

## Building energy efficient cities

European Commission

Buildings contribute to almost half of the energy consumption for any one country. It is, thusly, an appropriate starting point for tackling energy efficiency on a large scale. One focus of the research done by Yilmaz and Eicker is high rise glass-fronted buildings. These buildings have complicated automation systems that consume a lot of energy. Yet, there is also a lot of potential to reduce energy consumption with the help of various passive strategies.

Passive systems can be used to regulate building climates. At the University in Stuttgart strong lamps are used to simulate the sun heating office windows. According to Eicker, it is much more difficult to cool a room, compared to keeping a room warm. Good insulation and good windows are enough to keep an office complex warm, especially with all the computers, lighting and people generating heat inside. But keeping a building cool in the summer, and doing that efficiently, is still a problem. In this simulation set-up researchers test different shading systems. Their investigations are not just limited to thermal features, but include optical features and airflow, so the amount of fresh air coming into the office.

The German Ph.D. student Tobias Schulze is working with his Turkish colleagues at the Istanbul Technical University. A model of the Kanyon centre - a new development in Istanbul including offices, apartments and a shopping centre - is placed within the university's wind tunnel. Smoke is introduced to help visualise the airflow around the building and how it is affected by its surroundings. For example, other buildings can affect the air turbulences. Wind direction also plays a role, so the model must be turned around in the wind tunnel and viewed from all possible directions. Air pressure is measured by small sensors in the model. The pressure difference between two sides of a building forces air to flow through the buildings, which could be used for ventilation or cooling within the building.

Modelling carried out by Yilmaz and her team has already helped the building managers at Kanyon to improve the efficiency of their lighting. Further research studies are now considering how energy can be saved through natural ventilation, photovoltaic applications and better shading systems for cooling. They have also done studies looking at the relation between energy use and comfort.

An artificial sky at the Stuttgart University of Applied Sciences can be employed to simulate the light and shade dynamics for particular models. A high-power lamp acts as the sun, while the surrounding dome, acting as the sky, can be adjusted to give a realistic luminescence, including details like brighter regions around the sun and near the horizon. Scharnhauser Park, a site near Stuttgart, was studied with the use of this artificial sky. The level of sun falling on the buildings was analysed by adjusting the distances between the buildings.

There are, however, not just scientific and technical challenges in achieving a high

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Published on Electronic Component News (<http://www.ecnmag.com>)

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standard for energy efficiency, but also social challenges. Regardless of whether the optimal building systems or cooling systems are installed, it is still necessary that they are operated properly (for example, being switched on and off at appropriate times) and that the user within the building is aware of how energy can be saved.

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