Final report

1.1 Project details

Project title	EUDP 10-II, IEA Avanceret energirenovering af bygninger som ikke anvendes til beboelse EUDP-12-I, Avanceret energirenovering af bygninger som ikke anvendes til beboelse – tillæg 2012 English title: Advanced Renovation in Non Residential Buildings
Project identification (program abbrev. and file)	EUDP-2010-II Journal no. 64010-0436 EUDP-12-I (2012) Journal no. 64012-0113
Name of the programme which has funded the project	EUDP-2010-II EUDP-2012-I
Project managing company/institution (name and address)	Danish Building Research Institute (SBi), Aalborg University Copenhagen, A.C. Meyers Vænge 15, DK-2450 København SV
Project partners	Kirsten Engelund Thomsen & Jørgen Rose, SBi, AAU
CVR (central business register)	29102384
Date for submission	29.1.2015

1.2 Short description of project objective and results

The objectives of the IEA Task 47 "Advanced Renovation in Non-Residential Buildings" are to develop a solid knowledge base on how to renovate non-residential buildings towards the NZEB standards in a sustainable and cost efficient way as well as to identify the most important market and policy issues as well as marketing strategies for such renovations.

In the Task highly successful renovations and innovative concepts for the most important market segments have been analysed. To reach local authorities, companies and planners who need the knowledge on how to achieve market penetration using such solutions, the Task has to communicate success stories and planning knowledge with target audiences to support the acceleration of a market break-through of highly effective renovations in non-residential buildings. The EUDP project has ensured Danish participation in the Task.

In Danish:
Formålet med projektet var at sikre dansk deltagelse i IEA Task 47 " Avanceret energirenovering af bygninger som ikke anvendes til beboelse ". Projektet skulle dermed forøge udbyttet af den danske deltagelse i IEA Task 47.

Hovedformålet med nærværende projekt var at:

- Udvikle en solid viden om, hvordan man energirenoverer ikke-beboelsesbygninger mod Nearly Zero Energy Buildings (NZEB) standarder på en bæredygtig og omkostningseffektiv måde.
- Identificere de vigtigste markedsmæssige og politiske forhindringer samt marketing-strategier for at kunne gennemføre så omfattende energirenoveringer.

En bred vifte af teknologier er blevet vurderet i projektet, såsom gode ventilations- og køleløsninger, men solenergi og øvrige vedvarende energikilder vil naturligvis også spille en væsentlig rolle i at bringe det primære energiforbrug for denne type bygninger ned til NZEB niveau.

1.3 Executive summary

The project has ensured Danish participation in the IEA Task 47 ”Advanced Renovation in Non-Residential Buildings.” In this way Denmark participated in the development of solid knowledge on how to energy renovate buildings to reach a Nearly Zero Energy Buildings level in a sustainable and cost-effective manner. The most important market and policy obstacles for doing so were identified.

The participating countries were Australia, Austria, Belgium, Denmark, Germany, Italy and Norway. Exemplary non-residential renovation projects from all participant countries have demonstrated that total primary energy consumption can be drastically reduced together with improvements of the indoor climate. Because most property owners are not even aware that such savings are possible, they set energy targets too conservative. Buildings renovated to mediocre performance can be a lost opportunity for decades.

The project started in January 2011 and ended December 2014.

The task dealt with several types of non-residential buildings, including protected and historical buildings:

- Office buildings
- Educational buildings
- Nursing homes
- Hotels
- Super markets and shopping centres

The Task has resulted in a series of technical reports and workshops (the reports have been written and sent for approval at the EXCO):

- Design and performance of exemplary renovation projects, describing benefits, process and motivations [Subtask A].
- Building segments with the greatest multiplication and energy saving potentials [Subtask B].
- Decision making processes and the influence of barriers and non-energy-benefits [Subtask B].
- Key technologies for renovations and how to achieve NZEB standard for renovation with good indoor comfort [Subtask C].
- A global approach for building renovation based on environmental, urban infrastructure, comfort and health impacts [Subtask D].

Danish participation in and contribution to IEA task 47 was important as the outcome of the project may form the basis for a future EU directive on the energy performance of existing buildings.

