

Indoor environmental quality and energy efficient buildings

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Caisses des Dépôts

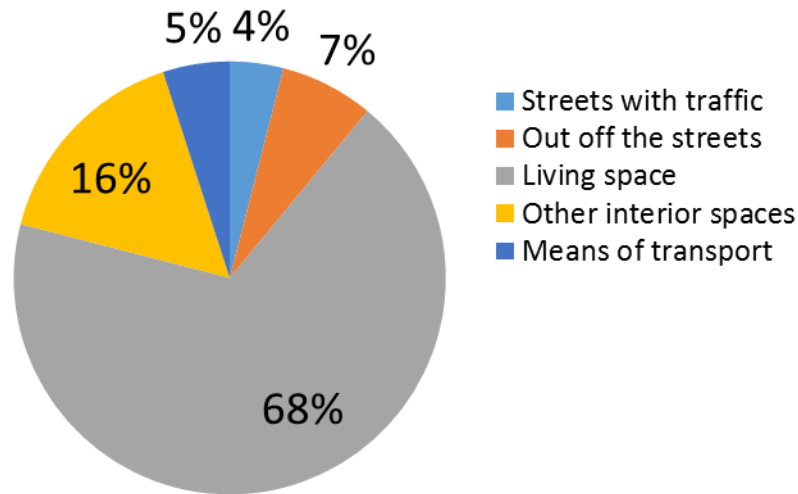
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Indoor Environment of Buildings

Up to 90 % of our life we spend indoors...



Indoors we are exposed to up to 5x higher air pollution than outdoors.

Indoor environment influences

- Health
- Performance in work
- Comfort



J. Adam Huggins, The New York Times 26.7.2007

Source: Braniš, M., Kolomazníková, J. (2010) Year-long continuous personal exposure to PM_{2.5} recorded by a fast responding portable nephelometer. Atmospheric Environment 44(24): 2865-2872

Buildings energy efficiency

“Energy Efficiency first”

YES...

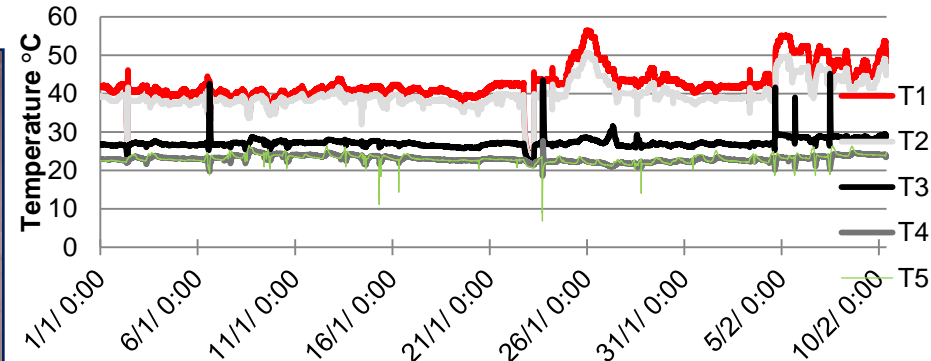
There is a massive energy saving potential yet to be exploited in buildings in Europe.

BUT...

