

ENERGY SAVINGS FROM INTELLIGENT METERING AND BEHAVIOURAL CHANGE: CASE STUDY BRAUNSTONE LEISURE CENTRE, LEICESTER, UK

This case study examines the benefits to a UK leisure centre of monitoring its gas, electricity and water consumption, using an automatic monitoring and targeting system, and of reviewing energy use using the system to evaluate savings for specific measures.

General description

Description of the building

Braunstone Leisure Centre is a £10 million state-of-the-art complex, which opened in December 2004. Over 16,000 people visited the new centre in its first two weeks of operation.

The building aims to have the feel of a private health club. It uses materials such as timber cladding and glazed curtain walling to give the centre a strong contemporary look.

The new centre features the country's largest piece of integrated art glass by artist Kathryn Hodgkinson. This depicts a design of trees found on Braunstone Park and was completed following consultation with local people in the area.

Facilities include a community pool and a main swimming pool (which can be divided into two) with seats for 300 spectators, a fitness suite (designed for both able bodied and those with disabilities), a crèche and a Sure Start nursery with outdoor play area. A six badminton court sports hall with spectator seating for up to 400 people, a conference/community room, a first aid room and cafeteria are also included.

Location

The leisure centre is situated in the city of Leicester in the UK, located at a latitude of 54° 37N and longitude of 1° 33W.

Leicester is a city with a long and varied past engrained in the fabric of its buildings and the character of its businesses and people. It is also a city which looks to the future, with the commitment to develop a quality environment over the next thirty years.



Levels of energy consumption

The Centre's projected annual consumption for 2006 is as shown in Table 1. (*Note: This uses estimated floor areas.*)

Electricity	1,394,256 kWh	310 kWh/m ²
Gas	3,242,607 kWh	721 kWh/m ²
Water	18,170 m ³	4.0 m ³ /m ²

Table 1: Centre's projected annual consumption

Table 2 presents the UK figures for typical annual energy consumption for sports centres with pools.

Good practice	Typical/ Fair	Poor practice
kWh/m ² / annum		
<510	510-745	>745

Table 2: UK energy consumption in sports centres with pools

This suggests a poor standard of energy performance. Further investigation is recommended.

Behavioural patterns

The centre's operational hours are Monday to Friday: 6.30am-10pm (Friday 9am-11am not open to the public, staff training at this time), Saturday: 8am-5pm and Sunday: 8am-6pm.

Needs assessment

Monitoring objectives

Responsibility for managing the building finances, including the utility bills, is shared between different departments within Leicester Council.

Prior to the installation of the intelligent metering and monitoring system the building manager was unable to obtain detailed profile data for energy and water or outside air temperature. This information can now be accessed by the Building Manager from the Energy Management Bureau, a service provided by Leicester City Council who instigated the installation of automatic meter reading systems from energy metering and monitoring company Energy Metering Technology.

Parameters to monitor

Energy and water are the most controllable elements in the centre's budget and by using simple and cost effective efficiency measures utility bills can often be reduced. For this reason these parameters were chosen to be monitored.

In addition supporting energy efficiency measures within the Centre allows the City Council to provide the best services in a cost effective manner.

Monitoring systems

The intelligent metering system used in Leicester was supplied by Energy Metering Technology of the UK. This includes the *Data Bird* data transmission system and the *Dynamat* software (a comprehensive monitoring and targeting package).

Hardware

It was necessary to replace the main electricity meter with a pulsed output device. In addition a system incorporating an interface to the existing main gas meter, CHP (combined heat and power) gas sub meter, main water meter, and pool make up meters was installed. This utilised 'Chatterbox' and 'chick' transmitters (with a mains powered 'chick' extender), to connect the meters to the data logger.

Communication (Data Transmission)

The Data Bird System uses low power radio at a local level to automatically transmit meter readings to a central receiver/data logger, thus avoiding the need for conventional hard wiring.

