CoNZ€Bs
Solution sets for the Cost reduction of new Nearly Zero-Energy Buildings

Gradbeni inštitut ZRMK
Building and Civil Engineering Institute

IAQVEC 2019 5-7 September, Bari, Italy

End-users' opinion on living in multi-family Nearly Zero-Energy Buildings (NZEBs)

Speaker:

Marjana Šijanec Zavrl

Building and Civil Engineering Institute ZRMK,

Slovenia

Authors:

M. Šijanec-Zavrl, M. Jacimovic (GI ZRMK)
H. Erhorn-Kluttig, H. Erhorn, M. Illner (Fraunhofer IBP)
K. Engelund Thomsen, K. Wittchen (AAU-SBi)
O. Mørck, M. Sanchez Mayoral Gutierrez (Kuben Management)
M. Zinzi, B. Mattoni, G. Fasano (ENEA)

H2020 CONZEBs aims – „focus on end-user“

- MSs prepared **action plans for construction of early NZEBs** before the full implementation of EPBD requirement on NZEBs - after 2020/2018.
  In the mean-time, several technical concepts for construction of high energy performance buildings - targeting the anticipated NZEBs performance levels - were tested in practice.

Barriers for better penetration of early NZEBs **:**

- current gap in life cycle costs (LCC) of a NZEB building and regular buildings,
- higher investment costs of NZEB
- **the lack of trust in NZEBs among end-users, due to complexity of systems and end-users' believes about various constraints regarding living in NZEBs.**

Woman, 45 years, living in a conventional 70-ties building:

»Triple glazing and windows hidden deep in thick walls will reduce the day-light in the house."

- CoNZEBs project (2017-2019) aims at reduction of the above barriers by studying in detail **the costs reduction opportunities** in new multi-family buildings (MFB) NZEBs and by **addressing most common end-users' myths and fears about living in NZEBs**.

- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

A survey on end-users' attitude to NZEB

CoNZEBs research hypothesis:

Understanding **the doubts and fears** as well as **the opinion of the end-users living and planning to live in NZEBS >>>**

will enable the development of **focused information activities for better acceptance of NZEBs**
among (current and future) tenants and owners
and
thus improve the market penetration of NZEB MFBs.

CONZEBs survey is focused on

- **identification of end-users' attitude to NZEBs** and
- **comparison of the findings** from 4 different countries.

- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

A survey on end-users' attitude to NZEB (2)

Multi-family building sectors in 4 countries strongly **differ** as per

- building tradition, and state of the art in buildings' energy performance (climate),
- the share of rental and users' owned flats,
- NZEB technical definition (or expected definition),
- penetration of early NZEB,
- end-users experiences, confidence in NZEBs and readiness to live in NZEB.

Differences in MFB-stock per countries

Distribution of population by tenure status, type of household and income group - EU-SILC survey [ilc_lvho02]

2017	Denmark	Germany	Italy	Slovenia
Tenant, rent at reduced price or fre	0,1	8,6	9,5	19,0
Tenant, rent at market price	37,7	40,0	18,0	5,4
Owner, with mortgage or loan	47,8	25,7	13,6	12,0
Owner, no outstanding mortgage or	14,4	25,7	58,8	63,6

Source: EUROSTAT

1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings

Šijanec-Zavrl, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Methodology

- A questionnaire – for current and potential future users of NZEBs
  - Common questions used in all participating countries
  - Country specific questions reflecting the national situation of early NZEBs.

- Types of questions:
  - ⌂ questions with multiple choices,
  - ⌂ questions with checkboxes,
  - ⌂ questions with linear scale from 1 to 5,
  - ⌂ questions with paragraph answers.
- The common part addressed the following main questions:
  - Do you know what an NZEB is?
  - Where did you get the information about the NZEB and how good (useful, understandable) this information was for you?
  - **What is important for you as an apartment user?**
  - **What do you think which technologies characterize most NZEBs**?
  - **What would be/were your decision triggers for living in an NZEB**?
  - In which type of building do you currently live?
  - Are you considering moving in a new apartment within the period of the next 5 years?
  - What kind of renewable energy sources do you use?
  - **Do you have any concerns/doubts regarding living i**n high energy efficient buildings?

