

Training social labor force Insulation Materials



Sustainable use of energy

Before we start to save energy.....

And what is your usage??

Measurement is knowledge!!



Why insulate?



1) Heating = largest share

Heating: 68%

Hot water: 16%

Kitchen: 8%

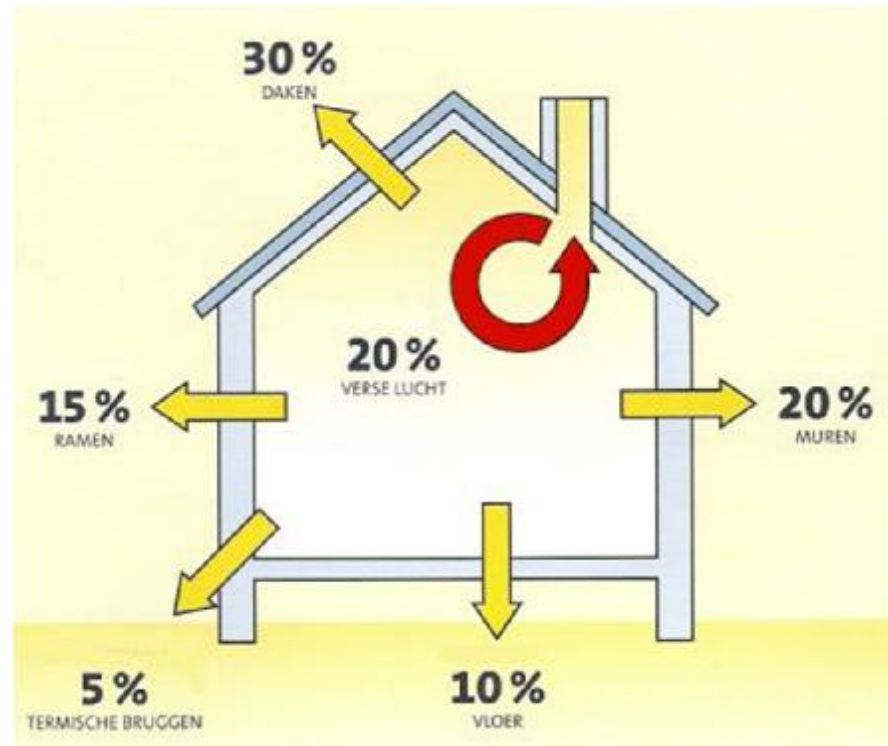
Diverse: 8%

Average electricity consumption: 3500 kWh

Average heating consumption: 23.000 kWh



Why insulate?



Thermal bridges: 5%
Windows: 15%
Roofs: 30%

Fresh Air: 20%
Walls: 20%
Floor: 10%

Why insulate?

- 2) Feeling of comfort : -Winter : warmth inside, cold outside
-Summer : keep heat out
- 3) Legal obligations in terms of insulation in new construction and renovation (only maximum u-values).

EPB : requirement 1: insulation level = K45

requirement 2 : maximum U-value roof insulation
= 0,3 or 13 cm insulation

Component	EPB	Low energy	Passive
Wall	0,4 or 8 cm	0,2 or 15 cm	0,15 or 30 cm
Roof	0,3 or 13 cm	0,15 or 25 cm	0,1 or 40 cm
Floor	0,4 or 8 cm	0,3 or 10 cm	0,15 or 20 cm

How to insulate?

Intermezzo: a few words and numbers in a row

- lambda-value = thermal conductivity coefficient material
 - .The lower, the better the insulation quality of the material
 - . $\lambda < 0,070$ = insulation material
- U-value = heat transfer coefficient of building element
 - .The lower, the better the insulating value of the building section
 - . $U = \lambda / \text{thickness}$
- R-value = thermal resistance of the building section
 - .The higher, the better the insulation quality of the building section
 - . $R = \text{thickness} / \lambda = 1/U$
- heat storage capacity C = ability to retain heat
 - .The higher, the better the heat can be retained



Overview insulation materials

1) Inorganic materials

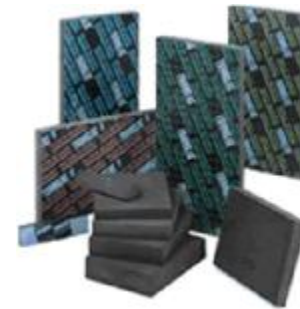
- Mineral wool: rock wool or glass wool
 - Material: glass or diabase
 - Flange covers or mats
 - Easy to find in the do-it-yourself shop
 - Ecologically acceptable: NIBE classification = 2b rock wool and 1b glass wool
 - $\lambda = 0,032$ to $0,040$ - $c = 800$ J/kgK
 - Disadvantage: irritation when placing and limited heat capacity
 - Application: walls, pitched roof and flat roof
 - Brands: knauf, isover, rockwool



Overview insulation materials

1) Inorganic materials

- Cellular glass
 - flameproof
 - Quite expensive
 - Ecologically acceptable: NIBE classification = 3a
 - $\lambda = 0,040$ to $0,050$ - $c = 840$
 - Application: cold bridge floor – wall, basement insulation, flat roofs, floor insulation
 - Brands: foamglas



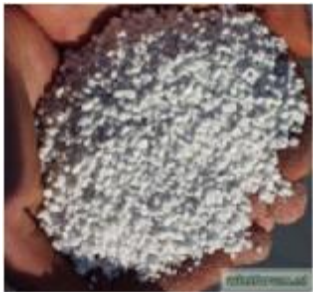
Overview insulation materials

1) Inorganic materials

- Perlite, vermiculite, silica

- Mineral rocks
- Ecologically acceptable: NIBE classification = 1a
- $\lambda = 0,050$ to $0,065$ – $c = 900$
- Application:

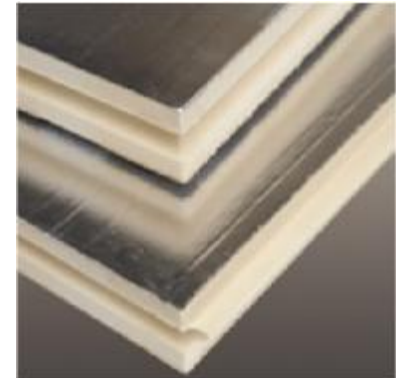
- Silicate Granules: cavity wall (SLS)
- Perlite Granules: floor insulation (SIBLI)
- Vermiculite Granules: floor insulation (in screed) or attic floor or cavity wall (vermex of vermiculite)
- Perlite Plates: flat roofs (fesco)



