CONTEXT

IRELAND'S GENERIC REPEAT DESIGN SCHOOLS PROGRAMME
The Irish Department of Education and Skills (DoE) is strongly committed to energy efficiency and to reducing CO2 by developing and implementing energy level ceilings in relation to school design that aim to remain below half of the accepted good practice in the field. This approach works within normal departmental budgetary limits to create school buildings that are breaking ground for building designers.
CELE Exchange 2011/5 © OECD 2011

TOWARDS NEARLY ZERO ENERGY BUILDINGS IN IRELAND.
The public sector aims to improve its energy efficiency by 33% by 2020 as set out in the National Energy Efficiency Action Plan (NEEAP) and, in accordance with the requirements of Directive 2010/31/EU on the energy performance of buildings (recast), will be seen to lead by example in order to demonstrate clearly to all sectors what is possible through a programme of strong and committed actions Public sector buildings will adopt the proposed nearly zero-energy standard for new buildings other than dwellings two years in advance of the private sector in 2018.
TOWARDS NEARLY ZERO ENERGY BUILDINGS IN IRELAND. PLANNING FOR 2020 AND BEYOND Department of the Environment, Community and Local Government November 2012

TOWARDS NEARLY ZERO ENERGY BUILDINGS IN IRELAND.
Post 2014 to 2020, the medium to long term goals of the Department of Education and Science will be to continue to reduce energy consumption in a cost effective and affordable manner in future schools buildings. The Department's passive house research strand is one area of focus that will address potential requirements for new buildings to consume 'nearly zero' energy. The passive research strand involves the research, design and construction of two four classroom primary schools.
TOWARDS NEARLY ZERO ENERGY BUILDINGS IN IRELAND. PLANNING FOR 2020 AND BEYOND Department of the Environment, Community and Local Government November 2012

TOWARDS NEARLY ZERO ENERGY BUILDINGS IN IRELAND.
3.2.2 Educational Buildings
...........Based on the current performance of 60kWh/m2/yr for primary schools and the cost optimal curves lowest lifecycle cost of 60kWh/m2/yr for primary schools it is anticipated that an indicative value in the region of 55-60 kWh/m2/yr will be the intermediate target for primary schools. This will be further assessed in the development of TGD L Buildings other than Dwellings 2014.
TOWARDS NEARLY ZERO ENERGY BUILDINGS IN IRELAND. PLANNING FOR 2020 AND BEYOND Department of the Environment, Community and Local Government November 2012

Table 5: Indicative Intermediate and NZEB ranges for Buildings other than dwellings based on cost optimal curves.

	Indicative Current Requirement	Cost Optimal Range	Proposed NZEB Range
	$kWh/m^2/yr$	$kWh/m^2/yr$	$kWh/m^2/yr$
Retail A/C	726	227 - 338	200 - 260
Hotel A/C	507	243 - 330	243 - 285
N/V Office	247	35 - 103	35 - 70
A/C Office	366	101 - 179	100 - 135
Primary School	111	8 - 80	45 - 50

TOWARDS NEARLY ZERO ENERGY BUILDINGS IN IRELAND. PLANNING FOR 2020 AND BEYOND Department of the Environment, Community and Local Government November 2012

BASE MODEL LAYOUT

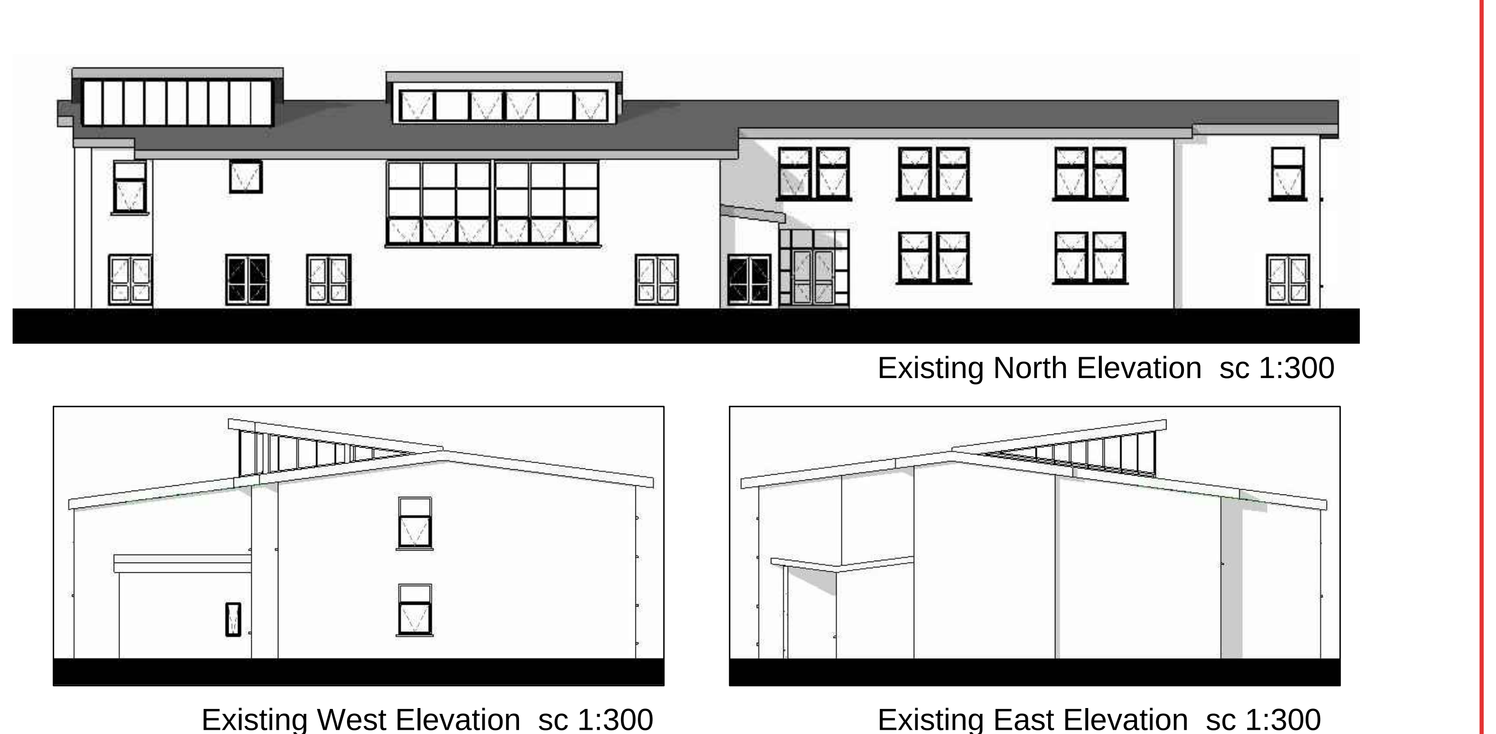
Existing Ground Floor Plan sc 1:300 — Existing First Floor Plan sc 1:300

