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Development of European Ecolabel Criteria for Buildings

ECOLABEL CRITERIA AND INDOOR PERFORMANCES
- Classification and certification of the indoor environment -

Prof. Maurizio Cellura, Prof. Gianfranco Rizzo

Dipartimento di Ricerche Energetiche ed Ambientali (DREAM)

Università di Palermo - Italy

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Introduction

□ Buildings are very special "product groups".

□ Actually their main mission consists in delivering suitable conditions to people living and/or working inside confined environments.

□ This pre-requisite should be properly verified, before any environmental (or energy) consideration concerning the building takes place.

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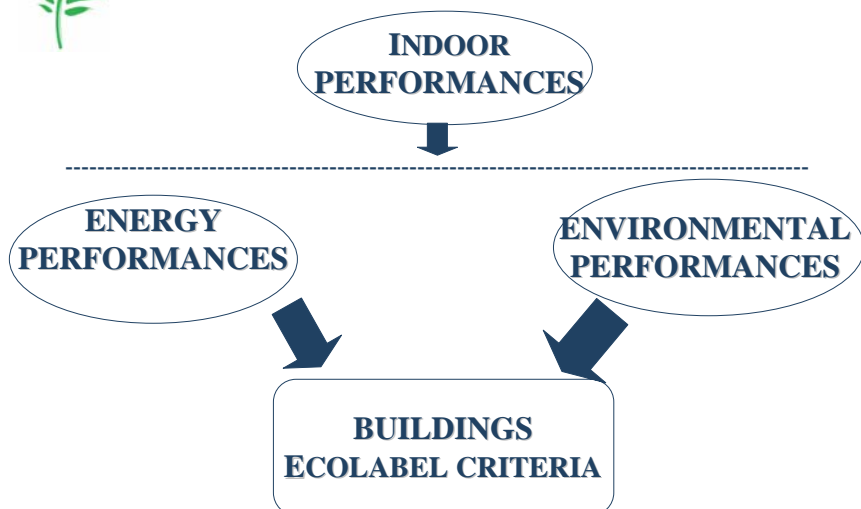
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□ Recent studies have shown that costs of poor indoor environment for the employer, the building owner and the society as a whole, are often considerable higher than the cost of the energy used in the same building.

□ "It has also been shown that good indoor environmental quality can improve overall work and learning performance and reduce absenteeism" [EN 15251].
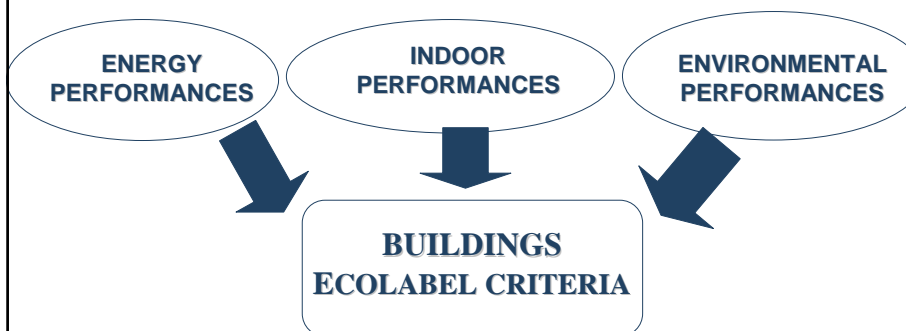

□ In addition uncomfortable occupants are likely to take actions to make themselves comfortable which may have energy implications.
□ An energy declaration without a declaration related to the indoor environment provides an **incomplete information**.
□ There is therefore a need for specifying criteria for the indoor environment for design, energy calculations, performance and operation of buildings

The indoor quality of buildings could be considered as a prerequisite in order of achieving the ECOLABEL criteria

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or, alternatively, as a group of criteria that, together with those referring to energy and environmental performances, will contribute to the definition of the ECOLABEL scheme

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□ In any case, it would be important referring, for the indoor performances of buildings, to an existing EU standard.

□ This is now possible, due the recent releasing of the EN 15251 European Standard " *Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics*".

EN 15251
Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics

□ This standard (Mandate M/343 given to CEN) supports essential requirements of EU Directive 2002/91/EC on the energy performance of buildings (EPBD).

□ It forms part of a series of standards aimed at European harmonisation of the methodology for the calculation of the energy performance of buildings ("Umbrella document" - CEN/TR 15615).

□ This standard is applicable to the following building types:
  single family houses
  apartment buildings
  offices, educational buildings
  hospitals
  hotels and restaurants
  sports facilities
  wholesale and retail trade service buildings.

□ The standard specifies how different categories of criteria for the indoor environment can be used.

□ The standard does not include criteria for local discomfort factors like draught, radiant temperature asymmetry, vertical air temperature differences and floor surface temperatures.

It provides a method for categorisation of indoor environment that is necessary to integrate complex indoor environment information to simple classification for the energy certificate (article 7 of EPBD).

Recommended input values are given for each of the different categories.

