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# **European Commission 'Intelligent Energy – Europe' programme**

Energy Savings from Intelligent Metering and Behavioural Change

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## **Report on savings identified (WP 2) & Final Energy Report (WP 2)**

**Work Package 2: Data Collection, Monitoring and Analysis  
Work Package Leader: Esbensen Consulting Engineers A/S**

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## Introduction

During Work Package 2, data has been monitored in all the buildings and saved in the SQL database for further analysing in order to identify possibilities for savings.

The Initial Energy Report was a part of the tool to establish the consumption-baseline for each building. Some buildings have, until this project began, not had any monitoring facilities installed, so no figures for comparison are available or they would have to be read manually by the technical staff each month.

The manual reading of meters does give an indication of over-consumption compared to previous periods. However, the manual reading cannot indicate possible leaks so quickly or identify the source from the where the over-consumption is taking place.

Each building is presented in this report with an overview of the key figures for heating, electricity and water monitored over the last 5 years, including figures for 2005 and 2006 where the Intelligent Metering project has been running. This provides the historical overview, and the overall view to identify how much energy and water has been saved during the years of this project.

The so-called 'Report on savings identified' has been integrated into this report, because it was found that the two reports were naturally overlapping and should be read as a whole together with the 'Final energy report'.

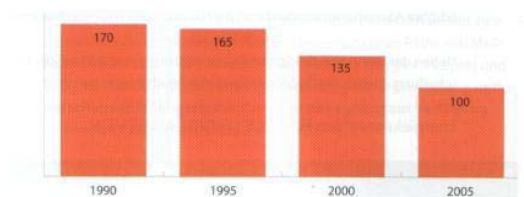
## Buildings from Austria

### ***Metering History – Lower Austria region***

The Lower Austrian government has different departments, which are responsible for their energy consumption. The district administration buildings (21 altogether in Lower Austria) are managed by the department „Geschäftsstelle für Energiewirtschaft“ in energy reasons. Since 2002 this buildings are controlled by the energy accounting intranet system of the Energy Agency Waldviertel. Before this time, since 1983, the „Geschäftsstelle für Energiewirtschaft“ controlled the energy consumption data by sheets and spreadsheet evaluation.

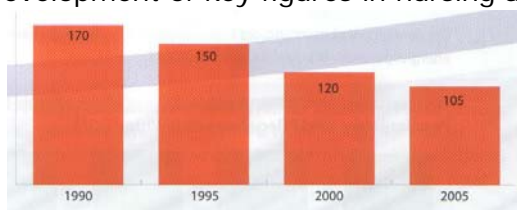
The nursing and older people homes of the Lower Austrian federal state evaluate their energy consumption by themselves. There is some existing data, but there is no extra energy accounting system used till now. The data are manually collected. There are 54 nursing- and elderly people homes in Lower Austria. The water consumption was not controlled until now in a strict way.

Development of key figures in administration buildings



Enhancement of key figures occurs because of renovation and new buildings.

Development of key figures in nursing and older people homes.



### ***Metering History - Grossschönau region***

Großschönau is since 2000 a "climate alliance municipality". It has committed itself to reduce CO<sub>2</sub>-emissions and act as a relevant local example. The mayor of Großschönau is responsible for meeting these targets and for the financial budget of the municipality. In this function he is aware of the running costs and emissions of the public buildings caused by heating and electricity. Once a year the running costs of the buildings get presented to the municipal council for approbation. Therefore the amount of consumed heating energy and electricity has been collected manually so far and compared in excel-sheets and diagrams. The documents used for the compilation were usually bills.

By metering the consumption of water, heat and electricity and publishing to results we will assure that not only the municipal council is aware of the costs of the used energy but also the originators of the energy consumption. Auxiliary we expect simplification within the energy budgeting process.

## Input for savings identified - Energieagentur Waldviertel

In the following, a number of points have been added that were brought up at the individual training meetings with the technical staff following after a period of monitoring, so that the advice could be given based on the actual consumption in the buildings.

So far, the energy management department has manually collected the consumption figures for the buildings included in this project, which is time consuming. By collecting the data automatically and displaying them via the web, it hopefully enhances the awareness on energy and water consumption from the building users and thereby, it will be possible for the county to decrease the consumption to the estimated level.

### Heating:

- ✓ During the trainings, we try to increase the awareness for energy consumption and energy savings.
- ✓ Everyone is responsible for his working place; due to everybody can control the temperature with the radiator thermostatic valve. It is necessary that everybody knows how to deal with the right ventilation. Wrong ventilation generates energy losses.
- ✓ If there are problem with the temperature, we advice to meter the temperature, to control the temperature and to adjust the temperature with the radiator thermostatic valve to regulate the temperature, not with the ventilation.
- ✓ The temperature after opening hours and on weekends is reduced.
- ✓ Rarely used rooms are only tempered. We advice to reduce the temperature.
- ✓ We control the difference between the outside and inside temperature. We would like to avoid over-heating in transit times (in Austria April-May and September- October). We vary the heat adjustments of the boiler.
- ✓ Boiler settings were not adapted to the requirement of the building users. The boiler temperature was too high, therefore there were increased losses.
- ✓ We optimised the hot water circulation, we adjust the time control. Therefore the losses are minimised.
- ✓ We reduced the temperature of hot water, the losses in tubing losses are minimised.
- ✓ In most building are heated with the aeration, this is very energy intensive. We adjust the settings; therefore we achieve high energy savings.
- ✓ The IT rooms are air-conditioned. There is no thermal detachment. That means there is an exchange of warm and cold air. This means increased energy consumption. We advice to apply a door brush, to realise the thermal detachment.
- ✓ The solar power plant for hot water in Wr Neustadt does not work well. We control the settings, and found out that a valve was out of order.
- ✓ Because of the energy consumption data of Wr Neustadt, that the control and communication system does not work well. There was no reduction at weekends and after working hours. Because of our calculations, the administration will substitute the control system earlier then scheduled.
- ✓ We advice to insulate the roof or suspended ceiling to reduce energy consumption.
- ✓ It is necessary to maintain the boiler and the heating system. Only a maintained system is energy efficient.
- ✓ We placed posters concerning ventilation and heating, and our red and green points to call attention. We also inform the staff, how much energy they use every day and how much could be saved.

## Electricity:

Higher than expected out of hours consumption has been seen. This has suggested an area for possible saving opportunities.

- ✓ Everyone is responsible for his working place, to switch off the lights, if there is enough daylight, to switch off monitors and computers, and so on.
- ✓ Control the settings of the aeration. Adapt the running hours to opening hours.
- ✓ Refrigerator should be switched-off in room if they are not used.
- ✓ Exterior lightning was only control through a twilight switch, now the lightning is controlled through a clock timer, the outside lightning is switch off at 10 pm. This saves 50 % energy and a lot of maintenance costs, because the endurance increases.
- ✓ The lightning in cellars and public accessible rooms was switch on constantly. We advice to install an off-delayed specified time all-or-nothing relay.
- ✓ Exchange of tungsten lightning, install energy efficient lightning
- ✓ Switch off electrical equipment, not leave them in stand-by. Especially computers: There is a possibility to adjustment the computer (over settings)
- ✓ Maintenance of refrigerators → pollution of heat exchanger, therefore the energy consumption increased. We advice to clean the exchanger.
- ✓ The temperature in air-conditioned IT rooms increased.
- ✓ We put red and green points at different places, e.g. toilets to switch off the light, at copiers to switch off after opening hours. We support the points by posters with explanations
- ✓ If possible, not to switch on lights near windows, if there is enough daylight.
- ✓ Switch off coffee machines, like SAECO, because they need a lot of energy to heat the water
- ✓ In case of new acquisition, have a look at the energy label, buy only energy efficient equipment
- ✓ we adjust the settings of heating pumps (number of revolutions)
- ✓ Giving information about the usage of dishwasher. In administration buildings there are for example three dishwashers, in every dishwasher there are only 5 cups every day. We advice to use synergies, for example usage of only one dishwasher.
- ✓ We advice to install motion detectors, for example in toilets or corridors.

## Water:

- ✓ We use red and green points in toilet to call attention. We ask to use the stop button that less water wasted through the sewer.
- ✓ We advice to use flow limitation, to waste less water. Water savings without big investments!
- ✓ Because of Intelligent Metering, administration building in Amstetten found out that there was a big loss of water over a long time period (Running toilets and a leakage at a valve)
- ✓ High consumption at non opening hours. Reasons: Washing the cars, flat in the administration buildings, and so on)
- ✓ If possible, we advice to use process water for toilets and so on instead of potable water. In nursing and older people homes, this could be a problem, because it has to be sure, that there is no danger for humans health (pollution, germs,...)

## Input for savings identified - Sonnenplatz

In the following, a number of points have been added that were brought up at the individual training meetings with the technical staff following after a period of monitoring, so that the advice could be given based on the actual consumption in the buildings.

### Heating:

Because of the actual consumption the heating system was checked if they are running properly.

- ✓ In the Gymnastic Hall the airing system was running without a linkage to the using hours based on the outside temperature. The technical staff registered this waste of energy and changed the settings of the airing system.
- ✓ In the Kindergarten the key figures are worse than others because the building has a bad a/v-ratio and a lot of large windows in all directions. The heating system includes a floor and wall heating system, which settings were optimized. The users were not aware, that this special kind of heating system is very indolent and therefore a change of the room temperature can't be achieved quickly. This was an important learning for them because now they are using the additional heating system and don't change the settings of the floor and wall heating system any more.
- ✓ We recognized in the Town Hall and the Public School that the heating system was used almost perfectly and few optimizations could have been achieved.

### Electricity:

This part was the most important for the regular users of the buildings. Almost no person was aware of the actual costs of kWh or 1 Watt of energy continuous used for one year (very interesting to show how much stand-by-energy costs):

- ✓ Green and red dots are in use to show the users good and bad energy consumers.
- ✓ The cleaning staff got a warning sign which is placed on computers or on teacher desks when they forgot to turn the light off or to switch the computer off.
- ✓ Within the building tours with the users we identified some light switches which are easy to forget. We agreed in exchanging them with time-controlled switches.
- ✓ Almost every computer workstation got a new power supply with a single-out switch for energy reasons and for security reasons (lightning ...), too.
- ✓ The above mentioned new setting of the airing system in the Gymnastic Hall also has an impact on the electricity use.
- ✓ Within the Public School we identified two fridges which were running the whole year (also during holidays) and were situated on warm places with some sunshine. They are now regularly plugged off and their position has been optimized.
- ✓ The increasing number of electricity consumption is unfortunately due to an increased demand because of new energy consumers. Within the Public School a complete classroom has been equipped with new computers for the children (15 workstations), and of course the necessary infrastructure (laptop, beamer, printer, switches, modems...) and the other three classes got 2 – 3 workstations each. The administration of the Kindergarten got a further workstation and new devices, the Town Hall got a better server, an additional workstation and a large Xerox-machine. So even with improvements in the infrastructure and energy efficient new devices, the key figure for electricity is increasing.

