ENERGY EFFICIENCY & GREEN BUILDING IN MOROCCO

02 MARS 2023

Who Are We?

2. WHO AM I ?

Mr. Zakaria Sadik, energy & sustainability engineer,
17 years experience

- Energy and Environment Trainer and Auditor, for building and industry

- European Passive House Designer (CEPH)

- HQE Certified Auditor and Referee™

- Expertise in:
Energy efficiency for building, Renewable Energy, comfort, health and well-being

- Adviser to the Morocco Green Building Council

- Managing Director of ALTO EKO

2. Who Are We?

ALTO EKO

Since its launch in 2016, ATO-EKO has supported its clients in the implementation of environmental and energy solutions adapted to their needs, at the scale of territories and buildings in Marco and Africa.

Through its expertise, ALTO-EKO works to improve the sanitary quality of spaces, to improve the comfort and living environment of building occupants by integrating the economic interest of customers and users through the overall cost approach.

Who Are We?

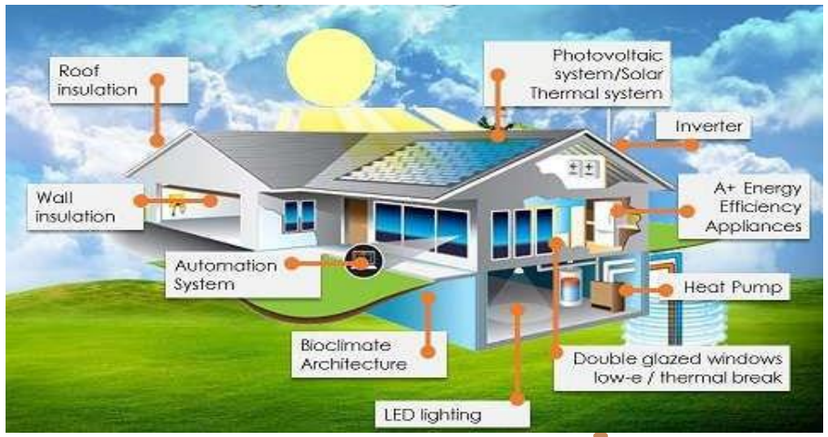
ALTO-EKO brings together a team of independent, open and experienced environmentalists who master all the environmental, energy, health and social aspects of the building: engineers, urban planners, architects, ecologists, and economists.

We provide our customers and partners with a strong capacity for innovation. Beyond certifications and qualifications, a whole team is at the service of the built environment of tomorrow.

Our Vision, Our Mission

Positively impact our environment by bringing pragmatic and competitive solutions to your projects. Serving your well-being as a user and satisfying your present and future expectations.

ALTO-EKO intervenes from the design to the operation of the building. We support project owners in their decisions and arbitrations, by providing relevant technical and environmental solutions, in particular resulting from our practice of project management design.



3. Our Missions

Missions

- Design and Optimization of buildings
- Evaluation of comfort in buildings
- Environmental certification
- Training and coaching

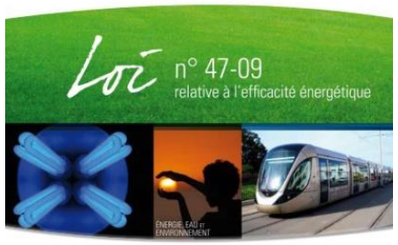
Credentials

- LEED Accredited Professionals
- HQE international and planning referents
- WELL accredited professionals
- BREEAM International Assessors
- Passive House Designer
- Certified Building Commissioning Professional - CBCP®

Local Context

Knowledge of the local regulatory context:

- Law 13-09 of Renewable Energy
- Law 47-09 of Energy Efficiency
- Decree 2-13-874 of Minimum Envelope performance
- ILTIZAM LABEL



BINAYATE By ADEREE

Certifications

Perfect knowledge of **HQE, LEED, WEEL, BREEAM, EDGE, OSMOZ and PASSIVHAUS** approaches since their launch in Morocco, with participation in several hundred certification operations.

U.S. GREEN BUILDING COUNCIL LEED USGBC

INTERNATIONAL WELL BUILDING INSTITUTE WELL

CODE FOR A SUSTAINABLE BUILT ENVIRONMENT BREEAM

HQE Edge Excellence In Design For Greater Efficiencies

LABEL Osmoz RÉFÉRENT RECONNU PAR CERTIVÉA

Passive House Institute

LABEL LA ACCESSIBILITÉ

Building Performance

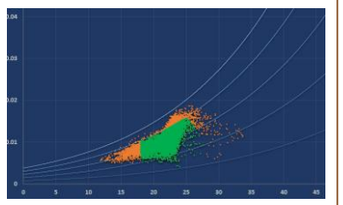
Realization of new and efficient studies on internationally recognized software :

- Dynamic Energy Modeling
- Thermal Comfort
- Daylighting
- Computational Fluid Dynamics
- Cabon Footprint
- Lighting Study – DIALUX

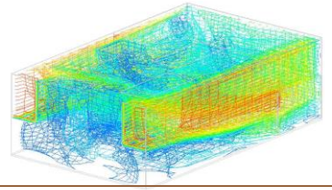
DesignBuilder SOFTWARE

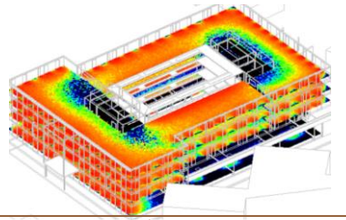
IES INTEGRATED ENVIRONMENTAL SOLUTIONS

PHPP



One Click LCA



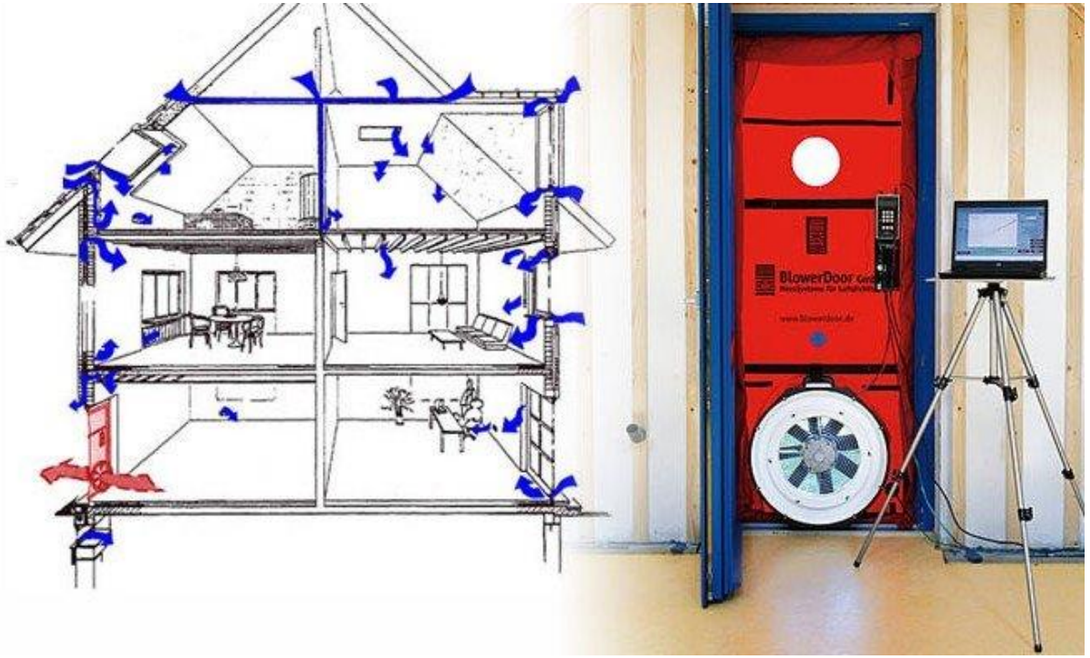


TRAINING ITEMS : HQE, LEED, BREEAM CERTIFICATION, ENERGY EFFICIENCY, RENEWABLE ENERGY

Formation LEED AP-GA V4 – SOGEA-SEGELEC Maroc

Formation LEED AP-GA BREEAM et HQE V4 – CMS

COMMISSIONING & VERIFICATION



Commissioning briefcase : Acoustic, Lighting, Air quality, Humidity, Water quality,

Blower Door Test
airtightness of the envelope

Electromagnetic Waves testing

Infrared thermal camera

4. REFERENCES

Linkcity Lot 76-1 Casa Anfa

Accompagnement certification HQE

McKinsey Office

AMO certification LEED ID+C

Centre commerial Cosmos

Audit Certification Edge

Siège FGIS Gabon

Accompagnement et audit Edge

Le Continental & Casa Business Tower

Suivi de chantier à faibles nuisances

Siège Société Generale

Concours HQE-Osmoz et Etudes écologue

Ocean Park Zenata

Etudes énergétiques et environnementales

Usine Roche

Conseil développement durable et études

Yazaki Meknes

Etude de faisabilité et feuille de route

Zenata Tower

Etudes thermiques et acoustiques et Conseil

Extension Université Privé de Fes

Audits certification Edge

Rue des Jardins

Audit Certification Edge

Siège CFG

Accompagnement certification LEED

Siège Munisys

Conformité RTCM

Usine Sensyo Pharmatech Lion

Accompagnement à la RTCM

Mastercard Office

Cité de la Gastronomie et du Vin

Villas particuliers

Ambassade Belge

Samae School Bouskoura

Example of a project

Energy Efficiency

&

PassivHaus

PRESENTATION NOTE - PASSIVHAUS

©Groupe 3A Architectes

PATRIMONIA

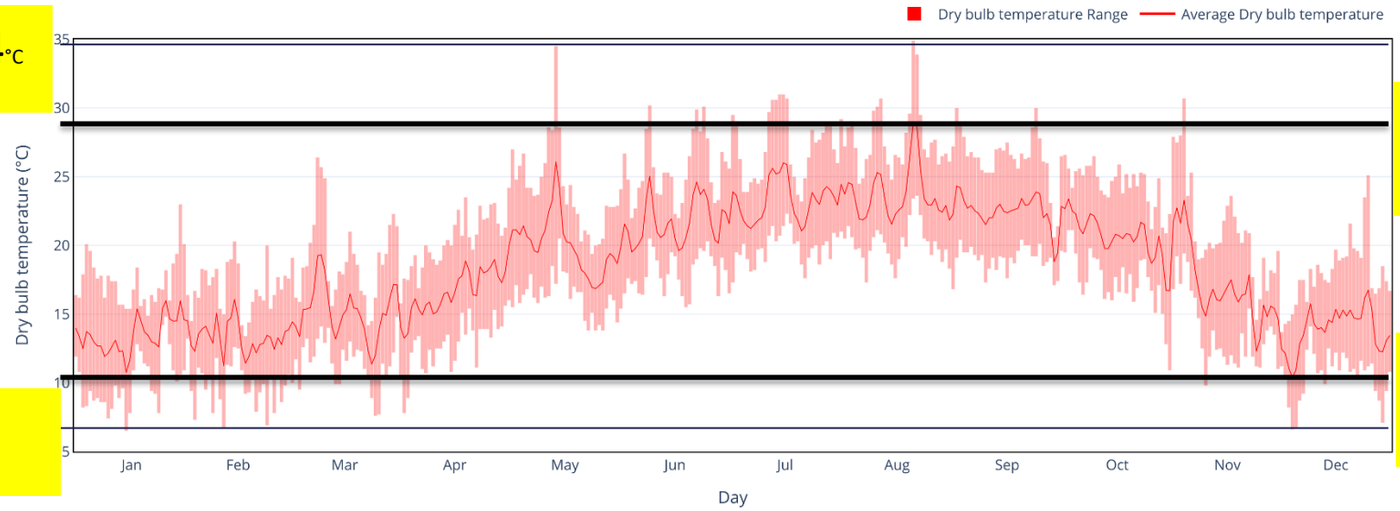
OFFICE BUILDING

By | ALTO EKO
www.alto-eko.com .