Methodology (2)

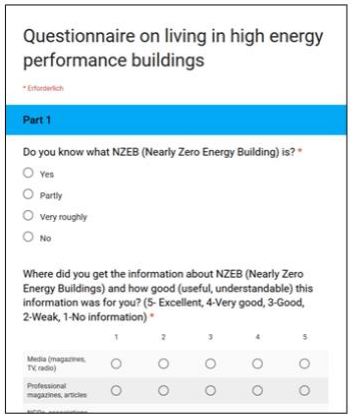
- English questionnaire available as online survey tool on the project web site
- Adapted & translated national languages versions.

Data collection approach:

- **Denmark** - online survey tool,
- **Germany, Slovenia and Italy** combined direct mailing (regular mail, e-mails) with printed questionnaire distributed to interested end-users during meetings,
- **Italy** also applied the online survey by using Google Forms and some face-to-face interviews.
- The survey was **conducted by housing organisations** and elaborated along the common template by research partners.
- The participation in the interviews for end-users was **voluntary** and the interview results were **anonymised**.

- Frankfurt, Copenhagen, Ljubljana, South/East Italy

Link to the questionnaire


Questionnaire on living in high energy performance buildings

* Erforderlich

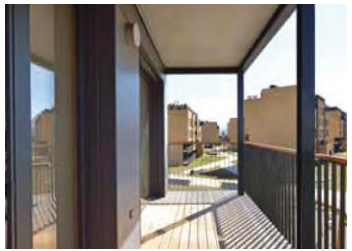
Part 1

Do you know what NZEB (Nearly Zero Energy Building) is? *

- Yes
- Partly
- Very roughly
- No

Where did you get the information about NZEB (Nearly Zero Energy Buildings) and how good (useful, understandable) this information was for you? (5- Excellent, 4-Very good, 3-Good, 2-Weak, 1-No information) *

	1	2	3	4	5
Media (magazines, TV, radio)					
Professional magazines, articles					

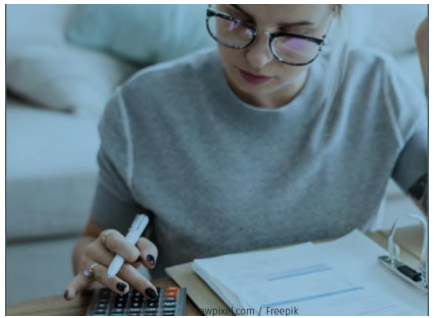


- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Respondents in numbers & structure

- Survey covered **293 end-users** of which
  - **112 are currently** living in an NZEB and
  - **181 are potential future** users of NZEBs.

Country	Current NZEB end-users	Potential future NZEB users	All respondents
Germany	36	10	46
Denmark	19	0	19
Italy	50	81	131
Slovenia	7	90	97
Total	**112**	**181**	**293**
	38%	62%	

