BREATHING WINDOWS

Bricker Project
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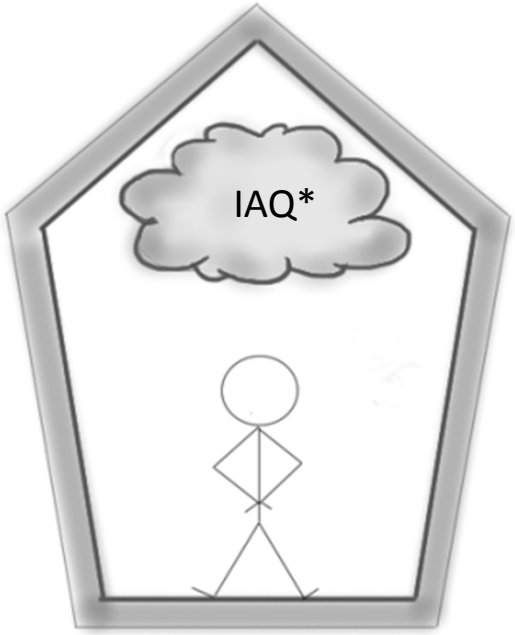
Why do we need to ventilate?

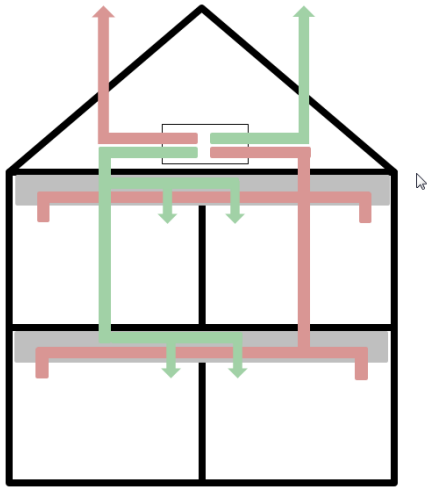


*IAQ = Indoor Air Quality

- We spend the major part of our **time inside** buildings
- **Airtightness** is coming **higher** and higher
- **Contaminant** mass flows is constant or **increasing**

Mechanical ventilation with heat recovery

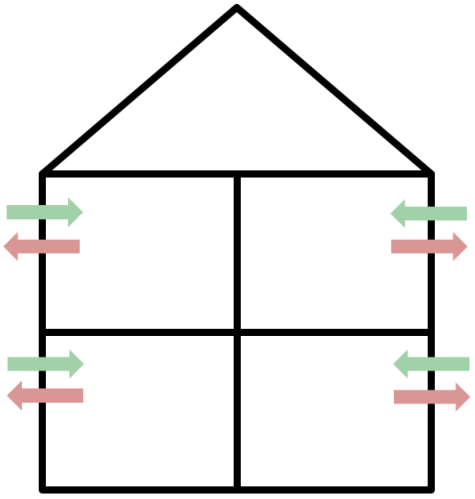
Centralized system



\+ Filter change
Oversized heat exchanger

\- Ducting network required
Maintenance of the network
Refurbishment
Sound interferences
Global regulation
…

Decentralized system



\+ Easy to install
Reduced ducting work
Easy to maintain
On demand regulation
Flexible
Pre-calibrated mass flows

\- Filter change requires multiple access

What does it look like?











Regulation and policies tertiary buildings

- Non-homogeneities between European countries
- Belgium decree based on EN13779 Standard

Category	Unit	Rate of outdoor air per person			
		Non-smoking area		Smoking area	
		Typical range	Default value	Typical range	Default value
IDA 1	$l.s^{-1}.person^{-1}$	> 15	20	> 30	40
IDA 2	$l.s^{-1}.person^{-1}$	10 – 15	12,5	20 - 30	25
IDA 3	$l.s^{-1}.person^{-1}$	6 – 10	8	12 — 20	16
IDA 4	$l.s^{-1}.person^{-1}$	< 6	5	< 12	10

