U-CERT

User-Centred Energy Performance
Assessment and Certification

ALDREN thermal comfort score

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EPC RECAST
ENERGY PERFORMANCE CERTIFICATE RECAST

U-CERT roadshow
May 2022

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ALDREN H2020 project

- transparent, consistent, common EU wide **assessment framework**
- to trigger **more ambitious renovation** through the improved metrics in certifications, decision-support protocols and tools.
- 2017 – 2020

ALDREN ALliance for Deep RENovation in buildings

www.aldren.eu

8 European partners were working together to increase the building energy renovation rate and quality

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ALDREN H2020 project

2 REPORTING **TOOLS**

EVC:
EUROPEAN VOLUNTARY CERTIFICATE

+

BRP:
BUILDING RENOVATION PASSPORT

4 STANDALONE **MODULES**

ENERGY RATING & TARGET + **ENERGY VERIFICATION** + **COMFORT & WELL-BEING** + **COST VALUE RISK**

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ALDREN Energy Rating

CALCULATION METHODOLOGY

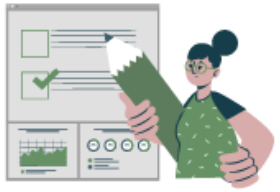
- Based on CEN standards as the reference methodology
- Hourly calculation step
- Indicators compliant with EPBD, Level(s) and EU Taxonomy

RATING AND ENERGY CLASSES

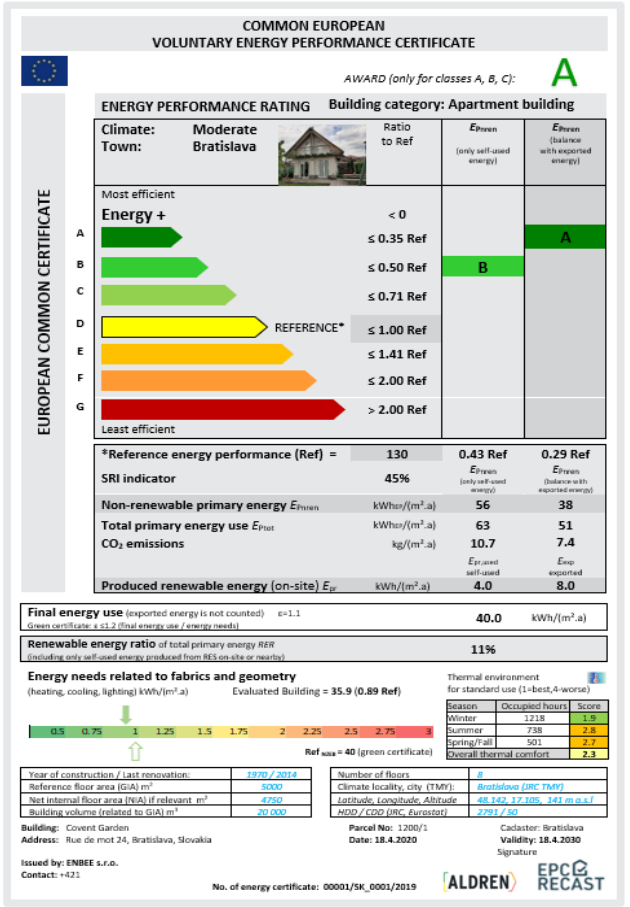
- Based on EN 52003-1
- Relative scale - the ratio to the „reference point“
- Absolute values for 3 climates
- Office buildings and Hotels
- **EPC RECAST PROJECT– aims to adapt ALDREN to residential buildings**

EPC RECAST
ENERGY PERFORMANCE CERTIFICATE RECAST

New toolbox to assess building energy performance and retrofit needs.



