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Train-to-NZEB
The Building Knowledge Hubs

Reports on the execution of annual Training Plans V3

Deliverable 4.1 of the TRAIN-TO-NZEB project,

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1. INTRODUCTION

This document aims to set out the FINAL training plan as part of the Train-to-nZEB project. There are a number of key milestones applicable to the development of the training plan which have been amended to accommodate the extension of the 6 month timeframe and these are as follows:

- July 2015: Initiated market research and analysis
- Nov 2015: Finalised ToR for BKHs and requirements for training
- Nov 15 to May 2016: **Training Plan V1** – Training Needs Analysis and Market Research
- Sept 2016: Trainers identified in each relevant partner countries
- Sept 2016 onwards: Promotion of the Training courses in each country
- August 2016 onwards: Trainers material to be developed and material made available
- Sept 2016 – June 2017: Carry out Train the Trainer workshops in each country
- April to Aug 2017: **Training Plan V2** – Process of monitoring and evaluation of Train the Trainer workshops and preparation of the training programmes
- Nov 2016 to Oct 2018: Carrying out training Courses in each country with process of monitoring
- Nov 2018: **Final Training Plan V3** – Collation of and evaluation of training workshops and recommendations for sustainable training programmes in the future.

This final report summarises all the Annual Training Plans as prepared for each BKH in each country – Bulgaria, Romania, Czech Republic, Turkey and Ukraine. The first training plan v1 discussed and highlighted the training needs analysis and the market research analysis within each country. The second training plan v2 researched the status quo of the construction market in each country with respect to energy efficiency and near zero energy buildings (nZEB) standards as well as low energy trainings in the fields of nZEB, sustainability and renewable technologies. Further to these studies, a clear understanding of the needs and skills gaps of the construction industry were identified and new training programmes or modified existing programmes were developed to suit the market.

Currently, Building Knowledge Hubs, BKHs are fitted out with fixed and mobile construction models, a varied array of materials, sustainable products and renewable energy systems (RES). These centres or hubs will support the training actions enabling an essential practical approach to training, working alongside theoretical learning in a classroom environment.

As part of the Train to nZEB project a number of trainings were delivered, monitored and evaluated to assess the trainers skills and knowledge, know how and gaps within the construction market. Programmes for Train the Trainer courses or Specific Training courses for specialists, craft/construction workers, and non-specialists, specific to each country, were designed, developed and/or adapted from other courses. These were scheduled and delivered as discussed in this report.

To progress from the first training plan reports v1 and v2, this report will cover more in depth evaluations of the completed courses and a final evaluation of the quality, strength and flexibility of the programmes.

The proposed execution of the Train-to-nZEB training programmes for the nominated three categories; the consortium has approved specialists, craft/construction workers and non-specialists training courses, and these in turn have been monitored and evaluated by the relevant partners in the consortium to ensure quality assurance. Each BKH promoted the training programmes with the involvement of the local industry, professionals and academic partnerships to encourage full intake for class attendance. A specific training plan submitted to the project consortium by each country, for comments, approval and quality control, have been evaluated during project meetings. Additional training material is available through the e-learning tool specifically directed at non-specialists and policy makers. The online learning outcomes are available in Appendix B with access to the tool at https://elearning.passivehouse.com/course/view.php?id=19.

The final training plan report V3 will summarise and evaluate the format, indicative content and learning outcomes of the training courses, delivery of these courses and a summary of feedback from the attendees and industry along with recommendations to promote their sustainability.

2. SUMMARY

Target Groups

The main target groups for training on the Train-to-nZEB project are categorized as follows:

- **Qualified specialists**: high qualified construction specialists, architects, engineers with 4th and higher level of qualification
- **Tradespeople** or general workers: construction specialists from 1st to 4th level of qualification; technicians (4th level of qualification) and installers (3rd level of qualification), and workers (1st or 2nd level of qualification).
- **Non-specialists**: public administration (public officials and policy makers), bankers, real estate experts, investors, representatives of the owners' associations, NGOs, specialized media.

For some of the countries it is believed that an additional category should be included:

- **Graduates, post-graduates and students** (General elective subjects)

Trainers

Currently there are a total of 91 trainers identified with appropriate qualification and criteria to deliver the trainings within the Train-to-nZEB project. This cohort include engineers, consultants, architects, research students, technology specialists and academics, who will have the task in providing nZEB trainings for the above target groups across each of the five countries namely: Bulgaria, Romania, Czech Republic, Turkey and Ukraine.

It was agreed by the consortium through the Train-to-nZEB project, that each Train the Trainer workshop should provide a certification of attendance to each qualified trainer, thus enable the trainer to deliver further training programmes within the Train-to-nZEB project. This will somewhat ensure a standardized level of competency for the Train-to-nZEB trainers. Examples of the Certificate of Completion are available in Appendix A all presenting the Train-to-nZEB logo.

Criteria of qualification

It is important to nominate qualified trainers with a minimum level of competency and knowledge. The criteria for qualification is to be specific for each country, however a minimum level was agreed by the Train-to-nZEB consortium to ascertain the level of competence and knowledge for the nominated trainers and thus quality assurance. The nominated trainers are selected with critical assistance from the project partners from each country ensuring the following minimum criteria:

- Those nominated should have the interest and the willingness to run workshops and training programmes on the nZEB training modules. These modules include issues around the building envelope, building services, RES in buildings, cost optimisation and the building market, products and technologies.
- A good attitude with a willingness to be involved and to be a trainer of others are of critical importance.

In addition, those nominated to take part should ideally be able to fulfil the majority of the following criteria:

- Relevant qualifications in technical area (engineer, architect, energy expert etc.)
- Competency in the application of energy efficiency technologies
- Experience of being a teacher or trainer and, if possible, qualifications in training
- Good degree of computer literacy with the capacity to use online learning tools for delivery and creation of learning materials
- Good knowledge of relevant EU Policies and Regulations
- Detailed knowledge of the market situation, policies, regulations and so on in the country in which they would intend to deliver training
- A capacity to carry out financial appraisals with particular emphasis on cost optimisation and nZEB projects.
- Good fluency and understanding of English and/or specific country of training.
- A capacity and a willingness to learn

It is likely that not all those nominated will have all of these qualifications and qualities but a background in appropriate energy technology and a willingness to learn are critical requirements.
Once this criterion was established, then each country partner agreed to nominate suitable candidates to attend the train the trainer workshops.

List of trainers

Each country will co-ordinate the identification of approved trainers for the project partnership, with the aim of identifying the initial trainers and add to the list as the training programmes progress. For public recognition, an online list of the certified Train-to-nZEB trainers is available on the website at http://www.train-to-nzeb.com/list-of-trainers and up dated regularly during the course of the project. At the time of reporting 91 trainers are listed and their names and qualifications can be viewed in Appendix C of this report.

Training the Trainers

Delivery Methodology

The proposed delivery for the Train the Trainer courses included a classroom and demonstration workshop. Depending on the requirements in each country these workshops were carried out over one or two days. Before the Train the Trainer workshops were implemented, the BKHs were established and fitted with accessible and important equipment, such as demonstration walls, working details and construction models and appropriate building materials, products and technologies to discuss and use during training.

The consortium have agreed and put in place a common certification for attendance and a memorandum of understanding (MOU) between all partners and BKH participants.

TRAINING CONTENT

The Train the Trainer course will employ all programmes, training aids and additional training instruments developed on BUS Pillar II (where available) and will focus on the following content:

(a) Building Envelope – 5 Basic principles: thermal insulation, thermal bridging, air tightness, appropriate window design and ventilation strategy leading to best practice installation for retrofit and new build.

(b) Building Services – Detailed principles: Controlled Ventilation (MVHR and Natural) and permeability testing, Heat Supply (DHW and space heating)

(c) RES in Buildings - Basic principles of RES installation in passive/nZEB buildings, PV installations in buildings, solar thermal installations for DHW, biomass boilers and installations, thermal pumps installation, (ASHP and GHSP), mini-wind turbines and installations, AC and ventilation, Hybrid heating installations

(d) Building Market, Products & Technologies - EU policies and regulations, economic viability (cost optimisation), innovative building technologies and materials on the market, building components and systems, mechanical systems (installations).

(e) Pedagogical Approaches - Delivery tools and styles, understanding cohort, preparation techniques and learning outcomes.

The Train the Trainer training workshops vary for each country and these are discussed in more detail in the next section, Country Analysis. The Train the Trainer activities are available on the Train-to-nZEB website at: http://www.train-to-nzeb.com/uploads/9/8/8/4/9884716/3.3_presentations_and_participants_lists_from_ttt_courses.pdf

3. COUNTRY ANALYSIS

The process of monitoring each of the annual training plans was carried out at three monthly intervals by all country partners and LIT, gathering information on a regular basis to be ready for evaluation during each project meeting. For this report, all the monitoring of the trainings for each country is summarised based on the information provided by the country partners during the course of the Train-to-nZEB project.

BULGARIA

Trainings

Target Groups

The main target groups in Bulgaria have been categorised as follows:

1. **Tradesperson or general workers**: construction specialists from 1st to 4th level of qualification; technicians (4th level of qualification) and installers (3rd level of qualification), and workers (1st or 2nd level of qualification).
2. **Qualified specialists**: high qualified construction specialists, architects, engineers with 4th and higher level of qualification
3. **Non-specialists**: public administration (public officials and policy makers), bankers, real estate experts, investors, representatives of the owners' associations, NGOs, specialized media.
4. **Graduates**, post-graduates and students (General elective subjects)

Training Facilities

In parallel with the initial Train the Trainers campaign, discussions with the University of Architecture, Civil Engineering and Geodesy, UACEG were initiated, resulting in the decision to establish the BKH in the University building and to start a new Master Programme on Energy Efficiency in Construction.

This completed the official signing of the Agreement between UACEG and the Bulgarian partners from the Train-to-nZEB consortium, the new BKH is now fully equipped and functional for training purposes. The BKH is used on a daily basis from 8am until 7pm in accordance to the admission procedure of the UACEG providing good flexibility in its usage.

The premises comprises of the following rooms: glass pavilion (60 sq. m.), ground space (30 sq. m.), hall 51 on the ground floor (60 sq. m.). The training unit is equip with working models and demonstration walls suitable to carry out practical training. Additional equipment and materials are provided to explain processes and installations during the training workshops.

Trainers

Train-to-nZEB Bulgaria strongly rely on the experience gathered in the BUILD UP Skills initiative. In the Pillar II project (BUILD UP Skills EnerPro), more than 100 trainers were trained on the basis of 5-day Train-the-Trainer course in Dublin Ireland, conducted by Passive House Academy, using the distance learning platform developed by Passive House Institute and 8 training courses in 7 Bulgarian cities conducted by project coordinator EnEffect. This intensive Train the Trainer campaign encompassed trainers from more than 10 vocational high schools and a significant number of vocational training centers, universities and the private sector, covering a large territory of the country.

Fig 1. EnerPro training for potential Train-to-nZEB trainers

In December 2015, before the Train to nZEB project, a 2-day Train the Trainer course was conducted in Dublin by PHA, which enabled Bulgarian team members from EnEffect, BCC and BSys to unify their vision for the content and delivery of the Train the Trainer activities. Due to the extensive teaching experience of these trainers and the fact that most had participated in this Train the Trainer course by Passive House Institute under the Intelligent Energy Europe framework (IEE), PassREg project, it was decided that explicit pedagogic training course was not necessary at this point.

On completion of this training, the most active and motivated trainers were identified and approached in person to confirm their availability and willingness to participate in future trainings for the Train-to-nZEB project. Additionally, a number of new trainers were also given the opportunity to participate in the Train-to-nZEB programme and work within the framework of nZEB. To ensure competent professional training of the new trainers, certain upskilling was required, particularly in the field of passive house and nZEB understanding. PHI and PHA were invited to deliver a dedicated Train the Trainer course in the University on the 3rd- 4th November 2016, pedagogical training was not provided within this training workshop.

Based on the above Train the Trainer workshops, 33 trainers are approved and the list is available on the Train-to-nZEB website at http://www.train-to-nzeb.com/list-of-trainers.html and also in Appendix C, Annex 1 of this report.

Training Courses

Train the Trainers Course

The Train the Trainer course is carried out in a blended training format by firstly completing the on-line Train the Trainer Course developed by PHI (www.elearning.passivehouse.com) accounting for 28 hours and then completing a classroom and demonstration training workshop accounting for 12 hours.

The 2 day Train the Trainer workshop was held in Sophia on the 3rd- 4th November 2016. The agenda and signed attendance sheets are presented for the Train the Trainer workshop held at UACEG for 26 participants and are available to view in Appendix D, Annex 1 of this report.

The training content at the Train the Trainer workshop was presented in English, however material for the training workshop has been translated into Bulgarian to assist with clearer understanding. This material is included in Appendix D, Annex 1 of this report.

It has been determined that the training courses need to be flexible, interesting, visual and practical based with clear and comprehensive up-to-date information in sustainable construction and in particular nZEB. The proposed delivery methodology for the training will be carried out in a blended format with on-line information being made available and in class practical and theory based learnings being applied. All the training courses are designed to provide modules devoted to nZEB principles, energy efficiency in buildings and Renewable Energy Systems (RES), as well as to provide facilities for demonstration workshops and testing of new products, technologies and innovative solutions. These courses are offered to all parties involved in

the entire construction value chain, including producers and distributors. The diverse background of the potential trainees would also contribute to the viability and practicability of the project content.

Training Courses for target groups

Having established through the market research that modules should be interesting, meaningful, comprehensive and accessible, focusing on best practices and real issues. The daily program should be a flexible combination of theory, practice and breaks, to enable participants to concentrate and study efficiently. It is equally important to recognise that each target group requires different needs, and this criteria should be considered when choosing a suitable trainer to carry out appropriate training.

The full list of training topics for each target group is presented below:

- **Tradespeople:** building envelope; building systems; building market, products and technologies; PVS; solar thermal; biomass; mini-wind; heating ventilation and AC; hybrid systems; certified passive house tradespeople; airtightness; ventilation systems with heat recovery; and insulation systems + thermal bridges.
- **Specialists:** Certified PH Designer/Consultant; nZEB design basics; airtightness; ventilation systems and heat recovery; insulation systems + thermal bridges; RES in nZEBs;
- **Non-specialists:** PH/nZEB economics; PH/nZEB basics; PH/nZEB design basics; airtightness; ventilation systems with heat recovery; insulation, PH windows & thermal bridges; RES in nZEBs.

Cat. No.	Training program / Occupation	No. hours	Short description / reference
A	**On-site Construction Crafts & Professions (TRADESPEOPLE)**		
1	Building Envelope (BUS EnerPro)	40	Online course + 2 days (theory and practice).
2	Building Systems (BUS EnerPro)	40	Online course + 2 days (theory and practice).
3	Building Market, Products and Technologies (BUS EnerPro)	40	Online course + 2 days (theory and practice).
4	PVs (BUS EnerPro)	40-60	Modular structure > 60% practice, each participant is encourage to attend more than 1 course
5	Solar thermal (BUS EnerPro)	40-60	Same as above
6	Biomass (BUS EnerPro)	40-60	Same as above
7	Mini-wind (BUS EnerPro)	40-60	Same as above
8	Thermal pumps (BUS EnerPro)	40-60	Same as above
9	Heating, ventilation and AC (BUS EnerPro)	40-60	Same as above
10	Hybrid systems (BUS EnerPro)	40-60	Same as above
11	Certified PH Tradesperson-envelope & systems	20	Following the PH scheme
12	Airtightness	16	Theory + practical
13	Ventilation systems with heat recovery	16-24	Theory + practical
14	Insulation systems + thermal bridges	16-24	Theory + practical
B	**Designers, consultants, building managers (SPECIALISTS)**		
1	Certified PH Designer / Consultant	56-80	Following the PH scheme
2	nZEB design basics	24	Online training + theory + demonstrations
3	Airtightness	16	Online training + practical
4	Ventilation systems with heat recovery	24	Online training + theory + practical
5	Insulation systems + thermal bridges	24	Online training + theory + practical
6	RES in nZEBs	24	theory + practical
C	**NON-SPECIALISTS**		
1	PH/nZEB economics	8	theory + demonstrations
2	PH/nZEB design basics	8	theory + demonstrations/ practical

3	Airtightness	8	theory + demonstrations/ practical
4	Ventilation systems with heat recovery	8	theory + demonstrations/ practical
5	Insulation, PH windows & thermal bridges	8	theory + demonstrations/ practical
6	RES in nZEBs	8	theory + demonstrations/ practical

Table 1. Training courses for target groups

For further information on the Learning Outcomes and indicative content for these courses, refer to Training Courses and LOs, Appendix E, Annex 1 of this report.

Monitoring and Evaluation

As part of the monitoring and evaluation process to measure the trainee's experience and satisfaction rates for the course, a number of factsheets were distributed at the beginning and end of the courses to ascertain feedback from the trainer. These factsheets are to be completed in the future Train the Trainer courses to determine the ability and skills of the trainers and to establish if the training content if appropriate for refresher courses etc. Additionally participants were furnished with learner feedback sheets to determine their understanding, levels of approval, participation, suitability of content and relevance of resources. Such identification would help guarantee that the subjects/topics are practically applicable and the training methods correspond to the trainee's needs.

%	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1. The content was relevant to my learning needs					
2. The trainer had a good knowledge of the material and general area					
3. The material was delivered at an appropriate pace					
4. Class participation was encouraged					
5. Programme materials were useful and relevant					
6. Training room was suitable for the programme					
7. I would recommend this training to others					

The training courses for construction workers commenced even before the opening of the Bulgarian BKH, as a result of the negotiated cooperation schemes between the regional professional schools for architecture and construction centres from five towns in Bulgaria **- Sliven, Stara Zagora, Silistra, Gabrovo and Yambol.** These regional training centres have been developed to provide building envelope courses (insulation and air tightness) for construction workers. For instance, in the period February-May 2017, the regional partners conducted 6 two-day-courses for 170 construction workers. These courses include the following topics: NZEB Basics, hydro and thermal insulation of buildings and equipment, living comfort, energy savings, etc.

After the official opening of the BKH, 45 training courses were carried out for a total number of 601 participants during the period June 2017 to September 2018.

These training courses included the following: NZEB and Passive House basics, Certified Passive House Tradesperson, Airtightness and blower door tests, Design and installation of windows, Multi-comfort house, Train-the-trainer – practical issues.

A number of non-specialist seminars and training courses were also conducted regionally increasing the number of participants to a total number of 771.

The courses are designed for the entire construction value chain, including producers and distributors, with modules devoted to nZEB principles, EE and RES solutions in buildings, providing demonstrations and practical experience and the testing of new products, technologies and innovative solutions. The diverse background of the trainees (covering engineers, architects, civil servants, NGOs representatives, construction workers, graduates, students, non-specialists, etc.) contributes to the viability and practicability of the project content and training experience. All of the participants and trainers were asked to measure their experience and satisfactory level through different means like entry tests, post-training surveys, interviews and other suitable methods, which allowed the partners to guarantee that the subjects/topics are practically applicable and the trainings correspond to the trainee's needs. Feedback from the participants is available in more detail in Appendix F within the Bulgarian final training plan and a number of quotes from the participants is as follows:

- *"Presenters pace and style were excellent. Very engaging"*
- *"Good, well-paced, and clear presentations."*
- *"The style was good and the ability of the presenter to expand was good."*
- *"Very knowledgeable and engaging."*
- *"Content was more than I could have hoped for."*
- *"Very comprehensive coverage with further support if required."*

Based on the **feedback** we could outline that one of the most common impressions shared by the majority of the participants in the trainings is that the teaching methods are directed with a modern and contemporary approach. The majority claim that the modules are interesting, comprehensive and focus on best practices and real life issues. The BKH's programs are well balanced between theory and practice. Another significant aspect is the diversity of the programs – the overall opinion is that they are different and appropriate for each target group with corresponding complexity and content. The practical exercises also receive a very high approval rate, however the majority of the participants would emphasise that additional practical exercises would benefit the courses greatly. BG BKH will take this into consideration in the future courses and balance theoretical and practical levels of teaching.

The following will present a summary of the feedback from the building technicians, site managers and other staff, managing buildings related to building renovation (construction specialists and construction workers). The feedback covers many different aspects of the trainings and the participants are convinced that the implementation of well thought projects requires certain skills. The construction specialists, site managers and contractors understand that they must be familiar with the general principles and standards (not just related to low energy), and that they have to update and expand their

competences regarding the technologies that are being used, the types of innovative materials and their different characteristics in the building envelope.
The main topics of the Construction Insulation course, for instance, are devoted to the common methods and normative requirements for the design and implementation of hydro, - thermal, - sound, - corrosion and fireproof insulation in the construction of buildings and facilities. The highly insulated envelope is at the heart of improving the occupants conditions in buildings, and combined with energy efficient building services will provide energy saving on space and hot water heating, as well as improving the health and comfort levels in of buildings. The trainings are organized and conducted by actively involving the participants in the learning process. The theoretical lessons alternate with hours of application of the acquired knowledge, summaries and control. The trainings are illustrated appropriately using interactive methods.

Another very important aspect of the feedback from all 3 target groups is the high level of satisfaction with the trainers, which of course is crucial for the success of the trainings.

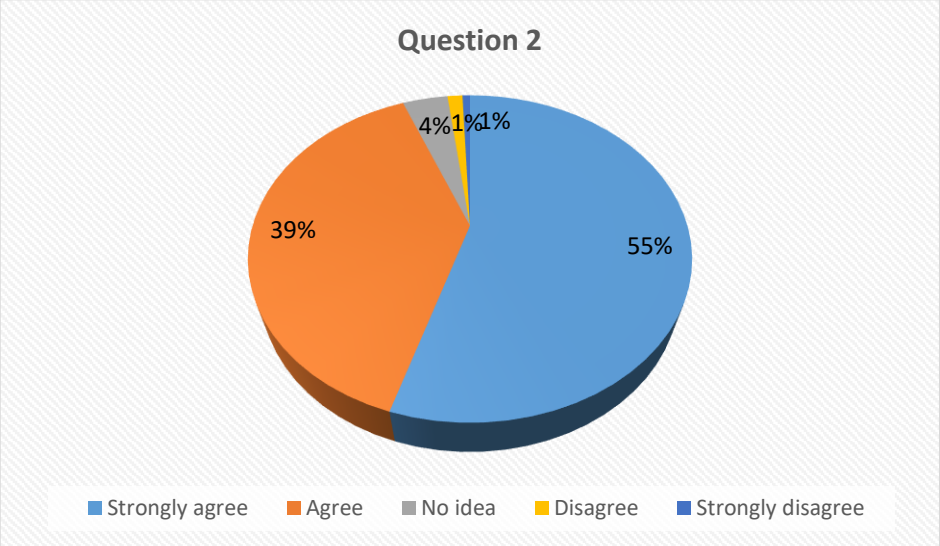

Figure 1. The answers given to “the trainer had a good knowledge of the material and general area” in the survey

In conclusion, the Bulgarian BKH and the trainings so far, as well as those planned for the future, have proven to be a great success in the local market. There is a serious lack of Energy Efficient or nZEB trainings in Bulgaria and the BKH is one of a kind, which automatically places it in both an advanced and a risky position. The advantage is that it is a leader and it serves as an exemplar in its country, but it is a risky business, because the lack of competition sometimes acts as a demotivating factor.
Nevertheless, over the last 16 months, the BG BKH Center is building a strong and serious reputation, and not only in professional circles, but thanks to the widespread dissemination and communication strategies, it has gained much popularity among non-specialists (journalists, NGO representatives and civil servants).
However, it is clear that there is a strong need for continuous improvement of the qualification and life-long training related to the application of the new technologies in the construction market. Enriching the content of the trainings is a constant task for all trainers at the BG BKH in terms of providing innovative energy efficient solutions or utilizing the missing competencies for the introduction, operation and maintenance of new or existing buildings and facilities.
The trainings are organized in accordance with the current requirements for expanding the professional knowledge, skills and competencies of the employees, as well as with the needs of the employers in the construction sector. The learning outcomes are related to the updating of knowledge on the methods of implementation of different types of building materials. Participants receive basic theoretical knowledge and

are being prepared to embrace and absorb future, more detailed theoretical and practical knowledge and skills in the different spheres of the building process.

Last, but not least, the trainings actively involve the participants in the learning process. All trainees go through practical experience, which allows discussions, exchange of ideas, opinions, and good practices.

BKH Bulgaria have put in place a strategy to upskill trainers as outlined in the following section Future Plans. It may be prudent to review the nZEB market need in Year 3, to determine if the number of trainers could be increased to facilitate demand in the nZEB market. It should also be considered that upskilling and refresher courses may be required to ensure that the trainers are upskilled regularly especially in the field of RES and innovative new materials. Additional information is available in Appendix D, Annex 1 - Bulgarian, Training Plan v2.

Future Plans

Although the initial Train the Trainer (TtT) courses were carried out in the first year of this project, it is important to carry out another TtT course to further train new trainers. It is envisaged that the approved group of trainers will complete a refreshment course annually and new trainers will be added on a year by year basis, as it is provisioned that regular TTT sessions will be conducted in the BKH (at least once per year, and more in case of demand from external parties). The courses will also be offered to new training centers willing to engage in the network. In case there are trainers without sufficient pedagogical background (at least 2 years of teaching practice in the past 5 years or academic degree), specialized pedagogical Train the Trainer courses will be held using the already available Train-to-nZEB training programmes and materials.

This however is likely to start after year 5 when hopefully demand is apparent.

The schedule for trainings for differing stakeholders is as follows:

TARGETS	YR 1	YR 2	YR 3	YR 4	YR 5	TOTAL
TTT - Number of trainers	24	-	-	-	-	24
Tradespeople - issued certificates	400	200	200	250	300	1350
Designers - issued certificates	80	40	40	50	60	270
Non-specialists - issued certificates	100	80	50	50	50	390

Table 2. The 5 year plan - future goals and overall strategy

For the short-term strategy during the project, BG BKH had completed a training schedule as follows:

- 2 local train the trainer (TTT) courses for small groups of 10-15 people;
- 60 training courses for construction tradespeople or 600 trainees' certificates;
- 12 training courses for designers, consultants and building managers or 120 trainees' certificates;
- 18 training courses for non-specialists with decision-making functions or 180 trainees.

The medium-term strategy applies after the project's end, for the following three years. The overall objectives for this period are 15-20 courses (15-20 participants per course) per year. As for the commercial price of the courses, the estimations indicate up to 190 BGN (97 EUR) for tradespeople; up to 300 BGN (153 EUR) for specialists; up to 50/80 BGN (26-41 EUR) for non-specialists. The schedule in the long-run is as follows:

- **3rd year** – 10-13 courses for 200 workers; 2-3 courses for 40 specialists; and 3-4 courses for 60 non-specialists;
- **4th year** – 12-15 courses for 250 workers; 2-3 courses for 50 specialists; and 4-5 courses for 70 non-specialists;
- **5th year** – 15-20 courses for 300 workers; 3-4 courses for 60 specialists; and 4-5 courses for 80 non-specialists;

With the start of the new active season at UACG in October 2018, the Bulgarian BKH introduced much more varied curriculum, which includes topics such as building physics and thermodynamics and RES, but it also continues to focus on air-tightness and ventilation systems with recuperation. The BKH also introduces a 2-day certified construction specialist course for Passive Buildings, which is held under the official program of the Passive House Institute - Germany.

Of course, many aspects could be improved and the trainings are far from perfect. Nevertheless, they have proven to be efficient, contemporary and satisfying for the majority of the participants. But the economy (cost of the courses, seasonal availability and employers' willingness) is what matters the most, especially in countries like Bulgaria where the overall EE knowledge and such contemporary topics are far from popular at the moment. Of course, the length of the course, the location, the lecturer, the course content, the theory/practice ratio, the communication flow, etc. – these all are extremely important factors, but they are not in the core of the issue.

The overall efforts and hard work provides a robust guarantee for the future sustainability of the Bulgarian BKH. Thanks to the great cooperation with the University of Architecture, Construction and Geodesy, the training programmes will continue next year and beyond, but it is still rather early to announce any dates since the project partners have to take into consideration the curriculum for each semester, and the Spring programme of the University is still not put in place. The project partners will announce through all available communication channels, the upcoming dates and topics for the 2019 trainings.

ROMANIA

Trainings

Target Groups

BKH Romania provide training and consultations in nZEB for construction workers, specialists and decision makers. The most relevant occupations for the implementation of nZEB training are as follows:

- **Construction workers (on site)**: Chief Engineer in Constructions, Solar Photovoltaic Systems Installer, HVAC Installer, Solar Thermal Systems Installer, Foreman in Constructions, Windows Systems Installer, Technician (builder, installations), ETICS Installer, Insulator etc.
- **High qualified specialists**: Installations Engineer / Designer, Engineer / Designer for Civil, Industrial and Agricultural Buildings, Architect, Energy Auditor for Buildings, Projects' Verifier, Technical Expert etc.
- **Non-specialists:** Building Administrator, Worker in Local Administration (investments & urbanism departments), Building/Real Estate Developer, President of Owners' Association, School Director etc.

Some additional skills considered relevant for the nZEB market, may require amendments to the existing training programs and are identified as: technical skills, project management, communication skills, physics in buildings, marketing, natural & mechanical ventilation etc.

Training Facilities

The project Train-to-NZEB is implemented in Romania by a team of three specialist organizations in the energy performance of buildings, urban development, consulting and business development and training in the construction sector, covering the entire range of activities related to the project. The collaboration (known as BKH RO) between the three organizations: the National Institute for Research and Development in Construction, Urban Planning and Sustainable Territorial Development "URBAN-INCERC" , Business Development Group (BDG) and the Foundation for Professional Training and Education Pre-FUTURE (FPIP) proved successful.

Cluster Pro-nZEB have supported Train-to-nZEB partners with the design and preparation of mock-ups, materials and small systems. These include the demonstration models crucial to carry out the training programmes. The main services provided by the BKH RO are technology demonstrations, theoretical & practical trainings, technical consultancy, R&D, technology integration, and nZEB. The local partners in Brasov have organized the construction and provision of materials to complete RES solar energy mock-ups specifically used for the RES modules within the training programmes. The main clients are on-site workers, high level specialists, designers and decision makers. The training courses are organized in-house and in partnership with in-house and external experts & trainers.

Fig 2. Training materials at Bucharest and Brasov BKHs.

Trainers

In order to participate as a trainer within the Train-to-nZEB program organised in the BKH RO, a person should prove competency in both the technical and pedagogical areas. The technical competences can be documented using previous certificates and diplomas, as well as from work expertise and background detailed in a CV. The pedagogical competences could be proven either by a document to certify fulfilment of

specific pedagogical training requirements for trainers (According to Romanian legislation, see below a-g), or by following the TTT pedagogical module developed (h).

a) Certificate of professional training for the TRAINER profession, issued by a certified training supplier (obtained for the 242401 position/occupation in the Nomenclature of Occupations in Romania in an authorized training program according to the Ordinance no 129/2000 on adult training),
b) Professional competencies or graduation certificate obtained in a UE member state. The recognition and equivalence of certificates will be made by the competent authority (respecting the legal procedures),
c) MASTER diploma in adult education or train the trainer, issued by a higher education institution,
d) DOCTOR diploma in education science, with a doctoral thesis in adult education field,
e) An attestation to prove that he/she is working in a teaching position at vocational, technical or high school level,
f) An attestation to prove that he/she is working in a teaching position in a higher education institution,
g) An attestation to prove that he/she is working in a teaching position in research,
h) Pedagogical training proved by participating at the TTT courses organized within the project.

A number of trainers attended and completed the Train-to-nZEB Train the Trainer course on 8th-9th February 2017 at NIRD URBAN-INCERC in Bucharest. These trainers are to be certified to train nZEB training to the construction industry and are mainly academics and experts in the field of sustainable construction. These trainers will be selected to train specific planned training courses based on their expertise and availability. A list of approved trainers is available in Appendix C, Annex 2 of this report with regular updates carried out on the website at: http://www.train-to-nzeb.com/list-of-trainers.

