X-tendo

INTRODUCTORY REPORTS

COMFORT INDICATOR

MARCH 2021

THE COMFORT INDICATOR ASSESSES THE LEVELS OF THERMAL COMFORT, INDOOR AIR QUALITY, VISUAL COMFORT AND ACOUSTIC COMFORT IN A BUILDING THROUGH RELIABLE AND EVIDENCE-BASED DATA INPUTS.

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WHY WE DEVELOPED THIS FEATURE

Ensuring adequate indoor environmental quality (IEQ) levels, including indoor air quality, thermal comfort, lighting and acoustics, is one of the most important benefits and drivers of building renovation and new construction. Currently these levels are not reported or covered in energy performance certificates (EPCs). EPCs constitute a critical source of information on the energy performance of the EU's building stock. They have the potential to become a compelling market tool to develop demand for energy efficiency in buildings and track the overall IEQ status, considering that energy efficiency and IEQ improvements are interrelated and should be simultaneously achieved. Scientific evidence shows that IEQ has a direct effect on health, comfort, wellbeing and productivity of the building occupants. Integrating the comfort indicator in EPCs will allow the assessment of the IEQ and consequently contribute to reducing negative health effects caused by inappropriate indoor conditions, and improving the comfort and wellbeing of building occupants

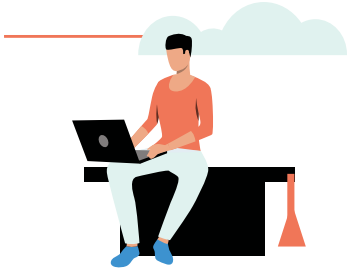
SCOPE OF APPLICATION

The comfort indicator is critical and may be applied to any building type. Indoor activities, outside noise, pollution, landscape and building characteristics have a significant impact on the indoor environmental quality. The **residential sector** is of exceptional importance as people spend approximately 60% of their day in their homes. Infants, young children, elderly and bedridden people spend an even greater proportion of their day in dwellings, and are more exposed to the adverse health effects of poor IEQ. **School building**s are also crucial as children spend a substantial amount of their day at school. Several studies conducted in school environments have shown that the indoor air quality in many classrooms is very unhealthy. The comfort indicator is also essential for **office buildings** as, apart from the large amount of time that employees spend indoors, various studies have shown that the IEQ has a significant impact on their work performance, productivity and wellbeing. The comfort indicator can be applied to both new and existing buildings***. If the building is in use and occupied, an operational rating is available, while for new or unoccupied buildings, a provisional asset rating is available.***[1]

Building typology	New and existing buildings • Residential (single-family and multi-family) • Non-residential (offices) • Public (schools, offices, etc.)
Tenure	Owner-occupied, unoccupied, co-operative, private rental, public rental
Property status	Renovating, renting, selling, buying

[1] Asset ratings are primarily based on checklists while operational ratings are based on monitoring and measurement

LEVEL OF EXPERTISE, SKILLS AND TRAINING



The assessor should have some fundamental technical and soft skills and intermediate expertise or knowledge of the subject for asset rating as it is primarily based on checklists. Additional intermediate skills are required for operational rating. These range from the ability to use the required monitoring instruments to the ability to execute a quick survey with the building occupants. Technical skills involve setting up and calibrating the monitoring devices and the ability to monitor and download data. Further skills are required for the analysis and interpretation of the results. The assessor should also be able to quickly inspect the interior of the building to identify malfunctions e.g. on the HVAC systems, presence of mould etc., but also identify harmful material on the building's structure such as paints, varnishes adhesives etc. In addition, the operational rating requires effective communication skills to collaborate with the building occupants to fill in the questionnaire and inform them of the benefits of doing so.

On required training, assuming that the assessor is an experienced energy expert with basic knowledge (e.g. of HVAC systems), then training would only be required for some IT software skills in relation to the simulation of the thermal conditions. For some Member States, this is already included in their EPC; however, if it is not, the training could last for about a full day. The assessor should familiarise themself with the use of the monitoring devices for all quality checks before the installation on-site. This is a self-training, and can take up to a day.

	Fundamental awareness (basic knowledge)	**Novice** (limited experience)	**Intermediate** (practical application)	**Advanced** (applied theory)	**Expert** (recognised authority)
Asset rating method			✓		
Operational rating method			✓		

GOOD PRACTICES

Integrating IEQ assessment in EPC schemes will enable a market push for better-performing buildings. Several tools and indexes have been developed addressing different aspects of IEQ. The TAIL index, developed as part of the ALDREN[3] project, provides a rating to describe the quality of the indoor environment of offices and hotels before and after deep renovation. Level(s)[4], an EU framework for core sustainability indicators for office and residential buildings, also covers indicators of the indoor environment such as indoor air quality, daylight, and thermal and acoustic comfort. The X-tendo comfort indicator has based its development on such good practices, adjusted to the needs of the EPC framework and assessment procedure.

