Building Energy Management

.....strategic planning for Banks

TREND

Document contents

The fast-track guide to minimising a bank's impact on climate change from its property estate

This guidance document outlines the technical considerations for the strategic development of an effective Building Management System infrastructure in the Banking Sector.

There is a pressing need in the banking sector to reduce operating costs. Other current business drivers across the sector include sustainability, carbon reduction, security of supply and globalization. Taking a strategic approach to the development of the Building Energy Management System (BEMS) will help the bank to deliver on all of these targets.

A BEMS typically controls up to 80% of a buildings 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 be sustained.

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1.0 Introduction

This guidance document outlines the technical considerations for the strategic development of an effective Building Management System infrastructure in the Banking Sector.

Current business drivers across the sector include sustainability, carbon reduction, security of supply and globalization. Taking a strategic approach to the development of the Building Management System will help the bank to deliver on all of these targets.

A strategic overview must consider solutions which will meet the individual needs of the varied building types that make up a bank's estate; from the close control and security of service required in data centres and comms rooms, sustainable operation of offices and call centres, to cost effective and repeatable designs for retail.

Systems must be suitably flexible to meet this broad specification while offering communications options which allow the bank to centrally manage all of its operational functions. Utilising IP over Ethernet provides a future-proof BMS installation which can reside on the bank's IT network or a dedicated ADSL, GSM or PSTN infrastructure.

The strategic development of the BMS across a business' building portfolio provides the ideal platform to realise the ambitions of a centrally managed estate.

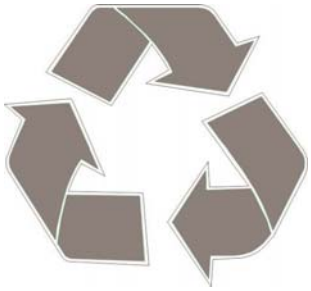
Create the capability to drive wide-scale performance enhancement initiatives, benchmark buildings against published guidelines, and roll-out repeatable design standards.

A robust infrastructure is only one element of the strategy. Effective operation can only be realised if the sweep of data collected by the BMS is transformed into useful information which can be delivered to users where and when they need it. Today's BMS uses SQL databases and a wide-array of visualisation tools which exploit the inherent data-collecting capability and provide sophisticated user interfaces. The output can be tailored to individual user groups and web-served across the entire infrastructure.

A range of services are available to support the bank's strategic plan. These range from energy controls audits, which have already made significant contributions to the carbon reduction of many Banks in the UK, to training and critical support services for data centres and comms rooms.

Intelligent support tools can be used to monitor the ongoing system performance, targeting maintenance activity to deliver continuous improvement and providing unprecedented visibility of building performance.

Sustainability can be further improved by ensuring that key building parameters are monitored through the BMS and evaluated against industry benchmarks providing real-time measurement of a buildings environmental performance. This can also help to inform the design of sustainable new buildings and systems, and provide evidence of the efficacy of energy based investments.



2.0 Sustainability

An effective BMS can allow buildings to perform seamlessly and thus free-up businesses to focus on operational issues. This can have a significant impact on operational cost, which is often underestimated in design. The Royal Academy of Engineering estimates the cost ratio for a new building as 1:5:200 for construction, maintenance and operation. Any system, which can help to reduce the operational element of the cost base will significantly reduce the whole life cost of the building

2.1 Future-proofing

A sustainable building design must include sufficient flexibility to meet all users needs, while remaining adaptable to design advances throughout the building's life.

Trend products are designed to be future proof. This is delivered in a variety of ways. New products are developed to be flexible, making expansion and upgrade simple and cost-effective. Migration of communications infrastructure to TCP/IP allows established protocols to be used and significantly reduces network costs.

Trend has an ethos of backward compatibility, meaning that old and new systems remain compatible and complete replacement is unnecessary. Security of investment is also provided by comprehensive warranties which can be extended to match the appropriate life-cycle, or expanded as part of a service level agreement from a range of service providers.