1. Horia PETRAN, PhD, Senior researcher, NIRD URBAN INCERC, <hp@incerc2004.ro>
2. Cristian PETCU, PhD, Senior researcher, NIRD URBAN INCERC, <cristian.petcu@yahoo.com>
3. Felicia MEREUTA, Building services engineer, FPIP, <felicia.mereuta@gmail.com>
4. Alina MEREUTA, Civil Engineer, FPIP , <aleenca@gmail.com>
5. Ciprian NANU, Business Developer, BDGroup, <ciprian.nanu@bdgroup.ro>
6. Narcisa DANILA, Business Developer, BDGroup, <narcisa.danila@bdgroup.ro>
7. Mihaela GEORGESCU, PhD, Assoc. Prof. University of Architecture and Urbanism “Ion Mincu” Bucharest, <mihaelastela.georgescu@yahoo.com>
8. Norana PETRE, Architect, Certified Passive House Designer, <norana.petre@atelier1.ro>
9. Marius Gherman, Engineer, Certified Passive House Designer, Home-energy, <homexenergy@gmail.com>
10. Ligioara FLOREA, Engineer, The Ownership Association of Thermo- Insulating Carpentry Producers, <ligiaflorea@gmail.com>
11. Gabriel CLISU, Engineer, Energy auditor, <gabriel.clisu@gmail.com>
12. Vlad Ciobanu, Engineer, Certified Passive House Designer, <c.vlad@zecaph.com>
13. Cezar CALEAP, Engineer, ZERO ENERGY Association, <euromaster22@yahoo.com>
14. Ede ABOS, Architect, Passive House Association of Romania, <ede.abos@asociatiacasapasiva.ro>
15. Radu GRIGORESCU, Engineer, QETICS - The Group for Quality Thermal Insulating Systems ‘’ETICS’’, <radu.grigorescu@qetics.ro>
16. Andrei CECLAN, PhD, Engineer, Servelect / Technical University Cluj-Napoca, <andrei.ceclan@servelect.ro>
17. Mugur BALAN, PhD, Prof., Technical University Cluj-Napoca, <Mugur.Balan@termo.utcluj.ro>

18. Ioan MOGA, PhD, Prof., Faculty of Civil Engineering, Technical University of Cluj-Napoca, <ioan.moga@ccm.utcluj.ro>
19. Ligia MOGA, PhD, Assoc. Prof., Faculty of Civil Engineering, Technical University of Cluj-Napoca, <ligia.moga@ccm.utcluj.ro>
20. Ancuta MAGUREAN, Engineer, energy auditor for buildings, <anca.magurean@yahoo.com>
21. Andrei BEJAN, Engineer, Romstal Academy, <andrei.bejan@romstal.ro>
22. Dorin BEU, PhD, Prof., Technical University of Cluj-Napoca, <dorin.beu@insta.utcluj.ro>
23. Florin DOMNITA, PhD, Prof., Technical University of Cluj-Napoca, <florin.domnita@insta.utcluj.ro>
24. Nicoleta COBARZAN, PhD, Assoc. Prof., Faculty of Civil Engineering, Technical University of Cluj-Napoca, <Nicoleta.Cobarzan@ccm.utcluj.ro>
25. Catalin DUMITRU, Engineer, SC CLASS MEISTER SRL, <office@classmeister.ro>
26. Zoltan MAROSY, PhD, Prof., Ecological University of Bucharest, <marosy.zoltan@gmail.com>
27. Cristi BURGHELEA, SC CMB Green Technology SRL, <cmbgreentechnology@gmail.com>
28. Mariana BORCEA, Engineer, energy auditor for buildings, Saint Gobain Construction Products Romania, Rigips Division, <mariana.borcea@saint-gobain.com>
29. Mihaela SIMION, engineer, energy auditor for buildings, Fabryo Corporation, <Mihaela.Simion@fabryo.com>
30. Marius ȘOVLETE, engineer, Creative Engineering, <ingineriecreativa@gmail.com>
31. Viorel FLOREA, civil engineer, Certified Passive House Designer, ASPRO PRODINVEST srl, <office@aspro.ro>
32. Ruxandra CRUȚESCU, Certified Passive House Designer, Associate professor, Facultaty of Architecture - University "Spiru Haret", <crutescuruxandra@gmail.com>
33. Irina OPRESCU, energy auditor for buildings, ACIR SERV SRL, <i_escu@yahoo.com>
34. Andrei DAMIAN, energy auditor for buildings, Associate Professor, Technical University of Civil Engineering Bucharest, <adamian7@yahoo.com>
35. Dragos SIMA, civil engineer, Aledra Systems, <dragos.al.sima@gmail.com>
36. Szabolcs VARGA, PhD, civil engineer, energy auditor for buildings, Certified Passive House Designer, V&V Projekt, <office@vvp.ro>
37. Aurel Maruneac, civil engineer, ROBSON Construct srl, maruneac@gmail.com

Training Courses

Train the Trainers Course

The Train the Trainers Program created a critical mass of trainers in Romania, who have the necessary technical knowledge, skills and experience to carry out specific nZEB training, in order to provide preliminary assistance to target groups in the construction industry. The Train the Trainer program designed on the structure and information from the PHI and PHA Train the Trainer, TtT Course (Passive House basics), and additional modules from LIT (Pedagogical approaches) and NIRD URBAN-INCERC (national specific nZEB information).

Fig 3. Train the Trainer Course held on 8th-9th February 2017 Classroom and Demonstration Activities

The course agenda and signed in attendance sheets of participants is available in Appendix D, Annex 2 of this report.

Training Content

The training session is carried out in two main parts; theoretical and practical based in the BKH facility at NIRD URBAN-INCERC:

- Technical training (Passive House principles and National context including cost optimal calculations), and Pedagogical training (tips and appropriate techniques to train different target groups).
- Practical training utilising demonstrative materials within the EPB centre such as: Mock-ups: insulation, airtightness, thermal bridges, various structures & ETICS, mechanical ventilation with heat recovery, airtightness room with air permeability test and working models/mock-ups for airtightness and insulation exercises.

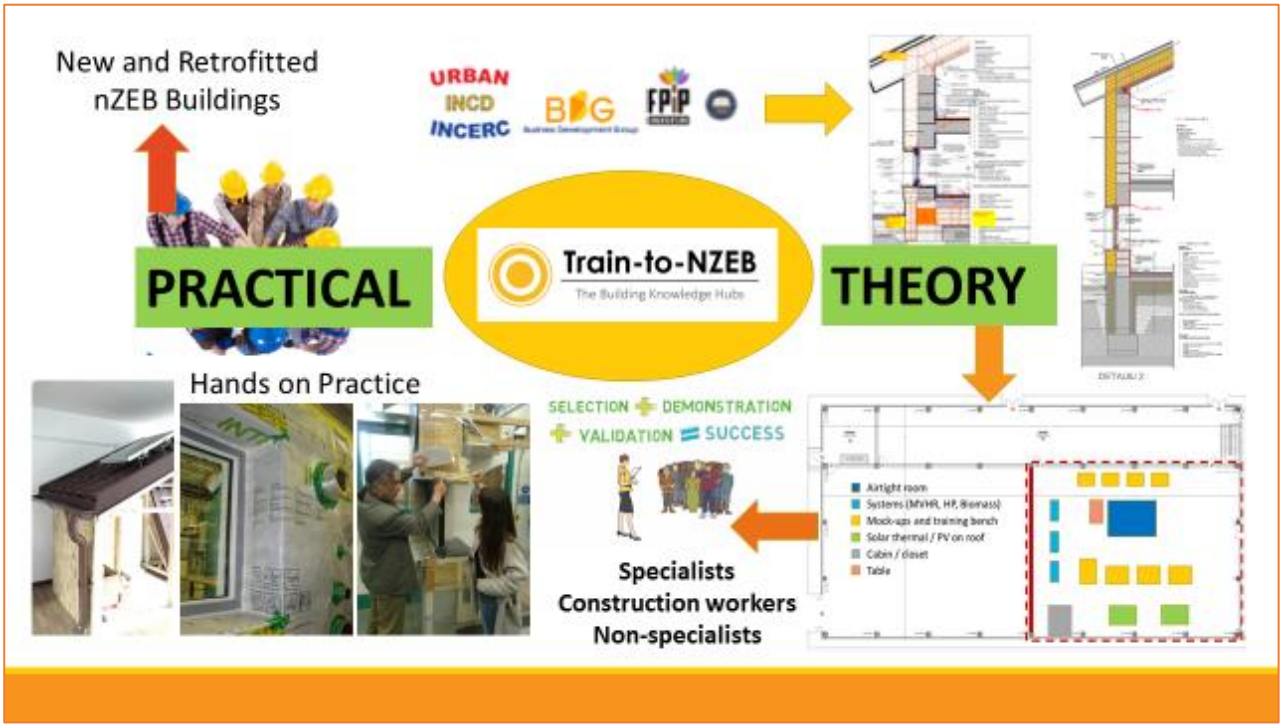

Fig 4. Process of training from theory to practical to provide nZEB

Proposed Delivery Methodology

The TTT course is to be interactive, with open discussions led by trainers. The majority of participants were selected from academic staff trained in architecture, civil & building services, engineering or building professionals with proven experience in passive houses / low energy buildings design or construction. Most of the selected trainees have technical knowledge in the field of constructions and installations, some have

already participated in training courses organized by PHI and others have already teaching/training experience and pedagogical formation (e.g. trainer certificate or sufficient activity in the education system). No formal evaluation or examination have been carried out at the end of the TTT course, but questions will be prepared by the trainers during the training modules, while a short recap is intended during the practical activities and demonstrations.
Feed-back from the participants will be sought based on a specific form prepared by one of the course organisers, LIT. This information will form the basis for evaluating, not only the Train the Trainer course but also for future training courses.

Training Courses for target groups

The courses are implemented with theoretical and practical classes, aiming at a minimum 50% practical hours. These training courses are framed in a number of modules, each with a detailed description of knowledge and skills gained, competence acquired, learning outcomes, training aids and materials, evaluation procedure and total duration.
In preparation, BKH Romania have listed a number of training programs to be provided by the BKH center after a series of meetings with stakeholders exploring the possibility of potential partnerships. Based on market analysis, the following list of training programs for each target group and learning objectives are defined:

Designers, consultants, building managers (specialists)

No.	Module	No. of hours	Concept and design principles of nearly zero energy buildings		nZEB energy performance rating (integrated design and energy efficiency)		RES systems for nZEBs	
			Module	hrs	Module	hrs	Module	hrs
1	nZEB buildings – general specifications	3		3		3		3
2	nZEB principles insulation envelope. Thermal bridges	2		2		0		0
	M2-1.1	0,5		0,5				
	M2-2.1	0,5		0,5				
	M2-2.2	0,5		0,5				
	M2-4.1	0,5		0,5				
3	Airtightness in nZEB buildings type	6		2		0		0
	M3-1.1	1		1				
	M3-1.5	0,5		0,5				
	M3-2.1	0,5		0,5				
4	Windows and other transparent exterior elements. U values for windows	2		2		0		0
	M4-1.1	1		1				
	M4-2.1	0,5		0,5				
	M4-3.1	0,5		0,5				
5	Heat gain through windows and other exterior transparent elements	2		2		0		0
	M5-1.1	0,5		0,5				
	M5-2.1	0,5		0,5				
	M5-3.1	0,5		0,5				
	M5-4.1	0,5		0,5				
6	Ventilation for nZEB -basic principles	2		2		0		0
7	Heating principles of spaces in passive houses/nZEB	3		3				
8	Solar shading and summer comfort	4		4				
9	Electricity consumption	2				2		
10	Principles for achieving energy balance	4				4		4

No.	Module	No. of hours	Concept and design principles of nearly zero energy buildings		nZEB energy performance rating (integrated design and energy efficiency)		RES systems for nZEBs	
			Module	hrs	Module	hrs	Module	hrs
11	Principles for calculating economic efficiency	6				6		6
13	On-site execution management and quality assurance	3				3		3
14	Refurbishments using nZEB components	3		3		3		
15	Information and support for nZEB occupants	2				2		2
16	Principles and overall solutions for the use of renewable energy in nZEB	6		6		6		6
17	Heating and DHW operating on biomass	6						6
18	Heating equipment with heat pumps	6						6
19	Mini-Wind systems for buildings	6						6
20	Solar electricity generation - PV systems	6						6
21	Thermal solar systems	6						6
22	Nearly zero energy building in the concept of green building	3		3		3		
	Total hours	**91**		**32**		**32**		**54**

On-site Construction Crafts & Professions

No.	Module	Hours	Building Envelope in nZEBs (Insulation systems + windows)		Ventilation systems with heat recovery in nZEB		Building Systems (HVAC) in nZEBs		Solar thermal systems		PV Systems (PVTRIN)
			Module	hrs	Module	hrs	Module	hrs	Module	hrs	Hours
1	Nearly zero energy buildings (nZEB) – general specifications	**3**		3		3		3			certified Photovoltaic systems installer
2	nZEB principles of envelope insulation. Thermal bridges	**6**		6							
3	Airtightness in nZEBs	**6**		6							
4	Windows and other transparent external elements	**6**		6							
5	Renovation of existing buildings using nZEB components	**3**		3		3		3			
6	Ventilation for buildings - basic principles	**3**				3		3			
7	Ventilation in a passive house / nZEB	**3**				3		3			
8	Heating via fresh air	**3**						3			
9	Basic principles: thermal energy supply	**3**						3			
10	Space heating in a passive house / nZEB	**3**						3			
11	Heating systems - execution details	**3**						3			
12	Heating systems - Renovation of existing buildings	**3**						3			
13	Integration of RES systems in buildings	**6**								6	
14	Economic efficiency - nZEB	**2**		2		2		2		2	
15	Process of construction and quality assurance	**2**		2		2		2		2	
16	Information and support for nZEB users	**1**		1		1		1		1	
17	Summer comfort. Shading Systems	**3**		3							
18	Legal framework and concepts for nZEB realisation	**1**		1		1		1		1	

No.	Module	Hours	Building Envelope in nZEBs (Insulation systems + windows)		Ventilation systems with heat recovery in nZEB		Building Systems (HVAC) in nZEBs		Solar thermal systems		PV Systems (PVTRIN)
			Module	hrs	Module	hrs	Module	hrs	Module	hrs	Hours
19	Nearly zero energy building in the concept of green building	**3**		3				3			
20	Thermal solar systems	**6**								6	
TOTAL HOURS		**69**		**36**		**18**		**36**		**18**	**120**

The certified Photovoltaic panels installer -COR 741103 is a specialization certified training course; the diploma offered is for graduation and is international recognized according to the law (ordinance 129/2000).

Module	Description	Hours Theory	Hours Practice
1	Permanent activities on construction sites	6	14
2	Photovoltaic systems	9	14
3	Support structures for photovoltaic systems	6	20
4	Connecting the photovoltaic system components	10	20
5	Maintenance and repair of photovoltaic systems	7	14
TOTAL 120 hours		38	82

non-specialists

MODULE	Hours	Theory, laboratory	Practical applications
1. Legal framework and concepts for nZEBs	6	3	3
2. Economic efficiency principles for nZEBs (cost optimality)	6	3	3
3. Building envelope in nZEBs (insulation, windows, thermal bridges and airtightness)	6	2	4
4. nZEB in the context of green buildings	6	3	3
Total hours	**24**	**11**	**13**

Fig 5. Training courses for target groups developed by BKH RO

The learning outcomes are defined for each module taking into account the defined competency (one per module) and specific knowledge & skills for the corresponding module. These are detailed further in Training Courses and LOs, in Appendix E, Annex 2 of this report and in the Training Plan v2 in Appendix F, Annex 2.

Monitoring and Evaluation

The successful implementation of the training programmes are dependent upon the successful completion of the objectives and learning outcomes. Therefore, BKH RO have ensured that some administrative actions are put in place:

1. An electronic record is available for all the successful trainers who have completed the Train the Trainer course and fit the criteria for qualification. It is important to show the level of competency of the trainers to ensure transparency and technical understanding for each of the training courses.
2. It is important to provide each participant a “certificate of completion” after completing a training programme or module of the course. These certificates provide value to the training programme and may encourage further training or assist with continuous (professional) development.
3. A number of measures have been carried out to ensure that the participants complete the course and have the skillset to do same.
    - Application form for each participant, to be able to check their eligibility for the target group,

- Signed attendance sheet

4. To evaluate the training workshops, a number of factsheets have been compiled by LIT. Factsheet 1 completed before the course starts, outlines the LOs, course content and delivery, whilst Factsheet 2 is completed after the event summarising the training workshop and any issues foreseen by the trainer. To support the factsheets and for publicity purposes, photos are taken to illustrate the performed activities.
5. To further monitor and evaluate the training programmes, each participant is requested to complete a feedback questionnaire at the end of the course. Feedback is provided in the form of multi choice questions about the course content, delivery and trainers. It is hoped that future evaluation is carried out to ascertain if the relevant nZEB training has made an impact on the work of the trainee whilst on the construction site.

Summary of implemented Train the Trainer course – Building Knowledge Hub Romania (BKH-RO)

Feedback from the questionnaires for the Train the Trainer workshop involved 51 participants with 36 questionnaires completed and received. Refer to Appendix E: Annex 2. A Summary is listed as follows:

1. **The relevance of the Train-the-Trainers "Passive House Concepts" course content was:**
   - **excellent (40%)**
   - **very good (54%)**
2. **The structure of the training course was:**
   - **very well planned, participants assimilated the necessary knowledge (82%)**
   - **it needs improvements (18%)**
     - more practical examples
     - more (local) case studies
     - more time dedicated for training
3. **Other subjects to be addressed in the future:**
   - cost efficiency for renovated and new buildings
   - a synthesis of common messages and customized ones for target groups
   - case studies analysing the real consumptions, post retrofit
   - renewable green technologies
   - retrofitting, practical training
   - more retrofitting aspects, more case studies and examples from Romania
   - cost benefit analysis
   - a more complex study of optimal realisation of renewables systems, on certain areas
   - specific subjects for the local social, economic and climate context in Romania; common design and execution solutions, possible to be adopted in Romania
   - more thermal bridges details
   - more details on thermal insulation and renewables systems
   - debate on changes to be applied to the new calculation methodology of energy performance
   - working groups with other experts (structures engineers, entrepreneurs, public authorities) for improving the buildings regulations
   - installations for nZEB
   - heat pumps, solar systems
   - comparative labelling of buildings
4. The trainers' activity during the training course (presence, professionalism) was:
   - excellent (74%)
5. The communication with the trainers was:
   - excellent, participants communicated very well with the trainers during the courses (83%)
6. **The methods used in transmitting the information were:**
   - excellent (33%)
   - very good (53%)

7. **The volume of information transmitted during the training course was:**
   - excellent (25%)
   - more than enough (50%)
8. **Participants' expectations have been fulfilled at the end of this course:**
   - very much (51%)
   - beyond expectations (37%)
9. **The organization of the training course (venue, catering etc.) was:**
   - excellent (36%)
   - very good (47%)
10. **Other suggestions:**
    - presentations from the training sessions to be sent to participants
    - more frequent training sessions
    - Train to nZEB or/and Train to PH?
    - solutions to be adapted to the legislative framework in Romania and to the seismic context
    - case studies in Romania, critical stages of the project and images from the execution phase, specific details
    - practical and interactive workshop in small groups for the participants to get to know each other
    - presentation of participants, the current situation in Romania, a clear presentation of local objectives under an action plan
    - more meetings initiated by URBAN-INCERC
    - Congratulations!

Fig 6. Results of the Feedback Survey -Train the trainers course – 08-09.02.2017

Summary of implemented training programs – Building Knowledge Hub Romania (BKH-RO)

It's necessary to make an evaluation every four months, for the courses implementation strategy, based on the feedback from the participants, work market analysis and training needs.

Programs for the non-specialists / decision makers:

Two courses were implemented for decision makers / non-specialists:

1. Legal framework and concepts for nZEBs – Basics (2 to 4 hours) and
2. Legal framework and concepts for nZEBs (6 to 8 hours).

The short version of the course (basics) was performed during larger workshops (e.g. together with ProgressHeat) and in locations without practical training facility, while the full day courses were organised within BKH-RO Bucharest or Brasov facilities and included 2 hours of practical exercises.

The courses have been organised in various cities representative for all regions in Romania.

The public administration representatives are interested in the discussion of the legal framework and apparently the technical elements are less appealing and just few participants have basic construction knowledge, which makes the training course less interesting (according to the feedback questionnaires – the neutral zone). The practical elements present interest, though they are not interested in spending more that 4-6 hours in a training course.

For the representatives of the owners' associations, the technical details are too complex; and interest is directed towards the practical elements, the materials exposed. Training which is longer than 4 hours/day is too tiring for them, they have problems retaining concentration.

However, the information about building physics and Passive House principles was greatly appreciated because of the novelty compared with the usual practice in Romania (especially when the theoretical presentations were combined with practical exercises and demonstrations). As a general feedback, the content was recommended as very good, but more examples tailored on the specific Romanian construction practice and Passive House / nZEB concrete examples were considered necessary for a future content update.

Programs for the construction workers / on-site specialists:

Six courses were implemented for construction workers / on-site specialists (of which 2 are planned for the next Train-to-nZEB period):

1. Passive House Certified Tradesperson (24 h – the course divided in 2 specialisations – Building envelope and Building system, organised in parallel sessions in the same training program),
2. PV systems installer (120 h – accredited under the national qualification system),
3. Building Envelope in nZEBs: Insulation systems + windows + thermal bridges (4 to 10 h),
4. Legal framework and concepts for nZEBs – Basics (2 to 4 hours),
5. Ventilation systems with heat recovery in nZEB (4 to 10 h) – planned,
6. Solar thermal systems (4 to 10 h) – planned.

The construction workers, qualified workers, technicians, foremen are all generally interested in this training, but difficult to bring to training sessions; if the diplomas were to be officially recognized by the Labour Ministry; these people would possess a greater motivation to attend. BKH-RO currently carry out flexible training courses, with timeframes of 18 to 36 hours, however many of the target groups are asking for a shorter and more compact training, so that the maximum duration can be 1-2 days. The companies are not interested in paying their employees to spend 3-7 days in a training course because the nZEB market demand is still low. This could be carried out in a two stage process or even as a part time course, so not to interfere with the workloads of the workers.
People agree with the need of change and are attracted to nZEB buildings, but their opinion is that the current legislation is fragmented and the bureaucracy is uninterested and big, which discourage them to pursue this direction.
The most popular training programs were the 'Passive House Tradespersons' and 'PV systems installer'. Both provide the possibility to obtain a recognised certification, both internationally in the construction industry and nationally by the ministries of education and labour.
The technicians, qualified workers are very interested in learning the nZEB technology, but it's very important for them to have a recognized diploma at the end of the course. They prefer 3-4 meetings of 2-3 hours/day. According to the feedback, the contents are satisfactory but they would prefer to have the possibility of having more complex practical exercises and site visits. These changes would incur higher costs by BKH-RO and at this point they are unable to cover. There is a neutral zone regarding the personal importance of this information for about 30% of the participants.
In the past 4 years it is difficult to encourage groups of specialists and tradespersons into training as it is a very demanding period on the construction market and the need for the workforce is acute. The company recommendation is that these trainings should take place on weekends, because the weekdays equate to valuable time for the Romanian entrepreneur.

Programs for the specialists – designers and experts:
The key course implemented for designers and experts was the Passive House Certified Designer / Consultant. The course content was translated in Romanian as well as the PHPP planning tool, which is offered together with the course material. A nZEB introduction is performed at the beginning of each course session to understand the usefulness of Passive House design in the nZEB context, while the new classification of PH (classic – plus – premium) could offer the missing piece required in nZEB compliance (renewable energy). Additional elements and discussion are given during the course regarding the national approach and application of the PH standard.
The course was implemented together with the Bucharest Branch of the Romanian Chamber of Architects (2 sessions) and is currently organised in collaboration with the Romanian Chamber of Architects in Cluj-Napoca. An examination is provided for the course participants in order to obtain the certification from PHI.
Currently there is no other training course for designers or experts developed and delivered in Romania due to the lack of reliable calculation methodology that could be used as a trusted software tool for nZEB calculation. The national calculation methodology was developed in 2006 and many difficulties occur within the application. It is currently under revision (started in 2017) to comply with the new set of EPBD standards and is expected to be published imminently.

The feedback from the course participants is generally very positive, however it is apparent that tailored examples for the Romanian construction is required and requested by several trainees.

On the local market it is clear the nZEB interest has increasingly grown in 2018, compared to 2016 when BKH-RO was established and training courses were advertised. Also, one can observe openness and availability from companies in supporting the development of facilities dedicated to training and awareness raising regarding the nZEB concept.

Both Bucharest and Brasov locations are easily accessible by car and by public transport. The Bucharest centre offer enough space for theoretical and practical training, whilst for the Brasov centre the space is no bigger than 60 sqm useful, which means that the practical exercises are limited. Here focus was made on building services, renewable sources; the construction mock-ups are smaller and a few, but with adequate materials. Changes regarding the initial number of hours for training were made during the training programs implementation for some sessions. The possibility was offered for the participants to choose the modules that they have most interest.

Also, changes were made regarding the promotional approach: at the beginning we promoted our courses mostly in the online environment and we received an uninterested, unsustainable response from the market. We then carried out personal visits to site managers, companies, owners associations and public administration. Sometimes the length and mode of courses were “negotiated” and all these actions enabled an easier gathering of groups of 15-20, which led to a rise of trainings numbers.

The PV training course is very well received and attended because its certification helps the companies to apply to government funded programs, which are currently being published. We organized 2 free sessions in 2017 and the next 3 were organized with a co-payment from the participants (85 EUR/p). After the end of the project, the fee will be 200 EUR/p.

The other successfully implemented training courses were the Passive House and the course for the introduction in the nZEB concept for the decision makers.

The PH tradespersons' course was implemented first as a free session, while the next courses were performed with a gradual increase in fees (basically to cover the costs of printing the manuals and catering) so that the course could become marketable at the end of the project (the last sessions are organised with a fee of 200 EUR/p, while the real cost of the course is over 400 EUR/p).
The PH designers' course was organised by the Chamber of Architects (from logistic PoV) with real fees differentiated by membership to the Chamber in the range of 800-1000 EUR/p (Train-to-nZEB contribution not included), however the costs were not fully covered for the first 2 sessions. The pool of interested specialists for this course appear to be still good, but better marketing for the next sessions is necessary in order to make it sustainable in implementation.
The 'Legal framework and concepts for nZEBs' course for decision makers was implemented as a free 1-day session (the costs of manual printing and catering were covered by Train-to-nZEB project and from the fees collected for PHTP courses), but it's implementation in the future needs a market approach: small fees (80-100 EUR/p) should be collected from 14-20 participants in order to make the implementation sustainable. While the target group is formed by public administration and building owners it could be difficult to gather the necessary number of participants per course without an additional funding source.

A total number of 530 trainees have completed 25 courses over 950 hours as outlined below:

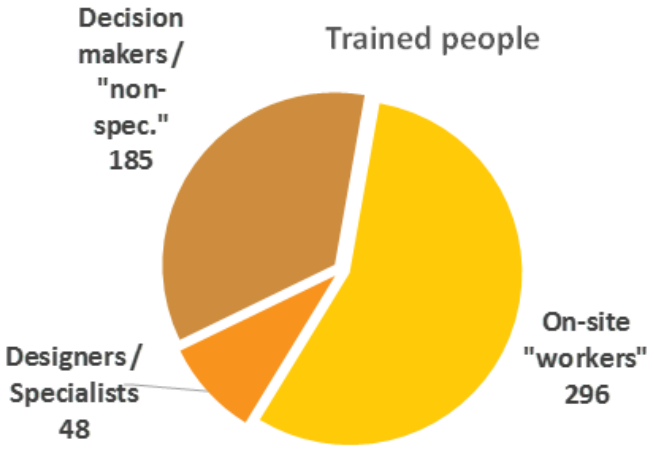

Fig 7. Breakdown of trained people – 08-09.02.2018

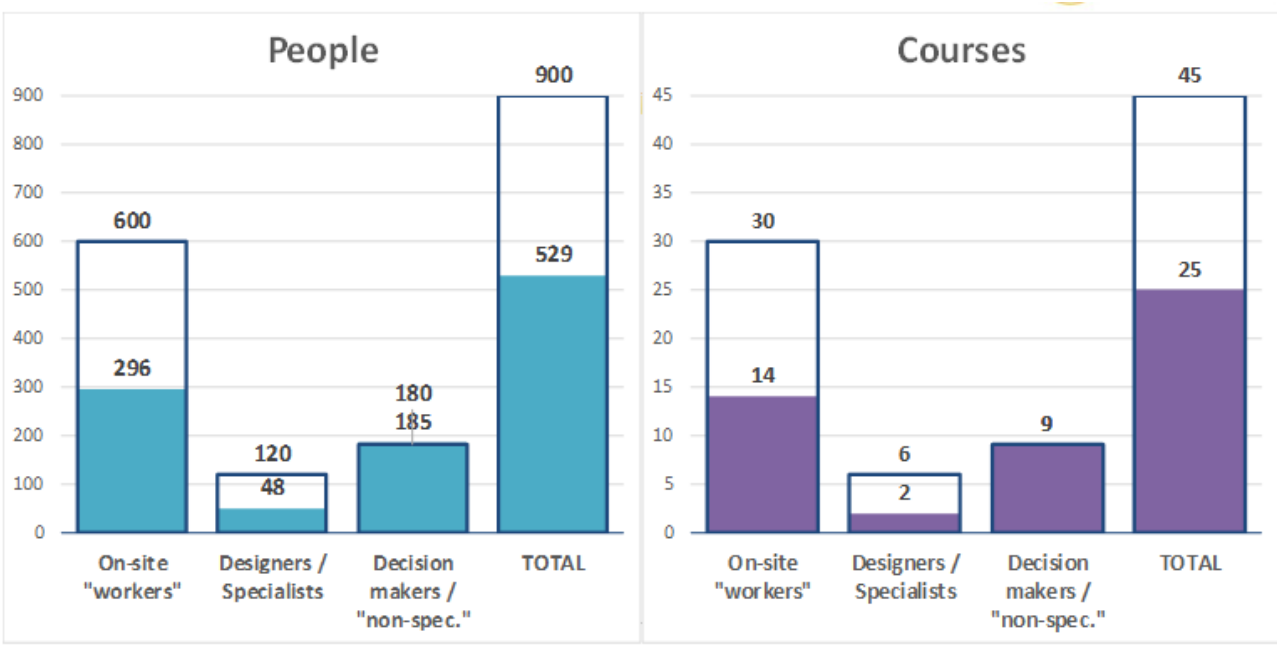

Figure 8. Targets reached for the Train-to-nZEB project till end of October 2018

Future Plans

The following courses are planned for the next 4 years:

- Legal framework and concepts for nZEBs course
- Passive House Certified Designer
- Passive House Certified Tradesperson
- Airtightness and ventilation systems with heat recovery in nZEB

The training sessions scheduled for the remaining period of the project (until 30 November 2018) are as follows:

27 August - 8 October 2018 (Brasov), PV systems installer (examination 13 October 2018)
1 October - 12 November 2018 (Brasov), PV systems installer (examination 14 November 2018)
7-9 November 2018 (Bucharest), Passive House Certified Tradesperson
13-15 November 2018 (Bucharest), Passive House Certified Tradesperson
25 October 2018 (Cluj Napoca), Legal framework and concepts for nZEBs course
26 October-24 November 2018 (Cluj Napoca), Passive House Certified Designer
25 October 2018 (Cluj Napoca), Legal framework and concepts for nZEBs course
30 October 2018 (Bucharest), Legal framework and concepts for nZEBs course
31 October 2018 (Bucharest), Legal framework and concepts for nZEBs – Basics course
26-27 October 2018 (Brasov), Ventilation systems with heat recovery in nZEB
16-17 November 2018 (Brasov), Building Envelope in nZEBs (Insulation systems, windows and thermal bridges)
23-24 November 2018 (Brasov), Solar thermal systems

Table 3. Trainings schedule for the Train-to-nZEB project till end of 2018

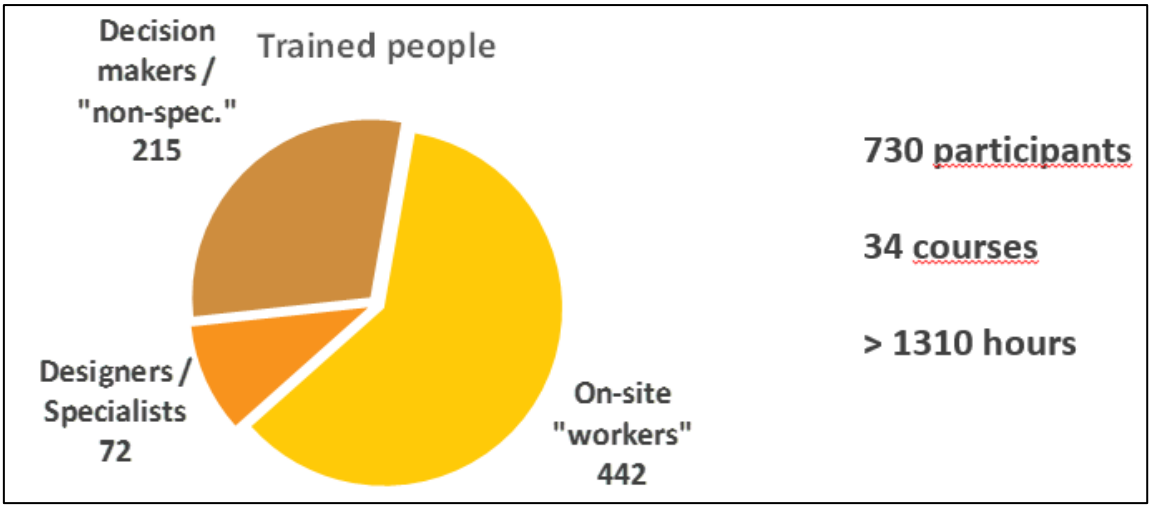

Fig 9. Proposed breakdown of trained people – till the end of 2018

A generic schedule of the training programs was established for the next year, but at this moment no specific dates have been fixed.

Other training courses to be developed and implemented will target the designers and experts, focused on airtightness and mechanical ventilation with heat recovery, considering the lack of requirements in the national technical regulations, but the specific importance of the topic for nZEB.

CZECH REPUBLIC

Trainings

Target Groups

Three main training programs are developed according to the needs of each target group – specialists, tradespeople and non-specialists. For tradespeople (on-site construction crafts) and specialists (professions) the training material is focused on the on-site works and processes, for specialists - on designing and construction management. The non-specialists require less hours of in-class training. The initial training will target employees from state authorities, decision makers and the general public.

