PASSIVE HOUSES

20°C all year round
without heating installations

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Bureau d'étude et conseil thermique

Sommaire

- Passive concept
- First passive house en Basque country
- An example in Aquitaine
- Conclusions
- Questions

Passive houses

Philosophy

A building dealing with a constant temperature during summer as winter without any heating or cooling system.

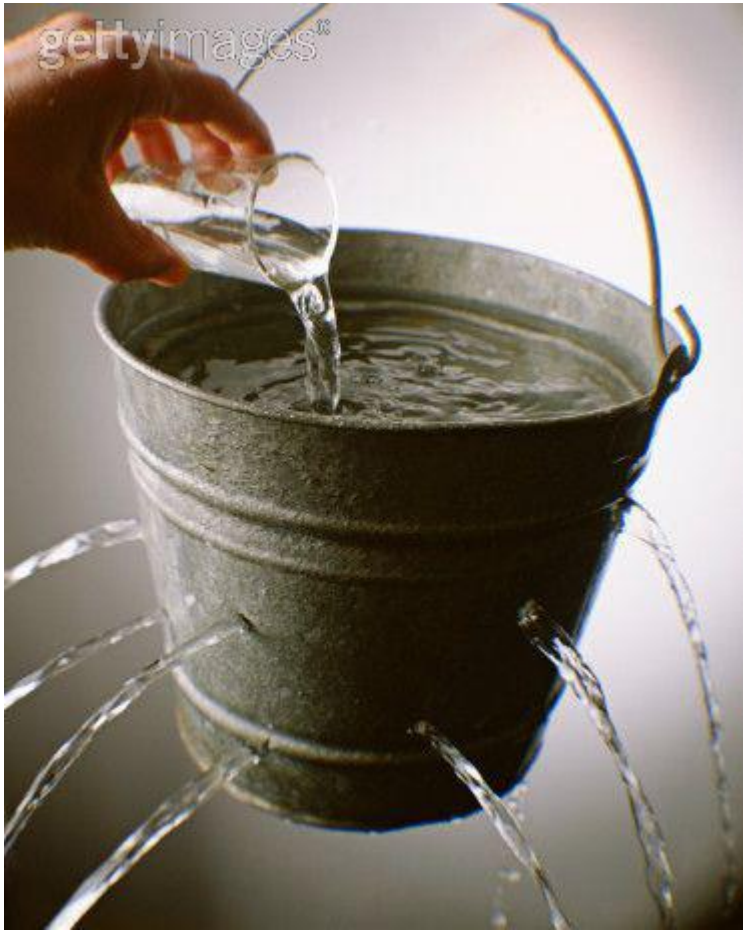
Criteria

- ✓ Low heat demand : 15 kWh/m²/an
- ✓ Energy consumption : 120 kWhEP/m²/an

(heat – domestic hot water – électroménager – auxiliaires)

- ✓ 10 W/m² : air heating
- ✓ Airtightness : 0,6 vol/h (50 Pascal)
- ✓ Summer confort : hours of discomfort (25˚C) < 10%