Overview insulation materials

2) Artificial materials

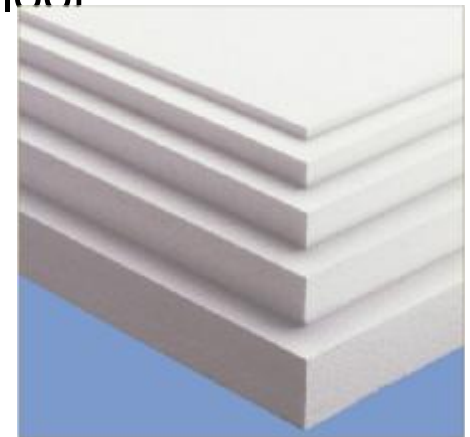
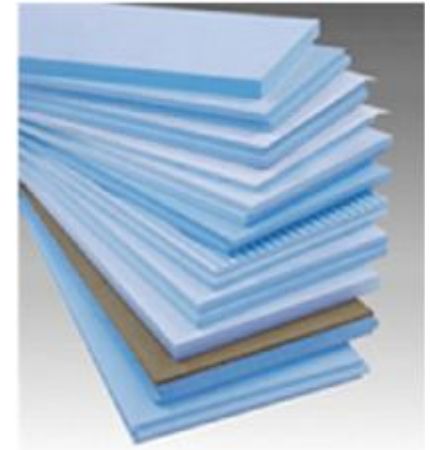
- Polyurethane (PUR) or Polyisocyanurate (PIR)
 - Based on isocyanates (chemical)
 - PIR is actually the fire technically enhanced PUR
 - $\lambda = 0,023$ to $0,028$ - $c = 1200$
 - Ecologically unacceptable: NIBE classification = 4c
 - Application:
 - Plates: flat en sarking roofs, cavity wall
 - Foam: floor, cavity or roof insulation
 - Disadvantage:
 - Flammable and damp proof material
 - Insulation loses its quality after a few years
 - Brands: Kingspan, Recticel, unilin, enertherm, extratherm



Overview insulation materials

2) Artificial materials

- Polystyrene (expanded (EPS) or extruded (XPS))
 - Based on styrene (residual product crude oil)
 - $\lambda = 0,032$ to $0,040$ – $c = 1500$
 - Ecologically acceptable: NIBE classification = 2b
 - Application: flat and sarking roofs, cavity wall, floor
 - Disadvantage:
 - Flammable and damp proof material
 - Brands: Ursa, isomo, styrofoam, basf, styrodur



Overview insulation materials

2) Artificial materials

- Resol
 - Based on resole resin or bakelite
 - Improved thermal values and better fire resistance
 - $\lambda = 0,021$
 - Ecologically acceptable: NIBE classification = 1c
 - Application: Plates: floor, flat roofs, cavity wall
 - Disadvantage:
 - Moisture sensitive
 - Fragile
 - Brands: Kingspan



Overview insulation materials

3) natural materials

- Cellulose : recycled paper
 - recycled newspapers with the addition of boron salts
 - High fire resistance and soundproofing
 - Moisture-regulating up to 30% and vapor permeable
 - Ideal for large and irregular compartments
 - High heat storage capaciteit $c = 2100$
 - $\Lambda = 0,039$
 - Application: in plates or blown off: floor scheduling, wood frame walls, pitched and flat roofs
 - Brands: Isofloc, dammstadt, isocell



Overview insulation materials

2) natural materials

- Hemp

- Hemp fibres with boron salts
- high fire resistance and fungicide
- Moisture regulating, soundproofing and vapor permeable
- High heat storage capacity $c = 1800$
- $\Lambda = 0,038 - 0,041$
- Application: scheduling plates (wall, floor and roof)
- Brands: canaflex van Steico, thermohenf, florapan plus van isover, terrachanvre



Overview insulation materials

2) natural materials

- Flax
 - Flax fibres with boron salts
 - High fire resistance and fungicide
 - Moisture regulating, soundproofing and vapor permeable
 - High heat storage capacity $c = 1600$
 - $\Lambda = 0,038 - 0,040$
 - Application: scheduling plates (wall, floor en roof)
 - Brands: isovlas, isolina



Overview insulation materials

2) natural materials

- Scheep wool
 - high fire resistance and fungicide
 - Good acoustic characteristics
 - Moisture-regulating up to 30% and vapor permeable
 - High heat storage capacity $c = 1600$
 - $\Lambda = 0,035 - 0,039$
 - Application: scheduling plates (wall, floor and roof)
 - Brands: doscha, black mountain



Overview insulation materials

2) natural materials

- Excelsior



- Based on coppice
- Fungicide and moisture resistant
- Vapor permeable
- High heat storage capacity $c = 2100$
- $\Lambda = 0,038 - 0,045$
- Application: scheduling plates (wall, floor and roof), as a shelter or separation wall, sarking roof, outer wall insulation, acoustic screed,...
- Brands: steico, pavatex, gutex, celit,



Overview insulation materials

2) natural materials

- cork

- Bark of the cork tree
- Fungicide and moisture resistant
- Good sound absorption
- High heat storage capacity $c = 1700$
- $\Lambda = 0,038 - 0,040$
- Application: granules between floor scheduling, plates as floor insulation, basement floor, roof,...
- Brands: vanaevermaet, wurth, le petit liege, T&G



Overview insulation materials

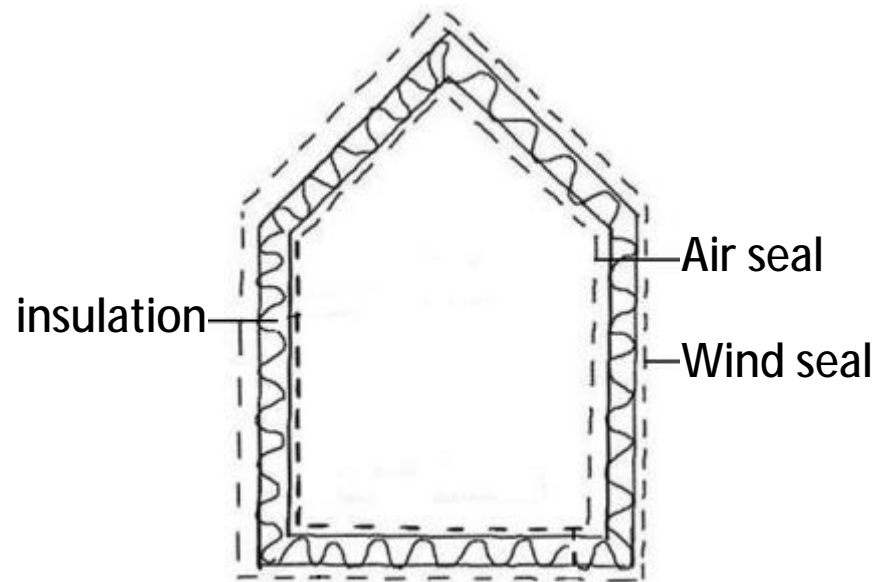
2) natural materials

- straw
 - Agricultural residue
 - Moisture regulating and vapor permeable
 - After plastering: fireproof, moisture resistant and fungicide
 - $\Lambda = 0,055$
 - Ecologically acceptable
 - Application: straw bale construction



