

ENERGY SAVINGS FROM INTELLIGENT METERING AND BEHAVIOURAL CHANGE: CASE STUDY Hollabrunn

This case study discusses the use, the use of data of the remote control counters, the trainings, and the consequential energy savings in a local government of Lower Austria.

1. Development of building standards of Lower Austria over the years

The European Union and all member states are committed to reduce the greenhouse gas emissions at 8 %. The aim of Austria is to reduce these emissions at 13 % on the basis of the year 1990. Lower Austria is also committed to reduce these emissions in the same dimension. To reach this aim, Lower Austria has to carry out a lot of measures. These measures concern basically the reduction of the demand of energy and to reduce greenhouse gas emissions. These measures could be, for example energy accounting (since 1993), overall refurbishment public buildings and so on. Because of the project Intelligent Metering, it is possible to carry out trainings with building occupants and to evaluate the profits. This project is very interesting, as we include the following parameter in the evaluation: the categories of buildings, standards of construction, usage of buildings, building users and many more.

2. Basics – General description of the building:



The local of the local government of Hollabrunn was built in 1980. In 2005 the building was refurbished.

Refurbished were:

- ü heating (change over to district heating)
- ü Hot water distribution
- ü Cold water distribution
- ü Lightning
- ü Toilets (partially)
- ü Probably in 2007, insulation at façade

This building is used as office and there is a small apartment inside. The owner of the building is the government of Lower Austria.

The façade was built in 1980 and is not state of the art.

The heated gross floor area amounts 3787,8 m².

2.1. Location:

The local government in Hollabrunn is located near the city centre and the location is on the lee side. The city of Hollabrunn is situated in the north of Weinviertel. The climate is not as the climate in Waidhofen, it is possible to say to climate is mild. The average heat degree days are 3526 kd (20/12).

2.2. Energy consumption:

The average energy demand in office buildings amounts in Austria between 54 kWh per square meter and year and 284 kWh per square meter and year. This great difference is the result of the outer shell, the heating system and the usage.



Abb. 1 - Energieverbrauch bezogen auf die Bruttogeschossfläche

The demand on electricity depends on the equipment, the number of working stations, the lightning, age of the lightning system, the efficiency and the controllability of the ventilation. According to our elicitation, amounts the energy demand between 16 kWh per square meter and year until 119 kWh per square meter and year.

2.3. Habits of building users:

Office hours:

Monday - Thursday 7.30 am -3.30 pm
Tuesday additionally 3.30pm -7.00pm,
Friday 7.30am -1.00pm

The recording of labour time happens electronically. Therefore the labour time beyond the office hours is flexible. The first begins at 6.30 am, and the cleaning personal works 4 hours longer than office hours are.

The building is used – expecting of bank holiday and weekends – all the year round.

2.4. Implementation:

The energy agency Waldviertel analyses the local government Hollbrunn:

- ✓ Adaptation of the existing counters (heating, electricity, water).
- ✓ Which counter for which area?

- ✓ an approximate determination of the possible energy savings
- ✓ appointment for the first training
- ✓ wiring of the counters
- ✓ Evaluation of an electrician, carrying out the installation
- ✓ specification of contact persons

After the first analyse, we create a tender for carrying out the adaptation of counters.

2.4.1. Counters for heating:

The counter meters die heating quantity. The change over to other counters was carried out trough the energy agency Waldviertel. The adaptation of the counters could be realised with the existing ones. It was only a module necessary to realise that the signal is converted into a impulse.



Frequency: 1 impulse = 1 kWh

2.4.2. Counter for electricity:

The counter is a converter counter. Because the existing counter was an analogue counter, it has to be changed. A electronic Impulse counters has to be installed. The change over of the counters was carried out by the energy utility. The offer contains the uncouple relays and the installation.

Frequency: 1 Impulse = 0,000333 kWh

2.4.3. Counters for water:

The existing counter was not appropriate to use them for remote control. The local water supply company carried out a tender for the adaptation. Water counters with Read Relays to be applied.

Frequency: 1 Impulse = 10 Liter.



The adaptation costs including installation, materials, working hours and VAT amounts approximately **3.654 EURO**.

2.4.4. Area determination:

Because of the existing flat in the local government of Hollabrunn, it is necessary to know how the energy consumption is charged.

