Building EQ
intelligize your energy management

Newsletter Issue 4 | December 2008

From data to information – Determining the energy savings potential

Within the project BuildingEQ, measurement systems for monitoring the building operation were installed in the twelve demonstration buildings. The goal of the monitoring is to identify the potential for energy savings which can be reached using a minimal amount of effort.

The consortium agreed upon a required minimal data set to be acquired for each of the buildings.

The measurement data are sent to a central server via internet where they are visualized automatically. The "Kreuzgebäude" located in Essen, Germany is the first demonstration building to have its measurement data posted online.

Since 2008 the complete set of measurement data for this building can be viewed online. Read more about the results of the first analysis at page 2 and 3.

See monitoring data at:

beq.ise.fraunhofer.de
Login: guest
Password: guest

Minimal Data Set

In order to evaluate the performance of a building, measured data – at least of the energy consumption – is necessary.

Generally in existing buildings, measured data of sufficient quality is not readily available. At the same time, monitoring all of the components in a system usually requires a considerable budget for additional measurements and is not feasible. Considering this situation, a minimal data set that provides insight into the performance without demanding too much budget, must be determined.

Within the framework of BuildingEQ, a minimal set of measured data was carefully selected. It is believed to be the minimal amount of measured data that is necessary to provide a rough overall assessment of the system performance.

item	measured value
consumption	total consumption of fuels
	total consumption of district heat
	total consumption of district cooling
	total consumption of electricity
	total consumption of water
weather	outdoor air temperature
	outdoor rel. humidity
	global irradiation
indoor conditions	indoor temperature
	indoor relative humidity
system	flow/return temperatures of main water circuits
	supply air temperature of main AHUs
	supply air relative humidity of main AHUs
	control signals of drives (pumps and fans), if available from BAS

First BuildingEQ workshops

The first two national workshops within the BuildingEQ program provide the opportunity for exchange and information on the topic of monitoring in non-residential buildings. Talks and discussions inform about energy performance certificates, continuous commissioning and software solutions.

Goals:
- Venue for inspiring exchanges between experts in the field of monitoring
- Presentation and discussion of approaches taken by Fraunhofer ISE
- Identification of trends and future perspectives in monitoring

Target groups:
- facility managers
- real estate owners
- planners
- consultants
- energy service providers!

- **Milan, Italy**
18 December 2008, 13:45 - 18:30
Politecnico di Milano/Italy

- **Freiburg, Germany:**
12 February 2009, 13:30 - 17:00
Solar Info Center in Freiburg/Germany

Further information, program and registration at:
- www.buildingeq.eu

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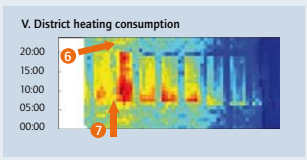
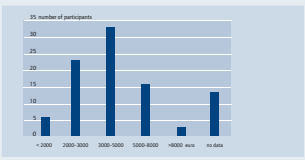


Measurement results: Using carpet plots, high-resolution time measurements over longer periods of time can be protrayed with clarity. **Page 2**



Survey: Results from the survey on the energy performance certificate in Germany shows that regulations should be simplified. **Page 4**