1.4 Project objectives

Buildings are responsible for up to 35 % of the total energy consumption in many of the IEA participating countries. The EU Parliament approved in April 2009 a recommendation that member states have to set intermediate goals for existing buildings to fix minimum percentage of buildings to be net zero energy by 2015 and 2020.

New construction accounts for approx. only 1% of the energy consumption in the total building stock. Therefore there is a great need for and potential by implementing comprehensive energy conservation in existing buildings. In May 2010 the EU Parliament approved a recast of the EPBD citing that member countries must establish objectives in order to stimulate energy renovation of existing buildings to become almost energy neutral buildings Nearly Zero Energy Buildings (NZEB). Examples of energy renovations have shown that it is possible to reduce the total primary energy consumption in buildings substantially and improve the indoor climate at the same time. Experience from these projects has not been systematically analysed, so energy targets for extensive renovations are often set too conservatively. Buildings already renovated to only mediocre levels may have lost the chance to achieve more ambitious levels, as profitability deteriorates substantially if further energy reductions are considered.

The objectives of IEA SHC Task 47 were to develop a solid knowledge base on how to renovate non-residential buildings towards the NZEB standards (Net-Zero Energy Buildings) in a sustainable and cost efficient way and to identify the most important market and policy issues as well as marketing strategies for such renovations.

The main purpose of this project was:

- To develop a solid knowledge of how to energy renovate non-residential buildings to achieve Nearly Zero Energy Buildings (NZEB) standards in a sustainable and cost-effective manner.
- To identify the key market and policy barriers, and marketing strategies to implement such extensive energy renovations.

A wide range of technologies have been assessed in the project, such as good ventilation and cooling solutions, but obviously solar radiation and other renewable energy sources will also play a significant role in bringing the primary energy consumption for this type of buildings to the NZEB level.

The project had Danish participation, and the overall objective of compiling existing knowledge from projects where extensive energy retrofit has been completed, and on this basis to develop guidelines for comprehensive solutions for efficient-energy renovation. This knowledge will be made available to building owners and others who face having to implement energy renovation. Thus, past experience is effectively used for the whole construction industry. The project’s background is IEA SHC Task 37: "Advanced Housing Renovation With Solar Energy and Conservation", in which similar solutions are determined for buildings used for habitation.

Other objectives for the EUDP project were:

1. To ensure Danish participation and contribution to the new IEA Task 47.
2. To collect and process knowledge from existing projects in both Denmark and abroad. The knowledge will be gathered in a database of lessons learnt that can be applied to future energy retrofit projects.
3. To make knowledge accessible and usable to make knowledge about how to implement far-reaching energy renovation of buildings to reach NZEB standards in a sustainable and cost-effective manner without compromising the indoor environment.
4. To develop guidelines for comprehensive solutions to reduce energy consumption.
5. To identify the key market and policy barriers, and marketing strategies to implement such extensive energy renovations

The following meetings and seminars were held:

Date	Place	Meeting/seminar/conference
2011		
31.03. – 01.04.	NO, Oslo	1. Task meeting
28.09. – 30.09.	DK, Copenhagen	2. Task meeting
2012		
12.04. – 13.04.	IT, Rome	3. Task meeting
09.07. – 11.07.	US, San Francisco	SHC 2012 – Conference
13.07. – 14.07.	US, San Francisco	ExCo meeting + OA meeting + Trade semi-nar 12.07.2014
05.09. – 06.09.	BE, Louvain la Neuve	4. Task meeting + Seminar on Subtask A PassiveHouse Symposium in Brussels
26.11. – 29.11.	BE, Brussels	ExCo meeting
2013		
03.04. – 05.04.	AU, Sydney	5. Task meeting; Task 47 seminar 5. April
12.06. – 15.06.	IT, Rome	ExCo meeting
23.09. – 25.09.	GE, Freiburg	SHC 2013
30.09. – 02.10.	AT, Graz	6. Task meeting, technical visit afternoon Monday 1.
29.10. – 31.10.	Singapore	ExCo meeting
2014		
01.04. – 03.04.	GE, Stuttgart/Frankfurt	7. Task meeting including seminar
16.05. – 18.05.	CA, Calgary	ExCo meeting
13.10. – 15.10.	Beijing, China	SHC2014
16.10. – 17.10.	Beijing, China	ExCo meeting - Final task management report
December		All reports are completed

1.5 Project results and dissemination of results

Projects results
Several reports have been produced in the project. In the following the main findings of each subtask is described.

