

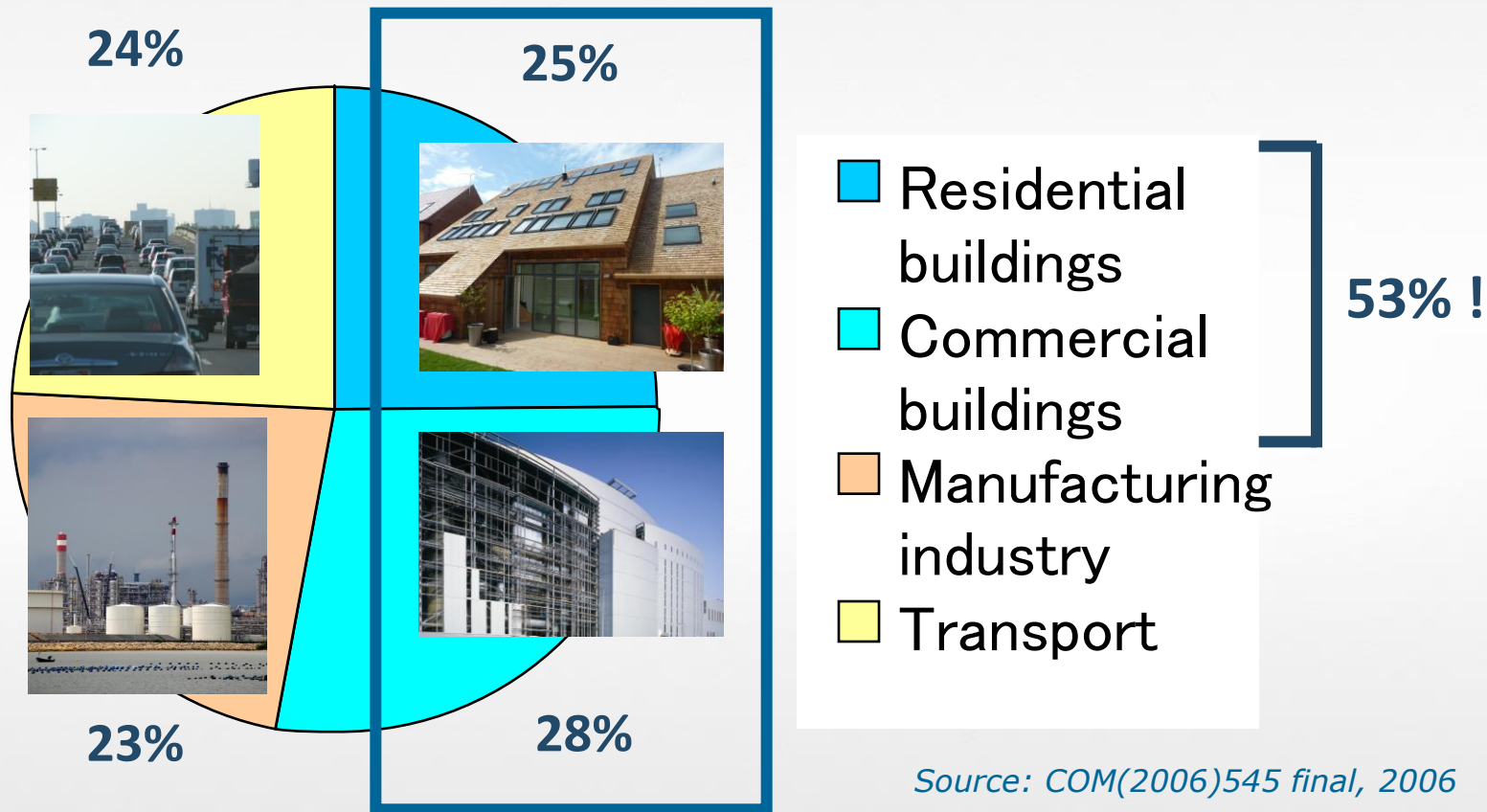
Insulation Technologies and Materials

**IEA - Building Envelope Technologies and Policies Workshop
Thursday 17 & Friday 18 November 2011, Paris**

