COM22 Heat in the City

Goal

Due to climate change, heat waves will occur more frequently, causing additional mortality and thermal indoor and outdoor discomfort (people). During the last decade, seven heat waves were recorded in the Netherlands. This is remarkable as there were only 38 heat waves in the Netherlands, in 105 years of heat wave recording (KNMI, 2006). Discomfort results in low labour productivity (profit) increased use of air conditioning systems, with extended use of primary energy sources and energy cost, enhancing CO2 production and energy consumption (planet). In urbanised areas, the "urban heat island effect" aggravates the problem. Dependence of active cooling devices will cause dramatic human and economic damage, when power plants fail. Main objectives of this study were to explore the nature and seriousness of the Urban Heat Island Effect in the Dutch context and to draft a scientific research agenda.

Research Questions

- Study the seriousness of the heating effect in the Dutch Context? Related questions are: "to what extent does the Urban Heat Island present itself in the Netherlands?" and "what health and discomfort problems does it cause?"
- Identify (passive) cooling options for homes and their built environment: which options are most effective to abate the Urban Heat Island Effect?
- Draft preliminary thumb rules for robust planning, and building design: which options in urban planning and building construction are cost effective and have a no regret character, in a sense that they enhance building and city space quality?
- What are the relevant research questions for a scientific research agenda?

Main activities

In 2003 there were between 1400 and 2200 heat-related deaths and another 1000 deaths during the two heat waves of 2006. The National Heat Plan was updated in 2007 and is mainly targeted at warning the population and specifically at risk groups such as people in hospitals and retirement homes. The Netherlands Board of Healthcare Institutions has also published a report on adaptation measures for dwellings in hot weather conditions. [3, 40-43] Strikingly, public awareness of the problem is very low in the Netherlands. Our two heat waves of 2006 rated as the world's 5th worst natural disaster in terms of actual deaths. However, few people seem to know of this fact and even fewer tend to worry about it.

Health criteria apply mainly to the sensitive population of the elderly and people with cardio respiratory diseases. These groups have difficulty with adapting their thermo physiological system to changes in temperatures and with temperature extremes. These groups require more active indoor climate control. Total control at fixed stationary conditions is not effective, as it will further diminish their capability to cope with changing temperatures. The optimum outdoor temperature at present is 16,5°C (ICIS, Huynen). Indoor optima for sensitive people still need to be established. It is clear that both temperature and humidity are relevant parameters. An indoor temperature of 25°C is empirically regarded as upper limit. High concentrations of particular matter contribute to 1/3 of heat stress related mortality in urbanised areas.

Comfort criteria have been clearly assessed by world wide research. There is a discrepancy between a person's sensation and the limit of acceptance. The maximum acceptable indoor temperature for not (actively) cooled buildings highly depends on the perception of outdoor temperature and the adaptive measures that a person can take such as sun screens, blinds, ventilation by grids, windows; but also behavioural adaptation by changing into lighter clothing of moving to cooler spaces. Also other psychological factors, such as perception of spaces and colours have an influence. Air humidity and draught also play an important role.

Measures

Building construction related measures for indoor climate control:

- Building insulation protects against outdoor heat;
- Shading of facades or windows by sun screens or blinds;

- Use of building mass to store heat/cold; only 7-9 cm's of the exchanging surface;
- Ventilation on demand;
- Use of free cooling, when outside temperature is lower; night cooling or ground tube;
- Phase change materials and new glazing systems are promising. Little effective in buildings are:
- Green roofs, as in many Dutch cases the building mass is already high;
- reflective roofs, when these roofs are well insulated;
- Water vaporising devices.

The building user should be the starting point, as his/her use of climate control means is vital. A long list of measures was put up and transformed into a design tool. This tool was discussed in a workshop with architects, builders and developers.

Building construction related measures, relevant for outdoor climate control may be:

- Green roofs and facades, retaining particulate matter and decreasing the building albedo;
- Using reflective materials to increase the building albedo;
- Using light materials to decrease accumulation of heat in the thermal building mass.

Spatial planning related measures, effective to reduce outdoor temperature are:

- Green in the city; trees provide both shade and cooling by vaporising water in summer;
- Water in the city provides a cooling effect in the nearby area;
- Using more reflective materials for roads and pavements when traffic safety permits it;
- Creating wind paths, for cool western winds are not regarded as an option, since it causes discomfort in the winter situation;
- Learning from traditional Mediterranean cities how to keep cities cool in summer (maintaining city canopy, shading at street level, fountains).

Spatial planning related measures, effective to reduce indoor temperature are:

- Green in the city; shading and vaporising effects;
- South-north orientation of building lots, to enable maximum shading effect of building related shading options, maintaining visual comfort for dwellers.

Contact

Projectleader
Ir. P.W. (Peter) van Oppen
SBR - Stichting Bouw Research
P.O. Box 1819
3000 BV Rotterdam
The Netherlands
T +31 10 206 5958
E p.v.oppen@sbr.nl
I www.sbr.nl

Programma Office Climate Spatial Planning
c/o Climate Centre, Vrije Universiteit, FALW
De Boelelaan 1085
1081 HV Amsterdam
The Netherlands
T +31 20 598 8648
E office@klimaatvoorruimte.nl
I www.climatechangesspatialplanning.nl

Scientific office
c/o Alterra, Wageningen UR
P.O. Box 47
6700 AA Wageningen
The Netherlands
T + 31 317 48 6540
E info@kennisvoorklimaat.nl