12/05/2023

Climate – Temperature and humidity

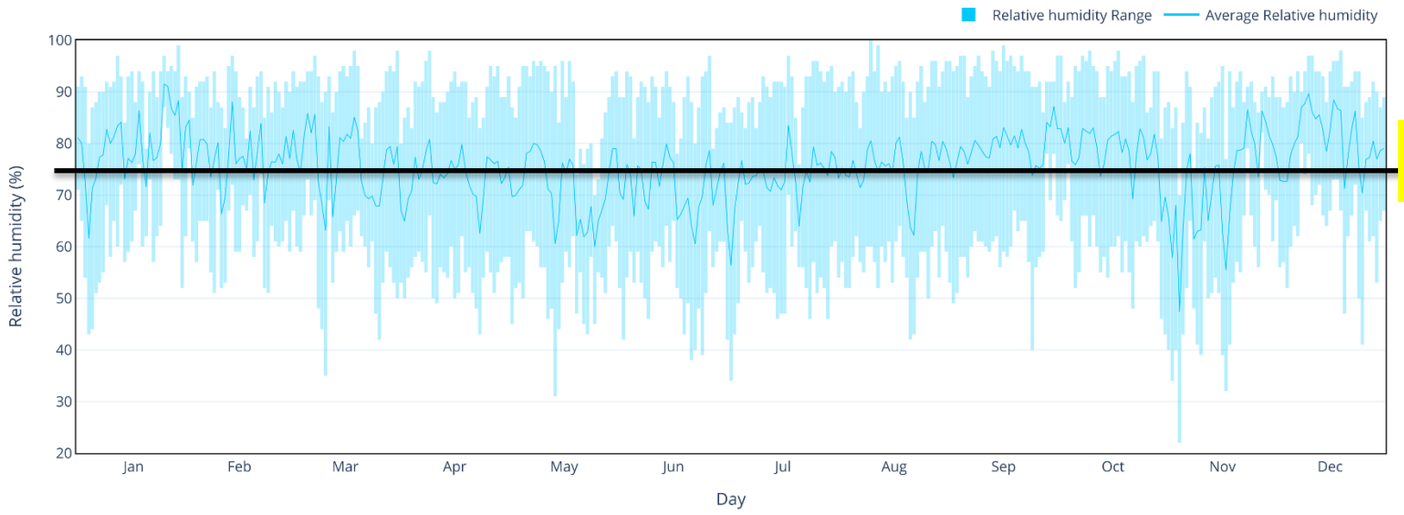
34°C
mini



29°C
Moyenne
haute jour

10°C
Moyenne
Basse jour

6°C
maxi



75%

Temperature

The average daily temperature in Casablanca varies between 10°C and 29°C giving an annual average of 18.5°C. An absolute daily maximum (resp. minimum) above 34°C (resp. 7°C) can be observed.

Relative Humidity

The annual average Relative Humidity (RH) in Casablanca exceeds 75%. It can be observed that the maximum daily RH can reach 95% and go down to 22% depending on the time of day.

5. PASSIVHAUS PROJECT- PRINCIPLES

PASSIVHAUS

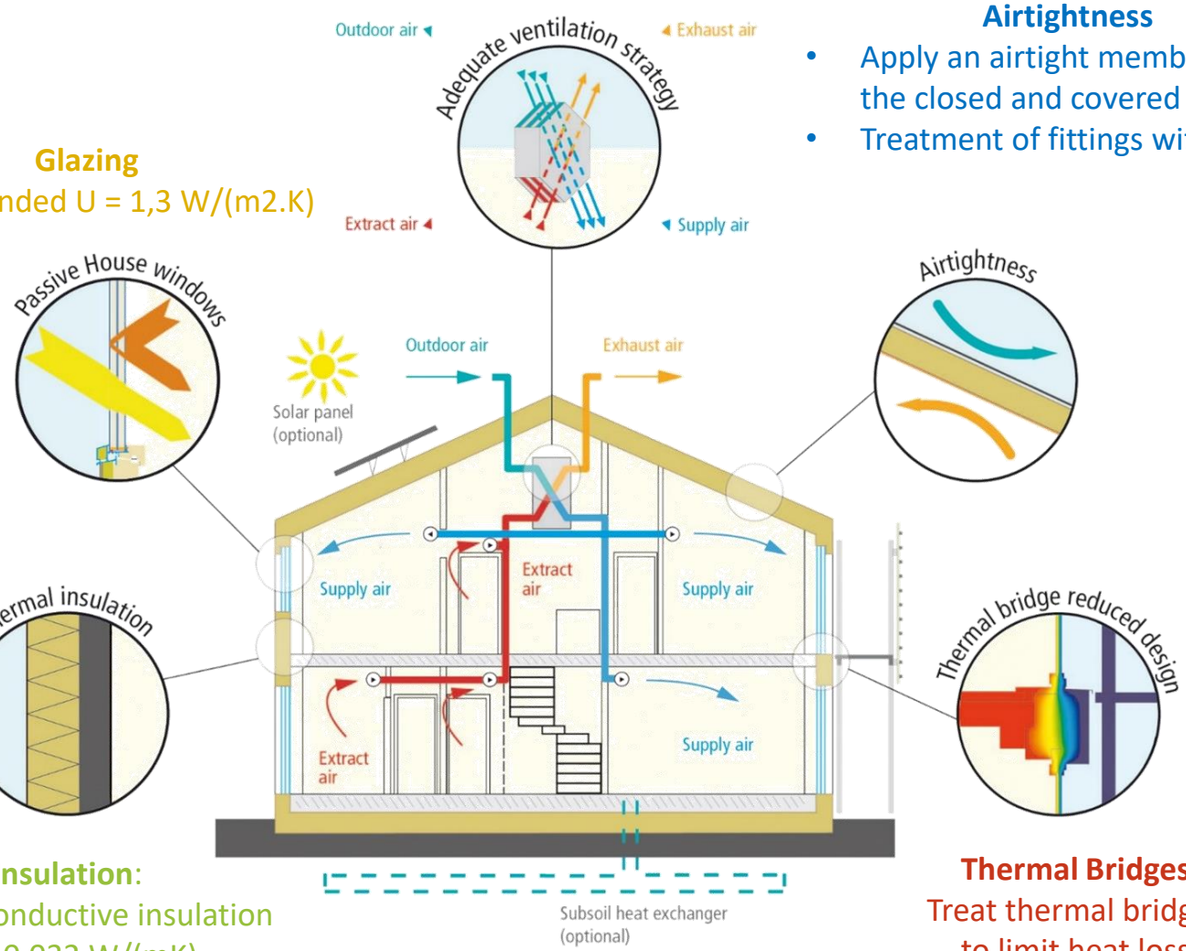
The PASSIVHAUS is a German label for the energy performance of buildings. It is granted to new airtight dwellings with low energy consumption.

Passive House Institute

Heating	Heating demands ≤ 15 kWh/m².year
Cooling	Cooling demands ≤ 15 kWh/m².year
Energy	Primary energy consumption ≤ 120 kWh/m².year
Airtightness	maximum infiltration of 0.6 vol/h for an n50 test
Comfort	A maximum of 5% of occupancy hours with a temperature > 25°C to be crossed with standard EN15251 or ASHRAE 55.

Ventilation:
Double flow mechanical ventilation

Glazing
Recommended U = 1,3 W/(m2.K)



Airtightness

- Apply an airtight membrane at the closed and covered level
- Treatment of fittings with a liquid

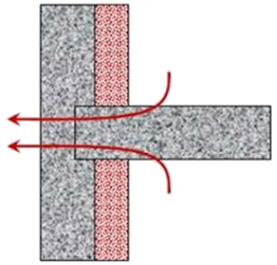
Insulation:
thermal conductive insulation
λR < 0.032 W/(mK)

Thermal Bridges
Treat thermal bridges to limit heat loss

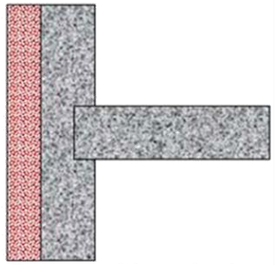
5.1. PASSIVHAUS PROJECT- INSULATION

Recommended Best practices

External thermal insulation is recommended. It does not represent a loss of surface and reduces thermal bridges.



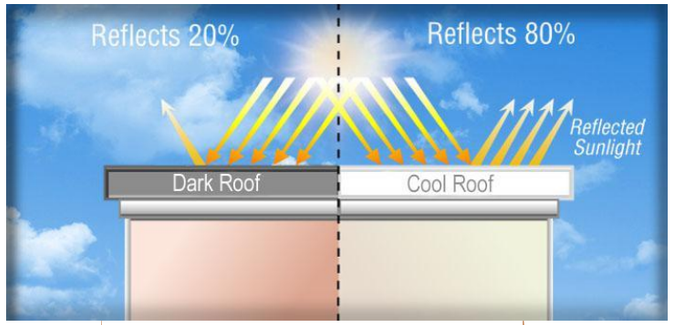
Internal insulation



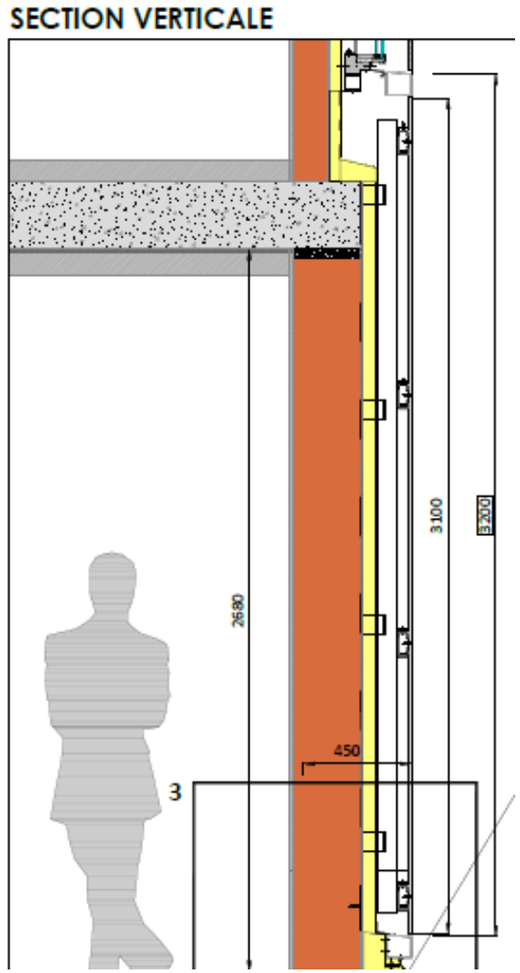
External insulation

In order to reduce the heat island effect and to avoid facade overheating, apply external coatings with the following SRIs:

- **Flat roofs (inclination ≤ 10°): SRI ≥ 90**
- **Sloped roofs (inclination ≤ 10°): SRI ≥ 50**



PATRIMONIA Project



PHPP Requirements

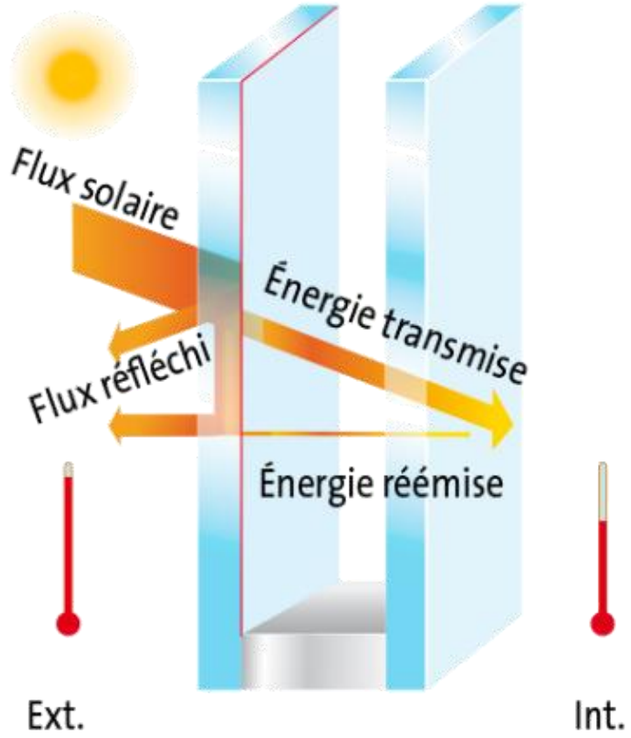
For hot to very hot climates, the thermal transmissions of the ceiling and the glazing can only exceed the EnerPHit requirements if exterior solar protection is provided. The characteristics of the glazing must be assessed according to ISO 1077-2 (thermal performance of windows), EN 673 (thermal transmission) and EN 410 (VLT and SHGC).

