Forumul National ETICS - a III a editie Bucuresti, 19.09.2019
Calitatea ETICS – un produs cu mai multe componente

Aspecte ale renovarii energetice a cladirilor in Romania

Noua metodologie de calcul a performantei energetice a cladirilor

Some aspects of Energy Renovation of buildings in Romania

About the new methodology of building performance calculation

Mihaela Georgescu

CONTEXT - CHALLENGES

- **European Directives**
  - **DIRECTIVE (EU) 2018/844, 2010/31/EU; 2012/27/EU**

long-term renovation strategies, deep renovation, renovation advice and one-stop-shops for consumers, the smart readiness indicator, energy poverty, trigger points,

- **OG - Recast 372 Roumanian Law**
- **European overarching standards CEN ISO 2017-2018-2019**
- **Long term national strategies,**
- **Recast of the National Methodology of EPB calculation**
- **Cost effective approaches, BIM,**
- **Towards nZEB,**
- **EAD, New standards for fire safety of buildings**

DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018
amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

Member States shall :

- describe their **national calculation methodology following the national annexes of the overarching standards**, namely ISO 52000-1, 52003-1, 52010-1, 52016-1, and 52018-1, developed under mandate **M/480** given to the European Committee for Standardisation (CEN).

- establish a **long-term renovation strategy** to support the renovation of the national stock of residential and non-residential buildings, both public and private, into a highly energy efficient and decarbonised building stock by 2050, **facilitating the cost-effective transformation of existing buildings into nearly zero-energy buildings**.

DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018

amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

The Union is committed to developing a **sustainable, competitive, secure and decarbonised energy system by 2050**.

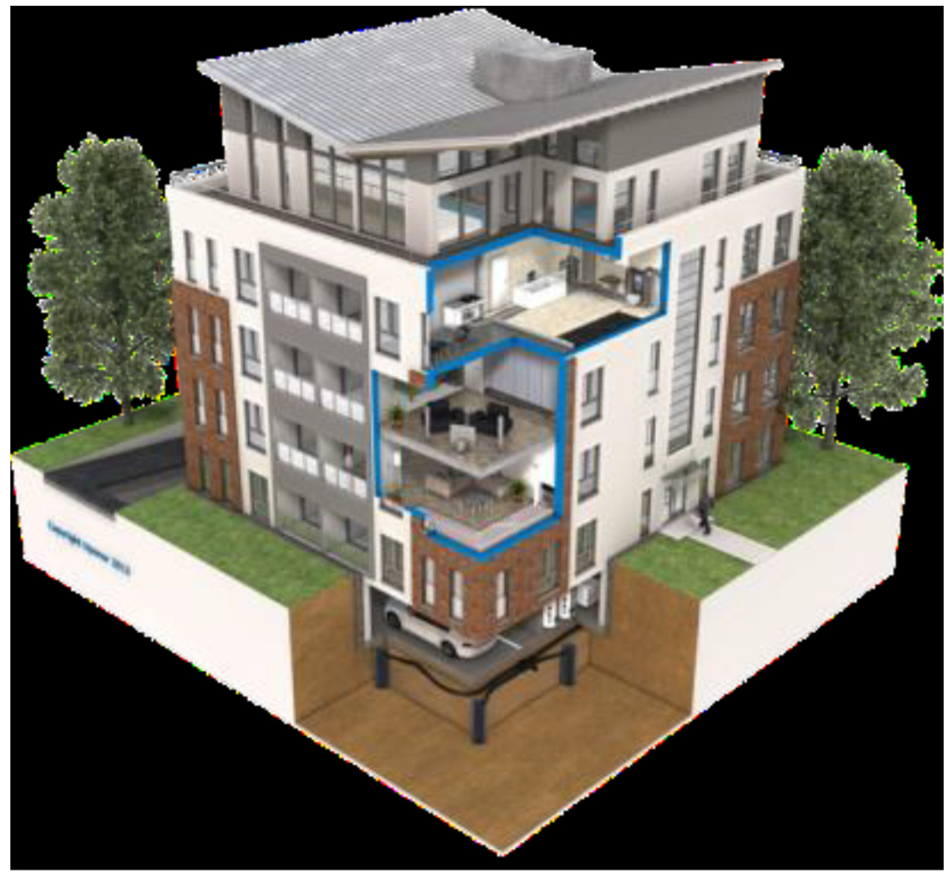
Member States and investors need measures that aim to reach the long-term greenhouse gas emission goal and that **decarbonise the building stock**, which is responsible for approximately 36 % of all CO2 emissions in the Union, by 2050.

A series of amendments are required to strengthen the current provisions of Directive 2010/31/EU and to simplify certain aspects.

The provisions on long-term renovation strategies laid down in Directive 2012/27/EU should be moved to Directive 2010/31/EU, where they fit more coherently.

- Member States should be able to use their **long-term renovation strategies to address fire safety and risks related to intense seismic activity which affect energy efficiency renovations and the lifetime of buildings**.
- The long-term renovation strategies deliver the necessary progress towards the **transformation of existing buildings into nearly zero-energy buildings, in particular by an increase in deep renovations.** There are necessary pertinent initiatives to promote **skills development (calificare)** and **education** in the construction and energy efficiency sectors
- Member States should consider introducing or continuing to apply requirements for a certain level of energy performance for rental properties, in accordance with the energy performance certificates.

