Intelligent Energy Europe

Executive Agency for Competitiveness and Innovation (EACI)

LCC-DATA

LCC-DATA

Life-Cycle-Costs in the Planning Process.

Constructing Energy Efficient Buildings taking running costs into account

Grant Agreement EIE/06/154/SI2.447798

D12
Energy and LCC calculations – interim report

Document ID: LCC-DATA-WP4-AEA-D12 Energy and LCC calculations Interim report
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Status: D
Distribution: PU
Issue date: 08.07.2008

AUSTRIAN ENERGY AGENCY

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Definitions and Abbreviations

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No necessary definitions

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No necessary definitions

1 Executive Summary

This report presents the status and the planned national activities for energy and LCC calculations, the first outcomes of the national collections as well as the experiences made to continue the common work for the international database of LLC and energy consumption.

The framework of this WP 4 is given by the created excel-sheet (annex 1).

2 Introduction

The following pages show the experiences made by each partner, the chosen tools, the preliminary results and planned activities.

3 Goals

The main goal is to create a common European cost database that will comprehend the relevant categories:

- construction costs
- operation costs
    - especially energy costs
- maintenance costs

This interim report presents the first lessons learnt from the data collection.

4 Status quo energy and LCC calculations

The chapter presents the status for the calculations planned or done, the overview of the buildings to be analysed, and information about tools for energy and LCC calculations and input data used.

4.1 AEA - Austrian Energy Agency

It was planned to use the database owned by University of Applied Sciences Kufstein who developed a benchmark-tool which includes the requested information on cost and energy consumption. However, the data input is under privacy by the partners. Furthermore it will not be filled with data before November 2008. Therefore AEA has been analysing additional options, such as other calculation tools and data collection methods. It is planned to collect energy consumption data and complete missing information with calculated values.

The case studies used for the calculations are provided by the WWFF (Vienna Business Agency). The first results are given in the following part:

Case 1:

The "TECHbase Vienna" is a technology and foundation centre with 13,000m² floor area and 100 parking spaces. The complex is located in the industrial area of Vienna 21st district. The total investment volume was 21 million euros. The complex was built in 14 month construction time.

The bureau complex contains 9,305 m² on 4 storeys, the 1st to 3rd are for the bureaus. The capacity of persons is 310, what means the average square is 30m²/person (including office, staircase etc.).

The performance and the maintenance level are high.

Case 2:

The "tech21" is an office building with 5,897m² floor area and 65 parking spaces. The building is located in the industrial area of Vienna 21st district. The whole building has 5 storeys; all are created for office using.

Case 3:

The "BRC-business and research centre" is an office building with 3,800 m² floor area for offices and 350 m² stock floor. The building is located in the industrial area of Vienna 20th district. The whole building has 7 storeys.

4.2 Berliner Energieagentur GmbH

The Berlin Energy Agency has an agreement with the Senate of Berlin for developing a strategy to reduce CO2-emissions of the building stock by 30% by building audits:

- identification of energy saving possibilities
- estimation of ecologic impacts (CO2)
- estimation of economical impacts (running costs, invest, savings…)

The project focuses on energy related matters.

The measured building stock covers

- approx 100 estates with approx 500 buildings
- 1.7 Mio m²
- 60,000 t/CO2
- Schools, prisons, museums, operas, theatres

The building audits are carried out by engineering consultants since beginning of June and shall be finished by the end of August. As the engineering consultants are not obliged to do LCC-calculations the BEA will do them after collecting the data of all buildings. The most interesting buildings will be selected for a LCC-calculation.

Regarding the LCC calculations, BEA plans to use LC-Profit (http://www.lcprofit.com/default_en.asp). In the former IEE LCC-Refurb project the

BEA used LEGEP which is currently under reconstruction and seems to be too powerful and detailed for early stage calculations to be undertaken in LCC-DATA.