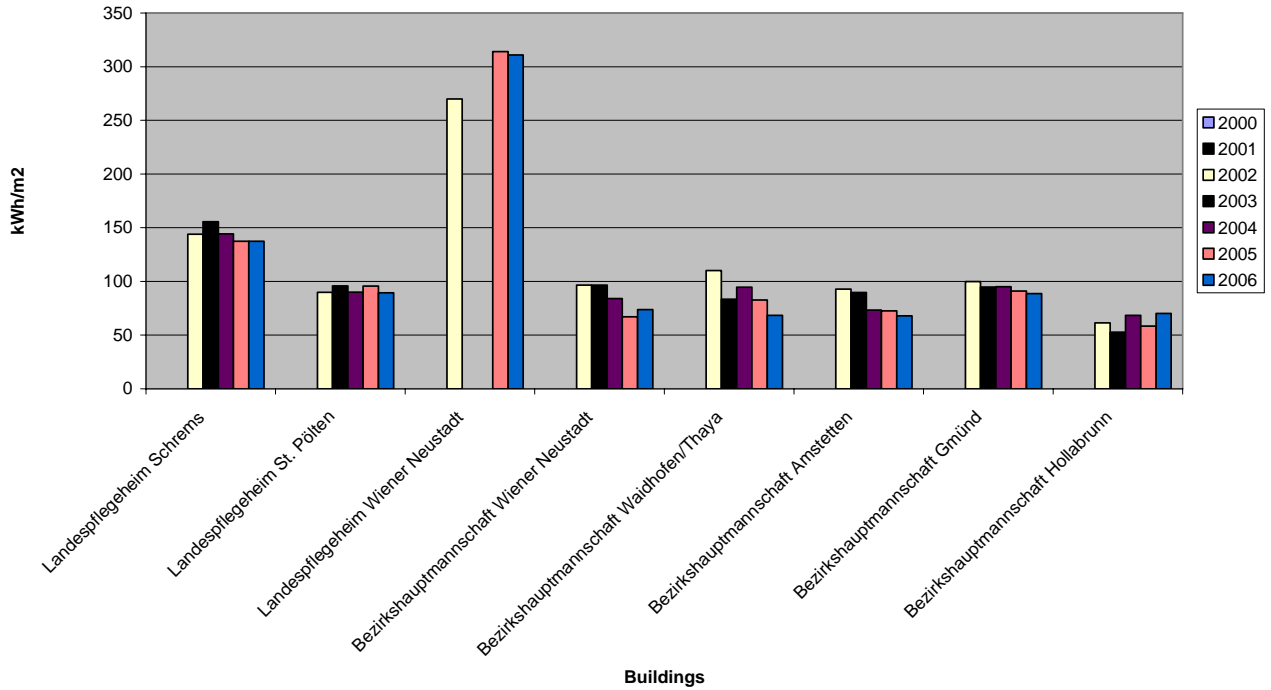
### Water:

The water consumption was in general on a very good level in the buildings:

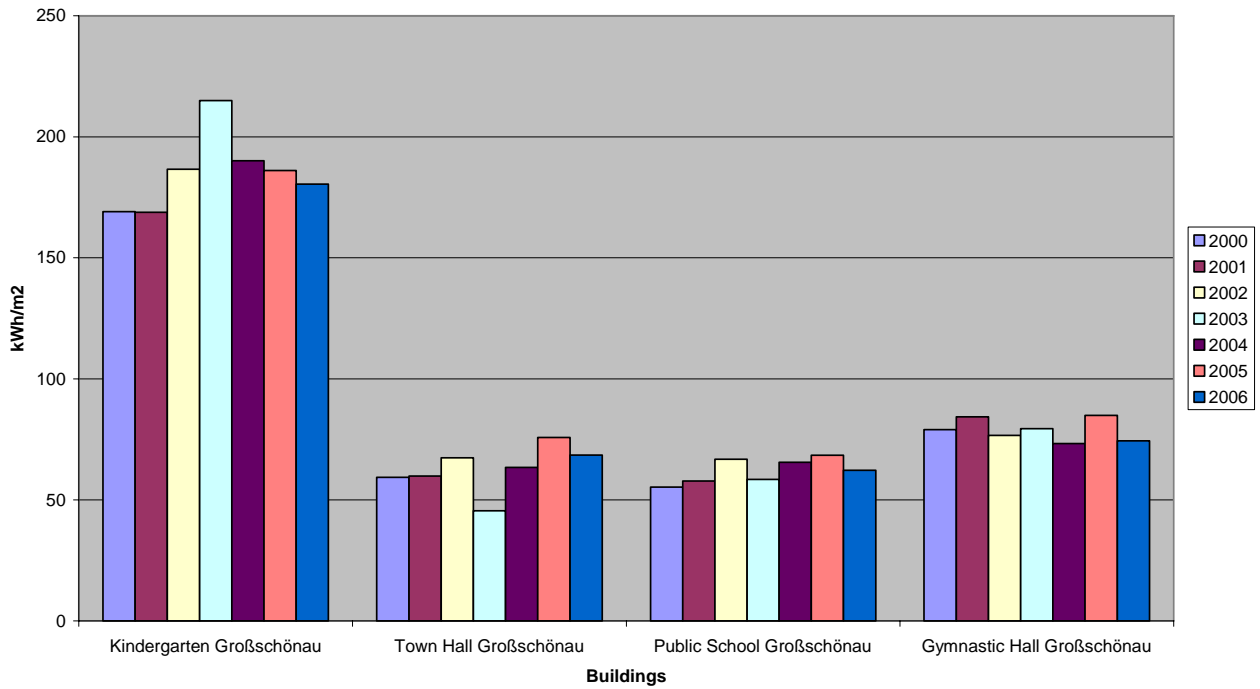
- ✓ Almost all of the water is used for cleaning and watering plants (especially in the Public School with a large atrium).
- ✓ No running toilets or other bad infrastructure has been identified.

