CISBAT

PROCEEDINGS VOL. I

INTERNATIONAL CONFERENCE

FUTURE BUILDINGS & DISTRICTS

SUSTAINABILITY FROM NANO TO URBAN SCALE

9 - 11 SEPTEMBER 2015 EPFL

LAUSANNE - SWITZERLAND

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PREFACE

"Future Buildings and Districts – From Nano to Urban Scale" was the topic of the international scientific conference CISBAT 2015, which took place in the Swiss lakeside city of Lausanne from 9 to 11 September 2015.

Designed as a platform for interdisciplinary dialog and presentations of innovative research and development in the field of sustainability in the built environment, the conference covered a wide range of subjects from solar nanotechnologies to the simulation of buildings and urban districts.

CISBAT 2015 was the 13th edition of CISBAT, whose vocation is to present new perspectives offered by renewable energies in the built environment as well as the latest results of research and development in sustainable building technology, in a setting that encourages networking at the international level. The conference assembled building scientists, engineers, urban planners and building designers from all over the world in an effort to promote clean technologies for sustainable buildings and cities. Close to 170 scientific papers were presented during three intense days of conference.

CISBAT 2015 was organized in scientific partnership with the Massachusetts Institute of Technology (MIT) and Cambridge University. Furthermore, the organizing committee was proud to be able to count on an international team of renowned scientists to ensure the quality of presented papers. The conference also teamed up for the third time with the Swiss Chapter of the International Building Performance Simulation Association (IBPSA-CH) to strengthen the subject of “Building Simulation”, one of the conference's leading topics.

Finally we were proud to host an outreach event of the Swiss Competence Centre for Energy Research “Future Energy Efficient Buildings and Districts” (SCCER FEEB&D) as well as a Workshop on Grid-Supportive Buildings organised by Fraunhofer IBP and E.ON Energy Research Center, RWTH Aachen.

Organised under the auspices of the Swiss federal Office of Energy (SFOE) and the Federal Commission for Technology and Innovation (CTI), CISBAT 2015 connected researchers and projects and gave an exciting insight into current research and development in the field of sustainable buildings and cities. It is our greatest wish that the conference will have led to a better understanding of the issues at stake and to fruitful, creative collaboration between its participants.

Prof. Dr J.-L. Scartezzini

Chairman of CISBAT 2015
Head of Solar Energy and Building Physics Laboratory (LESO-PB), Swiss Federal Institute of Technology Lausanne (EPFL)

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AN INNOVATIVE TRAINING MODEL FOR ECO-BUILDING TECHNOLOGIES IN RETROFITTING

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ABSTRACT

The innovative training model for eco-building technologies in retrofitting projects (founded by EU Commission in the IEE programme in the REE_TROFIT project http://www.reetrofit.eu/content.php) aims to contribute to solve the shortage of local qualified and accredited retrofitting experts, as foreseen in the EPBD and its recast - and as indicated by various European countries in an assessment by the EC - for increasing the energy performance of the existing building stock. The retrofitting training model will use in-house know-how and experiences of participants in carrying out vocational courses on innovative eco-building technologies. The training model defines best practices for institutionalization and implementation of vocational courses on renewable energy solutions and energy efficiency in retrofitting, setting up and implementing a large-scale educational scheme and fostering exchange of knowledge and best practices among stakeholders. One of the major milestones of the project is to raise awareness in the regional, national and European policy makers for the full implementation of the EPBD and its recasts. Additionally, during its lifespan, it intends to define an exploitation strategy for assuring the sustainability of training beyond the project duration and increase the local retrofitting markets.

The training scheme is founded on an innovative educational model specifically targeted for building professionals; the adopted retrofitting training model offers the following attractive features:

- Flexibility: applicable in contexts with different regulatory frameworks, climate, landscape restrictions, qualification levels of learners, etc.
- Transferability: capable of responding to local training needs through methodologies and tools transferable at European level.
- Innovation: accessible, affordable and capable of overcoming the problems encountered by previous training program experimented in the partnering countries.
- Modularity: offers different training programs which are composed of independent, closed, domain-specific modules that may be activated according to the different training needs.
- Brevity: offers training courses with a short duration, which are decomposed in shorter training tracks in order to ease the attendance of the targeted professionals.
- Plurality: different training methods, tools and media might be used in the training process in order to take in regard the trainees needs and to guarantee effectiveness.

