WFEO-CE

Impact of a respiratory infection pandemic on the ventilation industry – a paradigm shift

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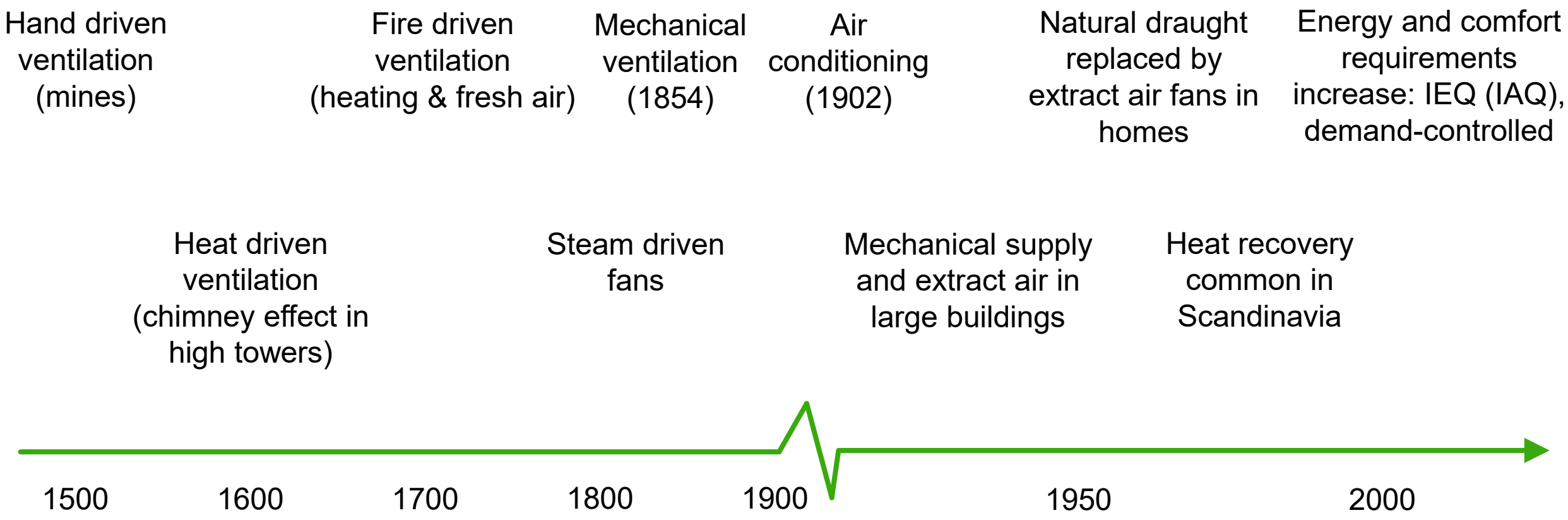
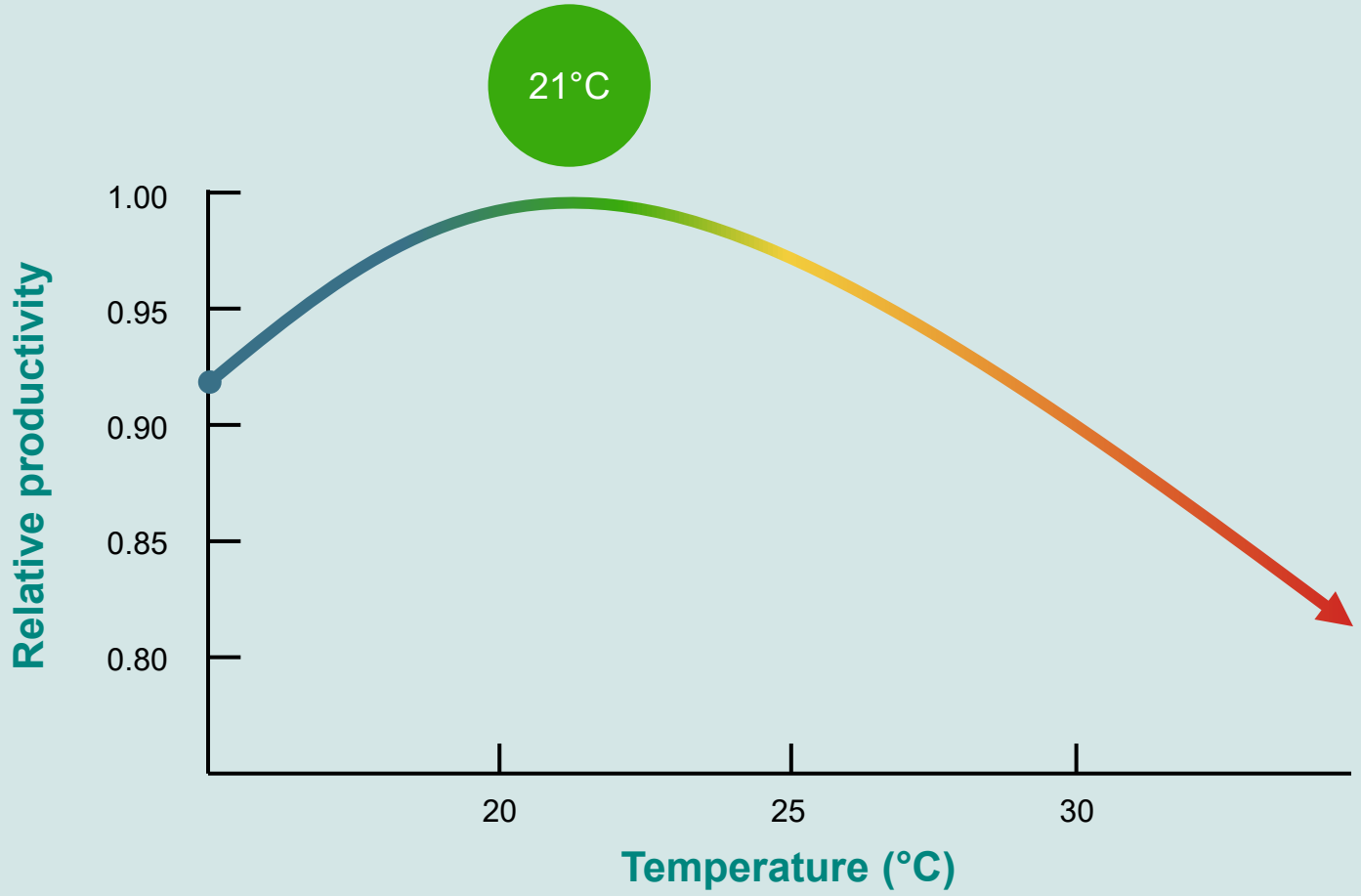
Swegon