How to insulate? The ideal construction

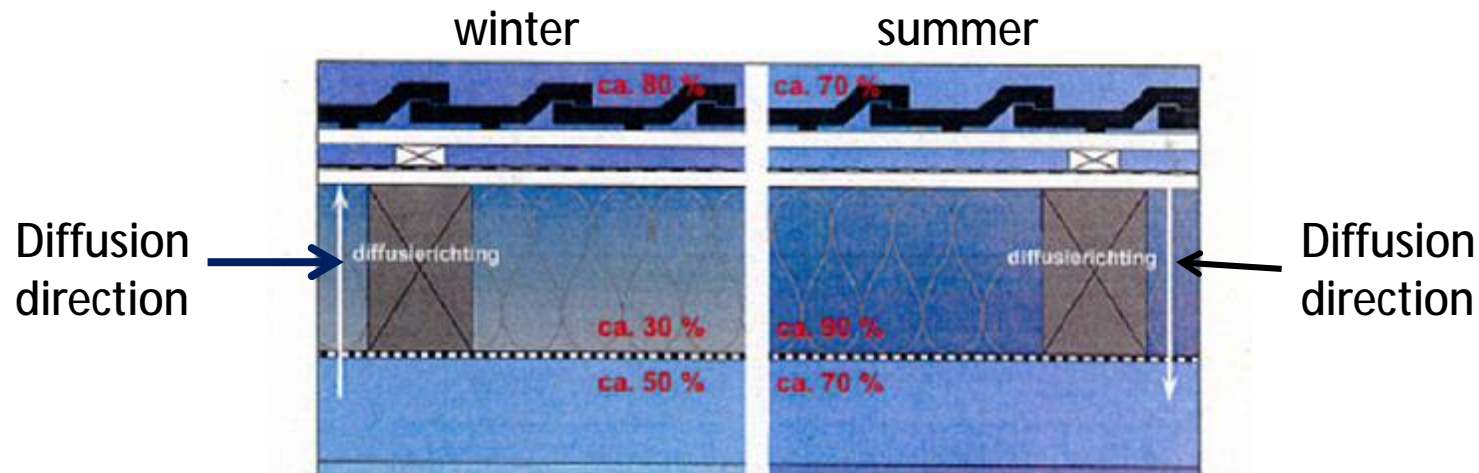
- Definition: insulation = Dry Still air
- Protect against Wind, Moisture and animals through
 - Wind seal on the outside (eg. Under-roof, external cavity,...)
 - Air sealing with vapor barrier features on the inside (eg. Air sealing foil, plaster,..)



How to insulate? The ideal construction

- Why air seal foil with vapor barrier features to attach on the inside?

-> vapor transport! \neq water transport



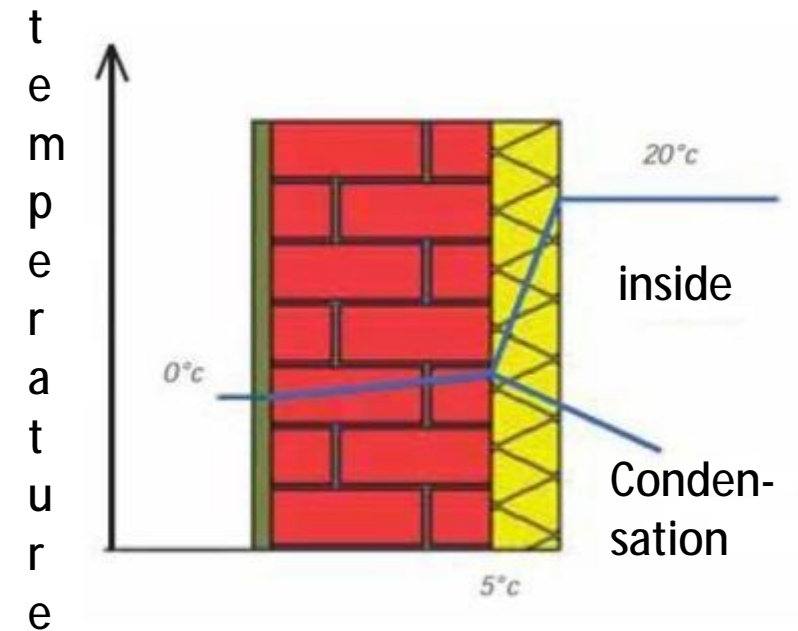
Average ambient humidity of the vapor barrier

40%

80%

How to insulate? The ideal construction?

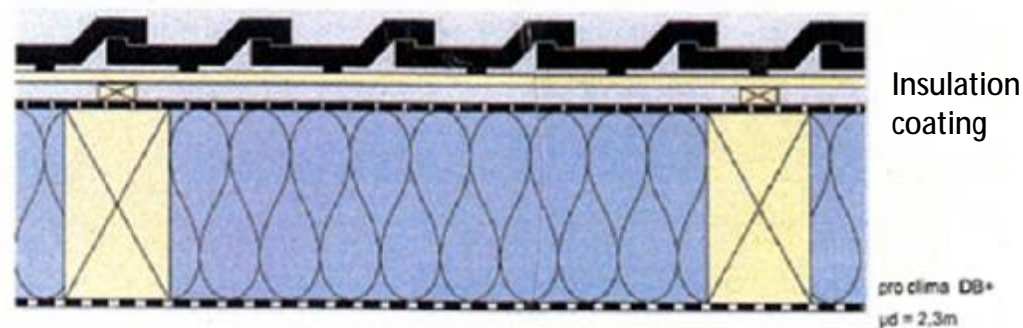
Prevent internal condensation!



How to insulate? The ideal construction

- Ideal situation to keep vapor transport under control:

Outside as vapor open as possible



Inside vapor proof no more than necessary

Hoe isoleren? De ideale opbouw

Difference partially vapor barrier – vapor barrier

- Vapor barrier is fully closed. (= aluminum or plastic foil)



- A partially vapor barrier lets more moisture through in the winter compared with a vapor barrier, but also provides a chance to dry out in the summer
- Intelligent or humidity-controlled partially vapor barrier: difference winter – summer.
Eg. Intello or DB+ of proclima, vario KM of isover



How to insulate your pitched roof?

Attic floor or pitched roof?



- Depending on the utilisation
- Attic floor preferred
 - Cheaper
 - Easier
 - Less volume to heat



How to insulate your pitched roof?

Between the supporting structure



How to insulate your pitched roof? – Between the supporting structure

Step 1: Under-roof present? If not -> first apply under-roof!

Features under-roof: waterproof, windproof, vapor permeable
A new under-roof: choose for wood fiber insulation panels
Brands Celit, Steico, Gutex, Pavatex



Step 2: stick your under-roof air-tight (biplex, menuiserite,...)



How to insulate your pitched roof? - Between the supporting structure

Step 3: provide a sufficiently thick partitioning depending on type of roof

- Roof trusses (typically 18 cm)
- Choose for standard trusses of 23 cm in a new construction
- For renovation eventual up to 25 cm.
- Purlin roof (7 cm available between the rafters)
- Thick the structure with plywood or wooden planks to 25 cm



Figure: purlin roof thicked out



Figure: roof trusses

How to insulate your pitched roof? - Between the supporting structure

Step 4: place the insulation

- Choose a sufficiently thick layer. Target thickness = 18cm - 25 cm.
Every cm pays!
- Completely fill the compartment
- Choose a material with a solid λ -value (min 0,040)
- Use woolly or bulk materials. Do not use sheet metal because it's hard to place it perfectly suited.
- Try to use natural materials!
- Do not use nail flange blanket!!
 - insufficient density
 - with vapor barrier



How to insulate your pitched roof? - Between the supporting structure

Step 5: place an air seal foil with vapor barrier features



Step 6: place ceiling battens as leadership cavity

- base for finishing
- leadership cavity so that the foil is not punctured
- More support for blowing in the cellulose

Note: when using cellulose insulation the blowing in from the insulation will be the last step (after placing the partially vapor barrier and the ceiling battens)

How to insulate your pitched roof?