***Keywords**: Retrofitting buildings, training, courses, renewable energy.*

INTRODUCTION

One of the main goals of the REE_TROFIT project is to assure a massive replication of training beyond the project duration in the EU MS.
The Guide for the institutionalization of training courses is one of the results of the research project, published in the final report and adopted by the Consortium. It provides practical

knowledge, guidance and suggestions to have the REE_TROFIT training recognized by different stakeholders in Europe (focusing on the REE_TROFIT partnering countries), and outlines the way to gain mutual recognition of the acquired qualification. More detailed information can be found in the extended version of the Guidelines for the institutionalization of training courses developed by REE_TROFIT partners.

The Guide addresses the following levels of audience:
1) The consortium partners, in order to share experiences and best practices;
2) Chambers of Commerce and vocational Training organizations providing operational information on the best way to institutionalize the training program;
3) Other stakeholders that can assure the replication of training in other EU member states beyond the duration of project.
The institutionalization of training should bring to a certification designed and implemented in accordance with regional, national and European framework. Moreover, the obtained certification could bring some advantages for trained people depending on the regional or national regulation (grid of salaries, right of access to specific market etc.). Considering the different local contexts, the institutionalization of the training model has been achieved with different specific approaches and local strategies focusing on the endorsement of relevant stakeholders. As a result, due to the endorsement of several institutions, high level of participation to the REE_ TROFIT training courses was secured.
Results of this activity are reported in the table below.

Country	Institution involved	Outcome toward REE_TROFIT institutionalization
IT	National Italian Union of Chambers of Commerce	"Committee on Sustainable Building Industry" inside the National Union of Italian Chambers of Commerce adopted and promoted the REE_TROFIT model toward the Italian Chambers of Commerce.
DK	Regional Vocational Training Centre	EUC-North. The REE_TROFIT model was adopted by EUC-North which collaborated in the delivery and promotion of training activities, also beyond project duration.
HU	Hungarian Chambers of Commerce.	FAT (National Adult Training Accreditation Committee) accreditation requested for the REE_TROFIT training model in Hungary.
GR	TEIC (Technological Educational Institute of Crete), Region of Crete, Technical Chamber in Greece.	TEIC as Higher Educational Institutes, requested the certification for the REE_ TROFIT training to the Greek authorities.
BG	Bulgarian Chambers of Commerce, high school of civil engineers and architects in Sofia and University Chernorisetz Hrabar in Varna.	Bulgarian Chambers of Commerce, high school of civil engineers and architects in Sofia and University Chernorisetz Hrabar in Varna have adopted the REE_TROFIT training model.
FR	Recognized Grenelle Environment (RGE): quality mark issued to French companies about energy performance improvement work on buildings.	A procedure was define to obtain the quality mark RGE for the REE_TROFIT training.

METHODOLOGY

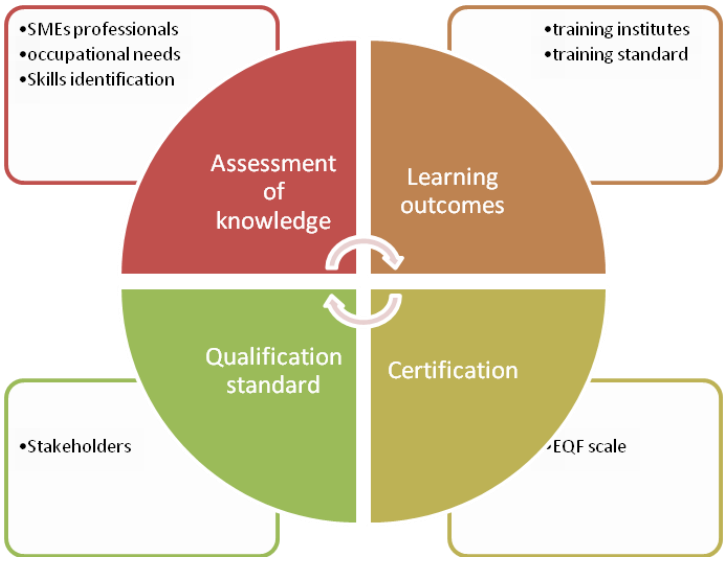
The certification standard should make qualified professionals identifiable on the labour market, thus bringing benefits to both professional and building companies; for this purpose it needs to be included in official, legitimate schemes. First, the organisation which is expected to assess and deliver the certification should be well known and recognized in the country and in the professional sector. In different countries, different certification schemes exist and this makes complex the choice of the suitable institution/organisation.

