impacts, and Policy Pathways for Second-Use Wood**

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# An industrial-scale view of second-use wood.

Ten chapters of analysis, five appendices of methods. From global supply dynamics through the Comparative Timber Maturity Index to a path-to-deployment for jurisdictions ready to scale.

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# THE FIRST GLOBAL VIEW OF SECOND- USE WOOD.

Construction and demolition waste is the world's largest solid-waste stream. Reclaimed wood remains one of the most under-leveraged tools available to jurisdictions seeking rapid, verifiable emissions reductions.

## IN THIS SUMMARY

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Findings, in seven points	04	Implications for Policymakers	06
Implications for Investors	07	Conclusion	07

# A global resource embodied in the buildings we are already taking down.

**2–3** Bn t / yr

## GLOBAL C&D WASTE

The world's largest solid-waste stream.

**5–15** %

## WOOD FRACTION GLOBALLY

Rising to 20–30% in timber-dominant markets.

**3–5** ×

## LOWER EMBODIED CARBON

Reclaimed lumber vs. comparable virgin products.

Construction and demolition (C&D) waste is the world's largest solid-waste stream, producing 2–3 billion tonnes each year, with wood representing 5–15 percent of this volume globally, rising to 20–30 percent in timber-dominant markets such as North America and Scandinavia. This wood embodies carbon harvested decades ago, yet most of it is still landfilled, burned, or downcycled—a loss of both climate value and material potential. As jurisdictions worldwide seek rapid, verifiable emissions reductions and resilient supply chains, reclaimed wood remains one of the most under-leveraged tools available.

This white paper presents the first globally comparative assessment of second-use wood systems. It evaluates supply, policy frameworks, market behaviour, standards development, climate impacts, and operating models across North America, Europe, Asia-Pacific, and Australia. It introduces two original contributions: the Comparative Timber Maturity Index (CTMI), a benchmark for jurisdictional performance, and a globally applicable framework for panelized disassembly paired with centralized processing hubs. Unlike traditional piece-by-piece deconstruction, panelized disassembly involves removing entire wall and floor sections intact for rapid off-site processing, significantly reducing on-site duration.

The findings show that second-use wood offers immediate, scalable, and cost-effective benefits. It can reduce emissions, strengthen circular economies, and create dependable material markets when supported by aligned policy, standards, and infrastructure.

## 01 A Global Resource Hidden in Plain Sight

Regions with high redevelopment volumes—Japan, China, Western Europe, and major North American cities—generate large and predictable flows of reclaimable wood. Much of this material originates from slow-grown softwood and hardwood species that outperform many contemporary commodity products in density, stability, and character.

Despite this, recovery rates remain low in most jurisdictions due to weak policy signals, limited infrastructure, and inconsistent grading standards.

## 02 Material Markets Are Established but Not Yet Optimized

Reclaimed wood is already valued across several buyer segments:

PRODUCT CATEGORY	PRICE BAND (USD)	METRIC EQUIVALENT
<b>Dimensional lumber</b>	\$2–6 / board foot	~\$320–960 / m <sup>3</sup>
<b>Flooring and panels</b>	\$7–12 / square foot	~\$75–130 / m <sup>2</sup>
<b>Beams and heritage timbers</b>	\$20–50 / linear foot	~\$65–165 / m

Demand spans retail chains, manufacturers, architects, designers, and boutique salvage markets. In most regions, supply—not demand—is the limiting factor.

## 03 Policy Determines Supply

Every high-performing jurisdiction shares the same feature: policy intervention. Examples include deconstruction mandates (Portland), clean-wood diversion thresholds (Vancouver), deposit–refund systems (Victoria), landfill taxes and surcharges (United Kingdom), and low-carbon procurement requirements (Nordics and Japan).

Where these frameworks exist, recovery volumes rise, markets stabilize, and reuse ecosystems mature. Where they are absent, second-use wood remains marginal.

## 04 Standards and Infrastructure Determine Reliability

High-quality markets require:

- Consistent grading systems, such as the Specification-Grade Recovered Lumber (SRL) framework
- Moisture control and kiln-drying capacity
- SKU-based product lines
- Digital traceability platforms

These elements underpin buyer confidence, support procurement requirements, and allow reclaimed wood to compete directly with virgin materials.

## 05 Climate Benefits Are Clear and Immediate

**Avoided landfill methane.** Landfilled dimensional lumber generates methane under anaerobic conditions. Using the EPA WARM v15 national-average factor, this equates to ~1.1 tCO<sub>2</sub>e per tonne of landfilled wood. Actual values vary with landfill gas-capture efficiency, but even conservative estimates show meaningful reductions.

**Substitution benefits.** Reclaimed lumber carries three to five times lower embodied carbon than comparable virgin products, even after kiln drying and finishing. This reflects avoided emissions from harvesting, milling, transport, and processing.

Both mechanisms are well established in LCA practice, quantifiable using existing methods, and yield significant, near-term reductions at low cost and with minimal complexity. Few material interventions offer comparable impact a similar scale.

## 06 Infrastructure Models Are Emerging and Converging

Across leading jurisdictions, individual components of advanced recovery systems are beginning to take shape, though few regions have integrated them into a unified, high-volume model. Common elements now emerging include the following:

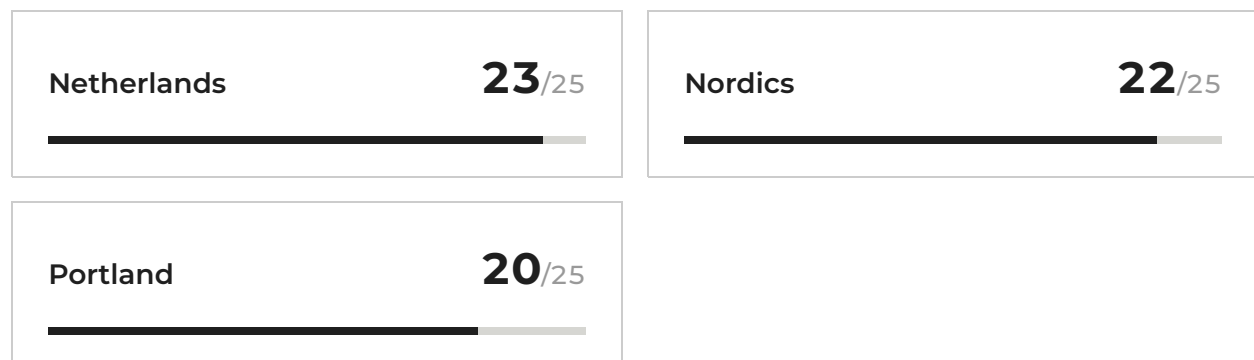
- Selective or component-based deconstruction that increases material yield
- Standardized on-site disassembly practices that improve recoverability and reduce material damage
- Centralized facilities capable of sorting, kiln-drying, metal recovery, and basic grading
- Specialized workflows to control contamination and improve product consistency
- Logistics systems that move wood from demolition sites into regional processing hubs

While these features exist independently in parts of Europe, Japan, and select North American cities, no jurisdiction has yet combined them into a fully coordinated, institution-grade system capable of delivering consistent, specification-ready reclaimed wood at scale. This integrated approach represents one of the most promising pathways for expanding reliable second-use wood supply globally.

A key factor enabling this shift is supply-chain integration: reclaimed lumber must enter the same distribution networks used for virgin timber to achieve market parity and scale effectively.

## 07 Comparative Timber Maturity Index (CTMI)

The CTMI evaluates jurisdictions across five dimensions: policy strength, supply capture, market depth, infrastructure and standards, and circular-impact performance.



Top performers include the Netherlands (23/25), the Nordics (22/25), and Portland (20/25). These jurisdictions demonstrate that coherent policy, coordinated infrastructure, and transparent markets produce the strongest outcomes.

## IMPLICATIONS

## Implications for Policymakers

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- **Reliable supply requires policy signals.** Without mandates, thresholds, or economic instruments, recovery markets do not scale.
- **Standards and infrastructure determine quality.** Grading, kiln capacity, traceability, and contamination control are prerequisites for mainstream adoption.
- **Procurement unlocks demand.** Public-sector specifications can stabilize markets and accelerate private-sector investment.
- **Circular timber systems can be commissioned and reach steady operational performance within 12 months** when supported by clear permitting pathways, aligned capital deployment, and coordinated industry training.
- Reclaimed wood offers one of the fastest pathways to reduce lifecycle emissions in buildings without relying on nascent technologies.

## IMPLICATIONS

## Implications for Investors

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- **The market opportunity is large and underdeveloped,** with strong demand across retail, manufacturing, and specification-driven channels.
- **Unit economics support scale,** with 30–50% gross margins for specification-grade products.
- Infrastructure-based business models (kilns, processing hubs, grading, marketplaces) align with impact capital, blended finance, and ESG-driven funds.
- Technology integration—AI grading, robotics, kiln optimization—creates defensibility and competitive advantages.
- Regional replication is straightforward, especially in markets with strong redevelopment cycles.