www.epc-recast.eu


COMMON EUROPEAN
VOLUNTARY ENERGY PERFORMANCE CERTIFICATE

AWARD (only for classes A, B, C): A

EUROPEAN COMMON CERTIFICATE

ENERGY PERFORMANCE RATING — Building category: Apartment building

Climate: Moderate
Town: Bratislava

		Ratio to Ref	E_{Pnren} (only self-used energy)	E_{Pnren} (balance with exported energy)
	Most efficient Energy +	< 0		
A		≤ 0.35 Ref		A
B		≤ 0.50 Ref	B	
C		≤ 0.71 Ref		
D	REFERENCE*	≤ 1.00 Ref		
E		≤ 1.41 Ref		
F		≤ 2.00 Ref		
G	Least efficient	> 2.00 Ref		

*Reference energy performance (Ref) =	130	0.43 Ref	0.29 Ref
SRI indicator	45%	E_{Pnren} (only self-used energy)	E_{Pnren} (balance with exported energy)
Non-renewable primary energy E_{Pnren}	kWh$_{ep}$/(m².a)	56	38
Total primary energy use E_{Ptot}	kWh$_{ep}$/(m².a)	63	51
CO_2 emissions	kg/(m².a)	10.7	7.4
		$E_{pr,used}$ self-used	E_{exp} exported
Produced renewable energy (on-site) E_{pr}	kWh/(m².a)	4.0	8.0

Final energy use (exported energy is not counted) ε=1.1 — 40.0 kWh/(m².a)
Green certificate: ε ≤1.2 (final energy use / energy needs)

Renewable energy ratio of total primary energy RER — 11%
(including only self-used energy produced from RES on-site or nearby)

Energy needs related to fabrics and geometry
(heating, cooling, lighting) kWh/(m².a) — Evaluated Building = 35.9 (0.89 Ref)

0.5 0.75 1 1.25 1.5 1.75 2 2.25 2.5 2.75 3
Ref$_{NZB}$ = 40 (green certificate)

Thermal environment for standard use (1=best,4=worse)

Season	Occupied hours	Score
Winter	1218	1.9
Summer	738	2.8
Spring/Fall	501	2.7
Overall thermal comfort		2.3

Year of construction / Last renovation:	1970 / 2014
Reference floor area (GIA) m²	5000
Net internal floor area (NIA) if relevant m²	4750
Building volume (related to GIA) m³	20 000

Number of floors	8
Climate locality, city (TMY):	Bratislava (IRC TMY)
Latitude, Longitude, Altitude	48.142, 17.105, 141 m a.s.l
HDD / CDD (IRC, Eurostat)	2791 / 50

Building: Covent Garden
Address: Rue de mot 24, Bratislava, Slovakia
Parcel No: 1200/1
Date: 18.4.2020
Cadaster: Bratislava
Validity: 18.4.2030
Signature
Issued by: ENBEE s.r.o.
Contact: +421
No. of energy certificate: 00001/SK_0001/2019
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ALDREN European Voluntary Certificate (EVC)

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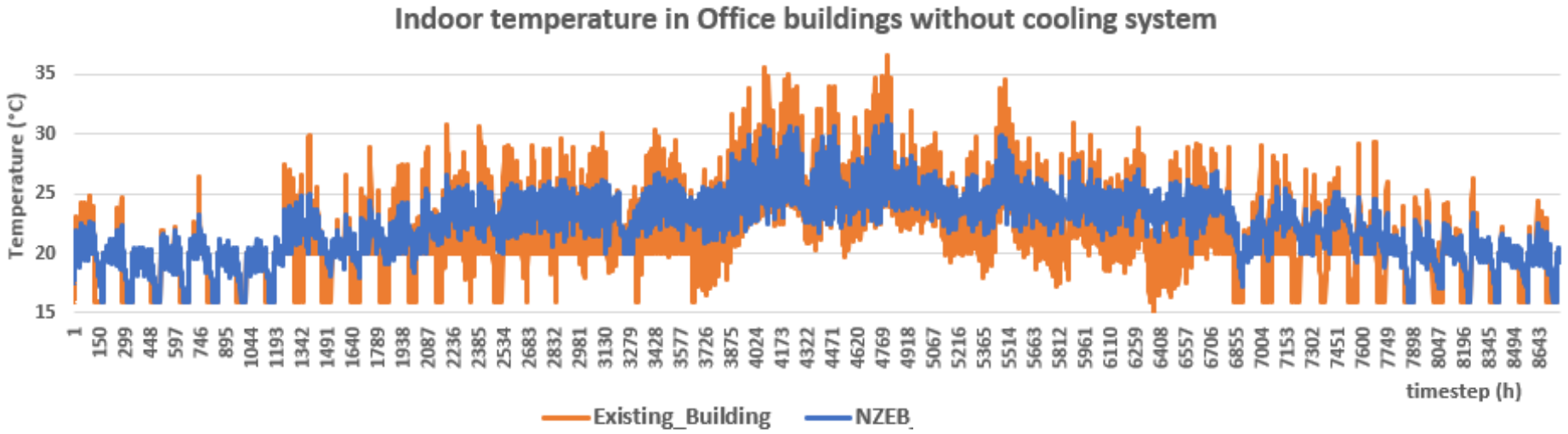
Why is it necessary to evaluate the thermal comfort associated with calculated energy?