The demand of energy and water is calculated as follows:

- ✓ Heating: there is no one's own counter for the flat,
- ✓ electricity: there is an one's own counter for electricity, charging is funded by the energy utility
- ✓ Hot water: there is no counter, the local government provides the hot water
- ✓ water: there is no counter, the local government provides the water

During the determination of the water consumption, the water supply changed. The existing system changes over to a system of non drinking water for toilets. This water is out of the one's one well.

Because of the flat, there is a demand on water and hot water in non office hours.

- ✓ The wiring was carried out by an electrician.
- ✓ The connection of the counters and of the data loggers were carried out by the energy agency Waldviertel.
- ✓ The parameterisation and the installation of the energy accounting system were carried out by the energy agency Waldviertel.
- ✓ The data transfer takes place once a day through analogue modem.
- ✓ The programming for the data transfer was carried out by Siemens Austria.

The transmitting through the modem keeps breaking down on some days, because of

maintenance works of the telephone company. The consumption data is these days had been stored and transmitted later.

3. First training for housing technical servants and managing directors

After the adaptation and installation works, were data's of demand collected and analysed. In November 2005 took a training session for housing technical servants and managing director's place. From the local government of Hollabrunn nobody participate to this first training.



Participants of the first training in St. Pölten
Lecturer: Roland Riemer

The aim of this training was to get to know the key person, the change experiences and to sensitize concerning the topic energy.

Because of the first training, was analyses carried out to show them at the training on the ground. This analysis was prepared with the energy accounting software EMC.

3.1.1. Heating:

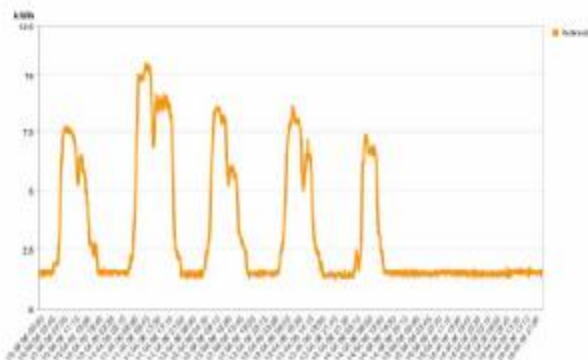
The graph below shows the demand on heating of an ordinary office building. The recurrent depressions are at weekends, where nobody uses the premises of the local government. This graph shows that the settings are all right.



3.1.2. Electricity



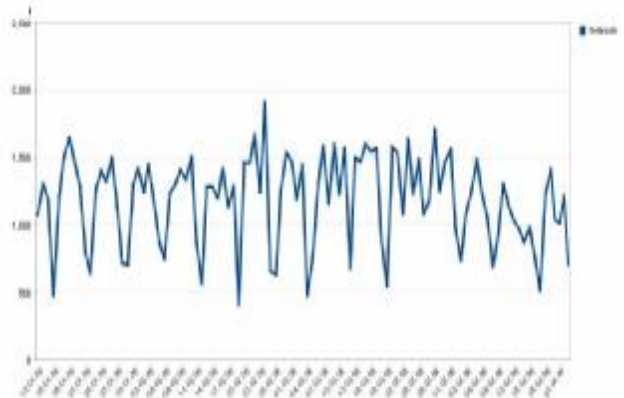
The graph above shows the demand of electricity of an ordinary office building. The recurrent depressions are at weekends, where nobody uses the premises of the local government.



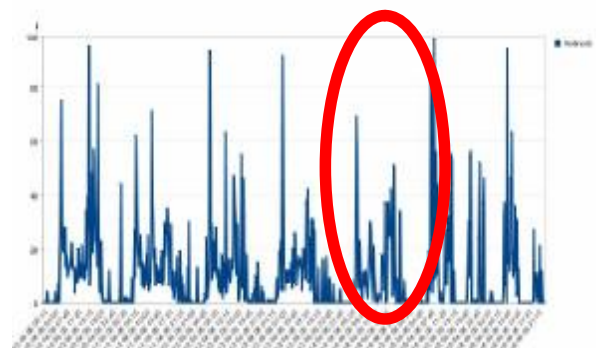
The graph above shows the evaluation of the consumption during a quarter (Monday till Sunday). The consumption at non working hours is very interesting, because the Stand by is constant. That means that there are no big consumers during the non working hours.

