Let's Work with Wood - our most versatile and renewable resource

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Wood is a highly versatile, sustainable and renewable resource. Consider your home or place of work; we often take for granted the large variety of wood components **within touching distance, all around us**. Every house, be it timber frame or traditional masonry-built, contains huge amounts of timber; in the roof rafters, bracing and battens, in the ceiling and floor joists, wall panelling, kitchens, cupboards, flooring, not to mention the decking and garden furniture (Plate 1).

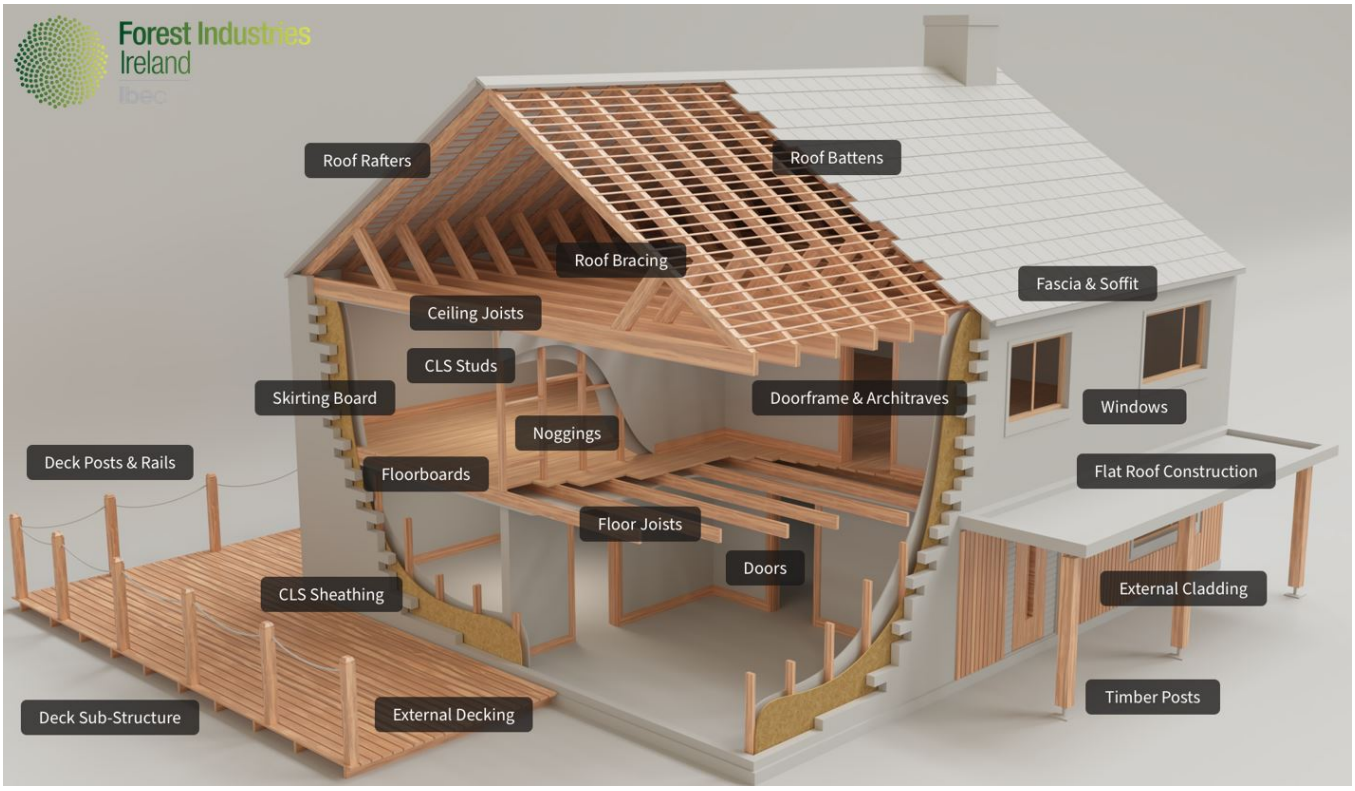


Plate 1: Wood – within touching distance and all around us

What you might also find striking is the range of wood types serving so many purposes within a typical housing build. We have conifer species (e.g. spruce) which provide core materials from roofing to wall panels, floor joists to decking. We have species such as cedar, naturally durable, and excellent for external trim/cladding (Plate 2). Then, of course, we have native broadleaf species such as oak, prized for its use in furniture, joinery, panelling and veneer production. The production of sustainable wood is natural part of the forest cycle.