Ventilation - History

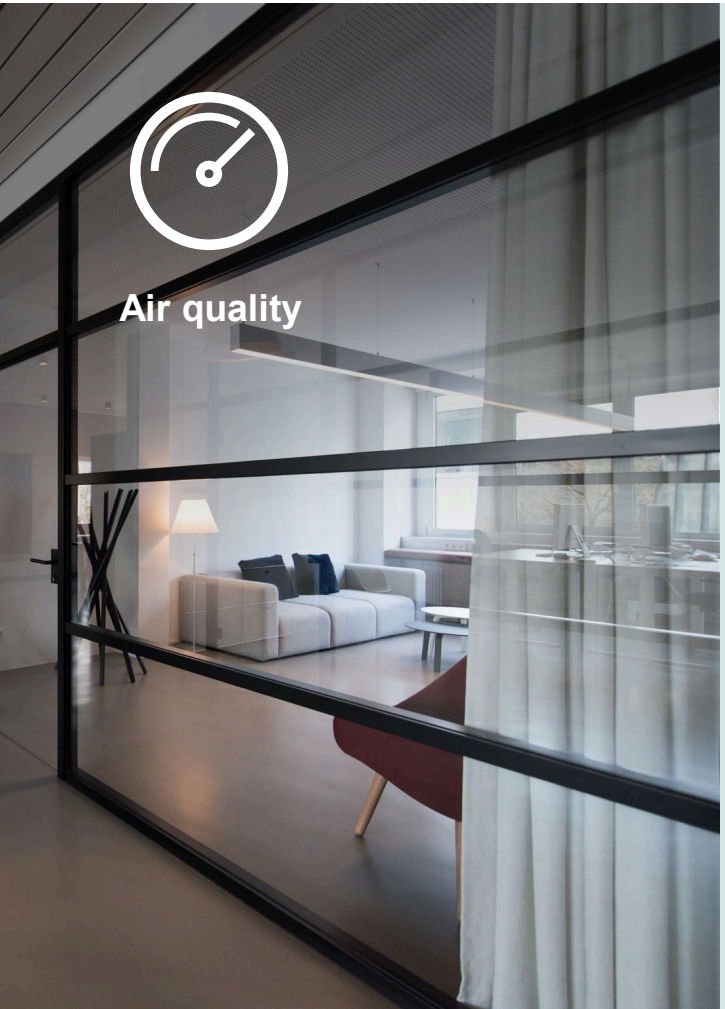


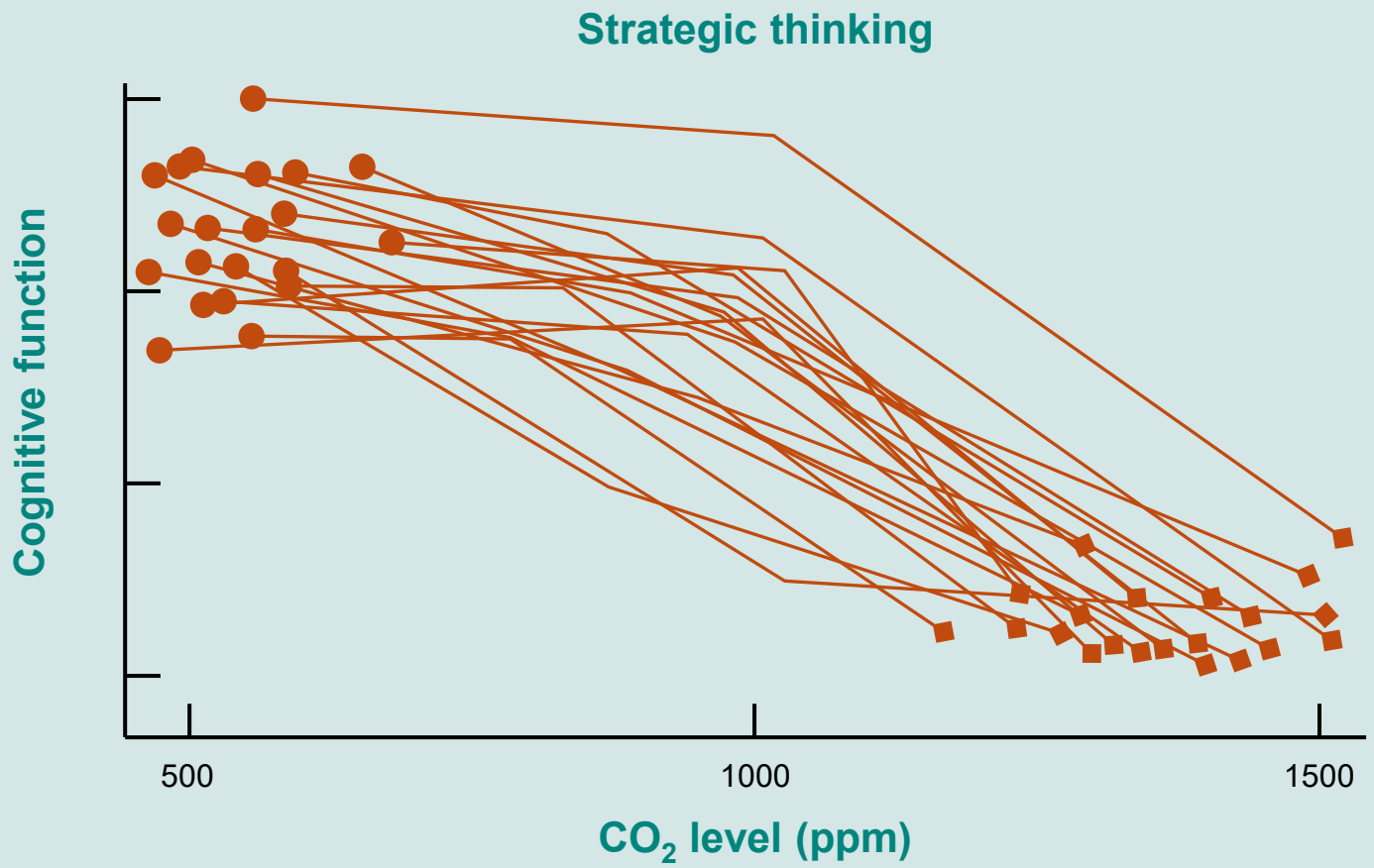
IEQ : Indoor Environment Quality
IAQ : Indoor Air Quality

