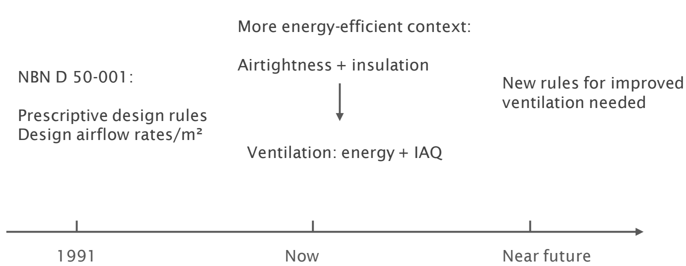
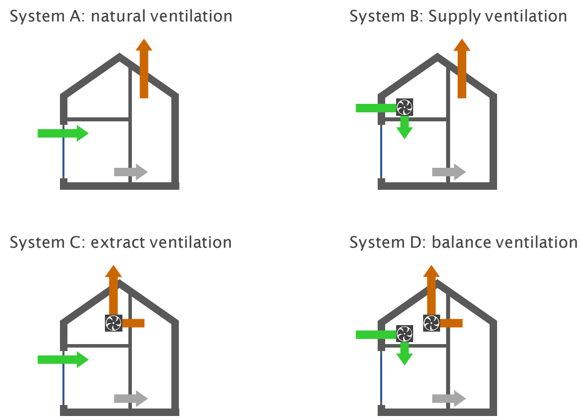
The influence of different ventilation strategies and airflow control on the IAQ in dwellings

AIVC Workshop 15 March 2017

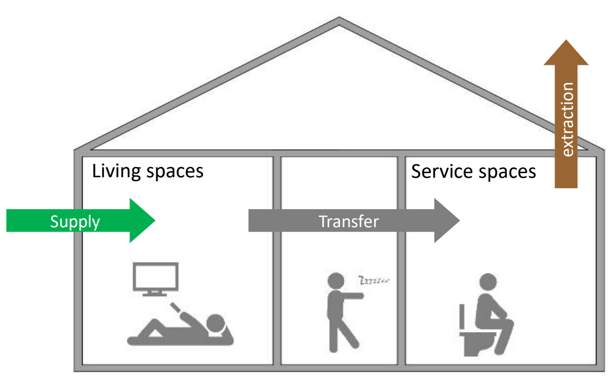
The standard NBN D 50-001 currently regulates the ventilation in dwellings



The standard defines 4 basic systems



The standard also dictates the airflow path through the dwelling



The standard presents some shortcomings to be tackled

- The 4 basic systems don’t provide an equivalent IAQ
- Manual airflow rate control and DCV are neglected
- Alternative ventilation strategies not treated

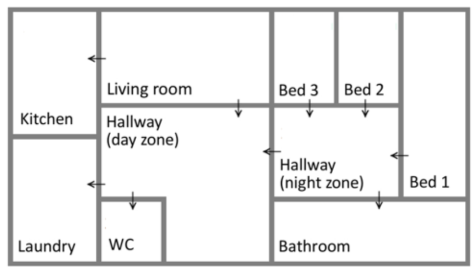
The standard presents some shortcomings to be tackled

- The 4 basic systems don’t provide an equivalent IAQ
- Compromise between lowering airflow rate/e-consumption and IAQ neglected (manual control and DCV)
- Alternative ventilation strategies not treated

CONTAM
Multizone Airflow and Contaminant Transport Analysis Software

4 ventilation strategies
with manual control and DCV

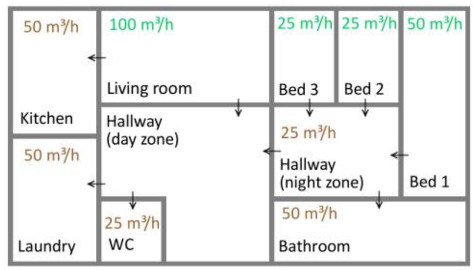
The dwelling consist of a day zone and a night zone



Following simulation conditions are used

Type of system	Perfectly controlled flow
Airflow rate	7 l/s.person + balanced flow rates
Airtightness	Airtight
Occupant profile	Fulltime occupancy (4 occupants)
Meteo	Typical Belgian winter day (T = 3.6˚C, RH = 86 %)
T_{indoor}	20 ˚C
Contaminants	Occupants: CO_2 and H_2O (CEN/TR 14788:2006) Activities: H_2O (CEN/TR 14788:2006) Building: VOC (fixed emission per m²)

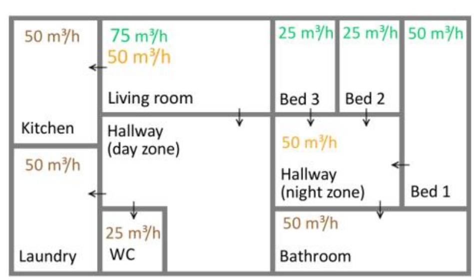
Classical strategy: Supply to the living spaces → transfer → exhaust from service spaces



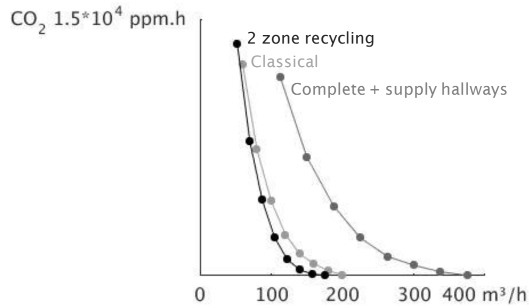
Complete strategy: Supply and exhaust in each living and service space

Supply hallways: Supply to the hallways → transfer → exhaust in all living and service spaces

