Building EQ
intelligize your energy management

Newsletter Issue 6 | December 2009

Ongoing commissioning achieved up to 30 % energy savings

The Building EQ project showed that introducing an ongoing commissioning process is able to improve the building performance significantly. Energy savings between 5 % and 30 % were achieved or at least identified. This was mainly done by continuously recording and evaluating the minimal data set [1], defined in Building EQ, in combination with model-based analysis. The simple payback time of such an approach ranges between 0.5 and 3 years [2].

The tools developed in Building EQ support this process by providing data import, features, data handling, intelligent data visualization and model based analysis. All of these proved to be very helpful in identifying saving potentials and deficiencies in the building operation.

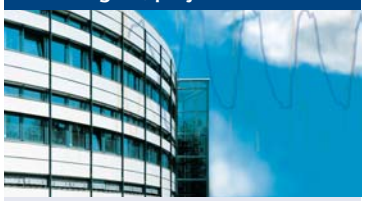
The industry partners implemented the features developed in Building EQ partially in their own products. Furthermore, several organizations like the University of Stuttgart and Politecnico die Milano started a systematic energy management that is based on the methods and ideas of Building EQ. From this point of view Building EQ generated significant impact and proved the importance and potential of ongoing commissioning for energy efficient building operation. However, Building EQ also identified many barriers for the introduction of such a process. Furthermore, the linkage to the EPBD that was originally intended proved not to be as simple as initially expected.

Most important findings

The most important findings concerning the implementation of the ongoing commissioning process and the tools could be summarized as follows:

- Introducing an **ongoing commissioning** improves the building performance significantly in most cases. Initial **savings of up to 30 %** are possible. Simple payback between 0.5 and 3 years seems to be realistic.
- Ongoing monitoring and evaluation of the **minimal data set** is necessary to make the achieved savings persistent. The minimal data set proved to be **able to detect and diagnose typical faults** in the building operation.
- Unfortunately the **EPBD** in the current state is **not able to support ongoing commissioning.** In the best case, the certification according to EPBD can be a starting point but only if an asset rating is performed comprehensively. This case exists only for a few Member States, at present, if existing buildings are considered.
- The **acquisition** and exchange **of the minimal data set** (measured data) was **a significant hurdle** – independent from the availability of a Building Automation System (BAS). Generally, BAS are not prepared for the analysis of building performance and for recording and exchanging measured data in an efficient and standardized way. Besides technical

Results of the Building EQ project



- Energy saving potential in the operation of buildings 5 – 30 %
- Realisiation of these potentials with low or no investment costs
- BuildingEQ methods and tools allow quick and cost efficient detection of these potentials
- Ongoing performance evaluation is prerequisite for energy efficient operation
- Consortium suggests amendment of EPBD with mandatory performance monitoring

[1] *The minimal data set is believed to be the minimal amount of measured data that is necessary to facilitate a rough overall assessment of the performance of the system. It comprises at least the following data points: main consumption data, weather data, indoor conditions, temperatures of main water circuits, temperature und humidity of main AHUs, control signals of drives.*

[2] *All results are available for download at www.buildingeq-online.net*

Newsletter Issue 6 | December 2009 | Content

Successful Symposium in Berlin: International experts presented strategies for energy efficiency...
Page 2

Overview demo buildings and achieved results: The achieved results vary a lot between the buildings...
Page 3

Supported by European Commission
Intelligent Energy Europe

problems, often organizational issues like unclear responsibilities and security delayed the data acquisition.

- The developed **tools proved to be a valuable support** for the initial and ongoing monitoring. Intelligent data visualization (including the pre-processing) and model based analysis were used extensively. However, especially for the ongoing monitoring (or fault detection and diagnosis) **more automation is needed** in order to integrate it in the daily routine of the operating staff. Manual approaches (e.g. checking hundreds of plots every day) are not feasible.

- Ongoing commissioning is much more than just the technical approach to record and assess data. To be successful, it is very **important to deal also with organizational issues.** The team members have to be identified, responsibilities have to be assigned, communication structures have to be set up. And above all, a common understanding of the whole process has to be achieved.

