



COST

European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

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 **cost**
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY





CO₂ SENSOR APPLICATIONS

Low-cost CO₂ sensor systems could have a large impact on both the environment and economy in Europe

The main CO₂ sensor applications are

1. Alarm

2. Process control

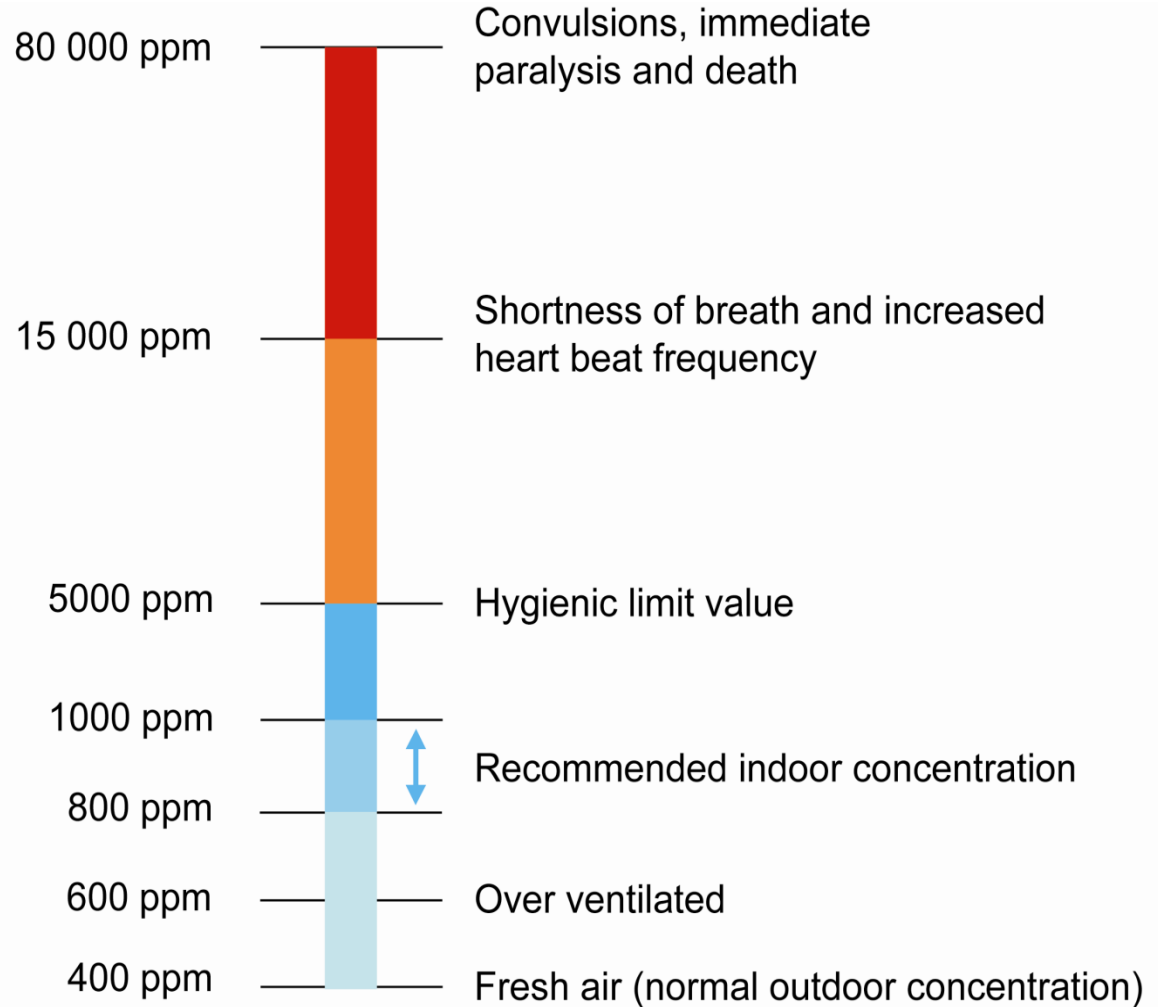
3. Ventilation

1 Alarm, CO₂ impact on health

CO₂ is neither harmless for us nor for the environment

High concentrations of CO₂ are fatal

CO₂ is difficult to notice because it is odorless and colourless



General Safety Alarm

- Environmental protection
- Healthy indoor & work environment
- 200 000 EU for hospitals saves



