Comfort Operational Rating Procedure (CORP) for next-generation Energy Performance Certificates

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Introduction

Adequate levels of indoor air quality, thermal comfort, lighting and acoustics within buildings are among the most effective drivers for renovation, they are rarely covered by Energy Performance Certificates (EPCs). Increased comfort tends to be a more important factor for occupants than energy savings and could therefore be a potent renovation trigger. None of the Member states have included a comfort assessment as a part of its EPC calculation methodology comprehensively.

The EPC Certificate typically comprises an energy efficiency label indicating the energy performance level of the building, general information about the building (age, climate etc.) together with recommendations on how to improve the building's performance. The EPCs serve as an information tool for building owners and occupiers and are already a powerful tool in some European countries for making decisions on energy efficiency improvements and real-estate transactions. There is an obvious potential to make them more useful and reliable for the end-users as well as the European building stock with the introduction of new feature such as Comfort.

Objective and methods

The purpose of this research is to develop an operational comfort rating for assessing the buildings that are already in use, as an extended feature for EPCs under the X-tendo project. Four main indicators (i) thermal comfort, (ii) indoor air quality, (iii) visual comfort, and (iv) acoustic comfort are used to calculate an overall comfort rating for residential, office and school buildings.

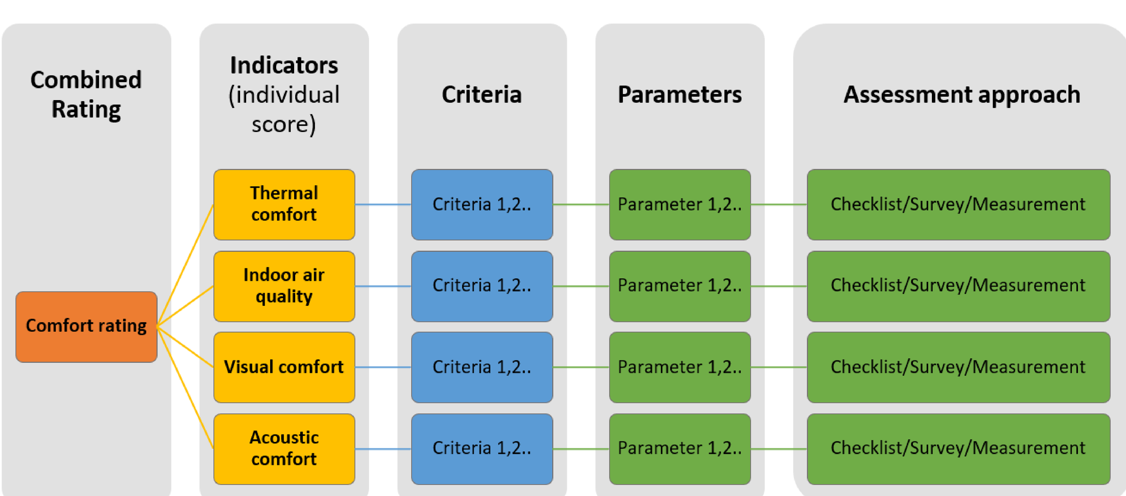

Figure 1: Operational comfort rating process

The methodology is based on evidence-based inputs collected using surveys, measurements, and checklists. All four indicators are assessed independently based on multiple criteria and under each criteria certain parameter thresholds must be met to achieve a required score. Indicators, criteria, and parameters are given relative weights to calculate a total score and overall rating. Each parameter can obtain a score of 0 (worst) to 10 (best) which is assessed using different assessment methods such as checklists, surveys or measurements. Individual scales for each parameter are developed for their scoring.