GENERIC REPEAT DESIGN SCHOOL FROM BASE CASE → ENERPHIT RETROFIT → PASSIVE HOUSE NEW BUILD

A comprehensive energy analysis of the existing GRD was undertaken using the design software tool Passive House Planning Package (PHPP). Condensation Risk Analysis was carried out using the software Builddesk U and Linear Thermal Bridge Analysis was undertaken using the software Therm.

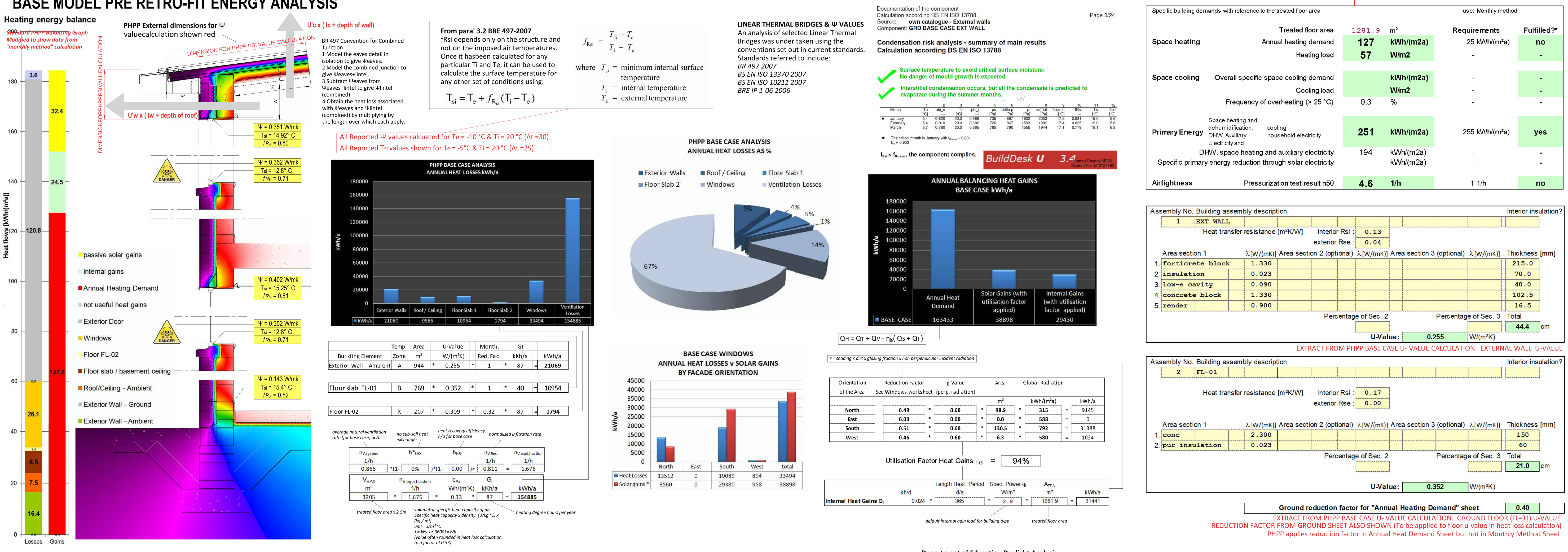
The proposed Enerphit Retrofit Solution is shown in Section AA Below and the Passive House solution is shown in Section BB. The Passive House new build is based on the same design and layout as the existing GRD school

