

PREPARE 



Education and Culture DG

Lifelong Learning Programme

TREO Report

Building sector

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1 Introduction

According to UNEP¹, buildings are a key component in limiting environmental impacts and to achieve goals regarding sustainable development. The sector is not only crucial for national European economies in providing employment (about 20 million jobs) and constituting to the GDP (almost 10% of GDP), but it also has a large impact on social and environmental issues. Therefore, the quality of the built environment has a big influence on the European population².

The eco-efficiency concept in buildings comprises at least four major components: performance, conformity, life cycle cost and environmental impact. There are several variations of the eco-efficiency concept in buildings: green buildings, bioclimatic design, eco-construction, etc.

In December 2013, the partners of TREO met in a two day workshop which was held in Vienna. The goal of the meeting was to optimise the building and construction related outcomes of the TRUST-IN project by visiting best practice examples, listening to presentations, and taking part in open discussions with experts. This report includes the minutes of the meeting, and furthermore, presents the changes to the course design, which are the result of discussions of the project partners and recommendations of different national experts of the education, and building and construction sector.

2 Summary of the workshop

3rd of December 2013

After meeting in Aspern Seestadt, the participants did a guided site visit of the new city project lakeside Aspern+, which is in the east of Vienna and has an area of 240 hectares. During the visit of Vienna's urban lakeside Aspern, the participants got an insight into the most important urban development venture ever initiated in Vienna and one of the largest of its kind in all of Europe. The planning area covers 240 hectares. The city is to be built in several construction phases over a period of at least two decades. The project is one of the leading examples in terms of sustainable urban planning in Austria and should be completed in 2028, when 20,000 residents will live there and 20,000 jobs should be offered. All of the buildings are assessed by the assessment tool Total Quality Building (TQB), which was presented after the site visit by the first lecturer Beate Lubitz-Prohaska. TQB is an open source online tool, which was produced by five different institutions in the field of sustainable construction. The building certificate itself is called OENGB. It is aimed at optimizing the building in the planning and using stage. Therefore, buildings can receive a planning certificate and a finished building certificate. Furthermore, follow up measurements in the final building have to be done. The certificate is in conformity with the CEN standards and the methodology went through a 3rd party assessment. The tool uses five main categories (location and facilities, economy and technical quality, energy and supply, health and comfort, and resource efficiency) with many sub criteria which are assessed and scored. Besides the already assessed 75 projects, about 50 other projects are currently in treatment. The IQ building, which is on the areal of lakeside Aspern+ and already certified with the TQB was presented by Felix Heisinger. The office building has a plus of energy by producing electricity with photovoltaic and VC, using modern lighting and ventilation systems as well as improved insulation and shadowing.

¹ UNEP (2014) <http://www.unep.org/resourceefficiency/Policy/ResourceEfficientCities/FocusAreas/SustainableBuildings/tabid/101666/Default.aspx>

² European Commission (2012) <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0433:FIN:EN:PDF>

4th of December 2013

As an expert for VET education, Johannes Fechner presented the klima:aktiv programme and related projects to prevent and mitigate climate change through voluntary measures including developing standards e.g. for smart buildings. Since 10 years the programme, which focuses on training and education, is active in the field of buildings, energy savings, energy efficiency, renewable energy, and mobility. A crucial point to the success of both the programme and the education is the cooperation with other training institutions, the partnership with experts, and the direct contact to households and companies. The programme works among others with the Chamber of Commerce training institute, one of the biggest suppliers of training in Austria. Together with the Austrian Institute for Ecological Building they developed an e-learning platform. Mr Fechner highlighted that the promotion of energy efficient and sustainable buildings depends strongly on the costing of the project, especially regarding the value of certificates and standards for investors. The discussion included how technicians can get updated knowledge on new energy and building technology including the use of certificated training and mutual recognition of training. In Austria there is a huge lack of skilled people to renovate buildings.

After the presentation of Johannes Fechner, the participants discussed which recommendations for resource efficiency training in the building sector can be derived and some questions arose:

Generally, the result of the TRUST-IN project gives a brief overview of VET in several of the participating countries in TREO, but what are the best training methods? Which topics should be covered? What can be improved and what could be added?

To answer these questions, the proposed course content should be presented to different stakeholders in our countries.

During the presentations, not all of the questions regarding best practices of smart and sustainable cities could be answered. The discussions led to the consensus that there is a need for the involvement of more stakeholders in order to obtain recommendations for VET. Therefore, each partner country asks relevant stakeholders (e.g. architects, project planners, civil engineers, building and construction craftsmen) of the building sector the following questions until the next meeting in San Sebastian in March 2014. The questions are related to the outcome of the TRUST-IN project:

- 1) Which issues are missing in the course design in TRUST-IN? Which competences should be covered? (Competences = Knowledge and skills - which can be obtained through education, training and work experience)
- 2) Which didactics can you recommend for the training?
- 3) Which training providers would you suggest for the training?

These questions can also be used for the other topics (tourism, mobility, energy, and food) in order to receive competent and topic related recommendations. When discussing the questions with stakeholders, it might be necessary to detail and specify the questions according to the content of the TRUST-IN results.

