Mayville Community Centre, Islington, North London

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The Mayville Community Centre project in Islington, north London, is a milestone in Britain's ambitions to build sustainably. The 19th century brick building has become the first non-domestic, fully-certified Passivhaus refurbishment in the UK

Description

The building was constructed in the 1890s as a generating station for London's tram network, and rescued from dereliction in 1973 by the Mildmay Community Partnership which turned it into a community centre for the local Mayville Estate. In 2006 bere:architects was commissioned to refurbish and extend the rundown building.

The existing concrete-framed building, oriented north-south, has three storeys (basement, ground and first) and single-storey extension. It has a nominal 600 mm-thick solid brick skin and pitched roof. Refurbishment works included internal replanning to create an extra 35 percent usable space split between community use and renting to fledgling businesses. A full upgrade of the fabric and its environmental systems was planned to meet the Passivhaus standard. The construction budget was £1.6 million.

A single-storey entrance block with reception and dining area was added, with access to a garden. This outdoor space is also accessible from enlarged openings to the ground floor south elevation, which have the added advantage of increasing winter solar gain. A south elevation lightwell, down to basement level, allows natural light, ventilation and solar gain, and provides access to the basement. Work was completed in July 2011.

Key features

- External walls damp-proofed down to footings. External insulation was extended right down to the foundations and 75mm of phenolic insulation was added to the building's basement concrete raft.
- Walls treated with 300mm of expanded polystyrene block fixed to the external face of the brickwork and finished with Permarock render. Below ground, basement walls were externally insulated with 200mm of extruded polystyrene insulation.
- Replacement standing seam zinc pitched roof with 400mm of insulation, installed over existing steel trusses. A layer of 300mm Rockwool insulation was placed between joists, with 100mm of denser Rockwool over the steel structure to avoid cold bridges. The insulation is covered with a Tyvek breathable membrane.
- German-made triple-glazed windows, detailed to avoid thermal bridging. Window frames were positioned with inflatable bags, and fixed with screws that locate but do not put pressure on the frame. Window frames were sealed into the openings with continuous tape.
- Mechanical ventilation with heat recovery (MVHR). The Passivhaus Planning Package (PHPP) design tool predicted a 7kW heating load on the coldest day of the year. The solution was a variable volume Paul Maxi MVHR unit sized to deliver 5.6 litres/second per person, at a specific fan power of 1.86 W/litres/second for the supply and extract fans combined. Heat recovery is via a corrugated plastic heat exchanger, said to deliver close to 90 percent heat reclaim.
- Boost ventilation is provided for key locations at times of high occupancy. A carbon dioxide sensor in the return air ductwork opens a ductwork damper to supply air directly to the hall. The cafe area also has boost ventilation.
- 8.4 kW Viessmann ground-source heat pump (GSHP), for space heating and top-up for hot water storage
- Photovoltaics: 126 m^2, rated at 18 kWp total output.
- Solar thermal: a single 3 m^2 panel as the building has limited need for hot water.
- Rainwater harvesting tank, collecting water from two small green roofs over the extension, and the roof of the main hall.
- Electric lighting: a mix of conventional T5 and compact low energy fluorescents. Daylight dimming controls and presence detection has been used where applicable. Large motorised south-facing roof-lights have been used to get daylight into the main hall and for summer night-purging.

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Outcomes

- Two airtightness tests were carried out, the final test showing a value of 0.43 air changes per hour. The airtightness value may lead to useful guidance on specialist contractor training, construction drawings, and design and installation of thermally-tight and air-tight junctions.
- The existing building consumed 581 kWh/m^2 a year before refurbishment. Using the PHPP, it was calculated that fabric improvements will reduce annual primary energy demand to 120 kWh/m^2, while space heating demand will be 13 kWh/m^2. Annual energy costs are anticipated to fall from £10,710 to around £600.
- The building has been certified by the Passivhaus Institute, and exceeds all Part L requirements. Using the Simplified Building Energy Model (SBEM), the target emissions rate was calculated at 18.8 kgCO_2/m^2 per annum, with the as-designed building emissions rate set at 13.7 kgCO_2/m^2 per annum, an 87.5 per cent improvement on the old building.
- The building's main annual energy end-uses break down as 5.6 kWh/m^2 per annum for the heat pump, 3 kWh/m^2 for the MVHR, and 15 kWh/m^2 for all lighting. The solar panel is estimated to deliver 1,341 kWh a year, and the photovoltaics 14,400 kWh a year.
- Funding from the Technology Strategy Board (TSB) is being used to monitor and evaluate the refurbishment. Forecast energy use is being compared with actual through independent analysis based on the CIBSE TM22 energy assessment method. Analysis of the Soft Landings handover, with training and long-term support by the professional team, is also being assessed. BSRIA is part of the Mayville building performance evaluation project research team and is reporting periodically on the building's performance.

Learning points

bere:architects gives the following key learning points from the project:

- Initially the client wanted advice on putting in a biomass plant, but the building was so poorly insulated that excessive amounts of biomass would have been needed to heat the building, so we started looking at how to save energy. The basement was dark, cold, draughty and unused so we suggested excavating soil against the south elevation and adding south-facing windows, which would bring in light and generate heat for the whole building.

- Passivhaus informed the design options and using the PHPP right from the start of the design avoided any mistakes. For example, putting in big windows on the north side generally means having to use more insulation, but careful analysis using PHPP enabled us to add two north-facing windows, but these were carefully sized and located to get maximum benefit without losing energy.

- It is unlikely that support from Homes for Islington would have been won for the large south facing windows purely on the argument that a nice garden would be created. Using PHPP enabled a clear and convincing demonstration of the long term energy and comfort benefits of the windows.

- The funders liked the fact that this was to be London's first non-domestic Passivhaus. We received about £260,000 of funding from the Council for renewables and the 90 percent heat recovery ventilation. The Carbon Trust, the Big Lottery Fund and the Communitybuilders Fund also contributed funds to the project. Passivhaus numbers helped persuade people of the massive long-term benefits for the community.

- Despite initial scepticism and even opposition from the mechanical and electrical contractor, the building does not have a building management system. It is really easy to use, and has controls that are no more complicated than a domestic thermostat. A ground source heat pump supplies any heat needed to the radiators which have simple thermostatic valves. All lights are manually switched on and off. Presence detectors are used to switch off forgotten lights. External, retractable blinds (and insulation) help keep the building cool in the summer. An extended after-care Soft Landings programme has helped ensure that users understand these simple controls, minimizing unregulated emissions.

- The airtightness at 0.43ach-1 at 50pa would be a triumph on any project - especially a retrofit - and provides quality assurance on the fabric, allowing the services to be sized and operated in accordance with the design model.

Sources and links

Client: Mildmay Community Partnership, Homes for Islington

Architect: Bere:architects

Contractor: Buxton Building Contractors

Services consultant: Alan Clarke

Quantity surveyor: E-Griffin Consulting

Heat recovery ventilation design: The Green Building Store

Substructure engineer: Conisbee