The EPBD requires that the EP of buildings also takes into account the indoor climate.



Summer Comfort : % of occupation hours outside the interval

	I	II	III	IV
	23.5-25.5 °C	23-26 °C	22-27 °C	21-28 °C
Existing_Building	87,5	64,8	37,9	25,3
NZEB_Building	74,2	38,1	21,6	13,4

The IEQ differs for an **old building** before renovation and **after renovation** to NZEB or for a building **with** and **without cooling**

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Why is it necessary to evaluate the thermal comfort associated with calculated energy?

1. Notify when a **better energy rating is caused by a poorer indoor environment**, as the energy use of a building may be lower **if the system is not installed** (e.g., building without cooling) or if system is **not properly taken into account in the energy calculation**;

2. The thermal comfort score reported together with the energy makes **visible the link between calculated energy and the IEQ**;

3. This allows **to valorise** a good design using **passive solutions ...**

4. **Important in case of fixed scale or fixed target values for NZEB ...**

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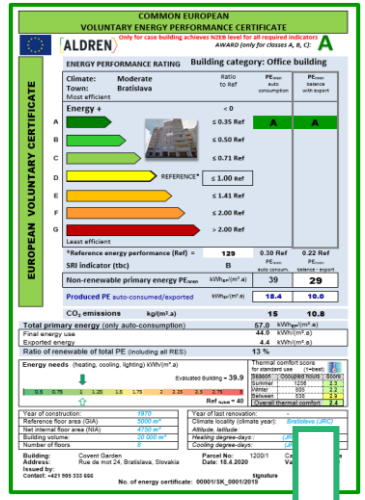
ALDREN Thermal Comfort Score

- Indicator based on **indoor operative temperature** from energy performance calculation in **hourly step** and **distribution of occupancy hours** into **IEQ categories I – IV (EN 16798:2019)**
- The score is reported for each season (**winter, summer, spring/fall**) in order to indicate a potential period of discomfort, and for the **overall thermal comfort**
- Score does not reflect the real comfort in the specific rooms, but **the conditions assumed for energy calculation** (link between energy class in EPC and related IEQ)



Period	Occupied hours	Category
Winter	1218	1.9
Summer	738	2.8
Spring/Fall	501	2.7
Overall thermal comfort score		2.3

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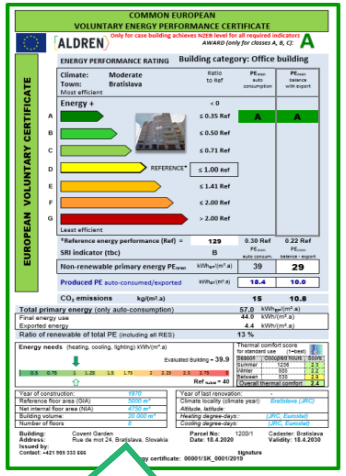
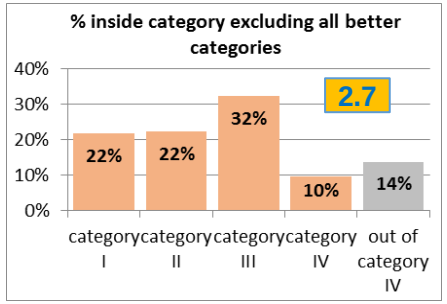
ALDREN Thermal Comfort Score

