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

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| MULTI PURPOSE BUILDING STUTTGART | DISTRICT HOSPITAL HAGENOW | MINISTRY DÜSSELDORF | KREUZGEBÄUDE ESSEN | STATE TREASURY HELSINKI | HUT ENGINEERING DEPARTMENT ESPOO | AURORA 2 JOENSUU | SENATE HEADQUARTERS HELSINKI | INFORMATIC SYSTEMS MILAN | LECTURE HALLS MILAN ELECTRONICS DEPARTMENT MILAN | DUKA HOUSE GOTHENBURG | NORDSTADEN GOTHENBURG

DEMONSTRATION BUILDING: AURORA 2, JOENSUU (FIN)

BuildingEQ found energy saving potentials of 20 – 50 %

Aurora 2 was an enlargement of the Aurora building in the University of Joensuu, Finland. The main characteristics of Aurora 2 were fixed through an architectural competition. The resulted solution by BIM [1] based design was much more energy efficient compared to Aurora 1 by traditional design. Nevertheless, the energy efficiency of Aurora 2 was not confirmed because of abnormal use of ventilation for emission removal during the 1st operation year. After that, energy efficiency monitoring has been missing. One barrier for energy management in Aurora 2 is shared main energy metering with other buildings.
The BuildingEQ analysis estimated energy saving potentials of 20 % for heating and up to 50 % for electricity. Continuous operation of many air handling units was identified as the main reason for an excess of energy consumption.

[1] Building information model

Overview

Kind of data acquisition	Building automation system
Yearly energy cost	68,000 Euro
Cost for installation of data acquisition for minimal data set	7,000 Euro = 10 % of yearly energy cost
Estimated possible savings	20,000 Euro/year = 29 % of yearly energy cost
Simple pay back (of data acquisition only)	0.4 years
Possible cost for engineering if 3 years of simple payback were acceptable	53,000 Euro

Building characteristics

OWNER: Senate Properties, a government owned enterprise under the Finnish Ministry of Finance
YEAR OF ERECTION: 2006
NET FLOOR AREA: 8,100 m²
UTILIZATION: The building is used for educational purposes There are mainly offices for researchers. Besides offices there are also a medical center, an auditorium for 250 persons and some class and seminar rooms in the building
CONSUMPTION OF ELECTRICITY: 946,000 kWh/a, 117 kWh/(m²·a)
CONSUMPTION OF HEATING: 855,000 kWh/a, 106 kWh/(m²·a)
BUILDING ENVELOPE: U-shaped building with two wings, glazed courtyards for distribution of daylight
BUILDING SERVICES:
- District heating
- Five air handling units with heat recovery from exhaust air, mechanical ventilation
- Domestic hot water by district heating

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

www.BuildingEQ.eu

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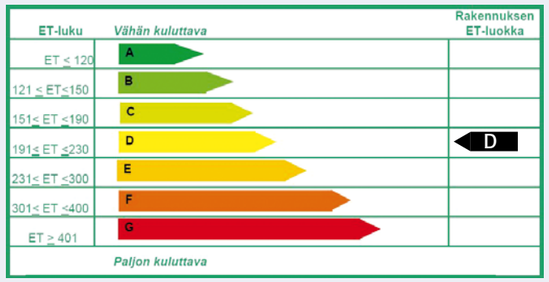
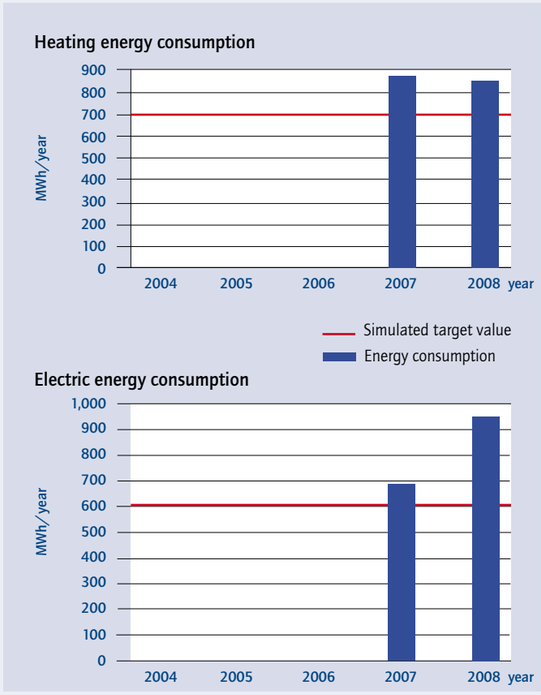
Intelligent Energy Europe

Result of certificate

As of 2009, 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 energy performance rating for the building is class D and it was defined based on measured energy consumption during year 2008. The biggest problem for defining energy certificate for the building and also potential source for errors in energy management is that the main energy meters are for several university buildings and Aurora 2 's part of the energy consumption is estimated.



A target consumption was simulated to the building by using spatial 3D model of the building and hourly dynamic simulation. Several simulations and targeting were used during the design phase to develop the energy efficiency of the building, but not during operation. The graph of the electricity and heating energy consumption for the last two years show excess consumption both in electricity (from +15 to 50 %) and in heating (from +20 to 25 %).



Overview saving potentials

DESCRIPTION OF SAVINGS	INFLUENCE
HEATING	
Check the inlet water temperature setpoint of the heating circuit for ventilation	Reduced heating energy and consumption
COOLING	
The cooled beam network analysis showed cooling during 22.09.2008–12.10.2008, although according to outside conditions there shouldn't be any need for cooling. Check possible leakages	Reduced electricity consumption
VENTILATION	
Reduce running hours of AHU311-315 from 24/7 to office hours	Reduced heating energy and electricity consumption

Analysis of Measured data

The analysis indicates that the air handling units (AHU) are running 24 hours on 7 days a week (1) through the whole year, which doesn't meet typical need for an university building. The carpet plot below shows the situation for one of the AHU.
Continuously operating AHUs were detected as the main reason for excess electricity and heating energy consumption. During the cold period of the year, 5 continuously operating AHUs consume clearly more heating energy, even with good heat recovery. Electricity consumption of fans in those AHUs is increased by 70 % (10/5 versus 24/7). So the most important saving action is the rescheduling the AHU operation.