**Shpresa Kotaji, Huntsman Environmental Affairs Manager
Oliver Loebel, PU Europe Secretary General**

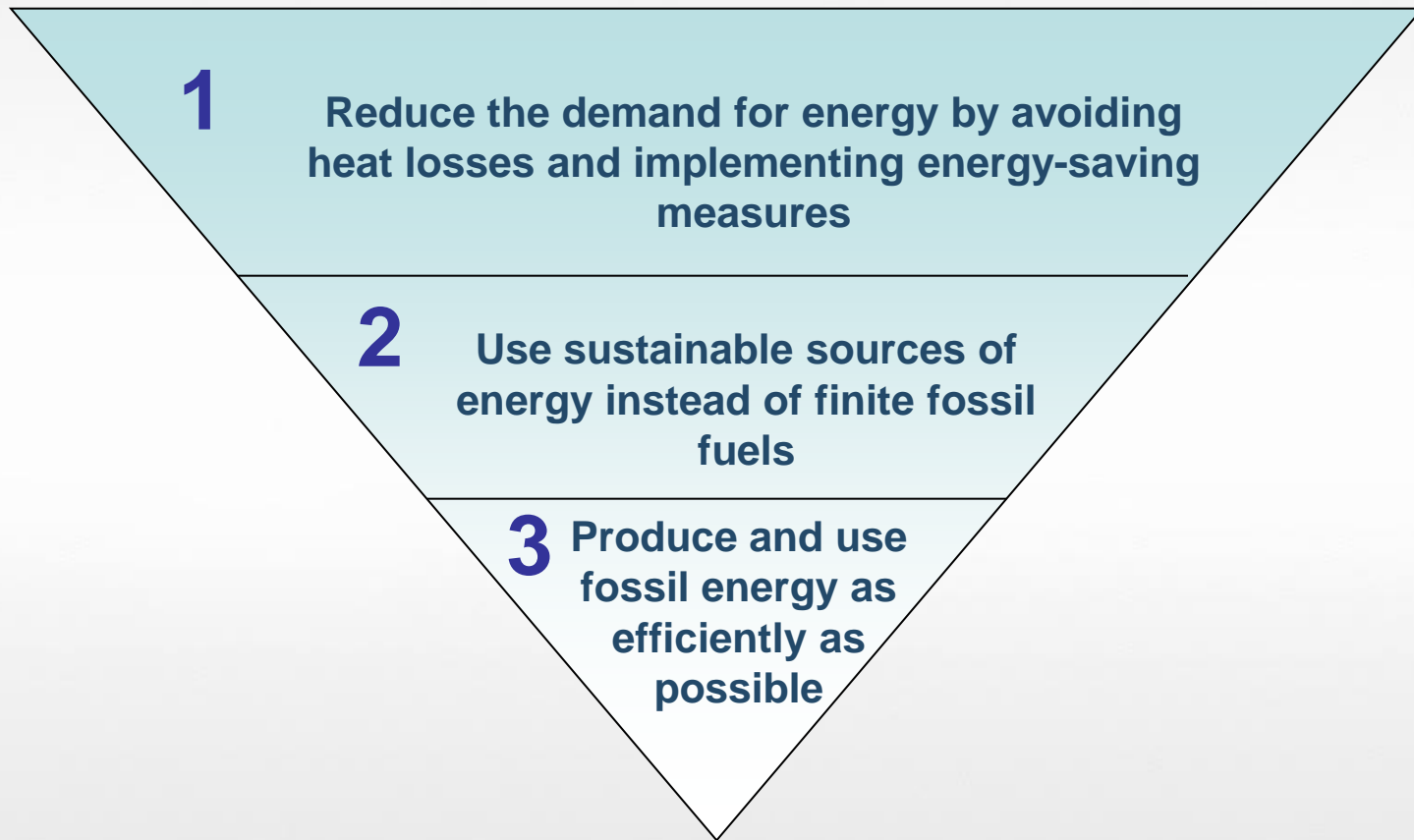
Buildings represent the biggest energy saving potential