Training Facilities

The Czech Technical University in Prague, Faculty of Civil Engineering of VŠB - Technical University of Ostrava and the Construction Centre of Sustainable Buildings in Vysoke, Myto are approved as the training centres for the Train the Trainer workshops. The CZ BKH was opened on the 2nd of March 2017 with a conference and exhibition of demonstrating models and technical equipment at the Building of Architecture and Building Foundation, ABF, Prague with 85 participants attending.

Fig 10. Training facilities in Prague and Ostrava

Trainers

Experience and knowledge of the state-of-the art and innovative technologies and techniques in construction industry are considered as the most important criteria in the evaluation of the trainers' competence. Furthermore, an academic title Ph.D. or equivalent is preferable, as well 8 - 10 years of experience in teaching. An approved shortlist of nine trainers willing and able to participate in the training of others are listed as follows:

	Title	First name	Surname	Profession	Organization	City	E-mail
1	Ing. arch	Nataliya	Anisimova	Consultant	SEVEn	Prague	natalie.anisimova@svn.cz
2	Ing.	Jiří	Karásek	Senior consultant	SEVEn	Prague	jiri.karasek@svn.cz
3	Ing. arch	Jan	Fibiger	Chairman of board	ABF	Prague	fibiger@abf-nadace.cz
4	Ing.	Bohuslav	Málek	Senior consultant	SEVEn	Prague	bohuslav.malek@svn.cz
5	Ing.	Petr	Matějka	Assistant professor	ČVUT FSv	Prague	petr.matejka@fsv.cvut.cz
6	Doc. Ing	Daniel	Macek	Associate professor	CTU FCE	Prague	daniel.macek@fsv.cvut.cz
7	Ing.	Jiří	Šála	Expert advisor	MODI	Prague	salamodi@volny.cz
8	Doc. Ing	Dana	Měšťanová	Associate professor	ČVUT FSv	Prague	dana.mestanova@fsv.cvut.cz
9	Ing.	Michal	Bureš	Associate professor	CTU FCE	Prague	michal.bures@fsv.cvut.cz

Table 4. List of approved nZEB Trainers

It is estimated that around 20 trainers are enough to provide trainings in the first 3 years in Czech Republic (initial group is smaller; the meeting date is depending on the capacity of the local nZEB training centre and availability of trainers). This list of trainers will be regularly updated and available at http://www.train-to-nzeb.com/list-of-trainers.html. The list will be further extended after trainers officially confirm their interest on delivering the specific trainings within the project. List available in Appendix C, Annex 3 at the end of this report.

Training Courses

Train the Trainers Course

The training format is blended with classroom and on-line study learning.

The first one day Train the Trainers workshop was held in Ostrava, at the venue of the Faculty of Civil Engineering of VŠB - Technical University of Ostrava on the 5th of October 2016. Many of the trainers were lecturers at this University and already have expertise and experience in teaching the principles of energy efficient construction. Nine trainers took part in the workshop and are now certified Train-to-nZEB trainers. The agenda and list of participants attending Ostrava Train the Trainer are available to view in Appendix D, Annex 3 at the end of this report.

The second Train the Trainer workshop was held on 19st of October 2016 at the Czech Technical University in Prague. The participants of the meeting were experts from the Faculty of Civil Engineering and experts from the University Centre for Energy Efficient Buildings. The possibilities of cooperation and a description of the role of trainers in the projects were presented as well. The agenda and list of participants attending Prague Train the Trainer are available to view in Appendix D, Annex 3 at the end of this report. The projects' content and objectives was also presented to potential trainers at the Construction Centre of Sustainable Buildings in Vysoke Myto. These participants were representatives of the institute, building professionals and other guests.

Course	Venue	Date	Number of Attendees
Train-to-nZEB Train the Trainer Course	Ostrava	5.10.2016	9
Train-to-nZEB Train the Trainer Course	Prague	19.10.2016	15
Train-to-nZEB Train the Trainer Course (presentation)	Vysoke Myto	18.10.2016	20

Table 5. List of Train the Trainer courses completed

Training Courses for Target Groups

Three main training programmes developed according to the needs of each target group – specialists, tradespeople and non-specialists, include:

1). nZEB – designing of buildings and building technology,

2). Nearly zero energy buildings – implementation and construction,

3). Nearly zero energy buildings – sustainable development of construction, maintenance and use, and there are 2 more in preparation.

4) Airtightness – a specialist course offered

The courses are specifically developed for the three main target groups: specialists, tradespeople, non-specialists. Each course consists of three parts - theoretical lessons, practical exercises and self-study with developed studying materials. Assessment and a short exam are carried out at the end of the course and after its successful completion the participants are awarded with a certificate of completion. An example of the certificate of completion is available in Appendix A of this report. All courses are accredited by the Czech Chamber of Authorized Engineers and Technicians, as part of long-life education system, proposed by the Chamber to all engineers and technicians authorized in the Czech Republic.

It is proposed that each course for the on-site construction crafts and professionals and the Designers, consultants, building managers (specialists) require 24 hours of learning in total with assessment in the form of question sheets and practical assessment work. The number of contact hours may vary depending on the specific course. The courses are based on the training materials from other EU-projects with adaptation to the national conditions and regulations.
The structure for each course is defined with indicative content and specific learning outcomes. These are available in Training Courses and LOs, Appendix E, Annex 3 at the end of this report.

Monitoring and Evaluation

The Train the Trainer workshops were held in Ostrava and Prague with future opportunities in other locations around Czech Republic. A feedback questionnaire was carried out to ascertain the viability of the Train the Trainer through its course content, delivery and management. Both of the Train the Trainer courses were carried out in a classroom environment using powerpoint materials in English. Emphasis on nZEB and passive house principles were presented with additional topics covering RES, costs and case studies.
Factsheets presenting the indicative content and delivery are available in Train the Trainer Courses and Participants, Appendix D, Annex 3 at the end of this report.

It is suggested that materials could be distributed during class to invoke discussion, which can be further replicated in the practical demonstration training unit. It is essential that all trainers are introduced to new innovative technologies, systems and products as they will be required to replicate this information to different target groups.

Training programme	No. of trainings	Average no. of participants per training	No. of participants registered for training	No. of participants trained
Energy performance of buildings (pilot trainings)	2	12	26	24
Sustainable development of construction, management and use of nZEBs	7	22	168	153
Implementation and construction of nZEBs	17	27	498	461
Design of buildings and technologies for nZEBs	9	12	117	109

TOTAL	**35**	**21**	**809**	**747**

Table 6. List of completed Training Courses till end of project

At the end of the project, there were 35 training courses completed, with 747 trained participants. The feedback was gathered from participants after the end of each course to assess the satisfaction rate, but also to determine gaps in the market and amendments to the existing training programmes.

Satisfaction Questionnaire

To assess the feedback and monitor the suitability of the trainings a number of questions were compiled and agreed with BKH CZ. These are included below:

Feedback - questionnaire	**Number of answers**	
	TOTAL	**%**
1) Did the course meet your expectations?		
a) Absolutely yes.	33	**18,6**
b) Yes.	115	**65,0**
c) Not really.	23	**13,0**
d) No.	6	**3,4**
2) You will use the newly acquired knowledge?		
a) Yes I will use it.	81	**45,5**
b) I will try some new knowledge.	62	**34,8**
c) Knowledge is difficult to use.	17	**9,6**
d) I don't now.	18	**10,1**
3) What was the total duration of the training?		
a) Too long.	*45*	***25,0***
b) Satisfactory.	*130*	***72,2***
c) Too short.	*5*	***2,8***
4) What are the indoor spaces for the course?		
a) Absolutely satisfactory.	*80*	***25,0***
b) Satisfactory.	*94*	***72,2***
c) Unsatisfactory.	*5*	***2,8***
5) How did you hear about the course?		
a) Invitation.	*72*	***39,6***
b) Internet.	*30*	***16,5***
c) Other:_____	*80*	***44,0***

Figure 11. Feedback questionnaire from participants

Feedback - questionnaire	Number of answers	
	TOTAL	%
1) Did the course meet your expectations?		
a) Absolutely yes.	33	18,6 %
b) Yes.	115	65,0 %
c) Not really.	23	13,0 %
d) No.	6	3,4 %
2) You will use the newly acquired knowledge?		
a) Yes I will use it.	81	45,5 %
b) I will try some new knowledge.	62	34,8 %
c) Knowledge is difficult to use.	17	9,6 %
d) I don't now.	18	10,1 %
3) What was the total duration of the training?		
a) Too long.	45	25,0 %
b) Satisfactory.	130	72,2 %
c) Too short.	5	2,8 %
4) What are the indoor spaces for the course?		
a) Absolutely satisfactory.	80	44,4 %
b) Satisfactory.	94	52,2 %
c) Unsatisfactory.	6	3,3 %
5) How did you hear about the course?		
a) Invitation.	72	39,6 %
b) Internet.	30	16,5 %
c) Other:_____	80	44,0 %

Figure 12. Summary of feedback questionnaire from participants

Feedback from the trainers and partners was also requested at month 30, and a summary outlining essential changes and improvements to the programmes during the project and afterwards, how **trainers** felt this training went, what and how the trainers and partners will continue with trainings, and any recommendations:

1. A short overview of each training programme (if not already provided)
Out of three main training programmes described in the Training plan, we intend one training on Blower-door testing (4 hours) on 31th of October (already 18 participants are enrolled!).
2. What was the response and feedback from trainers and participants for each of the training programmes.
The trainers were satisfied with the courses. Just the practical four-hours part was considered as too short. Therefore, we made it longer (6 hours) in the next period. Feedback from trainees is attached.
3. Summary from Yourselves on how the trainings went overall (good and bad and how you adapted the programmes to improve them if required)
There is an overall satisfaction with the courses. However, the demand for commercial trainings is not high enough to organize nZEB course e.g. on a weekly basis. Monthly basis is possible.

There is relatively high demand from the non-commercial sector, high schools and universities. Four courses (for four schools) will be organized in November.
4. To look at sustainability - Will the training programmes continue next year and beyond, if so have you dates confirmed?
The training center has now a full picture of costs, demand and trainers. So they will continue on a full commercial basis, probably with lower frequency of the courses. The dates are set up until the end of 2018.
5. Will you provide new trainings for nZEB if so what is needed or proposed.
Beyond the duration of the project, there will be definitely demand for shorter courses, for further cooperation with the schools (via some other programmes/projects) and for cooperation with the construction companies and suppliers of the construction materials. Those fields are worth to enlarging in the future (out of keeping the current courses).

Future Plans

The CZ BKH will also be required to discuss the need for future refreshment courses or perhaps add-on courses, not only for the trainers but also for the target groups. Additional target areas for training may also become apparent.

The future trainings will recommence in November 2018.

Meanwhile the Czech team of experts are preparing practical training of walls design, evaluating the completed courses (tests, questionnaires, certificates etc.), and there is a strong interest from local professional schools and universities for organized group visits.

TURKEY

Trainings

Ege University project team agreed to carry out two Train the Trainer (TTT) courses consisting of groups of 15-20 people; 30 training courses for construction workers (600 trainees); 6 training courses for designers, consultants and building managers (120); 9 training courses for non-specialists (180 trainees).

Target Groups

The Building Knowledge Hub Turkey (BKH TR) is organized as a part of Department of Civil Engineering of Ege University, Izmir, focused on the building sector to provide theoretical and practical trainings and complex consulting services on the design and execution of Nearly Zero Energy Buildings (nZEB), for construction workers, designers (high-level building professionals) and non-specialists.

Training Facilities

The official opening of the BKH in Turkey was carried out on 20th of June 2017. The location for the majority of the training will be held in Izmir, at the Department of Civil Engineering at EGE University which intends to provide not only training for the trainers, but also for the construction industry and policy makers.

Fig 13. BKH TR at the Department of Civil Engineering at EGE University, Izmir

Trainers

Criteria of qualification and competence.

Trainers have been selected after a preliminary screening process and the majority of candidates are academic staff employed in departments such as architecture and engineering. The majority of the trainers have obtained a Ph.D. degree qualification and are conversed with some level of pedagogical expertise.

The basic criteria for a nZEB trainer shall be a person having minimum of two years experience after graduation or equivalent qualifications. In addition to this, candidates should fulfil the following criteria:

- To graduate from architecture or engineering faculty and shall be in active teaching in universities.
- To have MSc. or PhD degree in related areas or should have experience more than 8 years.
- The pedagogical competences could be proven by a Master/PhD diploma or by a document showing fulfilment of specific pedagogical training requirements for trainers. Graduate students usually takes courses related to pedagogical formation during the MSc or PhD education in Turkey.

The participants in the Train the Trainers course have detailed knowledge in each of the training modules for the Training courses and depending on their skillset will carry out these specific trainings.

List of Trainers

Following on from the Train the Trainer workshop a number of trainers willing and able to provide training in nZEB have been shortlisted and this list will be further increased as more trainers are recognised and approved.

	NAME	EXPERTISE	e-mail
1	**Türkan GÖKSAL ÖZBALTA**	PhD. Architect, Professor at Ege University.	tozbalta@gmail.com
2	**Yusuf YILDIZ**	PhD. Architect, Assoc. Professor at Balıkesir University,	yusifyildiz@gmail.com
3	**Necdet ÖZBALTA**	PhD. Energy Engineer, Professor at Ege University.	necdet.ozbalta1@gmail.com
4	**Ali GÜNGÖR**	PhD. Mechnical Engineer, Professor at Ege University.	alignGR55@gmail.com
5	**Mustafa ENGİN**	PhD. Electrical Engineer, Assis.Professor at Ege University.	mustafa.engin@ege.edu.tr
6	**Semiha KARTAL**	PhD. Architect, Assist. Professor at Trakya University.	semihak@trakya.edu.tr
7	**Filiz UMAROĞULLARI**	PhD. Architect, Assist. Professor at Trakya University.	filizu@trakya.edu.tr
8	**Şener UNGAN**	Engineer , Metalurgist, Working on Glass Industrie.	
9	**İsmail CANER**	Mechnical Engineer, PhD student, Research assistant at Balikesir University.	ismailcnr10@gmail.com
10	**Merve KOÇYIĞIT**	Architect, MSc student, Working on energy efficiency in buildings.	merve_kocyigit93@hotmail.com

Table 7 List of approved trainers for the Train-to-nZEB project

The List of trainers is available on the website at: http://www.train-to-nzeb.com/list-of-trainers.htmlA
To ensure a recognition in training the nZEB courses it has been agreed to award a certificate of completion to the Train-to-nZEB Trainer on completion of the train the trainer course. A sample of this certificate of completion is available in Appendix A at the end of this report.

Training Courses

Train the Trainers Course

The objective of the Train the Trainers Program is to create a critical mass of trainers in Turkey to have the basic knowledge, skills and experience to implement the training modules in 'nZEB Training the Trainees course'. The first TTT course was completed on 13th of May 2016, at Ege University, Izmir with 22 trainers attending. A second Train the Trainer course was also executed on 20th of June 2017 with 102 attendees. These participants consisted of academics, construction sector representatives, and MSc and PhD students. The Agenda and Train the Trainer content is available in Appendix D, Annex 4 at the end of this report.

Training Courses for target groups

The Turkish BKH is to provide the following:

- Approximately 30 courses for construction workers on ten selected training programmes (24-40 hours, up to 22-25 participants per course).
- Six courses for designers and highly qualified building professionals on two training programmes (24-40 hours, 20 participants per course).
- Nine training courses for non-specialists on three training programmes (12-20 hours, 20 participants per course).

After completion of the Training Needs Analysis (TNA), a training programme incorporating a number of modules was developed. The course is based on the training content from other EU projects and materials but adapted to the Turkish regulations and conditions. It should be noted in Turkey that awareness of nZEB is very limited within the professional sector and even less so in the main construction industry.

The training courses have been developed using six defined modules to ensure flexibility and a minimum knowledge of nZEB training, thus requiring a level of classroom and practical training using visuals and practical models. The majority of the modules involve one hour of contact theoretical training in a classroom environment, one hour of contact practical training and two hours of self-study. Modules 1 and 6 are compulsory, whilst attendance at the other modules depend on the level required by the participant based on target group needs. Each training module will include continuous assessment and a final examination to enable transparent marking.

	MODULES	Module 1 nZEB Basic	Module 2 nZEB Advanced	Module 3 Retrofitting towards nZEB	Module 4 nZEB simulation	Module 5 Preparation of funding schemes	Module 6 Practice	Total duration
	Duration	7 hours	7 hours	4 hours	3 hours	3 hours		
TARGET GROUPS	**Designers (**Architects, engineers**)**	**X**	**X**	**X**	**X**		**X-2 hours**	**26 hours**
	Construction workers (theory/practical)	**X**		**X**			**X-3 hours**	**14 hours**
	Non-specialists (Municipalities, local/ national entities, professionals from construction sector**)**	**X**		**X**		**X**	**X-1 hours**	**15 hours**

Table 8: Basic structure of training programme

The training courses will be implemented by at least two trainers, of whom will be professionally competent and have experience in the areas of the specific training and delivery. It is important to provide value to the course and ensure a recognition in training of the specific module and course. It has been agreed to award an nZEB certificate of completion to the trainees on completion of each of these specific courses depending on their category. These certificates will be acceptable for continuous professional development (CPD) by many established organisations such as Architects and Engineers.

The training programmes are divided into 6 modules – 1). nZEB basic, 2). nZEB advanced, 3). retrofitting towards nZEB, 4). nZEB simulation, 5). Preparation of funding schemes, and 6). Practical. The content for the proposed training modules is broken down as follows with classroom, theory, practical and demonstration work:

Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
nZEB Basic	nZEB Advanced	Retrofitting towards nZEB	nZEB Simulation	Preparation of funding schemes	Practice
Definition of nZEB	Principles of bioclimatic design	Energy audit techniques	Introduction to energy building simulation	Available funding mechanisms and incentives	The major components in nZEB
National legislation, standards and regulations related to energy efficiency in buildings, passive house and nZEB	Introduction to passive house concept	Definition of renovation strategies	Current simulation tools/software	Practical investment calculation exercise	Monitoring systems
Basic building physics	Passive and active solar systems for heating and cooling	Passive and active renovation solutions	Practical applications of energy building simulation		Building energy management systems
Heat transfer mechanisms	Energy efficient HVAC systems	Application of renewable energy solutions	Understanding simulation results and errors		
Thermal bridge in buildings	RES	Energy efficient building components: windows and doors			
Thermal insulation materials	Energy efficient building materials	Life cycle cost assessment			
Construction techniques for thermal insulation	Natural lighting				
Solar control					

Table 9: breakdown of the modules of training programmes

Further information on the indicative content and learning outcomes are available in the Training Courses and LOs in Appendix E, Annex 4 at the end of this report.

Monitoring and Evaluation

Factsheets have been completed to assist with assessing the course content and materials. Feedback questionnaires were issued to all the participants in the train the trainer workshops, providing a summary to determine if the workshop could be improved or developed further. These factsheets are available in Appendix D, Annex 4 along with signed attendance sheets from the participants at the end of the report.
The Train the Trainer course received significant support from academicians as well as from private sector. They took part in the establishment of the BKH and in the theoretical + practical trainings.

The initial Train the Trainer course held in May 2016, received feedback from 15 of the 22 participants, the results are shown below:

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1. The content was relevant to my learning needs	65%	27%	8%	-	-
2. The trainer had a good knowledge of the material and general area	82%	18%	-	-	-
3. The material was delivered at an appropriate pace	73%	17%	10%	-	-
4. Class participation was encouraged	87%	13%	-	-	-
5. Programme materials were useful and relevant	89%	11%	-	-	-
6. Training room was suitable for the programme	100%	-	-	-	-
7. I would recommend this training to others	100%	-	-	-	-

Table 10: Feedback from the Train the Trainer workshop May 2016

Additionally questions related to how useful each part of the course was presented and suggestions on what else should be covered in these courses were asked. It was stated that all parts of the courses were acceptable however it was suggested to include certification systems (LEED, BREEAM etc), EE lighting and PH strategies for buildings.

Following the opening ceremony of the TR BKH, the team of experts organized the second Train the Trainer course on June 20th 2017. This course was carried out by partners from Germany and Ireland, providing theoretical training in the principles of PH/nZEB construction as well as LIT pedagogical training. A large number of participants attended, including students in the field of energy efficiency, architects and passive house experts and recognised policy makers within Turkey. Of these 108 participants, 55 questionnaires were completed and received.

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1. The content was relevant to my learning needs	82	16	2	-	-
2. The trainer had a good knowledge of the material and general area	98	2	-	-	-
3. The material was delivered at an appropriate pace	73	26	1	-	-
4. Class participation was encouraged	87	10	3		
5. Programme materials were useful and relevant	97	3	-	-	-
6. Training room was suitable for the programme	98	2			
7. I would recommend this training to others	63	37	-	-	-

Table 11: Feedback form the Train the Trainer workshop June 2017

The initial results are similar to the first training. However, it has been suggested that additional content could include information on heat pumps and more examples of innovative materials and products.

Summary of Training for Turkish BKHs

Designer

The two day training courses for designers were held at both Ege and Balikesir Universities. Participants are from the private sector employees, Municipality, Ministry and Universities staff, in particular a large number of architects/engineers showed interest in this training program. Four courses have so been completed training 127 specialists, these were designers, architects, engineers and surveyors.

The first session of training presented of the main objectives, learning outcomes and outputs of the training programme. The presentations were made using slide show forms and diagrams and each one was explained to the participants. After explaining the objectives and outputs, there was a presentation on the definition of nZEB and a brief outline of the criteria. This included information on national legislation, standards and regulations related to energy efficiency in buildings, passive house and nZEB. Following the presentation there was an opportunity for questions and answers. The modules concentrated on the different aspect of nZEB compliance.

The practice session involves discussions and detailing particular demonstration building models. Four practical examples were presented to the group as case studies outlining experiences and lessons learned in the construction of nZEB. Special attention was given to explain the importance of nZEB construction highlighting some specific details and features of construction necessary to achieve nZEB compliance. The participants subsequently received an overview on the “Role of low energy buildings”, where designers in particular should acknowledge, implement and encourage main design techniques on nZEB. Participants were encouraged to share experiences in the general on specific difficulties they faced in the construction sector. The training team facilitated discussions to identify solutions to those issues.

At the end of the training, the participants were asked to fill in a training evaluation form. Participants were highly satisfied with the administrative and logistical organization of the training. Participants also expressed

high appreciation for the topic and objectives of the training, as very relevant to their work. Quality of the training as well as learning achievements were also highly scored. The presentations were very useful in highlighting nZEB concept was aiming to get a picture of the whole system and the context in which it was being run. Most participants mentioned that they would recommend the training to their colleagues and recommended that more such training workshops should be organized at the national and regional levels.

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1. The content was relevant to my learning needs	52.08	45.83	2.08	0	0
2. The trainer had a good knowledge of the material and general area	72.91	27.08	0	0	0
3. The material was delivered at an appropriate pace	47.91	43.75	6.25	2.08	0
4. Class participation was encouraged	56.25	35.41	8.33	0	0
5. Programme materials were useful and relevant	68.75	31.25	0	0	0
6. Training room was suitable for the programme	39.58	41.66	10.41	8.33	0
7. I would recommend this training to others	64.58	35.41	0	0	0

8. In your opinion what was the most useful part of this training session? All, Passive house, regulations, practical part, energy efficient HVAC systems, energy efficient building materials. The practical part was very interesting and thought provoking. Examples from other countries were excellent and provided an opportunity to share ideas.
9. In your opinion what was the least useful part of this training session? More theory, heat transfer mechanisms,
10. In your opinion what additional content would you like to see added to the training session? Insulation materials, LEED and BREAM certificates,

Table 12. Summary of training evaluation form taken from Designer

The participants also mentioned that:

- Knowledge availability is critical for development of nZEB standard in Turkey. Translation of data in Turkish are useful processes to help gain such data.
- Relevant knowledge is necessary to constitute construction process and framework of legal status of nZEB in Turkey.
- Data collection from other countries is necessary to see nZEB examples.

In the first training plan for the designers, it was suggested that the theoretical part could be more detailed and comprehensive. In view of these comments the duration of the training modules were revised.

Tradepersons

The main objective behind the training is to get the participants learn the essential ins and outs of managing and constructing a nZEB building – from start to end. Along with that, the participants needed to understand what to focus on when managing their work, specially the nZEB projects they work on.
The training, on the whole, was considered to be successful in the scope of specified objectives. Participants understood the importance of the nZEB concept. The curricula was developed by taking the critics and suggestions of the attendees into consideration.
During the project 14 courses have been carried out with 588 tradepersons trained.

According to observations of the trainers, participants (tradepersons) have different learning needs and expectations from other target groups. Some already had a conceptual knowledge of energy efficient buildings and therefore were more interested in the practicality of those concepts. Others lacked basic knowledge of the subject matter and needed more time to learn. This has been clearly felt throughout the training as some practical sessions were more relevant to half of the participants. Several participants stressed that the theoretical trainings should be dominated by practical training.
Based on a feedback analysis, the duration of training programme was trimmed. From a training quality perspective, there is a need to set balance among increasing number of trainings and training duration. There were several difficulties in attendance from the over 40 age group as interest and the will for learning was much lower than the younger age groups. Therefore, the theoretical part of the course was shortened, and the duration of practical part increased. Another problem faced in trainings that some participants could not understand the objectives or found it difficult to see the relevance of the trainings to his/her profession.

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1. The content was relevant to my learning needs	44.18	46.84	5.31	2.99	0.66
2. The trainer had a good knowledge of the material and general area	54.81	39.20	3.98	1.32	0.66
3. The material was delivered at an appropriate pace	41.52	45.51	9.30	3.32	0.33
4. Class participation was encouraged	42.19	36.21	14.95	5.98	0.66
5. Programme materials were useful and relevant	57.80	35.88	3.98	1.99	0.33
6. Training room was suitable for the programme	45.51	38.87	8.30	4.98	2.32
7. I would recommend this training to others	51.49	34.21	9.63	3.65	0.99

8. In your opinion what was the most useful part of this training session? Renewable energy, local regulations
9. In your opinion what was the least useful part of this training session? More theory, calculation procedures for PV.
10. In your opinion what additional content would you like to see added to the training session? The lectures and discussions should be recorded so that they can benefit from the rich amount of information shared those who are unable to attend such a training

Table 13. Summary of training evaluation form taken from Workers

The training curricula was based on feedback from participants; however, the employees are still resisting the approval to send their workers to attend training as they are concerned with loss of work and manpower. The response of workers to trainings were positive. The participants, in groups, were able to evaluate the philosophy behind nZEB as well as its application and how it might be used. The nZEB construction practice were assessed by practical applications in the BKH, including airtightness, continuous insulation, as well as windows and glazings. The practical studies were also useful in increasing experience of the trainees. In particular, it was noted that individuals (from 18 to 27 years of age) who have received VET education are eager to learn more about renewable energy, low energy buildings and environmental problems.

Non-Specialists

There have been six training courses implemented for non-specialists in the period during 2017-2018, with 185 participants trained in total so far.

The training course for non-specialists were composed of theoretical part accompanied by interactive group exercises in BKH. The training courses aimed to increase the awareness of participants of nZEB concept and its significance. However, there were a few barriers which need to be addressed to increase the effectiveness of the trainings. Practical applications did not attract the attention of non-specialists. Participants were not well-informed of construction details: they did not have a professional aspect about the subject. Most books and literature in nZEB are written in English which was an obstacle for some participants to follow. Also, in literature, examples from other countries were not directly applicable for the local practice in Turkey.

Based on trainers' reports, there was some concern that some of the participants were still slightly unclear on some issues such as aim of training and importance of the subject. In order to resolve this issue, it was decided that during the practical phase trainers would communicate individually with some of the participants to ensure that they were aware of nZEB concept.

The followings should also be considered for future training:

- The trainings should be continued in the scope of a workshop.
- Individual training sessions should be made for attendees of different levels of motivation and knowledge.
- Construction details of nZEB concept is not directly applicable in hot humid climates and need to be modified to include local examples.

Participants completed a final feedback form in the last training session to reflect their opinions about trainings. Feedback was very positive: over 85% of respondents marked 'strongly agree' or 'agree' for all the questions on the feedback form. The training program was performed successfully, and all the participants took active part in all the training.

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1. The content was relevant to my learning needs	47	47	3.9	2.1	0
2. The trainer had a good knowledge of the material and general area	47	50.9	2.1	0	0
3. The material was delivered at an appropriate pace	35.29	52.9	9.8	2.04	0
4. Class participation was encouraged	25.49	33.3	35.41	1.9	3.9
5. Programme materials were useful and relevant	54.9	43.13	0	1.97	0
6. Training room was suitable for the programme	31.3	49	11.7	8	0
7. I would recommend this training to others	62.7	27.4	9.9	0	0

8. In your opinion what was the most useful part of this training session? Mostly given answer is "All parts of the training". Passive house, regulations.
9. In your opinion what was the least useful part of this training session? -
10. In your opinion what additional content would you like to see added to the training session? More information about local regulations and conditions, renewable energy sources, insulation materials and practice.

Table 14. Summary of training evaluation form taken from Non-specialist

In summary there were 24 training courses carried out across Turkey.

Groups	Training courses	Participants	Target
Construction workers	**14**	**588**	**600**
Designers	**4**	**127**	**120**
Non-specialists	**6**	**185**	**180**
Total	**24**	**900**	**900**

Table 15. Summary of Trainings from all 3 target groups

The 900 participants were from mainly Izmir and Balikesir, but with attendees from other schools across Turkey. The training target was reached by Turkey BKH mainly due to free training but also from the extensive outreach of the Turkey BKH.

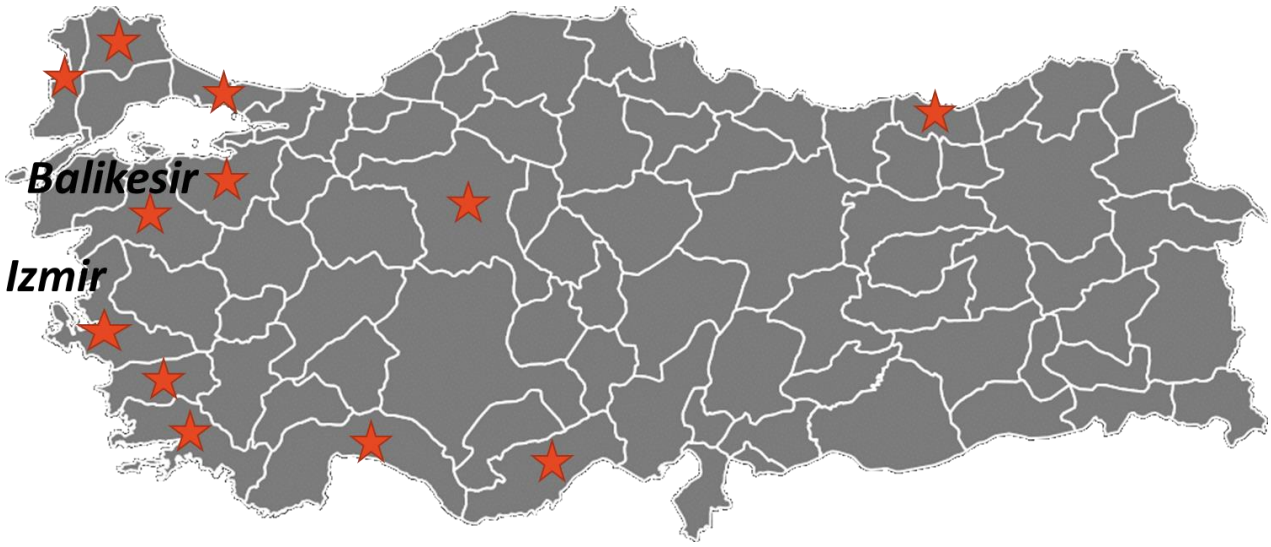

Fig 14. Outreach to other schools and construction companies for training across Turkey

Future Plans

As it is envisaged that the approved group of trainers will partake in Train the Trainer refreshment courses annually and new trainers will be able to avail of additional Train the Trainer courses to increase the number of trainers in Turkey. It is provisioned that the training courses for the professionals, construction workers and non-specialists will be conducted in the BKH at EGE university however if there is demand from external parties then these courses will also be offered to new training centers willing to engage in the network.
The future trainings for designers/engineers, construction workers and non-specialists are scheduled to start in September 2017 and to continue until April 2018 at EGE University.
It is intended that 15 courses for construction workers to train 300 trainees, 3 courses for architects, engineers, students, consultants and building managers and 4 courses for non-specialists will be carried out. The schedule for 2017 is listed as follows:

Future Training for Turkish BKHs

The trainings will continue for the undergraduate courses especially for the students of the Department of Architecture and Engineering. BKH TY are planning to proceed with new nZEB trainings, by supporting their

graduate & undergraduate courses. Practical applications of related graduate & undergraduate courses will be made within the Turkish Hub.

Within the scope of the nZEB Project, BKHs has been established in Ege and Balikesir Universities. Therefore, it is proposed to incorporate these new trainings into the curricula of established courses at the Department of Architecture, Civil Engineering and Mechanical Engineering and assist the recent graduated architects/engineers who are especially interested in the nZEB concept. As a result, demand for trainings it is evident that these trainings will increase in near future.

In accordance with agreement signed with different institutions and organizations including Balıkesir Chamber of Architects and Izmir Chamber of Civil Engineers, while Ege-BKH is still active, Balıkesir-BKH was established in the premises of the Balikesir University Faculty of Architecture with the opening ceremony in November 2018.

