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Investigation of ventilation strategies in the day-care institutions

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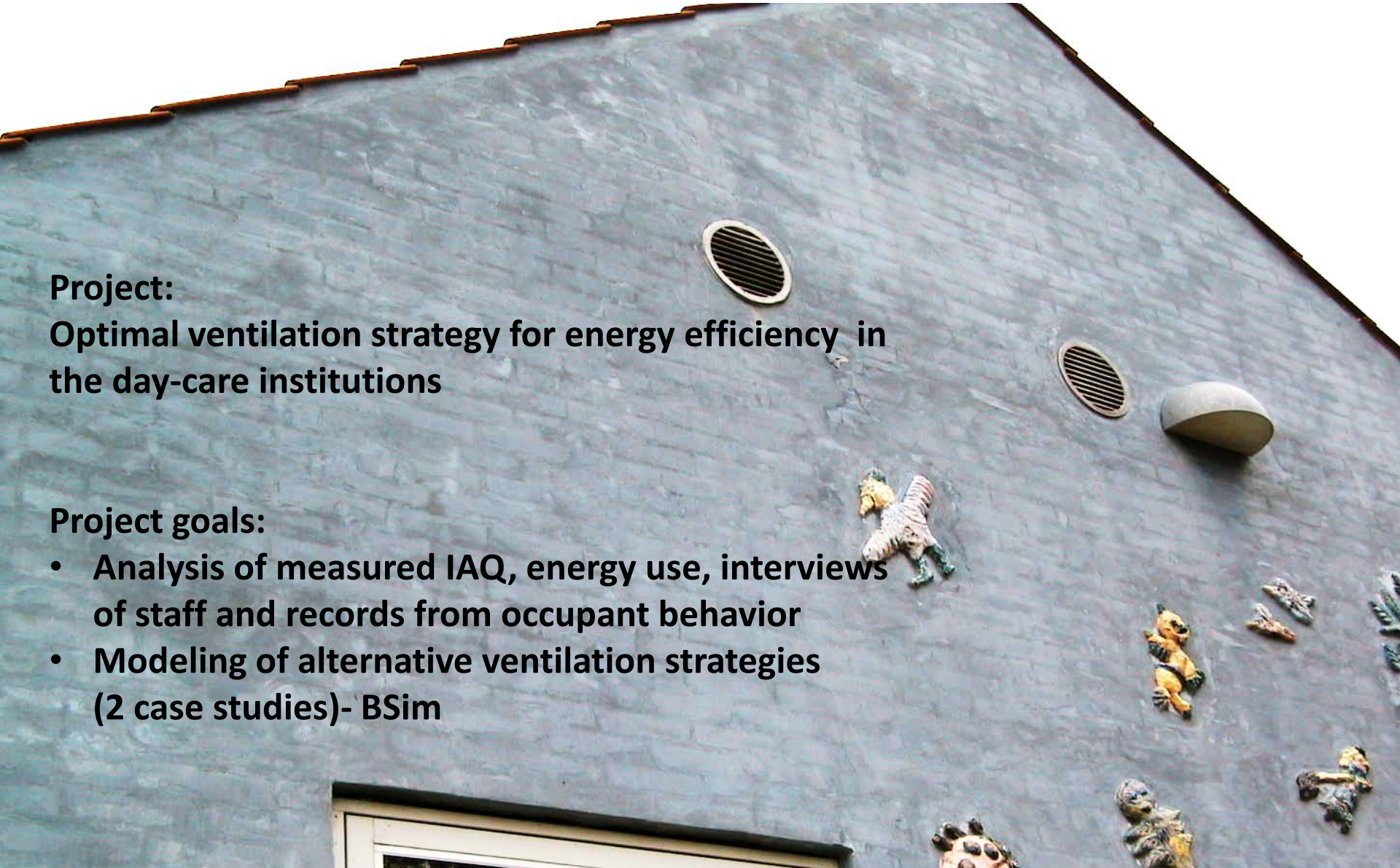
Background