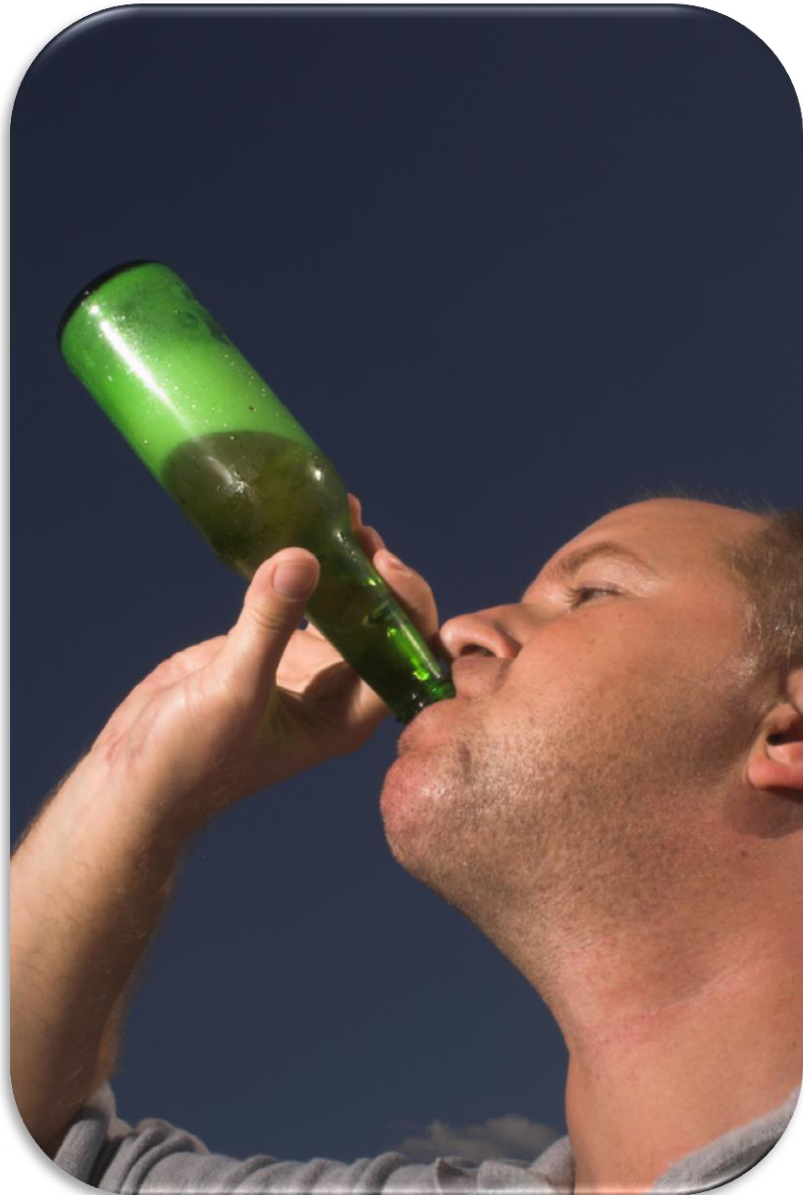


Beer and Soda

- Added CO₂ reduces the risk of bacteria in the drink
- CO₂ is used as propellant gas for beer and soda
- Every year people are harmed at restaurants due to CO₂ leakage

Beer and Soda

- Personal safety
- Saves life
- 200 000 EU hospital saves
- Reputation



Food Transportation and Storage

- Careful control of surrounding gases can slow down the ripening process
- CO₂ has an impact on decomposition and helps prevent pathogens





Food Transportation and Storage

- Higher efficiency
- Reduced loss in the supply chain
- Increased shelf life
- Enhanced flavours
- Improved product quality
- Reduced need for chemical spraying



2 Process control

- The concentration of CO₂ is tuned to give a higher efficiency in a process
- Corresponding sensor systems are specially developed for each application / surrounding

Chicken Farming

The fertilized eggs are placed in a chamber with controlled CO₂ concentration, depending on what stage of development the eggs are in



Chicken Farming

- Less staff
- Reduced losses
- More efficient process
- Slaughtering is faster, easier and more humane
- 16 000 European chicken farms could use this CO₂ application



Mushroom Farming

- The values of CO₂, temperature, and RH are individual for different mushroom types
- Accurate measurements and adjustments of the CO₂ concentration facilitate an optimal growth rate