On the supporting structure (sarkin roof)



How to insulate your pitched roof? On the supporting structure

When?

- If the roof structure has to remain visible
- If the inside is finished

Possible solutions:



Non –ecological: PUR
= vapor proof or not breathing

→ ecological: wood fibre insulation
bords
= vapor permeable or breathable



How to insulate your attic floor?

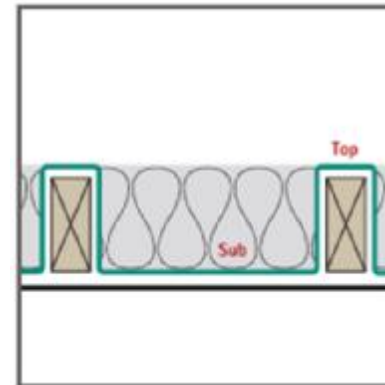
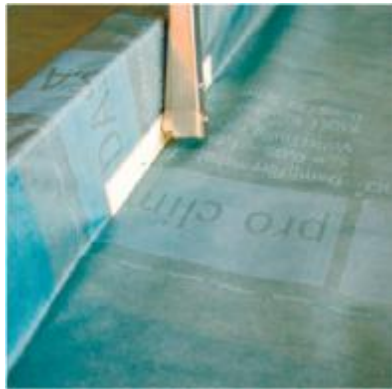
Between the supporting structure



How to insulate your attic floor?

Insulation between the existing structure

Option 1: apply the partially vapor barrier through the attic



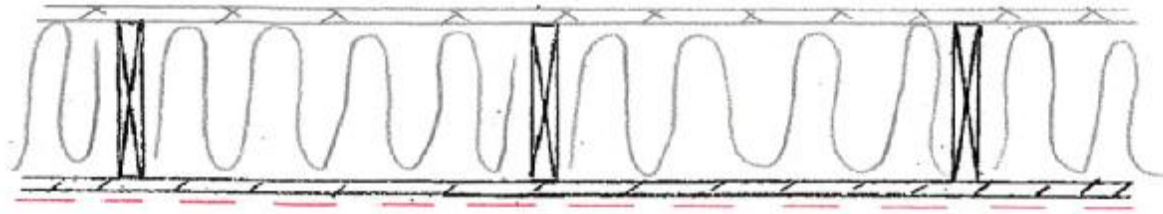
Work order:

- Placement of the partially vapor barrier (Pro Clima Dasatop) on the beams
- Fill the compartment with insulation
- Place walking floor

How to insulate your attic floor?

Insulation between the existing structure

Option 2: when placing a partially vapor barrier through the attic is impossible.



Work order:

- Placement of the partially vapor barrier (Pro Clima Santa) against the plaster on the ceiling
- Fill the compartment with insulation along the attic
- Place the walking floor

How to insulate your attic floor?

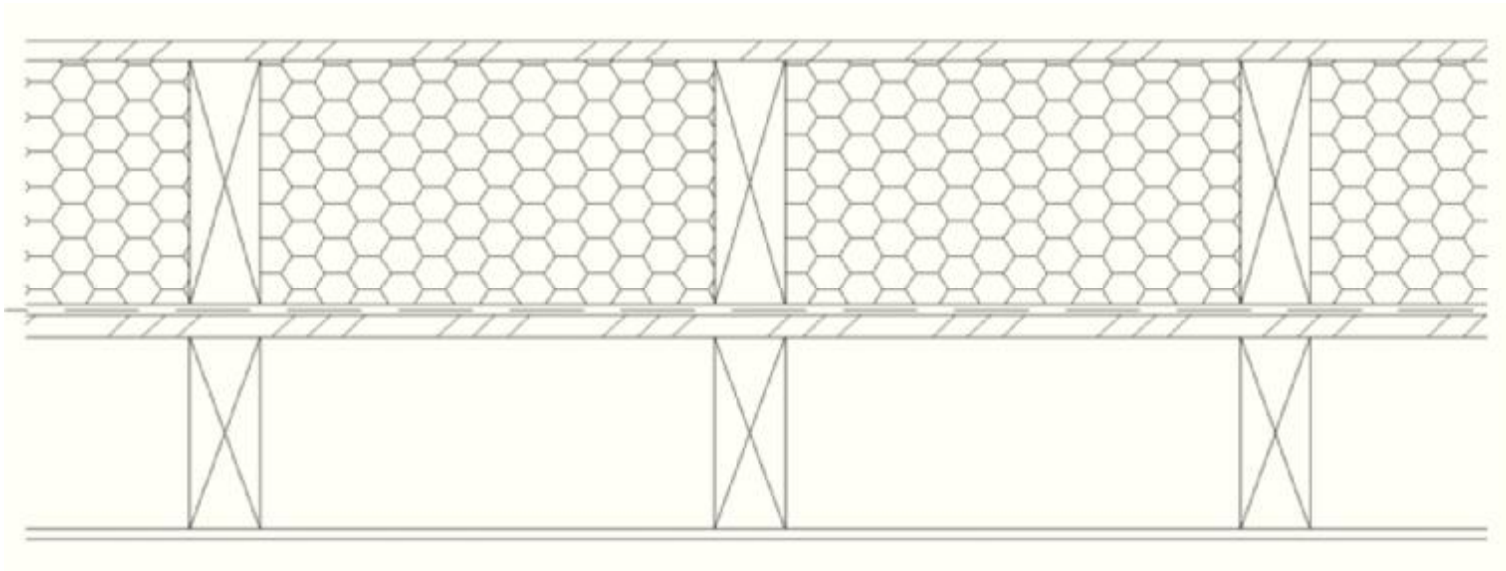
On the supporting structure



How to insulate your attic floor?

Insulation on the existing structure (eg. Concrete attic floor)

Option 1: new support structure with insulation between

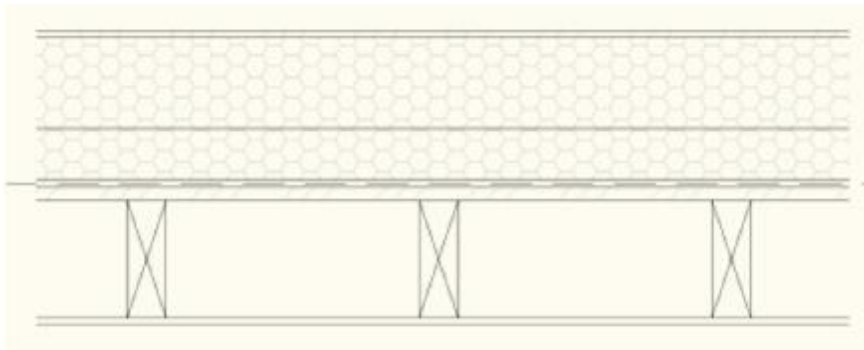


When applying this solution:

- When concrete floors or wooden scheduling in a room with sufficient height
- If the space above is used frequently.
- When heavy storage

How to insulate your attic floor?