3 Second draft of the course content

The table represents the outcome of the TRUST-IN project including the recommendations of different stakeholders of the building and construction sector of topics which should be explained in more detail to substantiate the original contents (*italic*):

3.1 Actualised course content

1. Introduction	<p>Resource efficient building is, in general, a result of a combination of architectural design, the selection of materials, equipment, HVAC technology, and the energy source. Energy and resource efficient building conditioning uses alternatives to conventional heating and cooling sources and conventional water supply systems.</p> <p>The course applies a holistic approach by bringing together different aspects of energy efficient urban planning down to details of construction.</p> <p><i>Clarify the definition of "building"</i></p> <p><i>Categorization: does it include industrial buildings, halls, storehouses vs. residential houses...?</i></p> <p>Buildings cover:</p> <ul style="list-style-type: none"> • 50% of direct and indirect resource consumption • 40% of heat consumption • 25 % of CO2 emissions • 35% of all waste generated
2. Motivation	<p>Need for a holistic approach for energy efficient buildings (planning, renovation and exploitation)</p> <ul style="list-style-type: none"> • <i>More details about the positive aspects of sustainable building</i> • <i>Local importance of sustainable building</i>
3. EU Directives and Other Documents	<p>The main legislative instrument to reduce the energy consumption of buildings is Energy Performance of Buildings Directive 2010/31/EU (EPBD)</p> <p><i>Strategy for the sustainable competitiveness of the construction sector and its enterprises (COM(2012) 433 final)</i></p> <p><i>Energy Efficiency Directive</i></p>
4. ISO, CEN and Other Standards	<p>More than 35 CEN standards on building performance, HVAC systems in buildings, etc.</p> <p><i>Passive House Standard (according to PHPP methodology)</i></p> <p><i>ISO standards: ISO 15221 Facility management, ISO 50001 Energy management</i></p>
5. History of the Eco-efficiency Concept	<p>The eco-efficiency concept in buildings comprises at least four major components:</p> <p>performance, conformity, life cycle cost and environmental impact. There are several variations of the eco-efficiency concept in buildings: green buildings, bioclimatic design, eco-construction, etc. There are also several certification systems on the topic developed over the last 20-30 years: Leadership in Energy and Environmental Design (LEED); BRE Environmental Assessment Method (BREEAM); Passive House Standard, etc.</p> <p>At European Union level there are several directives that establish regulations in the sector: Energy Performance Building Directive, Promotion of Renewables, etc.</p>

	<p>Methodologies for building certification has been developed, as well for inspection of boilers and HVAC systems. Since 2000 criteria and standard development</p> <p>6 Action programme on Environment</p> <p>CEN TC 350 Sustainable construction</p> <ul style="list-style-type: none"> • LCA approach (ISO 14 025 EPD and ISO 14040 and 14042 LCA) – pre-set parameters • Health & comfort • Life Cycle Costing <p>CEN TC 351 Hazardous substances in building products Published from 2012 and further</p> <ul style="list-style-type: none"> • <i>Inclusion of classical approaches to increase production efficiency (5S, Kaizen, involvement of employees)</i>
6. Energy: Renewables and Efficiency	<p>Definition of energy efficiency and indicators; energy sources; renewables; energy supply and demand at building level; consumption models and others.</p> <ul style="list-style-type: none"> • Passive house and Plus energy house concepts • Active houses • Climate Envelope • <i>Natural lighting and natural ventilation for the reduction of energy consumption and increased comfort</i> • <i>systematic organization of construction work</i> • <i>issue of thermal bridges</i> • <i>airtightness of building envelope.</i> • <i>Energy Performance Contracting</i>
7. Water Efficiency	<p>N/A</p> <ul style="list-style-type: none"> • <i>(Drinking) Water management, retention of rainwater.</i>
8. Material Efficiency	<ul style="list-style-type: none"> • Eco-materials, life cycle assessment, cost-benefit analysis • Relation to indoor quality (dangerous substances) • Cradle to Cradle concept • Life Cycle Management • LCA focus on renewable and non-renewable resources • Focus of the Lego brick principle in the construction stage. • Focus on water and energy consumption in the use stage • Reuse of building component and recycling of demolished building materials (roads and foundation of new buildings) • <i>material versatility to suit different environments and climates, in the chapter on material efficiency</i>
9. Social level	<p><i>Human exposure evaluation competences such as thermal comfort and indoor air quality in buildings. It relates to efficiency of HVAC systems, materials used for construction as well as occurrence of BRI (building related illness) as SBS (sick building syndrome) symptoms.</i></p> <p><i>Understand the ethical, social, economic and safety sides of construction problems and their solutions.</i></p> <p><i>Should have knowledge and be able to evaluate how implementation for energy saving will affect indoor air quality and quality of life in the building.</i></p> <p><i>Contents related to social behaviour and market perspective in relation to eco-innovative buildings, since according to their experience most of the times, the effort made by the company to provide added value through incorporating eco-innovating ways in the buildings may not be appreciated by the end-user if</i></p>