It is legible that on Thursdays the opening hours are much longer than on other days, because there is an higher energy consumption. The consumption on Fridays should be controlled, because there is an increase at 4.15 am in the morning.

3.1.3. Water:



The graph shows the water demand of water of an ordinary office building. The recurrent depressions are at weekends, where nobody uses the premises of the local government. Because there is no separate counter for water (office building and flat), there is a demand also on non office days.



4. First training on-site:

The first training took place on 24th April, 2006. The invitation for the training was dispatched by mail.

Schedule: Monday, 24th April, 2006

09:00 am	Beginning
09:00 am till 10:00 am	Discussion with the managing director and the technical housing servant
10:00 am till 12:00	Workshop with à Hr. Monschein (Roland Riemer) Workshop held by Verena Leidnix)
12:00 till 13:00	Break

4.1. Training matters

„Energy efficiency is no loss of comfort, , but rather an intelligent usage of existing resources“

The first part of the training is a short discussion. We discuss the matter of project, the aims and the measures. Furthermore we discuss the program EMC (energy accounting system) and show some graph of the actual demand.

The second part of the training session is split. Roland Riemer controls the settings with the housing technical servant (settings of heating, ventilation, hot water generation).

Verena Leidnix carries out the workshop with the administration personnel. We will speak about measures for energy savings. We would like to point out: shaping of

opinions and that only with little measures and behavioural changes, high energy savings could be reached. During the workshop this topic should be discussed:

- ÿ Water
- ÿ Lightning
- ÿ Ventilation
- ÿ Heating
- ÿ Kitchen in the office
- ÿ Cooking and so on

For all this measure, we create a poster. So the staff would be remembering every day.

- ÿ in the kitchen
- ÿ in the toilettes
- ÿ at the copier
- ÿ in the rooms
- ÿ at the elevator and so on.

Every collaborator and every visitor get a folder with the topics of the training and useful information for energy savings.

The first trainings session in the local government of Hollbarunn was carried out on 24th April, 2006.

The structure that should dominate in a local government looks as follows:

- ü The managing director is responsible for the energy costs, and he has to control that this costs are little as possible and the comfort for the staff is high.
- ü The housing technical servant should try to maintain the equipment and control the settings. He should come up to the requirement – mentioned above.
- ü The staff should use the energy as sparing as possible, they should not waste energy (not switch off the light, if they leave the room...).
- ü The cleaning persons are normally the latest who leave the building. They see the mistake of the administration personnel, e.g. copiers online; switch on lightning, tilted windows and so on. The cleaning personnel is one of the most necessary key personnel in an office building.

The participants were interested, but some were very bored. The evaluate the satisfaction of the participants, we got 4 (1 best

and 5 worst).The number of participants (6 persons) was adequate for the first training. The matters of training were enforced as announced.

The axiom of our training was:

- ü **when**
- ü **how much**
- ü **how long energy is used**

According to this axiom, we carried out this training with the housing technical servant. We control the settings of the following things::

- ü Heating
- ü Temperatures of hot water and times of circulation
- ü times of ventilation
- ü times of usage, opening hours
- ü Temperatures
- ü lightning (inside and outside)
- ü and so on

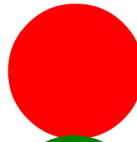
4.2. Workshop

4.2.1.Matters of the workshop

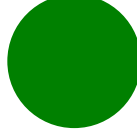
The training was executed as Workshop and not as frontal instructions. We did not develop a presentation on PowerPoint, because the exercises were executed in collaboration between the participants and us. So it was possible for us to react on question. The results were noted on a flip-chart.

We create a simple system, that every building users and visitor could see that the management attach value to energy efficiency. The system consists of 2 point, on green point and one red point.

Wastrel



This point means that this setting wastes energy. This setting should be avoided.



Efficient

This point means that this setting is more efficient than the red one.

Less resource was use.

We have created posters which should assist to follow the instruction of the points. We have also prepared information posters. These posters should be placed at highly frequented place, e.g. the kitchen, the copier, at the coffee machine and so on.

Everybody who comes into the building should get informed of Intelligent Metering and the measures.

In order that the building users disremember the measures for energy efficiency, did we design folder, with a lot of tips concerning energy and water. These tips could be used in the office and at home.



