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Ventilative cooling experiences by Renson: lessons learned and solutions

International Workshop AIVC-Venticool – Brussels – 19-20 March 2013
Ivan Pollet - Renson Ventilation

Healthy Concepts: for residential and non-residential applications

RENSON® VENTILATION SUNPROTECTION

<u>Several sectors</u>:

- Dwellings and apartments
- Health Care
- Schools
- Offices …

<u>3 systems</u>:

- Demand controlled hygienic ventilation (DCV)
- External solar protection
- Intensive nightcooling

- **Indoor air quality**
- **Acoustic comfort**
- **Thermal summer comfort**
- **Visual comfort**

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1. Process of applying ventilative cooling
2. Ventilative cooling in practice

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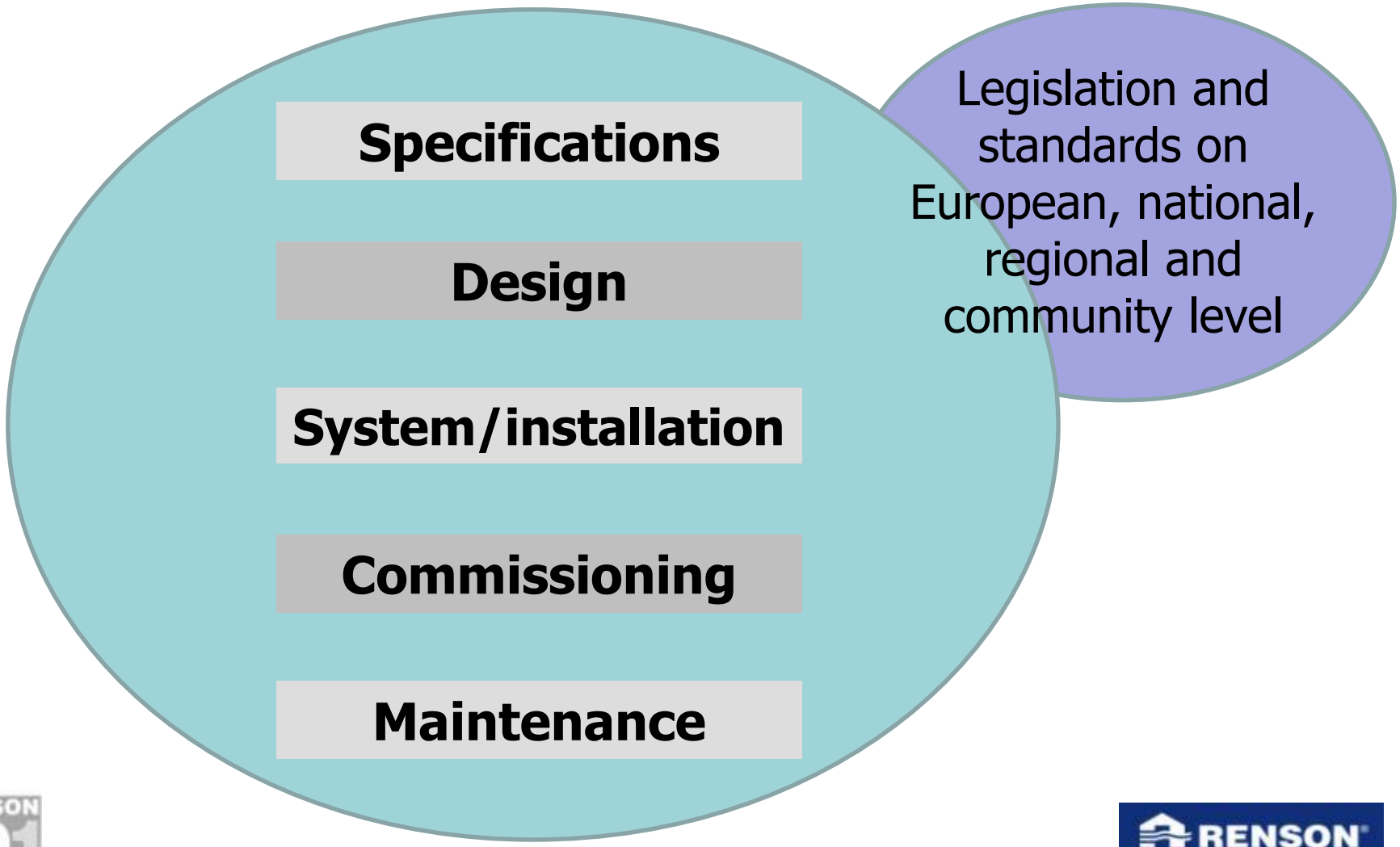
Process of applying ventilative cooling



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Process of applying ventilative cooling

European EPB-directive

Not explicitly mentioned to consider into the calculation methodology (annex I)

