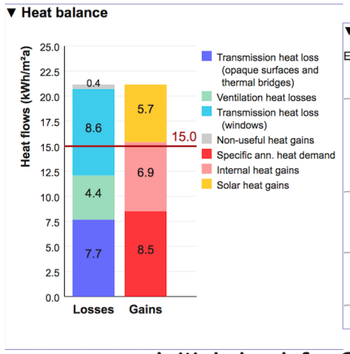


▼ Project overview

EDUCATIONAL LICENSE, NOT FOR PROFESSIONAL USE

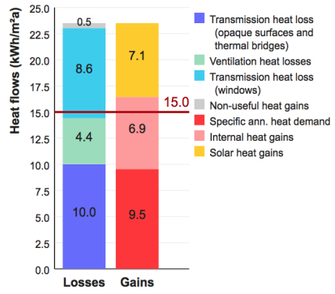
Climate	Firenze
Annual heat demand (Q_h)	8.5 kWh/m²a
Treated Floor Area (TFA)	108 m² (User-defined)
Thermal envelope area	282 m²
Heat Loss Form Factor	2.61
Projected building footprint	-.-- m²
Number of windows	22
Number of thermal surfaces	19
Number of thermal bridges	None defined
Thermal envelope checks	
The thermal envelope appears to be complete!	
Render mode	Render by Area Group

CLimate used is Firenze (which is the closest) because Milan is not in DesignPH, But it is corrected on the PH Excel sheet with Milan climate data, Hence majority of the iterations are done in the excel sheet because they couldnt be analysed or changed on designPH sketchup..

The unit with the least favourable orientation is analysed (The south facing one), because after testing, the layout was duplicated.

The building is a 3-storey so all three levels are analysed.
The first floor performs better than the rest therefore analysis for ground and second floor is presented.

Building Orientation is N-S axis, because the design is terraced units, hence suitable.



▼ Project overview

EDUCATIONAL LICENSE, NOT FOR PROFESSIONAL USE

Climate	Firenze
Annual heat demand (Q_h)	9.5 kWh/m²a
Treated Floor Area (TFA)	108 m² (User-defined)
Thermal envelope area	282 m²
Heat Loss Form Factor	2.61
Projected building footprint	-.-- m²
Number of windows	22
Number of thermal surfaces	19
Number of thermal bridges	None defined
Thermal envelope checks	
The thermal envelope appears to be complete!	
Render mode	Render by Area Group

PASSIVHAUS
Student Competition

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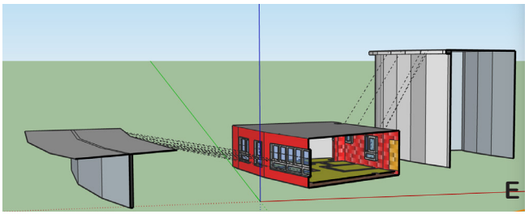
TARMAC
A CRH COMPANY

LATIFA MOHAMED

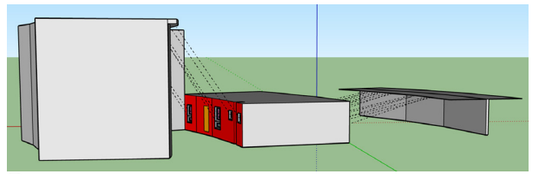
MEALAN; Versatile Food Hub

Oxford Brookes University

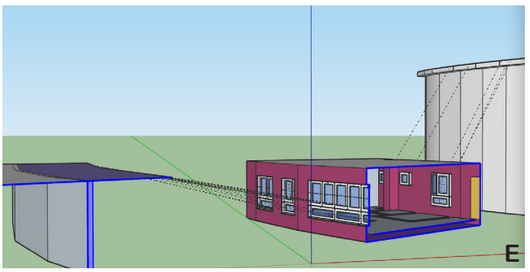
Initial check for Ground floor unit

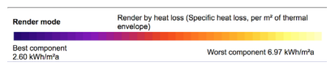


Green solid line points to the North

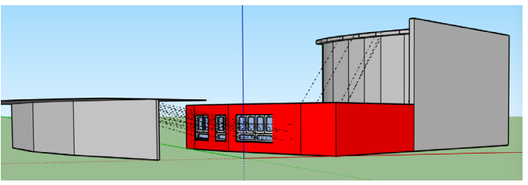


Base case

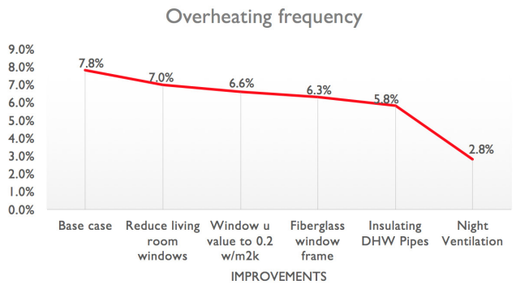




Wall thermal performance is good.