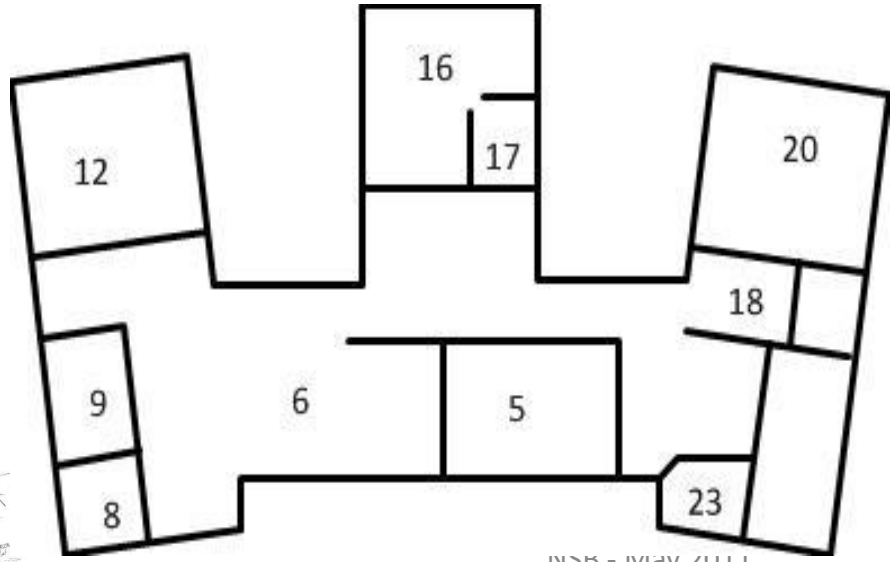
Project:
Optimal ventilation strategy for energy efficiency in the day-care institutions

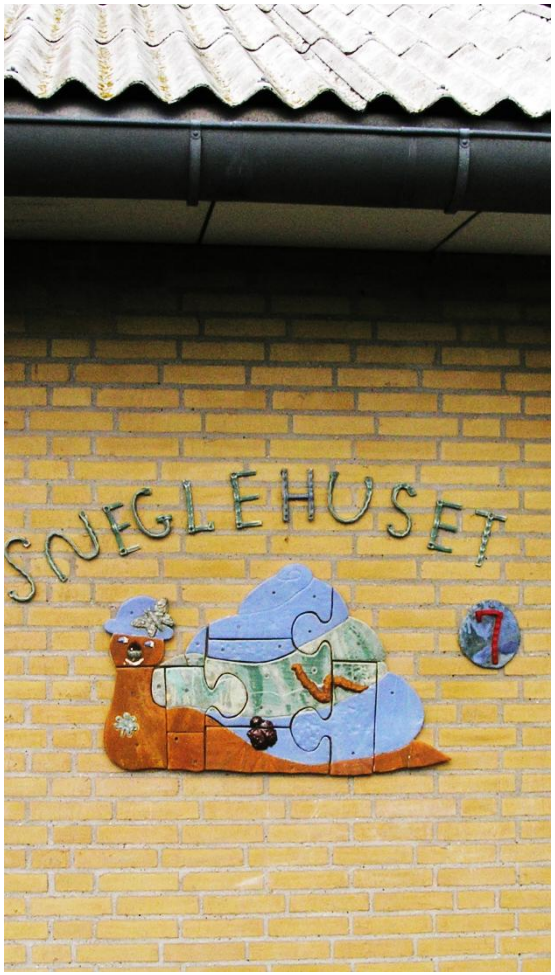
Project goals:

- **Analysis of measured IAQ, energy use, interviews of staff and records from occupant behavior**
- **Modeling of alternative ventilation strategies (2 case studies)- BSim**

Mechanically ventilated building

- Balanced CAV-system
- Floor heating
- 50 children
- 5 adults





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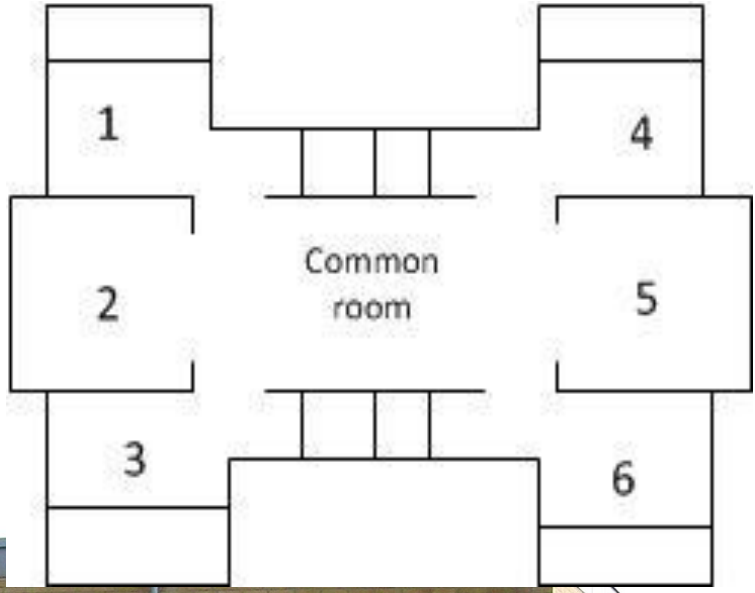
Naturally ventilated building