Data management (storage)

The meter reading data is then automatically downloaded to a PC at the Energy Efficiency Centre, where it is analysed using the *Dynamat* software

which produces a range of monitoring/analysis graphs.

The automatic meter reading package and analysis software (*Dynamat*) provides automatic data collection and validation. It highlights immediate problems and indicates faults and unusual consumption. The meter reading, profiling and analysis shows day peaks and night/weekend lows. It can reveal leaks and wastage.

This automatic reading of meters and data analysis allows monitoring against historical targets or theoretical guidelines. Consumption can be related to weather, occupancy, production or a signature of past consumption profiles.

Automatic reporting is on a regular, and on an exception, basis identifying trends that fall out of tolerance. Easy import and export of data enables data and reports to be saved in other formats so that information can be sent electronically. The software provides information which allows production of bills which enables Leicester City Council to recharge tenants for their individual usage.

Within the European Commission supported Intelligent Metering Project (ref. EIE/04/107/S07.38635) the half hourly information, once collected, is also transmitted to a common database and is used to generate consumption graphs which are displayed on the project website (www.intelmeter.com).

Costs

The cost of installation of the intelligent metering at the leisure centre was £3824.

Monitoring Management

Procedures

The system is configured to automatically send data to Leicester City Council's Energy Management Team.

Responsibilities

As with all of the buildings based in Leicester reviewing the monitoring output has been the responsibility of the Energy Management Bureau, a service provided by Leicester City Council.

Data Analysis

The graphs shown below are produced by the Energy Management Bureau.

Energy performance analysis

The gas usage is weather (degree day) related. However, electricity and water analysis is based on signature profiling. Signature profiling is the process by which the actual consumption is compared to the typical pattern of consumption for the building. In this case the software continuously learns the consumption pattern and uses the shape of the past consumption profile to predict future consumption. Alarms can be set to indicate higher, or lower, than expected usage.

Saving identification

It was recognised during an energy survey, in June 2005, that there was potential for energy saving measures to be put in place. One key area identified for energy saving measures were the motors that drive pumps and fans within the centre.

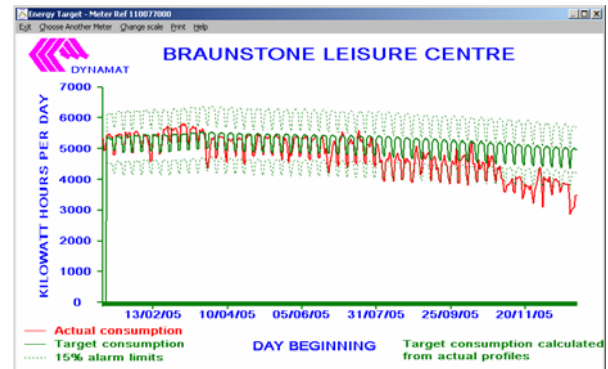
These drives would normally run continuously at full power for at least 15 hours a day, 7 days a week consuming increasingly expensive electricity. The use of variable speed drives to control the pool-water circulation pumps were looked at and implemented at the beginning of August 2005. This energy efficiency measure would allow the Centre to slow down or speed up the motors according to demand, rather than running at full power.

The benefits of fitting variable speed drive controls to electric motors have been well established for many years. It is also well known that many installed motors are actually oversized for the job that they perform.

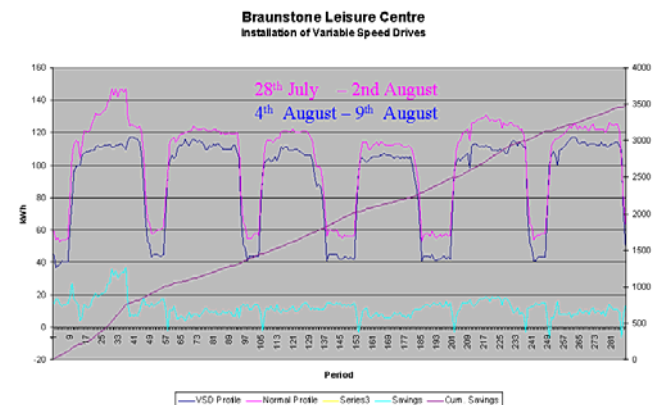
This means that a fairly modest decrease in motor speed will produce a relatively large reduction in energy consumption, under what is known as the "Cube Law." In other words, reducing the speed of an electric pump motor by just 20% can provide energy savings in the order of 50%.