Indoor Environment Quality



Indoor Environment Quality





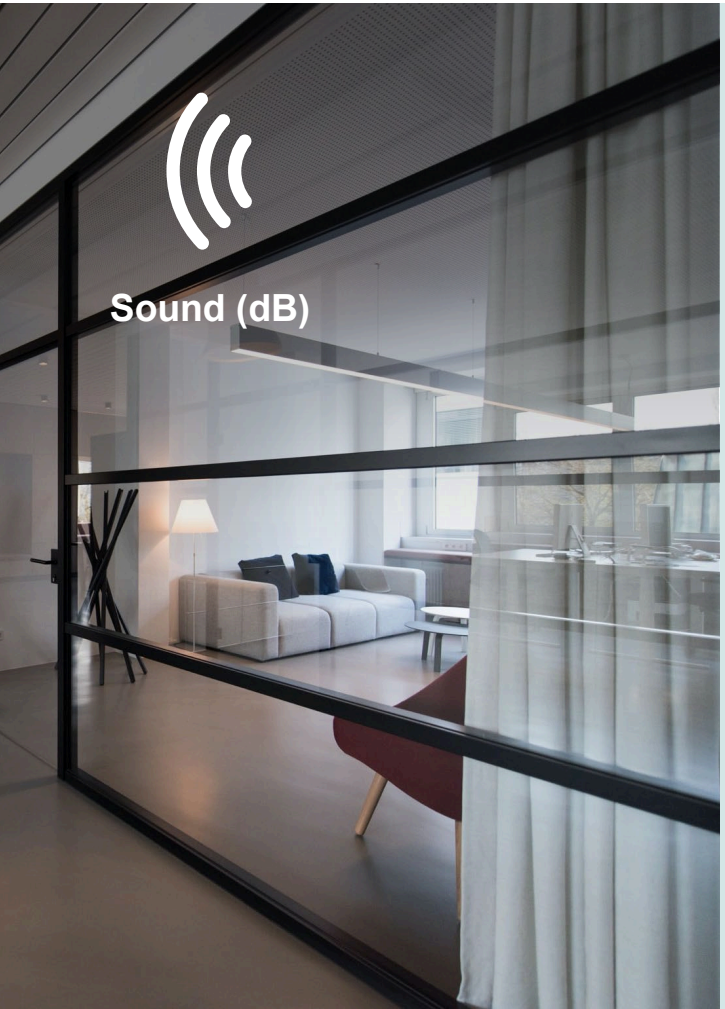
Indoor Environment Quality

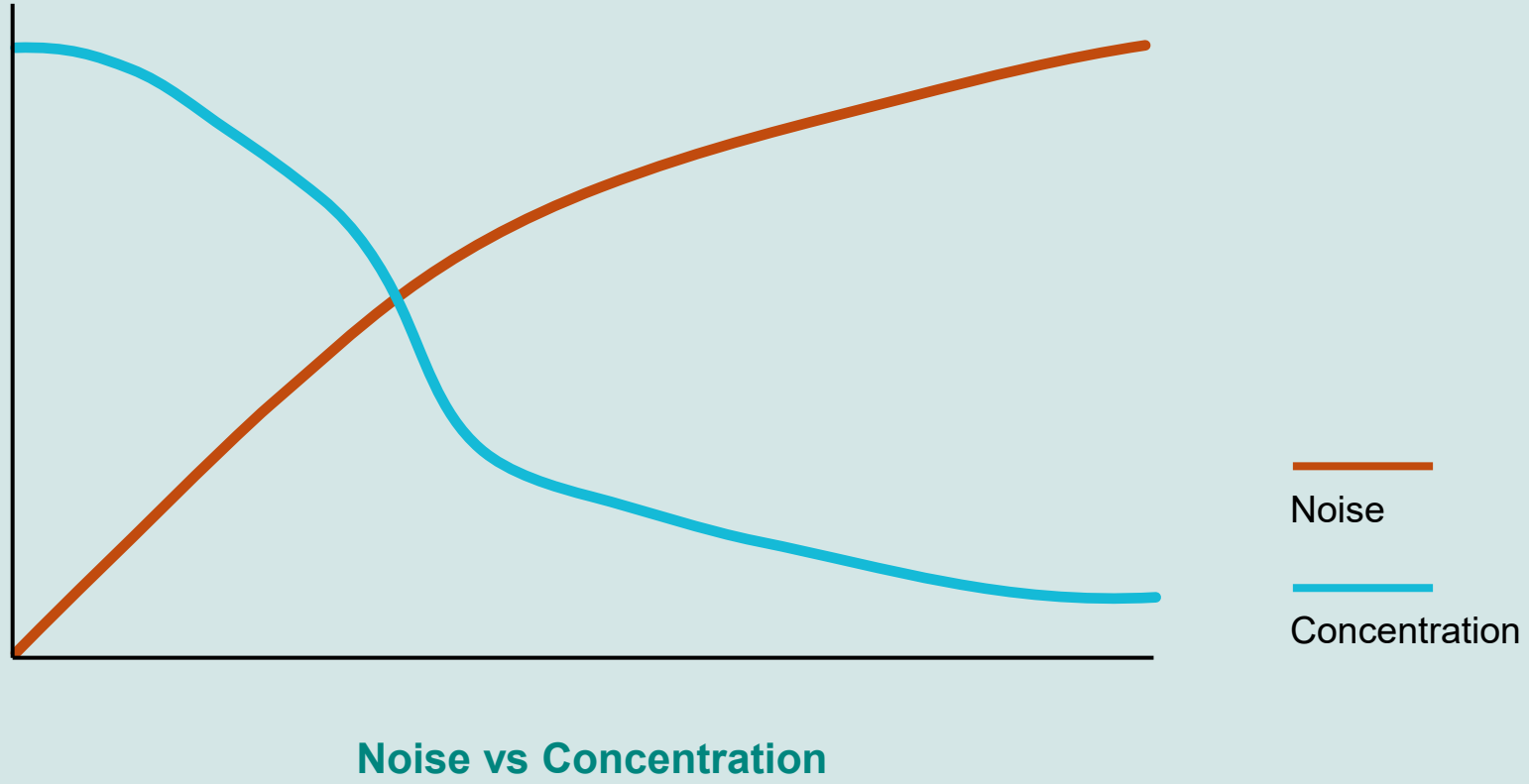
30% – 60% air humidity

Reduced risk of allergies, eczema and dry eyes

Prevents dehydration and cracks in building materials and interior décor

Indoor Environment Quality

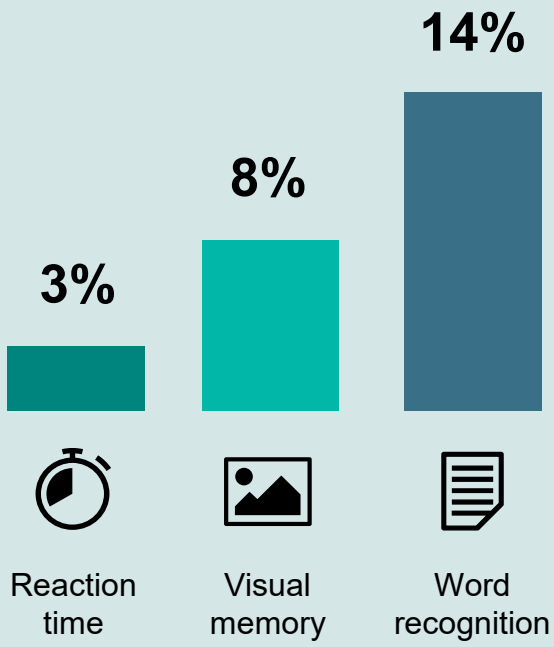