- Naturally ventilated (except for kitchen and toilets)
- CO_2 and temperature controlled
- Night cooling and pulse ventilation
- Max 100 pupils and 6 adults



Modeling cases

Mechanically ventilated building

Case 1. Actual building performance. Mechanically ventilated (CAV) building with presence of venting, initialized by occupants.

Case 2. Designed building performance. Mechanically ventilated (CAV) building without occupant involvement.

Case 3. VAV-system, controlled according to CO2 or/and air temperature. With presence of venting initialized by occupants. The VAV-system capacity is the same as in case 1 and case 2.

Case 4. VAV-system, controlled according to CO2 or/and air temperature. With presence of venting initialized by occupants. The VAV-system capacity is 50% bigger than in case 3.

Naturally ventilated building

Case 1. Actual building performance (including the occupant behaviour)
Case 2. Designed building performance. (excludingthe occupant behaviour)

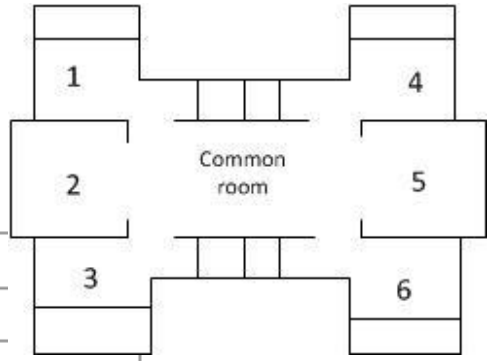
Validation of models

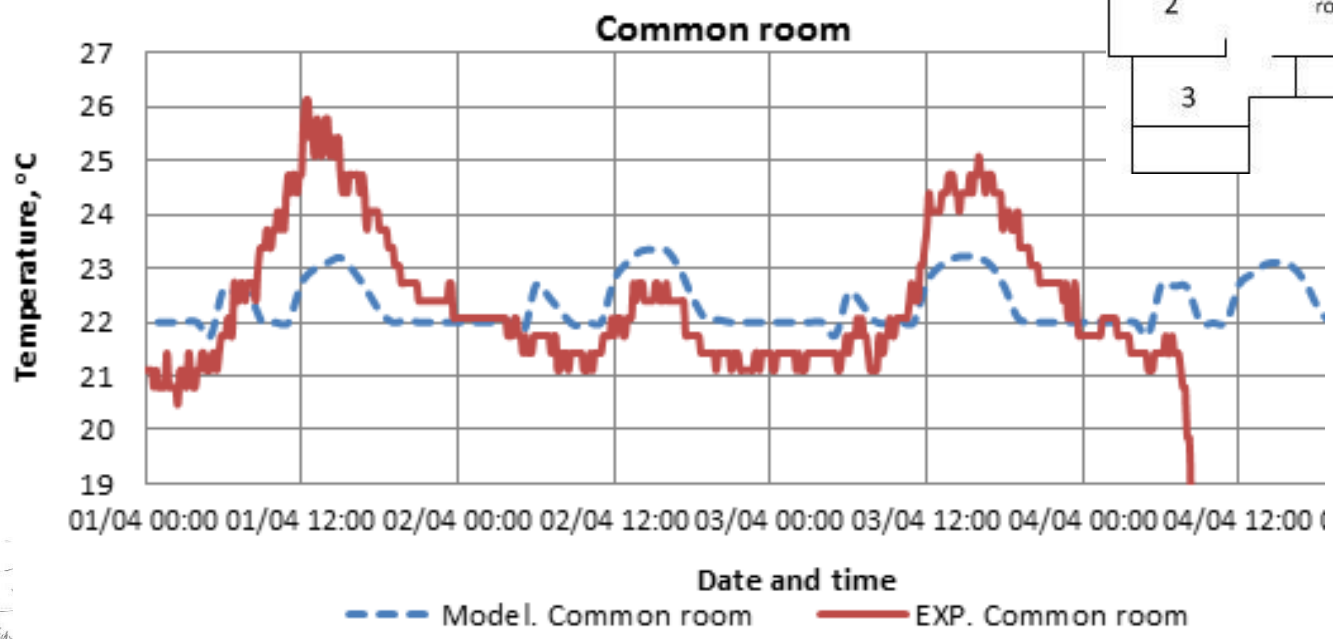
- Model of actual building performance is compared to the experimental data