# HEATING OVERVIEW

Austria Waidhofen, Gross Heating, kWh/m<sup>2</sup>

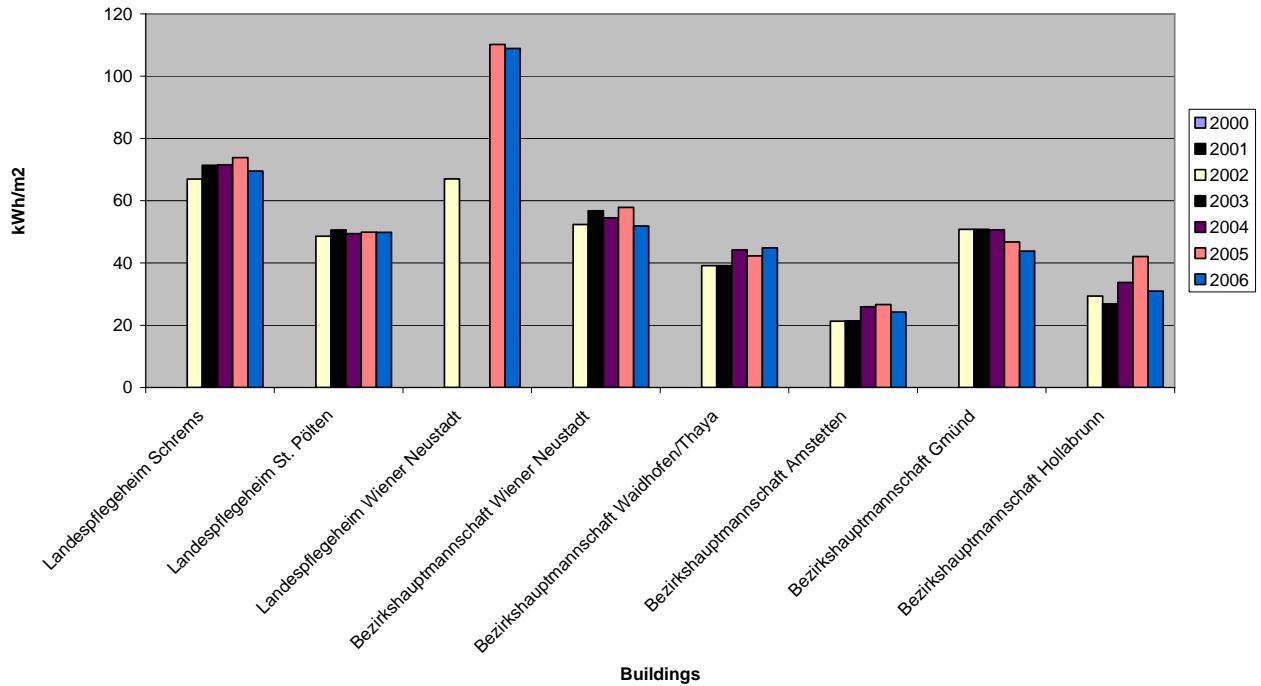


Austria Sonnenplatz, Gross Heating kWh/m<sup>2</sup>

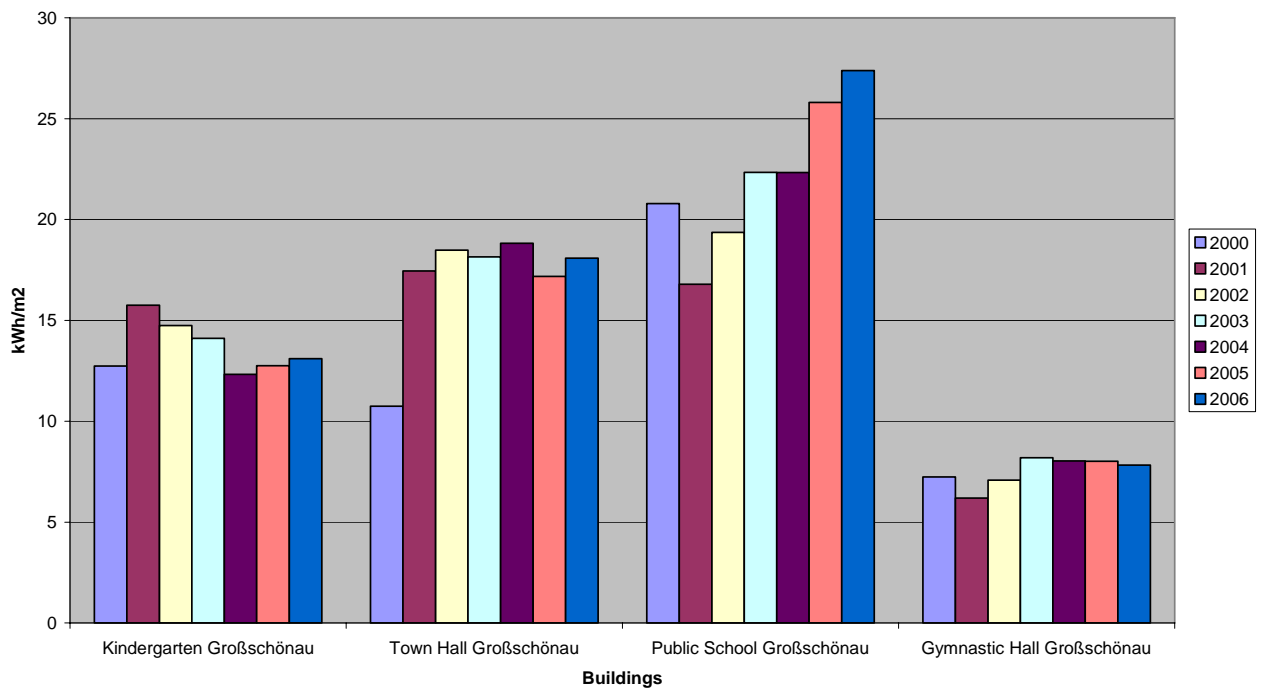


# ELECTRICITY OVERVIEW

Austria Waidhofen, Gross Electricity, kWh/m<sup>2</sup>

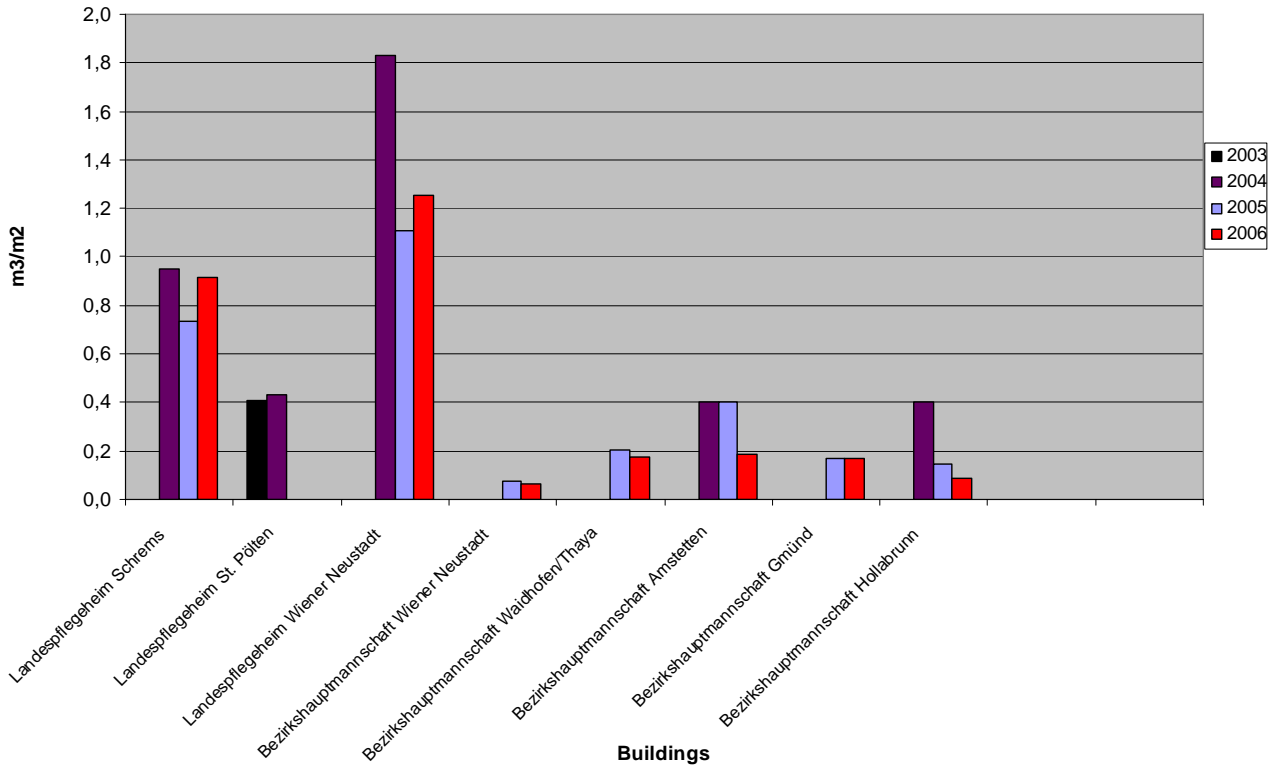


Austria Sonneplatz, Electricity kWh/m<sup>2</sup>

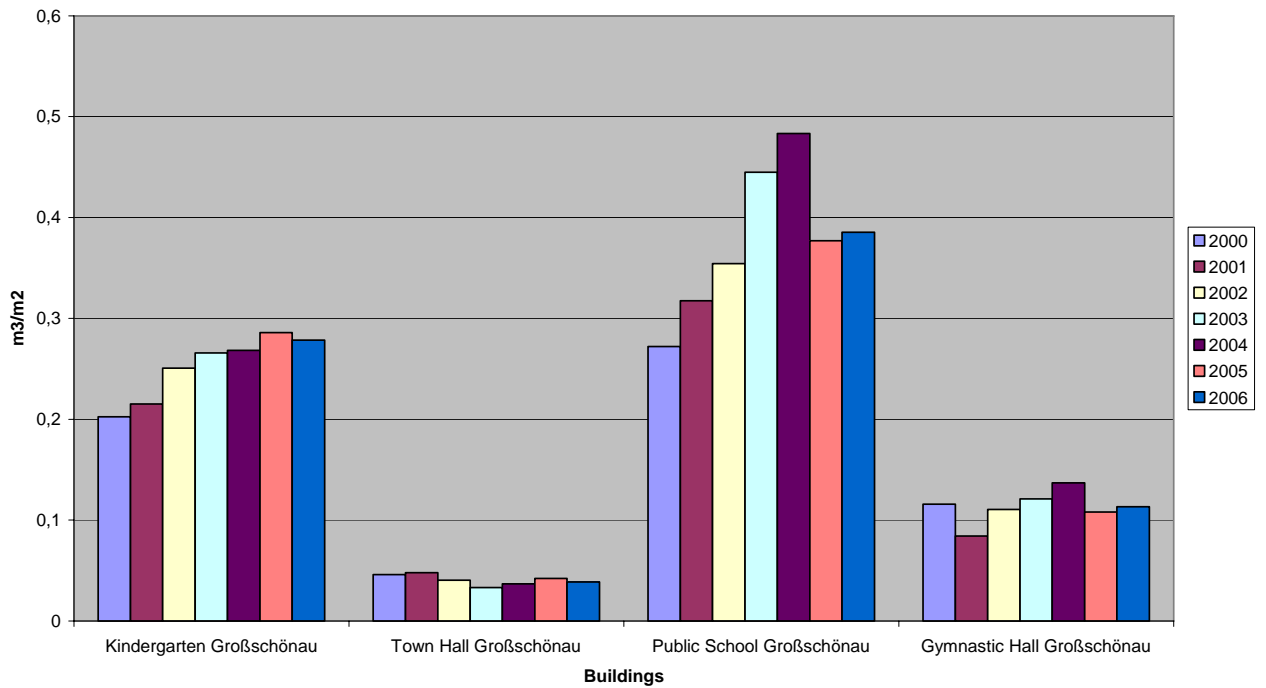


# WATER OVERVIEW

Austria Waidhofen Gross Water m3/m2



Austria Sonnenplatz, Water m3/m2



## **Buildings from DK**

### ***Metering History – County of South Jutland***

Since the mid-1990's it has been the norm to carry out energy management of buildings. For the County of South Jutland, the goal has been to bring down energy and water consumption in a large part of the public buildings by surveying the development in consumption and by clarifying the consumption figures to the building users. The energy policy for this county is specified for the period 2003-2008, where the goal is to bring down the key figures to the following:

-Heating: 156 kWh/m<sup>2</sup>  
-Electricity: 57,3 kWh/m<sup>2</sup>  
-Water: 0,60 m<sup>3</sup>/m<sup>2</sup>

So far, the energy management department has manually collected the consumption figures for the buildings included in this project, which is time consuming. By collecting the data automatically and displaying them via the web, it hopefully enhances the awareness on energy and water consumption from the building users and thereby, it will be possible for the county to decrease the consumption to the estimated level.

### ***Metering History – County of Vejle***

The aim in the County of Vejle is and has been for some years to promote a sustainable development and work actively towards preventing environmental problems in relation to the work of the County.

Including the environmental considerations should be a natural and important thing in the everyday activities. The County will thereby play an important role to ensure a clean environment for future generations

The county is committed to the following:

- Estimate the environmental relations for all general works in the county including building management.
- Reduce consumption of resources and waste
- Buy environmentally friendly products and services.
- Enhance the sustainable consciousness amongst the employees, and to educate and train the employees to prevent environmental problems
- As a minimum to abide by the existing rules and regulations for this area
- Ensure continuous improvements

## Input for savings identified - DK

In the following, a number of points have been added that were brought up at the individual training meetings with the technical staff following after a period of monitoring, so that the advice could be given based on the actual consumption in the buildings.

### Heating:

There have been some adjustments in the Building Management System (BMS) in order to save energy.

- ✓ After school hours the temperature goes down to 17 Degrees Celsius
- ✓ A decrease in the difference between the indoor and outdoor temperature has reduced the peaks on the graphs
- ✓ The Control system does not reduce the heat for the weekend until Saturday, which could be brought forward to the Friday afternoon

Further improvements have also been established at this personal meeting:

- ✓ The auditorium has a preheated FREMLØB, running all the time in order to reduce the amount of time it would take to heat up this large area. This will be checked as it seems that the unit has produced a lot of heat over the summer holidays
- ✓ Most of the Danish building receive the heating supply from a district heating system, and is also used as hot water heating. Therefore, the amount of heating is also reflecting the need for hot water. As the building is used by many people, the hot water consumption in the kitchen is vast. This was pointed out, but difficult to minimise as the staff is already aware of this fact and make an effort to decrease the hot water consumption.
- ✓ Buildings with a heavy structure and thick brick walls keep the heat in the building very well. However, in the summer time, the building is difficult to cool down over night, so what is saved in heating, is used for electricity to cool down the building! This was pointed out for some buildings, as a reason for the increase in electricity over the summer period. It was suggested to install blinds over the windows to minimise the heat from daylight in the summer,
- ✓ The building needs to erect more sensors in the classrooms in order to be able to run the building Management System on actual values. For example, the heating sensor can be placed in classrooms that are rarely used, and can therefore be informing the BMS to add heat in all classrooms, but this may not be needed in the rooms where there are students that give off heat or in the new building that is insulated better.