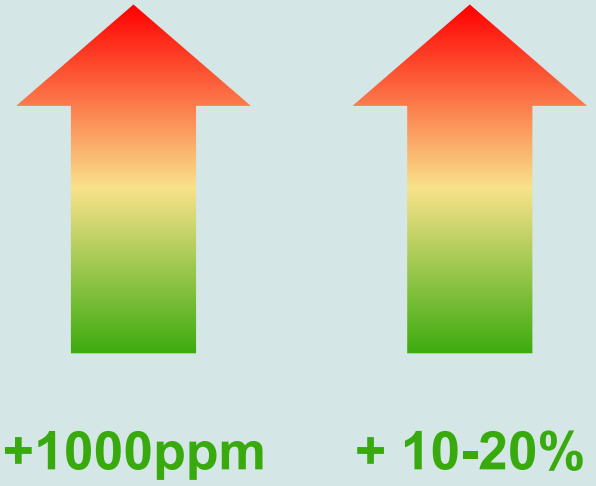
Noise vs Concentration

Indoor Environment Quality - Schools

Better airflow =
Better results

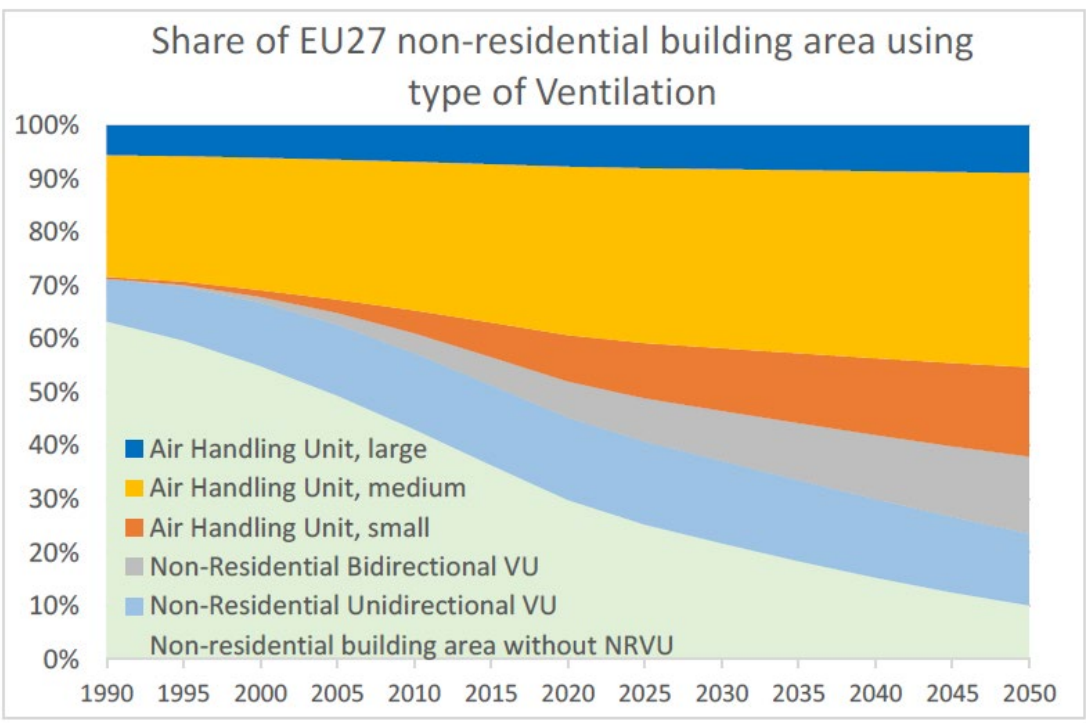


Poorer air quality =
Increased absences



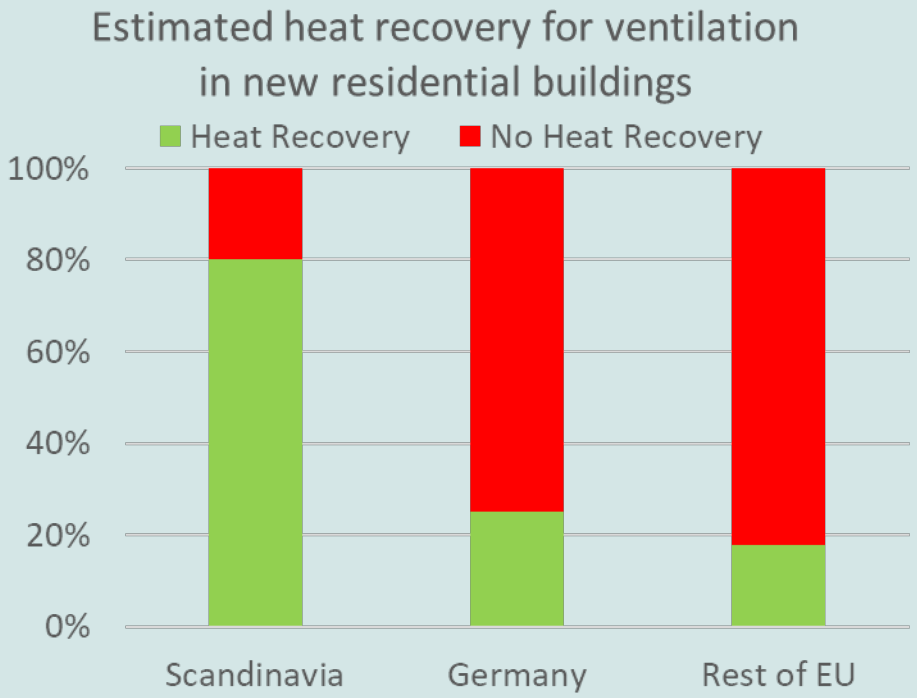
Ventilation - Status

Still a long way to go



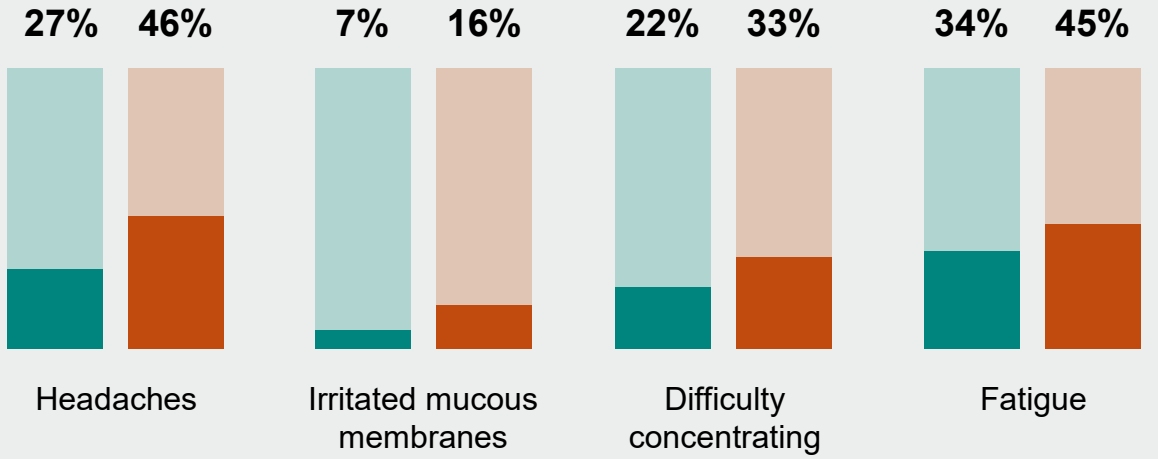
Source : Gandini, Analysis of the obligations for the assessment of the health risks related to the hygiene of air conditioning systems in indoor workplaces, with reference to the Risk Assessment Document (DVR) and to the microclimate conditions, 52nd AiCARR International Conference “HVAC and health, comfort, environment: Equipments and design for IEQ and sustainability”, September 2021.

Disparities between countries



IEQ - Results

Symptoms experienced in the workplace



Why ?

