DANIEL COYLE MRIAI ARCHITECT

DUBLIN SCHOOL OF ARCHITECTURE, DUBLIN INSTITUTE OF TECHNOLOGY, BOLTON STREET, DUBLIN 1 PG Diploma in Digital Analysis and Energy Retrofit DT774a

1 —

4 .

2 _____

SEMESTER 1 - ENERPHIT SCHOOLS PROJECT



Using the Passivhaus PHPP ("Passive House Planning Package") spreadsheet software as an iterative design tool, the Project explores the development of a comprehensive Design Strategy for the deep energy-retrofitting, upgrade and refurbishment of an existing single storey 1960s four-classroom Primary School Building, to achieve compliance with Passivhaus EnerPHit performance standards.

The EnerPHit Retrofit Strategy focuses on building form and geometry optimised for Natural Daylighting and Passive Solar Gains, "super-low energy" Fabric Insulation levels, near elimination of Liner Thermal Bridging, Air-tightness to minimise heat loss through air infiltration, a high level of indoor air quality maintained by an efficient Mechanical Ventilation System with Heat Recovery, efficiencies in Domestic Hot Water production and distribution, and energy efficient Space Heating, Electrical Power and Lighting equipment with responsive controls.

The proposed EnerPHit Retrofit solution is calculated to achieve a 95% reduction in Space Heating Annual Energy Demand, and an 85% reduction in Total Primary Energy Demand. The additional incorporation of on Photo-Voltaic panels and other on site renewables allows the potential to deliver a Nearly Zero Energy Building.

HEAT GAINS

14.7 24.4

EXISTING RETROFIT

-500

1:100

1:100

EXISTING RETROFIT

16.6

14.7

Existing School Building - Energy Analysis using PHPP



The energy performance of the existing school building was examined and calculated using the PHPP spreadsheet software as well as a range of other analysis tools and methodologies such as Design Builder (Dynamic Simulation Software), U-Value calculation software (Build Desk-U), Linear Thermal Bridge Modelling (Therm), and Hygrothermal Moisture Assessments for Surface and Interstitial Condensation.

This analysis demonstrates an unsustainably high energy usage for the existing school building with a calculated Space Heating Demand of over **531 kWh**/ (m²a), and a total Primary Energy Demand of 820 kWh/(m²a) - equating to an estimated total annual energy demand of over 257,480 kWh. The lack of thermal insulation and additional significant linear thermal bridging may also result in a substantial risk of surface and interstitial condensation, and potential mould growth.

Daylight Analysis carried out on a typical classroom space also demonstrated poor daylighting and illumination levels, with Average Daylight Factor significantly below the current Dept. of Education and Science recommendations.

PHPP EnerPHit Performance Criteria - Existing & Proposed Retrofit Solution

KEY TO SOUTH-WEST ELEVATION

3 - Zinc capping to parapet walls. 4 - New Passive alu-clad timber windows.

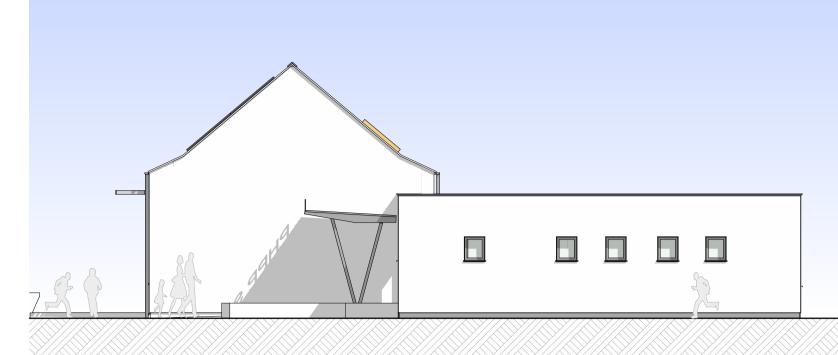
6 - New ramped disabled access.

5 - Brise Soleil to South-East Facade.