Recommendments future development of EPBD

In spite of all experienced barriers and the difficulties in linking the EPBD and ongoing commissioning, the Building EQ team is convinced that ongoing commissioning including ongoing monitoring and automated evaluation of building performance is necessary for an energy efficient operation of buildings and should be further supported by the EPBD. The BuildingEQ team recommends that the future development of the EPBD should take the following aspects into account:

- Prescription of a basic ongoing commissioning including a basic ongoing monitoring.
- Support BIM (Building Information Models) modeling of buildings: based
- Establish workflows to install building energy management and ongoing commissioning.
- Establish checklist for most efficient energy conserving methods.

Successful Symposium in Berlin

In October 2009, the project Building EQ was concluded after three years duration. A symposium was held in Berlin on behalf of the State of Baden-Wuerttemberg.

The Symposium not only provided insights into the ideas behind the project Building EQ as well as its course, but also showed the challenges and perspectives of a collective European path towards more energy efficiency in non-residential buildings. In addition to the guidelines of the EPBD, representatives from Germany, Hungary and Finland also discussed the European-wide certification program LEED.

In addition, the Symposium provided a platform for non-European countries to be heard. Experts from Japan and the USA presented their strategies. They indicated the possibilities for comparison and areas of application for the European practice. Thus, the Symposium not only represented the numerous ideas throughout Europe which were collected during the Project, but also extended beyond these borders and presented ideas on the international level.

In the concluding discussion led by Prof. Dr. Volker Wittwer, former Deputy Director of Fraunhofer ISE, the many different aspects were brought together. The central findings were discussed with respect to the energy management for the entire European continent in the near future.

All presentations can be downloaded from the project website: www.BuildingEQ.eu

Overview demo buildings and achieved results

Name City	Kreuzgebäude Essen	Wirtschaftsministerium Düsseldorf	Multi-Purpose Building Stuttgart
			
Construction year	1985	1953 –1961	1995
Utilization	Offices	Offices, canteen	Offices, laboratories
Net floor area	19,500 m²	30,000 m²	8,140 m²
Electricity consumption	51 kWh(m²·a)	44 kWh/(m²·a)	62 kWh/(m²·a)
Heating consumption	77 kWh/(m²·a)	80 kWh/(m²·a)	100 kWh/(m²·a)
Energy costs	135,000 euro/year	290,00 euro/year	60,000 euro/year
Cost for installation of data acquisition	23,000 euro	35,000 euro	6,000 euro
Estimated possible savings	20,000 euro/year	35,000 euro/year	12,000 euro/year
Percent of yearly energy costs	15 %	12 %	20 %
Simple pay back	< 1.5 years	< 1 years	< 0.5 years
Possible cost for engineering if 3 years of simple payback were acceptable	37,000 euro	70,000 euro	30,000 euro

Name City	District Hospital Hagenow	Lecture Halls Milan	Electronic Department Milan
			
Construction year	1937/1998	1998	2007
Utilization	Hospital	Class rooms	Offices
Net floor area	13,275 m²	2,970 m²	3,720 m²
Electricity consumption	121 kWh/(m²·a)	104 kWh/(m²·a)	250 kWh/(m²·a)
Heating consumption	232 kWh/(m²a)	93 kWh/(m²·a)	97 kWh/(m²·a)
Energy costs	400,000 euro/year	63,000 euro/year	156,000 euro/year
Cost for installation of data acquisition	20,000 euro	32,000 euro	46,000 euro
Estimated possible savings	50,000 euro/year	12,000 euro/year	10,000 euro/year
Percent of yearly energy costs	13 %	19 %	7 %
Simple pay back	0.4 years	< 3 years	< 5 years
Possible cost for engineering if 3 years of simple payback were acceptable	130,000 euro	4,000 euro	n.s.