Table 1 — Description of the applicability of the categories used

Category	Explanation
I	High level of expectation and is recommended for spaces occupied by very sensitive and fragile persons with special requirements like handicapped, sick, very young children and elderly persons
II	Normal level of expectation and should be used for new buildings and renovations
III	An acceptable, moderate level of expectation and may be used for existing buildings
IV	Values outside the criteria for the above categories. This category should only be accepted for a limited part of the year

EN 15251 European Standard

☐ In the framework of the EN 15251 regulation, it is proposed a classification and certification scheme for indoor environments to be included in the building energy declaration.

☐ The ANNEX A of the regulation lists some examples of quality categories for the design of mechanically cooled and heated buildings, concerning the thermal comfort issue, evaluated by means of PPD and PMV indices (EN ISO 7730).

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EN 15251 European Standard

Table A.1 — Examples of recommended categories for design of mechanical heated and cooled buildings

Category	Thermal state of the body as a whole	
	PPD %	Predicted Mean Vote
I	< 6	-0,2 < PMV < + 0,2
II	< 10	-0,5 < PMV < + 0,5
III	< 15	-0,7 < PMV < + 0,7
IV	> 15	PMV<-0,7; or +0,7<PMV

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EN 15251 European Standard

☐ As it is stated by the EN 15251 itself, the information about indoor environment of the building should be included with the energy certificate of the building (EBPD, 2002/91/EC) so that the total performance of the building can be evaluated.

☐ For this certificate the classification of indoor environment is necessary. But for the classification it may be useful to integrate complex indoor environment information into a simple overall indicator of indoor environmental quality of the building.

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EN 15251 European Standard

Classification of indoor environment can be based on showing the design criteria for each parameter, calculations or measurements over a time period (week, month, year) of relevant parameters like **room temperature**, **ventilation rates**, **humidity**, and **CO_2 concentrations**. The basis of evaluation has to be specified in the classification and certification.

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EN 15251: criteria for energy calculation

Table I.1 — Classification based on criteria for energy calculations

Criteria of indoor environment	Category of this building	Design Criteria
Thermal conditions in winter	II	20-24 °C
Thermal conditions in summer	III	22-27 °C
Air quality indicator, CO_2	II	500 ppm above outdoor
Ventilation rate	II	1 l/sm^2
Lighting		E_m > 500 lx; UGR<19; 80<R_a
Acoustic environment		Indoor noise <35 dB(A) \n Noise from outdoors <55 dB(A)

Recommended indoor temperatures for energy calculations

Type of building or space	Category	Temperature range for heating, °C \n Clothing ~ 1,0 clo	Temperature range for cooling, °C \n Clothing ~ 0,5 clo
Residential buildings, living spaces (bed room's living rooms etc.) \n Sedentary activity ~1,2 met	I	21,0 -25,0	23,5 - 25,5
	II	20,0-25,0	23,0 - 26,0
	III	18,0- 25,0	22,0 - 27,0
Residential buildings, other spaces (kitchens, storages etc.) \n Standing-walking activity ~1,5 met	I	18,0-25,0	
	II	16,0-25,0	
	III	14,0-25,0	
Offices and spaces with similar activity (single offices, open plan offices, conference rooms, auditorium, cafeteria, restaurants, class rooms, \n Sedentary activity ~1,2 met	I	21,0 – 23,0	23,5 - 25,5
	II	20,0 – 24,0	23,0 - 26,0
	III	19,0 – 25,0	22,0 - 27,0
Kindergarten \n Standing-walking activity ~1,4 met	I	19,0 – 21,0	22,5 - 24,5
	II	17,5 – 22,5	21,5 – 25,5
	III	16,5 – 23,5	21,0 - 26,0
Department store \n Standing-walking activity ~1,6 met	I	17,5 – 20,5	22,0 - 24,0
	II	16,0 – 22,0	21,0– 25,0
	III	15,0 – 23,0	20,0 - 26,0

Recommended criteria for lighting

Ra = colour rendering index

UGR= glare index

Type of building	Space	Maintained illuminance, $\bar{E}_m$, at working areas, lx	UGR	Ra	Remarks
Office buildings	Single offices	500	19	80	at 0,8 m
	Open plan offices	500	19	80	at 0,8 m
	Conference rooms	500	19	80	at 0,8 m
Educational buildings	Classrooms	300	19	80	at 0,8 m
	Classrooms for adult education	500	19	80	at 0,8 m
	Lecture hall	500	19	80	at 0,8 m
Hospitals	General ward lighting	100	19	80	at 0,8 m
	Simple examination	300	19	80	at 0,8 m
	Examination and treatment	1000	19	90	at 0,8 m
Hotels and restaurants	Restaurant, dining room	-	-	80	at 0,8 m
Sport facilities	Sports halls	300	22	80	at 0,1 m
Wholesale and retail premises	Sales area	300	22	80	at 0,8 m
	Till area	500	19	80	at 0,8 m
Circulation areas	Corridor	100	28	40	at 0,1 m
	Stairs	150	25	40	at 0,1 m
Other buildings	See EN 12464-1				

