# ENERGY MANAGEMENT

TREND

# SUSTAINABLE HEALTHCARE

## The fast-track guide to reducing energy and carbon emissions in a Healthcare environment

The NHS is currently undergoing significant transformation and there is continuous pressure to keep costs down. As with all industry sectors, the cost of energy and other utility bills are increasingly impacting on expenditure as these costs are rising faster than any others. The need to reduce energy bills and save carbon are two of the major issues that face the NHS today.

This guidance document outlines the considerations for the strategic development of an effective Building Energy Management System (BEMS) within the Healthcare Sector.

A BEMS typically controls up to 80% of a building's energy requirements. By optimising and maintaining the system – getting it to perform consistently with the way a building is used - it can deliver significant energy savings which can be measured, monitored and in turn sustained. Repeatedly, the installation of a BEMS has proved a highly cost-effective way for Healthcare establishments to cut their energy consumption – frequently making savings of more than 25%. This has often produced similar or greater cost reductions in maintenance expenditure.




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# INTRODUCTION

## The NHS is under huge pressure to deliver a more efficient and sustainable service.

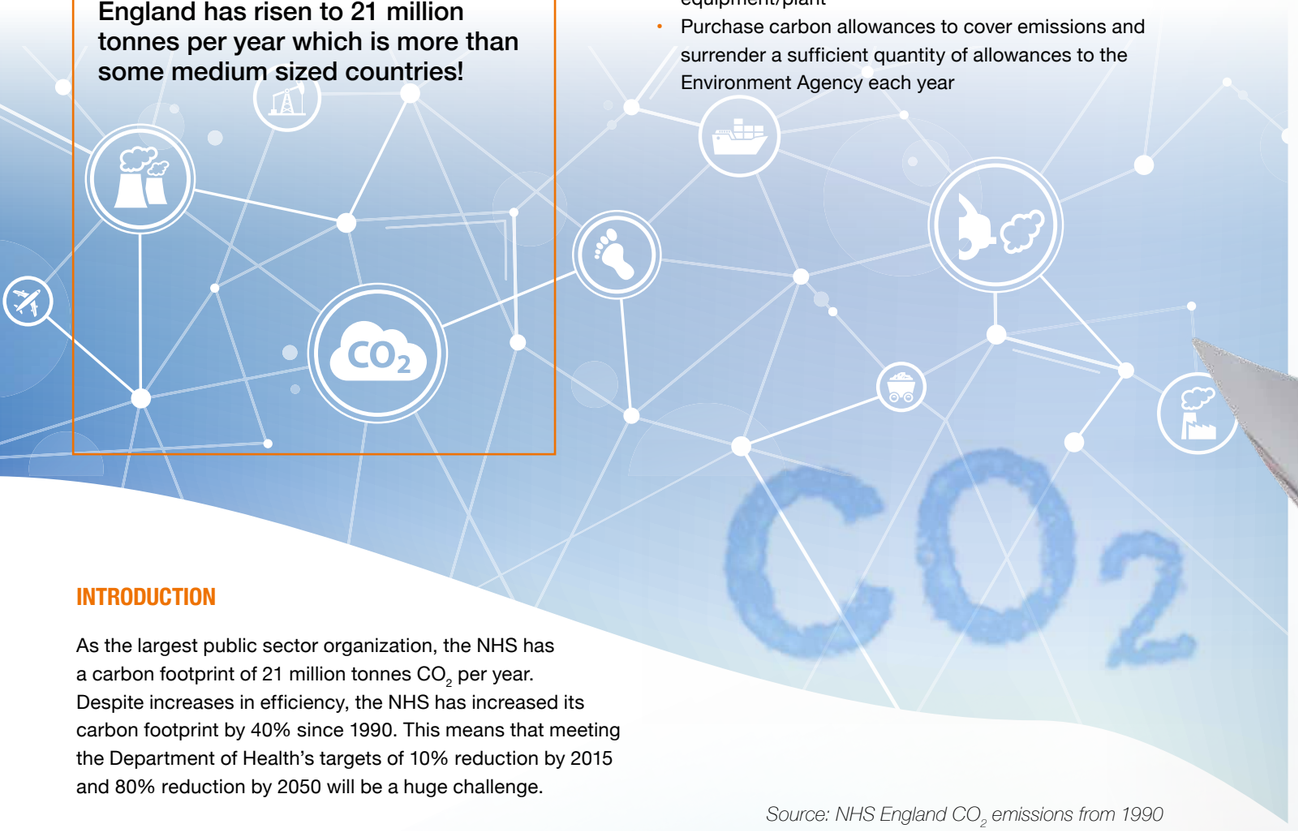
The NHS is expected to deliver improved quality of patient care and invest in more modern and expensive technology whilst at the same time being asked to cut costs and improve productivity. Meanwhile organisations are faced with ever increasing energy costs and more stringent legislation to cut energy consumption and reduce their carbon footprint. Estates and facility managers must take new and creative steps to put energy costs in check, because more has to be done with less money.