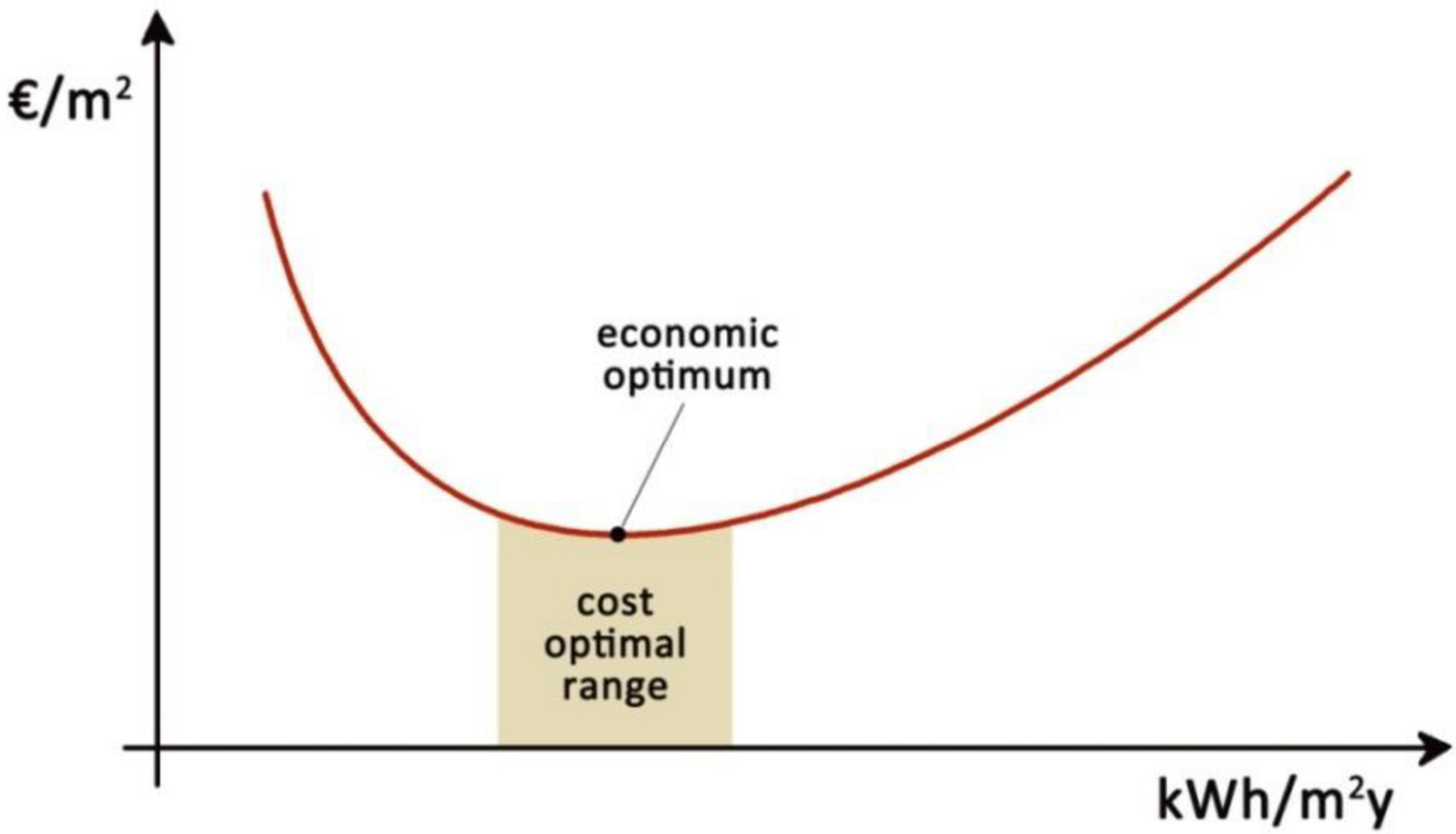
What does nZEB mean?



Which “energy”?

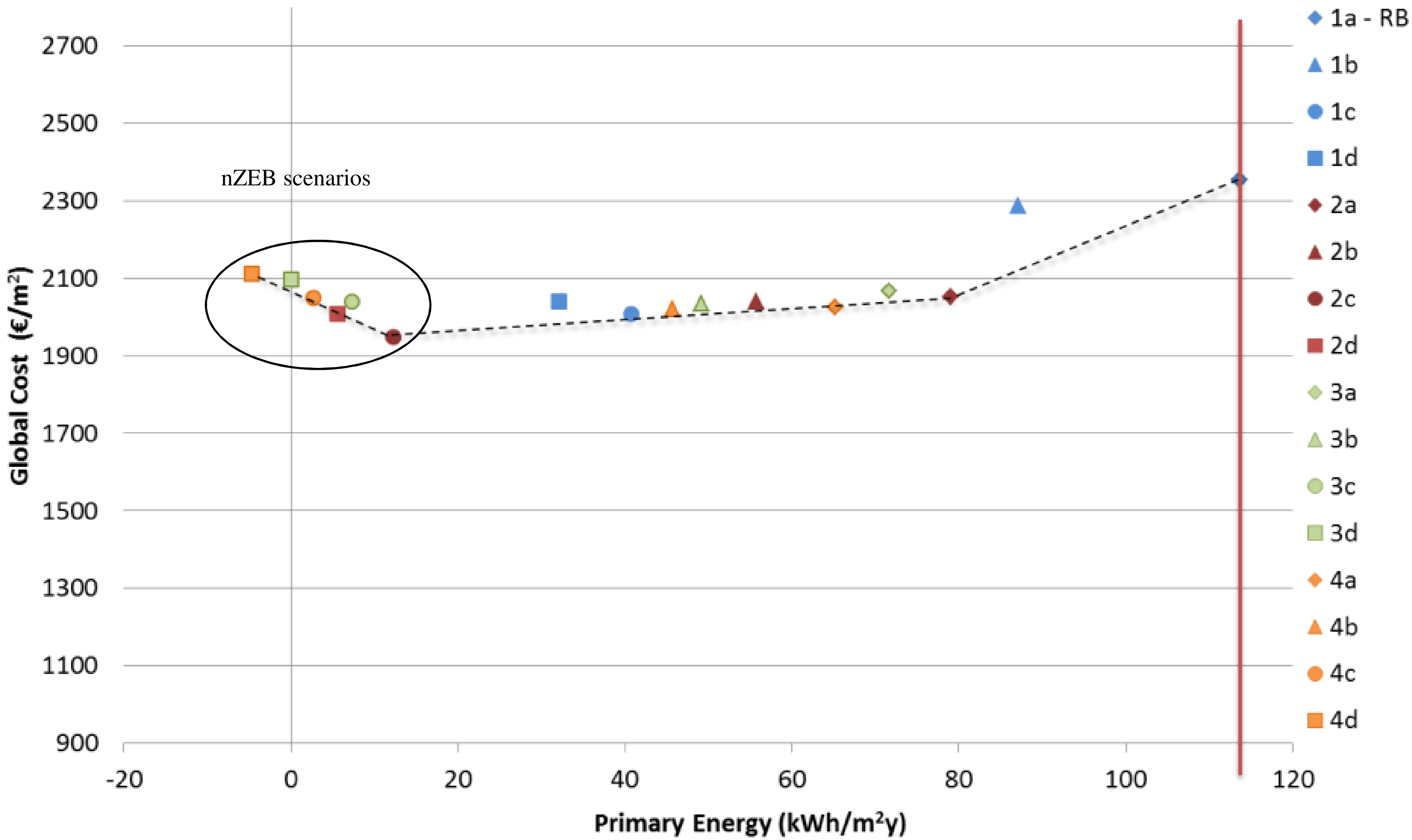
- Balance between the renewable energy produced on-site and the building's energy uses **(LOAD/GENERATION balance) – SITE ENERGY**
- Balance between the renewable energy produced/bought and the building's energy uses **(IMPORT/EXPORT balance) – PRIMARY ENERGY**
- Balance between the **incomes** due to renewable energy production and the building's energy **costs – ENERGY COST**
- Balance between the **emissions** credits gained by producing renewable (zero emissions) energy and the CO2 emissions related the building's energy uses – **ENERGY EMISSIONS**

