

First Experiences with demonstration buildings

■ Interview with Juha Muttillainen, Senate Properties Helsinki

Juha Muttillainen is the chief specialist for building services at Senate Properties (Helsinki), a state owned enterprise under the aegis of the Finnish Ministry of Finance, which is responsible for managing the Finnish state's property assets. Senate Properties provides some of the demonstration buildings which will be surveyed within the BuildingEQ project. The headquarters was visited by the consortium during the last project meeting in Helsinki.

Mr. Muttillainen, already in the foyer of your headquarter there is an impressive display system on energy consumption. Did you notice any effect that this installation may have had on the staff?

The system gave the possibility to react in real time to the changes in energy consumption and indoor conditions. Increased consumption of electricity during none-working hours has been noticed too. I must admit that our property manager is more conscious about the energy consumption. The staff is more interested in indoor conditions. Supposedly, their consciousness will increase because they can view the diagrams, which are updated daily.

Senate Properties has a very good overview of the energy consumption data of all of their buildings. Is it generally quite common in Finland to gather this data?

Since the 1970s, all major property owners collect data in a particular manner. However, Senate's database is the largest in quantity and duration.

However, the energy consumption for heating in your buildings has stagnated since the 1980s at a level of 40 kWh/m²a. (see digram next page)

Yes, heat consumption was reduced already during the 1970s by about 30 to 40%. In the 1990's Senates premises were changed from free-of-charge to the present rent system and the requirements for indoor conditions and ventilation increased. However, at the same time, this rent system is steering our tenants to use their premises more efficiently. Without changing their behaviour the consumption would have increased. So this figure describing the average nominal consumption is not the whole truth.

The electricity consumption rose even more than threefold in your buildings.

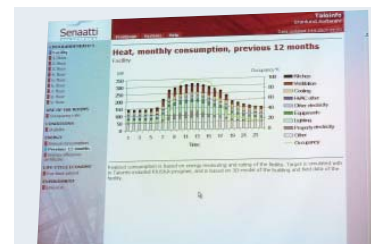
This has happened during the past 40 years because of better lighting and ventilation, computers, scientific equipment and cooling. It's essential to reduce the electricity consumption now. But it seems that the growth has stopped and has turned downwards last year. The electricity is mainly paid by our tenants but we also help them by giving advice and providing the consumption data free of charge. With this offer, the tenants obtain a feedback of their own consumer behaviour.



Juha Muttillainen, chief specialist for building services at Senate Properties (Helsinki)



Visited by BuildingEQ consortium: Headquarters of Senate Properties, Helsinki

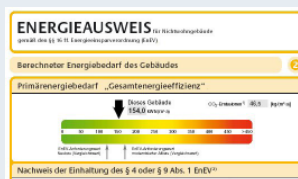


Impressing: In the foyer of Senate Properties Headquarters a sophisticated display system shows energy consumption data and temperatures for each room in the building, for example. All of the data are also available per intranet.

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Data acquisition at BuildingEQ
Difficulties arise in the daily practice of obtaining data as the example at Technical University of Milan shows.
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Status of EPBD implemetation
Most countries within the EU are still discussing the legislation and executive orders for implementation of the EPBD.
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Intelligent Energy  Europe

The European directive on energy end-use efficiency and energy services from 2006 foresees an energy reduction of 9% by 2015. How will Finland reach this target?

We have a large amount of energy intensive industry such as metal and forest. The products, however, are mainly used elsewhere in the EU and worldwide.

Because of the rather high performance of our combined energy production and the reductions in consumption made in the past, both the target and schedule are very demanding. Finland has already a high percentage of renewable energies, therefore the energy industry meets a great challenge that has to be solved.

Since Senate Properties did a lot concerning energy efficiency, what was the motivation to participate in the project BuildingEQ?

Senate Properties Headquarters, Helsinki

The building is a former grain mill with huge storage silos. It was renovated in 2002 and received several architectural awards. The building is L-shaped and consists of 9 floors with a clear height of only 2.4 m. As much as possible the old structures are maintained. For example, elevators and staircases are placed into the old grain silos. The floors are mainly used as open offices. The building includes a sophisticated graphical information interface which displays the current energy consumption, temperatures and the energy consumption dating back to 1975 on a screen in the foyer. This information is accessible to all visitors.