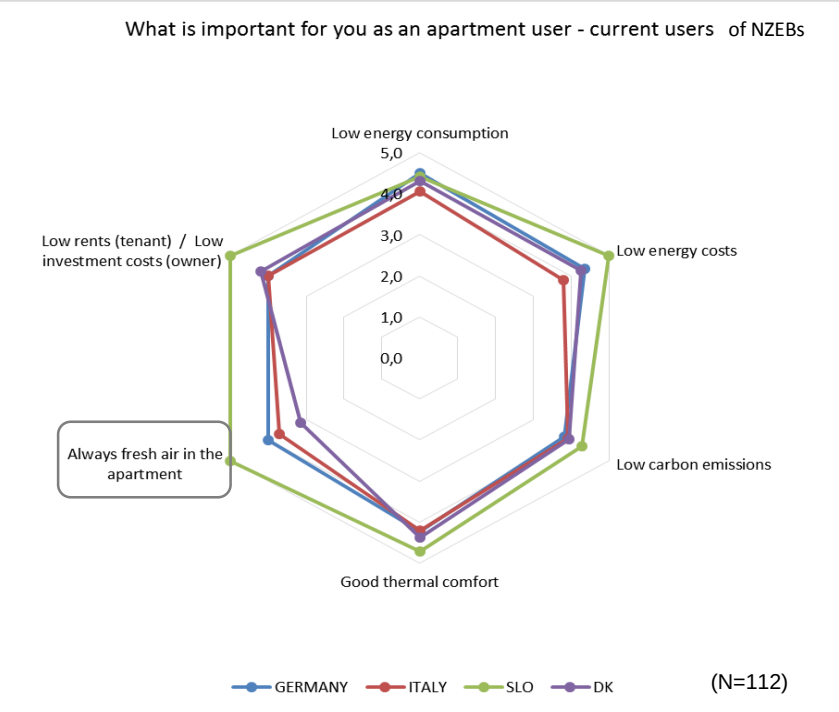


Common findings – end-users‘ expectations

- **Opinion of current NZEB residents** on the importance of certain **expectations about their flats in NZEBs**
- **„good thermal comfort“** and **„low energy use/costs“** (avg_rate 4,4, dev 0.1) are the most important features of the apartment for current NZEN end-users,

- **for Slovenian NZEB users** the most important are low investment costs, low energy costs, fresh indoor air and good thermal comfort,

  on the other hand **for Danish NZEB users** (they have MVHR) fresh air has a bit lower priority.

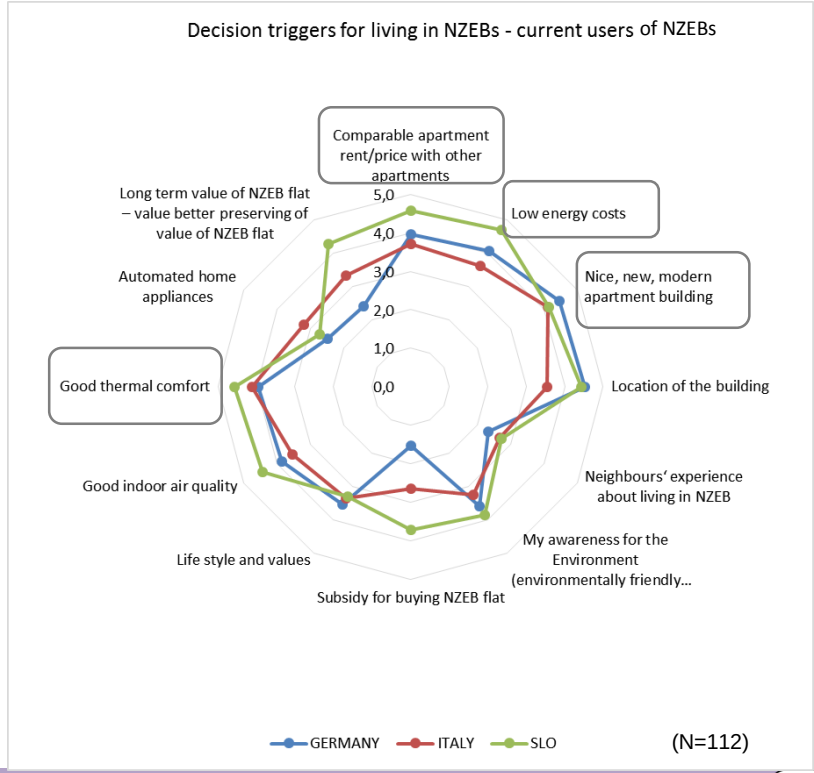


- 1558 – End-users’ opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Common findings – decision triggers to move into NZEB

- **Why did end-users move into an NZEB?**
- The overall most important triggers: **„nice, new, modern apartment“** and **„good thermal comfort“** (avg_rate 4.2)
- followed by „**costs** (rent, energy, maintenance)“ and „**location**“.

- Big deviation per countries in respondents' opinion on decision trigger "better preservation of NZEB flat value in long-term" (0.5).
- In case of owners' used apartments a ***value stability of real-estate*** is an important trigger for moving into NZEB.