⇒ not or slowly taken up by countries

⇒ no benefits on paper / EP-certificate

⇒ not or little applied

= great barrier

Legislation and standards on European, national, regional and community level

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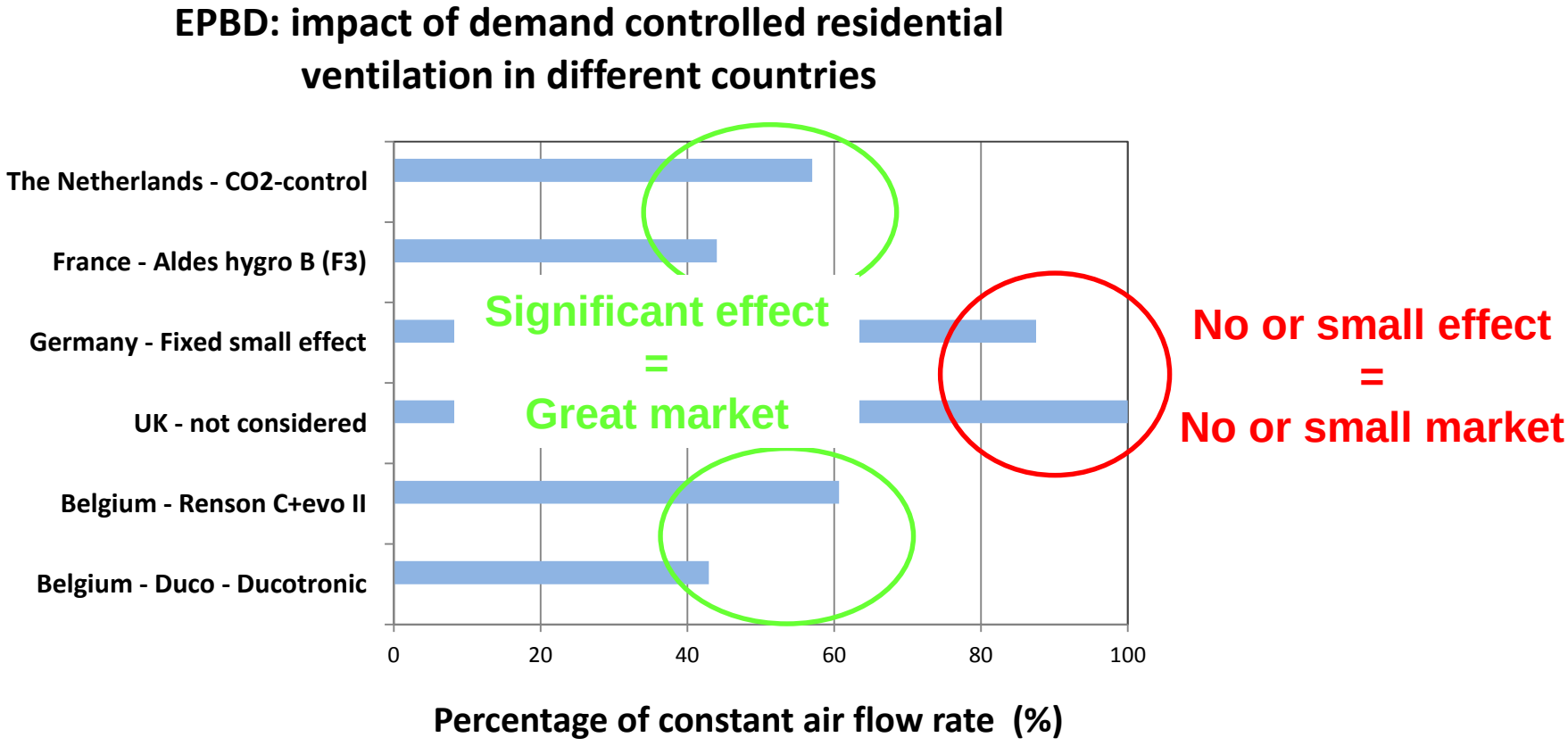
Impact of EPBD on the market: DCV



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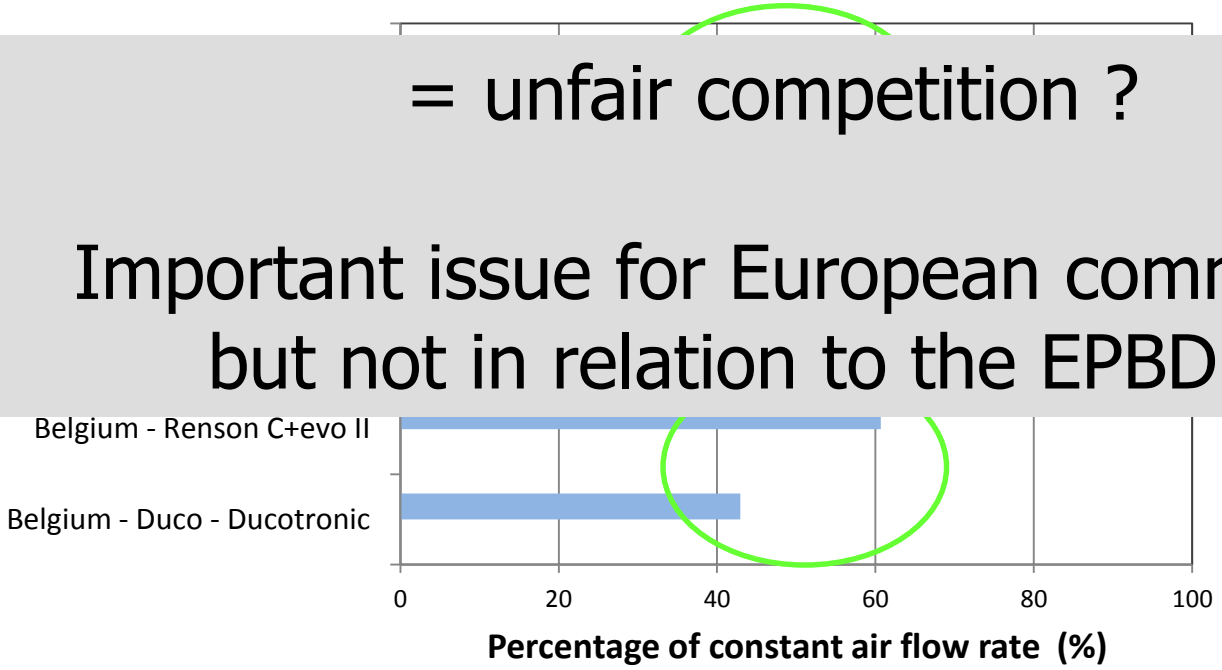
Impact of EPBD on the market: DCV

EPBD: impact of demand controlled residential ventilation in different countries



= unfair competition ?