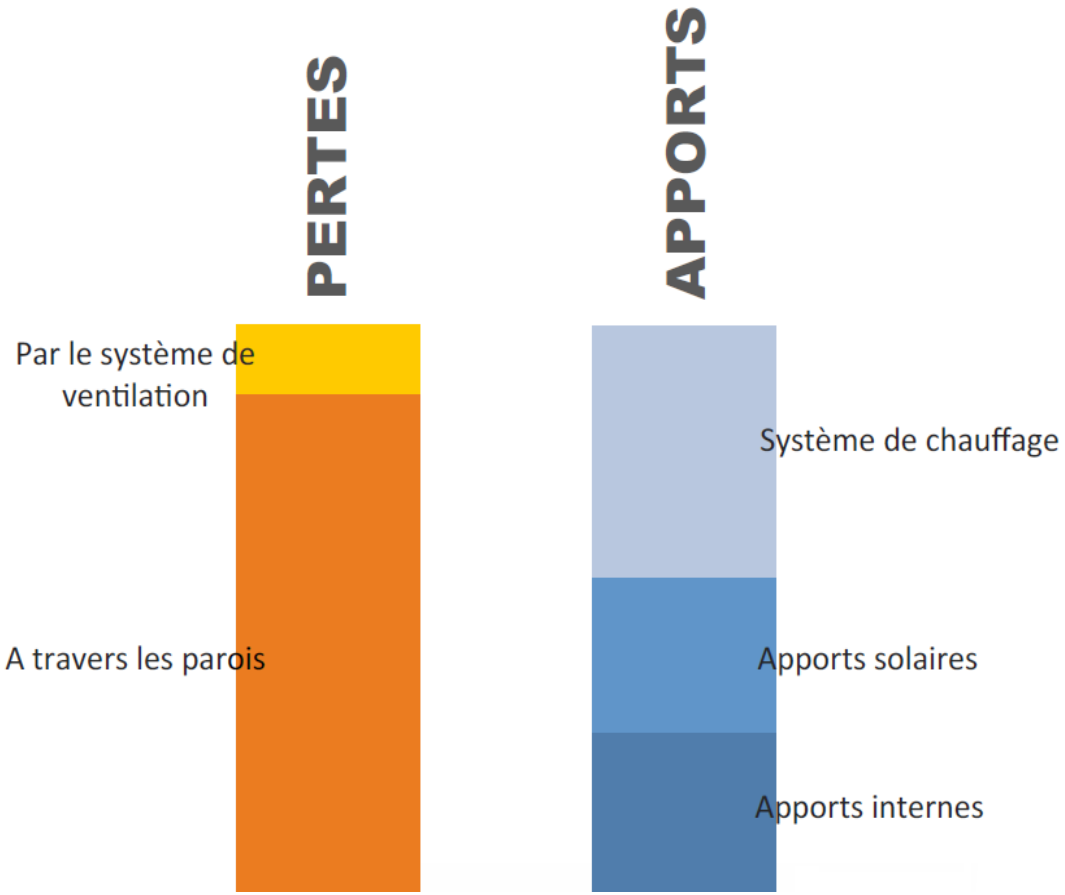
Passive houses



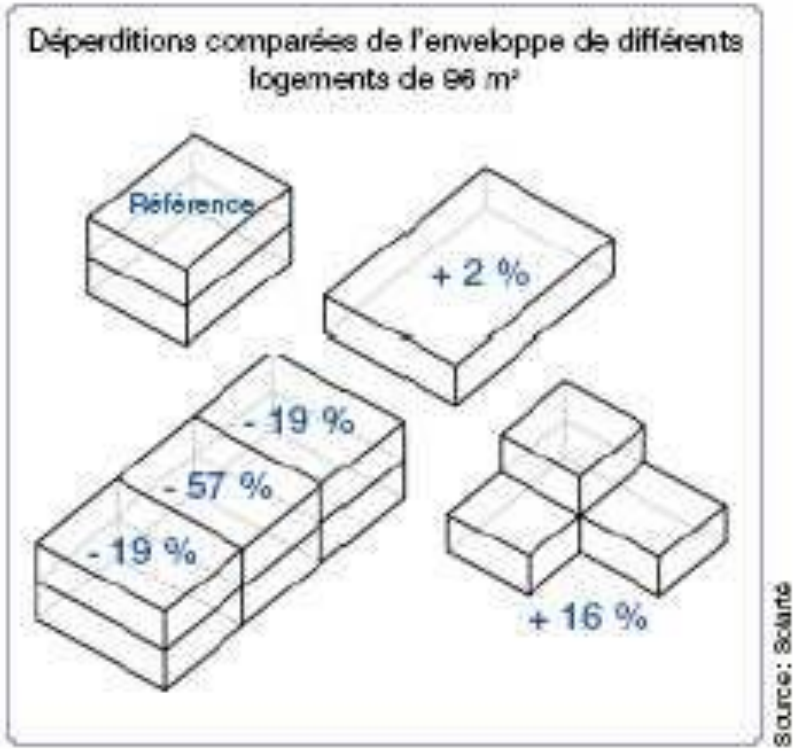
Incom / Outcom

Balance between heating incom and outcom

Passive houses



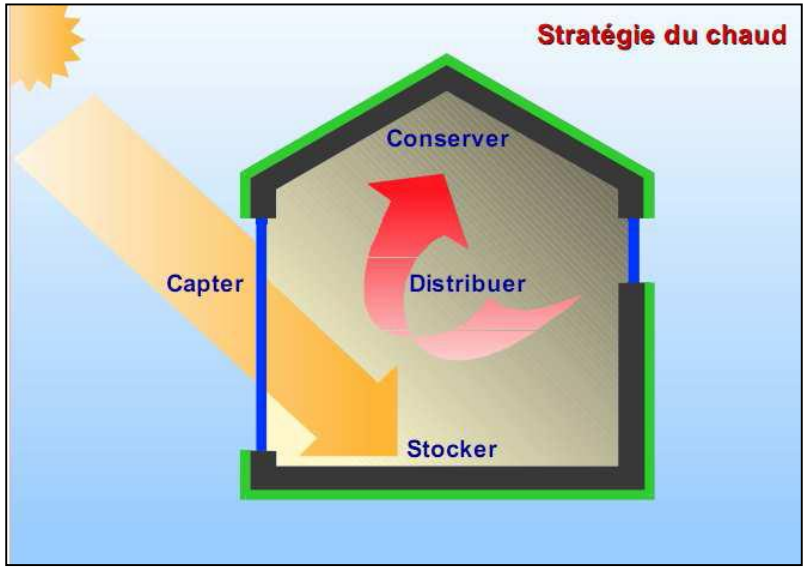
Bioclimatic conception

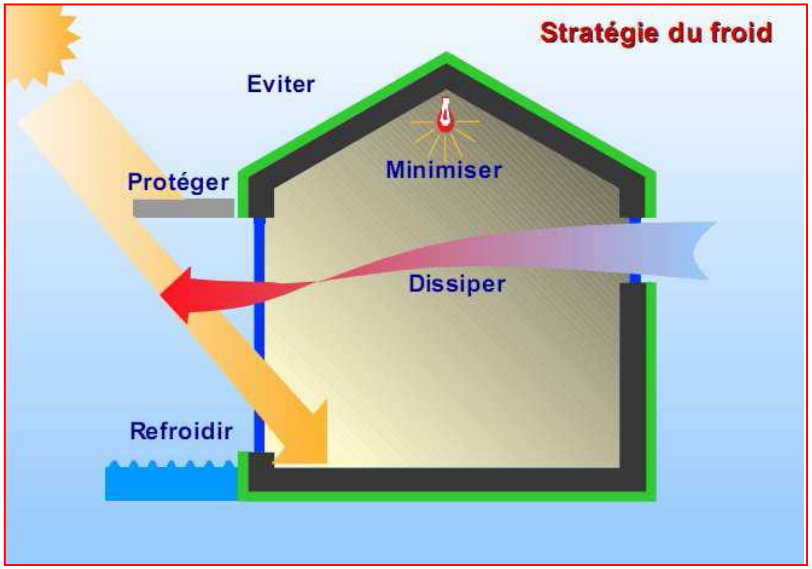


Build compact to limit outside exchanges

Bioclimatic conception

Passive Input





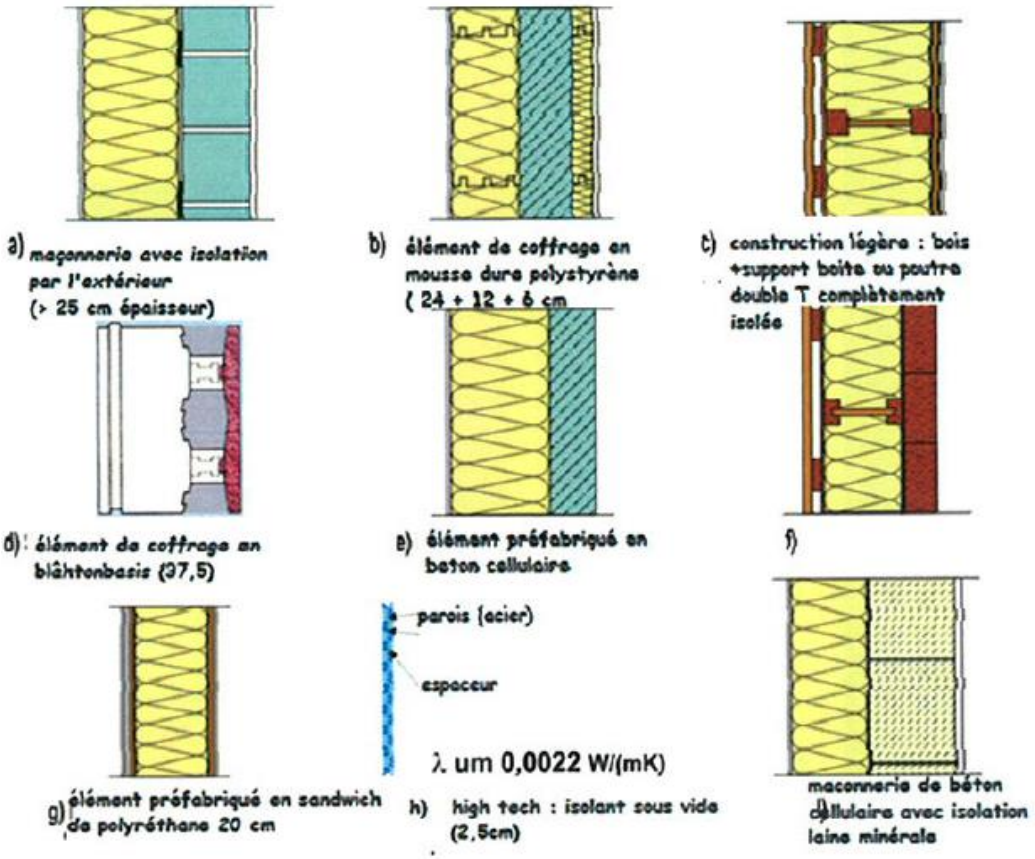
Cool period :
- Decrease thermical losses
- Prioritiz free heat input

Warm period :
- Decrease thermical free input
- Sur-ventilation

Thermal transmittance through building element

Results expectation…

All building methods are allowed !



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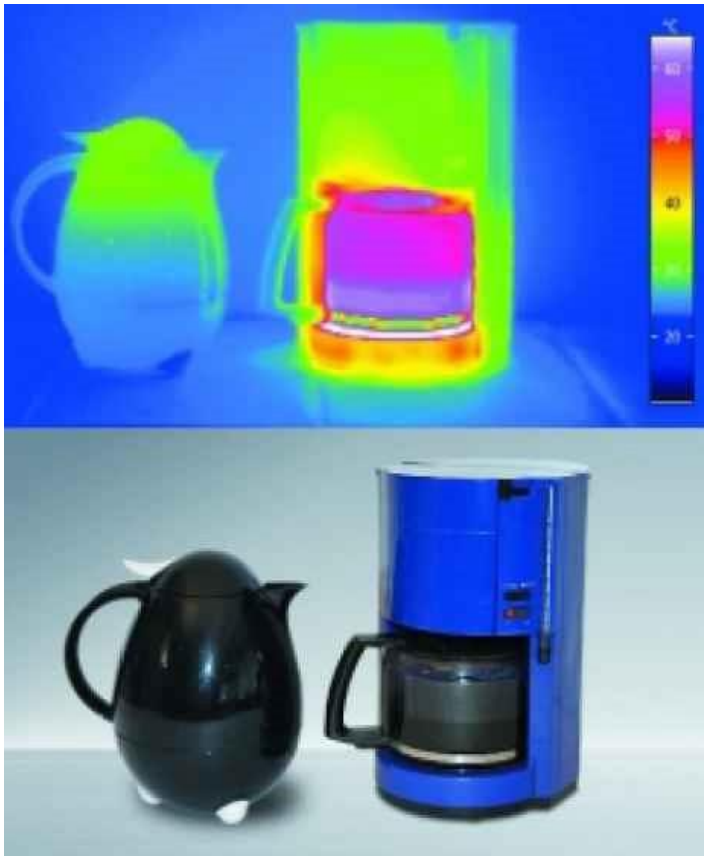
Thermal transmittance through building element

A good insulation keep warm



Thermal bridges

Build without thermal bridges : Insulation covers every parts of building without failure

<u>Thermal bridges consequences</u> :

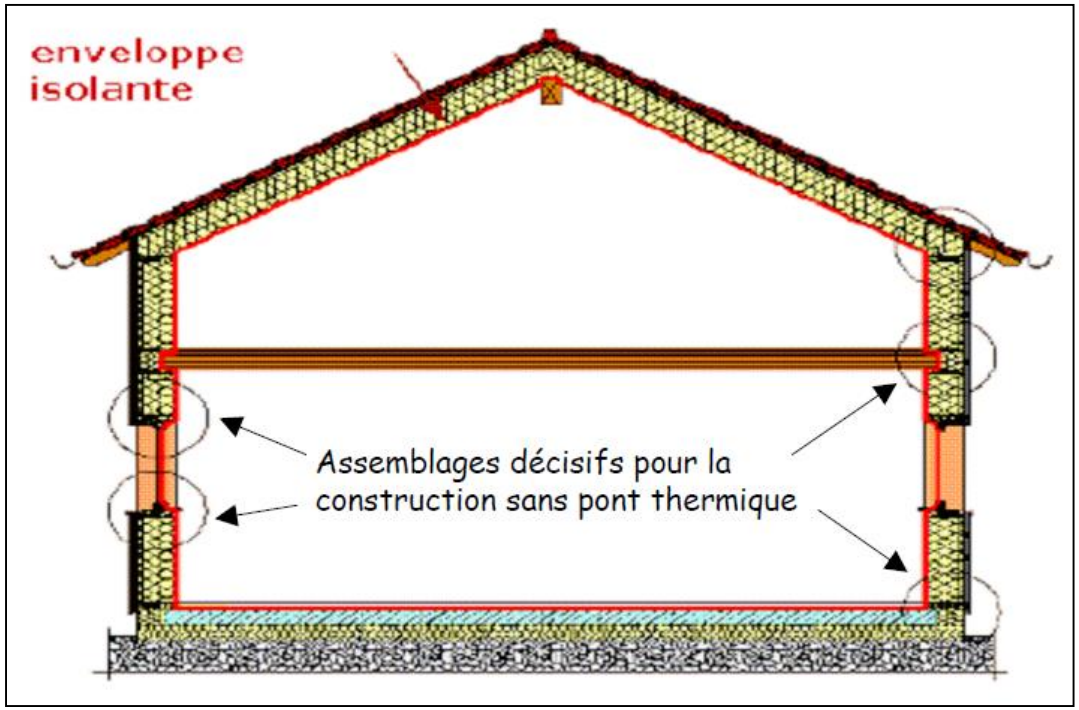
- Heating losses higher

- Increase of heat demands

- Lower surface temperature in the area (disconfort)

- Draught (disconfort)

- Condensation risk and moisture



Airtightness

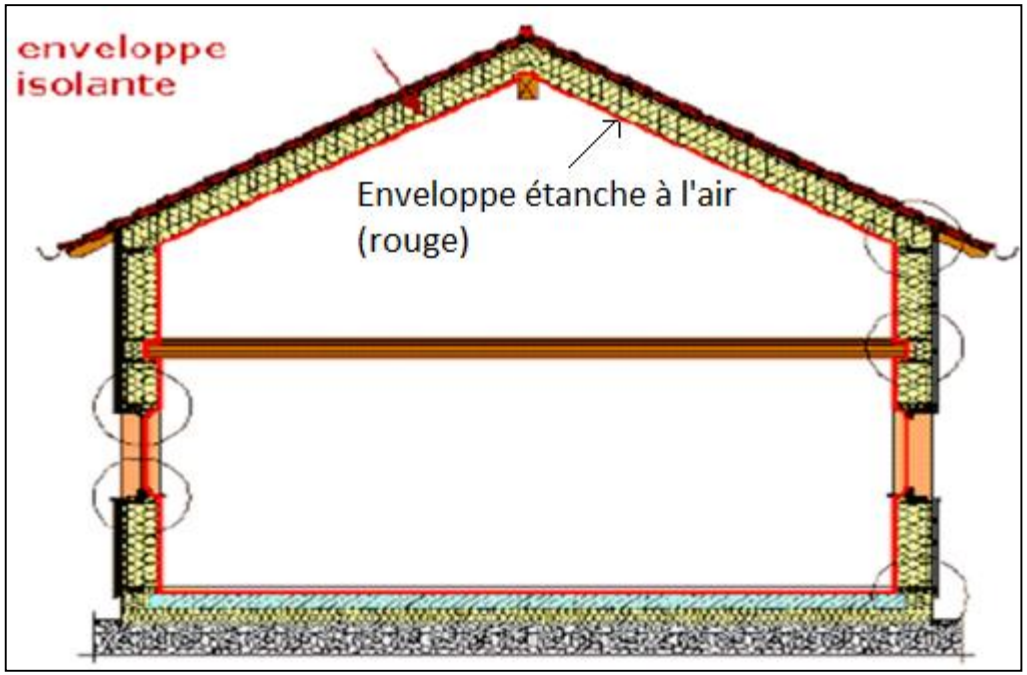
Airtight building enveloppe : avoid any leakages

<u>Conséquences des fuites d'air</u> :

- Cool air infiltration
- Draught
- Increase heat demands
- Risk of condensation of warm air humididy
- Building degradation

<u>Goal</u> :