Cost optimal analysis

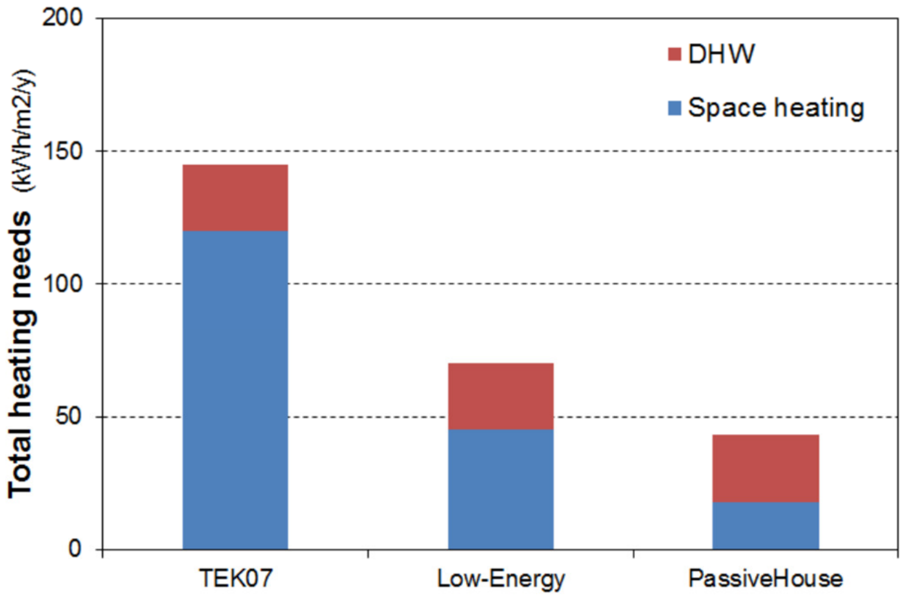


Achieve the **energy performance level** which leads to the **lowest cost** during the estimated economic lifecycle