- Input parameters:
  - Actual weather data
  - Actual occupancy and occupant behavior
  - Actual internal heat loads
  - Infiltration
- Parameters for comparison:
  - Temperature and CO_2 distribution in the zones

Naturally ventilated building model

- CO_2 and temperature controlled natural ventilation vs. VAV mechanical ventilation
- Modeling of pulse ventilation





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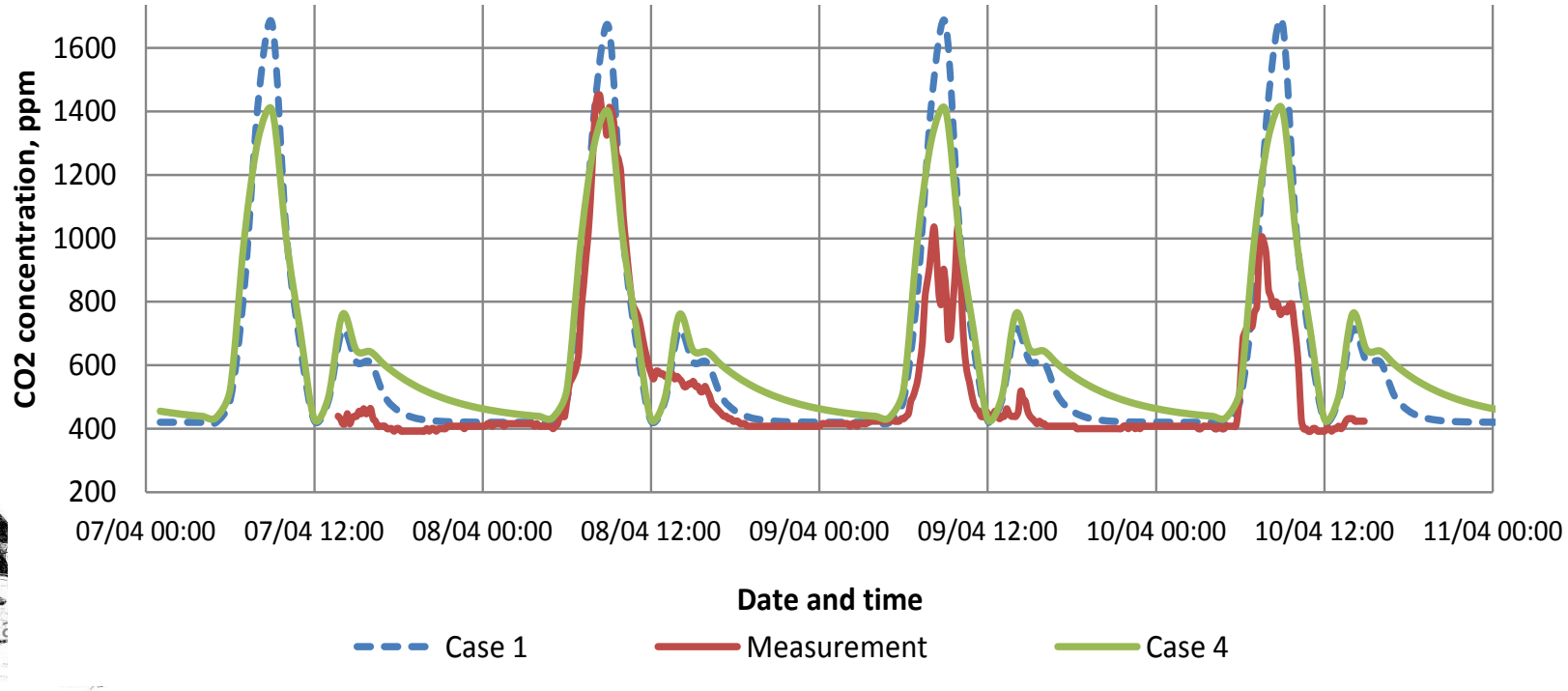
Results for mechanically ventilated building