Existing South Elevation

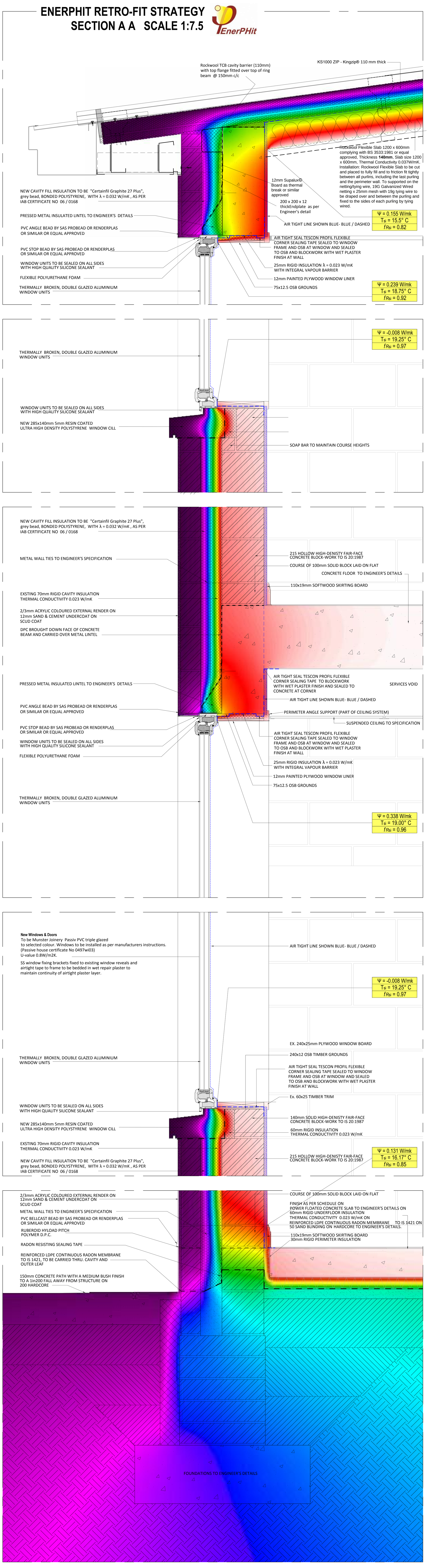


Existing North Elevation sc 1:300 — Existing West Elevation sc 1:300 — Existing East Elevation sc 1:300

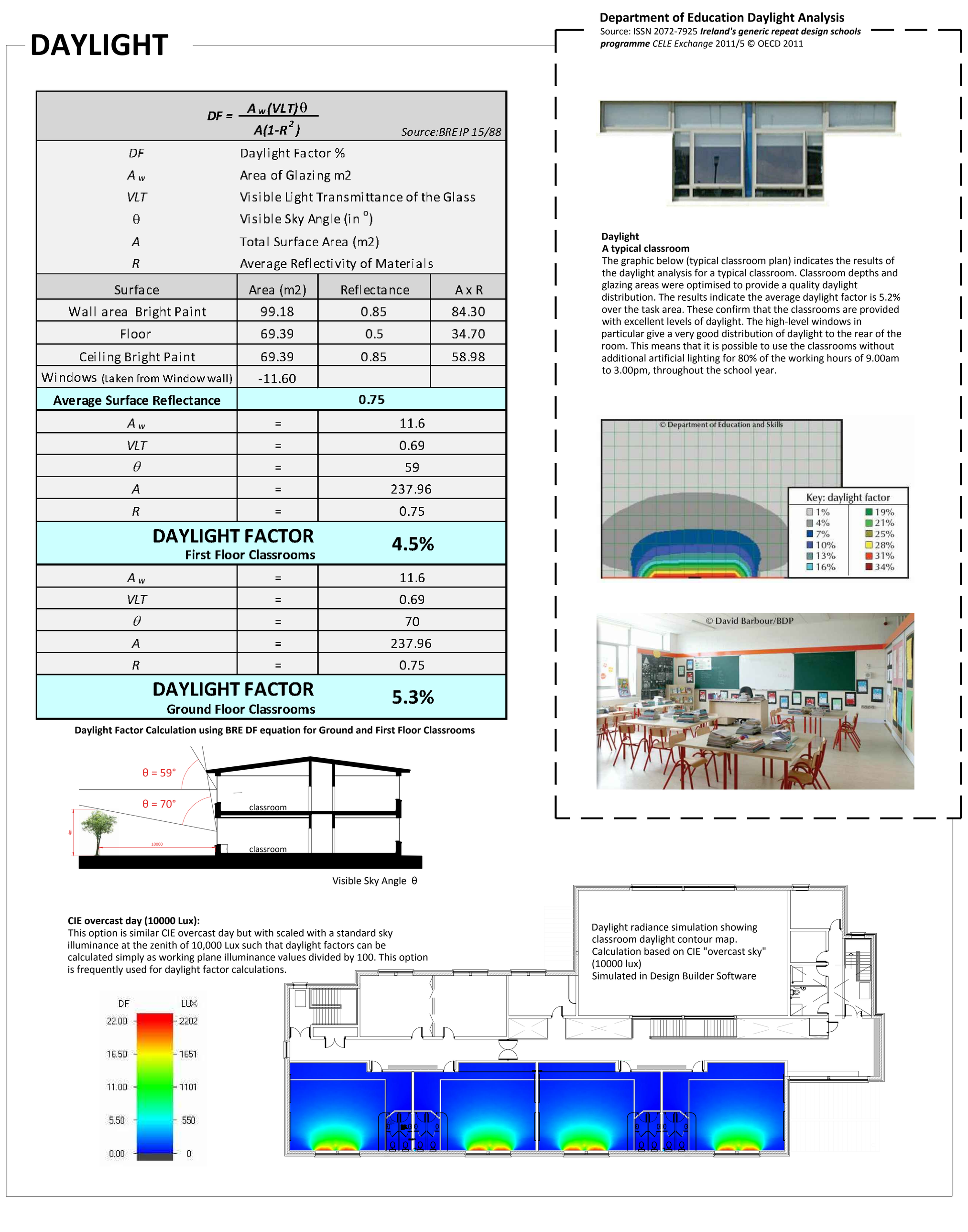
BASE MODEL PRE RETRO-FIT ENERGY ANALYSIS