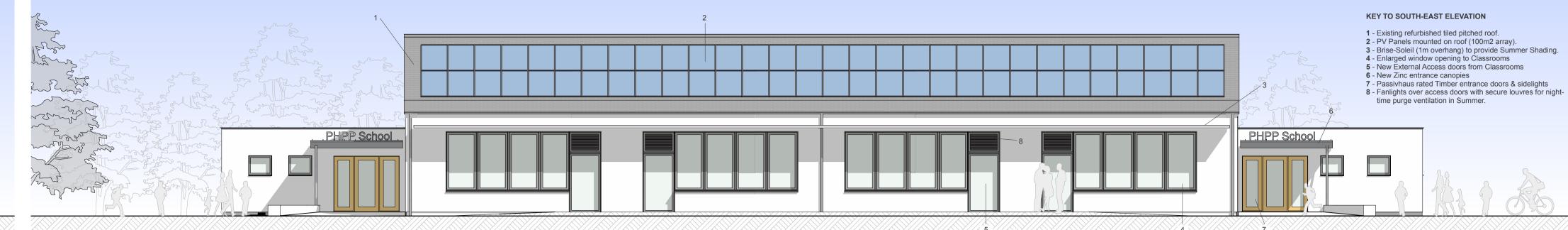
1 - 300mm EWI with silicate render finish. 2 - New Zinc clad entrance canopies.

	Criteria	Existing	Retrofit	Criteria	Existing	Retrofit
Quality Approved Energy Retrofit with Passive House Components Passive House Institute	Specific Heat Demand	531 kWh/(m2a)	max. 25 kWh/(m2a)	External Wall U-value	1.735 W/m ² K	max. 0.150 W/m ² K
	Total Primary Energy Demand	820 kWh/(m2a)	max. 132 kWh/(m2a)	Roof or top floor ceiling U-Value	1.279 W/m ² K	max. 0.120 W/m ² K
	Airtightness (n ₅₀)	10.57 ⁻¹	max. 1.0 ⁻¹	Windows U-Value (Installed)	2.56 Wh/m ² K	max. 0.85 Wh/m ² K
	Overheating Frequency (>25°C)	0%	max. 10%	Linear Thermal Bridges		max. +0.01 W/(m ² K
	Water Activity of Interior Surfaces		max. 80%	Ventilation (MHVR) Efficiency		η _{HR eff} ≥ <mark>75%</mark>
Fassive nouse institute						
EXISTING SCHOOL BUILDING				Primary Energy 820 Space Heating 531 kWh/(m2a)		