This paper shows the measures that should be undertaken in order to assist in this task, some of which require no extra investment.

**The carbon footprint for the NHS England has risen to 21 million tonnes per year which is more than some medium sized countries!**

To add to the pressure, from April 2010, the CRC (Carbon Reduction Commitment) Energy Efficiency Scheme began and the majority of NHS organisations are now affected. Organisations are required to:

- Ensure energy consumption and carbon emissions are measured accurately, and that energy consumption data is available
- Verify the energy consumption figures provided by the utility supply companies
- Provide an annual footprint report to the Environment Agency
- Produce an 'evidence pack' with supporting information for the footprint report
- Consider the implications of improved energy efficiency when purchasing or replacing energy consuming equipment/plant
- Purchase carbon allowances to cover emissions and surrender a sufficient quantity of allowances to the Environment Agency each year




### INTRODUCTION

As the largest public sector organization, the NHS has a carbon footprint of 21 million tonnes $CO_2$ per year. Despite increases in efficiency, the NHS has increased its carbon footprint by 40% since 1990. This means that meeting the Department of Health's targets of 10% reduction by 2015 and 80% reduction by 2050 will be a huge challenge.

This will require the current level of growth of emissions to not only be curbed, but the trend to be reversed and absolute emissions reduced.

*Source: NHS England $CO_2$ emissions from 1990 to 2020 with Climate Change Act targets. NHS Sustainable Development Unit – Saving carbon, Improving Health, Jan 2009*

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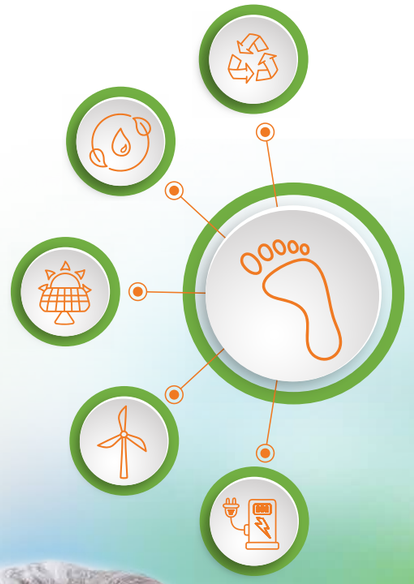
# SUSTAINABILITY



There are a multitude of ways to reduce the carbon footprint of an NHS Trust. But what can be done quickly that will deliver fast worthwhile results?