The following issues are important in order to identify the best way to address the institutionalisation of courses:
- type of occupation standard: complete job or part of an existing job;
- existence of a qualification organisation and/or qualification register;
- existence of certification in the professional sector.
Each framework has to be studied in each country in order to define the best certification system. The pathway to be covered will probably be different in different countries, but if all certifications are based on the same qualification standards (http://www.lucense.it/upload/file/REE_TROFIT_Final_Publishable_Report.pdf), the transparency of qualification acquired will be ensured, in accordance of European recommendation. Taking into consideration the intricate processes to identify the wide variety of qualifications, it is of utmost importance to implement a certification process that could be relevant in the different realities, for consistency and legitimacy purposes.
The new certification awarded may also be useful for professional qualification in local, regional or national regulations. The implementation of a tangible and coherent system serving the various actors' and users' needs then appears of utmost importance.
The general objective of the REE_TROFIT model is to elaborate an effective Vocational Educational Training (VET) model whose relevant characteristic is to provide short track training for already working people in the building market, able to assure the essence of sustainability in buildings is their capability to adapt to change over time.

Training quality

Quality assurance is a continuous and complex process, where feedback (made by trainers and tranees) plays a key role in reviewing the referenced criteria and indicators. The REE_TROFIT model suggests a framework for assuring quality taking into account four interrelated elements: planning, implementation, evaluation and assessment and review.

Figure 1: Scheme of certification and qualification standard



Evaluation and Assessment

The REE_TROFIT model recognises the importance of a continuous evaluation of the training programme and assessment of the training outcomes at different levels.

The REE_TROFIT model considers essential that the findings of the evaluation are provided to those concerned, including strengths, weaknesses, areas for improvement and recommendations for action. Also the relevant stakeholders (i.e. current and former trainees, staff, employers and trade union representatives) should be involved in discussions arising from evaluation results.