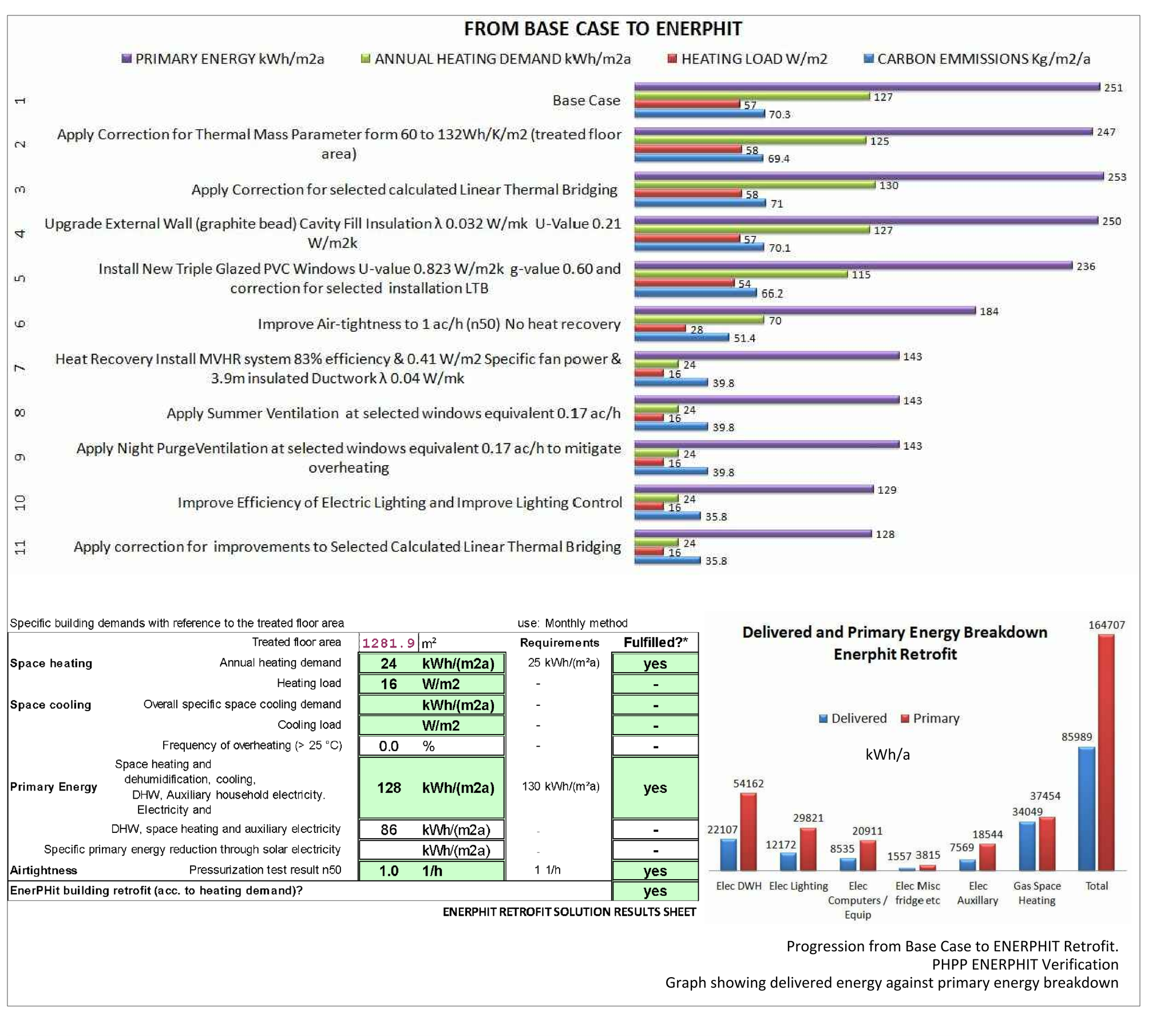
ENERPHIT RETRO-FIT STRATEGY SECTION A A SCALE 1:7.5



