Climate change is real, and its impacts are being felt in our lifetime. What we do as individuals, as businesses, and as a society will have implications for our children, and our children’s children. We therefore have a responsibility to future generations to challenge existing modes of practice and to find innovative solutions that can arrest our resource-intensive way of living.

Of course, the climate crisis is too big of an issue to solve independently. But if we focus on what we can change, and what we can do, then we can affect wider cultural and societal change that may just shift the dial in our favour. But where do we start?

The construction industry is accountable for 39% of all global carbon emissions. A staggering 8% of global carbon emissions can be attributed to the production of cement alone. If cement were a country, it would be the world’s third biggest polluter after China and the USA. Addressing our addiction to concrete is where we must start.

The solution is timber - but not as you know it. This exhibition is intended to inform, and to challenge what you think you know about this most humble and familiar of materials. We invite you to learn more about how and why timber is the only viable alternative to concrete and steel - the building material of the 21st Century.

Change your perceptions. Imagine a timber future. Welcome to our exhibition.
European forests grow 840 million m$^3$ of timber a year.
The timber species that are typically used for engineered timber are coniferous evergreen softwoods, predominantly Spruce, with varying quantities of Douglas Fir, Western Larch, and Pine. The Forest Stewardship Council (FSC) and Program for the Endorsement of Forest Certification (PEFC) are certification bodies for the forestry industry. In addition to country regulations, third-party certification confirms that forests are managed in line with challenging environmental, social, and economic requirements, empowering consumers and companies to choose sustainably sourced products. Across the world over 1 billion acres of forest is certified, with 16% of this having both PEFC and FSC certification.
Building with wood stimulates the growth of sustainable forests.
Sustainable forests are managed to balance the environmental, economic, and social needs of present and future generations. Every tree that is cut down is replaced by several new ones, ensuring that the annual growth of the forest exceeds the corresponding annual harvest.

Building with wood brings economic value to forests and provides incentives for land owners to manage and maintain them in a sustainable way, helping to safeguard supply and deliver long-term value.
Constant use and re-planting of new trees is the most efficient way to clean the atmosphere.
A growing tree captures 750 kg of CO2 per m³ of wood - equivalent to the emissions from a 6000 km drive. Trees between 30 and 70 years of age sequester CO2 from the atmosphere most effectively, while older mature trees are much less efficient. Natural forests typically reach maximum carbon storage capacity at the age of 100 years.

The constant use and re-planting of new trees, stimulated by building with wood, is therefore the most efficient way to store carbon and clean the atmosphere.
It takes European Forests 20 seconds to grow enough timber for a 60 sqm house.
The felling of trees and manufacturing of timber products is a **highly efficient, low waste process**. Engineered timber products like Glulam and CLT are derived from sawn solid sections of timber that are combined to create high value, load-bearing structural products. Manufacturing processes create lower value outputs including bark, chips, and sawdust that can be sold individually or utilised for secondary products. In contrast, the manufacture of LVL (laminated veneer lumber) maximises the whole tree by peeling, rather than cutting the log, to create thin layers of timber that are then combined together. The versatility of timber as a product and its potential for reuse ensures that wood-based materials form part of a **long value chain** that ensures carbon remains locked away.
Engineered timber components can be combined in versatile ways to create a variety of structural system solutions. This enables the delivery of buildings ranging from homes and offices, to factories and cultural facilities.

The choice of the appropriate solution depends upon many factors including the use, scale, and location of the relevant project. It also relies upon an understanding of the specific performance characteristics and constraints associated with each timber product, and its application as part of each structural system.
Buildings are responsible for 39% of global carbon emissions.
Buildings account for 39% of global energy-related carbon emissions: 28% from operational emissions and 11% from the embodied carbon associated with materials and construction. It is estimated that half of all new buildings’ emissions between now and 2050 will result from their embodied carbon.

To develop our cities in a more sustainable manner, we will need to decarbonise the production of concrete and steel, and use renewable resources including timber to minimise the carbon emissions arising from construction. This will require the urgent transformation of existing frameworks governing the development, design, construction, operation, and disposal of buildings and materials. This is especially true for countries like Italy where timber is not traditionally used.

Replacing concrete and steel with wood can save an average of 45 tons of CO2 per dwelling.
Timber is both replenishable and sustainable, offering us an alternative way of meeting increasing global housing demands. If we build in timber, as opposed to traditional materials with high levels of embodied carbon, we can save an average of 45 tons (40 tonnes) of CO2 per dwelling.

Constructing in wood means that buildings act as long-term carbon stores, and helps us to reduce the emissions associated with the use of alternative higher embodied carbon materials.
Timber is the only mainstream construction material that can be considered as truly replenishable.
Timber is the only mainstream construction material that can be considered as **truly replenishable** due to the speed at which it grows.
Timber buildings are 20% faster to erect than concrete.
The program savings that can be achieved using CLT are generally considered the most significant benefit associated with this method of construction. The overall construction period of a CLT building will typically be **15-20% faster** than an equivalent reinforced concrete built scheme.