Plate 2: Decorative cladding (Source: *Source: FII*)

Plate 3: Space, form, colour & texture: Ballyogen Environmental Management Centre, (Source: Dr Caitríona Uí Chúláin, NUI Galway)

From earliest of times, wood has been and will continue to be **nature's solution** to our housing needs. We must acknowledge our productive forests that deliver a renewable range of products, including the ideal material for housing and construction uses. Our forests supply the sawn timber and panel products that are the mainstay of house construction and the products can deliver exquisite internal and external finishes (Plates 3-4). Wood is a natural and durable material and can be specified for interior and exterior design. It can also provide us with a wonderful **wonderful, warm, comforting and eye-catching appearance,** enhancing the overall aesthetics of a building in the process.

Plate 4: Exquisite external (*Source: FII, 2020*)

Working with Engineered Wood

A **revolution is also underway** in the ways we can use timber as a structural material. Layers of basic individual boards can be bonded together, creating innovative and versatile engineered wood products. These open up an exciting 'doorway' for us in construction as alternatives to steel and concrete. We are talking here of 'mass timber' products such as Glued Laminated Wood (Glulam), Dowel Laminated Wood and Cross Laminated Timber (CLT).

Plate 5: Cross-Laminated Timber, Source: DRIMA.ie

Innovative research Dr Annette Harte and co-workers at the National University of Ireland, Galway shows that mass timber products demonstrate excellent load carrying characteristics. Such timber can be used in larger more complex structures (Harte, 2017). For example, Cross-Laminated Timber (CLT) made up of at least three layers of parallel boards, placed cross wise to each other and glued together under pressure (Plate 5). The result is a product

that delivers stability while the additional thickness (from the layers) results in exceptional strength and stiffness.

Glulam is an engineered product made by gluing together, under pressure and heat, laminates of timber that have been accurately planed. Glulam is of interest not only because its strength to weight ratio is better than steel and its embodied energy can be significantly less than the concrete/steel equivalent

There is now growing interest in the concept of **building higher with wood**, in whole or in part, at a scale not previously attainable. Perhaps the ultimate example is Mjostarnet in Norway (Plate 6). At over 85 metres, it is currently the world's tallest timber building. It contains a hotel, apartments, office and even a swimming hall! The Paris Agreement is said to have inspired its design and construction. A key success factor is the use of engineered wood such as Glulam timber beams (Plate 6, inset). Between **11,000-13,000 trees**, sourced from local Norwegian forests supplied most of the wood for this innovative project.

Plate 6: Mjøstarnet, in Brumunddal, Norway, the tallest wooden building in the world and (inset) Glulam engineered construction components. (*Source: Moelven.com*)

