Saving Energy using BEMS

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What is a BEMS?

BEMS is a generic term used to describe computer-based control systems for building and engineering services such as heating, ventilation and lighting etc. Other titles used are BMS Building Management System and EMS Energy Management Systems.

A BEMS is a system that helps to manage, control and monitor building engineering services within a single or group of buildings. A system when designed, installed, commissioned and operated correctly will significantly improve the operational efficiency of the engineering installation and its cost effectiveness in terms of labour and energy costs.
How to Justify using a BEMS system

All buildings need controls. BEMS can be cheaper than individual controls as we do not look at first costs but whole life costs and upgrading will need to be compared with energy savings.

CIBSE indicate energy savings up to 20% by the use of a BEMS system the saving to a commercial building on Hot water and Heating alone could be dramatic.

A BEMS can provide three key advantages over stand alone control.

• Provision of management information
• Remote operation, interrogation and alarm monitoring
• Greater flexibility and range of controls
How to justify installing a BEMS system

Typical energy usage of a Worcestershire School

Figure 1a Schools – percentage of energy use

- Catering (elec) 2%
- Hot water (elec) 1%
- Lighting (elec) 8%
- Office equipment 1%
- Other (elec) 2%
- Space heating (elec) 2%
- Catering (fossil fuel) 8%
- Hot water (fossil fuel) 15%
- Other (fossil fuel) 3%
- Space heating (fossil fuel) 58%

Figure 1b Schools – percentage of energy cost

- Catering (elec) 6%
- Hot water (elec) 2%
- Lighting (elec) 20%
- Office equipment 1%
- Other (elec) 4%
- Space heating (elec) 5%
- Catering (fossil fuel) 5%
- Hot water (fossil fuel) 10%
- Other (fossil fuel) 2%
- Space heating (fossil fuel) 45%

Source: Carbon Trust Publication: CTV019
BEMS costs, cost-effectiveness and benefits

Costs: Typical WCC specification BEMS system for new schools: 2.5% of project cost, or around £50 per square metre when designed by Consulting Engineers 2.0% of project cost, or around £40 per square metre when designed in-house

Savings: Typically 15-20% of annual heating fuel costs

Typical payback periods 8-10 years, BEMS lifetime 25-30 years Based on annual gas and oil costs, BEMS saves WCC and schools £330,000 a year with annual staffing and running costs approximately £60,000

Net cost benefit to WCC: £270,000 per annum
Benefits of BEMS and energy control

In 2005, based on 2002-3 DCSF benchmarks, Worcestershire schools were, on average, 15% more energy efficient than the UK norm.

In 2009, based on DEC scores, Worcestershire schools are, on average, 25% more energy efficient than the UK norm.

Achieved through BEMS and effective liaison with schools.
Advantages and Disadvantages

• **Advantages**
  - Relatively simple operation for trained users
  - Quick response to occupant complaints
  - Reduced energy consumption up to 20%
  - Improved plant performance and life expectancy
  - Graphical representation of plant operating conditions providing a simple understanding of the information presented
  - Improved management information such as historical records

• **Disadvantages**
  - Any BEMS will have a cost associated with it. These are not only initial design and installation, but also the operation and maintenance costs.
  - Need for a skilled operator to ensure maximum efficiency
  - Unless correctly specified, installed and operated a BEMS system can increase cost and environmental impacts.
WCC BEMS Operation

WCC Standard Control Methods

- Analogue temperature sensors located in representative spaces
- Control panel switches and plant isolators all monitored
- Water and air flow proving by monitoring motor current
- No “hand” positions on control panel switches (OFF/AUTO only)
- A single monitored switch provides manual over-ride
- Simple user-operated timed extension for out-of-hours running
- Zone hold-off control by simple user-operated monitored switching
- A single monitored switch controls summer/winter/holiday selection
- Time control extended to distributed HWS generation
Standardisation

WCC have also standardised their BEMS control systems by the choice of two control companies Trend control Ltd and Schneider Electric.

This allows competition for new installations without compromising standards.
Controlling Buildings and Behaviour

When operating the BEMS systems the controller can assess how plant is performing and alter room temperatures, heating and hot water times and CO2 ventilation accordingly to allow the occupier comfortable and healthy working environments.

- We can use the monitoring and temperature set points to assist efficiency behaviour on sites by having actual live data from sites and using “good” communication via telephone to sites and regular site visits.

- However, we haven’t had much success with this in the past. So, how can you get everyone to support energy efficiency?

- Influencing others is challenging, which is why it's worth understanding the psychological principles behind the influencing process.
Cialdini's Six Principles of Influence

• 1. Reciprocity
• 2. Commitment (and Consistency)
• 3. Social Proof
• 4. Liking
• 5. Authority
• 6. Scarcity
WCC Energy Efficiency Walk around

Consecutive days Eco Coolers Off/On

- Tuesday
- Wednesday

KW

Time of day

www.worcestershire.gov.uk/climatechange
Evaporative Cooling

Consecutive Fridays Eco Coolers Off / On

- Conventional cooling
- Eco coolers

Time of day

kW
Biomass
Solar PV
Further information:

www.worcestershire.gov.uk/spendtosave
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