UKRAINE

Trainings

Training Facilities

The Ukrainian Building Knowledge Hub was set up following a Memorandum of Understanding within the Kyiv National University of Construction and Architecture (KNUCA, Ukraine). The Ukrainian BKH was established in 2016 in the framework of the Project "Train-to-NZEB: The Building Knowledge Hubs" as the joint effort of Municipal Development Institute, Project Implementer in Ukraine, and Kyiv National University of Construction and Architecture (KNUCA), Project partner. The Ukrainian Centre is hosted by KNUCA.
The grand opening of the Ukrainian Building Knowledge Hub took place on November 16, 2016, in Kyiv.

Fig 15. BKH UA ready for training at KNUCA.

Target Groups

In order to meet this goal, project partner MDI mobilized support from a wide range of Energy Efficiency equipment and materials producers; with their assistance, detailed training programmes were developed, using the experience and also the existing training facilities and laboratories of local manufacturers.

Trainers

Criteria of qualification

The trainers will be selected from a pool of leading experts in energy efficiency in construction and architecture; it is anticipated to mobilize expertise of KNUCA and professionals from energy efficient equipment and materials producers (partner companies) who participate in the development of norms and regulations and national building standards.
The majority of trainings are to be delivered at BKH UA but some training will be carried out at manufacturing facilities of energy efficient equipment and materials producers, testing laboratories and on construction sites. Trainers learn about specific properties of materials and equipment (including manufacturing, assembly, and maintenance), constructive and technological solutions of energy efficient equipment and materials producers. Special master classes are also delivered for the trainers by the producers and manufacturers of equipment and materials.

List of trainers
Currently the list include the following:

Name	Title	Details
Oleg SERHEYCHUK	Doctor of Technical Sciences	Professor of the Department of Architectural Structures with Architecture Faculty of Kyiv National University of Building and Architecture; Member of the Construction Academy of Ukraine; Chairman of the Committee "Lighting and insolation" with the Technical Committee on "Energy Efficiency" of the Ministry of Regional Development, Construction and Housing and Municipal Economy of Ukraine.
Volodymyr SKOCHKO	Associate Professor	Doctoral Candidate of Department of Architectural Structures with Architecture Faculty of Kyiv National University of Building and Architecture; Coordinator of International Activities of Kyiv National University of Building and Architecture on energy efficiency in construction and architecture; Technical Specialist of Municipal Development Institute. (vladimir-skochko@yandex.ru)
Oleksandr POGOSOV	Associate Professor	Head of Laboratory with the Department of Heat Technology of Sanitary Engineering Faculty of Kyiv National University of Building and Architecture. (pogosov_aleksandr@ukr.net)

Table 16. List of approved trainers for the Train-to-nZEB project

Training Courses

Train the Trainers Course

Specialized 1-2 day workshops were conducted for the trainers at research laboratories, production facilities, and training centers of Project partners – producers of energy efficient equipment and materials. The workshops consisted of the theoretical and practical parts and were delivered by experts working in the sector where 20 participants attended and completed the course. The presentations developed for the train the trainer course are available at the link on the Train-to-nZEB website at: http://www.train-to-nzeb.com/uploads/9/8/8/4/9884716/3.3_presentations_and_participants_lists_from_ttt_courses.pdf

1. Workshop on energy efficient windows and other translucent structures (conducted by REHAU; 2 days)	
Theoretical part (1 day): Practical work at the	Specificities of windows and other translucent structures. Main definitions and terms. Energy efficient windows and doors. Normative documents. Fundamentals of building physics of translucent structures. Cold bridges. Ventilation.
Practical part (1 day):	Training Technological Centre. Assembly of PVC windows in a house with timber framework. Testing a window at a special stand.
2. Workshop on interior engineering systems of nearly zero-energy buildings (conducted by REHAU; 1 day)	
Theoretical part (4 hours):	Radiator heating and water supply systems. Heating systems: floors and walls.
Practical part (5 hours):	Wall heating: examples. Practical work at the Laboratory of Interior Engineering Networks.
3. Workshop on façade systems, decoration of facades with stucco and small decorative elements (conducted by Henkel Bautechnik; 1.5 days)	
Theoretical part (4 hours):	Types of façade systems. Requirements to façade systems, their certain elements and materials. Model façade design solutions. Heat insulation. Maintenance of bound external insulation of buildings and structures.
Practical part (8 hours):	Practical work at the Training Technological Centre. Heat insulation materials. Where heat insulation systems can be used. Assembly technologies
4. Workshop on practical aspects of insulation systems for inclined roofs of frame wall structures (conducted by URSA; 1 day)	

Theoretical part (4 hours):	Main types of insulation materials. Glass wool insulation. Extruded cellular polystyrene.
Practical part (4 hours):	Assembly. Working with glass wool. Working with extruded cellular polystyrene. Installation of hydro and vapor barriers.
5. Workshop on energy efficient design solutions with the use of ceramic wall blocks and ceramic tiles (conducted by Wienerberger; 1 day)	
Theoretical part (4 hours):	Properties and assortment of energy efficient ceramic wall blocks. Normative requirements.
Practical part (4 hours):	Design solutions and specificities about energy efficient ceramic wall products. Installation of energy efficient ceramic wall blocks. Typical mistakes during installation works. Specificities about installation of ceramic tiles.
6. Workshop on installation of aluminum façade systems of nearly zero-energy buildings (conducted by Techno-Alliance; 1 day)	
Theoretical part (4 hours):	Classes of translucent and ventilated façade systems. Impact of certain elements and materials used in translucent façade systems on their resulting heat resistance properties.
Practical part (4 hours):	Typical mistakes regarding installation of translucent and ventilated façade systems. Practical exercise.
7. Workshop on design and assembly principles regarding alternative energy sources (conducted by Vaillant; 2 days)	
Theoretical part (1 day):	Solar collectors. Gelio systems (DrainBack, auroTHERM). Heat pumps (types, primary heat energy sources). Practical exercise: auroSTEP, aroTHERM.
Practical part (1 day):	Operating auroSTEP: user; specialist. Setting effective performance parameters for auroFLOW plus. Programming of the aroTHERM heat pump, operation monitoring, feedback function. Use of automated tools of I7 systems.
8. Workshop on energy efficient ventilation, air conditioning, heating and hot water supply systems (conducted by Aclima; 2 days)	
Theoretical part (1 day):	Energy saving ventilation. Free cooling technology. Automatic devices and control systems of energy efficient climate equipment. Alternative heating technologies: heat pumps. Programming and configuring controllers. Regulation and control systems for micro climate control.
Practical part (1 day):	Modern control units for ventilation, conditioning and heat supply systems. Design of the modern heat pump. “Air-water” heat pumps (Hitachi, MYCOND).
9. Workshop on heat insulation for inclined roofs of frame wall structures, determination of heat losses with the help of the Blower Door Test (conducted by Yakir Limited Liability Company; 2 days)	
Theoretical part (1 day):	Sprayed heat insulation (H_2FOAM LITE: LD-C-50). What is air exchange. How to calculate it. Air exchange norms in residential and public buildings. European experience. Thermal modernization of private houses. Heat insulation of newly constructed buildings.
Practical part (1 day):	Blower Door Test. Determining heat energy losses with the help of the air filtration method. Energy audit. Infiltration test for building envelope. Sprayed heat insulation for insulating new and old buildings.
10. Workshop on heat insulation of building envelope (conducted by TECHNONIKOL; 1 day)	
Theoretical part (4 hours):	Tasks of heat insulation work. Heat insulation materials. Foundations. Façades.
Practical part (4 hours):	Assembly works. Start of assembly works. Typical mistakes during assembly.

Table 17. Breakdown of the Train the Trainer course consisting of 10 modules

Training Courses for target groups

The training content for the courses have been prepared jointly between the Municipal Development Institute, MDI and the Kyiv National University of Construction and Architecture. Trainings focus on the main principles of energy efficient buildings, nZEB and passive house approaches:

- Continuity of heat insulation (modern energy efficient building and insulation materials).
- Continuity of wind barrier.
- No cold bridges.
- Use of alternative energy sources (solar collectors; photoelectric solar panels; heat pumps, heat accumulators; wind generators; etc.).
- Use of recuperation systems, highly effective heating and air conditioning systems.
- Design and orientation of the building, use of solar energy for energy purposes.
- Use of local fuel and energy resource and combined production/consumption of energy.
- Climate considerations in selecting locations for buildings.
- Limitations about energy resources used in heating and hot water supply systems, other engineering networks and overall consumption of energy for all household purposes.

It is important to provide theoretical and practical teachings and these are to be included in the form of group work; class discussions; lectures combined with practical tasks at the Ukrainian nZEB Center; solving problems; discussion of solutions proposed. Special software is to be used for problems on building physics and in modeling of energy efficient engineering systems. It is anticipated that each participant will be able to work independently on a PC/laptop, to understand design methodology and to follow calculation algorithms proposed by the trainer. Training participants will have the opportunity to use samples of energy efficient materials/equipment available at the demonstration area at the Ukrainian BKH. The courses for non-professional decision makers will require limited knowledge of algorithms and specific technical systems.

Training audience	(A)	(B)	(C)
Trainer ↓ No of hours per a tr.course →	44	44	32
University (KNUCA) (lectures), hours	16	24	16
REHAU (workshop), hours	8	4	4
HENKEL (workshop), hours	3	2	2
VAILLANT (workshop), hours	6	4	3
URSA (workshop), hours	1	1	1
WIENERBERGER (workshop), hours	3	3	1
A-CLIMA (workshop), hours	4	4	3
TechnoNIKOL (workshop), hours	2	1	1
Techno-Aliance (workshop), hours	1	1	1
Total duration, hours	44	44	32
(A) - Construction industry workers			
(B) - Building industry professionals			
(C) - Non-professional decision-makers			

Table 18. Training Format for each target group

Additional detailed information on the timeframes and course content for the construction industry workers, building industry professionals and non-professional decision makers are available in Training Courses and LOs Appendix E, Annex 5 at the end of this report.

Monitoring and Evaluation

The trainings commenced in October 2016 at the Ukrainian BKH. Some workshops are carried out at manufacturing and training facilities of local Project partners – EE/materials producers/vendors, including the Training Center of REHAU. The activities include group work, class discussions, lectures combined with practical tasks, solving problems, and discussion of the proposed solutions. Special software is being used for

problems on building physics and on modelling of energy efficient engineering systems. Training participants have the opportunity to use samples of energy efficient materials/equipment which are available at the training unit at the Ukrainian nZEB Center/BKH.

The Ukrainian BKH have conducted 12 training workshops for 315 specialists and construction workers.

Training course	No of courses	No of participants
Specialist in Design and Construction of Nearly Zero-Energy Buildings	7	188
Designing Engineer on Nearly Zero-Energy Buildings	2	45
Project Manager of Project on Nearly Zero-Energy Buildings	3	82
	12	315

Table 19. Number of training courses and participants during the project

The training courses "Specialist in design and construction of nearly zero-energy buildings", for highly qualified building industry professionals were delivered by two trainers approved by the Train-to-nZEB Project. There were 188 participants in total (professionals, civil engineers, industrial engineers, architects, urban planning specialists, and specialists in GIS). The training course consists of four blocks:

1. Theoretical material and practical tasks.
2. Specialized workshops.
3. Activities at the Training Centre of REHAU.
4. Knowledge check (examination). Presentation of certificates.

Workshops were delivered by professionals delegated by 10 producers of energy efficient equipment and materials – Project partners in Ukraine: REHAU, Henkel Bautechnik, Winnerberger, TechoNIKOL, Aclima, Vaillant Group Ukraina, URSA, Techno-Alliance, Talisman Ltd., Yakor Ltd.

The next workshops "Designing engineer of nearly zero-energy buildings" specifically for highly qualified building professionals with 45 trained professionals include construction engineers, specialists in industrial building construction and civilian construction, architects and urban development specialists, heating specialists, electrical engineers, and specialists in alternative energy sources.

The final 3 training workshops for the "Project Manager of Project on Nearly Zero-Energy Buildings" were delivered to 82 participants in 3 separate courses.

All Factsheets presenting the indicative content and delivery are available in Train the Trainer Courses and Participants, Appendix D, Annex 5 at the end of this report.

Future Plans

The immediate future training courses at the Ukrainian BKH are scheduled as follows:

September 2018	**training for building industry workers**	**"Nearly Zero-Energy Buildings Construction Specialist**	**(44 hours),**
October 2018	training for building industry workers	"Nearly Zero-Energy Buildings Construction Specialist"	(44 hours),
November 2018	advanced training for designers	"Nearly Zero-Energy Buildings Project Designer"	(44 hours)
December 2018	training for building industry workers or advanced training for non-specialist	Nearly Zero-Energy Buildings Construction Specialist	(44 hours).

		"Nearly Zero-Energy Buildings Project Manager"	

Table 20. Future training courses for target groups in 2017.

Other trainings will continue whilst there is demand and BKH Ukraine will continue to develop trainings for any gaps in the market. One such gap is for energy auditing and BKH Ukraine plan to organize trainings for energy auditors. The recent Law on the Energy Efficiency of Buildings (Article 9), have encouraged the universities to provide signatories of agreements with the State Agency for Energy Efficiency and Energy Saving, to set up the so-called 'attestation commissions'. These commissions will certify professionals who have the skillset in energy efficiency to examine the construction of buildings and understand energy engineering systems in the buildings. Energy certificates of buildings will then be required for all buildings within this remit. KNUCA have arranged for such a commission within its NZEB Building Knowledge HUB where certified trainings and attestation for professionals in energy certification of buildings will be carried out. In addition to the Train-to-NZEB Certificate on completion of the training course, energy auditors trained by the Ukrainian HUB will be also awarded the state (now mandatory!) certificate.

APPENDICES

4. APPENDIX A – Examples of Training Certificate of Completion

This project is financed by HORIZON 2020 Programme of the European Union under Grant Agreement No 649810

Train-to-NZEB
The Building Knowledge Hubs

CERTIFICATE

OF ATTENDANCE
No BG000001

Presented to

ALEXANDER STANKOV

For successfully completed training course on

NZEB BASICS
TRAINING OF TRAINERS

The training course includes the following modules:

National definition of Nearly Zero-Energy Buildings / Basic Principles of Nearly Zero-Energy Buildings / Design and Construction of Nearly Zero-Energy Buildings / Heating and Ventilation in Nearly Zero-Energy Buildings / Renovation of Existing Buildings to NZEB levels

The training is conducted by:
EnEffect
Energy Efficiency Center

12 Октомври 2016

TRAINING PARTNERS:

КАМАРА НА СТРОИТЕЛИТЕ В БЪЛГАРИЯ
BULGARIAN CONSTRUCTION CHAMBER

УНИВЕРСИТЕТ ПО АРХИТЕКТУРА СТРОИТЕЛСТВО И ГЕОДЕЗИЯ

BSYS

5. APPENDIX B – E-learning Tool learning outcomes

Online training for decision makers – Learning targets

1.1 For all user categories:

- Understanding of the climate-independent Passive House definition:
    - A Passive House is a building, for which thermal comfort (ISO 7730) can be achieved solely by post-heating or post-cooling of the fresh air mass, which is required to achieve sufficient indoor air quality conditions – without the need for additional recirculation of air.

- Understanding of the five Passive House principles and the way these work both in winter and summer
    - Continuous insulation
    - Passive House windows
    - Continuous airtightness
    - No thermal bridges
    - Mechanical ventilation (with heat/humidity recovery)
- Understanding of the main advantages of Passive House buildings
    - Comfort
    - Healthy living
    - Cost-optimal over life cycle
    - Sustainable
    - Long-lasting buildings
- Understanding of the variety of Passive House buildings and knowledge of some examples
    - Many shapes
    - Many sizes
    - Various functions
    - Different budgets
    - Various construction materials
    - New or retrofitted
    - In any climate zone
- Understanding of the importance of third-party quality assurance
- Knowledge of the procedure to get a Passive House building delivered
    - Role of Certified Passive House Designer/Consultant
    - Software used for energy balancing and their reliability
    - Availability of Certified Passive House components
    - Role of Certified Passive House Tradespeople
    - Role of a Passive House Certifier
- Knowledge of the certification criteria for Passive House buildings and the certification classes
- Knowledge of reliable sources of information to deepen their knowledge about the Passive House concept
    - Brochures and Passive House Award books
    - Passive House Database for projects, components and professionals
    - Passive House networks
    - Accredited online and face-to-face training

2.1 End Users

- Information for users of Passive House buildings:
    - Opening windows: effect during summer and during winter.
    - Temporary shading: effect in winter and in summer.
    - Ventilation system: is not an air conditioning system; replacing of filters; continuous operation or shut-down with dry filters. How to operate. How to avoid dry air during low external temperatures.
    - Heating: night-time setback barely effective as a rule, small heating power supplied without interruption.
    - Significance of efficient electrical appliances.
    - Cooling: no peak loads; small, almost constant demand.

3.1 Investors

- Understanding of the Passive House standard as a NZEB solution
    - Proven concept
    - Reliable performance
    - Available specialized products
    - Long useful life
    - Easy to use
    - low maintenance
- Understanding of some additional advantages of Passive House buildings:
    - Higher tenant satisfaction
    - Lower cost due to unrented properties and tenant changes
    - New rent tariffs viable (space heating included)
    - Largely unaffected by rise in energy prices

4.1 Politicians

- Understanding of the Passive House standard as a NZEB solution
    - Proven concept
    - Reliable performance
    - Available specialized products
    - Long useful life
    - Easy to use
    - low maintenance
- Understanding of some additional advantages of Passive House buildings:
    - Energy independence
    - Economic growth
    - Local creation of value, mainly from SME's (builders and trades)
    - Extra tax payments from local businesses cover expenses for incentives
    - Less cash outflow from the region for energy increases spending capacity
- Knowledge of how to foster Passive House buildings
    - Public pilot projects
    - Acknowledge the Passive House standard as a NZEB solution
    - Accept the PHPP calculation as a proof of quality
    - Encourage third-party quality assurance
    - Wise subsidies and better loan rates based on very high energy efficiency only
    - Support training
    - Careful city planning

User and maintenance team information (booklet for end users)

6. APPENDIX C – Train-to-nZEB Approved Trainers listed

Annex 1: Trainers for the BULGARIAN BKH

No	Name	Organization	Email
1	Zdravko Genchev	CEE EnEffect	zgenchev@eneffect.bg
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4	Kamen Simeonov	CEE EnEffect	ksimeonov@eneffect.bg
5	Stanislav Andreev	CEE EnEffect	sandreev@eneffect.bg
6	Aleksandar Genchev	SolAir Architects	alexander@solair-bg.eu
7	Iglika Lutzkanova	SolAir Architects	iglika@solair-bg.eu
8	Dzhani Antova	BCC	dantova@ksb.bg
9	Maria Zheleva	BCC	mzheleva@ksb.bg
10	Nikolai Ivanov	BSYS	info@bsys.bg
11	Bogomil Stefanov	Hexagon	b.stefanov@hexagon-build.com
12	Stilyan Ivanov	freelance	stilianivanov@gmail.com
13	Radka Ruseva	PGTE Henri Ford	radkaruseva@yahoo.com
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33	Nikolai Madamliev	PGSA - Pazardzhik	pgsa_pivanova@abv.bg

Annex 2: Trainers for the ROMANIAN BKH

No	Name	Organization	Email
1	Zdravko Genchev	CEE EnEffect	zgenchev@eneffect.bg
2	Cristian PETCU	PhD, Senior researcher, NIRD URBAN INCERC	cristian.petcu@yahoo.com
3	Felicia MEREUTA	Building services engineer, FPIP,	felicia.mereuta@gmail.com
4	Alina MEREUTA	Civil Engineer, FPIP	aleenca@gmail.com
5	Ciprian NANU	Business Developer, BDGroup	ciprian.nanu@bdgroup.ro
6	Narcisa DANILA	Business Developer, BDGroup	narcisa.danila@bdgroup.ro
7	Mihaela GEORGESCU	PhD, Assoc. Prof. University of Architecture and Urbanism Bucharest	mihaelastela.georgescu@yahoo.com

8	Norana PETRE	Architect, Certified Passive House Designer	norana.petre@atelier1.ro
9	Marius Gherman	Engineer, Certified Passive House Designer, Home-energy	homexenergy@gmail.com
10	Ligioara FLOREA	Engineer, The Ownership Association of Thermo- Insulating Carpentry Producers	ligiaflorea@gmail.com
11	Gabriel CLISU	Engineer, Energy auditor	gabriel.clisu@gmail.com
12	Vlad Ciobanu	Engineer, Certified Passive House Designer	c.vlad@zecaph.com
13	Cezar CALEAP	ngineer, ZERO ENERGY Association,	euromaster22@yahoo.com
14	Ede ABOS	Architect, Passive House Association of Romania	ede.abos@asociatiacasapasiva.ro
15	Radu GRIGORESCU	Engineer, QETICS - The Group for Quality Thermal Insulating Systems	radu.grigorescu@qetics.ro
16	Andrei CECLAN	PhD Engineer, Servelect / Technical University Cluj-Napoca	andrei.ceclan@servelect.ro
17	Mugur BALAN	PhD, Prof Technical University Cluj-Napoca	Mugur.Balan@termo.utcluj.ro
18	Ioan MOGA	PhD, Prof Faculty of Civil Engineering, Technical University of Cluj-Napoca	ioan.moga@ccm.utcluj.ro
19	Ligia MOGA	PhD, Assoc. Prof Faculty of Civil Engineering, Technical University of Cluj-Napoca	ligia.moga@ccm.utcluj.ro
20	Ancuta MAGUREAN	Engineer, energy auditor for buildings,	anca.magurean@yahoo.com
21	Andrei BEJAN	Engineer, Romstal Academy,	andrei.bejan@romstal.ro
22	Dorin BEU	PhD, Prof Technical University of Cluj-Napoca,	dorin.beu@insta.utcluj.ro
23	Florin DOMNITA	PhD, Prof Technical University of Cluj-Napoca,	florin.domnita@insta.utcluj.ro
24	Nicoleta COBARZAN	PhD, Assoc. Prof Faculty of Civil Engineering, Technical University of Cluj-Napoca,	Nicoleta.Cobarzan@ccm.utcluj.ro
25	Catalin DUMITRU	Engineer SC CLASS MEISTER SRL,	office@classmeister.ro
26	Zoltan MAROSY	PhD, Prof., Ecological University of Bucharest,	marosy.zoltan@gmail.com
27	Cristi BURGHELEA	SC CMB Green Technology SRL,	cmbgreentechnology@gmail.com
28	Mariana BORCEA	Engineer, energy auditor for buildings, Saint Gobain Construction Products Romania, Rigips Division,	mariana.borcea@saint-gobain.com
29	Mihaela SIMION	engineer, energy auditor for buildings, Fabryo Corporation,	Mihaela.Simion@fabryo.com
30	Marius ȘOVLETE	engineer, Creative Engineering,	ingineriecreativa@gmail.com
31	Viorel FLOREA	civil engineer, Certified Passive House Designer, ASPRO PRODINVEST srl,	office@aspro.ro
32	Ruxandra CRUȚESCU	Certified Passive House Designer, Associate professor, Faculty of Architecture - University "Spiru Haret"	crutescuruxandra@gmail.com
33	Irina OPRESCU	energy auditor for buildings, ACIR SERV SRL,	i_escu@yahoo.com

34	Andrei DAMIAN	energy auditor for buildings, Associate Professor, Technical University of Civil Engineering Bucharest,	adamian7@yahoo.com
35	Dragos SIMA	civil engineer, Aledra Systems,	dragos.al.sima@gmail.com
36	Szabolcs VARGA	PhD, civil engineer, energy auditor for buildings, Certified Passive House Designer, V&V Projekt,	office@vvp.ro
37	Aurel Maruneac	civil engineer, ROBSON Construct srl,	maruneac@gmail.com

Annex 3: Trainers for the CZECH REPUBLIC BKH

No	Name	Organization	E-mail
1	Nataliya Anisimova	Ing. arch.Consultant SEVEn Prague	natalie.anisimova@svn.cz
2	Jan Fibiger	Ing. arch.Chairman of board ABF Prague	fibiger@abf-nadace.cz
3	Jiří Karásek	Ing.Senior consultant SEVEn Prague	jiri.karasek@svn.cz
4	Daniel Macek	Doc. Ing Associate professor CTU FCE Prague	daniel.macek@fsv.cvut.cz
5	Bohuslav Málek	Ing.Senior consultant SEVEn Prague	bohuslav.malek@svn.cz
6	Petr Matějka	Ing.Assistant professor ČVUT FSv Prague	petr.matejka@fsv.cvut.cz
7	Dana Měšťanová	Doc. Ing.Associate professor ČVUT FSv Prague	dana.mestanova@fsv.cvut.cz
8	Jiří Šála	Ing.Expert advisor MODI Prague	salamodi@volny.cz
9	Michal Bureš	Ing.Assistant professor CTU FCE Prague	michal.bures@fsv.cvut.cz

Annex 4 Trainers for the TURKEY BKH

No	NAME	EXPERTISE	e-mail
1	Türkan GÖKSAL ÖZBALTA	PhD. Architect, Professor at Ege University.	tozbalta@gmail.com
2	Yusuf YILDIZ	PhD. Architect, Assoc. Professor at Balıkesir University,	yusifyildiz@gmail.com
3	Necdet ÖZBALTA	PhD. Energy Engineer, Professor at Ege University.	necdet.ozbalta1@gmail.com
4	Ali GÜNGÖR	PhD. Mechnical Engineer, Professor at Ege University.	alignger55@gmail.com
5	Mustafa ENGİN	PhD. Electrical Engineer, Assis.Professor at Ege University.	mustafa.engin@ege.edu.tr
6	Semiha KARTAL	PhD. Architect, Assist. Professor at Trakya University.	semihak@trakya.edu.tr
7	Filiz UMAROĞULLARI	PhD. Architect, Assist. Professor at Trakya University.	filizu@trakya.edu.tr
8	Şener UNGAN	Engineer , Metalurgist, Working on Glass Industrie.	
9	İsmail CANER	Mechnical Engineer, PhD student, Research assistant at Balikesir University.	ismailcnr10@gmail.com
10	Merve KOÇYIĞIT	Architect , MSc student, Working on energy efficiency in buildings.	merve_kocyigit93@hotmail.com

Annex 5: Trainers for the UKRAINE BKH

No	Name	Title	Details
1	Oleg SERHEYCHUK	Professor of the Department of Architectural Structures with Architecture Faculty of Kyiv National University of Building and Architecture; Member of the Construction Academy of Ukraine; Chairman of the Committee "Lighting and insolation" with the Technical Committee on "Energy Efficiency" of the Ministry of Regional Development, Construction and Housing and Municipal Economy of Ukraine	.
2	Volodymyr SKOCHKO	Associate Professor Doctoral Candidate of Department of Architectural Structures with Architecture Faculty of Kyiv National University of Building and Architecture; Coordinator of International Activities of Kyiv National University of Building and Architecture on energy efficiency in construction and architecture; Technical Specialist of Municipal Development Institute.	vladimir-skochko@yandex.ru
3	Oleksandr POGOSOV	Associate Professor Head of Laboratory with the Department of Heat Technology of Sanitary Engineering Faculty of Kyiv National University of Building and Architecture.	pogosov_aleksandr@ukr.net

7. APPENDIX D – Train the Trainer Courses and Participants

Annex 1: Agenda for the TTT course for the Bulgarian BKH

Train the Trainer Course 1 - Principles of Passive and Nearly Zero Energy Buildings

Time	Day 1	Technique
13:30 – 13:45	**Opening and introduction**	
13:45 – 14:45	**1. NATIONAL DEFINITION FOR NEARLY ZERO-ENERGY BUILDING** Impact of the new regulations on the design and construction practice. New heat transfer requirements for building components, materials and products	Poster exhibition
14:45 – 15:30	**2. WHAT IS THE ESSENCE OF THE PASSIVE BUILDING?** Basic principles – situation, building envelope, major building components, MVHR	Video on insulation materials
15:30 – 16:00	Coffee break	
16:00 – 16:45	**3. HOW TO DESIGN AND BUILD PASSIVE HOUSES** Thermal bridges, airtightness, economic viability	Video on airtightness in buildings
16:45 – 17:30	**4. HOW TO HEAT AND VENTILATE A PASSIVE BUILDING?** Comfort of habitation and internal air quality. Centralized and decentralized ventilation systems	Video on ventilation systems
17:30 – 18:00	**5. WHAT SHOULD WE KNOW ABOUT RES INSTALLATIONS IN BUILDINGS** Assessment of the potential for installation of small-scale RES solutions in passive buildings: Electricity - autonomous PV systems and mini-wind installation. Thermal energy - solar thermal collectors, heat pumps	Announcement of RES course providers

Time	Day 2	Technique
09:00 – 09:15	**WHAT ELSE SHOULD WE KNOW ABOUT PASSIVE BUILDINGS?** Review of Day 1 and presentation of the agenda for Day 2	
09:15 – 10:00	**6. HOW TO RETROFIT EXISTING BUILDINGS ACCORDING TO THE PASSIVE HOUSE STANDARD?** The "EnerPHit" standard and the step-by-step renovation approach	Video on EnerPhit retrofit project
10:00 – 10:45	**7. PRACTICAL EXCERCISE** 1. Design of a continuous insulation layer and airtight building envelope and design of a ventilation system according pre-given conditions 2. Evaluation of the potential of a particular building for installation of renewable energy systems	
10:45 – 11:00	Coffee break	
10:30 – 11:15	**8. EU POLICIES AND PRACTICES ON ENERGY EFFICIENCY IN BUILDINGS** "Passive" regions and best practice cases	
11:15 – 11:45	**9. WHAT SHOULD WE AIM FOR?** Unlimited scope for the introduction of passive buildings. Examples by the winners of the second International Passive House Awards?	Review of the awarded projects
11:45 – 12:30	**10. WHAT ELSE COULD WE DO TOGETHER?** Presentation of the plans and activities of the Centre of Excellence on Energy Efficiency and RES in Buildings	Promotional video of the Brussels-based PH association PMP
12:30 – 13.00	Discussion	
13:00-14.00	**Lunch**	
14.00-16.00	**11-12. REVIEW AND EXERCISE ON THE DEMONSTRATION FACILITIES** Drawings and explanation of the principles presented on the construction models and hands-on exercises on the practice walls	Multimedia 3D building/component models shown

Train the Trainer Course 2: Agenda in Sofia, Bulgaria *(03 – 04.11.2016)*

Day 1 THE PASSIVE HOUSE: WHAT DO WE NEED TO KNOW?

Date: 03 November 2016
Location: University of Architecture, Civil Engineering and Geodesy (new building)
Address: 1, Hristo Smirnenski Blvd, 1164 Sofia, Bulgaria
Timing: 09:00 – 16:00

Time	TRAIN-THE-TRAINER SESSION
8:30 – 9:00	Arrival and registration
9:00 – 9:45	**Summary of Passive House bases and overview of PHPP** *Art McCormack, Passive House Academy*
9:45 – 10:30	**Certification and quality assurance: the certified training schemes by PHI. Economics/Energy cost comparison between PH and Normal** *Wolfgang Hasper, Passive House Institute*
10:30 – 11:00	Coffee break
11:00 – 11:45	**Insulation , including Lamda and U-values and materials demo** *Passive House Academy*
11:45 – 12:30	**Thermal (and repeating) thermal bridging** *Passive House Academy*
12:45 – 13:30	Lunch
13:30 – 14:15	**Increased airtightness and site examples** *Passive House Academy*
14:15 – 15:00	**Passive House windows and doors, including U-value calculation demo** *Passive House Academy*
15:00 – 15:15	Break
15:00 – 15:45	**Description of mechanical ventilation systems and training, including systems suited to retrofitting** *Passive House Institute*
15.45 – 16.30	**PHPP Show** *Passive House Institute*
16:30 – 17:15	**RES in Passive Houses. Q & A** *Passive House Institute*
17:30	Closing of the first day

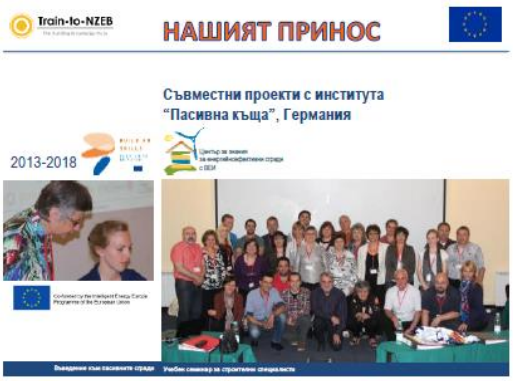
Day 2 THE PASSIVE HOUSE: WHAT DO WE NEED TO KNOW?