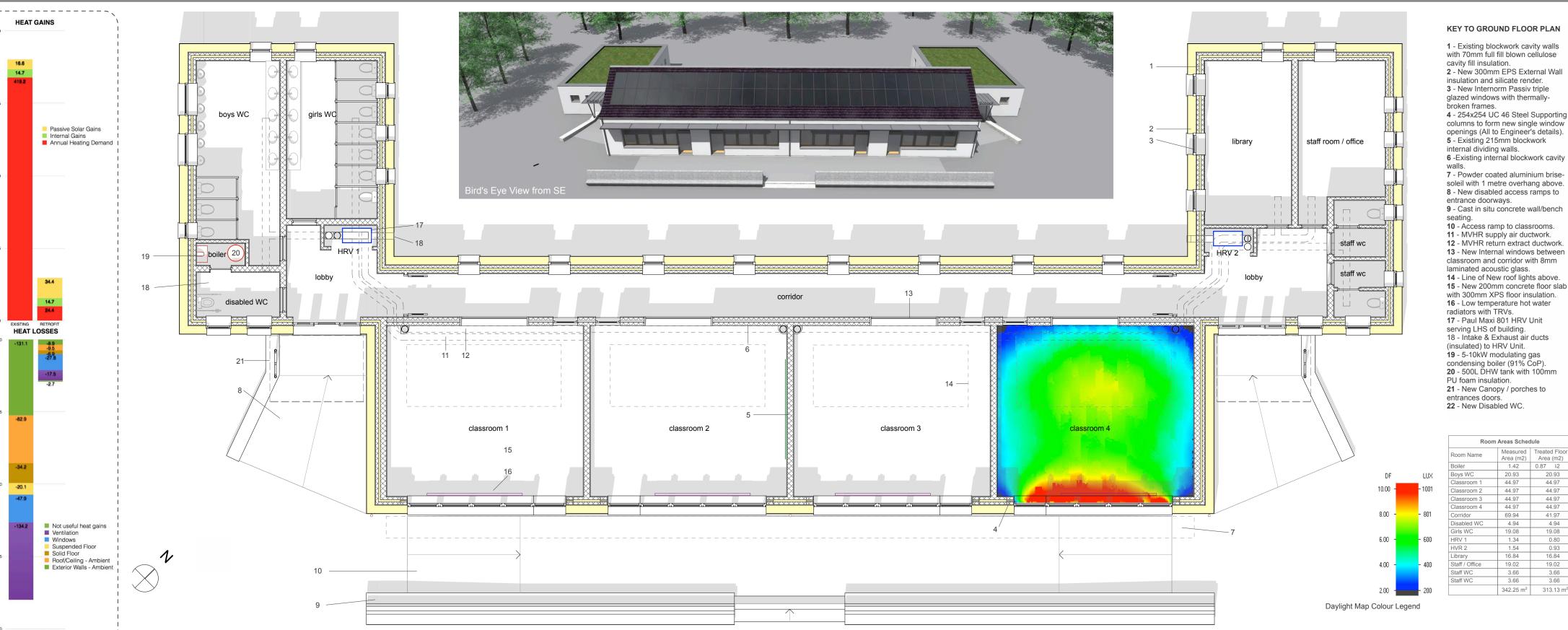
Space Heating



North-East Elevation



South-East Elevation



Ground Floor Plan (Proposed)

KEY TO NORTH-WEST ELEVATION

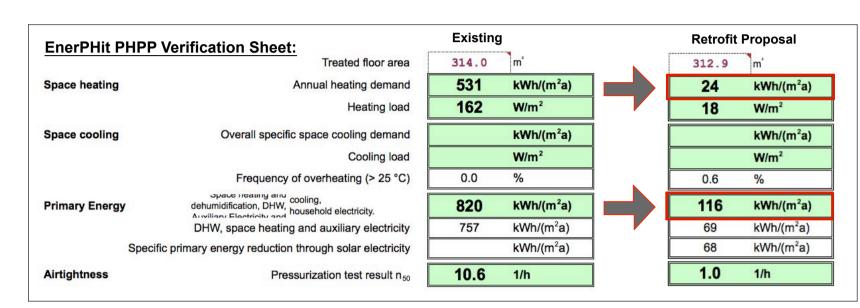
4 - New Zinc gutters & rainwater pipes

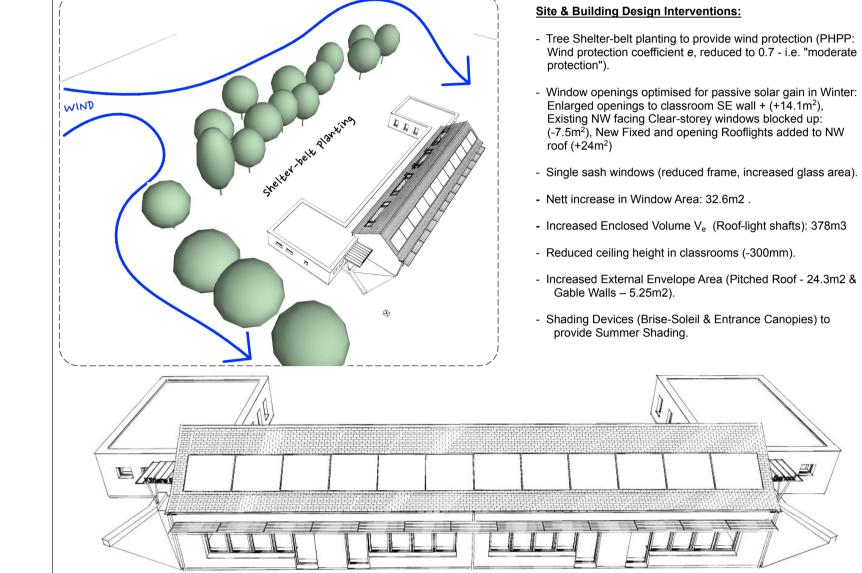
Existing tiled / slated pitched roof (refurbished).
 New Fakro Passiv Opening Rooflights (automated)
 New fixed triple glazed roof-lights.