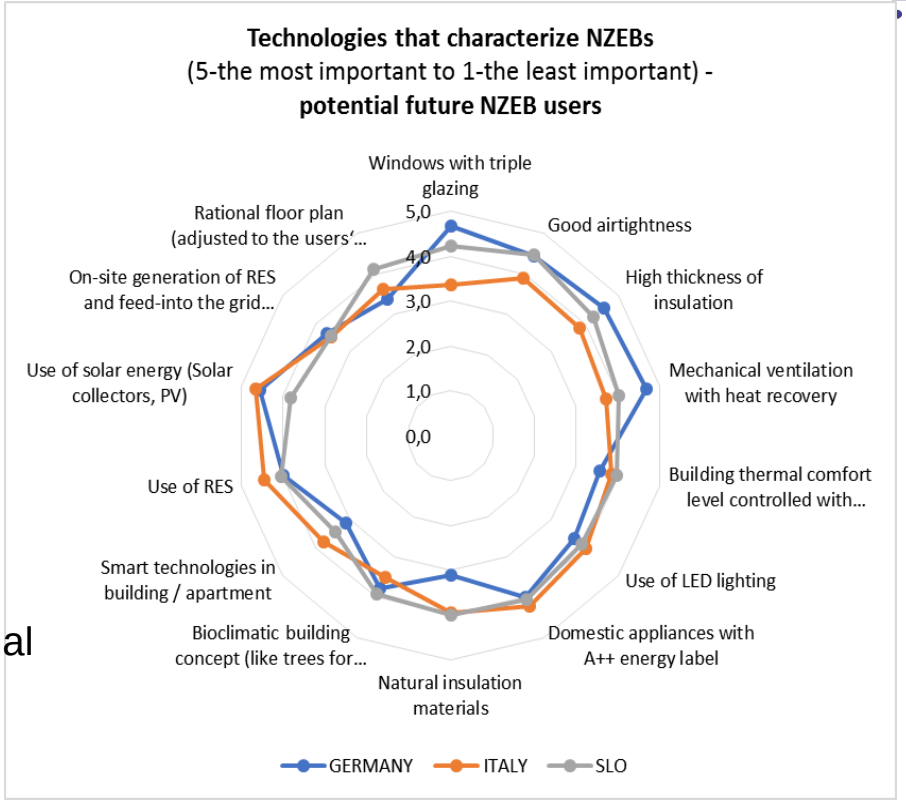
- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Common findings – NZEB related technologies

- **Perception of technologies that characterize NZEBs – as explained by potential future NZEB users**

- **In Italy** solar collectors, PV panels, use of RES, smart technologies, A++ appliances with LED lighting are of utmost significance if building is to meet NZEB level,

  while
  in Germany NZEB is associated mostly with triple glazing, good thermal insulation, envelope airtightness and mechanical ventilation.



- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Results - Slovenia

- Country specific question - related to dilemma: „the more tehnologies in NZEB – the higher maintenance costs“

- 32% of potential-future NZEB users expect bigger maitenance costs in NZEB,
- while none of current NZEB users experienced bigger costs in NZEB!