- 0,6 vol/h (50 PA)
- 3 or 4 times higher than BBC houses



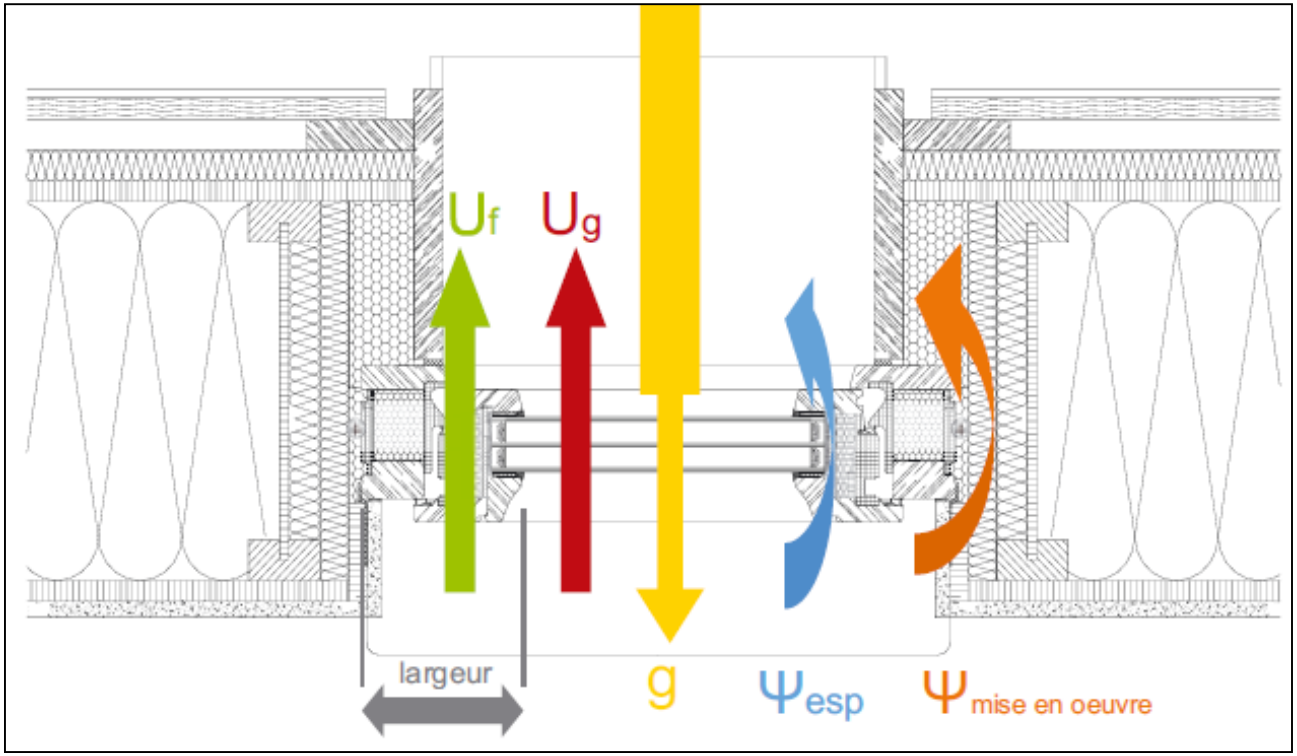
Airtightness Impact

Airtightness level n50	Heating demand kwhEU/m².an	Heating load W
0,13 vol/h	5,4	7,2
0,6 vol/h	6,6	9,2
2,4 vol/h	12,2	16,9
3,2 vol/h	15	20,3

12

Thermal transmittance through building element

Windows selection

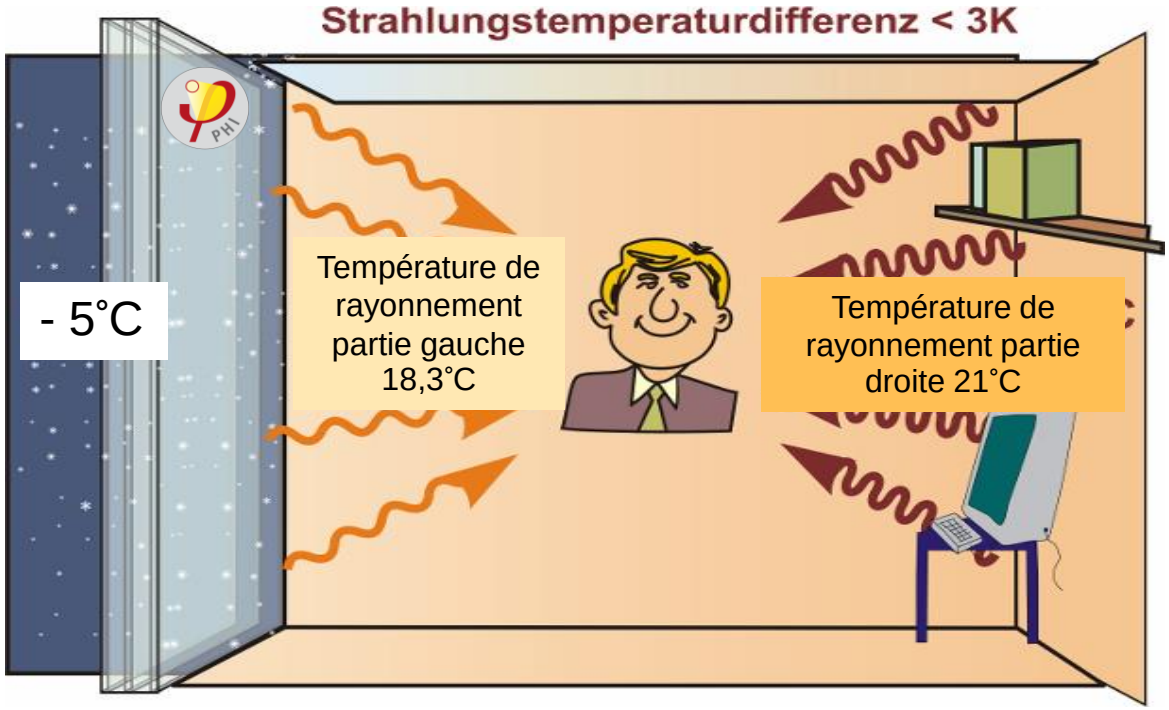


- Ug : glazing thermal transmittance
- Uf : frame thermal transmittance
- g : solar transmission factor

Ψ esp : thermal bridges of ‘espaceur’
Ψ meo : thermal bridges implementation

Confort – Effective Température

Parameters confort are the asymetry and temperature stratification



- **Difference of radiation température < 3 K**
- **Différence of stratification température < 2 K**

Mechanical ventilation with heat recovery ?

Air quality garantee

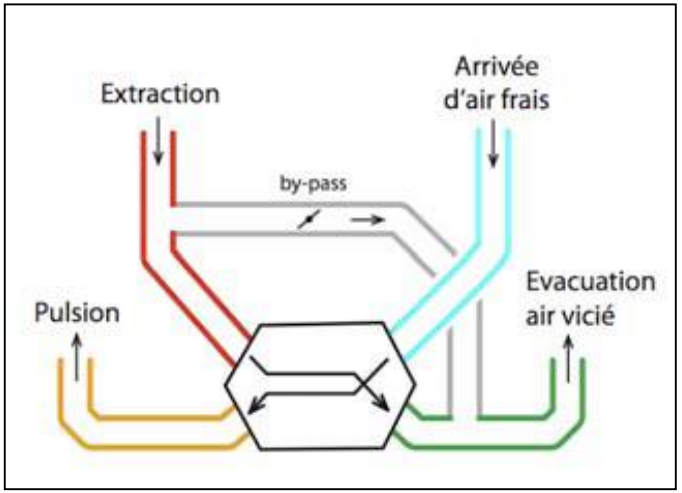
- Supply oxygen needed
- Evacuation of toxic subtances
  - Decrease pollution

Avoid humidity problems

- Evacuation of water vapor
  - Avoid moisture

Increase confort

- Air exchange permanently
  - Smell dissipation



- Only one central air supply
- Heat recovery efficiency ≈ 80%
- Low fan consumption ≈ 0,45 Wh/m3