Complexity

Ignorance

Multiple suppliers /owners

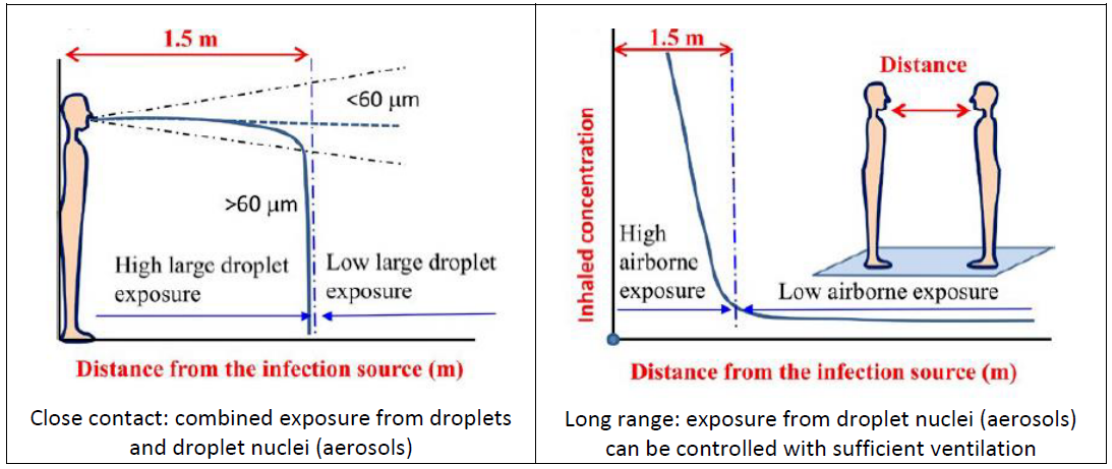
Lack of visualisation

COVID-19 – Largely Unprepared

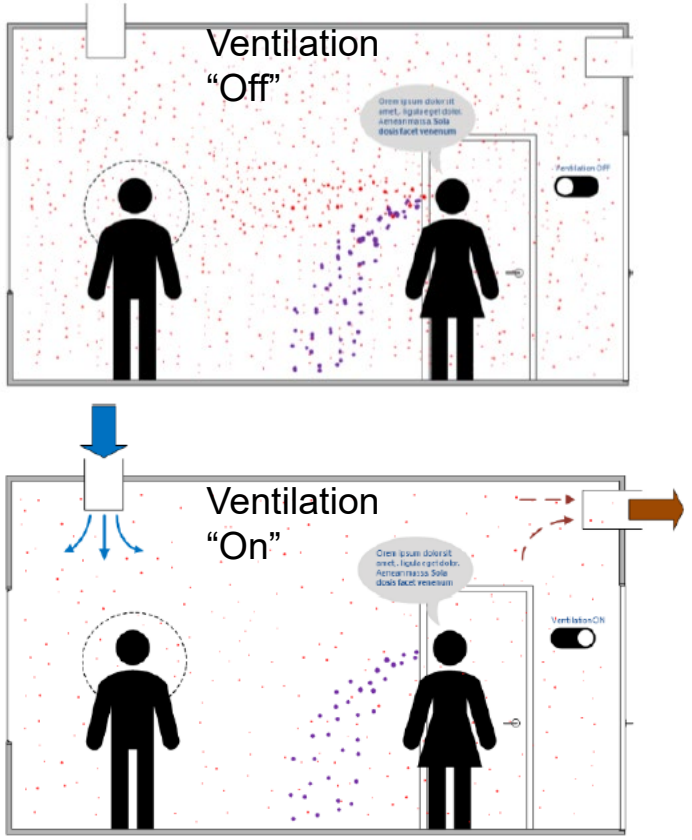
Before COVID-19, missing or weak government legislation dealing with airborne pathogen and respiratory infections. Absence or poor enforcement.

Main propagation from COVID-19 proven to be by nose and mouth emission of pathogens

COVID-19 illustrated how unprepared countries were



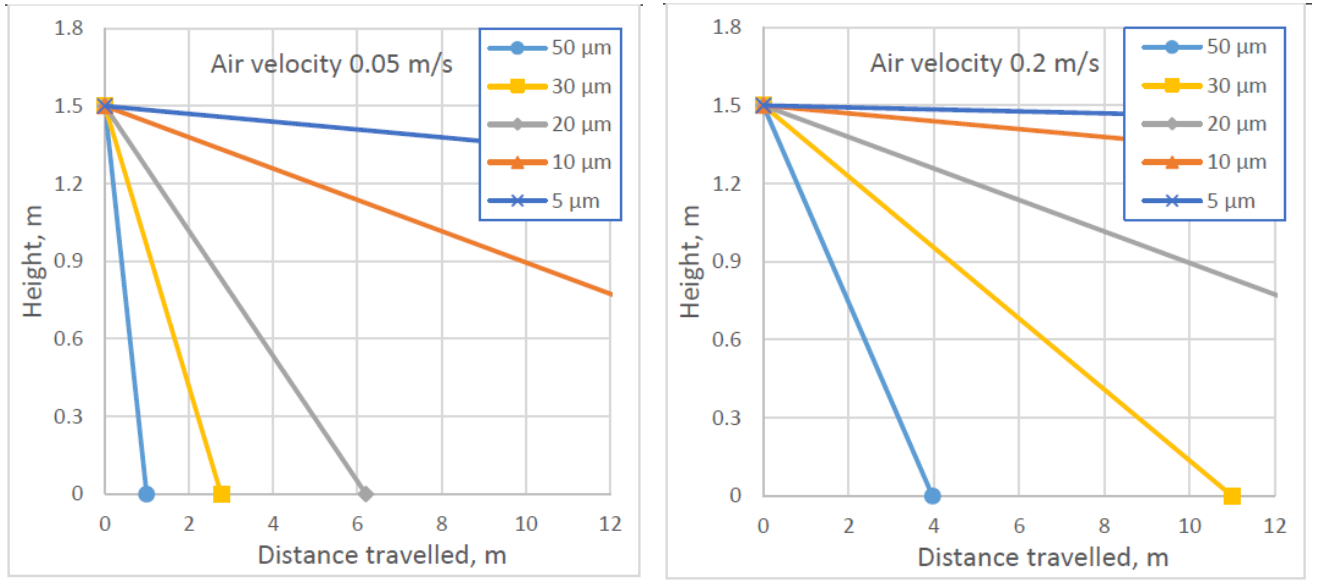
Courtesy from Liu et al., "Short-range airborne transmission of expiratory droplets between two people". Indoor Air 2017; 27: 452-462, 2017.



REHVA, "COVID-19 guidance document", https://www.rehva.eu/activities/covid-19-guidance/rehva-covid-19-guidance, April 2021.

COVID-19 - Reaction from scientific community

In 2020, besides pharma R&D, engineering also fully engaged in developing basic understanding in order to protect population. In particular, to provide pragmatic guidelines and recommendations to building operators for existing ventilation systems.



REHVA, "COVID-19 guidance document", https://www.rehva.eu/activities/covid-19-guidance/rehva-covid-19-guidance, April 2021.

