



## Ventilation system with low pressure drop

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### **Suggested topic: 3. New energy efficient buildings**

3.3 Building services engineering and components

3.5 Performance and evaluation

A mechanical ventilation system consists of several components. Most of the components cause pressure drops which has a negative influence on the energy use of the system. In this project a unique mechanical ventilation system is designed aiming at reducing the overall energy use by decreasing the pressure drop compared to a conventional mechanical ventilation system.

Ventilation systems are normally balanced so that the central fan pressurises the distribution system according to the largest pressure drop and then dampers are used to balance the remaining distribution ducts.

The new system is based on replacing the dampers with miniature fans. By replacing the dampers with miniature fans airflows can be controlled through adjusting the speed of the fans. Consequently, the main fan only needs to be dimensioned for the main duct and not for the entire distribution system.

However, when replacing dampers with miniature fans, the number of fans in the distribution system increases. Moreover, fan efficiency typically decreases with decreasing size. In order to achieve a reduction in the energy use, the efficiency of the miniature fans has to be high, so that the energy

requirement for the miniature fans are less than the energy requirement for the main fan in a conventional ventilation system with dampers. Traditionally small fans used to have a rather low efficiency compared to larger fans. Now energy-saving motors are available for small fans, and the efficiency is improved.

In this study the energy use of two mechanical ventilation systems are compared both theoretically and in full scale in a laboratory environment. The systems are analysed with air volumes ranging from 20 l/s to 120 l/s. Axial fans are used and the efficiencies are typical for such fans. The efficiency of the miniature fans used in this study is about half of the efficiency of the main fan.

By integrating miniature fans in duct systems instead of dampers it is found that there is a potential to save energy that varies with the air volume. Increasing the air volume in a ventilation system, pressure drop increases as well and so does the energy use for the main fan. In the system with miniature fans, the savings are found to be increasing with increasing air volume when compared to a conventional system with dampers.

Replacing just one damper, the one in the distribution duct with the highest pressure drop, with a miniature fan the energy saving potential increases with the length of the distribution duct.