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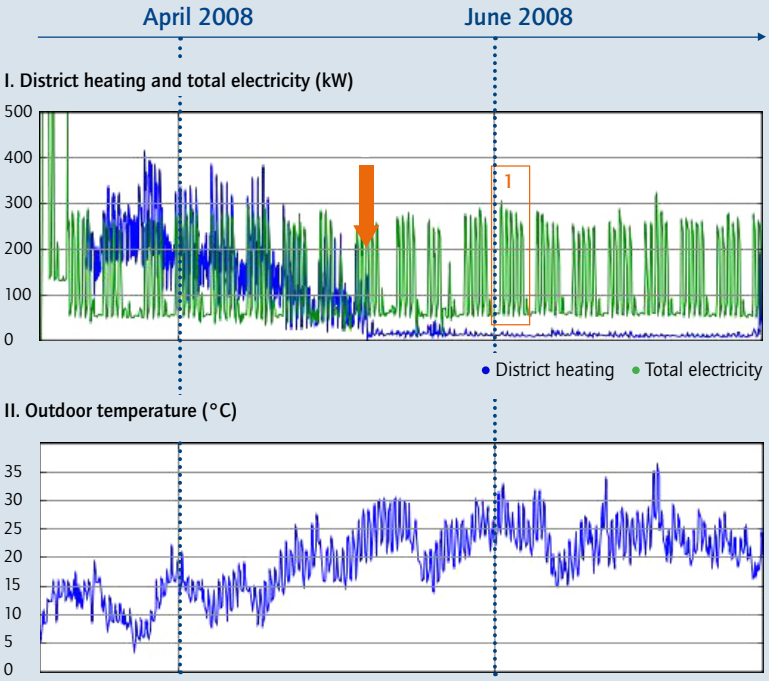
Intelligent Energy Europe

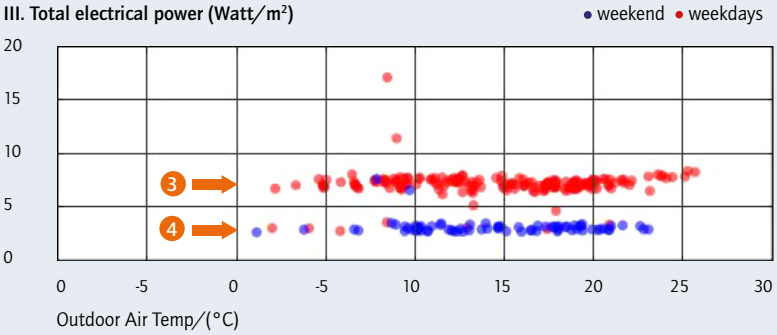
Kreuzgebäude: First measurement results and analyses available

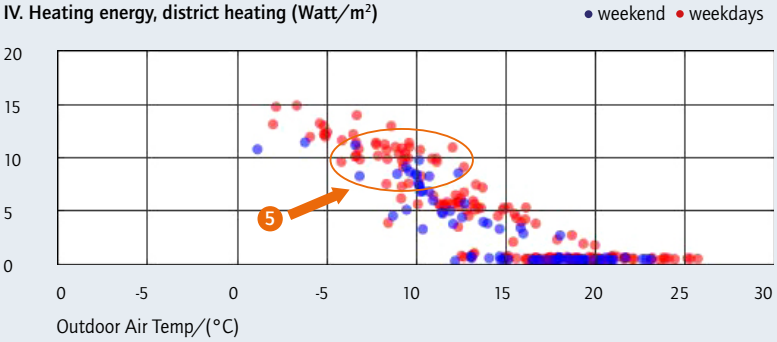
Since March 2008, first measurement data for the German Kreuzgebäude have been acquired. To date, data for both the heating period as well as the summer period are available. The results of the first analyses are shown here as an example.

From traditional time series ...

Both plots (I,II) demonstrate the classical method of displaying data in time series. The time period shown here is between March and July. In the lower plot, the course of the outdoor temperature is evident and the heating and electricity consumption are shown analogous directly above. The pattern of the weekly consumption (1) can be clearly recognized, especially the electricity consumption (green line). Also the dependence of the heating consumption (blue line) on the outdoor temperature is observed. The heating period ends at the beginning of May (2).