Important issue for European commission, but not in relation to the EPBD … ?

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Process of applying ventilative cooling

Fire/smoke regulation

- Fire compartment of a building

  = fire resistant air transfer devices

  = barrier

- Smoke evacuation used as ventilative cooling

  = opportunity

Legislation and standards on European, national, regional and community level

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Process of applying ventilative cooling

Specifications

- Operable windows often required

  = **opportunity**

- Protection/securing of openings
- Maximum indoor temperature < 25°C

  ⇒ no guarantee if only ventilative cooling

  = barrier (→ EN15251)

Legislation and standards on ropean, national, egional and munity level

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Process of applying ventilative cooling

Design

Lack of simple design rules within standards

- cooling capacity ? 5 W/m²/air exchange rate
- ventilation principles ? single sided, cross, …
- pressure difference across façade opening ?

  1 – 2 – 5 Pa

= barrier

Legislation and standards on
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gional and
munity level

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Design

Lack of simple design rules within standards

- protection/securing of openings: K of ξ-factor
- mechanical ventilation:
  - maximum air speed in ducts ?
  - maximum SFP (W/m³/s) ?
  - $\mathrm{COP} = \frac{\text{cooling power}}{\text{fan power}} = \frac{1200\ \Delta T\ (\text{in}-\text{out})}{\text{SFP}}$

Legislation and standards on
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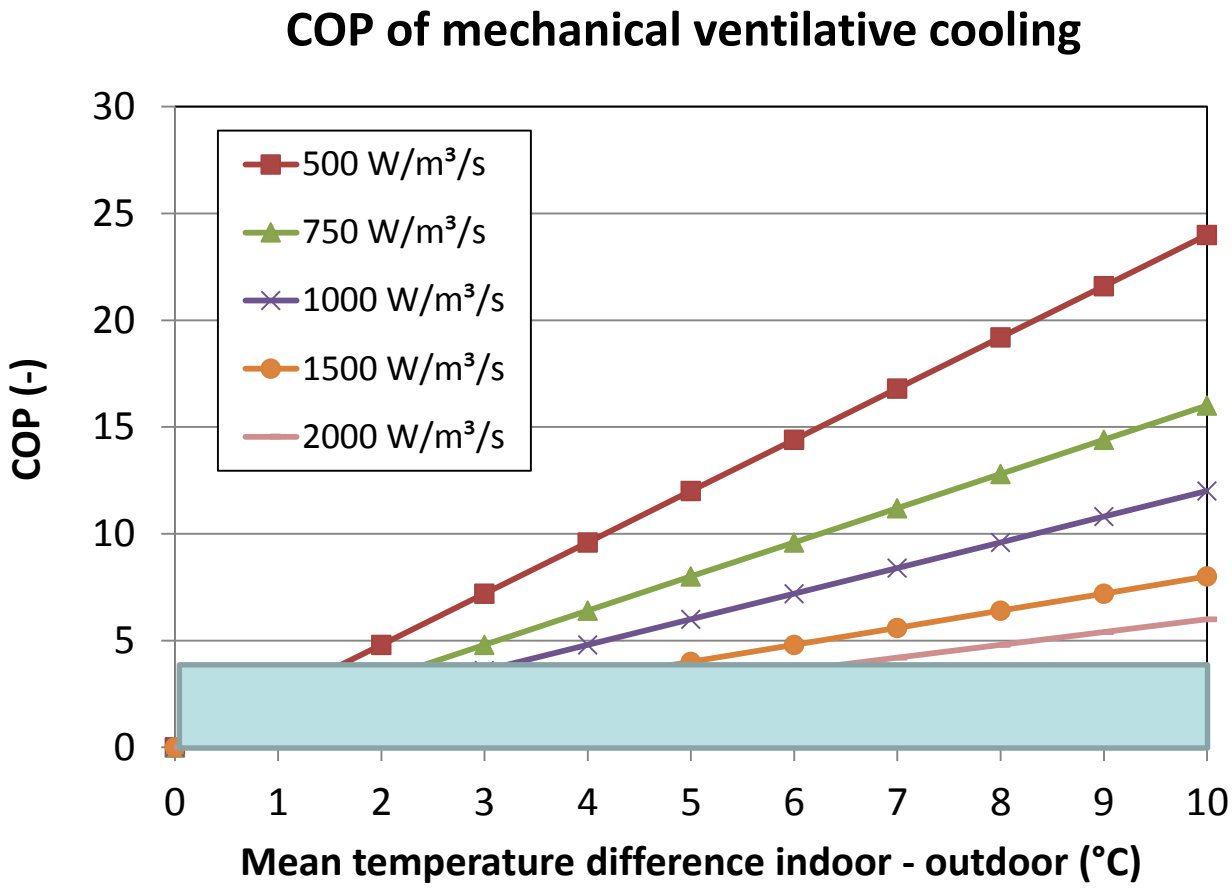
Mechanical ventilative cooling