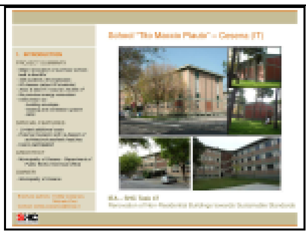
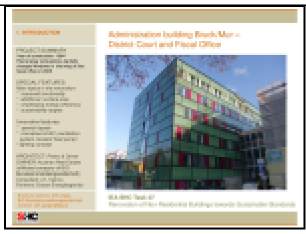
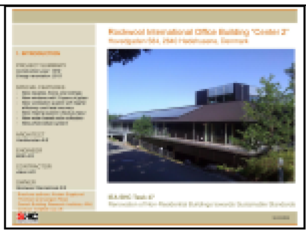
Subtask A: Advanced Exemplary Projects - Information Collection & Brief Analysis

The main deliverables of subtask A are:

- Data base describing main characteristics of renovation technologies
- Brochures describing exemplary renovation projects meeting the Task criteria among participating countries (4-6 pages including: energy characteristics, environmental impact, financing, health, process, architecture quality)
- Two dissemination seminars held in connection with expert meetings
- A summary report describing lessons learned from the exemplary projects.

The list of exemplary renovation projects is available on the Task webpage (and listed in the table on the following pages). The 20 individual projects are described in 8-page brochures presenting the key renovation actions as well as energy performance numbers, decision-making processes and costs.

The projects show a 50-90% reduction in heat consumption and a 50-70% reduction in overall energy demand. One of the buildings from Norway shows that it is possible to achieve a plus energy standard combined with the highest possible BREEAM score.

Project description	Picture
Franciscan Monastery, Graz By: Sophie Grünewald, TU Graz, Claudia Dankl, ÖGUT The main part of this protected monument is from 1250 to 1650. Solar thermal collectors and heat pump, 92% energy saving, the final 8% plan to be covered by PV.	
School Renovation Cesena, Italy Presentation that outlines a major renovation of a primary school built in the 1960s. Includes building envelope, heating system, renewable energy system and lighting.	
Kaiserstraße 7, Vienna; Austria By: Walter Hüttler, Johannes Rammerstorfer Monastery, listed Building from 1904 with residential use of the top floors. Primary energy demand reduced by 60%	
Administration building Bruck/Mur - Austria By: Dirk Jäger, BIG Bundesimmobiliengesellschaft The office building from 1964 has several innovative features like a special façade, bivalent heat pump and lighting concept. 140 m2 PV modules on the roof. 85% reduction in heat demand.	
TU Vienna Plus Energy - Austria By: Helmut Schöberl, Richard Hofer, Schöberl & Pöll GmbH; Claudia Dankl, Hannes Warmuth, ÖGUT The building from the 1970s renovated to a plus energy standard. Passive night-time cooling, and 336 kWp façade integrated PV system.	
Refurbishment of the Riva Bella School - Belgium By: Sophie Trachte; Contact : sophie.trachte@uclouvain.be The semi-prefabricated building from 1970 renovated in 2010/12 at very low budget. Prefabrication and re-use as well as free and night cooling.	
Solbraaveien Office Center - Asker, Norway By: Anna Svensson, Espen Aronsen The building from 1980-82 has reduced the energy consumption to 60% while increasing the indoor air quality.	
Rockwool International Office Building - Hedehusene, Denmark By: Kirsten Engelund Thomsen and Jørgen Rose The building from 1979 was renovated in 2013. Features heat pump, solar collectors and PV system.	

