International Energy Agency
Energy Conservation in
Buildings and Community
Systems Programme

Annex 56

Cost Effective Energy and GHG Optimization

In Building Renovation

Annex 56 Description

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A special thanks to Andreas Eckmanns, from the Swiss Federal Department of the Environment, Transport, Energy and Communications, for launching the initial idea of this project

Contents

1. Background

During the last decade, several standards and regulations regarding energy consumption of buildings have emerged, specifying increasing levels for energy efficiency requirements. As an example, the concept of "nearly-zero energy" buildings has been recently adopted by the EU to define tangible limits for EU Member States national building energy efficiency regulations. Although its borders are not yet fully clarified, prospects point to a hierarchical approach that will value energy conservation and efficiency, which implies a strong investment on the envelope and in building systems as well as the use of on-site renewables. However, present standards are mainly focused on new buildings, providing most of the time less guidance on the renovation of existing buildings that will have to face similar challenges in the near future. Today's standards do not respond effectively to the numerous technical, functional and economic constraints of existing buildings and often, the requirements, mainly targeted to energy efficiency measures, result in expensive processes and complex procedures, seldom accepted by users, owners or promoters. But, having in mind the overall objective of slowing down climate change, GHG reduction measures, like the use of renewable energy or on-site produced renewable energy, can be as effective as energy conservation and efficiency measures and sometimes be obtained in a more cost effective way. Therefore, in existing buildings, the most cost-effective renovation solution is often a combination of energy efficiency measures and GHG reduction measures. Hence it is relevant to investigate where is the balance point between these two types of measures in a cost/benefit perspective, which means to achieve the best building performance (less energy consumption, less GHG emissions, overall added value achieved by the renovation) at the lowest effort (investment, intervention in the building, users' disturbance). Therefore, a new methodology for energy and GHG optimized building renovation, as a basis for future standards, will be developed to be used by interested private entities and agencies for their renovation decisions as well as by governmental agencies for the definition of regulations and their implementation. This methodology will be accompanied by good-practice guides that integrate appropriate and cost effective technologies as well as by good renovation examples.

2. Objectives

This Annex aims at developing a new methodology, as the basis for future standards, to enable cost effective renovation of existing buildings while optimizing energy consumption and GHG-emissions reduction.

The main objective is to provide tools, guidelines, recommendations, best-practice examples, and background information to support decision makers, which includes technicians, owners, promoters and policy makers, in the evaluation of the efficiency, cost-effectiveness and acceptance of the renovation measures towards both the nearly-zero emission and the nearly-zero energy objectives. The overall objective is to identify the optimal range of "minimization of demand" and "generation of renewable energy" measures, i.e., **level a** and **level b** measures, according to Figure 1, in a cost/benefit perspective. One of the main questions is to understand how far it is possible to go with energy conservation and efficiency measures (initially often less expensive measures) and from which point the GHG reduction measures become more economical taking into account the local/regional context.

The project follows a broader approach going beyond the cost effective reduction of greenhouse gas emissions and energy consumption, focusing also on the overall added value

achieved in a renovation process, which means also identifying global quality improvement, economic impact of the intervention, operating cost reductions and some co-benefits like comfort improvement (thermal, natural lighting, indoor air quality, acoustics, etc.), increased value of the building and fewer problems related to building physics.