	<i>those improvements have economic impact in the final price.</i>
10. Methods	<p>The training methods will be lectures with discussions, laboratory exercises, field measurements, computer simulations, project groups</p> <ul style="list-style-type: none"> • Life Cycle Management • Including of potential residents in planning phase • Eco- innovation and design for sustainability due to long life time of buildings • Involvement of residents in apartment blocks and engagement of residents in private house at district level • <i>Concrete practical examples</i> <ul style="list-style-type: none"> ○ <i>Practical cost saving approach (which cost saving effects result from sustainable building)</i> ○ <i>Assessing (workshops) and visiting good practices and case studies</i> ○ <i>Include already existing visual simulations on effects of introducing or removing certain energy systems in a city, area, building block or dwellings.</i> • <i>Combination of:</i> <ul style="list-style-type: none"> ○ <i>Classroom courses (lectures, discussions, group work/tutorials)</i> ○ <i>Exchange platforms</i> ○ <i>Online resources (e-learning methods, use of social networks)</i> ○ <i>Practical work (case studies, videos)</i> ○ <i>Site visits (study tours, participation in symposiums)</i> • <i>Partly compulsory tests, examinations, laboratory, and excursions</i> • <i>Life-long learning courses in which participate professionals of the sector.</i> • <i>A "driving licence" approach, a modular approach could be used, so that the participants can pick from a menu according to their priorities</i>
11. Management	<p>The course could be led by a university or a life-long learning training institution (vocational training centre).</p> <ul style="list-style-type: none"> • ISO 50001 Energy management systems • ISO 14001 Environmental management (continuous improvement) • ISO 26000 guidelines on Social Responsible • OHSAS 18001
12. Sustainable Consumption	N/A
13. Organisations	<p>The involvement and engagement of several types of organizations (lecturers) on local, regional, and national level could be beneficial for the course:</p> <ul style="list-style-type: none"> • Training institution: <ul style="list-style-type: none"> ○ <i>Online Training providers</i> ○ <i>VET centres that offer training related to the sector</i> ○ <i>Any registered centre for professional training in cooperation with universities</i> ○ <i>Individual training providers for business or administration (training on side)</i> • University: <ul style="list-style-type: none"> ○ <i>VET services organized by technical universities (existing didactic infrastructure/experts)</i> • NGOs: <ul style="list-style-type: none"> ○ <i>Dealing with energy and resource efficiency</i> ○ <i>Non-for profit associations from the sector</i> • Professionals and unions: <ul style="list-style-type: none"> ○ <i>Designers and architects</i> ○ <i>Union of Architects, chamber of the engineers, installers</i> ○ <i>Sectorial business organizations</i> • <i>Experts:</i>

	<ul style="list-style-type: none"> ○ <i>In sustainability and eco-efficiency</i> ○ <i>From energy management institutions and companies</i> • <i>European Organization for Quality (www.eoq.org)</i> • <i>Country specific institutions (see recommendations)</i> <p>Select from CEN TC 350 member list</p>
14. Laboratory	<p>Blower-door test: Measuring instrument for quantifying the airtightness of a building. Air temperature and humidity levels are important issues for occupant health and comfort. A professional design and examination of the building's air barrier protects from draughts and dry indoor. Air resulting from air leaks through joints and gaps. Construction damages like mould caused by moisture finding its way into the insulation can be avoided. An airtight envelope protects from energy losses and takes care of the environment and the economy.</p> <p>Demonstration of other measurement equipment: Thermography camera for detecting thermal losses; radial thermometers; measurements of humidity and others related to the thermal comfort in buildings.</p> <p>Analysis of energy performance of buildings: Demonstration software(or other fulfilling the requirements of EN ISO 13790:2008 Energy performance of buildings - Calculation of energy use for space heating and cooling)</p> <p><i>Linking to certificate system (best to existing ones)</i></p> <p><i>Training on building assessment</i></p> <p><i>TQB-TOOL:</i> <i>Open source online building assessment tool.</i> <i>http://www.oegnb.net/en/tqb.htm</i></p>
15. Problem-Solving	<p>Several problem solving techniques could be used at stage of design of energy efficient building and rehabilitation of existing one by using of software and computer simulations. The problem approach is good also for homework and tasks for the trainees.</p> <p>Use PBL Problem Based Learning approach</p>
16. Field Work	<ul style="list-style-type: none"> • Analysis with thermography camera imaging the heat losses of a building envelope (from outside or inside) • Demonstration of eco-materials and construction systems, others • Visit best practise passive and energy plus houses, and best practise in renovation • Visit green roof solutions
17. Textbooks	<p>A number of textbooks can be applied on the different topics: green architecture; renewables; eco-materials, etc.</p> <p>Use You Tube – lots of good examples and demos of sustainable building etc. and use TED vision lessons</p>
18. Teach the Students	N/A
19. Teach the Teachers	N/A
20. Guides and Manuals	<p>Holistic energy efficient planning + construction http://www.intense-energy.eu/handbook-holistic-energy-efficient-planningconstruction/</p> <p>National resource institutes and universities, secondary technical schools have lots of relevant literature.</p>
21. PowerPoints and Videos	<ol style="list-style-type: none"> 1. Legislation 2. Quality control 3. Settlement planning and design principles

	<ul style="list-style-type: none"> 4. Energy carriers and renewable energy sources 5. Ecological materials 6. Cost-benefit assessment 7. Building physics 8. Construction of elements 9. Systems engineering
22. Quizzes	Quizzes on resource efficiency, legislation, ecological materials, and other topics could be applied.