Heat demands

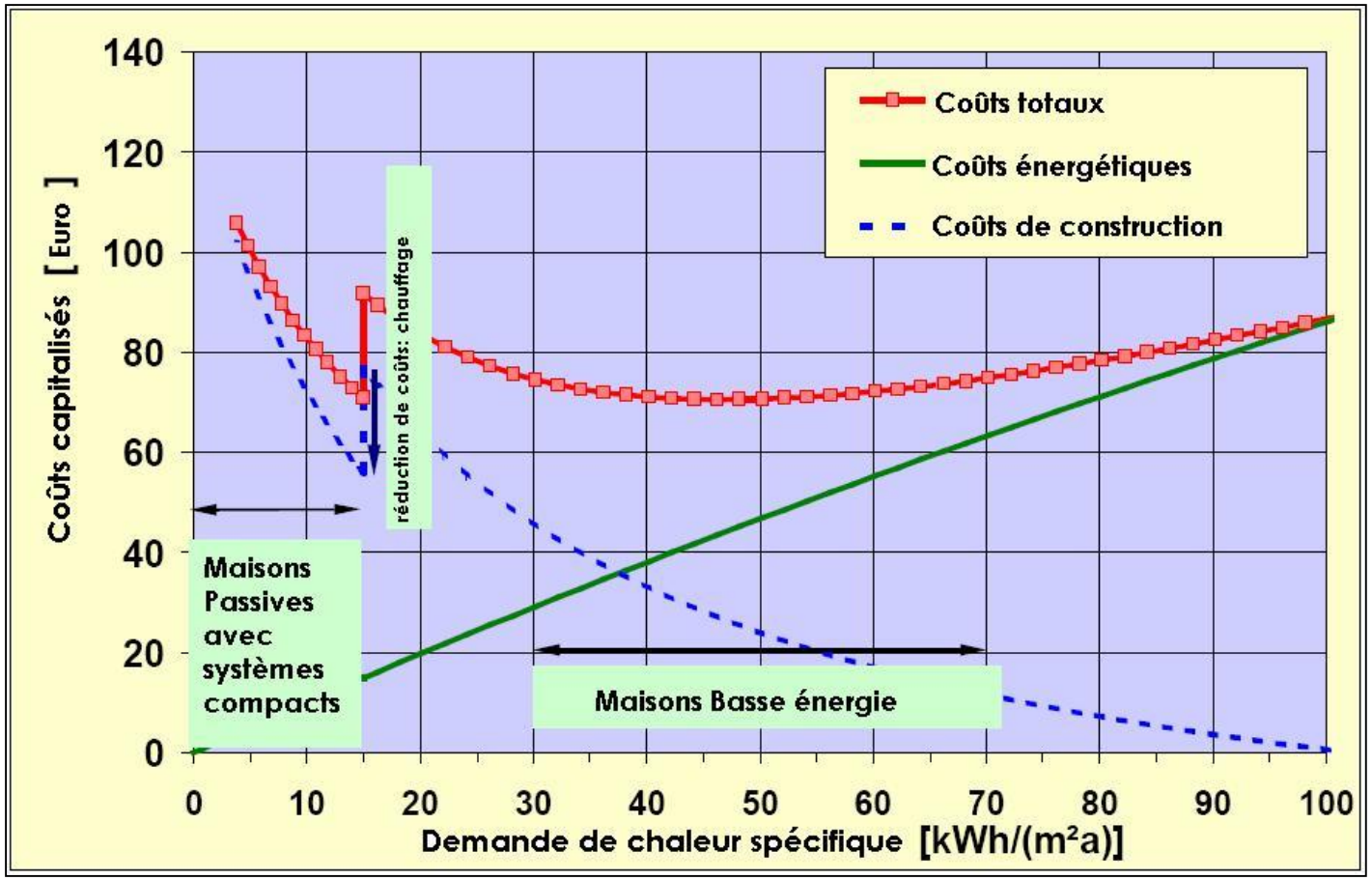
Very low

Ventilation provide heating and cooling

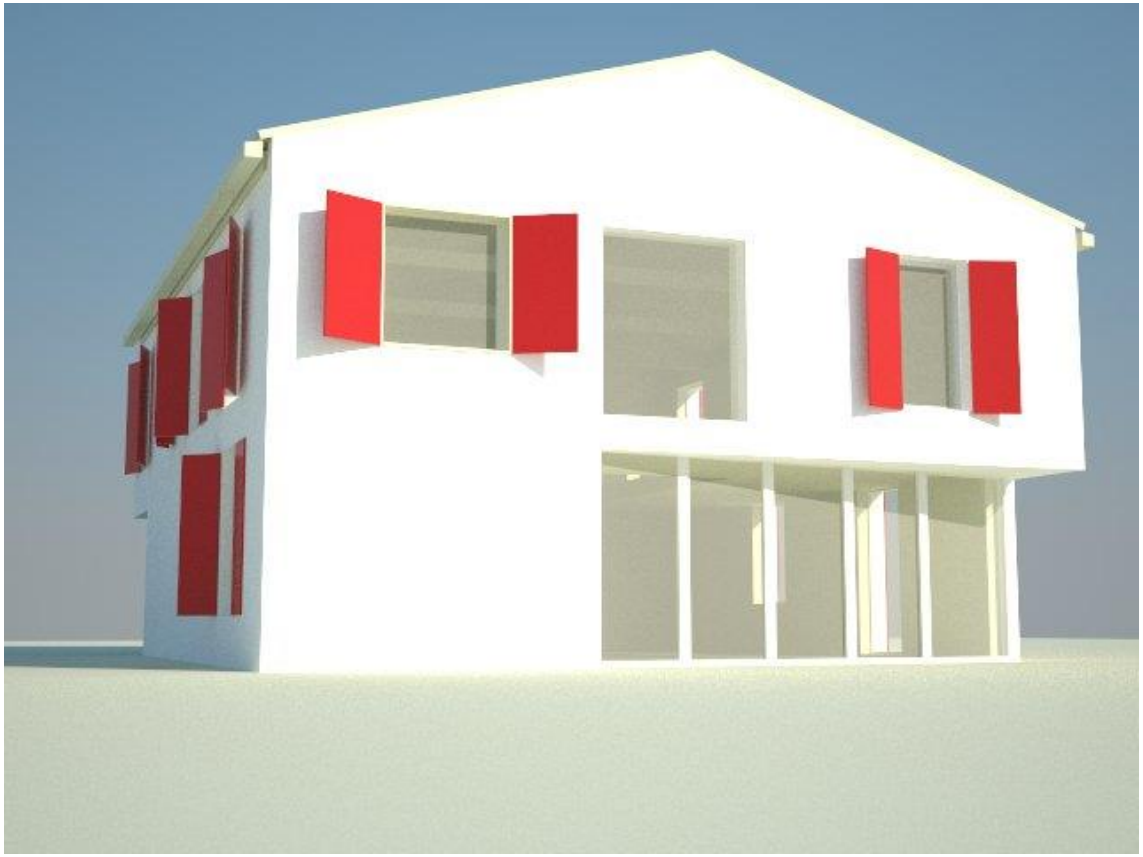
Air heating : heat power < 10 W/m²

High solutions variety

Investment


Coûts totaux
Coûts énergétiques
Coûts de construction
Coûts capitalisés [Euro]
140
120
100
80
60
40
20
0
réduction de coûts: chauffage
Maisons Passives avec systèmes compacts
Maisons Basse énergie
0
10
20
30
40
50
60
70
80
90
100
Demande de chaleur spécifique [kWh/(m²a)]

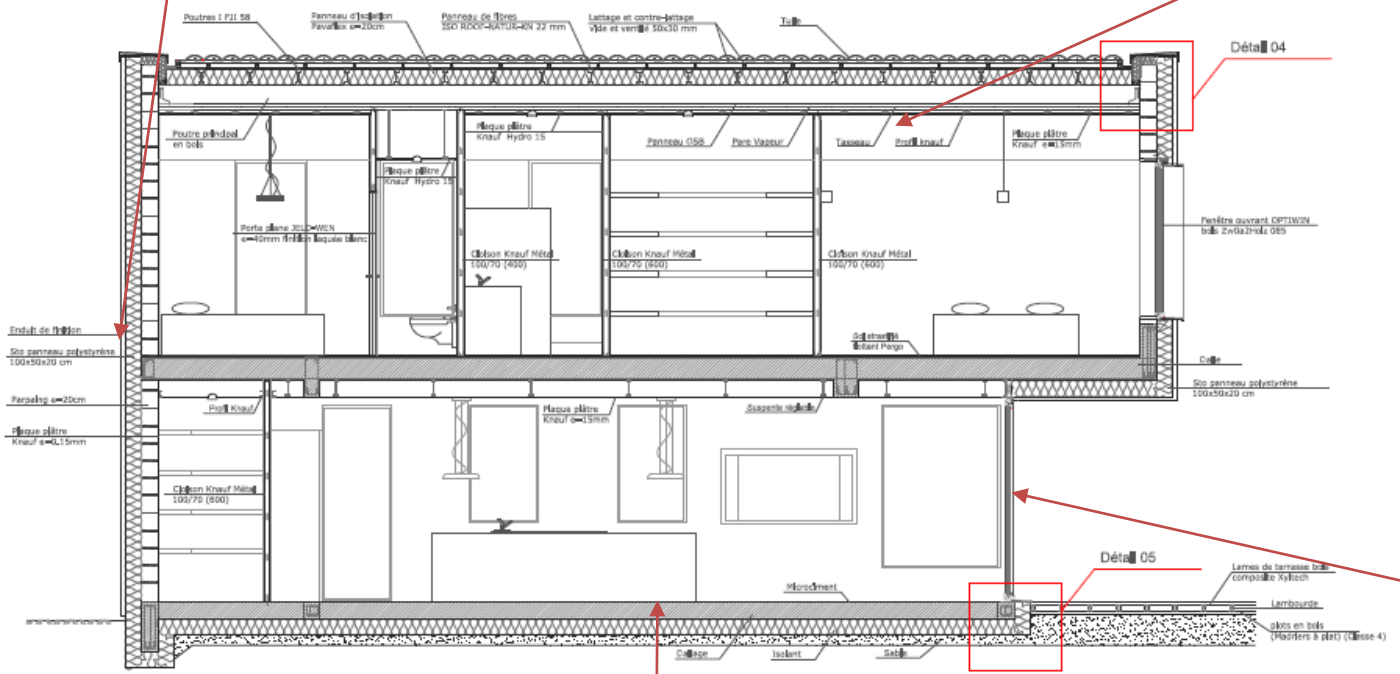
The first passive house in the Basque Country



The first passive house in the Basque Country

Parpaing isolé par l'extérieur
Isolé PSE (20cm)
U = 0,15 W/m²C

Charpente bois
Isolation Ouate de cellulose (30 cm) entre poutres I et fibre de bois (10 cm) entre chevrons
U = 0,10 W/m²C



Fenêtre bois triple vitrage
Isolé PSE (20cm)
Uw = 0,7 W/m²C
g = 45%

Dalle béton
Isolation polyuréthane sous dalle (14cm)
U = 0,16 W/m²C

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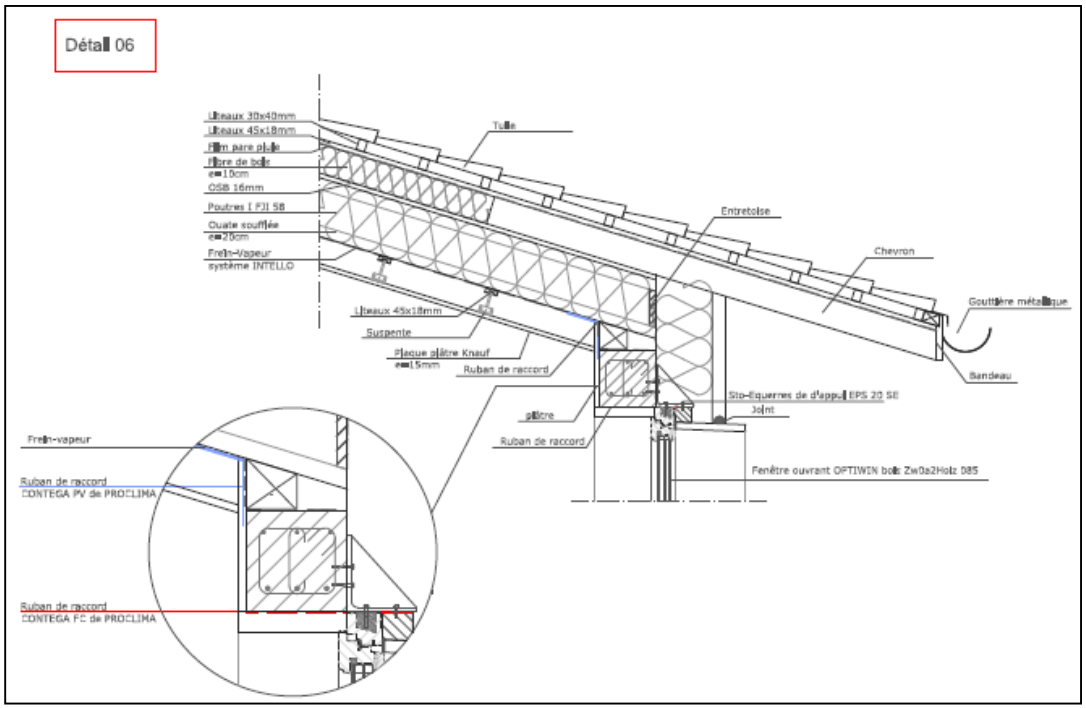
Thermal bridges and airtightness