Mushroom Farming

- 1 000 sites in Europe could use this application
- Less damage on the mushrooms
- Perfect shape
- Shorter growing period
- Higher profits



Greenhouse

For the growing plants it is important to have good control of ventilation, environment and CO₂ to give a maximum yield without risk of damage



Greenhouse

- Less damaged plants
- Shorter growing period
- Higher profits
- Yield increase with 8 - 10%



Incubator

Optimal cell growth condition requires perfect temperature, humidity and CO₂ concentration



Incubator

- Research studies with higher accuracy
- Stable growth control
- Efficient process



Capnometry

High accuracy CO₂ measurements facilitates individual treatments of various patients with different diagnosis





Capnometry

- Less hospital staff
- Less death events
- Shorter recovery time
- Safer treatments
- Individual-based treatments

Flue gas

- Energy optimisation in burners is essential to get as low operating costs as possible and at the same time benefit the environment in the best way



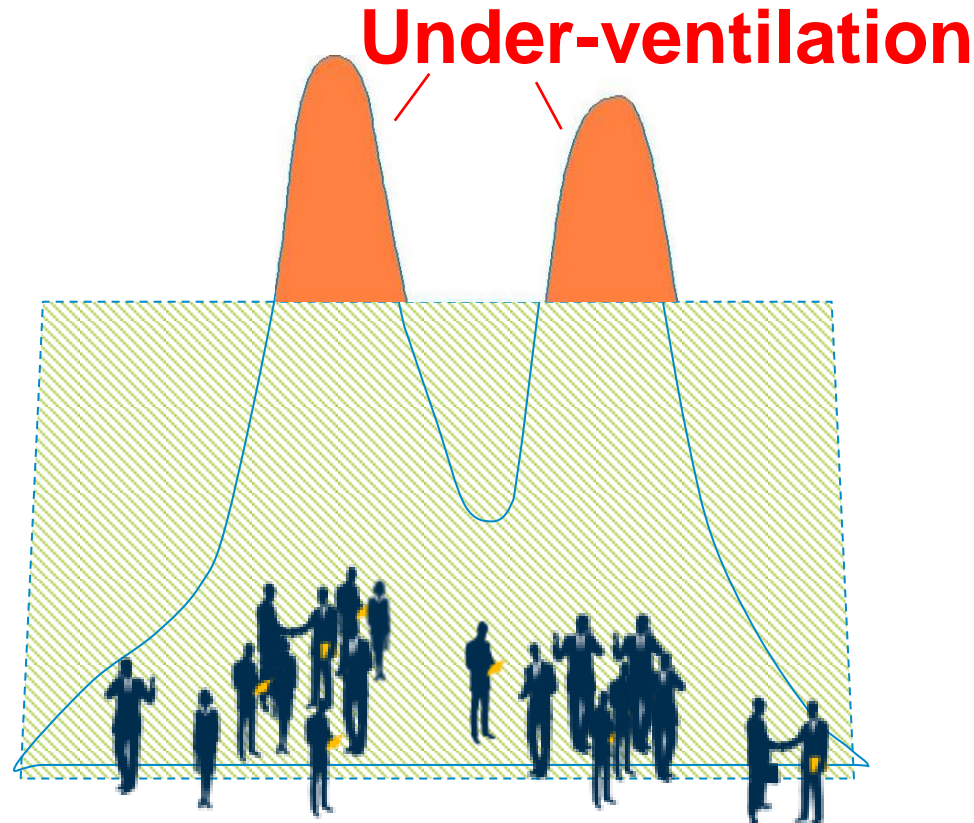
Flue gas

- Optimised combustion
- Less dangerous exhaust
- Energy & money savings
- Easier to control combustion of various fuels, such as waste or garbage
- 1 500 sites in EU could improve their flue gas control



