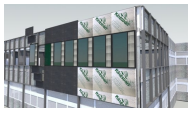
NBERT Building Retrofit and Concept 2018

Ireland's National Building Energy Retrofit Test-bed

Time-line

1974-2011

Main Campus (old building)



2011

Overall envelope design and concept

Feb-Sep 2012

New building construction and completion

2015-2016

Installation of solar panels on the roof: 24 kWp

2016-now

Ventilation studies and control strategy

Background

One of the largest or most significant challenges facing the building sector in Ireland, the European Union (EU) and internationally is the energy efficient retrofit of the existing building stock. As EU member states are required to make energy efficiency improvements every decade in the building area. The majority of this will inevitably come from reducing consumption in the existing building stock.

Key Targets

20% improvement energy efficiency by 2020

33% improvement energy efficiency in public buildings by 2020

40% reduction in emissions by 2030

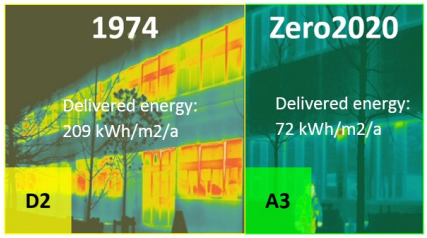
80% reduction in emissions by 2050

In Ireland, the stricter targets for publics buildings has led to the demand to set examples of nearly zero energy buildings (NZEB). These demands and targets resulted in the design and construction of the zero2020 building. A retrofitted low energy and NZEB located on the main campus of Cork Institute of Technology (CIT). ***The aim of the zero2020 project was to produce a building that would have net zero energy consumption in 2020.***

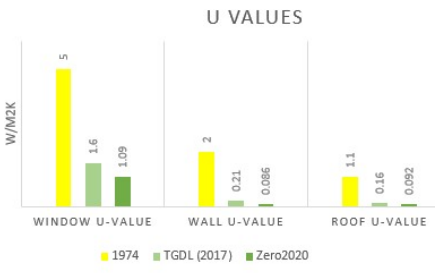
This building hosts the National Built Energy Retrofit test-bed (NBERT). NBERT is a highly instrumented test-bed which allows researchers and students access to a real world case study of successful and high-performance retrofit. NBERT gives researchers access to data and detailed building information via a web-based platform.

Zero2020 (Before & After)

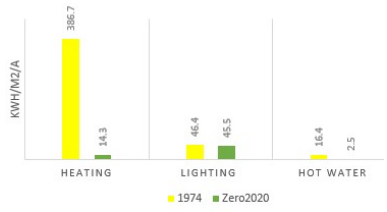
The existing building built in 1974 has a very poor performing thermal envelope with a very high level of air infiltration (see figures below). The heating is primarily delivered through perimeter radiators without TRVs supplied with hot water heated by gas boiler. There is a predefined heating system time schedule with no space temperature.



In the zero2020 building (which contains NBERT), the energy system is composed of an **air to water heat pump**, **low temperature radiators**. Moreover, a **micro-grid** powers the building while also exporting energy to the national grid. The improvements in the buildings fabric is clear above. This was also shown the building energy ratings achieved after the retrofit.

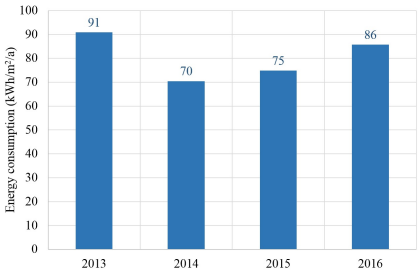


Energy consumption

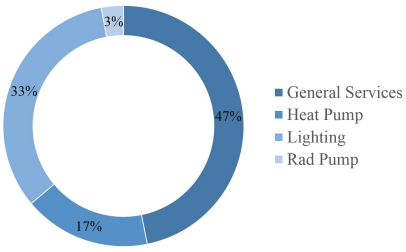


NBERT Performance (Now)

Following the extensive refurbishment, it took time for the building to get fully occupied. This can be seen in the image below which shows how the measured energy consumption has been slowly increasing over time from 2014-2016. One of major challenges currently is trying to reduce the electrical energy consumption in the building, due to high internal gains.

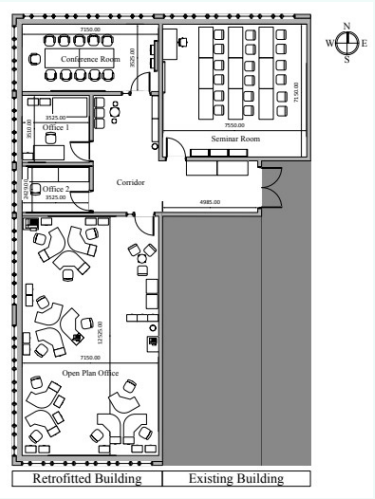


The key energy users in the building are broken into; general services, the heat pump, lighting and the radiator pump for the heating system. Below is an example of the breakdown of key energy users for 2016. Typically general services represent the majority of energy consumption in the building currently around 70-80% annually.



The indoor air quality is highly dependant on user control of the ventilation louvres.

High air quality is achieved 33% of the time.



Key Metrics

223 m2 floor area of the NBERT building

1% of the existing building

90 kWh/m2/a Energy consumption

56% Energy reduction

1.76 m3/h/m2 Air infiltration

14.25 kWh/m2/a Heating system

Tools

Ventilation Cooling Tool

Reduced Order building model

Air handling unit analysis