Case	Total, kWh	Specific, kWh/m2
Case 1	59142	70
Case 2	55007	65
Case 3	34655	41
Case 4	35996	43



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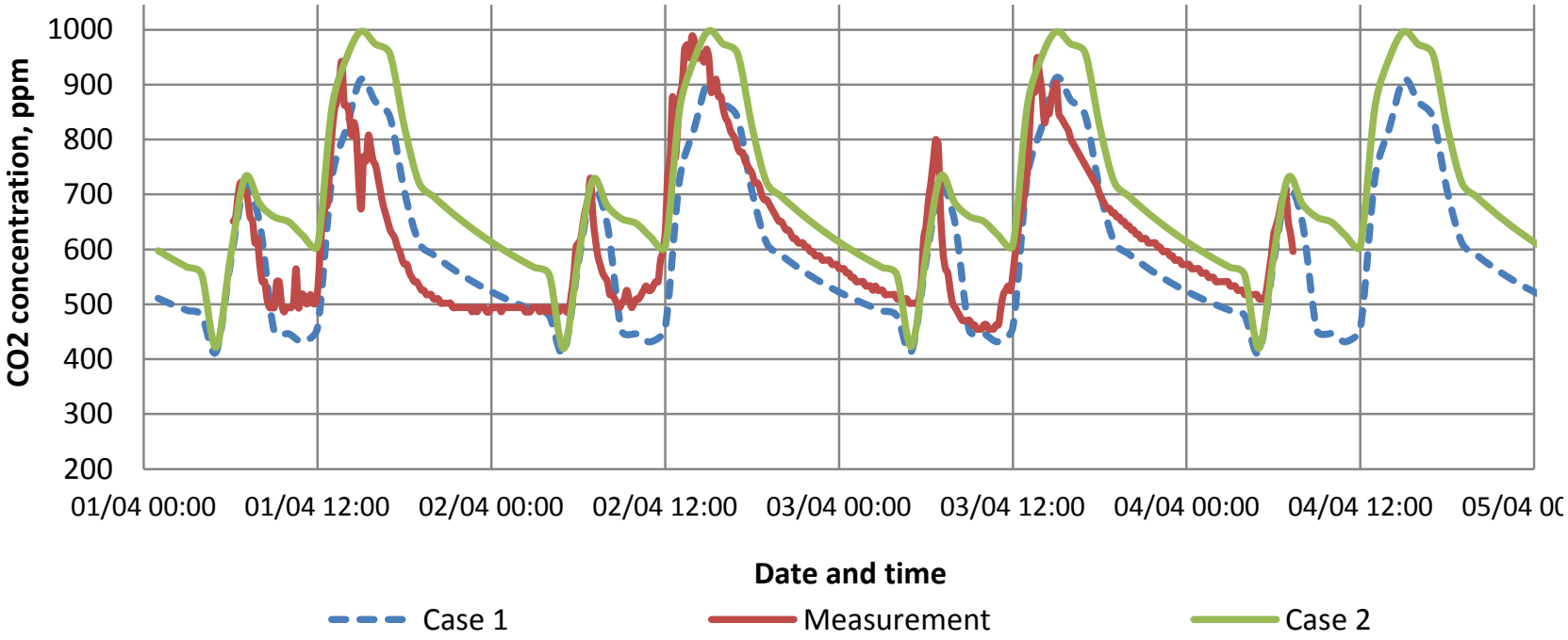
Results for naturally ventilated building

Case	Total, kWh	Specific, kWh/m2
Case 1	49680	99
Case 2	45159	90



Discussion

- The ventilation system in the day-care institutions requires the capacity and flexibility to adapt to the actual number of people in the rooms.

- With properly designed demand-controlled ventilation more energy can be saved while improving air quality, user comfort and health. This presupposes that the system is able to shift capacity between the individual rooms and can provide increased airflow to the most congested areas.

- For the time, when the architects are determined to design building with the flexible plan solutions, giving space to future user demands and changes in the building use, it is important that the technical systems in the buildings can follow such flexibility in the building use.