Reduce living room windows (due to high heat loss)



▼ Transmission heat loss (opaque surfaces and thermal bridges)

Group no.	Area group	Total area (m²)	Area weighted U-value (W/m²K)	Av. temp. factor	Ann. htg. degree hours (kKh/a)	Transmission heat losses (kWh/a)	Q_t (kWh/m²a)
7	External Door	2.48	0.17	1.00	41.00	17.25	0.16
8	External Wall - Ambient	114.17	0.09	1.00	41.00	442.28	4.10
9	External Wall - Ground	0.00			41.00		
10	Roof/Ceiling - Ambient	0.00			41.00		
11	Floor slab / Basement ceiling	142.06	0.11	0.60	41.00	369.13	3.42
12		0.00			41.00		
13		0.00			41.00		
14	Temperature zone X	0.00			41.00		
15	Thermal Bridges Ambient	0.00			41.00		
16	Perimeter Thermal Bridges	0.00			41.00		
17	Thermal Bridges Floor Slab / Basement Ceiling	0.00			41.00		
18	Partition Wall to Neighbour	171.12	0.10	0.00	41.00	0.00	0.00
		429.84				828.66	7.68

▼ Solar heat gains

Group no.	Area group	Win. area (m²)	Glazing area (m²)	g-value	Reduction factor	Radiation, G_s	Solar heat gains (kWh/a)	Q_s (kWh/m²a)
2	North Windows	0.00	0.00				0.00	0.00
3	East Windows	5.70	2.81	0.50	0.03	122.06	10.04	0.09
4	South Windows	0.00	0.00				0.00	0.00
5	West Windows	17.57	9.09	0.50	0.31	213.23	577.91	5.36
6	Horizontal Windows	0.00	0.00				0.00	0.00
		23.27	11.90				587.95	5.45

▼ Transmission heat loss (windows)

Group no.	Area group	Total area (m²)	Area weighted U-value (W/m²K)	Av. temp. factor	Ann. htg. degree hours (kKh/a)	Transmission heat losses (kWh/a)	Q_t (kWh/m²a)
2	North Windows	0.00			41.00		
3	East Windows	5.70	1.01	1.00	41.00	236.25	2.19
4	South Windows	0.00			41.00		
5	West Windows	17.57	0.96	1.00	41.00	694.04	6.43
6	Horizontal Windows	0.00			41.00		
		23.27				930.29	8.62

Maximum heat loss from windows, due to size and higher U-value.

▼ Transmission heat loss (windows)

Group no.	Area group	Total area (m²)	Area weighted U-value (W/m²K)	Av. temp. factor	Ann. htg. degree hours (kKh/a)	Transmission heat losses (kWh/a)	Q_t (kWh/m²a)
2	North Windows	0.00			41.00		
3	East Windows	5.70	0.49	1.00	41.00	114.05	1.06
4	South Windows	0.00			41.00		
5	West Windows	17.57	0.45	1.00	41.00	324.48	3.01
6	Horizontal Windows	0.00			41.00		
		23.27				438.52	4.06

Transmission heat loss reduced to half when frame and glazing type was changed

Specific building demands with reference to the treated floor area

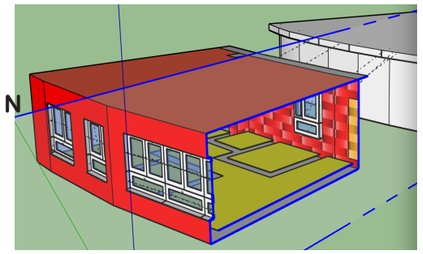
				Requirements	Fulfilled?*
	Treated floor area	107.9	m²		
Space heating	Heating demand	5	kWh/(m²a)	15 kWh/(m²a)	yes
	Heating load	6	W/m²	10 W/m²	yes
Space cooling	Overall specif. space cooling demand	7	kWh/(m²a)	18 kWh/(m²a)	yes
	Cooling load	4	W/m²	-	-
	Frequency of overheating (> 25 °C)		%	-	-
Primary energy	Heating, cooling, auxiliary electricity, dehumidification, DHW, lighting, electrical appliances: DHW, space heating and auxiliary electricity	72	kWh/(m²a)	120 kWh/(m²a)	yes
	Specific primary energy reduction through solar electricity	37	kWh/(m²a)	-	-
			kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	0.6	1/h	0.6 1/h	yes

