

Savings with natural and mixed-mode ventilation



The Fraunhofer-Institute for Building Physics in Stuttgart has performed detailed energy calculations of an office building with an area of almost 3000m² equipped with either natural (NV), mechanical (MV) or mixed-mode (MMV) ventilation. The building performance was investigated in three different locations in Europe; Copenhagen, London and Munich



Indoor air quality (CO₂) and thermal comfort (operative temperature) were evaluated in the report¹, in accordance with the European Norm “EN 15251” Category II. The indoor climate was kept identical for all three ventilation principles as this would make the consumed energy more comparable.

Category	Operative Temperature (Winter) [°C]	Operative Temperature (Summer) [°C]	Operative Temperature (Transient) [°C]	Carbon Dioxide Level during the year [ppm]
II	20 ≤ t _o ≤ 24	23 ≤ t _o ≤ 26	20 ≤ t _o ≤ 26	≤ 900

Requirements to the operative temperature and carbon dioxide level according to [EN 15251] Category II

Energy consumption

The figure on the right shows the primary energy consumption (sum of heating and fan electricity demand multiplied with primary energy factors for 2015) for the three ventilation principles. The result shows that natural ventilation uses 9-11 kWh/m²/year, mechanical ventilation 20-25 kWh/m²/year and mixed-mode ventilation 7-8.5 kWh/m²/year. Mixed-mode ventilation enables energy savings of 20-25% compared with natural ventilation and 60-70% compared with mechanical ventilation.²

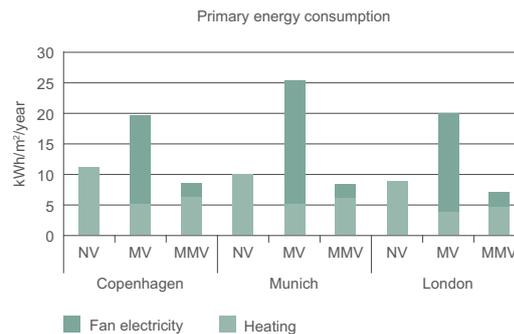


Figure 1: Data based on Fraunhofer IBP calculations and assumptions

Based on the Fraunhofer IBP energy calculations the CO₂ emissions and the economy seen over a 20 year period were calculated:

CO₂

In comparing the CO₂ emissions from electricity use and heating it can be seen that natural and mixed-mode ventilation emits much less CO₂ compared to a mechanical system during one year. The mixed-mode ventilation emits approximately 20% less than natural ventilation.

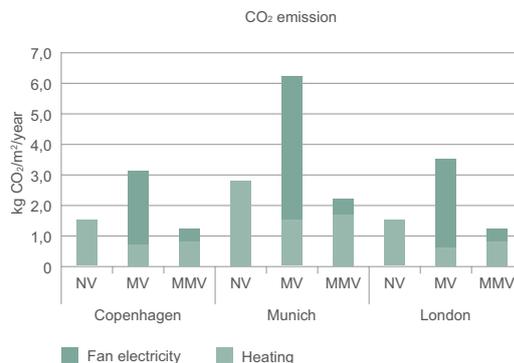


Figure 2: Calculations of CO₂ values carried out by WindowMaster

Economy

A Life Cycle Cost (LCC) over a 20 year period has been performed, which includes the capital cost, maintenance of the systems and the operational cost (electricity and heating). Over a 20 year period the natural ventilation system is 5 times cheaper than the mechanical system. The mixed-mode system is 2.5 times cheaper than the mechanical system.

Based on the energy calculations by the Fraunhofer IBP it was found that natural and mixed-mode ventilation reduce the energy, CO₂ emissions and Life Cycle Cost compared to a mechanical system. Each of the two systems has pros and cons and WindowMaster can help you choose the optimal system that fits your purpose/building.

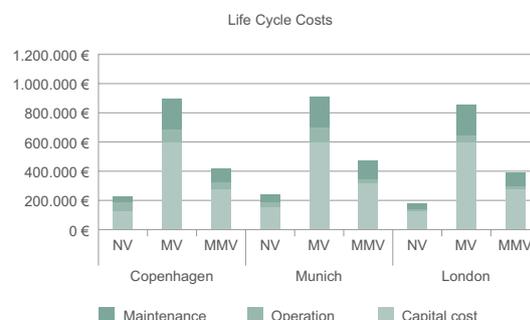


Figure 3: Calculations of Life Cycle Cost carried out by WindowMaster

Contact WindowMaster for further details about the report contents and calculations.

¹ Fraunhofer IBP report no RK 013/2012/295

² WindowMaster has calculated the energy performance for the mixed-mode ventilation based upon improvements suggested by Fraunhofer IBP