Estimated energy saving potential (%) 2020



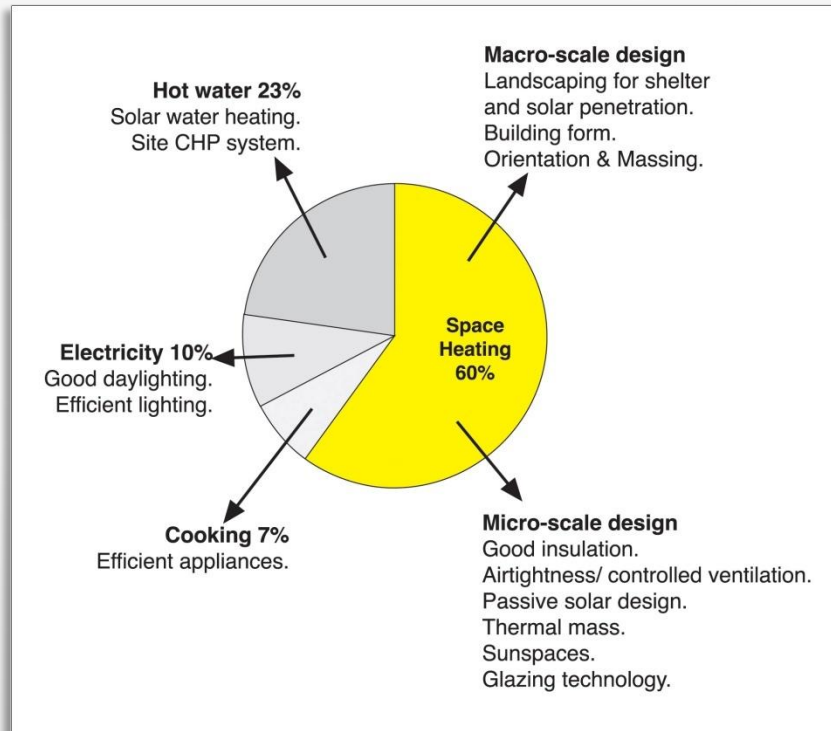
Strategies for building energy saving

Trias Energetica: the most sustainable energy is saved energy

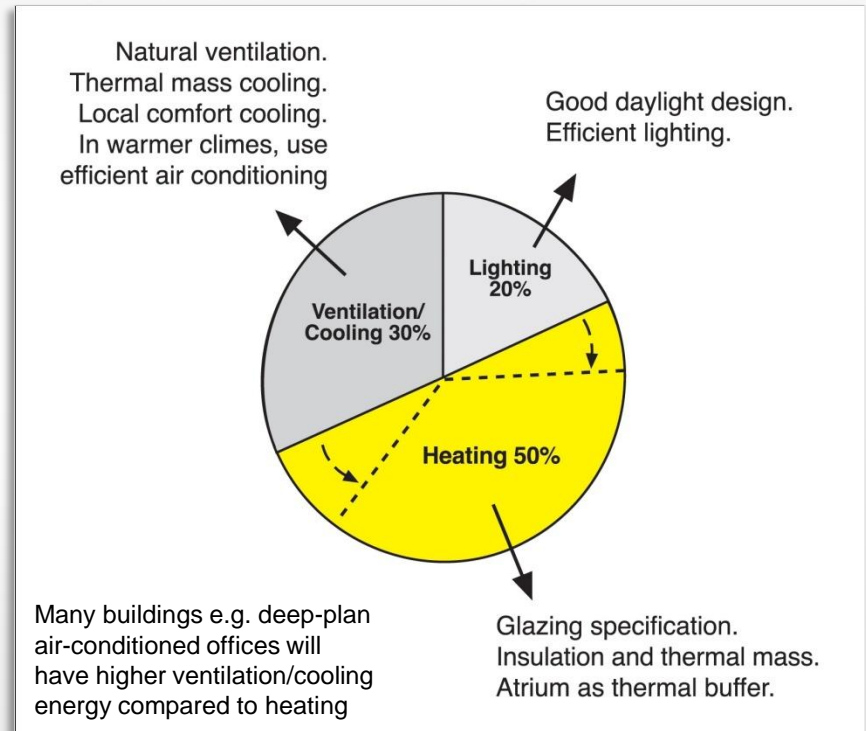


How to reduce building energy demand ?

Housing



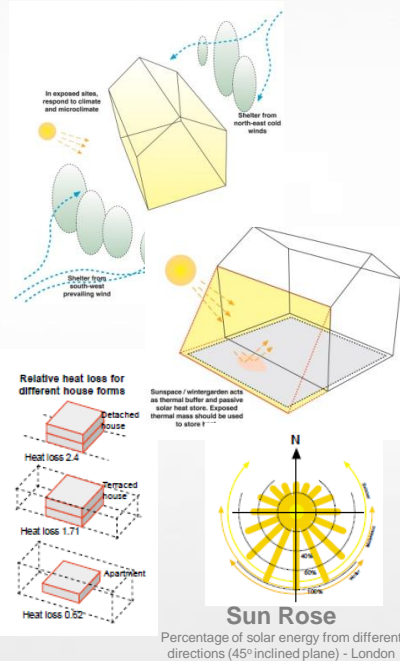
Commercial buildings



4 Steps to Low Energy Buildings

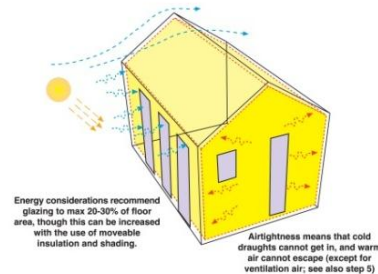
1.

Orientation Compact



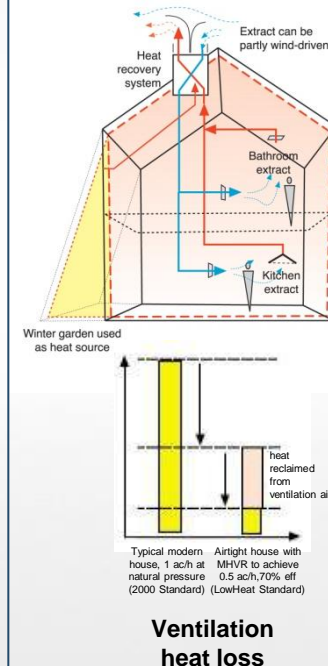
2.

Insulation + Airtightness



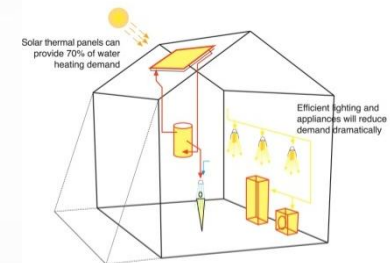
3.