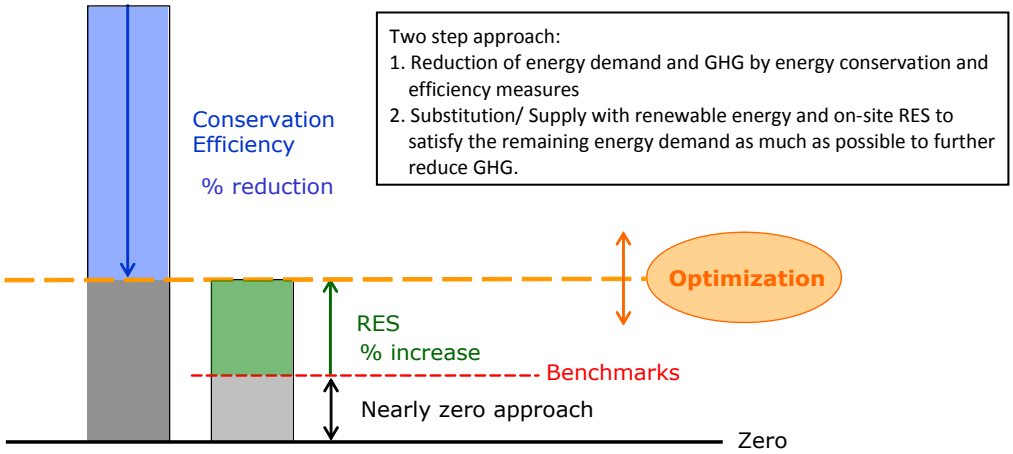

Figure 1: How to indicate an energy and GHG optimized building renovation (Geier S., Ott W.)

To achieve these goals, to have a bigger impact and to shorten the path to the application of the project results, it is important to take advantage of good examples and good practices already implemented as well as of existing and emerging efficient technologies with potential to be successfully applied.

It is also a main objective of this project to directly link the IEA to the target audience through accessible language and tools that enables them to understand the benefits but also the problems and risks associated with building renovation. Accurate understandable information must be provided so that decision-makers can make better decisions and choose the best options that apply to their specific needs.

The results of this project will be of major relevance for policy makers helping them to define the most appropriate policies, measures and incentives to put into practice for an effective renovation strategy. At EU level, these results will be very helpful in the preparation of the National Energy Efficiency Rehabilitation Plans that are required for all Member States by 2015 as a consequence of the implementation of the Energy Performance of Buildings Directive (EPBD) and its 2010-recast.

3. Scope

Annex 56 will be mainly focused on residential buildings, both single and multifamily houses. Other buildings with similar characteristics, like simple office buildings without complex HVAC systems, will also be presented as case-studies whenever relevant and useful information can be extracted from them within the main objectives of this project. These cases will also be used to prove the applicability of the developed methodology and tools to other buildings' categories besides residential buildings in order to increase the variety of solutions and innovations analysed and to promote public awareness. The renovation strategies will be defined from the perspective of the major interest groups: owners, promoters, technicians and policy makers.

4. Means

To reach the objectives, this Annex consists of four subtasks:

- Subtask A – Methodology (STA)
- Subtask B – Tools (STB)
- Subtask C - Case-Studies (STC)
- Subtask D - User Acceptance and Dissemination (STD)

During the Preparation Phase, the objectives, scope, work methodology and deliverables of Annex 56 have been defined. A detailed work plan was prepared for each subtask with the clear identification of its objectives, work packages, schedule, milestones, deliverables and links between subtasks. This work was performed by the subtask leaders in close collaboration with the operating agent. Participants have been identified and activity lists for the Working-Phase were prepared.

The specific objectives of each subtask are as follows:

4.1. Subtask A (STA): Methodology

The objective of this subtask is to define scope and methodology as well as calculation guidelines to enable cost-effective building renovation towards the nearly zero emissions objective. Within subtask A, the methodological framework for this Annex and its subtasks, will be established. Annex 56 will draw from the activities of related Annexes (Task 40, Annex 52, etc.) and will take into account upcoming requirements such as those imposed by EPBD recast. This Subtask will contribute to the establishment of cost optimized targets for energy consumption and greenhouse gas emissions within building renovation. It will also contribute to the clarification of the relationship between the emission targets and the energy targets depending on the respective country specific conditions and backgrounds. Different trade-off mechanisms will be investigated. Furthermore the decisive elements of the future standards for cost effective energy and GHG related building renovation will be worked out in Subtask A. Basic requirements (like comfort), other co-benefits achieved and eventual aesthetic preconditions are to be taken into account. On the other hand, it has to be checked if certain conditions which are an element of today's standards for new buildings can be waived for the renovation of certain categories of existing buildings.