* empty field: data missing; "-": no requirement

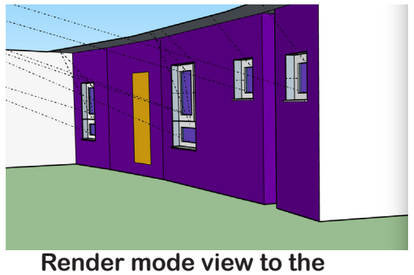
Passive House? yes

Other Improvements, such as shading was done on excel sheet because the shading used would overload the system, also ventilation type was changed, cooling strategies were improved for final results.

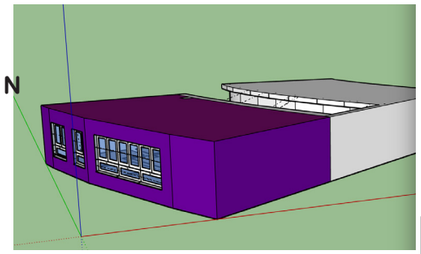
Initial check for Second floor unit

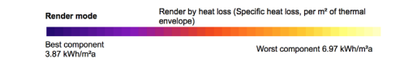


Base case



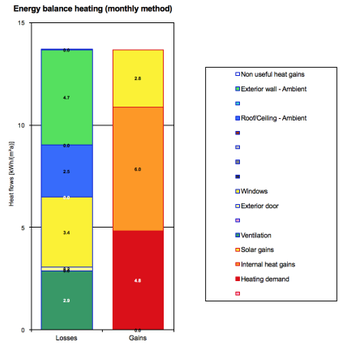
Render mode view to the courtyard. (base case)

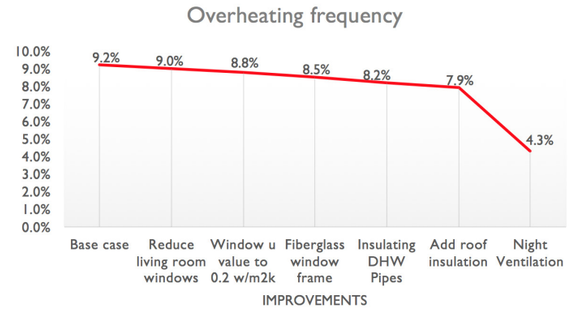


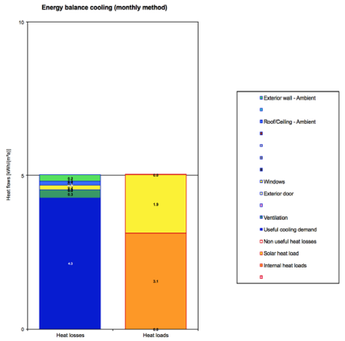


The roof is losing more heat than the walls, hence insulation will be added to the exterior, for better performance. Ground floor unit, perfoms better than the second floor unit because it's more shaded

Same changes as Ground floor unit were done to minimise the demand and also frequency of overheating.







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	Cooling load	4	W/m²	-	-
	Frequency of overheating (> 25 °C)		%	-	-
Primary energy	Heating, cooling, auxiliary electricity, dehumidification, DHW, lighting, electrical appliances: DHW, space heating and auxiliary electricity	72	kWh/(m²a)	120 kWh/(m²a)	yes
	Specific primary energy reduction through solar electricity	37	kWh/(m²a)	-	-
			kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	0.6	1/h	0.6 1/h	yes

* empty field: data missing; "-": no requirement

Passive House? yes

Final result

Design & development:

- Key design Iterations; Reducing the number of livingroom windows, changing the glazing type to CUIN insulating glass, changing the frame type to fiberglass, Insulating Domestic hot water pipes, improve night ventilation, adding roof insulation for second floor unit, changing all lights to LED.
- The size of the windows is left the same because the glazing and frame have been improved to high thermal performance therefore reducing more window size would result to more wall ratio than glazing hence increase in demand because the u-values for walls is greater than the windows.

designPH