Due to technical and organisational problems there are no data available for building Nordstan in Gothenburg

Name City	Informatic Systems Milan	Duka House Gothenburg	State Treasury Helsinki
			
Construction year	1961	1810	1984
Utilization	Offices	Retail, private school	Offices, restaurant
Net floor area	2,270 m^2	1,770 m^2	16,120 m^2
Electricity consumption	270 kWh/(m^2·a) incl. cooling	35 kWh/(m^2·a)	84 kWh/(m^2·a)
Heating consumption	88 kWh/(m^2·a)	130 kWh/(m^2·a)	178 kWh/(m^2·a)
Energy costs	95,000 euro/year	n.s.	226,000 euro/year
Cost for installation of data acquisition	32,000 euro	n.s.	2,500 euro
Estimated possible savings	4,000 euro/year	n.s.	13,500 euro/year
Percent of yearly energy costs	4 %	n.s.	6 %
Simple pay back	< 8 years	n.s.	< 0.2 years
Possible cost for engineering if 3 years of simple payback were acceptable	n.s.	n.s.	38,000 euro

Name City	Aurora 2 Joensuu	HUT Engineering Department Espoo	Senate Headquarter Helsinki
			
Construction year	2006	1966	1934
Utilization	Offices, medical center, auditorium, seminar rooms	Offices, auditoriums, seminar rooms, canteen	Offices, conference rooms, canteen
Net floor area	8,100 m^2	8,600 m^2	11,690 m^2
Electricity consumption	117 kWh/(m^2·a)	85 kWh/(m^2·a)	114 kWh/(m^2·a)
Heating consumption	106 kWh/(m^2·a)	101 kWh/(m^2·a)	66 kWh/(m^2·a)
Energy costs	68,000 euro/year	59,000 euro/year	Building is working correctly. No approvements needed.
Cost for installation of data acquisition	7,000 euro	5,000 euro	
Estimated possible savings	20,000 euro/year	14,000 euro/year	
Percent of yearly energy costs	29 %	24 %	
Simple pay back	< 0.4 years	< 0.4 years	
Possible cost for engineering if 3 years of simple payback were acceptable	53,000 euro	37,000 euro	

About Building EQ

BuildingEQ is a project in the Intelligent Energy Europe Programme of the European Commission. BuildingEQ aims at strengthening the implementation of the EPBD (Energy Performance of Buildings Directive) by linking the certification process with commissioning and optimisation of building performance. Within the scope of the project, methodologies and tools are to be developed that can be used for ongoing commissioning and optimisation of non-residential buildings using gathered data from the certification process according to the EPBD.
The emphasis will be on feasibility and cost-effectiveness of energy reduction measures with regard to building practice. Main target groups are the industry for Facility and Energy Management, real estate owners, energy agencies and energy consultants.

The consortium at a project meeting in Stuttgart

Consortium

Fraunhofer Institute for Solar Energy Systems (Project Coordination)
Freiburg / Germany, www.ise.fraunhofer.de

Energieagentur Regio Freiburg GmbH
Freiburg / Germany, www.energieagentur-freiburg.de

ennovatis GmbH
Großpösna / Germany, www.ennovatis.de

CIT Energy Management AB
Göteborg / Sweden, www.cit.chalmers.se

Politecnico di Milano
Milano / Italy, www.polimi.it

Olof Granlund Oy
Helsinki / Finland, www.granlund.fi

Official observer

Marcus Keane
Department of Civil & Environmental Engineering,
Galway / IRELAND, www.nuigalway.ie

Nick Chapazis
Commissioning Management Services,
Chalandri / GREECE

Zoltan Magyar
University of Pécs
Pécs/ HUNGARY, www.jpte.hu

Ralf Klein
Katholieke Hogeschool Sint-Lieven,
Associatie KU Leuven
Gent / BELGIUM, www.khleuven.be

Carles Vinardell
Architect
Barcelona / SPAIN

Imprint

Published by:
Fraunhofer Institute for Solar Energy Systems
Freiburg / GERMANY, www.ise.fraunhofer.de

Energieagentur Regio Freiburg GmbH
Freiburg / GERMANY,
www.energieagentur-freiburg.de
info @energieagentur-freiburg.de

Design:
triolog – kommunikation mit energie
Freiburg / GERMANY, www.triolog-web.de

Photo: Ralph Meißner

www.BuildingEQ.eu