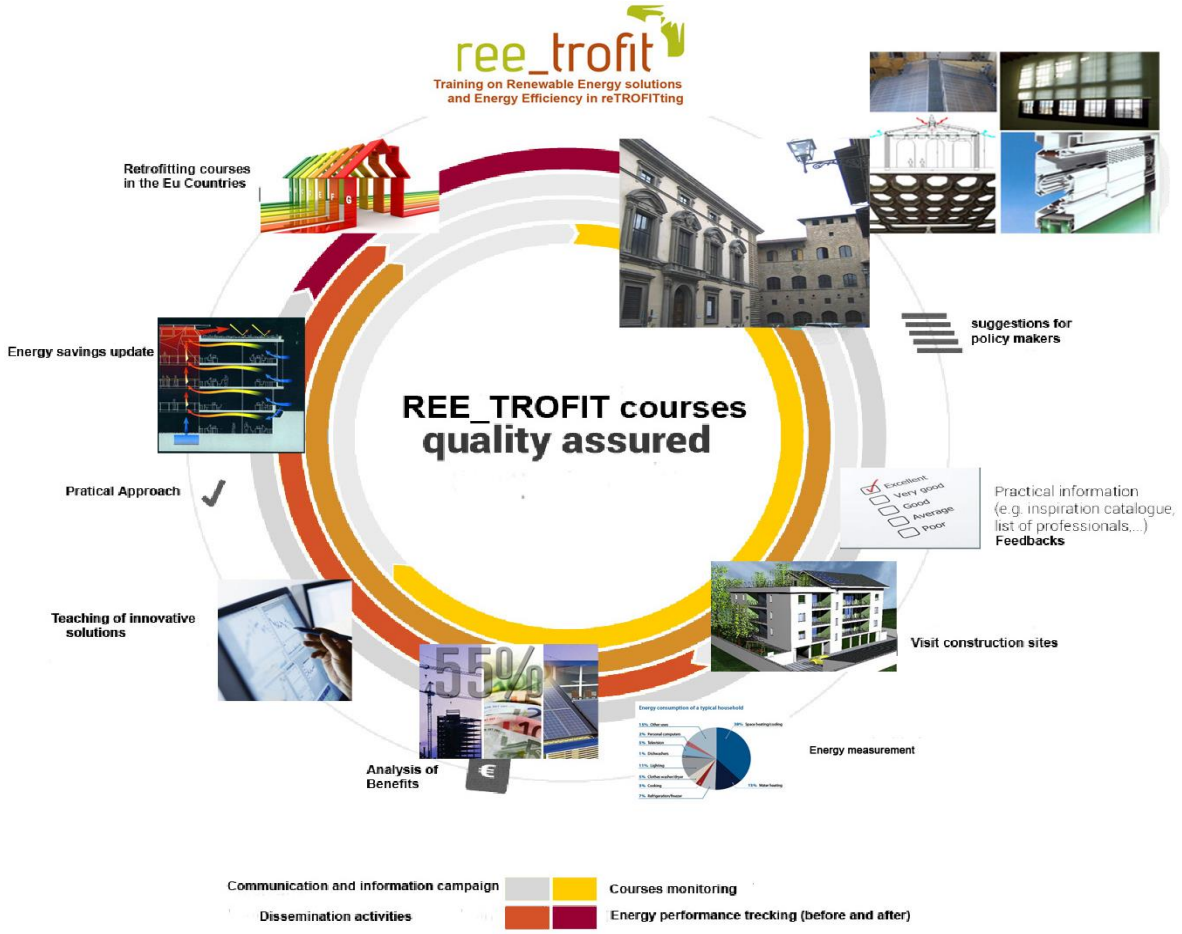


Figure 2: Scheme of the courses quality assured

Role and impact of trainees

REE_TROFIT courses include detailed information for cost-optimal energy saving retrofit, accompanied by financial analysis (i.e. payback times) and technical specifications, which haveproven crucial to evaluate energy benefit in retrofitting .
They provide energy experts and building professionals with energy advice tools that link to the EPBD methodology, and to grant or financial support (Regional and National, for instance Integration of renewable energies) schemes by imposing almost minimum levels for the overall energy performance of public or residential buildings after renovations. This methodology is important to firmly embed REE_TROFIT installers and builders as a key instrument in the start-up phase of any energy saving retrofit activity.
The existing cost differences between energy efficient and "standard" refurbishments have a great influence on the decision making process of the property owners. To encourage investment in ambitious energy saving retrofit, Public Institutions and policy makers are central. It is vital that policy makers' recommendations are accurate, based on robust data and analysis and are effectively communicated. But policy makers can decide that data and information can also play a dynamic role in the decision making process, beyond simply the information printed on the certificate. Further, the national or regional regulation issuing body can interact more with the supply chain, helping to create new systems that enable the select services such expert certified by Ree_trofit vocational courses and by Chambers of Commerce that participate to the Consortium.
More broadly, any programme's success in driving uptake for energy efficient and sustainable refurbishments is highly dependent on the quality of the advice and consultancy. This need for quality consultancy goes beyond the owners – for example to include landlords and tenant

representative bodies in rental situations. Such a "process management" role to ensure an integrated supply chain and seamless customer journey is something that is not formalised in most countries yet, but that we believe is necessary to maximise harvest of the energy efficiency potential of retrofits. It could however be performed by a number of different actors with the right level of training (site managers, assessors, project managers) and with the necessary independency and impartiality.

Training methods and Case Studies

Choice of the most useful training methods in relation to the training market context and the target group features. The standard course structure is a classroom phase, which lasts 16/24 hours divided into 3/4 hours modules.

The courses have a practical structure, based on:
• Case studies relating to building renovation, best if really existing, according to the logic of the guided project works. In fact, the trainer should analyze, together with the learners, a building renovation case, starting from analysis of the building features and context, and going on with the illustration of the existing solutions (technologies, systems, existing materials) in the different building sections and plants renovation, the identification of feasible solutions and finally the definition of the optimal option in the analyzed case.
• Brainstorming, discussion, problem solving: training should seek continuous involvement of participants through analysis and group discussions about explained topics. Of course, the number of attendees affect the active participation during the class work.
• Illustration of the existing solutions, through pictures, movies, viewing samples of products (workshop).
• Product exposition or training laboratory (optional): temporary or permanent showrooms of sustainable building products and systems (also organized with the products' manufacturers), as well as a training laboratory, allow for a "learning by doing" approach helping trainees to better understand and to have a pragmatic and realistic knowledge of the different topics.
• Study visits to building sites where eco-sustainable solutions are implemented: learning through sites and building visits is fundamental for vocational training considering that the trainees would have the possibility to directly experience real examples and realizations of the technologies and solutions discussed during the lessons.
• Solution of a practical problem. Practical problems and solutions are provided by the trainers and the trainees are guided through the process of finding the most viable solutions considering both the technical and economical viability.