### Electricity:

Since the beginning of the Intelligent Metering project, following improvements have been carried out:

- ✓ The students now turn on the classroom lights themselves on arrival in stead of the administrative staff, which means almost an hour saved in electricity
- ✓ The PC's have been changed little by little into flat screens instead
- ✓ Furthermore, some of the electricity consumption over the summer holidays is due to repair works of the school
- ✓ When the meters where installed to monitor the electricity consumption, it became clear that the previous monitoring system in some buildings had been counting wrong so the figures where showing a higher number than actually consumed, which altered the bill.
- ✓ Server rooms had previously been going through a thorough improvement regarding energy consumption. In connection with the Intelligent Metering project, natural ventilation was added to use as much as possible during the cooler period of the year and then supplemented with air condition when the temperature difference between the

inside and outside is minimum. This is switched on automatically with a temperature monitor.

- ✓ Administrational buildings have been equipped with additional hardware servers from other councils nearby, as they are integrating the systems for 2007, so this has caused an increase in electricity consumption compared to previous months, particularly noticeable in the standby consumption, which has increased with approximately 50%.
- ✓ Some buildings cover a large area, and it has therefore been suggested to the administration, that more heat and light sensors are installed. This way, the building can be divided into several sections and base the energy consumption on actual user needs when they are in the building.
- ✓ Many classrooms now have sensors on the lights, so when there are no students in the classroom, it turns off automatically. This has decreased the electricity consumption.
- ✓ Some of the classrooms used the lights also during the day, which should not be necessary, so it was decided that some of the plantation outside needed to be trimmed in order for the natural daylight to enter the classroom much easier.
- ✓ In the effort to save energy, some of the rooms seemed very dark due to the low lux-value chosen for the lighting system. This had caused an increase in small lamps on desks to supplement the main light in the ceiling. It was discussed to increase the lux value in the ceiling in order to save on the amount of small individual lights, which can be very energy consuming.
- ✓ In general, roof lights needed a thorough clean in order to give off the proper light in the classrooms. There were several individual lights installed as a compensation for the ineffective light, however, these could be saved if the roof lights were improved.
- ✓ The stand-by energy consumption was discussed and it was pointed out that it is possible to set up each computer to turn off automatically after a certain amount of time. In this way, it is not necessary for the students to have to remember to switch off, which has been an issue at some schools.
- ✓ One kitchen had a separate water boiler, running on electricity, which has now been connected to the district heating system instead and thereby saves on the electricity consumption.
- ✓ The building was suffering from moist problems, which also causes an increase in electricity consumption, as a number of de-moisturisers had been installed. It became clear that a few drains needed to be cleaned, so that the water outside would not run into the building.

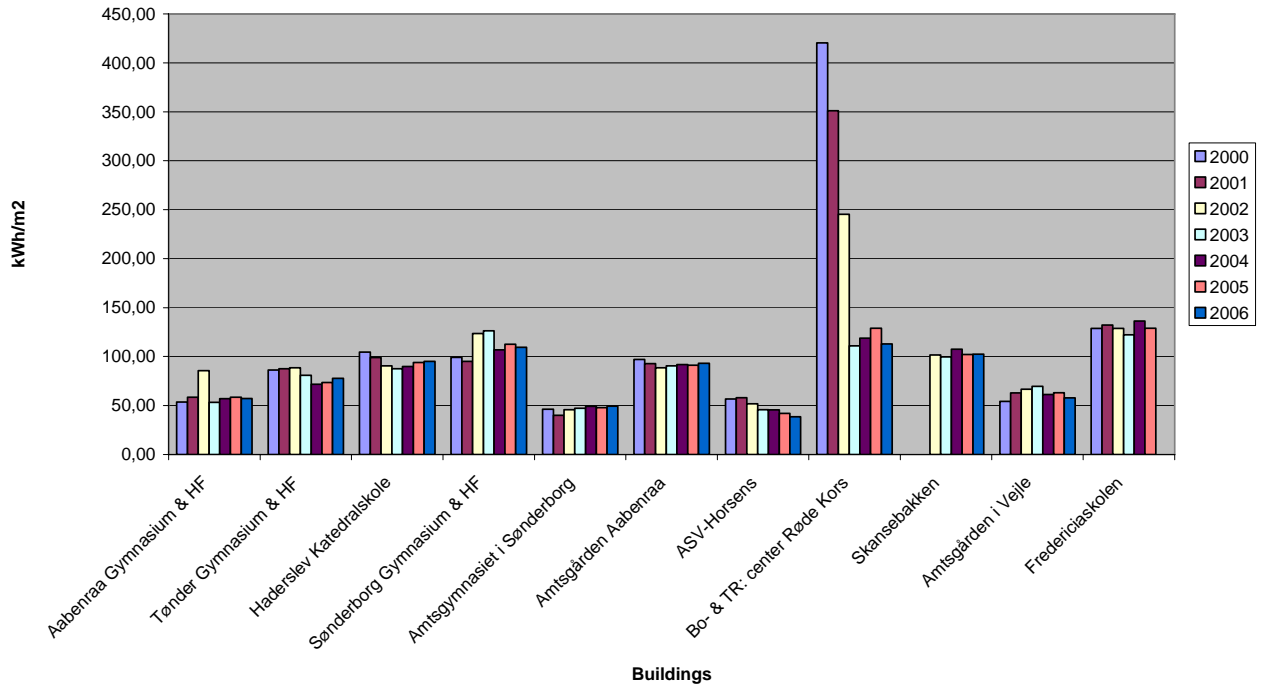
## **Water:**

The water consumption was in general on an acceptable level in the buildings, and would need further investments for example in water saving toilets.

- ✓ In one high school, 17 out of 45 water-saving toilets have been installed in week 7, 2006, (mid-February), which has reduced the overall water demand from 300-400 m<sup>3</sup>/month in February 2005 to around 70 m<sup>3</sup>/month in February 2006