Another purpose of this subtask is to highlight the relevance of co-benefits achieved in the renovation process and to evaluate how they can be used in decision-making processes. Energy and greenhouse gas optimized building renovation usually has various side effects often yielding substantial co-benefits which can be as important as energy cost savings (like increased user comfort, fewer problems with building physics, increased value of building, etc.). The challenge will be to find methods to represent co-benefits on a monetary, quantitative, or at least qualitative level in order to combine them with greenhouse gas and energy emission reduction measures.

Cost effective optimization of the reduction of GHG emissions and energy consumption within building renovation will be performed and demonstrated following two different approaches. In the first approach, the market approach, cost optimal renovation measures to reduce GHG emissions and energy consumption will be determined for different buildings categories and country contexts by using different cost perspectives (private and social). In the second approach, the normative approach, for one or two normatively preset nearly zero emission and/or primary energy targets, cost optimal renovation solutions will be determined to achieve these preset targets which go beyond the targets met by only cost effective measures

from the first approach. This cost/benefit analysis will be based on a life cycle approach relying on the life cycle of the renovation measures. The importance of also including life cycle assessment (LCA) of the materials in this study is recognized but at the same time considered a too complex task to be fully performed in this Annex. Thus, only a simplified approach will be integrated in the assessment of renovation measures and illustrated within selected case studies. Embodied energy and related emissions are increasingly integrated into energy and emission analyses, since the better the performance of buildings the more relevant embodied energy use and related emissions for building renovation becomes (materials and construction). Hence, considering future standards, it is important to integrate embodied energy consumption with its greenhouse gas emissions, at least as an option, into the renovation assessment and optimization procedures.

To achieve these objectives, Subtask A (STA) is divided into four work packages (WP):

WP A1: Methodological Guidelines and National Framework Conditions - The goal of this WP is the development of the methodology for the assessment of building renovation as well as for the derivation of target values for energy and GHG optimized building renovation. The methodology will be ready to be implemented as a new standard for building renovation by public or private entities.

WP A2: Cost optimization with respect to varying energy and GHG reduction targets - The goals of this WP are the assessment of renovation strategies to determine cost effective combinations of renovation measures which optimize energy and GHG savings as well as to evaluate the trade-offs between energy and GHG reduction measures in the case of building renovation.

WP A3: Energy consumption and GHG emissions with LC-approach – The goal of this WP is to define a flexible methodology that allows integrating embodied energy use and related GHG emissions into the cost optimized building renovation methodology to be developed in this project. Currently these issues attract increasing attention and cannot be ignored.

WP A4: Co-Benefits of Renovation Measures - WP A-4 aims at identifying relevant co-benefits related to building renovation and to demonstrate how such co-benefits can be integrated into decision making in the case of building renovation. To be effective for decision making, the relevance of co-benefits needs to be highlighted. It will be assessed to what extent the co-benefits identified can be quantified and used to evaluate the renovation strategies and measures.

4.2. Subtask B (STB): Tools

The objective of this subtask is to make further use of the methodology developed in Subtask A by developing and/or adapting tools to support the various decision makers in their renovation strategies or in evaluating and optimizing renovation measures for reaching (and defining) nearly zero GHG emissions in buildings renovation. The developed/adapted tools will have different levels of complexity and can be simple calculation tools, data bases, modules or objects for improved use of building information models or elaborated guidelines, or a renovation guide. The main issue will be to support the economic evaluation of energy and GHG emissions optimized building renovation. STB aims at supporting this decision process by making/adapting tools based on the methodology derived from STA and also on real data

delivered by STC, where the combination of costs (LCC), energy demand and GHG emissions for different renovation strategies can be studied and optimized for different types of buildings and different local and regional contexts.

Before starting tool development, there should be a clear overview of the needs and requirements of the different target groups and in what extent these needs are already covered by existing tools and what will have to be added to these tools to reach the objectives of this Annex. This Subtask will draw from the activities of related Annexes (Task 40 and Annex 52 and Annex 50 with its Retrofit Adviser Tool) and research projects. The results from a benchmark on existing tools will be an important input to the discussion and decision on what tools and on what level of detail these tools should be developed. The development of a web-based tool in order to be easily accessible and easily updated without the need of a big distribution organization will be evaluated.