## CLOSING

## Conclusion

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Reclaimed wood is a strategic global material resource, not a boutique salvage niche. With the right mix of policy, grading standards, infrastructure, and procurement, jurisdictions can convert a major waste stream into one of the most climate-positive and economically resilient material markets available.

This white paper provides a framework for scaling these systems internationally—transforming second-use wood into a foundational pillar of circular construction and global climate strategy.

# 01

## INTRODUCTION & CONTEXT

Construction and demolition activity generates the largest waste stream in the world, and wood remains a significant portion of that material. Most jurisdictions still treat it as a disposal problem rather than a recoverable asset.

### IN THIS CHAPTER

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The Global Scale of Wood Waste	08	Why Wood Recovery Matters	08
A Fragmented Global Landscape	08	Purpose of This White Paper	08
1.1 Mixed-Methods Analytical Framework	09	1.2 Data Sources and Normalization	10
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# 01 Introduction & Context

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Construction and demolition activity generates the largest waste stream in the world, and wood remains a significant portion of that material. Although reclaimed wood is now recognized as a climate-positive resource, most jurisdictions still treat it as a disposal problem rather than a recoverable asset. This section introduces the scale of the opportunity and the structural reasons why recovery has lagged despite clear environmental and economic benefits.

## The Global Scale of Wood Waste

Each year, an estimated 2–3 billion tonnes of C&D waste are generated worldwide, with wood representing approximately 5–15 percent of this total. Urban redevelopment cycles, aging housing stock, and density-driven infill projects continue to accelerate the volume of material entering the waste stream. Much of this wood is slow-grown softwood or hardwood harvested decades ago—material that carries inherent strength and character qualities no longer found in many contemporary commodity products.

Despite this, most jurisdictions recover only a fraction of what is technically and economically feasible. The primary reasons are structural: inconsistent policy signals, lack of dedicated infrastructure, variability in grading standards, and limited awareness of the material's potential value.

## Why Wood Recovery Matters

Reclaimed wood offers two primary benefits: climate impact and material performance. When landfilled, wood contributes to long-term methane emissions under standard international accounting methods. When reused, it replaces virgin timber products with significantly lower embodied carbon values, even after kiln-drying and processing. These benefits are immediate, quantifiable, and achievable with existing technologies.

At the same time, reclaimed wood provides manufacturers, builders, and designers with stable, high-quality supply. Species such as Douglas fir, pine, spruce, and various hardwoods—often harvested from old-growth forests—retain structural and aesthetic properties that make them desirable for interior finishing, furniture, panel products, and manufactured components.

## **A Fragmented Global Landscape**

Although the benefits are clear, global progress remains uneven. Regions such as the Netherlands, the Nordics, and parts of Japan have established mature systems for capturing, grading, and circulating reclaimed wood. Others, including many North American and Asia-Pacific markets, remain early in their development. The disparity is driven by policy strength, permitting frameworks, landfill economics, and market maturity.

This white paper provides a consolidated view of these global differences and establishes a shared analytical framework for comparing jurisdictions. The objective is not only to describe the current landscape but to illuminate the pathways by which emerging markets can accelerate progress.

## **Purpose of This White Paper**

This document is designed for policymakers, industry leaders, investors, and technical practitioners seeking a clear understanding of the global reclaimed-wood opportunity. It synthesizes existing data, introduces new analytical tools, and translates global lessons into actionable guidance. The goal is to support the development of scalable, resilient, and economically viable circular-timber systems that reduce emissions and strengthen material supply chains.

The chapters that follow build from this foundation, moving from global market dynamics to policy archetypes, regional benchmarks, climate impacts, operating models, and actionable recommendations.

## 1.1 Mixed-Methods Analytical Framework

This white paper uses a mixed-methods approach designed to compare jurisdictions with very different data availability, policy environments, and industry maturity levels. The analysis draws on three complementary inputs:

### Quantitative datasets

- Demolition and redevelopment volumes
- Municipal and regional waste audits
- Market-price catalogues for reclaimed and virgin wood
- Life-cycle assessment (LCA) databases and embodied-carbon factors

### Qualitative insights

- Policy and regulatory reviews across North America, Europe, and Asia-Pacific
- Case studies documenting operating models, procurement pathways, and regional recovery systems
- Practitioner and operator interviews from facility managers, deconstruction specialists, kiln operators, and reuse-market intermediaries

### Comparative frameworks

- The Comparative Timber Maturity Index (CTMI), developed for this study, which normalizes policy strength, supply capture, market depth, infrastructure, and circular-impact performance across jurisdictions

This triangulation approach allows the report to integrate disparate evidence into a consistent and comparable analytical picture.

## 1.2 Data Sources and Normalization Standards

The study draws on municipal, national, and market-based data sources, including:

### Municipal datasets

- Portland Bureau of Planning & Sustainability
- City of Vancouver and Metro Vancouver disposal streams
- City of Victoria diversion and deconstruction trials
- City of Edmonton demolition permits and redevelopment patterns

### National and supranational datasets

- Eurostat (European Union)
- Ministry of Land, Infrastructure, Transport and Tourism (Japan)
- China State Council and provincial statistics
- U.S. Environmental Protection Agency (EPA)
- Statistics Canada

### Market pricing and catalogues

- Windsor Plywood
- Habitat ReStore networks
- SalvoWEB (United Kingdom)
- Select salvage-industry price listings

### Carbon and LCA factors

- EPA WARM
- EN 15804 and ISO 21930 pathways
- USDA Forest Products Laboratory
- Peer-reviewed academic LCA studies

## Normalization protocols

To allow comparison across regions, all quantitative figures were normalized to the following units:

- board feet (bf) for dimensional lumber
- square feet (sq ft) for panelling and flooring
- cubic meters (m<sup>3</sup>) for total volume
- square meters (m<sup>2</sup>) for panel and flooring products
- linear feet (lf) or meters (m) for beams and timbers
- tonnes of CO<sub>2</sub>e for emissions impacts
- 12% moisture content for weight, pricing, and embodied-carbon comparability

This standardization allows for consistent cross-jurisdictional analysis even where original data formats differ.

## 1.3 Assumptions, Limitations, and Sensitivity Testing

### Core assumptions

<b>Recovery rates</b>	A baseline recovery range of 40–50% per building is assumed, reflecting results from North American pilot programs and European selective-deconstruction trials.
<b>Productivity expectations</b>	Standardized on-site disassembly is assumed to shorten site time and shift labour to controlled facility environments, maintaining recovery rates while improving grading consistency and contamination control.
<b>Carbon factors</b>	
<ul style="list-style-type: none"> <li>– Landfill wood modeled at <b>1.1 tCO<sub>2</sub>e per tonne</b> (EPA WARM).</li> <li>– Substitution benefits modeled at <b>3–5× lower global warming potential</b> for reclaimed lumber relative to virgin lumber, based on LCA datasets.</li> </ul>	
<b>Global market uncertainty</b>	A ±20% uncertainty range is applied to global market-size estimates due to variation in demolition cadence, material composition, and regional yield factors.

### Limitations

- Informal salvage markets are not comprehensively reported in most jurisdictions.
- Standardized grading frameworks remain limited outside Europe, the Nordics, and select U.S. cities.
- Regional moisture content, contamination profiles, and supply-chain structures introduce variability not fully captured in aggregated datasets.

### Sensitivity analysis

Sensitivity testing is provided in the appendices, illustrating how recovery rates, landfill-methane factors, kiln-drying energy intensity, and substitution values influence overall emissions and market-impact calculations.

# 02

## GLOBAL MARKET DYNAMICS

Two to three billion tonnes of construction and demolition material each year. In most regions, supply—not demand—is the limiting factor.

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2.3 Global Market Sizing	13	2.4 Emerging Standards and Innovations	14

## 02 Global Market Dynamics

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### 2.1 Demolition and Supply Dynamics

Global construction and demolition activity generates two to three billion tonnes of material each year, with wood accounting for an estimated five to fifteen percent depending on regional building typologies and the age of the structures being removed. Supply tends to be strongest in regions with rapid redevelopment, aging housing stock, or long histories of wood-framed construction.

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**Japan**

High annual demolition volumes produce substantial quantities of cedar and cypress. Formal reuse markets remain limited, and a significant share of this material continues to be chipped or burned despite its suitability for higher-value applications.

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**China**

Large-scale urban redevelopment results in major flows of reclaimable wood. However, limited infrastructure and inconsistent contamination controls mean much of this material is still landfilled or downcycled.

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**North America and Europe**

Older buildings contain slow-grown softwoods and hardwoods with desirable density and performance characteristics. These materials remain in strong demand for non-structural applications such as finishing lumber, flooring, and manufactured panels.

