

# **IEE SAVE ASIEPI WP7: Stimulation of better summer comfort by EPBD implementation**

## **FAQ on summer comfort**

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### **How is it possible to combine good indoor climate conditions during summer with a decrease in energy consumption?**

As has already been done for centuries before us, good indoor climate conditions during summer can be achieved through efficient use of the physical and natural conditions and sources around the building such as its position and orientation, the relief, the climate, the vegetation, the wind direction, air velocity etc. During design of the building such parameters need to be taken into account to prevent the building from overheating, by using proper materials, making efficient use of windows and openings, providing sufficient shading, night cooling, etc. Occupants should also be provided with control over their environment like for example openable windows and manual override on control systems to ensure satisfaction and increased adaptation levels during hot spells.

### **Are there means of assessing the performance of alternative cooling techniques?**

In line with the *principle of equivalence*, each Member State implements various EN standards into its regulations to assist in the evaluation of the performance of alternative cooling techniques. Examples of such standards are:

- EN 13790: Energy performance of buildings-Calculation of energy use for space heating and cooling
- EN 15241: Calculation methods for energy losses due to ventilation and infiltration in commercial buildings
- EN 15242: Calculation methods for the determination of air flow rates in buildings including infiltration

### **Which are the international guidelines and standards for thermal comfort and what tendency do they impose on summer comfort?**

The main international guidelines and standards on thermal comfort are:

- International Standard ISO 7730. This standard is based on Fanger's Predicted Mean Vote (PMV), which predicts the mean thermal sensation of a group of people, and the Predicted Percentage of people Dissatisfied with the environment (PPD).
- ASHRAE Std. 55. defines conditions that are being considered satisfactory for a specific percentage of users, including calculation methodologies for thermal comfort based on PMV/PPD
- CEN 15251. Criteria for the indoor environment including thermal, indoor air quality, light and noise. The CEN standard defines minimum ventilation requirements, minimum and maximum indoor temperatures that can be used for

energy calculation, assessment and certification. It is different than prescribed standards because it makes a difference between mechanically ventilated systems and naturally ventilated systems. For buildings without mechanical ventilation /cooling, alternative methods are proposed.

These guidelines and standards specify comfort in a broader sense that is easier to refer to and often stem from numerous more detailed and sophisticated guidelines and standards (normative references) such as:

- ISO 7243, Hot Environments – Estimation of the heat stress on working man, based on the WBGT Index (wet bulb globe temperature)
- ISO 7726, Ergonomics of the thermal environment — Instruments for measuring physical quantities
- ISO 7933, Ergonomics of the thermal environment — Analytical determination and interpretation of heat stress using calculation of the predicted heat strain
- ISO 8996, Ergonomics of the thermal environment — Determination of metabolic rate
- ISO 9920, Ergonomics of the thermal environment — Estimation of the thermal insulation and evaporative resistance of a clothing ensemble
- ISO 10551, Ergonomics of the thermal environment — Assessment of the influence of the thermal environment using subjective judgement scales
- ISO 11399, Ergonomics of the thermal environment — Principles and application of relevant International Standards
- ISO TR 11079, Ergonomics of the thermal environment — Analytical determination and interpretation of cold stress using calculation of the required clothing insulation (IREQ) and the assessment of local cooling effects
- ISO 13731, Ergonomics of the thermal environment — Vocabulary and symbols
- ISO/TS 13732-2, Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 2: Human contact with surfaces at moderate temperature
- ISO/TS 14415, Ergonomics of the thermal environment — Application of International Standards to people with special requirements
- Humphreys, M.A. and Nicol, J.F. (1998) Understanding the Adaptive Approach to Thermal Comfort, ASHRAE Transactions 104 (1) pp 991-1004
- DeDear (2004), Thermal Comfort in Practice. Indoor Air Journal. Vol 14. Supplement 7, pp 32-39.
- McCartney K.J and Nicol J.F. (2002) Developing an Adaptive Control Algorithm for Europe: Results of the SCATs Project. Energy and Buildings 34(6) pp 623-635

The general tendency on summer comfort should be to use the best available practical means, including alternative techniques, to control the indoor environment and provide stable indoor conditions in order to avoid discomfort, using the least possible energy.

### **What is adaptive comfort?**

Adaptive comfort builds on the principle that people experience differently and adapt, up to a certain extent, to a variety of indoor conditions, depending on their clothing, their activity and general physical condition. Therefore, contrary to the conventional cooling which is based on pre-calculated temperatures and humidity levels, the adaptive approach is based on a non fixed set of conditions, taking into account

thermal perception and behavior of the user, requiring him to take an active roll in controlling his indoor environment.

### **What would an adaptive standard be like?**

Based on the idea that the human body continually adapts to a variety of conditions, an adaptive standard, would not include fixed indoor parameters but, would aim to promote (easy) adaptation by using the following principles:

- People adapt more easily to the temperatures they are most familiar with. The range of conventional temperatures is population related and depends on geography, culture (customs) and climate. Therefore, the adaptive standard would define a range of conventional temperatures for each specific population and building type at different seasons of the year.
- Adaptation is easier under more or less stable conditions. An adaptive standard would indicate which degree of stability of indoor conditions is required and how to achieve this.
- A building may or may not provide opportunities for user friendly adaptation and control over the thermal environment. The adaptive standard would prescribe which opportunities for control are required (f.e. openable windows, temperature or solar controls, etc.)

The adaptive approach is beginning to influence standards and guidelines for comfort in buildings, as is evident from the use of field results in ASHRAE Standard 55-2004 (ASHRAE, 2004) and (in the UK) the CIBSE (Chartered Institute of Building Services Engineers) Guide (CIBSE, 2006).

### **Which are the Pro's and con's of passive cooling against mechanical air conditioning?**

Mechanical ventilation and air conditioning control the indoor conditions with a specific high consistency range that is independent of external conditions, whereas passive systems cannot be regulated that precisely and quickly. However, passive cooling makes proper use of the existing natural possibilities and principles, uncharged by side effects, thus simulating better the natural conditions, providing a feeling of comfort and using less to no energy.

### **What does the EPBD stipulate for summer comfort and how does this affect energy use and building design?**

Article 4 of the EPBD stipulates explicitly that attention should be paid to indoor climate conditions: *"Member States shall take the necessary measures to ensure that minimum energy performance requirements for buildings are set ... These requirements shall take account of general indoor climate conditions, in order to avoid possible negative effects..."*.

This is also listed in the annex of the EPBD: *"The methodology of calculation of energy performances of buildings shall include..."*

(d) ventilation; ...

(h) natural ventilation; ...

*(i) indoor climatic conditions, including the designed indoor climate."*

Whereas in the past the major challenge was to keep our buildings sufficiently warm, nowadays the challenge is in guaranteeing reasonable comfort conditions in summer without (or with minimum) cooling energy. It is therefore important that building designers and other stakeholders understand the thermal behavior of a building and its occupants and are aware of the available alternative techniques that substantially improve the comfort in the building and significantly decrease (or even eliminate) energy consumption. For example, solar and thermal control techniques, heat amortisation and heat dissipation techniques have been proven to be extremely efficient and may decrease the cooling load of buildings up to 80 %.