Option 2: flameproof insulation panels with under-floor attached or flameproof insulation panels with OSB on.

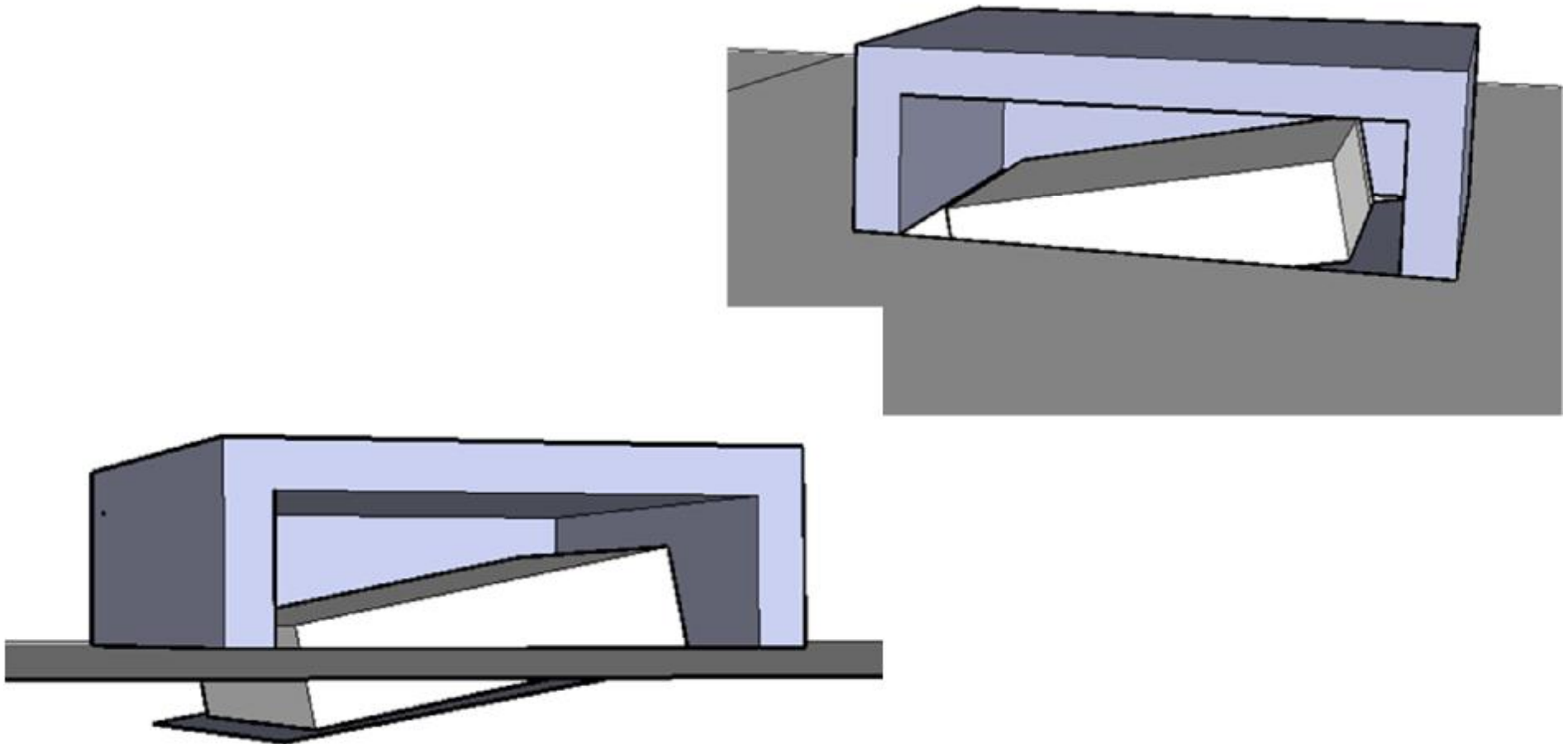


Only at low storage!



How to insulate your attic floor hatch?

Solution: fixed insulated curb with a flap insulated hatch



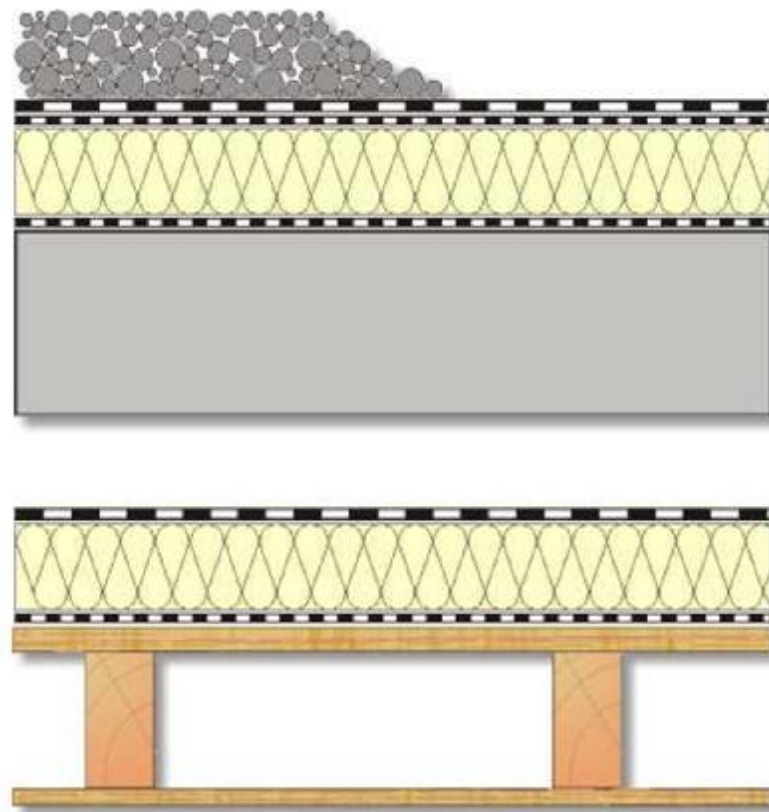
How to insulate your flat roof?

On the supporting structure



How to insulate your flat roof? - Warm roof

= Insulation will be placed on the supporting structure
Applying vapor barrier!!



How to insulate your flat roof?