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**Nordic Countries**

Well-developed auditing and material-tracking frameworks support high recovery potential, though a considerable share of reclaimed wood continues to be directed to recycling or energy recovery rather than higher-value reuse.

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Across all regions, the supply of recoverable wood represents a significant opportunity for jurisdictions seeking both emissions reductions and stronger circular-economy performance.

## 2.2 Market Demand and Buyer Segments

Demand for reclaimed construction wood spans several distinct buyer groups, each with specific requirements for quality, consistency, and performance.

### Wholesale and Retail Chains

These buyers require predictable dimensions, uniform moisture content, clear grading systems, and SKU-based product formats. Access to reclaimed wood through existing distribution networks is essential for scale.

### Architects and Designers

This segment influences specifications for commercial and residential projects. They prioritize provenance, consistent quality, and strong aesthetic characteristics.

### Manufacturers

Producers of furniture, millwork, and panels need kiln-dried inputs with stable dimensions and reliable performance. Standardization and moisture control are key to adoption.

### Boutique and Salvage Markets

These smaller-scale markets emphasize visual character and heritage value. While economically important, they operate at volumes insufficient to shift overall market dynamics.

## 2.3 Global Market Sizing

**\$30–50** Bn USD

### GLOBAL MARKET POTENTIAL

Non-structural reclaimed lumber, conservative triangulation.

**±20** %

### UNCERTAINTY RANGE

Variation in demolition cadence, material composition, and yield.

Global estimates of reclaimable construction wood vary due to differences in demolition patterns, building age, and the presence of informal recovery markets. Conservative triangulation suggests that hundreds of millions of tonnes of reclaimable wood are generated annually across major regions. Applying typical price ranges for non-structural reclaimed lumber indicates a market potential of USD \$30–50 billion.

At national scales, annual recovery potential often ranges in the tens or hundreds of millions of board feet, depending on redevelopment cycles, construction typologies, and the strength of deconstruction or diversion policies. Country-level illustrations and detailed calculations are provided in Appendix C.

## 2.4 Emerging Standards and Innovations

Several developments are shaping the future of reclaimed-wood markets.

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### Grading Protocols

The Netherlands and Nordic countries are testing pathways for reclaimed structural grading and expanded non-structural classifications. These efforts improve consistency and support higher-value applications.

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### Digital Marketplaces

Platforms such as SalvoWEB increase visibility into available material flows prior to demolition. Similar tools are emerging in other regions, improving access and reducing procurement friction.

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### Design for Disassembly

Timber and modular-construction practices in the Nordic region increasingly incorporate strategies that enable predictable disassembly and future material recovery.

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### Carbon Accounting Practices

Life-cycle assessment is becoming more prominent in procurement decisions, elevating the visibility of reclaimed wood as a low-carbon alternative to virgin products.

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These trends demonstrate how policy, technology, and design are converging to support higher-value reuse and stronger market development.

# 03

## POLICY AND STANDARDS LANDSCAPE

Every high-performing jurisdiction shares the same feature: policy intervention. Where these frameworks exist, recovery volumes rise. Where they are absent, second-use wood remains marginal.

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## 03 Policy and Standards Landscape

### 3.1 Global Policy Archetypes

Four primary policy archetypes shape reclaimed-wood recovery worldwide. Each establishes distinct incentives and obligations that determine recovery volumes, market behaviour, and the reliability of supply chains.

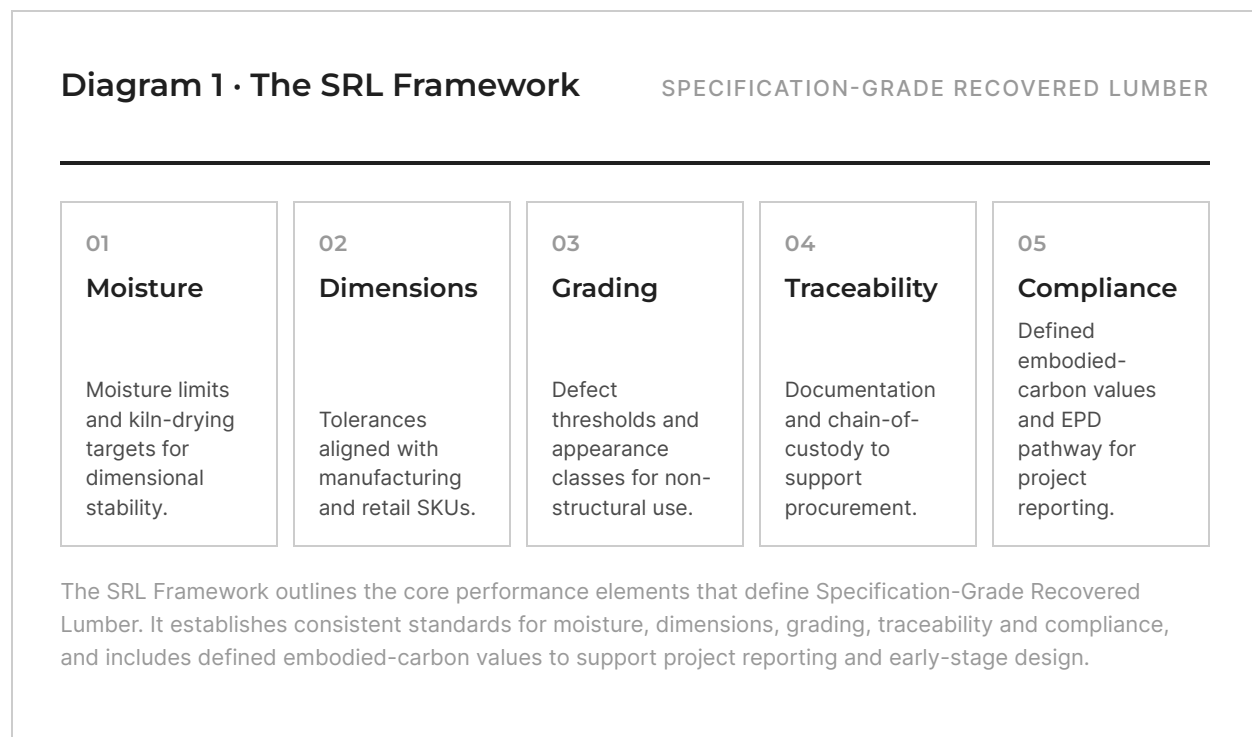
<b>Deconstruction Mandates</b>	Mandates require buildings to be dismantled selectively rather than demolished mechanically. These policies capture high-quality wood by preserving longer sections and reducing contamination. <b>Example:</b> Portland, Oregon.
<b>Diversions Thresholds</b>	Jurisdictions set minimum recovery or landfill-diversion requirements for clean wood, shifting baseline expectations for contractors and haulers. <b>Example:</b> Vancouver, British Columbia.
<b>Economic Instruments</b>	Landfill taxes, disposal surcharges, and deposit–refund systems alter cost structures and encourage reuse. Direct grants are also emerging to bridge the gap between demolition and deconstruction costs in the commercial sector. <b>Examples:</b> United Kingdom; Victoria, Canada; Portland (Commercial Deconstruction Grants).
<b>Procurement Standards</b>	Public tenders integrate life-cycle assessment (LCA), embodied-carbon thresholds, or reclaimed-content targets. When procurement specifies reclaimed wood, private-sector adoption accelerates. <b>Examples:</b> Nordic countries; Japan.

These four archetypes underpin nearly all high-performing reclaimed-wood ecosystems. Their effectiveness increases when implemented together rather than individually.

## 3.2 Standards and Grading

A unified grading system is essential to market confidence and supply-chain integration. The Specification-Grade Recovered Lumber (SRL) Technical Standard v1.0, developed through a collaboration with architects, specifiers and recovery operators in Western Canada, defines performance criteria for non-structural reclaimed construction wood. It establishes moisture limits, dimensional tolerances, defect thresholds, and appearance classes aligned with manufacturing and retail needs.

The standard is entering a national adoption pathway in Canada, including alignment with grading bodies and exploratory work toward an Environmental Product Declaration (EPD). This creates a replicable framework that allows policymakers to specify 'reclaimed' with the same technical confidence as virgin lumber.



### Regional Context

#### Europe

EN standards are being extended to reclaimed structural timber, and the Netherlands continues to advance certification schemes.

#### North America

Most grading discussions focus on pathways for certifying reclaimed wood for structural use. There is still no unified standard for non-structural reclaimed lumber, and most recovered material is sold without formal classification.

#### Asia-Pacific

Japan emphasizes reuse in traditional carpentry but lacks unified standards. Australia markets reclaimed hardwood largely as premium finishing material.