As the there is no decision concerning the buildings to be calculated, please find some examples below:

Case 1: JVA Tegel / prison

91 buildings constructed between 1898 and 1988 with a building area of approx 119,000 m². Approx 1,700 prisoners, canteen kitchen, workshops (wood, metal, dry cleaner …).

Case 2: Komische Oper Berlin / opera

constructed in 1892 + 1947 + 1966 with a building area of approx. 22,000 m².

Case 3: Oberstufenzentrum Handel / professional school

largest school of Europe, four buildings constructed in 1900 + 1978 + 1995 with approx. 38,000 m²

4.3 CITYPLAN

The energy and LCC calculations and general overview of the case studies buildings are to be done in CITYPLAN´s proprietary MS Excel tool. The collecting and uploading of information is up to the CITYPLAN where the partners (building owners) are responsible for the data reliability.

Case 1:

Actually there are 5 buildings in the hospital Jablonec nad Nisou which are planned as subjects to the energy and costs calculation. Further is to be discussed with the building owner if any of them should be excluded because of unrepresentative values according to their specific use (e.g. mostly technical background equipments operation). The total surface area is approximately 30,000 m2 in 2-5 storeys buildings. The energy and costs input data collecting process is in progress.

Case 2:

2 hospital 3-4 storeys buildings in Horice with over 2,000 m2. The buildings were built in 1930 and recently have been reconstructed. The energy and costs input data collecting process is in progress.

Case 3:

7 hospital 2-7 storeys buildings in Litomerice with over 20,000 m2. The date of construction of the buildings differs from 19th to the end of 20th century. Some of them have been reconstructed. The number of buildings included will probably be decreased according to conditions as for buildings #1. The energy and costs input data collecting process is in progress.

Case 4:

3 residential 13 storeys building in Kladno with nearly 20.000 m2. The buildings were built in 1930 and recently have been reconstructed. These buildings were already

included in European project ISEES. The energy and costs input data collecting process is in progress.

It is planned to include also some elementary schools buildings in the costs and energy calculations as it is showed to be useful to compare data of similar objects with other partners´ case studies (e.g. ZRMK). This data collecting is in progress as well.

4.4 CRES

The energy calculation for the case studies of CRES are developed through dynamic simulation energy model TRNSYS (Transient System Simulator). TRNSYS is used for energy modelling and it calculates the heating and cooling demand on monthly basis, as well as the internal temperatures in each defined thermal zone. The energy simulations have been already progressed for Case study building 1 and 2. Others will follow.

Regarding LCC calculations, CRES will mainly use LC-Profit tool, having experience from LCC-Refurb IEE project. LCC calculations are on the initial stage and will be progressed as soon as cost data is collected from the respective building owners/market actors.

Important factor for the selection of the case studies was the availability and possibility of accessing cost and technical data, as well as the potentiality of the buildings to be used as best practices in their field and be widely disseminated.

Case Study Building 1 / office building / existing building:

The first case study subjected to energy and LCC calculations is one of the CRES's office buildings in the greater area of Athens. It is a 2-storey building constructed in 1980, which was initially used as a domestic building until CRES moved in 1992. The total area is 1,412.49m2, with axis North-South.

The existing energy performance of the building is poor with need for refurbishment. The scenarios calculated focused on the thermal protection of the building in terms of insulating the external envelope and replacing the existing windows (incl. frames).

The calculated energy saving is in the range of 35-40% total – for heating and cooling.

LCC calculations will progress based on the above scenarios in order to define the most cost effective and energy efficient option.

Case Study Building 2 / office building / new building:

The second case study is the new office building of the Regulatory Authority for Energy (RAE) for which energy calculations have been progressed. It is an 8-storey building with total area of approx. 7,500 m2 (exc. basements), located in the centre of Athens. Basic orientations are NW-NE-SE.

The scenarios calculated focused on the different types of glazing system (based on their thermal and visual characteristics), on the proposed thickness of insulation for walls and roof, and for different kind of external shading systems.

