



energy services and technologies association

energy controls

Improving energy efficiency through
better control strategies



Introduction

Energy Controls monitor, regulate, control and manage building services including heating, cooling, air-conditioning, ventilation and lighting. Energy Controls exist to provide occupants with a good working environment, e.g. temperature and lighting, in situations where the loading and use of the building varies and with a strategy of minimising energy consumption, energy costs and carbon emissions.

Energy Controls comprise sensors, meters, controllers, communication network and actuators (valves, contactors, variable speed drives) and may be stand-alone, service specific, e.g. heating, or a comprehensive, integrated Building Energy Management System BEMS.

This booklet, devised by ESTA's Energy Controls Group, outlines how energy controls save energy and reduce CO2 emissions without compromising building services or the working environment and sets out 'five golden rules' to deliver a control regime saving energy, reducing emissions and lowering your building's running cost.

We have included issues to consider when looking to reduce the energy consumption of a building's HVAC system and covers new build, refurbishment project, or simply improving the efficiency of your current controls. Opportunities exist for savings by 'doing it better'. If you have any questions or need more information then visit the 'Energy Control Group' on the ESTA web site.

The 5 golden rules of efficient energy management

1

Only supply heating or cooling if there is a demand

It is clearly wasteful to heat a building (or run its boilers) on a blistering hot day when there is clearly no demand for heat. If the boilers or chillers are not required, make sure that they are turned off. Demand for heating or cooling may be identified by the difference between flow and return temperatures. No temperature differential equals no demand and supplying energy is wasteful.

2

React to external temperatures by automatically adjusting internal settings

The warmer it is outside, the less heating is required to deliver the required internal temperature set point. There is a simple 'straight line' relationship between the two. This also applies to chilling. Make sure your systems respond to these relationships and avoid unnecessary energy consumption.

3

Never operate heating and cooling in the same place at the same time

This sounds obvious but surprisingly this often happens. Ensure packaged air-conditioning such as ceiling mounted heat pumps cannot cool the space as radiators try to heat it. A notable exception is when controlling relative humidity, which is not common.

4

Control separate zones with different needs independently

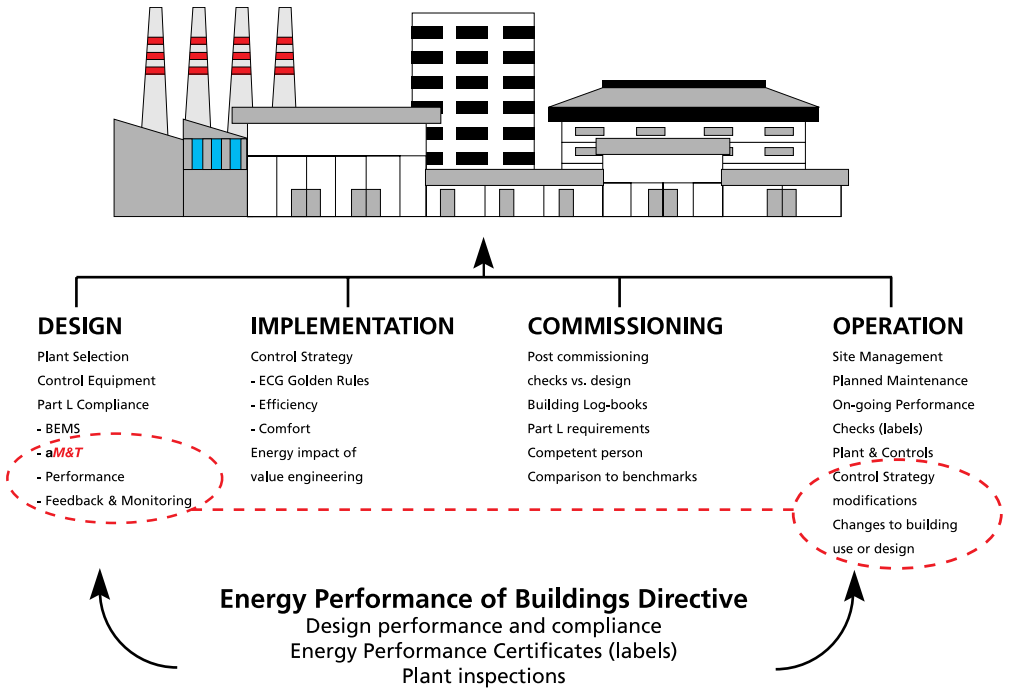
Create multiple zones in the building, each having its own operating characteristics. Each zone to provide a demand to central plant only when needed. Each zone must respond to its unique requirements rather than a 'one size fits all' strategy governing all zones. Independent time and temperature control for each separate zone is key to maximising efficiency.

5

Match output capacity to demand

Only use enough boiler or chiller output power to satisfy demand from the zones. Do not allow plant to run continually and 'dry cycle'. This often indicates poor plant control, particularly by a BEMS, where the BEMS 'enables' each boiler which then control on their internal thermostat. Boilers and chillers should be properly sequenced to just satisfy demand.