Controlled ventilation



4.

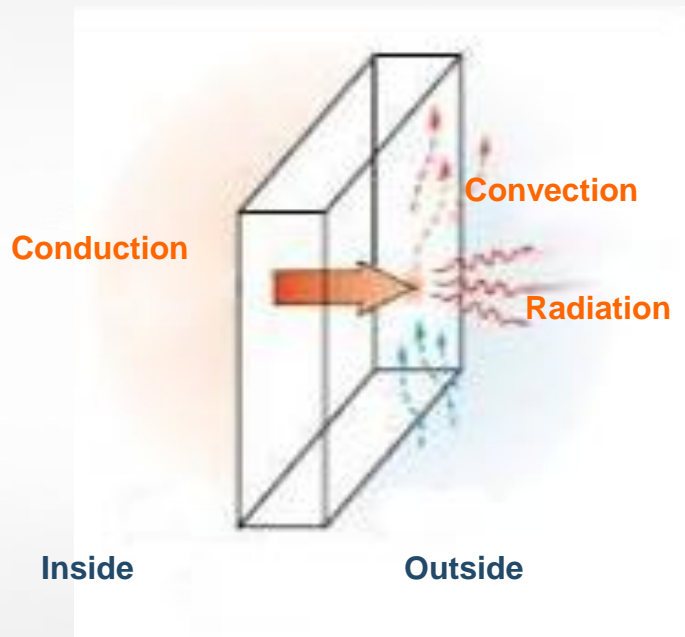
Efficient lighting + appliances



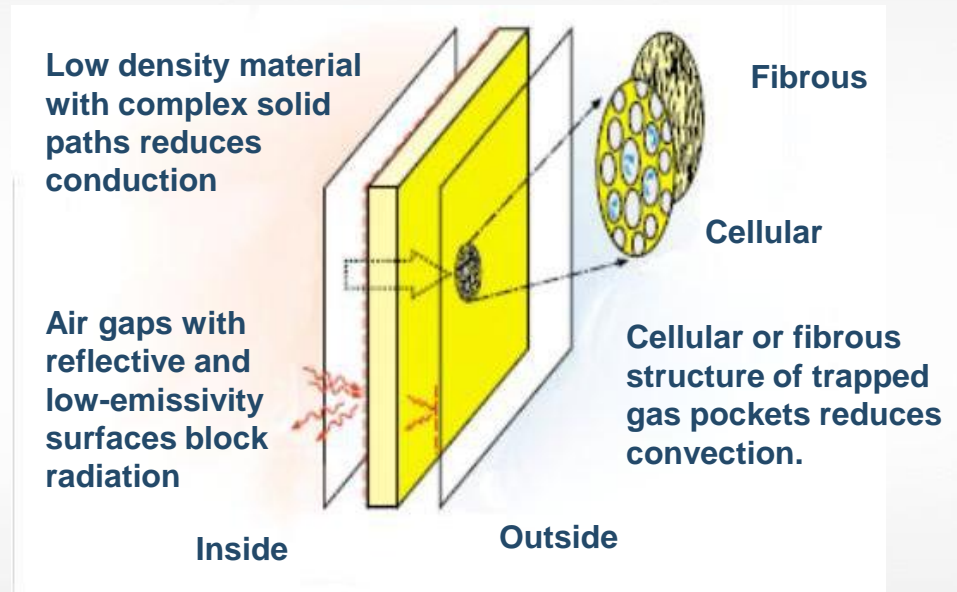
A+++

How building insulation works

Un-insulated wall



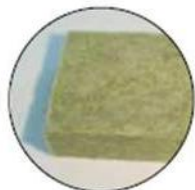
Insulated wall



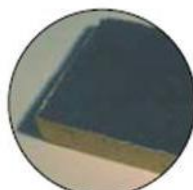
The types of insulation materials and heat loss rate

Classification of insulation materials

	Fibrous	Cellular
Mineral 'inorganic'	Rock wool RW Glass wool GW	Cellular glass Vermiculite
Oil-derived 'organic synthetic'		Rigid polyurethane PUR/PIR Phenolic EPS Expanded polystyrene XPS Extruded polystyrene
Plant / animal 'organic natural'	Cellulose Cotton Wool Flax	Cork



