Making the Move to Homegrown Bio Offsite Manufactured Timber

Transforming Timber

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OVERVIEW

The SNRG Demonstrator is a two-story volumetric home that was Scotland's first homegrown mass timber house. Exhibited at Cop26, it was designed and built using modern methods of construction (MMC) to Passivhaus standards, and provided technical and financial evidence that homegrown mass timber construction can go mainstream.

Homegrown cross-laminated timber (CLT) is vital to upscaling the production of the SNRG unit. To do so, the factors facilitating or undermining the move towards homegrown bio-OSM must be understood, including supply chain, procurement, and sustainability implications. Understanding risks and how to mitigate them is also essential to developing future opportunities for bio-OSM.

Consultation of realistic future demand for homegrown CLT timber modular construction to evaluate realistic rather than total market coverage identified the following scenarios for upscaling of production over the next 10 years: small (5K SNRG units), medium (5k to 10K SNRG units) and large (10K+ SNRG units) scale production. This summary outlines key takeaways from five reports that investigated the production of the SNRG unit and potential for upscaling. A range of methods were used to explore the areas of supply chain, procurement, and life cycle analysis.

SUPPLY CHAIN

Supply chain mapping and benchmarking was undertaken to understand upstream flow of components which are the main inputs in the production process. The organisation of logistics operations was investigated, and non-value adding activities or bottlenecks were identified. All suppliers of the SNRG unit were invited to a supply chain workshop where further data was gathered, and interviews were conducted with the timber supplier (EcoSystems Technologies) and the manufacturer (BSW Timber Ltd) to explore their views on the feasibility of different scenarios for upscaling production and their impacts on supply chains.

From the perspective of raw material availability, it was found that there is no concern from the supplier about the volume of logs going forward or a risk of disruption. Rather, the difficulty for BSW is to achieve market penetration against imported materials. In terms of manufacturing, production could be increased to 10-15K m3 in 12 months and to 30K m3 in 24 months. Anything above that would require substantial investment in a new facility. Finally, from a demand perspective, clarity is needed on UK government policy regarding the use of homegrown timber in the construction of homes and schools. Thus, scaling production is not limited by the availability of material or access to labour and skills, but rather by the forward visibility of continuity of demand and commitment to demand. Further information on supply chain details can be found in the other summary / report.

PROCUREMENT

Through interviews, case study analysis, and a workshop, an overview of UK procurement models was conducted. Following this, innovative procurement models that best facilitate the adoption of bio-OSM were identified and documented.

Several clients consider the Traditional procurement method the most suitable route because it allows more control over quality standards and gives certainty in terms of cost. On the other hand, this procurement approach is not holistic and does not promote collaboration. The Design & Build method endorses collaboration between designers and the main contractor. However, there is a higher risk that projects can be over budget due to less detailed information received at the bidding stage. Additionally, an extensive and detailed brief from the client is necessary in order to have more control over the project quality. The Balanced Scorecard (which evaluates themes at the bidding stage for project benefits in the areas of quality, cost, supply chain, employment, environmental sustainability, and health and safety) was introduced in 2016 for projects over a value of £10 million. The Social Value Model, mandatory for all central government procurement, uses metrics of economic inequality, fighting climate change, equal opportunities, and wellbeing, and therefore can promote the use of local resources.

All these models provide great opportunity for homegrown bio-OSM. However, some difficulties exist, which are detailed in the summary / report on procurement. In order to reduce the risks associated with the homegrown bio-OSM, the Integrated Project Insurance (IPI) Model seems to be most appropriate for overcoming these challenges. A distinctive element of the IPI model is the team selection based on skills, capabilities, and behaviour. This approach guarantees a no blame no claim culture within the team, with a mutual problem-solving attitude that can emphasise the benefits of homegrown bio-OSM.

LIFE CYCLE ANALYSIS (LCA)

The goal of the LCA study was to determine the global warming potential (GWP) impact of the SNRG Demonstrator unit. It aimed to quantify the carbon footprint of the unit under certain operational and end of life (EoL) scenarios. The scope included a cradle-to-grave analysis and all raw materials and energy inputs related to core, roof, internal partitions, and façade of the functional unit (FU) were included as far as they are known. Operational impacts of the use phase were considered based on a generic energy consumption profile, and environmental product declarations (EPDs) were used to extract embodied impacts of additional elements. A life cycle inventory (LCI) was used to collect data, and a life cycle impact assessment (LCIA) was used to better understand the environmental significance of the system's LCI results.

In the detailed report, results were presented for both the full module as well as normalised per unit of floor area. They indicate that the SNRG module meets the requirements of an extremely low carbon solution, being at the top of the scale of the LETI design targets in terms of upfront carbon and exceeding the RIBA 2030 design target in terms of whole life carbon. Results have also shown the significant carbon storage potential offered by the SNRG module given it is nearly entirely made of biomass. Analysis also indicates that embodied and operational carbon are equally important to successfully design a low carbon building from a whole life perspective, with embodied carbon accounting on average just over 55% of the whole life impacts for this method of construction.

CONCLUSIONS

Although the SNRG unit currently is at prototype stage and its commercial production has not commenced yet, its supply chain is already substantially established as many of the suppliers in this chain are large players with established material and components in the market. The Scottish timber supply chain illustrates characteristics aligned with the potential of a leagile approach. That is, lean and standardised product/commodity upstream with a delay in the uniqueness of the product, allowing for agility in response to demand downstream. As agility is aligned to customer pull, it requires collaborative planning, forecasting, and replenishment (CPFR). A Just-In-Time logistics approach is also required.

To facilitate the use of homegrown bio-OSM the following are recommended:

- New procurement methods need to be supported by the UK government and the construction industry through training and skills development.
- Embodied carbon needs to be regulated with the support of the research/educational sector.
- Procurement methods and contractual strategies should use an approach like the “Integrated Project Insurance Alliance” where risks are shared, promoting collaboration and innovation.
- Team selection should be based on skills, capabilities, and behaviour rather than cost.
- Project decisions must be taken from the whole team (i.e., designers, contractors, supply chain), and the design and construction phases must be aligned.

Ultimately, the construction industry has recognised the benefits of both OSM and mass timber. Alongside efficiencies in terms of cost, time, and quality, there are also benefits to promoting collaboration, the use of BIM, and sustainability. It’s therefore time to make the move to homegrown bio-OSM manufactured timber.

Transforming Timber

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