Climate zone according to PHPP	Windows (including exterior doors)				
	Overall[4]			Glazing[5]	Solar load[6]
	Max. heat transfer coefficient ($U_{D/W,installed}$)			Solar heat gain coefficient (g-value)	Max. specific solar load during cooling period
	[W/(m²K)]			-	[kWh/m²a]
					
Arctic	0.45	0.50	0.60	U_g - g*0.7 ≤ 0	
Cold	0.65	0.70	0.80	U_g - g*1.0 ≤ 0	
Cool-temperate	0.85	1.00	1.10	U_g - g*1.6 ≤ 0	
Warm-temperate	1.05	1.10	1.20	U_g - g*2.8 ≤ -1	
Warm	1.25	1.30	1.40	-	100

Recommended Best practices

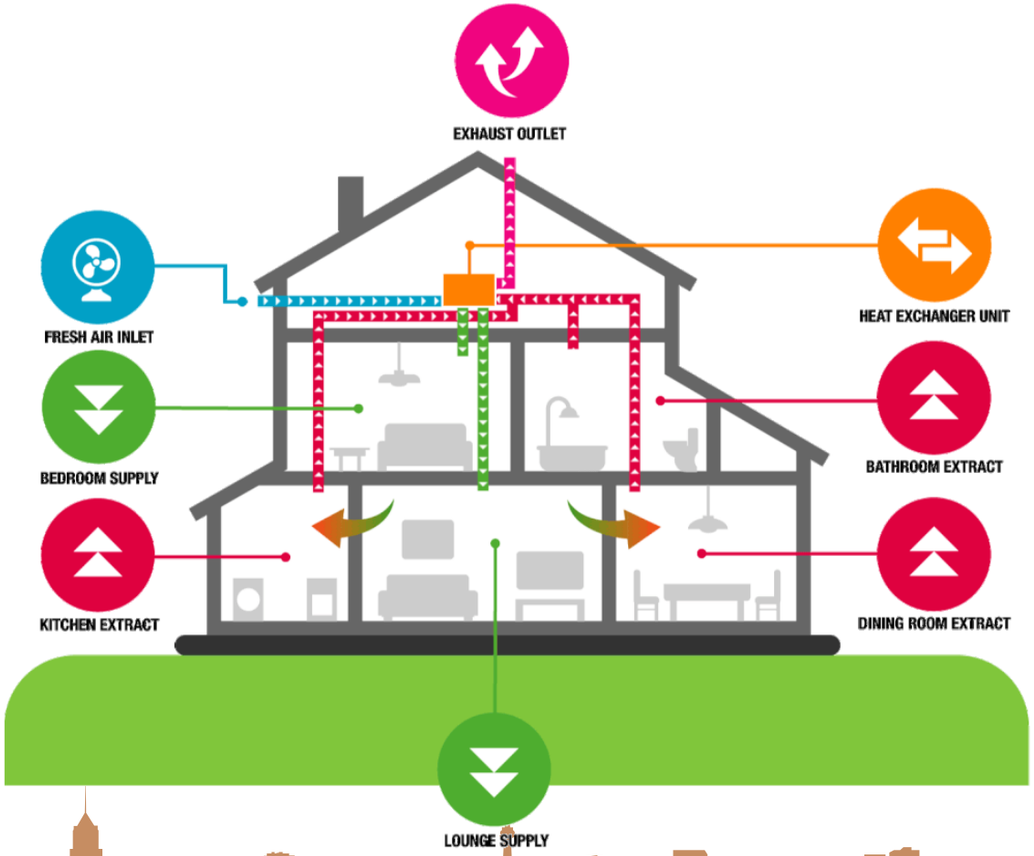
Double glazing with solar protection with the following characteristics is recommended:

- **FS: about 0.35;**
- **Ug: between 1 and 1.3 (W/m2.k)**



PHPP Requirements

Install mechanical ventilation with heat recovery (MVHR) with a minimum efficiency of 75%.
This requirement is not mandatory in hot climates.

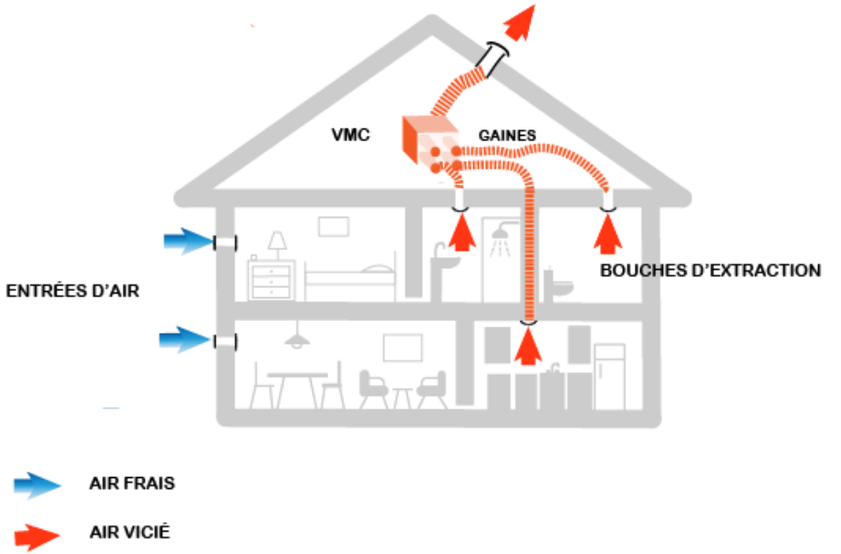


Recommended Best practices

The MVHR is not necessary in hot climates, since the number of hours below 15°C remains minimal in comparison. Admittedly, this solution presents an energy gain during heating periods, but in our case the energy losses of the pressure drops are substantial.

Simple Flow Mechanical Ventilation ensures the expected ventilation and comfort performance.

Operation of Mechanical ventilation



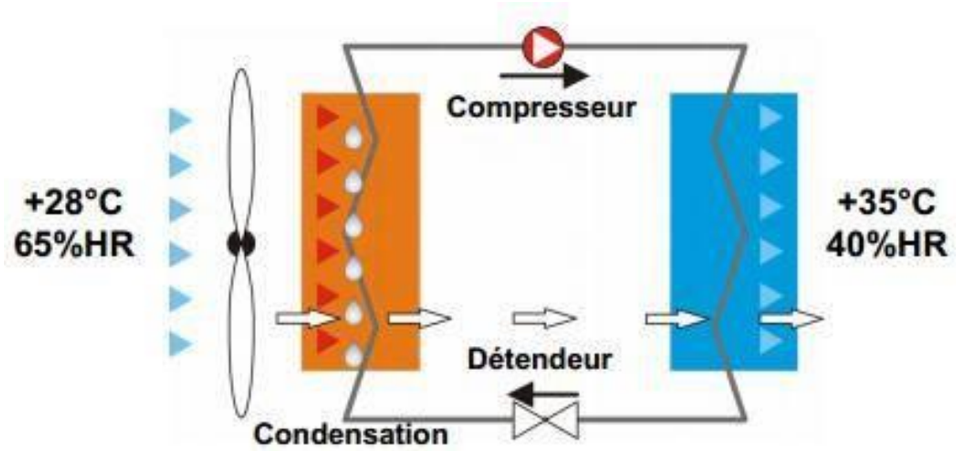
PHPP Requirements

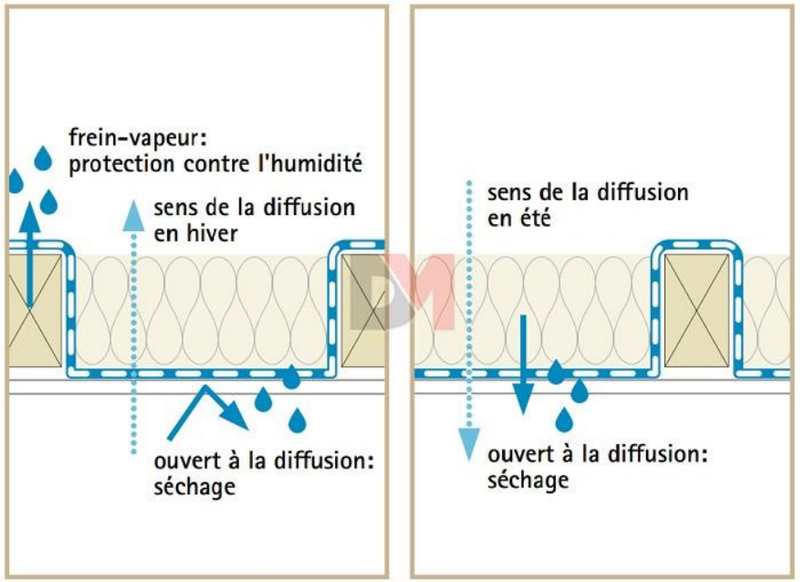
Assumption: humidity = 10 g/Person.h

Climate zone	Min. temperature factor $f_{Rsi=0.25\ m^2K/W}$ []
Arctic	0.80
Cold	0.75
Cool-temperate	0.70
Warm-temperate	0,65
Warm	0.55
Hot	-
Very hot	-

Recommended Best practices for Occupants Comfort

- All spaces must be ventilated;
- Equipment noise must be limited to 30db(A);
- All spaces with extended occupancy must have at least one openable window;
- Provide users with non-automatic devices for controlling and regulating lighting and solar protection;
- Provide users with devices allowing them to act on HVAC systems;
- Install dehumidification systems and anti-mold/condensation devices