- Indicator that shows the impact on the thermal comfort of the thermal quality of **building envelope**, **systems** and the **overall design** of building
- Evaluates **winter, summer, spring/autumn** periods under the **same conditions as used in energy calculation** (operating hours, set-point / set-back temperature, system on / off)



Example of building before and after renovation

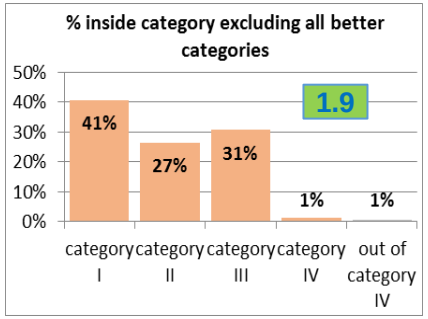
BEFORE RENOVATION



22.25-24.25 21.5-25 20.25-26 19-26.5

Spring/Fall

AFTER RENOVATION



ALDREN Thermal Comfort Score
(associated with calculated energy)

Before renovation

Period	Occupied hours	Category
Winter	1218	1.9
Summer	738	2.8
Spring/Fall	501	2.7
Overall thermal comfort score		2.3

After renovation

Period	Occupied hours	Category
Winter	1218	1.4
Summer	738	2.1
Spring/Fall	501	1.9
Overall thermal comfort score		1.7

IEQ categories (I-best, IV-worse) according to EN 16798-1:2019

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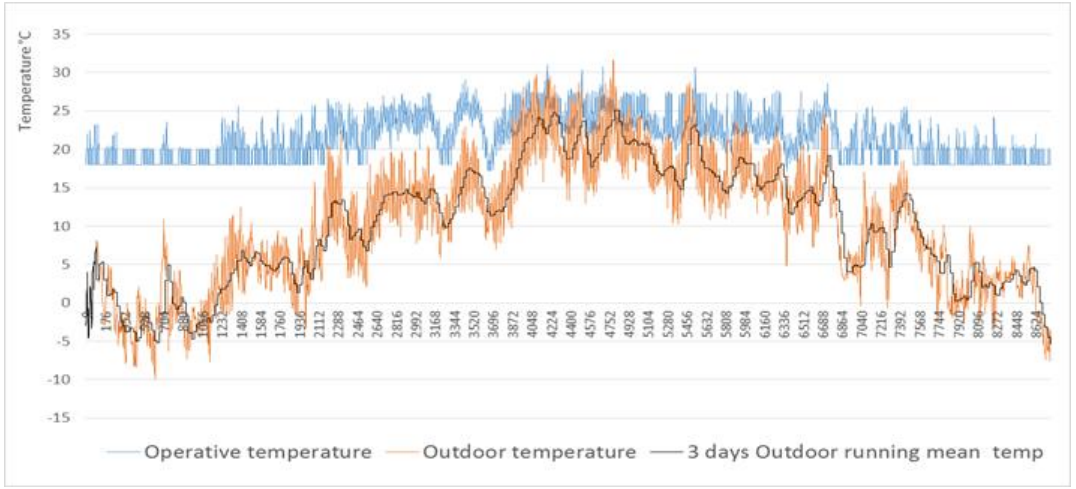
ALDREN Thermal Comfort Score

Calculation steps:

1. Extract the **hourly external temperature** and **internal operative temperature** from energy simulation
2. Assign the hours during occupancy to the seasons (**winter, summer, spring/fall**) based on the outdoor running mean temperature
3. Divide the hours during occupancy into the **IEQ categories I – IV** (intervals in EN 16798:2019) based on the **hourly operative temperature**
4. **Calculate the thermal comfort score** based on the % of occupancy hours outside the intervals using formulas in ALDREN D2.2
   https://aldren.eu/wp-content/uploads/2021/11/D2_2.pdf



Example:

Distribution of occupancy hours into 3 seasons

Winter (heating)	Summer (cooling)	Spring/Fall (between heating and cooling)	Total hours during occupancy
1218	738	501	2457

