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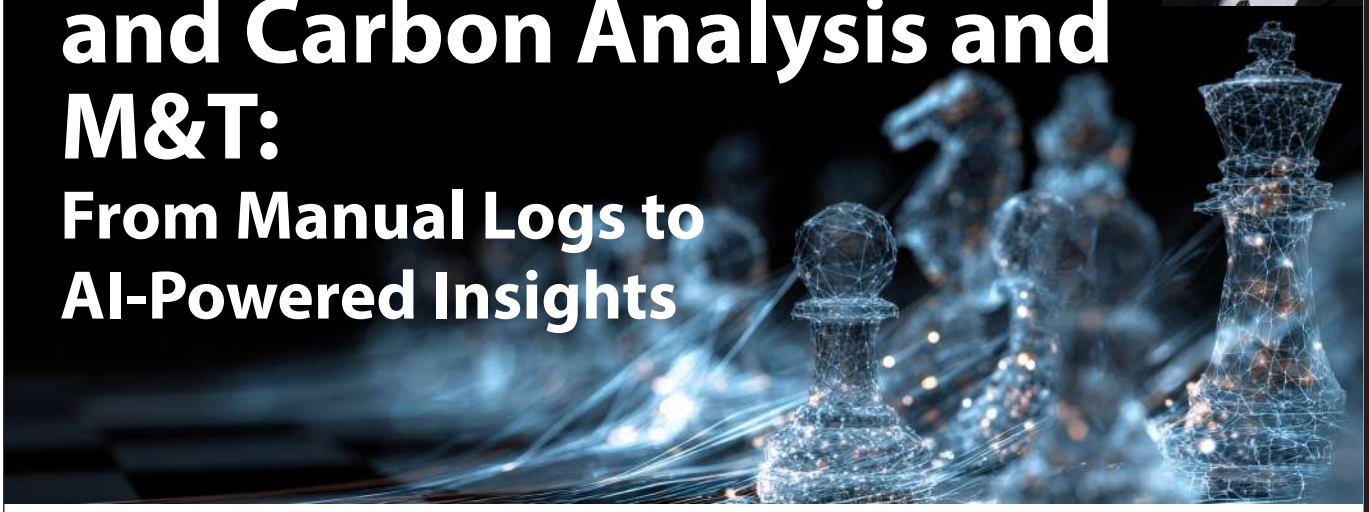
The Evolution of Energy and Carbon Analysis and M&T:

From Manual Logs to AI-Powered Insights



At its core, the development of energy and carbon analysis reflects our growing capacity to understand what was once invisible. This article traces how our understanding of energy use has progressed from basic utility tracking to the integrated, data-driven discipline essential for today's decarbonisation efforts.

As digital metering, real-time analytics and carbon accounting reshape how organisations measure and manage performance, M&T has evolved from a cost-control tool into a strategic foundation for achieving net zero goals. The progress highlights a key point: progress in energy and carbon management is not driven merely by technology, but by insight, the ability to interpret data, understand systems and act with intention. It underscores the importance of integrating carbon metrics with traditional energy management practices, ensuring that every kilowatt saved and every emission avoided contributes meaningfully to organisational resilience and global sustainability goals.

1970s

Although a few forward-thinking organisations employed a version of energy monitoring and targeting (M&T) before the 1970s, the main impetus for this emerged in that decade because of the oil crisis. This occurred due to Middle Eastern conflicts resulting in oil supply issues and significant price increases.

Early methods of energy saving were rudimentary and focused on behavioural change, and in the late 1970s and early 1980s the first M&T programs were founded, which included the development of analytical techniques using utility bill data analysis. Most systems were manual and did not consider variances such as weather or activity, and did not have the effect that today's processes have in terms of energy saving. The processes involved taking consumption data and manually inserting onto paper logs or records, a laborious process.

1980s

The introduction of computerisation in the 1980s made M&T systems more practical and accessible. This period saw M&T being used widely and in a more developed way. Computerised M&T systems could take into account relevant factors such as degree days for space heating and activity. Government organisations led the way in promoting M&T, with subsidies being provided and trade bodies becoming involved. Another approach that emerged in this period was the use of performance indicators for focusing attention. This was particularly effective in local authorities in the form of Normalised Performance Indicators (NPIs) developed by the Audit Commission and implemented as a national system.