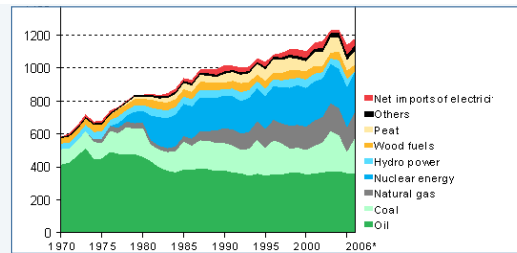
Senate Properties Headquarters
 Location: Helsinki, Finland
 Year of renovation: 2002
 Net floor area: 11,400 m²
 Use: office building
 Energy consumption
 for heating: 120 kWh/(m²a)
 for electricity: 75 kWh/(m²a)

Up to now we looked through our Finnish glasses. For us, participation in the BuildingEQ project means getting some new ideas from our partners and learning from other countries concerning energy issues.

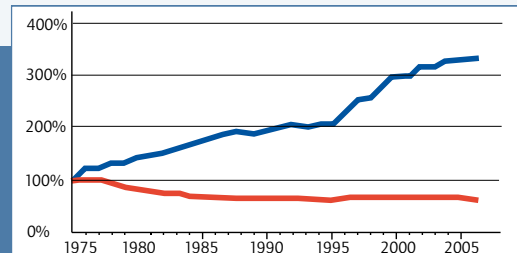
How do you estimate the role of the energy certificate for the Finnish building market?

Mainly, it is a question of "energy consciousness" as we talk about Senate's premises. Not much extra work is needed, since we already have the database and calculations in building projects in use every day. On the other hand, we own a lot of very special buildings, where the role of the energy certificate is not very relevant and a single certificate might not be comparable to anything.

Thank you for the interview, Mr. Muttillainen ■



Over the years, the energy consumption in Finland has continually risen. Oil, coal, natural gas and nuclear energy determine the mix to 80 percent.



Energy consumption for heat at Senate Properties buildings stagnates at the level of 1985, electricity consumption rises.

■ electricity
 ■ heat

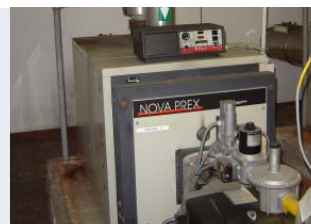
Problems to be solved: Data acquisition for demonstration buildings

Difficulties arise in daily practice in obtaining the basic data (plans, utility bills, technical data etc.) for the BuildingEQ-Project.

Data acquisition is a basic prerequisite for optimizing the building operation. Under adverse conditions this can require lots of time and costs. At the main campus of Technical University of Milan (Politecnico di Milano), for instance, there are about 25 buildings with different purposes of use presenting a complex structure. Barriers in gathering the data for three of the buildings are the lack of a central data collection point, lack of accountability and difficulties with the access authorization to the different parts of the buildings. The building plans were not always updated when building restorations were carried out. These plans are difficult to follow since numerous companies were involved in these measures. For the most part, the sites were visited and the real buildings were compared with the building plans finding mismatches in both HVAC systems

and building documents. As a result, several days were required in order to collect all of the data for the three demonstration buildings.

Additional installations of measurement equipment were necessary in order to be able to collect the minimum amount of hourly data required for the analysis. The costs for each of the three buildings lay between 7,500 and 10,000 Euro. By making use of in-house resources, the university could save app. 30% investment costs. It is advisable to obtain administrative consent from the highest level of the hierarchy and to collect the necessary information from the beginning. When a building manager centrally manages the data on location, then the data acquisition can be carried out without a problem within 3 - 4 days. Such an example is shown by ThyssenKrupp in Düsseldorf. Once an asset rating is completed, the effort for the application of FDD and Optimisation (see next page) is reduced drastically since all needed data are available. ■



At the Technical University of Milano it was difficult to obtain a minimum amount of data for the BuildingEQ project.

Continuous Commissioning and EPBD

Introduction

Today, after the certification process is performed according to the national implementation of the EPBD (Energy Performance of Buildings Directive), there is usually no continuous evaluation of the building performance in order to reach or to maintain an energy-efficient operation. As a result, the performance of buildings is often poor. An ongoing commissioning process is seen as a prerequisite for the persistence of the high energy performance of buildings.