2 Zones Recycling: Supply to the living spaces of night zone → transfer → recycling to living room (day zone) → transfer → exhaust from service spaces



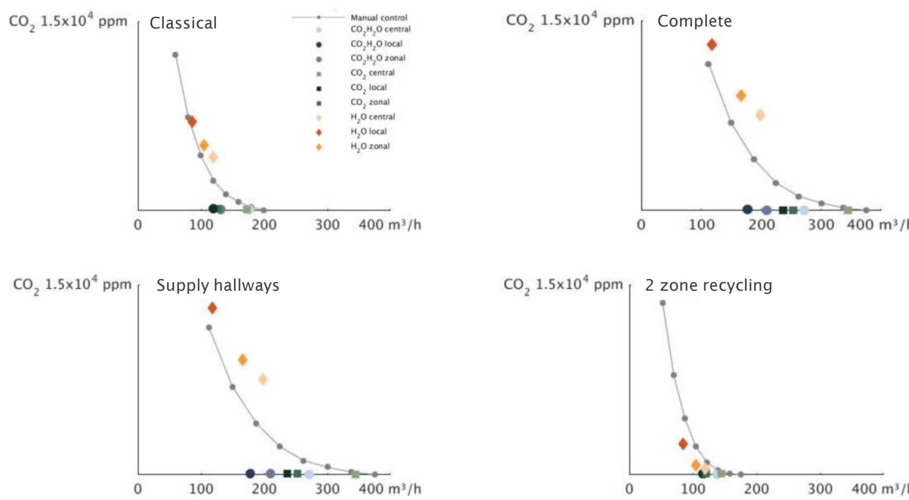
CO_2-levels: 2 main groups of ventilation strategies with manual airflow control exist



CO_2-levels: 2 main groups of ventilation strategies with manual airflow control exist

- The classical strategy is one of the most effective
  - The air is transferred from the living to service spaces
  - The same air is used twice for different pollutants (CO_2 vs. RH)
- The complete strategy and supply hallways give the same results
  - There is no transfer from living to service spaces
  - Supply in the hallways is equivalent to supply in the living spaces
- 2 zones recycling is slightly more effective compared to classical one
  - Limited potential because of balanced nominal flow rates

CO_2-levels: 2 main groups for each strategy with DCV exist
H_2O-controlled vs CO_2- and CO_2/H_2O-controlled



CO_2-levels: 2 main groups for each strategy with DCV exist
H_2O-controlled vs CO_2- and CO_2/H_2O-controlled

- For all strategies:

  CO_2/H_2O- and CO_2-controlled: OK

  H_2O-controlled: not OK

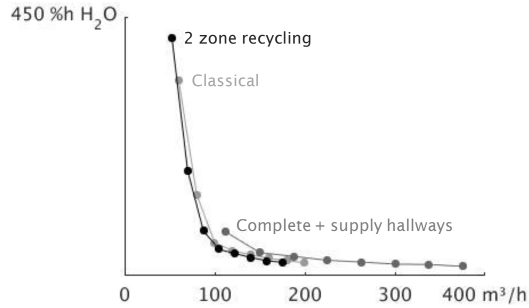
  Manually controlled: not secured

- The energy consumption

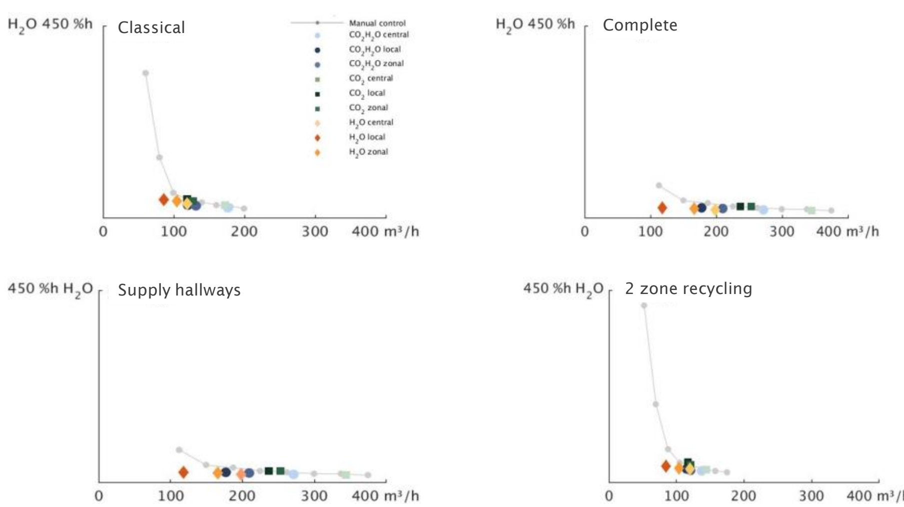
  Increases in the order: Local < Zonal < Central

  But higher reduction potential for the complete strategy and supply hallways compared to the classical strategy and 2 zones recycling

H_2O-levels: no significant difference for each strategy and between the 4 strategies at flow rates higher than 50%.



H_2O-levels: no significant difference between the different DCV systems for each strategy



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From all ventilation strategies is the classical strategy the most efficient in terms of flow rate/contaminant control

- All 4 strategies achieve negligible CO_2-exposures + comparable H_2O-levels @ 100 % design flow rate

- Manual airflow rate control doesn't always guarantee a good IAQ

  → minimal flow rates needed

- DCV-systems

  CO_2-levels: only CO_2- and CO_2/H_2O-detection achieve comparable CO_2-exposures to 100 % design flow rate and with much lower flow rates

  H_2O-levels: ALL DCV systems are equally (or slightly more) efficient than manual controlled rates.

  → H_2O-controlled DCV is overall less relevant (than manual control)

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