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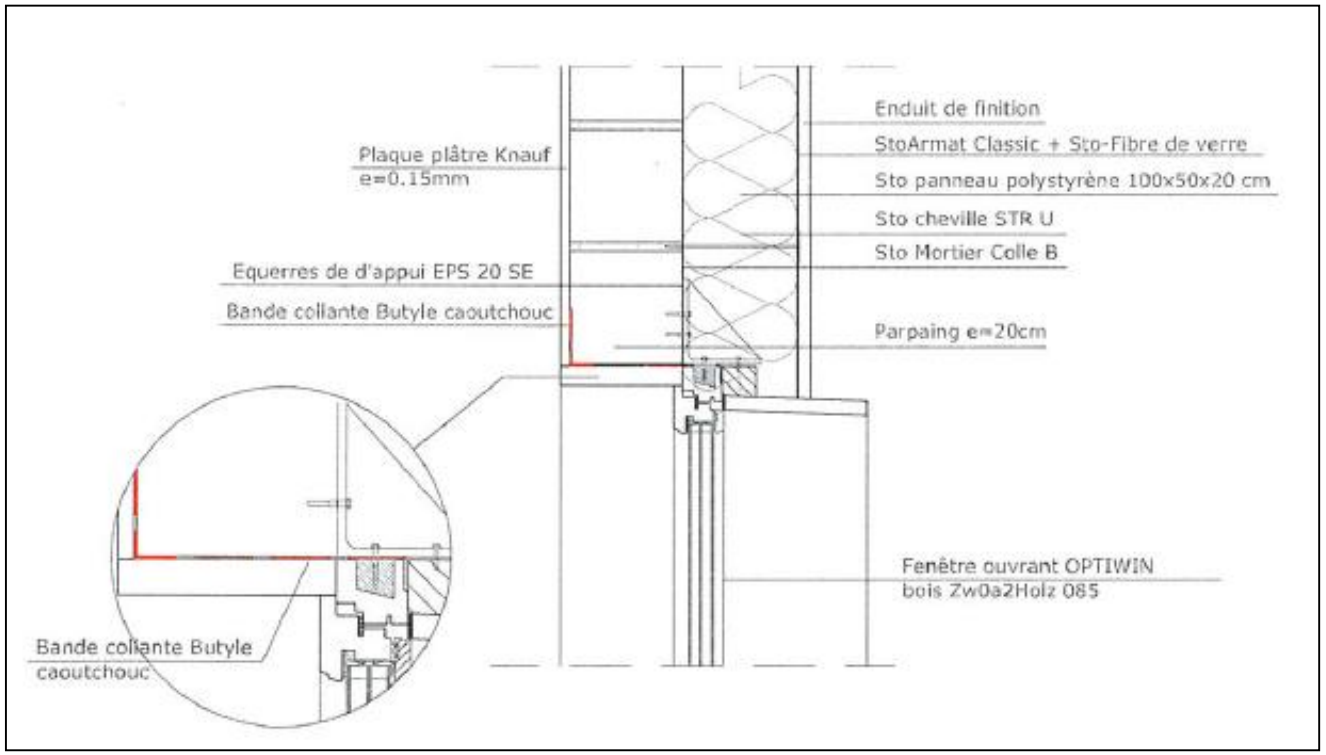
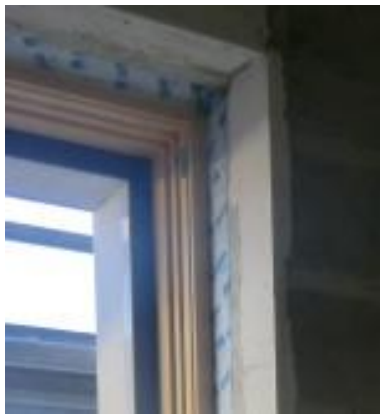
Thermal bridges and airtightness





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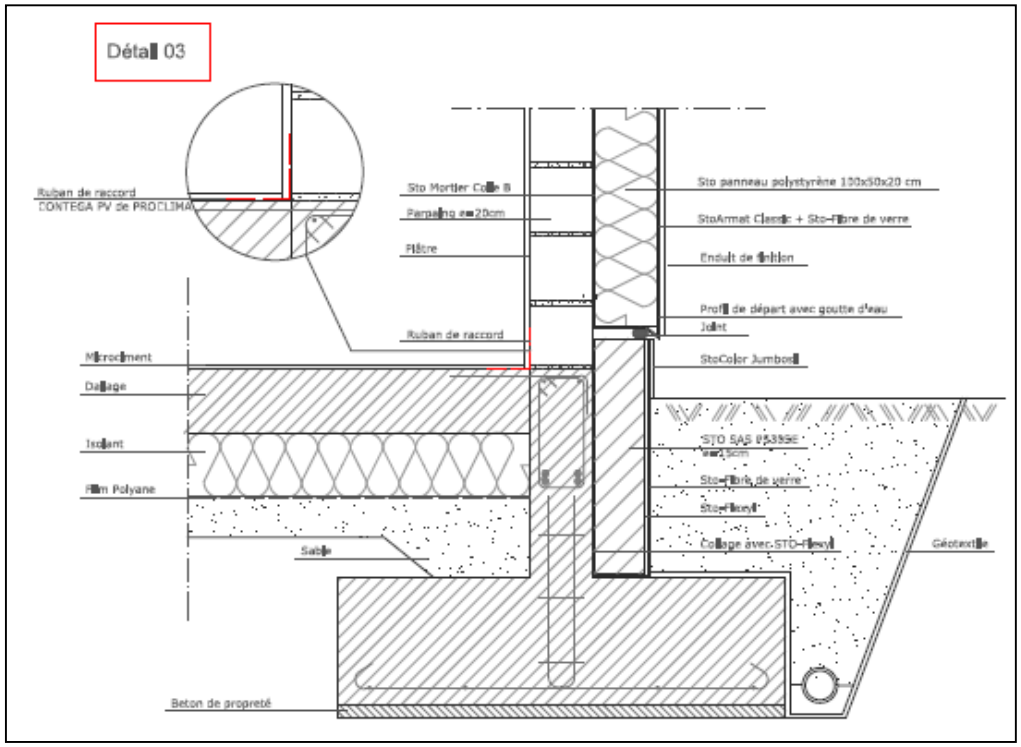
Thermal bridges and airtightness



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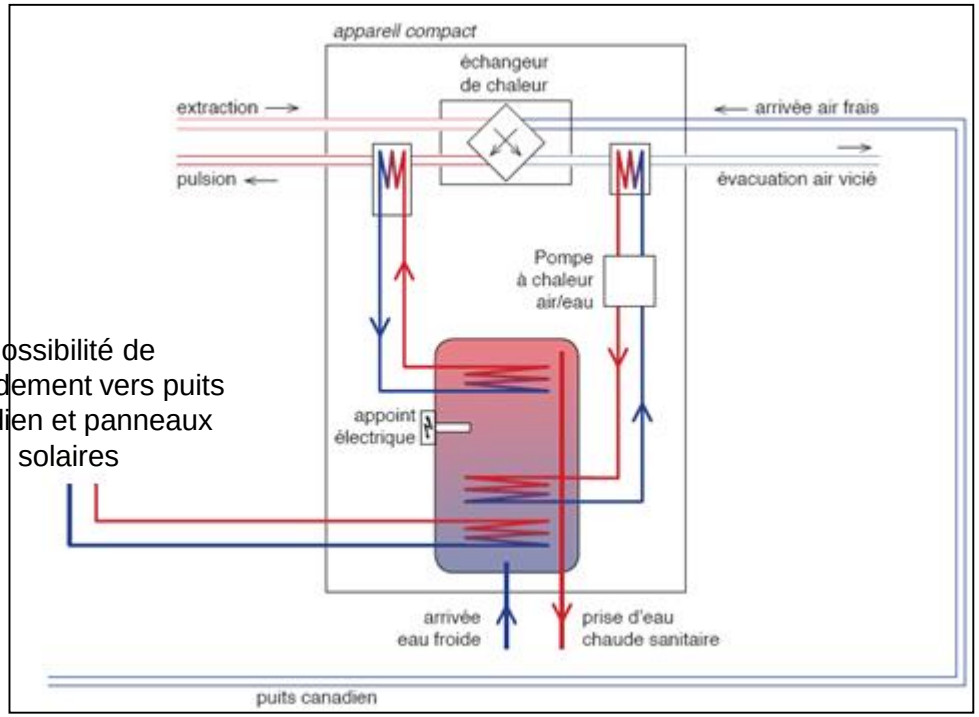
Ventilation and heating



Possibilité de raccordement vers puits canadien et panneaux solaires

- Heat pump power : 1,5 kW
- Domestic hot water : 200 L
- Ventilation : 205 m3/h
- Efficiency : 2,6

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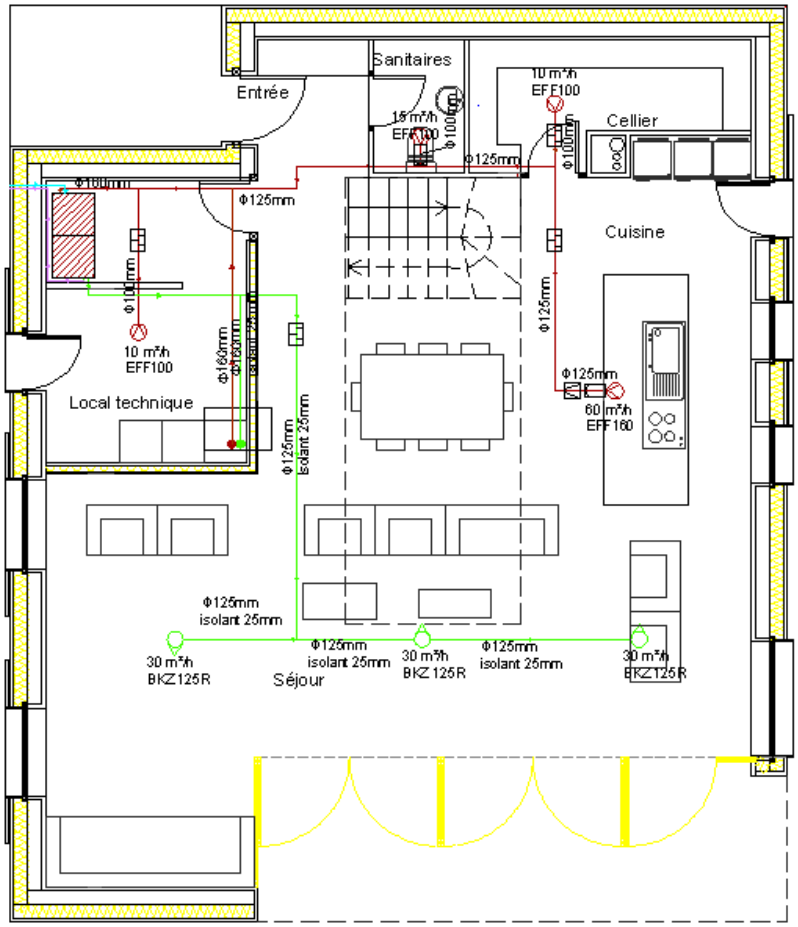
Ventilation and heating