3.2 General remarks from different stakeholders

- All contents must include practical and specific examples that companies may “understand” and “touch”
- Financial consideration: the cost-benefit link must be always explained and reasoned; all kind of costs and all kind of benefits
- Basic concept of holistic energy efficient planning and design should be covered – passive design for heating and cooling and others
- Nearly Zero Energy Buildings and cost optimality issue
- Integrated design of the building construction and installations, working together of all designers – architects, civil engineers, HVAC engineers to obtain cost optimal solution
- The legal applicable framework for energy efficient buildings
- It may not be necessary to include life cycle of materials when target audience are manual workers. Include economic context
- emphasis on urban and spatial planning (this is often the key cause of problems)
- It is a very comprehensive course, but too complex and theoretical for the secondary level. It is more appropriate for the post-secondary education
- Introduction of a compulsory subject "sustainable building" at (technical) schools

4 Draft headlines course

Unit identifier /name	Unit description	Element identifier/ name	Element description	Performance criteria (learning outcomes)	ECVET ³
U1/Introduction to the European Building and Construction sector	The unit provides an introduction to the sector, legislation, standards, eco efficiency and approaches to increase resource efficiency	U1 E1	Introduction to the European Building and Construction sector (TRUST-IN: 1-5): <ul style="list-style-type: none"> General data and Motivation for eco-efficiency 	<ul style="list-style-type: none"> The students will understand the context of resource efficiency and the construction sector 	0.5
		U1E2	<ul style="list-style-type: none"> EPBD 2010/31/EU and overview of Standards 	<ul style="list-style-type: none"> The students will get to know the general directions of the European Energy Strategy The students will get to know the main requirements of the Buildings Directive, the Energy Efficiency Directive and the Strategy for the sustainable competitiveness of the construction sector The students will get to know about the relevant standards The students will understand the energy efficiency potential in the building sector 	1
		U1E3	<ul style="list-style-type: none"> Four major concepts of eco-efficiency (Performance, conformity, life cycle cost and environmental impact). 	<ul style="list-style-type: none"> The students will be familiar with established approaches to increase resource efficiency 	0.5

³ 1 ECVET calculated analogous to ECTS. ECTS is the equivalent of 25 to 30 hours workload for the students, including preparation, studying, processing, wrap up

Unit identifier /name	Unit description	Element identifier/ name	Element description	Performance criteria (learning outcomes)	ECVET ³
U2/Introduction to Energy Efficiency and Renewable energy	The unit provides an introduction to energy efficiency, water efficiency, materials efficiency and social aspects	U2E1	1. Building Efficiency (TRUST-IN: 6-9) <ul style="list-style-type: none"> Energy efficiency and renewables 	<ul style="list-style-type: none"> The students will understand buildings energy related problems and how to overcome these problems The students will understand the benefits of energy management The students will get to know the basics of renewable energy The students will get to know the energy efficiency assessment method 	1
		U2E2	<ul style="list-style-type: none"> Water efficiency Material efficiency 	<ul style="list-style-type: none"> The students will understand buildings water related problems and how to overcome these problems The students will understand buildings materials related problems and how to overcome these problems 	0.5
		U2E3	<ul style="list-style-type: none"> Social improvements 	<ul style="list-style-type: none"> The students will understand health related and social problems and how to overcome these problems 	0.5

Unit identifier /name	Unit description	Element identifier/ name	Element description	Performance criteria (learning outcomes)	ECVET ³
U3/Practical implementation, tools, measurements	The unit provides an introduction to measuring techniques, evaluation schemes and their application	U3	<p>2. Practical application (TRUST-IN: 13-15)</p> <ul style="list-style-type: none"> • Concrete practical examples • Thermography camera for detecting thermal losses; radial thermometers; measurements of humidity and others related to the thermal comfort in buildings. • Use the topics of the TQB-assessment system (ASBC - Austrian Sustainable Building Council) to achieve an overall view on sustainable buildings. 	<ul style="list-style-type: none"> • The students will get to know how to perform the technical, economic and environmental analysis of a building • The students will practice calculations of energy savings • The student will be able to apply the knowledge in practice and present the results 	2

5 Recommendations

In order to achieve a successful VET system, different views should be considered. Each partner country contacted relevant stakeholders of the education and building & construction sector asking three main questions. The collected answers are listed in the following section:

5.1 Which issues are missing in the course design?

Austria:

- Inclusion of classical approaches to increase production efficiency (5S, Kaizen, involvement of employees)
- For teaching on energy efficient buildings there should be an emphasis on a holistic approach. Therefore, the use of the topics of the TQB-assessment system (ASBC - Austrian Sustainable Building Council) to achieve an overall view on sustainable buildings would be recommended.
- Comparison of the main topics with the existing course design TRUST-IN:

	Main topics of ÖGNB-assessment tool	Existing content in course design TRUST-IN	Recommended content in addition to existing course content
A	Location and Facilities	x	Infrastructure in the area, Location safety and building land quality
			Facilities quality and Accessibility
B	Economy and Technical Quality	x	Profitability within the life cycle - calculation
			Construction site management
			Flexibility and Durability
C	Energy and supply	Energy demand, Energy generation, Water demand	Water quality
D	Health and comfort	Thermal Comfort, Indoor air quality	Sound insulation
			Daylight and sunlight
E	Resource efficiency	Avoidance of critical materials	
		Regionality, recycling share, certified products	
		Eco-efficiency of entire building and Disposal	