Mineral wool



Cellular plastic



Cellulose fibre

The key equation relating U-value (heat loss rate) to lambda (thermal conductivity) and thickness (d)

$$U = \frac{\lambda}{d}$$

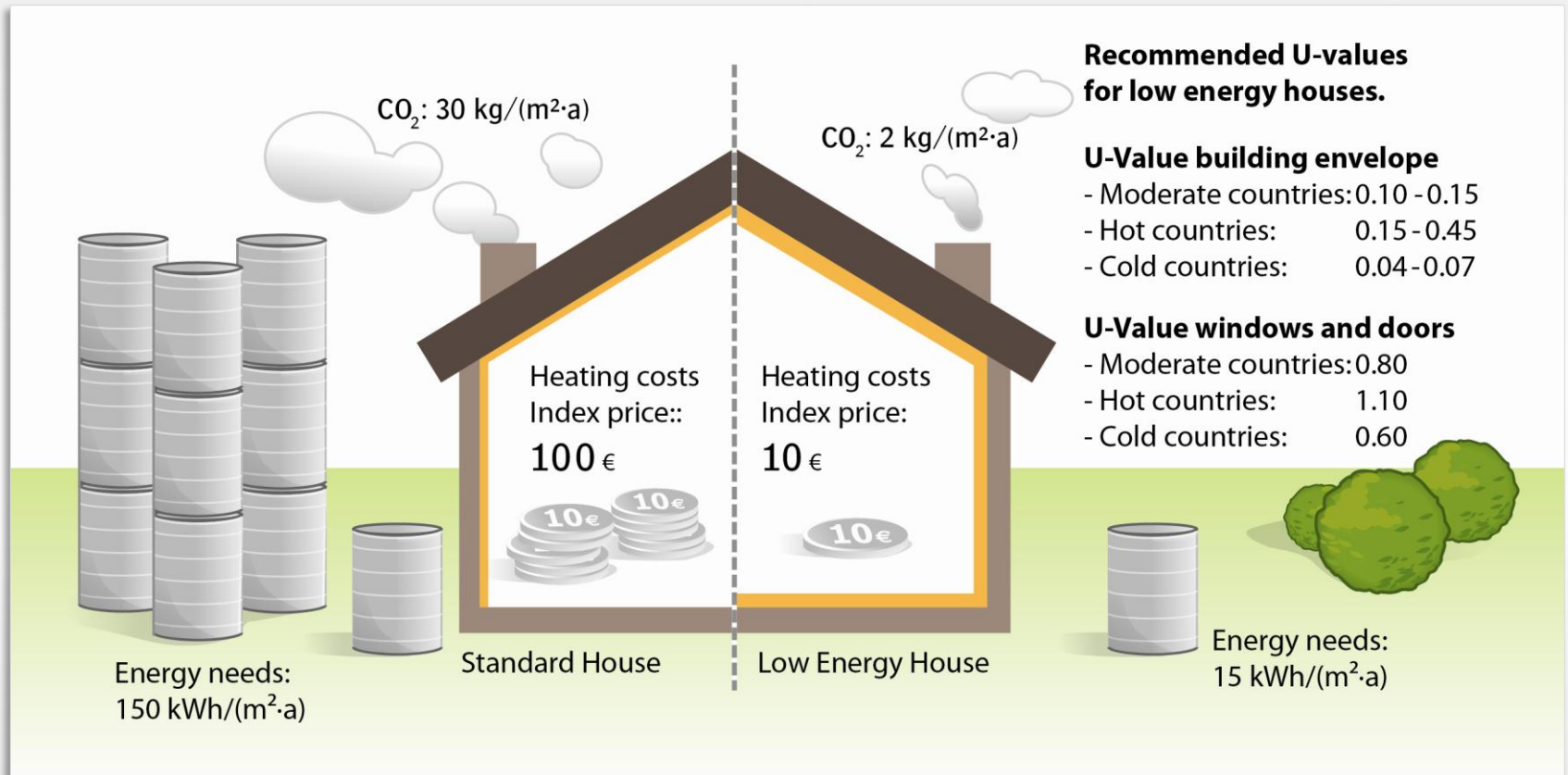
Heat loss rate $W/m^2 \cdot K$

Lambda, thermal conductivity $W/m \cdot K$

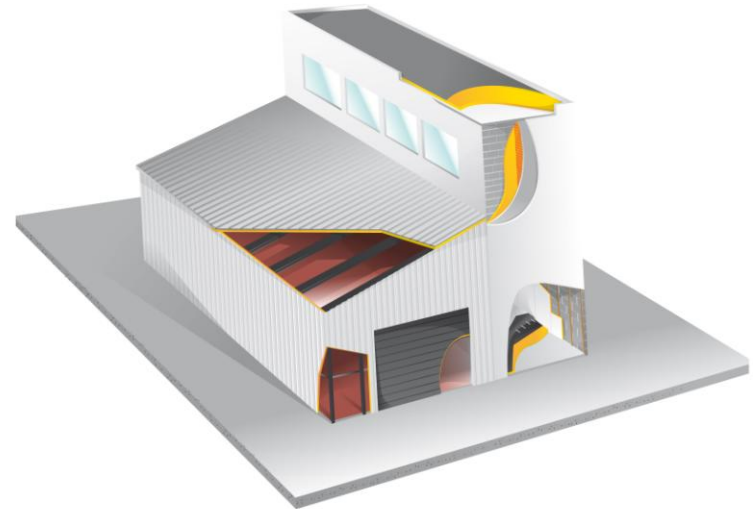
thickness of material m

Note: highly approximate, issues like thermal bridging must be considered

The importance of building insulation



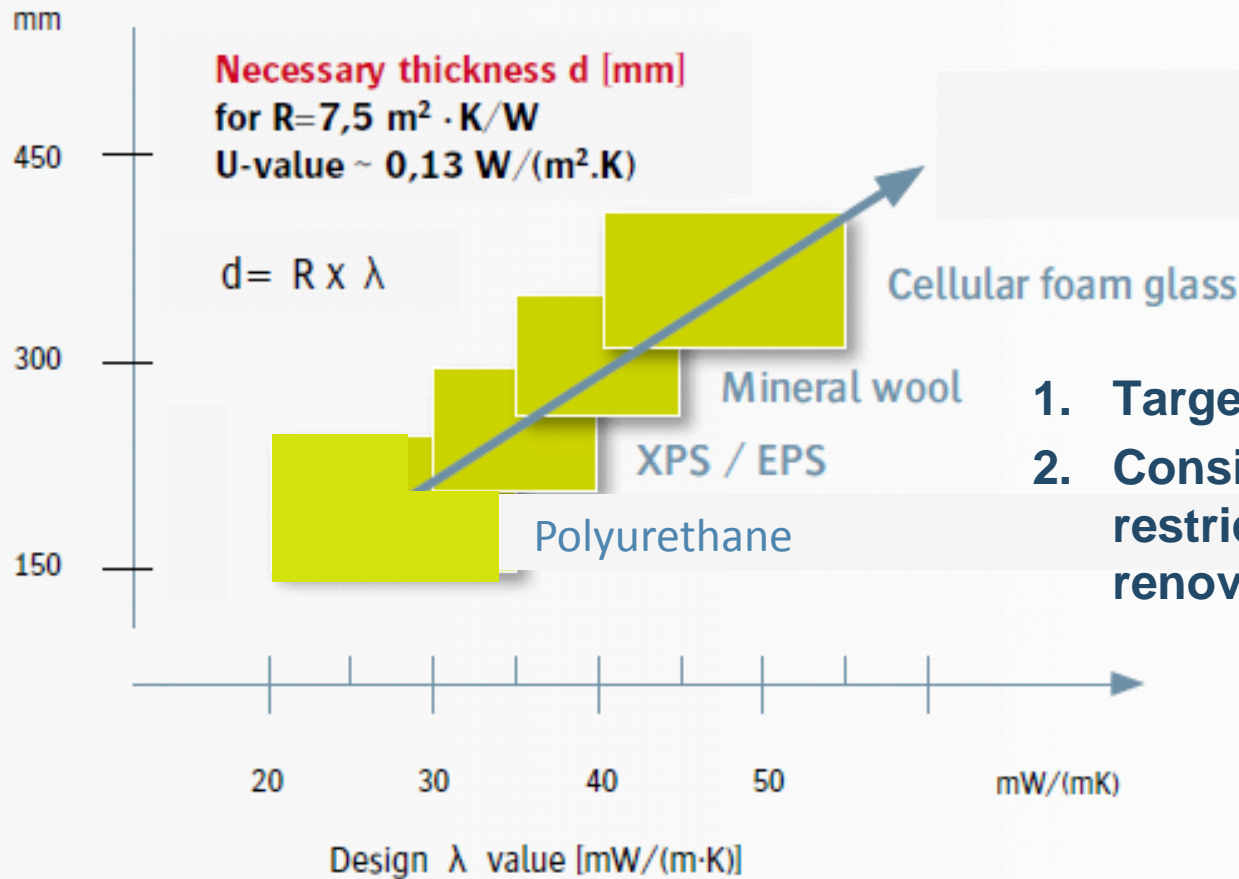
4 steps to insulation solution selection



In new build and renovation

1. Design for low thermal conductivity

Insulation thickness at same U-value



1. Target low U-value designs
2. Consider any thickness restriction (especially in renovation)

Step 2. Choose fit for purpose solutions and quality products

Typical applications	Pitched roofs	Walkable flat roofs	Walls	Ground floor
Polyurethane	✓	✓	✓	✓
EPS	✓	✓	✓	✓
XPS	✓	✓	✓	✓
Glass wool	✓	✗	✓	✗
Stone wool	✓	✓	✓	✓
Cellulose	✓	✗	✓	✗
Hemp	✓	✗	✓	✗

Choice might be restricted due to

- climate/exposure
 - Wind, flood, rain ...
- mechanical properties requirements
 - Walkability
- thickness restriction