Working area of standard airco

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Process of applying ventilative cooling

System/installation

- Simplicity ↔ automation
- Integration: - nightcooling / solar shading
  - hygienic and intensive ventilation
  - within the façade elements
- Acoustic insulated openings
- Mechanical support on exhaust

Legislation and standards on
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gional and
munity level

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Process of applying ventilative cooling

Commissioning and maintenance

- "Guarantee on correct performance"
- The more automated (sensors, actuators, fan), the more necessary
- A real "as-built" dossier and not "should built"
- An internal responsible

Legislation and standards on ropean, national, egional and munity level

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Process of applying ventilative cooling

Commissioning and maintenance

- **Soft Landings** means designers and constructors staying involved with buildings beyond practical completion. This will assist the client during the first months of operation and beyond, to help fine-tune and de-bug the systems, and ensure the occupiers understand how to control and best use their buildings.

Legislation and standards on
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munity level

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Ventilative cooling in practice

Offices

Renson offices (Waregem – Belgium)

BBL office (Brussels – Belgium)

Green office (Paris – France)

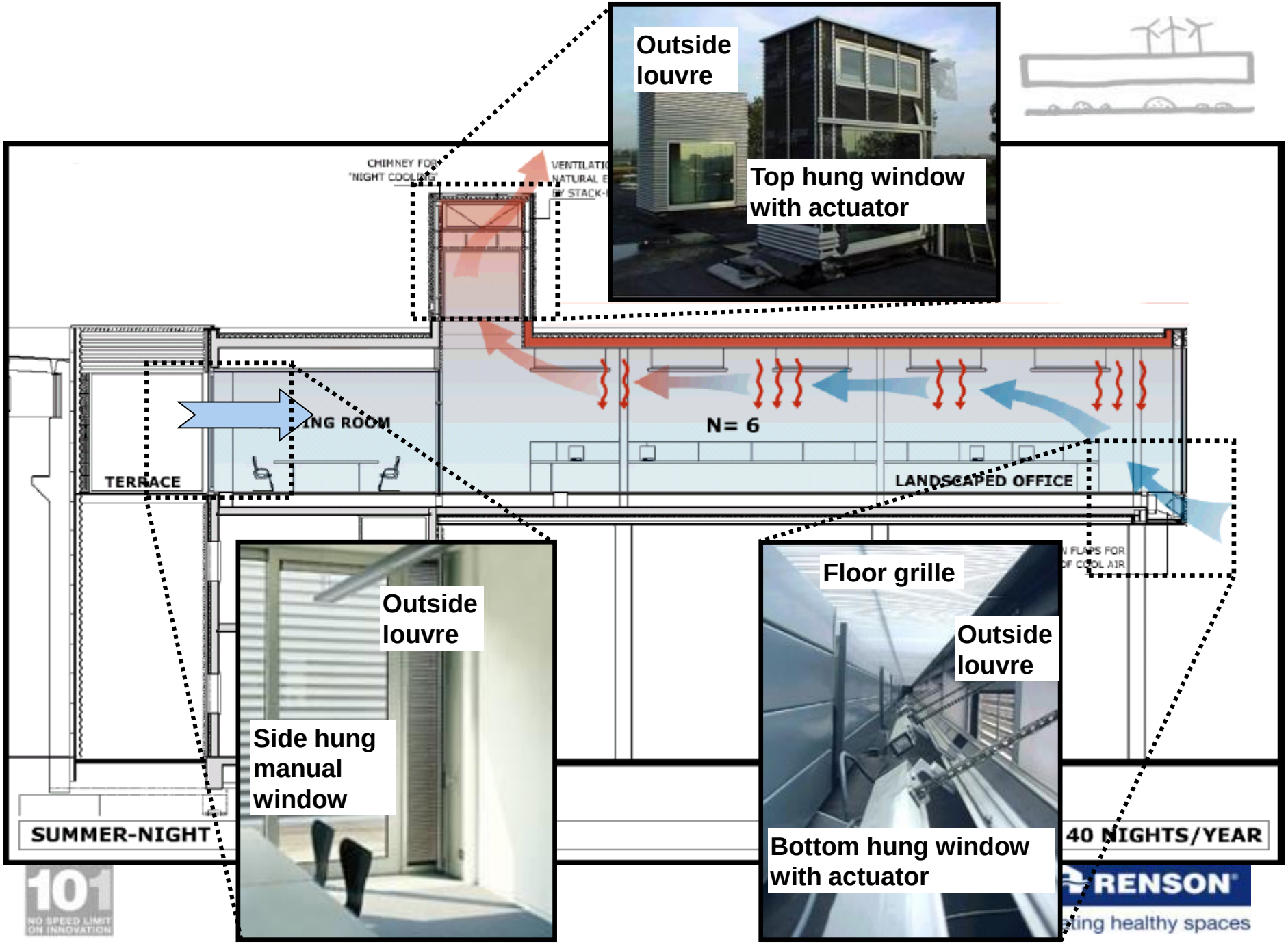
Tour Elithis (Dijon – France)

Residential sector

Healthbox II system

Renson offices (Waregem – Belgium, 2002)

- Passive stack nightcooling
- Average air exchange rate: 6 h^{-1}
- Free area of air supply: 2% of floor area
- Occupancy: 12 m^2/person
- Controlled by BMS
- Combined with external adjustable solar shading and exposed ceiling as thermal mass
- Summer of 2006: 76 nights in operation (20%)