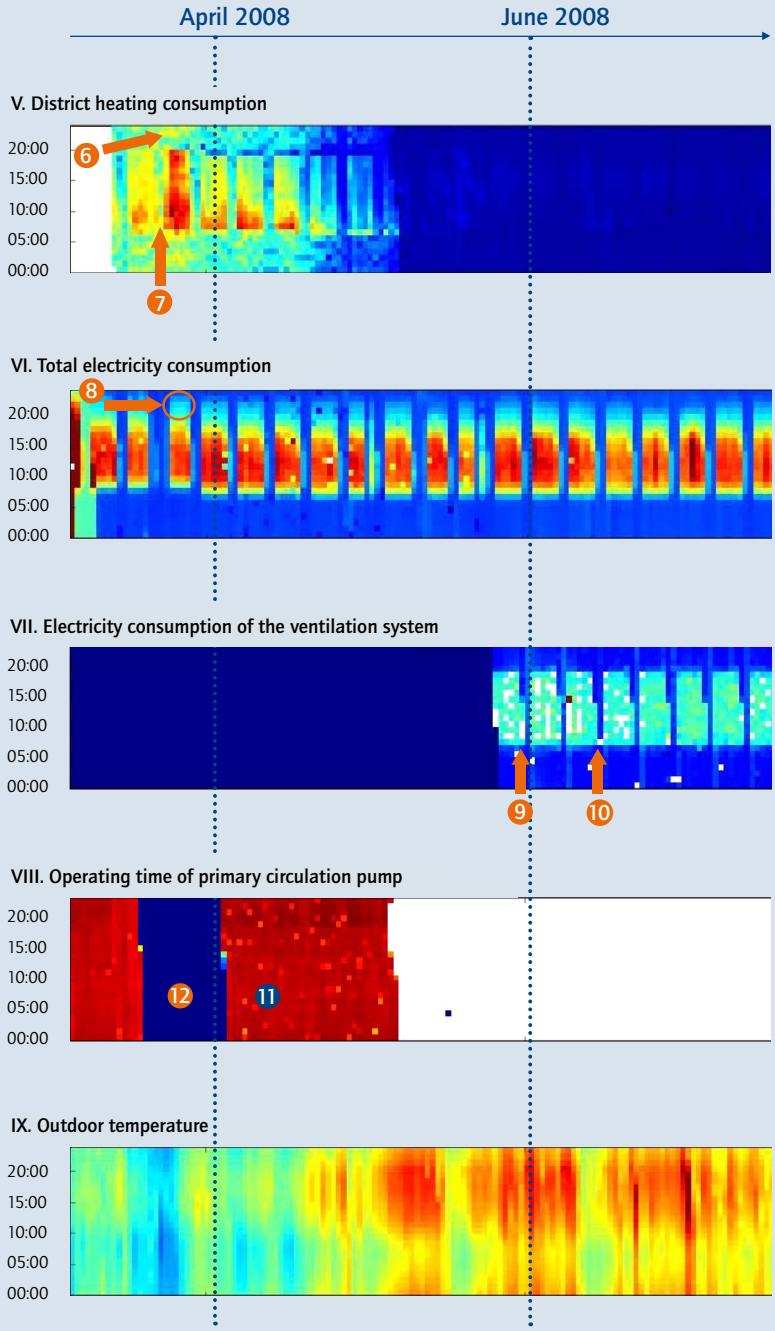


... to identification of control strategies and ...

The correlated dependence of two or more measurement values can be shown using scatter plots. A typical example here is the so-called energy signatures which show the dependence of the energy consumption on the outdoor temperature.

The energy signature of the electricity shows that the energy consumption is independent on the outdoor temperature. On workdays, the electrical power is about 8 W/m² (3) and on the weekend it is about 3 W/m² (4). In terms of the entire building, this is equivalent to a power of 60 kW.

For district heating, the signatur shows a deficient set-back on weekends, since no difference can be discerned between operation during the weekday as opposed to the weekend (5).



... operating schedules

Using carpet plots, high-resolution time measurements (hourly values) over longer periods of time can be portrayed with clarity.