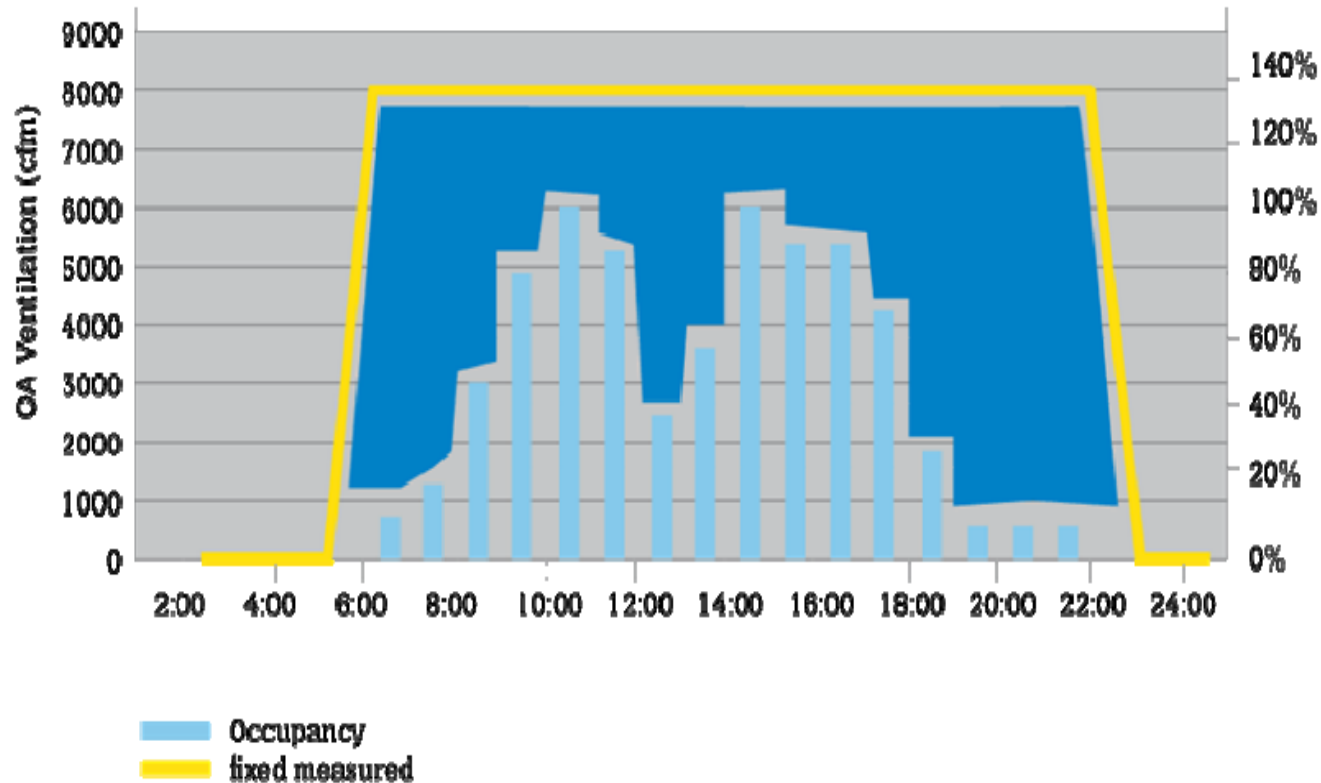
3 Ventilation

- Inadequate ventilation leads too a poor air quality causing health problems



3 Ventilation

Over-ventilation results in higher energy usage and costs



Minor Ventilation Control

- Saves about 30% energy
- Positive environmental impact
- Healthy indoor environment
- 670 MEU/year (class rooms)