4.2.2. Aim of the workshops

The aim of the trainings is to get in contact with energy efficiency and measures to save energy. For us, it was very important to get to know these guidelines:

Energy efficiency does not mean losing of comfort, but rather to utilise the available resources wisely.

In the connection with energy efficiency, we also hear the statement: if I do not take the initiative, nobody would do. Therefore we use the axiom: one's own initiative actual commandment

Therefore everybody could begin at his working place to search for energy wastrel

Guaranteed everybody will find something to change at his working place.

Thus we show that the constantly control is very important. Key personnel got the access rights to the energy accounting system to see how much energy they save or if they waste energy. This is very important to secure that in one month the building users still think on energy efficiency.

The energy agency Waldviertel designed a circulation which show how to information should be transferred. This circulation should not pause, but always circulate. Only this way we can guarantee that we get the best possible energy savings.

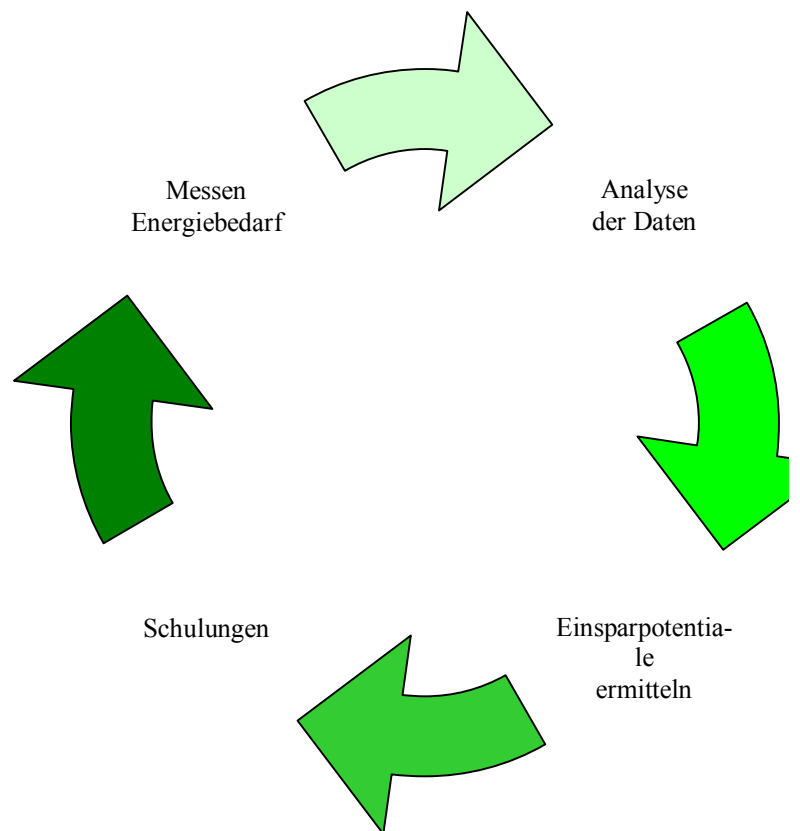
We transmitted a newsletter every month to the managing directors and heads of office. The newsletter deals with information about ventilation, heating, energy-savings lamp, usage of plants for cooling, and so on. The men's in charge should distribute the newsletter to the whole staff.

Small servings of information are better than a big surge of information, which gets in to oblivion.

Last but not least, it is very important to say that the training is not only a lecture, but every body should feel encourage to support the management to save energy.

Energy savings could not only find out by Energy Agency Waldviertel but also by every collaborator. But not every participant at the workshop did agree. At the workshop we saw that some of the key personnel are not interested.

Some of the advices we gave was commended like: We have a lot of work, we are not able to handle another task.



5. Unique parameter of the local government Hollabrunn:

During the first training, Roland Riemer and Mr. Monschein (housing technical servant) control all technical settings.

5.1. Heating:

The warmness is provided by district heating.

✓ Heat exchanger P = 240 kW

Since the beginning of the remote control monitoring, the warmness is provided by district heating. The supply temperature is after the heat exchanger, controlled by a heating curve. The supply temperature of

the separate heating circuits is controlled by some clock timers with weekday functions. The setting of the temperature comes after a pump and a valve. This possibility to control the temperature is very efficient.

The settings of the heating of the separate heating circuit were controlled, and if necessary adapted to usage. All settings were carried out with Mr. Monschein. Other measures to optimise the process are not foreseen.