2.2 Service & Support

The Government's advice on sustainable development recommends that, while intelligent systems 'can control virtually every aspect of the building operation' they should be flexible enough to accommodate the specific service requirements of different buildings. It also advises that 'where highly sophisticated systems are used it is important that they are professionally maintained to gain maximum benefit'.

The bank needs to be satisfied that they can competitively procure a professional maintenance function, which adds value to the operation of the system and helps to optimise performance. It is also critical that site staff be given the knowledge, resources and tools to drive the system effectively.

.....the BMS will make a significant contibution to minimising CO^2 emissions and contibute towards compliance of building regulations

Trend systems are supplied and installed by a network of systems integrators offering a range of services in a competitive marketplace. Maintenance support can be provided either by the integrators or directly by Trend. Trend has a nationwide support coverage and a 24/7 bureau.

Trend offer comprehensive operator training which enables the end user to drive the BMS, it also provides clients with many of the training packages provided for its own engineers and encourages the user to gain the skills necessary to optimise their systems.

2.3 Carbon Reduction

The UK Government's sustainable development policy requires that buildings are constructed to maximise energy efficiency and minimise their impact on the environment. This forms part of the strategy to reduce greenhouse gas emissions in line with the Kyoto Protocol and domestic targets.

Application of intelligent building systems can help address these issues and meet environmental key performance targets. A building management system which is designed to incorporate energy efficiency best practice will make a significant contribution to minimising CO2 emissions, contribute towards compliance of Part L of the Building Regulations and provide the environmental control, energy data and management procedures measured by BREEAM.

Intelligent building systems can be designed to form an integral part of an Environmental Management Systems such as ISO14001. They can provide a safe and comfortable working environment, reduce consumption of resources, and can provide:

- > Fuel and water consumption data
- > Building performance feedback
- > Emissions data
- > Environmental records
- > Life-cycle assessments
- > Staff awareness tools

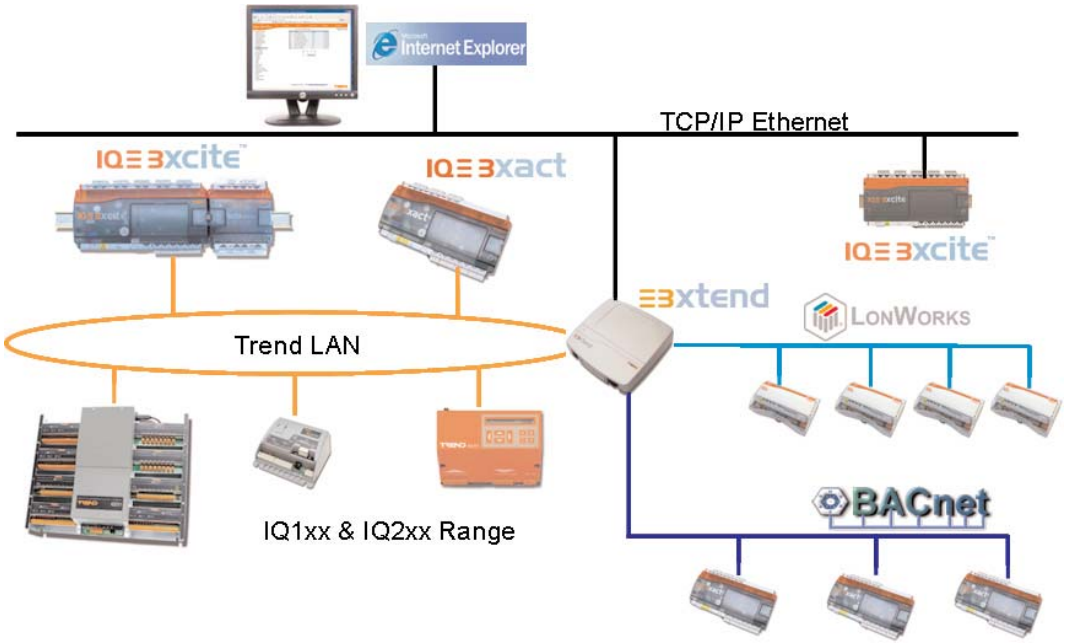
A BMS is also ideal as a monitoring and targeting system (M&T), since it is often distributed with the plant which is consuming the resource, has the technical capacity to monitor and record the field data and, perhaps more importantly, can analyse and react to the information to improve the performance of the building. Trend Services offer a remote energy management service providing monitoring and targeting to reduce energy costs and improve building performance.