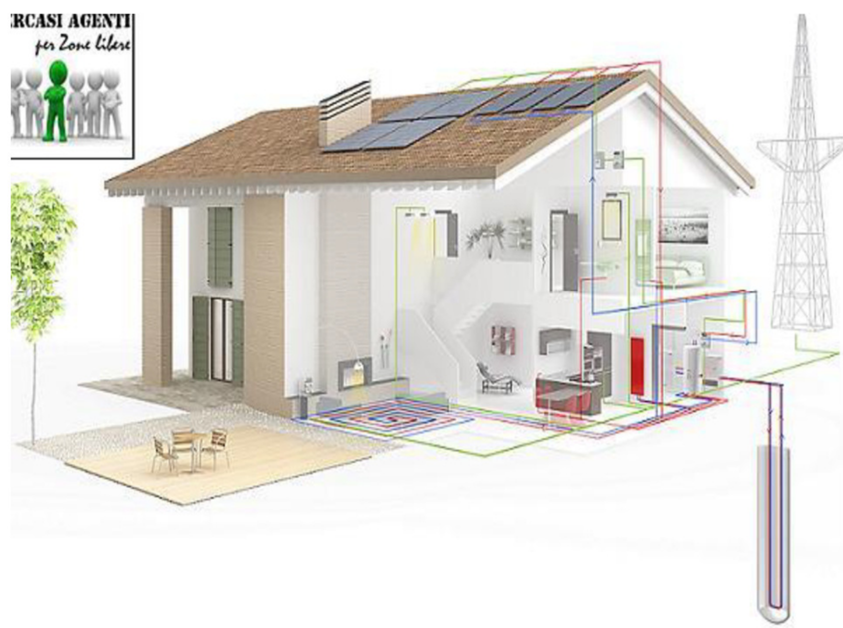
Nearly zero-energy buildings nZEB



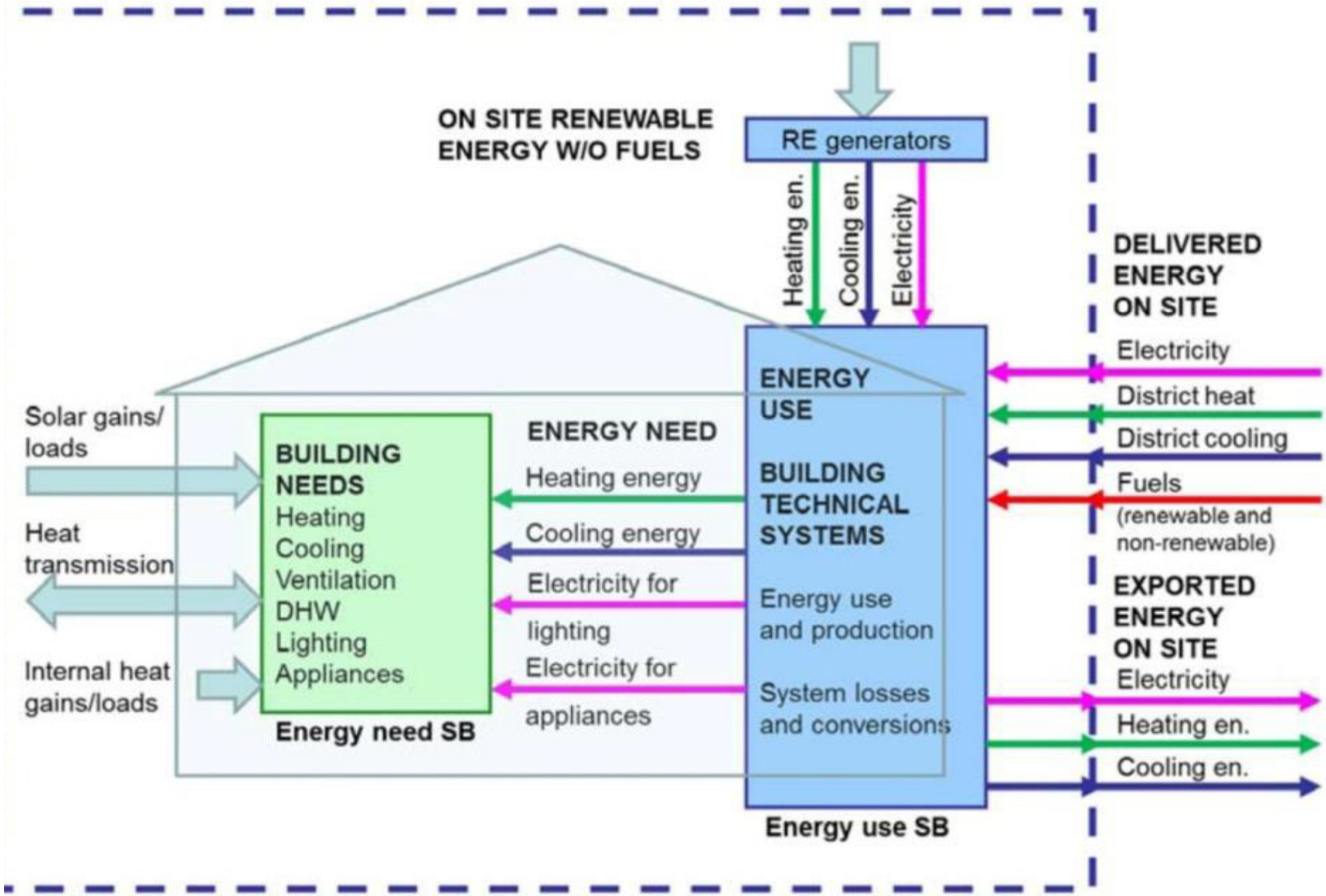
What's new in High Performing Buildings?



Amount of space heating has got significantly smaller in the total heating needs



Energy needs of electricity is becoming predominant (all-electric homes)

