4th Newsletter

May 2014

IEA EBC
Annex 56
Cost-effective energy and carbon emission optimization in building renovation

MEETINGS

Graz Meeting

The 4th meeting of the working phase of Annex 56 took place in Graz, Austria, on September 23rd, 24th and 25th 2013.

The 20 participants from 9 countries, were informed about the recent developments particularly regarding the achieved results in subtask A — methodology, generic calculations, LCIA and co-benefits, and subtask C — Case studies. Regarding subtask A, some results were presented after the definition of the methodology to be used for Annex 56.

Subtask C presented the detailed case studies and the shining examples already identified; the latter being a priority towards the

online publication of a brochure at the end of the current year. There was also the opportunity to visit some energy renovated buildings, in particular a residential building in Kapfenberg and a Federal building in Bruck an der Mur. More information about the subtask results can be found in the following pages.

BROCHURE SHINING EXAMPLES

One of the first outcomes of the Annex 56 project is the shining example brochure.
Currently that brochure is being revised, so it can be publically available.

More information at:
http://iea-annex56.org/index.aspx?MenuID=4

SHINING EXAMPLES

Within Annex 56, the gathering of case studies is one of the activities undertaken to reach the overall project objectives because it is a recognized fact that the process of decision-making has to be strongly supported by success stories from real life and experiences and lessons learned from practice.

The specific mission of the case study activity of the Annex 56 project is to provide significant feedback from practice (realised, ongoing or intended renovation projects) on a scientific basis.

The "Shining Examples" are gathered mainly for motivation and stimulation purposes, highlighting the advantages of aiming at far reaching energy and carbon emissions reductions, being still cost effective. The focus is to highlight advantages and innovative (but feasible) solutions and strategies.

Currently these are the examples available:

AUSTRIA
Kapfenberg

DENMARK
Traneparken, Hvalsø
Skodsborgvej, Virum

NETHERLANDS
Wijk van Morgen, Kerkrade

PORTUGAL
Lugar de Pontes, Melgaço
Neighborhood, Porto

SWEDEN
Brogården, Alingsås
Backa röd, Gothenburg

SWITZERLAND
Les Charpentiers, Morges

IEA EBC INDUSTRY WORKSHOP

Annex 56 Industry Workshop: September 25th 2013
Assembly Hall, Graz University of Technology

On the 25th September 2013 in Graz Technical University, was held an Industry Workshop that had a joint participation of Annex 56, Annex 57 and EU project AIDA, and counted 50 attendants.
The importance of a cost effective renovation strategy was presented — as part of the annex56 activities; the impact of building construction on carbon emissions and the associated embodied energy — as stated in annex 57 tasks; and the accelerated market entry of nZEB, and their impact on carbon emissions and embodied energy use, concerning AIDA project objectives.
The main target groups that benefit from the outcomes of the workshop are:

- Policy makers
- Owners/investors
- (Associations of) municipalities
- Technicians and building professionals
- People from practice (and research) → executive firms

Program

Words of welcome

- Prof Manuela Almeida and DI Dr Julia Maydl

Statements about high quality refurbishment

- Mag. Christian Krainer
- Discussion (moderation Mag. Claudia Dankl)

High quality refurbishment in research projects

- Cost optimal and cost effective result from parametric studies in generic buildings
  DI Roman Bollinger
- Case studies
  DI Dr. Julia Maydl
- Evaluation of Embodied Energy and Carbon Dioxide emissions for Building Construction
  Dr. Tove Malmqvist and Assoc. Prof. Dr. Aoife Wiberg
- nZEBs in municipal pratice: chances and challenges
  DI Raphael Bointner
- Panel discussion
  Moderation Mag. Claudia Dankl

Methodology for the assessment and optimization of costs, energy use and carbon emissions for building renovation

The methodology outlined has to provide the necessary basics for the assessment of existing buildings undergoing energy related renovation processes.

