

## International Conference on Sustainability in Energy and Buildings

### Invited Sessions

**Title of Session:**

***Smart Offsite Manufacturing of Innovative Modern Methods of Construction, for Building New / Retrofitting Existing Dwellings, to Meet Nearly to/Net-Zero Operational Energy and Carbon Targets***

**Name of Chairs:**

Dr John Littlewood & Professor Lloyd Scott

**Name of Co-Chair:**

Dr Clara Watkins

**Description:**

The challenges facing traditional forms of site-based construction of dwellings are many. In the UK and other northern European countries attracting young people to consider training in the traditional construction trade crafts such as brick/concrete block laying or carpentry (used to construct the external fabric of dwellings on building sites) is difficult, as weather often means these people are working in inclement conditions. In addition, with economic recessions that occur typically each decade, 1000's of skilled personnel exits those traditional building crafts. The research evidence suggests, the quality of construction using these traditional methods has been deteriorating for many years, especially as developers attempt to drive down their costs and as such leading to the 'cutting of corners' which in turn has unintended consequences, such as the Performance Gap (PG). The PG is where design aspirations do not meet operational energy targets. In addition, through various EU initiatives there is a drive to construct new dwellings that achieve nearly to net-zero operational and embodied carbon standards. The demand for new housing is increasing, as the global population continues to grow. For example, in the UK the target for new homes is 300,000 p.a. until 2030. Ireland's population projections show it reaching 6Million by 2051, which has led to household formation averages set at around 32,000 between now and 2051. This <sup>SEP</sup> compares to previous estimates of 25,000 new households per annum.

In 2020 another challenge has arisen on a global level which is impacting construction and normal day to day operations, the Covid-19 pandemic, with a structural impact on society and economies, and a period of massive disruption for housing delivery. Finally, changing, and adverse weather patterns pose significant demands on new housing construction, from flooding due to rapidly rising rivers and increased precipitation or sea levels; high winds; and excessive temperatures. Traditional building site construction of dwellings is facing more and more challenges in keeping up with the changing circumstances.

One answer to these challenges is Offsite Manufacturing (OSM) of Modern Methods of Construction (MMC) in controlled factory conditions. MMC used to construct dwellings typically involves manufacturing structural frames in factories using timber, or lightweight steel which is infilled with insulation, and windows/doors and services can also be fixed into the fabric, which is then transported to site for erection. Known also as Volumetric or Modular Construction. This is considerably quicker than single bricks/concrete blocks being joined singularly for the exterior fabric of a building.

With the growing interest in quantifying and significantly reducing the embodied carbon of materials used in buildings, then Design for Manufacture (DfM) and OSM of MMC using natural materials, such as timber, could provide the most efficient process and smart construction systems available to also achieve nearly to net-zero operational/embodied carbon dwellings. In addition, by using DfM processes in the OSM of MMC allows mass customisable pattern books to be developed, aligned to local/regional/national regulatory codes to accelerate delivery, and if also following lean manufacturing principles can incorporate robotic and automation into production. These systems are not limited to new

build dwellings and could be used to retrofit existing dwellings, to a higher and quicker standard than with traditional construction systems. Indeed, for the UK to meet its climate change commitments, 26 Million existing homes need 'deep retrofit' i.e. substantial upgrades to their construction fabric by 2050.

As outlined, the need for more aligned solutions to the rapid changes in the sector are clear, thus, this track welcomes short and/or full papers from the industrial, research and scientific communities to share their knowledge, practice, and innovation for a global response to new housing and retrofitting existing housing, that is resilient to all the above challenges and can give hope to current society and future generations for sustainable and resilient communities.

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<https://www.tudublin.ie/research/>

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