Comment:

Before the monitoring start, there was a electric night storage heating installed. Because of the existing control, on some days there was a little too cold. Therefore the topic energy savings in the field of heating is a delicate subject.

5.2. Electricity

In the field of electricity we would like to mention some suggestions that were very useful in other objects. For example:

- Reduction at corridor lightning
- Reduction of temperature in drinks machines, switch off the outside lightning, if they is not needed

All mentioned suggestions were not put into action.

5.3. Water:

In this field no essential measures took place. Only our red and green points were put at essential places (toilets).

5.3.1. Hot water:

The preparation of hot water is founded by district heating, the whole year. Hot water is distributed by a circulation pump. The operating time of the pump is controlled through a timer (week day's function). There is a great loss in the taps, so there are great losses within the preparation of hot water. These settings have a great impact on the energy savings balance. In this field the management would not like to change something.

6. Second Training:



2. Training Train-the-trainer Workshop

The energy agency Waldviertel offers – within the scope of the EU - project Intelligent Metering – a second training (with the main focus on heating). Person interested in participate such a training session, it does not matter if they participate the first one or not. Precognition is not necessary.

It is necessary to train the technical servant once more – especially at the beginning of heating season – to speak about outstanding question, the analyses and so on. Besides it is very important to control the settings of the heating.

In addition do we offer a train the trainer workshop for voluntaries, who are interested in energy efficiency and energy savings. In the future these persons are the speaking tubes between the staff and the energy agency. We design a manual with all topics which are necessary (details for heating, kitchen, water, ventilation etc.). These persons are energy representatives for this building. To the best advantage 2 person should accept this function.

If your are interested in carrying such trainings, contact us. If possible all trainings should take place at the day. To find an agreement on a suitable date please contact Ms. Verena Leidnix

The second training took place on 26th November, 2006 – with 1 attendee. The interest was not signalised by an active discussion.

6.1. Matter of the training:

In anticipation of the training did we show a film “AL GORE – an inconvenient truth?”

This film deals with climate change. Therefore the person got an insight of the actual situation. Moreover were a lot of article discussed, followed by a presentation. Roland Riemer has shown a brief summary of the analyses of all buildings participating. Afterwards we spoke about the building of the local government Hollabrunn in details.

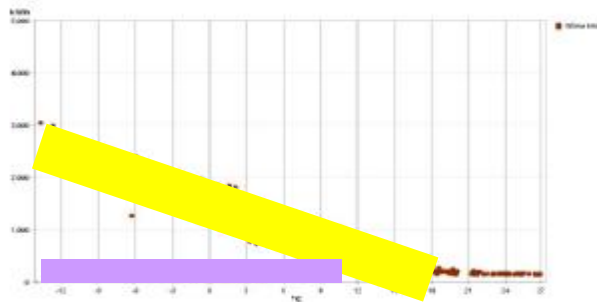
6.1.1. Analyses of the heating demand after the first training:

The consumption of heating energy reduced some days after the first training, but the reason for this could be the increased outside temperatures. Only the increased outside temperature could not bring such high savings, but also the changes at the settings. Furthermore the behaviour changes and the correct ventilation with the windows increased the savings. The consumption from June 2006 is because of the hot water consumption. The hot water consumption is constant during the week.



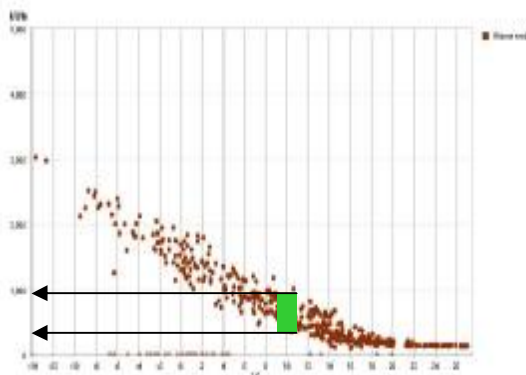
It is necessary to design an energy signature to analyse the effects of training in the field of heating. The trainings are held in spring, so there is a temperature rise due to seasonal differences. The aim is to analyse the data of heating without connection to the outside temperature.

The analyses with an energy signature characterise the demand on heating in kilowatt per hour at a certain temperature. So it is possible to compare the demand in spring and in autumn.



