Remote monitoring of utilities claims to r**educe energy bills** and **cut carbon** emissions

Why are all public sector organisations, whether schools, local authorities or operations like the NHS, under increasing pressure to monitor and control their consumption of gas, electricity and water? The cost of energy apart. the demands placed on the public sector to make an effective contribution to the UK Government's Climate Change Programme means that conventional methods of monitoring energy consumption cannot yield the information required with sufficient speed or focus to meet those obligations effectively.

An increasing number of public sector organisations – many of them schools and colleges – have gone down the route of smart monitoring, an approach to tracking energy consumption which provides real-time data that allows an organisation to evolve an effective energy reduction strategy.

It is immediately apparent to any passer-by that power is being wasted in a school when the lights are left on every evening, but it is less obvious without a more quantitative assessment that the central heating is coming on an hour too soon every weekday morning, for example.

It is unfortunate that even those with a responsibility for site facilities are unlikely to have the technical resources to reach such a conclusion. Wastage of this nature, which falls below the radar, accounts for a major proportion of the energy which can be saved.

It has always been possible for schools to break down their energy usage between buildings on their site, departments and any other facility for which there has been separate submetering.

With manual meter reading the only technology that has been available for tracking consumption, the use of gas, water and electricity has not been analysed at the daily or even sub-hourly intervals needed to provide the basis for fine-tuning systems to reduce consumption.

How far is it posible for the smart remote monitoring technologies developed by **Optimal Communications** help reduce costs and carbon emissions?

It has always been possible for schools to break down their **energy usage** between buildings on their site, departments and any other facility for which there has been separate sub-metering. But **manual meter reading** does not provide the basis on which systems can be fine-tuned.

Smart metering

One step forward from traditional manual metering is the 'smart meter', which is a physical replacement for the manual device which transmits readings to suppliers' accounts departments.

It is *smart* only to the extent that it sends that data automatically, at intervals, typically by a radio link. While eliminating the task and inherent cost of meter reading, the output from these smart meters is still geared to the needs of the utility vendor rather than the site management, its customer.

One benefit of smart metering is clearly the reduced cost of collecting customer data. There is an additional advantage in that the information can be collected more frequently so that patterns of consumption start to emerge – important to utility suppliers keen to optimise their production and distribution flows.

Whatever the perceived benefits of that generation of smart metering, the cost of implementation is high, involving the replacement of conventional meters one-for-one. Progress towards smart metering in the UK, therefore, is slow.

Compared with the monthly or quarterly readings generated manually, however, the half hour resolution which smart meters can provide is a major improvement.

But even that 'granularity' does not reflect the more rapid changes of consumption that will occur in real-world situations such as schools and hospitals.

Smart metering generally cannot deliver data for viewing within 24 hours of collection. This minimises its value to the monitoring and reduction process.

Real time energy monitoring

For a school or college to be totally aware of the way in which it uses energy – thereby allowing it to take more effective control of that consumption – the process of utility monitoring has to move rapidly from an art form to a science.

Rigorous intelligence gathering is required at every point in an organisation's infrastructure where energy is consumed. In the case of a school, for example, each boiler unit requires monitoring; each building on the site needs scrutiny of its electricity usage.

While half-hourly data is generally sufficient for energy managers, the ability to track data at these much shorter intervals is a powerful feature when encouraging the use of smart monitoring by public employees working across a range of disciplines.

This increased level of detail is invaluable to those members of staff in understanding the effects on utility consumption of any changes they might make to heating, lighting and water systems. The information derived in the process empowers management to make decisions which demonstrably reduce the overhead costs of an organisation. The remote monitoring of critical environmental conditions is an established technology in sectors such as the food processing industry, the health service and environmental protection.

In all of these applications, a sensing device specific to the application generates a data stream that is fed back to a central collection point.

Requirements for remote monitoring

A system capable of supporting remote monitoring therefore requires . . .

- Devices to monitor the flow of gas, water and electricity at a point;
- Communications technology to return data streams automatically to a collection point or base station;
- Communications technology to concentrate remote data streams and deliver these to a central management system either continuously or in batches at short intervals.

The information derived from data monitoring empowers management to make decisions which demonstrably reduce the overhead costs of running an organisation, while reducing carbon dioxide emissions.

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Optimal Smart Monitoring

Within the local authority sector, and education in particular, one remote monitoring system has been much in evidence in the award of contracts and pilot studies for energy-saving projects.

Optimal Communications Ltd of Gerrards Cross was awarded a contract in March 2008 by Hertfordshire County Council to deploy its ISX Smart Monitoring system throughout all of the Council's premises in the county.