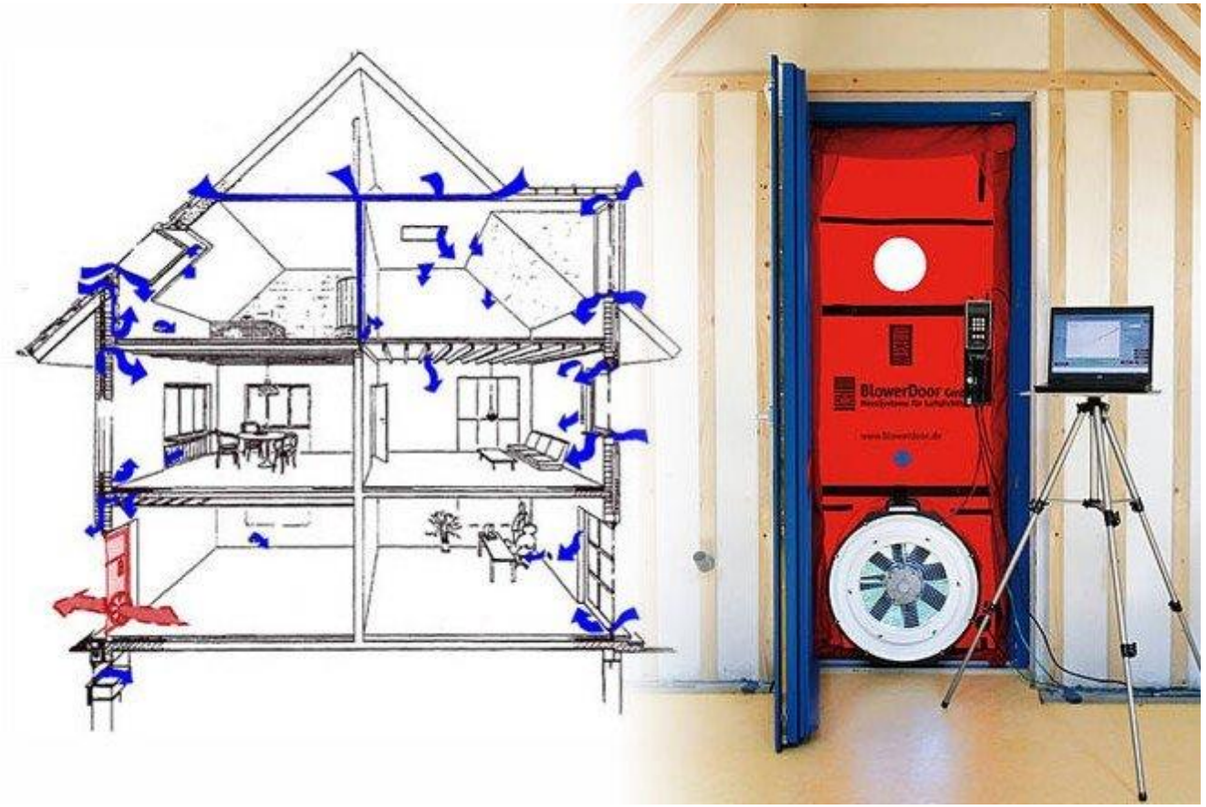




5.5. PASSIVHAUS PROJECT- AIRTIGHTNESS

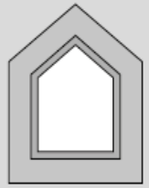
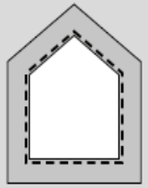
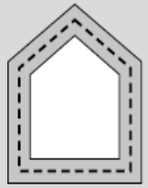
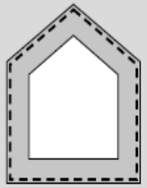
PHPP Requirements

Ensure good airtightness of the envelope so as to limit infiltration to less than 0.6 vol/h for an n50 blower door test according to EN 13829 (method A).



Recommended Best practices

- Identify the layer that will act as a barrier to infiltration at the level of the envelope and provide the details;
- Apply a liquid product at the building connections;
- To ensure the continuity of the waterproof membrane, apply a sealant.

Possibilité de disposition				
Revêtement intérieur comme couche d'étanchéité à l'air	Couche intérieure d'étanchéité à l'air	Couche d'étanchéité à l'air à l'intérieur de l'isolation thermique	Coupe vent étanche à l'air	Enveloppe du bâtiment massive étanche à l'air
				
Exemples de matériaux pour la couche d'étanchéité à l'air				
- Panneau en aggloméré - Panneau en carton-plâtre - Panneau en contre-plaqué - Panneau en fibres de bois	- (Papier Kraft) * - Feuilles plastiques - Papier ciré - Papier huilé - Feuilles recouvertes d'alu	- (Papier Kraft) * - Feuilles plastiques - Papier ciré - Papier huilé - Feuilles recouvertes d'alu	- Papier Kraft - Feuilles plastiques très perméables à la vapeur	- Béton - Mur en pierre - crépi - non crépi - Mur en brique - crépi - non crépi - Briques silico-calcaires - crépi - non crépi - Mur en pierre isolées ou spéciales - crépi

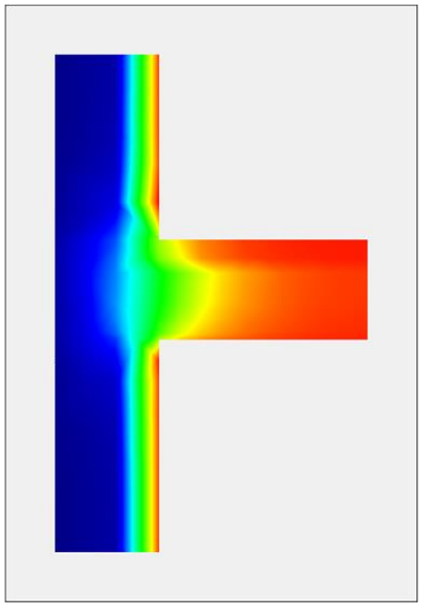
5.6. PASSIVHAUS PROJECT- THERMAL BRIDGES

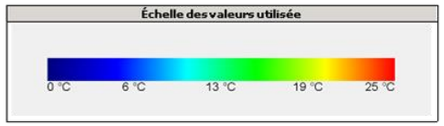
PHPP Requirements

Thermal bridges must be calculated according to EN ISO 10211. Details of all building connections must be provided.

Analyse du pont thermique linéaire IT.2.1 (NF EN ISO 10211)

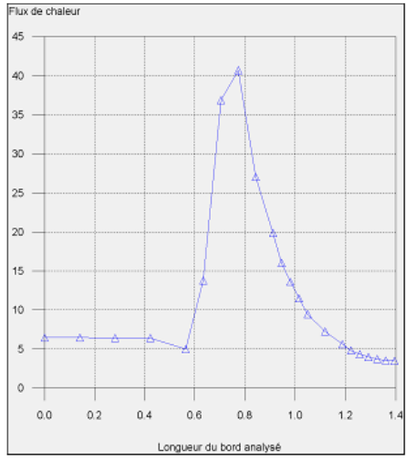
- DISTRIBUTION DE TEMPÉRATURES





Analyse du pont thermique linéaire IT.2.1 (NF EN ISO 10211)

- FLUX DE CHALEUR DANS LE BORD ANALYSÉ

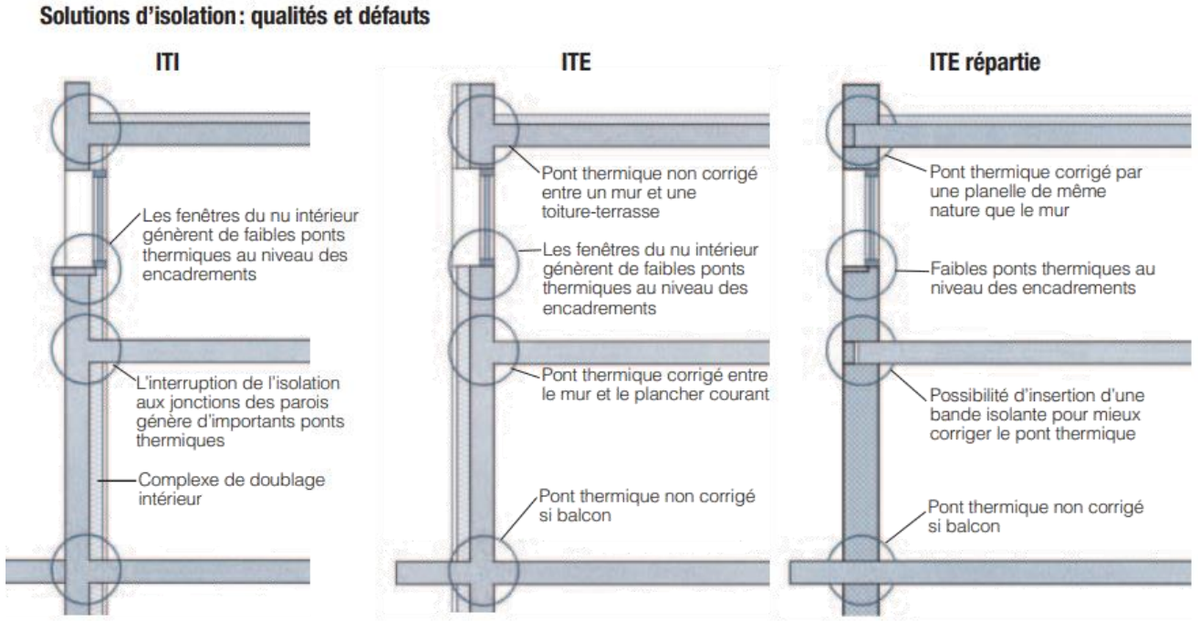


- CALCUL DE LA TRANSMITTANCE LINÉAIRE

Fluxdechaleurthéorique	4.583W/m
Fluxdechaleurréel	16.477W/m
Sautthermique	25.00°C
Transmittancedel'élémentL	0.260W/(m²K)
Transmittancelinéairecalculé	0.476W/(m·K)

Recommended Best practices

- Put in place thermal bridge breakers or planelles between the various connections of the constructive elements;
- Opt for a suspended facade with light elements (instead of stone) to limit thermal bridges linked to fixings.



Example : PROMONIA Project

Standard and connection details

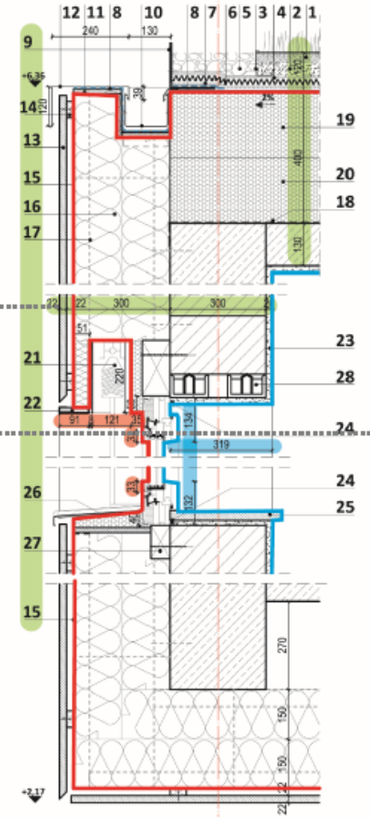
Detailed **construction drawings** should be prepared and submitted to the Certifier for **all** assemblies and connections of the building envelope. The thermal bridge details must be easily identifiable in the PHPP.