Date: 04 November 2016
Location: University of Architecture, Civil Engineering and Geodesy (new building)
Address: 1, Hristo Smirnenski Blvd, 1164 Sofia, Bulgaria
Timing: 09:00 – 16:00

Time	TRAIN-THE-TRAINER SESSION (cont)
09:00 – 10:00	**Explain** (PHA) **and sketch building envelope demonstration models and then describe the envelope re continuity of key energy-related components as a examples of integrated construction systems** (Participants) *Passive House Academy / participants*
10:00 – 10:30	Coffee break
10:30 – 11:30	**Construction and energy performance of 4 case study retrofits** *Passive House Academy*
11:30 – 12.30	**Demonstration of a sample PH design solution** *Passive House Academy / participants*
12:30 – 13:30	Lunch
13:30 – 16:00	**Presentations by Bulgarian BKH trainers and guest lectors (tbd)**
16:00	Closing of the TTT course

Train the Trainer Workshop sample presentations in Bulgaria

NATIONAL DEFINITION FOR NEARLY ZERO-ENERGY BUILDING



Train-to-NZEB

НАШИЯТ ПРИНОС

Първата сертифицирана пасивна сграда в България

Детска градина "Слънце" в Габрово

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Фокус: ЕЕ в сградите

Основен консуматор:

- 40% от енергията в ЕС и 36% от генерираните емисии на CO_2
- 75 % от сградите през 2050 вече са построени

Train-to-NZEB

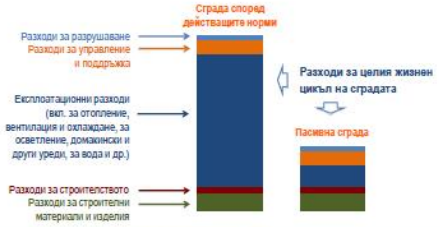
ЕВРОПЕЙСКА ПОЛИТИКА

Фокус: ЕЕ в сградите

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Фокус: ЕЕ в крайното потреление на енергия



Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Цели до 2030 г.

Намаляване на емисиите на парникови газове с **40%** спрямо равнището от 1990 г.

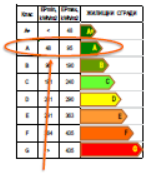
Делът на възобновяемите енергийни източници (ВЕИ) в целия ЕС да е да е най-малко **27%**

Повишаване на енергийната ефективност с **30%** (необвързваща цел)

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Директива за енергийните характеристики



+ 55% ВЕИ =
Почти нулево-енергийна сграда

Преминаване към строителство на **почти нулевоенергийни сгради (ПНЕС)** след 2020 г. (2018 г. за публични сгради)

Въвеждане на **класове за енергийна ефективност** с фиксирани стойности на интегрираната енергийна характеристика - kWh/m².а (кВч/m²/год).

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Политики на страните членки на ЕС
(по пътя към ПНЕС)

Видове конструкции

Сградна обвивка

Стени: Тухли (38%) / Стоманобетон (38%) / Дърво (24%)
Покриви: Стоманобетон (64%) / Дърво (36%)
Прозорци: 2/3 тройно остъклени / 1/3 двойно остъклени
Подове: 93% изолирани

Коефициент на топлопреминаване U

Стени: 0.29 W/m²K
Покрив: 0.14 W/m²K
Прозорци: 1.12 W/m²K
Под: 0.29 W/m²K
Врати: 0.98 W/m²K

Избрани примери

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Политики на страните членки на ЕС
(по пътя към ПНЕС)

Сградни системи

Отопление Термопомпи (13) / Газови котли (7) / Централно отопление (6) / Котли на биомаса (4) / Комбинирано производство + газов котел (1) / Сплит А/С системи (1)

Битова гореща вода 85% комбинирано / 9% електричество / 53% слънчева енергия

Вентилация 73% механична с рекуперация / 8% механична без рекуперация / 9% с механична с рекуперация + термопомпа / 6% отваряне на прозорците

Охлаждане 69% без охлаждане / 31% с охлаждане

Осветление 12% с детектори за присъствие / 9% с детектори за дневно осветление

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Политики на страните членки на ЕС
(по пътя към ПНЕС)

Дял на ВЕИ

ВЕИ системи

Слънчеви системи за производство на електричество - PV (70%)
Слънчеви системи за отопление (52%)
Геотермални системи (термопомпи, 30%)
Централно отопление (21%)
Биомаса (18%)
Въздушна термопомпа (климатик, 18%)
Комбинирано производство на енергия (3%)

Дял на ВЕИ 70% от общата крайна енергия

В повече от изискванята 74%

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Политики на страните членки на ЕС
(по пътя към ПНЕС)

	Оскъпяване в избраните примери на ПНЕС в сравнение с равнищата на енергийна ефективност според действащите национални норми		
	Средно	Най-ниско	Най-високо
% от общата стойност	11	0	25

При 52% от примерите е посочена обща стойност
При 33% от примерите е посочено оскъпяването

Train-to-NZEB

ЕВРОПЕЙСКА ПОЛИТИКА

Актуални нормативни документи

- Закон за енергийната ефективност
- План за действие за енергийна ефективност - 2014-1020 г.
- Национален план за сгради с близко до нулата потребление на енергия - 2015-2020 г.
- Доклад за изчисляване на оптималните по отношение на разходите равнища на минимални изисквания за енергийните характеристики на сградите в Република България
- Наредба № 7 за енергийна ефективност на сградите
- Наредба за енергийните характеристики на сградите

ЕВРОПЕЙСКА ПОЛИТИКА

Директива за енергийна ефективност, чл. 4

Дългосрочна стратегия за мобилизиране на инвестиции за саниране:

а) **преглед** на националния сграден фонд;

б) определяне на **разходно ефективни подходи** за саниране;

в) **политики и мерки за насърчаване** на разходно ефективно саниране на сгради, **включително поетапно саниране**;

г) ориентирана към бъдещето перспектива за насочване на **инвестиционните решения** на частни лица, строителната промишленост и финансовите институции;

д) основана на факти **преценка за очакваните икономии и ползите** в по-широк смисъл.

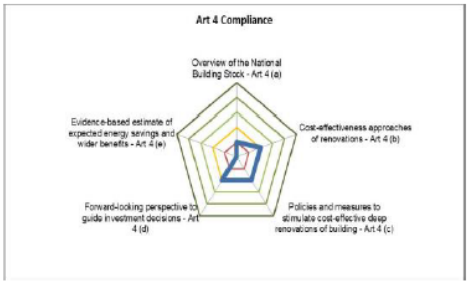
ДОКЛАД НА JRC

Чл. 4а: Преглед на сградния фонд	Липсва	Анекс II на НПДЕЕ предоставя общ преглед на националния сграден фонд, но не включва подробен набор от данни, както се изисква.	1
Чл. 4б: Рентабилност на обновяванията	Частично	Има общ преглед на разходите и рентабилността, но много елементи липсват и резултатите не са разгледани подробно.	2
Чл. 4в: Политики и мерки за стимулиране на дълбокото обновяване	Частично	Регулаторните мерки (транспонирането на ДЕКС) имат пряк ефект върху новите сгради, но оказват незначително влияние върху съществуващите. Дълбокото поетапно обновяване не е взето под внимание и в Анекс II на НПДЕЕ няма ясна перспектива.	2
Чл. 4г: Дългосрочна перспектива за „дълбоко" обновяване	Частично	Финансовата рамка не е добре определена. Изредени са 11 финансови инициативи, но не е ясно как те ще подпомогнат обновяването на националния сграден фонд	2
Чл. 4д: Оценка на енергийните спестявания и по-широките ползи	Липсва	Няма информация относно ползите от осъществяването на стратегията.	0

ДОКЛАД НА JRC

Обобщение	**Българската стратегия е погрешна и не предоставя ясна дългосрочна перспектива.** Вече постигнатите резултати при обновяването на съществуващия сграден фонд не са ясно описани и бъдещите цели не са определени. Заедно с това, методологията за изчисление на оптималните разходи (рентабилността), както и състоянието на техническите регламенти, са предадени в резюме, но техните последици за стратегията за обновяване не са ясно описани.
Амбиция	**Общата амбиция на стратегията изглежда слаба.**
Уместност	Реализираните мерки могат да имат положителен ефект върху сградния фонд, но основана на доказателства оценка на очакваните икономии на енергия не е предвидена.
Всеобхватност	Трябва да се предприемат допълнителни усилия за обновяването на сградната обвивка.
Препоръки	**Всички елементи на стратегията трябва да бъдат по-подробни и трябва да бъдат включени** основани на доказателства оценки на очакваните икономии на енергия. Добрите инициативи, които вече са предприети, следва да се засилят в областта на сградните обновявания, в рамките на една добре дефинирана рамка (контекст, бариери, цели, налични ресурси, рискове и т.н.).

ДОКЛАД НА JRC



НАЦИОНАЛНА ПОЛИТИКА

Предложения за развитие на програмата

- Набор и анализ на данни за жилищния сграден фонд
- Моделиране на сценарии за обновяване: Invert/EE-Lab
- Анализ на приложимостта на сценариите, препоръки и Пътна карта
- Обновяване „Стъпка по стъпка" до клас А
- Финансова рамка

Train-to-NZEB

Учебен семинар за строителни специалисти
Плевен, 14-16 ноември 2016 г.

ПРОЕКТИРАНЕ И СТРОИТЕЛСТВО НА ПАСИВНИ СГРАДИ

EnEffect

Разработка и адаптация:

ЕнЕфект
Център за енергийна ефективност
Бул. Хр. Смирненски 1
1164 София

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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СЪДЪРЖАНИЕ

А. Оптимални слънчеви печалби
Б. Сградна обвивка
В. Сградни системи за отопление, вентилация и охлаждане
Г. Почти 0-енергийна сграда
Д. Обновяване на съществуващи сгради

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

ПРИНЦИПИ

Шестте стълба на пасивната сграда

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

ПРИНЦИПИ

Концепцията "Пасивна къща"

Концепцията срещу стандарта

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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А

ОПТИМАЛНИ СЛЪНЧЕВИ ПЕЧАЛБИ

Ситуация / форма / ориентация

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

СИТУАЦИЯ

1 Оптимални слънчеви печалби - ситуация

Водеща роля на градоустройствения и архитектурния проект

Район с пасивни сгради в Антверп, Белгия

Квартал с пасивни сгради в Ханновер, Германия

Район с пасивни сгради в Хайделберг, Германия

Въведение към пасивните сгради Учебен семинар за строителни специалисти

ФОРМА

1 Оптимални слънчеви печалби - форма

Благоприятни форми:

- Големи многофамилни жилищни сгради
- Многоетажни апартаментни блокове
- Редови (сключени) сгради
- Големи еднофамилни сгради с опростена форма
- Всяка сграда с коефициент на компактност < 0.7

НПов : НОб < 0.7

Малките сгради с неправилни форми имат относително по-големи външни повърхности в сравнение с големите сгради с опростени форми. Поради това те са енергийно неефективни и се нуждаят от повече изолация и по-голяма въздушна плътност

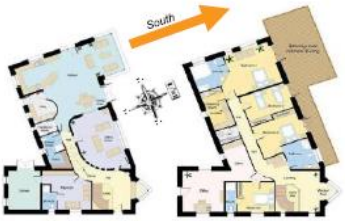
Въведение към пасивните сгради Учебен семинар за строителни специалисти

ОРИЕНТАЦИЯ

1 Оптимални слънчеви печалби - ориентация

Оптимална ориентация на помещенията:

Кухни (помещения за готвене) – на север / изток
Трапезарии (помещения за хранене) – на юг
Дневни помещения – на юг
Спални – на изток / юг
Мокри помещения – на север
Коридори – на север



Търсенето на оптимална ориентация е концепция, която съществува от преди около 5000 години

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Б

СГРАДНА ОБВИВКА

Топлоизолация / прозорци и врати / въздушна плътност / топлинни мостове

Въведение към пасивните сгради Учебен семинар за строителни специалисти

СГРАДНА ОБВИВКА

2 Повишена топлоизолация

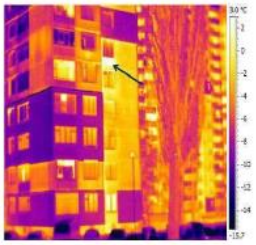
Осреднени топлинни загуби през външната обвивка на сградата

Въведение към пасивните сгради Учебен семинар за строителни специалисти

СГРАДНА ОБВИВКА

2 Повишена топлоизолация

Термографско изображение на частично изолирана сграда



Въведение към пасивните сгради Учебен семинар за строителни специалисти

СГРАДНА ОБВИВКА

2 Повишена топлоизолация

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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СГРАДНА ОБВИВКА

2 Повишена топлоизолация

Изолация по стени

Водеща роля на архитектурния проект

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СГРАДНА ОБВИВКА

2 Повишена топлоизолация

Изолация по покриви

Изолация под основи

Водеща роля на архитектурния проект

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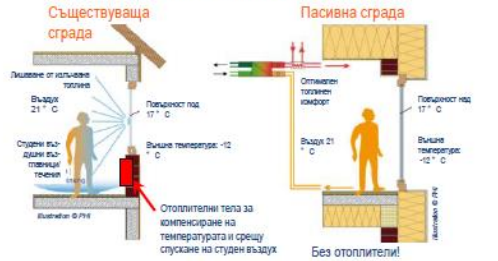
СГРАДНА ОБВИВКА

3 Висококачествени прозорци



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СГРАДНА ОБВИВКА

3 Висококачествени прозорци

Рамката е разположена пред зидарията, в изолационния слой

Точково закрепване с използване на метални ъгли

Свързване на прозореца с въздухонепроницаемия слой

Прехвърляне на товара през квадратната греда

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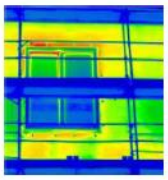
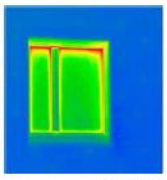
СГРАДНА ОБВИВКА

3 Висококачествени прозорци

Водеща роля на архитектурния проект и стгроителното изпълнение



Монтаж на прозорец без изолационна лента



Монтаж на прозорец с изолационна лента

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СГРАДНА ОБВИВКА

3 Висококачествени прозорци

Засенчващи устройства

Водеща роля на архитектурния проект и строителното изпълнение

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СГРАДНА ОБВИВКА

4 Висока въздушна плътност

Водеща роля на архитектурния проект и на строителното изпълнение

Уплътнителни ленти

Непрекъснат въздухонепроницаем слой

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СГРАДНА ОБВИВКА

4 Висока въздушна плътност

Уплътнителни ленти

Водеща роля на архитектурния проект и на строителното изпълнение

Провеждане на текст за въздушна плътност

Предимства

Предпазват сградата от увреждане (поява на конденз в конструкцията)

Икономия на енергия

Подобрен комфорт на обитаване без течения

Имат основно значение за функционирането на вентилационната система и оползотворяването на отпадъчната топлина

Подобрена шумоизолация

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СГРАДНА ОБВИВКА

5 Минимални топлинни мостове

Аплицирани балкони

Окачени балкони

Водеща роля на архитектурния и конструктивния проект

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СГРАДНИ СИСТЕМИ

6 Вентилация с рекуперация

Концепция за вентилация в пасивна сграда

- Чист въздух в помещенията
- Въздухът се обменя и без да има хора
- Без миризми от кухнята и тоалетната
- Филтриран въздух за страдащите от алергии
- Без влага и мухъл

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ПРИНЦИПИ

Концепцията "Пасивна къща"

Физически качества на сградата

1. Оптимални слънчеви печалби → Ситуация
2. Повишена топлоизолация
3. Висококачествени врати и прозорци
4. Висока въздушна плътност
5. Минимални топлинни мостове

→ Сградна обвивка

6. Вентилация с рекуперация → Сградни системи

Концепцията и стандартът

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ОТ ПС КЪМ ПНЕС

Допълнителни изисквания към почти нулевоенергийната сграда (ПНЕС)

Социално-политически изисквания

7. Икономическа ефективност
8. Висок дял на ВЕИ
9. Минимални емисии на CO_2

Социално-политически елементи на концепцията «Пасивна къща»

Изисквания на Директивата на ЕС за енергийните характеристики на сградите (обновена през 2010 г.)

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ОТ ПС КЪМ ПНЕС

7 Икономическа ефективност

Водеща роля на интегрирания проект

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ОТ ПС КЪМ ПНЕС

7 Икономическа ефективност

Социални жилища в Брюксел

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ОТ ПС КЪМ ПНЕС

9 Минимални емисии на CO^2

Водеща роля на интегрирания проект

Слънчеви сгради (80-те години)

3-литрови сгради (90-те години)

Сгради без въглерод (Обединено кралство)

"Зелени" сгради - с минимален екологичен отпечатък върху окръжаващата среда

България: ПНЕС – най-малко 55% от енергията в сградата да е от ВЕИ

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ПРОБЛЕМИ И РЕШЕНИЯ

Необновени съществуващи сгради

Конденз и мухъл

Решение
- Топлоизолация
- Вентилационна система

Причини
- Ниски температури по повърхността
- Висока влажност в помещенията

Влошен топлинен комфорт

Решение
- Топлоизолация и прозорци за ПК
- Въздухо-непроницаемост

Причини
- Големи температурни разлики
- Течения

Лошо качество на въздуха

Решение
- Вентилационна система с рекуперация

Причини
- Незадоволителен въздухообмен
- Ненадежден и нередовен въздухообмен

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ПРОБЛЕМИ И РЕШЕНИЯ

Необновени съществуващи сгради

Високи разходи за отопление

Решение
- Преодоляване на топлинните загуби чрез:
  - изолация
  - избягване на ТМ
  - прозорци за ПК
  - въздухонепроница-ема конструкция
  - вентилация с рекуперация

Причини
- Високи топлинни загуби, дължащи се на:
  - топлопроводимост (външни сградни компоненти)
  - въздухообмен

Замърсяване на околната среда

Решение
- Намаляване на топлопотреблението с използване на компоненти на ПК

Причини
- Изгаряне на газ, нефт или въглища за отопление на сгради

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ПРОБЛЕМИ И РЕШЕНИЯ

Най-чести предизвикателства

Ако една сграда си струва да се обнови, направете го както трябва !

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ПРОБЛЕМИ И РЕШЕНИЯ

Най-чести предизвикателства

- Лепило, нанесено с назъбена мистрия
- Лепило, нанесено по линейно-точковия метод (1-2 cm)
- Релсови крепежни елементи (< 3cm)
- Регулируеми дюбели (< 7 cm)
- Нивелираща мазилка
- Оставяне на неравностите в първоначалното им състояние

Компенсиране на неравностите

Въведение към пасивните сгради | Учебен семинар за строителни специалисти

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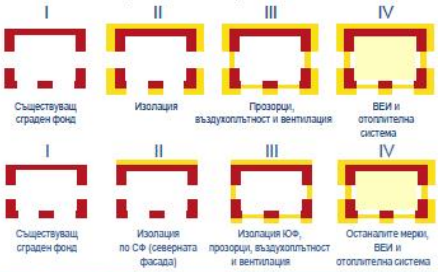
СТЪПКА ПО СТЪПКА

Примерно планиране на стъпките



Въведение към пасивните сгради | Учебен семинар за строителни специалисти

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НАЦИОНАЛНА ПРОГРАМА

Пълно, но компромисно обновяване или амбициозно обновяване на стъпки

Състояние на съществуващия сграден фонд в България

Програми за обновяване на многофамилни жилищните сгради

"Блокиращият" ефект на компромисното обновяване на сградите и мястото на подхода "стъпка по стъпка"

Възможни първи стъпки към максималното оползотворяване на потенциала за енергийно ефективност при обновяването на сградните фондове

Въведение към пасивните сгради | Учебен семинар за строителни специалисти

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ГАРАНТИРАНЕ НА КАЧЕСТВОТО НА ПРОЕКТА И ИЗПЪЛНЕНИЕТО

Въведение към пасивните сгради | Учебен семинар за строителни специалисти

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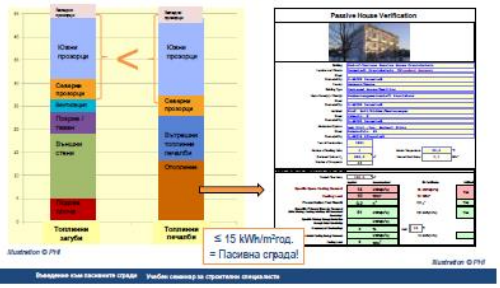
КАЧЕСТВО

Софтуерен пакет за проектиране на ПК



Въведение към пасивните сгради | Учебен семинар за строителни специалисти

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КАЧЕСТВО

Сертификат за ново строителство

Сертифициране, като "Качествено одобрена пасивна сграда", ако стандартът Пасивна сграда (за нови сгради) е достигнат

Текущите критерии за сертифициране, както и списъкът на оторизираните от Института "Пасивна къща" сертифициращи, можете да намерите на адрес

www.passiv.de

Въведение към пасивните сгради | Учебен семинар за строителни специалисти

Passive House in Bulgaria

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НАЧАЛОТО

Първата сертифицирана пасивна сграда в България - стени




Детска градина "Слънце" в Габрово. Проектирана със съдействието на ЕнЕфект Дизайн и ЕкоЕнергия

Архитектура: СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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НАЧАЛОТО

Първата сертифицирана пасивна сграда в България - прозорци





Детска градина "Слънце" в Габрово. Проектирана със съдействието на ЕнЕфект Дизайн и ЕкоЕнергия

Архитектура: СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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НАЧАЛОТО

Първата сертифицирана пасивна сграда в България - покрив




Детска градина "Слънце" в Габрово. Проектирана със съдействието на ЕнЕфект Дизайн и ЕкоЕнергия

Архитектура: СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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НАЧАЛОТО

Първата сертифицирана пасивна сграда в България - вентилация

Концентрация CO_2 при естествена вентилация с отваряне на прозорци

Концентрация CO_2 при механична вентилация с рекуперация

Концентрация CO_2 в съответствие със стандарта DIN

Идеална концентрация на CO_2 (Др. Петенкойфер)

ВЕНТИЛАЦИЯТА ОСИГУРЯВА ЗДРАВОСЛОВЕН РЕЖИМ И ВИСОКО РАВНИЩЕ НА КОМФОРТ.

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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НАЧАЛОТО

Пасивни сгради в България

Еднофамилна къща в с. Бистрица

Архитектура: СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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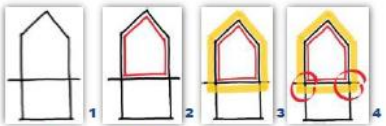
НАЧАЛОТО

Пасивни сгради в България



Еднофамилна къща в с. Бистрица

Архитектура: СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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НАЧАЛОТО

Пасивни сгради в България

ПАСИВНА КЪЩА С ГАРАЖ

ПАСИВНА КЪЩА В ХАМБУРГ

Еднофамилна къща
в с. Бистрица

Архитектура:
СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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НАЧАЛОТО

Пасивни сгради в България

ПАСИВНА КЪЩА С ГАРАЖ

Еднофамилна къща
в с. Бистрица

Архитектура:
СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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НАЧАЛОТО

Пасивни сгради в България

ПАСИВНА КЪЩА С ГАРАЖ

Еднофамилна къща
в с. Бистрица

Архитектура:
СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

ПАСИВНА КЪЩА С ГАРАЖ

Еднофамилна къща
в с. Бистрица

Архитектура:
СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

СЕВЕРНА ФАСАДА - НЕОТОПЛЯЕМ ГАРАЖ

Еднофамилна къща
в с. Бистрица

Архитектура:
СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

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в с. Бистрица

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НАЧАЛОТО

Пасивни сгради в България

ТЕРАСИТЕ В ПАСИВНАТА КЪЩА

СТАНДАРТНО ИЗПЪЛНЕНИЕ НА БАЛКОНИ ПРИ ЕНЕРГИЙНО ЕФЕКТИВНО ОБНОВЯВАНЕ НА ЖИЛИЩНИ СГРАДИ В ГЕРМАНИЯ

ЖИЛИЩНА СГРАДА В БРЮКСЕЛ

ЖИЛИЩНА СГРАДА В ЛОНДОН
СИСТЕМА ЗА ОКАЧЕНИ БАЛКОНИ HALFEN

Въвеждане към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

ТЕРАСИТЕ В ПАСИВНАТА КЪЩА

СЕВЕРНА ФАСАДА – Тераса с прекъснат термо мост

Еднофамилна къща в с. Бистрица

Архитектура: СолЕр Архитекти

Въвеждане към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

ТЕРАСИТЕ В ПАСИВНАТА КЪЩА

ГРУБИЯТ СТРОЕЖ . . .

ИЗОЛАЦИЯТА . . .

МАЗИЛКАТА . . .

Еднофамилна къща в с. Бистрица

Архитектура: СолЕр Архитекти

Въвеждане към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Въвеждане към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

Спортно-образователен център за деца и младежи и църква „Св. Дева Мария помощница на християните" в Стара Загора

Показатели:
Специфична нужда от енергия за отопление: 14,15 kWh/m²a
Специфична нужда от първична енергия: 55 kWh/m²a

Архитектура: СолЕр Архитекти

Въвеждане към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

Спортно-образователен център за деца и младежи и църква „Св. Дева Мария помощница на християните" в Стара Загора

Архитектура: СолЕр Архитекти

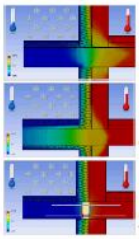
Въвеждане към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

ТЕРАСИТЕ В ПАСИВНАТА КЪЩА



ИЗОЛАЦИЯ ОТ ГОРНАТА СТРАНА, БЕЗ ПРЕКЪСНАТ ТЕРМОМОСТ

ИЗОЛАЦИЯ ОТ ГОРНАТА И ДОЛНАТА СТРАНА, БЕЗ ПРЕКЪСНАТ ТЕРМОМОСТ

ИЗОЛАЦИЯ ОТ ГОРНАТА СТРАНА, С ПРЕКЪСНАТ ТЕРМОМОСТ

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

Спортно-образователен център за деца и младежи и църква „Св. Дева Мария помощница на християните" в Стара Загора

Архитектура: СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Пасивни сгради в България

Спортно-образователен център за деца и младежи и църква „Св. Дева Мария помощница на християните" в Стара Загора

Архитектура: СолЕр Архитекти

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Католически храм "Успение Богородично", Враца

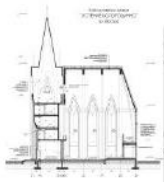
Архитектура:
СолЕр Архитекти, София

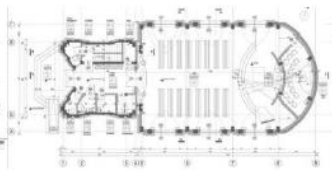
Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Католически храм "Успение Богородично", Враца





Архитектура:
СолЕр Архитекти, София

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Train-to-NZEB

НАЧАЛОТО

Католически храм "Успение Богородично", Враца

Архитектура:
СолЕр Архитекти, София

Въведение към пасивните сгради Учебен семинар за строителни специалисти

Annex 2: Agenda for the ROMANIAN BKH TTT course

	FACTSHEET 1	Delivery Proposal 8th February 2017
1a	**Partner Organisation**	**NIRD URBAN-INCERC**
1b	**Title**	**Train-to-nZEB Training Workshop in ROMANIA** –Train the Trainers
1c	**Type of Delivery**	Classroom, hands-on practical work

1d

SCHEDULE OF TRAINING

The Training of Trainers Program aims to create a critical mass of trainers in Romania who have the necessary technical knowledge, skills and experience about specific training modules in the nZEB Training courses, in order to provide preliminary assistance to trainers. The program is designed on the structure and information from the PHI and PHA TTT Course (Passive House basics), with additional module from LIT (Pedagogical approaches) and NIRD URBAN-INCERC (national specific nZEB information).

The course is schedule for 2 days, in the period 8-9.02.2017, in conjunction with the Train-to-nZEB consortium meeting (7.02.2017). The course agenda is presented in Appendix.

RESOURCES AVAILABLE

The training course will be organised in classroom and in the practical training facility at NIRD URBAN-INCERC.

The training session is focused on two main parts:

- Technical training (Passive House principles and National context including cost optimal calculations),
- Pedagogical training (tips and appropriate techniques to train others).

Training materials for theory (classroom) will be provided by the trainers on their specific modules (according to the agenda), as PowerPoint presentations.

The demonstrative materials in the practical facility within the EPB centre will allow the practical approach of the themes presented by PHA, PHI, LIT:

- Mock-ups: insulation, airtightness, thermal bridges, various structures & ETICS,
- Mechanical ventilation with heat recovery,
- Airtight room,
- Working models/mock-ups for airtightness and insulation exercises.

ACTIVIITES

Different types of teaching tools are going to be employed, such as: presentations, open discussions, case studies, practical applications and demonstrations.

DELIVERY

The trainees are part of the preliminary list of potential trainers who have accepted to become trainers connected with the BKH-RO. Majority of candidates were selected from academic staff in architecture and civil & building services engineering or building professionals with proven experience in passive houses / low energy buildings design or construction. Most of the selected trainees have technical knowledge in the field of constructions and installations, while some of them have already participated in training courses organized by PHI. Some of them have already teaching/training experience and pedagogical formation (e.g. trainer certificate or sufficient activity in the education system).

The TTT course is intended to be interactive, with open discussions led by trainers. No formal evaluation or examination is intended to be organised at the end of the TTT course, but questions will be prepared by the trainers during the training modules, while short recap is intended during the practical activities and demonstrations.

Feed-back from the participants will be sought based on specific form prepared by the course organisers.

1e	**Name of Trainer (s):**Art McCormack (PHA), Susanne Winkel, Dragos Arnautu (PHI), Elisabeth O'Brien (LIT), Horia Petran (NIRD URBAN-INCERC)	
1f	**Organisation**	NIRD URBAN-INCERC
1h	**Address:**	266 Pantelimon Sos., 021652 Bucharest, Romania

1g		
	Delivery Address	**266 Pantelimon Sos., 021652 Bucharest, Romania**
	Target Group	**Potential Trainers for T2nZEB courses**
	Proposed number of Attendees	**48**
	How will this event be promoted	**E-mails to T2nZEB list of trainers**
	Other (identify)	**+ Cluster Pro-nZEB**

AGENDA

TRAIN-TO-NZEB: Train-the-Trainers Course on nZEB Basics – Passive House Concepts
08-09.02.2017 Bucharest, Romania

Day 1 THE PASSIVE HOUSE: WHAT DO WE NEED TO KNOW?

Date: 8 February 2017
Location: NIRD URBAN-INCERC (BKH-RO, Bucharest facilities)
Address: 266, Pantelimon Sos., 021652 Bucharest, Romania (map)
Timing: 08:30 – 17:30

	TRAIN-THE-TRAINER SESSION
8:30 – 9:00	Arrival and registration
9:00 – 9:45	**Summary of Passive House bases and overview of PHPP** *Art McCormack, Passive House Academy*
9:45 – 10:30	**Certification and quality assurance: the certified training schemes by PHI. Economics/Energy cost comparison between PH and Normal** *Representative of Passive House Institute*
10:30 – 11:00	Coffee break
11:00 – 11:45	**Insulation, including Lambda and U-values and materials demo** *Art McCormack, Passive House Academy*
11:45 – 12:30	**Thermal (and repeating) thermal bridging** *Art McCormack, Passive House Academy*
12:30 – 13:30	Lunch
13:30 – 14:00	**Increased airtightness and site examples** *Art McCormack, Passive House Academy*
14:00 – 14:30	**Passive House windows and doors, including U-value calculation demo** *Art McCormack, Passive House Academy*
14:30 – 15:00	**Description of mechanical ventilation systems and training, including systems suited to retrofitting** *Representative of Passive House Institute*
15:00 – 15:30	Coffee Break + short visit to practical training facility of BKH-RO
15:30 – 16:15	**Train to nZEB – Pedagogical Approaches** *Lis O'Brien, Limerick Institute of Technology*
16:15– 16:45	**PHPP Show** *Representative of Passive House Institute*
16:45– 17:30	**RES in Passive Houses. Q & A** *Representative of Passive House Institute*
17:30	Closing of the first day

Day 2 THE PASSIVE HOUSE: WHAT DO WE NEED TO KNOW?