The time savings are driven by several factors: the speed of erection; the reduction in follow on trades, secondary components and systems; increased quality and precision; the ease of fixing to timber; just in time delivery; concurrent working; greater program and procurement certainty.

The installation of CLT is **easier, quieter, and safer** than traditional methods too, as it helps to mitigate wet trades and minimise the number of personnel on site.
Wooden buildings reduce stress, aid concentration and improve productivity.
Biophilic design in the workplace has been shown to raise productivity by 15%, increase creativity, improve staff retention, and reduce absenteeism.

Post-occupancy evaluation shows that those people in workplaces featuring natural materials like wood rate their personal productivity, ability to concentrate, and overall mood more positively. This demonstrates the positive impact that the use of wood can have on personal well-being.
Regulatory and Policy Barriers

- Lack of competency and professional pathways certification
- Restrictive bureaucracy for timber buildings
- Old-fashioned and conservative legislation
- Absence of significant directives

Financial Barriers

- General mistrust from financial institutions
- Lack of Return on Investment in the short term
- Purchasing costs of bio-based materials
- Insufficient clarity on criteria that make timber buildings ‘sustainable’
Technological Barriers

- Absence of continuity from BIM to construction
- Absence of certifications for end-to-end quality
- Poor development of end-of-life scenarios
- The lowest price criterion applied by public administration is disadvantageous

Environmental Barriers

- Absence of an incentive for the supply chain
- Absence of short supply chains in the country
- Sustainability in Energy performance certifications is not considered
- Biogenic CO2 storage is disadvantaged in static LCAs
Social and Cultural Barriers

- Lack of knowledge in the final users
- Lack of collaboration between the stakeholders
- Lack of information shared between the stakeholders
- Lack of communication between the sector and politics

- Lack of knowledge in the Public Administration about the benefits
Timber in the Italian Market

- 4° European producer for timber constructions
- 6% 6% of new construction is realized using mass timber technologies
- €1.34m €1.34 m total revenue for timber construction industry in Italy
- € 543m Residential
- €269m Non-residential buildings
- €573m Other timber productions
- 36% Italian territory covered by forests
- 9m m3 Quantity of wood imported in Italy
- 80% Percentage of imported wood in relation to domestic demand

Sources: FederlegnoArredo (2021) IIsole24Ore (2022)
The graph shows the distribution of the main building technologies in European countries by multi-storey buildings from 2004 to 2019.

In Italy, of the available case studies, panelised all timber technology is the most widespread.

Sources: Salvadori et Al., 2019
A special project by the Federated Innovation. Stakeholders collaborate at writing the proposal to be submitted, clarifying the role each one will play.

Develop a campaign aimed at attracting politicians and the public.

Develop content and take care of engagement for municipal officials.

Structuring an effective training program by distinguishing different targets.

A communication strategy to promote and invite people to participate in the call for best practices.
Local competence standards and professional certification routes to recognise and identify competent professionals in safe and efficient design of timber buildings

A systematic audit of current policies to identify and define gaps and counterproductive policies. A feasibility study in support of a pro-wood policy portfolio

‘Best practices’ drawn up considering EU examples

A building model that meets regulatory, insurance and other stakeholder requirements, in the most efficient way possible, as a first step towards the development of a local timber guide
A collaborative white paper proposal which identifies criteria for timber building projects aligned with ESGs, EU Taxonomy, and SFDR, with the purpose of certifying compliance.

Analysis / research of data availability to quantify loss of value of unsustainable investment.

A model proposal for alternative insurance financial risk assessment.

An investment model, e.g., a ‘timber fund’ for timber buildings in Italy considering S.A.L.E. protocol and any other available assurance means.
Environmental Initiatives

A dedicated software to reduce time and costs for producing EPDs and carbon footprint assessments, helping Italian companies involved in the mass timber supply.

Conduct a feasibility study of a dedicated business model for the Italian market, involving industry association FederLegnoArredo.

Review of the actual Energy Performance Certification scheme and implementation of a computational model LCA method, considering both the embodied and the operational emissions.

Workshops and coordination meetings to develop a new proposal about the dynamic modelling for the calculation and to write an EU community-level position paper with stakeholder.
Building / playbook with Design for Manufacturing And Disassembling (DfMAD) process that can be agreed upon across key value chain stakeholders

Practical examples of circular End of Life (EoL) from research institutions and manufacturers through the Timber Living Lab

Insurance rulebook based on the UK experience applied to the Italian market

Investigate how the S.A.L.E. protocol (or any other assurance certification protocol) meets the needs of insurers and designers and define improvement opportunities
Timber structure grown in 21 minutes in European forests.
Built in 2017, the 8-storey Wood City residential buildings maximise wood-based modular technology to create 98 flats. Internal compartmentation is provided by the structural frame.

The 7.2m spans are covered with LVL RIB, a composite slab element made of structural LVL (Laminated veneer lumber): a panel with a T-shaped cross-section comprising an LVL X top layer and LVL S ribs structurally bonded together.

For the walls, LVL massive elements produced by re-gluing multiple layers of LVL S in a vacuum press were installed.