Office and Workshop Building at Fraunhofer ISE - Germany ***Fraunhofer ISE Campus*** By: Doreen Kalz and Arnulf Dinke Building from 1975 renovated in 2011. Wall insulation including ventilation ducts.	
Powerhouse Kjørbo – Norway By: Arne Førland-Larsen Two office buildings from early 1980s are renovated to a plus energy standard using high insulation standard, PV and ground coupled heat pump.	
Printing Workshop and Office Building - Germany By: Doreen Kalz Building from 1978 renovated in 2005 and 2011. Thermal comfort evaluated both in summer and winter condition.	
Schüco Italian Headquarter - Italy By: G. Pansa, T. Poli The building from 1990 includes several solar energy installations; 600 kWp PV system, solar absorption chiller 15 kWf and 10 m2 solar collectors for DHW.	
Boligselskapet Sjaelland Office Building - Denmark By: Jørgen Rose and Kirsten Engelund Thomsen The office building from 1968 was extended with a penthouse to the top of the building. 130 m2 PV-system included.	
Kampen School, Norway By: Mads Mysen and Anna Svensson A demonstration project where new concepts for energy efficient ventilation and lighting are integrated, using the existing ducts and demand control sensors.	
School in Schwanenstadt - Austria By: Claudia Dankl, Thomas Steffi and Susanne Supper School building from 1960s with numerous expansions. Renovated in 2006/07 to meet the passive house standards.	
Osram Culture Centre – Denmark By: Jørgen Rose and Kirsten Engelund Thomsen Built in 1953 as an industrial building and renovated in 2009. The first prefabricated building in Copenhagen.	

Kindergarten Vejtoften - Denmark By: Jørgen Rose and Kirsten Engelund Thomsen Built in 1971 with minimal insulation standard. One of 27 kidergartens in the municipality that will undergo and extensive energy renovation. The method developed in this project will be applied in all the other kindergartens.	
NVE Building - Norway By: Anders Johan Almas, Michael Klinski, Niels Lassen The office building was constructed through 1962 -64 fir the Norwegian Water Resources and Energy Directorate. Protected elements both internal and external. The first protected buiilding in Norway to be renovated to energy level B or better.	
Norwegian Tax Authority Building Renovation - Oslo, Norway By: Task 47 Presentation that outlines the renovation of the high-rise Norwegian Tax Authority building in Oslo, Norway. The renovation includes high insulated building facade, increased air tightness, energy recovery, and high efficiency technical systems.	

Four of the buildings do not include information of the energy use before the renovation and these buildings are not included in the energy statistics. The remaining 16 projects have saved 67 % in average.

Figure 1 summarizes the energy demand after renovation.

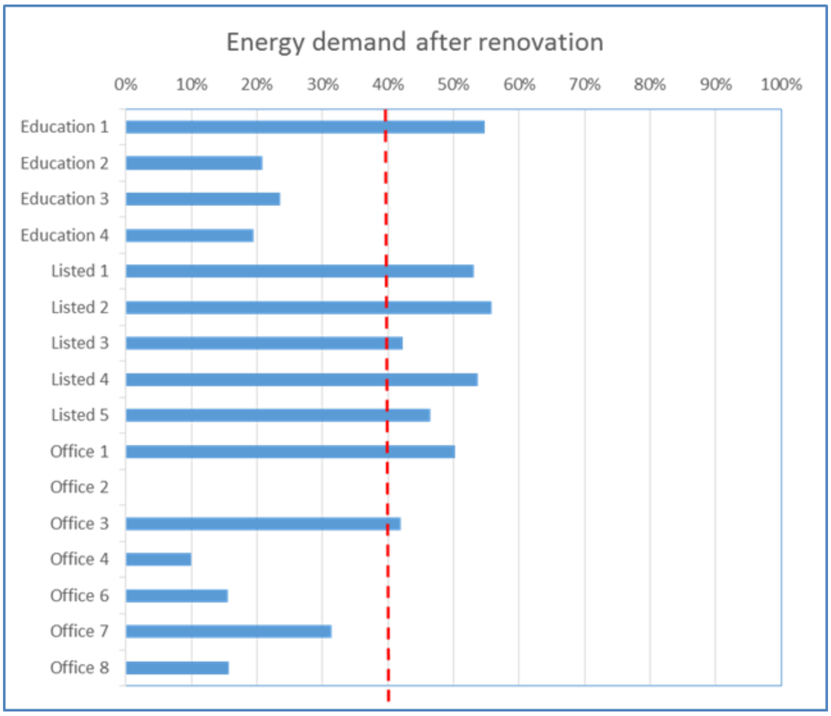


Figure 1. Reduction in energy demand for the Task 47 exemplary buildings.