Here the course of each day runs along the y-axis from the "bottom" (y=0:00) to the "top" (y=23:00) and the days are plotted next to each other accordingly on the x-axis. The measurement value itself is portrayed in different colours. For days having a similar course of measurement values, the colour pattern is respectively similar. Such patterns can be visually identified very quickly.

In the winter months, the district heating does not show a distinct profile. In the night (6) and on the weekend (7), a large amount of heat consumption occurs. The assumption that the temperature set-back control does not operate optimally is confirmed.

On the weekdays, the complete electricity consumption evidences a course which is similar to the district heating, which however lasts later in the evening hours (up to 21:00). The electricity consumption of the ventilation system indicates that some of the systems also are in operation on Saturday (9) and Sunday (10). This results in electrical base load of 7 kW.

The primary circulation pump used to supply the heat registers of the ventilation system operates continuously during the winter months (11). In March, non-continuous measurement data are recorded (12).

Summary of the results

The evaluation of the measurement data for the German „Kreuzgebäude" shows that typical or commonly available potential energy saving measures can be identified by using only the mi-nimal data set. For the most part, the energy saving potential can be realized by applying measures which involve no or only a small investment.

For the Kreuzgebäude, several of these potentials could be identified and appropriate measures were carried out. An reduction of energy demand of 10% could be reached. This is equivalent to a savings of 15,000 euro/year. These savings shall also be demonstrated using the measured values.

Typical or commonly occurring potential for energy savings that can be detected using the minimal data set are:

- No or deficient temperature set-back during nights or on weekends
- Operation schedules not adjusted (e.g. fan and the pump for the heating coil)
- Heating/cooling curve is deficient
- Mass flow rate is too high (i.e. temperature difference is too low in the heating/cooling loops)
- Over or under dimensioning of the generators
- Faults in the measurement equipment (using the wrong factors for meters, falsely connected meters, uncalibrated sensors, ...)

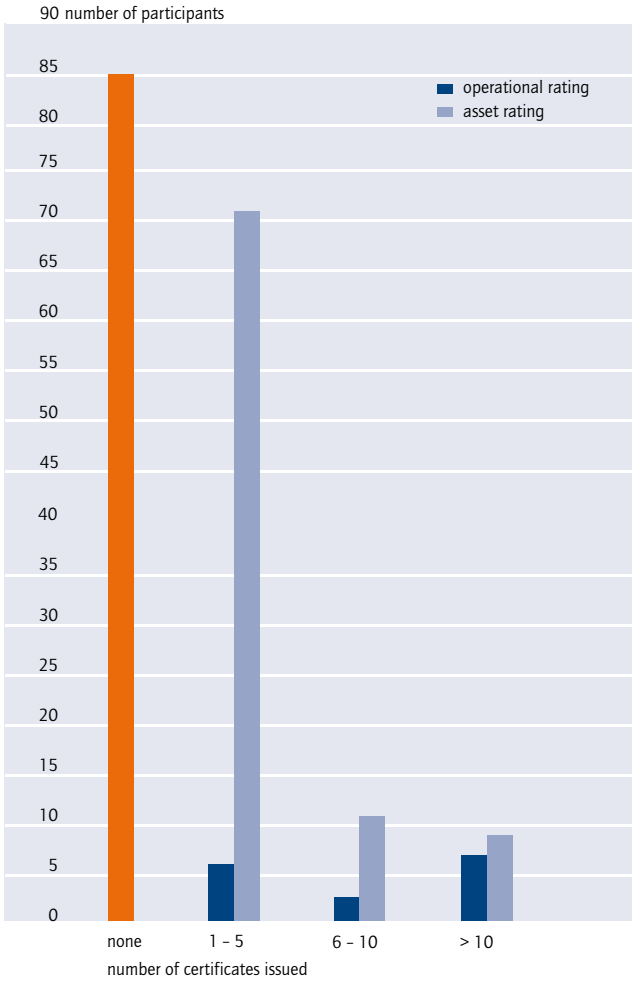
Results from the survey on the energy performance certificates

When the Energy Saving Ordinance EnEV 2007 came into effect in Germany, the energy evaluation of non-residential buildings acquired new meaning. The energy certificate and the standard DIN V 18599 were introduced as a balancing standard for non-residential buildings.