In just 26 weeks, the timber superstructure was erected.
- 3777 tons of CO2 from the atmosphere = emissions of 1404 cars per year
Built in 2019, the 8-storey Wood City Office building exploits the potential of combining solid timber and RIB floors.

The skeleton is constructed from mass timber and the 8.2m spans are covered with LVL RIB. This ensures greater **internal flexibility** enabling the integration of pipes and insulation between the beams with building services located around the stiffening core.

In **just 18 weeks**, the timber superstructure was erected.

Compared to a concrete slab, LVL RIB Floor has a **significantly smaller carbon footprint**. In addition, the Sylva LVL RIB acts as carbon storage (-115kg). And while the floor locks in the carbon, new CO$_2$ is absorbed by replanted trees.
6545 m³ of timber regrown in just 56 minutes
Built in 2018, 25 King Street is Australia’s tallest engineered timber office building. The 10-storey office building in Brisbane has a total floor area of 14,921 square meters with 6,545 m3 of CLT & Glulam elements.

The timber stores the equivalent carbon of 1600 annual car emissions and achieved the 6 Star Green Star Design award, making it one of the most sustainable buildings in Australia.

Sustainably sourced timber is of course renewable and all the timber in this building was regrown in less than 1 hour!

CLT elements are pre-fabricated before delivery to the construction site, which means less time and resources use, less waste, and less disturbances onsite and in the surrounding community.
A highly innovative, optimised kit of parts.
DfMA (Design for Manufacture and Assembly) principals were adopted from the outset to ensure that the design of these innovative buildings incorporates standardised, prefabricated timber components in a cost effective and structurally efficient manner.

Both buildings have low embodied carbon profiles (achieving a LETI ‘B’ rating). However, a quarter of their embodied carbon emissions are offset by the carbon stored within the structural timber components. Designed to circular economy principles, individual structural elements can be dismantled and reused or re-purposed at the end of the building’s useful life.

At 13 floors (above ground) and 56 meters high, ‘Horizon’ will be the tallest wooden building in Italy and one of the tallest in Europe.
Exploded axonometric showing component parts

- Glulam beams
- Glulam columns
- Facade panel
- Window panel
- Shading support
- Shading
- Timber rib deck slab
- Concrete core

Exploded axonometric showing primary structural elements
A vision for the future of workspace.

Image: Black and White Building © Forbes Massie
The simplicity of this engineered timber office building belies its **ground-breaking innovation**. Setting a powerful sustainable agenda with only 410 kgCO₂e/m² embodied carbon (A1-A5), material use has been optimised. Each component is designed to be as efficient as possible, resulting in an honest design without excess.

The building utilises a hybrid timber structure comprising of a beech LVL post and beam frame, CLT floor slabs, and a CLT core, that is pin-jointed and bolted to facilitate the future recovery of structural components.

With no load-bearing internal partition walls and the MEP carefully coordinated to minimise visual intrusion, the layout can be adapted as future demands change.
Using timber rather than concrete reduced the embodied carbon by 60%
Reduce, reuse, recycle.
This six storey office building explores the principles of **reduce, reuse, and recycle** by incorporating a hybrid CLT and steel structure to maximise spans, minimise the number of internal columns, and deliver 34,000 sq ft of genuinely flexible workspace.

Circular economy and **zero waste** principles were the driving force behind the design approach. Every element of the construction has been detailed to facilitate the reuse and recycling of materials at the end of the building’s useful life. Structural components are bolted together, and applied elements including SIPs, cladding, and steel balustrades can all be easily taken apart.
The honest interiors have been designed to avoid unnecessary materials. The CLT soffits are left exposed, and where finishes were required, natural materials such as clay plaster and linoleum tiles have been used. Offcuts from the CLT structure have even been reused as furniture. A natural colour palette of earthy tones and natural textures complements the timber and promotes user connections to nature, **enhancing well-being**.
The hybrid timber structure stores over 2,000 t of CO₂.
Floors consist of prefabricated timber-concrete composite (TCC) panels, which are supported on top of the CLT load-bearing walls.
To reduce torsional effects under wind loads, the load bearing CLT walls are designed to be part of the stability system.
Hybrid timber concrete composite slabs improve the resistance to accidental loads.
The first commercial office space in the US capital to incorporate a vertical mass timber extension.
New timber connections for project’s fire rating and accommodating the structural loads.
The use of exposed timber is sustainable, aesthetically appealing and reduces costs and disruption.
Energy savings of 27% were achieved for levels seven to ten.
Stability is provided by the diaphragm action of the cross laminated timber (CLT) floor planks transferring horizontal forces to the cores.
Timber as structural material means achieving prefabricated systems that speed up and make the construction operation efficient.
The lightweight timber superstructure reduces foundation loads by 13%.
Embodied carbon calculations were done to compare timber structure against hybrid steel with CLT and also traditional concrete or steel systems.

Using our own in-house calculation software, we were able to demonstrate that the whole building was significantly beyond zero embodied carbon, due to 1200 ton of carbon sequestered in the structure.

This is equivalent to 12 years of regulated operational carbon or 6 years of total operational carbon.