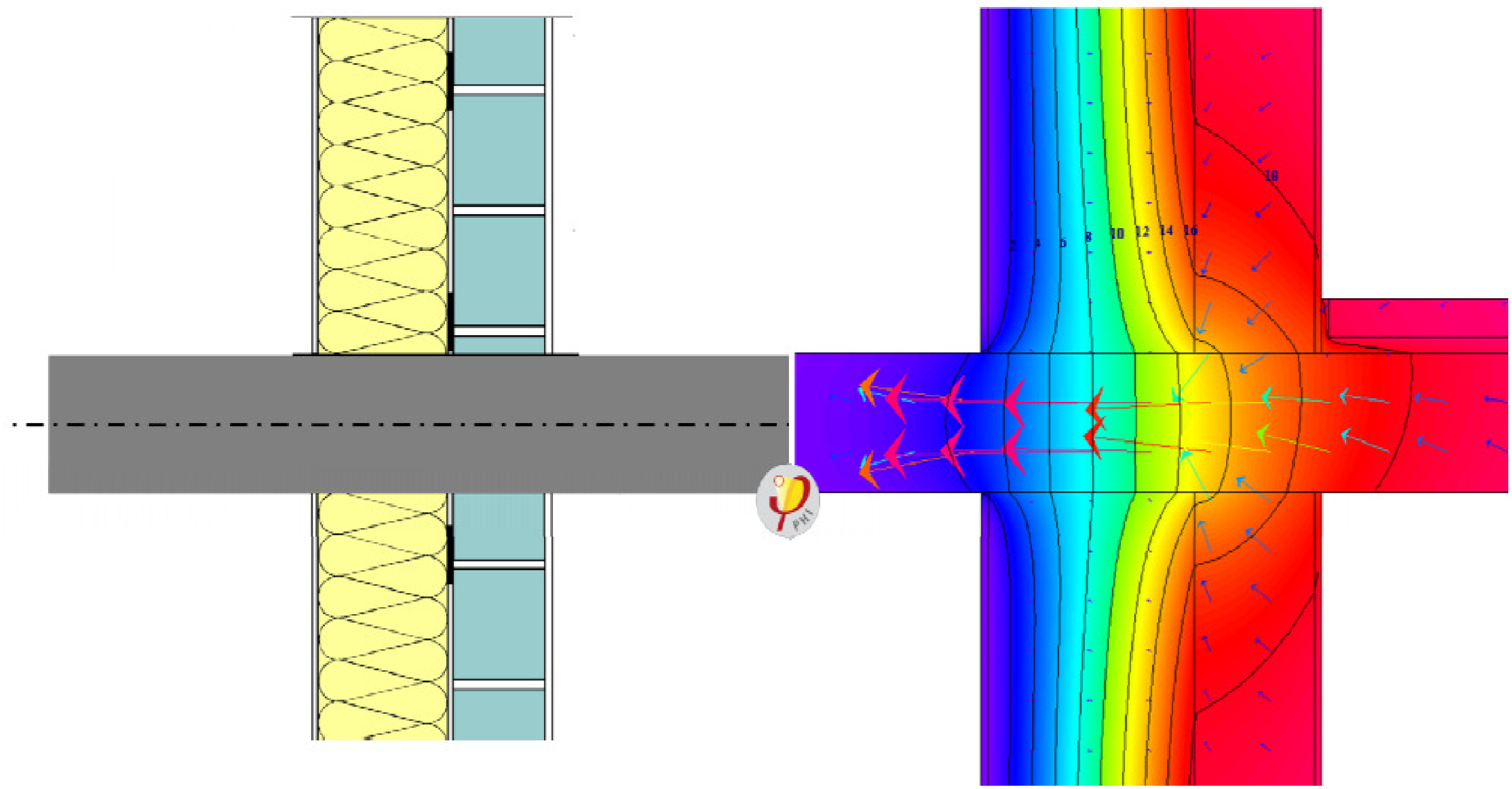


Building site boundary = system boundary of delivered and exported energy on site

Concerning **indoor air quality**, better performing buildings provide **higher comfort levels and wellbeing** for their occupants and **improve health**.

- **Thermal bridges**, **inadequate insulation** and **unplanned air pathways** can result in surface temperatures below the dew point of the air and in dampness.
- It is therefore **essential to ensure a complete and homogeneous insulation of the building** including balconies, fenestrations, roofs, walls, doors and floors, and particular attention should be paid to preventing the temperature on any inner surface of the building from dropping below the dew point temperature.
- The **details** are very important.

Example of unacceptable thermal bridge



OG - Recast of Energy Performance of Buildings (EPB) Law 372/2019

- 1. **clădire** - ansamblu de spaţii cu funcţiuni precizate, delimitat de elementele de construcţie care alcătuiesc anvelopa termică a clădirii, inclusiv sistemele tehnice aferente acesteia, **în care energia este utilizată pentru asigurarea confortului interior pentru ocuparea umană**;

- 2. **performanţa energetică a clădirii** - energia calculată conform metodologiei de la art. 4 pentru a răspunde necesităţilor legate de **utilizarea normală a clădirii**, necesităţi care includ în principal: încălzirea, prepararea apei calde menajere, răcirea, ventilarea şi iluminatul;

OG - Recast of 372 Law

- **5. sistem de climatizare** - combinaţie a componentelor necesare asigurării unei forme de tratare a aerului interior, prin care **temperatura poate fi reglată**. Prin climatizare se poate realiza şi reglarea umidităţii şi purităţii aerului;

- **12. sistem tehnic al clădirii** - totalitate a echipamentelor tehnice ale unei clădiri sau ale unei unităţi de clădire destinate pentru încălzire a spațiului, răcire a spațiului, ventilare, apă caldă menajeră, iluminat integrat, automatizare și control, generare de energie electrică în situ sau pentru o combinaţie a acestora **inclusiv acele sisteme care folosesc energie din surse regenerabile, ale unei clădiri sau ale unei unități de clădire**;

OG - Recast of 372 Law

- **13. anvelopa termică a clădirii** - totalitatea elementelor de construcţie care delimitează spaţiul interior încălzit **la nivel de confort** al unei clădiri, de mediul exterior şi/sau de spaţii neîncălzite/mai puţin încălzite;

- **15. clădire al cărei consum de energie este aproape egal cu zero** - clădire cu o performanţă energetică foarte ridicată, la care consumul de energie pentru asigurarea performantei energetice este aproape egal cu zero sau este foarte scăzut şi este acoperit, **în proporţie de minimum 30 %, cu energie din surse regenerabile, inclusiv cu energie din surse regenerabile produsă la faţa locului sau în apropiere;**

OG - Recast of 372 Law

- 35. **foaie de parcurs** - plan personalizat pe termen lung pentru îmbunătățirea din punct de vedere al eficienței energetice a clădirii, finanțat din surse proprii ale proprietarilor sau prin oferirea de asigurări instituțiilor de finanțare, care ia în considerare nevoile locatarilor și care permite menținerea imaginii de ansamblu asupra istoricului acesteia, precum și planificarea etapelor de renovare în vederea obținerii unor niveluri de renovare majoră cu un orizont de timp lung;
- 36. **praguri de declanșare** - momentele oportune, în ciclul de viață al unei clădiri, pentru realizarea unor renovări privind eficiența energetică;
- 37. **renovarea aprofundată** - renovarea care conduce la îmbunătățirea cu peste 60% a performanței energetice a unei clădiri;

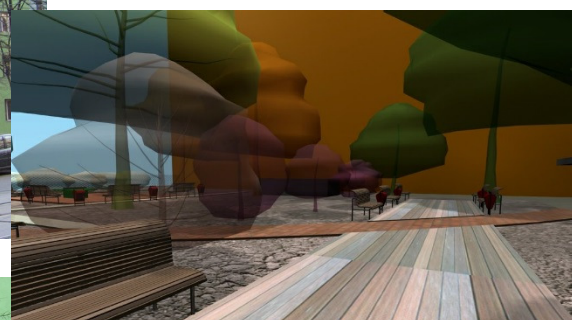
OG - Recast of 372 Law

- 38. **paşaport pentru renovarea clădirilor** - documentul care descrie renovarea unei clădiri, efectuată în etape, desfăşurată pe o durată de până la 20 de ani, rezultată în urma auditului energetic al clădirii;
- 39. **parc imobiliar decarbonizat** - parc imobiliar ale cărui emisii de carbon au fost reduse la zero, prin reducerea necesarului de energie şi asigurarea acestuia, în măsura posibilităţilor, din surse cu emisii de carbon egale cu zero.”