The assessment comprises as main impact categories the cost, primary energy use and carbon emissions impacts of energy related building renovation.

The results of the assessment shall allow to appraise the energy performance of the building as well as the level of reduction of energy use, carbon emissions mitigation and related costs of building renovation strategies or measures for the sake of:

- Evaluating and optimizing different renovation measures, taking into account costs, energy use and carbon emissions impacts for a specific building or renovation project
- Appraise the outcome of energy or carbon emissions related policy programs targeted at mobilizing mitigation potentials from the renovation of the stock of existing buildings
- Standard setting for energy performance or carbon emissions of existing buildings after renovation
- Guidelines for building owners and investors seeking cost effective building renovation measures with the highest reductions of energy consumption and carbon emissions at lowest possible costs.

Components of energy consumption of residential buildings to be taken into account:

- Basis for the assessment of energy related renovation measures and resulting energy performance of the building is the operational energy use for Heating, Ventilation and Air Conditioning (HVAC), Domestic Hot Water (DHW), built in lighting and auxiliary consumption of electricity (from building technology) in the building.
- Energy consumption of common building appliances like lifts, escalators, washing machines, dryers, etc. is suggested to be at least monitored, since their share on overall energy consumption of a building increases with decreasing energy needs of renovated buildings. Full integration in the assessment has to be decided, depending on the context, since appliances like washing machines, dryers, refrigerators, etc. are installed sometimes by the building owners and sometimes by the occupants.
- Embodied primary energy use of building materials used for building renovation is suggested to be integrated in the assessment if necessary LCIA-data is available. The share of embodied energy consumption with respect to total consumption of primary energy is increasing with decreasing operational energy use due to energy related building renovation. But the relevance of embodied energy use as well as the options to reduce it are lower than in the case of new buildings.

A preliminary final report is currently being revised by IEA EBC reviewers and will be delivered to the IEA EBC ExCo and possibly to the European Commission after integration of the feedbacks of the reviewers. The report will be published afterwards on the project's webpage (download).

The final report with additional contributions to cooling and co-benefits will be prepared until August.

SUBTASK C — CASE STUDIES

The work of this subtask is to identify and select some realized, on going or intended renovation projects that can provide significant feedback from success-stories in reality and experiences and lessons learned from practice.

The presentation of these cases will help relevant players of the renovation process, to clearly understand the advantages of acting in the energy related components of the building, such as building envelope or building systems and equipments.

Two different categories were defined for these case studies — the detailed case studies and the shining examples. When the task is concluded, both categories will be available online (www.iea-annex56.org), and in the beginning of 2014 an electronic publication with the shining examples will be available for download.

All participating countries were asked to provide different case studies in both categories and to identify which of them could be used as shinning or detailed case studies.

SHINING EXAMPLE — KAPFENBERG, AUSTRIA

Project summary

The existing building was in high need of renovation.

The overall intentions were:

- 80% energy efficiency—80% reduction if the energy demand of the existing building
- 80% ratio of renewable energy sources—80% of the total energy consumption of the renovated building should be provided by renewable energy sources
- 80% reduction of CO_2 emissions—80% reduction of the CO_2 emissions of the existing building

Site:	Johann Böhm Strasse 34/36 8605 Kapfenberg, Austria
Altitude:	502 m
Heating degree days:	3794 (base temp 20°C)
Cooling degree days:	0
Owner:	ennstal SG
Architect:	Nussmüller Architekten ZT-GmbH
Energy concept:	AEE INTEC





Element	Area, m²	U-value before renovation, W/m²K	U-value after renovation, W/m²K
Facade	1463	0.87	< 0.17
Ceiling	711	0.39	< 0.30
Windows, doors	349	2.50	< 0.90
Roof	711	0.74	< 0.10

Building envelope before the renovation

The existing building was a typical Austrian building from the 1960's made of prefabricated sandwich concrete elements without an additional insulation. Only the wood wool panels of the prefabricated concrete elements performed as a slight thermal insulation.