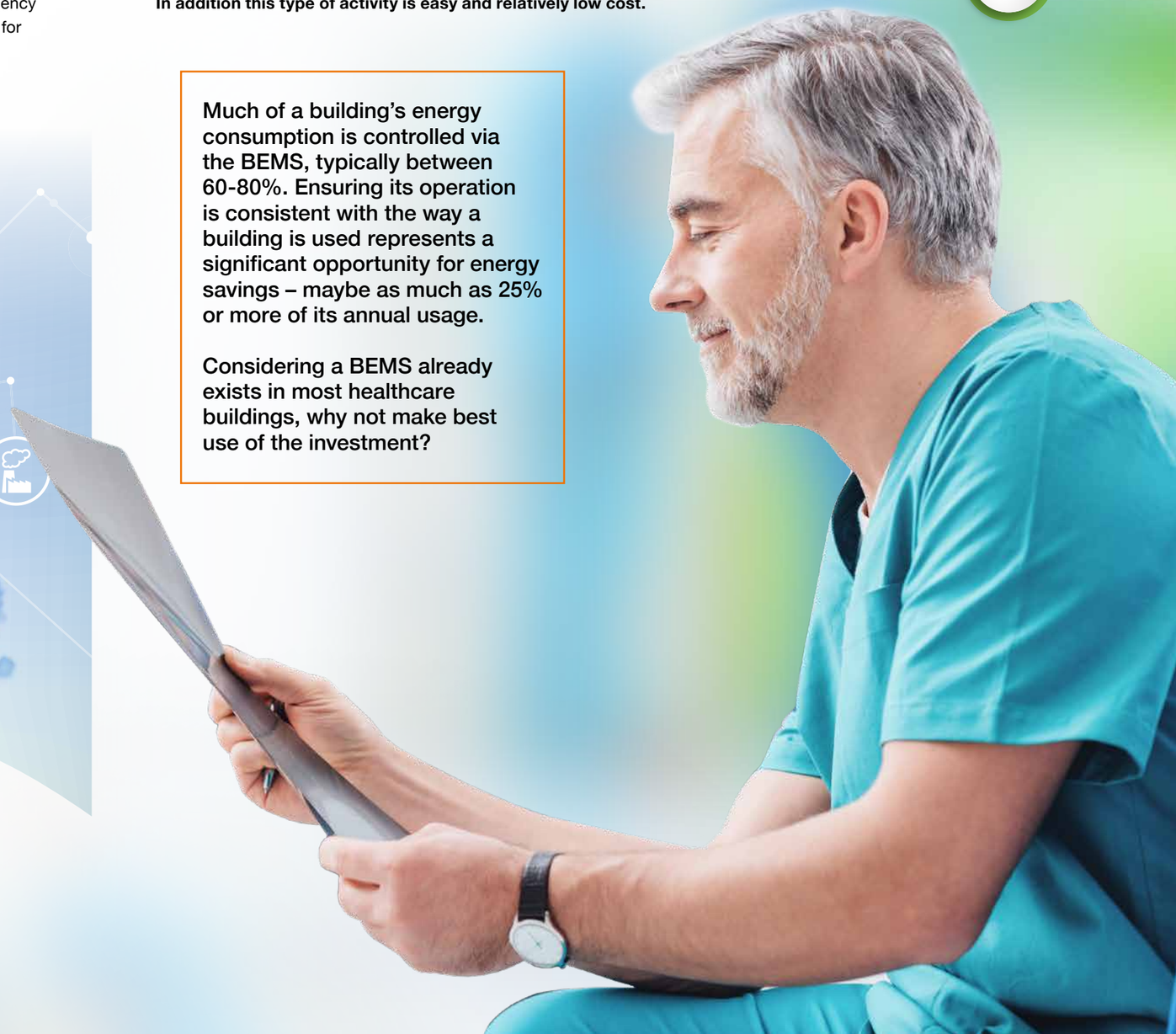
The logical answer is to focus on those areas where large energy savings can be made quickly and easily. This will often mean looking no further than the Building Energy Management System.

The illustration below highlights some of the actions a Trust could take to reduce its carbon footprint. This type of analysis provides a convenient way to prioritise activities. In reality the picture will vary significantly depending upon an organisations own circumstances. Unfortunately the BEMS is often forgotten when looking for a solution but in most cases by just reviewing and adjusting how you manage and control your energy will often yield significant energy savings.

**In addition this type of activity is easy and relatively low cost.**

**Much of a building's energy consumption is controlled via the BEMS, typically between 60-80%. Ensuring its operation is consistent with the way a building is used represents a significant opportunity for energy savings – maybe as much as 25% or more of its annual usage.**

**Considering a BEMS already exists in most healthcare buildings, why not make best use of the investment?**



# BEMS

## So what is a Building Energy Management System (BEMS)?

Building Energy Management Systems monitor and control services such as heating, ventilation and air-conditioning, ensuring they operate at maximum levels of efficiency and economy. This is achieved by maintaining the optimum balance between conditions, energy usage and operating requirements. The key components are:

### CONTROLLERS

Microcomputer controllers receive signals from field devices and according to their programmed operational settings, take action to control plant equipment.