### 3.3 Comparative Policy Benchmarking (CTMI Index)

The Comparative Timber Maturity Index (CTMI) scores jurisdictions across five dimensions:

DIMENSION	SCALE
Policy Strength	0–5
Supply Capture	0–5
Market Depth	0–5
Infrastructure and Standards	0–5
Circular Impact	0–5

**NOTE:** Anchor definitions for each CTMI score (0–5) are provided in Appendix D. These outline the criteria for low, moderate, and high maturity within each dimension to ensure transparency and comparability across jurisdictions.

## CTMI Results

JURISDICTION	CTMI	SUMMARY
<b>Netherlands</b>	<b>23/25</b>	Integrated standards, strong policy, deep markets.
<b>Nordics</b>	<b>22/25</b>	Procurement leadership and digital innovation.
<b>Portland</b>	<b>20/25</b>	Mandate-driven supply, emerging infrastructure.
<b>Vancouver</b>	<b>18/25</b>	Strong diversion rules, moderate standards.
<b>United Kingdom</b>	<b>17/25</b>	Landfill tax effective, markets still skewed to recycling.
<b>Japan</b>	<b>15/25</b>	Strong supply, moderate reuse, cultural acceptance.
<b>Alberta</b>	<b>5/25</b>	Limited policy support and low current supply capture; strong potential for rapid advancement through integrated circular infrastructure.

The benchmarking confirms that policy remains the single most decisive lever in reclaimed-wood market performance. Jurisdictions with clear mandates and strong economic instruments consistently outperform those without.

# 04

## SUPPLY MAPPING — REGIONAL SNAPSHOTS

From Portland's residential mandate to the Netherlands' digital marketplace. Twelve jurisdictions at very different stages of the same arc.

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4.1 North America

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4.2 Europe

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4.3 Asia-Pacific

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## 04 Supply Mapping

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### 4.1 North America

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<b>Portland, U.S.</b>	First U.S. city with a residential deconstruction mandate (2016). In 2025, the framework expanded to the commercial sector through a tiered grant program. This initiative offers funding to offset deconstruction costs for commercial projects over 800 sq. ft., signaling a major policy shift from residential regulation to broader, incentive-driven commercial recovery.
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<b>Vancouver, Canada</b>	Clean-wood diversion threshold of 75 percent. Builders are required to separate and divert material. Supply is predictable but dependent on consistent enforcement.
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<b>Victoria, Canada</b>	Deposit-refund system incentivizes compliance. Early results show strong recovery potential, though administrative burden is noted.
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<b>Toronto, Canada</b>	Emerging pilots are underway. The region has a large, older housing stock and significant unrealized recovery capacity.
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### Alberta, Canada — The “Greenfield” Opportunity

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<b>Why Alberta is Included</b>	Alberta represents a distinct market typology: high-volume demolition operating in a low-regulation environment. Unlike land-constrained cities like Vancouver, Alberta's waste management is characterized by low tipping fees and no deconstruction mandates.
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<b>The Opportunity</b>	This absence of regulation provides a rigorous stress test for circular economics. In this “greenfield” environment, recovery cannot rely on policy subsidies; it must achieve cost parity with cheap landfilling through operational efficiency.
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<b>The Solution</b>	By deploying panelized disassembly and centralized industrial processing, the region is positioned to bypass boutique salvage and scale toward 40–50% dimensional recovery rates based on validated recovery modeling and early field experience. Alberta serves as the primary case study for how infrastructure—not just policy—can drive the circular transition.
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## 4.2 Europe

<b>Netherlands</b>	Digital marketplace tools such as Insert and structural-grading pilot projects position the Netherlands among the most advanced global models.
<b>United Kingdom</b>	A landfill tax—which rose from £103.70 to £126.15 per tonne in April 2025—has diverted large volumes of wood, though most flows into biomass rather than higher-value reuse pathways.
<b>Germany</b>	Recycling culture is strong, but reuse infrastructure remains limited. The sector is in transition.
<b>Nordic Countries</b>	Procurement standards and high CTMI scores demonstrate strong integration of reclaimed wood into public tenders.

## 4.3 Asia-Pacific

<b>Japan</b>	More than 400,000 homes are deconstructed annually. Much of the resulting wood is chipped or incinerated. Traditional carpentry (miyadaiku) preserves a cultural appreciation for reuse, but broader market integration remains weak.
<b>China</b>	Massive demolition cycles generate more than 100 million tonnes of wood waste each year. Reuse infrastructure and supporting policies remain limited.
<b>Australia</b>	A niche but strong market exists for reclaimed hardwoods. Policy is limited, but consumer demand for premium flooring and furniture drives the sector.



MATERIAL

Specification-Grade Recovered  
Lumber. Kiln-dried, denailed,  
dimensionally graded.

SRL™ · Northmark Materials

Plate 01

# 05

## OPERATING MODELS & SAFETY

Four operating models, in order of industrial maturity. Panelized disassembly paired with centralized processing solves the two biggest barriers to scale: site speed and safety.

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## 05 Operating Models & Safety

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### 5.1 Hand Deconstruction

Full manual dismantling using hand tools. Highest recovery quality with minimal contamination, but slow and labour-intensive. Best suited for heritage structures or constrained sites where selective salvage is required.

### 5.2 Hybrid Demolition with Sorting

Mechanical demolition paired with on-site sorting stations. Faster than hand deconstruction and compatible with existing demolition practices, but recovery rates vary (15–35%) and wood often suffers mechanical damage.

### 5.3 Selective Dismantling + Centralized Processing

Targeted removal of higher-value components with remaining assemblies processed at centralized facilities. Improves moisture control, grading consistency, and SKU standardization. Requires coordinated logistics and reliable facility capacity.

### 5.4 Component-Based or Panelized Disassembly (The Industrial Shift)

This model represents the adaptation of modern “Design for Disassembly” (DfD) and off-site construction principles to the demolition sector. Instead of piece-by-piece dismantling, entire wall, roof, and floor sections are removed intact.

This approach shifts the work from the uncontrolled, hazardous demolition site to a controlled facility environment. This mirrors the evolution of the manufacturing sector: moving labour to where efficiency and safety are highest. While still emerging as a standard practice, this method solves the two biggest barriers to scale: site speed and safety.

## 5.5 Labour Economics & Workforce Impacts

Deconstruction and processing rely on lead operators, technicians, sorters, drivers, and facility-based quality-control staff. Training curves are short (4–8 weeks). Standardized moisture control and grading reduce returns and support reliable supply.

## 5.6 Health, Safety & Compliance Considerations

Includes asbestos and lead surveys, lockout–tagout protocols, fall protection, dust mitigation, kiln-area fire prevention, and contamination-management protocols. Neighbourhood impacts require noise control, dust suppression, and clear traffic-management plans.

## 5.7 Neighbourhood Impacts Across Operating Models

Urban infill projects take place in established neighbourhoods where noise, dust, access limitations, and safety concerns shape both community acceptance and political feasibility. Each operating model carries a distinct neighbourhood impact profile.

### Hand Deconstruction

- Low mechanical noise but long site duration
- High daily presence of workers and equipment
- Cumulative disruption is significant despite minimal machinery use

### Hybrid Demolition with Sorting

- High peak noise from mechanical demolition
- Short duration but greater dust, vibration, and debris drift
- Increased truck movements for multiple small-load hauls

### Selective Dismantling + Centralized Processing

- Moderate site duration
- Reduced heavy-equipment use
- Fewer hauling cycles compared to hybrid demolition
- More predictable scheduling within bylaw and noise constraints

### Component-Based or Panelized Disassembly

- Shortest site duration for typical infill projects (often 1–2 shifts)
- Lower noise and vibration due to limited mechanical demolition
- Reduced dust and debris since assemblies remain intact until indoor processing
- Fewer truck movements through consolidated panel transport
- Improved safety for neighbours, pedestrians, and adjacent homes

These advantages make component-based disassembly a compelling option for municipalities balancing density, livability, and community expectations.

# 06

## MARKET DEMAND & ECONOMICS

Unit economics for specification-grade products support 30–50 percent gross margins. The constraint is no longer demand—it is supply-chain integration.

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## 06 Market Demand & Economics

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### 6.1 Buyer Segments

The reclaimed wood economy serves multiple buyer segments, each with distinct expectations and price sensitivities.

<b>Wholesale and Retail Chains</b>	Require consistent SKUs such as dimensional lumber and flooring. Value predictable moisture content, grading, and logistics support.
<b>Architects and Designers</b>	Prioritize provenance, grain pattern, and dependable supply. Their specifications influence commercial and residential adoption.
<b>Manufacturers</b>	Need kiln-dried, dimensionally stable inputs for furniture, panels, and millwork. Standardization and moisture control are essential.
<b>Salvage and Boutique Markets</b>	Seek one-off heritage pieces such as mantels, beams, or large-format slabs. Often command the highest unit margins but operate at low overall volume.