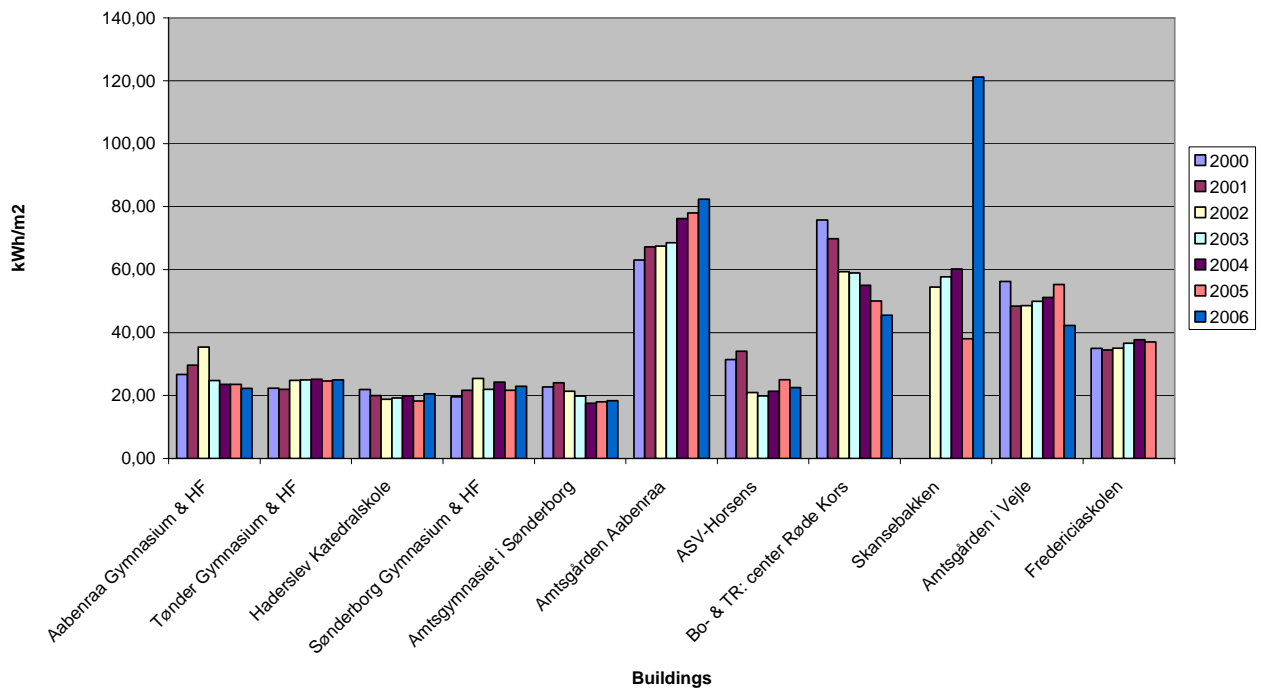
# HEATING OVERVIEW

Denmark, Gross Heating kWh/m<sup>2</sup>



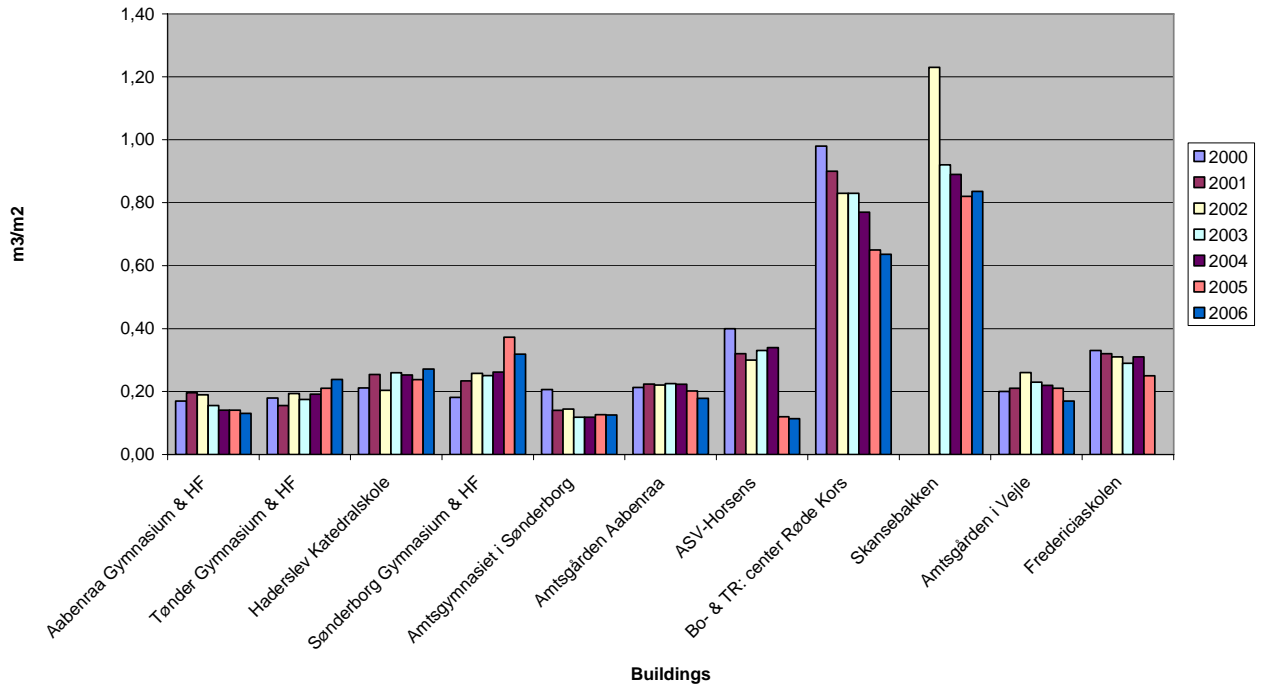
# ELECTRICITY OVERVIEW

Denmark, Gross Electricity kWh/m<sup>2</sup>



# WATER OVERVIEW

Denmark, Gross Water m3/m2



## **Buildings from UK**

### ***Metering history - Leicester City***

Leicester City Council has a target of reducing the council's total building energy consumption to 50% of the 1990 level by 2025. The City Council has monitored the energy use of the council's buildings for a number of years.

The Council has used a computerised Energy Accounting System to store, process and analyse billing information. From this it has been possible to identify an exception in cost or consumption at a building, and take corrective action before it becomes too expensive. The use of energy has also been normalised for variations in weather and floor areas from year to year. The system has enabled targets to be set accurately, which has helped in planning budgets and forecasting expenditure. It has also been helpful in evaluating the savings from investment projects.

Also, Leicester has used computerized Building Energy Management Systems (BMS) to provide sophisticated on-line monitoring of selected remote sites to provide up-to the-minute reports of consumption and operating status.

While the City Council's energy monitoring systems have traditionally been based around billing data provided by the utilities, this type of system can only detect an increase in consumption 2 or 3 months after it occurs. Also, it was found that the deregulation of the energy markets has made it more difficult to obtain accurate, reliable energy data and manual reading of meters presents a practical problem. Therefore the Energy Management Section investigated intelligent metering systems that could capture real time data.

In recent years intelligent metering equipment has been installed in a number of Leicester City Council's buildings. The intelligent metering system uses low power radio to automatically transmit meter readings to a central receiver/data logger, avoiding the need for conventional hard wiring. The meter reading data is then automatically downloaded to a computer at the Energy Efficiency Centre, where it is analysed.

## Input for savings identified - UK

The intelligent metering graphs have been reviewed for possible savings opportunities. Also, some possible energy saving opportunities have been identified at the individual training visits to different buildings.

### Heating:

There has been some gas baseload noticed on an intelligent metering graph when the weather was becoming warmer which has been a possible saving opportunity.

A heating profile for a school changed from continuous use of heating for a couple of weeks to normal consumption and then to continuous heating again. This indicated a saving opportunity (due to faulty pumps).

For some buildings a higher than expected out of hours consumption, over a holiday period, has been noticed. For example, a gas profile for a school showed the use of heating over the summer. This was found to be due to incorrect heating control settings.

- ✓ In some buildings there may be an opportunity to ensure furniture, etc. is not blocking heaters.
- ✓ It has been found that windows can sometimes be left open when heating is on.
- ✓ In some buildings some outside doors were being left open.
- ✓ It would be possible to add some draught proofing on an external door to reduce air gaps.
- ✓ There could be possible improvements to the zoning for heating in one building
- ✓ Checks can be made to ensure the Building Management System is set correctly (e.g. to avoid overheating).
- ✓ In a swimming pool, consideration could be given to the use of a pool cover, and variable speed drives for ventilation.
- ✓ In one building a long pipe run from the water heater to the major user was identified. Consideration can be given to whether it is appropriate to install a new heater.
- ✓ For one site, there could be a possibility for using roof insulation or a suspended ceiling in depot stores with an air curtain/roller shutter doors to make it easier to heat.
- ✓ In one building an opportunity for insulating flanges/valves in the boiler room has been identified.

### Electricity:

In some cases a high electricity baseload has been noticed from the intelligent metering graphs. Higher than expected out of hours consumption has been seen. This has suggested an area for possible saving opportunities.

- ✓ In some buildings it could be possible to not switch all lights on at the start of the day.
- ✓ In some buildings the person spoken to believed it was best to leave fluorescent strip lighting on all day rather than switch it off when not needed.
- ✓ Consideration should be given to the use of energy efficient light fittings when they are being replaced.
- ✓ Some tungsten light bulbs could be replaced by energy efficient compact fluorescent light bulbs.
- ✓ There has been potential for savings on lighting from the use of lighting sensors.
- ✓ In some cases, consideration could be given to replacing high wattage tungsten light bulbs.
- ✓ In some buildings consideration could be given to whether rewiring of switches was appropriate to give greater control over which lights are switched on or off.

- ✓ There is scope for labeling some lights in schools to show which can be turned off.
- ✓ There is the potential for using light pipes in some buildings (e.g. with refurbishment of a corridor).
- ✓ The use of solar window film instead of blinds could be considered in one school to keep out bright sunlight.
- ✓ Computers can be set to energy saving mode when not in use, and switched off when not in use for long periods.
- ✓ It can be ensured that photocopiers are switched off at the end of the day, perhaps considering the use of a timer unit.
- ✓ There has been an opportunity to avoid leaving equipment on standby.
- ✓ An electric water heater was found which could be switched off manually or have a timer unit fitted.
- ✓ There could be an opportunity to replace an old fridge with an energy efficiency version.
- ✓ There may be the possibility of using an energy saving savaplug with refrigeration.
- ✓ There could be a saving from advising buildings users on not filling kettles more than is needed.
- ✓ Some vending machines could be switched off at night
- ✓ In one school there was scope for arranging automatic control of extractor fans.
- ✓ Building users can avoid using air conditioning when the window is open, so allowing warm air in.
- ✓ There may be an opportunity to ensure that air conditioning is switched off when not needed.
  
- ✓ There has been scope for increasing staff and building user energy awareness.
- ✓ Energy efficiency can be planned into routine repairs and upgrades by maintenance staff.

## **Water:**

For some buildings a water baseload was noticed on the intelligent metering graphs which there may have been an opportunity to reduce. Unusual water consumption showing a possible water leak has been noticed.

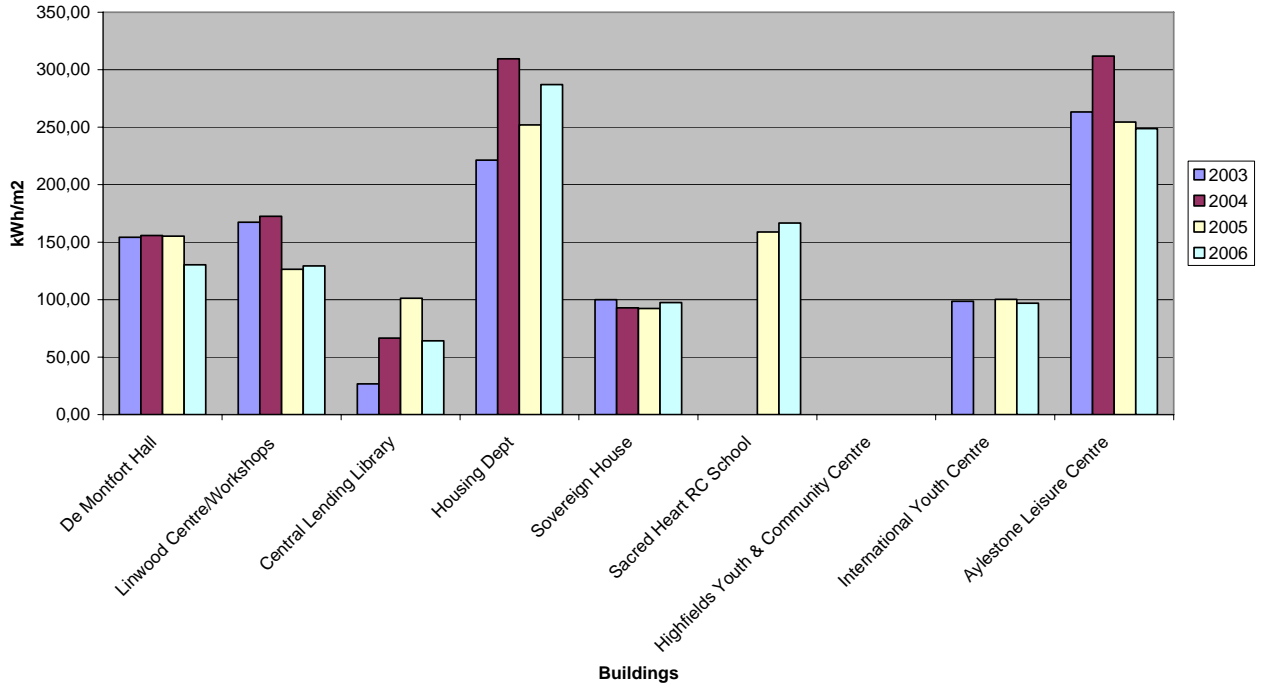
- ✓ A few buildings had the possibility for water savings by using push taps.
- ✓ There have been possibilities for using flush controls in some toilets.
- ✓ In some cases, some taps have been left on when not needed.