Date: 9 February 2017
Location: NIRD URBAN-INCERC (BKH-RO, Bucharest facilities)
Address: 266, Pantelimon Sos., 021652 Bucharest, Romania (map)
Timing: 09:00 – 16:00

	TRAIN-THE-TRAINER SESSION (continuation)
09:00 – 10:30	**Explain** (PHA) **and sketch building envelope demonstration models and then describe the envelope re continuity of key energy-related components as a examples of integrated construction systems** (Participants) *Art McCormack, Passive House Academy* *& representative of BKH Romania / participants*
10:30 – 11:00	Coffee break
11:00 – 12:00	**Construction and energy performance of 4 case study retrofits** *Art McCormack, Passive House Academy*
12:00 – 12:30	**Demonstration of a sample PH design solution** *Art McCormack, Passive House Academy / participants*
12:30 – 13:30	Lunch

13:30 – 16:00	**Presentations by Romanian BKH trainers and guest lectors (Horia Petran): How is nZEB defined in Romania? Performance levels, status of National Regulation and market development in Romania.** **Demonstrations and exercises in the practical training facility of BKH-RO.**
16:00	Closing of the TTT course

FACTSHEET 2 – Evaluation of Trainers Workshop 8th February 2017

2a	**Partner Organisation**	NIRD-URBAN BUCURESTI
2b	**Title**	**Train--to-nZEB Training Workshop in ROMANIA** –Train the Trainers
2c	**Type of Delivery**	Classroom, hands-on practical work
2d	**ANALYSE** In Romania, the nZEB concept has been only recently defined and, although some experience about low energy buildings exists, the achievement of the defined levels of performance is not effectively supported by detailed guidelines and specific competences development in the national education system. Moreover, the principles which form the "Passive House" concept are not well known and applied in Romania, although this would be the best starting point for developing the nZEB concept (… high energy performance of the building, which requires nearly zero or very low amount of energy). Thus, high levels of thermal insulation and airtightness of the building envelope, as well as mechanical ventilation with heat recovery are not usual practice in Romania. The Train-to-nZEB programs are aiming at filling these gaps in order to facilitate the effective implementation of nZEB concept in practice. The main objective of the Training of Trainers Program is to create a critical mass of trainers in Romania who have the necessary technical knowledge, skills and experience about specific training modules in the nZEB Training courses (developed for the three target groups defined in the training plan for Train-to-nZEB), in order to provide preliminary assistance to trainers. This training provided the participants with more information about the purpose and objectives and related technical information about the nZEB concept, (Passive House Principles and National contexts including cost optimal calculations), tips and techniques to train others to learn, how to apply the Passive House principles. From the analysis of the answers provided by the trainees, it is advisable to organize other TTT sessions in order to update the technical information (including more case studies applicable in Romania). **DESIGN** The TTT program aimed to cover the need for professional training of various professionals interested in becoming trainers in T2nZEB courses, to update their knowledge of Passive House concept and renewable use in buildings and cover new subjects which are national specific (e.g. national requirements, traditional construction technologies and adaptation to PH/nZEB principles), The learning objectives are: - To incorporate knowledge and new skills related to low energy buildings (to implement the nZEB concept by applying the PH principles); - To understand the principles and technologies that underpin the implementation of the NZEB principles, - To prepare for conducting training programs for the target groups identified in T2nZEB project in order to implement the principles of the nZEB in Romania. The course was organised for 2 days in the period 8-9.02.2017, from 9.00 to 17.30. The trainees actively participated in the training, both at the theory sessions and at the demonstrative session (practice). The trainees' list is attached in the appendix. No formal evaluation or examination is intended to be organised at the end of the TTT course, but questions will be prepared by the trainers during the training modules, while short recap is intended during the practical activities and demonstrations. **DEVELOP** **The following content was presented during the TTT course:** - Summary of Passive House bases and overview of PHPP, - Certification and quality assurance: the certified training schemes by PHI. Economics/Energy cost comparison between PH and conventional houses, - Insulation, including Lambda and U-values and demo materials,

- Thermal (and repeating) thermal bridging,
- Increased airtightness and site examples,
- Passive House windows and doors, including U-value calculation demo,
- Description of mechanical ventilation systems and training, including systems suited to retrofitting,
- Train to nZEB – Pedagogical Approaches,
- RES in Passive Houses.

Front and group activities were organized: lectures and presentations, discussion groups, practical exercises.

IMPLEMENT

The Train-the-Trainers course was organized between 8th and 9th of February 2017 with the support of Train-to-NZEB project partners, who participated as trainers in the program:

- Art McCormack, Passive House Academy,
- Susanne Winkel and Dragos Arnautu - Passive House Institute,
- Elisabeth O'Brien, Limerick Institute of Technology,
- Horia Petran – NIRD URBAN-INCERC.

The course took place at the training facilities within NIRD URBAN-INCERC in Bucharest and was attended by 56 persons (including project partners). The list of attendees for both days is presented in Appendix 1.

The course participants were construction and building services specialists, technical university professors, energy auditors, architects, and professionals working within the productive sector (construction materials, systems and technologies). From the pedagogical point of view, some of the trainers comply with the requirements set in the national qualification system (for trainers), while others took advantage by the pedagogical module of train-the-trainers which was included in the program. The participation to the course was done based on the invitations sent by the hosts to the persons who agreed to register the data on the project site (T2nZEB list of trainers) and by the network of member organisations of the Cluster Pro-nZEB.

The course has been also promoted by social media (Facebook and Twitter) and on the website of NIRD URBAN-INCERC.

From the administrative point f view, this first training session organised by the BKH-RO partners was a challenge and the experience was very useful for the next sessions to be organised during the T2nZEB project.

EVALUATE

The TTT program is considered to be formative, based on new information and knowledge transmitted for some of the participants, but also summative, taking into account the previous knowledge and experience for most of the trainees. The training program was a free course provided by the T2nZEB project.

No formal evaluation or examination was organised at the end of the TTT course, but questions and answers were prepared by the trainers during the training modules, while short recap is intended during the practical activities and demonstrations.

An evaluation form was prepared and distributed during the second day to document the feed-back from the participants. The results of the feed-back questionnaire are presented in Appendix 2.

2e	**Name of Trainer (s):** Art McCormack (PHA), Susanne Winkel, Dragos Arnautu (PHI), Elisabeth O'Brien (LIT), Horia Petran (BKH-RO)	
2f	**Organisation:**	NIRD-URBAN BUCURESTI
2h	**Address:**	SOS. PANTELIMON 266, BUCHAREST, ROMANIA

2g	**Delivery Address**	**266 Pantelimon Sos., 021652 Bucharest, Romania**
	Target Groups	**Potential Trainers for T2nZEB courses**
	Number of Attendees	**56**
	Details of promotion	**E-mails to T2nZEB list of trainers + Cluster Pro-nZEB**
	Other (identify)	

Results of the Feedback Survey -Train the trainers course – 08-09.02.2017

From a total of 56 participants there were received 36 questionnaires.

11. **The relevance of the Train-the-Trainers "Passive House Concepts" course content was:**
    - **excellent (40%)**
    - **very good (54%)**
12. **The structure of the training course was:**
    - **very well planned, participants assimilated the necessary knowledge (82%)**
    - **it needs improvements (18%)**
        - more practical examples
        - more (local) case studies
        - more time dedicated for training
13. **Other subjects to be addressed in the future:**
    - cost efficiency for renovated and new buildings
    - a synthesis of common messages and customized ones for target groups
    - case studies analysing the real consumptions, post retrofit
    - renewable green technologies
    - retrofitting, practical training
    - more retrofitting aspects, more case studies and examples from Romania
    - cost benefit analysis
    - a more complex study of optimal realisation of renewables systems, on certain areas
    - specific subjects for the local social, economic and climate context in Romania; common design and execution solutions, possible to be adopted in Romania
    - more thermal bridges details
    - more details on thermal insulation and renewables systems
    - debate on changes to be applied to the new calculation methodology of energy performance
    - working groups with other experts (structures engineers, entrepreneurs, public authorities) for improving the buildings regulations
    - installations for NZEB
    - heat pumps, solar systems
    - comparative labelling of buildings
14. The trainers' activity during the training course (presence, professionalism) was:
    - excellent (74%)
15. The communication with the trainers was:
    - excellent, participants communicated very well with the trainers during the courses (83%)
16. **The methods used in transmitting the information were:**
    - excellent (33%)
    - very good (53%)
17. **The volume of information transmitted during the training course was:**
    - excellent (25%)
    - more than enough (50%)
18. **Participants' expectations have been fulfilled at the end of this course:**
    - very much (51%)
    - beyond expectations (37%)
19. **The organization of the training course (venue, catering etc.) was:**
    - excellent (36%)
    - very good (47%)

20. **Other suggestions:**
    - presentations from the training sessions to be sent to participants
    - more frequent training sessions
    - Train to NZEB or/and Train to PH?
    - solutions to be adapted to the legislative framework in Romania and to the seismic context
    - case studies in Romania, critical stages of the project and images from the execution phase, specific details
    - practical and interactive workshop in small groups for the participants to get to know each other
    - presentation of participants, the current situation in Romania, a clear presentation of local objectives under an action plan
    - more meetings initiated by URBAN-INCERC
    - Congratulations!

Other information - Train the Trainers course – 08-09.02.2017

Presentations from trainers were available only from LIT and BKH-RO/NIRD URBAN-INCERC.

Photos from the training workshop:

Annex 3: Agenda for the TTT course for the CZECH REPUBLIC BKH

SEVEn STŘEDISKO PRO EFEKTIVNÍ VYUŽÍVÁNÍ ENERGIE, o.p.s. THE ENERGY EFFICIENCY CENTER

Train-to-NZEB The Building Knowledge Hubs

TRAIN-TO-NZEB: Train the Trainers meeting
19. 10. 2016
Praha, Česká republika

Místo: Fakulta stavební ČVUT v Praze, katedra Ekonomiky a řízení ve stavebnictví, místnost B-469

Adresa: Thákurova 7, 166 29 Praha 6, Česká republika

Datum: 19. 10. 2016 Čas: 9:30 – 13:00

Program:

9:00 – 9:30	Registrace účastníků
9:30 – 13:00	Train-to-NZEB: Train the Trainers meeting
9:30 – 9:50	**Zahájení** *(doc. Aleš Tomek)*
9:50 – 10:20	**Iniciativa BUILD UP Skills v Evropě** *(Jiří Karásek)* - Q&A
10:20 – 10:40	**Praktické modely Train-to-NZEB** *(Jan Pojar)* - Školicí centrum v Irsku - Praktické modely stavebních konstrukcí (vizualizace, detaily, výkresy) - Q&A
10:40 – 11:30	Občerstvení
11:30 – 12:00	**Role lektorů v rámci projektu Train-to-NZEB** *(Jiří Karásek)* - Cíle projektu - Představení školicích center a partnerů projektu - Současné aktivity projektu - Školicí programy - Databáze školitelů (síť pro sdílení a výměnu zkušeností a informací)
12:00 – 12:45	**Diskuse**
12:45 – 13:00	**Zakončení** *(doc. Aleš Tomek)*

This project has received funding from the European Union's Horizon 2020 programme under Grant Agreement No 649810

TRAIN-TO-NZEB: Train the Trainers meeting
5. 10. 2016
Ostrava, Česká republika

Vážení lektoři a experti projektu „Train-to-NZEB",

tímto si Vás dovolujeme pozvat na iniciační meeting Train the Trainers projektu Train-to-NZEB, pořádaný ve spolupráci s Českým svazem stavebních inženýrů.

Těšíme se na Vás a prosíme o potvrzení Vaší účasti.

S pozdravem
František Kuda a Jiří Karásek

Místo: Fakulta stavební, Vysoká škola báňská – Technická univerzita Ostrava, Zasedací místnost děkana Fakulty stavební LPOH 104
Adresa: Ludvíka Poděště 1875/17, 708 33 Ostrava – Poruba, Česká republika

Datum: 5. 10. 2016 Čas: 10:00 – 14:00

Program:

09:30 – 10:00	Registrace účastníků
10:00 – 14:00	Train-to-NZEB: Train the Trainers meeting
10:00 – 10:20	**Zahájení** *(doc. František Kuda)*
10:20 – 10:50	**Iniciativa BUILD UP Skills v Evropě** *(Jiří Karásek)* - *Q&A*
10:50 – 11:20	**Představení projektu Train-to-NZEB** *(Nataliya Anisimova)* - Cíle projektu - Představení školicích center a partnerů projektu - Současné aktivity projektu - *Q&A*
11:20 – 12:00	Občerstvení
12:00 – 12:30	**Role lektorů v rámci projektu Train-to-NZEB** *(Jiří Karásek)* - Školicí programy - Praktické modely - Databáze školitelů (síť pro sdílení a výměnu zkušeností a informací)
12:30 – 13:45	**Diskuse**
13:45 – 14:00	**Zakončení** *(doc. František Kuda)*

Agenda for Vysoké Mýto on 18-10-2016 is similar to previous Train the Trainer workshops

Annex 4: Agenda for the TTT course for the TURKEY BKH

	FACTSHEET 1	Delivery Proposal 13th May 2016
1a	**Partner Organisation**	**Ege University**
1b	**Title**	**Train-to-nZEB Training - Train the Trainers Workshop in Ege University**
1c	**Type of Delivery**	**Classroom, discussion and hands-on practical work**

1d

SCHEDULE OF TRAINING

The course is schedule for one day (13.05.2016) and consists of theorotical and practical trainings to provide necessary knowledge, skils and experince about training modules for NZEB. The course agenda is presented in Appendix.

RESOURCES AVAILABLE

Theorotical course will be organised in classrooms including laptop, speakers, projector, whiteboard, markers, and eraser. Practical training will be made in BKH Turkey. It has different working models and several equipments (blowdoor test, infrared camera, thermal comfort tool). Several exercises will be made by using these tools. During the course, powerpoint presentations to the training modules will be provided for participants.

ACTIVIITES

Different types of teaching tools are going to be employed, such as: presentations, open discussions, case studies, practical applications and demonstrations. They are the method of relaying factual information which includes principles, concepts, ideas and all theoretical knowledge about a given topic. In a lecture the instructor tells, explains, describes or relates whatever information the trainees are required to learn through listening and understanding. It is therefore teacher-centred.

DELIVERY

The trainees are part of the preliminary list of potential trainers who have accepted to become trainers connected with the BKH-TR. Candidates are selected from academic staff in architecture, civil and mechanical engineering which have knoledge about low energy buildings. Most of them have already teaching experience and pedagogical formation. The TTT course is intended to be interactive, with open discussions by trainers.

The proposed blended delivery for the Train the Trainer courses include a classroom and demonstration workshop. These one day course is to be handled to ensure a common understanding for training modules among participants. In addition, one of the two most essential training methods is to demonstrate; the other is to explain. Both are vital to the success of training courses.

Traditional selected-response or fill-in-the-blank test can be used to monitor and test the learning. A feed-back from the participants will be taken based on a specific form prepared by the BKH-Turkey.

1e	**Name of Trainer (s):** Prof. Dr. Türkan Göksal Özbalta, Prof. Dr. Necdet Özbalta, Assoc. Prof. Dr. Yusuf YILDIZ	
1f	**Organisation**	Ege University
1h	**Address:**	Ege University, Department of Civil Engineering, Bornova/Izmir

1g		
	Delivery Address	Ege University, Department of Civil Engineering, Bornova/Izmir
	Target Group	Potential Trainers for T2nZEB courses
	Proposed number of Attendees	25
	How will this event be promoted	E-mail
	Other	

Agenda

Train-to-NZEB
The Building Knowledge Hubs

Eğitmen Eğitimine Yönelik Toplantı Programı	
10:00 – 10:45	**Kayıt / Tanışma**
10:45 – 11:00	Çay/Kahve arası
11:00 – 12:00	*Yaklaşık Sıfır Enerjili Binalar Konusunda AB Projesinin Tanıtımı (Train to Nearly Zero Energy Building H2020 EU Project)*
12:00 – 13:30	Öğle Yemeği - Ege Üniversitesi Lokali (EBSO Enerji alt Komisyon Üyeleri, Akademisyen Destek Grubu, Dış Paydaşlar ve diğer katılımcılar ile birlikte)
13:30 – 14:30	***nZEB Projesi kapsamında - Pasif Bina / Sıfır Enerjili Bina / Artı Enerjili Bina Uygulamalarının Değerlendirilmesi*** *Darmstadt/Freiburg/Hannover vb. Örnekler (T.Göksal Özbalta)*
14:30 – 14:45	Çay / Kahve arası
14:45 – 15:30	***nZEB Eğitmenler Eğitimi – Eğitim Modüllerinin Aktarılması*** *(Y. Yıldız)*
15:30 – 15:00	Çay/Kahve arası
16:00 – 17:30	***- nZEB Eğitim Modülleri üzerine Bilgi-Görüş Paylaşımı*** ***- Genel Değerlendirme*** - Dış paydaşlar - Eğitim desteği - Sektörün katkıları

This project has received funding from the European Union's Horizon 2020 programme under Grant Agreement No 649810

The agenda for first Train-the-Trainers course

	FACTSHEET 2	Evaluation of Train the Trainer Workshop 13th May 2016
2a	**Partner Organisation**	**Ege University**
2b	**Title**	**Train-to-nZEB Training - Train the Trainers Workshop in Ege University**
2c	**Type of Delivery**	**Classroom, discussion and hands-on practical work**
2d	**ANALYSE**	

The nZEB concept has not been defined yet in Turkey but experience about low energy buildings exists. High levels of thermal insulation and airtightness of the building envelope, as well as mechanical ventilation with heat recovery are not common practice in Turkey. The Train-to-nZEB programs are aiming at filling these gaps in order to facilitate the effective implementation of nZEB concept in practice.

The main objective of the Training of Trainers Program is to create a critical mass of trainers in Turkey who have the necessary technical knowledge, skills and experience about specific training modules in the nZEB Training courses, in order to provide preliminary assistance to trainers. This training provided the participants with more information about the purpose and objectives and related technical information about the nZEB concept. From the analysis of the survey results, it is advisable to organize other TTT sessions in order to update the technical information for nZEB concept.

This training is introduce participants to course structure, content and demostration models. Participants should be selected carefully. They should have basic knowledge about subjects presented during the training because all knowledge cannot be taken by participants in a limited time.

DESIGN

The TTT program includes knowledge of nZEB concept, renewable energy use in buildings national requirements, traditional construction technologies and adaptation to nZEB principles.

The course was organised for 1 days in 13.05.2016 from 10.00 to 17.30. The trainees actively participated in the training both at the theory and practice sessions. The trainees' list is attached in the appendix.

The learning objectives are:

- Articulate a clear and comprehensive nZEB concept which is verified during design development.
- Comprehend the characteristics, uses and significance of demonstration models and principles of their composition.
- Understand the innovative renewables and technologies and identify potential solutions.
- Increase awareness of delivery methodologies and pedagogical approaches

No formal evaluation or examination is intended to be organised at the end of the TTT course and short recap is intended during the practical activities and demonstrations.

DEVELOP

The content of the course is the following:

- Definition of nZEB
- Passive house and low energy building basics
- Thermal insulation and thermal bridge
- Air conditioning with heat recovery
- Renewable-energy supply systems
- Demonstration of models
- Delivery methodologies and pedagogical approaches

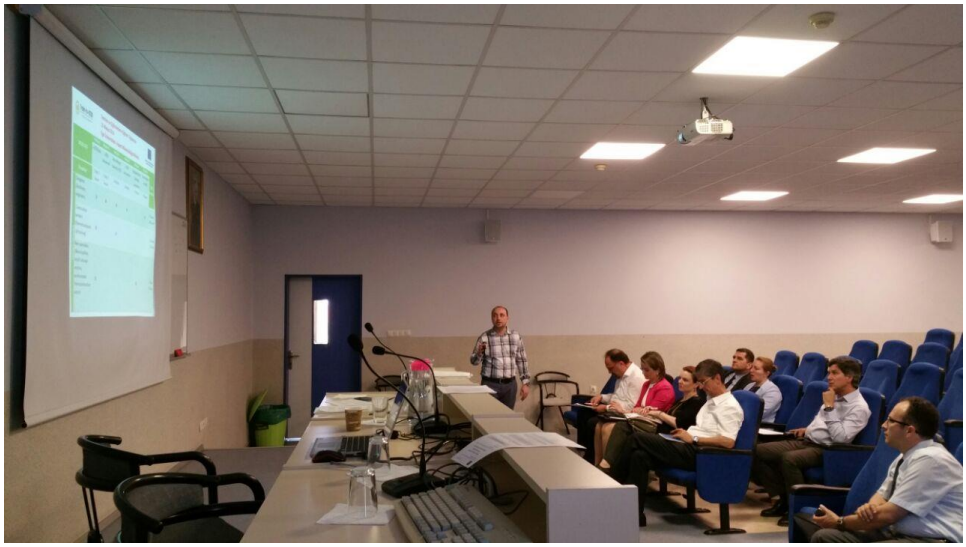
Two training methods were used; demonstrating and explaining. In other words, lecture is one of the most suitable learning activities for this course because it is conveying material verbally, sometimes with visual aids, to a group of learners. Power point presentations were printed as a textbook and they are given by the trainers. Front and group activities were organized for practical exercises.

IMPLEMENT

	Training was delivered by Prof. Dr. Türkan Göksal Özbalta, Prof. Dr. Necdet Özbalta and Assoc. Prof. Dr. Yusuf YILDIZ. 22 person was joined the course. Participants consist of academicians (architects and engineers) and professionals from different sectors. The existing location and facilities were enough because the course was given in a university building (Department of Civil Engineering in Ege University). A memorandum of understanding which is a nonbinding agreement between two or more parties outlining the terms and details of an understanding, including each parties' requirements and responsibilities was signed by each participant and trainer. The course took place at the training facilities within Department of Civil Engineering of Ege University in Izmir and was attended by 22 persons. The list of attendees is presented in Appendix 1.The course participants were building sector specialists, academicians, and professionals working within the productive sector (construction materials, systems and technologies). The participation to the course was done based on the invitations sent by the hosts to the persons who agreed to register. This first TTT session organised by the BKH-TR was a challenge and the experience was very useful for the next sessions to be organised during the T2nZEB project. **EVALUATE** "Satisfaction and participant reaction" method is used for evaluation of training. The most basic evaluation of training measures satisfaction. The trainer is hand out a survey at the end of the course to see how the participants reacted to the training and to measure satisfaction rates with our training courses. The results of the feed-back questionnaire are presented in Appendix 2. No formal evaluation or examination was organised at the end of the TTT course.	
	Name of Trainer (s): Prof. Dr. Türkan Göksal Özbalta, Prof. Dr. Necdet Özbalta, Assoc. Prof. Dr. Yusuf YILDIZ	
2f	**Organisation:**	Ege University
2h	**Address:**	Ege University, Department of Civil Engineering, Bornova/Izmir

2g		
	Delivery Address	**Ege University, Department of Civil Engineering, Bornova/Izmir**
	Target Groups	**Potential Trainers for T2nZEB courses**
	Number of Attendees	**22**
	Details of promotion	**E-mail**
	Other	

Photos from train the trainer



Feedback Questionnaire

Feedback questionnaire was developed in Turkish language for participants to let them assess the quality of the course. The main focus is laid upon skills acquired and length/place of the course.

Results of the Feedback Survey -Train the trainers course – 13.05.2016
From a total of 22 participants, 15 questionnaires were received.

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
1. The content was relevant to my learning needs	65%	27%	8%	-	-
2. The trainer had a good knowledge of the material and general area	82%	18%	-	-	-
3. The material was delivered at an appropriate pace	73%	17%	10%	-	-
4. Class participation was encouraged	87%	13%	-	-	-
5. Programme materials were useful and relevant	89%	11%	-	-	-
6. Training room was suitable for the programme	100%	-	-	-	-
7. I would recommend this training to others	100%	-	-	-	-

8. In your opinion what was the most useful part of this training session?

All parts of the training is most helpful.

9. In your opinion what was the least useful part of this training session?

All parts of the training is most helpful.
The participants proposes that the courses should be in small groups.

10. In your opinion what additional content would you like to see added to the training session?

- Energy efficient certification systems (LEED, BREAM, etc.),
- Energy efficient lighting,
- Passive design strategies for buildings.

	FACTSHEET 1	Delivery Proposal 20th June 2017
1a	**Partner Organisation**	**Ege University**
1b	**Title**	**Train-to-nZEB Training - Train the Trainers Workshop in Ege University**
1c	**Type of Delivery**	**Classroom, discussion and hands-on practical work**
1d	**SCHEDULE OF TRAINING** The course is schedule for one day (20.06.2017) in conjunction with the Train-to-nZEB consortium meeting (19.06.2017) and consists of theoretical and practical trainings to provide necessary knowledge, skills and experience about training modules for NZEB The course agenda is presented in Appendix 1. **RESOURCES AVAILABLE** Theoretical course will be organised in classrooms including laptop, speakers, projector, whiteboard, markers, and eraser. Practical training will be made in BKH Turkey. It has different working models and several equipment (blowdoor test, infrared camera, thermal comfort tool). Several exercises will be made by using these tools. During the course, PowerPoint presentations to the training modules will be provided for participants. The training session is focused on technical and pedagogical trainings (tips and appropriate techniques to train others).	

ACTIVIITES

Different types of teaching tools are going to be employed, such as: presentations, open discussions, case studies, practical applications and demonstrations. They are the method of relaying factual information which includes principles, concepts, ideas and all theoretical knowledge about a given topic. In a lecture the instructor tells, explains, describes or relates whatever information the trainees are required to learn through listening and understanding. It is therefore teacher-centred.

DELIVERY

The trainees are part of the preliminary list of potential trainers who have accepted to become trainers connected with the BKH-TR. Candidates are selected from academic staff in architecture, civil and mechanical engineering which have knowledge about low energy buildings. Most of them have already teaching experience and pedagogical formation. The TTT course is intended to be interactive, with open discussions by trainers.

The proposed blended delivery for the Train the Trainer courses include a classroom and demonstration workshop. These one day course is to be handled to ensure a common understanding for training modules among participants. In addition, one of the two most essential training methods is to demonstrate; the other is to explain. Both are vital to the success of training courses.

Traditional selected-response or fill-in-the-blank test can be used to monitor and test the learning. A feed-back from the participants will be taken based on a specific form prepared by the BKH-Turkey.

1e	**Name of Trainer (s):** Art McCormack (PHA), Camille Sifferlen (PHI), Elisabeth O'Brien (LIT),	
1f	**Organisation**	Ege University
1h	**Address:**	Ege University, Department of Civil Engineering, Bornova/Izmir
1g	**Delivery Address**	Ege University, Department of Civil Engineering, Bornova/Izmir
	Target Group	Potential Trainers for T2nZEB courses
	Proposed number of Attendees	120
	How will this event be promoted	E-mail
	Other	

Train-to-NZEB
The Building Knowledge Hubs

TRAIN-TO-NZEB: Train-the-Trainers Course on Passive House Concepts
20.06.2017
Izmir, Turkey

THE PASSIVE HOUSE: WHAT DO WE NEED TO KNOW?

Date: 20 June 2017
Location: Department of Civil Engineering, Ege University Bornova Campus, Bornova/Izmir Room: 304

Timing: 08:30 – 17:30

	TRAIN-THE-TRAINER SESSION
8:30 – 9:00	Arrival and registration
9:00 – 9:45	**Summary of Passive House bases and overview of PHPP**
	Art McCormack, Passive House Academy
9:45 – 10:30	**Certification and quality assurance: the certified training schemes by PHI. Economics/Energy cost comparison between PH and Normal**
	Representative of Passive House Institute
10:30 – 11:00	Coffee break
11:00 – 11:45	**Insulation , including Lambda and U-values and materials demo**
	Art McCormack, Passive House Academy
11:45 – 12:30	**Thermal (and repeating) thermal bridging**
	Art McCormack, Passive House Academy
12:30 – 13:30	Lunch
13:30 – 14:00	**Increased airtightness and site examples**
	Art McCormack, Passive House Academy
14:00 – 14:30	**Passive House windows and doors, including U-value calculation demo**
	Art McCormack, Passive House Academy
14:30 – 15:00	**Description of mechanical ventilation systems and training, including systems suited to retrofitting**
	Representative of Passive House Institute
15:00 – 15:30	Coffee Break + short visit to practical training facility of BKH-EGE
15:30 – 16:15	**Train to nZEB – Pedagogical Approaches**
	Lis O'Brien, Limerick Institute of Technology
16:15– 16:45	**PHPP Show**
	Representative of Passive House Institute
16:45– 17:30	**RES in Passive Houses. Q & A**
	Representative of Passive House Institute
17:30	Closure

This project has received funding from the European Union's Horizon 2020 programme under Grant Agreement No 649810

The agenda for second Train-the-Trainers course

Annex 5: Agenda for the TTT course for the UKRAINE BKH

2. Workshop on energy efficient windows and other translucent structures (conducted by REHAU; 2 days)	
Theoretical part (1 day): Practical work at the	Specificities of windows and other translucent structures. Main definitions and terms. Energy efficient windows and doors. Normative documents. Fundamentals of building physics of translucent structures. Cold bridges. Ventilation.
Practical part (1 day):	Training Technological Centre. Assembly of PVC windows in a house with timber framework. Testing a window at a special stand.
2. Workshop on interior engineering systems of nearly zero-energy buildings (conducted by REHAU; 1 day)	
Theoretical part (4 hours):	Radiator heating and water supply systems. Heating systems: floors and walls.
Practical part (5 hours):	Wall heating: examples. Practical work at the Laboratory of Interior Engineering Networks.
3. Workshop on façade systems, decoration of facades with stucco and small decorative elements (conducted by Henkel Bautechnik; 1.5 days)	
Theoretical part (4 hours):	Types of façade systems. Requirements to façade systems, their certain elements and materials. Model façade design solutions. Heat insulation. Maintenance of bound external insulation of buildings and structures.
Practical part (8 hours):	Practical work at the Training Technological Centre. Heat insulation materials. Where heat insulation systems can be used. Assembly technologies
4. Workshop on practical aspects of insulation systems for inclined roofs of frame wall structures (conducted by URSA; 1 day)	
Theoretical part (4 hours):	Main types of insulation materials. Glass wool insulation. Extruded cellular polystyrene.
Practical part (4 hours):	Assembly. Working with glass wool. Working with extruded cellular polystyrene. Installation of hydro and vapor barriers.
5. Workshop on energy efficient design solutions with the use of ceramic wall blocks and ceramic tiles (conducted by Wienerberger; 1 day)	
Theoretical part (4 hours):	Properties and assortment of energy efficient ceramic wall blocks. Normative requirements.
Practical part (4 hours):	Design solutions and specificities about energy efficient ceramic wall products. Installation of energy efficient ceramic wall blocks. Typical mistakes during installation works. Specificities about installation of ceramic tiles.
6. Workshop on installation of aluminum façade systems of nearly zero-energy buildings (conducted by Techno-Alliance; 1 day)	
Theoretical part (4 hours):	Classes of translucent and ventilated façade systems. Impact of certain elements and materials used in translucent façade systems on their resulting heat resistance properties.
Practical part (4 hours):	Typical mistakes regarding installation of translucent and ventilated façade systems. Practical exercise.
7. Workshop on design and assembly principles regarding alternative energy sources (conducted by Vaillant; 2 days)	

Theoretical part (1 day):	Solar collectors. Gelio systems (DrainBack, auroTHERM). Heat pumps (types, primary heat energy sources). Practical exercise: auroSTEP, aroTHERM.
Practical part (1 day):	Operating auroSTEP: user; specialist. Setting effective performance parameters for auroFLOW plus. Programming of the aroTHERM heat pump, operation monitoring, feedback function. Use of automated tools of I7 systems.
8. Workshop on energy efficient ventilation, air conditioning, heating and hot water supply systems (conducted by Aclima; 2 days)	
Theoretical part (1 day):	Energy saving ventilation. Free cooling technology. Automatic devices and control systems of energy efficient climate equipment. Alternative heating technologies: heat pumps. Programming and configuring controllers. Regulation and control systems for micro climate control.
Practical part (1 day):	Modern control units for ventilation, conditioning and heat supply systems. Design of the modern heat pump. "Air-water" heat pumps (Hitachi, MYCOND).
9. Workshop on heat insulation for inclined roofs of frame wall structures, determination of heat losses with the help of the Blower Door Test (conducted by Yakir Limited Liability Company; 2 days)	
Theoretical part (1 day):	Sprayed heat insulation (H_2FOAM LITE: LD-C-50). What is air exchange. How to calculate it. Air exchange norms in residential and public buildings. European experience. Thermal modernization of private houses. Heat insulation of newly constructed buildings.
Practical part (1 day):	Blower Door Test. Determining heat energy losses with the help of the air filtration method. Energy audit. Infiltration test for building envelope. Sprayed heat insulation for insulating new and old buildings.
10. Workshop on heat insulation of building envelope (conducted by TECHNONIKOL; 1 day)	
Theoretical part (4 hours):	Tasks of heat insulation work. Heat insulation materials. Foundations. Façades.
Practical part (4 hours):	Assembly works. Start of assembly works. Typical mistakes during assembly.