Thickness in mm of heterogeneous layers

Description of each component of the detail (incl. heterogeneous layers), product manufacturer and name, thickness [mm], thermal conductivity

For masonry/concrete materials:
a| resistance class
b| reinforcement degree
c| volume density

Scale:
1:5
or
1:10
or
1:20



1. 30 mm roof vegetation
2. 40 mm extensive soil layer
3. Metal profile to separate the gravel from the soil
4. Geotextile membrane
5. 70 mm 15-30 gr gravel
6. Water retention and drainage layer
7. Mechanical protection layer
8. Synthetic waterproofing membrane, resistant to root penetration
9. Perimetral plastic profile with side penetrations for drainage
10. 13x20 cm galvanized steel rectangular gutter
11. 15 mm OSB board
12. Drip edge - galvanized steel profile
13. 22x40 mm wood panel façade elements with 5 mm gap
14. 22x40 mm wooden support elements for the façade; Black coating
15. Ventilated façade membrane resistant to wind, UV and moisture
16. 2x150 mm thermal Insulation – Basalt wool
17. Vertical façade carrier (2 wooden fireproof beams 30x50 mm connected by OSB boards)
18. Diffusion and vapor barrier membrane
19. 200 mm thermal Insulation EPS + Slope EPS
20. 200 mm thermal Insulation EPS
21. External shading with hidden raff store
22. OSB + galvanized steel profile
23. Interior plaster applied until the concrete slab level
24. Window perimeter plaster, applied on airtight tape layer
25. 30 mm wooden interior window sill
26. Aluminum exterior window sill
27. 60x100 mm window footing wooden beam
28. Prefabricated lintel

J Passive House, Romania | blipsz architecture

See page 27 for acceptable file formats and general requirements

Graphic identification and external dimensions of the thermal envelope

Graphic identification of the airtight layer

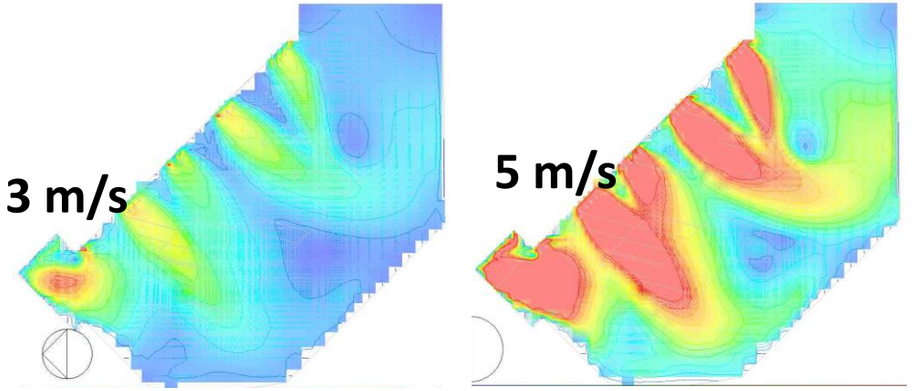
C6. Détails de l'enveloppe	Carnet de détails de l'enveloppe	- Détails pour tous les raccords - Type de chaque composant et sa conductivité - Densité de fixation	Entreprise/Façadier			MAJ du carnet selon les éléments réellement mis en place
		- Chaque détail présenté en C6. Détails doit faire l'objet	ALTO EKO			MAJ selon les élments réellement en place
		s et des vitrages ion ontants, linteau efficient ψ de l'intercalaire ype de protection solaire U	Entreprise/Façadier			MAJ de la nomenclature selon les composants réellement mis en oeuvre
		, type, largeur (mm), door g, TL, FS				
		HVAC: Air ext, AN, Air vicié, les u des prises et rejets d'air : LT	Entreprise Fluides			
			ALTO EKO/ Entreprise HVAC			
			Entreprise HVAC			
		ions de conditionnement d'air uissances, T(°C) ux	Entreprise HVAC			
		ions d'ECS, les débits, avec la conception	Entreprise Fluides			
			Entreprise CFA CFO			
			ALTO EKO			MAJ EXE
		ouches (air neuf, air vicié, air iveaux de bruit, la présence de entilation partie équilibrage	Entreprise HVAC			
		rméabilité à l'air n 50 sous 50 dépression par rapport à sur la totalité de l'enveloppe ffée	Entreprise HVAC/ALTO EKO			
		u maître d'oeuvre que la conforme avec le dossier de	MOE			
		e commandes détaillant la ants et de l'étanchéité à l'air, y compris protections solaires : CVC	Entreprises			
R5. Photos	Factures/bons de commandes	e commandes détaillant la fourniture et la pose des isolants et de l'étanchéité à l'air, des menuiseries extérieures y compris protections solaires	Entreprises			

Thermal comfort

Actual situation

Air velocity

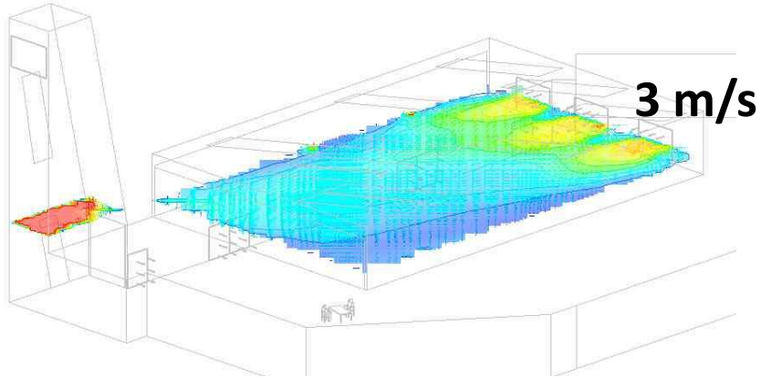
Height = 1.2m

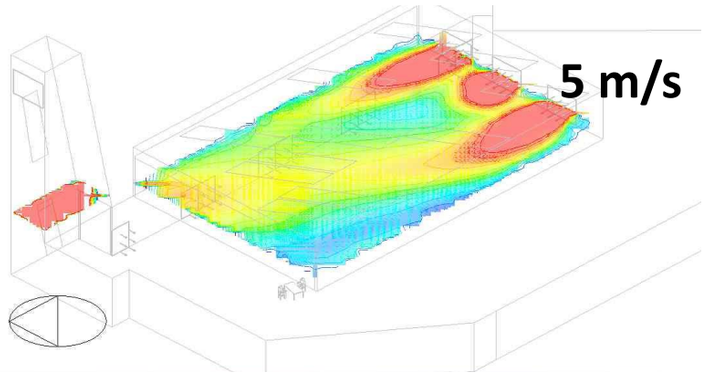


On the ground floor, wind speed will not exceed 5 m/s (red area).

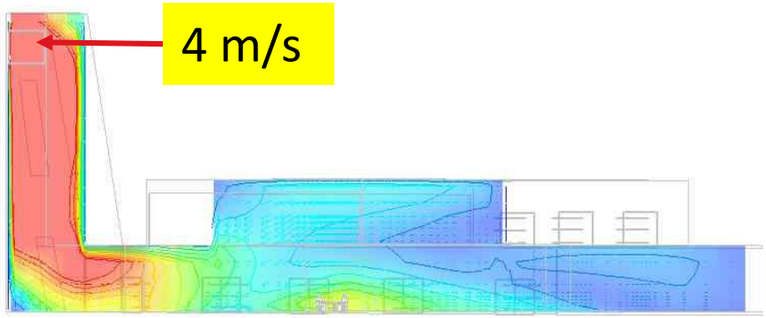
Wind entering the ground floor covers the whole space. Its speed decreases while moving away from the doors. With wind velocities under 5 m/s, it is still considered comfortable for the occupants.

Height = 7.3m





The wind that enters from the windows on the upper level on the right helps to evacuate the air towards the wind tower.
Wind entering the first floor covers the whole space.
Its speed decreases while moving away from the doors.
The speed increases at the level of the wind tower.



The wind tower plays an important role in the evacuation of air from the Food Market thanks to the doors and windows on the ground floor and in double height.

The speed of the air accelerates at the level of the Tower thanks to its bevelled shape.

This modeling is made on the basis of a wind at 3 m/s.

The mechanical ventilation with a flow rate of 5556 l/s (20 000 m3/h). With an occupation of 800 people and a surface of 2795 m² is calculated on the basis of the ASHRAE standard.

Thermal Comfort

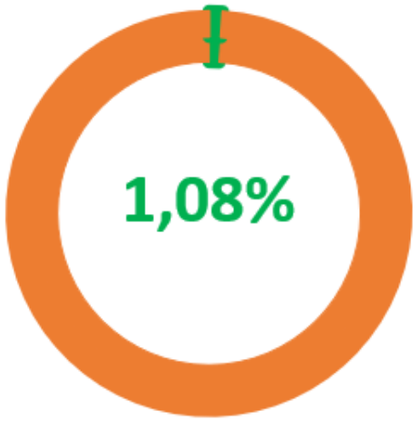
GIVONI

In August and during the occupation period the comfort rate is negligible (1%)

THERMAL COMFORT PARAMETERS	Min	Max
Opv TEMPERATURE	18 °C	28 °C
REL. HUMIDITY	20 %	80 %

OCCUPANCY	Min	Max
PERIOD	10 h	24 h
WEEKEND	None	None
Period	August	

TOTAL PERIOD HOURS	744	Hours	100,00%
TOTAL COMFORTABLE	97	Hours	13,04%
TOTAL UNCOMFORTABLE	647	Hours	86,96%
TOTAL OCCUPIED HOURS	465	Hours	100,00%
COMFORTABLE OCCUPIED	5	Hours	1,08%
UNCOMFORTABLE OCCUPIED	460	Hours	98,92%

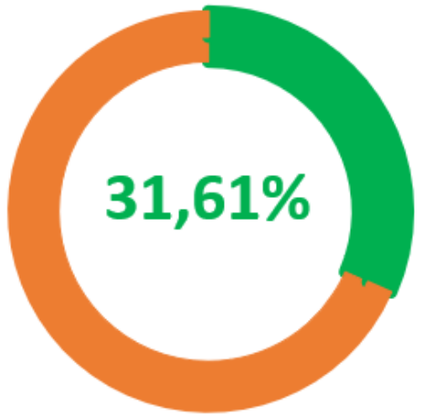


The ventilation of the Foord Market and the beveled wind tower make it possible to refresh this space and improve comfort from 1% to more than 31% of the occupancy period. <u>i.e. an increase of more than 30%.</u>

THERMAL COMFORT PARAMETERS	Min	Max
Opv TEMPERATURE	18 °C	28 °C
REL. HUMIDITY	20 %	80 %

OCCUPANCY	Min	Max
PERIOD	10 h	24 h
WEEKEND	None	None
Period	August	

TOTAL PERIOD HOURS	744	Hours	100,00%
TOTAL COMFORTABLE	232	Hours	31,18%
TOTAL UNCOMFORTABLE	512	Hours	68,82%
TOTAL OCCUPIED HOURS	465	Hours	100,00%
COMFORTABLE OCCUPIED	147	Hours	31,61%
UNCOMFORTABLE OCCUPIED	318	Hours	68,39%

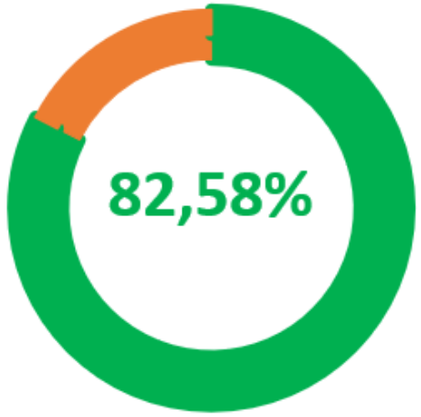


In December and with doors and windows closed, thermal comfort is assured for more than 80% of the occupancy period.