Outside louvre
Top hung window with actuator
CHIMNEY FOR 'NIGHT COOLING'
VENTILATIO
NATURAL E
BY STACK-
ING ROOM
N= 6
TERRACE
LANDSCAPED OFFICE
N FLAPS FOR OF COOL AIR
Outside louvre
Side hung manual window
Floor grille
Outside louvre
Bottom hung window with actuator
SUMMER-NIGHT
40 NIGHTS/YEAR
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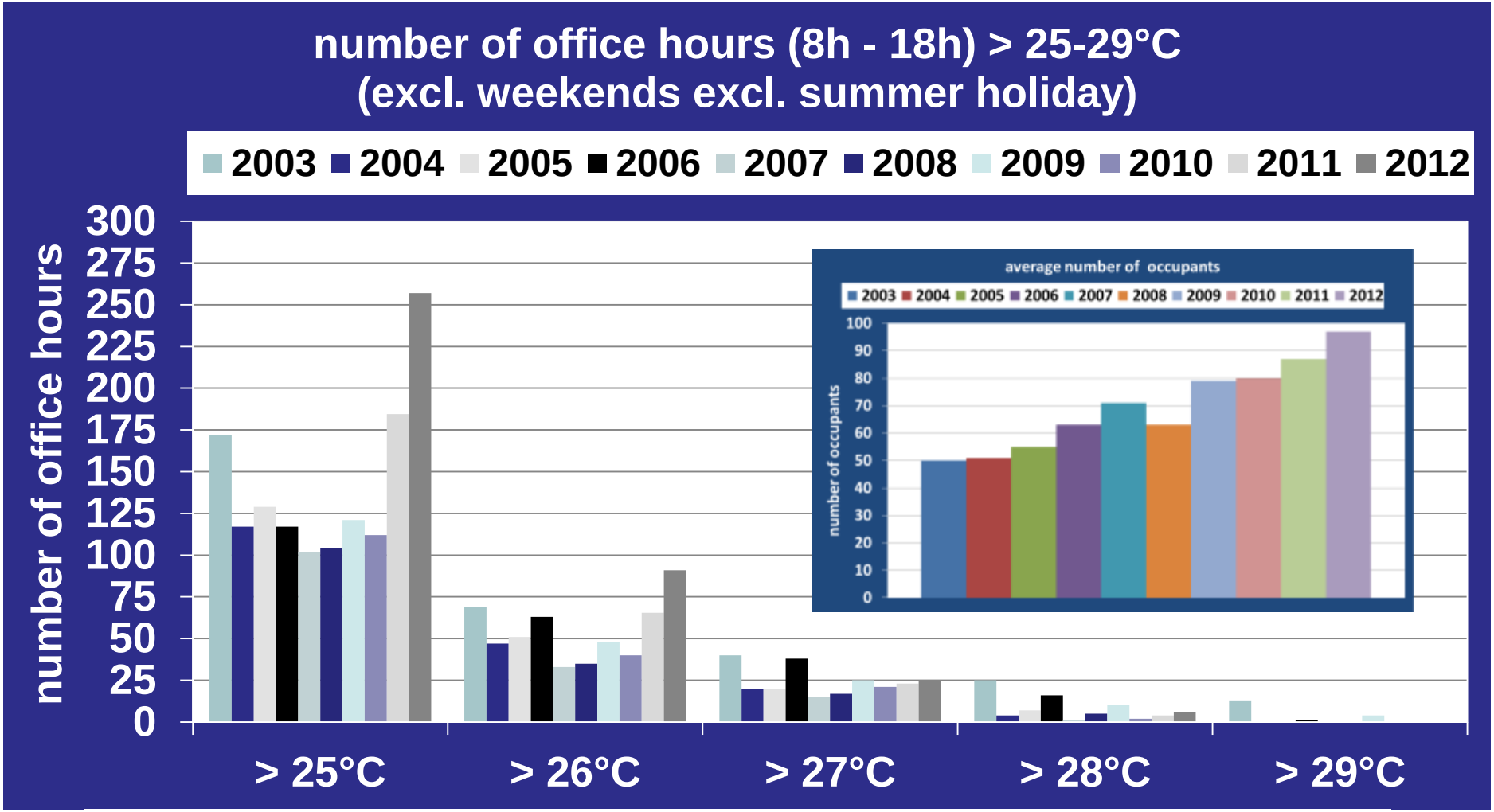
Renson offices (Waregem – Belgium, 2002)



- **Number of occupants more than doubled**
- **Number/power of computer(screens) strongly increased**

Renson showroom (Waregem – Belgium, 2013)

- Located **under the offices**
- **Vertical screens** as solar protection
- **Hybrid nightcooling system:** natural cross ventilation, supported by mechanical exhaust (5 h^{-1})
- **Floor cooling** on reversible heat pump ~ 30 W/m²