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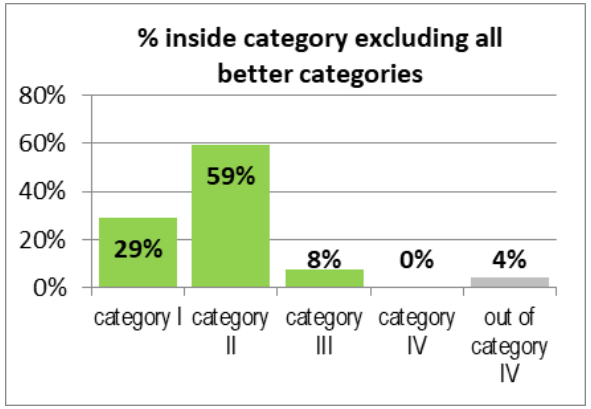
ALDREN Thermal Comfort Score

Example of reporting

Example of distribution of occupancy hours during the **winter (heating) season** into IEQ categories

Estimation of the score for **winter (heating) season**:

Category	Weight	% of hours out of category	% inside category, except for all better categories
IEQ_{I}	1	71%	29%
IEQ_{II}	2	12.0%	59%
IEQ_{III}	3	4.4%	8%
IEQ_{IV}	4	4%	0%
out of IEQ_{IV}	5		**4%**
		Score	**1.9**



(Bjarne Olesen):

((100-IEQI,%out)*1 +
(IEQI,%out - IEQII,%out)*2 +
(IEQII,%out - IEQIII,%out)*3 +
(IEQIII,%out - IEQIV,%out) *4 +
(IEQIV,%out*5)) /100

Thermal environment
for standard use (1=best, 4-worse)

Season	Occupied hours	Score
Winter	1218	1.9
Summer	738	2.8
Spring/Fall	501	2.7
Overall thermal comfort		**2.3**

The scale

≤ 2
>2.0 ≤ 2.5
>2.5 ≤ 3
>3

Level of expectation for IEQ categories (EN 16798:2019):

- IEQ_{I} High – special needs (children, elderly, handicapped)
- **IEQ_{II} Medium – normal, used for design and operation**
- IEQ_{III} Moderate – still provides acceptable environment
- IEQ_{IV} Low – should only be used for a short time