Bulgaria:

- Basic concept of holistic energy efficient planning and design should be covered – passive design for heating and cooling and others
- Nearly Zero Energy Buildings and cost optimality issue.
- Integrated design of the building construction and installations, working together of all designers – architects, civil engineers, HVAC engineers to obtain cost optimal solution

Czech Republic:

- I miss (i) accent on accuracy and systematic organization of construction work; (ii) issue of thermal bridges; and (iii) airtightness of building envelope. On the other hand, it may not be necessary to include life cycle of materials when target audience are manual workers. I would also include economic context, and (drinking) water management, retention of rainwater.
- A clear definition and categorization of "building". Does it include industrial buildings, halls, storehouses vs. residential houses...?
- emphasis on urban and spatial planning (this is often the key cause of problems)
- legislation: Energy Efficiency Directive
- Passive House Standard (according to PHPP methodology)
- ISO standards: ISO 15221 Facility management, ISO 50001 Energy management
- include the topic "Energy Performance Contracting"
- include the topic "Water management/efficiency" (it has raising importance in facility management and it will raise even more in a future; e.g. water savings, use of rainwater, closed loops...)
- bigger emphasis on a use of RES in buildings + co-generation
- use of green vegetation (e.g. green roofs)

Lithuania:

- Include human exposure evaluation competences such as thermal comfort and indoor air quality in buildings. It relates to efficiency of HVAC systems, materials used for construction as well as occurrence of BRI (building related illness) as SBS (sick building syndrome) symptoms.
- Quite completely covers "Energy and resource efficient buildings". Nothing to add.
- Durability of building materials and structures:
 - Should have knowledge and be able to measure physical characteristics of building materials and constructions, technological parameters of construction processes as well as document them correctly.
 - Understand the ethical, social, economic and safety sides of construction problems and their solutions.
- Interaction between energy saving and indoor air quality:
 - Should have knowledge and be able to evaluate how implementation for energy saving will affect indoor air quality and quality of life in the building.

Poland:

- Practical cost saving approach (which cost saving effects could have a sustainable building)
- Focus on best practices
- More details about the positive expects of sustainable building(maybe in point 2. Of the concept: Motivation)
- Local importance of sustainable building

Portugal:

- In Section 3, EU Directives, include the Strategy for the sustainable competitiveness of the construction sector and its enterprises (COM(2012) 433 final)
- In Section 6, Energy: Renewables and Efficiency, include the topics of natural lighting and natural ventilation for the reduction of energy consumption and increased comfort

Romania:

- Financial consideration
- The legal applicable framework for energy efficient buildings

Slovenia:

- The course covers almost everything. Stakeholders mentioned Material labelling – what is something made of (from what kind of material). Green-, alternative-, bio-, sustainable-technologies should be mentioned.

Spain:

- After analysing the content outline of the TRUST-IN Project, according to the opinion of this person all contents may be covered by the proposed course. However, it is emphasized in the incorporation of the concept and contents about material versatility to suit different environments and climates, in the chapter on material efficiency.
- On the other hand, this person highlights the importance of incorporating some contents related to social behaviour and market perspective in relation to eco-innovative buildings, since according to their experience most of the times, the effort made by the company to provide added value through incorporating eco-innovating ways in the buildings may not be appreciated by the end-user if those improvements have economic impact in the final price.
- Furthermore, there may be aspects of an apartment, such as terraces, that are valued positively from the demand-side even consider a plus, while from the perspective of energy efficiency can become a problem.
- Trust In contents are considered as enough, as they cover existing needs. Two concepts must be highlighted:
 - All contents must include practical and specific examples that companies may “understand” and “touch”.
 - The cost-benefit link must be always explained and reasoned; all kind of costs and all kind of benefits

5.2 Which didactics could you recommend for the training (how would you do the training)?

Austria:

- Work on case studies to learn together from each other
- Formation of a platform for mutual learning.
- To emphasize on the holistic view I would recommend a training on building assessment. It would give an important overview on the relevant topics. Also it would link the knowledge on different special technical issues and help thinking in a broader context to know about the influences between the different aspects (e.g. sunlight and cooling). The TQB-tool (ASBC - Austrian Sustainable Building Council) is an open source tool. It is available for free in the internet and therefore it can be easily used for teaching.

Bulgaria:

- Site visits should be included together with class lectures, measurements, etc.
- Use of thermograph analysis and thermal bridges detection and measures for reduction of their effect have to be included.

- Combination of desk training with books and other materials and practical work – measurements, simplified energy audits, practical work for design of buildings and HVAC systems, others. Discussions of different cases and solving renovation problems, e.g. for building cultural monument or others have to be included.