### Market Perception

In North America, reclaimed lumber is still widely associated with character-driven or rustic design. This perception limits its presence in mainstream construction, where reliability and specification-grade standards are required. The introduction of grading systems such as SRL aims to reposition reclaimed wood as a consistent, scalable material category.

## 6.2 Price Bands

Market pricing varies across regions and product categories. All pricing is presented in USD for comparability, with metric equivalents provided for international readers.

PRODUCT	USD (IMPERIAL)	METRIC EQUIVALENT	NOTES
<b>Dimensional lumber</b>	\$2–6 / board foot	~\$320–960 / m <sup>3</sup>	Depending on species and grade.
<b>Flooring and panels</b>	\$7–12 / square foot	~\$75–130 / m <sup>2</sup>	—
<b>Beams and mantels</b>	\$20–50 / linear foot	~\$65–165 / m	—
<b>Architectural salvage</b>		Highly variable	Heritage items often command significant premiums.

## 6.3 Unit Economics and Cost Drivers

### Feedstock Acquisition Assumption

The industrial recovery model assumes a zero-cost or negative-cost feedstock position for recoverable wood. In most construction and demolition markets, demolition contractors are paid to remove structures and manage waste disposal, with landfill tipping fees embedded in the demolition price and borne by the builder or property owner. Until it is deconstructed, decontaminated, denailed, processed, dried, and graded, demolition wood has no functional market value and is treated as a cost-bearing waste stream rather than a traded input.

Under the industrial recovery model, feedstock is captured through client-directed diversion at the point of generation. Builders or property owners specify an alternative disposal pathway in which recoverable wood is redirected from landfill to a recovery facility, while a disposal fee is still incurred as part of the demolition process. No acquisition payment is made for unprocessed material prior to sorting, drying, and grading. At industrial scale, there is no consistent market evidence that recovered, unprocessed demolition lumber commands a positive purchase price before processing. While isolated exceptions may occur, they are not indicative of repeatable or scalable market conditions.

The industrial recovery model remains resilient under variance because value creation occurs downstream. Processing costs are low relative to the value of finished, specification-grade products, and overall economics are driven by recovery yields, processing requirements, logistics, labour, and facility overhead rather than feedstock purchase price.

## Typical cost stack (USD per board foot)

COST COMPONENT	USD / BF	NOTES
Labour	\$0.40–0.70	Sorting, denailing, QC, kiln tending.
Processing (kiln drying, planing, grading)	\$0.25–0.40	—
Logistics	\$0.10–0.20	Assumes regional hub model with <50km radius.
Overhead (facility, equipment, administration)	\$0.15–0.30	—
<b>Total</b>	<b>\$0.90–1.60 / bf</b>	Metric equivalent: approximately USD \$320–570 per m <sup>3</sup> .

# 30–50 %

## GROSS MARGIN RANGE

Depending on product mix, grading consistency, and sales channel.

# \$320–570 USD / m<sup>3</sup>

## TOTAL COST (METRIC)

Equivalent to \$0.90–1.60 per board foot.

Gross margins typically range from 30–50 percent, depending on product mix, grading consistency, and sales channel.

## 6.4 Revenue Channels

- **Wholesale B2B:** Lower margins but high volume.
- **Direct-to-Designer/Architect:** Higher premiums; project-based demand.
- **Manufacturing contracts:** Stable, specification-driven demand.
- **E-commerce and digital marketplaces:** Increasingly important in European markets.

## 6.5 Market Risks and Sensitivities

- **Supply volatility:** Dependent on demolition activity levels, policy enforcement, and asset-owner disposal decisions.
- **Pricing pressure:** Virgin softwood price fluctuations affect competitiveness.
- **Consumer perception:** Persistent concerns regarding contamination or reliability.
- **Policy uncertainty:** Weak or inconsistent regulation undermines recovery incentives.

**Outlook:** With coordinated policy, grading standards, and supply-chain integration, reclaimed wood can match or outperform virgin-lumber pricing while maintaining premiums in design-driven and sustainability-oriented segments.

## 6.6 Supply-Chain Integration: The Path to Scale

The success of reclaimed lumber depends not only on recovery and processing systems but also on its ability to move through the same commercial pathways used by virgin timber. In many regions, reclaimed wood remains confined to boutique salvage stores, project-specific reuse, or informal resale channels. While these markets carry cultural value, they cannot deliver the consistency, volume, or reliability required for institutional adoption.

For reclaimed wood to function as a true commercial product, it must enter existing lumber-distribution networks—national wholesalers, regional logistics hubs, retail chains, and manufacturing supply streams. These networks provide the purchasing contracts, inventory systems, transport infrastructure, and market visibility that reclaimed lumber requires to scale.

A key enabler of this alignment is the availability of standardized, specification-ready product formats such as Specification-Grade Recovered Lumber (SRL). Unified grading, moisture control, dimensional tolerances, and SKU-based product lines make reclaimed lumber compatible with procurement catalogues, warehousing systems, and point-of-sale infrastructure already used for virgin products.

When reclaimed wood flows through these established channels, markets deepen, pricing stabilizes, and supply signals strengthen. This alignment reduces retailer risk, accelerates adoption among builders and manufacturers, and increases investor confidence.

# 07

## CLIMATE AND ENVIRONMENTAL IMPACTS

Two mechanisms, well-established in LCA practice: avoided landfill methane and substitution for virgin timber. Significant near-term reductions, at low cost, with minimal complexity.

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## 07 Climate and Environmental Impacts

### 7.1 Carbon Accounting Framework

Reclaimed wood delivers climate benefits through two primary mechanisms.

<b>Avoided emissions</b>	Preventing methane (CH <sub>4</sub> ) release from landfilled wood.
<b>Substitution benefits</b>	Replacing virgin timber products that carry higher embodied energy and emissions from harvesting, milling, and transport.

**Functional unit:** One tonne of recovered, kiln-dried lumber at 12 percent moisture content.

**System boundary:** Includes on-site disassembly, transport, centralized processing, kiln drying, and distribution. Excludes end-of-life impacts for second-use wood, assuming extended carbon storage.

### 7.2 Avoided Landfill Emissions

When demolition wood enters a landfill, portions of the material can decompose anaerobically, producing methane (CH<sub>4</sub>), a greenhouse gas 28 times more potent than carbon dioxide over a 100-year timeframe. Not all construction and demolition wood follows the same decay pathway—some material remains exposed to oxygen in transfer stations or mixed-waste piles. Once buried in compacted landfill cells, however, a significant fraction will degrade under low-oxygen conditions.

For consistency with international accounting practices, this analysis applies the EPA WARM v15 emission factor of approximately 1.1 tCO<sub>2</sub>e per tonne of landfilled dimensional lumber, based on average North American landfill conditions and a 100-year global warming potential (GWP100) of 28 for methane. Actual emissions vary by landfill type, gas-capture efficiency, moisture levels, and how wood is mixed with other organics. Facilities with higher gas-capture rates report lower net emissions (0.4–0.9 tCO<sub>2</sub>e per tonne), while unmanaged or low-capture landfills align more closely with the WARM default.

## Regional Decay Variables

It is recognized that anaerobic decay rates (k-values) vary significantly by climate. Arid or cold regions, such as the Canadian Prairies, typically exhibit slower methane generation profiles than the US national average used in the WARM model. While local variances may reduce the immediate methane-avoidance factor in specific jurisdictions, this analysis retains the standardized EPA baseline to ensure comparability with international reporting frameworks. Sensitivity testing (Appendix B) models conservative scenarios with reduced decay rates to account for these climatic variables.

Even under these conservative assumptions, diversion yields material climate benefits.

<p><b>8,000– 10,000</b> tCO<sub>2e</sub> / yr</p> <p><b>AVOIDED EMISSIONS</b></p> <p>At 40–50% recovery rates, diverting reclaimed wood from 1,000 typical homes.</p>	<p><b>±30</b> %</p> <p><b>REGIONAL VARIABILITY</b></p> <p>Emission factors differ with landfill conditions and capture systems.</p>
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**Impact:** At 40–50 percent recovery rates, diverting reclaimed wood from 1,000 typical homes avoids 8,000–10,000 tonnes of CO<sub>2e</sub> annually.

**Sensitivity:** Emission factors differ with landfill conditions and capture systems, with an estimated ±30 percent variability across regional contexts.

## 7.3 Substitution Benefits

Reclaimed wood has three to five times lower embodied carbon than virgin lumber, even after kiln drying and planing. When properly graded and kiln-dried, reclaimed lumber performs reliably across non-structural applications such as flooring, panels, and manufactured furniture.

Structural use requires formal stress testing and certification, as reclaimed material does not automatically qualify for structural grading.

**Multiplier effect:** Substitution benefits increase significantly when reclaimed wood is used in high-volume product categories.