22-36 $m^3/h/pers$

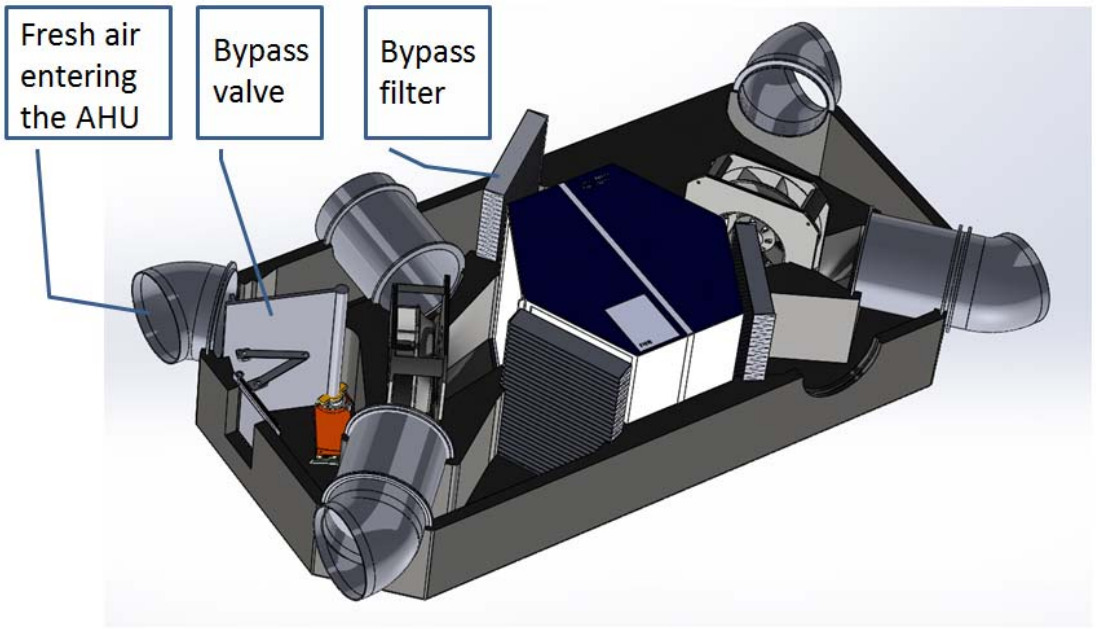
- Simulations has been made with the mean value of **7,5 l/s/pers**
- Number of units has been chosen supposing the **maximum occupancy**

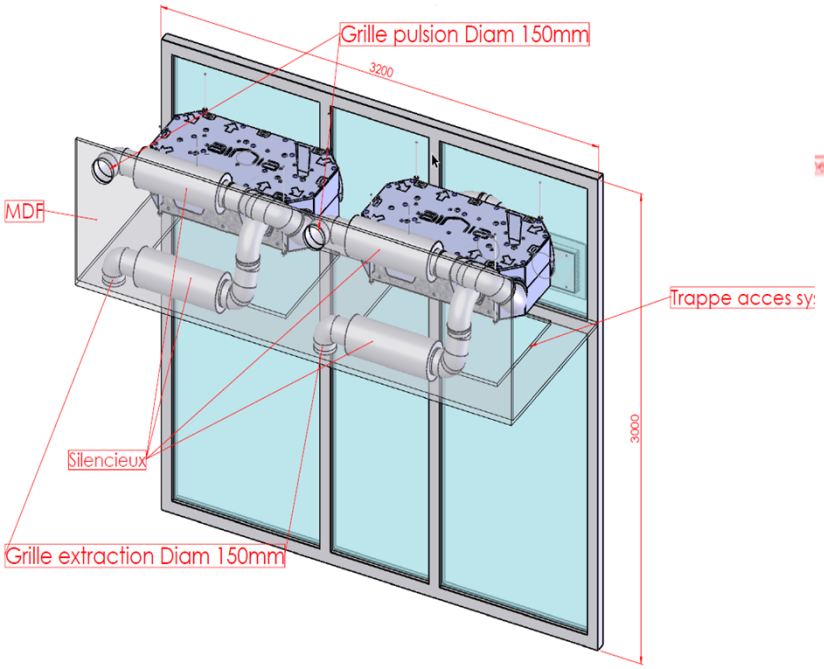
Energy and comfort analysis of the classroom via a dynamic model