Why do we need ongoing commissioning?

Users request a comfortable and healthy indoor environment, but they no longer accept the excessive use of natural resources or polluting the outdoor environment.

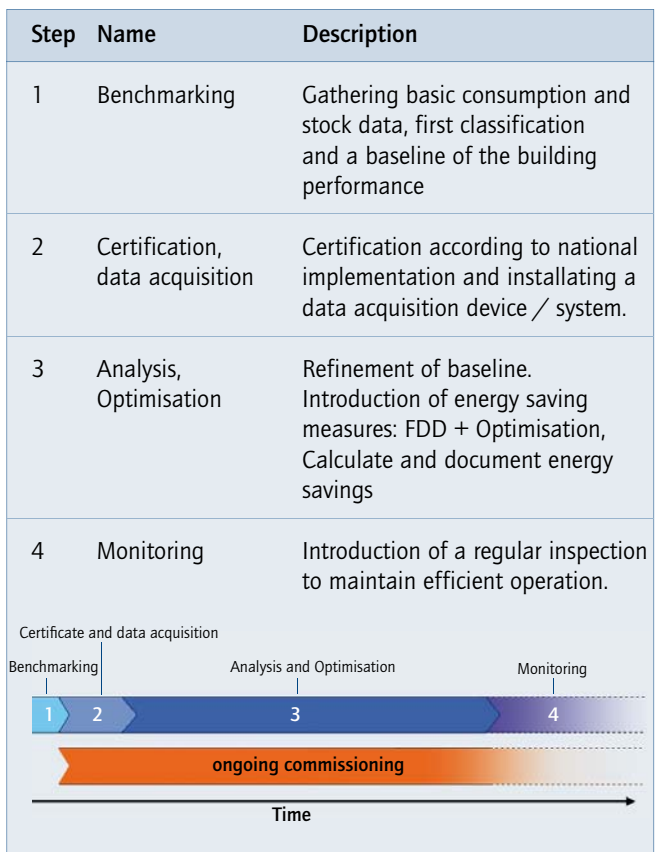
The heating, ventilation and air conditioning (HVAC) industry seeks solutions to fulfil these higher requirements. We are clearly leaving the time of low efficiency stand alone products and entering a period of high efficiency integrated systems. Moving from simple products to large systems enables one to develop more efficient and flexible solutions, but it also leads to a higher level of complexity. Ongoing commissioning is one of the new approaches to manage the complexity of today's building and HVAC systems. The primary obstacles that impede the adoption of commissioning as a routine process for all buildings are clearly: lack of awareness, lack of time and high perceived costs. One of the tasks in an ongoing commissioning process is FDD + Optimisation.

FDD + Optimisation

FDD (Fault Detection and Diagnosis, see explanation in the infobox on the next page) in the field of building operation is still in its infancy. The first attempts of systematic FDD in buildings go back to the late 80s. Many different approaches have been tested theoretically or in the lab but the systematisation is missing. Furthermore, the wealth of different models and approaches which have been tested positively by the scientific community has not yet made it to the field. The number of commercial FDD tools that are available on the market is quite low and many of the tools are still under development. For BuildingEQ, a 4-step process was developed (see graphic) for the ongoing commissioning in the demonstration buildings. It is important to notice that the continuous commissioning approach can be introduced right after step 1 as a classification of the building is available already at that stage.

Outlook

Currently there is a large interest worldwide for continuous commissioning especially for commercial buildings. The most advanced industry exists in the USA, probably because of the high saving potentials in US buildings. Building EQ evaluates existing concepts and adapt them to the European market.



By the use of FDD and Optimisation energy savings up to 20 - 30% are achievable in the ideal case.

What does Commissioning mean?

Commissioning (Cx) is, in general, a quality assurance process for buildings. It involves achieving, verifying, and documenting the performance of each system to meet the building's operational needs according to the owner's functional criteria.

In the practice, one can distinguish 4 types of commissioning:

- Initial Commissioning (I-Cx) is applied to new buildings
- Retro-Commissioning (Retro-Cx) is first-time commissioning for an existing building
- Re-Commissioning (Re-Cx) is a commissioning process implemented after I-Cx or Retro-Cx
- On-Going Commissioning (On-Going Cx) is a commissioning process conducted continually for the purposes of maintaining, improving and optimising the performance of building systems after I-Cx or Retro-Cx.