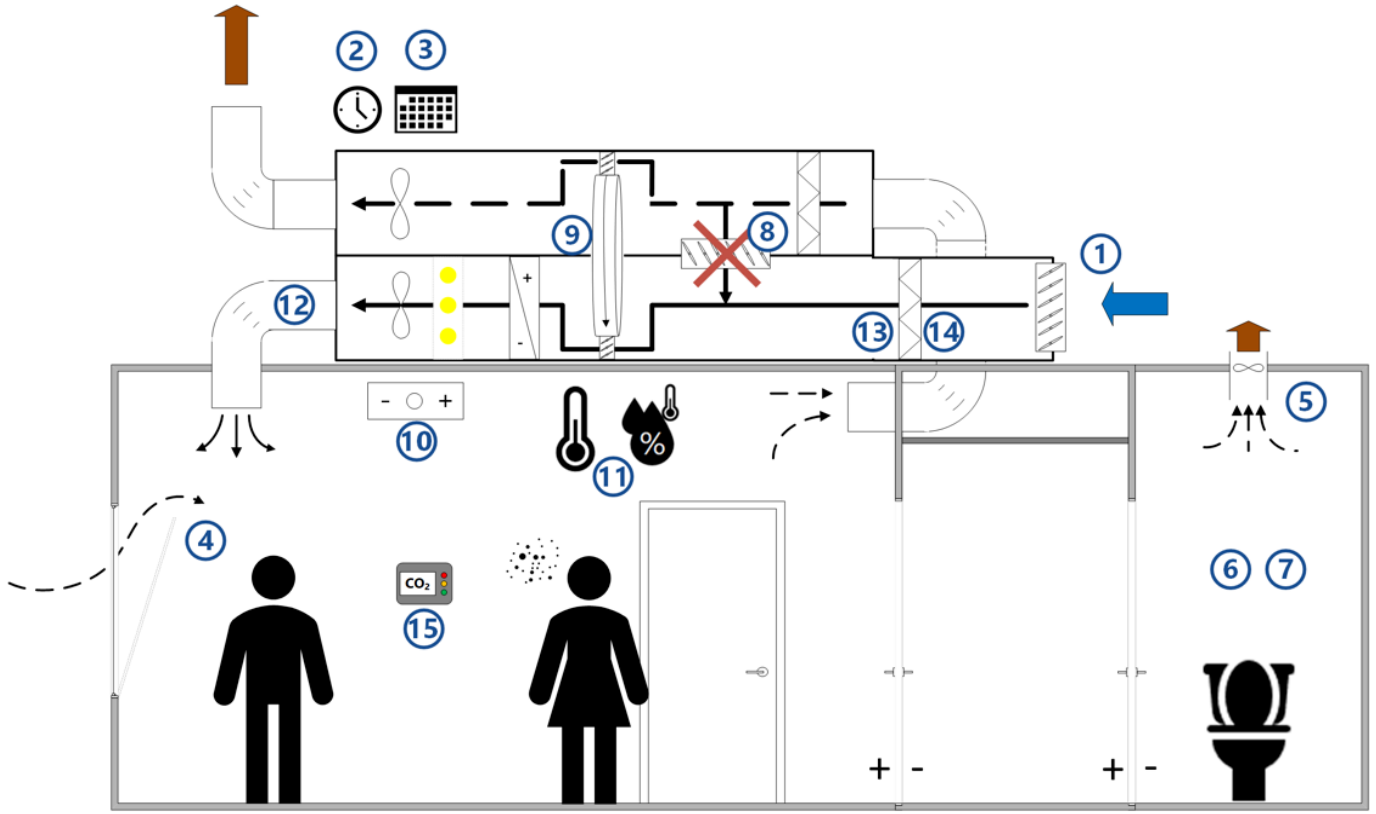
After initial confusion early 2020, consensus was quickly reached amongst scientific community (medicine, engineers) that proper ventilation was key to limit indoor virus transmission. Governments followed.

ASHRAE and REHVA (1) have now produced guidelines for ventilation, but lacking government legislation and enforcement

COVID-19 - Reaction from scientific community

REHVA COVID-19 guidances [1] cover following

- 1. Ventilation rates
- 2. Ventilation operation times
- 3. Continuous operation of ventilation
- 4. Window opening
- 5. Toilet ventilation
- 6. Windows in toilets
- 7. Flushing toilets
- 8. Recirculation
- 9. Heat recovery equipment
- 10. Fan coils and induction units
- 11. Heating, cooling and possible humidification setpoints
- 12. Duct cleaning
- 13. Outdoor air and extract air filters
- 14. Maintenance works
- 15. IAQ monitoring



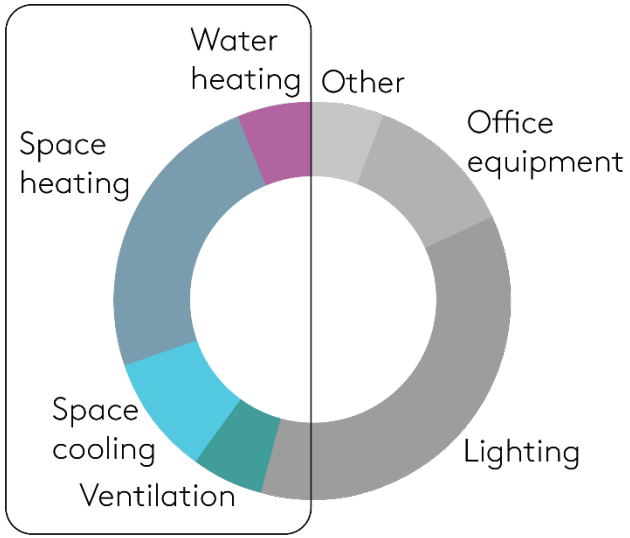
(1) REHVA, COVID-19 guidance document, https://www.rehva.eu/activities/covid-19-guidance/rehva-covid-19-guidance, April 2021.