Participant Lists

	Тренер	Посада	Організація
01	Сергейчук Олег	д.т.н., професор кафедри архітектурних конструкцій архітектурного факультету КНУБА, дійсний член Академії Будівництва України, голова комісії "Освітлення, інсоляція" в технічному комітеті «Енергоефективність» у Міністерстві регіонального розвитку України.	Київський національний університет будівництва і архітектури (КНУБА)
02	Скочко Володимир	*к.т.н., доцент, докторант кафедри архітектурних конструкцій архітектурного факультету КНУБА, координатор міжнародних проектів з енергозбереження в будівництві та архітектурі; **технічний експерт	* КНУБА; **ВБО «Інститут місцевого розвитку»
03	Погосов Олександр	к.т.н., доцент, завідувач лабораторією кафедри теплотехніки санітарно-технічного факультету КНУБА	КНУБА
04	Біленко Олексій	заступник директора з міжнародних проектів	ТОВ «РЕХАУ»
05	Галайда Леонід	інженер відділу внутрішніх інженерних мереж	ТОВ «РЕХАУ»
06	Гречин Вадим	технічний консультант	ТОВ «Вінербергер»
07	Євтушенко В'ячеслав	провідний менеджер зі збуту	ТОВ з ІІ «Хенкель Баутехнік (Україна)»
08	Величко Анатолій	директор технічного департаменту	ТОВ з ІІ «Хенкель Баутехнік (Україна)»
09	Дац Павло	керівник напрямку «Освіта» в Україні (будівельна академія)	ТОВ «Завод «ТехноНІКОЛЬ»
10	Сергій Золюк	директор департаменту сервісу	ТОВ «АКЛІМА»
11	Шевченко Олександр	директор напрямку «Опалення та енергозберігаючі технології»	ТОВ «АКЛІМА»
12	Рубан Вадим	директор по маркетингу	ТОВ «АКЛІМА»
13	Юцкевич Людмила	провідний фахівець	ТОВ «АКЛІМА»
14	Глазова Раїса	керівник відділу навчань	ДП «Вайлллант група Україна»
15	Власюк Вадим		ДП «Вайлллант група Україна»
16	Сулацков Олексій	технічний консультант	ПІІ «УРСА»
17	Поляков Юрій	директор	ТОВ «Компанія «Техно-Альянс»
18	Андрієць Вадим	провідний спеціаліст	ТОВ «Талісман» ЛТД»
19	Осипчук Янів	керівник відділу продажів	ТОВ «ЯКІР»
20	Мацевич Ігор	директор	ТОВ «ЯКІР»

8. APPENDIX E – Training Courses and LOs

Annex 1: List of Training Courses for the BULGARIAN BKH 2016-2018

Course Overview

Cat. No.	Training program / Occupation	No. hours	Short description / reference
A	**On-site Construction Crafts & Professions (TRADESPEOPLE)**		
1	Building Envelope (BUS EnerPro)	40	Online course + 2 days (theory and practice).
2	Building Systems (BUS EnerPro)	40	Online course + 2 days (theory and practice).
3	Building Market, Products and Technologies (BUS EnerPro)	40	Online course + 2 days (theory and practice).
4	PVs (BUS EnerPro)	40-60	Modular structure > 60% practice, each participant is encourage to attend more than 1 course
5	Solar thermal (BUS EnerPro)	40-60	Same as above
6	Biomass (BUS EnerPro)	40-60	Same as above
7	Mini-wind (BUS EnerPro)	40-60	Same as above
8	Thermal pumps (BUS EnerPro)	40-60	Same as above
9	Heating, ventilation and AC (BUS EnerPro)	40-60	Same as above
10	Hybrid systems (BUS EnerPro)	40-60	Same as above
11	Certified PH Tradesperson-envelope & systems	20	Following the PH scheme
12	Airtightness	16	Theory + practical
13	Ventilation systems with heat recovery	16-24	Theory + practical
14	Insulation systems + thermal bridges	16-24	Theory + practical
B	**Designers, consultants, building managers (SPECIALISTS)**		
1	Certified PH Designer / Consultant	56-80	Following the PH scheme
2	nZEB design basics	24	Online training + theory + demonstrations
3	Airtightness	16	Online training + practical
4	Ventilation systems with heat recovery	24	Online training + theory + practical
5	Insulation systems + thermal bridges	24	Online training + theory + practical
6	RES in nZEBs	24	theory + practical
C	**NON-SPECIALISTS**		
1	PH/nZEB economics	8	theory + demonstrations
2	PH/nZEB design basics	8	theory + demonstrations/ practical
3	Airtightness	8	theory + demonstrations/ practical
4	Ventilation systems with heat recovery	8	theory + demonstrations/ practical
5	Insulation, PH windows & thermal bridges	8	theory + demonstrations/ practical
6	RES in nZEBs	8	theory + demonstrations/ practical

Learning Outcomes

BUILDING ENVELOPE	BUILDING SYSTEMS	BUILDING MARKET
Low-energy and passive buildings At the end of the training on the subject, the students must know: • The characteristics of low-energy and passive buildings; • The principles of design and cost effectiveness of passive houses; • The specifics of the construction of the building envelope of passive buildings; • The specifics of the construction of building systems of passive houses. Students should be able to: • Determine if a building is low energy or passive; • Define the passive house concept and the passive house standard;		

<table>
<tr><td colspan="3">• Analyze the advantages of low-energy and passive buildings and their energy efficiency.</td></tr>
<tr><td colspan="2">2. Airtightness
At the end of the training on the subject, the students must know:
• The methods for measuring the airtightness: Blower-door test;
• The most common points where leakages may occur.
Students should be able to:
• Analyze the working conditions and choose the appropriate technology to perform specific construction tasks;
• Assess the quality of the work performed in accordance with the regulations and standards;
• Synthesize the acquired knowledge to properly organize the workplace.
• Successfully avoid or eliminate leakage points
Evaluation: test, practical task</td><td>2. Classification and types of materials for the insulation layer of the low energy and passive buildings
At the end of the trainings, the students must know:
Inorganic insulation materials and products based on mineral, glass and basalt wool
Organic insulating materials and products
Thermal reflective materials improving the energy efficiency of the building
The students should be able to:
Advise and offer appropriate types of materials and products for implementing the insulating layer of the building envelope of low energy and passive buildings in new construction and renovation of existing buildings.
Provide consultations on the current market supply in Bulgaria for the types of materials suitable for the construction of low energy and passive buildings, and the renovation of existing ones.
Evaluation: test</td></tr>
<tr><td>3. Thermal bridges
At the end of the training on the subject, the students must know:
• What is a thermal bridge, what damages are inflicted on buildings as a result of thermal bridging;
• Basic rules to prevent thermal bridges;
• Solutions for: foundation, roofs, eaves, edges projecting from the façade, openings in the insulation layer;
• Technological process (consistency) of the assembly of thermal insulation when eliminating thermal bridges;
• The basic requirements for labour safety, hygiene and fire safety.
Students should be able to:
• Rationally organize the workplace;
• Implement the technological sequence of thermal insulation assembly when eliminating thermal bridges;
• Read technical documentation;
• Describe the structure of the layers of insulation for the elimination of thermal bridges.
Evaluation: test, practical task</td><td>3. Ventilation - main principles
At the end of the training on the subject, the students must know:
- Why is ventilation essential?: Indoor air contaminants; Relationship between the relative indoor air humidity and sources of humidity inside the building, the rate of fresh air supply and the outdoor temperature; prevention of mould formation
- Controlled home ventilation with heat recovery: Heat recovery, the principle of cross-ventilation; Different ventilation concepts (centralised and decentralised ventilation systems)
- Key components of ventilation systems - heat recovery unit, filters, fans, leading away of condensation;
- Key components of ventilation installations - pipelines, grids, openings for fresh air and exhaust air.
- Basic knowledge regarding dimensioning, selection, and setup of units</td><td>3. Materials, technologies and construction market for execution of thermal insulation systems of basement and foundations of low energy and passive buildings -
At the end of the trainings, the student must know:
Types of materials to overcome the thermal bridges and to execute thermal insulation systems of basement and foundations of low energy and passive buildings offered by Bulgarian and European manufacturers
New technologies for thermal insulation systems of the basement and foundations of low energy and passive buildings.
The market supply of construction materials and insulation systems for basement and foundations of low-energy and passive buildings offered by Bulgarian and European manufacturers.
The capacity of the industry for insulation materials and products in Bulgaria to meet the performance requirements of thermal insulation systems of passive house
The students should be able to:
Analyse the advantages of low energy and passive buildings and their energy efficiency levels</td></tr>
</table>

	Students should be able to: - To schematically arrange the equipment of the ventilation system Evaluation: test	Consult on the specifics in the construction of basement and foundations of passive and low-energy buildings – about the type and quality of the materials and their effective application with regard to the local construction market; Analyze the market and the technical solutions for thermal insulation systems by different manufacturers for the implementation of the basement and foundation of low-energy and passive buildings and to advice users. Evaluation: test
4. Thermal insulation of the foundations At the end of the training on the subject, the students must know: • The materials for insulation of foundations • The rules for consistent execution of insulation of foundations • How to control the implementation, acceptance and measuring of the insulation of the foundations • The basic requirements for labour safety, hygiene and fire safety. Students should be able to: • Rationally organize the workplace; • Implement the technological sequence for insulation of foundations; • Read technical documentation; • Describe the structure of the layers of insulation for thermal insulation of foundations with different insulation systems. Evaluation: test, practical task	**4. Ventilation - components, assembly** At the end of the training on the subject, the students must know: - How to reduce losses of pressure in the pipelines; the basic principles of dimensioning of pipelines; - Airtight piping, choice of output for exhaust air and inlet for fresh air, components of air transfer, airtight and thermal bridges-free openings for the outside air and the exhaust air pipes - Important protective measures for a ventilation system and its correct implementation: reduction of cross-talk transmission and structure-borne sound; different types of frost protection; fire safety and smoke protection - Initial operation: necessity for adjustment; carrying out adjustments; - Summer ventilation - Ventilation system in existing buildings, prerequisites and advantages, space-saving devices and duct installation Students should be able to: - Install a small decentralized ventilation system on a stand; - Make airtight passes through exterior walls; - Adjust the ventilation system - Setting the airflow of a grille, setup of bypass, etc.	**4. Materials, technologies and construction market to implement integrated external thermal insulation systems for facade walls of low energy and passive buildings** At the end of the trainings, the students must know: The types of materials to overcome the thermal bridges and to secure airtight performance of thermal insulation systems of facade walls of low energy and passive buildings offered by Bulgarian and European manufacturers New technologies for the implementation of integrated external thermal insulation systems for facade walls and achieving of airtightness of low energy and passive buildings. The market situation and supply of materials for the integrated external thermal insulation systems for facade walls of low energy and passive buildings offered by Bulgarian and European manufacturers The capacity of the industry for insulation materials and products in Bulgaria to meet the performance requirements of thermal insulation systems for facade walls of passive house The students should be able to: Analyse the advantages of low energy and passive buildings and their energy efficiency levels Consult on the specifics in the construction of basement and foundations of passive and low-energy buildings – about the type and quality of the materials and their effective application with regard to the local construction market; Analyze the market and the technical solutions for thermal insulation systems

	Evaluation: test, practical task, direct observation	for facade walls by different manufacturers and to advice users. Evaluation: test
5. Thermal insulation of facade walls At the end of the training on the subject, the students must know: • The materials for insulation of facade walls; • The rules for consistent execution of insulation of facade walls; • How to control the implementation, acceptance and measuring of the insulation of facade walls; • The basic requirements for labour safety, hygiene and fire safety. Students should be able to: • Rationally organize the workplace; • Implement the technological sequence for insulation of facade walls; • Read technical documentation; • Describe the structure of the layers of insulation for thermal insulation of facade walls with different insulation systems. Evaluation: test, practical task	**5. Heating via fresh air** At the end of the training on the subject, the students must know: - Scaling up of fresh air heating systems - Heating via fresh air in passive houses and correct installation of fresh air heating coils - Prerequisites, setup and functioning of supply air heating Students should be able to: - Install heaters and heating sections of ventilation equipment; - Make adjustment of heating section; - Make connections of the electric heaters to the electric installation; - Connect compact systems for heating via fresh air; Evaluation: oral questions, practical task	**5. Materials, technologies and construction market for installation of thermal insulation systems for roofs of low energy and passive buildings** At the end of the module, the trainees should know: The types of roofs and roof covers The types of materials to overcome the thermal bridges and to secure airtight performance of thermal insulation systems of the various types of roofs for low energy and passive buildings offered by Bulgarian and European manufacturers New technologies for the implementation of thermal insulation systems for roofs and achieving of airtightness of low energy and passive buildings. The market situation and supply of materials for the thermal insulation systems for roof of low energy and passive buildings offered by Bulgarian and European manufacturers The capacity of the industry for insulation materials and products in Bulgaria to meet the performance requirements of thermal insulation systems for roofs of passive house The students should be able to: Define the concept of passive and low-energy building; Analyse the advantages of low energy and passive buildings and their energy efficiency levels Consult on the specifics in the construction of roofs of passive and low-energy buildings – about the type and quality of the materials and their effective application with regard to the local construction market; Analyse the market and the technical solutions for thermal insulation systems for roof by different manufacturers and to advice users. Evaluation: test
6. Thermal insulation of roofs At the end of the training on the subject, the students must know: • The materials for insulation of roofs; • The rules for consistent execution of insulation of roofs;	**6. Heating - Heat generation and heat distribution in the Passive House** At the end of the training on the subject, the students must know:	**6. Materials, technologies and construction market for the implementation of transparent building components - windows, doors and other transparent external elements for low energy and passive buildings** At the end of the module, the trainees should know:

• How to control the implementation, acceptance and measuring of the insulation of roofs; • The basic requirements for labour safety, hygiene and fire safety. Students should be able to: • Rationally organize the workplace; • Implement the technological sequence for insulation of roofs; • Read technical documentation; • Describe the structure of the layers of the construction for thermal insulation of roofs. Evaluation: test, practical task	- Assessment of a conventional heating system in the Passive House - Heating demand and necessary heating output for provision of domestic hot water and heating - Hot water storage: coordination with heat generator, insulation of hot water storage tanks, measures for prevention of legionella - Heat generation and hot water provision in detached houses and multi-storey buildings - Unsuitability of conventional heat generators for detached Passive Houses - Suitability of renewable energy sources - Heat storage and regulation for smaller heat generators - Evaluation of different heat generators for use in the Passive House - Typical setup of a system in a detached Passive House - Setup, function and evaluation of compact heat pump units - The principle behind heat pump systems and their setup - Setup and function of a ground-coupled compact heat pump unit - Safety measures and dependence of combustion processes on outdoor air in the Passive House - Gas-based compact units - Setup and function of a primary wood-pellet stove - Typical installation layout with an integrated pellet stove Students should be able to: 3. Evaluation - test, project (scheme for connection of a heating installation)	Types of windows and glazing, achieving parameters for low energy and passive buildings for thermal conductivity and air permeability (triple glazing, multi-chamber frames, low-emission coatings) Quality indicators, standards and conditions for the implementation of windows and glazing in low energy and passive buildings. Construction market for the implementation of transparent building components - windows, doors and other transparent external elements for low energy and passive buildings from Bulgarian and European manufacturers. The trainees should be able to: To consult on and offer systems with PVC, wooden and mixed profile, triple glazing, metal stiffening profiles, hardware, fasteners and tools for thermal and waterproofing of the windows of the various manufacturers, suitable for use in low-energy and passive buildings To advise consumers about new products and technical solutions on the market in Bulgaria suitable for implementation of the transparent building components - windows, doors and other transparent external elements for low energy and passive buildings. To offer solutions by various manufacturers of windows to the users, following the supply on the Bulgarian market. Evaluation: test
7. Joinery: windows, doors and other transparent external components At the end of the training on the subject, the students must know: • The technology and rules for consistent execution of the joinery and glazing;	**7. Heating - Implementation-relevant details** At the end of the training on the subject, the students must know: - Thermal insulation of pipes and fixtures, useable and non-useable distribution heat losses, installation space required for insulation	**7. Materials, technologies and building market for ventilation systems** At the end of the training on the subject, the students must know: Why is ventilation essential?: Indoor air contaminants (oxygen, odours, condensation, mould). Types of recuperators and regenerators of heat with high efficiency heat exchange, suitable for passive houses;

• The technology for instalment of different types of joinery and glazing; • The quality indicators, standards and conditions for acceptance of the installed joinery elements and glazing. Students should be able to: • Analyse the conditions of work and choose the appropriate technology to perform specific construction tasks; • Assess the quality of work performed in accordance with the regulations and standards; • Synthesize the acquired knowledge to properly organize the workplace. • Remove the existing windows • Install PVC windows • Properly use and process of materials and tools. • Use PVC profile systems, metal stiffening profiles, hardware, fasteners and tools for thermal insulation and waterproofing of the windows. • Work with electricity and electrical tools • Carry out work safely standing on ladders and scaffoldings with foundation • Know and implement the operating procedures in the correct sequence. Evaluation: test, practical task	- Basic principles for planning of duct systems for heating/DHW/ventilation - Penetration of the airtight level by heating system pipes - Reduction of the energy consumption of circulating pumps - Reduction of the pressure losses in duct systems - Purpose and procedures for hydraulic balancing Students should be able to: Evaluation: test, practical task, direct observation	Types of decentralized ventilation systems with highly efficient heat recovery Types of room ventilation units with recuperation and heat regeneration; The students should be able to: To consult on and offer ventilation systems depending on the customer's needs - the scale of the building, the air flow, if it is reconstruction or a new building; To advise consumers about new products and technical solutions on the market in Bulgaria suitable for implementation of ventilation systems in low energy and passive buildings. To offer to the users solutions for ventilation units by various manufacturers, according to the supply on the Bulgarian market. Evaluation: test
8. Building renovation At the end of the training on the subject, the students must know: • How to insulate walls, floor and roof, to install highly energy efficient windows, to achieve airtightness and to install a ventilation system. • How to analyse data in order to justify the requirements, procedures and methods for the renovation of the existing building; to analyze the results from the energy audit and the technical certification (passport) of the building. Students should be able to: • Analyze the conditions of work and choose the appropriate technology to perform specific construction tasks;	**8. Refurbishment of existing buildings** At the end of the training on the subject, the students must know: - Main types of installations in existing buildings; - Building installations, incompatible with passive houses; - Ensuring of air tightness during the construction of new heating and ventilation systems; - Modernisation of the heating system within the context of overall refurbishment - Power and modulation ranges for DHW generation and heating during refurbishment	**8. Classification and types of materials for the execution of an airtight envelope for low energy and passive buildings** At the end of the training on the subject, the students must know: Airtight materials and products used in construction in Bulgaria - concrete, plaster, airtight insulating materials; Types of airtight materials used for insulation of large non-airtight elements - walls, roofs, etc.; Types of airtight materials, components and products suitable for airtight insulation between individual elements (between wall and windows, wall and roof, skylights, etc.) Students should be able to: To consult on and offer appropriate types of airtight materials and products for the execution of the building envelope of low energy and passive

• Assess the quality of work performed in accordance with the regulations and standards; • Synthesize the acquired knowledge to properly organize the workplace; • Avoid and eliminate leakage points; • Detect the weak points in the building in which thermal bridges and air leakages occur; to know the appropriate insulation materials and their main characteristics and to use them. Evaluation: test, practical task	- Suitability of existing heaters after the refurbishment - Retrofitting buildings with exhaust air systems Students should be able to: - Make airtight passes through exterior walls in existing buildings; - Connect to heating system; - Installation indoor ventilation units. Evaluation: test, practical task, direct observation	buildings, in new construction and renovation of existing buildings To consult on market supply in Bulgaria for the types of airtight materials in the construction of low energy and passive buildings, and the renovation of existing buildings. Evaluation: test
	9. Integration of RES solutions in buildings At the end of the training on the subject, the students must know: - Basic knowledge of photovoltaic installations; - Basic knowledge of mini-wind turbines and installations; - Types of integration of renewable energy solutions in the building transmission systems; - Basic knowledge of solar thermal installations; - Basic knowledge of biomass boilers and installation (emphasis on airtightness); - Basic knowledge of heat pumps; - Basic knowledge of hybrid heating systems; - Integration of RES in building heating and air conditioning systems and hot water installations; Students should be able to: - Connect RES installations to the heating system; - Connect RES installations to the electricity grid; Evaluation: test, practical task, direct observation	**9. Integration of RES solutions in buildings** At the end of the training on the subject, the students must know: - Basic knowledge of photovoltaic installations; - Basic knowledge of mini-wind turbines and installations; - Types of integration of renewable energy solutions in the building transmission systems; - Basic knowledge of solar thermal installations; - Basic knowledge of biomass boilers and installation (emphasis on airtightness); - Basic knowledge of heat pumps; - Basic knowledge of hybrid heating systems; - Integration of RES in building heating and air conditioning systems and hot water installations; The students should be able to: Calculate and explain the economic benefits and technical specifics from installation of renewable energy systems for heating and cooling in new buildings and renovations; - To calculate and explain the economic benefits and technical specifics of installing renewable energy systems generating electricity in new buildings and renovations; Evaluation: test

Annex 2: List of Training Courses for the ROMANIAN BKH 2016-2018

The Learning outcomes for the modules in the training courses are outlined in the Training Plan v2 in Appendix F, Annex 2.

Modules and correlation matrix for the definition of training courses related to Designers, consultants, building managers (specialists)

No.	Module	No. of hours	Concept and design principles of nearly zero energy buildings		nZEB energy performance rating (integrated design and energy efficiency)		RES systems for nZEBs	
			Module	hrs	Module	hrs	Module	hrs
1	nZEB buildings – general specifications	3		3		3		3
2	nZEB principles insulation envelope. Thermal bridges	2		2		0		0
	M2-1.1	0,5		0,5				
	M2-2.1	0,5		0,5				
	M2-2.2	0,5		0,5				
	M2-4.1	0,5		0,5				
3	Airtightness in nZEB buildings type	6		2		0		0
	M3-1.1	1		1				
	M3-1.5	0,5		0,5				
	M3-2.1	0,5		0,5				
4	Windows and other transparent exterior elements. U values for windows	2		2		0		0
	M4-1.1	1		1				
	M4-2.1	0,5		0,5				
	M4-3.1	0,5		0,5				
5	Heat gain through windows and other exterior transparent elements	2		2		0		0
	M5-1.1	0,5		0,5				
	M5-2.1	0,5		0,5				
	M5-3.1	0,5		0,5				
	M5-4.1	0,5		0,5				
6	Ventilation for nZEB -basic principles	2		2		0		0
7	Heating principles of spaces in passive houses/nZEB	3		3				
8	Solar shading and summer comfort	4		4				
9	Electricity consumption	2				2		
10	Principles for achieving energy balance	4				4		4
11	Principles for calculating economic efficiency	6				6		6
13	On-site execution management and quality assurance	3				3		3
14	Refurbishments using nZEB components	3		3		3		
15	Information and support for nZEB occupants	2				2		2
16	Principles and overall solutions for the use of renewable energy in nZEB	6		6		6		6
17	Heating and DHW operating on biomass	6						6
18	Heating equipment with heat pumps	6						6
19	Mini-Wind systems for buildings	6						6
20	Solar electricity generation - PV systems	6						6
21	Thermal solar systems	6						6

No.	Module	No. of hours	Concept and design principles of nearly zero energy buildings		nZEB energy performance rating (integrated design and energy efficiency)		RES systems for nZEBs	
			Module	hrs	Module	hrs	Module	hrs
22	Nearly zero energy building in the concept of green building	3		3		3		
	Total hours	**91**		**32**		**32**		**54**

On-site Construction Crafts & Professions

No.	Module	Hours	Building Envelope in nZEBs (Insulation systems + windows)		Ventilation systems with heat recovery in nZEB		Building Systems (HVAC) in nZEBs		Solar thermal systems		PV Systems (PVTRIN)
			Module	hrs	Module	hrs	Module	hrs	Module	hrs	Hours
1	Nearly zero energy buildings (nZEB) – general specifications	**3**		3		3		3			certified Photovoltaic systems installer
2	nZEB principles of envelope insulation. Thermal bridges	**6**		6							
3	Airtightness in nZEBs	**6**		6							
4	Windows and other transparent external elements	**6**		6							
5	Renovation of existing buildings using nZEB components	**3**		3		3		3			
6	Ventilation for buildings - basic principles	**3**				3		3			
7	Ventilation in a passive house / nZEB	**3**				3		3			
8	Heating via fresh air	**3**						3			
9	Basic principles: thermal energy supply	**3**						3			
10	Space heating in a passive house / nZEB	**3**						3			
11	Heating systems - execution details	**3**						3			
12	Heating systems - Renovation of existing buildings	**3**						3			
13	Integration of RES systems in buildings	**6**								6	
14	Economic efficiency - nZEB	**2**		2		2		2		2	
15	Process of construction and quality assurance	**2**		2		2		2		2	
16	Information and support for nZEB users	**1**		1		1		1		1	
17	Summer comfort. Shading Systems	**3**		3							
18	Legal framework and concepts for nZEB realisation	**1**		1		1		1		1	
19	Nearly zero energy building in the concept of green building	**3**		3				3			
20	Thermal solar systems	**6**								6	
TOTAL HOURS		**69**		**36**		**18**		**36**		**18**	**120**

The certified Photovoltaic panels installer -COR 741103 is a specialization certified training course; the diploma offered is for graduation and is international recognized according to the law (ordinance 129/2000).

Module	Description	Hours Theory	Hours Practice
1	Permanent activities on construction sites	6	14
2	Photovoltaic systems	9	14

3	Support structures for photovoltaic systems	6	20
4	Connecting the photovoltaic system components	10	20
5	Maintenance and repair of photovoltaic systems	7	14
TOTAL 120 hours		38	82

non-specialists

MODULE	Hours	**Theory, laboratory**	**Practical applications**
1. Legal framework and concepts for nZEBs	6	3	3
2. Economic efficiency principles for nZEBs (cost optimality)	6	3	3
3. Building envelope in nZEBs (insulation, windows, thermal bridges and airtightness)	6	2	4
4. nZEB in the context of green buildings	6	3	3
Total hours	**24**	**11**	**13**

Annex 3: List of Training Courses for the CZECH REPUBLIC BKH 2016-2018

PROPOSED STRUCTURE OF THE COURSE

The structure of the basic course "Fundamentals of nZEB" is presented in the document as an example.

Introduction and summary

The aim of the course is to explain to the participants how building professionals can contribute to a sustainable environment by means of design, construction and operation on the building, neighbourhood and city scale and to present an appropriate distribution of responsibilities and roles in building projects, ensure integrated design, and optimise synergies between the building and its surroundings and users leading to increase of nZEBs implementation.

Course Overview

The cause is formed by an in-class part, practical training and self-study. Preliminary duration of this course is 24 hours in total: 8 hours in-class, 4 hours of practical training and 12 hours of self-study.

Learning Outcomes

The aims of the training is that the participant can understand the changing role and responsibility of building professionals in society, including the need for continuously updated knowledge of, and critical attitude towards the industries, organisations, regulations and procedures involved in developing sustainable building projects.

Expected learning outcome for the construction professionals are as follows. The participants of the course are:

- able to list the materials used to increase energy efficiency of buildings and can describe their energy efficiency impact;
- can show examples how different form/shape of the buildings and location will affect indoor environment. The are able to explain how a given form/shape will impact indoor environment;
- can describe example of design for the energy recovery from grey waters outlet air and/or passive/active use of RES including from grey waters;
- are able to list regulations related to energy efficiency, when designing energy efficiency measures;
- are able to understand LCA and overall sustainability assessment of buildings;
- are able assessing the impact of a concrete measure on daylight in the indoor environment;
- able to explain rules in certifying buildings and can list available tools used for certifying buildings;
- able to explain how technical equipment influence each other performance;
- can list laws and standards applicable to building certification and explain the ways of their application with regard to particular building type;
- can explain how the building envelope impacts HVAC related decisions;
- can explain criteria for technical and process quality of the project;
- can list the elements for life-cycle assessment of the building;
- can identify the requirements and skills needed to plan, execute and manage a building project in co-operation with an interdisciplinary design team and stakeholders;
- can distinguish methods of investigation, assessment and evaluation required to achieve a low-carbon building.

Course 1: nZEB – designing of buildings and building technology

The course is primarily aimed at the proper design of technology and structural details, as well as structures of nearly zero energy buildings (nZEB). The target group are mainly designers, architects, site managers, engineers, construction economists, site supervisors, project managers, energy specialists etc. The course consists of three

parts; they are theoretical lessons, practical exercises and self-study with developed studying materials. The course ends up with a test and after its successful completion the participants are awarded a certificate.

The course is included into life-long education program of the CZ chamber of certifies engineers and technicians. The training program is rated with 1 credit point.

Structure, duration and price of the course:

Duration of the course:

8 hours of theoretical studies, 4 hours of practical exercise and 12 hours of self-study - 24 hours in total.

Duration was adjusted to the local conditions with respect to low time availability among professionals and conditions of courses in a similar field on the market offered to construction professionals.

Theoretical part:

- The principles of sustainable development and legislative requirements (45 minutes)
- The life cycle of buildings, energy performance and certification of buildings (45 minutes)
- Nearly zero energy buildings, renewable energy sources and technologies (90 minutes)
- Lunch break (30 minutes)
- Building materials, structures and reconstruction of nZEB (90 minutes)
- Proper realization of nZEB, quality control and examples of fault structures (90 minutes)
- Test (20 minutes)

Practical part:

- Demonstrations of details and structures on the building models (90 minutes)
- Demonstrations of technology (blower door test, thermal imager, ventilation equipment, RES etc.) (90 minutes)

Self-study with training materials:

- Repetition of the course program
- Study of further training materials

Dates for theoretical part: 27.4.2017, 17.5.2017, 7.6.2017

Dates for the practical part: 28.4.2017, 19.5.2017, 8.6.2017

Price for participants in CZK: 1 800

Price for the participants partially covers costs of organisation of the courses by the training center.

Training modules:

Theoretical training:

The principles of sustainable development and legislative requirements (45 minutes)

Focusing on the principles of sustainability and sustainable development, major environmental problems, the strategy for sustainable building design and the impact of buildings on the environment. Czech national and international European legislation on energy efficiency and related to nZEB. Objectives and Directives of EU and their impact on the objectives and strategy of the Czech Republic.

The life cycle of buildings, energy performance and certification of buildings (45 minutes))

Description of the life cycle of the building and the associated cycle of costs. Cost-optimal level. The significance of efficient energy use, energy audits, energy performance certificates and international instruments for the evaluation and certification of the quality of buildings.

Nearly zero energy buildings, renewable energy sources and technologies (90 minutes)

nZEB definition and basic principles, description of the differences between nZEB and a passive house. Description of the principles of solar thermal and photovoltaic systems, home wind power stations, heat pumps, biomass systems and mechanical ventilation systems with heat recovery. Application of renewable energy for different building types, depending on the climate conditions and the concept of active buildings.

Building materials, structures and reconstruction of nZEB (90 minutes)

New building materials and materials commonly used by construction of low-energy and passive houses. Influence of the selection of materials to the design and quality of implementation of building structures, as well as to the energy performance of the building. Structures and compositions compliant with nZEB standard. Proper design and implementation process of reconstruction of the building in nZEB standard.

Proper realization of nZEB, quality control and examples of fault structures (90 minutes))

Principles of proper design of details of building structures and their impact on the durability of the structure. Quality control and quality management during construction. Presentation of examples of disorders caused by faulty details design.

Practical training:

Demonstrations of details and design on the models of structures (90 minutes)

Detailed explanation, including demonstration of details and structures on four training models of different building structures. Description of the operation principle of a building structure and analysis of their material composition. Interpretation, including description and analysis of each model for about 20 minutes.

Demonstrations of technology (blower door test, thermal imager, ventilation equipment, RES etc.) (90 minutes)

Demonstrations and description of the technology at the stand with ventilation unit, working with the thermal imager, demonstration of the measuring equipment at the blower door test and measurer of CO_2 concentration. Supplemented by interpretation, description of the measurement procedure and its justification, analysis of the results of measurements.

Test:

The theoretical part will be finished with the final test. After evaluating the test, successful graduates will be awarded certificates. Certificates can be collected in person at the ABF Foundation.

Learning outcomes:

Trainee should be able to describe principles of nZEB including its material and technical solutions, explain the principles of sustainable development and the importance of energy savings. Trainee should be aware of the importance of the quality of nZEB design and implementation, as well as of the impacts on its functionality and durability. He/she should have an overview of the legislative requirements to nZEB and international instruments for assessing quality of buildings. Trainee should be able to explain the differences between energy audit, EPB certificate and assessments; to understand the principles of technology used in nZEB and possibilities for using renewable energy sources in nZEB; properly and efficiently to resolve the design of construction details for new buildings and renovations. Trainee should be able to describe the life cycle of the building and be aware of the progress of the costs over the cycle.

Course 2: Nearly zero energy buildings – implementation and construction.

The course focuses primarily on the correct implementation of construction details and structures of nearly zero energy buildings (nZEB). The target group are first of all construction workers, craftsmen, site managers, engineers, construction economists, construction supervisors, project managers etc. The course consists of three parts that are

the theoretical lessons, practical exercises and self-study with training materials. The course finishes up with a test and after its successful completion the trainees are awarded with certificates.

The course is included into life-long education program of the CZ chamber of certifies engineers and technicians. The training program is rated with 1 credit point.

Structure, duration and price of the course:

Duration of the course:

8 hours of theoretical studies, 4 hours of practical exercise and 12 hours of self-study - 24 hours in total (one training hour is 45 minutes long).

Duration was adjusted to the local conditions with respect to low time availability among professionals and conditions of courses on the market in a similar field, offered to construction professionals.

Theoretical part:

- The principles of sustainable development and legislative requirements (45 minutes)
- The life cycle of buildings, energy performance and certification of buildings (45 minutes)
- Nearly zero energy buildings, renewable energy sources and technologies (90 minutes)
- Lunch break (30 minutes)
- Building materials, structures and reconstruction of nZEB (90 minutes)
- Proper realization of nZEB, quality control and examples of fault structures (90 minutes)
- Test (20 minutes)

Practical part

- Demonstrations of details and structures on the building models (90 minutes)
- Demonstrations of technology (blower door test, thermal imager, ventilation equipment etc.) (90 minutes)

Self-study with training materials:

- Repetition of the course program
- Study of further training materials

Dates for theoretical part: 20.4.2017, 1.6.2017

Dates for the practical part: 24.4.2017, 2.6.2017

Price for participants in CZK: 1 800

Price for the participants partially covers costs of organisation of the courses by the training center.

Training modules:

Theoretical training:

The principles of sustainable development and legislative requirements (45 minutes)

Focusing on the principles of sustainability and sustainable development, major environmental problems, the strategy for sustainable building design and the impact of buildings on the environment. Czech national and international European legislation in energy efficiency and related to nZEB. Objectives and Directives of EU and their impact on the objectives and strategy of the Czech Republic.

The life cycle of buildings, energy performance and certification of buildings (45 minutes)

Description of the life cycle of the building and the associated cycle of costs. Cost-optimal level. The significance of efficient energy use, energy audits, energy performance certificates and international instruments for the evaluation and certification of the quality of buildings.

Nearly zero energy buildings, renewable energy sources and technologies (90 minutes)

nZEB definition and basic principles, description of the differences between nZEB and a passive house. Description of the principles of solar thermal and photovoltaic systems, home wind power stations, heat pumps, biomass systems and mechanical ventilation systems with heat recovery. Application of renewable energy for different building types, depending on the climate conditions and the concept of active buildings.

