DATA ON RESIDENTIAL NEARLY ZERO ENERGY BUILDINGS (nZEB) DESIGN IN EASTERN EUROPE

APPENDIX 1: QUESTIONAIRE

Instructions Provide a 4-8 page review regarding the challenges and status of nZEB in your country. Develop your paragraphs to answer the following questions and sub-questions. Local references, studies, graphs, or case studies examples are highly appreciated. Please cite the key reference with your text and provide a list of references at the end of the document. The questions below are indicative; please try your best to answer them. Also, feel free to elaborate and explore other key concepts or concerns. You are welcome to exceed the 4-page limit if you like. Do not hesitate to ask contractors, architects, mechanical engineers, and developers to provide the best snapshot picture or overview of your country's situation. Please send me the file in word format.

Author(s): Please indicate your author name and your affiliation as you would like to have it on the paper.

Overview of the challenges of nearly zero energy buildings (nZEB) in Eastern European Countries & Overview of overheating calculation methods in European building energy codes and standards

Aim and Purpose: This paper aims to overview the technical and societal challenges of applying nZEB in Eastern Europe. The cost challenge is excluded from this study. The focus should be on current or future EPBD regulation in your country. The goal is also to provide an overview of the overheating calculation methods accordingly to European building energy codes and standards.

1. **Please fill out the following table regarding nZEB status in your country. Feel free to develop the answers.**

Legislation	
Definition nZEB available	Yes / No
Min. threshold set	Yes / No
Subsidy retrofitting towards nZEB	Yes / No
Min. Energy efficiency PE use intensity ($kWh/m^2.a$)	
Min. perf. Threshold heating demand ($kWh/m^2.a$)	
Min. perf. Threshold cooling demand ($kWh/m^2.a$)	
Life Cycle Assessment	Yes / No
CO_2	Yes / No
Airtightness	Yes / No
Compactness requirement or indicator	Yes / No

Heating Cooling Balance	
Cost optimality approach	Yes / No
Reference building	Yes / No
Natural ventilation possible	Yes / No
Mechanical ventilation requirements	
Technical System Min. performance requirements	
Thermal Comfort Limits	
Climate Zones	
Overheating risk	Yes / No
Thermal comfort Standard	Yes / No
Efficiency vs Renewable Threshold RES (%)	
Construction Quality	
Available materials	High / Medium / Low
Available knowledge	High / Medium / Low

2. **Please provide a map of the climatic areas in your country. Cite the source and make sure to share a high-resolution document.**

3. **What is the minimum energy efficiency threshold for nZEB in your country?**

There is an agreement in Europe to use the end-use and primary energy use intensity indicator to reflect the depletion of fossil fuels and proportional CO_2 emissions. The EPBD recast introduced the concept of nZEB, implying, for new buildings, very high energy performances and low energy needs that must be suppressed by renewable energy sources harvested on site after the end of 2020.

a. *In your country, what are the minimum energy efficiency threshold regarding end-use and primary energy use intensity and CO^2 emissions?*

b. *If there is no minimum threshold, which threshold do you suggest for your country and why?*

c. *Several European countries opt to comply with the PassivHaus Standard to guarantee a minimum performance threshold of 15kWh/m2/a for heating demand. Could this become the case in your country? and why?*

4. **What is the Heating-Cooling balance for nZEB in your country?**

The heating and cooling demand balance are significant for high-performance buildings. In cooling or heating-dominated climates, building designers seek bioclimatic and passive strategies to deal with only one acclimatization system to reduce cost and achieve maximum possible comfort.

a. *Describe your countries' seasonal climate intensity and heating and cooling balance. If you have a climate contrast (for example, heating-dominated cities and cooling-dominated cities), provide your recommendations for the three following options: Cooling dominated zones, Heating dominated zones, Heating and Cooling dominated zones.*

b. *Can you reach nearly zero heating demand?*

c. *Should we opt for highly airtight envelopes or medium airtight envelopes in your country?*

d. *What is the influence of the heating/cooling balance on your energy supply network capacity regarding the electric or thermal demand?*

5. What is the Thermal comfort limits for nZEB in your country?

In 2019, the European Committee for Standardization (CEN) introduced the European standards EN 16798, which suggests adopting the Fanger's PMV/PPD model for mechanically heated and/or cooled buildings and Humphreys and Nicol's adaptive model for buildings without mechanical cooling systems. In 2008, the PassivHaus standard required comfort levels complying with the static model of EN 15251 / 16798 respecting the following rule: the number of hours above 25°C may not exceed 5% of the time working. This criterion is verified by using a dynamic simulation. In Eastern Europe, no studies investigated the correlation between the variations of minimum performance threshold and suitable or fit-to-purpose comfort models in continental climates.