During this period a key technology that emerged was Building Energy Management Systems (BEMS). These were widely adopted by owners of large portfolios, such as local authorities and government agencies, and this resulted in several benefits, such as alarm handling and control of building services. Early systems used minicomputers as central stations and were extremely

expensive to install but costs fell as personal computers were introduced, and more "intelligence" was added to outstations, thus reducing field wiring costs. During this period, digital submeters became more affordable and could be linked to the BEMS, enabling closer monitoring and management of consumption.

This period also saw the rise of the energy management consultancy market with many large organisations bringing in consultancy teams to establish M&T systems, carry out audits, implement projects, and deliver communication and awareness schemes. Another major development in this period was the introduction of Contract Energy Management (CEM), which initially went under various names including "Third Party Financing", "Energy Performance Contracting" and "Energy Service Contracting".

1990s

During the 1990s and beyond, energy reporting became more important, not just because of the cost of energy rising, but the increased importance of reducing carbon emissions. Organisations felt they had a social and sustainability obligation to limit carbon emissions, which had several benefits including cost saving, reducing reputational risk and attracting customers. In particular, in the built environment, forward thinking developers and building owners realised that it was becoming a necessity to demonstrate green credentials.

2000s

Operational metrics were starting to develop, with the Energy Performance of Building Directive introduction in the 2000s being the main driver. This introduced Energy Performance Certificates (EPCs) aimed at reducing energy waste and emissions supporting UK's climate goals. Also, Display Energy Certificates (DECs) became a legal requirement for all buildings in the public sector and where members of the public accessed public buildings. As the UK's targets became more stringent, the ratings required in an EPC have increased.

There has been a lot written about the benefits of EPCs and DECs, and although they do have their drawbacks, there is no doubt they have helped in reducing energy consumption and carbon emissions. Other metrics and standards have begun to gain traction in recent years, such as NABERS UK, which has two product offerings for office buildings, "Design for Performance" for new buildings and "Energy for Offices" for existing buildings.

2010s

A game changer in terms of data provision and therefore closer monitoring and management was when electricity consumption was recorded and provided in half hourly (HH) intervals. The 2011 Energy Act introduced the concept of half hourly metering to the UK market. For larger consumers, the availability of HH data offered more granularity giving a much more detailed view of consumption. It enabled building owners and managers to monitor energy almost in real time, enabling immediate adjustments to reduce costs and improve efficiency. It also introduced the potential to improve automatic control and streamline energy audits, and identify hidden energy saving opportunities.

Advances in technology have made it easier and more affordable to interrogate and present large data sets in an easy-to-read format. Cloud based energy systems enable real time monitoring, integration with other systems, automated reporting, along with cost reporting. They can take advantage of the increase of the "Internet of Things" (IoT), data analytics and artificial intelligence to optimise energy efficiency, reduce cost and support sustainability initiatives.

These platforms provide real-time insights and analytics into energy consumption, support automated controls and demand-response strategies, further improving energy efficiency and reducing operational costs. Additionally, they provide automated reporting tools that strengthen compliance and support informed decision-making.

Security of these platforms is an issue that needs to be considered, but this can be addressed through the implementation of robust encryption methods, regular security audits and strict access controls.

Automated alarm reporting is now becoming a common facility with energy management systems. This means the role of the energy manager could be more strategic and corroborative, rather than having to spend time interrogating systems to discover where energy is being wasted.

2020s

Artificial intelligence is transforming energy management. It is doing this by predictive analysis and optimising energy performance. For example, algorithms can analyse the large amount of half hourly electricity data from meters and can predict where energy is being wasted or where there is a spike in consumption. This can be done in seconds and displayed in a user-friendly way on screen, with the option of downloading reports with cost benefit analysis.

The future of energy management will continue with enhanced machine learning which is giving the capability of improved data integration along with real time analytics. This gives more accurate forecasting using larger datasets and picking up complex patterns in the data. This will allow seamless integration with other systems and datasets, giving insights into performance that could never be seen before. It will facilitate energy managers and others to be able to respond quickly to changing conditions.

All of this advancement means, rather than being reactive as experienced under a traditional M&T system, it will enable a proactive approach with operational changes being made in real time. My view is that there is still a place for a manual M&T approach for some organisations, but the pace of AI, the scalability of the IoT and improvement in controls will result in opportunities for many organisations to take advantage of much more automated processes than have ever existed.

Author's profile:

Mitch works as Energy Manager for the London Fire Brigade. He has been involved in energy management for over 40 years, from being a design engineer, through to facilities manager and energy manager in both the public and private sectors.