Ventilation – Investment, Energy

- Global harm of COVID-19 estimated 1 trillion $ / month (1)
- Ventilation 1% of building investment cost

- Energy consumption by buildings represents over a third of global energy
- HVAC represents a fifth of the building direct electrical energy consumption or up to 45% when space heating and water heating are thermally activated by heat pumps
- Electrical energy needs for ventilation and to compensate for thermal losses is far from negligible

Electrical energy consumption in commercial buildings



Source data : IEA Commercial buildings energy consumption survey

Electrical energy required and impact of energy recovery ventilation vs. simple extraction

Electrical TWh/yr	with heat recovery	no heat recovery
10 m3/hr-pers	11	18
35 m3/hr-pers	36	43

# 1GW power plants required	with heat recovery	no heat recovery
10 m3/hr-pers	1	2
35 m3/hr-pers	4	5

Illustration : estimation for EU-27+UK+NO+CH

(1) Science (sciencemag.org), “A paradigm shift to combat indoor respiratory infection, AAAS, Vol 372, issue 6543, 2021.

Why ? Sounds familiar ?

Misunderstanding (misbelief) of relevance of airborne contagion

Invisible

Measurement and traceability difficult

Complexity - cross disciplinary, multiple suppliers and owners

Complexity - multiple and conflicting parameters (multi-objective optimization)

Lack of visualization

IEQ & Ventilation – A new paradigm

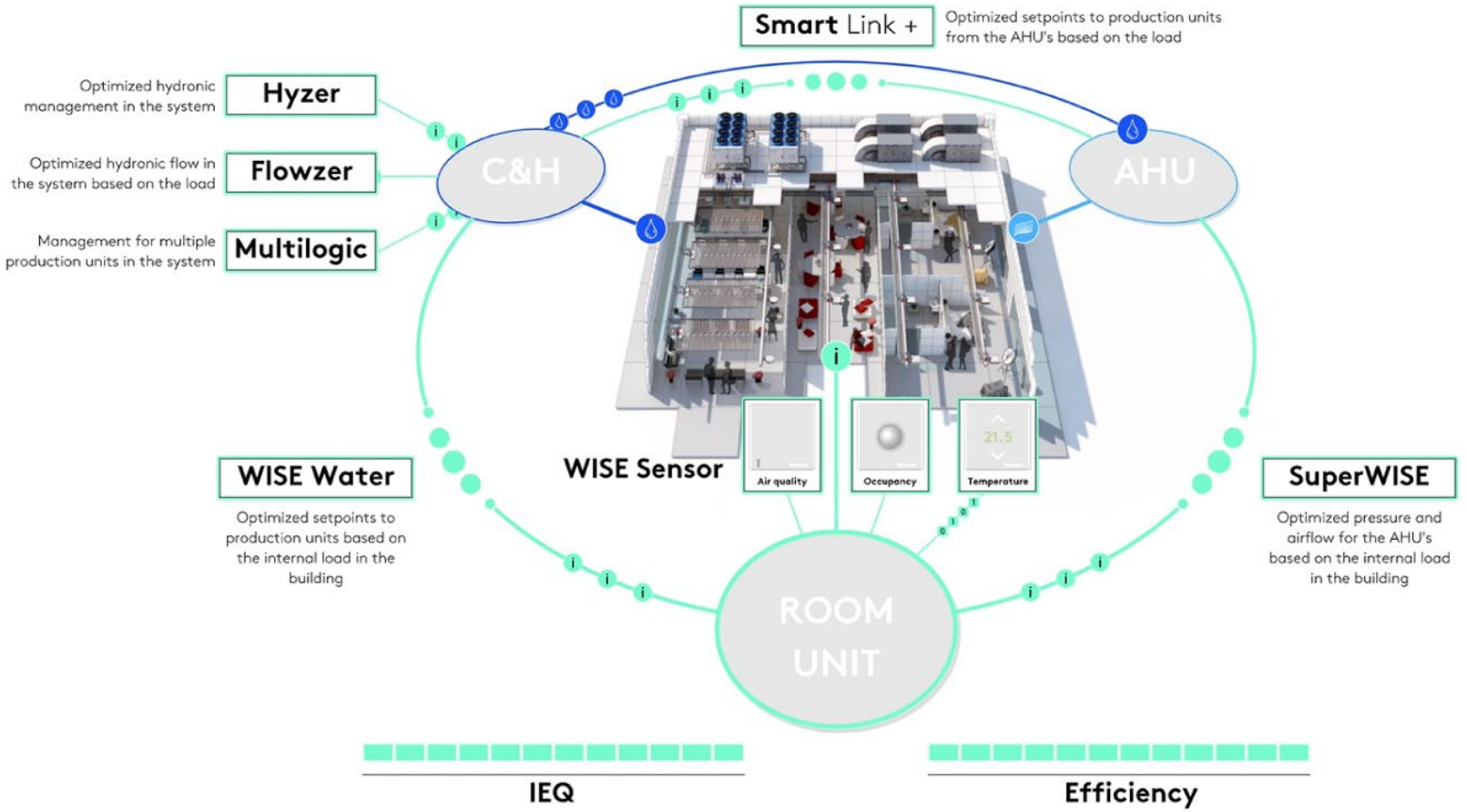
What did we learn :

- Dominant role of airborne transmission in respiratory infections
- IEQ cannot be limited to today main comfort parameters (thermal, humidity,CO2 and VOC, acoustics, odor). Airborne pathogen transmission must be included.
- Key role of state of the art ventilation systems for limiting respiratory infection transmission

And now ? As engineers, we have a fantastic challenge and responsibility ahead of us :

- Strengthen government legislation for ventilation in order to better account for airborne transmission and infection. Enforce their application.
- Master increasingly complex systems with conflicting multi-parameters requirements
- Strengthen cross-disciplinary work at all levels
- Develop innovative technologies to include airborne transmission as part of our IEQ systems and multi parameters controls
- Minimize environmental impact (energy, sustainability) of IEQ systems in new and existing buildings ⇔ new technologies, measurement techniques, controls
- Minimize cost impact while doing all the above
- Convince investors about the relevance of IEQ versus investment cost

IEQ & Ventilation – A new paradigm



Feel good **inside**