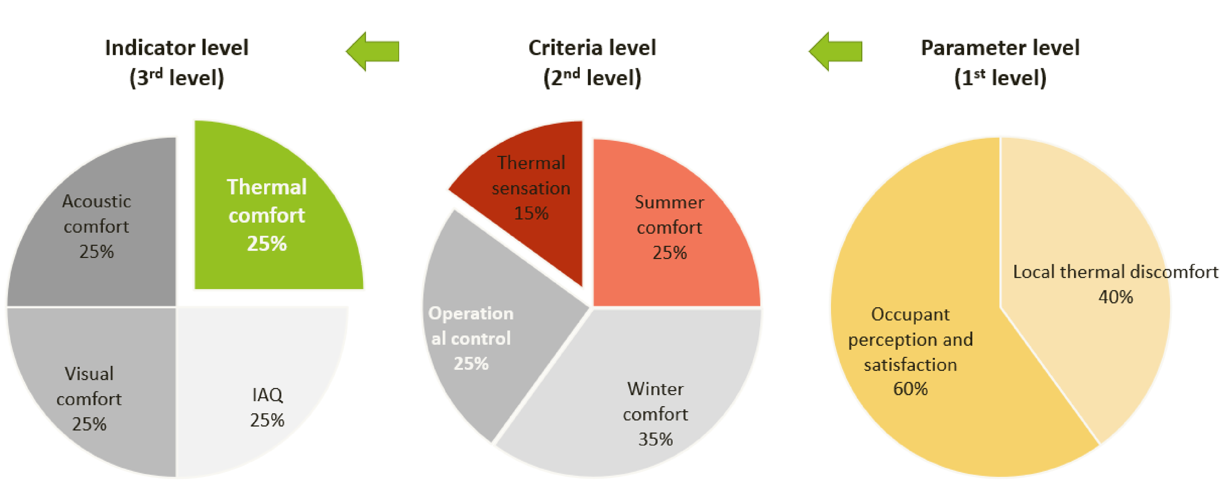

Figure 2: Example of three level of weights for thermal comfort indicator

Figure 3: Combined comfort rating dashboard

Assessment approach for operational rating

❑ Measurements

On-site measurements are crucial to objectively evaluate the indoor environmental quality. Therefore, CORP incorporates few key measurements in the buildings for calculation of the comfort rating. The measurements are conducted based on standard protocols. Measurements to be conducted by the assessor are Temperature (Temp, °C), relative humidity (RH,%), CO_2 (ppm)

❑ Surveys

Building occupants and their perception are the most important source of information regarding IEQ and its effects on their health, comfort and well-being. In case of dwellings, the main occupier (person spending the most time inside the living room) should fill in the survey. For schools, the teacher teaching in the examined classroom, and for offices the employee spending most of the time in an office should fill in the survey. Surveys are filled in by the building occupant (during the assessor's visit onsite).

❑ Checklists

A large amount of information cannot not be captured through the selected measurements and survey; therefore, it is important to include checklists for assessing additional information about the indoor environment. Checklists are filled in by the expert issuing the EPC during the onsite visit for the building's inspection and installation of the monitoring equipment.

By combining the findings from (objective) measurements, information from checklists and user's (subjective) perception, satisfaction and preference, a clear, comprehensive and holistic profile of the indoor environmental quality and the comfort feature is created.

Testing results

Country	ROMANIA	PORTUGAL	GREECE	AUSTRIA
Type of Testing	In-building Testing	In-building Testing	In-building Testing	In-building Testing
Number of testing cases	1 SFH, 1MFH, 1 Office, 1 Kindergarten/ School	1 SFH, 1 MFH, 1 Office, 1 School	2 Apartments, 2 Offices	4 SFH, 4 MFH, 1 School, 1 Public building
Testing Period	02/2021 – 12/2021	06/2021 – 02/2022	07/2021 - 12/2021	05/2021 – 12/2021

Table 1: Summary of test projects

	COMFORT RATING	Thermal comfort	Indoor Air Quality	Visual comfort	Acoustic comfort
ROMANIA					
SFH	7.6	5.5	7.9	8.2	8.8
MFH	6.6	5.1	8.0	6.8	7.7
OFFICE	6.2	3.3	7.3	8.8	8.0
SCHOOL	7.2	3.0	6.8	7.2	7.6
PORTUGAL					
RES#1	7.1	8.0	7.2	4.0	7.0
RES#2	6.9	6.5	6.9	7.4	3.7
RES#3	6.0	7.3	5.1	3.9	6.9
RES#4	5.3	4.7	6.8	6.5	3.7
School	6.0	2.7	5.7	6.2	6.3
Office	4.3	3.5	5.0	6.6	4.5
AUSTRIA					
SFH#1	7.7	8.4	7.9	5.3	9.2
SFH#2	7.2	8.9	7.4	5.9	6.6
SFH#3	6.8	9.4	6.9	4.5	6.4
MFH#1	7.4	9.6	8.3	3.5	8.1
MFH#2	7.3	9.0	8.2	4.3	7.5
MFH#3	6.9	6.3	6.6	7.3	7.5
GREECE					
MFH#1	5.1	2.6	5.4	5.1	7.2
MFH#1	5.2	2.7	5.0	5.4	7.5
Office#1	6.2	3.9	6.1	7.4	7.6
Office#2	6.5	4.6	5.0	8.6	7.9