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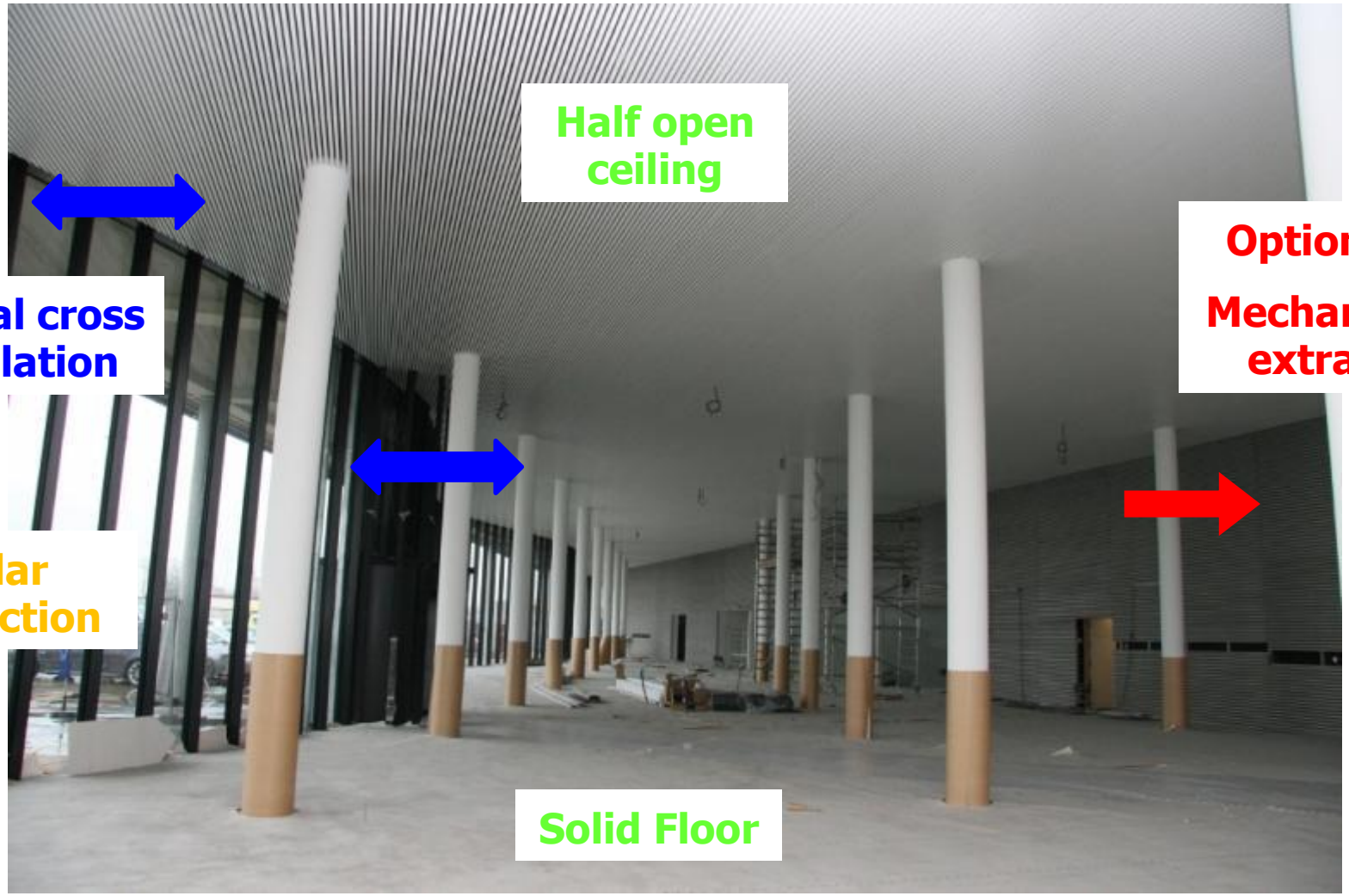
Renson showroom (Waregem – Belgium, 2013)



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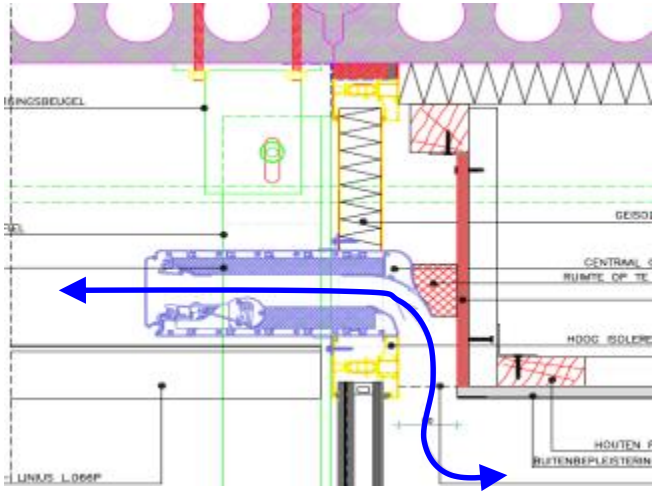
Renson showroom (Waregem – Belgium, 2013)



- **Natural air supply – exhaust:**
  - acoustic insulating automated window vents at the top of the windows (also used for hygienic ventilation)
  - automated windows integrated in the plenum above the entrance doors