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Indoor system noise criteria of some spaces and buildings (1)

Table E.1 — Examples of design A-weighted sound pressure level

Building	Type of space	Sound pressure level [dB(A)]	
		Typical range	Default design value
Residential	Living room	25 to 40	32
	Bed room	20 to 35	26
Child care institutions	Nursery schools	30 to 45	40
	Day nurseries	30 to 45	40
Places of assembly	Auditoriums	30 to 35	33
	Libraries	28 to 35	30
	Cinemas	30 to 35	33
	Court rooms	30 to 40	35
	Museums	28 to 35	30
Commercial	Retail shops	35 to 50	40
	Department stores	40 to 50	45
	Supermarkets	40 to 50	45
	Computer rooms, large	40 to 60	50
	Computer rooms, small	40 to 50	45
Hospitals	Corridors	35 to 45	40
	Operating theatres	30 to 48	40
	Wards	25 to 35	30
	Bedrooms night-time	20 to 35	30
	Bedrooms daytime	25 to 40	30

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Indoor system noise criteria of some spaces and buildings (2)

Hotels	Lobbies	35 to 45	40
	Reception rooms	35 to 45	40
	Hotel rooms (during night-time)	25 to 35	30
	Hotel rooms (during daytime)	30 to 40	35
Offices	Small offices	30 to 40	35
	Conference rooms	30 to 40	35
	Landscaped offices	35 to 45	40
	Office cubicles	35 to 45	40
Restaurants	Cafeterias	35 to 50	40
	Restaurants	35 to 50	45
	Kitchens	40 to 60	55
Schools	Classrooms	30 to 40	35
	Corridors	35 to 50	40
	Gymnasiums	35 to 45	40
	Teacher rooms	30 to 40	35
Sport	Covered sports stadiums	35 to 50	45
	Swimming baths	40 to 50	45
General	Toilets	40 to 50	45
	Cloakrooms	40 to 50	45

Long term evaluation of the indoor environment

☐ The evaluation of indoor environment of a building is done by evaluating the indoor environment of typical rooms representing different zones in the building. Evaluation can be based on:

design

calculations

measurements

questionnaires

Classification and certification of the indoor environment

☐ The evaluation of the indoor environment includes:
1. thermal criteria for winter
2. thermal criteria for summer
3. air quality and ventilation criteria
4. lighting criteria
5. acoustic criteria.

☐ Classification of indoor environment can be based on showing the design criteria for each parameter, calculations or measurements over a time period (week, month, year) of relevant parameters like room temperature, ventilation rates, humidity, and CO_2 concentrations.

☐ The basis of evaluation has to be specified in the classification and certification. An example is shown in Annex I of the standard.

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ANNEX I - 1
Classification by means of design criteria

The classification is made by showing a table with criteria used for energy calculations as shown in the example in Table I.1.

Table I.1 — Classification based on criteria for energy calculations

Criteria of indoor environment	Category of this building	Design Criteria
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ANNEX I - 4
Subjective responses from occupants

☐ By using all or some of the scales recommended in Annex I the occupants are asked to fill in the questionnaires at representative times during the year (winter-spring-summer-fall). The percentage of people voting acceptable (thermal environment and air quality) is calculated for each of the representative spaces in the buildings.

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ANNEX I - 4
Subjective responses from occupants

Table I.2 — Examples of using the subjective reaction as classification of the indoor environment

Classification based on occupants responses	Percentage						
People finding the thermal environment acceptable	85						
People finding the indoor air quality acceptable	80						
Distribution on thermal sensation votes	-3	-2	-1	0	+1	+2	+3
	0	5	10	53	20	10	2
Distribution of temperature preference	Colder		Unchanged		Warmer		
	20		75		5		

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An aggregate indicator?

- Some attempts have been produced by researchers in order of singling out an aggregate indicator of the whole indoor performance of buildings.
- Anyway, "due to the many parameters and insufficient knowledge on the combined influence of the indoor environmental parameters, it is recommended to make an overall classification based on only thermal environment and indoor air quality".

Some suggestion for a method

- Certification and classification of the indoor environment could be based on:
- design ⟶ new buildings (6.2, 6.3, 6.4, 6.5, 6.6)
- calculations ⟶ existing buildings (*Annex F*)
- measurements ⟶ existing buildings (*Annexes G, E*)
- questionnaires ⟶ existing buildings (*Annex H*)

For the overall evaluation it is recommended that a comfort "foot-print" is given for thermal conditions and indoor air quality conditions separately. This can be shown as the percentage of time temperatures, ventilation rates or CO_2 concentrations are within the different categories (I, II, III, and IV).

Conclusions

☐ The EN 15251 European Standard can be considered as a useful tool for assessing criteria suitable for a building Ecolabel scheme.

☐ It is also consistent with the EPB Directive.

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Conclusions

☐ In order of properly applying the EN Standard the kind of building interesting the Ecolabel criteria must be defined.

☐ Although the standard is mainly for considering the influence of indoor conditions on the energy demand of buildings, it would avoid the application of several specific standards for the assessment of the indoor performances.

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