Table 2: Summary of results from test projects

CORP was tested on different building types such as SFH, MFH, Office and Schools with varying functionality and occupancy. The objective of the testing was to assess user comfort in different types of buildings by quantifying thermal comfort, indoor air quality, visual comfort, and acoustic comfort, each on a scale 1-10, with an overall comfort indicator also on a scale 1-10. Some key findings derived from the testing in four countries are given below:

- Significant differences in all tests were found mainly for thermal comfort indicators which, in turn, led to visible differences in the overall comfort rating.
- Due to measurement requirements for summer and winter under normal conditions of use for CORP it is more likely to be accurate in comfort perception.
- CORP has the capacity to be used a design tool for buildings.
- Overall comfort rating shows a good level of comfort in all test cases, but it overshadows the low score in sub-indicators.

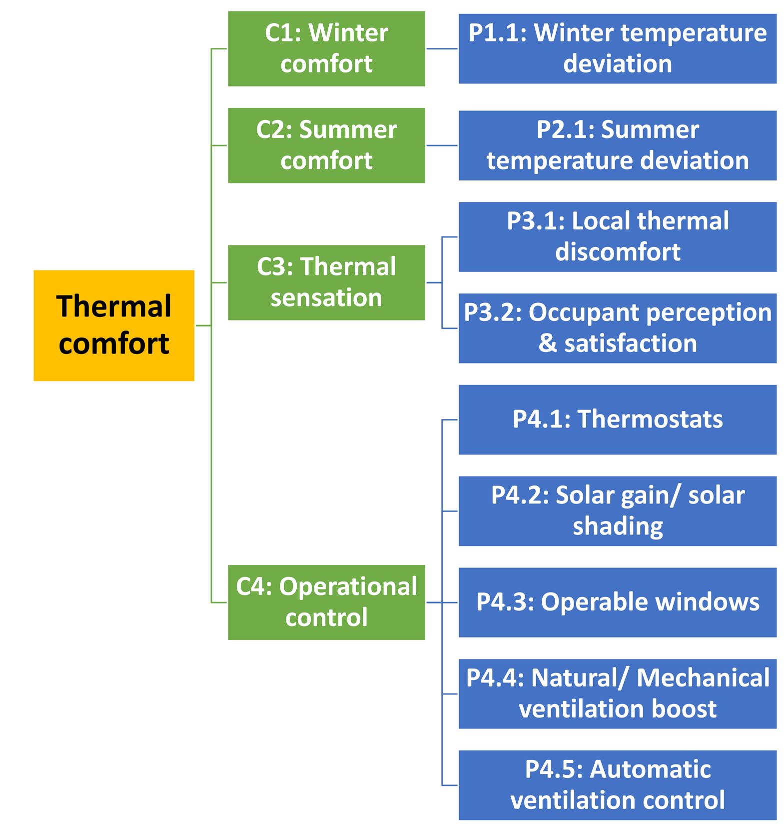

Figure 4: Thermal comfort criterion and parameters

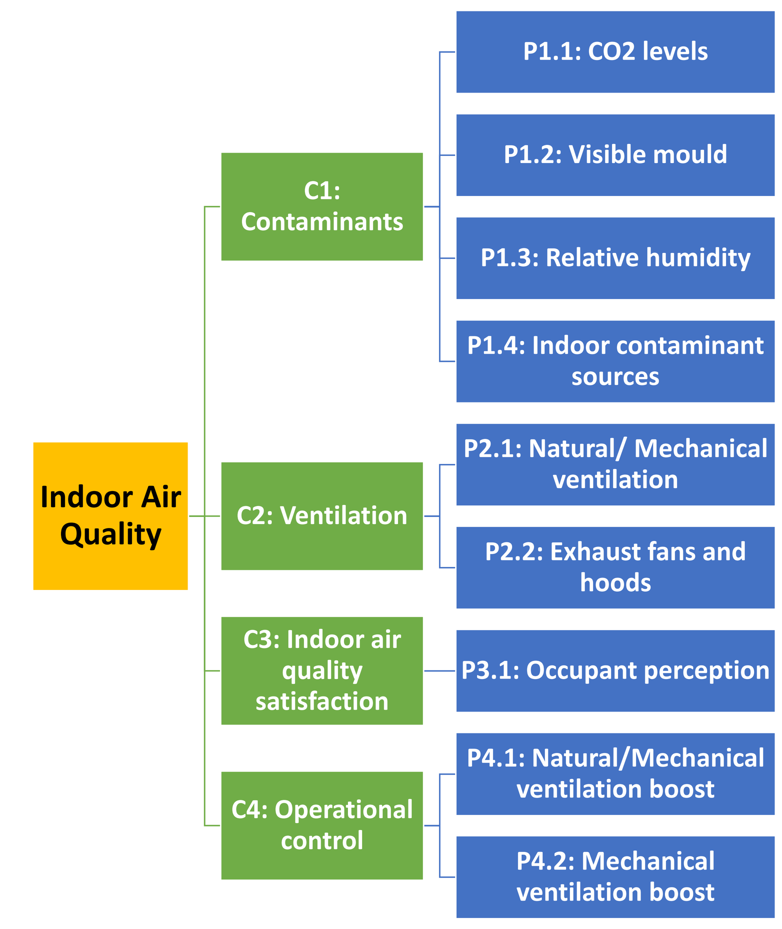

Figure 5: Indoor air quality criterion and parameters

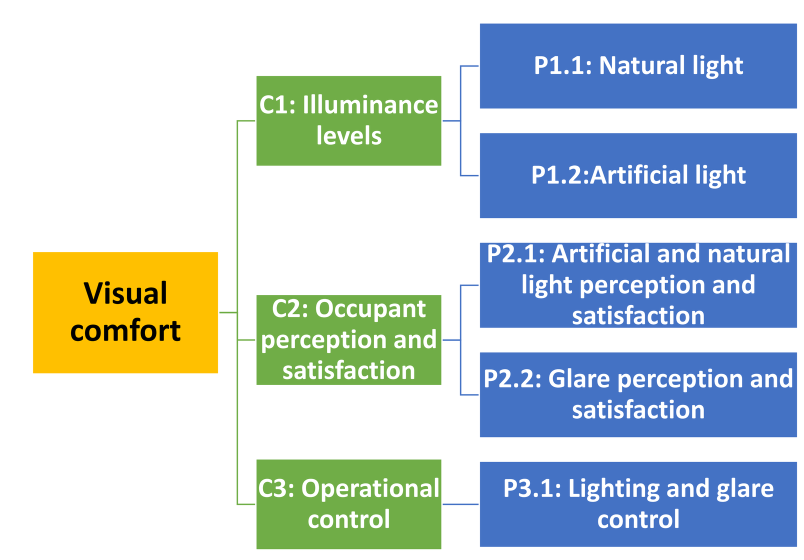

Figure 6: Visual comfort criterion and parameters

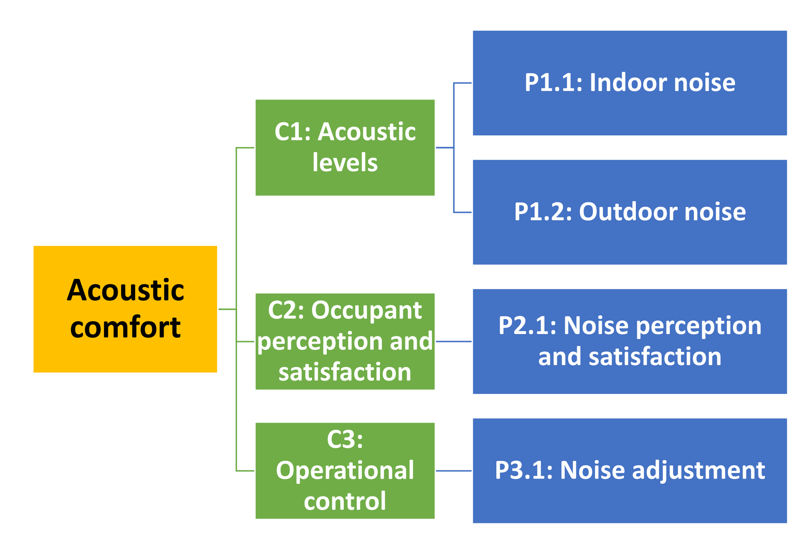

Figure 7: Acoustic comfort criterion and parameters

Read more

Zuhaib, S.; Schmatzberger, S.; et al., (2021), "Next-generation Energy Performance Certificates: End-user needs and expectations", Energy Policy 2021, 161, 112723, https://doi.org/10.1016/j.enpol.2021.112723

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Schmatzberger, S.; Zuhaib, S., (2020) "Understanding end-users needs and expectations of the next generation Energy Performance Certificates Scheme", X-tendo.

Acknowledgements

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