The graph above shows a summary of the energy signature of the local government in Hollabrunn. Every point characterises the demand at a certain temperature. There are two different scenarios for energy demand during one week.

1. The heating is verified to the usage of the building. The temperature inside must be the same independent from the outside temperature. The building users must not freeze or sweat. (see above the yellow bar)
2. The building is also heated outside the office hours, but at less inside temperature. (see above the violet bar)



Analysing the energy signature before the first training:

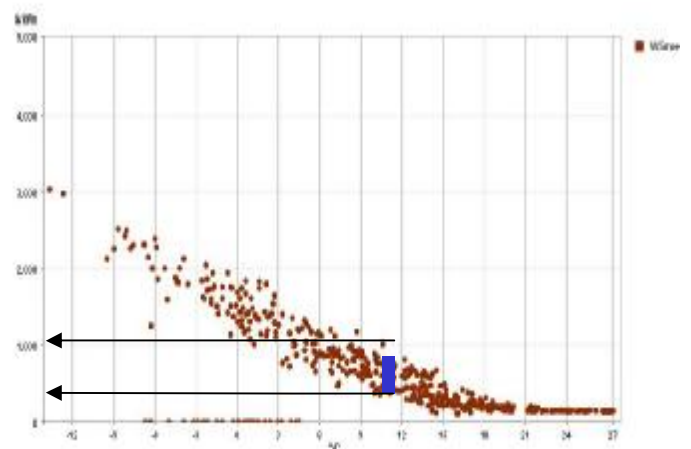
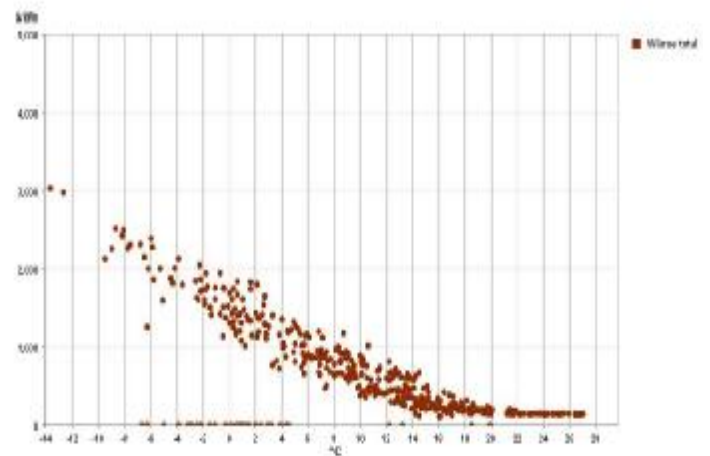
The graph shows energy consumption at the two different scenarios of 300 till 1000 kWh at a temperature of 10 degrees.

Analyses of the energy signature after the training:

The graph shows energy consumption at the two different scenarios of 250 till less than 1000 kWh at a temperature of 10 degrees.

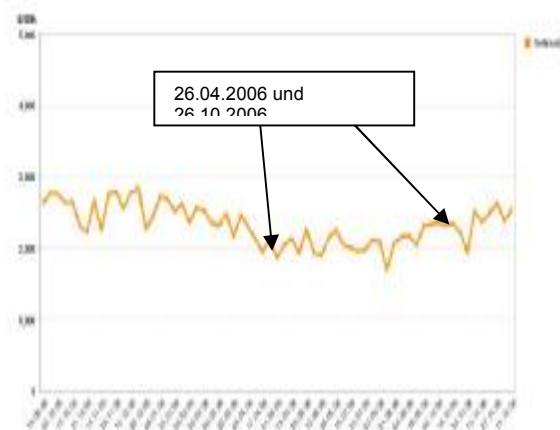
Summary of the energy signatures before and after the trainings:

We could prove that we get an energy saving because of our trainings, and not because of the increased outside temperature.