## 7.4 Comparative Benchmarks

Reclaimed wood exhibits significantly lower embodied-carbon intensity (kg CO<sub>2</sub>e per kg) than virgin timber, concrete, and steel when assessed on a cradle-to-gate basis. As a post-use material pathway, it avoids emissions associated with harvesting, primary processing, and disposal, making it one of the lowest-carbon commercial wood options available. Embodied-carbon benefits are greatest when reclaimed wood substitutes for carbon-intensive materials particularly when substituting for virgin wood products used in concrete formwork and other temporary construction applications.

## 7.5 Ancillary Environmental Benefits

- **Biodiversity protection:** Reduced pressure on primary forests.
- **Air quality:** Lower particulate emissions than biomass incineration.
- **Waste diversion:** Reduces landfill demand and long-term leachate risk.
- **Circular economy:** Extends product lifecycles and aligns with SDG 12 (Responsible Consumption and Production).

## 7.6 Limitations and Uncertainties

- **Data variability:** Significant regional variation in landfill gas capture and demolition practices.
- **Temporal storage:** Duration of carbon storage in second-use products varies by use case.
- **Scope exclusions:** Avoided land-use change emissions from reduced logging are not included.

**Conclusion.** Reclaimed wood consistently ranks among the lowest-carbon building materials. Its climate advantages stem from both avoided landfill methane and substitution for virgin timber. Scaling recovery infrastructure and aligning policy pathways would unlock substantial, near-term greenhouse-gas reductions.

# 08

## RISKS, BARRIERS, AND MITIGATIONS

Each risk paired with its mitigation. Technical, market, supply, regulatory, financial, and social — the full operating surface.

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## 08 Risks, Barriers, and Mitigations

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### 8.1 Technical Risks

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#### RISK 01 Contamination

Reclaimed wood may carry two forms of contamination:

- **Biological contamination** such as mold, fungi, or insect activity. These risks are typically neutralized through kiln drying or other heat-treatment processes, which sterilize biological organisms and prevent further microbial development.
- **Chemical contamination** such as lead-based coatings, asbestos-containing materials, treated lumber, or other hazardous substances. These contaminants cannot be neutralized through drying or standard processing and must be identified and removed through regulated abatement procedures before any recovery activity begins.

**MITIGATION** Conduct hazardous-material assessments and complete required abatement prior to dismantling; apply clear reject and exclusion protocols at intake; and maintain dust control, metal removal, and contamination-identification systems during processing.

#### RISK 02 Grading Inconsistency

Lack of unified grading standards and absence of structural-certification pathways weaken buyer confidence.

**MITIGATION** Implement standardized non-structural grading frameworks; collaborate with grading associations to pilot national alignment.

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## 8.2 Market and Commercial Risks

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### RISK 03 **Price Competition**

Virgin softwood can undercut reclaimed lumber during oversupply cycles. Older reclaimed material often has higher density and better dimensional stability, supporting differentiated positioning.

**MITIGATION** Position reclaimed wood where density, stability, carbon reporting, and provenance provide clear value; reinforce reliability through specification-grade standards and controlled moisture management.

---

### RISK 04 **Demand Uncertainty**

Buyers unfamiliar with reclaimed lumber may hesitate due to inconsistent supply or unclear classifications.

**MITIGATION** Establish specification-grade classifications; support adoption through A&D education, procurement language, and demonstration projects.

---

## 8.3 Supply and Feedstock Risks

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### RISK 05 **Volatility**

Supply fluctuates with redevelopment cycles and the presence or absence of mandatory diversion requirements.

**MITIGATION** Establish long-term disposal and diversion agreements that specify routing of recoverable materials; implement diversion requirements, deposit–refund mechanisms, or mandatory pre-demolition material assessments to stabilize feedstock availability.

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### RISK 06 **Biofuel Competition**

Growing industrial biomass demand can divert high-quality wood into combustion or pelletization pathways.

**MITIGATION** Prioritize reuse over energy recovery through policy and procurement frameworks; adopt reuse-first material hierarchies; apply differentiated tipping fees or incentives that favour material recovery over combustion.

---

### RISK 07 **Scale Limits**

Informal salvage systems cannot deliver the volume, grading consistency, moisture control, or throughput required for commercial markets.

**MITIGATION** Develop centralized recovery and processing hubs with mechanized sorting, kiln drying capacity, and standardized grading protocols to enable consistent, scalable supply.

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## 8.4 Policy and Regulatory Risks

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### RISK 08 **Weak Enforcement**

Policies that lack consistent enforcement produce unstable supply and uneven market participation.

**MITIGATION** Strengthen monitoring and compliance frameworks; integrate standardized digital reporting; require third-party verification where appropriate.

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### RISK 09 **Jurisdictional Misalignment**

Differences across municipal, regional, and national regulatory bodies impede scale and replication.

**MITIGATION** Harmonize definitions and performance criteria; establish multi-level coordination or working groups; adopt shared circular-economy frameworks to support cross-jurisdictional alignment.

---

### RISK 10 **Outdated Classification Rules**

Building codes, standards, and procurement guidelines often do not recognize reclaimed wood as a standardized material input.

**MITIGATION** Update procurement and specification language to include specification-grade reclaimed wood classifications; encourage standards bodies to develop crosswalks with existing ASTM, EN, and CSA frameworks.

---

### RISK 11 **Lack of Circularity Hierarchy**

Treating energy recovery as equivalent to material reuse reduces the availability of recoverable wood for higher-value applications.

**MITIGATION** Embed a clear material hierarchy—reuse, recycling, energy recovery, landfill—and align fees, incentives, and procurement rules accordingly.

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## 8.5 Financial and Investment Risks

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### RISK 12 **Capital Intensity**

Recovery and processing hubs require significant upfront investment in facilities and equipment.

**MITIGATION** Stage capital deployment; employ blended finance structures; align procurement and commissioning with throughput milestones.

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### RISK 13 **Revenue Variability**

Cash flow is sensitive to redevelopment cycles and early-market adoption dynamics.

**MITIGATION** Diversify revenue streams; develop long-term off-take agreements and procurement commitments that provide predictable demand and revenue visibility.

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### RISK 14 **Working Capital Demands**

Kiln drying, grading, and planing introduce processing time and inventory holding requirements that increase working capital pressure.

**MITIGATION** Optimize kiln scheduling and batch flows; standardize SKUs where possible; improve demand forecasting through pre-orders, procurement frameworks, and contractual commitments.

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## 8.6 Social and Workforce Risks

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### RISK 15 Labour Shortages

Recovery and processing roles can be difficult to fill in tight labour markets.

**MITIGATION** Establish training partnerships; develop short, competency-based training modules; support workforce upskilling pathways.

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### RISK 16 Health and Safety

Operations may involve exposure to asbestos, lead, silica dust, heat, and interaction with heavy equipment.

**MITIGATION** Implement occupational health and safety-compliant standard operating procedures; enforce appropriate personal protective equipment; conduct recurring safety audits; integrate contamination surveys and real-time air monitoring.

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# 09

## CASE STUDIES

Seven jurisdictions, four continents. How policy design, infrastructure maturity, and market conditions shape reclaimed-wood outcomes — from Portland's mandate to Alberta's greenfield.

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## 09 Case Studies

The following case studies illustrate how policy design, infrastructure maturity, and market conditions shape reclaimed-wood outcomes across different jurisdictions. Together, they provide a comparative view of systems at varying stages of development and highlight the mechanisms that most influence supply capture, market stability, and circular-timber performance.

### 9.1 · PORTLAND, OREGON

CTMI **20**/25

#### The “Hybrid” Mandate & Incentive Model

CONTEXT	First U.S. jurisdiction to implement a residential deconstruction requirement (2016).	POLICY LEVER	A dual approach. A strict mandate requires pre-1940 homes to be deconstructed. As of 2025, this is paired with a Commercial Deconstruction Grant, offering non-competitive, tiered funding (up to \$12,000 per project) to property owners who verify salvage yields.
OUTCOMES	The residential mandate successfully regularized the workforce (approx. 250 homes/year). The new commercial grants are designed to unlock larger-volume fibre flows from the retail and office sectors without requiring immediate regulation.		

**LESSON** Mature jurisdictions evolve. Portland demonstrates that once a residential baseline is established via mandate, governments will layer financial incentives to de-risk the higher-volume commercial market.

9.2 · VANCOUVER, CANADA

CTMI **18**/25

## Diversion Thresholds

**CONTEXT** High demolition activity driven by residential infill. **POLICY LEVER** Minimum 75 percent clean-wood diversion requirement.

**OUTCOMES** More predictable material flows; results depend on consistent inspection practices and adequate enforcement capacity.

**LESSON** Diversion thresholds shift industry norms but require strong oversight and transparent performance tracking to achieve full impact.

