Passivhaus development project at Woodmill and St Columba's RC High School

Project overview

A Net Zero Public Sector Buildings (NZPSB) standard 'pathfinder' project, the replacement of Woodmill & St Columba's (WSC) High School comprised the joining of two high schools within a common building.

Built adjacent to the new Fife College campus on the Dunfermline Learning Campus joint site, the project adopted the NZPSB framework throughout, including verifying the embodied carbon across the works.

Rybka were appointed as Mechanical, Electrical and Plumbing (MEP) and Sustainability Consultants to help deliver the 2700 pupil combined campus.

Designed against the backdrop of the COVID pandemic, the project was impacted by both rising cost pressures and procurement difficulties for traditionally 'basic' materials.

The Rybka team negotiated these challenges through careful product selection and by ensuring the early buy-in of key subcontractors - only possible due to the confidence the well-considered and 'gap-free' design offered.

Throughout the works, MEP installations were closely inspected to ensure that system performance and energy in-use matched, or improved, Passivhaus Planning Package (PHPP) and CIBSE Technical Memorandum 54 (TM54) operational energy analysis models. Pipe and duct installations were similarly scrutinised to ensure that the project's high standards were met.

Local Authority: Fife Council
Architect: AHR
Value: £100M
Timescale: 16-month design phase, 26-month site works

At a glance

- **Built to Passivhaus standards**
- **Designed to accommodate 2,700 pupils**
- **One of the largest education buildings in the UK**
- **Community facility**
- **Large area dedicated to additional support needs (ASN)**

Education | Energy performance | Solar | Passivhaus

Project delivery

Significant dynamic modelling was undertaken throughout the design phases, which included both Climate Based Daylight Modelling (CBDM) and Thermal Modelling. This commenced in Hub Stage 1 (RIBA Stages 1 & 2) with iterative modelling on select 'typical' classrooms and other key strategic rooms in order to help inform the optimal layout and fenestration arrangements for those spaces. That was then extended through the other rooms in Hub Stage 2 (RIBA Stages 3 & 4) in order to identify where the performance was compromised as a result of, for example, corner rooms, or those with significant shading as a result of building geometry.

Operational energy modelling was undertaken in order to ensure that the building, as designed, was on course to meet the Scottish Future Trust's (SFT's) Learning Estate Investment Programme (LEIP) energy targets for core hours, and to help verify the PHPP outputs.

The project was taken to BIM Level 2, which was utilised for clash detection and included COBie data. Key subcontractors also utilised the BIM environment and provided information to ensure co-ordination on site. Something particularly important structurally, as a large part of the main school block was constructed in precast concrete and the sports block in cross-laminated timber (CLT). The critical requirement to pre-form the builder's work in connection with services (BWICS) openings in those elements made it essential that the level of co-ordination was accurate.

Fully electrically heated, the only natural gas source for the building is within the science labs and the CDT forge. Due to the scale of the building and the need to minimise pipework heat losses for Passivhaus, the decision was made to split the air source heat pump (ASHP) heating system into four 'quadrants' for the main school building and another for the sports block. This solution helped to minimise pipe size, reduce pumping power, and ensured that the primary plant was local to the areas served. Similarly, domestic hot water was generated centrally for high load centres, such as the main kitchen, food technology and the sports block changing rooms. Local, point-of-use electric water heaters supply hot water for other areas.

In order to maximise efficiencies and minimise the number of external façade penetrations, ventilation for the project was designed to be via a centralised Passivhaus-accredited air handling unit (AHUs). These units were located on the roof with carefully designed 'dog boxes' at riser heads to ensure that low air leakage performance of the building is maintained as the ducts enter the building. The AHU heat recovery efficiency is such that heater batteries were not required in the AHUs, negating any associated pipe losses and further roof penetrations. Units are CO_2 controlled, with each unit generally serving a cluster of around 8-10 classrooms.

The roof houses a significant photovoltaic (PV) array, which was supported by design stage modelling to verify the optimal area of panels required. This ensures that the vast majority of electricity generated is used on-site and the export energy minimised.

Result

The school was opened in 2024 with some 2,700 pupils making use of the exceptional facilities. The project was successfully delivered, meeting Passivhaus requirements and setting a new standard for education facilities.

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