QUALITY IS IMPORTANT

- For the success of the renovation works, of great importance is the attention given to the **quality of the works realized at the level of each link: design, execution, operation**.
- This is the aspect highlighted at present in all European countries and on which it is necessary to learn.
- **Continuous training programs** have been launched, there are already courses that specialize architects and construction engineers in designing green buildings, with low energy consumption without neglecting the achievement of appropriate comfort conditions.
- There are **programs for training and qualifying the workers** who carry out the renovation work so that their quality improves and the life span of the work increases.
- **It is time to make everyone aware of the necessity of doing well in our current activity. We need strictness.**

PILOT BUILDING - Căminul studenţesc nr. 2, B-dul Lacul Tei, UTCB – new facades in 2007



Executed by
HENKEL CERESIT
For AAECR

Advocacy for multicriterial, interdisciplinary, integrated approach

In order to truly increase the value of a building on the occasion of its energy rehabilitation, necessarily accompanied by the structural consolidation - when appropriate, the improvement of the energy balance must be accompanied by the careful analysis of many other aspects that can be remedied with this occasion, from which should not be missing:

- **the urban study, the rehabilitation at urban level, the landscaping of the space between buildings, the reconsideration of the space between blocks and, modernizing the networks, creating public spaces, arranging parking lots etc.**
- **inserting spaces for kindergartens, education, commerce functional rehabilitation inside the building, etc. and last but not least**
- **making new facades and modern terraces, bridges or attics.**
- **improvement of the heat island effect during the hot period of the year, etc.**

Some aspects to be studied and harmonized

- the use of **unconventional energy sources**,
- the creation of technical or functional **greenhouses** attached to the building,
- the improvement of comfort in winter and summer by providing fixed or **mobile devices for shading** or **night ventilation**.

The numerous systems of labeling of buildings of type BREEAM, LEED, DGNB, CASBEE, green buildings etc. highlight this.

Thermal rehabilitation of the "Prietenia" residential complex comprising 18 residential blocks, str. Prieteniei, Sfântu Gheorghe, jud. Covasna

One project instead of 18
How to attract interes and funds

Executed by ARCON

Revised Mc 001, Chapter 2 Building Envelope

The methodology includes the provisions of the new European standards SR CEN ISO 2017-2018.

Some new aspects:

- **Additions regarding the calculation of the thermal transmittance of the glass elements, (SR EN ISO 10077-1: 2018, SR EN ISO 10077-2: 2018). Complements regarding the influence of shading and sun protection devices (sun visors with various positions), (SR EN ISO 52016-1, SR EN ISO 52022-1: 2018).**
- **Provisions regarding the specific calculation of curtain walls (SR EN ISO 12631: 2018).**
- **For the elements in contact with the ground, simplified calculation, (SR EN 12831 - 1: 2017). And complex calculation according (SR EN 13770: 2017).**

MINIMUM REQUIREMENTS FOR THERMAL AND ENERGY PERFORMANCE were highlighted at the building envelope level, for each category of building-unit-element thereof, including for BUILDINGS WHICH ENERGY CONSUMPTION IS APPROACH TO ZERO - NZEB.

Tabel 2. 1. Tabel sintetic privind aspectele și calculele pentru care se utilizează prevederile din capitolul 2 și standardele europene recomandate

Cladirea (ca atare)		
Submodul 1	**Descriere**	**Standarde**
	M2	
1	Generalitați	-
2	Necesar de energie al clădirii	SR EN ISO 52016-1 SR EN ISO 52017-1 SR CEN ISO/TR 52016-2
3	Condiții interioare fără sisteme (liber)	SR EN ISO 52016-1 SR EN ISO 52017-1 SR CEN ISO/TR 52016-2
4	Modalități de exprimare a performanței energetice	SR EN ISO 52018-1 SR CEN ISO/TR 52018-2
5	Transfer termic prin transmisie	SR EN ISO 13789 SR EN ISO 13370 SR EN ISO 6946 SR EN ISO 10211 SR EN ISO 14683 SR CEN ISO/TR 52019-2 SR EN ISO 10077-1 SR EN ISO 10077-2 SR EN ISO 12631
6	Transfer termic prin infiltrații și ventilare	SR EN ISO 13789
7	Aporturi interne de căldură	A se vedea M1-6
8	Aporturi solare de căldură	SR EN ISO 52022-3 SR EN ISO 52022-1 SR CEN ISO/TR 52022-2
9	Dinamica clădirii (masa termică)	SR EN ISO 13786
10	Permeabilitatea la aer a anvelopei clădirii	SR EN ISO 9972

Superficial temperature factor, fRsi :