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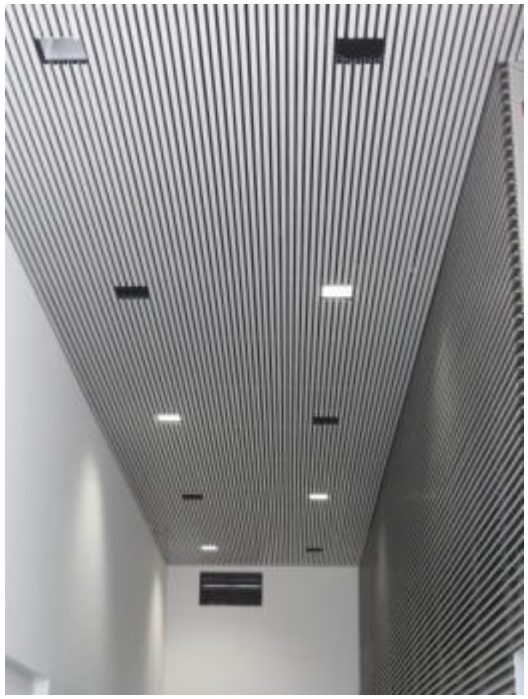
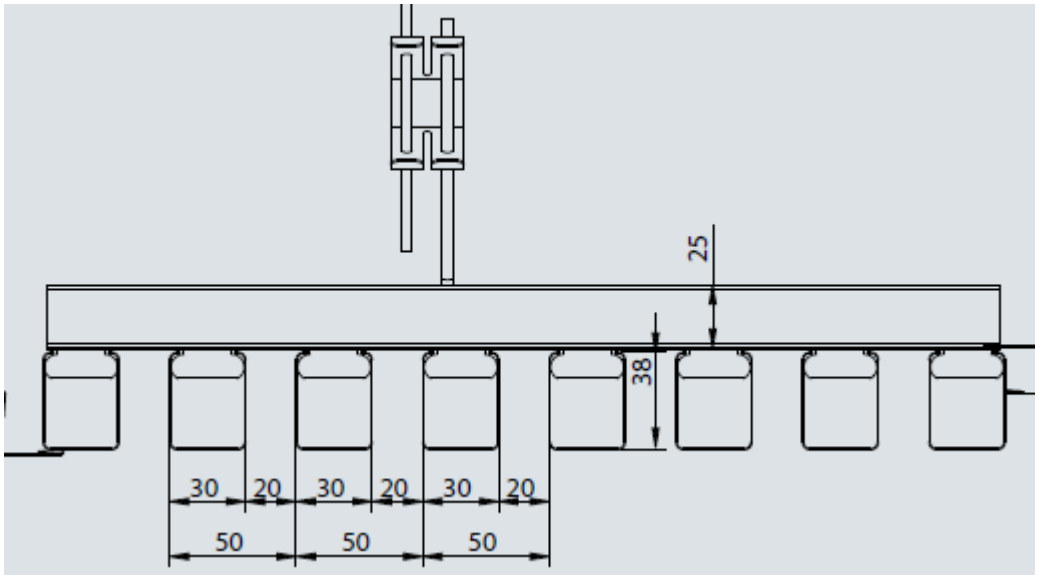
Renson showroom (Waregem – Belgium, 2013)





- **Half open ceiling covered by acoustic absorption profiles**
  - thermal mass available
  - acoustic absorption
  - integration of lightings, loudspeakers, ducts, …

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Renson showroom (Waregem – Belgium, 2013)

- **Mechanical exhaust if needed**
- **SFP = 800 W/m³/s**

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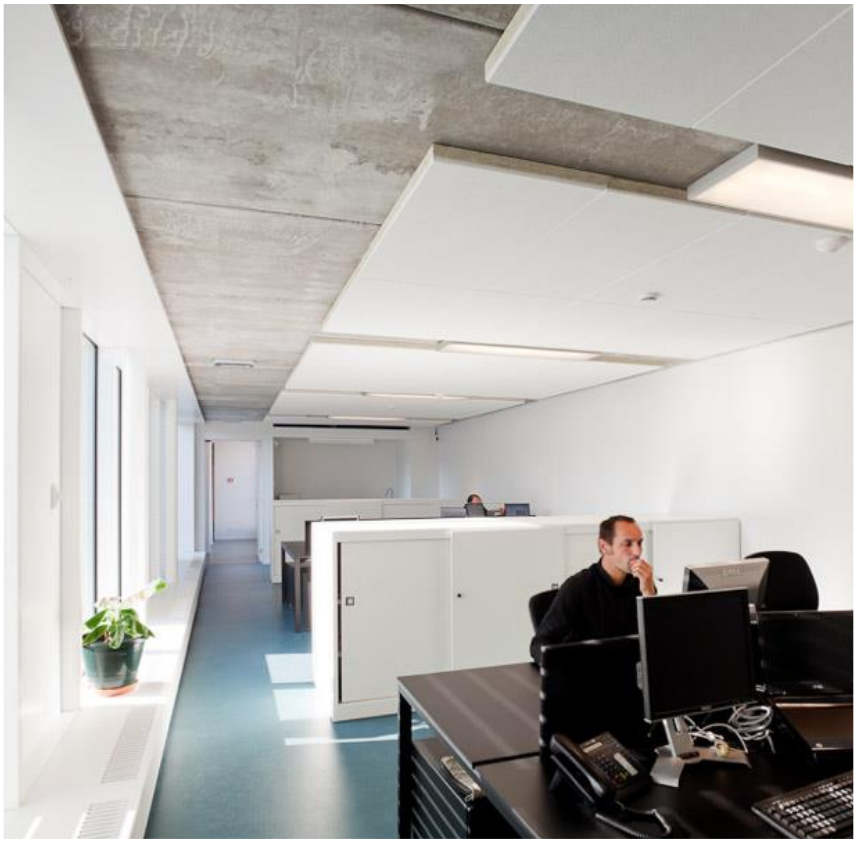
BBL office (Brussels – Belgium, 2012)



- **Renovation and extension of an office – 4 floors**
- **Nightcooling with mechanical extract – 6 h^{-1}**
- **Half open ceiling**

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BBL office (Brussels – Belgium, 2012)

- **Facade openings – manually operated**
- **Protected/secured by sliding solar protection louvres**