- 71% of current NZEB users claim not to have bigger maintenance costs

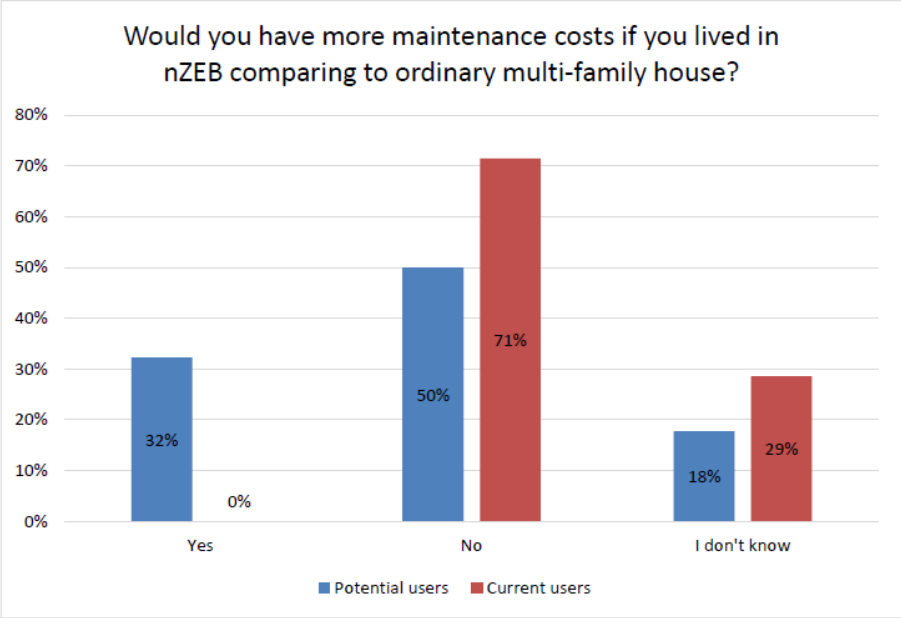


Figure 114: Comparison of the questionnaire for the question "In your opinion, do you have more maintenance costs in NZEBs comparing to ordinary multi-family house buildings?" (Potential NZEB users: N=90, current NZEB users: N=7; Slovenia)

Results - Denmark

- **84% of Danish NZEB residents would choose a NZEB again** if they had to move to another apartment!

- Their **experience with living in NZEBs** (comfort, cost, indoor climate, IAQ) is evaluated as **„good“** (rate 4 on 1-5 scale).

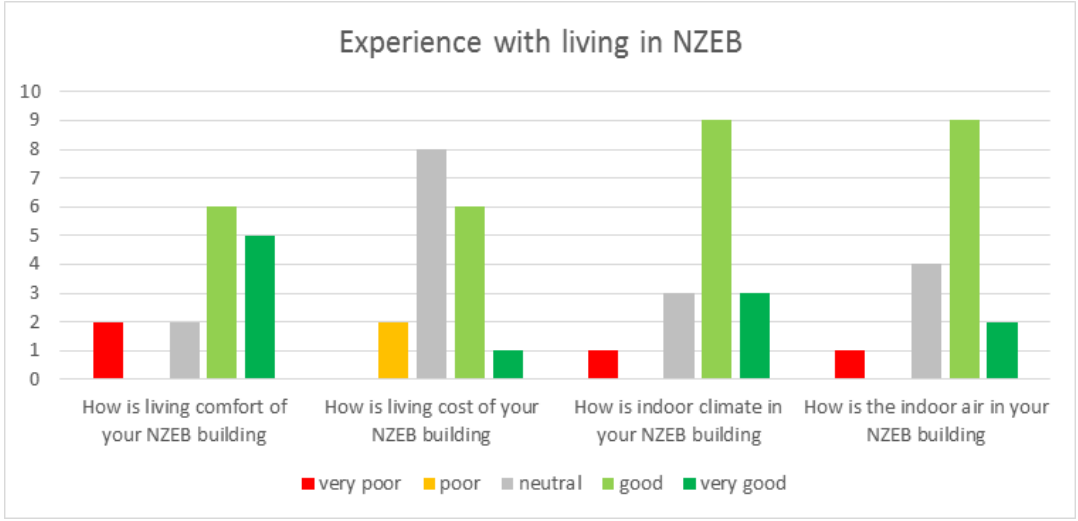


Figure: Knowledge about NZEB solutions among NZEB users in Denmark (N=19)

Results – Italy – the need for technical knowledge

- Respondents living in NZEBs **evaluated technological skills that are necessary to use NZEB buildings**.
- **Most respondents** believe that **technological expertise** for the optimal use of NZEB buildings is **useful, if not necessary.**