a.1. *Explain the reference standards used in your country to evaluate thermal comfort in nZEBS.*

a.2. *Cite the reference.*

a.3. *Is the comfort assessed based on a static comfort model (like Fanger) or an adaptive comfort model (EN 15251 / 16798)? Explain.*

a.4. *Please fill out the following table regarding overheating in your country. Feel free to develop your answers.*

Country		*France*	*Belgium*
Climate and weather data			
Is comfort dependent on national geographic climate zones? If yes, list them.	Yes / No	*Yes: H1a, H1b, H1c, H2a, H2b, H2c, H2d, H3*	*Yes: Brussels, Flanders, Wallonia*
Do you have a specific comfort calculation approach for heatwaves?	Yes / No	*No*	*No*
Do you take into account the urban heat island effect?	Yes / No	*No*	*No*
Does your overheating methodology take into account future climate change weather files with extreme scenarios?	Yes / No	*No*	*No*

Occupant type			
What is your comfort standard?		*ISO 7730* *EN 15251*	*Passive House (Brussels)* *ISO 13790 (Flanders & Wallonia)*
Does your method embrace the four occupant categories (I, II, III, IV)? *	Yes / No	*Yes*	*No*
Comfort model			
What is your overheating indicator?		*DIES (durée d'inconfort d'été statistique): statistical summer discomfort duration*	$I_{overh} = \sum_{m=1}^{12} Q_{excess\ norm,m}$ *where* $Q_{excess\ norm,\ m}$ *is the excess of heat gains to the indoor set-point temperature for month m*
Is your comfort model based on an adaptative or static method?	Static / Adaptive	*Mixed: adaptive and static for sleeping rooms*	*Static (Brussels), adaptive (Flanders & Wallonia)*
What are your overheating thresholds?		● *all living spaces except sleeping rooms depend on an adaptative model* ● *maximum 28°C operative temperature in sleeping rooms*	*Recommended range: 1000 Kh <* I_{overh} *< 6500 Kh*
Does your model consider local, personalized heating/cooling & ventilation systems (ceiling fans, air-conditioned chairs, electric heating mattresses…)?	Yes / No	*Yes*	*No*
Simulation model			
Is your calculation based on a static/quasi-dynamic/dynamic model? What is the calculation timestep?	Static / Quasi-dynamic / Dynamic	*Dynamic model & hourly calculations*	
Is your overheating calculation based on a single or multizone	Single zone / Multizone	*Multizone model*	

model?			
Does your calculation distinguish sleeping rooms from other living areas?	Yes / No	*Yes*	
Envelope			
Does your method oblige the installation of external shading?	Yes / No	*No*	*No*
Does your method oblige the limitation of the window to wall ratio? If yes, what is the limit?	Yes / No	*No*	*No*
Does your method set an expected G-value? If yes, what is the limit?	Yes / No	*No*	*No*

b. *Do you have fuel poverty problems in your country that might influence the nZEB objective? Explain.*

c.1. *What are the overheating criteria for nZEBs in your country?*

c.2. *What is the overheating risk for nZEB's (highly insulated) in your climate?*

c.3 *How do you evaluate overheating risk in nZEBs in your country? Please share the calculation method and overheating hours limit threshold.*

d. *Can we rely on passive cooling, or must we include active cooling systems for nZEBs in your country?*

6. What is the minimum renewables threshold for nZEB in your country?

Energy efficiency and renewable energy technologies provide essential opportunities to reduce greenhouse gas emissions. Efficiency is a policymaking principle that recognizes the central role of cost-effective energy savings in meeting energy, climate, and economic goals.

a. *Is it more accessible in your country to invest in renewables than in energy efficiency? And why?*

b. *Would you recommend imposing an onsite minimum renewable threshold for energy production produced (from renewable sources)? How much should that threshold be? 30, 50, or 70% of the demand?*

c. *Are regulations and policies ready for encouraging energy-producing buildings in your countries? Is your energy grid ready for that?*

7. What is the construction quality for nZEB in your country?

NZEBs require high construction through new technologies, high-tech components, specialized competencies, and high-level expertise. To achieve NZEBs, the use of energy-efficient technologies and materials is necessary. These technologies and materials must respond to the exigencies of the NZEBs and satisfy the NZEB market demand.

a. *Should we address high-tech nZEB solutions or low-tech nZEB solutions? How and why?*

b. *What are the main barriers to high-quality nZEB construction in your country?*

8. **What should be (your own recommendation) the minimum EE and RET in your country? Fill in the table below** (EE energy efficiency, RET Renewable Energy Threshold onsite):

Category	**EE threshold**		**RES threshold**
	Heating	**Cooling**	

9. **Please list the key publications I should mention concerning your overview (APA style is recommended). Don't forget the national standard in the mother tongue language of your country.**