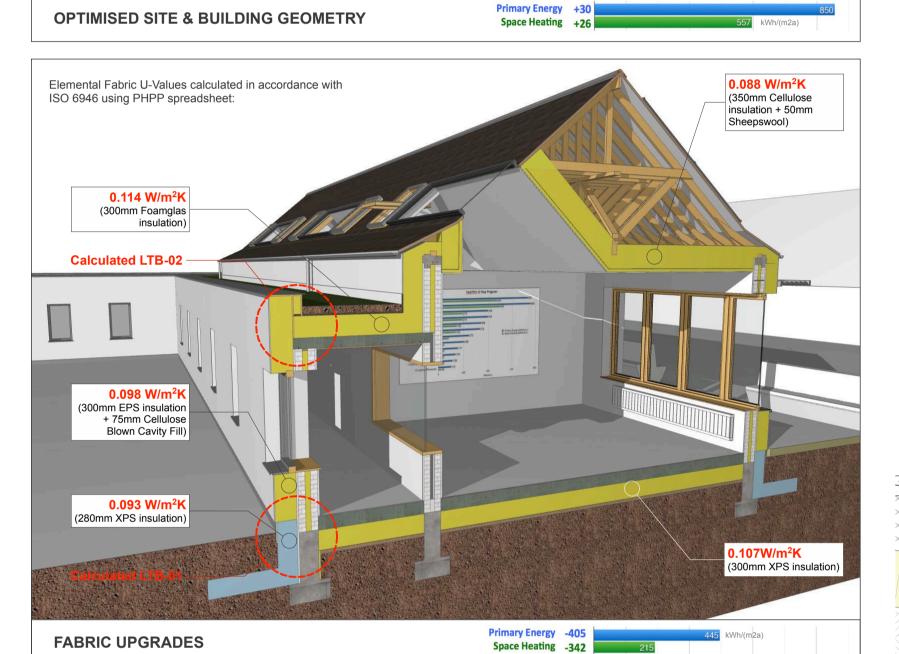
1:100

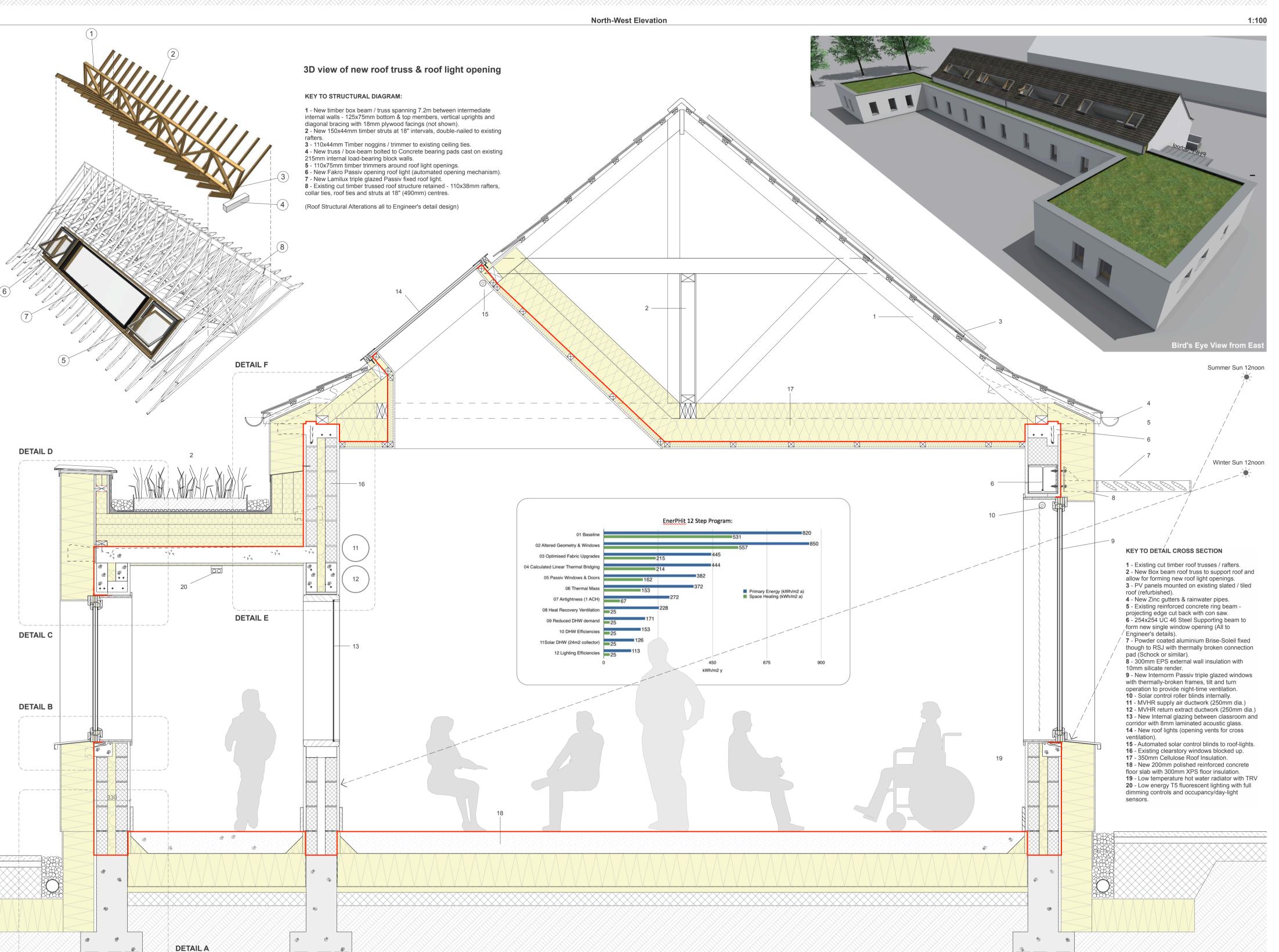
1:100

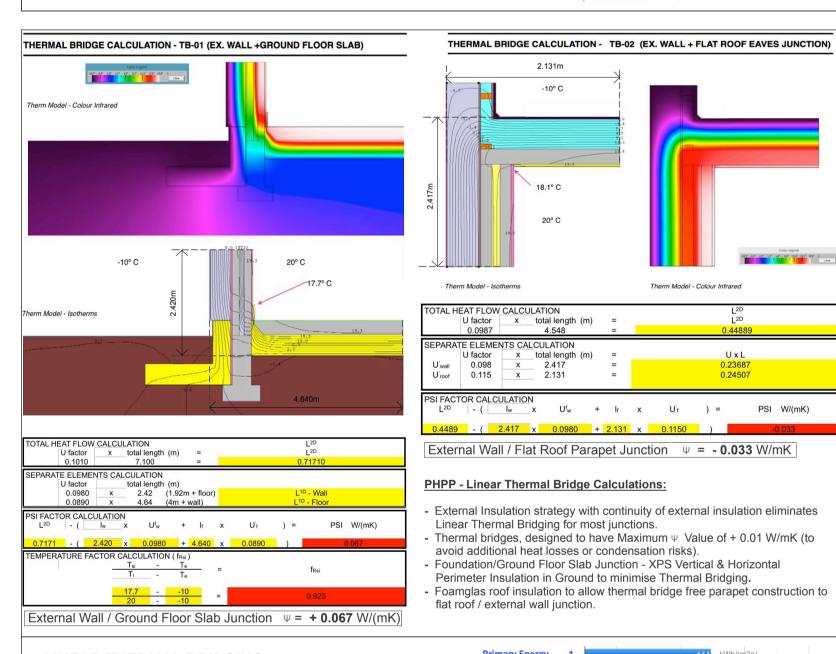