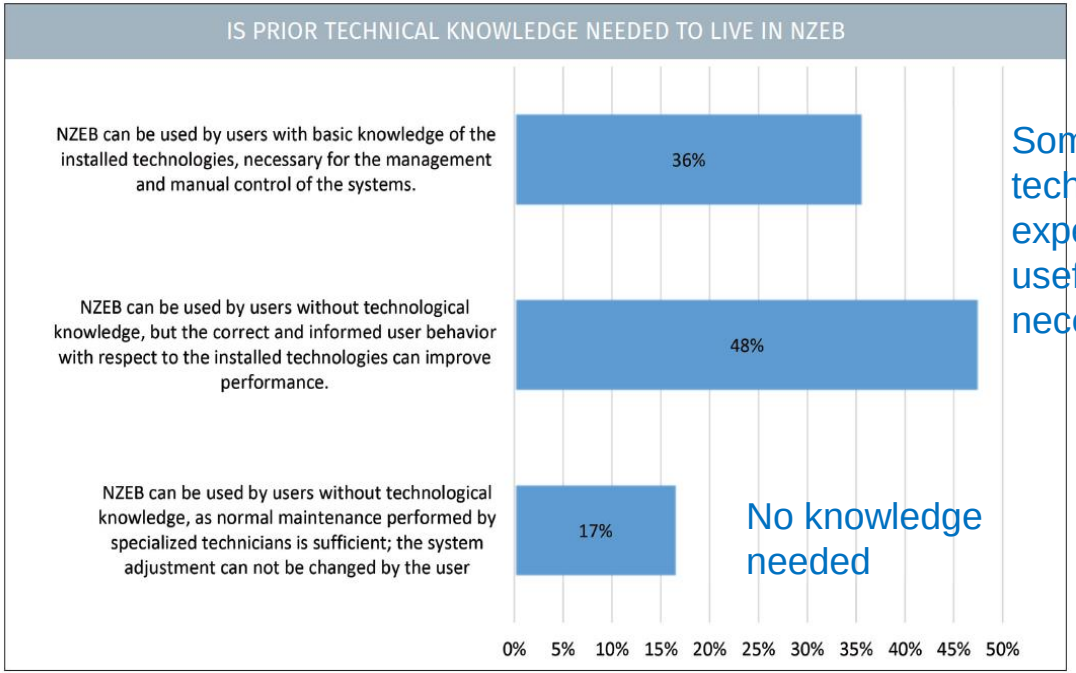


Figure 8: How vital is prior technical knowledge to live in NZEB (Italy)

- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Summary – concerns and doubts

Survey addressed respondents' **concerns and doubts about living in NZEBs**, which are in general connected to:

- **the indoor air quality** (especially the dry air in connection to ventilation systems with heat recovery during the winter),
- **the longevity** of advanced materials and life-time good performance technical building systems in NZEBs,
- **the user friendliness** of control systems and ICT appliances,
- **the cost benefit** of numerous technologies and **their actual usefulness**.

Man, 47 years old, living in a conventional 70s apartement building:

"I am worried about ageing of advanced materials used in NZEB, how durable the sealants can be?"

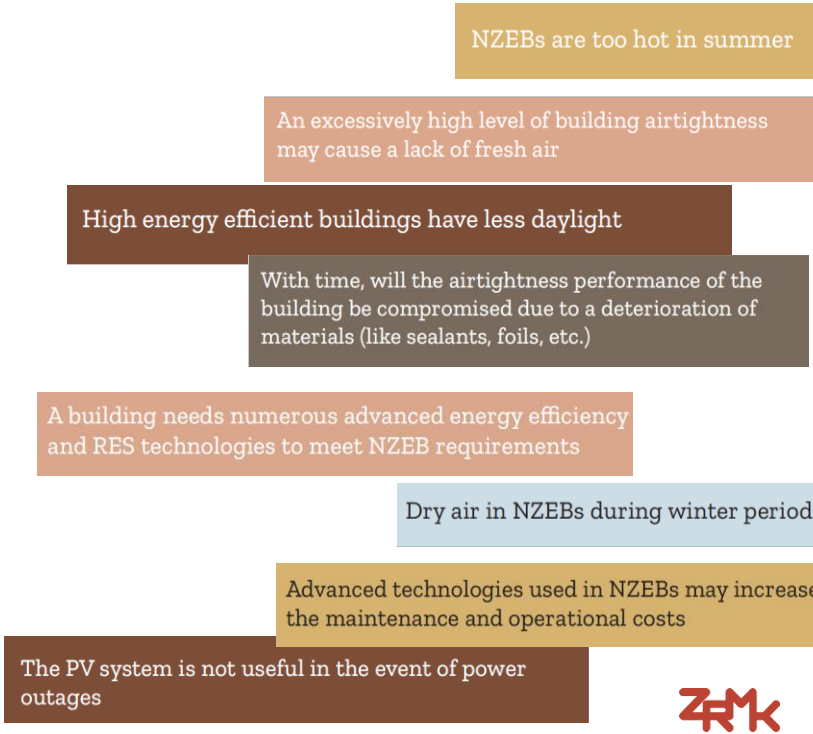
- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Myths about NZEBs