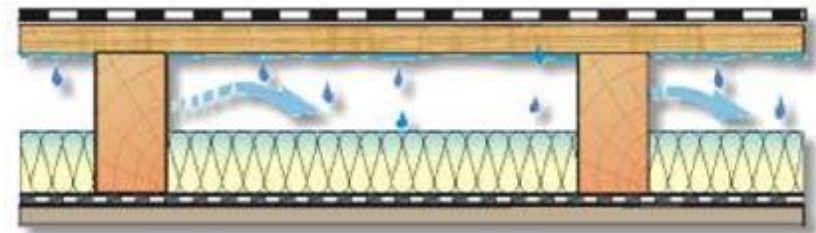
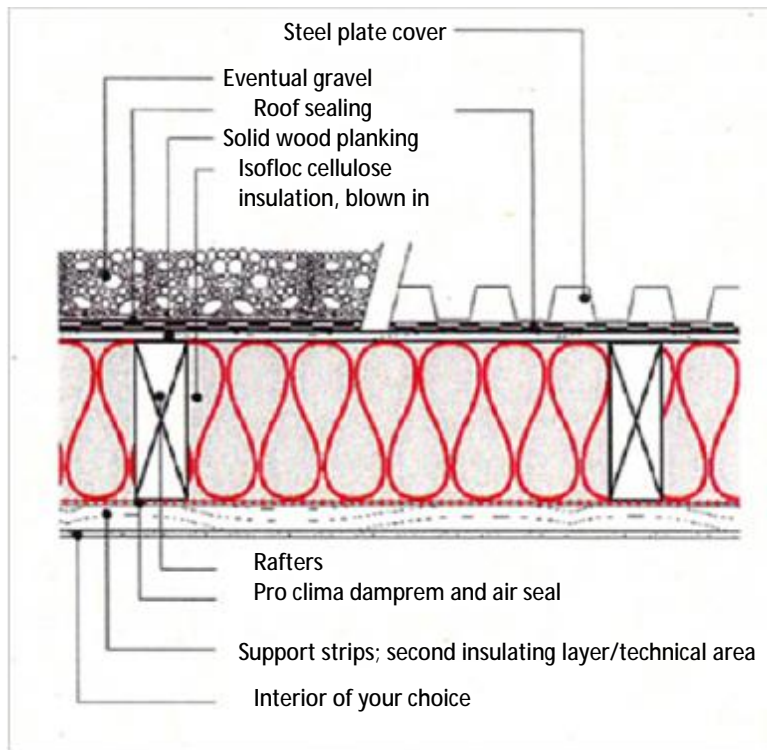
Between the supporting structure



How to insulate your flat roof? - Compact roof

= Insulation between the supporting structure

Application of the moisture-steered vapor barrier foil

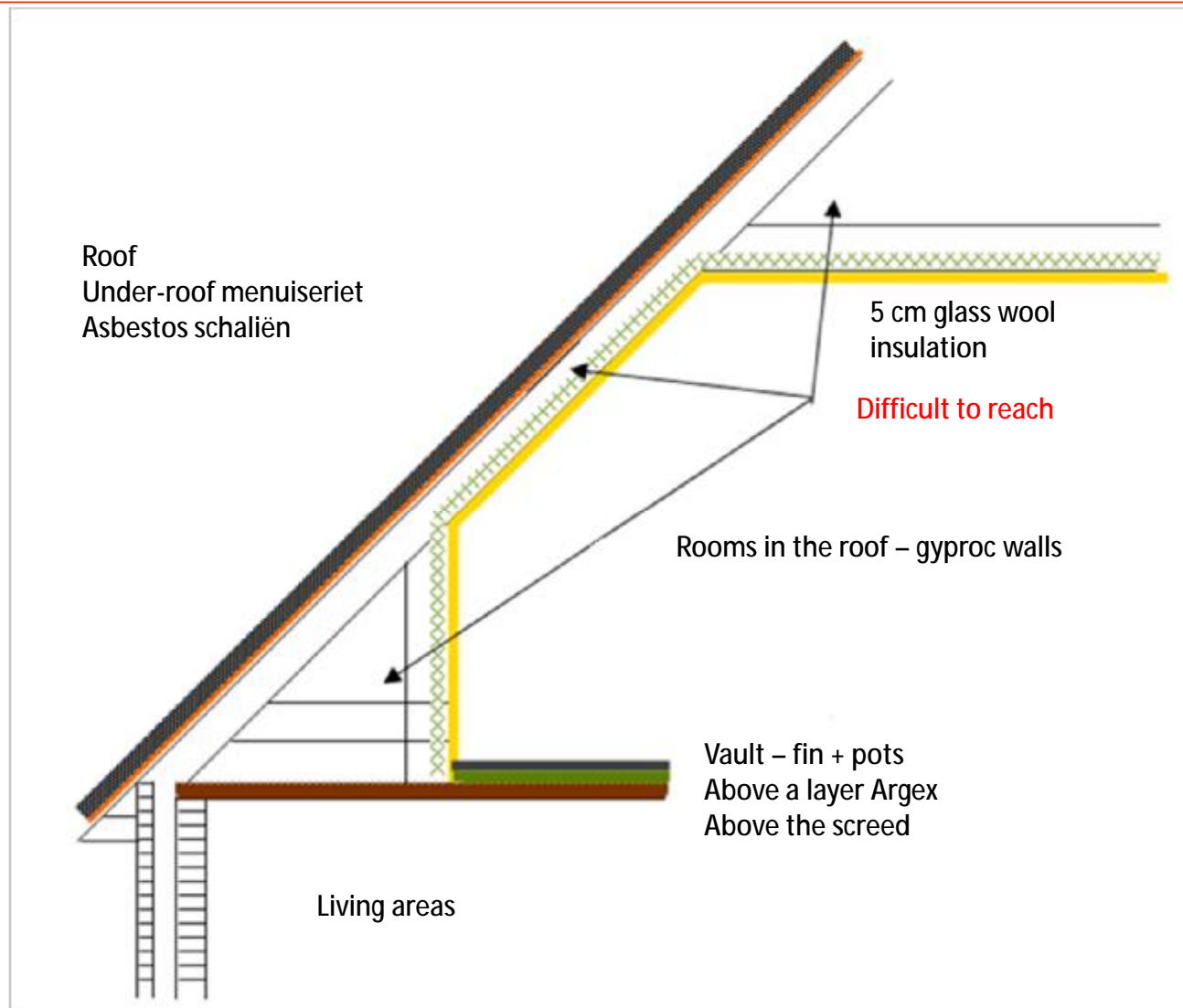


Note: don't confuse with a 'cold' roof

What about difficult to reach roofs that are insufficiently insulated?