9.3 · VICTORIA, CANADA

CTMI **16**/25

## Deposit–Refund System

**CONTEXT** Smaller municipality with notable policy innovation. **POLICY LEVER** Builders pay a deposit that is refunded only when diversion and recovery thresholds are met.

**OUTCOMES** Early evidence shows strong compliance, though some administrative burden has been noted.

**LESSON** Financial incentives are effective motivators, but administrative systems must be efficient and supported by clear diversion metrics.

## 9.4 · NETHERLANDS

CTMI **23**/25**Standards + Digital Marketplace**

**CONTEXT** Among the most advanced reuse economies globally.

**POLICY LEVER** EN standards extended to reclaimed structural timber; digital marketplace enabling pre-demolition listings and traceability.

**OUTCOMES** High-grade reclaimed wood enters mainstream construction; transparent digital supply chains improve market confidence.

**LESSON** Integrated standards combined with digital tools unlock both supply reliability and consistent demand.

## 9.5 · UNITED KINGDOM

CTMI **17**/25**Landfill Tax**

**CONTEXT** Strong economic lever introduced to discourage landfilling.

**POLICY LEVER** Landfill tax is currently £103.70 per tonne (2024 rates), with a confirmed increase to £126.15 per tonne scheduled for April 2025, creating an immediate financial lever for diversion.

**OUTCOMES** High diversion rates achieved, but a large share of material shifted to biomass incineration rather than reuse.

**LESSON** Economic disincentives are powerful but must be paired with reuse-focused infrastructure to avoid downcycling or combustion lock-in.

9.6 · JAPAN

CTMI **15**/25

## Cultural Reuse + Scale Challenges

**CONTEXT** 400,000–500,000 homes demolished annually.

**POLICY LEVER** Limited formal mandates; strong cultural traditions of wood reuse (miyadaiku carpentry).

**OUTCOMES** High-quality cedar and cypress often downcycled; reuse pathways remain fragmented.

**LESSON** Cultural norms support reuse, but scaling requires modern infrastructure, standardized grading, and consistent recovery channels.

9.7 · ALBERTA, CANADA

CTMI **5**/25 → 20/25

## The Infrastructure-First Model

**CONTEXT** A high-volume demolition market operating in a regulatory vacuum. Alberta currently lacks the deconstruction mandates or disposal bans found in coastal jurisdictions.

**POLICY LEVER** In the absence of policy mandates, the primary lever is economic arbitrage. The model relies on competing directly with landfill economics through efficiency rather than regulation.

**OUTCOMES** Pilot data indicates that by bypassing boutique salvage and implementing panelized disassembly paired with centralized manufacturing hubs, operators can achieve 40–50% structural recovery rates purely on market fundamentals.

**LESSON** Alberta demonstrates that while policy accelerates adoption, it is not strictly a prerequisite. Industrial infrastructure, when optimized for speed and cost, can create a viable circular timber economy even in conservative regulatory environments.

# 10

## RECOMMENDATIONS

Aligned policy, standardized workflows, recognized classifications, and purpose-built processing infrastructure. The conditions for high-volume, specification-grade wood recovery.

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# 10 Recommendations

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Circular-wood systems cannot scale through isolated pilots, boutique salvage, or stand-alone material-exchange tools. A mature reclaimed-wood category depends on aligned policy, standardized workflows, recognized material classifications, and purpose-built processing infrastructure. Clear classification is central, as it allows reclaimed wood to function as a defined product rather than a variable waste stream. Infrastructure should scale to local volumes. The recommendations below outline the essential conditions for jurisdictions seeking to enable high-volume, specification-grade wood recovery.

## 10.1 Policy Actions

### **Adopt recovery requirements**

Introduce deconstruction mandates or minimum wood-recovery thresholds for applicable building types. Pair these measures with enforceable permitting, contamination screening, and digital reporting to ensure consistent performance.

### **Align economic signals with circular outcomes**

Use differentiated landfill surcharges, deposit–refund systems, and performance-based incentives to direct clean wood away from disposal and toward reuse. Early implementation should focus on non-structural categories with clear, low-risk reuse pathways.

### **Lead through procurement**

Integrate reclaimed-wood classifications, moisture and grading requirements, and basic life-cycle reporting into public procurement templates. Treat reclaimed wood as a recognized low-carbon option within standard building and design specifications, enabling procurement-driven demand certainty for private capital investment.

## 10.2 Infrastructure Development

<b>Build regional recovery hubs</b>	Support industrial facilities equipped with tipping floors, mechanized sorting, ventilation controls, RF kiln capacity, and standardized grading and moisture protocols. These facilities represent core circular-economy infrastructure rather than pilot-scale demonstrations.
<b>Deploy a hub-and-spoke system</b>	Combine standardized on-site panelized disassembly with centralized processing. This model improves safety, raises recovery yields, and maintains consistent quality across diverse building types.
<b>Advance technical standardization</b>	Develop shared grading conventions, moisture targets, SKU definitions, contamination protocols, and quality-assurance documentation. These standards reduce buyer uncertainty and allow reclaimed wood to move through existing retail, manufacturing, and construction channels without friction.
<b>Enable digital visibility</b>	Use digital marketplaces linked to municipal permitting systems to list pre-demolition opportunities and provide early insight into recoverable materials. This improves planning for builders, processors, designers, and manufacturers.

## 10.3 Industry Practices

<b>Adopt standardized panelized disassembly</b>	Apply uniform SOPs for on-site panelization followed by controlled at-facility deconstruction. This approach supports higher yields, improves hazard control, and produces consistent inputs for grading and kiln operation, reducing risk and cost for downstream buyers and manufacturers.
<b>Strengthen workforce pathways</b>	Develop short, competency-based training programs in disassembly techniques, hazard identification, kiln operation, grading, and moisture control. Emphasize inclusive hiring and rapid, practical onboarding.
<b>Embed contamination and quality controls</b>	Use front-end hazardous-materials audits, moisture testing, and standardized QC documentation to ensure safe, predictable material supply and reduce downstream variability.

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## 10.4 Market Development

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**Position reclaimed wood as specification-grade**

Present reclaimed wood as consistent, specification-grade finishing lumber with verified provenance and demonstrable climate value, capable of serving mainstream commercial volumes rather than niche or decorative demand. Avoid framing reclaimed products solely around “character” or aesthetics, which limits adoption in mainstream markets.

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**Integrate reclaimed wood into established channels**

Develop partnerships with retailers, manufacturers, and architectural-specification platforms to normalize reclaimed-wood products within existing distribution and procurement pathways.

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**Build literacy and confidence**

Expand education for architects, designers, builders, and public-sector teams on moisture standards, grading, performance characteristics, design applications, and climate benefits. Use demonstration projects to anchor early adoption and support procurement integration.

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## 10.5 Research and Innovation

Research and innovation should prioritize deployment-enabling improvements rather than category validation, which has already been established.

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### **Refine life-cycle assessment methods**

Standardize boundary conditions, moisture assumptions, and system definitions so that LCAs for reclaimed wood are comparable across jurisdictions. Clearer accounting improves procurement decisions and policy design.

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### **Develop and test advanced processing technologies**

Support targeted R&D on robotics, AI-enabled grading, yield-optimization tools, and inline detection systems where they demonstrably improve safety, throughput, or data quality. These technologies are most appropriate in high-volume hubs and should be developed through grants, public-sector pilots, or research partnerships rather than early-stage commercial deployment.

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### **Strengthen material-flow and contamination research**

Support studies mapping contamination patterns, moisture profiles, typical recovery yields, and salvage variability across housing vintages. These data inform grading pathways, infrastructure planning, and future standards.

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### **Advance circular-design practices**

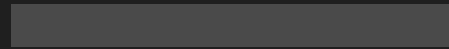
Encourage Design for Disassembly (DfD) in new construction to improve future recoverability and reduce lifecycle emissions. Promote modular assemblies, mechanical fasteners, and clear documentation of material treatments.

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### **Enable data-rich demonstration sites**

Develop pilot projects that combine panelized disassembly, kiln protocols, standardized grading, and digital traceability. These sites generate the evidence needed for future code updates, procurement integration, and national standards.

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# PATH TO DEPLOYMENT

The feasibility phase of circular timber is complete. The studies have been conducted, the carbon impacts validated, and the operating models tested. The constraint is no longer knowledge — it is industrial capacity.

CLOSING

## Path to Deployment

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Reclaimed wood is no longer a boutique or marginal resource. It is a practical, low-carbon material stream with direct relevance to housing, infrastructure, climate policy, and economic resilience. Evidence across multiple jurisdictions shows that recovery rates rise, markets stabilize, and emissions fall when clear policy direction is paired with purpose-built infrastructure and standardized industrial practice.