The basement ceiling was insulated with approx. 6 cm polystyrene. The old roof was a pitched roof with no insulation. The ceiling to the unheated attic was insulated with 5 cm wood wool panels.

The existing windows were double glazed windows with an U-value of 2.5 W/m^{2}K. "The missing airtightness of the existing windows caused high infiltration heat losses."

Heating, ventilation, cooling and lighting systems before renovation

In the existing building a variety of different heating systems was installed: a central gas heating, electric furnaces, electric night storage heaters, oil heaters, wood-burning stoves and coal furnaces.

The ventilation of the existing building was accomplished by opening the windows; no mechanical ventilation system was installed.

The enormous energy demand caused very high heating and operating costs. A high quality refurbishment of the building with a change in the layout of the apartments should make the building more attractive to new residents and young families.

Description of building before renovation (building situation, building system, renovation needs and renovation options.

The analysed building is a residential building which was built between 1960 and 1961. The four-story building has a length of 65 m (east and west façade) and a depth of 10 m (north and south façade).

On each floor nine apartments were located which varied from 20 to 65 m^2 living space. These apartments didn´t meet the current way of living because they were too small. For this reason not all flats were rented.

Overall Energy Saving Concept

The retrofit concept is based on energy efficiency measures (highly insulated, use of prefabricated facade elements,…), on a high ratio of renewable energy sources and on an intelligent integration in the existing heat and electricity grid.

Building

Instead of conventional insulation systems the façade in this project is covered with large-sized active and passive façade elements.

These façade elements include on the one hand traditional rear-ventilated constructions (various surfaces possible) and on the other hand active elements to generate energy like solar thermal or photovoltaic panels.

The old pitched roof is removed and a new flat roof is established. The roof is highly insulated with approximately 35-40 cm. The windows are already integrated in the prefabricated façade modules and are of high thermal quality (triple glazing).
Inside works include among other things also the change of the layout of the flats to make them more attractive to new residents.

Building Services

Heating: The basic heat supply of the renovated building is accomplished by the local district heating. Additionally 144 m² solar thermal panels are installed on the south facade. Both, district heating and solar thermal system, store the produced heat in a 7500 litre buffer storage. From the buffer storage a 2-pipe-system (flow and return) brings the heat to the 32 flats where the heat for domestic hot water is stored in a small boiler. Radiators emit the heat in the flats.

Ventilation: A new mechanical ventilation system with heat recovery is installed (heat recover efficiency 65% / SFP 0.45 Wh/m³). The ventilation unit is positioned on the flat roof and the existing shafts of the building are used for the ventilation ducts. In one half of the flats the ventilation system is controlled automatically based on the CO_2 concentration, in the other half of the flats the residents can control the ventilation system by a three-stage switch individually.

Photovoltaic: Photovoltaic panels with a size of 550 m² resp. 80 kWp are installed on the roof on an extra mounted scaffold which has the form of a wing. Additionally 80 m² resp. 12 kWp are installed on the south façade.

Calculated energy savings:

The transmission heat losses from the building envelope can be reduced from 336 MWh/year (existing building) to 86 MWh/year (renovated building). This means energy savings of 250 MWh/year.

The infiltration heat losses can be reduced from 89 MWh/year (existing building) to 47 MWh/year (renovated building). This means energy savings of 42 MWh/year.

In total 292 MWh/year can be saved for heating and domestic hot water.

As a result of the renovation the usable energy gains in the building (internal and solar gains) are reduced from 125 MWh/year to 85 MWh/year. This means 40 MWh/year less energy gains are usable after the renovation.

As a consequence of that the calculated total energy savings are 252 MWh/year.

Calculated energy generation:

The calculated energy generation of the solar thermal system is 39.5 MWh/year; the energy generation of the photovoltaic panels is about 80 MWh/year.