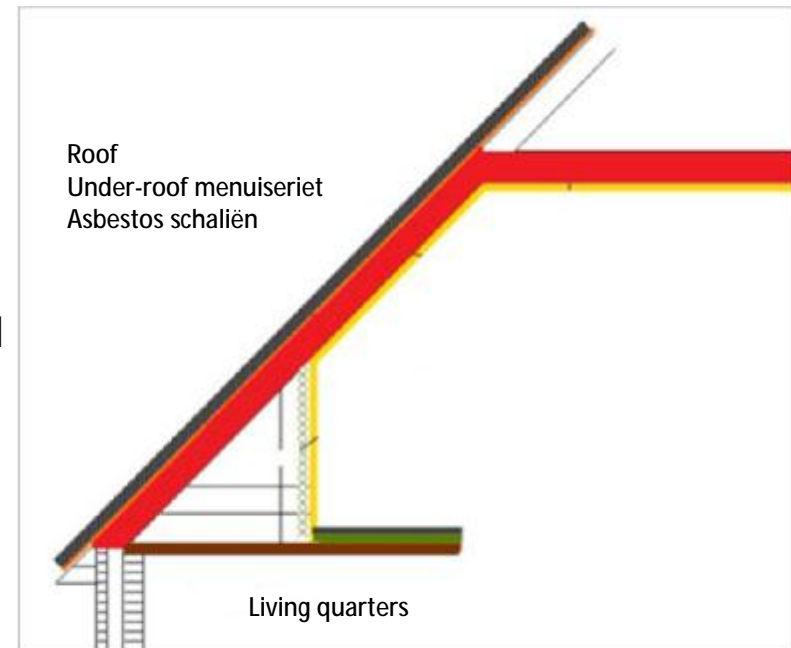


Hard to reach roofs

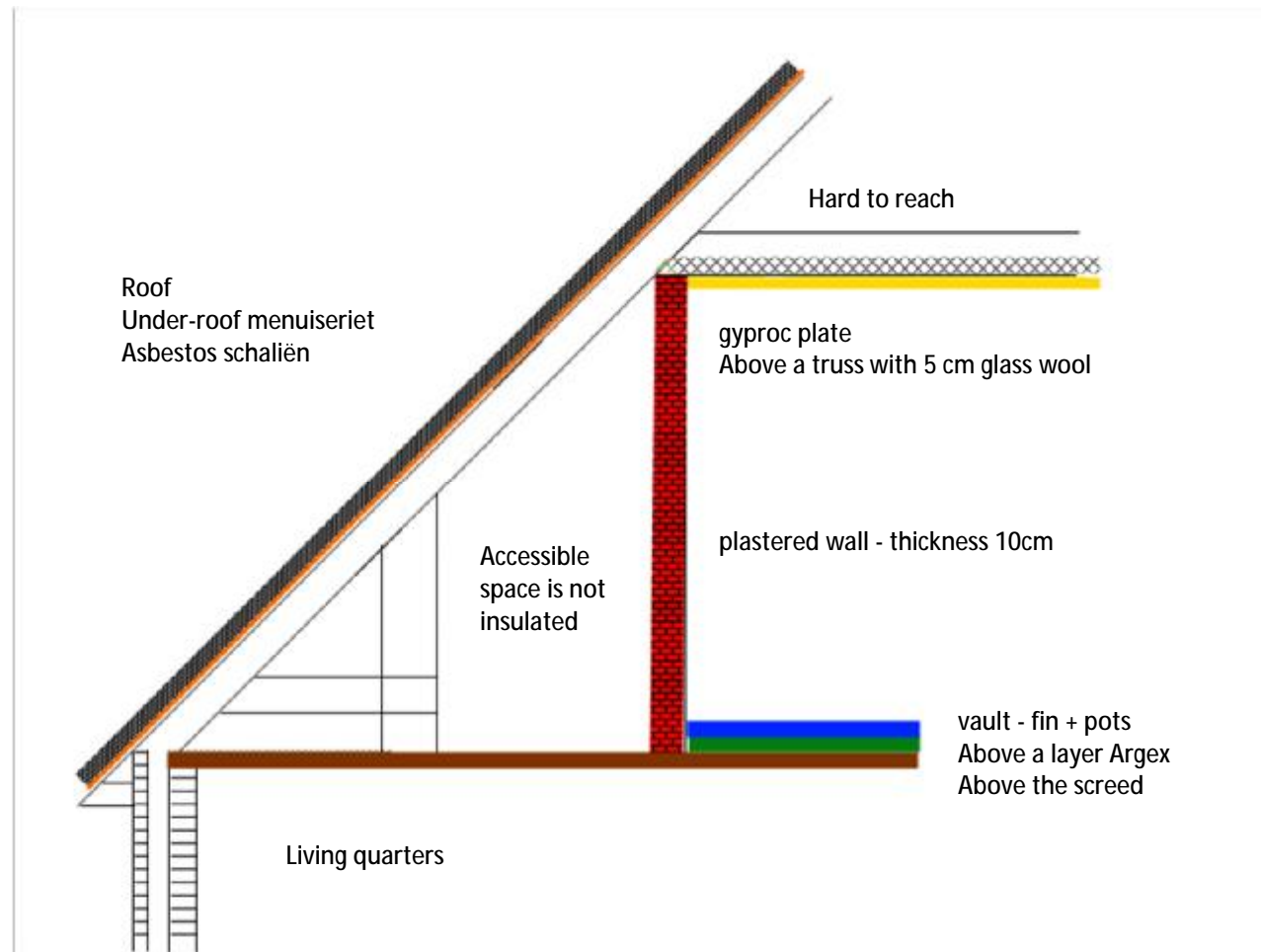


Hard to reach roofs

- 2 possible solutions:
 - On the inside:
 - Abort existing finish
 - Remove existing 'bad' insulation with vapor barrier
 - Windproof taping under-roof
 - Placing insulation and vapor control foil
 - Placing new finishing
 - Along the outside:
 - Takeout pans and under-roof
 - Attaching vapor control foil and insulation woven on the beams
 - Attaching wood fiber insulation under-roof
 - Replacing pans



Hard to reach roofs



Hard to reach roofs

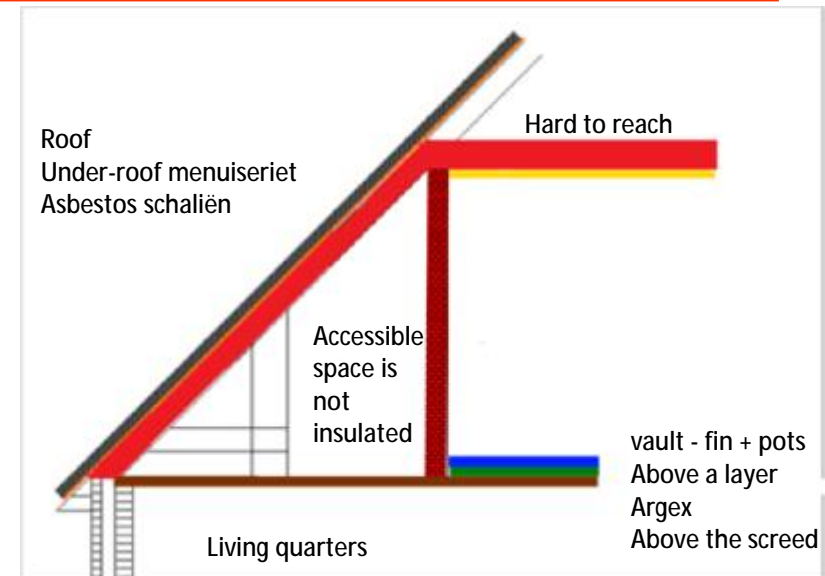
- solutions:

- Sloping part:

- Windprove taping under-roof
 - Placing insulation and vapor control foil

- Attic floor:

- Preferably get out the existing insulation
 - Through 1 large opening: blow loose cellulose on the ceiling
 - When using cellulose, there's no need for a partially vapor barrier. Plaster provides the air seal and the cellulose buffers the moisture.