There have also been examples of energy and water efficiency measures and practices in the buildings visited which could be considered in other buildings. For example:

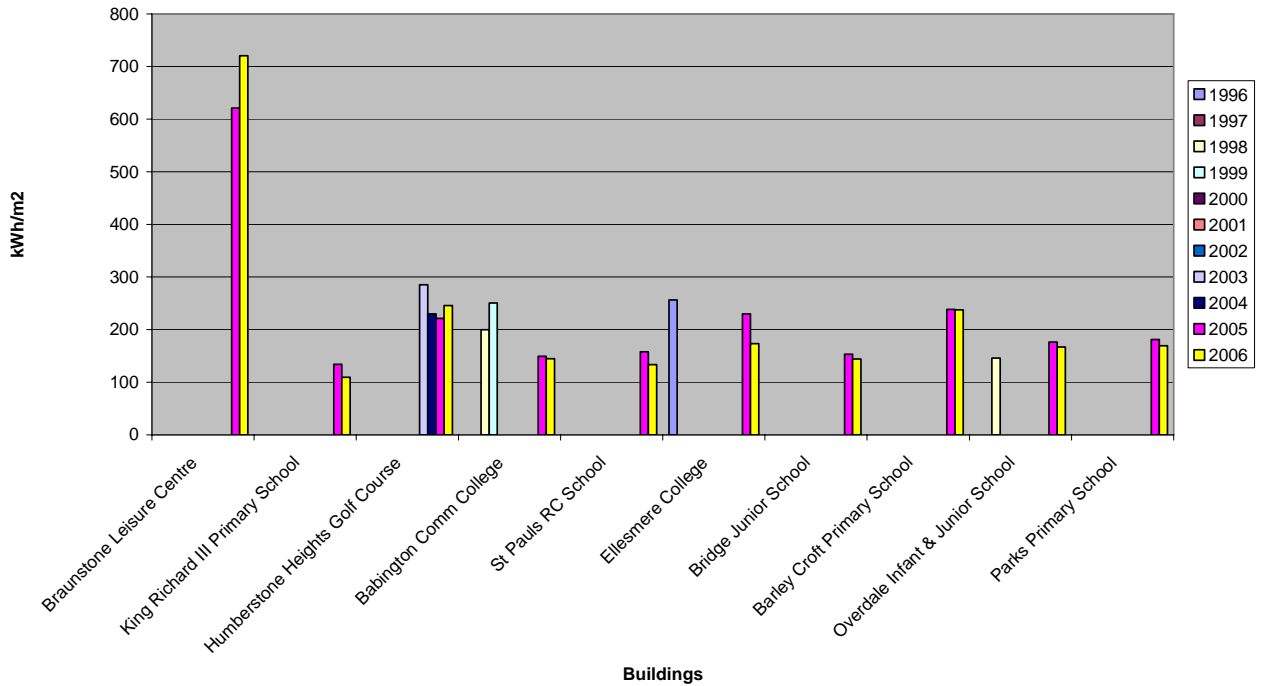
- ✓ Lighting sensors used
- ✓ Energy efficient fluorescent tubes used
- ✓ Light pipes, bringing natural lighting into building, used
- ✓ In one school the Business Manager sends an email to staff who leave their computer on.
- ✓ Pupils switch off computers
- ✓ Old computers recycled for use in community
- ✓ Flat screen monitors are used with computers
- ✓ Rainwater harvesting system used
- ✓ Flush controls used in toilets
- ✓ Energy aware staff who try to reduce energy use where possible
- ✓ Energy and water using equipment switched off when not needed (e.g. instantaneous water heater)
- ✓ E-Team with EMAS in certain schools