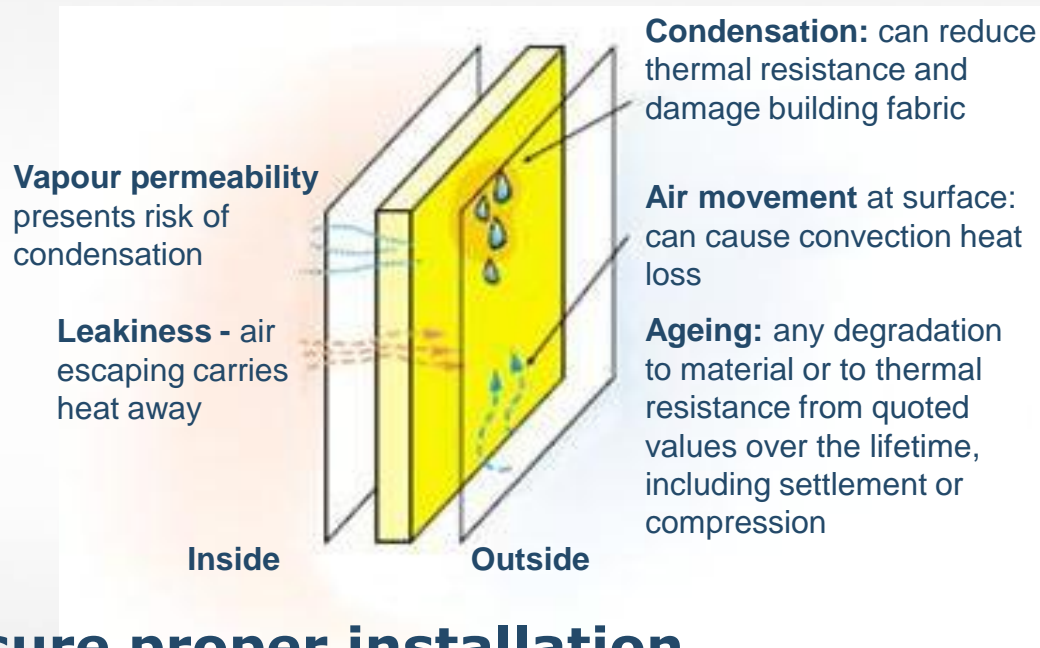
Quality and performance testing

- Prefer material with certified declared thermal properties according to standards (e.g. CE marking, ASTM...)

- Ensure insulation can be applied
- Ensure right ancillary materials are used to secure proper function
- Choose quality product with certified declared properties

Step 3. Design for durability and low failure risk

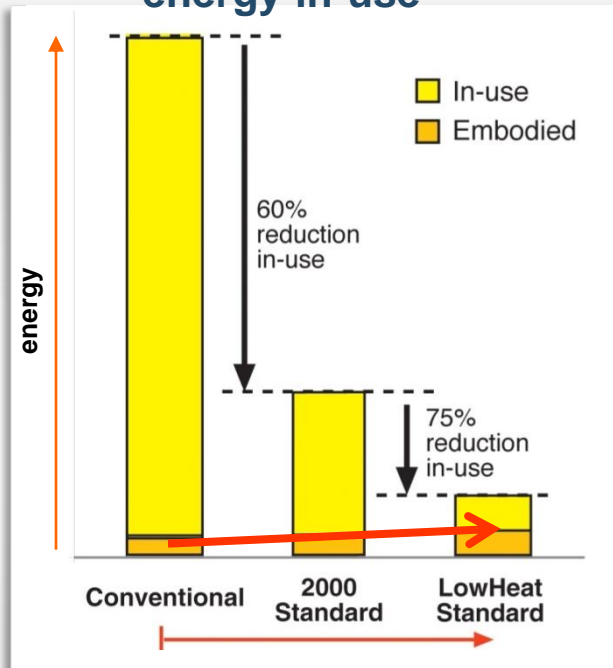
Installation risks: all materials are vulnerable to poor installation leaving gaps or physical deterioration (compression). Good workmanship is essential



- **Ensure proper installation**
- **Ensure proper detailing to avoid premature performances losses**

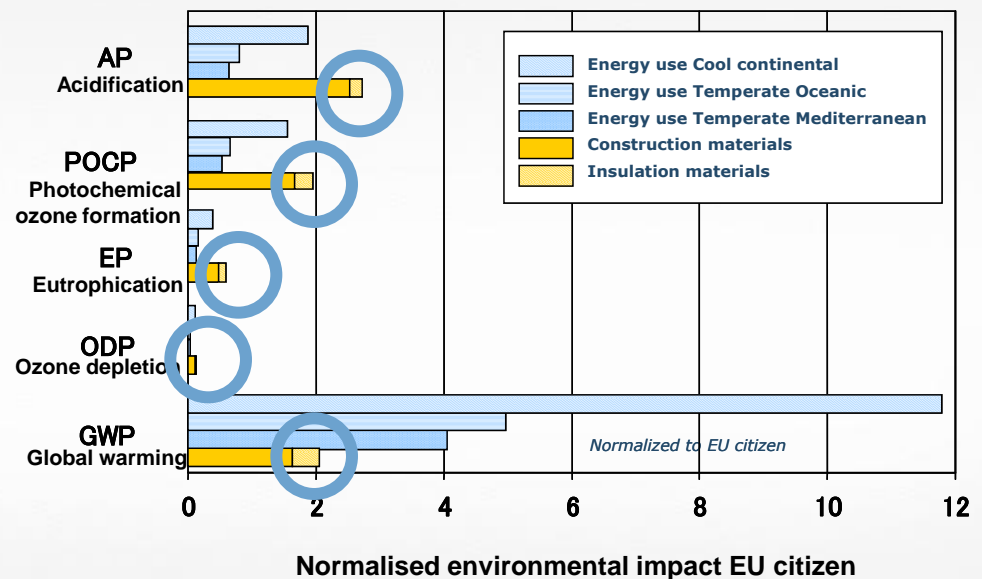
Step 4. Design for reduced building embodied environmental impacts