Trend Energy Services operate an energy monitoring system called iMat. This provides a web-based analysis of building energy performance with consumption profiles and exception reporting which can be accessed via a standard web-browser.

System performance can also be improved by the Trend Bureau's remote response service. Specialist engineers with remote access can fault find, monitor and adjust control strategies to maximise the effectiveness of the BMS.

3.0 Building Management System

The latest range of IQ3xcite controllers are fully configurable distributed devices, specifically designed to run on TCP/IP networks with embedded XML web capability to allow remote interrogation by web browsers.



This infrastructure makes interrogation of the BMS simpler since any PC residing on the site IT network could be given access to BMS data. A variety of user interfaces are available for the Trend system, including the 963 supervisor, which is a Microsoft Windows based graphical supervisor with a full suite of BMS software functions. Graphical displays in web page format reside in each controller and can be accessed by a full colour touch screen display or by web browsers, such as Microsoft Internet Explorer.

This allows live and historic system information to be accessed and analysed either by the Facilities Management team, Energy Manager or any other building user via a standard PC with web-browser, without the need for proprietary BMS software.

The 963 and touch screen interfaces present graphical information as web pages, making it possible, perhaps for the first time, to allow all of the building users to interact with the building's systems and providing an excellent tool to promote staff awareness.

The BMS connectivity and its capacity to share information with other systems is greatly enhanced, opening up the potential for a variety of standard connectivity formats:

- TCP/IP (Transmission Control Protocol/Internet Protocol) - language of the Internet
- SNMP (Simple Network Management Protocol) - IT network standard
- SMS (Short Message Service) - text messaging
- XML (extensible Mark-up Language) - format of data on the Web
- Open protocols such as ModBus, BACnet and LON

Application is not limited to BMS supervisory software. The data can be used by proprietary maintenance packages (PPM), monitoring and targeting software (M&T), business software such as Microsoft Office, and business systems such as SAP and Oracle.

3.1 Energy Efficient Control Techniques

Building Management Systems bring two major benefits which conventional controls cannot. Firstly, they provide continuous feedback of building performance which allows the user to fine tune the operation of plant. This is further enhanced by alarm reporting and maintenance data which enables proactive management of the building.

Secondly, they are software based and are almost entirely configurable to the users requirements. This ensures an exact fit to the building requirements while offering scope for the application of energy efficient control techniques.

Optimum Start & Stop

The occupancy profile of most buildings means that temperatures need to be achieved for a fixed time start. The length of time for which the heating or cooling must operate to achieve comfort will vary depending on the type of system, building structure and ambient conditions and will therefore constantly vary. An optimiser calculates the 'warm-up' or 'cool-down' time from room and outside temperatures and will continually adjust this calculation to match building needs and maximise energy efficiency.

Optimisers can also provide an optimum stop facility whereby the heating plant can be switched off before the end of occupancy if room temperatures are within comfort levels. This can be particularly effective with the increased use of computers and other heat sources. Most

optimisers allow the 'cool-down' period to be overridden before the end of occupancy if there is too great a fall in room temperature.

Weather Compensation

The Building Regulations require weather compensated control to be provided, however, for compensated control to operate efficiently it is essential to incorporate above and below temperature room trim. This ensures that compensated flow temperatures are forced down when the room temperature reaches an upper limit. This control must also incorporate a time element or integral action to ensure that the flow temperature is continually reduced until the room temperature returns to acceptable limits.