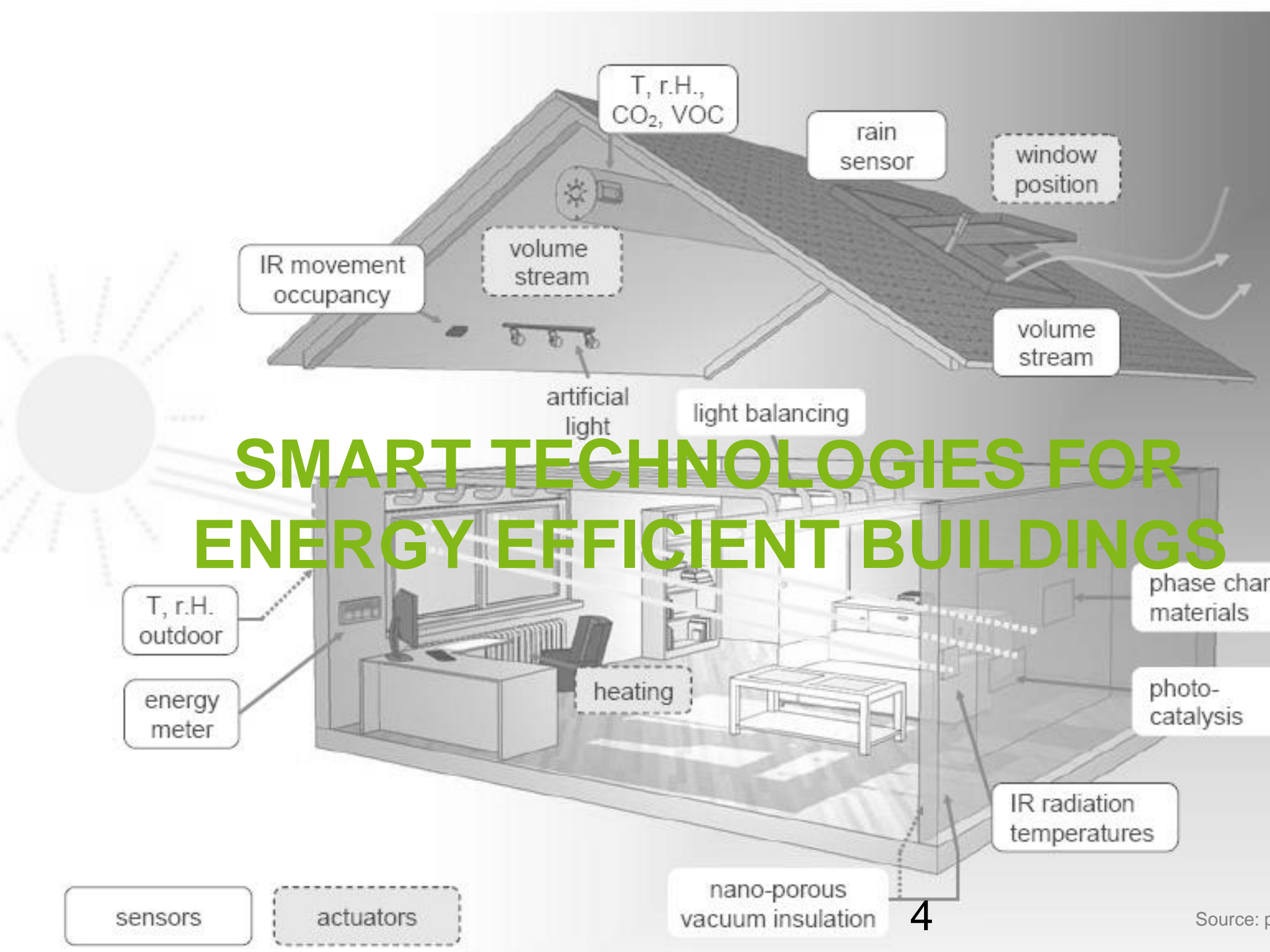
Buildings energy refurbishment needs a holistic approach considering energy efficiency and IEQ at the same time.



REHVA *Apartment after replacement of windows*



Example of heating system problem after refurbishment



T, r.H.,
CO₂, VOC

rain
sensor

window
position

IR movement
occupancy

volume
stream

volume
stream

artificial
light

light balancing

SMART TECHNOLOGIES FOR ENERGY EFFICIENT BUILDINGS

T, r.H.
outdoor

energy
meter

heating

phase char
materials

photo-
catalysis

IR radiation
temperatures

nano-porous
vacuum insulation

4

sensors

actuators

Holistic approach with 8 metrics

Economy

- Lifecycle Cost (EN 15643-4)