The dotted red line shows the Task 47 target value for Task 47 projects. It should be noted that the energy numbers are not directly comparable due to different standards for calculations and reporting among the participating countries. Therefore the saving is given as a percentage instead of actual energy numbers.

One of the educational buildings has a higher demand than the target value; however this building was also included as it showed a very low cost renovation. It can also be seen that it is difficult to reach the 60% reduction level for historic/listed buildings. In many cases it is not possible to change façades and/or windows which significantly limit the energy saving potential.

Based on the 20 renovation projects, it seems not possible to make a significant relation between energy savings and renovation costs.

For most of the projects with cost information available, costs for energy saving measures seem to be in the range of 70 to 210 €/m^2 with the corresponding energy savings from 45 - 60%.

Subtask B: Market and Policy issues and Marketing Strategies

The main deliverables of subtask B are:

- Gathering building stock analyses for the countries actively participating in the subtask for further analysing of interesting segments. Together with an analysis of the ownership structure this will form the information foundation for identifying segments with high potential.
- In depth descriptions of decision making processes in case studies (positive and negative experiences) in the participating countries (minimum 2 case studies from the participating countries in the subtask). This will include in depth interviews with building owners, occupants etc. These reports will also describe how non energy benefits of the investments have influenced the process, and how attitudes change among decision makers during the process. The report will also include a description of their strategic choices and what happened during the process issues related to occupants in the building.
- Based on [B2] and project descriptions delivered by subtask A, a discussion with conclusions regarding barriers and driving forces in decision making processes will be summarized. This report should be of great interest for building owners and actors in the building industry.
- -Based on the other deliverables and through an analysis of effects of existing regulations and incentives, it will be discussed how authorities may increase the number of ambitious energy efficiency projects in the non-residential sector.
- A selection of the different sub deliveries are gathered in a final report. This report sums up potential strategies for different actors: "Upgrading of the non-residential building stock towards nZEB standard. Recommendations to authorities and construction industry".

The researchers in Task 47 interviewed key actors in the decision process in nine of the projects from six of the partner countries. In some projects the ambition level changed during the process. How and why this happened is discussed in the final report of Subtask B.

Figure 2. Subtask B report and accompanying Annexes for the report.

The main findings of Subtask B can be summarized in two different sets of recommendations; Recommendation to authorities and recommendations to the building industry:

AUTHORITIES	Strengthen drivers	Eliminate barriers
Increase attractiveness	• As part of information campaigns use relevant media and conferences to show good examples. • Place particular spotlight on the enthusiasts (both within owner organization and advisors). • Actors receiving grants also see this as confirmation of a good decision and see this strengthening the organization's image.	• Develop convincing arguments for nZEB. • Endorse serious frontrunners. • In some countries it is obligatory that companies have a statement about their impact on the environment. This could be extended by an obligation to state what energy labels their buildings hold. This increases the awareness of the issue of the energy efficiency of buildings.
Increase competitiveness	• Increased tax on energy. • Energy labelling systems provide a neutral reference for comparing buildings on energy per formance and thereby increase the focus on this as a competitive advantage.	• Put in place training programs for all relevant crafts to be updated on nZEB upgrading. • Announce stepwise enforcement of building codes.
Make it more affordable	• Stronger subventions programs for owners upgrading towards nZEB (driver in some projects).	• Stronger subventions programs for owners upgrading towards nZEB standard (barrier in other projects).
Make it more available	• Make sure the top management of building owner companies see the benefits of nZEB upgrading and as a consequence they will be more open for such initiatives within their own projects.	• When public bodies upgrade their own buildings, nZEB ambition should be required. In this way both experience and good examples are developed locally. Tender processes must be defined adequately to avoid pure focus on price. A partnering contact for the design phase seems to be a good solution for this. • Facilitate arenas for the industry to meet with researchers and other companies to share experiences.

