The HOSPITALS project aims to demonstrate the significant reduction that can be achieved in the total energy demand and CO_2 emissions of the European health care building sector. The HOSPITALS project is supported by the European Commission through the ENERGIE subprogramme of the European Union's Fifth Framework Programme for RTD (EU Contract. NO: NNE5-2001-00295). Within the project various demonstration projects are underway incorporating innovative energyefficient techniques and achieving substantial reductions in energy consumption.
This brochure focuses on the ventilation and cooling concepts that have been applied in the demonstration hospitals.

VENTILATION AND COOLING STRATEGIES

Deventer Hospital

Hospital patients are vulnerable. They require a high quality indoor climate, the risk of spreading pollutants or chemicals through the air must be minimised and indoor temperatures must be comfortable. The aim at the demonstration hospitals is to combine improved indoor air quality and comfort levels with reduced energy demand and efficient energy supply. Different energy targets and design solutions have been chosen for the demonstration projects based on:
- the type of hospital and specific requirements of the patients
- scale of building work being undertaken, from renovation to new build
- available energy sources
- local climate conditions

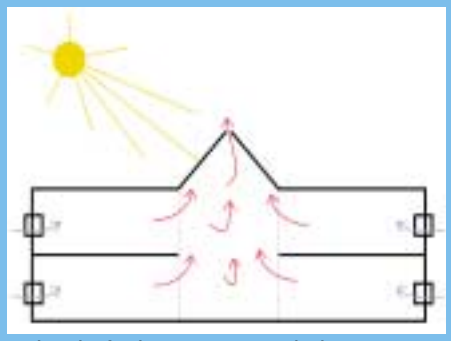
Balance between patient requirements and ecology

In **Fachkrankenhaus Nordfriesland** in Bredstedt, Germany, the main objective was to improve the conditions for the building users by using innovative (natural) resources and minimising the use of metal and PVC in living areas. The ventilation principle is hybrid: natural infiltration through vents or openable windows in the facade and fan-assisted exhaust from bathrooms, toilets and kitchen areas. Control devices measure the humidity and CO_2 level during the heating season and air temperature during the summer. For various combinations of internal loads and outdoor conditions the control system responds to comfort requirements in the most energy-efficient way.

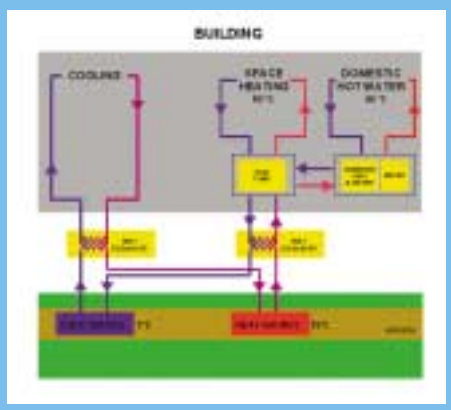
HOSPITALS

HOSPITALS

Wind driven roof mounted coils in Aabenraa Hospital



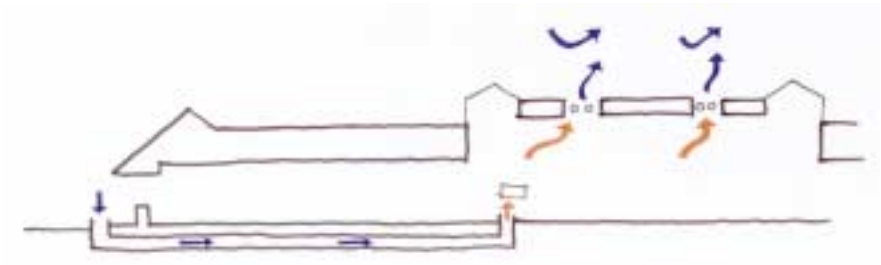
Solar drafts in Meyer Hospital



Ground source cooling in Deventer Hospital

Preheating of ventilation air in buffer space in Fachkrankenhaus Nordfriesland

Optimising the ventilation system in an existing building



In Aabenraa Hospital, Denmark, a displacement ventilation system is used.
Fresh air is drawn in through the basement and exhausted via roof-integrated wind cowls, assisted by fans if necessary. The air coming in from the basement is at a constant temperature of around 16°C. Integrated convectors in the floor heat the air up to comfort levels.

Key ventilation and cooling concepts

Displacement ventilation uses the upward movement of warm air to create ventilation flows. For example **solar drafts** are created when the sun heats specific buffer spaces. This principle and the direct use of fresh air can be used to create **natural ventilation.**

Double skin facades create a buffer between the outdoor and indoor climate and can be used for preheating of infiltration air during winter and creating solar drafts for natural ventilation during summer. If these passive ventilation techniques do not provide sufficient air change, **hybrid ventilation** can be used, applying additional mechanical ventilation as needed.