### SUPERVISORS

Supervisors are user interfaces which view or amend the system data as well as providing a wide range of energy analysis and maintenance functions.

### NETWORKS

Networks allow devices to communicate across a physical distance either locally, across a wide area network, or remotely by using standard browser technology. This means information can be accessed anytime, anywhere, ensuring total building continuity.

### FIELD DEVICES

Field devices such as sensors etc send or receive data directly to controllers for either local or remote control & monitoring. If you don't measure or monitor an area or item then you cannot control it.

## Maximising the effectiveness of a BEMS

A BEMS is also ideal as an energy monitoring and targeting system (M&T), since it is often distributed with the building services plant which is consuming the resource, has the capacity to monitor and record the field data and perhaps more importantly, can analyse and react to the information to improve the performance of the building.

In a hospital environment it will carry out its job, day in, day out and this will include:

- Provision of correct environmental conditions, including close control of temperature, humidity and pressure in high dependency and critical areas
- Providing proof of environmental conditions by monitoring and reporting of logged data
- Control and monitoring of hot and cold water services to avoid risk of Legionnaires bacteria
- Compliance with Building Regulations Part L & HTM's
- Ensuring continuity of building services by monitoring of the building services and instantly notifying the right people by targeted alarms
- Monitoring and managing energy on the site
- But for various reasons many BEMS are out of synch with their environment and are thus not working to their full potential

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# YOUR BUILDING'S ENERGY PERFORMANCE

## So where does energy waste occur?

The most common problem is that settings such as temperature setpoints are altered and not always restored to their original values which leads to excess energy use.

The effect can be the same if parts of a system are manually overridden and then not returned to 'auto' – which can and does happen, even to the extent of control linkages being permanently disconnected.

**In intermittently occupied areas occupation hours may be extended or reduced and no record made to facilitate returning to normal settings after the event.**

Most buildings undergo change, some very frequently. The use of a particular area could be altered, or floors might be re-partitioned. Such changes will generally require system re-optimisation or in other words amending the way the system works to reflect the change in use. Failing to do this can lead to heating or cooling of unoccupied areas, rooms being overheated and sensors being wrongly positioned – all of which can have expensive consequences.

Another common reason for reduction of system performance and increased costs is where insufficient maintenance provision has been made. Whilst the BEMS have few moving parts and are generally very reliable, some components such as sensors, valves/actuators can over time go out of calibration, resulting in a reduction in control accuracy and an increase in energy.

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# USING THE BEMS TO GET BACK CONTROL – THE ESSENTIAL STEPS

### STEP 1 – REVIEW

In order to understand what energy savings can be achieved, it is important to audit the current situation within your building. A BEMS energy audit reviews the existing controls for building services, and identifies opportunities where energy savings can be made - some of which can be actioned on the day to provide immediate payback.

From past experience, there is generally a set of common control

- Heating and cooling operating at the same time
- Inappropriate temperature and humidity set points
- Demand led control strategies missing
- Heating and cooling control loops in need of tuning
- Heating and cooling dead bands not set up correctly
- Sensors in inappropriate positions
- Sensors not calibrated correctly
- Incorrect time scheduling of plant
- Lack of optimum start and stop routines

A survey might also identify how further savings could be made by carrying out more significant changes or additions to the BEMS – like fitting variable speed drives on air handling plant.

**Following the survey, a report will be submitted detailing any issues identified, modifications made and expected energy savings - allowing you to make informed decisions about the next steps. However, any proposal for additional work needs to be presented as a fully costed business case, with predicted savings and payback on investment.**

### BEMS BEST PRACTICE EXAMPLE 1

A BEMS energy audit was carried out at Sidmouth Hospital in Devon. During the engineer's time on site, improvements to the BEMS settings were made which included altering heating times in intermittently occupied areas from 24 hour a day to only between 06:00 and 22:00 and by reducing heating setpoints to 21°C. These actions resulted in an estimated £7,000 of savings per annum and a reduction of over 43 tonnes of carbon.