The calculated energy saving is about 8% for insulation and glazing upgrade while the external shading systems achieves an energy saving of about 13%.

Case Study Buildings of KED / office building / existing buildings:

Cooperation with the Hellenic Public Real Estate Corporation has been established for the identification of buildings as cost input into the project database, as well as for the energy and LCC calculations.

Among various suggested case studies (mostly office buildings), one will be selected for energy and LCC calculations at this stage of the project. Other case studies might be used for LCC stage 1 calculation.

4.5 SINTEF

Energy calculations are planned to be done by autumn 2008, this due to changes in building regulations and new standards for calculating energy demand. Tools are under development and should be available by May 2008.

LCC calculations have started on two cases and is planned to be completed by June 2008. It is planned further cases added to the project in autumn.

Case 1

Building owner: Statsbygg - The Directorate of Public Construction and Property

College building for teacher education. The case is a co location project with 16,000 m2 new building combined to 18,000 m2 exiting building. The case is 2-3 storeys high.

Location: Bakketeigen in Horten, Vestfold Norway.

Status: construction period is 2008-2010.

The LCC calculation will preformed on basis of input from the early design stage. The LCC calculation is already done by a consultant, but the building owner has the experience these need to be updated due to input that are used. The directorate of public Construction and property use the LCC calculations as an input on stipulating the rent.

Case 2

Building owner: Statsbygg - The Directorate of Public Construction and Property

New college building , central building of 7600 m2 planned to facilitate canteen, learning centre, library, offices and some teaching auditorium. The case is 5 storeys high.

Location: Fosshaugane Campus in Sogndal, Sogn og Fjordane Norway

Status: design stage

The LCC calculation will be performed on basis of input from the early design stage. The LCC calculations are already done by a consultant, but the building owner has the experience that these need to be updated due to changes in design and updated input values. Statsbygg uses the LCC calculations as an input for setting the rent.

Energy calculations were performed by consultants in 2003 in the early design stage. New calculations are needed since the plan has been revised and new regulations are implemented.

Information about tool and input data

Tool for LCC calculations is LCProfit developed by Statsbygg.

As input data SINTEF will use two main sources for the two first cases; Nfr database – Keynumbers for Benchmarking and keynumbers from the database of Statsbygg

4.6 ZRMK

Energy calculations and LCC calculations started in the beginning of 2008 and will be continued. The calculation methodology according to EPBD requirements has been prepared, but the official software tools are not ready yet. For the time being the energy calculations are done based on the excel sheet prepared by ZRMK and by using professional tools like IDA ICE and Energy +.

LCC calculations are being calculated by LC profit.

Case 1

Elementary school Frana Albrehta, Kamnik

Elementary school of 3,600 m2, extension planned to 5,400 m2 floor area. The existing school suffers from low thermal insulation, overheating problems, low earthquake resistance and functionality. The building has 3 storeys. Currently, architectural competition for renovation / rebuilding is going on.

Location: Municipality Kamnik.

Status: reconstruction period is 2009-2010.

The LCC calculation will be performed on basis of input from the early design stage. Energy calculation will be done based on EPBD methodology.

Case 2

Elementary school Toma Brejca, Kamnik

Elementary school of 2,670 m2, renovation and extension planned to 5,500 m2 floor area. The existing school suffers from low thermal insulation, overheating problems and functionality. The building has 3 storeys. Currently, architectural competition for renovation / rebuilding is going on.

Location: Municipality Kamnik.

Status: reconstruction period is 2009-2010.

The LCC calculation will be performed on basis of input from the early design stage. Energy calculation will be done based on EPBD methodology.

Case 3

Elementary school Žabnica (OŠ France Prešern),

Elementary school is planned for renovation and building of additional sports hall. The building was built in 60-ties in brick, floor area 796 m2, ground floor and 2 storeys. Advanced solar panels and PV components were also considered.