$$fRsi=(\theta si-\theta e)/(\theta i-\theta e)=(R-Rsi)/R$$

there is no risk of superficial condensation if : fRsi < fRsi, critic

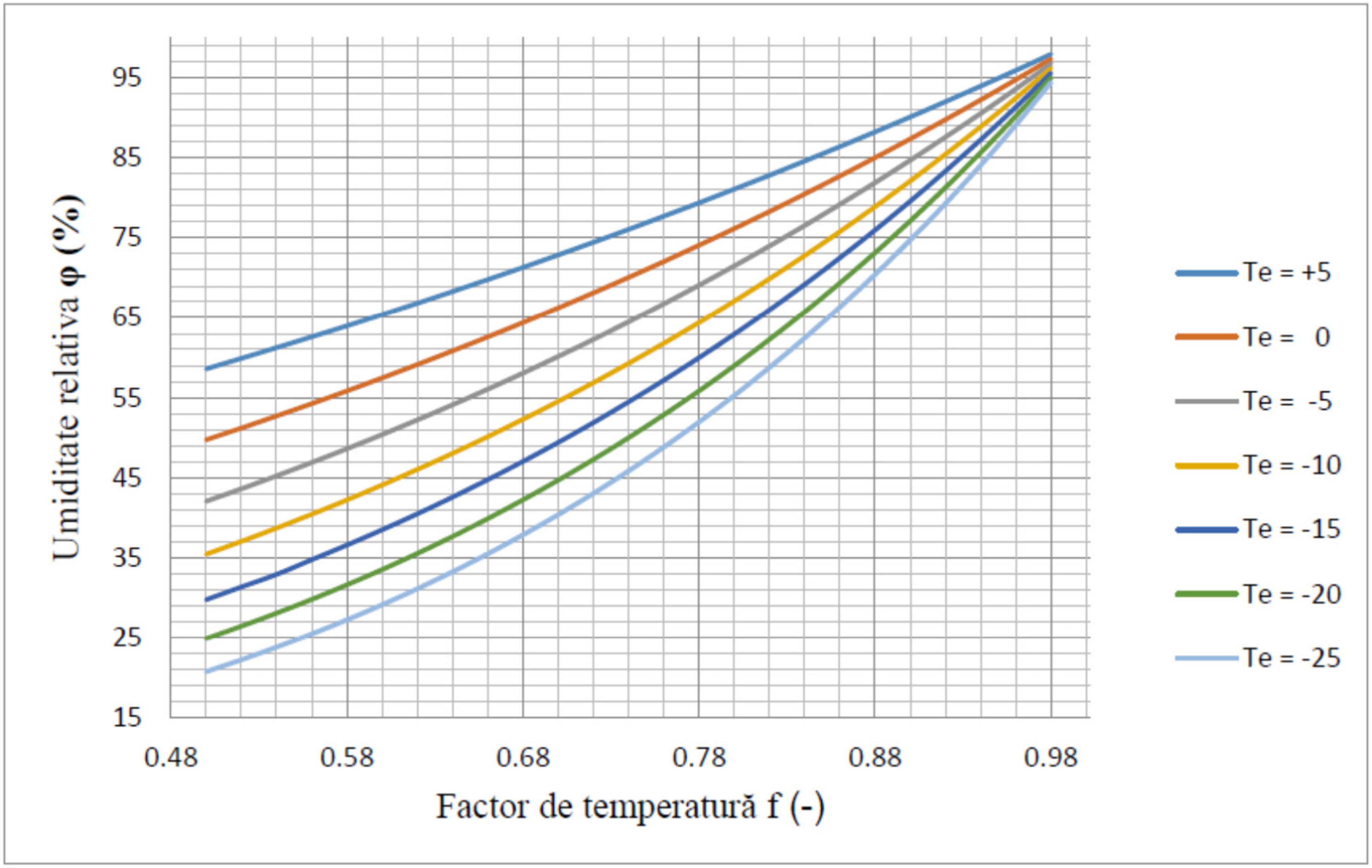


Figura 2.3. Valorile critice ale factorului de temperatură funcţie de umiditatea relativă a aerului interior și temperatura aerului exterior.

When designing residential buildings from energy point of view, the following must be cumulatively respected :

- **a) R’m ≥ R’min for each building element, or, *U’* ≤ *U*'max [W/(m2K)],**
- **b) G ≤ GN [W/m3K]**
- **c) specific annual primary energy consumption for building heating**

  qan ≤ qan,max,

  ≤ P+4E, qan,max=153kWh/m2an iar pentru

  ≥ P+4E qan,max=117kWh/m2an.

Minimum corrected thermal resistances for residential buildings

Tabel 2. 5.a Rezistenţe termice corectate minime (valori normate/de referinţă)

ELEMENT DE ANVELOPĂ	R'_{min} [m²K/W]	U'_{max} [W/m²K]
Pereţi exteriori (exclusiv suprafeţele vitrate, inclusiv pereţii adiacenţi rosturilor deschise)	2,50	0,40
Tâmplărie exterioară	0,90	1,10
Planşee peste ultimul nivel, sub terase sau poduri	7,00	0,14
Planşee peste subsoluri neîncălzite şi pivniţe	2,90	0,35
Pereţi adiacenţi rosturilor închise	1,10	0,90
Planşee care delimitează clădirea la partea inferioară, de exterior (la bowindouri, ganguri de trecere, ş.a.)	4,50	0,22
Plăci pe sol (peste cota terenului sistematizat - CTS)	4,50	0,22
Plăci la partea inferioară a demisolurilor sau a subsolurilor încălzite (sub CTS)	4,80	0,21
Pereţi exteriori, sub CTS, la demisolurile sau la subsolurile încălzite	2,90	0,35

The optimal solar factor g is chosen based on several factors: destination, orientation, weight of the glazed area within the envelope

Resuls:

by choosing an optimal solar factor, the sizing of HVAC installations will also be optimal.

Tabel 2.5.b. Factorul solar g al elementelor vitrate din anvelopa clădirilor rezidențiale

Factor solar, g - elemente vitrate					
Orientare elemente vitrate	Zona climatică				
	I	II	III	IV	V
Expuse la lumina soarelui	0,30 ÷ 0,37	0,33 ÷ 0,43	0,37 ÷ 0,47	0,43 ÷ 0,50	> 0,50

For glazing that is not exposed to solar radiation, the solar factor g may be> 0.50 regardless of the climate zone.

If the same aspect of the glazing is desired on all orientations, the glazing chosen for the orientation exposed to sunlight, can also be placed on the orientation not exposed to sunlight.

The following are presented:

- the MAP OF ROMANIA WITH THE CLIMATIC ZONES FOR THE WINTER PERIOD for the thermal calculations during the cold season and

- the PERFORMANCE PARAMETERS for the buildings whose energy consumption is almost zero - nZEB.