Tool development has been a part of several IEA Annexes and international projects, most of them targeting architects or consulting engineers. In Annex 56, the tool development will be carried out on a more general level highlighting the balance between energy efficiency measures and renewable energy use. In this Annex, the tool development will be mainly directed towards other user groups besides technicians, with a special focus on policy makers. The tools to be developed have a particular relevance for this particular target group since such tools can be important instruments to support the development of national energy efficiency plans with appropriate policies, measures and incentives in order to get effective renovation strategies. Building promoters and owners are other user groups in need of information and support tools in order to make better decisions in what concerns cost optimized renovation solutions.

An interactive Renovation Portal, accessible to different users, with links to guidelines, tools, policies and overview of renovation measures, will be developed, in close collaboration with STD, to fulfil different user needs.

Subtask B (STB) is divided into the following four work packages:

WP B1: User requirements and needs and tools overview - The main objective of this WP is to get a clear overview of the needs and requirements of the different target groups taking into consideration the developed methodology, and further to clarify to what extent these needs are already covered by existing tools (for instance what data bases or calculation tools are already in use and what tools are needed to bind the modules together). Through literature review and surveys, done in cooperation with STA and STD, the needs, requirements and gaps will be identified.

WP B2: Building Information Models (BIM) and data bases - Use of BIM technology can ease the design and decision making process if the needed information (i.e. databases) and analysing tools are available. BIM are mainly used by architects and consulting engineers and there are several commercial tools available. The main objective of this WP is to explore the possibility of integrating modules with innovative renovation measures in existing tools.

WP B3: Tools development - The main objective of this WP is to develop new tools and add-ons to existing ones to fulfil the identified needs and requirements. The tools will be based on the developed methodology and on the analysed case-studies. The main issue will be to

support the economic evaluation of energy and GHG emissions optimized building renovation as well as deal with added value related issues.

WP B4: Renovation Portal with guidelines for different user groups - The different user groups have different needs and level of experience and knowledge. The idea of a renovation portal, where different users can find targeted information, requires a good overview of the potential users and their needs. Making the methodological guidelines available at the renovation portal will enable the users to understand what type of measures can be required to reach the targeted level for energy use and GHG emissions. Decision makers will find information about how the different measures contribute to energy savings and GHG reductions, how the living situation is influenced (for instance the contribution to indoor climate), the costs associated and co-benefits of carrying out energy and GHG optimized building renovation.

4.3. Subtask C (STC) : Case-Studies

The process of decision-making has to be strongly supported by success-stories in reality and experiences and lessons learned from practice. Therefore the specific mission of Subtask C is to provide significant feedback from practice (realized, ongoing or intended renovation projects) on a scientific basis. The main objectives of Subtask C are:

- To understand barriers and constraints for high performance renovations by a thorough analysis of case studies and feedback from practice in order to identify and show measures how to overcome them;
- To validate the theoretically developed methodology in STA with practical experiences within realized renovations in order to identify possible inconsistencies and providing feedback to refine the methodology;
- To reach an in-depth understanding of the performance of some selected case studies in order to increase the general understanding of the performance of technologies applied in practice;
- To support decision-makers and experts with profound, scientific based information (as result of thoroughly analysed case-studies) for their future decisions;
- To show successful renovation projects in order to motivate decision-makers and stimulate the market.

In Subtask C it is expected that every country provides at least one (preferentially more) demonstration projects in order to cover a broad variety of different building, climate and framework conditions. This pool of demonstration projects will be used at two different levels. First, within Case Studies I, it will provide a selection of “Shining Examples” to encourage decision makers to promote efficient and cost effective renovations and then, within Case Studies II, it will provide assorted samples for further deeper analysis purposes using real data.

