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nZEB101

Abstract

The aim of *nZEB101* was to uncover key nZEB design and operation lessons as Ireland embarks on the unprecedented mass market implementation of these low-energy buildings. To achieve this the nZEB101 project evaluated a large cohort of housing in Ireland newly built, or retrofit, to the new nZEB standard. The project compared the designed and estimated energy use of the houses to in-use data, assessing the achievement of energy efficiency targets related to the nZEB standard. nZEB101 monitored and analysed in detail the in-use performance of heat pump technology and the fabric of nZEBs. The research outcomes of nZEB101 have been published in a number of academic journals and disseminated at conferences. The key outcomes are listed below.

Research Outcomes

- The majority of nZEB buildings monitored are underperforming relative to the design expectation or building energy rating. On average buildings are underperforming by one BER band.
- Occupants report high levels of satisfaction with nZEB dwellings.
- Comfort take back is evident in many homes resulting in high energy consumption.
- Interior temperatures are high (e.g., 20-25C) and much higher than values listed in the DEAP.
- The fabrics of nZEBs underperformed in many cases, with measured U-values multiples of the expected or design U-value, particularly in retrofit scenarios.

- Heat pumps are commonly operating with lower efficiencies than those proposed by manufacturers for the products. A COP of 2.5 is typical. This finding aligns with findings of larger datasets from the UK. Underperformance is due to both unrealistically rated COPs in the Irish context, as well as poor installation and poor sizing of heat pump system and emitter.
- The embodied carbon of retrofit to nZEB standard is in the range 125-250 kgCO2/m2 of floor area.

Recommendations

- We recommend taking a whole life carbon approach to evaluation of nZEB.
- We recommend post occupancy evaluation of retrofit and new builds with responsibility for performance shared between the architect and contractor.
- We recommend widespread up-skilling of heat pump installers.
- We recommend greater care and checking of heat pump installation, including emitter sizing, heat pump location, pipe run lengths etc.
- We recommend on-site testing of building fabrics, using heat flux sensors, at the time of retrofit or new build works.
- We recommend education of tenants or development of guidelines for tenants in how best to operate nZEB and their technologies. nZEB should come with an operating manual.
- We recommend stricter building control.
- We recommend a revision of the DEAP methodology to account for more realistic internal (and external) temperatures.