Facing the global overheating through mitigation and adaptation technologies - the role of ventilation

Mattheos Santamouris

Anita Lawrence Chair on High Performance Architecture
Faculty of Built Environment
University of New South Wales, Sydney, Australia
m.santamouris@unsw.edu.au

SUMMARY

Regional climate change in cities is the most documented phenomenon of climate change . Higher urban temperatures are documented experimentally for more than 450 major cities in the world. Numerous investigations demonstrate that the mean magnitude of the temperature increase may exceed 4-6 C, while at the peak it may exceed 10 C. The serious increase of the frequency and the strength of heat waves creates strong synergies between the global and regional climate change and intensify the magnitude of the overheating

Urban overheating causes a serious impact both on the energy demand and generation sectors. It increases the cooling energy consumption of buildings, rises the peak electricity demand and obliges utilities to built additional power plants, it affects seriously health issues and in particular heat related mortality and morbidity, impacts the concentration of pollutants and damages the urban environmental quality, and finally deteriorates the levels of local vulnerability and thermal comfort.

To counterbalance the problem of urban overheating, numerous heat mitigation systems and technologies are proposed, and implemented in more thyan 250 large scale urban projects. Mitigation policies and technologies aim to strength the cooling potential of heat sinks and weaken the intensity of the heat sources. Among the developed mitigation technologies, the use of advanced, materials like the recently developed photonic components and the reflective, cool materials, the implementation of additional greenery in buildings and open spaces, the use of passive evaporative systems involving additional irrigation of urban zones and finally the dissipation of the excess heat into the ground seems to provide the higher mitigation potential

Although mitigation seems to seriously counterbalance the impacts of urban overheating, there is a need to adapt the built environment to face the present and future climate challenges. Adaptation technologies involving advanced energy and environmental systems for buildings, may minimize the energy needs of buildings and provide indoor comfortable conditions with the minimum energy use. Advanced ventilation technologies assisted by hybrid dissipation technologies like sub-ambient radiative systems, seems to provide a very high adaptation potential.

The present paper reviews and reports the recent progress and knowledge on the specific impact of current and projected urban overheating in energy, peak electricity demand, air quality, mortality and morbidity and urban vulnerability. In parallel, it discusses new findings related to the characteristics and the magnitude of urban overheating, .and reports and analyse the recent knowledge on the synergies between urban heat island and heat waves. Finally, it presents the recent developments in the field of mitigation and adaptation technologies for buildings and cities and provides inside information on the current and future potential