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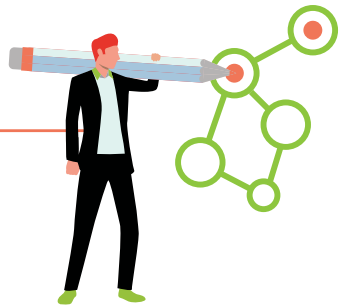
[2] Or energy expert, i.e. the person responsible for issuing this next-generation EPC.
[3] ALDREN | ALliance for Deep RENovation in buildings
[4] Level(s) (europa.eu)

METHODS AND ASPECTS INCLUDED



The methodology for the evaluation of the comfort feature is based on evidence-based inputs. Operational rating uses measurements, surveys and checklists together, while asset rating uses only checklists. Four main indicators will be assessed within the comfort feature: (i) thermal comfort, (ii) indoor air quality, (iii) visual comfort, and (iv) acoustic comfort. To identify the overall IEQ level, all four indicators will be assessed independently based on multiple criteria. Under each criterion, certain parameters must be met to achieve a required score. The score will be awarded using the relevant assessment method (e.g. checklist, survey, monitoring etc.). Indicators, criteria and parameters are given relative weightings to calculate a total score and overall rating. The comfort rating will give an overall idea of the indoor environment and provide guidance in applying corrective measures.

HOW WE WILL IMPLEMENT IT

For occupied buildings, the operational rating is based on on-site measurements, building occupant surveys and checklists filled in by the assessor. For unoccupied buildings, both new and existing, an asset rating is applied. This is a simpler evaluation approach mainly based on checklists. The developed methodologies for both assessment procedures, in the form of an Excel tool and a user guide, will be used initially for testing on real cases. The following steps will be used for its implementation:

- Discussion and planning with the implementing partners on the monitoring and testing procedures (number of buildings/selection of building typologies/testing duration etc.)
- Training of implementing partners to equip the assessors with required knowledge on testing (description of protocols and guidance etc.)
- Selection and purchase, if not already available, of monitoring devices to be used in test cases
- Addressing possible questions/issues/feedback from the implementing partners during the testing phase
- Evaluation of the results and methodology after testing is complete
- Based on lessons learnt from the testing, validation of the methodology for its further use.

OVERALL EVALUATION

LESSONS LEARNT

- Feasibility to evaluate multiple occupied zones in a building is limited.
- Method requires tailored approach for different building types.
- Member States have varied interest in the four indicators.

PREREQUISITES

- Purchase and use of the monitoring equipment.
- Familiarisation with the calculation procedures before entering data.
- Seasonal monitoring requirements in operational rating.

REPLICATION

- Method is highly replicable and flexible for all building types.
- Method fully adjustable to meet the requirements of all Member States.
- Easy replication due to use of related EN/ISO standards that are applied by all Member States.

PROS

- Two assessment options available: (1) asset rating, (2) operational rating.
- Cost-efficient compared to traditional assessments.
- Robust, reliable and trustworthy method for IEQ evaluation.

CONS

- A few assumptions are made that may affect the accuracy of the outputs (e.g., number of occupants, continuity of conditions).
- Measurements necessary for operational rating require more time for relevant assessment.

RISKS

- Owner/users not willing to fill in the questionnaire.
- Occupant/owner consent required for installation of devices and data collection from buildings.
- Potential negative impact on the energy performance rating if an energy-efficient building has poor IEQ.

RECOMMENDATIONS

- Based on the lessons learnt from the testing, alternative ways of scoring may be suggested.
- Asset rating must be followed by operational rating for more accurate assessment when the building is occupied.
- Use of multi-functional measurement devices would be cost-effective.

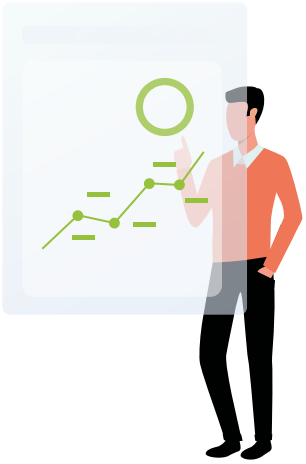
NEXT STEPS

- In the long term, depending on the measurement capabilities, additional parameters may be considered to refine the assessment.
- Depending on the availability and cost of IEQ sensors developed by the market, additional spaces and parameters can be further monitored.
- Support implementing partners for integration in their existing EPC schemes.

COMPLEXITY

- The methodology does not fully consider the impact of one indicator on another due to dynamic relationships.
- Given the multiple criteria, it is strongly advised that the assessor explicitly reads and understands the user guide before filling in the calculation spreadsheet.
- The comfort assessment requires new data inputs over a larger period of time than existing EPC system.

COMPLIANCE WITH CROSS-CUTTING CRITERIA



QUALITY AND RELIABILITY OF EPCS

The comfort rating system and its indicators are developed by reliable experts to ensure high quality in the execution of the evaluation process. Each indicator is thoroughly checked for inconsistencies to eliminate any risks that may arise from data collection to final analysis. Training of implementing partners is foreseen to equip them with knowledge for good quality assessments.

USER-FRIENDLINESS

The resulting comfort rating is simple, can be communicated visually, and is easy to understand for a wide range of audiences, from end-users to policymakers. The scale used for all indicators is colourful and clear (very bad, bad, acceptable, good and excellent). The assessment process is well guided for the assessor and can be easily conducted for different building types.

CONSISTENCY WITH STANDARDS

This methodology builds on relevant standards such as the EN ISO 15251, EN 16798-1: 2019, EN 7730 but also other well developed and reliable methods, frameworks and indexes (e.g. WELL, LEED, TAIL index, Level(s)).

ECONOMIC AND POLITICAL FEASIBILITY

Costs, including monitoring instrument, training, on-site visits etc., are kept to the minimum while assuring necessary technical specifications and effectiveness. The results of the methodology will be easily comparable across Member States. Studies have indicated a great interest in this feature by public authorities from EU countries.

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LAAECR Asociația Auditorilor Energetici pentru Clădiri din România

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