Sustainable cooling in cities-
Assessment of human exposure to the outside environment

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ABSTRACT

One of the objectives of IEA-EBC Annexe 97 is to establish a comprehensive set of key performance indicators (KPIs) to evaluate the comfort, health, productivity, and safety of people during exposure in cities to the outside environment.

Even if we spend on average about 90% of the time indoors, the outdoor environment is also important for people's health and well-being. Trends like "Tiny-Houses" will increase the need for outdoor areas providing acceptable environments. Most people would like to sit outside at restaurants, cafés, sports events, etc. during the summertime. Many types of people during different activities are exposed to the outdoor environment. People are exposed during transportation (train, bus, waiting area, platforms), during sports activities (spectators, athletes, leisure exercise), and outside work. (building and road construction, others).

The focus of Annexe 97 is the exposure of people in cities. Here, the cooling of buildings may create a heat island. Buildings may reflect sunshine that may cause glare and increase radiant heat. Building ventilation and particular emissions from industrial buildings may create unacceptable outdoor conditions regarding smells or particles. Especially under extreme weather conditions, the exposures can be harmful (heat waves, forest fires).

This talk will focus on how to. Evaluate the exposure to people. Other activities of the annexe are dealing with methods to improve the outdoor conditions for people using different methods for cooling, like evaporative cooling at outdoor spaces in dry locations, and shading trees. Or roofing in semi-outdoor spaces.

In literature, most of the KPI's deal with exposure to the thermal environment. There is a need to look at KPI's for other factors like air quality, noise, light, etc. Over 120 years of study of thermal indices exist in the literature. It involves the perspectives of human thermal comfort and stress in both indoor and outdoor environments. The KPIs can be categorised into 3 types of indices: Rational index, Empirical index, and Direct index. The rational indices are based on the human physiological model of heat exchange between the human and the surrounding environment. Empirical indices used a multiple regression model to reflect human responses in each environment and behavioural activity. Direct indices emerge from the previous two types of indices, which are suitable for practical use through instrumental measurements.

The effect of the transient conditions going from inside the conditioned space to outside and vice versa needs evaluation methods. Therefore, multiple KPI's and different threshold values will be needed.

KEYWORDS

Outdoor environment, heat stress, human exposure, shading, evaporative cooling