Location: Žabnica, Municipality Kranj

Investment planned: 2008-2009

Status: energy calculations completed – EPBD methodology + additional tools for solar panels, LCC calculation of level 1 done.

Case 4

Shop building, standard size of a centre

Shop buildings (standardized) are frequently being built, size: 4,500 m2, when new construction is planned the structural system and envelope technologies are considered in terms of energy efficiency, LCC and indoor comfort conditions.

Location: Dolenjska

Investment planned: 2009

Status: Energy calculation was done by IDA ICE. LCC calculation was done by LC-Profit, at early design stage, using the statistical data.

Case 5

Condominium Komenda

Apartment building with 138 flats, 11,500 m2 of useful floor area. New construction planned for late 2008. The optimized energy concept and the lowest LCC were targeted.

Location: Komenda

Investment planned: 2008-2010

Status: detailed energy calculation by EPBD methodology and Energy + for systems and detailed LCC calculation in design phase was completed in spring 2008.

5 Overview on progress of WP4

The first task of the LCC-DATA project was to create an excel-sheet to ensure that all partners collect the same data. The second task was to find case study buildings. This task is still ongoing. Up to now, the partners analysed first case study buildings. Based on the data to be collected key figures for further calculations will be assessed. These key figures will be used for case study buildings to calculate the LCC and energy costs.

Task one: Development of the common data structure - done. The excel sheet with the requirements is to be found in the annex 1.

Task two: Find case study buildings for data collection – in progress.

Task three: Assessment of key numbers – in progress.

Task four: Energy and LCC calculations – in progress. It is the task for all project partners in the next months to carry out bottom-up energy and LCC calculations with the key figures from the case studies. Based on the case studies partly introduced above the first key figures will be used for further case studies to show the functionality of the case study outcome.

Task five: the database – in progress. Out of the case studies the first key figures for the database input are available. The national dissemination of the partners will lead to more data users, and this will be followed by more data input for the database. In May 2009 it is planned to introduce the enlarged database for public use after completion of the project LCC-DATA.

6 Annex 1) the common excel-sheet

Building information
Name of building
Address
Address 2
Location
Country
Owner
Type of building
Year of construction
Year of renovation (if relevant)
Performance level
Maintenance level
Building management System
Capacity [persons]
Heated floor area
Non heated floor area, e.g. parking area
Ratio window area/floor area [%]
Window area per orientation
Window are m2
Type of solar shading
Main building material
Type of heating system
Heating control / regulation
Domestic water heating
Type of ventilation system
Ventilation air flow [m³/h]
Ventilation – running time [hours/week]
Ventilation control
Type of cooling system
Installed lighting power [kW]
Lighting control and automations
Energy demand [kWh/yr]
Energy demand [kWh/m²/yr]
Water demand [m³/yr]

Currency	(examples given)
Main category	**sub category**
Capital costs	
	Project costs
	Remaining costs
Administration costs	
	Taxes and fees
	External fees
	Administration and management
	Insurance
	Various
Operating costs	
	Operation and inspection executed by own employees
	Operation and inspection executed by external companies
	Outdoor operation and inspection executed by own employees
	Outdoor operation and inspection executed by external companies
	Various
Maintenance costs	
	Periodical maintenance of exterior of the building
	Periodic maintenance of internal of the building
	Replacement of exterior
	Replacement of interior
	Emergency repair work for exterior
	Emergence interior repair
	Outdoor
Development costs	
	Development and upgrading of exterior of the building
	Development and upgrading of internal of the building
	Development of upgrading outdoor
Consumption costs	
	Energy
	Heating
	Cooling
	Electricity
	Water and drainage
	Waste Handling
Cleaning costs	
	Daily/periodic
	Main cleaning
	Special cleaning
	Window cleaning
	Facade cleaning
	Outdoor cleaning
Service costs	