Figure 3. Recommendation to authorities (Source: Subtask B Summary Report)

INDUSTRY	Strengthen drivers	Eliminate barriers
Increase attractiveness	• Identify the owner segments which focus on sustainability. • Use relevant media and conferences to show good examples. • Place spotlight on the enthusiasts (both within owner organization and advisors).	• Develop convincing arguments for nZEB.
Increase competitiveness	• Research projects which focus on combining best innovations on component level in order to make more efficient retrofitting processes. • Smart changes of floor plan can improve the area efficiency per employee. Also smart extensions of the existing building, for instance add an extra floor on the top may also improve the economy of the project.	• Better initial audits of the building will reduce the amount of unforeseen challenges. • Systematic training programs to update the skills of all personnel involved in the projects; from planning, construction and hand over/use. • Use of QA tools to assure the quality of a) products/systems, b) competence of the involved actors and c) processes.
Make it more affordable	• Offer of ESCO contracts where the owner pays in accordance with the energy savings obtained.	• Offer of financing as part of the upgrading package.
Make it more available	• Spread the experiences to new regions so new potential clients can see good examples in their neighbourhood. • Make sure the top management of building owner companies see the benefits of nZEB upgrading and as a consequence they will be more open to such initiatives within their own projects.	• As it is a challenge to do deep retrofitting while the tenants stay in the building, use of prefa bricated solutions may reduce the level of dis turbance as well as the length of the on site retrofitting process.

Figure 4. Recommendations to the building industry (Source: Subtask B Summary Report)

Subtask C: Assessment of Technical Solutions and Operational Management

The main deliverables of subtask C are:

- A detailed description of two best case buildings (school and office building) considering the building (i) before and (ii) after retrofit. A third step is the description of the building performance (iii) with optimized control and operation algorithms applied.
- A technical report with recommendations for (i) the assessment of new technologies for retrofit and (ii) a description of successful path to "near-zero energy buildings" (NZEB) with good indoor comfort: "SHC TASK 47: RENOVATION OF NON-RESIDENTIAL BUILDINGS TOWARDS SUSTAINABLE STANDARDS".

The performance of eight buildings was analysed in terms of energy consumption and thermal comfort achieved using long-term monitoring data in high time resolution. In particular, a comparison was made between the performance before and after the retrofit. These buildings studied show that they achieved their ambitious target values set during the design stage. Denmark has contributed to Subtask C with detailed information concerning the kindergarten Vejtoften in Høje Taastrup.

The final report describing the findings of Subtask C is presently being finalized by Germany (Subtask C leader Doreen Kalz). Unfortunately, it was not possible to have the results of the Subtask C for this national report on the Danish IEA SHC Task 47 participation.

Subtask D: Environmental and Health Impact Assessment

The main deliverables of subtask D are:

- Prepare a guideline for designers and planners, based on the selected criteria and innovative concepts analysis. The guideline will be illustrated by good exemplary projects.

Subtask D addresses indoor comfort and quality of life, with a special focus on school buildings refurbishment. Most schools in Europe are old, outdated and sorely lacking comfort. This discomfort has important consequences on the health of children and teachers (who represent a large proportion of the European population), but also on the learning and teaching abilities. The objective of this work is to offer designers and developers renovation guidelines to significantly improve the energy performance of schools, the comfort of children and teachers, and the quality of life and use of school buildings.

All these recommendations are included in a Guide, with chapters on:

- Improve the comfort and quality of life
- Reduce the consumption of fossil fuels
- Reduce the consumption of non-energy resources (materials, water, etc.)
- Reduce waste (waste water, building and domestic waste).

The guide has been divided into 5 separate deliverables with different focus areas; 0. Introduction, 1. Comfort and quality of life, 2. Services and energy efficiency, 3. Reduce resources consumption and 4. Reduce waste production.