Building materials, structures and reconstruction of nZEB (90 minutes)

New building materials and materials commonly used by construction of low-energy and passive houses. Influence of the selection of materials to the design and quality of implementation of building structures, as well as to the energy performance of the building. Structures and compositions compliant with nZEB standard. Proper design and implementation process in reconstruction of the building in nZEB standard.

Proper realization of nZEB, quality control and examples of fault structures (90 minutes)

Principles of proper design of details of building structures and their impact on the durability of the structure. Quality control and quality management during construction. Presentation of examples of disorders caused by faulty details development or implementation.

Practical training:

Demonstrations of details and design on the models of structures (90 minutes)

Detailed explanation, including demonstration of details and structures on four training models of different building structures. Description of the operation principle of a building structure and analysis of their material composition. Interpretation, including description and analysis of each model for about 20 minutes.

Demonstrations of technology (blower door test, thermal imager, ventilation equipment, RES etc.) (90 minutes)

Demonstrations and description of the technology at the stand with ventilation unit, working with the thermal imager, demonstration of the measuring equipment at the blower door test and measurer of CO_2 concentration. Supplemented by interpretation, description of the measurement procedure and its justification, analysis of the results of measurements.

Test:

The theoretical part will be finished with the final test. After evaluating the test, successful graduates will be awarded certificates.

Learning outcomes:

Trainee should be able to describe principles of nZEB including its material and technical solutions, explain the principles of sustainable development and the importance of energy savings. Trainee should be aware of the importance of the quality of nZEB design and implementation, as well as of the impacts on its functionality and durability. He/she should have an overview of the legislative requirements to nZEB and international instruments for assessing quality of buildings. Trainee should be able to explain the differences between energy audit, EPB certificate and assessments; to understand the principles of technology used in nZEB and possibilities for using renewable energy sources in nZEB; properly and efficiently to resolve the design of construction details for new buildings and renovations. Trainee should be able to describe the life cycle of the building and be aware of the progress of the costs over the cycle.

Course 3: Nearly zero energy buildings – sustainable development of construction, maintenance and use.

The course focuses primarily on the sustainable development of construction, maintenance and use of nearly zero energy buildings (nZEB). The target group are first of all general public, state authorities, municipalities, media, managers, buildings' administrators etc. The course consists of three parts that are the theoretical lessons, practical

exercises and self-study with training materials. The course finishes up with a test and after its successful completion the trainees are awarded with certificates.

The course is included into life-long education program of the CZ chamber of certifies engineers and technicians. The training program is rated with 1 credit point.

Structure, duration and price of the course:

Duration of the course: 6 hours of theoretical studies, 2 hours of practical exercise and 16 hours of self-study - 24 hours in total (one training hour is 45 minutes long).

Duration was adjusted to the local conditions with respect to low time availability among professionals and conditions of courses on the market in a similar field, offered to construction professionals.

Theoretical part:

- The principles of sustainable development and legislative requirements (45 minutes)
- The life cycle of buildings, energy performance and certification of buildings (45 minutes)
- Nearly zero energy buildings, renewable energy sources and technologies (45 minutes)
- Building materials, structures and reconstruction of nZEB (45 minutes)
- Lunch break (30 minutes)
- Building management, principles of use and quality control of nZEB (90 minutes)
- Test (20 minutes)

Practical part

- Demonstrations of details and structures with use of the building models (45 minutes)
- Demonstrations of technology (blower door test, thermal imager, ventilation equipment etc.) (45 minutes)

Self-study with training materials:

- Repetition of the course program
- Study of further training materials

Dates for theoretical and practical parts: 4.5.2017, 22.5.2017, 13.6.2017

Theoretical and practical part are joined to one day training for this course due to shorter in-class training and more overall program for the general public and employees of state authorities.

Price for participants in CZK: 800

Price for the participants partially covers costs of organisation of the courses by the training center.

Training modules:

Theoretical training:

The principles of sustainable development and legislative requirements (45 minutes)

Focusing on the principles of sustainability and sustainable development, major environmental problems, the strategy for sustainable building design and the impact of buildings on the environment. Czech national and international European legislation in energy efficiency and related to nZEB. Objectives and Directives of EU and their impact on the objectives and strategy of the Czech Republic.

The life cycle of buildings, energy performance and certification of buildings (45 minutes)

Description of the life cycle of the building and the associated cycle of costs. Cost-optimal level. The significance of efficient energy use, energy audits, energy performance certificates and international instruments for the evaluation and certification of the quality of buildings.

Nearly zero energy buildings, renewable energy sources and technologies (45 minutes)

nZEB definition and basic principles, description of the differences between nZEB and a passive house. Description of the principles of solar thermal and photovoltaic systems, home wind power stations, heat pumps, biomass systems and mechanical ventilation systems with heat recovery. Application of renewable energy for different building types, depending on the climate conditions and the concept of active buildings.

Building materials, structures and reconstruction of nZEB (45 minutes)

New building materials and materials commonly used by construction of low-energy and passive houses. Influence of the selection of materials to the design and quality of implementation of building structures, as well as to the energy performance of the building. Structures and compositions compliant with nZEB standard. Proper design and implementation process in reconstruction of the building in nZEB standard.

Building management, principles of use and quality control of nZEB (90 minutes)

Focusing on building management, proper operation of building equipment for optimal internal environment and principles of heating, ventilation, air conditioning and cooling. Proofed user practices and facility management. Principles of proper use of nZEB and its impact on durability of the whole structure. Quality control and quality management during repairs and renovations. Presentation of examples of disorders caused by faulty construction or design processes.

Practical training:

Demonstrations of details and design on the models of structures (45 minutes)

Detailed explanation, including demonstration of details and structures on four training models of different building structures. Description of the operation principle of a building structure and analysis of their material composition. Interpretation, including description and analysis of each model for about 10 minutes.

Demonstrations of technology (blower door test, thermal imager, ventilation equipment, RES etc.) (45 minutes)

Demonstrations and description of the technology at the stand with ventilation unit, working with the thermal imager, demonstration of the measuring equipment at the blower door test and measurer of CO_2 concentration. Supplemented by interpretation, description of the measurement procedure and its justification, analysis of the results of measurements.

Test:

The theoretical part will be finished with the final test. After evaluating the test, successful graduates will be awarded certificates.

Learning outcomes:

Trainee should be able to describe principles of nZEB including its material and technical solutions, explain the principles of sustainable development and the importance of energy savings. Trainee should be aware of the importance of the quality of nZEB design and implementation, as well as of the impacts on its functionality and durability. He/she should have an overview of the legislative requirements to nZEB and international instruments for assessing quality of buildings. Trainee should be able to explain the differences between energy audit, EPB certificate and assessments; to understand the principles of technology used in nZEB principles of their proper use and facility management. Trainee should be able to describe the life cycle of the building and be aware of the progress of the costs over the cycle; to have an overview of related decrees, laws and European directives.

Annex 4: List of Training Courses for the TURKEY BKH 2016-2018

Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
nZEB Basic	nZEB Advanced	Retrofitting towards nZEB	nZEB Simulation	Preparation of funding schemes	Practice
Definition of nZEB	Principles of bioclimatic design	Energy audit techniques	Introduction to energy building simulation	Available funding mechanisms and incentives	The major components in nZEB
National legislation, standards and regulations related to energy efficiency in buildings, passive house and nZEB	Introduction to passive house concept	Definition of renovation strategies	Current simulation tools/software	Practical investment calculation exercise	Monitoring systems
Basic building physics	Passive and active solar systems for heating and cooling	Passive and active renovation solutions	Practical applications of energy building simulation		Building energy management systems
Heat transfer mechanisms	Energy efficient HVAC systems	Application of renewable energy solutions	Understanding simulation results and errors		
Thermal bridge in buildings	RES	Energy efficient building components: windows and doors			
Thermal insulation materials	Energy efficient building materials	Life cycle cost assessment			
Construction techniques for thermal insulation	Natural lighting				
Solar control					

All courses consist of an in class part, practical training and self-study. Preliminary duration of courses changes based on the number of modules taken by participants.

Learning Outcomes

The general goal of the training is to train building professionals in NZEB strategies and technologies in order to accelerate the adaptation of the recast EU Energy Performance in Buildings Directive. On successful completion of the course, participants will have developed an in depth understanding of the NZEB concept as it applies in their country and around Europe, and the skills necessary to contribute to the NZEB transformation of the local building stock. Learning outcomes based on the target groups are as follows:

Expected learning outcomes for the construction workers:

- able to describe types of materials used to increase energy efficiency in buildings and can identify their impact on energy efficiency
- are able to know local regulations and standards related to energy efficiency for existing and new buildings
- able to understand importance of nZEB, passive house, low energy building concept and sustainability in buildings
- able to understand importance of construction stage to build a nZEB, passive house, and low energy building
- able to describe significant points and stages for implementation of insulation, air tightness and etc. to build a nZEB and low energy building
- able to understand effects of active systems on building energy performance

Expected learning outcomes for the designers:

- able to understand nZEB, passive house, low energy building concept and sustainability in buildings
- able to describe design and construction stages of nZEB and low energy building
- can identify methods for investigation and evaluation necessary to manage a low energy building
- can explain passive design and active measures to increase energy efficiency in buildings
- are able to know local regulations and standards related to energy efficiency for existing and new buildings
- can describe the requirements and skills needed to plan, execute and manage a building project in cooperation with an interdisciplinary design team and stakeholders;

Expected learning outcomes for the non-specialists:

- can understand importance of interdisciplinary design and plan to execute and manage a low energy building project
- able to define local procedures and regulations for a design and construct a low energy building
- able to explain rules in certifying buildings and can list available methods used for certifying buildings
- can list laws and standards and explain the ways of their application with regard to low energy building
- can understand criteria for quality of the building project
- can list the elements for life cycle assessment of the building

Indicative syllabus

The course is based on the training content prepared based on other EU projects and materials belong to trainers with adaptation to the Turkish conditions. The training is planned as 6 modules. Each module except 1consists of1 hour for theoretical training in class,1 hour for practical training and 2 hours for self-study. One of the modules is generated only for practical training.

Module 1 and 6 are compulsory, plus other modules that are selected based on target group needs (Table 1). Each training module will include a final examination. A "nZEB Trainer" and "nZEB" certificate will be awarded to a trainer and trainee that participates in "train the trainer" and "train to trainees" courses that has completed a set of specific training modules and a final examination. The proposed training modules are as follows:

	MODULES	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Total duration
		nZEB Basic	nZEB Advanced	Retrofitting towards nZEB	nZEB simulation	Preparation of funding schemes	Practice	
	Duration	4 hours	3 hours	3 hours	2 hours	2 hours		
TARGET GROUPS	**Designers (**Architects, engineers**)**	**X**	**X**	**X**	**X**		**X-2 hours**	**14 hours**
TARGET GROUPS	**Construction workers** (theory/practical training)	**X**		**X**			**X-3 hours**	**10 hours**
TARGET GROUPS	**Non-specialists (**Municipalities, local and national entities, professionals from construction sector**)**	**X**		**X**		**X**	**X-1 hours**	**10 hours**

Additional detailed information on the modules are available in the Training Plan v2 in Appendix F, Annex 4.

Annex 5: List of Training Courses for the UKRAINE BKH 2016-2018

Training: Construction Workers

This course accounts for 44 hours, including 16 hours of lectures and 28 hours of practice; knowledge checks (1 hour); 10 minutes/person for knowledge verification.

(A) TRAINING PROGRAM FOR THE CONSTRUCTION INDUSTRY WORKERS (MASTERS, JOB FOREMASTERS AND FOREMEN, ENGINEERING SUPERVISION STAFF)	
1. Physical processes in the building envelope during heat, humidity and air transfer	
1.1 Heat transfer.	2 hours
1.2 Humidity transfer.	
1.3 Air transfer.	
1.4 Heat resistance.	
2. Normative requirements to heat insulating jacket	
2.1 Thermal physic requirements to structures	(2 hours).
2.2 Requirements to energy efficiency of buildings	
2.3 Requirements to heat reliability of the building envelope.	
2.4 Engineering and physical-mechanical requirements to the insulating jacket.	
3. Modern heat insulating materials	
3.1 Groups of heat insulating materials, their properties and application: 3.1.1 Heat-insulating materials: construction. 3.1.2 Heat-insulating materials: assembly works.	(2 hours).
3.2 Selection of insulating materials: feasibility study.	
3.3 Use of heat-insulating materials in the new energy efficient buildings.	
3.4 Blown-out concrete. Improving heat insulation features of self-bearing frame filling by using gas concrete and foam concrete.	
3.5 Self-bearing ceramic envelope heat insulating framing.	
Practical task on chapters 1, 2 and 3 - To develop a project on thermal modernization of the existing wall structure.	
Workshop on “Practical aspects regarding insulation of inclined roofs of frame wall structures” (to be conducted by URSA)	(1 hour).
Workshop on “Energy efficient design solutions providing for the use of wall ceramic blocks and ceramic tiles” (to be conducted by Wienerberger)	(3 hours).
4. Constructive energy efficient solutions in the building sector	
4.1 Classification of façade systems: 4.1.1 Prefabricated facade systems covered with plaster or pieces of decoration elements. 4.1.2 Prefabricated facade systems covered with bricks or wall stones. 4.1.3 Prefabricated facade systems covered with transparent elements.	(3 hours).
4.2 Coating. Improving heat insulation features of the coating: 4.2.1 Selecting coating materials. 4.2.2 Specificities about energy efficient coating.	
4.3 Windows and other translucent structures. Design of translucent envelope: 4.3.1 Thermal physical processes in the translucent structures. 4.3.2 Selecting energy efficient translucent structures. Modernization of the structures. 4.3.3 Assembly of the modern translucent structures.	
4.4 Reducing losses of energy by means of optimization/modernization of the foundation structures and wall structures of basements.	
4.5 Constructive energy efficient solutions for door apertures.	
4.6 Energy efficient solutions for overlap structures.	
Workshop on “Practical aspects regarding façade systems. Prefabricated façade systems covered with stucco or small decorative elements” (to be conducted by Henkel Bautechnik Ukraina	(3 hours).
Workshop on “Energy efficient window and other translucent structures” (to be conducted by REHAU)	(4 hours).
Workshop on “Practical aspects regarding aluminum façade systems for nearly-zero energy buildings” (to be conducted by Techno-Alliance)	(1 hour).
5. Licensing in the building sector. Concurrence of design documentation in the context of energy efficient buildings and structures with relevant authorities	
5.1 Structure and contents of design documentation. Complicacy categories and types of consequences.	(1 hour).

5.2 Licenses and certificates for design and construction activities in Ukraine: 5.2.1 Concurrence of design documentation with relevant expertise authorities. 5.2.2 Procedures on the start of construction of complexes and engineering networks and putting facilities into operation.	
5.3 Norms governing preparation of estimation documentation on nearly zero energy buildings.	
6. Selecting a source of heat supply	
6.1 Energy indicators of a source of heat supply. 6.1.1 Types of heat loads, calculation of the annual consumption of the organic fuel. 6.1.2 Daily and seasonal schedules on heat energy consumption by heating systems. 6.1.3 Qualitative and quantitative regulation of heat energy carrier and its effective use. 6.1.4 Diversification and decentralization of energy sources. 6.1.5 Cogeneration as a combined production of heat and electric energy. Trigeneration as a combined production of heat (heating + cooling) and electric energy.	(1 hour).
6.2 Heat schemes of the sources of heat supply: 6.2.1 Heating substations: 6.2.2 Modern heat schemes and possibilities for the regulation of heat in boiler houses. 6.2.3 Use of alternative energy sources. Alternative fuels and specificities of Ukraine's climate.	
6.3 Energy losses during heat energy generation, transportation, and consumption.	
6.4 Environmental requirements to energy sources, including alternative energy sources, as set by relevant EU Directives which are currently harmonized with Ukrainian laws. Definition of green house gas emission.	
Practical tasks and presentation from Aclima	
7. Selection, design, and assembly of energy saving heat supply and hot water supply systems	
7.1 Normative requirements to heating and hot (tap) water supply systems. Key changes in the requirements after State Building Norms DBN B.2.5-67:2013 and DBN B.2.5-64:2012 were adopted.	(2 hours).
7.2 Regulation of heat supply to a building from the angle of heat regime regulation on the level of an individual apartment and the building in whole.	
7.3 Average and maximum load in the centralized hot water supply systems. Selecting the best heat energy source and tanks for indirect heating when hot water is accumulated in the tanks.	
7.4 Energy efficient heating systems. Changing quantitative and qualitative values of the systems depending on the proposed approach: 7.4.1 Selecting a heater and connection types. 7.4.2 Design of devices of the heating systems depending on the temperature levels of the heat energy source. 7.4.3 Heating systems: modern assembly technologies.	
7.5 Calculating and monitoring of the use of heat energy sources. Local and centralized monitoring of heat loss.	
7.6 Relevant software for the heating systems (for example, Audytor C.O.).	
Presentation from Aclima	
8. Design and installation of the energy efficient ventilation systems for a building	
8.1 Energy efficient ventilation systems with natural circulation of the air.	(1 hour).
8.2 Energy efficient ventilation systems with forced ventilation of premises: 8.2.1 Mechanical exhaust ventilation with natural air intake. 8.2.2 Mechanical inlet and exhaust ventilation. 8.2.3 Centralized ventilation systems, systems with individual fans and mixed systems. 8.2.4 Combination of various ventilation systems for having the energy efficient air exchange regime.	
8.3 Utilization of ventilated air (recuperating, regenerating and use of transitional heat carrier).	
8.4 Alternative energy sources used for heating fresh air.	
Workshop on "Equipment of internal engineering systems of nearly-zero energy buildings" (to be conducted by REHAU)	(4 hours).
Workshop on "Energy saving ventilation, air conditioning, heating, and hot (tap) water supply systems: how it works?" (to be conducted by Aclima)	(4 hours).
Workshop on "Design and assembly of alternative energy sources" (to be conducted by Vaillant)	(6 hours).
9. Cooling systems in buildings and facilities	
9.1 Passive cooling systems of buildings and structures.	(1 hour).
9.2 Active cooling systems of buildings and structures.	

9.3 Cooling systems in buildings and structures when trigeneration - combined cooling, heat and power generation - system is in place.	

Training: Designers

44 hours, including 24 hours of lectures and 20 hours of practice; knowledge checks (1 hour); 10 minutes/person for knowledge verification

(B) TRAINING PROGRAM FOR THE BUILDING INDUSTRY PROFESSIONALS (DESIGNERS, ARCHITECTS, ENGINEERS, CONSTRUCTION WORKS COORDINATORS, DESIGN AND CONSTRUCTION CONSULTANTS)	
1. Design of energy efficient buildings: Methodology	
1.1 Climatic analysis of a construction site: temperature, relative humidity, wind speed, solar radiation, precipitation. Determining the impact of climate on urban planning and design of the energy efficient buildings.	
1.2 Comprehensive approach to the integrated energy efficient technologies in design, construction and maintenance of buildings and facilities in different climate and environmental conditions.	
1.3 Complex criteria pertinent to optimization of the engineering networks: ventilation, air conditioning, heating, hot water supply, electricity supply, cold water supply and sanitation. Automatic control of micro-climate. Automatic control of the technological (if necessary) processes.	(2 hours).
1.4 Recommendations on the economic and environmental feasibility for various approaches regarding the use of the alternative energy sources for different facilities in the specific natural and climatic conditions.	
Practical works and Aclima Presentation	
2. Design of energy efficient buildings	
2.1 Design of residential buildings. Rating buildings, systems, equipment, building envelope and energy resources by the degree of energy efficiency.	
2.2 General principles regarding design of energy efficient buildings: 2.2.1 Space and planning parameters. 2.2.2 Constructive solutions. 2.2.3 Engineering and technical solutions.	
2.3 Passive houses: 2.3.1 Space and planning parameters. 2.3.2 Constructive solutions. 2.3.3 Engineering and technical solutions.	(4 hours).
2.4 Zero-energy buildings: 2.4.1 Space and planning parameters. 2.4.2 Constructive solutions. 2.4.3 Engineering and technical solutions.	
2.5 Buildings with positive energy balance: 2.5.1 Space and planning parameters. 2.5.2 Constructive solutions. 2.5.3 Engineering and technical solutions.	
Workshop on “Practical aspects regarding façade systems. Prefabricated façade systems covered with stucco or small decorative elements” (to be conducted by Henkel Bautechnik Ukraina)	(2 hours).
Workshop on “Practical aspects regarding aluminum façade systems for nearly-zero energy buildings” (to be conducted by Techno-Alliance)	(1 hour).
3. Engineering calculations of energy efficient structures	
3.1 Lighting in buildings: calculation methodology; modernization: 3.1.1 Norms and requirements. 3.1.2 Natural lighting: design and calculations. Side, overhead, combined, transportable and accumulated lighting. 3.1.3 Artificial lighting: design and calculations. 3.1.4 Combined lighting: design and calculations.	(4 hours).
3.2 Use of solar irradiation in a building: 3.2.1 Norms and requirements. 3.2.2 Methods for calculating the duration of solar irradiation. 3.2.3 Sun protection: design and optimization.	

3.3 Sound insulation in energy efficient buildings: 3.3.1 Norms and requirements. 3.3.2 Calculating sound insulation indicators for the modern energy efficient building envelope. 3.3.3 Design of sound insulation of light external structures and translucent structures.	
3.4 Design of the heat insulated building jacket: 3.4.1 Norms and requirements. 3.4.2 Calculation of heat transfer resistance. 3.4.3 Calculation of heat and humidity condition of the building envelope. 3.4.4 Calculation of heat resistance of building envelopes and premises. 3.4.5 Systemic methods for optimization of building envelopes by a reliability indicator.	
3.5 Energy efficiency class of the building: 3.5.1 Energy consumption for heating. 3.5.2 Energy consumption for cooling. 3.5.3 Energy consumption for ventilation. 3.5.4 Energy consumption for lighting. 3.5.5 Energy consumption for hot water supply. 3.5.6 Optimization of the heating, electricity, water supply and sanitation systems with the aim of achieving the best possible efficiency of consumption of the energy resources.	
Workshop on “Practical aspects regarding insulation of inclined roofs of frame wall structures” (to be conducted by URSA)	(1 hour).
Workshop on “Energy efficient windows and other translucent building envelope” (to be conducted by REHAU)	(2 hours).
Workshop on “Energy efficient wall ceramic blocks and ceramic tiles” (to be conducted by Wienerberger)	(3 hours).
4. Automated design of energy efficient buildings: software and computer systems	
4.1 Design of two- and three-dimensional warm floors: Term, Windows, Ansys, SolidWorks, etc. Design of geometric models, calculation algorithms, data entry, identification of errors, analysis of calculation results: 4.1.1 Analysis of the constructive assemblies of buildings and identification of “cold (heat) bridges”. Recommendations regarding improvement of the poor heat insulation. 4.1.2 Developing a temperature field model in the assembly of a building structure. 4.1.3 Modeling of the humidity field in the assembly of a building structure.	(4 hours).
4.2 Design systems for the energy efficient buildings: EnergyPlus, PHPP, Autodesk Ecotect Analysis, etc. Design of geometric models, calculation algorithms, data entry, identification of errors, analysis of calculation results.	
5. Licensing in the building sector. Concurrence of design documentation in the context of energy efficient buildings and structures	
5.1 Structure and content of the design documentation. Complicacy categories and types of consequences.	
5.2 Licenses and certificates for design and construction activities in Ukraine: 5.2.1 Concurrence of design documentation with relevant expertise authorities. 5.2.2 Start of construction of complexes and engineering networks and putting facilities into operation.	(1 hour).
5.3 Norms governing preparation of estimation documentation on nearly-zero energy buildings.	
6. Selection of a source of heat supply	
6.1 Energy indicators of a source of heat supply. 6.1.1 Types of heat loads, calculation of the annual consumption of the organic fuel. 6.1.2 Daily and seasonal schedules on heat energy consumption by heating systems. 6.1.3 Qualitative and quantitative regulation of heat energy carrier and its effective use. 6.1.4 Diversification and decentralization of energy sources.	(3 hours).
6.2 Heat schemes of heat supply sources: 6.2.1. Heating substations: 6.2.2 Modern heat schemes. Heat regulation at boiler houses.	
6.3 Specific energy losses at heat energy generation, transportation and consumption	
7. Alternative energy sources and design of the modern building and facilities	

7.1 Wind energy in design of electric networks of modern buildings: 7.1.1 Design of wind electric generators. Key issues about installation and operation of wind electric generators in the modern buildings. 7.1.2 Adaptation of the electric network of a building to use and accumulate wind energy.	(3 hours).
7.2 Solar energy in the heating systems of the modern buildings: 7.2.1 Solar collectors in autonomous or mixed (partly autonomous) hot water supply systems. 7.2.2 Types of solar collectors. Selecting a solar collector. 7.2.3 Design of structural components for installation of solar collectors and supplementary equipment. Recommendations on the location of the solar collectors. 7.2.4 Heat schemes of centralized hot water supply systems in a building when centralized water supply system and/or organic fuels and solar collectors are used in the building.	
7.3 Photoelectric elements: 7.3.1 Design of structural components for the photoelectric elements and supplementary equipment. Key issues about locations for the photoelectric elements. 7.3.2 Specific issues regarding the combination of photoelectric elements and centralized electricity supply.	
7.4 Heat pumps in modern buildings: 7.4.1 Effectiveness of a heat pump: definition. 7.4.2 Impact of the low-potential environment on the effectiveness of a heat pump. 7.4.3 Modern elements of a heat pump. Inverter and spiral compressors. Types of refrigerants. Selecting a refrigerant. Cascade heat pump systems. 7.4.4 Low emission energy sources (wind, soil, water) and heat pumps. 7.4.5 Wastewater and other secondary energy sources and heat pumps. 7.4.6 Heating and hot water supply systems and energy produced by heat pumps, changing temperature schedules of the heating system. 7.4.7 Specific features about the buildings where heat pumps will be installed.	
Presentation by Aclima	
8. Selection, design and assembly of energy saving heating and hot water supply systems	
8.1 Regulating heat supply inside the building from the perspective of regulating the heating regime by apartment and in the building in whole.	(2 hours).
8.2 Average and maximum load in the centralized hot water supply systems. Selecting the best heat energy source and tanks for indirect heating when hot water is accumulated in the tanks.	
8.3 Energy efficient heating systems. Varying quantitative and qualitative indicators when a specific approach is applied: 8.3.1 Heaters and system connection types. 8.3.2 Calculations on the parameters of the heaters depending on the temperature of a heat supply source. 8.3.3 Modern technologies for assembly of the heating systems.	
8.4 Systems used for estimating and monitoring of heat resources consumption. Local and centralized monitoring of heat losses.	
8.5 Software used for heating systems modeling (on the example of Audytor C.O.).	
Demonstration and presentation from Aclima	
Workshop on “Equipment for internal engineering systems in nearly-zero energy buildings” (to be conducted by REHAU)	(2 hours).
9. Design and installation of the energy efficient ventilation system inside the building	
9.1 Energy efficient ventilation systems with natural circulation of air.	(1 hour).
9.2 Energy efficient ventilation systems with compulsory ventilation: 9.2.1 Mechanical exhaust ventilation with natural air intake. 9.2.2 Mechanical supply-and-exhaust ventilation. 9.2.3 Centralized ventilation systems, systems with individual ventilators and systems with combination of several types of the ventilation systems. 9.2.4 Best combination of different types of ventilation systems with the aim of having the energy saving air exchange regime.	
9.3 Use of recuperators.	
9.4 Use of the alternative energy sources for heating of the supply air.	

Workshop on “Energy saving ventilation, air conditioning, heating, and hot water supply systems: how it works?” (to be conducted by Aclima)	(4 hours).
Workshop on “Design and assembly of alternative energy sources” (to be conducted by Vaillant)	(4 hours).
10. A nearly-zero energy building as the inclusive combination of the effective engineering solutions on the building envelope, engineering networks, utilization of the secondary energy resources – all working under the intellectual system for micro-climate monitoring and management	(1 hour).

Training: Non-Specialist

The course requires 32 hours of training, which includes 16 hours of lectures and 16 hours of practice; knowledge checks (1 hour); 10 minutes/person for knowledge verification

(C) TRAINING PROGRAM FOR NON-PROFESSIONAL DECISION-MAKERS (KEY EXECUTIVES AND REPRESENTATIVES OF GOVERNMENT INSTITUTIONS)	
1. Legislation governing energy efficiency in the building industry	
1.1 Background on the requirements to energy efficiency in Ukraine.	(2 hours).
1.2 Current national norms vs relevant international norms.	
1.3 Improvement of the energy efficiency norms in Ukraine from the perspective of the environmental issues worldwide.	
1.4 Engineering and technical issues, management, financial and other issues pertinent to energy efficient buildings.	
2. Design and installation of energy efficient heating and heat supply systems	
2.1 Regulating heat supply to the building. Heat regime regulation on the level of an individual apartment and in the building in whole.	(2 hours).
2.2 Energy efficient heating systems.	
2.3 Systems used for estimating and monitoring of heat resources consumption. Local and centralized monitoring of heat energy consumption. Installation of thermostats and heat meters with convectors and heaters.	
Presentation by Aclima	
3. Energy efficient design of electricity supply systems	
3.1 Optimization of the electricity supply system for working in the autonomous energy saving operation modes.	(1 hour).
3.2 Adaptation of the electricity supply system to the modern energy saving equipment as well as the alternative electric energy sources.	
3.3 Systems used for monitoring and control of consumption of electric energy. Local and centralized monitoring of electric energy consumption. Installation of meters and local on-off automated electricity supply systems.	
4. Energy efficiency measures in the gas supply and water supply systems in the modern buildings	
4.1 Efficient consumption of natural gas. Systems used to estimate and monitor and regulate natural gas consumption.	(1 hour).
4.2 Reduction of water consumption. Systems used to estimate and monitor water consumption.	
5. Improving effectiveness of maintenance of buildings and facilities.	
5.1 Thermal modernization of buildings: 5.1.1 Standard requirements to thermal modernization. 5.1.2. Examination and energy audit of buildings and engineering systems of buildings. 5.1.3. Heat safety of building envelope: heat failures of the seal course of the buildings. Classification of heat failures. Methodology for examination of heat safety of building envelope and energy efficiency of buildings. 5.1.4. Energy passports of buildings. Data/information in the energy passport. Estimation of heat losses through the heat retention jacket of the building and ventilation. Estimation on solar irradiation. Estimation on the net heat loss of the building. Energy efficiency rating of the buildings. 5.1.5. Thermal modernization of the building: scenarios. 5.1.6. Technical and economic assessment of the thermal modernization scenarios.	(4 hours)
5.2 Thermal sanation (deep retrofit) of housing stock: 5.2.1 Mandatory energy efficiency improvements in buildings and facilities.	

5.2.2 Voluntary energy efficiency improvements in the framework of the thermal modernization of buildings and facilities.	
Presentation by Aclima	
6. Automated systems for regulation of energy consumption and micro-climate control in the building	
6.1 Regulation and monitoring of heat energy consumption.	(1 hour).
6.2 Regulation and monitoring of water consumption.	
6.3 Regulation and monitoring of electric energy consumption.	
6.4 Regulation and monitoring of the micro-climate in the building.	
6.5 Regulation and monitoring of air exchange in the building.	
6.6 Software used for monitoring and regulation of energy resources consumption.	
7. Certification of buildings	
7.1 Modern systems for the green certification of buildings.	(1 hour).
7.2 Energy certification of buildings.	
7.3 Estimation of energy indicators in the course of certification of buildings.	
8. Energy audit of buildings	
8.1 Screening and selecting of facilities for energy audit.	(1 hour).
8.2 Equipment and devices used by energy auditors.	
8.3 Phases of energy audit.	
8.4 Estimation of energy consumption of a building.	
8.5 Analysis of energy consumption and recommendations on improving the energy parameters of a building.	
9. Investments into energy efficient new construction. State support to construction of energy efficient buildings	
9.1 Banks.	(1 hour).
9.2 Private investors.	
9.3 State programs.	
10. Heat supply sources, diversification and decentralization of energy sources. Alternative energy sources	(1 hour).
11. A nearly-zero energy building as the inclusive combination of the effective engineering solutions on the building envelope, engineering networks, utilization of the secondary energy resources – all working under the intellectual system for micro-climate monitoring and management	(1 hour).
1. Workshop on “Practical aspects regarding façade systems. Prefabricated façade systems to be covered with stucco or small decorative elements” (to be conducted by Henkel Bautechnik Ukraina)	(2 hours).
2. Workshop on “Practical aspects regarding insulation of inclined roofs of frame wall structures” (to be conducted by URSA)	(1 hour).
3. Workshop on “Energy efficient design solutions providing for the use of wall ceramic blocks and ceramic tiles” (to be conducted by Wienerberger)	(1 hour).
4. Workshop on “Energy saving ventilation, cooling (air conditioning), heating and hot water supply systems: how it works?” (to be conducted by Aclima)	(3 hours).
5. Workshop on “Practical aspects regarding assembly of aluminum façade systems for nearly-zero energy buildings” (to be conducted by Techno-Alliance)	(1 hour).
6. Workshop on “Translucent building envelope and equipment of internal engineering networks in nearly-zero energy buildings” (to be conducted by REHAU)	(4 hours).
7. Workshop on “Design and assembly of alternative energy sources” (to be conducted by Vaillant)	(3 hours).