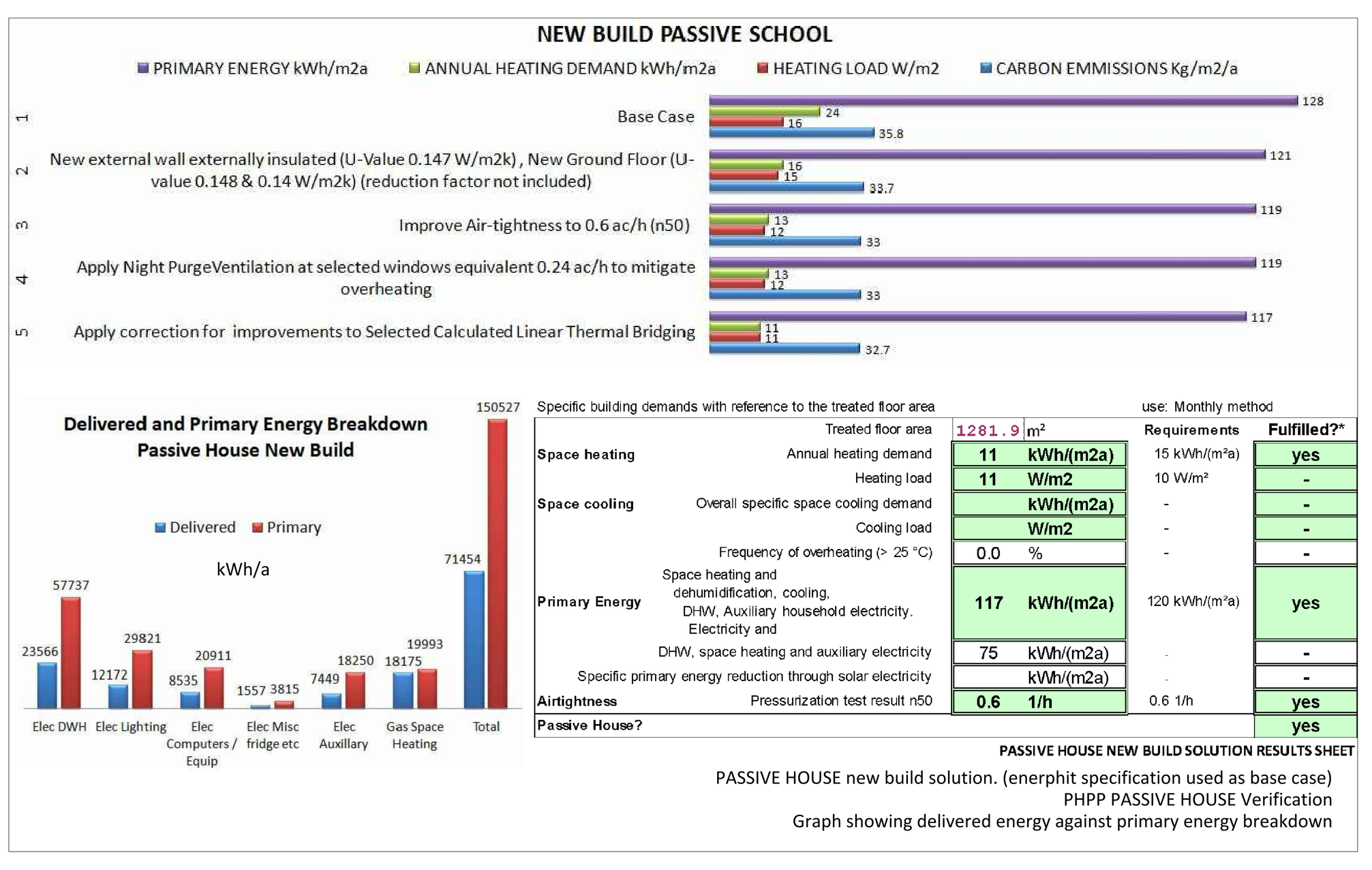
DAYLIGHT



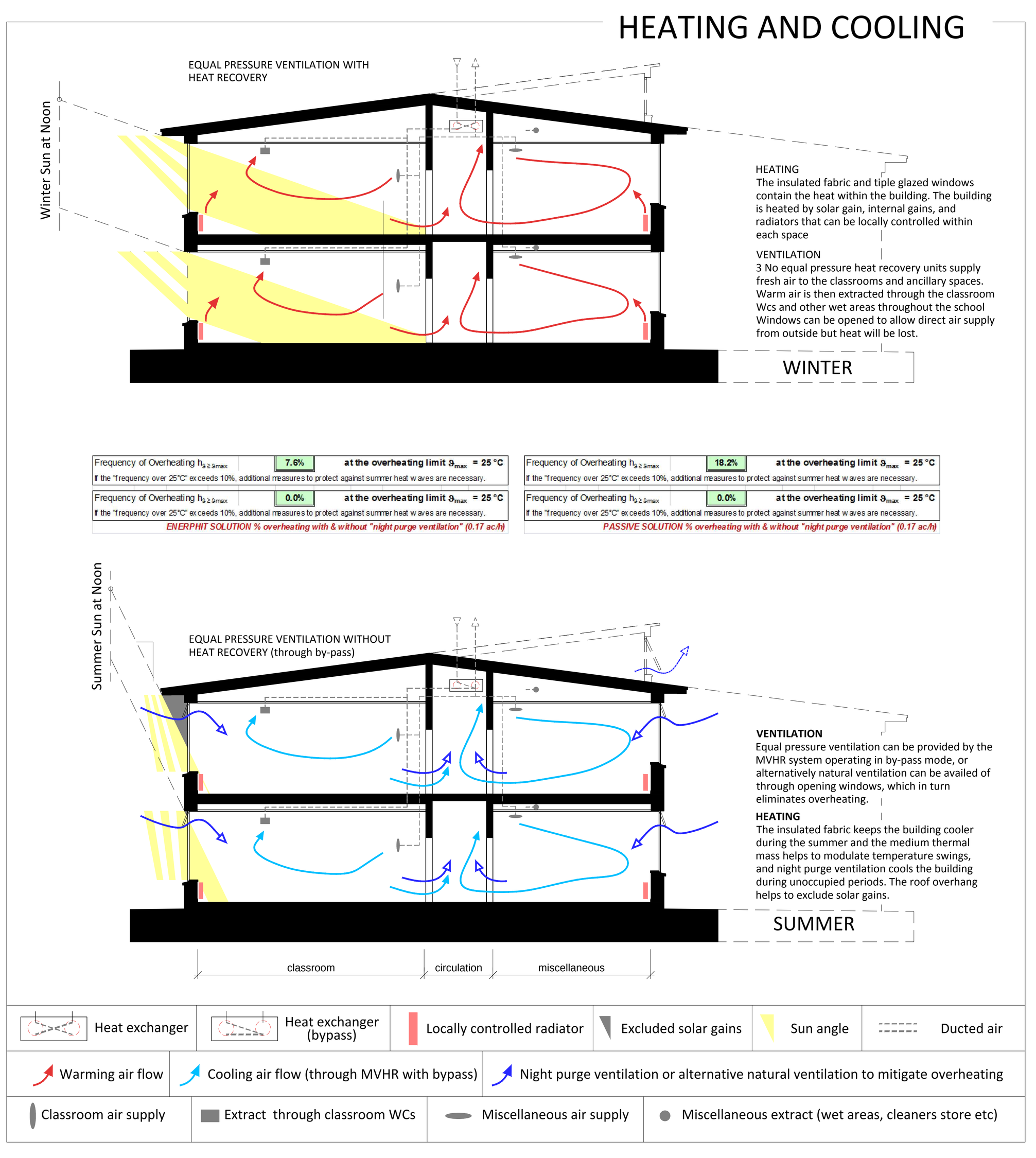
FROM BASE CASE TO ENERPHIT



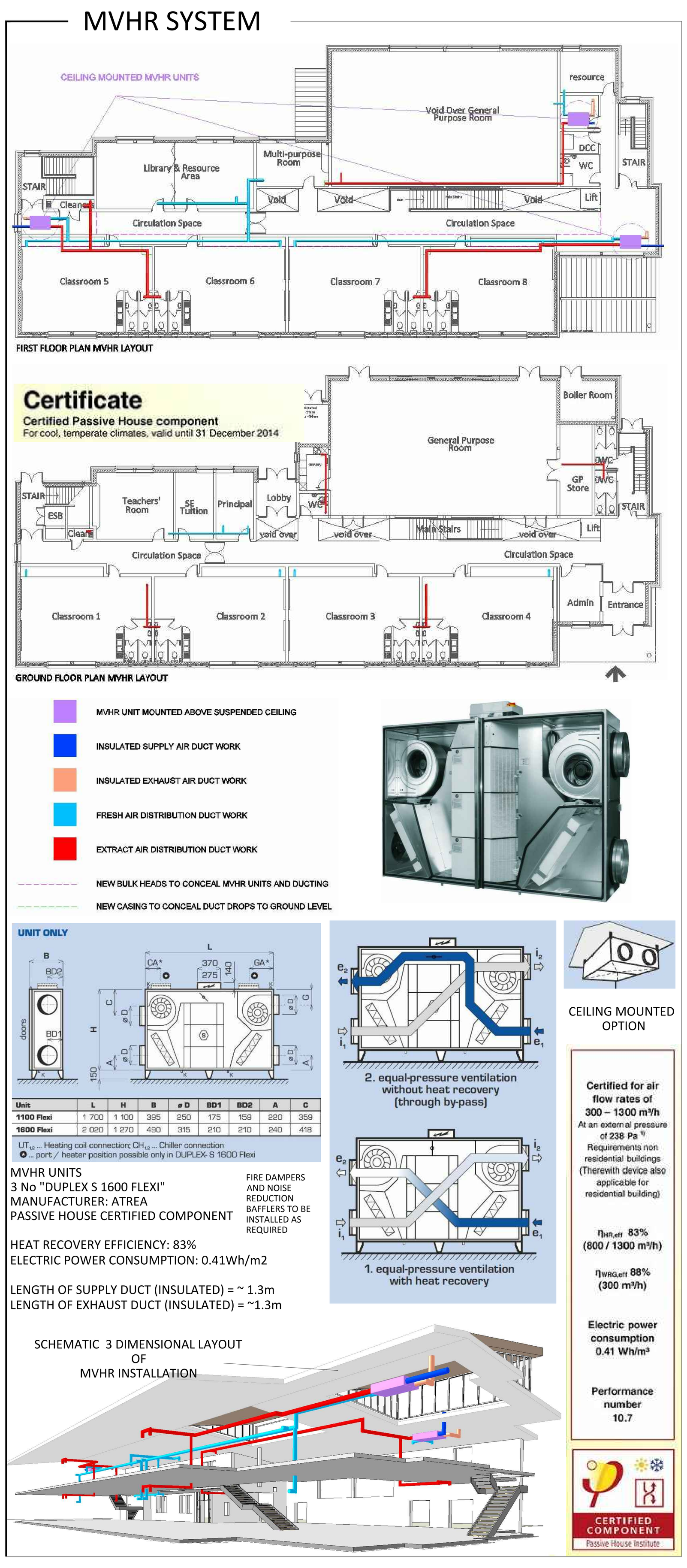
NEW BUILD PASSIVE SCHOOL



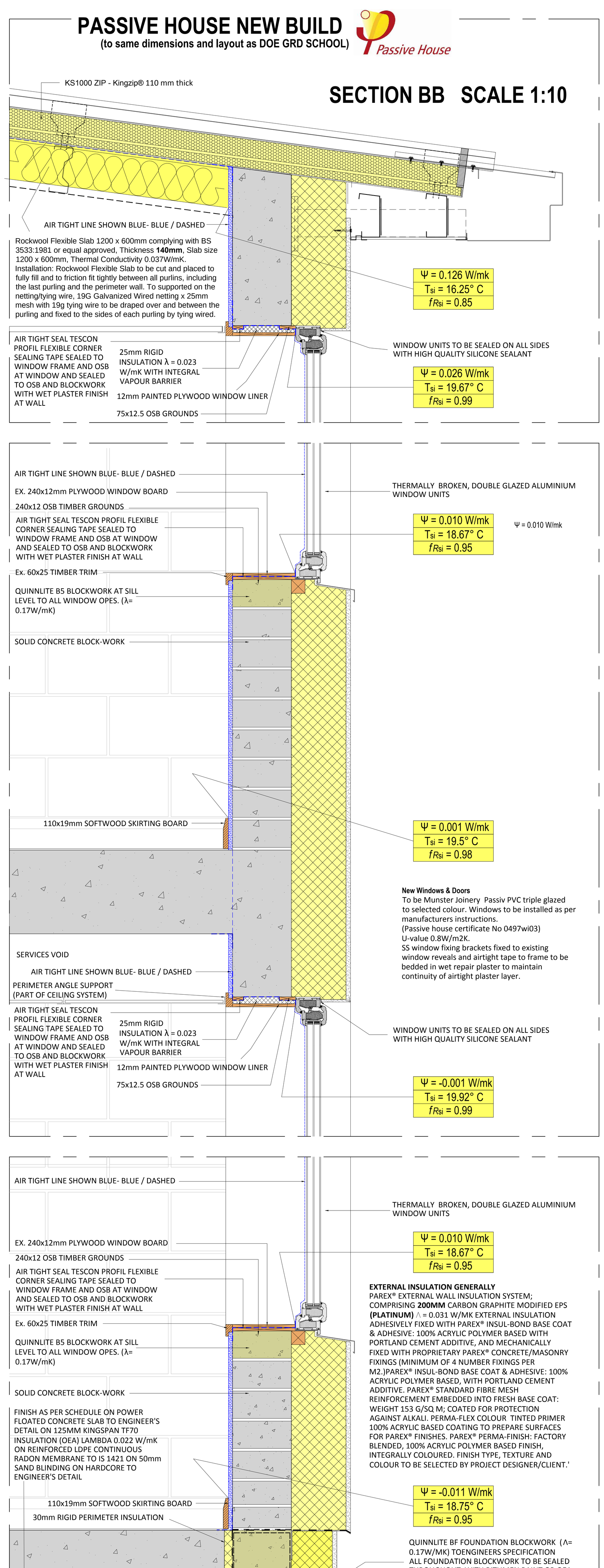
HEATING AND COOLING



MVHR SYSTEM



PASSIVE HOUSE NEW BUILD (to same dimensions and layout as DOE GRD SCHOOL) SECTION BB SCALE 1:10



Annual Heat Demand equation as applied in PHPP: $Q_H = Q_T + Q_V - \eta_g(Q_S + Q_I)$