From the end-users opinions about living in NZEBs some typical myths were extracted, like:

- **Myth 1:** “too high building airtightness may cause the lack of fresh air” or
- **Myth 2:** “small windows (to cut energy losses) with low light transmission of advanced glazing systems couse inadequate daylight levels in NZEBs“
- ….

- In a CONZEBs brochure for tenants and users of owners’ occupied flats in NZEB multi-family buildings **10 myths were explained and dispelled with professional clarification**

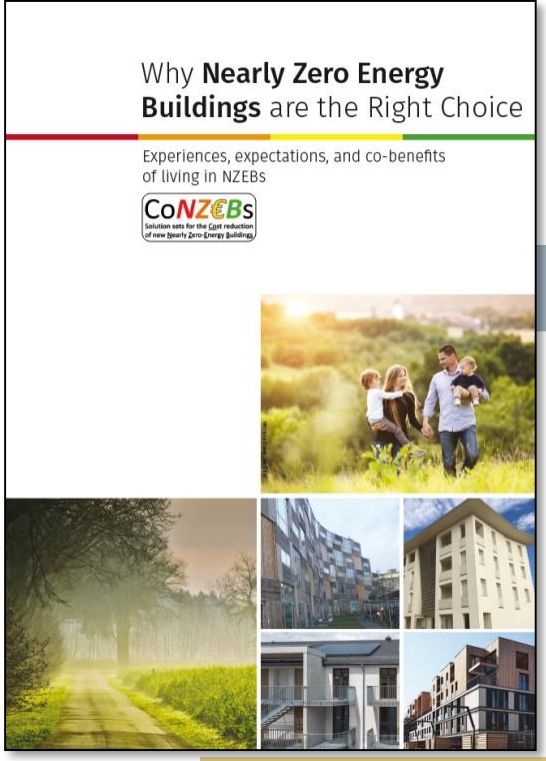


Conclusion

Understanding

- **the doubts** and **fears**,
- the **opinion** of end-users living and planning to live in NZEBs
- **expectations** about dwelling
- **negative and positive** experiences
- **prejudices, myths** about NZEBs

- Information activities for **better acceptance of NZEBs** among (current and future NZEB) tenants and owners.
- The guide **„Why NZEBs are the right choice“** was developed
- www.conzebs.eu



- 1558 – End-users' opinion on living in multi-family Nearly Zero-Energy Buildings
- **Šijanec-Zavrl**, Jacimovic, Erhorn-Kluttig, Erhorn, Illner, Engelund Thomsen, Wittchen, Mørck, Sanchez Mayoral Gutierrez, Zinzi, Mattoni, Fasano

Acknowledgements

The CoNZEBs project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 754046. The paper reflects the authors' views. The Commission is not responsible for any use that may be made of the information it contains.

In Germany, national co-funding is provided by Bundesministerium für Umwelt, Naturschutz, Bau und Reaktor-sicherheit within the research initiative Zukunft Bau (SWD-10.08.18.7-17.33).

Project website with all reports: **www.conzebs.eu**

Questions and Comments?