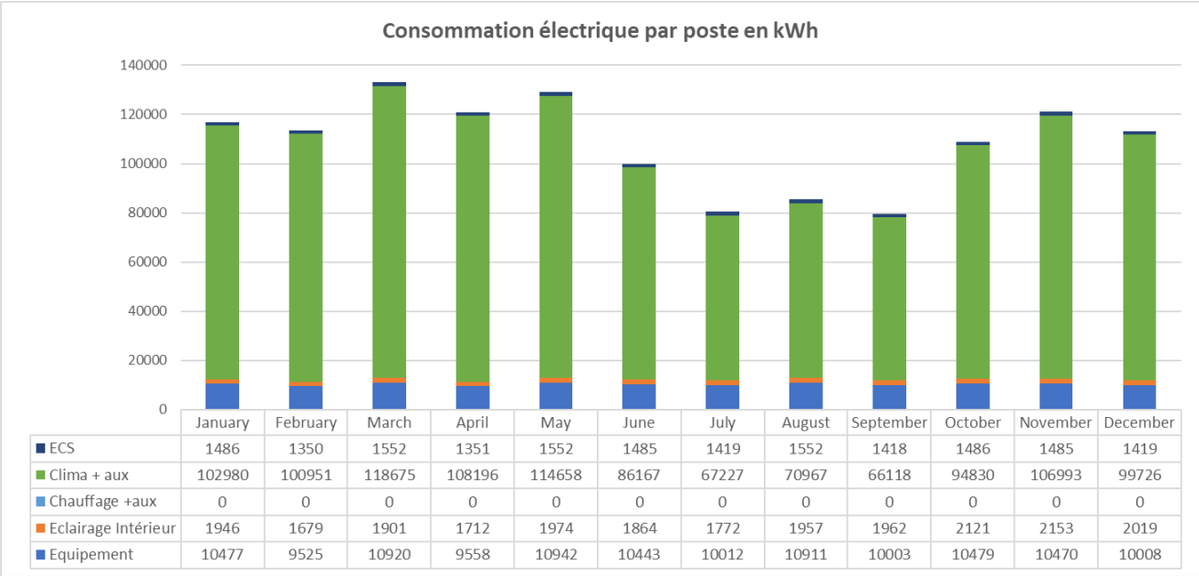
THERMAL COMFORT PARAMETERS	Min	Max
Opv TEMPERATURE	18 °C	28 °C
REL. HUMIDITY	20 %	80 %

OCCUPANCY	Min	Max
PERIOD	10 h	24 h
WEEKEND	None	None
Period	December	

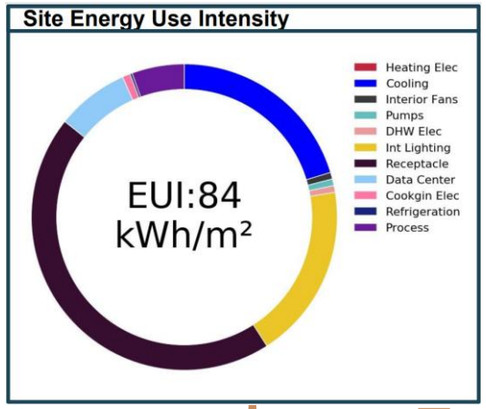
TOTAL PERIOD HOURS	744	Hours	100,00%
TOTAL COMFORTABLE	434	Hours	58,33%
TOTAL UNCOMFORTABLE	310	Hours	41,67%
TOTAL OCCUPIED HOURS	465	Hours	100,00%
COMFORTABLE OCCUPIED	384	Hours	82,58%
UNCOMFORTABLE OCCUPIED	81	Hours	17,42%

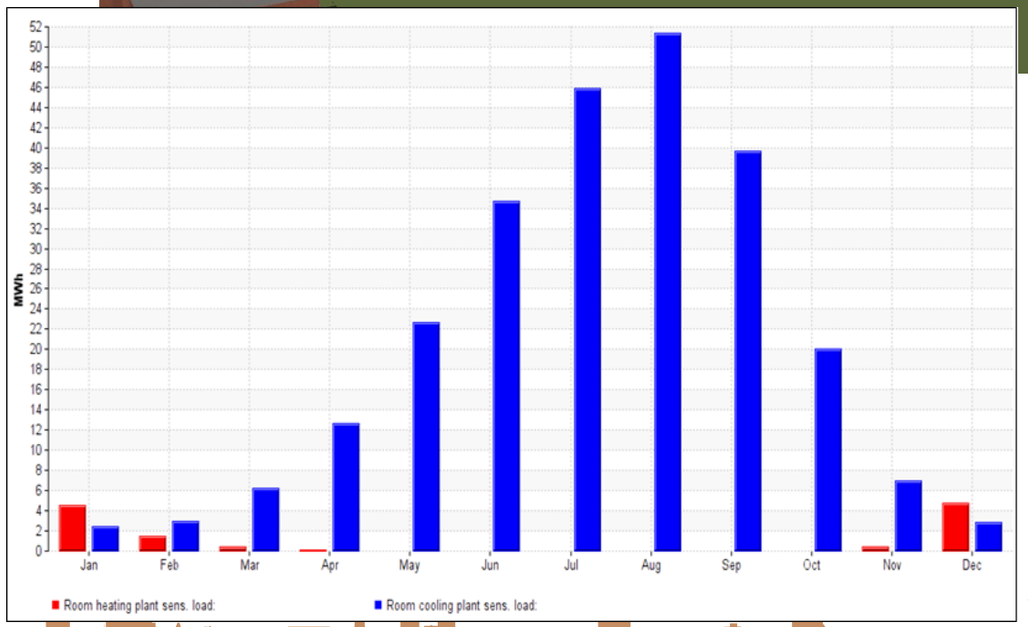


Dynamic Thermal Simulation

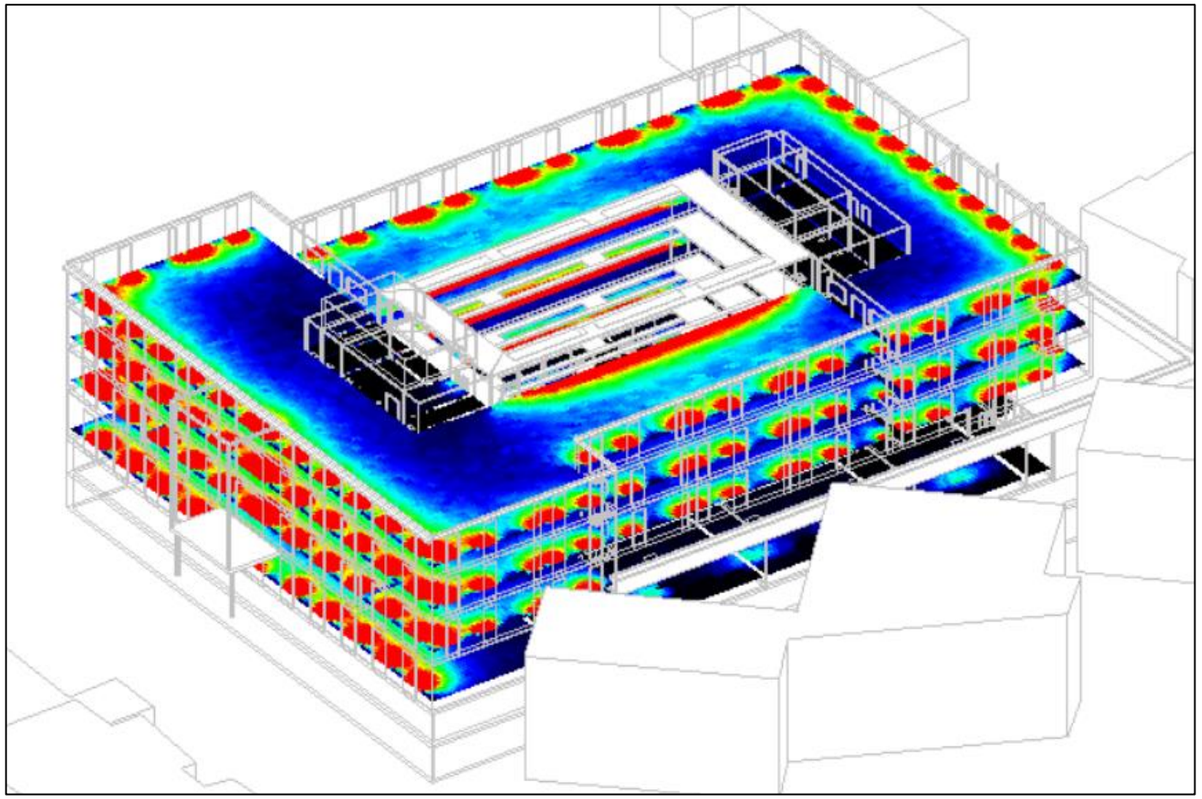


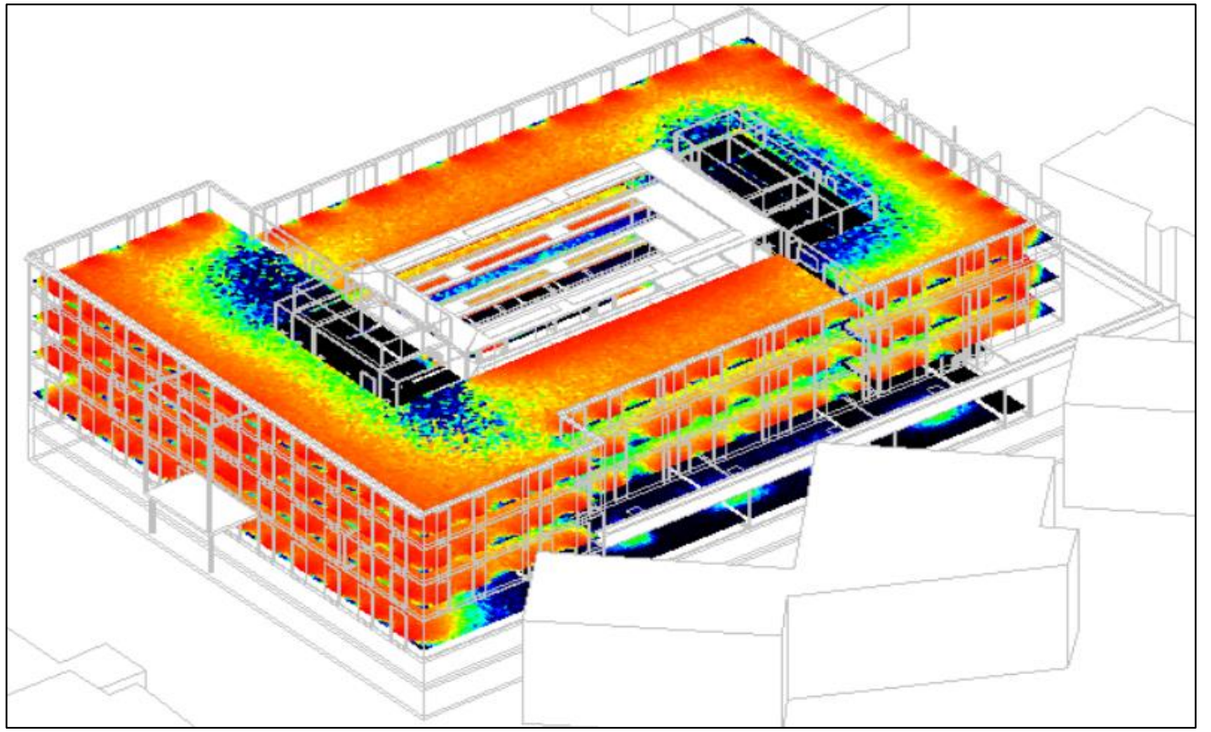
	January	February	March	April	May	June	July	August	September	October	November	December
ECS	1486	1350	1552	1351	1552	1485	1419	1552	1418	1486	1485	1419
Clima + aux	102980	100951	118675	108196	114658	86167	67227	70967	66118	94830	106993	99726
Chauffage +aux	0	0	0	0	0	0	0	0	0	0	0	0
Eclairage Intérieur	1946	1679	1901	1712	1974	1864	1772	1957	1962	2121	2153	2019
Equipement	10477	9525	10920	9558	10942	10443	10012	10911	10003	10479	10470	10008



