

## Timber frame

# Volumetric building: idea to realisation

**David Jenkins, Director of the Welsh woodland management partnership Coed Cymru, describes a unique manufacturing system that maximises the use of indigenous UK timber components**

**Ty Unnos translates into English as “House in one Night” and this is was the origin of many rural dwellings in Wales until the late 19th century. It was believed then that, if a house could be built on common land in one night and smoke rose from the chimney at dawn, then the freehold of the land belonged to that person who constructed the property on it.**

In 2007 the name Ty Unnos, with its roots deep in Welsh folk history and associations with self reliance and making best use of local materials, was chosen to describe a collaborative research programme undertaken by a consortium of public private and academic partners.

The 21st Century Ty Unnos came about when the Countryside Council for Wales asked Coed Cymru to investigate how to produce affordable rural homes using homegrown softwood. Coed Cymru used its long-established partnership with The Welsh School of Architecture and Bangor University to develop the project, funded by the Countryside Council for Wales, Wood Knowledge Wales, the Environment Agency and Powys County Council. Consultants Cowleytimberwork and Burroughs provided engineering expertise.

Coed Cymru started producing products with Welsh timber in 1990 and has successfully developed outdoor furniture, laminated flooring, windows, doors, cladding and wood chips for fuel, and now Ty Unnos. After the initial study, they secured further investment from the Technology Strategy Board and new partners: Pontrilas Timber, Kenton Jones Ltd and Blaenau Gwent County Borough Council.

The Ty Unnos system, which is now being manufactured and marketed for affordable housing by the Oswestry company Elements Europe, has won a string of major awards for innovation including TRADA 75<sup>th</sup> Anniversary Award.

### Renewable source

Builders have traditionally preferred Scandinavian or Baltic timbers due to their stability in comparison to the locally sourced timber, which grows faster in the UK's environmental conditions.

Spruce grows very quickly in the mild, wet Welsh climate and this produces timber of low density with a tendency to twist as it dries. These disadvantages can be overcome by compounding small sections into larger components that fit well with the need to provide wide voids for insulation.

The building system comprises a series of portal frames made from Welsh spruce beams. Secondary ladder beams span between these frames to form floor and ceiling joists and wall studs before pre-insulated infill panels with voids for windows and doors are attached.

### Ty Unnos Modular

Elements Europe saw the opportunity to develop Ty Unnos Modular™, a volumetric housing system based on the original concept, using locally sourced materials and local labour wherever possible. The system is designed to reduce site, labour and waste costs whilst improving thermal performance.

So far, Elements Europe has developed 15 house types from one-bedroom apartments to luxury four-bedroom homes, all made in a factory. The modular system is capable of providing accommodation up to three storeys, in various arrangements, to maximise site density. Their layouts comply with various Registered Social Landlord spatial requirements, Welsh Assembly Government, Homes and Communities Agency and Lifetime Homes standards.

*“House in one night” ready for occupants. Photo: Coed Cymru*



## Timber frame



Ground floor panels assembled. Photo: Coed Cymru

It has been inspiring to work with this very dynamic company to bring what was a very interesting research project to a commercial reality.

Designed primarily for the low-rise residential market, Ty Unnos Modular™ is set to radically change established house construction methods, by maximising the use of indigenous UK timber components uniquely manufactured to form the building superstructure.

The use of 'home-grown' timber in the structure of the Ty Unnos Modular™ system ensures that the carbon footprint is kept to a minimum.

Timber is procured from local forests with Forestry Stewardship Council approval to maintain a locally sourced product. It is graded, machine cut, kiln dried then treated and fabricated into structural components for assembly into a volumetric housing solution.

The UK has 1.6 million hectares of softwood plantations, producing some 9.8 million tonnes of timber annually. This plentiful supply ensures timber can be used in construction industry for the foreseeable future. By enforcing a tree re-planting policy, stock can be maintained, allowing timber supply for Ty Unnos into perpetuity.

### Sustainable technology

The unique structure, and integrated supply-chain, epitomises 'lean' construction principles by addressing waste in a number of ways, primarily by components manufactured from a single standard timber component dimension. Off-cuts are fed back into the manufacturing process for re-work and integration into the next structural component.

The unique configuration of structural components provides an internal wall cavity with the potential to be filled with a range of insulation materials – recycled paper is the environmentally preferred insulation – providing a wall U-value of 0.17 W/m<sup>2</sup>K and exceptional thermal performance levels. Allied to the thermal performance is an exceptional air-tightness standard, all helping to reduce carbon emissions.

This combination of thermal performance, air-tightness and a mechanical ventilation heat recovery system provides a residential solution that is exceptionally economical to run while maintaining a comfortable room temperature.

Ty Unnos Modular™ achieves Code for Sustainable Homes (CSH) Level 4, which exceeds the standard required by the 2010 revision of Approved Document L for England and Wales. Code Levels 5 and 6 are attainable using additional bolt-on features.

Although finish quality and the energy performance are substantially improved, costs are still comparable with traditional construction methods. Cost is contained due to the abundant nature of the raw materials and efficient fabrication methods in its volumetric construction.

### Realisation: the roll out

In order to control the application of the technology, Ty Unnos Modular™ will be rolled out via a select number of developers within the UK residential market, strategically selected and located to satisfy the UK demand. These developers are selected according to their approach to the model, the technology, and above all their determination to help to provide sustainable affordable residential accommodation within the framework developed.

TRADA Technology is assisting Coed Cymru to obtain the European Technical Approval needed for this timber frame building kit to be offered to developers.