In the first phase, within Case Studies I, the objective is the demonstration of a series of “Shining Examples” for motivation and stimulation purposes highlighting the advantages of the energy and GHG cost optimized renovation. Therefore, it is important to impose minimum requirements (regarding energy and GHG related targets) for the cases to be selected in this portfolio in order to make sure they can properly illustrate the objectives of this project. The focus will be on editing the information for dissemination purposes of the demonstration projects and to highlight advantages and innovative (but feasible) solutions and strategies. A

cross-section analysis of the provided demonstration projects should identify similarities, differences and general findings and "highlight" exemplary solutions.

In the second phase, within Case Studies II, the objective is to perform detailed studies focusing on studying the impact and relevance of different renovation measures and strategies within the project objectives in order to support the decision making process. Concerted actions with STA within parametric studies, lifecycle approach and assessment of renovation alternatives will be carried out in order to validate the methodology developed in STA against real data from selected case-studies. Case Studies II will also be used to assess the impact of some qualitative criteria in the decision-making process like constraints, barriers and co-benefits regarding architectural, financial, technical and socio-economic aspects. Some of these issues have already been investigated in other projects (IEA Task 37, Annexes 36, 46, 50 and IEE Projects SQUARE and ROSH) but they can provide a good foundation for structured and target-oriented analysis of the case-studies. A further feedback from practice – especially regarding qualitative criteria - should also arise from site-visits of demonstration-projects during the expert meetings.

The work within Subtask C (STC) is divided into the following three work packages:

WP C1: Case Studies I - "Shining Examples" - The objective of this WP is the publication of a series of successful realized demonstration projects within all Annex 56 partner countries that will highlight successful solutions and provide general findings, similarities and differences emerging out of the demonstration projects from the different countries. The selection of the "Shining Examples" will be based on the compliance of common minimum requirements in energy performance, GHG emissions in accordance with the Annex objectives.

WP C2: Case Studies II - "Detailed Case Studies" - The objective of this WP is a deeper analysis of selected case studies in order to validate the theoretically developed methodology based on generic data with data and experiences from practice. Concerted actions with Subtask A in the field of parametric studies, assessment of renovation alternatives and transferability of solutions and benchmarks, lifecycle approach and qualitative criteria will be done. The confrontation of the generic data with real data will allow a further improvement of the methodology in Subtask A and will contribute to a better understanding of the performance of renovation technologies in practice.

WP C3: Reporting - The objective of this WP is to obtain an optimized and target group oriented publication of the results of Subtask C (the successful demonstration projects) in order to contribute to the overall Annex 56 dissemination strategy. A double-sided approach will address the identified target groups: a brochure with "Shining Examples" that will provide a more advertising approach of a broader variety of successful renovation projects for motivation purposes and the Final Report "Detailed Case Studies" that will provide more detailed information on the deeper analysis within the Case Studies II and overall results of Subtask C.

4.4. Subtask D (STD): User Acceptance and Dissemination

This subtask deals with two key aspects, user acceptance and dissemination, that will be developed along the entire Annex timetable with different approaches and effort rates. This

subtask will be focused on the identified target groups: the policy makers, technicians, owners and promoters.

a) **User Acceptance** - this stage will be of great relevance for the Annex development and it is expected to have a stronger activity during its first years in order to provide the inputs necessary to the development of the remaining subtasks. Within this WP, it is relevant to characterize and understand the acceptance, motivation, needs, obstacles and drivers of the chosen target groups with respect to the renovation process. Moreover, the involvement of all participating countries in this task will help identifying common constraints, needs and motivations of stakeholders and also different levels of maturity in the renovation process.

b) **Dissemination** - target groups will be addressed through specific dissemination actions, like the Annex 56 website; Electronic Newsletters; Meetings with key stakeholders, namely key players among the EPBD recast, to let them know about the Annex's work and promote their involvement; Participation in formal events like conferences and workshops to present the Annex's work; Press Releases and other communications will be issued by participants using their own existing and available channels; International Conference to present the final results of the Annex.

To achieve the objectives, Subtask D (STD) is divided into two work packages (WP):

WP D1: User Acceptance - Focusing on WP D1, and regarding its importance as an input for the development of all other Subtasks, it is relevant to characterize and understand the acceptance, motivation, needs, obstacles and drivers of the chosen target groups to the renovation process. This will be done by literature review on previous studies, surveys and socio-economic research.