L'échangeur



Des bouches

Des filtres

Des gaines rigides et lisses

Des silencieux

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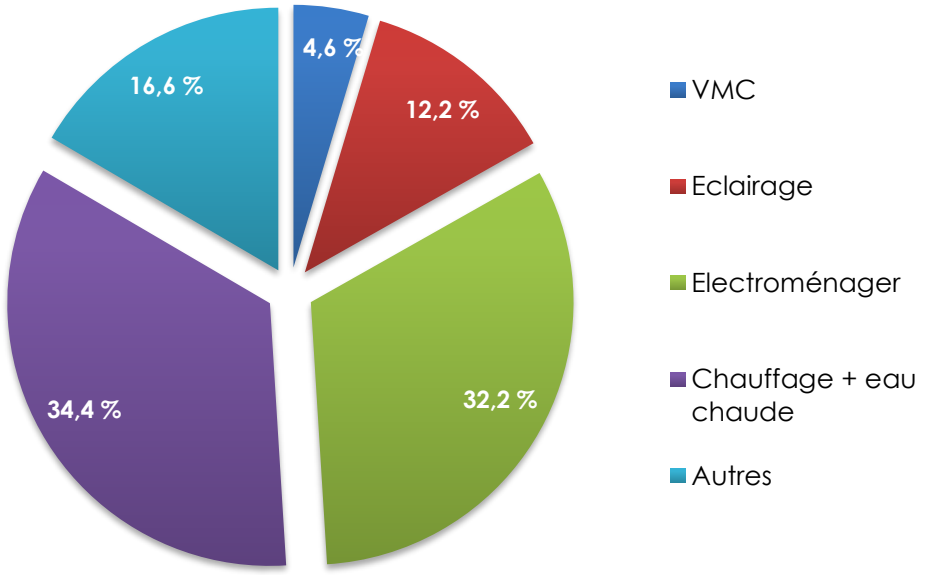
Energy demand in one year

6 500 kWh in one year : **850 €** including each following items :

- Mechanical ventilation with heat recovery
- Lighting
- Home appliance
- Heating + DWH system
- Others (sockets, computers, etc.)



Répartition de chaque poste par rapport à la consommation générale d'énergies

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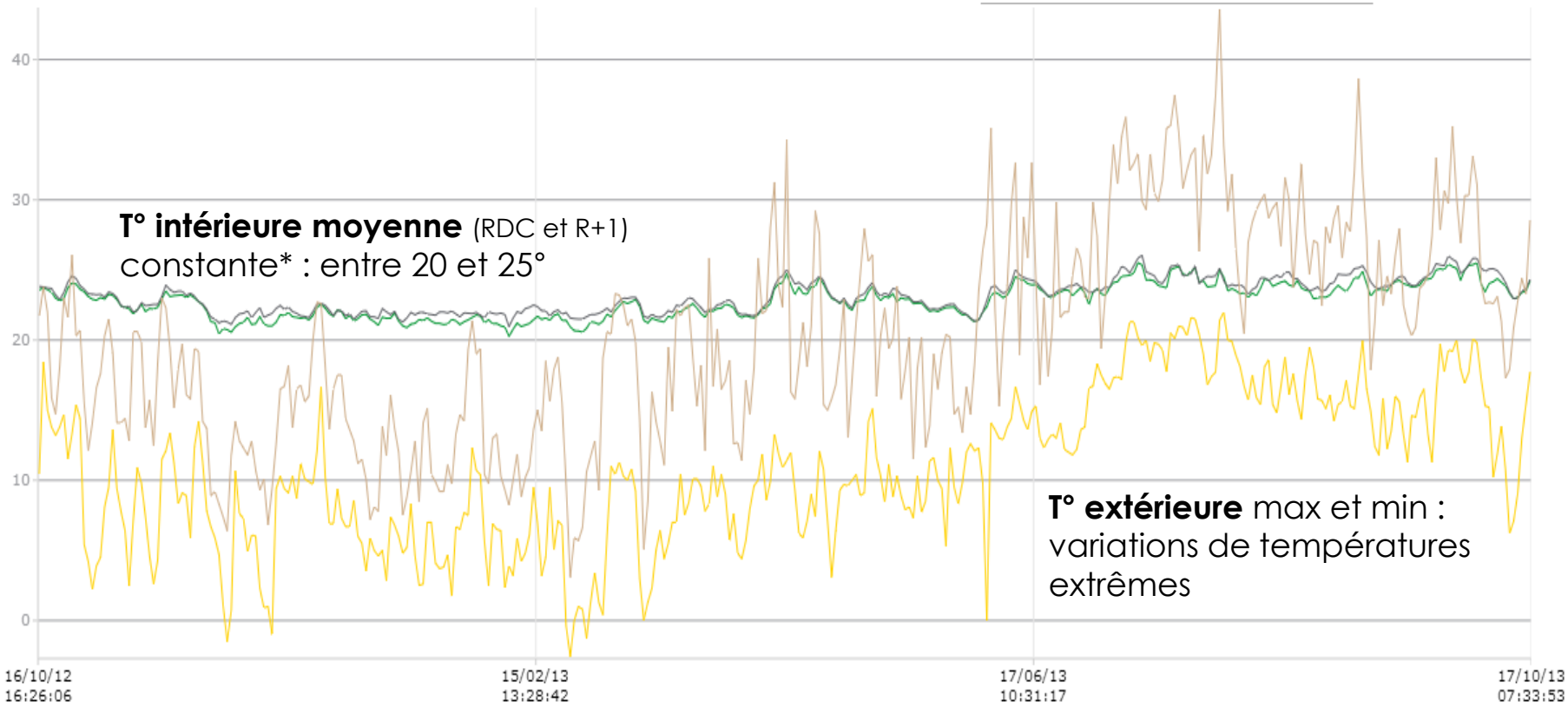
Variation des températures au cours d'une année



*On peut cependant observer quelques pics qu'il serait intéressant d'analyser.

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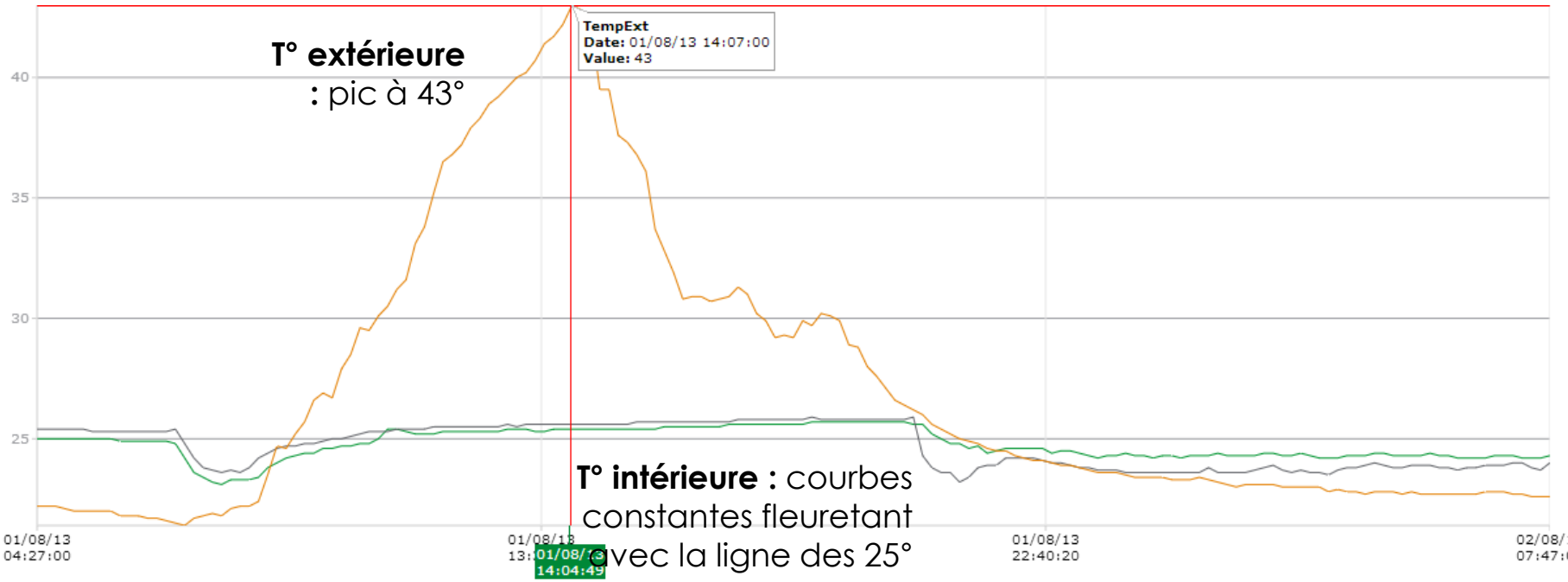
Journée la plus chaude de l'été 2013 : 1er Août 2013



T° extérieure : pic à 43°

T° intérieure : courbes constantes fleuretant avec la ligne des 25°

Volets restés entrebâillés toute la journée

Ouverture des fenêtres au moment où la T° a baissé

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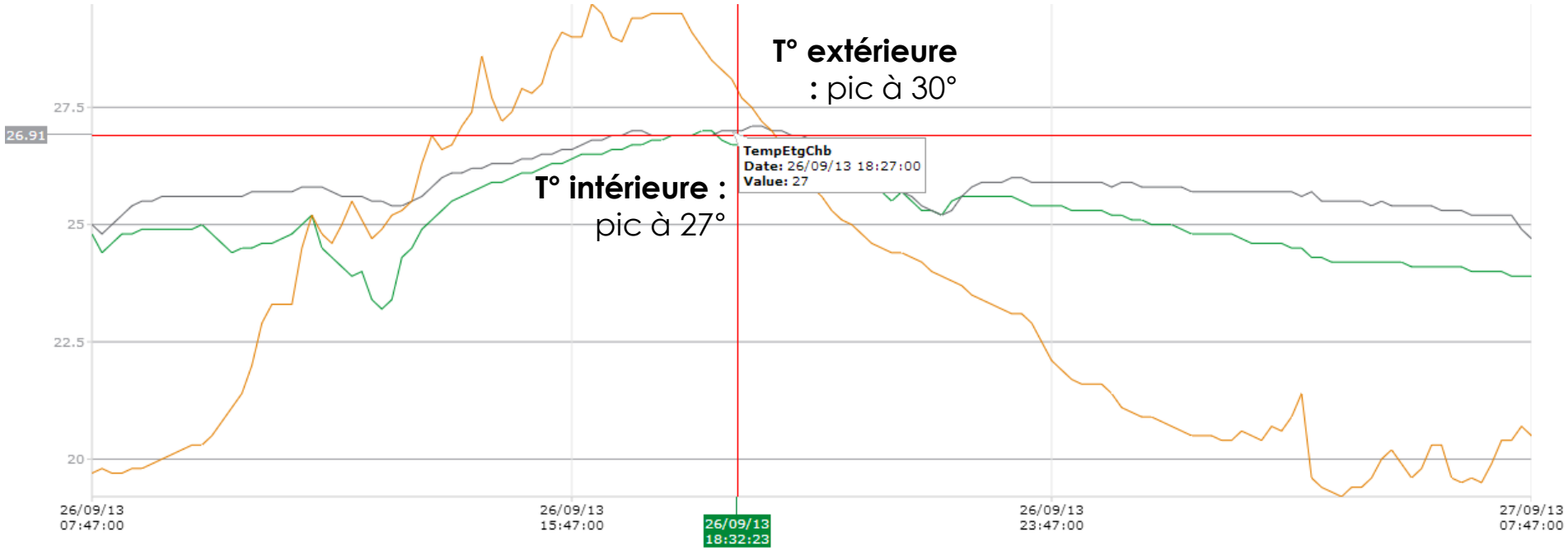
Journée assez chaude où la maison a été mal gérée