Price comparison materials

Compact roof – pitched roof between roof structure

Type	Brand	Insulation value	Thickness (mm)	Price (€/m ²)
Celulose flakes	isofloc	0.039	180	12.6
Wood fiber flakes	steico	0.040	180	9.4
Flax	isovlas	0.038	180	16.37
Hemp	biofib	0.040	180	21.91
Wood fiber	steico	0.040	180	22.89
Glass wool	Isover confort 35	0.035	160	8.2
Rockwool	Rockwool rockflex	0.035	160	9.24

Price comparison materials

Attic floor

Type	Brand	Insulation value	Thickness (mm)	Price (€/m ²)
Cellulose flakes	Isofloc	0.039	180	12.6
Wood fiber flakes	Steico	0.040	180	9.4
Flax	Isovlas	0.038	180	16.37
Hemp	Biofib	0.040	180	21.91
Wood fiber	Steico	0.040	180	22.89
Glass wool	Isover confort 35	0.035	160	8.2
Rockwool	Rockwool rockflex	0.035	160	9.24
Cork	marienstede	0.040	160	23.4

Price comparison materials

Warm roof

Type	Brand	Insulation value	Thickness (mm)	U-value	Price (€/m ²)
Pur	Recticel eurothane bl3	0.023	2 x 60	0.19	26.2
Rockwool	Rockwool Rhinox	0.040	180	0.22	26.91
Wood fiber	Gutex thermoflat	0.039	160	0.24	44.59

Sarkin roof

Type	Brand	Insulation value	Thickness (mm)	Price (€/m ²) exl. VAT
Pur	Recticel powerroof	0.023	2 x 60	27.52
Wood fiber	Steico special	0.046	2 x 120	81.91
Wood fiber	Gutex thermosafe	0.037	2 x 180	36.51

What is the price of air sealing materials?

- Target price for placement of partially vapor barrier:
15€/m²
- Do-it-yourselfers: see www.isoproc.be

Where to find sustainable insulation?

- Distributors celit, pro clima and isofloc
See www.isoproc.be for outlets and installers
- Distributor Steico, celit pro clima and isofloc
[See www.eurabo.be](http://www.eurabo.be) for installers
- Distributor gutex, pro clima and climacell
See www.wonenennatuur.be for installers

Fire resistance insulation

Movie: difference of fire resistance between Cellulose, EPS and rockwool.



Premiums for roof insulation (existing home)

- Tax benefit

- * Registered contractor
- * 40 % of the investment (€2830)
- * At least 5 years old – excess deduction carried forward to next years
- * thermal resistance $R > 3 \text{ m}^2/\text{KW}$ -> ci 14cm insulation

- Network operator

- * thermal resistance R-value > 3 -> ci 14 cm insulation
- * €4/m² at the contractor
- * €2/m² for do-it-yourself
- * Be connected to the electricity grid before 1/1/2006

- Flemish roof premium

- * 500 €
- * Automatically when premium requested with the network operator
- * At least 40 m²

- Municipal premium

- * Search via www.energiesparen.be or www.premiezoeker.be

Examples



Some examples - pitched roof



Some examples



Some examples



Some examples



Some examples



Some examples



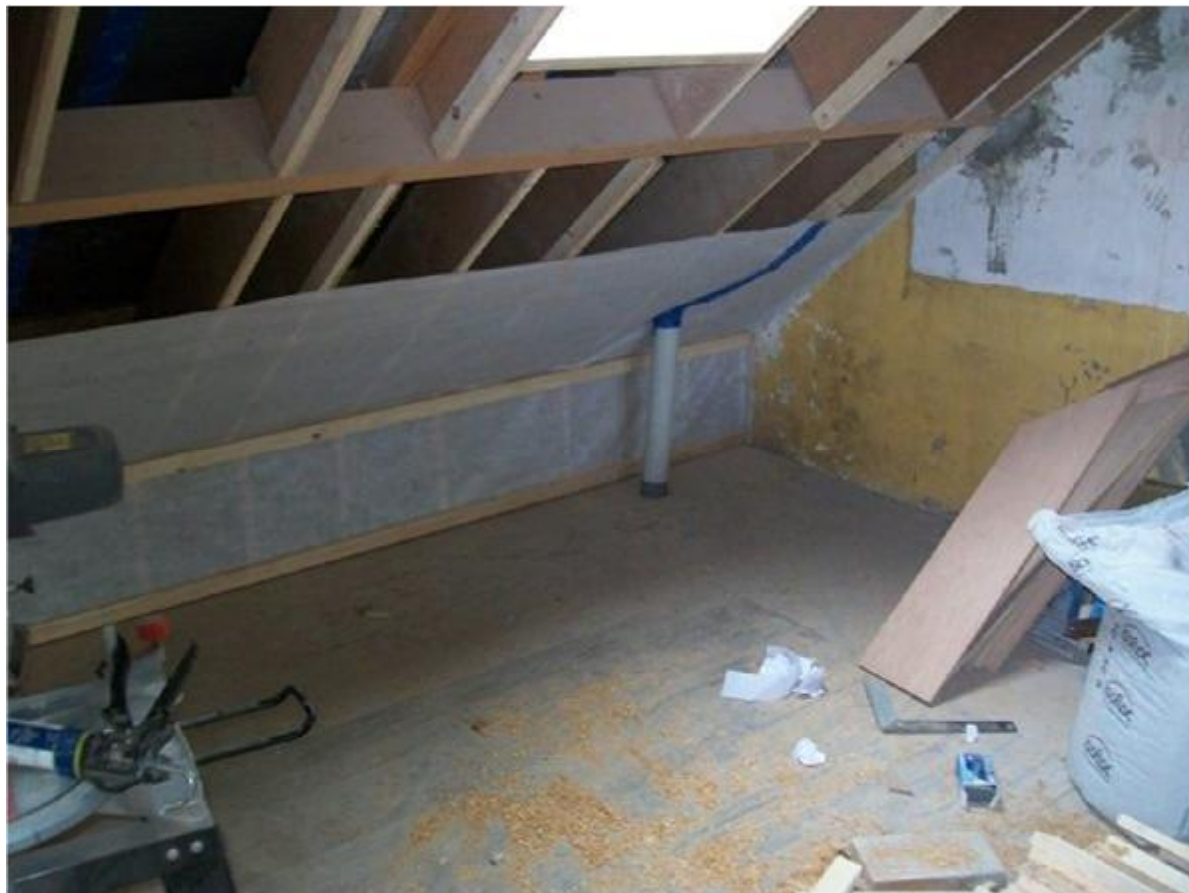
Plaster layer for bonding

Attaching solid insulation
to areas with less than 10
cm

Some examples



Some examples



Some examples



Some examples



Some examples



Some examples



Some examples



Some examples



Some examples



Some examples – after-insulation attic floor



Some examples – after-insulation attic floor

Steps:

- Sticking partially vapor barrier DB+
- Potting cork granules
- Close laying floorboards



Questions?