  ⇒ **multifunctionality: window protection**

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Green office (Paris – France, 2011)

- **Positive energy building – 23.300 m² over 6 floors:**
  - Total energy consumption: 62 kWh/m²/year
  - Total produced energy: 64 kWh/m²/year
    - Photovoltaic: 4200 m²
    - Cogeneration (CHP) on bio-diesel

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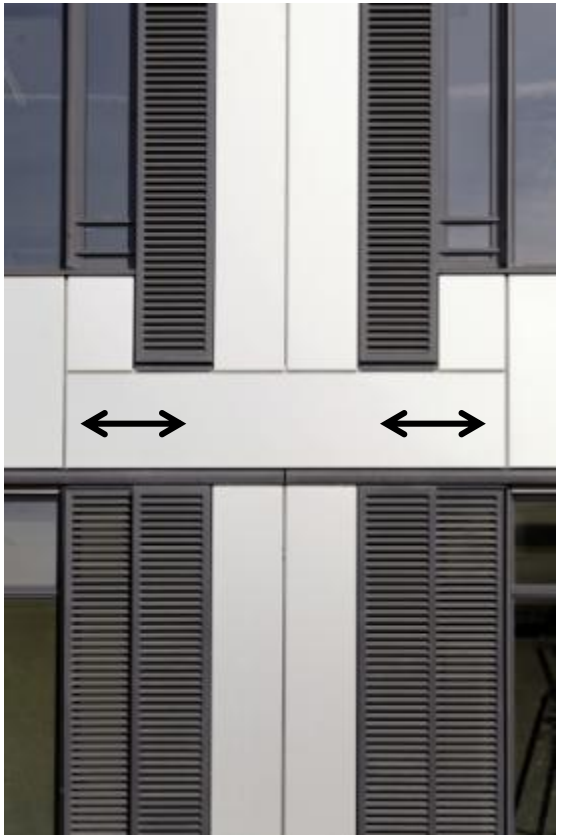
Green office (Paris – France, 2011)

- **Solar protection: sliding louvres - screens**
  - Solar heat control
  - Daylight control
  - Protection/security of openings for nightcooling
- **Concrete slabs** as thermal mass
- **Ceiling fans** to increase summer comfort



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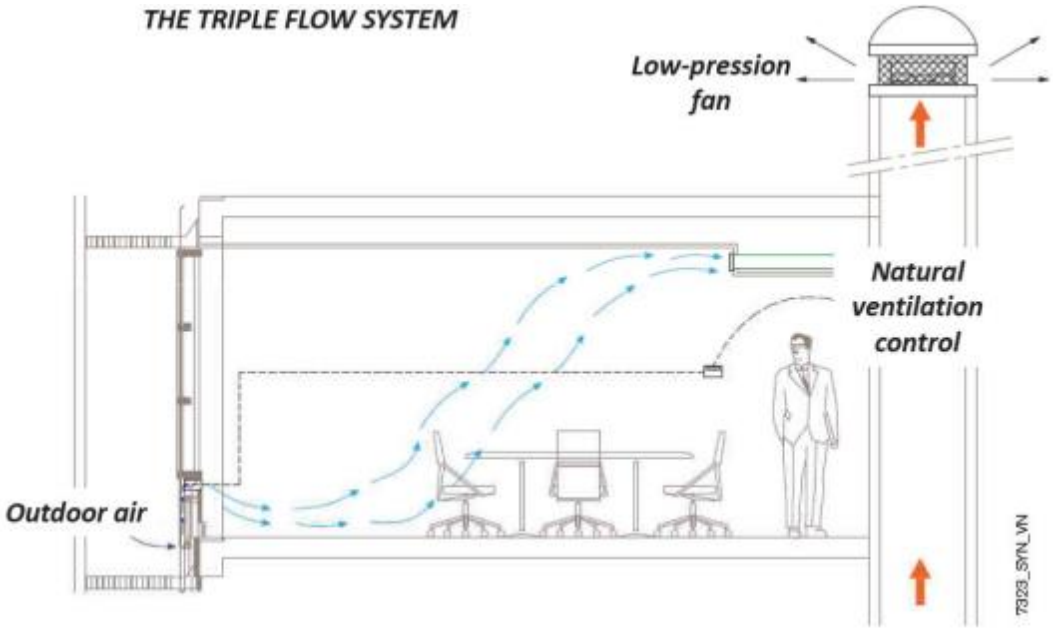
Tour Elithis (Dijon – France, 2009)

- **Positive-energy building – 5.000 m² over 10 floors:**
  - Total energy consumption: ~100 kWh/m²/year
  - Total energy production : - Photovoltaic: 40 kWh/m²/year (560 m²)
    - Boiler on wood granulates
  - External solar shading shield

Tour Elithis (Dijon – France, 2009)

Motorized air supply by means of vents



- **Ventilative cooling** with natural supply (acoustic vents) and low pressure mechanical exhaust ventilation from atrium during **daytime** (T > 10 °C) or **nighttime** (3 h^{-1})
- **Occupancy:** 15 m²/person
- Adiabatic + compressor **cooling** ~ 7 kWh/m²/year
- **Lighting**: 2 W/m² + occupancy and daylight control

Renson Healthbox II (residential sector)

Demand controlled mechanical extract ventilation (MEV)

Burglary resistant louvre WK2
before operable window

Control valves

Air flow rate of each room (living and/or functional rooms) controlled on internal and external air temperature

- Cooling rate is automatically increased during hot periods with lower outdoor air temperature

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Thanks for your attention