Czech Republic:

- For such a course, e-learning seems to me inappropriate. I would prefer workshop with practical cases and supporting materials in printed form.
- Workshops and case studies
- introduce compulsory subject "sustainable building" at (technical) schools
- partly compulsory tests and examinations

Lithuania:

- Lectures and discussions, case study analysis, design of the projects
- Methods of teaching are understandable. In my opinion the following issues are also covered – lectures, laboratories, problem solving, field work. textbooks, possibly e-learning, PowerPoints, videos, etc.
- Formal lecture, small group tutorials, group work, seminar, problem solving sessions

Poland:

- Visiting local good practices in field of sustainable building
- Linking to certificate system (best to existing ones)
- Interviewing/Engaging local, regional and national Experts in transferring the knowledge

Portugal:

- Action-based learning methods where in-classroom training is intermixed with practical applications
- E-learning methods
- Use of social networks

Romania:

- Case studies, videos, study tours and participation in symposiums

Slovenia:

- In curriculum they included case studies, excursions, presenting videos etc.

Spain:

- According to the contributions of the answerer, the best option would be to combine a classroom course with online resources. As for the didactics, it would be highly valued the time dedicated to group problem solving techniques and methods as well as field work and demonstration techniques, in which are analysed experiences and case studies. Thus, the content related to the demo part and the dynamics of group problem solving are considered of great importance.
- The following proposals have been collected:
 - To include very visual simulations that already exist on which are the effects produced by introducing or removing certain energy systems in a city, area, building blocks or dwellings.

- To consider materials or equipment that can be touched.
- In situ visits and practical videos are considered as very interesting and helpful didactics.

5.3 Which training providers would you suggest for such a training?

Austria:

- Quite a few ones possible, depends on strategic positioning of the training course: most widespread are the Wifis of the provinces as well as the institution of the chamber of commerce, but also a university of applied science (like Kuchl)
- A "driving licence" approach, a modular approach could be used, so that the participants can pick from a menu according to their priorities
- Making use of an E-learning platform
- DonauuniversitätKrems (University for Continuing Education), <http://www.donauuni.ac.at/en/index.php>. Danube University Krems is the Austrian university for continuing education. Its courses are specifically oriented toward the needs of working professionals.
- IBO, <http://www.ibo.at>. The Austrian Institute for Healthy and Ecological Building is providing information on the impact of buildings on human health, well-being and environment.
- klima:aktiv, <http://www.klimaaktiv.at/english.html>. klima:aktiv education coordination presents a network for VET in various sectors, like energy technology and savings in buildings.
- Energieinstitut Vorarlberg, <https://www.energieinstitut.at/>. The Energy Institute Vorarlberg offers trainings for various target groups in the sectors energy and buildings.

Bulgaria:

- University of Architecture, Construction and Geodesy in Sofia
- Any registered centre for professional training in cooperation with universities.
- Branch association or chamber, other designated national NGO: Union of Architects, Chamber of the Engineers in Investment Design, others.

Czech Republic:

- From Czech providers, I recommend the Centre of Passive House, Czech Technical University - Faculty of Civil Engineering, and architects (individuals).
- European Organization for Quality (www.eoq.org)
- training of teachers of relevant subjects + expert from practice
- compulsory practice and excursions

Lithuania:

- Academic staff (university teachers and researchers) and social partners (representatives of the companies having know-how in the sustainable building and development).
- Because TRUST IN is somehow related to vocational education (3rd, 4th, 5th professional qualification level) spectrum of teachers could be very wide. In addition to organizations which are mentioned in item 12, p. 35, also could be involved lecturers of colleges, teachers of vocational schools, engineering staff of stakeholders, etc.
- Lectures from universities and colleges.

Poland:

- Online Training providers

- VET services organized by technical universities (existing didactic infrastructure/experts)
- Individual Training providers for business or administration (training on side)

Portugal:

- LNEG, National Laboratory of Energy and Geology
- CENFIC, Southern Vocational Training Centre of Construction and Public Works
- CICCOPN Northern Vocational Training Centre of Construction and Public Works
- CTCV, Technological Centre of Ceramics and Glass
- ADENE, Energy Agency

Romania:

- Experts in sustainability and eco-efficiency
- Non-for profit associations from the sector
- Experts from Energy Management Institutions and companies
- Designers and architects

Spain:

- Due to the changes that are taking place on this domain (new regulations, standards, new materials, etc.) the best option would be life-long learning courses in which professionals of the sector participate.
- The following training providers have been suggested:
 - VET centres that offer training related to the sector.
 - Sectorial business organizations.
 - To create a social culture among children to make these concepts closer from them, and generate interest from the beginning, increasing this way the demand for eco innovation.
 - To disseminate these concepts in society in general, making eco-innovation more visible and increasing this way the demand.

Slovenia:

- Especially experts from companies, who work in the field and can make real observations and present real case studies.
- In some high schools they are connected with some companies to provide students with examples from practice.