A functioning reclaimed-wood system requires more than isolated pilots. It depends on aligned regulation, modern processing hubs, shared grading conventions, and coordination across builders, designers, manufacturers, and public agencies. When these elements work together, reclaimed wood can move through the same commercial pathways as virgin lumber and meet equivalent procurement and design requirements.

Decisions made over the next decade will determine whether reclaimed wood remains a limited, project-specific material or becomes a core component of a modern circular-materials economy. With coordinated action, jurisdictions can reduce emissions, protect valuable fibre, and build durable markets that strengthen both climate performance and long-term economic outcomes.

The feasibility phase of circular timber is complete. The studies have been conducted, the carbon impacts validated, and the operating models tested in both regulated and unregulated markets. The constraint is no longer a lack of knowledge but a lack of industrial capacity. The focus of policymakers and investors must now shift from assessing the potential of second-use wood to deploying the infrastructure, standards, and policy frameworks required to scale it.

## Extended Case Studies

JURISDICTION	CTMI	PROFILE
<b>Germany</b>	~14/25	Established recycling culture; most reclaimed wood is chipped or downcycled. Reuse markets remain limited, though policy continues to evolve toward circular construction.
<b>Nordics</b> (excluding CTMI case study)	22/25	Public procurement standards drive strong demand for low-carbon materials. Widespread use of pre-demolition audits and material-passport systems.
<b>China</b>	10/25	Largest demolition volumes globally (100M+ tonnes of wood waste annually). Policy infrastructure for reuse is minimal; material typically landfilled or combusted.
<b>Australia</b>	13/25	Robust demand for reclaimed hardwood in flooring and furniture markets. Policy structure remains fragmented, with most activity driven by market forces.
<b>Toronto, Canada</b>	12/25	Growing set of pilots supported by NGOs and circular-economy networks. Significant opportunity for scale given the size and age of the housing stock.

# Methods Detail

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<b>Recovery-rate sensitivity analysis</b>	Modelled at 30%, 40%, 50%, and 60% recovery across representative demolition scenarios.
<b>Carbon-factor ranges</b>	Methane generation: 0.9–1.3 tCO <sub>2</sub> e per tonne of landfilled wood. Substitution effect: reclaimed lumber shows 3–5× lower GWP than virgin material.
<b>Market-sizing triangulation</b>	Combined top-down estimates (housing stock × demolition cadence × recovery yield) with bottom-up analysis (per-home wood audit × product price bands).
<b>Uncertainty notation</b>	A ±20% margin of error is applied to global estimates to reflect regional variability in demolition methods, landfill conditions, and measurement practices.

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# CTMI Scoring Framework

The Comparative Timber Maturity Index uses a 0–5 scale across five dimensions. Scores represent the following maturity levels:

DIMENSION	SCORE 5 — MATURE	SCORE 3 — EMERGING	SCORE 1 — ABSENT
<b>Policy &amp; Regulation</b>	National mandate or regulatory framework requiring material recovery or deconstruction; enforcement mechanisms in place.	Emerging policies or municipal-level requirements; partial enforcement.	No formal policy activity; voluntary measures only.
<b>Infrastructure &amp; Processing</b>	Established network of processing hubs with standardized workflows, grading, moisture control, and commercial distribution.	Limited number of facilities; inconsistent practices; partial grading or drying capability.	No dedicated infrastructure; ad-hoc or artisanal salvage.
<b>Market Integration</b>	Reclaimed wood widely available in retail, manufacturing, and design channels; stable demand.	Some market activity but inconsistent supply or product categories.	Minimal market presence; reclaimed wood treated as a niche or character-only material.
<b>Data, Standards &amp; Reporting</b>	National standards for grading, QA, moisture, and/or LCA reporting; digital tools widely used.	Early-stage standards or pilots; inconsistent adoption.	No standards or reporting frameworks.
<b>Circular Ecosystem Coordination</b>	Alignment across government, industry, and research institutions with active collaboration and shared frameworks.	Some partnerships or local collaborations; limited coordination.	Fragmented ecosystem; no systemic alignment.

# Data Assumptions & System Boundaries

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This appendix summarizes the key methodological assumptions, emission factors, boundaries, and data sources used throughout the analysis. The intent is to provide transparency, improve comparability, and ensure alignment with accepted international accounting frameworks.

## E.1 Global C&D Waste Estimates

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### Global 2–3 billion tonne figure

The estimate referenced in Section 2 reflects the commonly cited global construction and demolition (C&D) waste range reported by Eurostat, OECD, and UN-Habitat. This total includes excavation and soil, which represent a significant share of reported C&D waste volumes in many jurisdictions.

### Interpretation for this paper

Where reclaimed wood potential is discussed, the analysis refers only to solid building-derived waste (excluding soil, dredge, and excavation materials). This avoids overstating the pool of recoverable wood.

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## E.2 Recovery Rate Assumptions

Recovery modelling uses a 40–50 percent recovery rate of the wood fraction, not of the entire building mass.

- Older North American residential structures typically contain 20–35 percent wood by mass.
- A 40–50 percent yield of that fraction results in approximately 8–12 percent recovery of total building mass, depending on construction era and condition.

This rate reflects outcomes from documented deconstruction projects in Portland, Vancouver, and Victoria, as well as field audits of mid-century housing stock.

## E.3 Carbon Accounting Boundaries

<b>Functional Unit</b>	One tonne of recovered, kiln-dried softwood lumber at ~12 percent moisture content (MC).
<b>System Boundary</b>	<p><b>Includes:</b></p> <ul style="list-style-type: none"> <li>– on-site disassembly</li> <li>– transportation to processing facility</li> <li>– at-facility deconstruction and metal removal</li> <li>– kiln drying</li> <li>– milling, grading, and packaging</li> <li>– distribution to point of sale</li> </ul> <p><b>Excludes:</b></p> <ul style="list-style-type: none"> <li>– end-of-life outcomes for recovered lumber (assumed long-lived storage)</li> <li>– upstream forestry impacts for virgin timber (captured only for substitution estimates)</li> <li>– soil carbon and land-use change (LULUCF) effects</li> </ul>
<b>Temporal Boundary</b>	100-year global warming potential (GWP100), consistent with IPCC and EPA WARM conventions.

## E.4 Avoided Landfill Emissions

### Primary Emission Factor

The analysis adopts the EPA WARM v15 national-average emission factor for dimensional lumber in mixed municipal solid waste (MSW) landfills:

**~1.1 tCO<sub>2</sub>e per tonne of landfilled wood**

This factor reflects anaerobic decay, methane production, and methane oxidation and capture in a mixed landfill environment.

### Sensitivity Range

Field evidence and modelled scenarios indicate meaningful variability depending on:

- landfill moisture
- presence of cover materials
- landfill gas-capture efficiency
- whether wood enters a mixed MSW or C&D-only landfill

For this reason, the paper includes a sensitivity range of **0.4–1.1 tCO<sub>2</sub>e per tonne** to reflect credible bounds. The central estimate remains 1.1 tCO<sub>2</sub>e/t for methodological consistency.

## E.5 Substitution Benefits

Substitution values compare reclaimed wood to virgin softwood products on a cradle-to-gate basis.

- Virgin lumber typically carries embodied emissions that are 3–5 times higher than reclaimed wood when accounting for harvesting, milling, drying, and transport.
- Reclaimed wood emissions include only the processing and drying steps; no upstream forestry impacts are incurred.

This comparative range is based on LCA studies from USDA Forest Products Laboratory, NRCan, and European timber associations.

## E.6 Market Sizing Methodology

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<b>Top-Down Approach</b>	housing stock × annual demolition cadence × recoverable wood fraction × recovery yield
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<b>Bottom-Up Approach</b>	<ul style="list-style-type: none"> <li>– per-home wood audits</li> <li>– typical dimensional lumber quantities in mid-century homes</li> <li>– price-band triangulation based on market-grade categories</li> </ul>
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A ±20 percent uncertainty margin is applied to reflect variability in construction types, recovery yields, contamination, and demolition practices.

## E.7 Limits, Exclusions, and Caveats

- Data availability varies significantly across jurisdictions; caution is advised when comparing markets with different landfill regulations, tipping fees, or demolition methods.
- Carbon storage duration in long-lived reclaimed products has uncertainty; end-of-life scenarios are not explicitly modelled.
- Contamination rates (asbestos, lead, treated wood) are locally dependent and influence yield variability.
- Global C&D waste figures rely on differing national reporting standards and may include excavation materials unless disaggregated.

## E.8 Rationale for These Boundaries

The boundaries and assumptions used here reflect:

- alignment with EPA WARM and IPCC GWP100
- consistency with urban wood recovery studies in North America
- transparency for comparison across jurisdictions
- avoidance of over-claiming or overstating global or national potential

They provide a replicable, conservative, and policy-aligned framework for reclaimed-wood carbon accounting.

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END OF DOCUMENT

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