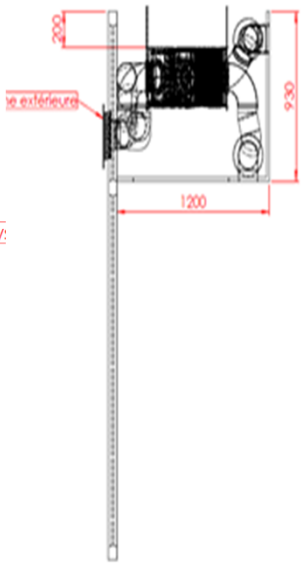
SISAL	Occupancy flow rate = 2700m³/h (100 people) non-occupancy flow rate = 2700m³/h			
	System **A**	System **C**	V1 System **D decentralized**	V2 **Bricker smart and high performance aerating window**
Maximum CO_2 concentration [ppm]	5000	1500	1500	1500
Heating demand [kwh]	>>>>>	42 676	20 196	11 891

SISAL	Occupancy flow rate = 2700m³/h (100 people) non-occupancy flow rate = 200m³/h	
	V1 System D decentralized	V2 Bricker smart and high performance aerating window
Maximum CO_2 concentration during the day [ppm]	1500	1500
Heating demand [kwh]	6855	4633

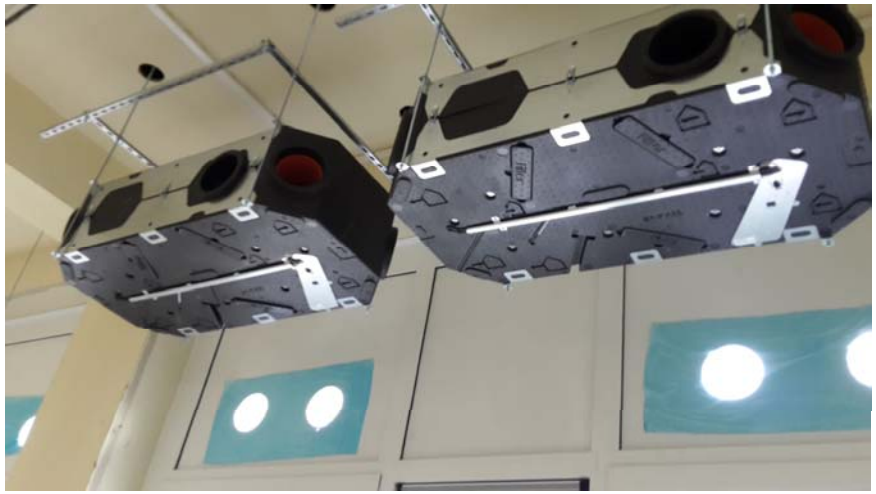
Decentralized unit scheme







On site installation



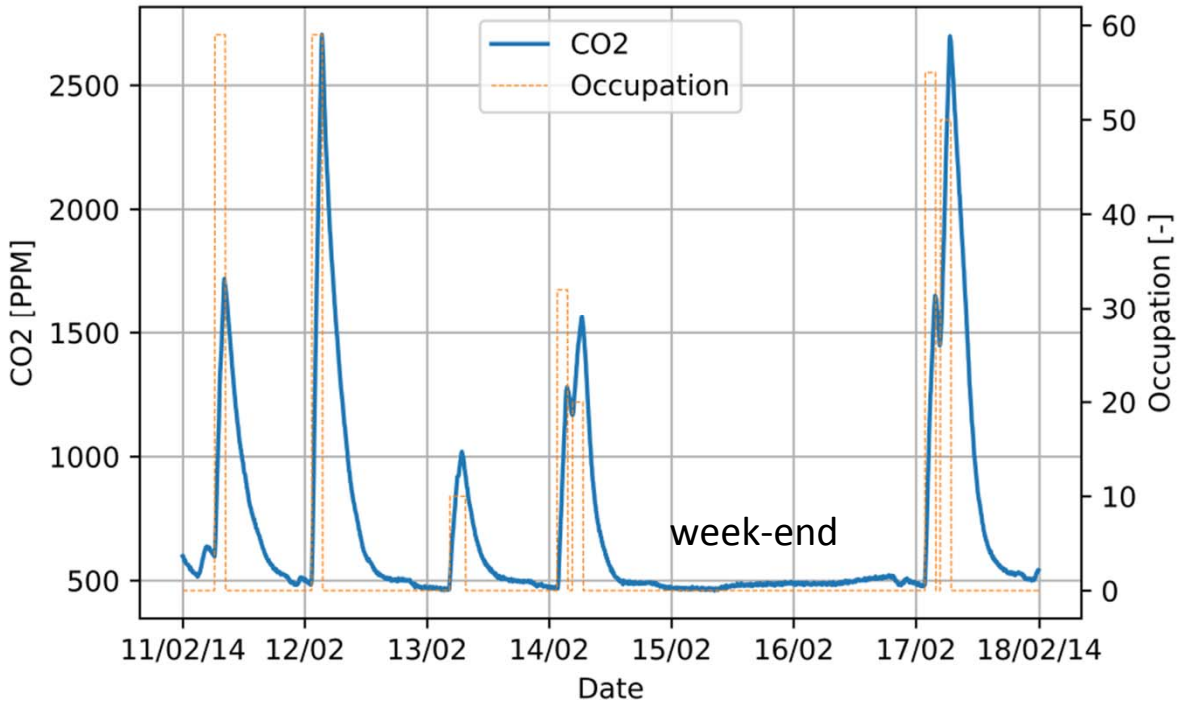
Control & regulation specification

3 different piloting and control systems are considered:

- **Manually** (5 constant levels) 
- By a **timer** (automatic) 
- By **CO_2** (or equivalent) sensor 

Monitoring (1)

A monitoring of the **CO2** level has been been made **before** the refurbishment project