6 Annex

6.1 Invitation list

Austria:

Johannes Fresner, STENUM GmbH
 Maria Kalleitner-Huber, Austrian Institute of Ecology (organizer)
 Sebastian Freiberger, STENUM (minutes)
 Willi Sieber, AIE

Bulgaria:

Mariana Asanova, SERC (Social and Environmentally Responsibility Centre), not present
 Zdravko Georgiev, Social and Environmental Responsibility Center

Czech Republic:

Vladimir Dobes, ENVIROS/EMPRESS, not present

Denmark:

Kim Christiansen, Danish Standards Foundation
 Stig Hirsbak, Aalborg University (leading partner)

Lithuania:

Jurgis Staniskis, Centre for sustainable industrial development, University of Kaunas

Poland:

Thomas Schönfelder, ATMOTERM

Portugal:

Cristina Rocha, LNEG National Laboratory of Energy and Geology
 David Camacho, LNEG

Romania:

Aida Sorina Szilagyi, Centrum National Pentru Productiesi Consum Durabil Churian, CNPPCD (Center for Sustainable Development)
 Catalina Culda, Timisoara Chamber of Commerce, Industry and Agriculture
 Diana Fiti, Timisoara CoC
 Gabriela Fistis, CNPPCD
 Octavian Culda, Timisoara CoC
 Vukasin Bucur, Timisoara CoC

Slovenia:

Borut Hojnik, Nigrad d.d. komunalnopodjetje (municipal road maintenance; contact: Rebeka Lukman)
 Dejan Stevic, Nigrad
 Katja Kocuvan, University of Maribor, Faculty for Chemistry and Chemical Engineering
 Natalija Curic, UM FCCE
 Peter Glavic, UM FCCE, Association of Economists in Maribor
 Ziberna Bojana, Nigrad, SI

Spain:

Oihana Hernaez, PROSPEKTIKER

Guests:

Beate Lubitz-Prohaska, AIE
 Robert Lechner, AIE
 Johannes Fechner, 17&4

6.2 Workshop programme

3.12.2013	Content	Organisation	Experts/Stakeholders
14:00 – 15:30	Introduction of assessment tool Total Quality Building (TQB) and certified buildings https://www.oegnb.net/en/tqbtest.htm ASBC - Austrian Sustainable Building Council	Maria Kalleitner-Huber	Beate Lubitz-Prohaska, Austrian Institute of Ecology
15:30 – 18:00	Excursion: Visiting a TQB certified building in Vienna	AIE	Architect, technical planner, auditor
19:00	Common dinner Gasthaus Stafler	Willi Sieber	special guest

4.12.2013	Content	Organisation	Experts/Stakeholders
09:00 – 11:00	Group work with relevant stakeholders, e. g. TQB users and development team of TQB Education Platform	Maria, Willi, Johannes Fresner	Representatives of technical schools, VET institutions, construction companies, klima:aktiv education coordinator
11:30 – 13:00	Headlines for course on resource efficiency in building sector (draft) and recommendations	Willi	TREO-Team
13:00-14:00	Snack and Closing	Maria	Willi

6.3 Signed participants list



TREO – Training on Resource Efficiency and Optimization







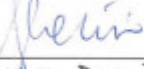





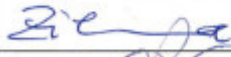


1st Workshop on Building and Construction,
Austrian Institute of Ecology, Seidengasse 13, 1070 Vienna

Attendance list 03/12/2013

Name	Institution	Signature
Aida Sorina Szilagyi	Centrul National Pentru Productie si Consum Durabil	
Andrei Churican	Centrul National Pentru Productie si Consum Durabil	
Borut Hojnik	Nigrad d.d. komunalno podjetje	
Catalina CULDA	Timis Chamber of Commerce, Industry and Agriculture	
Cristina Rocha	LNEG National Laboratory of Energy and Geology	
David Camacho	LNEG National Laboratory of Energy and Geology	
Dejan Stević	Nigrad d.d. komunalno podjetje	
Diana FITI	Timis Chamber of Commerce, Industry and Agriculture	
Dr. Johannes Fresner, MSC	STENUM GmbH	
Gabriela Fistis	Centrul National Pentru Productie si Consum Durabil	
Jurgis Staniskis	Subalansuotos pramonės plėtros centras - Centre for sustainable industrial development	
Katja Kocuvan	University of Maribor, Faculty for Chemistry and Chemical Engineering	
Kim Christiansen	Danish Standards Foundation	

1st Workshop on Building and Construction,
Austrian Institute of Ecology, Seidengasse 13, 1070 Vienna

Attendance list 03/12/2013

Name	Institution	Signature
Maria Kalleitner-Huber	Austrian Institute of Ecology	
Natalija Čurič	University of Maribor, Faculty for Chemistry and Chemical Engineering	
Octavian CULDA	Timis Chamber of Commerce, Industry and Agriculture	
Oihana Hernaez	PROSPEKTIKER - European Institute for Future Studies and Strategic Planning	
Peter Glavič	University of Maribor, Faculty for Chemistry and Chemical Engineering	
Sebastian Freiburger	STENUM Unternehmensberatung und Forschungsgesellschaft für Umweltfragen mbH	
Stig Hirsbak	Aalborg University - Department of development and planning	
Thomas Schönfelder	ATMOTERM spolka akcyjna	
Vukasin BUCUR	Timis Chamber of Commerce, Industry and Agriculture	
Willi Sieber	Austrian Institute of Ecology	
Žiberna Bojana	Nigrad d.d. komunalno podjetje	
Zdravko GEORGIEV	Social and Environmental Responsibility Center	
Beate Lubitz-Prohaska	Austrian Institute of Ecology	
Robert Lechner	Austrian Institute of Ecology	

1st Workshop on Building and Construction,
Austrian Institute of Ecology, Seidengasse 13, 1070 Vienna