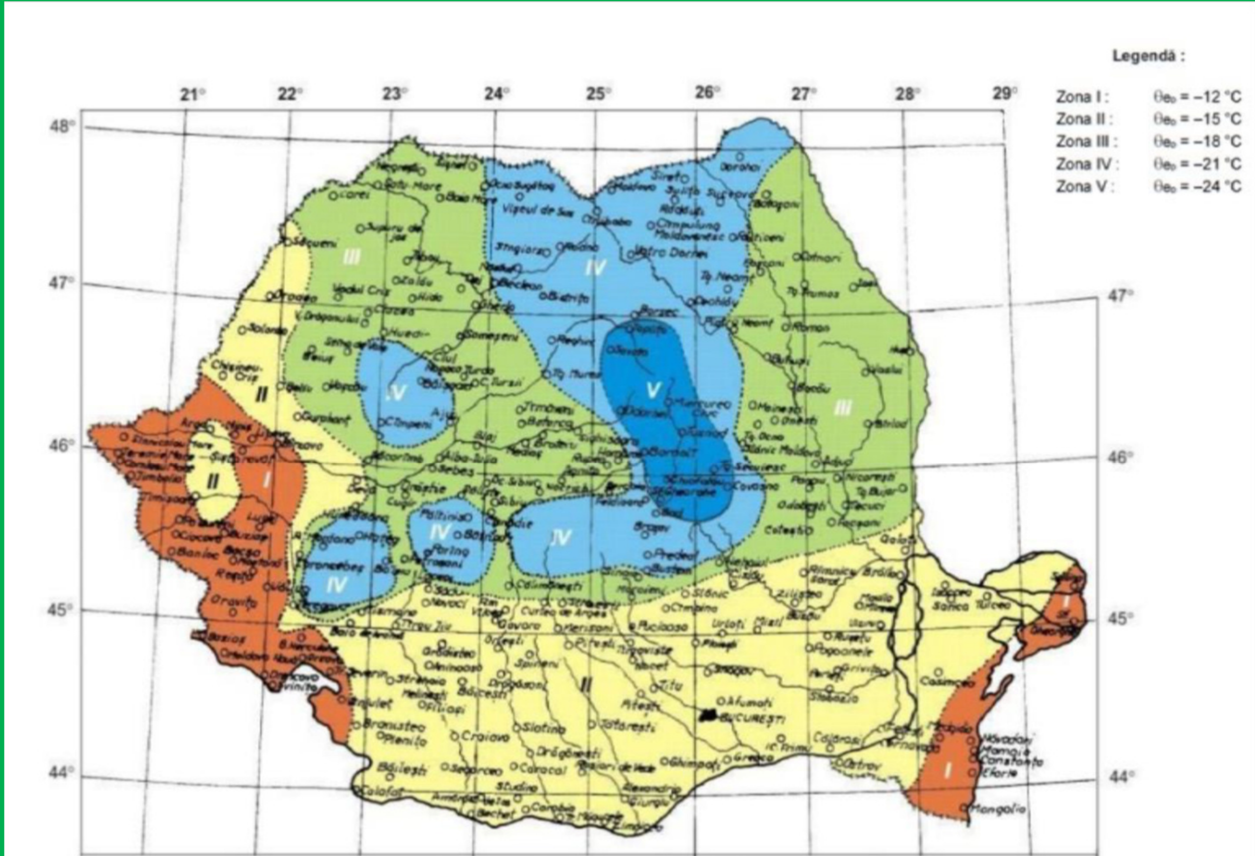


Figura A.1 – Zonarea climatică – iarnă de calcul

Maximum allowable limit values of total primary energy (from renewable and non-renewable sources) and CO2 emissions for nZEB

Tabel 2.11 Valorile limită maxim admise ale energiei primare şi ale emisiilor de CO2 pentru cladirile al căror consum de energie este aproape zero

Zona climatică	Orizont	CLĂDIRI DE BIROURI		CLĂDIRI DESTINATE ÎNVĂȚĂMÂNTULUI		CLĂDIRI DESTINATE SISTEMULUI SANITAR		CLĂDIRI DE LOCUIT COLECTIVE		CLĂDIRI DE LOCUIT INDIVIDUALE	
		Energie primară [kWh/m²,an]	Degajări CO_2 [kg/m²,an]	Energie primară [kWh/m²,an]	Degajări CO_2 [kg/m²,an]	Energie primară [kWh/m²,an]	Degajări CO_2 [kg/m²,an]	Energie primară [kWh/m²,an]	Degajări CO_2 [kg/m²,an]	Energie primară [kWh/m²,an]	Degajări CO_2 [kg/m²,an]
I	31 dec. 2019	50	13	100	25	79	21	100	25	115	31
	31 dec. 2021	45	12	92	24	76	21	93	25	98	24
II	31 dec. 2019	57	15	120	35	97	27	105	28	121	34
	31 dec. 2021	57	15	115	30	97	26	100	27	111	30
III	31 dec. 2019	69	19	136	37	115	32	122	34	155	41
	31 dec. 2021	69	19	136	37	115	32	111	30	145	40
IV	31 dec. 2019	89	24	172	48	149	42	144	36	201	51
	31 dec. 2021	83	24	170	49	142	41	127	35	189	42
V	31 dec. 2019	98	28	192	56	174	49	152	38	229	57
	31 dec. 2021	89	24	185	53	167	48	135	37	217	54

In Romania it is established that the energy from renewable sources produced locally or nearby, should be at least 30%.

Average values proposed for nZEB

Tabel 2. 12. - Valori medii U şi R pentru elemente de anvelopă a clădirii tip nZEB în România

Elementele anvelopei clădirii	Valori medii	
	U $W/(m^2K)$	R m^2K/W
Pereţi exteriori	0,25	4,00
Ferestre	1,00*	1,00
Acoperiş	0,12	8,33
Planşeu peste subsol neîncălzit/ Placa pe sol	0,33	3,03

Notă: *ferestrele sunt de tipul vitraj triplu

PROPOSALS

- **INTEGRATED ADVANCED RESEARCHES – ADVANCED VARIOUS SOLUTIONS OF BUILDINGS ENVELOPE/FACADES - EAD**
- **MULTICRITERIAL DEEP RENOVATION OF DISTRICTS**
- **nZEB PILOT BUILDINGS**

Thank you for your attention