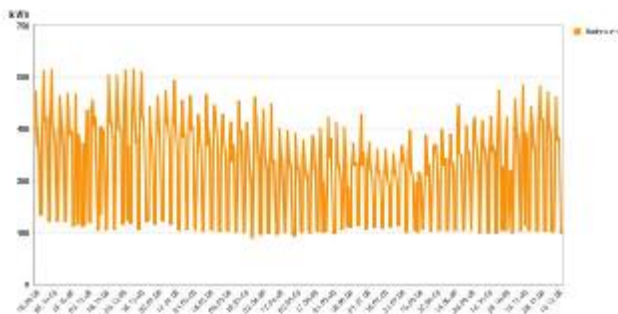


6.1.2. Analysing the electricity consumption after the training:

The energy consumption in case of electricity reduced some days after the training. The graph shows a weekly resolution. The graph shows the possibility of short-time energy savings.



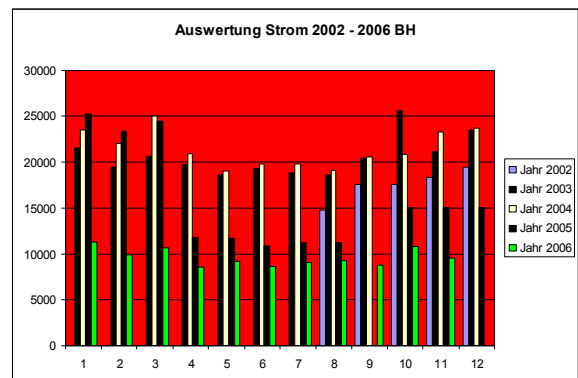
Furthermore it is necessary to guarantee an efficient usage of lightning, avoiding Stand-by consumption at copiers and so on. Therefore there is a constant energy saving. (Daily resolution)



The energy saving could better be seen at a comparison with the year before.



The graph above shows essential energy savings in October and November. The data of December and September were not recallable for the whole month.



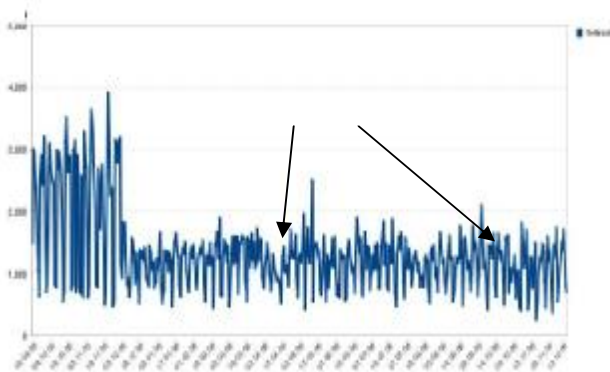
The local government use since 2002 a computer-aided energy accounting system. The energy agency advises the existing system; consequently it is possible to compare more data than available in EMC.

This graph shows that the reduction on energy demand is sustainable.

From 2002 til 2005 the heating was provided by electricity. Therefore the energy consumption could only compare from April 2005.

6.1.3. Analyses of the water consumption after the first training:

In the field of water consumption, for us it was not possible to carry out any changes in settings. Therefore the savings are only put into effect through the staff and the visitors. During the refurbishment at the water distribution, there the water supply was split into two circuits.



After the changeover to a two circuit system, it was possible to save 44 % of water.

After the training, the water consumption decreased a little bit, but some more days after training, one or two weeks, the consumption highly increased.

A weekly resolution shows that water consumption over one year.



This graph shows that the measures of the training sessions only reach small savings. Reasons for this could be that the staff forgot to save water because they think of the two circuit system. We may think that they do not have to look on their water consumption. After the second training, there was also a saving, but after a half month the consumption reached the old level.

Summary of savings took place after the first training on 26th April, 2006.

Savings in the field of electricity, comparison of the consumption one month after and one month before the training:

- **17,4 %**

Savings in the field of water consumption, Comparison of the consumption one month after and one month before the training:

- **+ 7,92 %**

Savings in the field of heating, Comparison of the consumption one month after and one month before the training:

- **+/- 0,00 %**

Assessment of the heating savings is very difficult, and was charged through the energy signature.

6.2. Judgement of the training measures and energy savings:

At this example, it is possible to show that the trainings measure only take place if every body support the measures, and is interested in energy savings and sustainability. In this building, the staffs were not interested. The reasons were manifold. One point was for sure the night storage heating which do not function. The topic "Energy saving and Energy efficiency" is not popular. Furthermore, during the training sessions were carried out some refurbishments in the building. The willingness of the staff is very small.

Incentives for the staff could be:

1. Savings are returned to staff, not financial, but in another way. Small present could be a nice reward.
2. The management should give this topic more importance.