Attendance list 04/12/2013

Name	Institution	Signature
Aida Sorina Szilagy	Centrul National Pentru Productie si Consum Durabil	
Andrei Churican	Centrul National Pentru Productie si Consum Durabil	
Borut Hojnik	Nigrad d.d. komunalno podjetje	
Catalina CULDA	Timis Chamber of Commerce, Industry and Agriculture	
Cristina Rocha	LNEG National Laboratory of Energy and Geology	
David Camacho	LNEG National Laboratory of Energy and Geology	
Dejan Stević	Nigrad d.d. komunalno podjetje	
Diana FITI	Timis Chamber of Commerce, Industry and Agriculture	
Dr. Johannes Fresner, MSG <i>MG</i>	STENUM GmbH	
Gabriela Fistis	Centrul National Pentru Productie si Consum Durabil	
Jurgis Staniskis	Subalansuotos pramonės plėtros centras - Centre for sustainable industrial development	
Katja Kocuvan	University of Maribor, Faculty for Chemistry and Chemical Engineering	
Kim Christiansen	Danish Standards Foundation	
Julia Lindenthal	Austrian Institute of Ecology	



1st Workshop on Building and Construction

Attendance list 04/12/2013

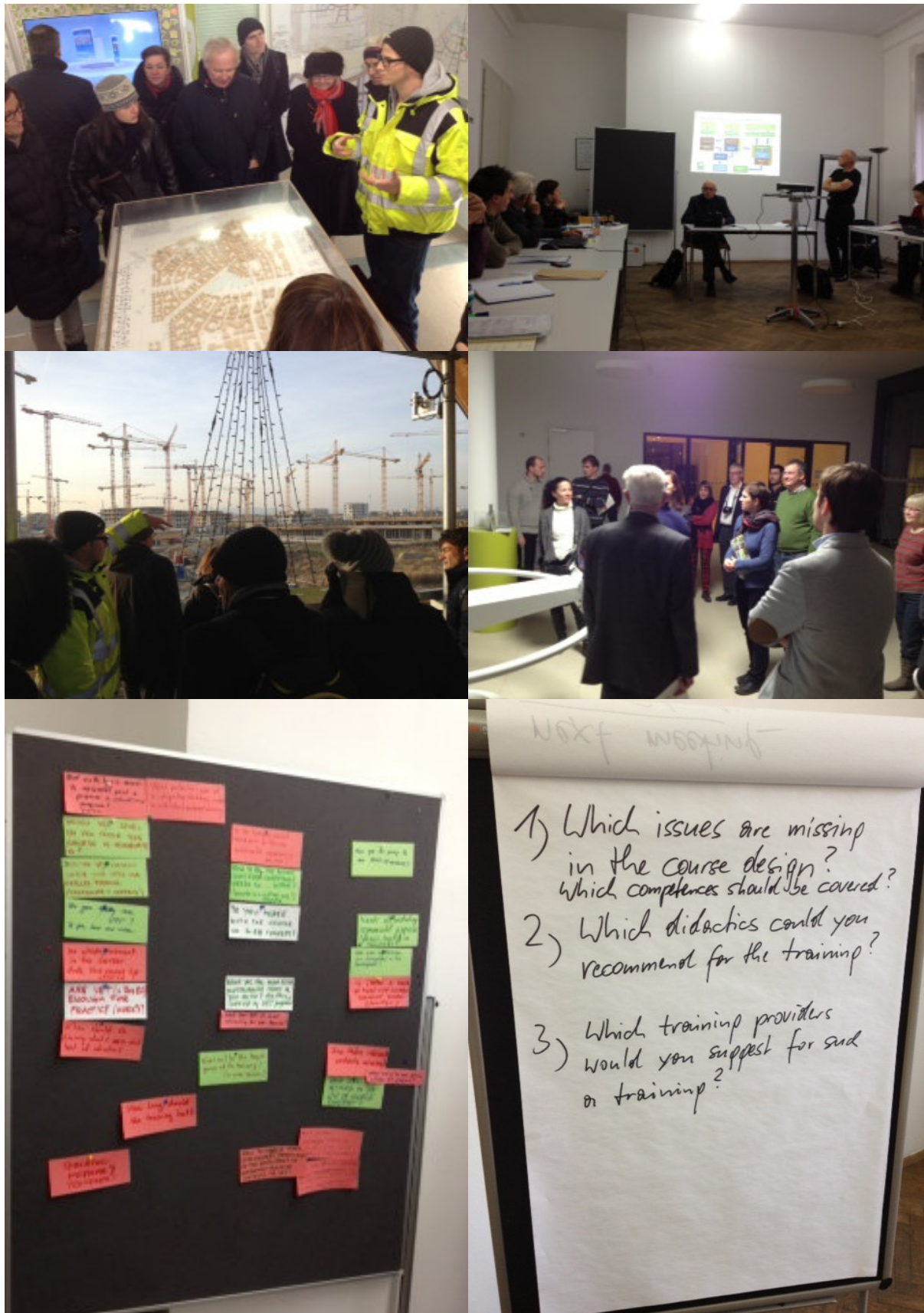
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Natalija Čurič	University of Maribor, Faculty for Chemistry and Chemical Engineering	
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This project has been funded with support from the European Commission.

6.4 Photos of the meeting



6.5 Presentations

For the presentations of this meeting please see Annex – Collection of presentations.