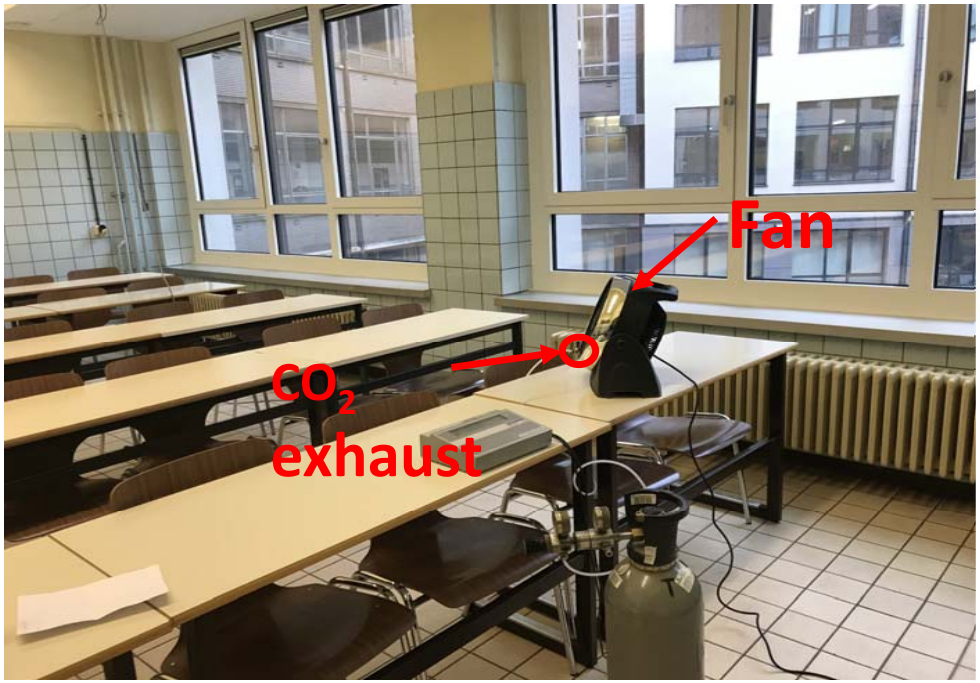


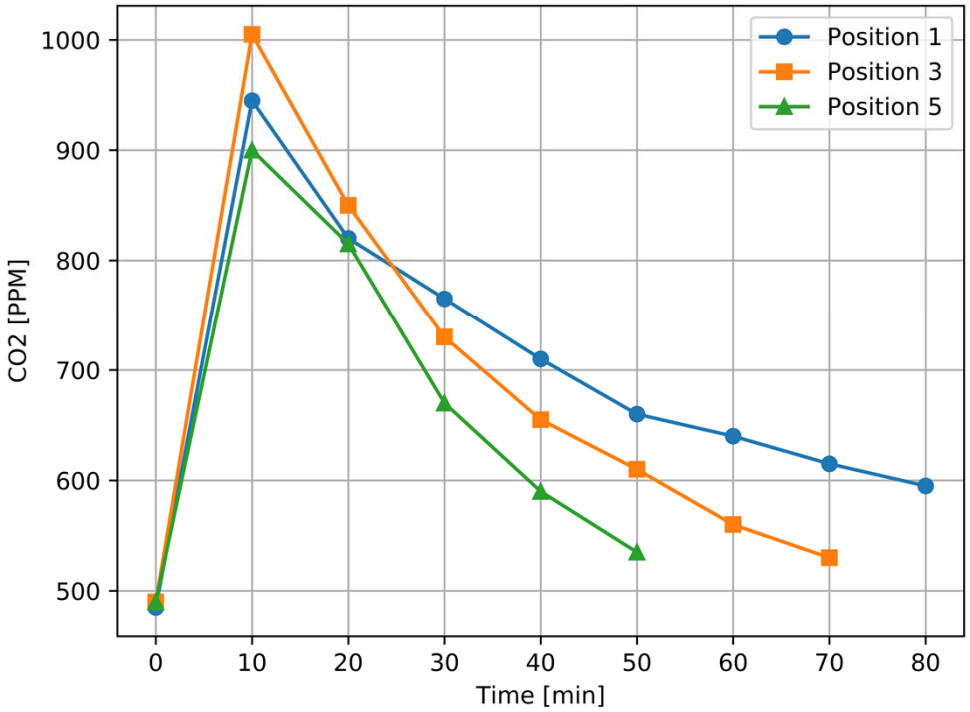
Monitoring (2)

- **Difficulties** in **monitoring** the occupancy
  - Datasheet forms not always completed
  - **Behavior uncertainty** (doors and windows opening, position of ventilation system, etc.)
- Different monitoring strategies have been tried
  - **Fixed** probes with internal data logger
  - **IOT** probes
- Comparison between before and after
  - Airtightness has not been monitored before rework program
  - Mechanical ventilation was **one brick** of the full Bricker system (insulation, airtightness, heating, etc.). This increases the **complexity** in driving conclusions about the comparison before and after the refurbishment

CO_2 artificial injection

- Goal : **controlled** measure of the CO_2 rate evolution for different ventilation flow rates.





Conclusions

- The Bricker project did allow a scale-up of windows integrated DHRV unit.
- Standards and simulations enables the definition of a **standard replicable module** that has been engineered, realized and tested.
- **22 units** have been implemented in 4 classrooms
- This installation has been undertaken consistently with the improvement of additional active and passive improvements
- **By-pass** functionality and **timer control** have been identified as the best strategies for classroom application.
- **Monitoring** before / after has been organized. First conclusions are:
  - Decentralized ventilation with HR is **effective** : control of the in/out flow rates associated with heat recovery.
  - High attention must be paid to supply air vents (position, flow direction)
  - IOT based sensor are promising but the question of monitoring the occupancy level and behavior is still pending
- **Integration** remains a big part of the **cost**. In the future, optimization will facilitate the integration

Perspectives

- Ventilation units installed in the frame of Bricker project are a promising technology that can be still **improved**
- New project aiming at developing enhanced unit: **Silenthalpic**
  - Project funded by the Walloon Region involving different industrial partners and research centers
  - Three main pillars:
    1. **Acoustic** of the unit
    2. Design of a heat + **mass** exchanger
    3. **Evolving** system (ventilation strategies, communication between units wit IOT, etc.)

Thank You!