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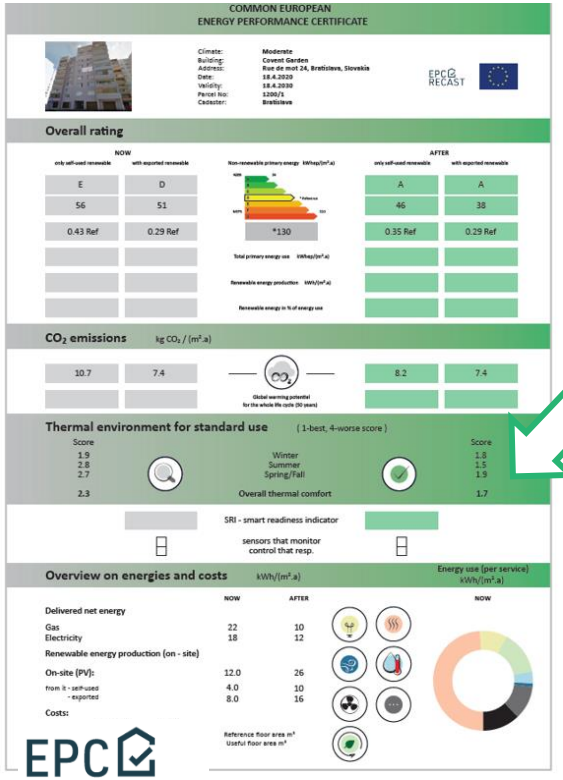
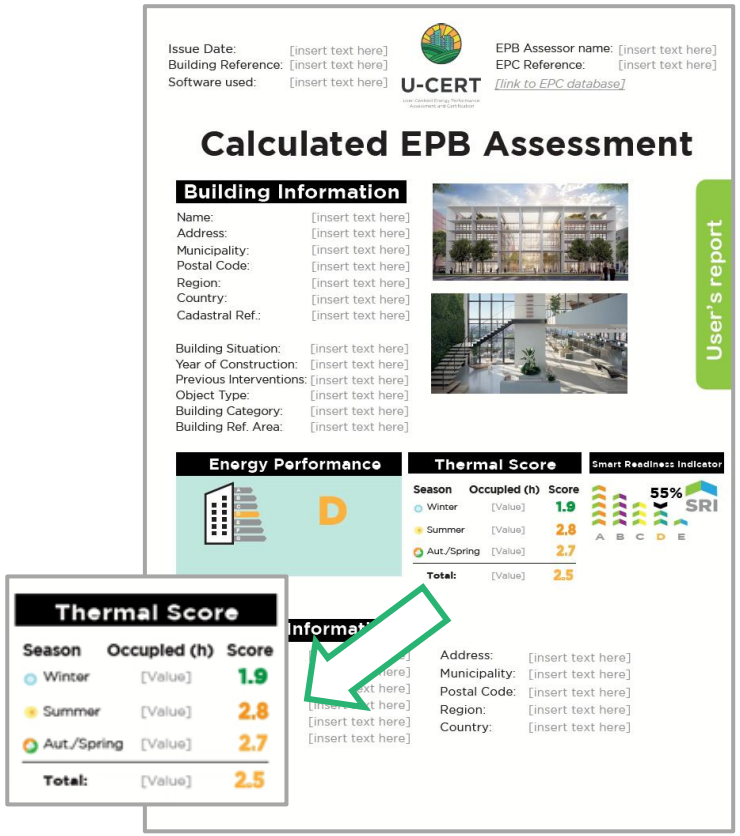
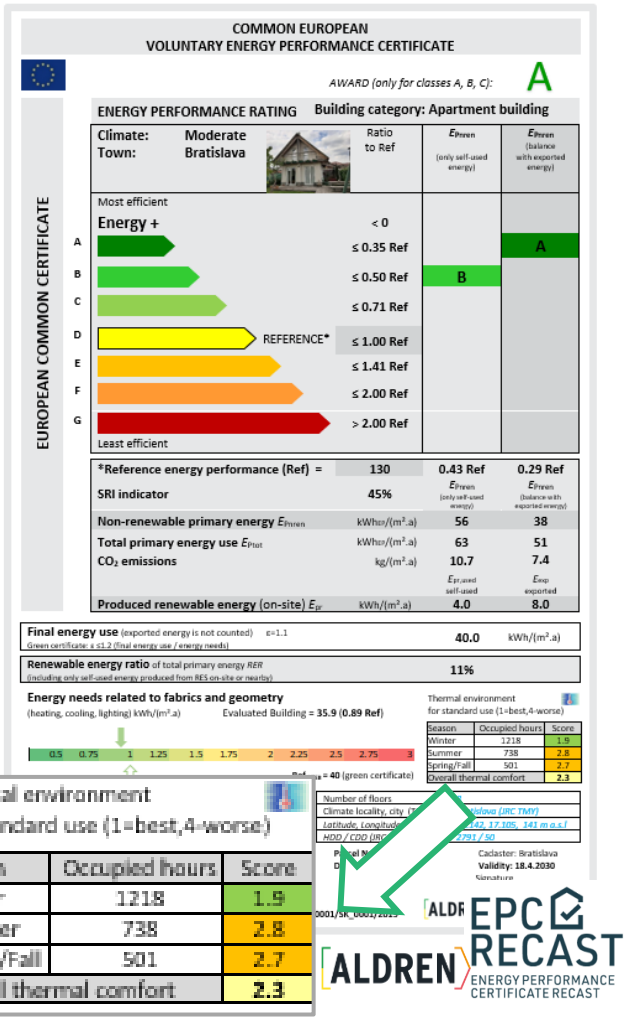
ALDREN Thermal Comfort Score in EPCs

The score for indoor thermal comfort reported together with energy use in EPCs



Current and after renovation





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