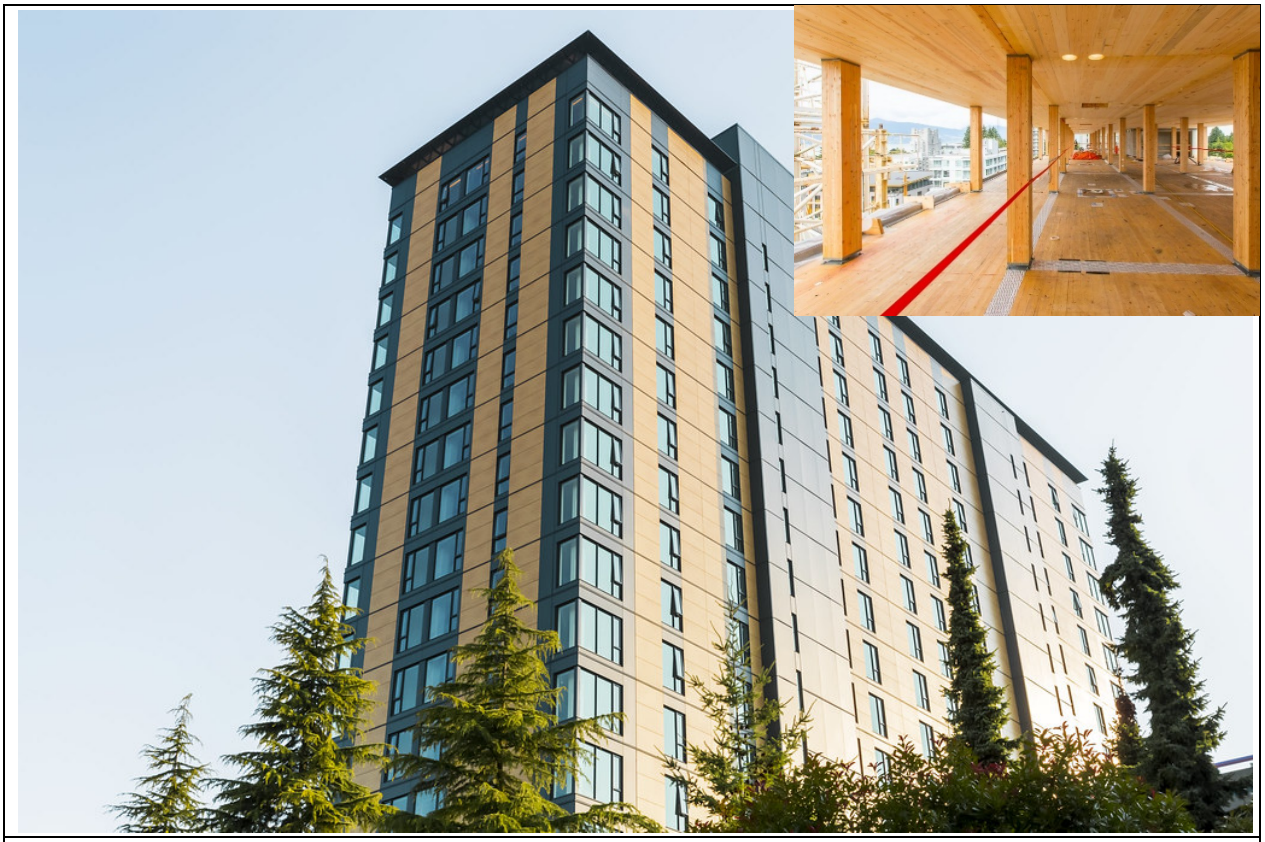


Plate 7: Brock Commons Student Residences in the University of British Columbia, Vancouver which (inset) uses CLT floor panels and Glulam Columns (Source: Harte. NUIG)

The Brock Commons student residence at the University of British Columbia, in Vancouver comprises an 18-storey tall wood hybrid building completed in less than 70 days after the prefabrication components arrived on site. It includes 17 stories of mass timber construction above a concrete podium. The floor structure comprises cross-laminated timber panels supported on glue laminated timber columns (Plate 7 and inset). The carbon dioxide equivalent avoided by using wood products over other materials in Brock Commons is an estimated 2,430 metric tonnes. The Canadian Wood Council 'Wood Works!' model has a mission statement 'to ensure the built environment in Canada maximises the use of wood-based solutions by advocating, education and connecting'.

Working Closer to Home

We also have very good examples that highlight the use of engineered wood, closer to home. Mass timber products can provide the strength and versatility to be considered in many new builds. From the use of CLT in house extensions to the beauty of decorative Glulam support beams, working with wood provides a range of options (Plates 8-11).