Fault Detection and Diagnosis (FDD)

Fault Detection and Diagnosis (FDD) aims to recognize and diagnose faults quickly, systematically and – as far as possible – automatically before additional damage to the system occurs or before the system fails. This is achieved by a combination of continuous monitoring and data analysis.

Building faults are conditions or events in building operation that hinder achieving both a comfortable indoor climate and an efficient energy supply at the same time. Faults are thus defined as an unintentional worsening in the scheduled operation.

The cause of faults can lie in insufficient planning or implementation, false operation or poor maintenance. Typical mistakes in building operation are unintended and unnecessary operation of pumps and fans during nights and weekends. Mathematical models of the building and systems play an important role in FDD. Another prerequisite for FDD is an ongoing monitoring to keep track of the operation and its changes. ■

Status of the implementation of EPBD in European Countries

In general, detailed information on the actual status of the implementation of EPBD in European countries is hardly available. Since legislation is in progress in many countries, it is obvious that the information on the building platform website can be revised.

Certification

In nine countries, certification for new buildings is already in force. For existing buildings most countries will introduce an energy certificate in 2008/2009.

Six countries will apply asset rating mostly for new buildings and in some cases with simplified calculation methods using default values. In Denmark and Austria certification based on energy demand is obligatory for all buildings.

Inspection

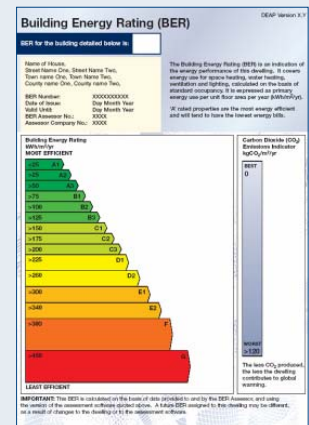
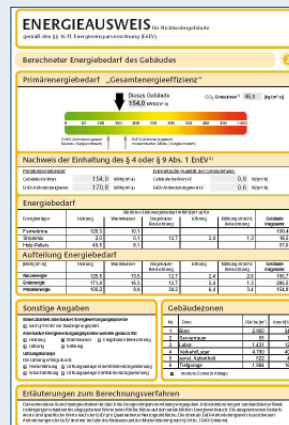
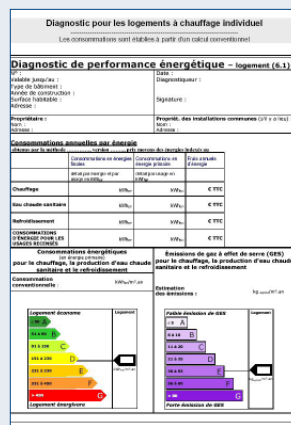
The inspection of boilers is covered by existing law in 16 countries. These regulations have to be amended, in part. Execution orders for inspection of air conditioning systems are under discussion in almost all countries. Information about the interval of inspection is very rare.

Requirements on existing buildings

Requirements for existing buildings have to be applied in most countries when major renovation is undertaken. Mainly, there are requirements on the maximum U-value for each building component (14 countries) and in 7 cases on energy demand.

Results

The different national implementations are very diverse. Furthermore, for existing buildings mostly operational rating is applied. Consequently, there will be no common basis for the European tool being developed in the Building EQ project. However, Building EQ will base the tools on a minimal data set that should be available in many buildings. ■

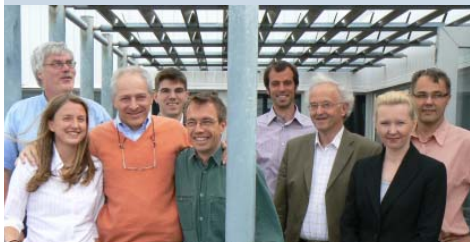


Energy Certificates look different in the European countries. The figures show exemplary the main page of certificates in Denmark, France, Germany and Ireland (from left).

About BuildingEQ

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.

Granlund invited the consortium for the BuildingEQ project meeting in June 2007, Helsinki.



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.

www.BuildingEQ.net

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