Ground source cooling & heating use ground water as the source of heat and cold and as the “sink” for surplus heat and cold removed from the building. With **heat exchangers** the heat or cold can be extracted from these sources and provided to another system.

Heat pumps are electrical or gas driven devices that extract heat from one place and transfer it to another with a compression process. Heat pumps can be used for refrigeration or heating.

Air - Water systems use **fan coil units** to heat or cool air using hot or chilled water as a source.

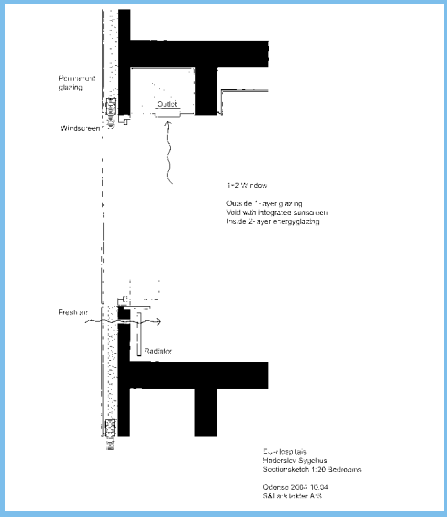
All - Air Systems provide air to each space to control comfort aspects. An **air handling unit** is used to circulate heated or cooled air through the central heating system.

The use of a **demand control system** for ventilation, cooling and heating ensures that energy is efficiently used where and when needed. The use of **decentralised controls** for heating and cooling offers flexibility in using spaces for different functions.

Torun City Hospital

The renovation of Torun City Hospital, Poland, focuses on thermal improvement of the building envelope. The ventilation system is based on natural ventilation, with air infiltration through the windows and exhaust through existing ducts.

In Haderslev Hospital in the County of South Jutland, Denmark, a 300 bed hospital built in 1970 needs renovation. The design developed replaces the inefficient and uncomfortable old air-air system with a new water-based heating system. The old system is converted to a solely fresh air supply system with greatly reduced air volumes. Some of the existing air supply ducts are assumed to be contaminated, so in selected wards a hybrid ventilation system has been designed with pre-heated ventilation air drawn in through the facade and fan assisted exhaust ventilation. An advanced demand control system (temperature/CO_2) is used to reduce air supply and heat demand when demand is low. The system does not include active cooling, so several studies were carried out to make sure overheating will not occur in summer.



Hybrid ventilation system with preheated fresh air through double skin facade at Haderslev

Energy Conscious Design for New Hospital Buildings

In Deventer Hospital, the Netherlands, a new general regional hospital provides facilities to accommodate 15,000 patients per year. The new building design incorporates an all air system for cooling and heating. Recuperation of energy is achieved by means of a rotating air wheel. Even though mechanical ventilation is provided, users will be able to open windows for additional natural ventilation. Heating and cooling is primarily based on underground heat and cold storage. During summer, a cold storage system in aquifers will provide almost 100% of the cooling energy.


Terminal concept Deventer Hospital for outpatient visits


All air system without radiators near the facade allows free arrangement of rooms.

In Florence, Italy the new paediatric Meyer hospital will be realised. To save on energy for cooling, passive cooling and ventilation techniques are used as much as possible, with air conditioning only where necessary. A sunspace functions as a buffer area for the building. The heated air is used to create solar drafts providing a natural air flow through the building. Trees will be planted around the hospital and part of the roof will be covered in grass. The respiration of the vegetation will provide a cool microclimate. A centralized energy management system is included to obtain the full potential from the HVAC system and to select the most appropriate operational strategy in each case.

»An all air system creates flexibility«, explains Cees van Mil, project manager for the construction of Deventer Hospital.
»The air inlet and outlet can be placed in the ceiling, and no space is required for radiators. This allows more flexible use of the space.
Main ducts are situated above the circulation spaces, making future changes or extensions easier because the main parts of the installation would not need adaptation.

Patients and staff will experience the advantages. The inlet air will be filtered and humidified in dry periods. The temperature can be lowered or increased very quickly in each room.

The system still allows opening and closing of windows during spring and autumn. This ensures patients and staff always enjoy a healthy indoor environment. It will be possible to create overpressure in a room to create an isolated environment if necessary for a risk case.«


Meyer Hospital in Florence

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Information about The Fifth Framework Programme is available at the following website: http://cordis/lu/fp5/home.html
Futher information on DG for Energy and Transport activities is available at the internet website address: http://europa.eu.int/comm/energy/res/index_en.htm

The HOSPITALS internet website address is **http//www.eu-hospitals.net**