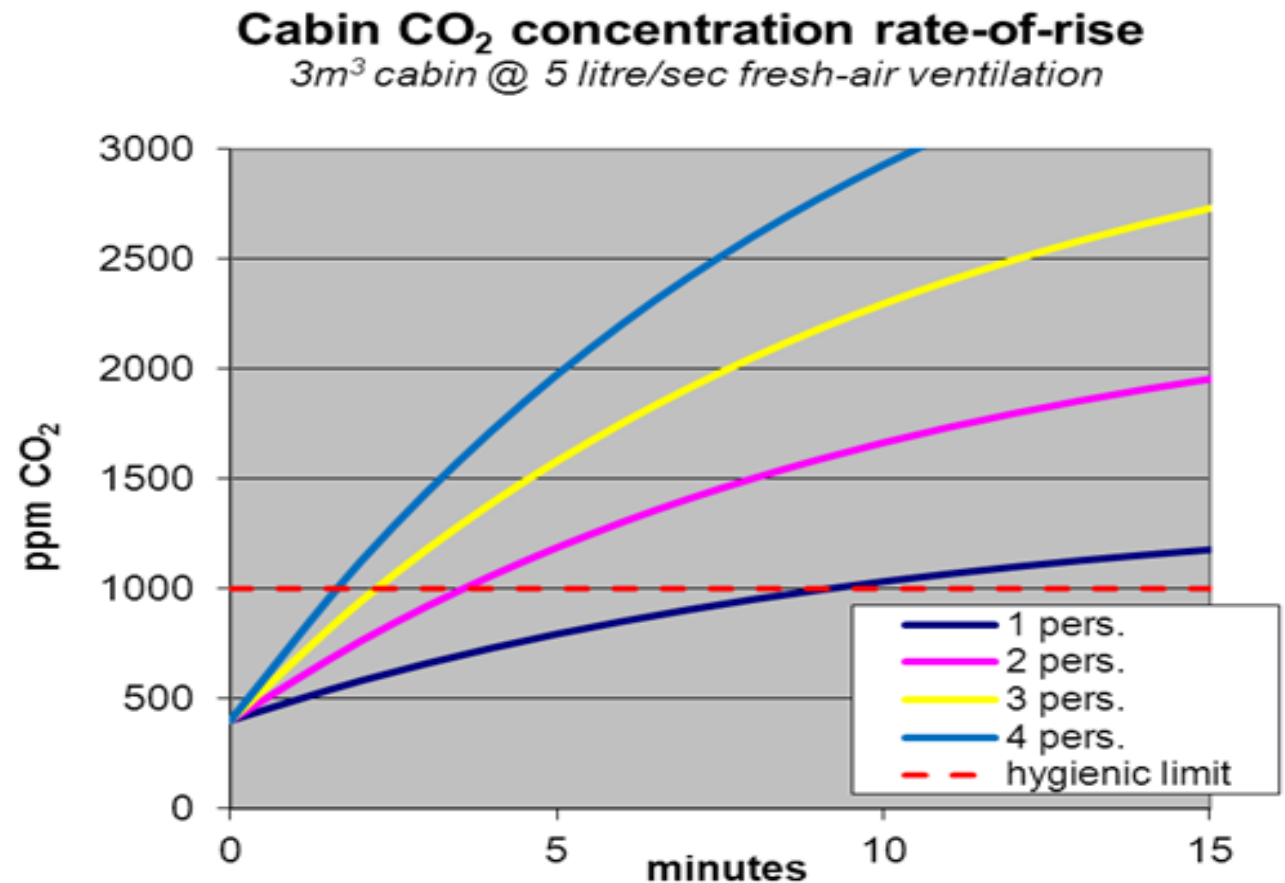
Cabin air



- People get tired by high CO₂ concentrations and therefore it can be a danger
- The CO₂ concentration level rises for every person in a cabin

Cabin air

- Energy saving of 1300 MEU/year
- Healthy cabin air
- Driver safety



Ice Arena

The CO₂ -value varies a lot in the stadium whether it is empty or at maximum capacity during a key match

- Energy saving
- Healthy indoor environment
- 4 MEU/year





Garage and Tunnel

- A warm running modern engine with catalyst generates 140 X more CO₂ than CO
- CO₂ measurements and ventilation control in garage surroundings leads too fewer people suffering from either CO₂ or CO poisoning

Garage and Tunnel

- Environmental savings
- Reduced costs 12 kEU/year
- Public safety



Building Management System

Measures CO₂ (+ temp, RH) to determine the correct level of fresh air in a larger zone, to adjust the ventilation system



Building Management System

- Energy saving
- Reduced costs
- Higher in-door air quality
- 100 MEU/year (sky scrapes)





Concluding remarks

- Today there are many cheap CO₂ sensors available on the market
- Efficient control systems have been developed for many different applications
- Normally an installation is fully paid after 1-2 years and could last >15 years



In future?

Hopefully our European leaders will change construction rules or general legislation so that smart **CO₂ sensor systems** become **obligatory**:

- new industries, farms, plants
- pubs, schools, other buildings ...
- restoration of old buildings / plants



Conclusion

Cheap CO₂ sensor systems give Europe a better out-door air quality!

In addition:

- >2 billion EU saving / year for energy
- Avoiding ~200 events of death / year
- >140 million EU saving / year due to less hospital days
- ~8% yield increase for in-door farming applications



Thank you for your attention!

Example of installation

The Kremlin in Moscow has a CO₂ based ventilation system since 1995



Photo from 2000



Photo from 2008

Recent photos,
found on internet, 2013