WP D2: Dissemination – Key stakeholders will be involved into strategic discussions from the beginning of the working phase. All the dissemination materials should be developed in English, for a global dissemination strategy. All project partners can, at any moment, translate the deliverables to their national language, if they need to present the Annex results in any conference, workshop, or in any other event. They also will promote the Annex 56 deliverables in their own websites, by providing a link to the Annex 56 website.

5. Deliverables and Target Audience

The deliverables of Annex 56 will be the following:

- **Subtask A:** Methodology Report on Cost Efficient Energy and GHG Optimized Building Renovation; Report on Integration of Embodied Energy and LCA into the Assessment of Renovation Measures; Report on Co-Benefits and overall Added Value of Energy and GHG optimised Building Renovation.
- **Subtask B:** Decision making tools. These tools will integrate data bases with renovation measures for the optimisation of the renovation process. A web based renovation sub-portal to be included in the Annex website will be developed.
- **Subtask C:** Brochure "Shining Examples" as a stepwise publication (presentation, web-based brochure, printed brochure); Final report on "Detailed Case Studies".
- **Subtask D:** Website; Annex 56 Newsletters; Renovation Guidebook; executive summary for policy makers.

The target audience of these deliverables will be: Decision Makers as Policy Makers, Architects, Planners, Consultants, Promoters, Technicians and Designers, as well as Scientists and Owners. A particular focus will be put on multipliers such as Advisory Entities and Organizations.

6. Time Schedule

The concept for Annex 56 was approved in June 2010 and the Preparation Phase ended in June 2011.

This Annex will last four years. Three and a half years, till the end of 2014, to define and test all the methodologies and tools developed under this project so that relevant and accurate information can be made available for policy makers, helping them in preparing the National Energy Efficiency Action Plans including the mandatory reporting for the Energy Performance of Buildings Directive by 2015, and one extra semester totally devoted to carry out the dissemination plans, one of the key aspects of this project. The timetable for the four subtasks foreseen for the project is the following:

Subtask	Year 1		Year 2		Year 3		Year 4	
	2nd semester 2011	1st semester 2012	2nd semester 2012	1st semester 2013	2nd semester 2013	1st semester 2014	2nd semester 2014	1st semester 2015
A - Methodology								
B - Tools								
C - Case-studies								
D - User Acceptance								
D - Dissemination								

7. Management Structure

The overall responsibility for the management of the proposed Annex belongs to the Operating Agent – Manuela Almeida, from University of Minho, Portugal, supported by the Portuguese National Energy Agency – ADENE. The Operating Agent is responsible for the overall performance and the time schedule of the Annex, for reporting and for information and dissemination activities.

The Operating Agent is assisted by four Subtask leaders. Each Subtask also has a co-leader that helps coordinating all the work performed within its subtask and both ensure the achievement of all planned tasks within the project's objectives in close cooperation with the operating agent. The Subtask Leaders and Co-leaders are participants who provide a high level of expertise to the subtask they manage and undertake substantial research and development in the field of the subtask. They co-ordinate the work performed under the subtask, assist the Operating Agent in preparing the detailed work plans, coordinate the technical reports resulting from the Subtask and assist the Operating Agent in editing the final reports and deliverables of the Annex.

The leaders and the co-leaders of these subtasks are the following:

Subtask A – Methodology
Leader: Walter Ott, econcept, Switzerland
Co-leader: Manuela Almeida, University of Minho, Portugal

Subtask B – Tools
Leader: Guri Krigsvoll, Oslo and Akershus University College of Applied Sciences, Norway
Co-leader: Piercarlo Romagnoni, University of Venice, Italy

Subtask C – Case-Studies
Leader: Sonja Geier, AEE - Institute for Sustainable Technologies (AEE INTEC), Austria
Co-leader: Ove Mørck, Cenergia Energy Consultants, Denmark

Subtask D – User Acceptance and Dissemination
Leader: Paulo Santos, Portuguese Energy Agency, Portugal
Co-leader: Yet to be selected