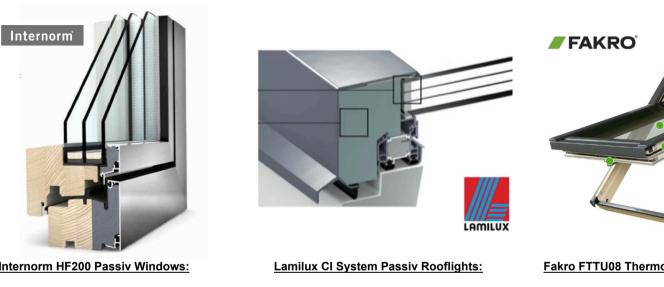




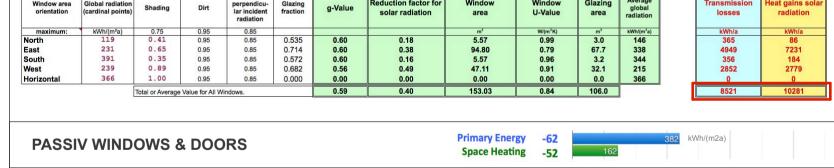


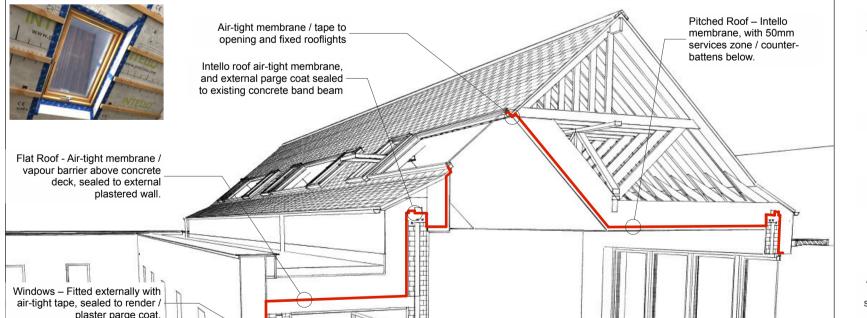