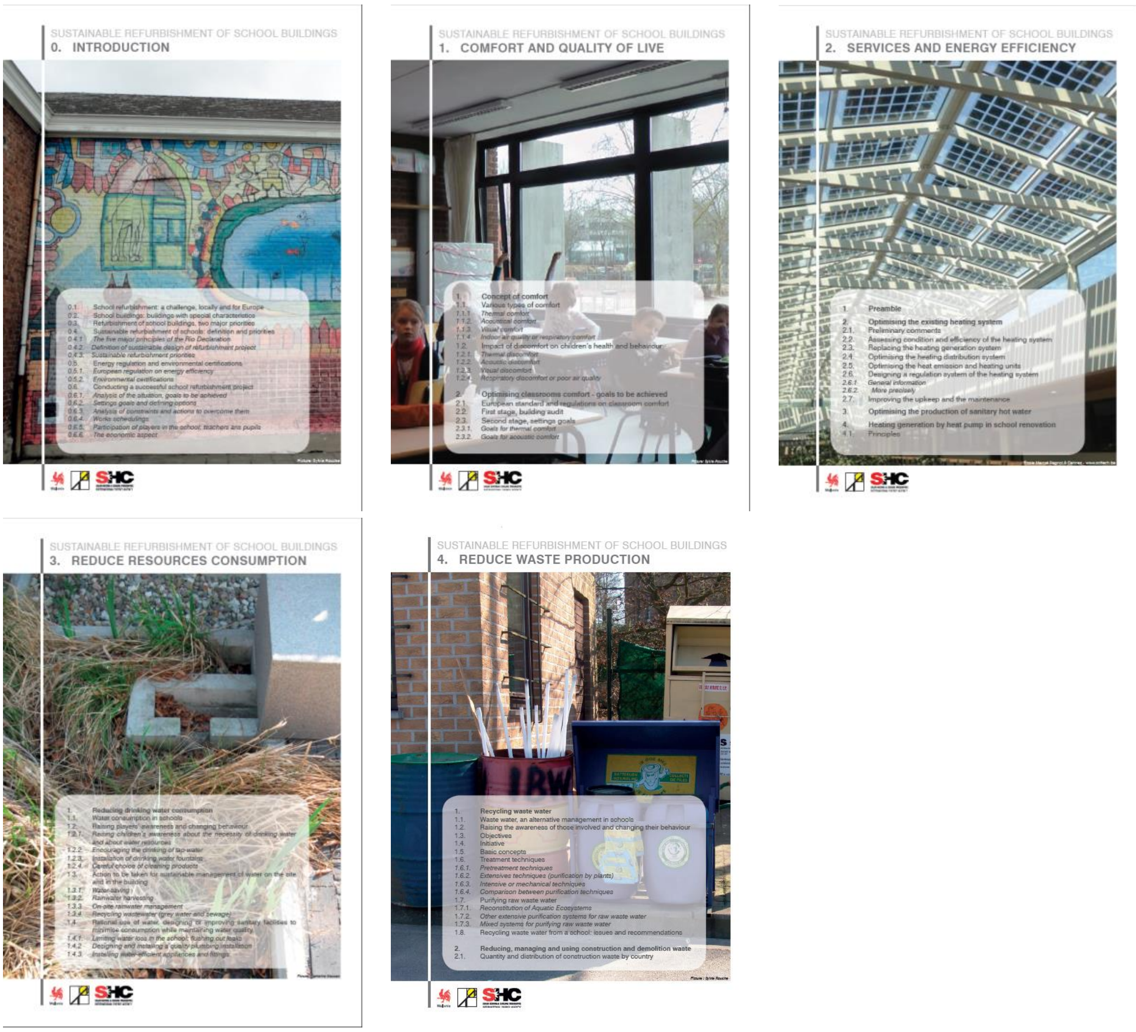


Figure 5. The 5 deliverables comprising the work carried out in Subtask D.

The Guides are illustrated with innovative concepts of exemplary projects and links with the BREEAM Assessment methodology.

Guide 1 on "Comfort and quality of life" presents guidelines on how to address issues concerning the different types of comfort, i.e. thermal comfort, acoustical comfort, visual comfort, indoor air quality or respiratory comfort and how to optimise classroom comfort in general.