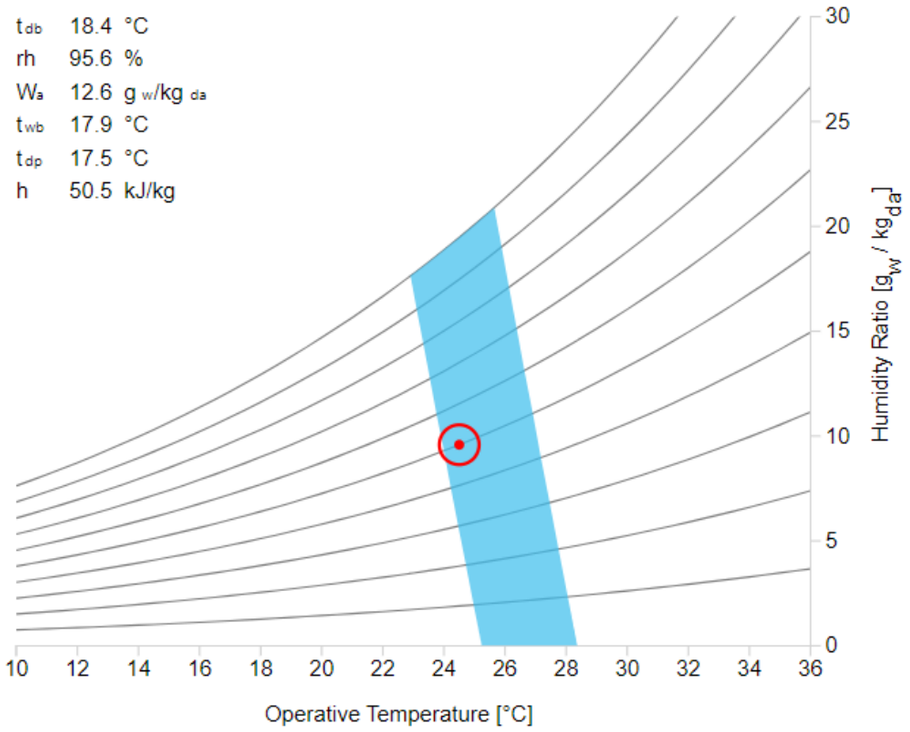


Daylighting and Glare





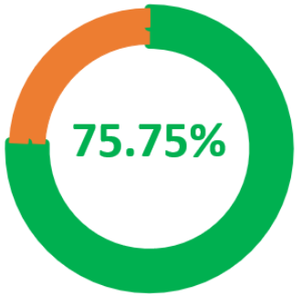
Thermal Comfort

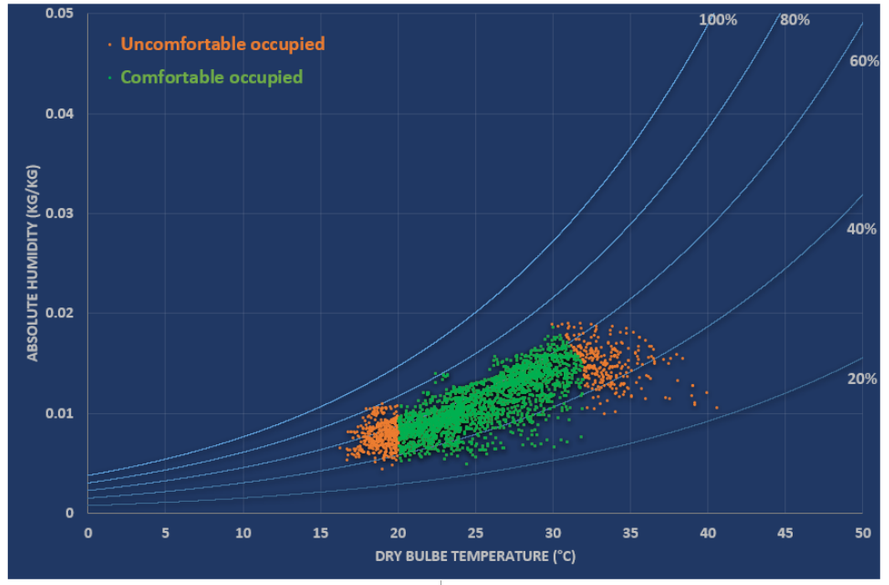


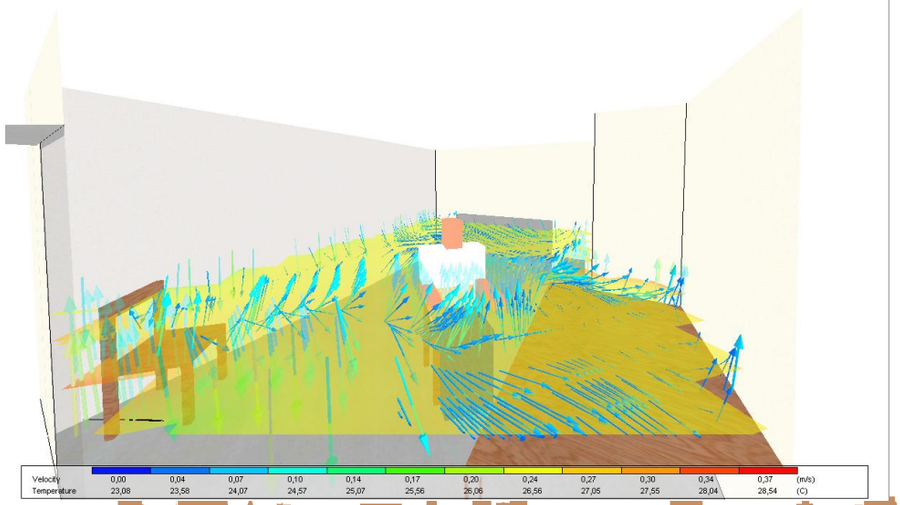
THERMAL COMFORT PARAMETERS			
Air velocity	1		m/s
	Min	Max	
Air TEMPERATURE	20 °C	32 °C	
REL. HUMIDITY	20 %	100 %	

OCCUPANCY		
	Min	Max
PERIOD	16 h	23 h
WEEKEND	None	None
Period	Year	

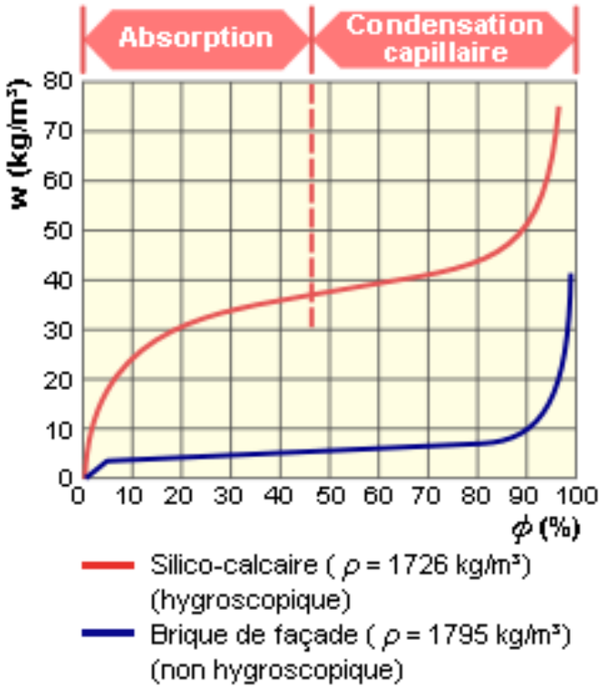
TOTAL PERIOD HOURS	8760	Hours	100.00%
TOTAL COMFORTABLE	5993	Hours	68.41%
TOTAL UNCOMFORTABLE	2767	Hours	31.59%
TOTAL OCCUPIED HOURS	2920	Hours	100.00%
COMFORTABLE OCCUPIED	2212	Hours	75.75%
UNCOMFORTABLE OCCUPIED	708	Hours	24.25%

