CARBON BITES

From the CIBSE YOUNG ENERGY PERFORMANCE GROUP

Metering

What is Metering?

Metering in buildings is installed primarily to monitor the consumption of three main utilities; electricity, gas and water. At building level these have been monitored for decades, primarily for billing purposes, however in recent years building sub-metering, particularly for energy consumption, is proving to be a valuable tool in understanding energy end uses, and consequently building energy performance. Typically, gas and water use is monitored using flow meters, and energy consumption through clamping supply with current transformers at building level, distribution board level or even individual appliance level. Data from the meters can be transmitted via a number of ways e.g. using analogue phone lines or GSM / GPRS networks, however within buildings Ethernet cables are usually used to communicate data to the Building Management System (BMS). Nevertheless, smart infrastructure (such as BMS) can be costly to install, fix and manage. This is due to complications that can arise over the lifetime of a building with changes in data transmission methods and software updates.

Understanding where, how and why energy is used in buildings is essential to its management. With reference to the so-called "energy performance gap" the mismatch between the design predicted and the actual in-use energy consumption, metering can provide useful information on the energy end-uses break down. Consequently providing input with regards to what could be done to close this gap both through i) the inclusion of more end uses on the modelling side; and ii) the identification of waste on the building use side. The use of metering in this way, to investigate energy consumption for the identification of potential waste and to inform building managers how to manage buildings better, initially seems to be a straightforward process, however buildings both new and old are proving to be notoriously tricky to monitor. Reasons for this amongst others include incorrect or incomplete installation of equipment, and a poor understanding of what needs to be monitored.

Part L of the Building Regulations require all new non-domestic buildings over 1000m^2 to have sub-metering installed, covering at least 90% of regulated loads with automatic meter reading and data collection. However, there is no requirement for this data to be examined by a trained eye. Adding to this there is often a misconception amongst building managers that the installation of these meters will automatically result in energy savings with little or no effort to change how the building is being used. Effective training and support for building managers is consequently very valuable in this niche area of building management. However, as the installation of metering itself can be costly, despite the potential monetary savings over the lifetime of the building through effective analysis of metering data, additional funding for training of building managers often not considered in building projects.

Saadia Ansari, Reading University, May 2016

Key Issues & Considerations

- Initial capital for metering installation
- Meter reconciliation and correct installation
- Data management, storage and transmission
- Data analysis for energy management
- Purpose for the metering e.g. for energy management or occupier billing?
- Presence of existing sub-meters in the building
- Do the costs of the installation outweigh potential savings?
- Can virtual sub-metering be used to reduce costs?

Further Information

- CIBSE TM39 Building Energy Metering
- BBP Better Metering Toolkit
- Carbon Trust "Metering"

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Case Study: Innovate UK BPE projects

Innovate UK monitored more than 50 non-domestic high performance buildings, under its £8 million Building Performance Evaluation Programme (BPE). The study examined projects where data was available, focusing on the buildings' fabric and systems, and how satisfied occupants are with the properties. The types of buildings monitored included, schools, laboratories, offices, healthcare centres and hotels. One of the key deliverables of the project was the analysis of at least 2 years of energy use data, however as the project unfolded it became evident that the metering installed in many of the buildings was insufficient for this purpose.

The level of metering varied across the buildings, with some buildings not splitting up the end uses into enough detail, whereas some buildings had an impractical level of submetering providing too much detail. There were numerous examples where equipment was not installed correctly, either where meters were not physically connected to the BMS (see image below), or where CT's were installed the wrong way round or with the CT ratio incorrectly configured. Renewable energy technologies also posed problems for metering as these were not always effectively integrated with the rest of the building monitoring. In the case of PV this could mean that generated electricity could cause meters in the buildings to log negative values.

It was also noted that there was an overreliance on BMS systems with some buildings managers believing them to be Energy Management Systems (EMS) and expecting them to automate building systems to minimise energy consumption. Further complications with BMS included data being overwritten after seven days without building managers realising that they had to download it for further analysis. CIBSE's TM39 *Building Energy Metering* is currently being revised to address some of the problems that this project has flagged up.

Key Lessons Learnt

- Guidance / training of contractors to ensure metering is appropriate to the building
- Metering guidance for industry needs improving
- Softlandings framework could help to metering projects to be more successful
- High level meter reconciliation at handover to show that metering hierarchy is correct

Further Information

- BPE project report
- Building Data Exchange (data from the BPE buildings)