'Joined-up Thinking' for the design, implementation and operation of a building:



The Energy Performance of Buildings Directive encourages a joined-up approach, where the building's actual energy performance in operation matches its predicted design performance. How can this be achieved? The following section sets out how a project's design, implementation, commissioning and operation all contribute to a joined-up building that performs efficiently.

Design

Plant selection: select the most efficient plant and equipment available for your application. Where possible use only equipment recommended in the Carbon Trust's Energy Technology List (www.eca.gov.uk).

Control equipment: select control equipment suitable for the application. Again, from the Energy Technology List.

BEMS: often the 'E' for Energy is forgotten when specifying a BEMS. Make sure the 'E' is an integral part of the design and specification of your control system.

aM&T and performance monitoring/feedback: closing the loop between design and operation can only really be achieved if metering and/or other performance monitoring is specified.

Part L requirements:* has specific requirements for plant, control systems and monitoring. Ensure your building complies.

Implementation

Control strategy: as a minimum apply the Energy Control Group 'five golden rules'. The strategy should provide the most efficient form of plant operation while maintaining the comfort of the occupants and ensuring plant safety.

Energy impact of 'value' engineering: performance specification is often reduced by 'value engineering' at contract implementation. The impact on energy efficiency is frequently overlooked. Ensure that any 'value' changes are fully assessed for their impact on the operational energy requirements of the building. Ensure the building energy rating target is stated and complies when finished.

* Part L applies to England and Wales.
For Scotland: Non-Domestic Technical Handbook, Section 6 Energy
For Northern Ireland: Building Regulations Technical Booklet F2
Check Part L compliance using SBEM (Simplified Building Energy Model) freely available from www.ncm.bre.co.uk

What key performance indicators (KPI's) should be used: Firstly, we suggest making sure that you meet pre-specified temperature set points. Secondly energy consumption, a target annual CO2 emission will be required for Part L compliance. Derive an associated energy target in kWh/m²/annum. Ensure that you can monitor and collect the relevant energy meters data and use the information provided. Use existing benchmarks to compare with actual performance, in time you should be able to set your own benchmarks. Consider using a full automatic monitoring and targeting system (**aM&T**) as part of an integrated control system.

Commissioning

Post commissioning results vs design parameters: during commissioning compare building performance against design target using the BEMS and **aM&T** systems together. Commissioning should always include the set-up and checking of the building in both summer and winter modes of operation.

Building log books: required for Part L compliance, log books should always be completed including a full set of building design performance data and details of the 'as commissioned' control system settings. This information is an essential part of 'closing the loop' and allows for effective management of the building in the years to come.

Part L requirements: ensure your building fully complies with the commissioning and log book requirements of the Part L of the Building Regulations.

Competent persons: control systems, plant and other energy efficient devices should only ever be commissioned and setup by competent persons. ESTA funded development of training modules for building controls in HVAC. These are supported by the Energy Controls Group and they are run by the Electrical Contractors Association. For more details visit: www.eca.co.uk/SupportServices/EducationAndTraining/courses.asp

Operation

Planned maintenance: implement a programme of planned preventative maintenance on all plant, control and any peripheral control equipment such as sensors and actuators.

Ongoing performance checks: manage the effectiveness and efficiency of the building through a programme of performance checks using the BEMS with feedback provided by the *aM&T* or other monitoring systems.

Plant and control strategy modifications: constantly assess and modify strategies for maximum energy efficiency. Where possible use controls systems able to self-tune to optimise performance.

Changes to building use or design: amend control strategies to allow for changes in the buildings use or physical design.

Bringing it Full Circle

Energy Controls will continuously deliver energy efficiency if they are used regularly as a management tool matching the building set-up to actual occupant use.

Energy Management is an ongoing process. BEMS require an investment of time to ensure that they are used effectively. To maintain and improve energy efficiency, a 'fit and use' scenario works better than 'fit and forget'. To maximise value, ensure that many personnel use the system to aid their specific roles. Invest the time and know what deliverables are expected.

Support and energy management using Energy Controls can be implemented in-house or outsourced to a range of specialists.

With high energy costs, the benefits for getting it right can be significant. The cost of getting it wrong is even higher.

energy controls group

The Energy Controls Group of ESTA represents a wide range of manufactures, suppliers and service providers that specialise in control systems the help manage the built environment and enhance the energy efficiency of a building. Our members' products include complete control systems, such as Building Energy Management Systems (BEMS), application specific control products, energy saving devices, peripheral equipment, and variable speed drives and motors. In addition, many members offer specialist services to enhance, maintain and operate control systems at their optimal performance. The Group promotes the correct and efficient use of its members products and services and is committed to helping building designers, owners, operators and occupants to achieve the efficient use of energy within buildings.

For an up to date list of the Energy Controls Group members please visit the ESTA website at www.esta.org.uk.