The REE_TROFIT training courses provide tools and knowledge to evaluate different materials, components, technologies and building solutions, in order to choose the better approach to address high indoor comfort and high energy performance in building retrofitting. Moreover, the vocational courses allow the trainees to take contact and compare products and the materials of companies operating in different fields of the building sector allowing for the establishment of a potential working collaboration, besides the training activities. At the end of the vocational training course, participants are provided with a certificate of attendance and are registered on the on-line repository of the REE_TROFIT web portal in order to increase their visibility toward citizens, housing and consumer associations and customers in need of information regarding building companies and professionals able to implement a high energy efficient retrofitting solution.

RESULTS

During the project duration, the localized vocational courses have been implemented through 3 test trials (rolling cycles) in each of the 6 participating countries. The rolling cycle approach

allowed the training programs to be tested, improved upon and optimized for the following training batch. Courses were implemented in rolling cycles and partners organized, promoted and delivered vocational training courses over 3 iterative test batches in the 6 partner countries. Following the plan-do-check-act strategy, after each cycle, feedbacks from participants were collected and analyzed with a specific validation methodology, the training contents were enriched (e.g. new modules and multimedia) and the methodology improved through annual internal trainers' review workshops. Preparatory activities, organisation and delivery of three batches of training courses in each partnering country were successfully performed. The number of participants was higher than expected: 1483 professionals were trained (instead of the 450 foreseen participants), among which 453 electrical installers, 512 thermo-hydraulic installers, 518 construction professionals. 1293 trainees out of 1483 participants (87%) obtained a Certificate of Attendance. Moreover, the REE_ TROFIT training courses resulted in positive evaluation by trainees, in particular the overall evaluation about the training courses resulted on average 4,4 on 5.

CONCLUSION

The Ree_trofit project is demonstrating that by focusing on initiatives to link supply and demand for refurbishment with focus on energy saving, and particularly by promoting quality and building trust, vocational courses can successfully drive retrofit actions towards low energy buildings. However, assessing that impact of Ree_trofit certification action will, as things stand today, be difficult. Currently, levels of general retrofit activity are poorly monitored across Europe and there is virtually no monitoring of retrofit activity undertaken in response to Energy savings measures. There is in other words a huge potential for much better tracking and analysis to identify the remaining potential for action on energy efficiency and CO_2 emissions improvements in European homes. This is yet another important element that could support policy makers, market actors, local authorities, and householders themselves in planning low carbon improvement strategies.

Partners of the REE_TROFIT project: Italy: Lucense (Coordinator) Mr Stefan Guerra, Italy: Chamber of Commerce and Industry of Lucca Greece: Technological Educational Institute of Crete Hungary: Chamber of Commerce and Industry Bács-Kiskun County France: Chamber of Commerce and Industry of the Drôme Italy: Abita Interuniversity Research Centre Denmark: Engineering College of Aarhus Bulgaria: Bulgarian Chamber of Commerce and Industry Bulgaria: European Labour Institute

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We also thank the Swiss Competence Center for Energy Research “Future Buildings and District”, supported by the Swiss Federal Commission for Technology and Innovation, for their partnership and funding of the Outreach Event.

Our scientific partners from Cambridge University, the Massachusetts Institute of Technology and the Swiss Chapter of the International Building Simulation Association as well as the members of the CISBAT scientific committee and the session chairs have enthusiastically supported the conference and ensured its quality. We would like to express our sincere thanks for the time and effort they have spent to make it a success.

Behind the scenes, we have received much competent support from the EPFL administration as well as from our caterers and diverse suppliers. We herewith express our sincere thanks for their efficient and friendly collaboration.

The active and uncomplicated help of all staff members of the Solar Energy and Building Physics Laboratory was much appreciated. Special thanks go to our technical and IT staff whose professionalism and excellent organisation was essential at every stage of preparation and during the conference.

Finally, we cordially thank all speakers, authors and participants who have brought CISBAT 2015 to life.

Prof. Dr J.-L. Scartezzini
Chairman of CISBAT 2015
Head of Solar Energy and Building Physics Laboratory (LESO-PB), Swiss Federal Institute of Technology Lausanne (EPFL)

Barbara Smith
CISBAT Conference Manager

To the authors of CISBAT 2015 papers,

We are pleased to inform you that all papers published in the CISBAT 2015 proceedings are now available online with individual Digital Object Identifiers (DOI).

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If you liked CISBAT 2015, you will not want to miss the next CISBAT Conference, which will take place from 6 to 8 September 2017. We will send you the Call for papers in due time.

With kind regards from all of us here at the EPFL Solar Energy and Building Physics Lab in Lausanne,

Barbara

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Barbara Smith, Conference Manager
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