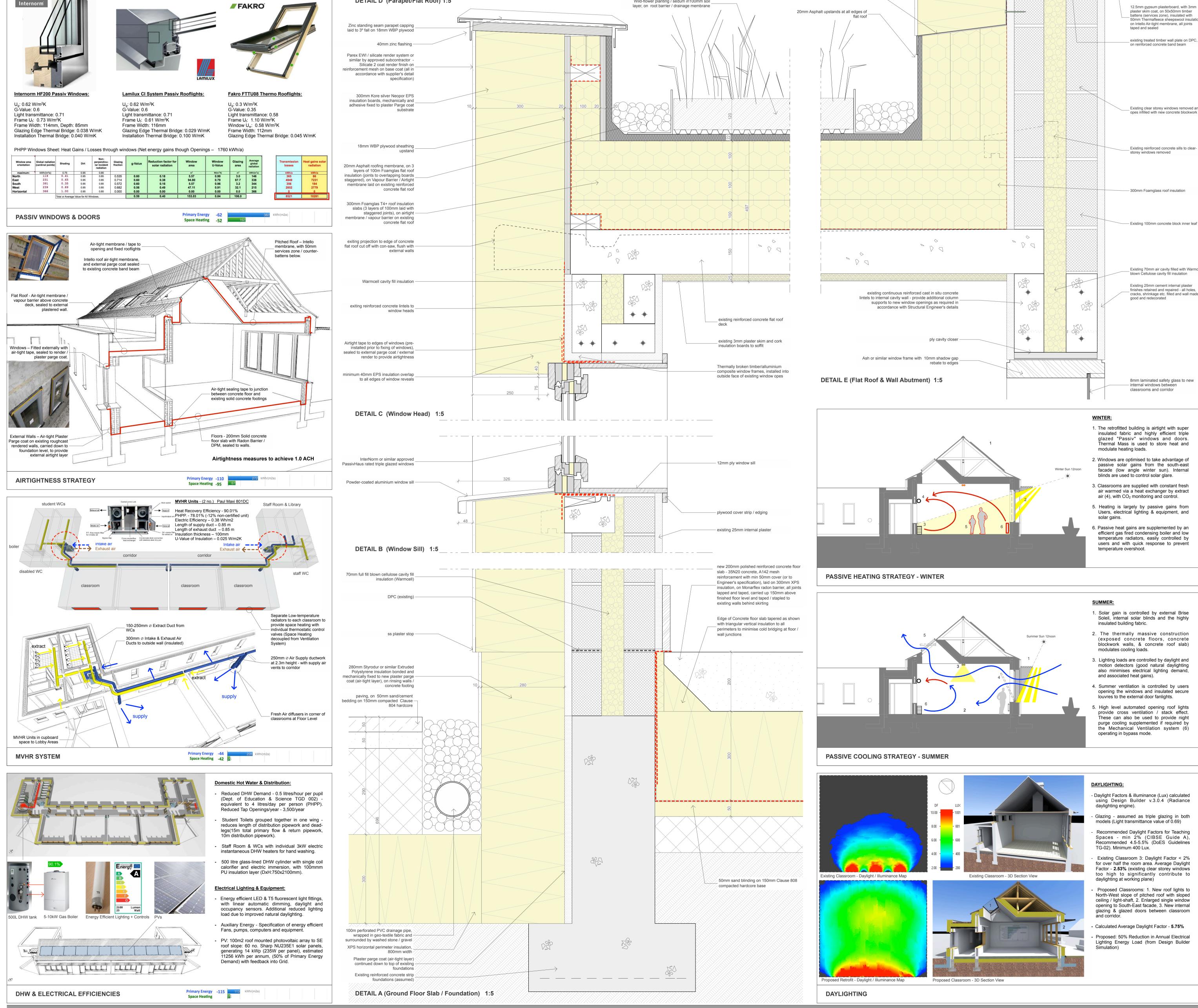


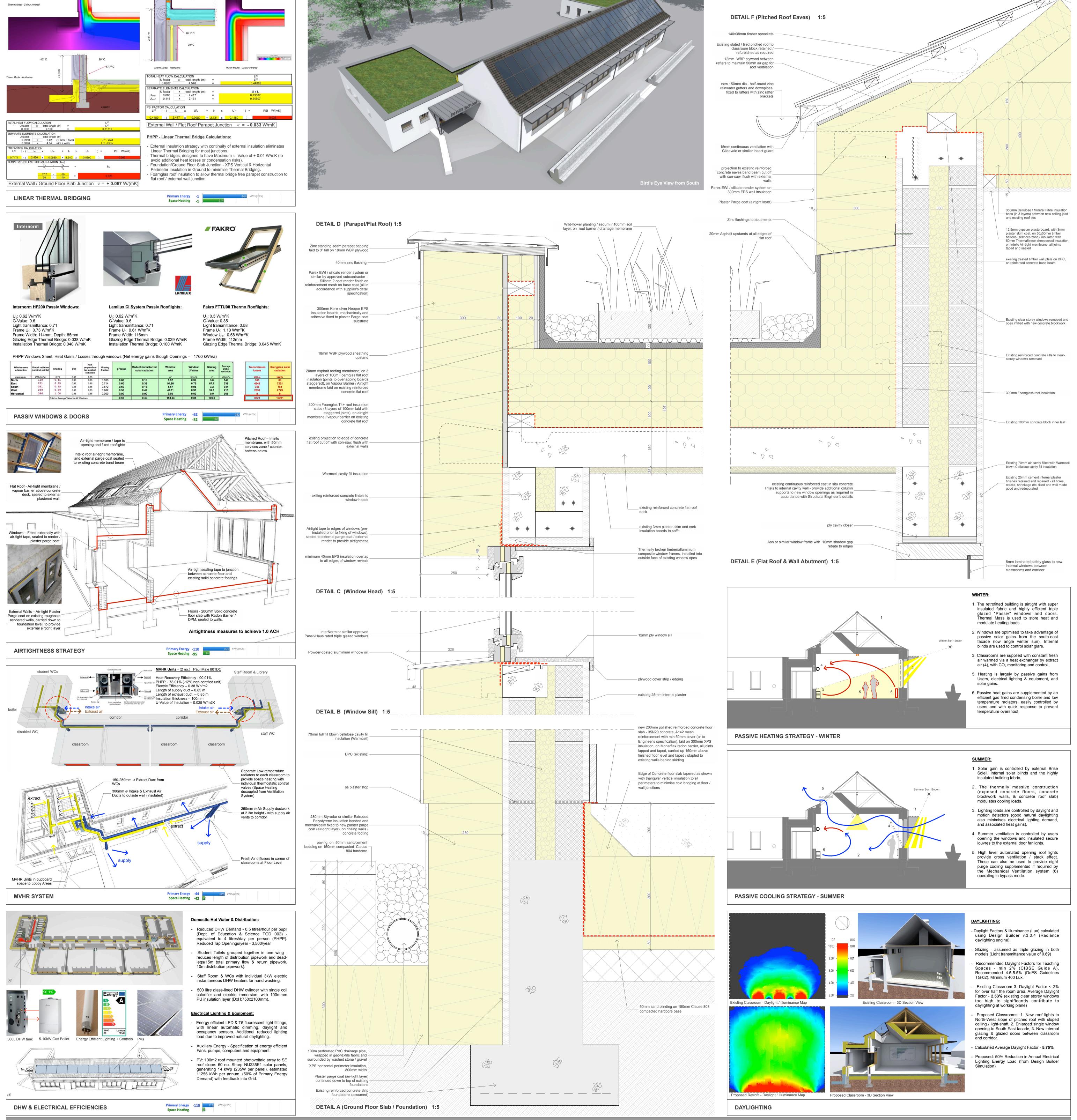












DANIEL COYLE MRIAI ARCHITECT

DUBLIN SCHOOL OF ARCHITECTURE, DUBLIN INSTITUTE OF TECHNOLOGY, BOLTON STREET, DUBLIN 1 PG Diploma in Digital Analysis and Energy Retrofit DT774a

SEMESTER 1 - ENERPHIT SCHOOLS PROJECT