Volets restés ouverts et fenêtres en oscillo battants = augmentation de la T° intérieure à partir de 12h pour atteindre un pic de 27°

Ouverture des fenêtres = baisse de la T° intérieure jusqu'à atteindre une T° normale et constante inférieure à 25°

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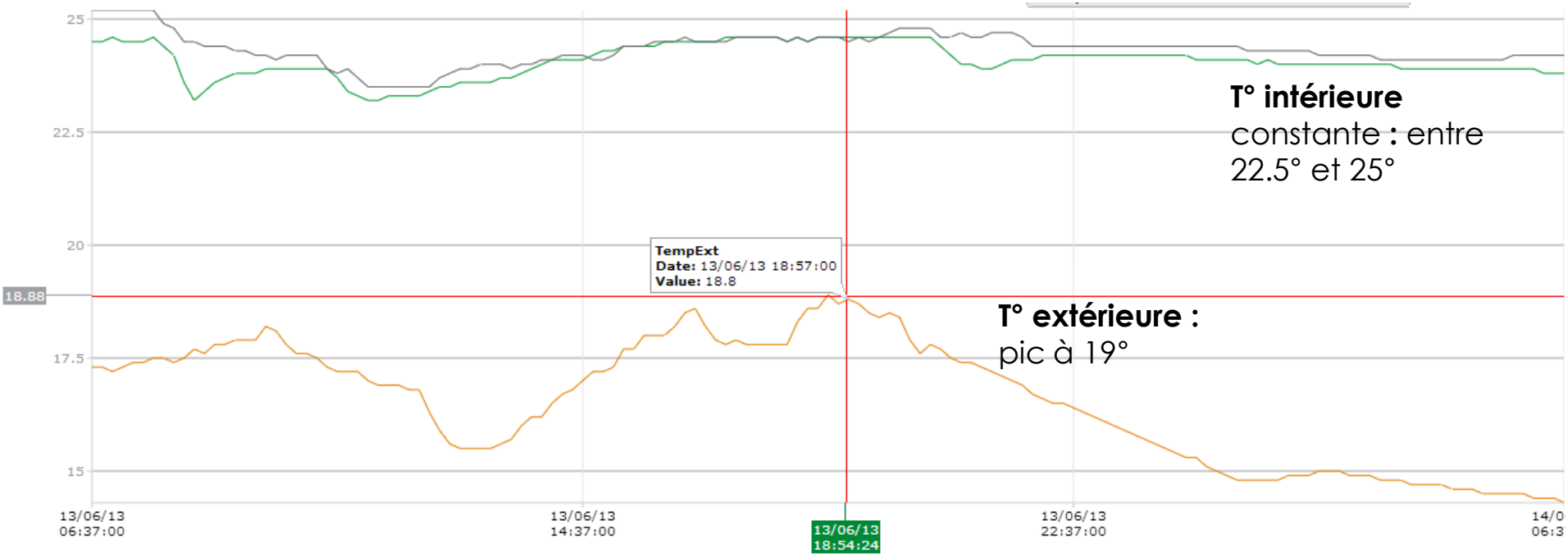
A cold day in June



T° intérieure
constante : entre 22.5° et 25°

T° extérieure :
pic à 19°

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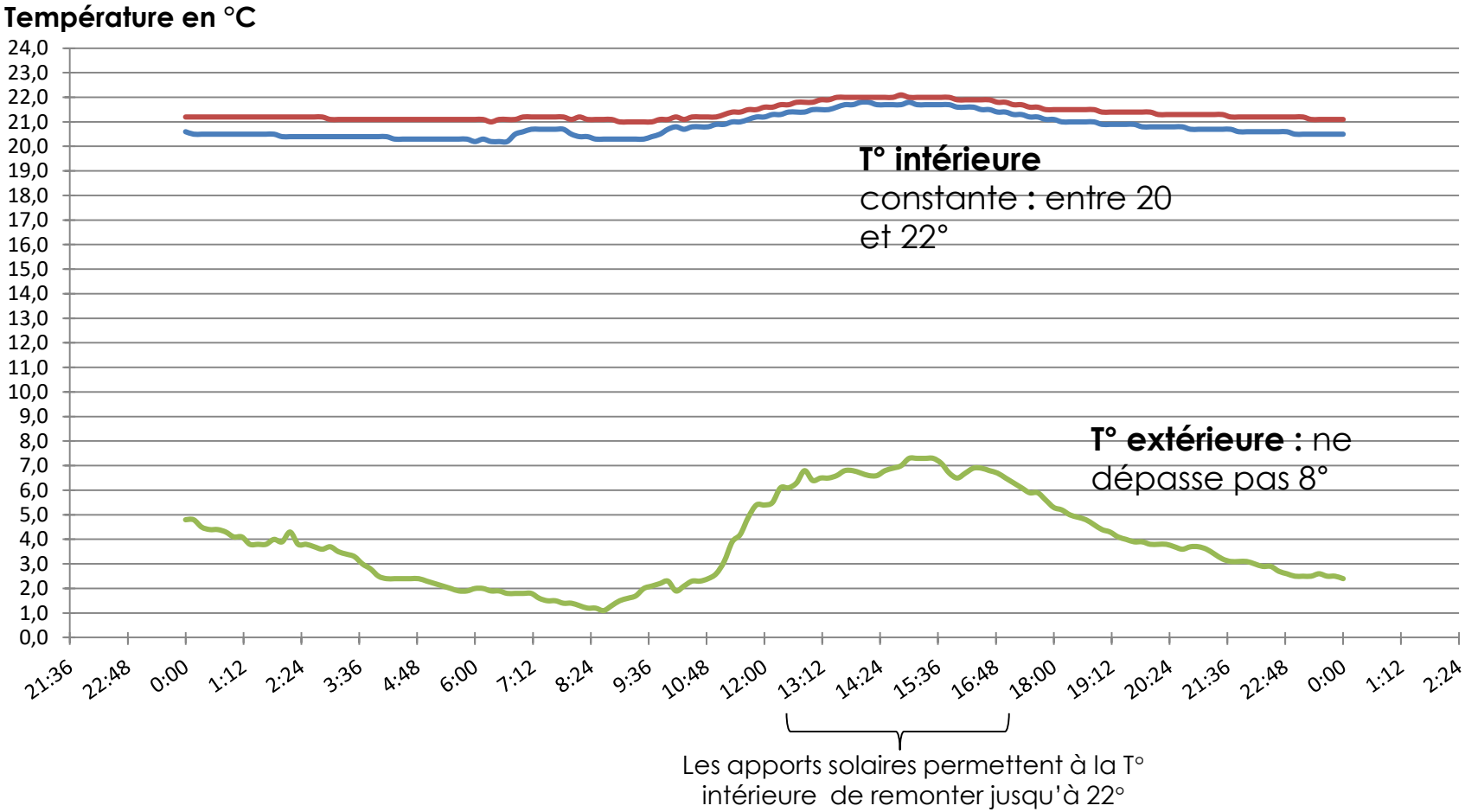
Cool day in winter : 30 November 2012



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Example of passive house

Mont de Marsan

Treated Floor Area :
186 m²

- Ventilation HELIOS, KWL EC 270
- Bouche chauffante et appoint électrique

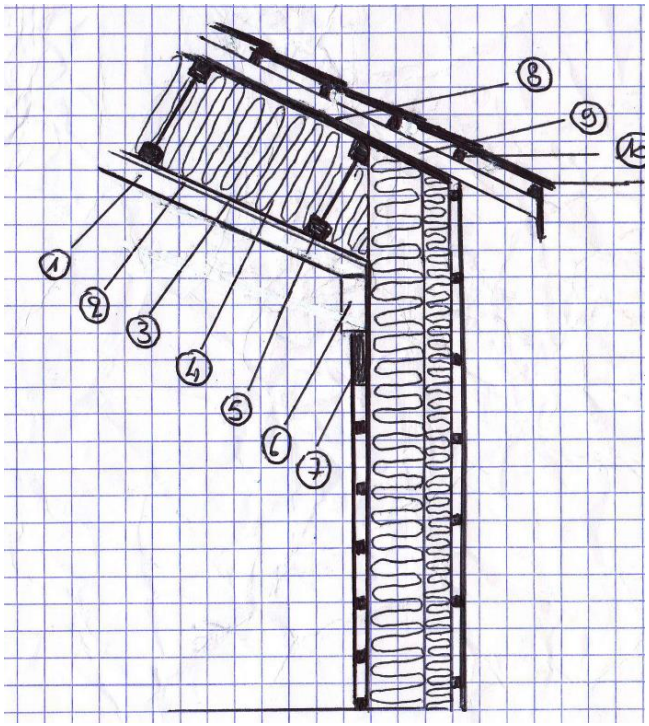
- Domestic hot water in heat enveloppe

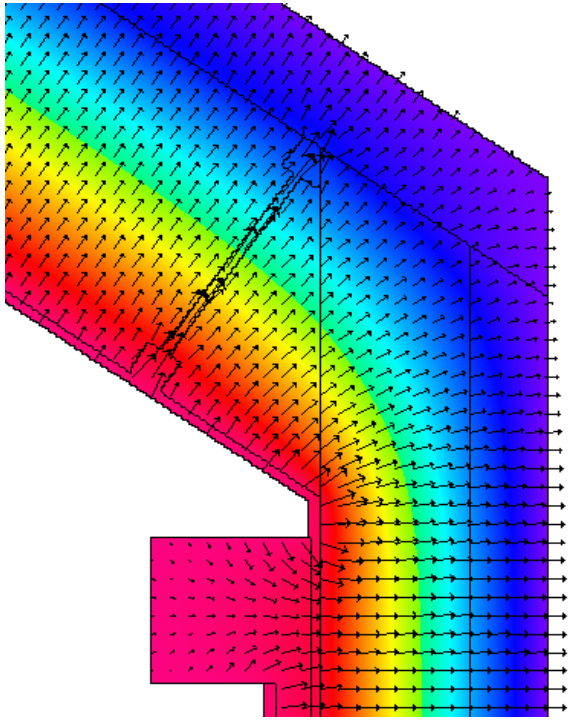
- Frame Minco, Extrem 66 – Uf : 1,35
- Glazing 4PUN-18-4-18-PUN4 VIR4-18Arg-4-18Arg-4VIR
- U_g value = 0.65 W/(m²K) - g value = 47 %
- Average U_w value = 1.07 W/(m²K)