8. Specific Obligations and Responsibilities of the Operating Agent

The additional duties of the Operating Agent are:

1. Preparation of a detailed work program for the Annex in consultation with the Annex participants and to submit the program for approval to the Executive Committee;
2. Providing the participants with the necessary guidelines for the work they have to carry out;
3. Coordination of the efforts of the participants and the flow of information;
4. Preparation and chairing of the Annex working meetings;
5. Reporting the results of the Annex meetings to participants and to the Executive Committee;
6. Preparation of the reports and other deliverables, mentioned under section (5), together with the participants;
7. Publication of the reports and other deliverables, mentioned under section (5), after approval by the Executive Committee. That approval should be gained at the latest six months after completion of the Annex;
8. Providing semi-annual reports to the Executive Committee on the progress and the results of the work performed under the Annex;
9. Performing such additional services and actions as may be decided by the Executive Committee, acting by unanimity.

9. Specific Obligations and Responsibilities of the Participants

1. Each participant will work in at least one of the work packages of the Annex;
2. Each participant will provide the Operating Agent with information and written material on the work carried out in the work package he or she is working on;
3. Each participant will take part in reviewing the final report of the work package he or she is working on;
4. Every participating institution will attend all the semi-annual Annex working meetings. If several people from the same country participate, that country should designate at least one expert to act as a technical contact regarding the national contribution.

10. Funding

1. *Semi-annual meetings*. The working meetings will be hosted in turn by one of the participants of each participating country. The costs of organizing the meeting will be borne by the host participant;

2. *Publications*. The costs of publishing the final reports will be met by the Operating Agent;
3. *Task sharing activities*. Each participating country will commit a minimum of six person-months of labour for each year of the Annex term. In addition, the Operating Agent will commit a further six person-months per year;
4. *Individual financial obligations*. Each participating country will bear all costs it incurs in carrying out the Annex activities. Funding is expected to cover labour costs, consumables, investments, reporting (included eventual overhead costs) and travelling for participation in two expert meetings per year during the proposed four years of the working phase of the Annex. For the Operating Agent, funding will allow for an extra six person-months per year and the attendance at the two semi-annual Executive Committee meetings during the working phase as well as after its end until final approval by the ECBS Executive Committee.

11. Information and Intellectual Property

1. All Annex related information will be stored in an Annex website. Each participating country and each participant has access to a protected part of that website. The site will be managed by the Operating Agent. For the duration of the Annex, all specific Annex documents, except published reports and general Annex information, are considered not to be public domain;
2. All Annex participants have the right to publish congress and journal papers that report on Annex related work. When doing so, the IEA Implementing Agreement ECBCS will be acknowledged as one of the vehicles that assisted in carrying out the work;
3. All final reports will be public domain with ECBCS copyright.

12. Participating Countries and Organizations

At the end of the Preparation Phase, eleven countries have expressed interest in participating in Annex 56 activities. Nine countries have already confirmed their participation: Portugal, Switzerland, Austria, Norway, Denmark, Italy, Finland, China and the Netherlands. Sweden is still looking for funding and Spain is interested in participating but it was not able to find funding. Participating countries and organizations are the following:

Portugal	University of Minho – Civil Engineering Department ADENE – Portuguese National Energy Agency
Switzerland	econcept AG, Zürich University of Applied Sciences Western Switzerland
Austria	AEE - Institute for Sustainable Technologies (AEE INTEC)
Norway	Oslo and Akershus University College of Applied Sciences NTNU/SINTEF Building and Infrastructure
Finland	VTT – Technical Research Center of Finland
China	Tsinghua University, Institute of Building Technology Research
Italy	IUAV - University of Venice Politecnico di Milano, Building Environment Science & Technology
Denmark	Cenergia Energy Consultants Aalborg University

	Danish Building Research Institute
	Danish Technological Institute
The Netherlands	Cauberg-Huygen Raadgevende Ingenieurs BV
	ECN - Energy Research Centre of the Netherlands
Sweden	Lund Technical School
Spain	University of La Coruña

Manuela Almeida
October 2011