## STEP 2 – MONITOR

If energy savings are to be maintained then it is necessary to closely monitor consumption, which will highlight any tendency for energy performance to once again decline. There are a number of on-line monitoring and targeting packages available, one example being Trend's Energy Manager.

Trend's Energy Manager software is able to continually compare actual and expected usage (taking into account other data such as temperature conditions) and automatically generates a report when the difference is too great.

### BEMS BEST PRACTICE EXAMPLE 2

At Charing Cross Hospital energy meters were installed in all the main plant rooms and were monitored by the Trend BEMS. The resulting data allowed them to identify and eliminate energy wastage in many ways, yet without causing staff and patients to suffer – in fact they did not even notice the changes.

The hospital operates 24/7, but some areas such as offices are not used overnight. Maximum savings were made by providing heating and ventilation only when they are occupied. Using the BEMS they can see what's running when it should be switched off. They examined all areas of the buildings and were able to match heating times closely with periods of occupation, so saving energy.


## STEP 3 – MAINTAIN

If necessary, other means can be deployed to quickly diagnose the exact cause of energy overuse. For this purpose a web-based BEMS 'performance tool' could be used. This will check the functioning of the system – including its control loops and sensors – and can also highlight events such as valves becoming stuck open, controls being manually overridden and other potential sources of energy waste.

These tools allow a problem to be identified, diagnosed and rectified in a matter of hours and thus avoid months or even years of energy over-consumption.

> **"Without the regular service visits and check-ups the system's performance would gradually have deteriorated and we would never have sustained such a high level of energy savings."**

Through its control and monitoring of domestic hot water services, the Trend BEMS plays another important role, helping to combat the risk of legionellosis.
of the buildings and were able to match heating times closely with periods of occupation, so saving energy.

### BEMS BEST PRACTICE EXAMPLE 3

Trend Building Management Systems have made a crucial contribution to the large energy savings made by St James' Hospital, Portsmouth, and seventeen other NHS premises in the Hampshire area.

St James' Hospital has an impressive record for cutting energy consumption, having continued to make savings year after year. Much has been achieved through good housekeeping and the installation of energy efficient plant and equipment. However, no measure has had a greater effect on savings than the introduction of the still-expanding Trend BEMS.

## STEP 4 – DEMONSTRATE

With CRC legislation increasing the focus on carbon emissions within NHS organisations, it is vital to demonstrate the energy savings that are made. Energy managers and FM providers often face difficulties getting senior management buy-in on carbon efficiency measures because energy costs are not always at the top of their priority list.

Building owners and users also now demand accurate, timely data showing a building's energy consumption and carbon emissions.

By applying the BEMS monitoring and control best practices recommended, NHS Trusts can control their energy and carbon usage and at the same time demonstrate their commitment to the ongoing management of energy performance against targets.

### BEMS BEST PRACTICE EXAMPLE 4

Trusts can use their BEMS to demonstrate their commitment to $CO_2$ reduction and to show the results and indeed the impact of their energy saving measures.

One way of doing this is through products such as the Trend EnergyEYE, a large format display that accesses utility meter readings from a BEMS and presents a continually updated record of a building's energy consumption and carbon emissions, showing at a glance whether they are on, below or above performance targets.

# SUMMARY

NHS Energy and facilities managers are now offered everything needed to get the performance of the BEMS back on track – and then keep it there. Importantly it is possible to achieve both a quick win on savings and a long-term reduction in a buildings' energy consumption and carbon footprint.

There are many other approaches to cutting carbon emissions, but few if any are likely to have such an immediate effect or make a bigger impact than employing a BEMS. In contrast, the payback period for a wind turbine could be well over 50 years.

Since performance decay tends to be most pronounced early on in the life of a building and it is almost never too soon to consider the value of system optimisation. Considering a BEMS already exists in most healthcare buildings, why not make best use of that investment?

It should play an important part in helping the NHS Trusts meet their energy and carbon reduction targets.

Furthermore, the successful outcome of energy and carbon saving projects relies heavily upon the awareness and support of the building occupants - maximising the power of the BEMS to publicise energy efficiency achievements and to promote energy conscious behaviour to stakeholders and the local community.

> **The successful outcome of implementing any energy and carbon saving project relies heavily upon the awareness and support of the building occupants.**

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