Q_H	Annual Heating Demand kWh
Q_T	Annual Transmission heat losses kWh (Walls, Floors, Windows, Roofs, LTBs, etc)
Q_V	Annual Ventilation Losses kWh (Natural ventilation, System Ventilation, Infiltration)
Q_S	Annual available Solar Gains kWh (Window glazing, Rooflights)
Q_I	Annual available Internal Gains kWh (People, Lighting, Equipment, etc)
η_g	Reduction Factor applied to available Solar and Internal Gains

BASE CASE ANNUAL HEAT DEMAND CALCULATON $Q_H = Q_T + Q_V - \eta_g(Q_S + Q_I)$

Q_H	=	Q_T	+	Q_V	-	η_g	(	Q_S	+	Q_I	)
Q_H	=	76876	+	154885	-	0.94	(	41557	+	31441	)
Q_H	163433	kWh/a									
Q_H / Treated Floor Area	=	127 $kWh/m^2/a$									

Treated Floor Area = 1281.9m²

ENERPHIT SOLUTION ANNUAL HEAT DEMAND CALCULATON $Q_H = Q_T + Q_V - \eta_g(Q_S + Q_I)$

Q_H	=	Q_T	+	Q_V	-	η_g	(	Q_S	+	Q_I	)
Q_H	=	60000	+	30038	-	0.87	(	37395	+	31441	)
Q_H	30361	kWh/a									
Q_H / Treated Floor Area	=	24 $kWh/m^2/a$									