1° optimise building energy-in-use



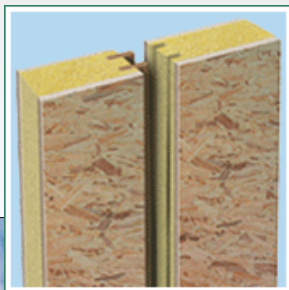
→ Designing for low energy increases the relative embodied impact, but...

2° reduced embodied impact if that does not compromise in-use performance



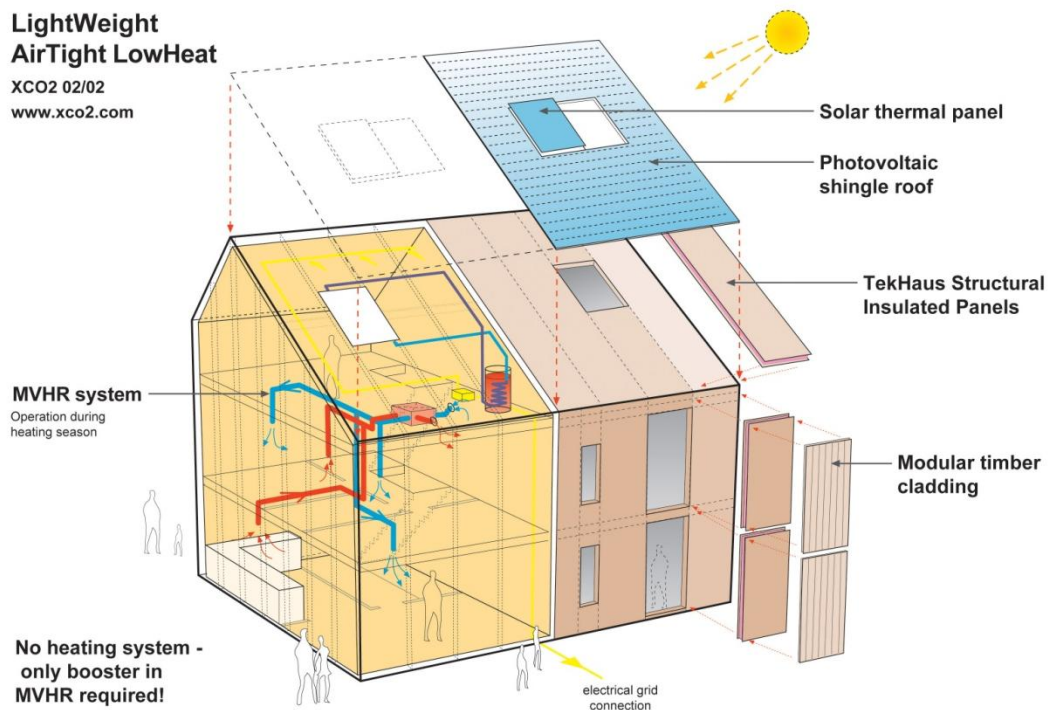
→ Insulation choice itself has limited impact on the building embodied impacts

New trend - prefabricated elements/units



LightWeight AirTight LowHeat

XCO2 02/02
www.xco2.com



Highly insulated low energy houses today's technologies, available across the regions



Conclusions

- **Almost half of our energy is used in buildings**
- **Today's high performance insulation and thermal design can dramatically reduce heat losses – solutions are already available and applied across all regions, both in new build and renovation**
- **The choice of the most appropriate insulation product has to be decided on a case-by-case basis as it largely depends on the building type and design and climate zone**
- **The following principles must be respected when specifying insulation products for low energy buildings:**
 - Firstly design the building for low thermal losses
 - Then, choose insulation products and solutions fit for the applications
 - and, following this, ensure the longevity of the thermal performance over the lifetime of the building through choosing quality materials with certified performance levels.
 - Finally, the environmental performance of suitable insulation products should be determined using an overall life cycle methodology
- **There is an increasing trend to develop factory-made durable high quality building envelope elements combining high insulation level, high air-tightness and fast erection speed**

Thank you for your attention

While all the information and recommendations in this publication are to the best of our knowledge, information and belief accurate at the date of publication, nothing herein is to be construed as a warranty, express or otherwise. In all cases, it is the responsibility of the user to determine the applicability of such information.