For the users, the energy analysis for non-residential buildings presents difficulties. This was a main result of the survey carried out in September 2008 by the magazine "Gebäude-Energieberater" (www.geb-info.de) in co-operation with the Energieagentur Regio Freiburg. Of the 176 persons who partook in the survey, 57% were engineers, 37% architects and 3% were skilled labourers or held other occupations respectively. All of the participants live in Germany.

Several of the participants stated that as of yet they have not prepared any energy certificates for non-residential buildings. Last year, 73% of the people surveyed fell into this category. This year this percentage was reduced to 39%. In 2008 for the most part, each issuer completed between one and five certificates for non-residential buildings. Energy certificates with an asset rating make up the majority of the issued certificates (Fig. 1). Only a few people issued more than ten energy certificates, and in this higher category, the fraction of energy certificates based on an operational rating was also greater.

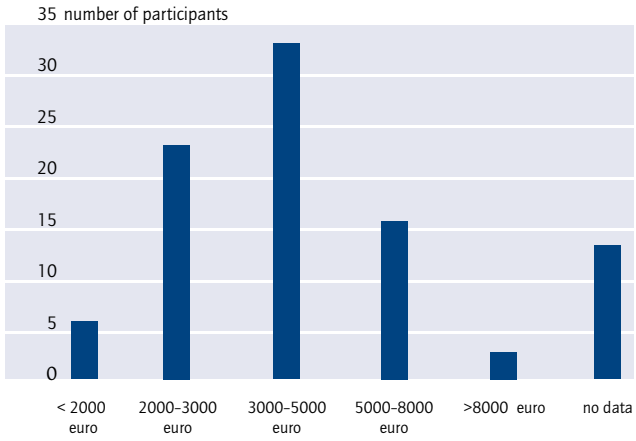
Fig. 1: Number of certificates issued per participant



In the first place, a planned renovation of the building is a motivation for the owner to have an energy certificate issued for a non-residential building. In 36% of the cases, this was the motivation for issuing the energy certificate. For another 25%, the new requirements on 1 July 2009 motivated the application for an energy certificate. Another 19% had an energy certificate issued because the building was planned to be sold or to be newly rented. The rest of the energy certificates were issued for new buildings.

Finding the appropriate fee for the evaluation of non-residential buildings is a new and often difficult topic for many energy consultants. The amount of the fee often lies quite a bit above the level for residential buildings and this must be so represented to the customer. In the following example, the participants in the survey estimated the price of an energy certificate based on an operational rating for the following object: eight storey building with a simple geometry, useful floor area 4,000 m², air-conditioned cafeteria, air-conditioned conference/seminar rooms, one central heating plant and several ventilation units (Fig. 2).

Fig. 2: Cost Estimate for Energy Performence Certificate (asset rating)



About 23% of the participants estimated the costs to be between 2,000 and 3,000 euro, 33% between 3,000 and 5,000 euro, and 16% between 5,000 and 8,000 euro respectively. For the question concerning the difficulties in carrying out the energy certificates for non-residential building and suggestions for improvement, the message was relatively clear. Primarily the complexity of the DIN V 18955 was criticized and people commented that it is hard to understand. Furthermore, the calculation steps could not be easily followed.

Many participants wish that the DIN V 18599 were more compact, clearer and straightforward. Additionally, they would like simplifications and more user profiles. The regulations should be more simply formulated. The software for non-residential buildings should be more user friendly, transparent and overall clearer. They requested that the calculation steps be more transparent, more partial results be shown and that tips on plausibility be given even during the intermediate steps.

More information at: www.geb-info.de

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.
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.

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