The HVAC plant design allows for a variety of heating types which may be applied across the building portfolio. This means that weather compensation must be sufficiently flexible to ensure that high and low temperature heating mediums are equally as effective. This would be achieved by providing a range of standard and shallow slopes. All of the parameters can be made available for user adjustment to maximise efficiency.

Override Facilities

The characteristics of most heating systems are such that the heat output does not vary linearly with the heating medium flow temperature. To maintain an acceptable building condition in cold weather the compensator settings permit overheating in mild weather.

The simple solution to this problem is to use a weather dependent switch, which inhibits boilers and pumps on an outside air temperature high-limit to reduce over-heating and avoid the circulation of warm water in mild conditions. This considerably reduces energy usage during spring and autumn. A BMS is ideally suited to this approach since it networks primary plant control with field demand conditions.

....a site can be monitored remotely to measure and record the savings achieved

Demand Based Control

One of the benefits of a BMS is that it can implement global control philosophies between associated plantrooms or on a sitewide basis. This allows central plant to be controlled on a zone demand basis. An example of this is to inhibit compensated heating pumps and mixing valves when a room high-limit is reached. If all zones in an area are satisfied, allowing for the demands of domestic hot water, then the boilers can also be disabled which reduces the losses from dry-cycling (running boilers when there is no demand).

Free Cooling

Building Management Systems can be configured to optimise the control of any HVAC system. With air handling plant they can cascade room and extract temperatures to derive a demand based supply air temperature which can, in turn, be accurately controlled to avoid hunting between heating and cooling and to utilise the prevailing ambient conditions to maximum effect.

Free cooling is a simple means of ensuring that the first part of any cooling load is taken up by the available fresh air before forced cooling is introduced.

Enthalpy Control is a more sophisticated technique whereby the recirculation rate is controlled by enthalpy sensors which minimise fresh air intake in cold weather but allow 100% fresh air intake in summer to expand the availablity of free cooling.

Monitoring & Targeting

A BMS can record and display energy consumption data. The information can be used as a tool to target specific problem areas or to automatically control plant on a demand basis. Cost centres can also be charged for their proportion of the site energy usage. This promotes ownership and can be very useful in encouraging the user to take simple but effective steps to reduce their own consumption.

While remaining relatively simple, the control techniques discussed above have been proven to make significant energy savings. Combining them with a clear understanding of building occupancy patterns has helped many organisations deliver effective carbon reduction strategies.

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4.0 Visualisation

To drive the maximum benefit from the extensive range of data gathered by the BMS, information must be analysed effectively and presented to as wide a group of building users and occupants as possible. This requires visualisation tools which are extremely flexible and can be tailored to meet users' needs, but which can be standardised across a group of users to minimise roll-out costs.

The application of dashboard style 963 displays allows the key parameters for a building or system to be summarised on a single consistent page. The example below illustrates how this might be used for a retail application. Detailed analysis tools are hidden behind the various metrics to allow more in-depth investigation.

Implementing a Trend 963 supervisor on the IP network allows selected data to be web-served to a variety of building operators.

.....dashboard displays allo the key parameters of a building to be viewed on a single page

This means that graphical interfaces can be viewed from anywhere on the network using a standard web-browser. VPN remote access can also extend this to mobile technologies such as GPRS and 3G. This real-time access to the building systems greatly enhances service availability and security of supply.

The delivery of data can also be used in the bank's carbon reduction strategy. We have already discussed how the BMS can be used to reduce consumption by ensuring that energy efficient control techniques are implemented across the building portfolio; this can be further enhanced by connecting utility meters via the BMS. Local systems can use consumption data to control plant efficiently using load shedding, however, a centrally connected BMS also allows metered data to be compiled and analysed effectively. This information is critical for early diagnosis of over-consumption.