The guide also describes strategies on how to ensure the thermal comfort in school buildings, based on several important factors, i.e. how to optimise the volume and compactness of the existing building, how to optimise the envelope of an existing school building, what to focus on regarding the insulation of the envelope and how to reduce/avoid thermal bridges, how to achieve a high level of airtightness, optimizing glazed surfaces to limit overheating and allow for good daylighting etc.
Guide 2 on "Services and energy efficiency" has a main focus on energy efficiency through optimisation of the services, i.e. heating, ventilation, air conditioning and cooling of the building. The guide describes how to optimise the existing heating system and how to opti-

mise the production of sanitary hot water. It also discusses new heating system solutions such as heat generation by heat pumps and using solar energy for production of sanitary hot water. The guide also discusses in detail how to optimise the artificial lighting in classrooms.

Furthermore, the guide goes through electricity production through cogeneration systems and electricity production from renewable sources, e.g. PV systems etc. and finally it also covers the aspects of heat recovery from a ventilation system including preheating and/or precooling of air by underground heat exchanger.

Guide 3 on "Reduce resources consumption" focuses on how to reduce resource consumption in school buildings with a primary focus on reducing clean (drinking) water consumption and recovering and utilising rain water. 55 % of water consumption in schools is used for sanitary, cleaning and laundry facilities and this part of the consumption does not need to be drinking water standard.

The guide covers many aspects on how to reduce consumption (installing water-efficient appliances etc.) including the reduction of losses in sanitary installations (leaks etc.) in general but also in-depth guidelines on how to achieve the highest level of recovery and reuse of rain water.

The final chapter discusses controlling the consumption of natural resources in a wider perspective, recycling, resource availability etc.

Guide 4 on "Reduce waste production" focuses on recycling of waste water and reducing, managing and using construction and demolition waste.

The guide explains the cycle from fresh clean water that becomes waste water and then the process before, once again, the same water can be utilised as clean water. Cleaning of water is a costly and/or time-consuming process and therefore reducing clean water use is much more efficient.

Concerning the reduction, management and use of construction and demolition waste, the guide gives advice on how to reduce construction waste both for the new buildings – starting with the design-phase of the project and for renovation projects, i.e. through the choice of materials and design that will, throughout the lifetime of the building, reduce the overall construction waste of the project.

Dissemination of results

The reports described above will be uploaded on the website as soon as approval from the EXCO exists: http://task47.iea-shc.org/

The following seminars have been held (presentations etc. from individual seminars can be obtained via the IEA SHC Task 47 webpage):

- Workshop: Retrofit of Non-Residential Buildings, September 7, 2012 – Brussels, Belgium
- Seminar: Renovation of Non-Residential Buildings towards Sustainable Standards, April 5, 2013 – Sydney, Australia
- Seminar: Renovation of Non-Residential Buildings towards Sustainable Standards, April 3, 2014 – Frankfurt, Germany
- Seminar: Renovation of Non-Residential Buildings towards Sustainable Standards, October 15, 2014 – Beijing, China

1.6 Utilization of project results

The project involves participation in the IEA project, so there is no apparent technology added value for users. The project has generated some of the necessary knowledge to help Danmark to meet stringent national energy policy objectives on energy retrofit of the existing building stock. Thereby, Denmark can help meet individual and joint international demands for deep reductions in CO_2 emissions.

The project has had the purpose of securing Danish participation in an IEA project and did not have the purpose to develop commercial products. However, it should not be excluded that future methods developed during the project can be commercialized at a later stage.

1.7 Project conclusion and perspective

The project had an international character so it was expected to encourage greater international cooperation in the development and research with regard to extensive energy retrofit projects and knowledge. The project could be instrumental in ushering in deep renovation of large properties and break down some of the barriers that exist in this area. At a national level this could lead to a large energy saving potential, since Danish enterprises will be able to access the latest knowledge and information about good and efficient renovation examples.

One of the main results from the project is the evaluation of innovative overall solutions for extensive energy retrofit of existing buildings, which can form the basis for future renovation projects. This allows the results of the project to help reducing gross energy consumption in the existing Danish building mass, so that the overall energy policy goals can be obtained.

Annex
Link for the webpage: http://task47.iea-shc.org/