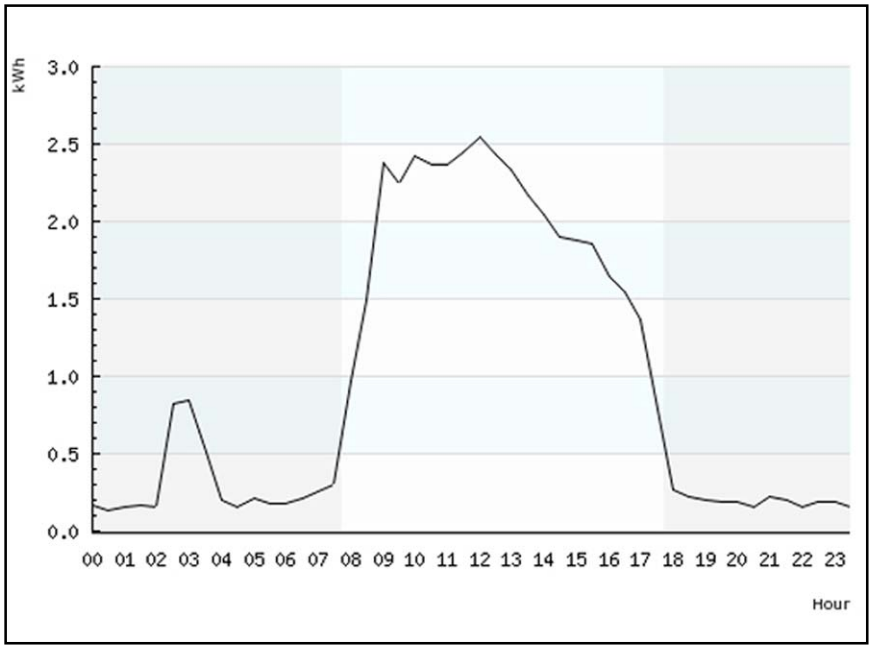
This follows a succession of smaller contracts with authorities which include Oxford County Council, Milton Keynes Council and Chilterns District Council, Significantly, contracts have been awarded by other public sector bodies including East & North Herts NHS Trust.

Given the high level of scrutiny involved in such contract awards, the Optimal solution would appear to be meeting the requirements of the commissioning authorities.

The Optimal ISX collects data at intervals down to 5 minutes and delivers it in real-time to the user community. On those two grounds it should never be described as a smart *metering* system.

- It collects and makes the data available to view in real-time.
- It communicates over radio (in virtually all of its installations to date) to data concentrators from which the raw data is fed back to a management centre by GPRS, dial-up or the Internet as the situation dictates.
- It works normally in the licence-free 434 MHz band, and at power levels limited by regulation, Optimal technology can operate within a radius of around 300 metres from the radio base station. That range means that environments as diverse as hospital sites, water networks and university campuses are within the scope of the vendor's technology.
- 64 sensors can be linked to a base station, making multiple sensor environments cost-effective to operate.
- Optimal maintains a constant check on the incoming data stream so that anomalies can be flagged up quickly, and action taken to correct them. Centralised monitoring means that there is a minimal delay in reducing unnecessary consumption.
- The information processed from the incoming data streams can be delivered through Internet-enabled PCs to an unlimited number of users at an unlimited number of locations without the need to install additional hardware or software.

Users can view **real time data** from the Optimal ISX system in the **most appropriate format**. The options range from direct unit measurements such as litres of water or Kilowatt-hours of electricity, through the number of Kilogrammes of CO_2 emitted, to a **financial cost** which has been calculated on-line as the data is collected.



Above: ISX *demonstrates the electricity consumption over the course of a day in October* 2008 *at a client school.*

Top right: *Total* CO_2 *produced per day in September* 2008 *at the same school.*

Lower right: *Total* CO2 *in the year to date at the client school.*

Whatever arrangements might be in place on the customer site for tracking the data that has been collected, Optimal maintains a constant check on that data through its central management bureau so that anomalies can be flagged up quickly and action taken to correct them.

It might be a case simply of calling the site staff if lights are being left on over a weekend in a building where this would normally not happen, but centralised monitoring means that there is a minimal delay in reducing unnecessary consumption.

Users can view real time data in the most appropriate format. The options range from direct unit measurements such as litres of water or Kilowatt-hours of electricity, through the number of Kilogrammes of CO_2 emitted, to a financial cost which has been calculated online as the data is collected.

Converting the data into pictorial representations of costs or savings greatly increases the impact of the information. In an academic institution, for example, monitors in an entrance hall showing energy being saved might be all that it takes to bring the site users 'on message'.

Interpreting savings in terms of a graphic showing the books that could be bought with the money increases the impact and leaves no-one in any doubt about the consequences of their actions.

With climate change playing an increasing part in education, online access can be provided by Optimal to students tracking energy consumption as part of their studies.

Optimal Smart Monitoring

Trials in schools have proved extremely successful, both in terms of reducing consumption costs and as an educational tool for use by students. Empowering its employees to view real-time utility consumption at their own establishments creates greater awareness at that local level of further opportunities to reduce energy consumption and the carbon emissions which it generates.

An authority may choose to configure the Optimal system to view and profile data from establishments in the same area of operations, such as fire stations and libraries. It would then be in a position to determine the differences between the best and worst performing establishments in each category.

This will help provide greater understanding of the reasons for those variations in performance. The additional information gathered in this way will enable a greater degree of communication and information transfer between similar establishments. The achievements of the best performers will be used to assist the less successful establishments reach compa-

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rable levels of savings and hence carbon reduction.

Optimal's smart monitoring system can collect other relevant usage statistics related to an establishment and collate it with the utility data to create a more encompassing assessment of the carbon footprint both locally and for the Council as a whole.

Data could be collected, for example, from operational areas such as street lighting, waste materials, travel and paper consumption; all of which contribute to carbon emissions.

Climate Change Programme

If all employees of an authority can view real-time consumption data down to an establishment level, this will encourage a much wider cross section of the staff to understand their own carbon footprints. Armed with that knowledge, they can make a positive contribution to the national Climate Change Programme by reducing the carbon emissions from their own establishments.

The schools and further education sector provides some of the greatest opportunities for the system .The teaching of environmental awareness is an increasingly important component of many teaching disciplines.

The ability to monitor and report on a school's utility consumption down to five minute intervals means that students can investigate first-hand the effect of their switching off utility-consuming appliances in part of their school.

The impact of those changes on consumption and carbon emissions is apparent in real-time. It helps students to understand more clearly how quite small modifications to human behaviour can impact significantly upon the environment.

As a result, teachers are provided with a powerful teaching resource.§