Trend Energy Bureau use a system called iMat which provides day+1 utility consumption measured against expected profiles. The output is web-served to selected users in a simple graphical format as shown overleaf. Consumption which is outwith the expected profile produces an exception report which can be sent by e-mail to the building operator for immediate rectification.

Utility data from the BMS can also be used to increase staff awareness of their impact on the environment. The animated energy display below presents a mix of consumption data, carbon footprint and staff messages and is designed for building receptions. It uses data from the SQL database presented in an HTML format.

These are just a few examples of the visualisation options available. The use of SQL database and web technologies allows the user interface to be tailored to meet the bank's business requirements.

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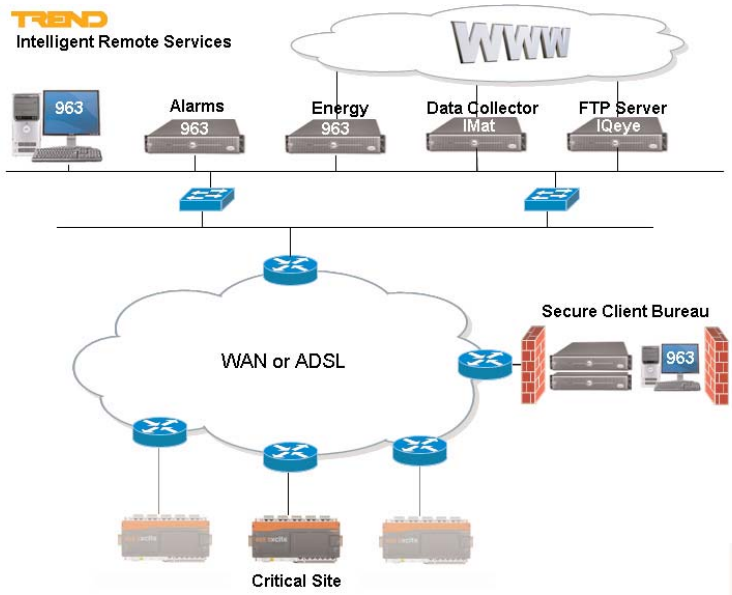
5.0 Security of supply

Having established a robust IP based infrastructure for the BMS, a bank can now use this platform to improve service availability and to monitor and control critical plant and systems.

The Trend BMS has an extensive track record of controlling the critical environment in datacentres throughout the UK. The IQ system is ideally suited to provide the close control required in a computer hall and the 963 SQL database provides an audit trail for the management and analysis of system performance. The



BMS can also be readily integrated with common datacentre plant such as air-conditioning units, Chillers, UPS and PDUs. This is commonly achieved at a network level to provide extensive point monitoring to inform proactive maintenance functions.

While datacentres tend to be standalone operations, banks will also have a large number of distributed critical areas in the form of comms rooms. The BMS infrastructure can be used to provide a resilient means of managing the environment and plant within distributed comms rooms. Alarms can be handled by an in-house bureau or retransmitted to outsourced FM providers.

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Trend critical area monitoring utilises a Trend IQ3xcite controller with on-board web-server. Remote alarm reporting and interrogation is via the IP Ethernet connection on the bank's network or ADSL modem router.

The system monitors temperature and humidity conditions in the comms room as well as providing alarm conditions for plant such as UPS, air-conditioning, fire, gas-suppression, leak detection and generators.

5.0 Globalisation

The centralised BMS infrastructure provides the perfect platform for a global building management strategy. Whether the system uses the bank network or ADSL, the use of web-technologies enables both the collection of BMS data and the distribution of management data.

Trend has developed a number of modular solutions and specifications for datacentre, comms room, retail and head office applications which can readily be rolled-out across a global building portfolio.

Trend has an extensive network of regional offices and supply partners throughout EMEA, Asia-

Pacific and North America to support the implementation and maintenance of repeatable system designs.

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