# HEATING OVERVIEW

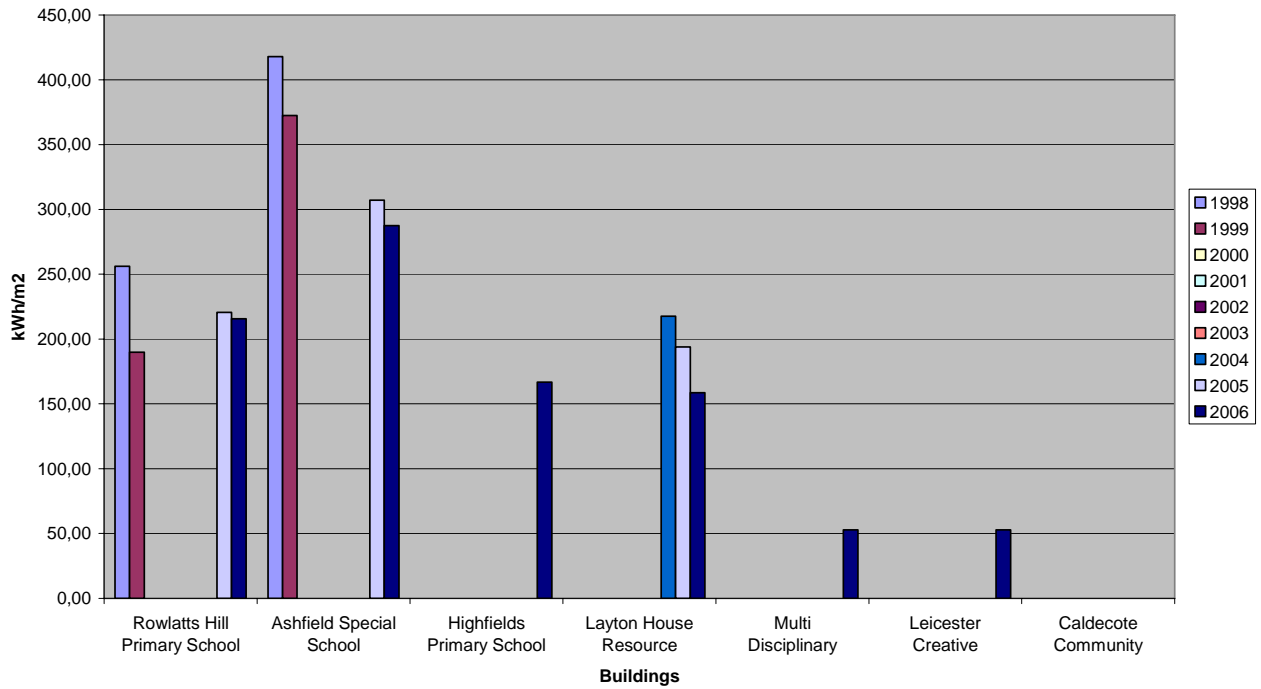
UK, Gross Heating kWh/m2



UK, Gross Heating kWh/m2

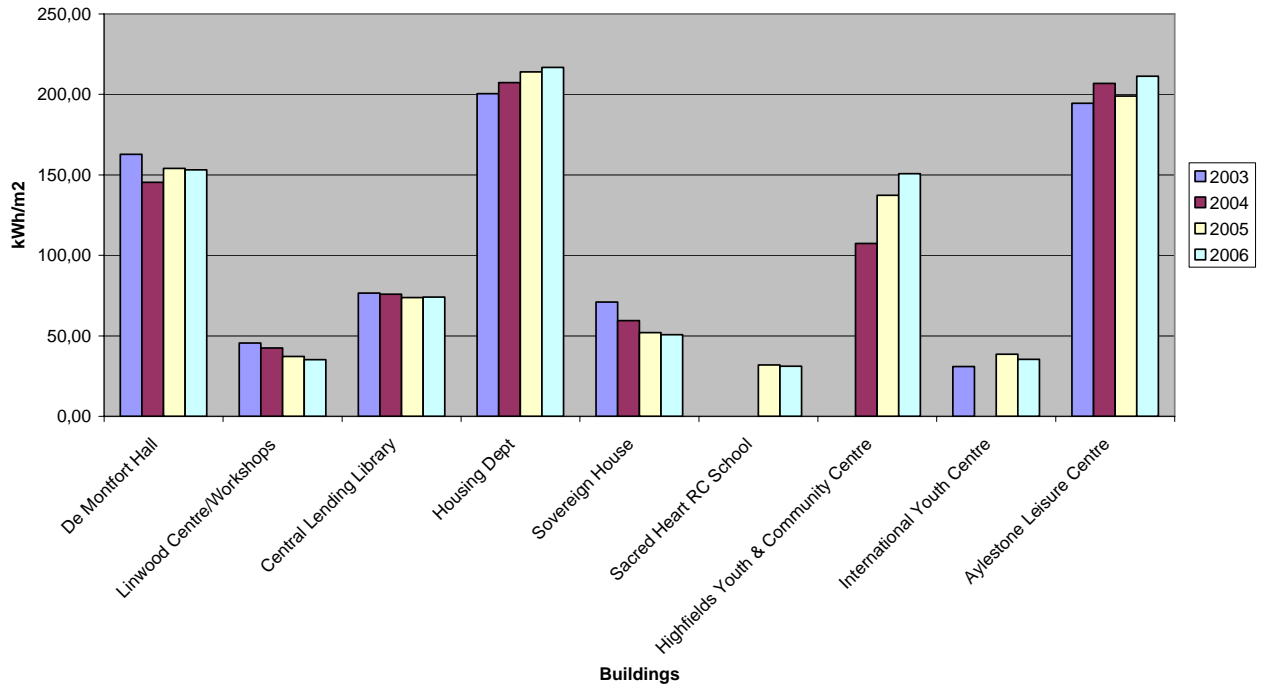


### UK, Gross Heating kWh/m2



## ELECTRICITY OVERVIEW

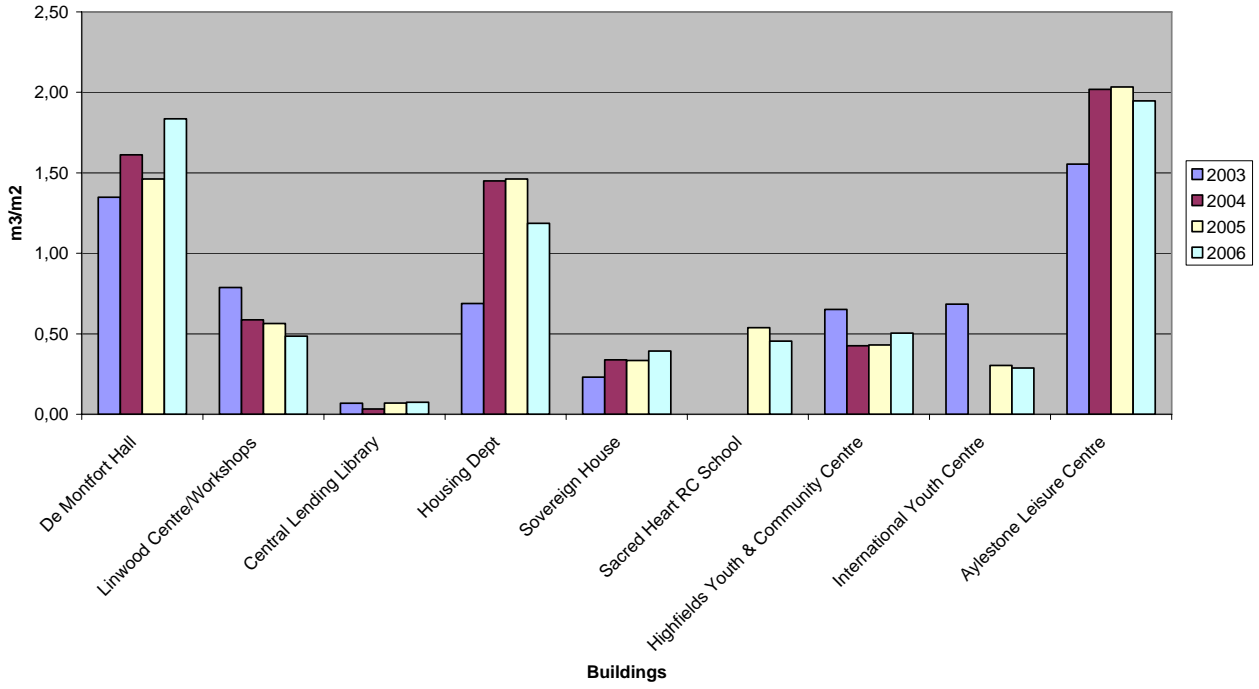
### UK, Electricity kWh/m2



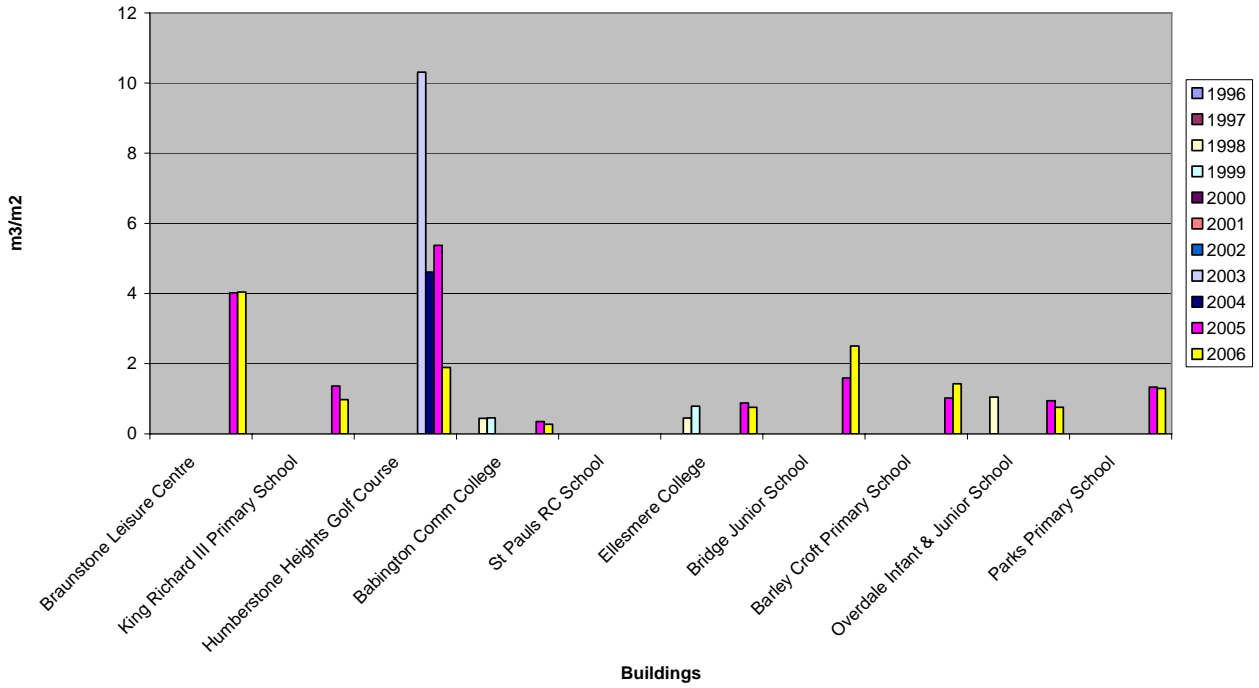


# WATER OVERVIEW

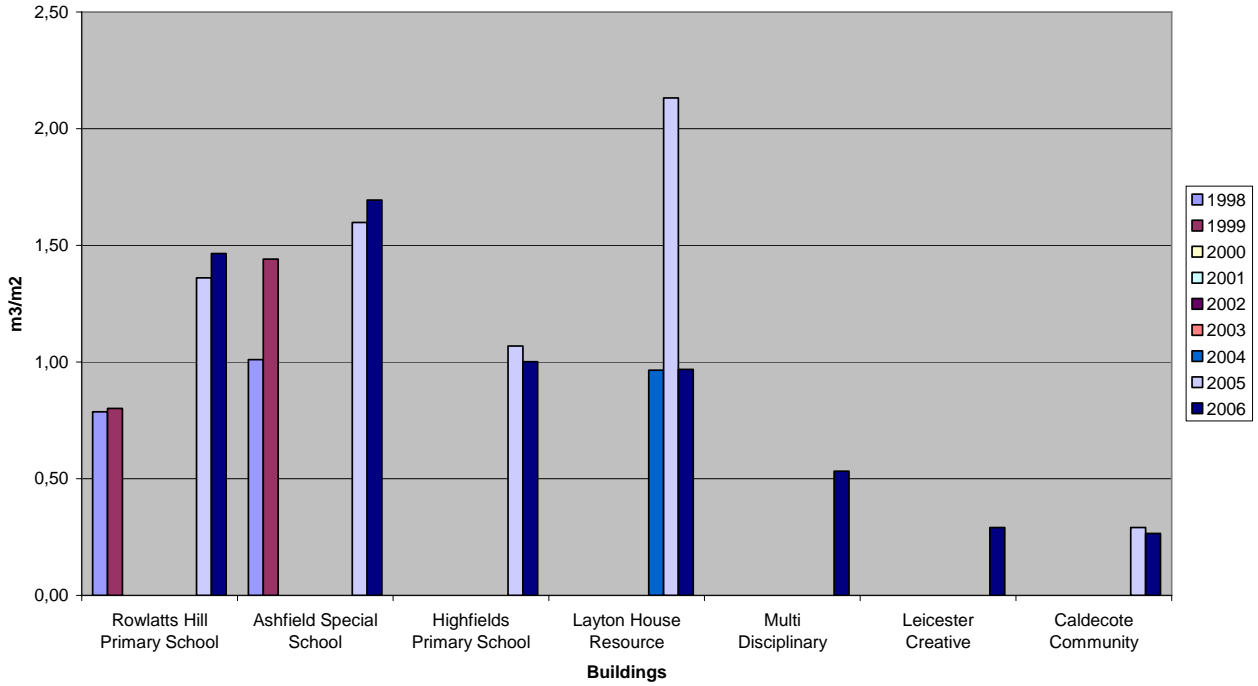
UK, Gross Water m3/m2



UK, Gross Water m3/m2



**UK, Gross Water m3/m2**



Schools receive their own energy bills but this information is not provided to the Energy Management Team at Leicester City Council. The above graphs show consumption information for schools obtained from intelligent metering for recent years, and where available some data from energy bills from previous years. Some buildings are new buildings (e.g. Multi-disciplinary centre for homeless people) and so less data is available for these.

Actual floor area data has not been available for some buildings. For example, floor areas have been estimated for the Linwood Centre, Highfields Youth and Community Centre, International Youth Centre, Multi Disciplinary Centre for Homeless People, the Leicester Creative Business Depot, and Braunstone Leisure Centre.

## **Buildings from Germany**

### ***Metering history - District of Kassel***

The district of Kassel started with energy management in 1993. From that time all monthly meter readings and also all energy bills were recorded in an oracle-based database. All building areas were checked and registered at that time. The responsibility for this work is at the department of energy-management of the council. Up till now the work is entered manually to spreadsheets. The basis of data is sometimes very poor because there are no meters for every building.

In 2005, the district council has started to install electronical meters for half-hourly meter-readings, at first as heat meters in the new built wood-energy plants. The utility companies gave the access to look on their database, were they collect the quarter-hourly meter readings for electricity.

In the buildings of the communities and commercial buildings there is no energy-management at all. Up until now, the energy consumption is only checked by looking at the bills.

## Input for savings identified - Germany

In the following we point out some of the saving potentials we identified and savings we practised during the Intelligent Metering project.

### Heating:

- ✓ The temperature of the heating system had been reduced
- ✓ The difference  $\Delta t$  of the heating circuit was increased
- ✓ The beginning of the heating time on Mondays was put to a later time
- ✓ In some rooms new valves were replaced by new thermostatic valves
- ✓ Ventilation systems were switched off in the afternoon during cleaning works instead running up to the evening time
- ✓ The using times of warm- water circulation systems were reduced
- ✓ Pupils were advised to open windows shortly full in the breaks and not with a small opening all the time.

### Electricity:

Since the beginning of the Intelligent Metering project, following improvements have been carried out:

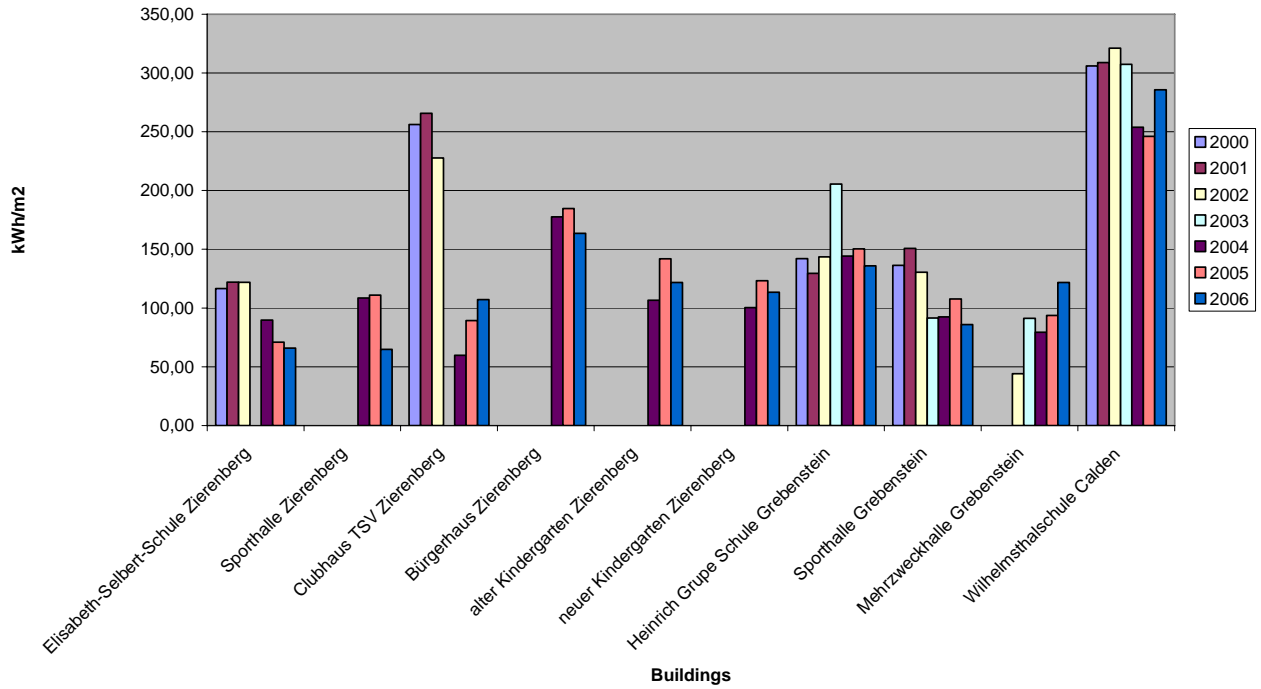
- ✓ The computer equipment was turned off after lessons by using the main switch of the room when available
- ✓ The other PC's get a socket with a switch
- ✓ Some electric equipment will be switch of in holidays
- ✓ Some electricity meters were new installed in the project, so now it is possible to check the electric consumption of these buildings for the first time
- ✓ The settings of the timers of the lighting systems were checked
- ✓ Electrical hot water systems will be switched of during holidays
- ✓ The power of the heating- pumps was reduced to a lower lever so this saves heating energy too
- ✓ When renovation work will be done in schools, classrooms now get sensors for the lights, so when there are no students in the classroom, it turns off automatically.
- ✓