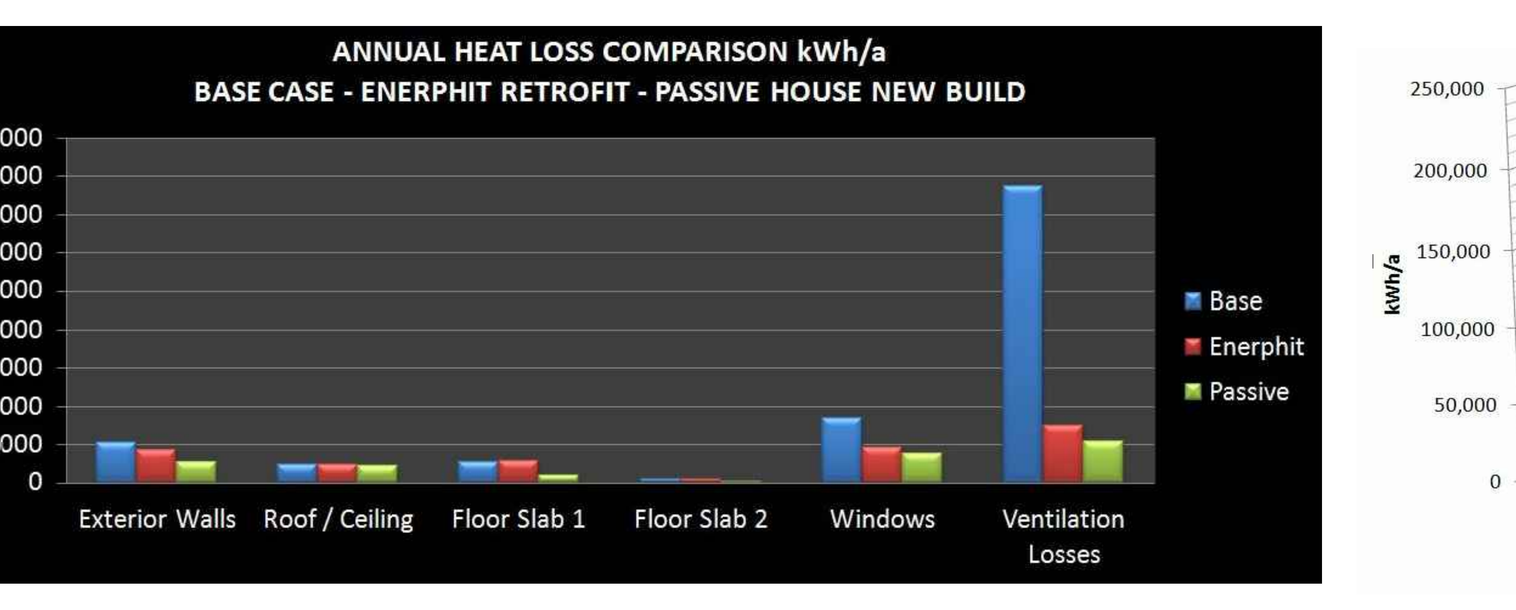
Treated Floor Area = 1281.9m²

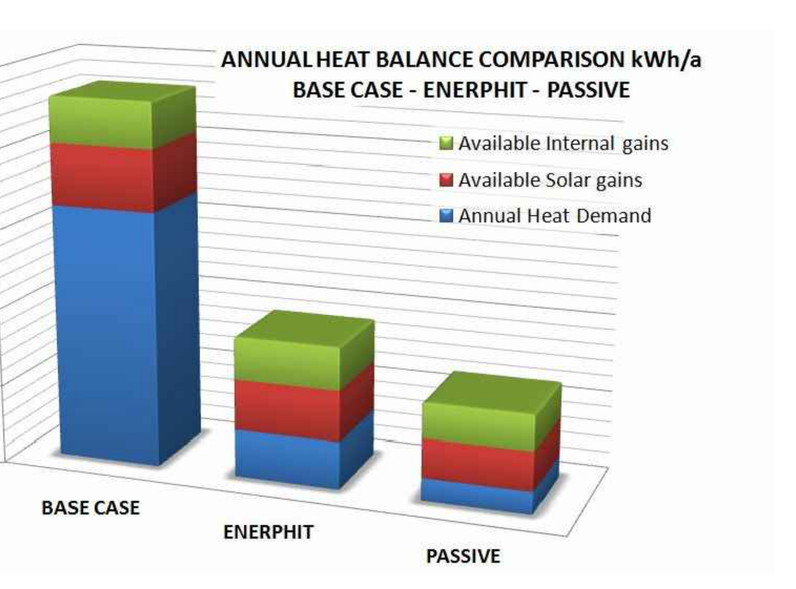
PASSIVE HOUSE SOLUTION ANNUAL HEAT DEMAND CALCULATOR $Q_H = Q_T + Q_V - \eta_g(Q_S + Q_I)$

Q_H	=	Q_T	+	Q_V	-	η_g	(	Q_S	+	Q_I	)
Q_H	=	40223	+	21485	-	0.86	(	28912	+	26101	)
Q_H	14325	kWh/a									
Q_H / Treated Floor Area	=	11 $kWh/m^2/a$									

Treated Floor Area = 1281.9m²

ELECTRIC LIGHTING & CONTROLS
Reduce lighting loads with new T5 Energy efficient flourescent lighting, with automatic dimming & linear daylight controls and motion sensors





SELECTED LTB CALCULATIONS PROGRESSION FROM BASE CASE TO ENERPHIT TO PASSIVE HOUSE

	LINEAR THERMAL BRIDGE JUNCTION all calculated on the south side classroom elevation		BASE CASE W/mK	ENERPHIT RETROFIT W/mK	PASSIVE HOUSE W/mK
1	GROUND FLOOR FL01		0.143	0.131	-0.011
2	WINDOW SILL		0.352	-0.008	0.010
3	GROUND FLOOR INTERMEDIARY FLOOR & WINDOW HEAD COMBINED	A	0.416	0.340	0.000
4	INTERMEDIARY FLOOR	B	0.014	0.002	0.001
5	GROUND FLOOR WINDOW HEAD	A-B	0.402	0.338	-0.001
6	COMBINED ROOF EAVES & 1st FLOOR WINDOW HEAD	C	0.524	0.394	0.152
7	ROOF EAVES	D	0.173	0.155	0.126
8	1st FLOOR WINDOW HEAD	C-D	0.351	0.239	0.026

Grey shaded modeled as combined junctions according to BR497-2007 Conventions.
Calculated values applied in PHPP progression from Base to Enerphit to Passive.
Not all LTB's could be modelled in the time available. In consequence the LTB losses are understated, particularly in the base case analysis.
To mitigate the effect of this understatement the Energy Savings available through applying a more favourable "wind protection coefficient" of 0.7 (equivalent to moderate shelter throught site specific planting) was not applied in either the Enerphit or Passive