Building EQ
intelligize your energy management

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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

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

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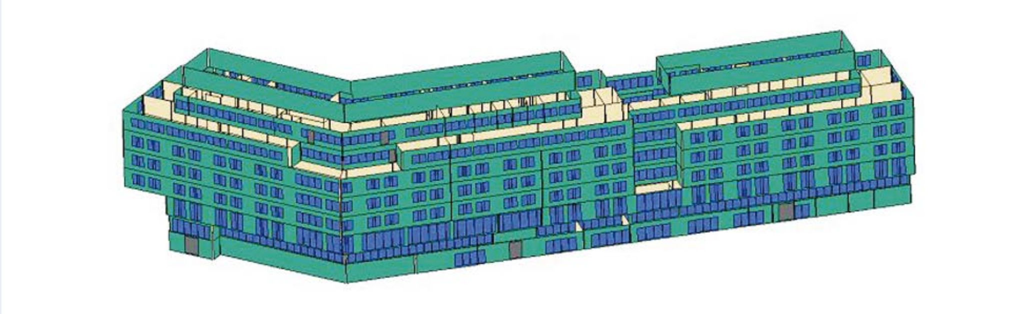
Project in brief

DEMONSTRATION BUILDING: STATE TREASURY, HELSINKI (FIN)



Still potential energy savings after renovation

The implemented BuildingEQ data gathering and analysis identified some possible system malfunction and potential energy savings to avoid unnecessary energy consumption by the heating and cooling systems after recent renovation.

Overview

Kind of data acquisition	Building automation system
Yearly energy cost	226,000 Euro
Cost for installation of data acquisition for minimal data set	2,500 Euro = 1 % of yearly energy cost
Estimated possible savings	13,500 Euro/year = 6 % of yearly energy cost
Simple pay back (of data acquisition only)	<0.2 years
Possible cost for engineering if 3 years of simple payback were acceptable	38,000 Euro

The savings potential was estimated roughly by separate calculations. The first results show that the realisation of these savings can be done with no or low investment costs.
To confirm the causes for malfunctions in system operation and define more accurate estimate of the savings potential, further studies are needed.

Building characteristics

OWNER: Senate Properties, a government owned enterprise under the Finnish Ministry of Finance
YEAR OF ERECTION: 1984
NET FLOOR AREA: 16,116 m²
UTILIZATION: Typical office building with a restaurant
CONSUMPTION OF ELECTRICITY: 1,362 MWh/a, 84 kWh/(m²·a)
CONSUMPTION OF HEATING: 2,887 MWh/a, 178 kWh/(m²·a)
CONSUMPTION OF COOLING: 165,000 kWh/a, 10 kWh/(m²·a)
BUILDING ENVELOPE: A concrete supporting structure and red brick surfacing, window strips on the facade
BUILDING SERVICES:
- District heating
- Eight air handling units with water-glycol heat recovery, heating and cooling, mechanical ventilation
- District cooling after renovation
- Domestic hot water by district heating, using a separate heat exchanger

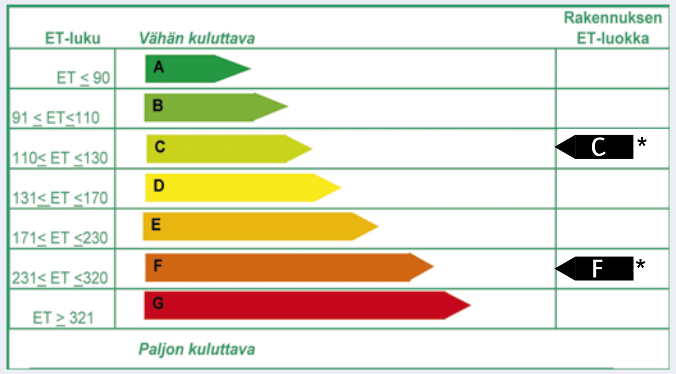
Results of the Building EQ project

- Energy saving potential in the operation of buildings 5 - 30 %
- Realisation 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

Supported by European Commission
Intelligent Energy Europe

Result of certificate

Since 2009 in Finnland, energy performance certificates for existing buildings are required. The certification of non-residential buildings in the building stock is carried out using the actual energy consumption (operational rating OR) as a basis. As well as the heating energy, the electricity consumption and the cooling energy are considered. The user-dependent electricity consumption for electrical devices like PC's, refrigerators, etc. is not included. The gross floor area is used as reference value.
The energy efficiency is divided into 7 classes from A (highest efficiency) to G (lowest efficiency). The boundary values defining the classes are set depending on the building use. This distribution is based on statistical values of the energy consumption of existing buildings in Finland.
The building was having major renovation during year 2007. The energy performance rating given to the building before the renovation was class C.
In the renovation the air conditioning was modernized by adding cooling system to increase the indoor air quality in the spaces. The energy performance rating after renovation was defined for last 12 months (11/2008–10/2009), which included the, in part, abnormal use of ventilation for emission removal during the 1st operation year. The first resulted energy performance rating after renovation was F. Depending on the coming implementations of savings and continuous commissioning procedures the future energy rating is estimated to be D or E for normal operation case.



*C = Certificate before renovation (2007)
*F = Certificate after renovation (2009)

Overview saving potentials

DESCRIPTION OF SAVINGS	INFLUENCE
HEATING	
Optimize the setback in ventilation network	Reduced heating demand and distribution losses
Avoid radiator network supply temperature rise during summer to 45 °C	Reduced heating energy consumption
Adjustment of supply temperature and pump operation for ventilation heating networks	Reduced heating energy consumption
COOLING	
Check why the cooling network supply temperatures for ventilation and fan coils has changed from 10 °C to over 40 °C from September to November 2009	Reduced heating consumption and better indoor conditions
VENTILATION	
Reduce running hours of air handling unit supply fan from 24/7 to office hours	Reduced heating energy and electricity consumption
Check air handling unit exhaust fan operation according to the need	Reduced heating energy consumption and better pressurization balance

Analysis of Measured data

In the signatures for the heating circuit of ventilation, we can find that the system pump is also operating for quite long periods during the summer, when there should be no need for heating in the ventilation system. The presented values of operation rate are daily averages (graph I).
The heating circuit pump operation during summer on long periods can be confirmed by using the carpet plot diagram of the pump control signals (blue: off, orange: on) (graph II).
Also it can be found that the supply water temperature can be quite high, between 40 °C and 50 °C, occasionally during summer conditions (graph III).

The temperature difference in the heating circuit shows that the heat is consumed somewhere*. Potential cause is malfunction in the system by leakages in the pipeline or through controlling valves.
The BuildingEQ analyses identified the above and also other possible malfunctions in the system. Further studies are needed to confirm the causes. The potential savings were roughly estimated by separate calculations.

*during summer (graph IV)