### Water:

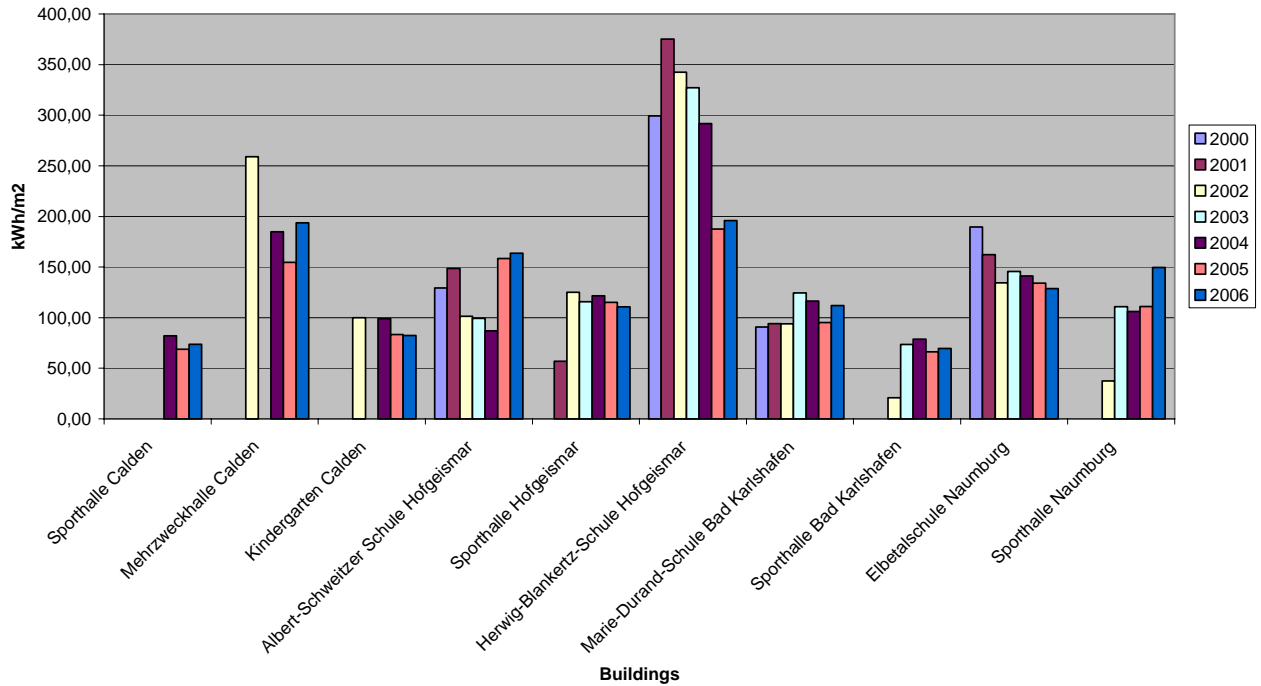
The water consumption was reduced by investments in water saving equipment ten years ago. Now it becomes necessary to repair a lot of this equipment to hold the savings in one school a rain water using plant for toilets was reactivated

# HEATING OVERVIEW

Germany, Gross Heating kWh/m2



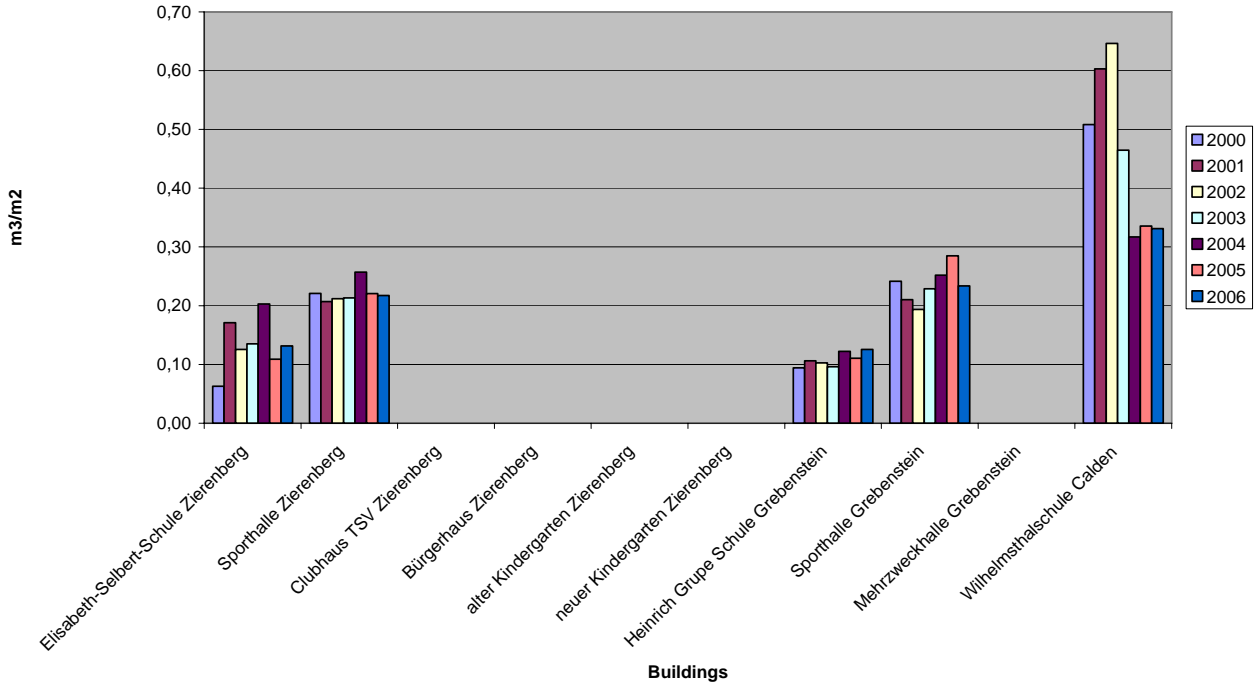
Germany, Gross Heating kWh/m2



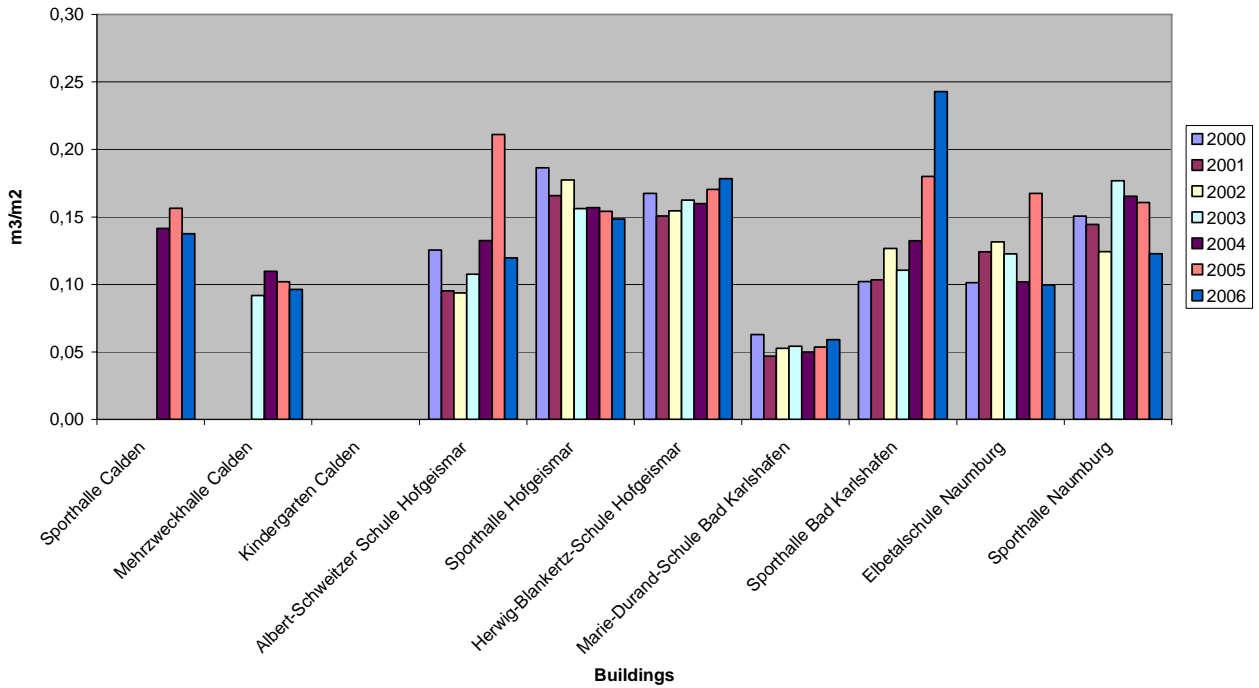


# WATER OVERVIEW

Germany, Gross Water m3/m2



Germany, Gross Water m3/m2



### Missing figures

In some cases no data were available, this causes in missing or damaged meters. Some meters were installed during the project so here we have no data from former years. In some cases heating system were converted to wood- based district heating system. Here for the year of the works we have no data