Example of passive house

Roof
Ouate de cellulose entre Poutre I 314 mm
Panneau Agepan DWD 16 mm
U-value = 0.11 W/(m²K)

Exterior wall
Fibre de bois in Ossature 195 mm
Fibre de bois à l'extérieur : 100 mm
U-value = 0.15 W/(m²K)



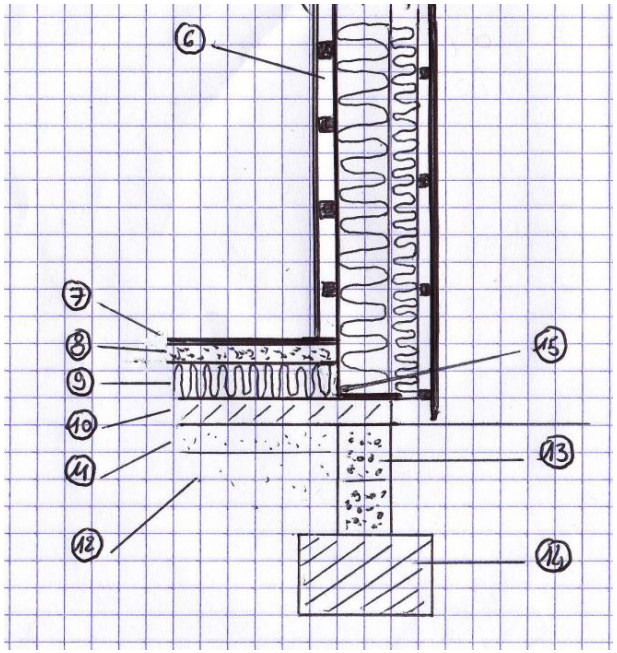


Ψ = **-0,020 W/(m.K)**
(référence PHPP)
Ψ = **0,018 W/(m.K)**
(référence RT)

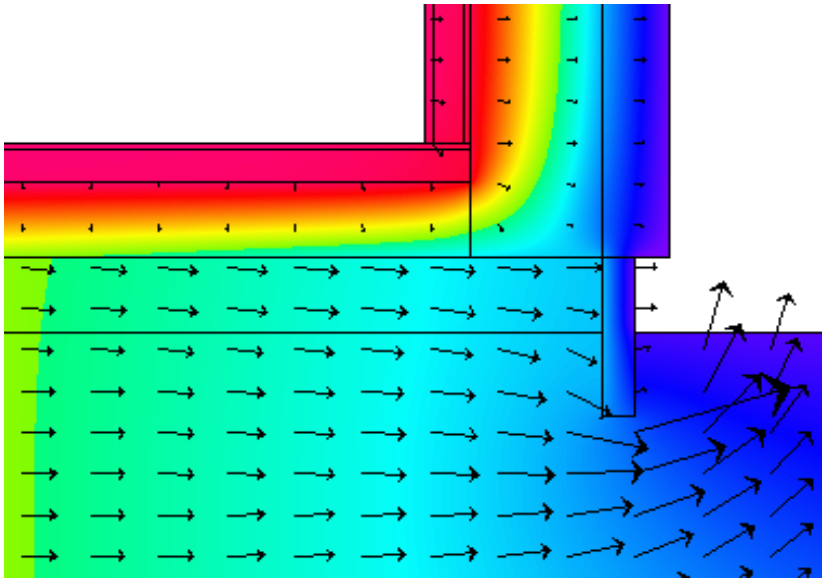
Example of passive house

Basement floor / floor slab
Polyurethane projeté 120 mm
Dalle béton 120 mm
U-value = 0.19 W/(m²K)

Exterior wall
Fibre de bois in Ossature 195 mm
Fibre de bois à l'extérieur : 100 mm
U-value = 0.15 W/(m²K)



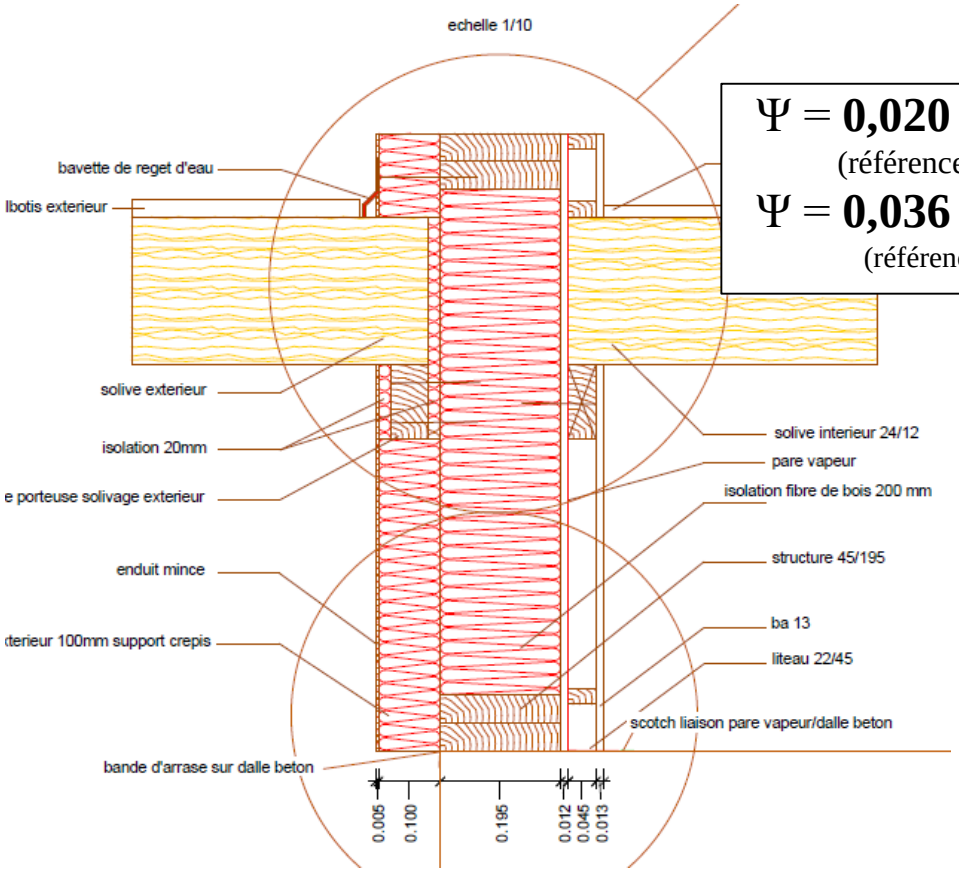
Ψ = **-0,015 W/(m.K)**
(référence PHPP)



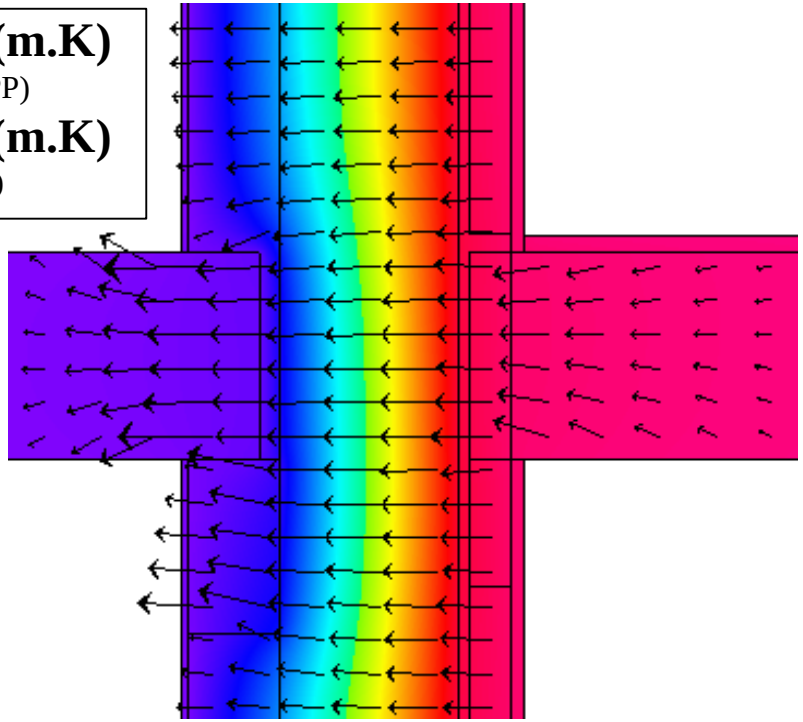
Example of passive house

Exterior wall
Fibre de bois in Ossature 195 mm
Fibre de bois à l'extérieur : 100 mm
U-value = 0.15 W/(m²K)

Exterior wall
Fibre de bois in Ossature 195 mm
Fibre de bois à l'extérieur : 100 mm
U-value = 0.15 W/(m²K)



$\Psi = 0{,}020$ W/(m.K)
(référence PHPP)
$\Psi = 0{,}036$ W/(m.K)
(référence RT)



Évolution of passive houses

Passive building in the world

- 32 000 passive building in the world
- 2 000 in France

LES BÂTIMENTS LABELLISÉS

- In France : 300 labelling buildings
- 1 millions of m² labelling in the world
- Increase of tertiare and collectif buildings

- **In Pau :** OPH launch a tender for a passiv collectiv building with 10 accomodations

- **In Rennes** : each new opération developp a label « Passivhaus »

- **In Nantes** : 600 passive accomodations will grow up, forming the highest certificat complex in Europe

- **In Spain**, one passive house with Passif Premium (positive) has just been certifies in Majorque

Conclusions…

- Confort
- Good quality air in all seasons
- Low energy cost

- Open windows authorized !

DES QUESTIONS !?

La maison passive, c'est pour les allemands?!

Quoi, une maison passive ?!

Maison passive, étiquette A+++ !!!?

Est-ce qu'on peut ouvrir les fenêtres ?!

La maison passive, ca coute combien ?!

Et la rénovation passive ?!

Maison passive, c'est moche ?!

Pour nous contacter :

 05 59 01 11 63

 contact@carbone64.fr

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