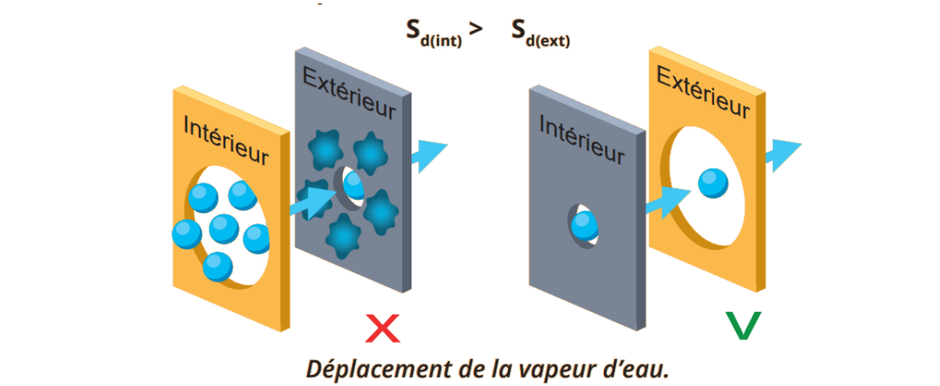


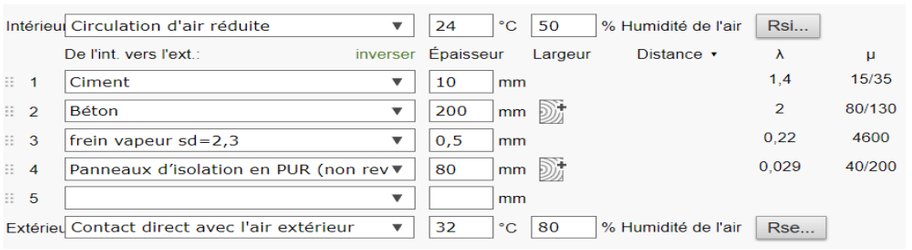


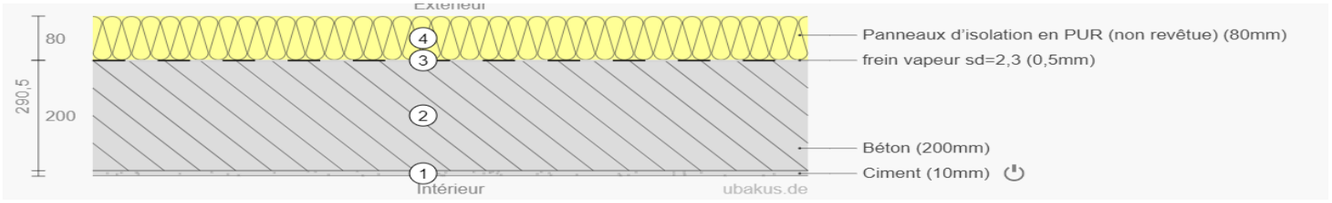


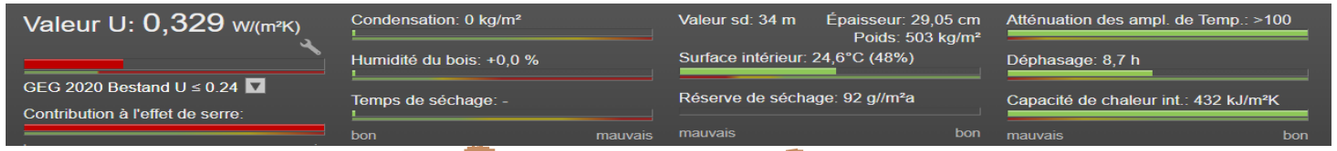
Sanitary Quality of Spaces



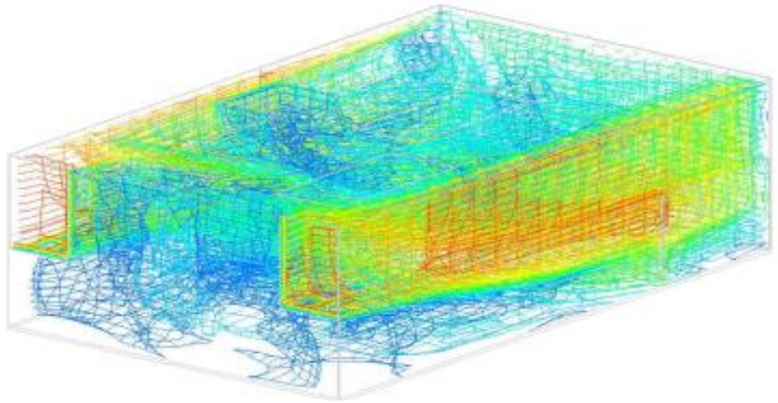


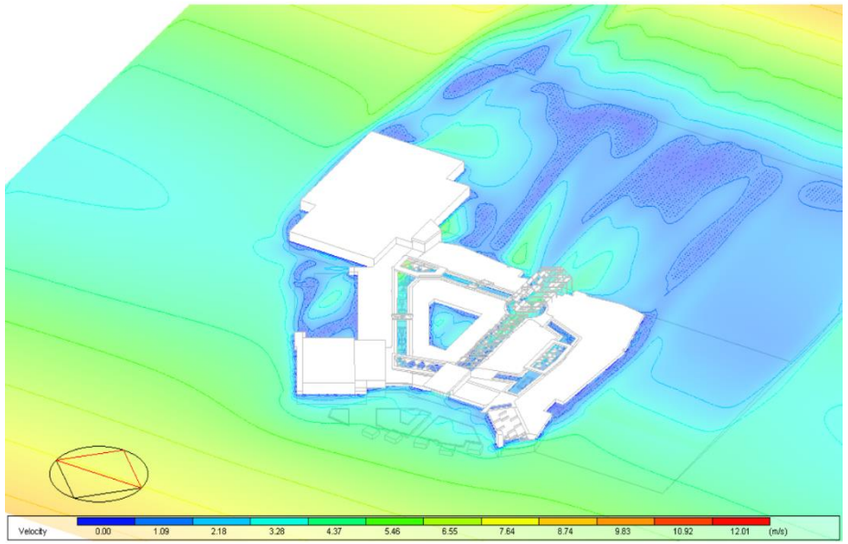


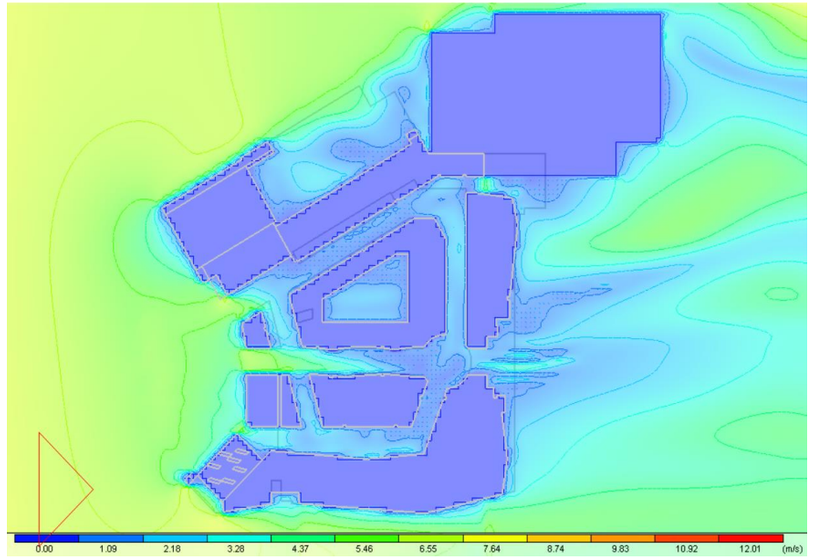


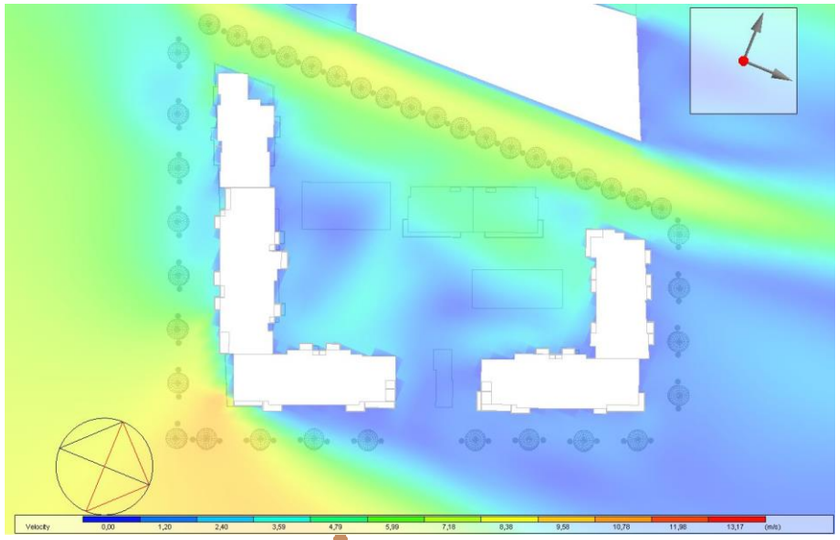


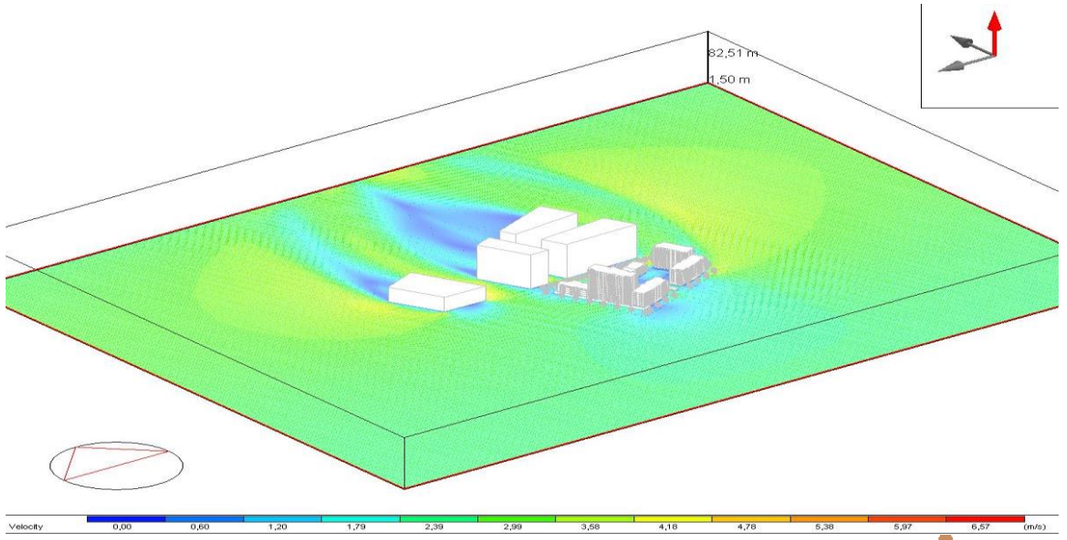
Computer Fluid Computational







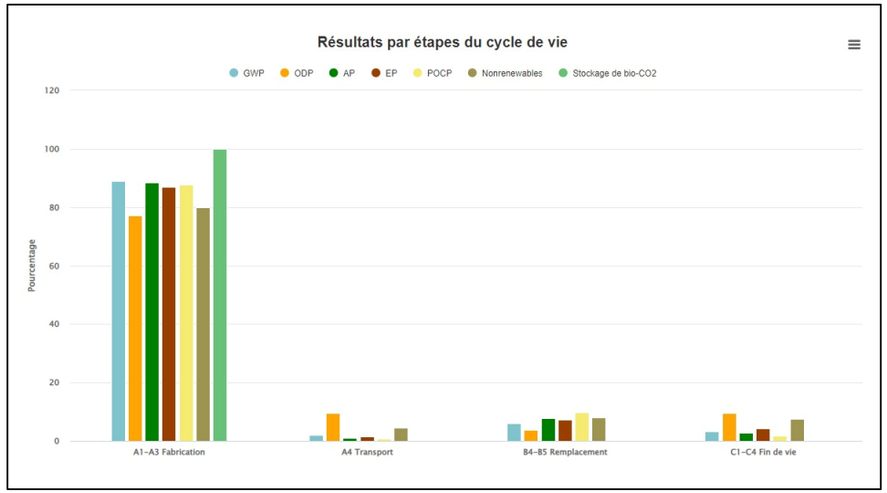


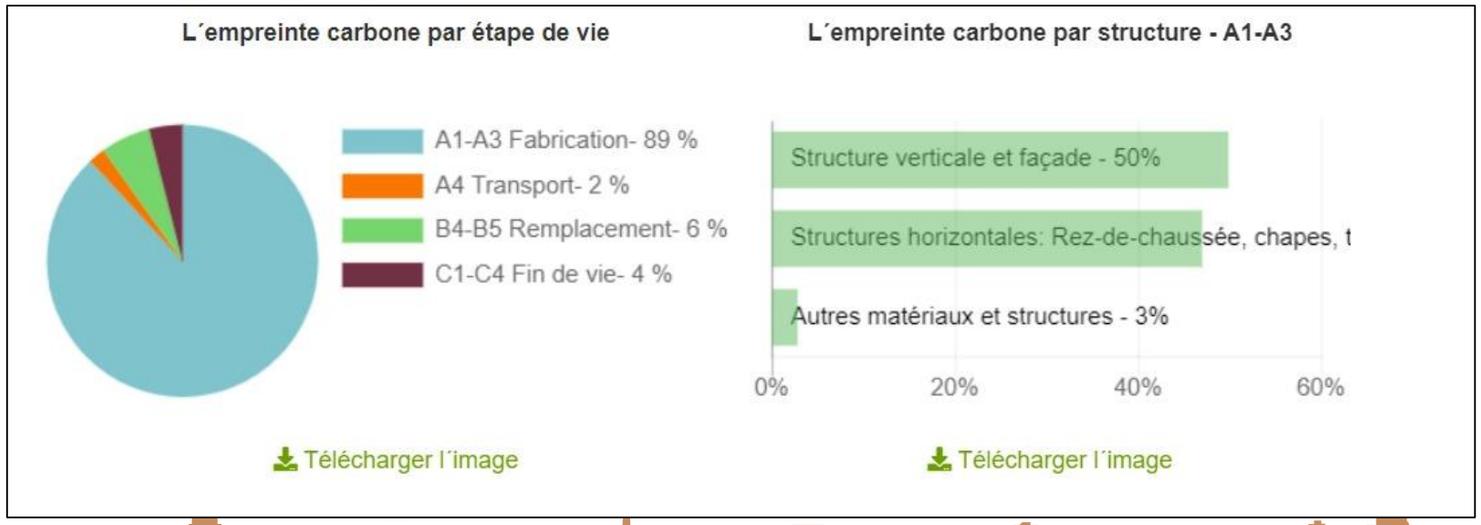


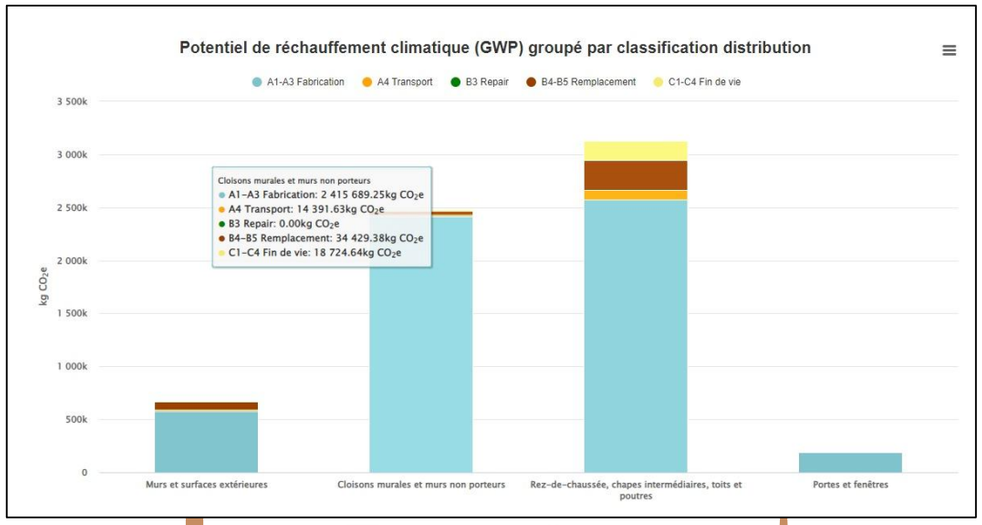
AJOUTER LA SLIDE SUR LE CONFORT THERMIQUE DANS LE FOOD COURT DU MALL DE ZENATA. (VOIR AVEC HABIB)

Ajouter la slide sur le confort thermique dans le Food Court du Mall de Zenata.

Life Cycle Assessment & EPD Consulting







THANK YOU

ALTO EKO

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