Five variable speed drives were installed on all of the main pool and training pool circulation pumps. These were rated: 3 x 18.5kW (main pool) and 2 x 15kW (training pool).

The following graph from Leicester's intelligent metering system shows target energy consumption for the leisure centre and the savings achieved after the variable speed drives are installed:



The graph (below) shows the actual measured savings, continuous and cumulative, in kWh, obtained following the installation of the variable speed drive (VSD) systems.



The total cost of implementing this energy saving measure was £20,063. This was funded through the Carbon Trust/Leicester City Council LAEF (Local Authority Energy Finance) Scheme. This is the Council's internal energy efficiency funding programme which operates as a loan based scheme. The savings achieved from this measure in the first year amount to (240,000 kWh) £18,000. The payback period is, therefore, just over one year.

Lessons learnt

There has been no measurable deterioration of the quality of the pool water, even though the flow rate has been slightly lowered.

Significant environmental savings are also expected in the form of lower atmospheric emissions from burning fossil fuels to produce electricity.

In addition, variable speed drive controls give other benefits in terms of reducing the mechanical load on the motor, which

should extend its useful lifetime and cut the amount of maintenance required.

Using the intelligent metering system has delivered a simple and easy illustration of the savings delivered by this measure to staff at the centre.

Training package

A training package, produced as part of the intelligent metering project was passed to the centre. The training package's aim was to provide support so that building users could change their usage patterns in order to save energy and water. It considered the drivers required for behavioural change:

Enabling - This is the range of techniques and factors where the intervener provides alternatives to existing unsustainable actions and behaviours.

Engaging - These are the tools available to communicate with and engage in the sustainable development process.

Incentivising - In this case they are municipal authority interventions, for example rewards for reducing energy and water use.

To ensure that these drivers translate into real change **catalysing** is required. This is where combinations of the three drivers are brought together with one key element that stimulates mainstream change in actions and behaviour.

Training used

A specific training visit was made to the centre in June 2005 to deliver and discuss the training pack and review the immediate and future potential for energy efficiency and hence consider cost saving measures through an energy walk-round survey. Intelligent metering graphs were shown to duty officers.

An action plan was produced which included a wide range of measures ranging from ensuring that equipment was not left on standby overnight and that lights are switched off when not needed to possible energy efficiency measures such as considering the use of a pool cover.

Analysis of training actions

An action plan detailing targets for actions for the short and medium term was also developed as part of the outcome from this meeting. This is being progressed and it is hoped that further savings can be identified. Save energy posters have been provided to the leisure centre and put up. Also, possible lighting energy efficiency improvements are being investigated, such as the use of light sensors in the sports hall.

Lessons learnt

The use of detailed energy monitoring information (e.g. showing savings from a previous energy efficiency improvement in the building) can help engage with staff when providing energy efficiency training.

Conclusions

Assessing savings

There are some lessons that have been learnt on this new build site.

Energy efficiency must play a significant role in all new buildings and this should be clear to designers. For example, some of the energy saving actions could have been considered during the original building specification.

In addition care needs to be taken at the design stage for the correct assessment of energy usage – in this case the intelligent metering and monitoring has revealed a much lower energy usage than predicted and this has had significant cost implications in the incorrect contract specification for the supply of energy over the first few years of operation of the building.

The specific figures for energy savings from the variable speed drives indicated an annual saving of 240,000 kWh equivalent to approximately £18,000. For the cost of the installation this amounted to a payback period of just over one year.