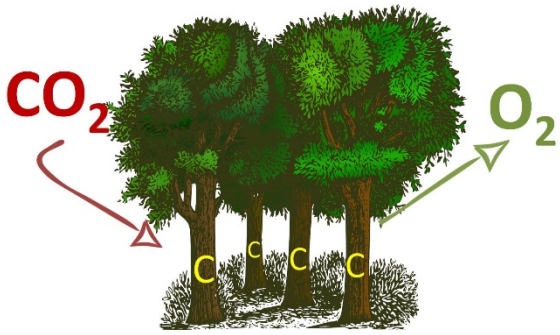

Plates 8-11. Clockwise from top right: CLT on a housing extension, Cork. Glulam post and beams at Centre Parks, Decorative Glulam supports at the Whitford House Hotel and Leisure Centre and at the Naval Headquarters Haulboline. (Source: Cedarlan.ie)

Working with Wood for Energy

Growing and sustainably using wood as a renewable source of energy can directly substitute for fossil fuel energy, increasing our self-sufficiency and therefore securing Ireland's long-term energy security. Wood as a source of heat has a large potential in Ireland. This resource is a proven technology with high efficiency and is locally available. Modern wood-fuelled heating systems offer the same level of convenience and reliability as oil or gas boiler systems. With the introduction of the Support Scheme for Renewable Heat, there is a growing interest in wood energy from the tourism, industrial, agricultural sectors and other non-domestic heat users.

We recently learned how Danone, the Wexford-based baby formula plant has become the first facility of its kind in the world to certified as carbon neutral. Danone has prioritised climate considerations, resulting in CO_2 savings of 10,000 tonnes, representing a 70% CO_2 reduction over the last decade. Over the same period, the facility has doubled baby formula production levels. Danone sources 100 per cent renewable electricity and uses a high-tech biomass boiler, powered by renewable wood fuels as an important component in reducing emissions. Teagasc works with forest owners and forest owner groups such as the Irish Wood Producers in optimising the wood resources produced from our private forest resource. The wood fuel powering the boiler is sourced from the local wood chipping industry. This is delivering a positive economic impact in county Wexford. The use of wood-based energy is helping Danone to be more competitive and more resilient for the future.

Delivering Multiple Carbon Benefits



Sustainable forest management deliver multiple carbon benefits. Trees and wood products have a unique ability to store carbon. As trees grow, they absorb carbon dioxide. When the trees are sustainably harvested and used to make wood products, the carbon remains stored in the wood for the life of those products The production and processing of wood also uses much less energy – called embodied energy – than most other building materials, giving wood products a significantly lower carbon footprint. Wood products which displace non-wood products in structural (e.g. internal or external wall, wood frame or beam) and non-structural (e.g. door, ceiling/floor cover, cladding) can lead to an average emission reduction of 1.3 to 1.6 times compare to alternative materials, respectively (*Hetemäki et al, 2020*). At the end of its useful life, sustainably sourced forest-based biomass products can be converted into carbon-neutral thermal (heat) energy and used for heating and/or electricity. (*COFORD, 2017*).

Working in the Bioeconomy

Wood is a key resource that can help us move to a low carbon future. Virtually everything that can be made from fossil resources can also be made from biological resources. Substituting sustainably produced woody biomass for fossil resources facilitates decarbonisation and continued economic growth. The bioeconomy refers to economic activity derived from the use of biological resources to produce food, feed materials and energy. The circular economy refers to economic activity based on the use, reuse and recycling of resources and materials. In a circular economy,

the value of materials value is preserved for as long as possible with the overall aim of minimising the use of non-renewable resources.

A team of researchers, led by Dr Maurice Collins, University of Limerick, is working on the cascading principle - whereby higher value applications can be preferentially derived from biological resources such as lignin from wood. The idea is to utilise waste bio-resources from forestry to produce advanced engineering materials for automotive, biomedical and energy applications. New innovative materials may ve capable of lowering the cost of end products by 30% while cutting in half the carbon footprint of carbon fibre production to be more suited to wood chip.

Our message for you!

There is great potential for to work with wood. It is a natural fibre, with an extraordinary range of applications, enriching all our lives. From regular construction, to high-rise buildings, from bioenergy to the bioeconomy, the options, like our productive forests, grow each day. So let's take pride in the product and work much more with our natural resource!

Why not consider the range of uses from your local area and share your findings and photos on https://www.facebook.com/forestry.teagasc/. We look forward to your new discoveries. Please also feel free to share this article with your colleagues and networks.