Energy

- Imported energy
- Imported primary energy
- Baseload power

Global warming

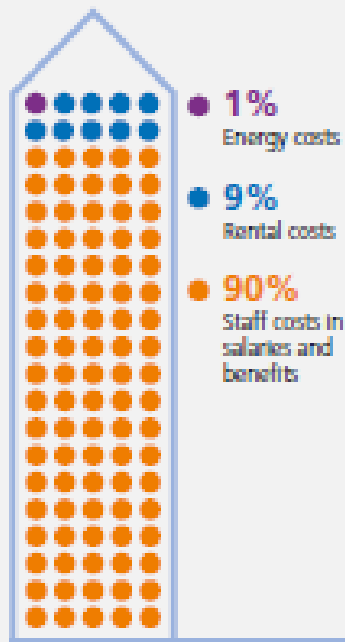
- Life-cycle carbon footprint (EN 15978)
- Operating carbon footprint (GHG Protocol)

Occupants

- Indoor air quality classification
- Share of satisfied occupants

Staff costs, including salaries and benefits, typically account for about 90% of business operating costs.

Typical business operating costs¹



10% Variation

A 10% variation applied equally to each cost has a far from equal impact

+/- 0.1%

Energy costs

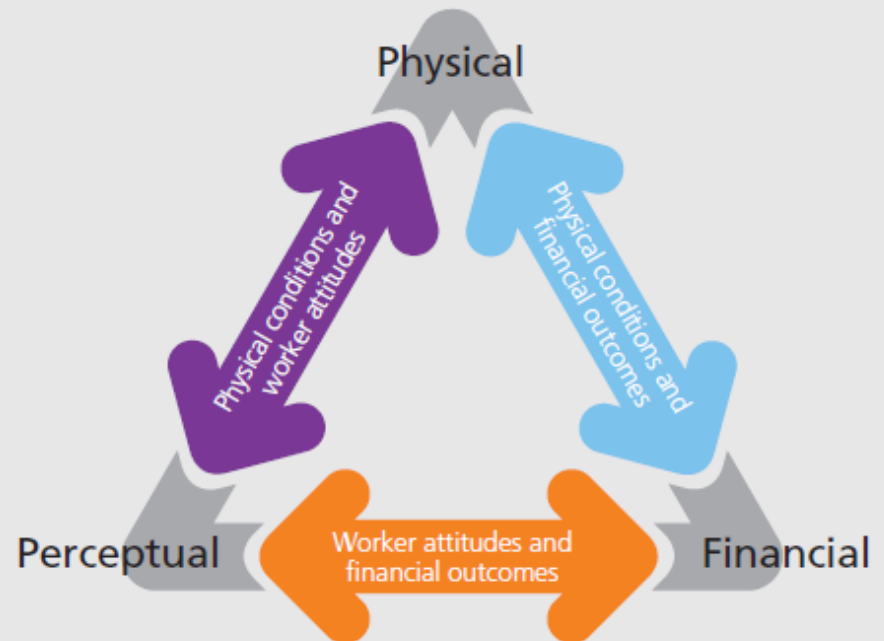
+/- 0.9%

Rental costs

+/- 9.0%

Staff costs

Summary of metrics framework and key relationships



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Source: **Health, Wellbeing & Productivity in Offices** by WGBC

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In the current market valuation **plant systems benefits** are not straight contemplated

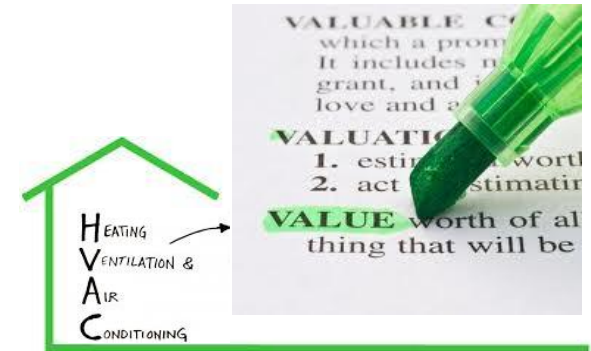
crucial relevance of a suitable **building valuation** to give useful information to investors and decision makers



Why is it a crucial problem for the systems suppliers?

Because fundamental challenges taking place in the market make it ripe for innovation:

Integration of renewable energy
Energy efficiency
Improved comfort
Occupants' interaction



HVAC benefits valuation can support the innovation

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